THE CHEMICAL FORMULARY

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A COLLECTION OF VALUABLE, TIMELY, PRACTICAL
COMMERCIAL FORMULAE AND RECIPES FOR
MAKING THOUSANDS OF PRODUCTS IN
MANY FIELDS OF INDUSTRY

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H. BENNETT

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PREFACE

Chemistry as taught in our schools and colleges is confined to synthesis, analysis and engineering—and properly so. It is part of the proper foundation for the education of the chemist.

Many a chemist on entering an industry soon finds that the bulk of the products manufactured by his concern are not synthetic or definite chemical compounds but are mixtures, blends or highly complex compounds of which he knows little or nothing. The literature in this field, if any, may be meagre, scattered or antiquated.

Even chemists, with years of experience in one or more industries, spend considerable time and effort in acquainting themselves on entering a new field. Consulting chemists, similarly, have problems brought to them from industries foreign to them. A definite need has existed for an up-to-date compilation of formulae for chemical compounding and treatment. Since the fields to be covered are many and varied, an editorial board was formed, composed of chemists and engineers in many industries.

Many publications, laboratories, manufacturing companies and individuals have been drawn upon to obtain the latest and best information. It is felt that the formulae given in this volume will save chemists and allied workers much time and effort.

Manufacturers and sellers of chemicals will find in these formulae new uses for their products. Non-chemical executives, professional men and others, who may be interested, will gain from this volume a "speaking acquaintance" with products which they may be using, trying, or with which they are in contact.

It often happens that two individuals using the same ingredients in the same formula get different results. This may be the result of slight deviations or unfamiliarity with the intricacies of a new technique. Accordingly, repeated experiments may be necessary to get the best results. Although many of the formulae given are being used commercially many have been taken from patent specifications and the literature. Since these sources are often subject to various errors and omissions, due regard must be given to this factor. Wherever possible it is advisable to consult with other chemists or technical workers regarding commercial production. This will save time and money and avoid "headaches."

It is seldom that any formula will give exactly the results which one requires. Formulae are useful as starting points from which to work out one's own ideas. Formulae very often give us ideas which may help us in our specific problems. In a compilation of this kind errors of omission, commission and printing may occur, We shall be glad to receive any constructive criticism in this, our first attempt.

To the layman, it is suggested that he arrange for the services of a chemist or technical worker familiar with the specific field in which he is interested. Although this involves an expense it will insure quicker and better formulation without wastage of time and materials.

H. BENNETT

PREFACE TO VOLUME V

Sufficient new formulae have been gathered to compile a fifth volume of the *Chemical Formulary*—an addition which will broaden and bring up-to-date the contents of volumes I, II, III and IV. Because the board of editors feels that information of this nature, to be most helpful, should be released as soon as possible and since we have had hundreds of inquiries as to when Volume V would be ready, an early publication date was decided upon.

Schools and colleges in increasing numbers seem to find it advisable to use the *Chemical Formulary* as an aid in promoting a practical interest in chemistry. By its use, students learn to make cosmetics, inks, polishes, insecticides, paints and countless other products. The result is that chemistry becomes an extremely interesting practical and useful subject. This interest often continues even when the students reach the theoretical or less interesting phases of this subject.

Since some mature users of this book have not had the good fortune to have had previous training or experience in the art of chemical compounding, the simple introductory chapter of directions and advice has been included. This chapter should be studied carefully by all beginners (and some more experienced workers) and some of the preparations given therein should be made before attempting to duplicate the more complex formulae in the succeeding chapters.

An enlarged directory of sources of chemicals and supplies has been added. This should prove useful in locating new as well as old materials and products.

It is a sincere pleasure to acknowledge the valuable assistance of the members of the board of editors and others who have given of their time and knowledge in contributing the special formulae which have made this volume possible.

H. BENNETT

NOTE

All the formulas in volumes I, II, III, IV and V are different. Thus, if you do not find what you are looking for in this volume, you may find it in one of the others.

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ABBREVIATIONS

amp.	ampere
amp./dm^2	amperes per square decimeter
amp./sq. ft.	amperes per square foot
anhydr.	anhydrous
avoir.	avoirdupois
Bé.	Baumé
b.p.	boiling point
C.	Centigrade
°C.	degrees Centigrade
cc.	cubic centimeter
c.d.	current density
cm.	centimeter
cm^3	cubic centimeter
conc.	concentrated
c.p.	chemically pure
cps.	centipoises
cu. ft.	cubic foot
cu. in.	cubic inch
cwt.	hundredweight
d.	density
dil.	dilute
dm.	decimeter
dm^2	square decimeter
dr.	dram
E.	Engler
F.	Fahrenheit
°F.	degrees Fahrenheit
f.f.c.	free from chlorine
f.f.p.a.	free from prussic acid
fl. dr.	fluid dram
fl. oz.	fluid ounce
f.p.	freezing point
ft.	foot
ft.^{2}	square foot
g.	gram
gal.	gallon
gr.	grain
hl.	hectoliter
hr.	hour
in.	inch
kg.	kilogram
l.	liter
lb.	pound
liq.	liquid
m.	meter
min.	minim, minute
ml.	milliliter—cubic centimer
mm.	millimeter
m.p.	melting point
N.	normal
N.F.	National Formulary
oz.	ounce
pH	hydrogen-ion concentration
p.p.m.	parts per million

pt.	pint
pwt.	pennyweight
q.s.	a quantity sufficient to make
qt.	quart
r.p.m.	revolutions per minute
S.A.E.	Society of Automotive Engineers
sec.	second
sp.	spirits
sp. gr.	specific gravity
sq. dm.	square decimeter
tech.	technical
tinc.	tincture
tr.	tincture
Tw.	Twaddell
U.S.P.	United States Pharmacopeia
v.	volt
visc.	viscosity
vol.	volume
wt.	weight
x.	extra

CHAPTER I

INTRODUCTION

At the suggestion of a number of teachers of chemistry and home economics the following introductory matter has been included.

The contents of this section are written in a simple way so that anyone, regardless of technical education or experience, can start making simple products without any complicated or expensive machinery. For commercial productions, however, suitable equipment is necessary.

Chemical specialties en masse are composed of pigments, gums, resins, solvents, oils, greases, fats, waxes, emulsifying agents, water, chemicals of great diversity, dyestuffs, and perfumes. To compound certain of these with some of the others requires certain definite and well-studied procedure, any departure from which will inevitably result in failure. The successful steps are given with the formulas. Follow them explicitly. If the directions require that A should be added to B, carry this out literally, and not in reverse fashion. In making an emulsion, the job is often quite as tricky as the making of mayonnaise. In making mayonnaise, you add the oil to the egg, *slowly,* with constant and even and regular stirring. If you do it correctly, you get mayonnaise. If you depart from any of these details: if you add the egg to the oil, or pour the oil in too quickly, or fail to stir regularly, the result is a complete disappointment. The same disappointment might be expected if the prescribed procedure of any other formula is violated.

The next point in importance is the scrupulous use of the proper ingredients. Substitutions are sure to result in inferior quality, if not in complete failure. Use what the formula calls for. If a cheaper product is desired, do not obtain it by substituting a cheaper material for the one prescribed: resort to a different formula. Not infrequently a formula will call for some ingredient which is difficult to obtain: in such cases, either reject the formula or substitute a similar material only after preliminary experiment demonstrates its usability. There is a limit to which this rule may reasonably be extended. In some instances the substitution of an equivalent ingredient may legitimately be made. For example: when the formula calls for *white wax* (beeswax), yellow wax can be used, if the color of the finished product is a matter of secondary importance. Yellow beeswax can often replace white beeswax, making due allowance for color: but paraffin will *not* replace beeswax, even though its light color recommends it above yellow beeswax.

And this leads to the third point: the use of good quality ingredients, and ingredients of the correct quality. Ordinary lanolin is not the same thing as *anhydrous* lanolin: the replacement of one for the other, weight for weight, will give discouragingly different results. Use exactly what the formula calls for: if you are unacquainted with the material and a doubt arises as to just what is meant, discard the formula and use one that you understand. Buy your materials from reliable sources. Many ingredients are obtainable in a number of different grades: if the formula does not designate the grade, it is understood that the best grade is to be used. Remember that a formula and the directions can tell you only a part of the story. Some skill is often required to attain success. Practice with a small batch in such cases until you are sure of your technique. Many instances can be cited. If the formula calls for steeping quince seed for 30 minutes in cold water, your duplication of this procedure may produce a mucilage of too thin a consistency. The originator of the formula may have used a fresher grade of seed, or his conception of what "cold" water means may be different from yours. You should have a feeling for the right degree of mucilaginousness, and if steeping the seed for 30 minutes fails to produce it, steep them longer until you get the right kind of mucilage.

If you do not know what the right kind is, you will have to experiment until you find out. Hence the recommendation to make small experimental batches until successful results are arrived at. Another case is the use of dyestuffs for coloring lotions, and the like. Dyes vary in strength: they are all very powerful in tinting value: it is not always easy to state in quantitative terms how much to use. You must establish the quantity by carefully adding minute quantities until you have the desired tint. Gum tragacanth is one of those products which can give much trouble. It varies widely in solubility and bodying power: the quantity prescribed in the formula may be entirely unsuitable for *your* grade of tragacanth. Hence a correction is necessary, which can only be made after experiments to determine *how much* to correct.

In short, if you are completely inexperienced, you can profit greatly by gaining some experience through recourse to experiment. Such products as mouth washes, hair tonics, astringent lotions, need little or no experience, because they are as a rule merely mixtures of simple liquid and solid ingredients, the latter dissolving without difficulty and the whole being a clear solution that is ready for use when mixed. On the other hand, face creams, tooth pastes, lubricating greases, wax polishes, etc., which require relatively elaborate procedure and which depend for their usability on a definite final viscosity, must be made with the exercise of some skill, and not infrequently some experience.

Figuring

Some prefer proportions expressed by weight, volume or in terms of percentages. In different industries and foreign countries various systems of weights and measures are used. For this reason no one set of units could be satisfactory for everyone. Thus divers formulae appear with different units in accordance with their sources of origin. In some cases, parts instead of percentages or weight or volume is designated. On the pages preceding the index, tables of weights and measures are given. These are of use in changing from one system to another. The following examples illustrate typical units:

Ink for Marking Glass

Glycerin	40	Ammonium Sulphate	10
Barium Sulphate	15	Oxalic Acid	8
Ammonium Bifluoride	15	Water	12

Here no units are mentioned. When such is the case it is standard practice to use parts by weight, using the same system throughout. Thus here we may use ounces or grams as desired. But if ounces are used for one item then ounces must be the unit for all the other items in the particular formula.

Flexible Glue

Glue, Powdered	30.9 %	Glycerin	5.15%
Sorbitol (85%)	15.45%	Water	48.5 %

Where no units of weight or volume but percentages are given then forget the percentages and use the same instructions as given under Example No. 1.

Example No. 3

Antiseptic Ointment

Petrolatum	16 parts	Benzoic Acid	1 part
Coconut Oil	12 parts	Chlorthymol	1 part
Salicylic Acid	1 part		

The same instructions as given under Example No. 1 apply to Example No. 3.

It is not wise in many cases to make up too large a quantity of material until one has first made a number of small batches to first master the necessary technique and also to see whether it is suitable for the particular outlet for which it is intended. Since, in many cases, a formula may be given in proportions as made up on a commercial factory scale, it is advisable to reduce the proportions accordingly. Thus, taking the following formula:

Example No. 4

Neutral Cleansing Cream

Mineral Oil	**80 lb.**	**Water**	**90 lb.**
Spermaceti	**30 lb.**	**Glycerin**	**10 lb.**
Glyceryl Monostearate	**24 lb.**	**Perfume**	**to suit**

Here, instead of pounds, grams may be used. Thus this formula would then read:

Mineral Oil	80 g.	Water	90 g.
Spermaceti	30 g.	Glycerin	10 g.
Glyceryl Monostearate	24 g.	Perfume	to suit

Reduction in bulk may also be obtained by taking the same fractional part or portion of each ingredient in a formula. Thus in the following formula:

Example No. 5

Vinegar Face Lotion

Acetic Acid (80%)	20	Alcohol	440
Glycerin	20	Water	500
Perfume	20		

We can divide each amount by ten and the finished bulk is only 1/10th of the original formula. Thus it becomes:

Acetic Acid (80%)	2	Alcohol	44
Glycerin	2	Water	50
Perfume	2		

Apparatus

For most preparations pots, pans, china and glassware, such as is used in every household, will be satisfactory. For making fine mixtures and emulsions a "malted-milk" mixer or egg-beater is necessary. For weighing, a small, low priced scale should be purchased from a laboratory supply house. For measuring of fluids, glass graduates or measuring glasses may be purchased from your local druggist. Where a thermometer is necessary a chemical thermometer should be obtained from a druggist or chemical supply house.

Methods

To better understand the products which you intend making, it is advisable that you read the complete section covering such products. Very often an important idea is thus gotten. You may learn different methods that may be used and also avoid errors which many beginners are prone to make.

Containers for Compounding

Where discoloration or contamination is to be avoided (as in light colored, or food and drug products) it is best to use enameled or earthenware vessels. Aluminum, as well, is highly desirable in such cases but it should not be used with alkalies as the latter dissolve and corrode this metal.

Heating

To avoid overheating, it is advisable to use a double boiler when temperatures below 212° F. (temperature of boiling water) will suffice. If a double boiler is not at hand, any pot may be filled with water and the vessel containing the ingredients to be heated is placed therein. The pot may then be heated by any flame without fear of overheating. The water in the pot, however, should be replenished from time to time as necessary—it must not be allowed to "go dry." To get uniform higher temperatures, oil, grease or wax is used in the outer container in place of water. Here of course care must be taken to stop heating when thick fumes are given off as these are inflammable. When higher uniform temperatures are necessary, molten lead may be used as a heating medium. Of course, where materials melt uniformly and stirring is possible, direct heating over an open flame is permissible.

Where instructions indicate working at a certain temperature, it is important that the proper temperature be attained—not by guesswork, but by the use of a thermometer. Deviations from indicated temperatures will usually result in spoiled preparations.

Temperature Measurements

In Great Britain and the United States, the Fahrenheit scale of temperature measurement is used. The temperature of boiling water is 212° Fahrenheit (212° F.); the temperature of melting ice is 32° Fahrenheit (32° F.).

In scientific work and in most foreign countries the Centigrade scale is used. On this scale of temperature measurement, the temperature of boiling water is 100 degrees Centigrade (100° C.) and the temperature of melting ice is 0 degrees Centigrade (0° C.).

The temperature of liquids is measured by a glass thermometer. The latter is inserted as deeply as possible in the liquid and is moved about until the temperature remains steady. It takes a little time for the glass of the thermometer to come to the temperatures of the liquid. The thermometer should not be placed against the bottom or side of the container, but near the center of the liquid in the vessel. Since the glass of the bulb of the thermometer is very thin, it can be broken easily by striking it against any hard surface. A cold thermometer should be warmed gradually (by holding over the surface of a hot liquid) before immersion. Similiarly the hot thermometer when taken out should not be put into cold water suddenly. A sharp change in temperature will often crack the glass.

Mixing and Dissolving

Ordinary solution (e.g. sugar in water) is hastened by stirring and warming. Where the ingredients are not corrosive, a clean stick, bone or composition fork or spoon is used as a mixing device. These may also be used for mixing thick creams or pastes. In cases where most efficient stirring is necessary (as in making mayonnaise, milky polishes, etc.) an egg-beater or a malted-milk mixer is necessary.

Filtering and Clarification

When dirt or undissolved particles are present in a liquid, they are removed by settling or filtering. In the former the solution is allowed to stand and if the particles are heavier than the liquid they will gradually sink to the bottom. The upper liquid may be poured or siphoned off carefully and in some cases is then of sufficient clarity to be used. If, however, the particles do not settle out then they must be filtered off. If the particles are coarse they may be filtered or strained through muslin or other cloth. If they are very small particles then filter paper is used. Filter papers may be obtained in various degrees of fineness. Coarse filter paper filters rapidly but will not, of course, take out extremely fine particles. For the latter, it is necessary to use a very fine grade of filter paper. In extreme cases even this paper may not be fine enough. Here it will be necessary to add to the liquid 1-3% of infusorial earth or magnesium carbonate. The latter clog up the pores of the filter paper and thus reduce their size and hold back undissolved material of extreme fineness. In all such filtering, it is advisable to take the first portions of the filtered liquid and pour them through the filter again as they may develop cloudiness in standing.

Decolorizing

The most commonly used decolorizer is decolorizing carbon. The latter is added to the liquid to the extent of 1-5% and heated with stirring for ½ hour to as high a temperature as is feasible. It is then allowed to stand for a while and filtered. In some cases bleaching must be resorted to. Examples of this are given in this book.

Pulverizing and Grinding

Large masses or lumps are first broken up by wrapping in a clean cloth and placing between two boards and pounding with a hammer. The smaller pieces are then pounded again to reduce their size. Finer grinding is done in a mortar with a pestle.

Spoilage and Loss

All containers should be closed when not in use to prevent evaporation or contamination by dust; also because, in some cases, air affects the material adversely. Many materials attack or corrode the metal containers in which they are received. This is particularly true of liquids. The latter, therefore, should be transferred to glass bottles which should be as full as possible. Corks should be covered with aluminum foil (or dipped in melted paraffin wax when alkalies are present).

Materials such as glue, gums, oilve oil or other vegetable or animal products may ferment or become rancid. This produces discoloration or unpleasant odors. To avoid this, suitable antiseptics or preservatives must be used. Too great stress cannot be placed on cleanliness. All containers must be cleaned thoroughly before use to avoid various complications.

Weighing and Measuring

Since, in most cases, small quantities are to be weighed, it is necessary to get a light scale. Heavy scales should not be used for weighing small amounts as they are not accurate for this type of weighing.

For measuring volume (liquids) measuring glasses or cylinders (graduates) should be used. Since this glassware cracks when heated or cooled suddenly it should not be subjected to sudden changes of temperature.

Caution

Some chemicals are corrosive and poisonous. In many cases they are labeled as such. As a precautionary measure, it is advised not to smell bottles directly, but only to sniff a few inches from the cork or stopper. Always work in a well ventilated room when handling poisonous or unknown chemicals. If anything is spilled, it should be wiped off and washed away at once.

Where to Buy Chemicals and Apparatus

Many chemicals and most glassware can be purchased from your druggist. A list of suppliers of all products will be found at the end of this book.

ADVICE

This book is the result of co-operation of many chemists and engineers who have given freely of their time and knowledge. It is their business to act as consultants and, for a fee, to give advice on technical matters. As publishers, we do not maintain a laboratory or consulting service to compete with them.

Please, therefore, do not ask us for advice or opinions, but confer with a chemist in your vicinity.

Extra Reading

Keep up with new developments of new materials and methods by reading technical magazines. Many technical publications are listed under references in the back section of this book.

Calculating Costs

Purchases of raw materials, in small quantities, are naturally higher in price than when bought in large quantities. Commercial prices, as given in the trade papers and catalogs of manufacturers, are for quantities such as barrels, drums or sacks. For example, a pound of epsom salts, bought at retail, may cost 10 or 15 cents. In barrel lots its price today is about 2 to 3 cents per pound.

Typical Costing Calculation

Formula for Beer- or Milk Pipe Cleaner

Soda Ash	25 lb. @	.02½ per lb. =	$0.63
Sodium Perborate	75 lb. @	.16 per lb. =	12.00
Total	100 lb.	Total	$12.63

If 100 lb. cost $12.63, 1 lb. will cost $12.63 divided by 100 or about $0.126 per lb. for raw materials, assuming no loss.

Always weigh the amount of finished product and use *this* weight in calculating costs. Most compounding results in some loss of material because of spillage, sticking to apparatus, evaporation, etc. Costs of making experimental lots are always high and should not be used for figuring costs. To meet competition, it is necessary to buy in larger units and costs should be based on the latter.

Elementary Preparations

The recipes that follow have been gotten up in a very simple way. Only one of each type is given so as to avoid confusion. These have been selected because of their importance and because they can be made readily.

The succeeding chapters go into greater detail and give many different types and modifications of these and other recipes for home and commercial use.

Cleansing Creams

Cleansing creams as the name implies serve as skin cleaners. Their basic ingredients are oils and waxes which are rubbed into the skin. When wiped off they carry off dirt and dead skin. The liquefying type of cleansing cream contains no water and melts or liquefies when rubbed on the skin. To suit different climates and likes and dislikes harder or softer products can be made.

Cleansing Cream (Liquefying)

Liquid Petrolatum (White Mineral Oil)	5½ oz.
Paraffin Wax	2½ oz.
Petrolatum (Vaseline)	2 oz.

Melt together with stirring in an aluminum or enamelled dish and allow to cool. Then stir in a dash of perfume oil. Allow to stand until a haziness appears and then pour into jars, which should be allowed to stand *undisturbed* over night.

Cold Creams

The most important facial cream is cold cream. This type of cream consists of a mineral oil and wax which are emulsified in water with a little borax or glycosterin. The function of a cold cream is to furnish a greasy film which takes up dirt and waste tissue which are removed when the skin is wiped thoroughly. Many modifications of this basic cream are enountered in stores. They vary in color, odor, and in claims but, essentially, they are no more useful than this simple cream. The latest type of cold cream is the non-greasy cold cream which is of particular interest because it is non-alkaline and therefore non-irritating to sensitive skins.

Cold Cream

Liquid Petrolatum (White Mineral Oil)	52 g.
White Beeswax	14 g.

Heat the above in an aluminum or enamelled double boiler (the water in the outer pot should be brought to a boil). In a separate aluminum or enamelled pot dissolve.

Borax	1 g.
Water	33 c.c.

and bring this to a boil. Add this in a thin stream, to the melted wax, while stirring vigorously in one direction only, to the melted wax mixture. Use a fork for stirring. When the mixture turns to a smooth thin cream, immerse the bottom of the thermometer in it from time to time, stirring continuously. When the temperature drops to 140° F. add ½ c.c. of perfume oil and continue stirring until the temperature drops to 120° F. At this point pour into jars where the cream will "set" after a while. If a harder cream is desired, reduce the amount of liquid petrolatum. If a softer cream is wanted increase it.

Cold Cream (Non-Greasy)

White Paraffin Wax	1¼ oz.
Petrolatum (Vaseline)	1½ oz.
Glycosterin or Glyceryl Monostearate	2¼ oz.
Liquid Petrolatum (White Mineral Oil)	3 oz.

Heat the above in an aluminum or enamelled double boiler (the water in the outer pot should be boiling). Stir until clear. To this slowly add, while stirring vigorously with a fork,

Water (boiling)	10 oz.

Continue stirring until smooth and then add with stirring, a little perfume oil. Pour into jars at 110-130° F. and cover the jars as soon as possible.

Vanishing Creams

Vanishing creams are non-greasy creams, soapy in nature. Some are white and others have a very beautiful pearly appearance. This type of cream depends on its soapiness for its cleansing character and is useful as a powder base.

Vanishing Cream

Stearic Acid	18 oz.

Melt the above in an aluminum or enamelled double boiler (the water in the outer pot must be boiling). To the above add, in a thin stream, while stirring vigorously with a fork, the following boiling solution made in an aluminum or enamelled pot:

Potassium Carbonate	¼ oz.
Glycerin	6½ oz.
Water	5 lb.

Continue stirring until the temperature falls to 135° F., then stir in a little perfume oil and stir from time to time until cold. Allow to stand over night and stir again the next day. Pack into jars which should be closed tightly.

Hand Lotions

Hand lotions are usually clear or milky liquids or salves which are useful in protecting the skin from roughness and redness because of exposure to cold, hot water, soap and other materials. "Chapped" hands are a common occurrence. The use of a good hand lotion keeps the skin smooth, soft, and in a normally healthy condition. The lotion is best applied at night, rather freely, and cotton gloves may be worn to prevent soiling. During the day it should be put on sparingly and the excess wiped off.

Hand Lotion (Salve)

Boric Acid	1 oz.
Glycerin	6 oz.

Warm the above in an aluminum or enamelled dish and stir with a clean wooden stick until dissolved (clear). Then allow to cool and work into the following mixture with a potato masher, or rounded stick, adding only a little of the above liquid at a time to the mixture below and not adding a further portion until it is fully absorbed.

Lanolin	6 oz.
Petrolatum or "Vaseline"	8 oz.

If it is desired to impart a pleasant odor to this lotion a little perfume may be added and worked in.

Hand Lotion (Milky Liquid)

Lanolin	¼ teaspoonful
Glycosterin or Glyceryl Monostearate	1 oz.
Tincture of	

Benzoin	2 oz.
Witch Hazel	25 oz.

Melt the first two items together in an aluminum or enamelled double boiler. If no double boiler is at hand improvise one by standing the dish in a small pot containing boiling water. When the mixture becomes clear remove from the double boiler and add slowly, while stirring vigorously with a fork or stick, the tincture of benzoin and then the witch hazel. Continue stirring until cool and then put into one or two large bottles and shake vigorously. The finished lotion is a beautiful milky liquid comparable to the best hand lotions on the market sold at high prices.

Brushless Shaving Creams

Brushless or latherless shaving creams are soapy in nature and do not require lathering or water. The formula given below is of the latest type being free from alkali and non-irritating. It should be borne in mind, however, that certain beards are not softened by this type of cream and require the old-fashioned lathering shaving cream.

Brushless Shaving Cream

White Mineral Oil	10 oz.
Glycosterin or Glyceryl Monostearate	10 oz.
Water	50 oz.

Heat the first two ingredients together in a pyrex or enamelled dish to 150° F. and into this run slowly, while stirring with a fork, the water which has been heated to boiling. Allow to cool to 105° F. and while stirring add a few drops of perfume oil. Continue stirring until cold.

Mouth Washes

Mouth washes and oral antiseptics are of practically negligible value. Many, however, insist on their use because of their refreshing taste and deodorizing value.

Mouth Wash

Benzoic Acid	⅝ oz.
Tincture of Rhatany	3 oz.
Alcohol	20 oz.
Peppermint Oil	⅛ oz.

Just shake together in a dry bottle until it is dissolved and it is ready. A teaspoonful is used to a small wineglassful of water.

Tooth Powders

Tooth powders depend for their cleansing action on soap and mild abrasives such as precipitated chalk and magnesium carbonate. The antiseptic present is practically of no value. The flavoring ingredients mask the taste of the soap and give the user's mouth a pleasant after-taste.

Tooth Powder

Magnesium Carbonate	420 g.
Precipitated Chalk	565 g.
Sodium Perborate	55 g.
Sodium Bicarbonate	45 g.
Soap, Powdered White	50 g.
Sugar, Powdered	90 g.
Wintergreen Oil	8 cc.
Cinnamon Oil	2 cc.
Menthol	1 g.

Dissolve the last three ingredients together and then rub well into the sugar. Add the soap and perborate mixing in well. Add the chalk with good mixing and then the sodium bicarbonate and magnesium carbonate. Mix thoroughly and sift through a fine wire screen. Keep dry.

Foot Powders

Foot powders consist of a filler such as talc or starch with or without an antiseptic or deodorizer. In the following formula the perborates liberate oxygen when in contact with perspiration which tends to destroy unpleasant odors. The talc acts as a lubricant and prevents friction and chafing.

Foot Powder

Sodium Perborate	3 oz.
Zinc Peroxide	2 oz.
Talc	15 oz.

Shake together thoroughly in a dry container until uniformly mixed. This powder must be kept dry or it will spoil.

Liniments

Liniments usually consist of an oil and an irritant such as methyl salicylate or turpentine. The oil acts as a solvent and tempering agent for the irritant. The irritant produces a rush of blood and warmth which is often slightly helpful.

Liniment, Sore Muscle

Olive Oil	6 fl. oz.
Methyl Salicylate	3 fl. oz.

Shake together and keep in a well stoppered bottle. Apply externally but do not apply to chafed or cut skin.

Chest-Rubs

In spite of the fact that chest-rubs are practically useless countless sufferers use them. Their action is similar to that of liniments and they differ only in that they are in the form of a salve.

"Chest-Rub" Salve

Yellow Petrolatum or Yellow Vaseline	1 lb.
Paraffin Wax	1 oz.
Eucalyptus Oil	2 fl. oz.
Menthol	½ oz.
Cassia Oil	⅛ fl. oz.
Turpentine	½ fl. oz.

Melt the vaseline and paraffin wax together in a double boiler and then add the menthol. Remove from the heat, stir, and cool a little; then stir in the oils, turpentine, and acid. When it begins to thicken pour into tins and cover.

Insect Repellents

Preparations of this type may irritate sensitive skins. Moreover, they will not always work. Psychologically they often are helpful, even though they may not keep insects away, because they give one confidence of protection.

Mosquito Repelling Oil

Cedar Oil	2 fl. oz.
Citronella Oil	4 fl. oz.
Spirits of Camphor	8 fl. oz.

Just shake together in a dry bottle and it is ready for use. This preparation may be smeared on the skin as often as is necessary to repel mosquitoes and other insects.

Fly Sprays

Fly sprays usually consist of deodorized kerosene, perfuming material, and an active insecticide. In some cases they merely stun the flies who may later recover and begin buzzing again.

Fly Spray

Deodorized Kerosene	89 fl. oz.
Methyl Salicylate	1 fl. oz.
Pyrethrum Powder	10 oz.

Mix thoroughly by stirring from time to time; allow to stand covered over night and then filter through muslin.

Caution: This spray is inflammable and should not be used near open flames.

Deodorant Spray

(For public buildings, sick-rooms, lavatories, etc.)

Pine Needle Oil	2 oz.
Formaldehyde	2 oz.
*Acetone	6 oz.
*Isopropyl Alcohol	20 oz.

One ounce of the above is mixed with a pint of water for spraying.

Cresol Disinfectant

†Caustic Soda	25½ g.
Water	140 cc.

Dissolve the above in a pyrex or enamelled dish and warm it. To this add slowly the following warmed mixture:

†Cresylic Acid	500 cc.
Rosin	170 g.

Stir until dissolved and add water to make 1000 cc.

Ant Poison

Sugar	1 lb.
Water	1 qt.
‡Arsenate of Soda	125 g.

Boil and stir until uniform; strain through muslin; add a spoonful of honey.

Bedbug Exterminator

*Kerosene	90 fl. oz.
Clove Oil	5 fl. oz.
§Cresol	1 fl. oz.
Pine Oil	4 fl. oz.

Simply shake and bottle.

Mothproofing Fluid (Non-Staining)

Sodium Aluminum Silicofluoride	½ oz.
Water	98 oz.
Glycerin	½ oz.
Sulfatate (Wetting Agent)	¼ oz.

Stir until dissolved.

Fly Paper

Rosin	32 oz.
Rosin Oil	20 oz.
Castor Oil	8 oz.

Heat the above in an aluminum or enamelled pot on a gas stove with stirring until all the rosin has melted and dissolved. While hot pour on firm paper sheets of suitable size which have been brushed with soap water just before coating. Smooth out the coating with a long knife or piece of thin flat wood and allow to cool. If a

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* Inflammable.
† Do not get this on skin as it is corrosive.
‡ Poison.
§ Corrosive to skin.

heavier coating is desirable increase the amount of rosin used. Similarly a thinner coating is gotten by reducing the amount of rosin. The finished paper should be laid flat and not exposed to undue heat.

Household Baking Powder

Bicarbonate of Soda	28 oz.
Mono Calcium Phosphate	35 oz.
Corn Starch	27 oz.

Mix the above powders thoroughly in a dry can by shaking and rolling for a half hour. Pack into dry air-tight tins as moisture will cause lumping.

Malted Milk Powder

Malt Extract, Powdered	5 oz.
Skim Milk, Powdered	2 oz.
Sugar, Powdered	3 oz.

Mix thoroughly by shaking and rolling in a dry can. Pack in an air-tight container.

Cocoa Malt Powder

Corn Sugar	55 oz.
Malt, Powdered, Mild	19 oz.
Skim Milk, Powdered	12½ oz.
Cocoa	13 oz.
Vanillin	⅛ oz.
Salt, Powdered	⅜ oz.

Mix thoroughly and then run through a fine wire sieve.

Sweet Cocoa Powder

Cocoa	17½ oz.
Sugar, Powdered	32½ oz.
Vanillin	¾ g.

Mix thoroughly and sift.

Pure Lemon Extract

Lemon Oil U.S.P.	6½ fl. oz.
Alcohol	121½ fl. oz.

Shake together in a gallon jug till dissolved.

Artificial Vanilla Flavor

Vanillin	¾ oz.
Coumarin	¼ oz.
Alcohol	2 pt.

Stir the above in a glass or china pitcher until dissolved. Then stir in the following solution which has been made by stirring in another pitcher.

Sugar	12 oz.
Water	5¼ pt.
Glycerin	1 pt.

Color brown by adding sufficient "burnt" sugar coloring.

Canary Bird Food

Yolk of Eggs, Dried and Chopped	2 oz.
Poppy Heads (Coarse Powder)	1 oz.
Cuttlefish Bone (Coarse Powder)	1 oz.
Granulated Sugar	2 oz.
Soda Crackers, Powdered	8 oz.

Mix well together.

Writing Ink (Blue-Black)

Naphthol Blue Black	1 oz.
Gum Arabic, Powdered	½ oz.
Carbolic Acid	¼ oz.
Water	1 gal.

Stir together in a glass or enamelled vessel until dissolved.

Laundry Marking Ink (Indelible)

A. Soda Ash	1 oz.
Gum Arabic, Powdered	1 oz.
Water	10 fl. oz.

Stir the above until dissolved.

B. Silver Nitrate	4 oz.
Gum, Arabic Powdered	4 oz.
Lampblack	2 oz.
Water	40 fl. oz.

Stir this in a glass or porcelain dish until dissolved. Do not expose this to strong light or it will spoil. Finally pour into a brown glass bottle. In using these solutions wet the cloth with solution A and allow to dry. Then write on it with solution B using a quill pen.

Marking Crayon (Green)

Ceresin	8 oz.
Carnauba Wax	7 oz.
Paraffin Wax	4 oz.
Beeswax	1 oz.
Talc	10 oz.
Chrome Green	3 oz.

Melt the first four ingredients in any container and then add the last two slowly while stirring. Remove from the heat and continue stirring until thickening begins. Then pour into molds. If other color crayons are desired, other pigments may be used. For example for black, use carbon or bone-black; for blue, Prussian blue; for red, orange chrome yellow.

Antique Coloring for Copper

Copper Nitrate	4 oz.
Acetic Acid	1 oz.
Water	2 oz.

Dissolve by stirring together in a

glass or porcelain vessel. Pack in glass bottles.

To Use: Wet the copper to be colored and apply the above solution hot.

Blue-Black Finish on Steel

a. Place object in molten sodium nitrate (700–800° F.) for 2–3 minutes. Remove and allow to cool somewhat; wash in hot water; dry and oil with mineral or linseed oil.

b. Place in following solution for 15 minutes:

Copper Sulphate	½ oz.
Iron Chloride	1 lb.
Hydrochloric Acid	4 oz.
Nitric Acid	⅛ oz.
Water	1 gal.

Then allow to dry for several hours; place in above solution again for 15 min.; remove and dry for 10 hours. Place in boiling water for ½ hour; dry and scratch brush very lightly. Oil with mineral or linseed oil and wipe dry.

Rust Prevention Compound

Lanolin	1 oz.
*Naphtha	2 oz.

Mix until dissolved.

The metal to be protected is cleaned with a dry cloth and then coated with the above composition.

Metal Polish

Naphtha	62 oz.
Oleic Acid	⅛ oz.
Abrasive	7 oz.
Triethanolamine Oleate	⅛ oz.
Ammonia (26°)	1 oz.
Water	1 gal.

In one container mix together the naphtha and oleic acid to a clear solution. Dissolve the triethanolamine oleate in water separately, stir in the abrasive, if it is of a clay type, and then add the naphtha solution. Stir the resulting mixture at a high speed until a uniform creamy emulsion results. Then add the ammonia and mix well, but do not agitate as vigorously as before.

Glass Etching Fluid

Hot Water	12 fl. oz.
†Ammonium Bifluoride	15 oz.
Oxalic Acid	8 oz.
Ammonium Sulfate	10 oz.
Glycerin	40 oz.
Barium Sulfate	15 oz.

Warm the washed glass slightly before writing on it with this fluid. Allow the fluid to act on the glass for about two minutes.

Leather Preservative

Neatsfoot Oil (Cold Pressed)	10 oz.
Castor Oil	10 oz.

Just shake together.

This is an excellent preservative for leather book bindings, luggage and other leather goods.

White Shoe Dressing

Lithopone	19 oz.
Titanium Dioxide	1 oz.
Shellac (Bleached)	3 oz.
Ammonium Hydroxide	¼ fl. oz.
Water	25 fl. oz.
Alcohol	25 fl. oz.
Glycerin	1 oz.

Dissolve the last four ingredients by mixing in a porcelain vessel. When dissolved stir in the first two pigments. Keep in stoppered bottles and shake before using.

Waterproofing for Shoes

Wool Grease	8 oz.
Dark Petrolatum	4 oz.
Paraffin Wax	4 oz.

Melt together in any container. Apply this grease warm but never hotter than the hand can bear.

Polishes

Polishes are usually used to restore the original lustre and finish of a smooth surface. As a secondary purpose they are expected to clean the surface and also to prevent corrosion or deterioration. There is no one polish which will give good results on all surfaces.

Most polishes depend on oil or wax for their lustering or polishing properties. Oil polishes are applied easily but the surfaces on which they are used attract dust and show finger marks. Wax polishes are more difficult to apply but are more lasting.

Oil or wax polishes are of two types: waterless and with water. The former are clear or translucent and the latter are milky in appearance.

For use on metals abrasives of various kinds such as tripoli, silica dust or infusorial earth are incorporated to grind away oxide films or corrosion products present.

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* Inflammable—keep away from flames.

† Corrosive.

Shoe Polish (Black)

Carnauba Wax	5½ oz.
Crude Montan Wax	5½ oz.

Melt together in a double boiler (the water in outer container should be at a boil) then stir in the following melted and dissolved mixture:

Stearic Acid	2 oz.
Nigrosine Base	1 oz.

Then stir in

Ceresin	15 oz.

Remove all flames and run in slowly, while stirring

Turpentine	90 fl. oz.

Allow mixture to cool to 105° F. and pour into air-tight tins which should be allowed to stand undisturbed over night.

Auto Polish (Clear Oil Type)

Paraffin (Mineral) Oil	5 pt.
Raw Linseed Oil	2 pt.
China Wood Oil	½ pt.
*Benzol	¼ pt.
Kerosene	¼ pt.
Amyl Acetate	1 tbsp.

Shake together in a glass jug and keep stoppered.

Auto and Floor Wax (Paste Type)

Yellow Beeswax	1 oz.
Ceresin	2½ oz.
Carnauba Wax	4½ oz.
Montan Wax	1¼ oz.
*Naphtha or Mineral Spirits	1 pt.
*Turpentine	2 oz.
Pine Oil	½ oz.

Melt the waxes together in a double boiler. Turn off the heat and run in the last three ingredients in a thin stream and stir with a fork. Pour into cans; cover and allow to stand undisturbed overnight.

Furniture Polish (Oil and Wax Type)

Thin Paraffin (Mineral Oil	1 pt.
Carnauba Wax, Powdered	¼ oz.
Ceresin Wax	⅛ oz.

Heat together until all of the wax is melted. Allow to cool and pour into bottles before mixture turns cloudy.

Polishing Wax (Liquid)

Beeswax, Yellow	1 oz.
Ceresin Wax	4 oz.

Melt together and then cool to 130° F.; turn off all flames and stir in slowly.

*Turpentine	17 fl. oz.
Pine Oil	½ fl. oz.

Pour into cans or bottles which are closed tightly to prevent evaporation.

Floor Oil

Mineral Oil	46 fl. oz.
Beeswax	½ oz.
Carnauba Wax	1 oz.

Heat together in double boiler until dissolved (clear). Turn off flame and stir in

*Turpentine	3 fl. oz.

Lubricants

Lubricants in the form of oils or greases are used to prevent friction and wearing of parts which rub together. Lubricants must be chosen to fit specific uses. They consist of oils and fats often compounded with soaps and other unctuous materials. For heavy duty heavy oils or greases are used and light oils for light duty.

Gun Lubricant

White Petrolatum	15 oz.
Bone Oil (Acid Free)	5 oz.

Warm gently and mix together.

Graphite Grease

Ceresin	7 oz.
Tallow	7 oz.

Warm together and gradually work in, with a stick

Graphite	3 oz.

Stir until uniform and pack in tins when thickening begins.

Penetrating Oil

(For freeing rusted bolts, screws, etc.)

Kerosene	2 oz.
Thin Mineral Oil	7 oz.
Secondary Butyl Alcohol	1 oz.

Shake together and keep in a stoppered bottle.

Molding Material

White Glue	13 lb.
Rosin	13 lb.
Raw Linseed Oil	⅛ qt.
Glycerin	1 qt.
Whiting	19 lb.

This mixture is prepared by cooking the white glue until it is dissolved. Then cook separately the rosin and raw linseed oil until they are dissolved. Add the rosin, oil, and glycerin to the cooked glue, stirring in the whiting until the mass makes up to

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* Inflammable—Keep away from flames.

* Inflammable.

the consistency of putty. Keep the mixture hot.

Place this putty mass in the die, pressing it firmly into the same and allowing it to cool slightly before removing. The finished product is ready to use within a few hours after removal. Suitable colors can be added to secure brown, red, black or other color.

In applying ornaments made of this composition to a wood surface, they are first steamed to make them flexible; in this condition they can be glued to the wood surface easily and securely. They can be bent to any shape, and no nails are required for applying them.

Grafting Wax

Wool Grease	11 oz.
Rosin	22 oz.
Paraffin Wax	6 oz.
Beeswax	4 oz.
Japan Wax	1 oz.
Rosin Oil	9 oz.
Pine Oil	1 oz.

Melt together until clear and pour into tins. This composition can be made thinner by increasing the amount of rosin oil and thicker by decreasing it.

Candles

Paraffin Wax	30 oz.
Stearic Acid	17½ oz.
Beeswax	2½ oz.

Melt together and stir until clear. If colored candles are desired a pinch of any oil soluble dye is dissolved at this stage. Pour into vertical molds in which wicks are hung.

Adhesives

Adhesives are sticky substances used to unite two surfaces. Adhesives are specifically called glues, pastes, cements, mucilages, lutes, etc. For different uses different types are required.

Wall Patching Plaster

Plaster of Paris	32 oz.
Dextrin	4 oz.
Pumice Powder	4 oz.

Mix thoroughly by shaking and rolling in a dry container. Keep away from moisture.

Cement Floor Hardener

Magnesium Fluosilicate	1 lb.
Water	15 pt.

Mix until dissolved.

In using this, the cement should first be washed with clean water and then drenched with the above solution.

Paperhanger's Paste

Use a cheap grade of rye or wheat flour, mix thoroughly with cold water to about the consistency of dough or a little thinner, being careful to remove all lumps. Stir in a tablespoonful of powdered alum to a quart of flour, then pour in boiling water, stirring rapidly until the flour is thoroughly cooked. Let this cool before using and thin with cold water.

a.	White or Fish Glue	4 oz.
	Cold Water	8 oz.
b.	Venice Turpentine	2 fl. oz.
c.	Rye Flour	1 lb.
	Cold Water	16 fl. oz.
d.	Boiling Water	64 fl. oz.

Soak the 4 oz. of glue in the cold water for 4 hours. Dissolve on a water bath (glue-pot) and while hot stir in the Venice turpentine. Make up *c* into a batter free from lumps and pour into *d.* Stir briskly, and finally add the glue solution. This makes a very strong paste, and it will adhere to a painted surface, owing to the Venice turpentine in its composition.

Aquarium Cement

Litharge	10 oz.
Plaster of Paris	10 oz.
Powdered Rosin	1 oz.
Dry White Sand	10 oz.
Boiled Linseed Oil	Sufficent

Mix all together in the dry state, and make into a stiff putty with the oil when wanted for use.

Do not fill the aquarium for three days after cementing. This cement hardens under water, and will stick to wood, stone, metal, or glass, and, as it resists the action of sea-water, it is useful for marine aquaria. The linseed oil may have an addition of drier to the putty made up four or five hours before use, but after standing fifteen hours, however, it loses its strength when in the mass.

Wood Dough Plastic

*Collodion	86 g.
Ester Gum, Powdered	9 g.
Wood Flour	30 g.

Allow first two ingredients to stand until dissolved, stirring from time to time. Then while stirring add the wood flour a little at a time until

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* Inflammable.

uniform. This product can be made softer by adding more collodion.

Putty

Whiting	80 oz.
Raw Linseed Oil	16 oz.

Rub together until smooth. Keep in closed container.

Wood Floor Bleach

Sodium Metasilicate	90 oz.
Sodium Perborate	10 oz.

Mix thoroughly and keep dry in a closed can. Use 1 pound to a gallon of boiling water. Mop or brush on the floor, allow to stand ½ hour, then rub off and rinse well with water.

* Paint Remover

Benzol	5 pt.
Ethyl Acetate	3 pt.
Butyl Acetate	2 pt.
Paraffin Wax	½ lb.

Stir together until dissolved.

Soaps and Cleaners

Soaps are made from a fat or fatty acid and an alkali. They lather and produce a foam which entraps dirt and grease which is washed away with water. There are numerous kinds of soaps depending on the uses to which they are to be put.

Cleaners consist of solvent such as naphtha with or without a soap. Abrasive cleaners are soap pastes containing powdered pumice, stone, silica, etc.

Liquid Soap (Concentrated)

Water	11 oz.
†Caustic Potash (Solid)	1 oz.
Glycerin	4 oz.
Red Oil (Oleic Acid)	4 oz.

Dissolve the caustic in water, add the glycerin and bring to a boil in an enamelled pot. Remove from heat, add the red oil slowly while stirring. If a more neutral soap is wanted, use a little more red oil.

Saddle Soap

Beeswax	5 oz.
†Caustic Potash	0.8 oz.
Water	8 oz.

Boil for 5 minutes while stirring. In another vessel heat

Castile Soap	1.6 oz.
Water	8 oz.

Mix the two with good stirring; remove from heat and add

Turpentine	12 oz.

while stirring.

Mechanics Hand Soap Paste

Water	1.8 qt.
White Soap Chips	1.5 lb.
Glycerin	2.4 oz.
Borax	6 oz.
Dry Sodium Carbonate	3 oz.
Coarse Pumice Powder	2.2 lb.
Safrol	enough to scent

Dissolve the soap in ⅔ of the water by heat. Dissolve the last three in the rest of the water. Pour the two solutions together and stir well. When it begins to thicken, sift in the pumice, stirring constantly till thick, then pour into cans. Vary amount of water, for heavier or softer paste (water cannot be added to the finished soap).

Dry Cleaning Fluid

Glycol Oleate	2 fl. oz.
Carbon Tetrachloride	60 fl. oz.
Varnoline (Naphtha)	20 fl. oz.
Benzine	18 fl. oz.

An excellent cleaner that will not injure the finest fabrics.

Wall Paper Cleaner

Whiting	10 lb.
Magnesia Calcined	2 lb.
Fuller's Earth	2 lb.
Pumice Powder	12 oz.
Lemenone or Citronella Oil	4 oz.

Mix well together.

Household Cleaner

Soap Powder	2 oz.
Soda Ash	3 oz.
Trisodium Phosphate	40 oz.
Finely Ground Silica	55 oz.

Mix well and put up in the usual containers.

Window Cleanser

Castile Soap	2 oz.
Water	5 oz.
Chalk	4 oz.
French Chalk	3 oz.
Tripoli Powder	2 oz.
Petroleum Spirits	5 oz.

Mix well and pack in tight containers.

Straw Hat Cleaner

Sponge the hat with a solution of

Sodium Hyposulphite	10 oz.
Glycerin	5 oz.

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* Inflammable.

† Do not get on skin as it is corrosive.

Alcohol	10 oz.
Water	75 oz.

Lay aside in a damp place for 24 hours and then apply

Citric Acid	2 oz.
Alcohol	10 oz.
Water	90 oz.

Press with a moderately hot iron after stiffening with gum water if necessary.

Grease, Oil, Paint & Lacquer Spot Remover

Alcohol	1 oz.
Ethyl Acetate	2 oz.
Butyl Acetate	2 oz.
Toluol	2 oz.
Carbon Tetrachloride	3 oz.

Place garment with spot over a piece of clean paper or cloth and wet with the above fluid; rub with clean cloth toward center of spot. Use a clean section of cloth for rubbing and clean paper or cloth for each application of the fluid. The above product is inflammable and should be kept away from flames. Use of cleaners of this type should be out-of-doors or in well-ventilated rooms as the fumes are toxic.

Paint Brush Cleaner

Mix (1)	
Kerosene	2 pt.
Oleic Acid	1 pt.
Mix (2)	
Strong Liquid Ammonia, 28%	¼ pt.
Denatured Alcohol	¼ pt.

Slowly stir 2 into 1 until a smooth mixture results. To clean brushes, pour into a can and stand the brushes in it overnight. In the morning, wash out with warm water.

Rust & Ink Remover

Immerse portion of fabric with rust or ink spot alternately in Solution A and B, rinsing with water after each immersion.

Solution A	
Ammonium Sulphide Solution	1 oz.
Water	19 oz.
Solution B	
*Oxalic Acid	1 oz.
Water	19 oz.

Javelle Water (Laundry Bleach)

Bleaching Powder	2 oz.
Soda Ash	2 oz.
Water	5 gal.

Mix well until reaction is completed. Allow to settle overnight and siphon off the clear liquid.

Laundry Blue (Liquid)

Prussian Blue	1 oz.
Distilled Water	32 oz.
*Oxalic Acid	¼ oz.

Dissolve by mixing in a crock or wooden tub.

"Glassine" Paper

Paper is coated with or dipped in the following solution and then hung up to dry.

Gum Copal	10 oz.
Alcohol	30 fl. oz.
Castor Oil	1 fl. oz.

Dissolve by letting stand overnight in a covered jar and stirring the next day.

Waterproofing Paper and Fibreboard

The following composition and method of application will render uncalendered paper, fibreboard, and similar porous material waterproof and proof against the passage or penetration of water.

Paraffin (Melting Point about 130° F.)	22.5 oz.
Trihydroxyethylamine Stearate	3.0 oz.
Water	74.5 oz.

The paraffin wax is melted and the stearate added to same. The water is then heated to nearly boiling and then vigorously agitated with a suitable mechanical stirring device while the above mixture of melted wax and emulsifier is slowly added. This mixture is cooled while it is stirred.

The paper or fibreboard is coated on the side which is to be in contact with water. This is then quickly heated to the melting point of the wax, which then coalesces into a continuous film that does not soak into the paper which is preferentially wetted by the water. This method works most effectively on paper pulp moulded containers and possesses the advantages of being much cheaper than dipping in melted paraffin as only about a tenth as much paraffin is needed. In addition, the outside of the container is not greasy, and can be printed upon after treatment which is not the case when treated with melted wax.

Waterproofing Liquid

Paraffin Wax	⅝ oz.

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* Poisonous.

* Poison.

Gum Dammar	**1⅛ oz.**
Pure Rubber	**⅛ oz.**
Benzol	**13 oz.**
Carbon Tetrachloride to make	**1 gal.**

Dissolve rubber in benzol; add other ingredients and allow to dissolve. (Inflammable.)

The above is suitable for wearing apparel and wood. It is applied by brushing on two or more coats, allowing each to dry before applying another coating. Apply outdoors as vapors are inflammable and toxic.

Waterproofing Heavy Canvas

Raw Linseed Oil	**1 gal.**
Beeswax, Crude	**13 oz.**
White Lead	1 lb.
Rosin	**12 oz.**

Heat the above, while stirring, until all lumps are gone and apply warm to upper side of canvas; wetting the canvas with a sponge on the underside before applying.

Cement Waterproofing

Chinawood Oil Fatty Acids	**10 oz.**
Paraffin Wax	10 oz.
Kerosene	2½ gal.

Stir until dissolved. This is painted or sprayed on cement walls, which must be dry.

Oil and Greaseproofing Paper and Fibreboard

This solution applied by brush, spray, or dipping will leave a thin film which is impervious to oils and grease. Applied to paper or fibre containers, it will enable them to retain oils and greases. All the following ingredients are by weight:

Starch	**6.6 oz.**
Caustic Soda	**0.1 oz.**
Glycerin	**2.0 oz.**
Sugar	**0.6 oz.**
Water	**90.5 oz.**
Sodium Salicylate	**0.2 oz.**

The caustic soda is dissolved in the water and then the starch is made into a thick paste by adding a portion of this solution. This paste is then added to the water. This mixture is placed in a water jacket and heated to about 85° C. until all the starch granules have broken and the temperature maintained for about half an hour longer. The other substances are then added and thoroughly mixed and the composition is completed and ready for application. A smaller water content may be used if applied hot and a thicker coating will result. Two coats will result in a very considerable resistance to oil penetration.

Fireproof Paper

Ammonium Sulphate	8 oz.
Boric Acid	3 oz.
Borax	1¾ oz.
Water	100 fl. oz.

Mix together in a gallon jug, by shaking, until dissolved.

The paper to be treated is dipped into this solution in a pan, until uniformly saturated. It is then taken out and hung up to dry. Wrinkles can be prevented by drying between cloths in a press.

Fireproofing Canvas

Ammonium Phosphate	1 lb.
Ammonium Chloride	2 lb.
Water	½ gal.

Impregnate with above; squeeze out excess and dry. Washing or exposure to rain will remove fireproofing salts.

Fireproofing Light Fabrics

Borax	10 oz.
Boric Acid	8 oz.
Water	1 gal.

Impregnate; squeeze and dry. Fabrics so impregnated must be treated again after washing or exposure to rain as the fireproofing salts wash out easily.

Dry Fire Extinguisher

Ammonium Sulphate	15 oz.
Sodium Bicarbonate	9 oz.
Ammonium Phosphate	1 oz.
Red Ochre	2 oz.
Silex	23 oz.

Use powdered materials only; mix well and pass through a fine sieve. Pack in tight containers to prevent "lumping."

Fire Extinguishing Liquid

Carbon Tetrachloride	95 oz.
Solvent Naphtha	5 oz.

The inclusion of the naphtha minimizes production of toxic fumes when extinguishing fires.

Fire Kindler

Rosin or Pitch	10 oz.
Sawdust	10 or more oz.

Melt, mix, and cast in forms.

Solidified Gasoline

*Gasoline	**½ gal.**

*** Inflammable.**

White Soap (Fine Shaved)	12	oz.
Water	1	pt.
Household Ammonia	5	oz.

Heat the water, add soap, mix and when cool add the ammonia. Then slowly work in the gasoline to form semi-solid mass.

Boiler Compound

Soda Ash	87 oz.
Trisodium Phosphate	10 oz.
Starch	1 oz.
Tannic Acid	2 oz.

Use powdered materials, mixing well and then pass through a fine sieve.

Anti-Freezes

The materials listed below are the basic ingredients used in all good anti-freeze liquids. Of these, alcohol is the only one that evaporates. Radiators containing alcohol should be tested from time to time to be sure of protection. A hydrometer for testing alcohol solution strength can be bought from sellers of denatured alcohol.

Anti-Freeze Liquids

Pints of anti-freeze per gal. of water for protection at:

	+10° F.	0° F.	—10° F.	—20° F.
Denatured Alcohol 180° proof	3.4	4.9	6.5	8.3
Denatured Alcohol 188° proof	3.3	4.7	6.0	7.7
Glycerin 95%	3.3	5.3	7.1	9.0
Radiator Glycerin 60%	10.0	18.7	39.0	106.5
Ethylene Glycol 95%	2.7	4.0	5.1	6.5

Specific gravity for protection at:

	+10° F.	0° F.	—10° F.	—20° F.	—30° F.
Denatured Alcohol	0.968	0.959	0.950	0.942	0.921
Glycerin	1.090	1.112	1.131	1.147	1.158
Ethylene Glycol	1.038	1.048	1.056	1.064	1.069

Soldering Flux (Non-corrosive)

Rosin, Powdered	1 oz.
Denatured Alcohol	4 oz.

Soak overnight and mix well.

Photographic Solutions

Developing Solution

Stock Solution A

Dissolve the following, separately, in glass or enamel dishes.

Pyro	4 oz.
Sodium Bisulphite, Pure	280 gr.
Potassium Bromide	32 gr.
Distilled Water	64 oz.

Stock Solution B

Sodium Sulphite, Pure	7 oz.
Sodium Carbonate, Pure	5 oz.
Distilled Water	64 oz.

To use take the following proportions:

Stock Solution A	2 oz.
Stock Solution B	2 oz.
Distilled Water	16 oz.

At a temperature of 65° F. this developer requires about 8 minutes.

Acid Hardening Fixing Bath

A.	Sodium Hyposulphite	32 oz.
	Distilled Water	8 oz.

Stir until dissolved and then add the following chemicals in the order given below, stirring each until dissolved:

B.	Distilled Water (Warm)	2½ oz.
	Sodium Sulphite, Pure	½ oz.
	Acetic Acid (28%), Pure	1½ oz.
	Potassium Alum Powder	½ oz.

Add Solution B to A and store in dark bottles away from light.

CHAPTER TWO

ADHESIVES FOR PAPER

Formula No. 1

a. Borax	4 lb.
Water	66 lb.
b. Dextrin, Light	70 lb.
c. Glucose	5 lb.

Dissolve *a* at about 40°C. and pour it on *b*, mixing to get the desired dextrin solution. Now add *c*. Mix.

No. 2

(Waterproof)

Incorporate 10% dry weight of a resin emulsion into latex having a solids content of about 35%.

No. 3

(For Envelopes)

Mastic Resin	60 g.
Rosin	320 g.
Sandarac Resin	100 g.
Ether	100 g.
Alcohol	500 g.

No. 4

(For Envelopes)

Sandarac Resin	10 g.
Copal Resin	3 g.
Orange Shellac	4 g.
Rosin	3 g.
Venice Turpentine	2 g.
Turpentine	40 cc.
Alcohol	40 cc.

No. 5

(Cold Seal for Envelopes)

U. S. Patent 2,142,193

Asbestos Meal	8.7 oz.
Cellulose Acetate	2.5 oz.
Coloring Matter	1.3 oz.
Ethyl Acetanilide	0.4 oz.
Triphenyl Phosphate	0.4 oz.
Rubber Hydrochloride	0.9 oz.
Methylene Chloride	10.2 oz.
Methanol	0.6 oz.

No. 6

(Library)

Pale Crepe Rubber	100 g.
Zinc Oxide	3 g.
Stearic Acid	2 g.
Agerite White (Antioxidant)	1 g.
Aviation Gasoline	1 pt.

No. 7

(Photo-Library)

White Dextrin	10 oz.
Potato Starch	10 oz.
Water	7 pt.

Make into a paste with part of the water. Add the rest of the water and heat on a steam bath (or use a double boiler) until a smooth solution results. Stir constantly and add, with continued stirring:

Glycerin	3 oz.
Phenol	30 drops
Formaldehyde	⅛ oz.
Sassafras Oil	10 drops

No. 8

(Photos)

Dextrin, White	24 kg.
Water	46 l.
Ginger Grass Oil	10 g.

No. 9

(For Waxed Paper)

Shellac	25 g.
Copaiba Balsam	5 g.
Alcohol	70 g.

No. 10

(For Wall Paper)

Methyl Cellulose	1 oz.
Water (Boiling)	40–60 oz.

Pour boiling water over the methyl cellulose, to swell it. Cool and stir until uniform.

No. 11

(Thermoplastic Label)

A label adhesive which dries on the labels yet is sufficiently thermoplastic to permit application to carton with a hot iron, is as follows:

Ethyl Cellulose (Low Viscosity)	20 oz.
Batavia Dammar A/E	40 oz.
Paraffin Wax	2 oz.
Toluol	116 oz.
Anhydrous Alcohol	14.5 oz.
Butyl Acetate	14.5 oz.

No. 12

(For Oily or Waxy Surfaces)

U. S. Patent 2,162,194

Potassium Hydroxide	0.5 g.
Animal Glue	12.5 g.
Water	85.0 cc.
Rezinel	7.5 g.
Trihydroxyethylamine Abietate (Hydroresin)	25.0 g.

In making up the adhesive above

described, it is preferable first to dissolve the caustic alkali in about twenty-five parts of water heated to the boiling point, or thereabouts. The hydroresin and the rezinel then are added, these ingredients preferably having first been heated to a temperature of 50° C. prior to stirring them into the alkali solution. The glue, which desirably is in a granulated form, is first dissolved in the remaining proportion of the water, say sixty parts, heated to a temperature of 80° C., or thereabouts, and the two solutions then are mixed together and stirred until they are well blended.

No. 13

(For Labeling Machines)

Water, Distilled	150 l.
Dextrin	300 kg.
Sodium Bisulphite	2 kg.
Alum	4 kg.
Formaldehyde, Concentrated	6 kg.

No. 14

(For All Kinds of Surfaces)

German Patent 626,010

a. Gum Arabic	75 g.
Water (Heated to 50°C)	100 g.
b. Crude Rubber (In Small Pieces)	10 g.
c. Lime Water (Saturated)	300 g.
d. Sodium Sulphate	5 g.
e. Starch	50 g.
Lime Water (Saturated)	300 g.
f. Waterglass	50 g.
Water	500 g.

Prepare *a* and add *b* at 50°C. Add *a* and *b* to boiling *c*, boil for 30 minutes and add *d*.

To this mixture add the paste *c* obtained by boiling, and add *e* and *f*.

Boil the whole for 20 minutes, and let cool.

No. 15

(Glass to Paper)

Hungarian Patent 121,456

Gelatin	500 g.
Water	7500 g.
Calcium Chlorate (26°Bé.)	750 cc.
Boric Acid	100 g.

PAPER TO METAL

No. 16

Glue (Flake)	45 g.
Cold Water	55 g.
Calcium Chloride, Anhydrous	13 g.
Phenol	0.5 g.

Swell the glue in the water, and dissolve finally without boiling. In the solution dissolve the calcium chloride, and preserve with the phenol.

No. 17

a. Wheat Starch	400 g.
Water	1000 g.
b. Gelatin	40 g.
Water, Boiling	1800 g.
c. Sodium Silicate Solution	400 g.
d. Turpentine	200 g.

To the hot solution *b* add the paste *a* in a slow jet, stirring thoroughly. To this add *c* and *d*.

No. 18

Rosin	60 g.
Mastic	10 g.
Sandarac	20 g.
Ether	5 g.
Alcohol	75–100 g.

No. 19

Alcoholic Shellac, Viscous.

No. 20

Cellulose Acetate Viscous Solution.

No. 21

Chromium Gelatin.

No. 22

Canada Balsam.

PAPER AND CELLULOID TO METAL

No. 23

a. Dextrin	40 g.
Glucose	1 g.
Water	40 g.
b. Aluminum Sulphate	1 g.
Water	30 g.
c. Glycerin	3 g.

Mix solutions *a* and *b* and heat until quite clear. Add *c*. Mix thoroughly.

No. 24

a. Gum Arabic	50 g.
Water	30 g.
b. Glycerin	10 g.
c. Antimony Trichloride	2 g.

Disperse *a*. Add *b*, *c*, mixing thoroughly.

No. 25

a. Orange Shellac	100 g.
Alcohol	200 g.
b. Linseed Oil Varnish	25 g.

Dissolve *a* and mix with *b*.

No. 26

Manila Copal or Rosin	100 g.
Caustic Potash	25 g.
Water, Boiling	200 g.

No. 27

Celluloid Waste	10 g.
Amyl Acetate	15 g.
Butyl Alcohol	10 g.
Benzene	25 g.
Ethyl Acetate	45 g.

No. 28

Celluloid	10 g.

Benzene	20 g.
Acetone	20 g.
Alcohol	25 g.
Butyl Acetate	30 g.

No. 29

Rosin	33 g.
Camphor	2 g.
Alcohol	65 g.

No. 30

Shellac, Powdered	2 g.
Borax, Powdered	4 g.
Casein, Powdered	5 g.
Water	to swell

No. 31

Fish Glue	10 g.
Celluloid Solution in Glacial Acetic Acid	10 g.

No. 32

Galipot	17 g.
Linseed Oil Fatty Acid	1 g.
Alcohol	5 g.

No. 33

Caustic Potash (50° Bé.)	1 g.
Alcohol	120 g.
Manila Copal Soft	70 g.
Elemi, Gum	10 g.

No. 34

Bleached Shellac	25 g.
Copaiba Balsam	5 g.
Alcohol	70 g.

No. 35

Starch	200 kg.
Sodium Silicate, 28–30° Bé.	150 kg.
Water	650 kg.
Preservative	5 kg.

Wet the starch with a little of the water, and add the rest of the water (boiling) to it. As soon as the gel is formed, add the waterglass in a thin jet with good agitation. Preserve when cooled.

FOR BAGS

No. 36

(Bag Adhesive)

a. Rubber Solution (8%)	40 lb.
b. Shellac Solution (15% Alcoholic)	40 lb.
Thick Turpentine	1–1.5 lb.

Mix solutions *a* and *b*.

No. 37

a. India Rubber (cut into small pieces)	18 lb.
b. Carbon Disulphide or Trichlorethylene	20 lb.
Benzene	10 lb.
Turpentine Oil	10 lb.

Dissolve *a* in the combined solvent *b*.

No. 38

a. India Rubber	6 lb.
Trichlorethylene	30 lb.
b. Shellac or Rosin	10–15 lb.
Alcohol	42 lb.

Mix the clear solutions *a* and *b*.

No. 39

a. Crude Rubber	5–8 lb.
Dichlorethylene	30 lb.
b. Shellac	5 lb.
Larch Turpentine	1 lb.
Alcohol	30 lb.
c. Castor Oil	0.5–1 lb.

Mix *a* and *b* and add the plasticizer *c*.

No. 40

a. Crude Rubber	1000 g.
Rosin	100 g.
Zinc White	100 g.
Lanolin	50 g.
b. Benzine (gasoline)	2000 g.

Dissolve *a* in *b* on water bath.

CELLOPHANE

Formula No. 1

Dextrin	33 g.
Water	45 cc.
Alcohol	15 cc.
Glycerol	5 g.

Mix well and filter if desired. The filtrate may be decolorized by 2 cc. lime-water (2%).

No. 2

Gum Arabic	17½ oz.
Water	15½ oz.
Glycerine	30 oz.
Formaldehyde	.05 oz.

No. 3

Dissolve 7 oz. of calcium chloride in its own weight of water. Place 5 oz. of leaf gelatin into 88 oz. of water brought to just below the boiling point. Mix the two solutions while hot.

CELLULOSE ACETATE FILM

Formula No. 1

Washed Safety X-Ray Film	10 g.
Glacial Acetic Acid	90 g.

No. 2

Cellulose Acetate (High Viscosity)	5 g.
Gelatin	5 g.
Glacial Acetic Acid	90 g.

Both of these compositions function in a similar manner, and make an excellent bond with a minimum of warping for this type of sheeting. The joint is almost invisible, and has a strength equivalent to the sheet itself.

CELLULOID TO METAL SURFACES

Rosin	33 g.
Camphor	2 g.
Alcohol	30 g.
Acetone	40 g.

CELLULOSE ACETATE

U. S. Patent 2,153,584

Formula No. 1

9 parts by weight of gelatin and 124 parts by weight of sugar are dissolved in 140 parts by weight of water. The solution obtained, which sets at ordinary temperatures and should be used at about 35–40° C., is very suitable for effecting adhesion between a cellulose acetate foil and paper, cardboard or the like.

No. 2

9 parts by weight of gelatin and 124 parts by weight of sugar are dissolved in 100 parts by weight of water. The solution obtained is similar to that in formula 1 except that it is more suitable for use in effecting adhesion between cellulose acetate foils or between a cellulose acetate foil and another article having a basis of cellulose acetate.

PORCELAIN AND CHINA

Formula No. 1

(Porcelain and Metal)

Calcium Fluoride, Finely Powdered	2 lb.
Glass, Powdered	1 lb.
Sodium Silicate (36–38°Bé.)	to form a dough

No. 2

(Not Heat and Solvent Resistant)

Venice Turpentine	10 lb.
Mastic	35 lb.
Bleached Shellac	50 lb.
Zinc Oxide	5 lb.

Melt the resins on a water bath. Add the pigment slowly with stirring.

Apply like a sealing wax, then press the hot fractured parts together, let cool.

No. 3

When a cement for porcelain, metals or stoneware is desired, casein mixed with sodium silicate and lime makes an efficient mixture.

Dried casein is soaked in an equal weight of water for two hours. The casein swells. Then the sodium silicate and lime are stirred in.

No. 4

This china glue is a vegetable product which is produced in the following manner: In a wooden vat which is provided with a wooden stirring device 10 kg. high grade potato flour and 40 litres of water are thoroughly mixed until a milky emulsion is formed. Then 2.4 kg. sodium hydroxide solution (40° Bé.) is gradually added in a thin stream under steady stirring whereby the mass is finally converted into a clear gelatinous glue. For the purpose of proper homogenation the stirring device should be operated at a speed of 60 revolutions per minute for a period of 1 to 2 hours whereupon through gradual addition of a mixture of 2.2 kg. nitric acid (36° Bé.) and 5 litres water, the starch glue which has been hydrolyzed by the sodium hydroxide solution becomes neutralized. After a further stirring for half an hour there is added to the uniformly white glue 40 g. phosphoric acid (sp. gr. 1.3) and finally for the purpose of preservation 400 g. formalin (formaldehyde 40%) and 50 g. betanaphthol. The finished glue may be slightly alkaline and neutralization need not be complete. If no stirring device is obtainable on which all the metal parts can be covered with wood, a wooden paddle may be used; however, the mixture will be rarely uniform as the stirring of the mass by hand is rather difficult.

TEXTILES

Felt to Glass, Wood, Metal

Formula No. 1

Rubber, Waste	40 lb.
Rosin	35 lb.
Linseed Oil Varnish	25 lb.

Melt together.

No. 2

a. Carbon Disulphide	80 lb.
Gutta Percha	20 lb.
b. Shellac	28 lb.
Venice Turpentine	2 lb.
Alcohol, Denatured	70 lb.

Mix solutions *a* and *b.*

No. 3

Gutta Percha	100 lb.
Asphalt	100 lb.
Turpentine	15 lb.

Melt together. Inflammable! Apply hot.

No. 4

a. Rubber	10 lb.
Petroleum, or other Solvent	100 lb.
b. Asphalt	20 lb.

Make solution *a;* melt *b* and add to *a* with stirring. Use warm.

No. 5

a. A 12% glue solution in water

b. A solution of 2 lb. of shellac in 6 lb. of alcohol

c. A solution of 4 g. of casein in 600 g. of water, containing enough ammonia.

Mix about equal parts just before

use. Put this on the felt, dry briefly, then warm up, and press against the other object.

No. 6

Wheat Flour	50 kg.
Water	200 kg.
Alum	1 kg.
Rosin, Powdered	4 kg.

No. 7

a. Gutta Percha	10 kg.
Dichlorethylene	20 kg.
Turpentine or Benzol	20 kg.
b. Asphaltum, Powdered, Syrian	30 kg.
or	
Shellac Solution, 5% in Alcohol	60 kg.

Make up the solution *a* and add the asphaltum powder, or the shellac solution *b*.

No. 8

(Thermoplastic)

U. S. Patent 2,120,054

A thermoplastic adhesive for use in uniting fabrics consists of 100 parts of a polymerized derivative of methacrylic acid, 10 parts dibutyl phthalate, and 1 part chlorinated rubber.

ADHESIVE TAPE COMPOSITION

British Patent 481,593

Formula No. 1

Copal Resin	80 g.
Castor Oil	20 g.

No. 2

Pitch	30 g.
Castor Oil	16 g.
Phenol-Formaldehyde Resin	54 g.

NON-ADHERING GUMMED TAPE

British Patent 482,225

The gummed surface is treated with a 10% solution of triethanolamine palmitate or an emulsion of an oil fat or wax.

LEATHER

Formula No. 1

Butyl Acetate	10 g.
Ethyl Acetate	25 g.
Gasoline	47 g.
Synthetic Rubber	18 g.

No. 2

U. S. Patent 2,163,610

Benzene	1–3 g.
Trichlorethylene	5½–2 g.
Plastic Chloroprene (Polymerized)	1 g.

(Leather and Rubber)

Finnish Patent 16,403

Carbon Disulphide	100 g.
Sulphur	5 g.
Crude Rubber	25 g.
Leather Powder	8 g.
Rosin Soot	12 g.
Ammonia	4 g.

The mixture dries to an elastic, waterproof film when exposed to the air.

BELT

Formula No. 1

Shellac	1 lb.
Gutta Percha	2.5 lb.
Carbon Disulphide	10 lb.
White Spirit	4 lb.
Turpentine	2 lb.

No. 2

Leather Glue	8 kg.
Fish Glue	3 kg.
Water	14 l.
Turpentine, Venice	1½ kg.
Phenol or Formaldehyde	70 g.

No. 3

Celluloid	2–3 lb.
Acetone	10 lb.

No. 4

Glue	100 g.
Water	100 g.
Glycerin	5 g.
Potassium Dichromate	3 g.

Soak glue in cold water then warm in double boiler. Add glycerin and dichromate.

SHOEMAKERS' RUBBER CEMENT

Benzine	1.2 l.
Para Rubber	40 g.
Rosin	30 g.

Stir (cold or on steam bath) until clearly dissolved.

LINOLEUM

Formula No. 1

Batu Scraped	30 lb.
High Solvency Petroleum Thinner (Union Solvent No. 8)	30 lb.
Fuller's Earth	40 lb.

Dissolve the batu in the high solvency petroleum thinner by mixing. Add the Fuller's earth and stir until it thoroughly into the resin solution until a uniform mixture is obtained.

No. 2

Manila DBB	30 lb.
Solox	15 lb.
Union Solvent No. 8	15 lb.
Fuller's Earth	40 lb.

No. 3

U. S. Patent 2,064,139

Oxidized Linseed Oil (Alcohol Soluble)	27–35 g.
Manila Gum	6–10 g.

Bentonite	35–40 g.
Alcohol	25 g.

WOOD

Powdered Casein Cold Glues

Formula No. 1

Lactic Acid Casein	70 lb.
Disodium Phosphate, Powdered	5 lb.
Calcium Hydroxide, Powdered from Marble	6 lb.
Sodium Fluoride, Powdered	4 lb.
Chalk, Powdered	12 lb.
Mineral Oil (Engler Viscosity at 50°C.=2)	3 lb.

Mix in a powder mixer. The mineral oil is used to wet the water-soluble salts.

No. 2

(Quick Dissolving)

Lactic Acid Casein	65 lb.
Trisodium Phosphate, Powdered	12 lb.
Marble Calcium Hydroxide, Powdered	15 lb.
Sodium Sulphite, Powdered	2 lb.
Infusorial Earth	4 lb.
Mineral Oil (Viscosity 2° Engler at 50°C.)	2 lb.

No. 3

(Long Working Life)

Lactic Acid Casein	70 lb.
Calcium Hydroxide, Powdered from Dolomite	15 lb.
Trisodium Phosphate, Powdered	4 lb.
Borax, Powdered	4 lb.
Infusorial Earth	5 lb.
Sodium Fluoride, Powdered	2 lb.

No. 4

(Quick Dissolving; Long Working Life)

Lactic Acid Casein	65 lb.
Calcium Hydroxide, Powdered from Dolomite	12 lb.
Trisodium Phosphate, Powdered	5 lb.
Sodium Silicate, Solid, Powdered	8 lb.
Light Spar, Powdered	8 lb.
Zinc Silico Fluoride, Powdered	2 lb.

No. 5

(For Veneer)

*Lactic Acid Casein	70 lb.
Borax, Powdered	8.6 lb.
Calcium Hydroxide, from Marble	12 lb.
Chalk, Powdered	4 lb.
Infusorial Earth	5 lb.
Preservative	0.4 lb.

Veneer

German Patent No. 629,586

No. 6

a. Casein	60 kg.
Water, Cold	100 l.
b. Triethanolamine	10 kg.
Water	200 l.

Mix the paste *a* with the hot (60° C.) solution *b*, stirring and keeping at 60° C. until homongeneous.

No. 7

a. Casein	60 kg.
Water	100 l.
b. Borax	9.2 kg.
Water	100 l.
Triethanolamine	10 kg.

Procedure as in No. 1.

No. 8

(Soya Bean)

An adhesive of satisfactory quality can be made by using the formula:

Soya Protein	100 oz.
Calcium Oxide	15 oz.
Water	500 oz.
Sodium Silicate	7 oz.
Cement	2 oz.

Carpenter's Veneer

Formula No. 1

Slaked Marble Lime	20 g.
Sodium Fluoride	5 g.
Sodium Sulphite	3 g.
Petroleum	3 g.
Casein, Dry, Ground	69 g.

No. 2

Powdered Glue	50–75 lb.
Calcium Phosphate	50–25 lb.

No. 3

German Patent No. 605,756

a. Glue	100 kg.
Water	200 kg.
b. Urea	8 kg.
c. Glycerin, or Glycol	8 kg.

Soak *a* and dissolve completely by heating. Add *b* and *c*. Make boils in a suitable machine.

No. 4

Swiss Patent 192,582

Starch Flour	20 g.
Sodium Naphthalene Sulphonate	10 g.
Bone Glue	80 g.
Formaldehyde	4 g.
Water	100 g.
Sodium Bisulphite	2 g.

No. 5

(Cabinet Makers')

Glue	175 g.
Glycerin	10 g.
Water	175 g.

---

* Acidity: 10 g. use 0.8cc of 0.1N Sodium Hydroxide.

Betanaphthol	½ g.
Terpineol	½ g.

Soak the glue in the water overnight, then heat to not over 150° F., stirring until the glue is dissolved. Dissolve in the other ingredients, with stirring. Pour the mixture into mold and allow to cool and set.

No. 6

(Revivifying)

U. S. Patent 2,137,948

Use one part thin mucilage such as acacia gum, or an adhesive, and water. The purpose of this ingredient is to make the surfaces that touch each other slightly sticky or tacky.

Two parts glycerin. This ingredient swells the wood to its normal natural shape and size.

One part ethylene glycol. This ingredient also swells the wood. It also penetrates and carries the glycerin and gum with it. It does not evaporate, and consequently prevents the wood from ever drying out or shrinking.

The mucilage and glycerin are boiled together in a double boiler. This removes most of the water which is primarily used to dissolve the gum and mix it with the glycerin. When this mixture has cooled, the ethylene glycol is added.

When this composition of matter is applied in lieu of glue at time of manufacture, the compound will permanently protect joints from loosening or squeaking. When used on old furniture, tools and so forth, it restores the wood and tightens joints which have worked loose.

The compound is a wood revivifier and not a glue or wood filler. It is preferably to be used wherever a joint depends not upon adhesion of one surface to another, but upon a tight fit of wood inserted in wood or metal, or metal inserted in wood, and the use of the compound will insure permanent tightening of the joint.

Barrel Sealer, Odorless

Petrolatum, High Viscosity	70 lb.
Paraffin Wax (50–52° C.)	18 lb.
Beeswax	12 lb.

METALS

Metals to Wood, Glass and Stone

The number of cements is legion and their properties run the entire gamut of resistances with properties, which fit them for every conceivable purpose; and in spite of scientific investigations, which indicate that more wisely chosen and compounded mixtures of each type serve the purpose better if used correctly; the concoction of newer ones still continues.

This condition is perhaps being promoted by the introduction of newer synthetic binding materials and recently developed fillers, which due to slightly different properties must be used in varying amounts. Advantages of price and misdirected advice by salesmen will continue to keep the composition of these products fifty per cent. mystery and fifty per cent. filler. Hence, until a better method of classification is developed and until more is known about the properties of each mixture under use, one must be content with tables of those which have stood the test of trial, and from such mixtures technical men can easily formulate new ones to meet special needs by elimination of components soluble in contacting liquids and substitution of components insoluble in them.

The present tendency is to classify chemically resistant cements in groups according to one component, to which the cementing action is attributed and as a result we find them under such headings like glycerol litharge, sodium silicate, oxychloride, and miscellaneous. This is, of course, the simplest method and perhaps the most scientific, but the writer feels that in classifying a group of mixtures consisting of at least six components, the hardening action of which is based upon evaporation of solvent, cooling, chemical action or all three operating simultaneously, the most useful classification is according to purpose.

In view of the fact that chemically resistant cements comprise only a part of the field and are undergoing development upon semi-scientific lines to fit them more suitably for that particular industry, their application for general purposes and to other industries is out of the question; hence, from the formulae submitted in this article one can see that no class of raw materials is particularly favored and even though these mixtures may serve other purposes, they or modified forms of them will usually suffice for special needs.

Metal and Glass

Formula No. 1

White Shellac	50 g.

Tricresyl Phosphate	5 g.
Pumice (Powdered)	45 g.

This mixture is melted with constant stirring and shortly before use any one of the following mixtures are stirred in with due consideration of the purpose to which it is to be applied.

a. Copal Varnish (Solvent Alcohol)	18 g.
Linseed Oil (Raw or Boiled)	54 g.
White Lead	14 g.
Red Lead	14 g.
b. Powdered Silica	25 g.
Slaked Lime	25 g.
Litharge	50 g.

Warm linseed oil varnish should be stirred in to the formation of a workable paste.

c. Burgundy Pitch	50 g.
Black Pitch	12 g.
Yellow Wax (Beeswax)	25 g.

These are melted and then the filler is stirred in.

Kieselguhr	13 g.

The following mixtures are used independently.

No. 2

Sodium Hydroxide	7.5 g.
Rosin	22.5 g.
Water	40.0 g.
Gypsum (Dehydrated)	30.0 g.

This is to be applied while warm and hardens in one hour.

No. 3

Rosin	52 g.
Tallow or Stearic Acid	26 g.
Red Lead	22 g.

This is applied hot and is satisfactory for glazing of skylights which have metal frames.

No. 4

Cumar	25 g.
Solvent	15 g.
Infusorial Earth	25 g.
Feldspar	35 g.

The above formulae fall into the conventional class of organic binder cements and, all except one being resistant to water, none are resistant to alkalies, and organic solvents like aliphatic and aromatic hydrocarbons which necessitates other combinations for such liquids and illustrates the necessity of a wise choice.

Metal and Wood

No. 5

Rosin	66 g.
Venice Turpentine (Imported)	28 g.
Linseed Oil	6 g.

This is melted before use and applied hot.

No. 6

Shellac (White or Orange)	50 g.
Gutta Percha	50 g.

Melt, stir well and pour into molds for use like sealing wax.

No. 7

Gelatin	23 g.
Glue	23 g.
Acetic Acid (20%)	46 g.
Alum	1 g.
Alcohol	7 g.

Used warm upon iron and wood.

No. 8

Viscous Glue Solution	77 g.
Linseed Oil Varnish	23 g.

Used warm.

No. 9

Whiting	38 g.
White Lead	53 g.
Linseed Oil Varnish	9 g.

For joining zinc and wood.

No. 10

Rosin	70 g.
Gutta Percha	30 g.

Used warm for joining aluminum and wood.

No. 11

Viscous Glue Solution	50 g.
Slaked Lime	45 g.
Glycerin	5 g.

For joining wood to brass after the latter has been etched with acid.

Metal to Metal

No. 12

Linseed Oil Varnish	50 g.
Fresh Lime	50 g.

Apply hot to clean surfaces.

No. 13

Copal Varnish (Spirit)	25 g.
Linseed Varnish	9 g.
Venice Turpentine	5 g.
Turpentine	2 g.
Marine Glue	9 g.
Slaked Lime	50 g.

No. 14

Graphite	10 g.
Manganese Dioxide	68 g.
Clay (Dry)	2 g.
White Lead	4 g.
Red Lead	2 g.
Linseed Varnish	14 g.

No. 15

Powdered Glue	30 g.
Slaked Lime	50 g.
Sulphur	20 g.

Applied warm to zinc plates.

No. 16

Zinc Dust	34 g.
Whiting	66 g.

This is stirred with a sodium silicate solution of 33° Bé., and 1.3 to 82 ratio until the desired consistency is obtained. It is serviceable in joining zinc to zinc and can be polished upon exposed surfaces.

No. 17

Zinc Oxide	10 g.
Zinc Chloride Solution	10 g.

No. 18

(Rubber or Metal to Fabric)

British Patent 432,493

Paris White	40 g.
Rosin	3 g.
Dammar	15 g.
Benzol	15 g.
Naphtha	23 g.
Rubber	1½ g.

Allow gums and rubber to "dissolve" in solvents and then mix in pigment.

No. 19

U. S. Patent 2,026,475

Lacquer	1.750 lb.
Iron Filings	5.000 lb.
Whiting	1.500 lb.
Hydraulic Cement	0.750 lb.
Aluminum Powder	0.125 lb.

(Cold-Sealing "Waxes")

(For Collapsible Tubes)

No. 20

a.	Cellulose Acetate	200 g.
	Acetone	800 g.
	Castor Oil	40–65 g.
b.	Lithopone	250 g.
	Acetone	250 g.
or		
b.	Ultramarine Blue	150 g.
	Acetone	250 g.
or		
b.	Copper Bronze	150 g.
	Acetone	250 g.

Make the lacquer *a* and thin this with the pigment—suspension *b*, for white, blue, or gold color using the suitable pigment.

No. 21

Shellac, Bleached	100 g.
Sandarac	40 g.
Castor Oil	15 g.
Alcohol, Denatured	430 g.

Color: as in formula No. 1 or use an alcohol-soluble dye.

No. 22

British Patent No. 439,657

Rubber	2 oz.
Ester Gum	2 oz.
Gasoline	2 oz.
Acetone	10 oz.

No. 23

"Glyptal" Type Resin	10 oz.
Nitrocellulose	14 oz.
Diethyl Tartrate	6 oz.
Toluol	27 oz.
Ethyl Acetate	33 oz.
Alcohol	10 oz.

Metal Foil to Paper

Glycol-Bori-Borate	25 lb.
Invert Sugar (75 Brix)	50 lb.
Calcium Carbonate	25 lb.

The carbonate is dissolved in the sugar, and the Glycol-Bori-Borate then added with vigorous stirring. For varying effects, part or all of the invert sugar may be replaced with more calcium carbonate. The proportions given above are approximate; it may be necessary to experiment to obtain optimum percentages for specific problems. This adhesive is particularly useful in adhering metal foil to paper. The film is very slow drying and flexible for prolonged periods, and maintains its tack indefinitely.

Metal Foils

Formula No. 1

(Water Resistant)

a.	Nitrocotton	70 kg.
	Ester Gum	12 kg.
b.	Benzol	50 kg.
	Alcohol	20 kg.
	Ethyl Acetate	25 kg.
	Butyl Acetate	5 kg.

Dissolve *a* in *b*.

No. 2

(Solvent Resistant)

a.	Wheat Starch	80 kg.
	Water	200 kg.
b.	Gelatin	8 kg.
	Water	350 kg.
c.	Sodium Silicate (36–38° Bé.)	80 kg.
d.	Thick-Turpentine	40 kg.

To the paste *a* which should be free of lumps, add the boiling solution *b* with stirring. Add *c*, cool, and stir in *d*.

Container Seal

Formula No. 1

Canadian Patent 358,797

Smoked Sheet Rubber	350 lb.
Clay	500 lb.
Castor Oil	70 lb.
Zinc Oxide	35 lb.
Sulphur	10.5 lb.
Diphenylguanadine	3.5 lb.

Mill together; form into sheets of proper thickness and vulcanize under a steam pressure of 40 lbs./square inch.

No. 2

Canadian Patent 358,798

350 parts of rubber and 350 parts newsprint pulp are dry-worked until

the fiber is absorbed, mixed and a paste contg. 100 parts casein to 1000 parts water added; 500 parts water is added, and mixing is continued until a paste is formed; 3–5% ammonia (28%) is added to stabilize the dispersion.

No. 3

British Patent 441,877

Colloidal Graphite (20%) in water	75 lb.
Gum Tragacanth (½–1% solution)	10 lb.
Latex (40%)	22 gal.

Plastic Cement

Canadian Patent 381,502

Alcohol	4 g.
Shellac	2 g.
Asbestos, Powdered	1 g.

Tin Cans

Formula No. 1

Manila Gum, W. S.	150 lb.
Elemi	5 lb.
Ether	100 lb.
Solox (Anhydrous Alcohol)	55 lb.

The materials are mixed by "cold cutting."

No. 2

Elemi	58 lb.
Batavia Dammar	14 lb.
Water	128 lb.
Triethanolamine	3 lb.
Oleic Acid	7 lb.
Commercial Latex Solution (About 36% Latex)	70 lb.

Melt the Elemi and stir in the Dammar. Raise the temperature to 125° C. When the mixture is homogeneous, allow to cool and set the container into a boiling water bath. Add the oleic acid and then the triethanolamine with stirring. Add the water, pre-heated to boiling, portion by portion, stirring and incorporating after each small portion has been added before adding the next portion. The mixture thickens at first but as additions of water continue it changes to a thin white liquid. After all the water has been added, allow the mixture to cool but continue the stirring until it is cool. Add the latex solution with stirring.

No. 3

Manila DBB (Ground)	144 lb.
Water	206 lb.
Ammonium Hydroxide	60 lb.
Commercial Latex Solution (About 36% Latex)	3690 lb.

Mix the Manila, water and ammonia until all the resin dissolves. Strain. To this solution, add the latex solution.

No. 4

Manila DBB	144 lb.
Water	206 lb.
Ammonium Hydroxide	60 lb.
Commercial Latex Solution (About 36% Latex)	1230 lb.

Mix the Manila, water and ammonia until all the resin dissolves. Strain. To this solution, add the latex solution.

No. 5

a. Wheat Starch	40 g.
Water	100 cc.
b. Cologne Glue	4 g.
Water	180 cc.
c. Waterglass	40 g.
d. Turpentine	20 g.

Make up *a* with thorough stirring. Take *b* up to a boil, and add *a* to *b* with stirring. Add slowly! When the desired consistency has been reached add *c*, stir and cool, finally stir in *d*.

No. 6

a. Glue	25 g.
Vinegar, Strong	100 cc.
b. Rice Starch	50 g.
Water, Cold	400 cc.
c. Carbolic Acid	20 g.

Soak *a* over night, and add *b* to *a*. Take up to a short boil. Add *c*. Cool.

No. 7

a. Gelatin	8 g.
Wheat Starch	80 g.
Water	560 g.
b. Turpentine, Venice	40 g.
c. Sodium Silicate	60 g.
Preservative	0.6 g.

Soak the gelatin in a part of the water, and make a paste of the starch with another part of the water. This mixed yields *a*, which is heated to 70°C. To it, melted *b* (on water bath) is added. Finally the silicate is mixed in.

A preservative is necessary.

No. 8

Borax-Casein Glue	97–95 g.
Rosin, Melted	3– 5 g.

Mix the melted rosin with a suitable casein glue.

No. 9

a. Dextrin	40 g.
Glucose	1 g.
Water	40 g.
b. Aluminum Sulphate	1 g.
Water	20 g.
c. Glycerin	3 g.

Add solution *b* to the dispersion *a* and heat until clear. Add *c*,

No. 10

Colophony or Manila Copal	1 kg.
Caustic Potash	0.25 kg.
Water	2 kg.

Boil together, strain.

No. 11

The gummed, wetted labels should be put on freshly applied, moistened collodion layer.

No. 12

Xylol	7 lb.
Mastic	7 lb.
Sandarac	7 lb.
Ether	30 lb.
Alcohol	100 lb.

No. 13

Gum Arabic	50 g.
Glycerin	10 g.
Water	90 g.
Antimony Chloride, Liquid	2 g.

No. 14

Water	100 g.
Starch	10 g.
Glauber's Salt	10 g.
Formaldehyde Solution	1 g.
Turpentine, Venice	2–6 g.

To the dispersion of starch in water (added cold, stirred, and heated), the other three ingredients are added one by one.

No. 15

Put a piece of gutta percha between the label and the tin (which has been heated previously over an open flame). Press and even with a cloth. Remove the gutta percha outside the label by wiping with a cloth.

No. 16

a.	Tragacanth, Powdered	2 g.
	Water, Boiling	16 g.
b.	Flour	6 g.
	Dextrin	1 g.
	Water, Cold	4 g.
c.	Water, Boiling	24 g.
d.	Glycerin	1 g.
e.	Salicylic Acid	1 g.

Mix *a* and *b* and add *c*, *d* and *e*. Stir until smooth, boil for four minutes.

No. 17

Ordinary Starch Paste	20 kg.
Antimony Hydroxide in Tartaric Acid Solution	1 kg.

No. 18

a.	Wheat Starch	100 g.
	Water	250 g.
b.	Gelatin	10 g.
	Water, Boiling	450 g.
c.	Waterglass	100 g.
d.	Turpentine	50 g.

Mix *a* cold, heat to boil and add to the boiling *b*. When gelatinous, add *c* and stir. When cold, mix in *d*.

No. 19

Rubber, Crude	8 g.
Tetralin	100 g.
Mastic, Powder	15 g.

White Clay or Whiting if wanted.

No. 20

Potato Starch	5 kg.
Calcium Chloride (25% Solution, 65° C.)	25 kg.
Water, Hot	30–35 kg.
Starch Syrup	8 kg.

Can Joint Seal

Formula No. 1

U. S. Patent 2,013,651

Rubber Latex	60 oz.
Alginic Acid	40 oz.

No. 2

British Patent 449,000

Heat Sensitive Latex (58%)	100 oz.
Ammonia	3–4 oz.
Zinc Oxide	0.3 oz.
Pigment	5 oz.

No. 3

U. S. Patent 2,075,885

Rosin	200 oz.
Hydrated Lime	10 oz.
Methyl Abietate	12 oz.

No. 4

Canadian Patent 367,342

a.	Bentonite	14 oz.
	Water	86 oz.
b.	Ammonium Alginate	4 oz.
	Water	96 oz.
c.	Casein	30 oz.
	Ammonia (28%)	70 oz.
	Zinc Oxide	1 oz.
	Water	6.4 oz.
	Ammonia (28%)	4 oz.
d.	Latex (38% Solids)	64 oz.
	Accelerator	6½ oz.

Add 12 oz. *a* to 1 oz. *b* and 6 oz. *c*. The mixture is then added to *d* and mixed.

Pipe Jointings

Formula No. 1

Jointing cast iron pipes with aluminum foil instead of lead has been developed by engineers, who recommend foil 0.002 to 0.004 in. thick, crumpled and caulked into the lead space. A depth of 0.4 in. is as effective as the customary 0.8 in. of lead, since aluminum is 3 to 10 times as strong as lead. Joints of this depth have withstood 150 lb. per sq. in. pressure without leakage. For 2" to 6" pipe the cost of aluminum joints is equal to or possibly 10% less than lead. Molten aluminum joints are out of the question because of the high melting point.

No. 2

Canadian Patent 367,463

Corn Oil	40 oz.
Bentonite, Air-Floated	26 oz.
Whiting, Bolted	16 oz.
Any Non-Acid Filler	18 oz.

No. 3

China Clay	70 oz.
Linseed Oil	40 oz.

Mix until uniform.

No. 4

U. S. Patent 2,059,403

White Lead	15 lb.
Linseed Oil	15 lb.
Paraffin Wax	400 lb.

No. 5

(Waterproof Plastic)

Mineral Oil	700 g.
Latex (33%)	100 g.

Heat at 100°C. while stirring, for 1 hour. Put into heavy duty dough mixer and add a little at a time.

Clay	470 g.

Mix until uniform.

No. 6

Petroleum Pitch	58
Chlorinated Diphenyl	17
Mineral Oil	25

The above was used in sealing the Time Capsule at the N. Y. World's Fair.

GASKET CEMENT

Formula No. 1

Batu Scraped	50 lb.
Toluol	7.5 lb.
Mineral Spirits	42.5 lb.

Mix the batu scraped with the toluol and half the mineral spirits. Agitate until a homogeneous mixture is obtained. Add the remainder of the mineral spirits and agitate.

No. 2

Manila Resin	50 lb.
Solox (Denatured Alcohol)	35 lb.

Mix the ingredients by agitation until a uniform mixture is obtained.

Paint Pail and Drum Gasket Seal

U. S. Patent 2,114,308

Latex, Concentrated	28.0 lb.
Barytes	30.0 lb.
Casein	1.5 lb.
Sulphur	0.5 lb.
Diphenylguanadine	0.3 lb.
Zinc Oxide	4.0 lb.
Water to make	100 lb.

Water Resistant Seam Dope

Dissolve Arochlor resin (m.p. 60° C.) in a mixture of 75% methyl cellosolve acetate and 25% mineral spirits to a solids content of about 75%.

Sound Deadening Adhesive

U. S. Patent 2,175,767

Sodium Silicate	60 lb.
Emulsified Asphalt	12 lb.
Clay	28 lb.

The above is used for fixing pads to metal in vehicles.

WATERPROOF ADHESIVES

Formula No. 1

Gum Elemi	49 lb.
Castor Oil	1 lb.

Melt materials at as low a temperature as possible until the mixture is homogeneous.

This adhesive has a stiff tackiness which it retains. It is very light in color.

No. 2

Gum Elemi	95 lb.
Castor Oil	5 lb.

Melt materials at as low a temperature as possible until the mixture is homogeneous.

This adhesive is tacky and not as viscous or stiff as number 1. It retains its tackiness. It is very light in color.

No. 3

Gum Elemi	90 lb.
Castor Oil	10 lb.

Melt materials at as low a temperature as possible until the mixture is homogeneous.

This adhesive is stringy and tacky. It retains its tackiness. It is very light in color.

No. 4

Gum Elemi	80 lb.
Castor Oil	20 lb.

Melt materials at as low a temperature as possible until the mixture is homogeneous.

This adhesive is soft and tacky. It retains its tackiness. It is very light in color.

No. 5

Gum Elemi	49 lb.
Castor Oil	1 lb.
Batavia Dammar A/E	5 lb.

Melt all materials together at as low a temperature as possible until the mixture is homogeneous.

This adhesive is slightly stringy and remains tacky. It is very good for sticking paper to painted surfaces when it is desired to remove the paper at a later date without having any of it adhering to the surface. It is very light in color.

No. 6

Gum Elemi	49 lb.
Castor Oil	1 lb.
Batavia Dammar A/E	2.5 lb.

Melt all materials together at as low a temperature as possible until the mixture is homogeneous.

This adhesive is thinner than No. 5 but is also very good for sticking paper to surface when it is desired to remove the paper at a later date without its adhering to the surface. It is very light in color.

No. 7

Gum Elemi	49 lb.
Castor Oil	1 lb.
Batavia Dammar A/E	7.5 lb.

Melt all materials at as low a temperature as possible until the mixture is homogeneous.

This adhesive possesses a very stiff tackiness, which it retains. It is very light in color.

No. 8

Gum Elemi	49 lb.
Castor Oil	1 lb.
Manila Macassar W. S.	5 lb.

Melt all materials at as low a temperature as possible until the mixture is homogeneous.

This adhesive has a stiff tackiness. It dries and becomes brittle.

No. 9

Gum Elemi	49 lb.
Castor Oil	1 lb.
Manila Macassar W. S.	7 lb.

Melt all materials at as low a temperature as possible until the mixture is homogeneous.

This adhesive has a stiff tackiness. It dries and becomes brittle. It is very light in color.

No. 10

Gum Elemi	100 lb.
Extra Light Vegetable Pitch	¼ lb.

Melt the materials at as low a temperature as possible until the mixture is homogeneous.

This adhesive has a stiff, stringy tackiness. Its film becomes brittle on aging overnight. It is very light in color.

No. 11

Gum Elemi	100 lb.
Extra Light Vegetable Pitch	½ lb.

Melt the materials at as low a temperature as possible until the mixture is homogeneous.

This adhesive is stringy and tacky. Its film dries. It is very light in color.

No. 12

Gum Elemi	100 lb.
Extra Light Vegetable Pitch	1 lb.

Melt the materials at as low a temperature as possible until the mixture is homogeneous.

This adhesive is stringy and tacky. It retains its tack. It is very light in color.

No. 13

Gum Elemi	98 lb.
Extra Light Vegetable Pitch	2 lb.

Melt the materials at as low a temperature as possible until the mixture is homogeneous.

This adhesive has a stringy tackiness which it retains. It is very light in color.

No. 14

Gum Elemi	49 lb.
Extra Light Vegetable Pitch	1 lb.
Batavia Dammar A/E	5 lb.

Melt the materials at as low a temperature as possible until the mixture is homogeneous.

This adhesive has only a slight tackiness and its film becomes dry and brittle. It is very light in color.

No. 15

Gum Elemi	49 lb.
Extra Light Vegetable Pitch	1 lb.
Batavia Dammar A/E	7½ lb.

Melt the materials at as low a temperature as possible until the mixture is homogeneous.

This adhesive has only a slight tackiness and its film becomes dry and brittle. It is very light in color.

No. 16

Gum Elemi	49 lb.
Extra Light Vegetable Pitch	1 lb.
Macassar Manila W. S.	5 lb.

Melt the materials at as low a temperature as possible until the mixture is homogeneous.

This adhesive has only a slight tack, its film becoming dry and brittle. It is very light in color.

No. 17

Gum Elemi	49 lb.
Extra Light Vegetable Pitch	1 lb.
Macassar Manila W. S.	7½ lb.

Melt the materials at as low a temperature as possible until the mixture is homogeneous.

This adhesive has only a slight tack, its film becoming dry and brittle. It is very light in color.

No. 18

(For Glass)

Gum Rosin	7½ lb.
Thermally Processed Congo Resin	2½ lb.
Dry Color	½ lb.

Melt the materials at as low a temperature as possible and stir until the mixture is homogeneous.

This adhesive is useful in the grinding of lenses in attaching the lenses to a steel block. It is not greatly affected by the heat resulting from grinding and has very good adhesion for glass.

No. 19

Thermally Processed Congo	60 lb.
Elemi	40 lb.
Dry Color	½ lb.

Melt the materials at as low a temperature as possible and stir the mixture until it is homogeneous.

This adhesive is useful in the grinding of lenses in attaching the lenses to a steel block. It is not greatly affected by the heat resulting from grinding and has very good adhesion for glass.

No. 20

(For Tapes)

Commercial Crepe Rubber Solution (20% Crepe Rubber in Benzol)	100 lb.
Batavia Dammar	14½ lb.
Benzol	14½ lb.
Mineral Oil	9.6 lb.

Mix the dammar, benzol and mineral oil until a homogeneous solution is obtained. Add the solution of crepe rubber in benzol and stir until a homogeneous solution is obtained.

This material gives a tacky film, which is useful as a cement or adhesive for tapes.

No. 21

Manila DBB	40 lb.
Solox (Anhydrous Alcohol)	65 lb.
Butanol	65 lb.
Paraffin Wax	25 lb.
Oleic Acid	6 lb.
Triethanolamine	2 lb.

Dissolve the manila DBB in solox and butanol. Heat this solution to 85°C. and hold it at that temperature throughout the process.

Heat the paraffin and oleic acid until they are molten and homogeneous. Add the triethanolamine with stirring. Add this mixture to the warm solution of manila DBB slowly and with continued agitation. A paste forms.

No. 22

Manila DBB	40 lb.
Solox (Anhydrous Alcohol)	65 lb.
Butanol	65 lb.
Ozokerite	25 lb.
Oleic Acid	6 lb.
Triethanolamine	2 lb.

Dissolve the manila DBB in solox and butanol. Heat this solution to 85°C. and hold it at that temperature throughout the process.

Heat the wax and oleic acid until they are molten and homogeneous. Add the triethanolamine with stirring. Add this mixture to the warm solution of manila DBB slowly and with continued agitation. A paste forms.

No. 23

Manila DBB	40 lb.
Solox	65 lb.
Butanol	65 lb.
Carnauba Wax	25 lb.
Oleic Acid	6 lb.
Triethanolamine	2 lb.

Dissolve the manila DBB in solox and butanol. Heat this solution to 85°C. and hold it at that temperature throughout the process.

Heat the wax and oleic acid until they are molten and homogeneous. Add the triethanolamine with stirring. Add this mixture to the warm solution of manila DBB slowly and with stirring. A paste forms.

No. 24

Manila DBB	40 lb.
Solox (Anhydrous Alcohol)	65 lb.
Butanol	65 lb.
Japan Wax	25 lb.
Oleic Acid	6 lb.
Triethanolamine	2 lb.

Dissolve the manila DBB in solox and butanol. Heat this solution to 85°C. and hold it at that temperature throughout the process.

Heat the wax and oleic acid until they are molten and homogeneous. Add the triethanolamine with stirring. Add this mixture to the warm solution of manila DBB slowly and with stirring. A paste forms.

No. 25

Manila DBB	40 lb.
Solox (Anhydrous Alcohol)	65 lb.
Butanol	65 lb.
Beeswax	25 lb.
Oleic Acid	6 lb.
Triethanolamine	2 lb.

Dissolve the manila DBB in solox and butanol. Heat this solution to 85°C. and hold it at that temperature throughout the process.

Heat the wax and oleic acid until they are molten and homogeneous. Add the triethanolamine with stirring. Add this mixture to the warm solution of manila DBB, slowly and with stirring. A paste forms.

No. 26

Manila DBB	40 lb.
Solox (Anhydrous Alcohol)	65 lb.
Butanol	65 lb.
Crude Montan Wax	25 lb.
Oleic Acid	6 lb.
Triethanolamine	2 lb.

Dissolve the manila DBB in solox and butanol. Heat this solution to 85°C. and hold it at that temperature throughout the process.

Heat the wax and oleic acid until they are molten and homogeneous. Add the triethanolamine with stirring. Add this mixture to the warm solution of manila DBB slowly and with stirring. A paste emulsion forms.

No. 27

Manila DBB	20 lb.
Solox (Anhydrous Alcohol)	15 lb.
Butanol	15 lb.
Montan Wax	12½ lb.
Toluol	37½ lb.

Dissolve the manila DBB in the solox and butanol. Dissolve the montan wax in the toluol. Add the wax solution to the manila solution.

No. 28

Manila DBB	20 lb.
Solox (Anhydrous Alcohol)	15 lb.
Butanol	15 lb.
Japan Wax	12½ lb.
Toluol	37½ lb.

Dissolve the manila DBB in the solox and butanol. Dissolve the Japan wax in the toluol. Add this solution to the manila solution.

THERMOPLASTIC ADHESIVES

Formula No. 1

British Patent 428,456

Chlorinated Rubber	10 oz.
Tricresyl Phosphate	1 oz.
Nigrosine	sufficient to color
Water	20 oz.

Disperse above in a colloid mill. Apply this dispersion or dried product with pressure as adhesive between non-porous materials such as glass, plastics or metals.

No. 2

U. S. Patent 2,072,631

Vinyl Acetate, Polymerized Vinyl Chloride, Polymerized	Composite	100 oz.
Dibutyl Phthallate		10 oz.
Chlorinated Rubber		1 oz.

This melts at about 300°F. and is adhesive at temperatures below 212°F.

No. 3

U. S. Patent 2,053,773

A thermoplastic composition for use in uniting layers of fabric and which maintains its adhesive qualities at temperatures below 212°F. comprises between 10 and 90 parts of a composite polymer of conjointly polymerized vinyl acetate and vinyl chloride, mixed with between 90 and 10 parts of a simple polymer of vinyl acetate, a small quantity of vat blue, and a solvent.

No. 4

Ethyl Cellulose	15 oz.
Dammar Gum (Dewaxed) (7 lb. cut)	10 oz.
Dibutyl Phthalate	5 oz.
Ethyl Alcohol	15 oz.
Toluol	55 oz.

No. 5

Ethyl Cellulose	10 lb.
Rosin	15 lb.
Hercolyn	5 lb.

Melt together and apply hot.

No. 6

Vinyl Chloride	10 lb.
Dibutyl Phthalate	1 lb.
Ethyl Acetate	15 lb.
Toluol	75 lb.

UNIVERSAL CEMENTS

Formula No. 1

a. Polyvinyl Acetate, Hard, High Viscosity	6 kg.
Polyvinyl Acetate, Medium Viscosity	6 kg.
Ethyl Acetate	75 kg.
Methanol	5 kg.
b. Water	8 kg.

Make solution *a*, stir in *b*.

No. 2

Celluloid, Medium to High Viscosity	7–10 kg.
Polyvinyl Acetate or Ethyl Polyacrylate, Low Viscosity	5 kg.
Methanol or Ethanol	15 kg.
Ethyl Acetate	70 kg.

No. 3

a. Polyvinyl Acetate, Medium Viscous	7 kg.
or Ethyl Polyacrylate Medium Viscous	7 kg.
Celluloid	3 kg.
Toluol	85 kg.
Carbon Tetrachloride	5 kg.
Benzene	5 kg.
b. Aluminum Stearate or Palmitate, made into a paste with white spirit, 1:4	0.5–1 kg.

Add *b* to solution *a*.

If copper or zinc naphthenates are used instead of aluminum soaps, the cement becomes mold-resistant. Formula No. 3 is water-repellent.

No. 4

Polyvinyl Acetate, Medium Viscous	5 kg.
Polyacrylic Ester Medium Viscous	5 kg.
Film Waste or Celluloid	5 kg.
Alcohol (Denatured with Toluol)	10 kg.
Ethyl Acetate	80 kg.
Iron Oxide	100–200 kg.

To become water-repellent, the cement should be mixed with aluminum salts, as in No. 3.

No. 5

(Quick-Binding, Rust-Protecting)

Polyvinyl Ester, High Viscosity	12–15 kg.
Polyacrylic Ester High Viscosity	12–15 kg.
Benzene	45 kg.
Toluene	45 kg.
Minimum	to desired viscosity

Foul-proof, when copper or zinc naphthenate is incorporated. For ship-underwater cements.

No. 6

To fill small holes in metals, use No. 5, using aluminum powder instead of minium.

No. 7

Polyvinyl Ester, Hard, Low Viscosity	2 kg.
Polyacrylic Ester Hard, Low Viscosity	2 kg.
Celluloid (Film Waste)	45 kg.
Ethyl Acetate	16 kg.
Butyl Acetate	2 kg.
Alcohol	2 kg.
Wood Flour	to desired consistency

For wood gluing.

No. 8

Polyvinyl Ester, Low Viscosity	5 kg.
Polyacrylic Ester Low Viscosity	5 kg.
Film Waste	4 kg.
Polymeric Acetaldehyde Resin	2 kg.
Acetone	35 kg.
Butyl Acetate	5 kg.
Alcohol	10 kg.

For plastics.

No. 9

Polyvinyl Ester, Soft, High Viscosity	10 kg.
Polyacrylic Ester Soft, High Viscosity	10 kg.
Methylene Chloride	22.5 kg.
Trichlorethylene	1.25 kg.
Phenyl Chloride	1.25 kg.

For rubber.

To make this formula water-repellent, either minium or aluminum soaps should be added, as in No. 3.

No. 10

Celluloid	1 kg.
Polyvinyl Ester, Soft, High Viscosity	2 kg.
Polyacrylic Ester Soft, High Viscosity	2 kg.
Amyl Acetate	5 kg.
Butyl Acetate	5 kg.
Ethyl Acetate	10 kg.
Acetone	60 kg.
Dibutyl Phthalate	0.2–0.5 kg.

For film.

No. 11

Rosin	20 g.
Castor Oil	10 g.
Benzol	70 g.

This composition will bond any type of material to almost any other type, as it adheres tenaciously to all types of surfaces. It has high initial tack, and is not intended to dry hard. The hardness of the ultimate lamination of adhesive can be increased by the increasing of the rosin content.

No. 12

(Reclaimed Rubber Cement)

U. S. Patent 1,937,861

One hundred parts by weight of reclaimed inner tubes are mixed with 100 parts of rosin and 5 parts of powdered quick-lime. The mixture is thinned with 300 parts of gasoline. The resulting cement is an excellent adhesive, adhering permanently to wood, metal, glass, fabric, leather, rubber, etc. It is particularly useful for affixing vulcanized rubber matting to floors, etc., since the adhesion is not appreciably affected by moisture nor by the heat of the summer sun. Similar results are secured when magnesia or litharge is substituted for the lime.

GLASS

Formula No. 1

(Waterproof Binder for Glass Fibres)

U. S. Patent 2,131,750

Casein	100 g.
Borax	18 g.
Stearic Acid	24 g.
Ammonia	100 cc.
Latex (68%)	214 cc.
Zinc Chloride	5.7 g.

No. 2

(Cementing to Wood and Metal)

Large pieces of glass require an elastic intermediate layer, such as felt, fabric or cork sheets, when applied to wood. The use of cork sheets (an Italian patent) is the best technique known. Some adhesives are suggested: for zinc, 200 g. gelatin, 150 g. water, 50 g. acetic acid, 50 g. 90% alcohol, 50 g. alum; for tin, flour paste; for aluminum, 100 g. casein, 10 g. caustic soda, 20 g. slaked lime, 170 g. water, and small amounts of sodium silicate. It is generally necessary to etch the metal surface. For glass to glass joints the following are useful: (1) 5 g. cellulose acetate, 10 g. methanol, 100 g. tetrachloroethane; (2) 75 g. gum rubber, 15 g. gum mastic, 60 g. chloroform; (3) 200 g. casein, 40 g. ammonia and 1000 g. water.

No. 3

(Glass to Metal)

Shellac	15 oz.
Pine Tar	8 oz.

Warm together and mix.

No. 4

(Bottle Seals)

Alcoholic Shellac Solution (30%)	50 g.
Dextrin	2 g.
Chalk	4 g.
White Concrete	5 g.
Gypsum	4 g.

The finely ground mineral powders—which may partly be replaced by pigments—are mixed with the shellac solution and the dextrin until a fine, smooth, and homogeneous paste results.

Yellow: Use ochre, chromium yellow.

Red: Iron Oxides, Minium.

Blue: Ultramarine, Prussian Blue.

ACID PROOF CARBOY

Formula No. 1

Sulphur, Melted	4 kg.
Sand	3 kg.

No. 2

Chalk or Silica	25 kg.
Alum	0.1 kg.
Sodium Silicate	75 kg.

No. 3

Gypsum	400 g.
Clay	300 g.
Sulphur	200 g.
Graphite or Bole	100 g.

Make a thick paste with water, put on the top of the carboy (stoppered with a clay seal). Cover the plastic mass with some bag cloth and allow to harden.

BOTTLE SEALING WAX

Formula No. 1

(First Quality)

Colophony (Rosin)	38 kg.
Turpentine, Thick	20 kg.
Paraffin in Blocks (50/52° C.)	4 kg.
Whiting	10 kg.
Barite	10 kg.
Zinc Oxide	18 kg.

No. 2

(Best Quality; Insoluble in Alcohol)

Carnauba Wax	30 kg.
Beeswax	20 kg.
Paraffin in Blocks (50/52° C.)	20 kg.
Whiting	4 kg.
Barite	10 kg.
Chrome Orange	16 kg.

No. 3

(Second Quality)

Colophony	30 kg.
Turpentine, Thick	22 kg.
Scale Paraffin Wax	6 kg.
Whiting	12 kg.
Barite	12 kg.
Chrome Yellow	18 kg.

No. 4

(Second Quality, Insoluble in Alcohol)

Montan Wax, Crude or Bleached	40 kg
Japan Wax	10 kg.
Scale Paraffin Wax	15 kg.
Whiting	9 kg.
Barite	10 kg.
Zinc Oxide	16 kg.

No. 5

(Extra Flexible; Not Soluble in Alcohol)

Montan Wax	8 kg.
Japan Wax	20 kg.
Scale Paraffin Wax	52 kg.
Lithopone	20 kg.

No. 6

Paraffin, Scale	70 kg.
Beeswax	10 kg.
Japan Wax	17 kg.
Oil-Soluble Dye	3 kg.

DEXTRIN

Dextrins and gums are simply roasted starches to which have been added small quantities of dilute acid, or an alkali, depending on whether dextrins or gums are the desired end products. The product may be varied almost endlessly by variation in the kind and quantity of acid used; the time and temperature of the roasting, or dextrinizing process; and in the kind of starch used; corn starch, for example, under exactly similar treatment as regards acidulation and time of conversion, yielding a vastly different dextrin than when potato starch is used.

Ordinarily, corn starch, potato starch and tapioca starches are used in the production of dextrins and gums and the manufacture is conducted in a steam-jacketed, steel drum, having a capacity of approximately 1,000 lbs. and fitted with a rotating steel ribbon, or agitator, adapted to keep the starch in constant motion during the conversion process. An outlet at the bottom of the drum is provided for the rapid removal of the dextrin when the roasting is completed, and the dextrin is discharged through this opening onto a moving belt, whence it is carried to a reel or sieve, fitted with 150–200 mesh silk bolting-cloth, similar to that used in flour mills. Here the particles of charred matter, splinters and other foreign material are removed, and the dextrin is ready for packing or bagging.

Additional to the foregoing, each drum is fitted with a high pressure steam connection, and a cold water inlet for cooling the roasted starch, so that there may be no further conversion of the heated mass after dextrinization is completed. An atomizing device is also provided for spraying the diluted acids into the starch before dextrinizing.

Following are typical examples of operating conditions for the manufacture of the commonly used Gums and Dextrins.

British Gum

Corn Starch	1,000	lb.
Soda Bicarbonate	300	lb.
Steam Pressure	200	lb.
Time of Conversion approximately	8½	hours

Product is discharged from converter when a solubility of 25 to 30 is attained.

The solubility of the gum is determined by weighing 10 grams of the product into 200 cc. of distilled water in a 500 cc. flask. The flask is agitated for 5 minutes, after which a portion of the solution is filtered and run into a 50 cc. pycnometer and weighed at 20° C. The pycnometer is now emptied, filled with distilled water, and weighed at 20° C.; the difference in weight in grams, multiplied by 200 gives the solubility.

Canary Dextrin

Corn Starch	1,000	lb.
Nitric Acid (9° Bé.)	3,400	cc.
Steam Pressure	135	lb.
Time of Conversion	6–6½	hours
Solubility	90–95	

The foregoing product, when dissolved in an equal weight of water, should yield a clear, molasses-like, free flowing syrup. If the solution thickens, after standing 24 hours, it indicates the use of insufficient acid, too short a conversion period, or low steam pressure.

Resealing Envelope

Tapioca Starch	800	lb.
Hydrochloric Acid (3° Bé.)	1,800	cc.
Steam Pressure	110	lb.
Conversion Time	3–5	hours
Solubility	90–95	

When desired solubility has been attained, cold water is immediately circulated through the steam jacket, to prevent further conversion.

White Corn

Corn Starch	1,000	lb.
Hydrochloric Acid (4° Bé.)	3,000	cc.
Steam Pressure	80–85	lb.
Solubility	4–4.5	

After 1 hour conversion add:

Calcium Carbonate	1¼	lb.
Soda Bicarbonate	¾	lb.

This product, when cooked with 5 parts of water, yields a heavy, jelly-like paste.

Tapioca Gum (Heavy)

Tapioca Starch	600	lb.
Corn Starch	200	lb.
Hydrochloric Acid (5° Bé.)	2,500	cc.
Steam Pressure	100	lb.
Time of Conversion	2½	hours

White Potato

This dextrin is used in the manufacture of white library paste.

Potato Starch	800 lb.
Hydrochloric Acid (9½° Bé.)	2,600 cc.
Steam Pressure	50 lb.
Time	2–2½ hours
Solubility	24

The moisture content of potato starch may run as high as 15–18%. This moisture is driven off at the temperature of dextrinization. On storing for several weeks, much of this moisture is reabsorbed.

Dark Potato

Potato Starch	850 lb.
Nitric Acid (11½° Bé.)	2,900 cc.
Steam Pressure	100 lb.
Solubility	90–96

POWER GLUE

This product is intended for use as a covering for wooden or metal pulley faces, to prevent belt slippage.

The glue is applied to the pulley, after which the pulley face is wound with cheese cloth and an additional coating of the glue applied to the upper surface of the fabric. This glue, when properly applied, reduces power losses resulting from slipping belts from 15%–20%.

Sodium Silicate ("N" Grade)	90 lb.
Kaolin	8 lb.
Venetian Red	2 lb.

Heat sodium silicate to 80–100° C.; then add the well mixed and sieved dry ingredients. Stir until a homogeneous mass is attained.

DEXTRIN ADHESIVES

Formula No. 1

(Tasteless and Odorless)

Water, 40–60° C.	120 kg.
Potassium Permanganate	0.5 kg.
Dextrin, White	100 kg.
Muriatic Acid, 22° Bé.	0.05 kg.
Sodium Bisulphite, 30/40° Bé.	until white

Dissolve the dextrin in the potassium permanganate solution, let stand for 1½–2 hours. Disperse the acid well, and add slowly the bisulphite solution with thorough stirring, until pure white.

No. 2

(For Collapsible Tubes)

Dextrin, White	30 kg.
Capillary Syrup	10 kg.
Water	50 l.
Glycerin	0.5 kg.

Stir the dextrin with the cold water until free of lumps. Take up to exactly 70/71° C. to dissolve. Add other ingredients. Stir. Let rest. Fill up after a few days.

No. 3

(In Glassy Pieces)

Knead dextrin of chosen quality with a ¼% nitric acid solution in a strong kneading machine. Roll out in pans to sheets of 2 cm. strength and dry cautiously at 110-120° C.

Smash the dried substance.

Whitest grades are obtained by treating a 20° Bé. solution of yellow "Superior"—dextrin with decolorizing carbon, filtering in a filter-press, evaporating in a vacuum apparatus.

Used as substitute for gum arabic.

No. 4

a. Dextrin	48 kg.
b. Borax, Powdered	6 kg.
c. Glucose	5 kg.
d. Water	42 kg.

Dissolve *b* in the hot water *d*, add *a* and *c*, and heat with continuous stirring (without boiling), until everything is dissolved. The amount of water evaporated has to be added again, which helps the dissolving.

Boil down to a yield of 100 kg., strain through flannel, and let stand for about 3 months before using.

No. 5

(Type "Pelikanol")

Dextrin, White	40 lb.
Water, Hot	50 lb.
Sugar, Syrup	8 lb.
Glycerin, Water-White Refined	2 lb.
Preservative	
Perfume (Bergamot or Citronella Oil)	to suit

To the dextrin solution add the other ingredients. Keep standing for several days.

No. 6

(Tube)

a. Dextrin, Yellow or White	70 g.
Water	120 g.
b. Glycerin	5 g.
c. Formaldehyde or Betanaphthol	2 g.

Make up a dextrin solution free from lumps with hot water *a*, add *b* and preserve with *c* while hot.

A smaller amount (0.1-0.2) of an effective modern preservative can be taken instead of *c*.

No. 7

"COLD" PASTES

Dextrin, Yellow, Soluble in Cold Water	100	kg.
Water, Cold	50	l.
Glycerin, Straw-Colored	3–4½	kg.

Procedure: To the dextrin add the cold water in small portions with good agitation, until free of lumps. When all is homogeneous, warm up but *avoid boiling.* When a clear solution is obtained, cool to about 40/50°C., add the glycerin, mix well, and fill into containers for storage or shipment. Let stand and "ripen" for a few weeks before shipping, since changes in consistency occur (goes heavy!). If the paste has gone too heavy, thin down with (cooled) boiled water.

Viscosity of dextrin pastes has to be determined over various periods of time.

No. 8

Dextrin, Yellow	100	kg.
Dextrin, White	30	kg.
Water	90	l.

Procedure as in No. 1.

To the 70–75° C. warm clear solution add separately:

Capillary Syrup (44–45° Bé.)	20	kg.
Waterglass (38/40° Bé.)	0.250	kg.
Sodium Bisulphite Lye (36–40° Bé.)	0.5	kg.

Filter or sift.

No. 9

(For Gumming)

Dextrin, Yellow	100	kg.
Sodium Bisulphite	1	kg.
Water	50	l.
Borax, Crystallized	2.5	kg.
Capillary Syrup	5	kg.
Glycerin, Yellow (22° Bé.)	2	kg.

No. 10

Dextrin, Light, Sifted, and Exposed to Dustless Air for Several Days	125	kg.
Water	100	l.
Borax, Dissolved hot, and cooled	7½	kg.

Mix cold, and warm as in No. 1, take off foam, cool in covered kettle. To the cooled solution add separately:

+Sodium Hypochlorite Lye (18–20° Bé.)	6	kg.
+Caustic Soda (38–40° Bé.)	6	kg.
+Sulphurous Acid (5° Bé.)	6	kg.

Let "ripen."

No. 11

(Water Resistant)

British Patent 453,132

Dextrin	80–90	oz.
Gluten	20–10	oz.

Water to give desired consistency.

No. 12

(Cork to Synthetic Plastic)

Gypsum	40–45	oz.
Dextrin	30–35	oz.
Casein	5–10	oz.
Fish Glue	3– 6	oz.
Borax	1– 3	oz.

Water sufficient to make desired consistency.

Casein

Preparation

1. Sulphuric Acid Casein.

Skim Milk	3000	g.
Sulphuric Acid, Concentrated	6.0	g.
Yield	100	g.

Precipitation Temp. 120° F.

Quite apart from its economic aspects skim milk is to be preferred over whole milk since the butter fat present in whole milk would be precipitated along with the casein during acidulation thus necessitating a special treatment for its subsequent removal. The skim milk is gradually heated to 120° F. in an enamelware container, preferably of the double-boiler type; any container that is subject to attack by acids cannot be employed. When 120° F. has been reached 6.0 g. of concentrated sulphuric acid, diluted first with 100 cc. of water, are added slowly to the milk which is agitated briskly with a high speed electric stirrer. The acidulation precipitates the casein as a fine curd. If the acid is added too rapidly or without first being diluted, a thick pasty mass will be formed which will occlude a major portion of the acid locally and prevent it from fulfilling its function. After all the acid has been added agitation is continued for five minutes, whereupon agitation is ceased and the mixture allowed to stand a short while to allow the curd to collect. The clear liquid remaining is decanted and the curd is filtered in a filter press and washed with cold water. In the event a filter press is not available the curd can be filtered and washed in a canvas cloth bag with the assistance of a fruit press or bench vise. Care should be taken to wash the curd thoroughly until litmus paper indicates that all free acid has been removed. The washed and pressed casein curd should then be broken up or disintegrated into a fluffy meal before it is dried. This can be accomplished by passing the curd through a food mill or a flour sifter. The material should be spread in a thin layer on trays or shallow pans and dried in an oven at not over 125° F. The casein can then be ground to any desired size in a burr stone mill or by means of a mortar and pestle and graded by sieving. Commercial grades are classified ordinarily from 20 mesh to 100 mesh.

2. Hydrochloric Acid Casein.

Skim Milk	3000 g.
Hydrochloric Acid, Concentrated	4.5 g.
Yield	100 g.

Precipitation Temp. 115° F.

The same procedure as outlined above for the production of sulphuric casein can be used here except for the change in the amount of acid used and the temperature of acidulation.

3. Grain Casein.

Skim Milk	3000 g.
Hydrochloric Acid, Concentrated	15 g.
Yield	100 g.

Precipitation Temp. 95° F.

The same procedure as that already described above can be employed with the necessary changes in the amount of acid and temperature. The granular nature of the product is brought about by the over-abundant quantity of acid added to bring about precipitation.

Casein from Skim Milk

Heat skim milk to 120° F. and remove any foam. Add muriatic (hydrochloric) acid which has been diluted about two to one with water until with constant stirring a clear separation of curd and whey is obtained. This will take place in a few minutes. Too little or too much acid is undesirable and the amount of acid used should be gauged very carefully. The amount can be judged in advance by adding varying amounts of the diluted acid to half-pint samples of the skim arranged in pint or quart milk bottles, selecting the sample showing the clearest whey and the best separation of curd. The amount of acid required for the batch of skim milk can then be calculated very accurately.

The clear whey is drained off as soon as the separation is complete and the curd washed three or four times with cold water, hand shredding the curd to make the washing effective. After washing, the curd is shoveled from the vat into press cloths in a press form which in turn is placed on the drainboard at the bottom of the press. The form is filled with the curd, the ends of the cloth lapped over the curd mass and the form then removed; another cloth is used and the form placed on top of the first mass and so on until all of the curd is in the press. Pressure is then applied and increased at intervals as needed. The curd is usually pressed over night and in the morning solid cakes of curd are obtained.

CASEIN ADHESIVES

Formula No. 1

Casein	22 kg.
Water	59.8 kg.
Ammonia (0.925)	18 kg.
Preservative	0.1 kg.

No. 2

German Patent 621,138

Casein	30 g.
Urea	2.5 g.
Water	47.5 g.
Paraformaldehyde	0.5 g.

No. 3

Casein	30 g.
Thiourea	15 g.
Water	55 g.

No. 4

Casein	40 g.
Thiourea	20 g.
Water	40 g.
Butylated Naphthalin-Sulphonic Acid	1.5 g.

The adhesives are prepared by efficient mixing. They are applied suitably on roughened surfaces, cold, or better at 50–70° C. holding the pasted articles together for one-half hour under good pressure (about 50 atm.)

No. 5

1. Caustic Soda	4 g.
2. Ammonia (25%)	10 g.
3. Soda Ash	20 g.

The above are the best concentrations of alkali for dissolving casein (air-dried).

No. 6

(For Casein Plastics)

German Patent 621,138

Casein	100 g.
Urea	50–100 g.
Water	100–200 g.

Pigments, fillers, or hardening agents may be included.

Neutral Solutions

U. S. Patent 2,063,134

Formula No. 7

Casein	20 g.
Sulphonated Castor Oil	5 g.
Water	75 g.

Warm together and mix until smooth.

No. 8

Casein	20 g.
Sulphonated Castor Oil	70 g.
Water	10 g.

No. 9

Casein	18.2 g.
Sulphonated Olive Oil	18.2 g.
Water	54.5 g.
Diethylene Glycol	9.1 g.

No. 10

Casein	19.4 g.
Sulphonated Coconut Oil	19.4 g.
Water	58.3 g.
Triethanolamine	2.9 g.

No. 11

(Waterproof and Oilproof Binder)

U. S. Patent 2,131,750

A new binder can be mixed with porous fibre to make a waterproof composition. This material consists essentially of the following ingredients:

Casein	100 g.
Borax	18 g.
Stearic Acid	24 g.
Zinc Chloride	5.7 g.
Concentrated Ammonia	100 cc.
Latex (Normal 68% Solids)	214 g.

No. 12

(Non-Foaming Protein)

U. S. Patent 2,097,239

The glue base consists of 47 oz. of soymeal, 46 oz. cottonseed meal, 5 oz. milk casein and 2 oz. trisodium phosphate. 100 oz. of this base are dissolved in water with the aid of 7 oz. lime and 9 oz. caustic soda, with the subsequent addition of 30 oz. sodium silicate solution. A convenient mixing procedure is as follows: To 300 oz. of water at about 70° F. in the glue kettle add 100 oz. glue powder and stir for two minutes. Add 7 oz. of lime suspended in 25 oz. water and stir for ten minutes. Add 9 oz. caustic soda dissolved in 25 oz. water and stir two minutes. Add 30 oz. sodium silicate solution (e.g., "water glass" of 41° Bé. which contains about 36% of silicate and about 64% of water) and stir four minutes. The mixing is completed in twenty minutes. Total water (in addition to that present in the water glass, about 19.2 oz.) 380 oz. In the above operation the stirrer rotated at 60 R.P.M. A portion (100 cc.) of the glue thus prepared is weighed.

The glue in the kettle is then subjected to beating (i.e., stirring at 120 R.P.M.) for 10 minutes, after which a second 100 cc. sample is weighed. The percentage decrease of weight is found to be 20%.

No. 13

(Non-Foaming Casein)

Mix 1% of diglycol laurate into the powdered casein which absorbs and retains it. This casein may be stored and shipped as desired.

Reducing Foaming of Casein Solutions

Add 0.3–0.5% of following:

Alcohol	1 lb.
Petroleum	1 lb.
Clove Oil	1 lb.

Bookbinders' (Gold) Size

U. S. Patent 2,089,063

Formula No. 1

Egg Albumen	4–15 oz.
Water	35–70 oz.
Amyl Acetate	4–14 oz.

No. 2

Egg Albumen	3–14 oz.
Starch	3–12 oz.
Water	35–80 oz.
Amyl Acetate	4–14 oz.

No. 3

Egg Albumen	4–12 oz.
Glucose	3–10 oz.
Starch	1– 5 oz.
Water	35–85 oz.
Amyl Acetate	4–14 oz.

No. 4

Egg Albumen	4–13 oz.
Glucose	3–10 oz.
Starch	1– 5 oz.
Water	35–85 oz.
Amyl Acetate	4–14 oz.
Ethylene Glycol	1–10 oz.

No. 5

Egg Albumen	4–13 oz.
Glucose	3–10 oz.
Starch	1– 5 oz.
Water	35–85 oz.
Acetic Acid (28%)	1– 8 oz.
Ammonia Water (26%)	1– 8 oz.

No. 6

Egg Albumen	3–12 oz.
Glucose	3– 9 oz.
Amyl Acetate	3–16 oz.
Acetic Acid (28%)	1– 8 oz.
Ammonia Water (26%)	1– 8 oz.
Ethylene Glycol	1–10 oz.
Ethyl Acetate	1– 6 oz.
Acetone	1– 6 oz.

Alcohol	1– 8 oz.
Flour	1– 2 oz.
Corn Starch	1– 6 oz.
Water	40–90 oz.

No. 7

Egg Albumen	18 oz.
Glucose	8 oz.
Amyl Acetate	16 oz.
Acetic Acid (28%)	4 oz.
Ammonia Water (26%)	4 oz.
Ethylene Glycol	2 oz.
Ethyl Acetate	6 oz.
Acetone	3 oz.
Alcohol	5 oz.
Flour	1 oz.
Corn Starch	2 oz.
Water	45–50 oz.

PUTTY

Formula No. 1

(Spatula-Putty)

Lithopone	50 kg.
Spar (Calcspar)	50 kg.
Chalk	100 kg.
Casein Solution*	50 kg.

No. 2

Slate, Powdered	100 kg.
Barytes (Heavy Spar)	20 kg.
Lead Linoleate	20 kg.
Chalk	10 kg.
Lacquer (Oil, Artificial Resin, or Cellulose)	50 kg.
Drier	5 kg.
Thinner (White Spirit)	as desired

No. 3

(Quick Setting)

Plaster of Paris	65 oz.
Brick Clay	17½ oz.
Silica	17½ oz.

Mix in sufficient water to make a smooth paste before using.

No. 4

(Filler)

Zinc White	25 kg.
Whiting	25 kg.
Cheap Mineral Filler	60 kg.
To color Red, add Iron Oxide Red	10 kg.

With this filler, use about 20–40 kg. of one of the above lacquers to bind.

No. 5

(Horse Shoe)

Gutta Percha	45 lb.
Ammoniac Resin	20 lb.
Rosin Oil	5 lb.

(Casement)	No. 6 Beading Putty	No. 7 Quick Drying
Whiting	75 lb.	32 lb.
White Lead	25 lb.	52 lb.
Silica	5 lb.	16 lb.
Red Lead	5 lb.	—
Linseed Oil	20 lb.	10 lb.
Japan Gold Size	—	4 lb.
Short Oil Gum Varnish	—	5 lb.

No. 6 is slow drying but can be ground in an edge runner mill and the drying hastened by putting in the liquid driers—about 5 lb. to the above make—and then give a final mix. The proportions of the driers and liquid ingredients, of course, have to be adjusted to suit the particular grade of materials being used. No. 7 is ground in an edge runner mill but the addition of the gold size and varnish should be delayed till the end of the grinding. In any case the linseed oil and pigment mixture should be kept several days to ensure thorough incorporation of the oil before the mass is finished off.

No. 8

French Patent 842,633

Boiled Linseed Oil	65 g.
Spindle Oil (Mineral)	85 g.
Glycol Monoricinoleate	2 g.
Water	10 g.

Mix vigorously until emulsified and then work in by kneading:

Whiting	840 g.

COLD SEALING WAXES

Formula No. 1

Celluloid	80 g.
Acetone	210 g.
Amyl Acetate	700 g.
Castor Oil	10 g.
Pigment	to suit

No. 2

Acetyl Cellulose	180 g.
Acetone	700 g.
Benzene	150 g.
Methyl Ethyl Ketone	100 g.
Methyl Alcohol	50 g.
Pigment	to suit

No. 3

Celluloid	15 g.
Camphor	1 g.
Light Benzine	15 g.
Ether	20 g.
Acetone	20 g.
Amyl Acetate	30 g.
Castor Oil	2–3 g.
Titanium Dioxide	to suit

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*Casein Solution

a. Casein, Powdered	100 kg.
Water	250 kg.
b. Potassium Hydroxide	6 kg.
Water	20 kg.
c. Phenol	5 kg.

No. 4

a.	Venetian Turpentine	50 g.
	Rosin	150 g.
	Shellac	200 g.
b.	Ether	100 g.
	Alcohol, Absolute	500 g.
	Dye	to suit

No. 5

Collodion Wool	60 g.
Ester Gum	20 g.
Ether	30 g.
Castor Oil	7 g.
Methyl Alcohol, to make	1,000 g.
Color	to suit

No. 6

(Melted by the warmth of the hand)

Rosin	3 kg.
Pine Rosin, Purified	3 kg.
Mutton Tallow	3 kg.
Venetian Turpentine	4 kg.
Chalk, Powdered	4 kg.
Minium	4.5 kg.

Caulking Compounds

For leaks in pipes, sinks, or floor the following will be found a most desirable and handy material. It is to be mixed and kept in a wide necked jar so the compound may be dug out as needed with the putty knife.

Asphalt	34 g.
Kerosene	26 g.
Asbestos Meal	40 g.

The asphalt is dissolved in the kerosene, which may be hastened by placing the container in a pan of hot water away from the flame. When thoroughly dissolved the asbestos powder is worked in a little at a time until a rather stiff putty has been achieved. There is a consistency that is just right. One that does not flow and drip when applied from underneath and which is still sufficiently workable to be easily forced into narrow cracks. The caulk or mend will be found to be waterproof and when used to seal rat-holes will discourage the rodents from the place.

Plastic Caulking Materials

Formula No. 1

Oil: Three parts blown fish and 1 part raw tung heated to 270° C.

Pigment:	Precipitated Whiting	60%
	Talc	25%
	Zinc Sulphide	10%
	Asbestos *7K*	5%

		%		%		%
No. 2	Precipitated Whiting Talc Lithopone Asbestos, *7M*	35 30 30 5	Fish oil blown with small amount of commercial drier.	32	....	..
No. 3	Precipitated Whiting Talc Lithopone Asbestos, *7M* Asbestos, *Fl*	50 25 10 10 5	Fish oil blown at 130° C. 0.05% cobalt added as drier. Varnish 2%.	37	Mineral spirits	3
No. 4	Precipitated Whiting Asbestine Titanox Asbestos, *7D*	50 30 15 5	Fish oil blown at 140° C. 0.1% cobalt and 0.2% lead added as drier.	33	Mineral spirits	5
No. 5	Ground Limestone Talc Asbestos, *7M*	50 40 10	Blown fish oil (commercial) and boiled linseed oil (9:1).	37	....	..
No. 6	Chalk Whiting Talc Zinc Sulphide Asbestos, *Fl*	40 30 15 15	Blown fish oil (commercial) and raw linseed oil (24:1). 0.2% Mn added as drier.	29	Mineral spirits	4
No. 7	Precipitated Whiting Talc Lithopone Asbestos, *Fl* Asbestos, *7M*	40 25 15 15 5	Blown fish oil (commercial) and raw linseed oil (24:1). 0.05% cobalt added as drier. Varnish 2%.	41	Mineral spirits	5
No. 8	Precipitated Whiting Talc Lithopone Asbestos, *7D*	50 25 15 10	Soybean oil blown at 120° C. 0.01% cobalt added as drier. Varnish 2%.	38	Mineral spirits	4
No. 9	Precipitated Whiting Talc Lithopone Asbestos, *7H*	50 25 15 10	Soybean oil blown at 140° C., varnish, 2%. 0.08% cobalt added as drier.	43	....	..
No. 10	Precipitated Whiting Talc Lithopone Asbestine Asbestos, *7M*	50 10 15 15 10	Mixture of soybean and tung oils (4:1) heated to 285° C. 0.05% cobalt as drier.	32	Mineral spirits	5

No. 11	Ground Limestone	60
	Lithopone	30
	Asbestos, *7M*	10
No. 12	Ground Limestone	35
	Lithopone	30
	Talc	30
	Asbestos, *7M*	5
No. 13	Precipitated Whiting	40
	Talc	25
	Lithopone	15
	Asbestos, *Fl*	10
	Asbestos, *7M*	10
No. 14	Precipitated Whiting	40
	Talc	25
	Lithopone	15
	Asbestos, *Fl*	10
	Asbestos, *7M*	10
No. 15	Precipitated Whiting	50
	Asbestine	25
	Lithopone	15
	Asbestos, *7M*	10

Blown perilla oil (commercial).	22	Mineral spirits	6
Mixture of blown perilla oil (commercial) and raw tung oil.	25	Mineral spirits	5
Mixture of polymerized linseed and raw soybean oils (3:1).	42	Mineral spirits	5
Polymerized linseed oil. 0.05% cobalt added as drier. Varnish 2%.	46	Mineral spirits	6
Linseed oil blown at 120° C. 0.24% lead and 0.03% manganese added as driers.	36	Mineral spirits	5

MISCELLANEOUS

Laboratory Cement

The following formula gives a cement that has been found very satisfactory for use as an adhesive in making gas tight joints as well as for various other uses where it is desirable to stick two objects together. It has been used several times on various substances. In no instance has it failed to adhere firmly if the surfaces were moderately dry. It appears not to be affected by chemical reagents in moderate concentrations.

Asphalt	1 g.
Rosin	6 g.
Rubber	3 g.
Turpentine	1 g.

An old inner tube from an auto tire serves as a satisfactory source of rubber. Cut it into strips 2 or 3 mm. wide. Mix the rosin and asphalt and heat with a small flame until melted and then add the rubber. Heat the mass at as low a temperature as possible and still keep it fluid, until the rubber is nearly all melted. This should require two or three hours. The turpentine is then added and the mixture is heated two or three hours more, or until the mass becomes homogeneous. It should be stirred at intervals of 15 to 30 minutes.

A very satisfactory amount of the cement is made up as follows:

Asphalt	25 g.
Rosin	150 g.
Rubber	75 g.
Turpentine	25 cc.

The materials should be heated in a beaker, or casserole, of a liter capacity. There is some tendency to froth when the rubber is added. The mass does not have to be heated continuously. It may be heated at short intervals at the convenience of the operator.

After the mass has become homogeneous, it may be cast into sticks. A mold for the sticks may be made as follows. Nail cleats, 1 cm. thick, to a piece of board. A space of 1 cm. should be allowed between the cleats. The grooves are then coated with vaseline. Strips of thin paper are then cut the length of the grooves and 6 or 7 cm. wide and pressed into the grooves. The molten cement is poured onto the paper and allowed to cool.

The cement is applied by holding in a small gas flame until it liquefies, or catches fire. It is then applied directly. If a gas flame is not available, a candle may be used.

The above formula gives a pliant cement that is somewhat sticky when cold. However, it will not adhere to the fingers when touched. A harder and less pliant cement may be made by increasing the amount of rosin.

The dish in which the cement was prepared may be cleaned by warming and rubbing with a cloth moistened with turpentine, or carbon tetrachloride, and dipped in a mixture of sand and sodium carbonate.

ACID PROOF CEMENTS

Formula No. 1

A handy acid resisting cement can be made by mixing sodium silicate and asbestos powder to the consistency of a thin paste. If allowed to dry for a day, the resulting cement will resist the strongest acids.

No. 2

Resistant to Sulphuric Acid

Sulphur	100 lb.
Tallow	2 lb.
Rosin	2 lb.

REDUCING FOAM IN GLUES

Formula No. 1

German Patent 642,103

Addition of 0.3% of sulphonated fatty alcohol will prevent the formation of persistent foam.

No. 2

Add 0.01–2% secondary octyl alcohol.

No. 3

Add 0.3–0.5% neutral fat to glue to diminish foam.

Bleaching Glue

Canadian Patent 384,588

Potassium Nitrate	1–2 g.
Hydrogen Peroxide	0.6 g.

The above is figured on glue solids in liquor. Agitate liquor with above and dry.

SOYBEAN GLUES

Formula No. 1

(Flour Cold)

Soybean Protein	15 lb.
Water	200 lb.
Ammonia (26%)	1 lb.
Caustic Soda	1 lb.
Casein Glue for Wood	800 lb.

No. 2

(Special)

Italian Patent 352,378

a.	Soybean Flour	43 kg.
	Soda Ash	2 kg.
	Water	200 kg.
b.	Lime	10 kg.
	Water	50 kg.
c.	Soda Ash	4 kg.
	Water	10 kg.
d.	Sodium Silicate	30 kg.
e.	Carbon Disulphide	1.8 kg.
	Carbon Tetrachloride	1.2 kg.

Make up solution *a.* Take 100 kg. of this solution, and mix, in the order given, with *b* to *e.*

Tooth Cement

Infusorial earth, finely powdered, is mixed with a 70% solution of soft, to medium hard polymeric ester. The mass is molded into rods after the solvent has evaporated.

For use, warm up the mass in hot water or with a burning match.

Transparent Cement

In making displays for show windows, display cases or the like, when it is desired to place photographs directly upon the glass, printed side up, the following transparent cement is easily made and acts effectively:

Glycerin	4 oz.
Gum Arabic (Best Selected)	4 oz.
Powdered Gum Tragacanth	1 oz.
Distilled Water	32 oz.

Dissolve the tragacanth in half the water, the gum arabic in the other half. Mix the solutions and incorporate the glycerin and mix thoroughly. For satisfactory results it is especially important that the gum arabic be of the best grade. If the preparation is not as clear as desired, it may be filtered through absorbent cotton for further clarity. If this is not to be used at once add a good preservative.

Strong Mucilage

Gum Arabic	2 oz.
Water	32 oz.
Glycerin	2 oz.
Salicylic Acid	90 gr.

A light colored mucilage results.

Cold Sealing Mass

U. S. Patent 2,142,193

A cold sealing mass in the form of a uniform paste comprises the following ingredients in substantially the following proportions:

Asbestos Meal	8.7 lb.
Acetylcellulose	2.5 lb.
Coloring Matter	1.3 lb.
Ethylacetanilide	0.4 lb.
Caoutchouc Chloride	0.9 lb.
Methylene Chloride	10.2 lb.
Methyl Alcohol	0.6 lb.

Printers' Roller

U. S. Patent 2,170,273

Glue	1 lb.
Triethanolamine Lactate	1–2 lb.

Warm with water, mixing slowly. The amount of water added is determined by consistency desired.

Laminating Lumarith to Cardboard

Animal Glue (80G.)	100 lb.
Water	200 lb.
Aquaresin G B (Glycol Bori-Borate)	50 lb.

Electrical Sealing Compound

U. S. Patent 2,075,885

Rosin	200 lb.

Heat to 265° C. and stir in

Slaked Lime	10 lb.

Mix for 20 minutes at 27° C. and stir in at 150° C.:

Methyl Abietate	12 lb.

Low Expansion Insulating Filler

British Patent 478,353

Mineral Oil	75 g.

Rosin	25 g.
Silica	300 g.

Vacuum Tight Lute

German Patent 668,623

Talcum	90 g.
Borax	10 g.
Glycerin	to make workable.

NON-DRYING ADHESIVE

Formula No. 1

1. Rosin	60 oz.
2. Diethylene Glycol	7 oz.
3. Caustic Potash (45%)	10 oz.
4. Water	16 oz.
5. Yumidol (83% Sorbitol)	7 oz.

Melt *1* and *2* add slowly with stirring *3* and *4* heated to 90° C. Add *5* and mix till uniform.

No. 2

U. S. Patent 2,095,614

Tallow	340
Aluminum Oleate	85
Mineral Oil	85
Rosin Oil	85
Asbestos, Powdered	170
Talc	340

No. 3

1. Rosin	60 oz.
2. Diethylene Glycol	14 oz.
3. Caustic Potash (45%)	7½ oz.
4. Yumidol (83% Sorbitol)	9 oz.

Warm *1* and *2* together until uniform then stir in *3* and *4* until dissolved.

Vulcanizable Latex Adhesive

Rubber (From 60% Latex)	100.00 oz.
Sulphur	1.50 oz.
Zinc Oxide	2.00 oz.
Zenite	1.50 oz.
Tetrone A	0.25 oz.
Neozone D	1.00 oz.

Cure: 30 minutes at 212° F. in dry heat or 10 minutes at 240° F. in dry heat.

Non-Penetrating Laminating Adhesive

U. S. Patent 2,078,727

Asphalt	15–40 lb.
Cottonseed Pitch	17–30 lb.
Gilsonite	4–10 lb.
Slate Flour	45–55 lb.

Apply hot.

Improved Cellulose Ester Adhesive

U. S. Patent 2,092,084

At least one surface is coated with a cellulose nitrate solution and allowed to dry. Then apply a mixture of

Propylene Oxide	1 oz.
Dibutyl Phthalate	99 oz.

and press surfaces together.

FLEXIBLE ADHESIVES

U. S. Patent 2,170,273

Formula No. 1

Casein	100 lb.
Borax	20 lb.
Monoethanolamine Lactate	20 lb.

No. 2

Gelatin	100 lb.
Diethanolamine Lactate	15 lb.

To both of the above add sufficient water to get consistency desired. They are best dissolved on a water bath.

Base for Plastic Lettering

(Non Weather-Proof)

Gum Arabic	20 g.
Vegetable Glue	6 g.
Glycerin	12 g.
Calcium Sulfate	60 g.
Water, Boiling	8 g.
Pigment of Desired Color	as desired

Glue for Ivory

Glue	50 g.
Water	100 g.
Gum Mastic	5 g.
Alcohol	20 g.

Glue is soaked in water to which is added gum mastic which has been dissolved in alcohol.

Military Shell Cement

Shellac	7.50 lb.
Alcohol	8.00 lb.
Stockholm Tar	5.00 lb.
Venetian Red Oxide	20.75 lb.

Warm and mix until uniform.

CHAPTER THREE

BEVERAGES

Home Made Wine

Stem, wash, and press any variety of grapes desired. To each gallon of juice, add two pounds of sugar. Then sterilize the sweetened juice by heating to boiling. Transfer the hot juice to a sterile container, and stopper with a cotton plug.

Allow to cool to about room temperature and then inoculate with a culture of Bacillus Logos or other appropriate alcohol-producing organism.

When the fermentation has ceased, siphon into clean bottles, cap, and store for aging.

CORDIALS

The proper manufacture of cordials can be very profitable.

The field at present is overloaded with cordials, which not only smell or taste like perfume, but after drinking, one's breath remains perfumed. This is largely due to the rectifier not having a properly trained chemist at the head of his department. When it comes to blending of volatile oils one must have years of experience before commencing the treatment of the various substances which are used as flavoring agents. It is proposed briefly to describe the physiology of the sense of taste and smell to indicate the importance of flavoring bodies in the assimilation of food-stuffs.

Closely allied to the sense of taste is that of smell, the two are frequently referred to as the chemical senses, because their excitation depends upon specific chemical subsubstances. In a great many cases, especially with aromatic bodies, the two senses function together. Experimentally they may be readily divided, if the sense of smell is suspended either by nasal catarrah or by closing the nostrils. Many of the flavors cannot be distinguished. The gustatory sense is, in fact, the most uneducated and backward of the senses in the majority of individuals.

The influence of sight is also interesting. In this respect if the suggestion conveyed by the eyes is removed either by blindfolding the subject or by making the object unusual in appearance the sense of taste is found to be very erratic.

Influence of Taste on Cordials

The four primary or elementary tastes are sweet, bitter, acid, and saline and it is usual for the taste organs of the tongue to be able to distinguish these under any but very abnormal circumstances.

Most flavoring bodies are, however, of a compound character, having a tendency towards one or more of the above primary tastes and containing also some aromatic body either of a volatile or extractive nature. In dealing with such bodies the combined faculties of taste and smell are required, but both are commonly classified as taste.

Taking the simple tastes, sweet, bitter, acid and saline, it has been demonstrated that the areas of sensibility vary with each. For example: it is found that the central area of the tongue is comparatively insensitive to most tastes, but that the area of sensibility varies according to whether the substance applied to it is sweet, bitter, acid or saline.

It has been established that the tip of the tongue is most sensitive to sweet substances and that the base is least sensitive. The sensibility diminishes gradually from the tip to the base and from the sides inwards.

The base of the tongue near the lingual V—is most sensitive to bitter substances and the tip is the least sensitive. From the base along the sides a rapid diminution in sensibility occurs, while from the sides inwards a gradual lessening of perception is evident.

The maximum sensibility to acid has been shown to occur about halfway down each side of the tongue; the sensibility diminishing towards both tip and base. Also, from the edges of the tongue inwards towards the central insensitive area the sensibility to acid gradually diminishes.

The tip and edges of the tongue are most keenly perceptive of saline substances, the base being least sensitive. From the edges inwards the sensibility to salt is fairly constant until the insensitive area is reached.

The sensibility of the taste-organs of the tongue may be modified in many ways. For example: if the tongue is held in iced water for ten minutes it is rendered insensitive to most tastes other than those of an acid description. The action of water at a temperature of 50° C. for a similar length of time has the same effect.

After treating the tongue with dilute solutions of hydrochloric acid and salt, distilled water gives a sweet sensation on the tongue. Many other so-called contrast sensations of this type have been noted.

The temporary suspension of the power of taste for several or all of the elementary tastes is produced by treating the tongue with certain substances, cocaine, eucaine, B-stovaine, etc.

INFUSION, MACERATION AND DIGESTION

In order to extract the soluble principles in substances which cannot be advantageously distilled, liquor dealers are often obliged to resort to infusion. This consists in submitting them for a greater or lesser period of time to the action of any liquid, with or without the aid of heat.

When the principles to be extracted are soluble in water, and at the same time but slightly volatile, boiling water is poured on the substance of which the infusion is required. The vessel is carefully covered, and the whole allowed to remain untouched for some minutes or even some hours, according to the greater or lesser penetrability of the substance, and the required strength of the infusion.

If an infusion of dried leaves or flowers is required, they are first moistened with a little boiling water, and a little time allowed for them to swell and soften before adding the rest of the water. Infusions made by adding all the water at once, as is still frequently practiced, are deficient both in flavor and perfume.

MACERATION:—When an infusion is made without the aid of heat, it is termed maceration. This takes a much longer time than an infusion, properly called; it rarely requires less than a day, sometimes several weeks. Those substances to which heat would be injurious, or which are easily soluble, are treated in this way. In many distillations this method is made use of to soften the substances before putting into the still; and, to facilitate the extraction of their odorous principle, liquor manufacturers macerate in pure alcohol, the plants whose odorous principles they wish to extract, in order to preserve them till they are required for distillation. Compound wines and toilet and table vinegar are prepared by maceration, these liquors being readily decomposed by heat.

DIGESTION:—is a prolonged infusion which is usually conducted at a medium temperature between that required for an infusion, and that of a maceration. Its object is usually to impregnate the alcohol with the principles of a substance which would be but slowly extracted without the aid of a certain amount of heat, such as that of the sun, or of hot ashes.

Mixing together two or more liquors and allowing them to stand for some days, is also called digestion.

Infusions, whether made with or without heat, should be made in vessels which cannot be attacked by any of the substances with which they are in contact, and closed sufficiently tight to prevent the loss of the most volatile principles.

The tin cucurbit, with cover, is, in the two respects, best adapted for infusions, in water. Maceration and digestion are usually performed in vessels of stoneware, or glass, which are placed on a sand bath when a regular and uniform heat is required.

Whatever may be the form or nature of the vessels employed, care must be taken not to fill them full, also to cover those which are to be placed on the sand-bath with a damp piece of parchment tightly tied around the top, with many pin holes pricked in it. If this double precaution is neglected, the increased volume produced by the heat and also the expansion of the air may burst it. Moreover, the process is never so well conducted in a vessel that is too full.

It is necessary to break and bruise, in some convenient way, the substances from which the infusion is required, in order that a large surface may be simultaneously exposed to the action of the liquid; to agitate from time to time the vessel in which it is contained; to present fresh surfaces; to proportion the length of the operation to the degree of consistency of the substances employed; lastly, to treat each by that particular mode of infusion best adapted to its nature.

In order that the different substances which are to enter into the composition of a liquor, produced by infusion, may all be acted on to the same extent, the infusion must be commenced with the hardest substances, to which those which are softer must be added, when the first are considered sufficiently softened. Without this precaution the latter would furnish a great deal too much to the infusion, while the former would not contribute sufficient. In certain cases the substances to be infused must be used whole; this is when the most important principle is contained in the exterior.

The time employed for an infusion should be proportioned to the character and solubility of the principles to be extracted; the odorous principle, for instance, being usually the most soluble of all, particularly in alcohol, it is better, when that is principally desired, to shorten the time, in order to get a milder product; both cold and hot infusions give thick and sharp liquors, when carried on too long.

It is therefore usually found that, with few exceptions, the quicker an infusion has been carried on long enough, the liquor must at once be drawn from the marc or residue, either by passing it through a sieve or a wet cloth, if it is necessary to press it. Those substances which absorb much liquid, or those of which the most important principle is not contained in the exterior, are squeezed either by hand or in a press. In other cases this is avoided. In order to have fine and clear extracts, they are then filtered.

To produce tinctures of high bouquet and not overcharged with color, spirit of 80 per cent must, in general, be employed; then macerate for a week at a temperature of 65° F. But if a saving of time is an object, stronger spirit may be used, and a heat maintained of 100° F., taking care to stir from time to time to present fresh surfaces to the action of the spirit, then, after letting stand for some hours, it is drawn off with pressure, if necessary, and carefully filtered. Tinctures improve with age by a kind of more intimate combination which takes place between the different principles of which they are composed, but they must be preserved in flasks, well corked, and stored in a place neither too hot nor too cold; light ultimately occasions a species of decomposition. It may be observed that tinctures show a degree of strength, as marked by the hydrometer, inferior to that of the spirit originally employed, in the same proportion as the strength of the tincture, but this change is only due to the substances they hold in solution, and which add to their specific gravity, without there having been any real loss of strength, unless very watery substances have been macerated in it.

Well prepared tinctures have the advantage over distilled spirits, that they keep without change, the perfume and the flavor of the substances they hold in solution; they retain the aroma of some which yield none by distillation, have no fiery or empyreumatic taste, and lastly, their preparation is less troublesome, and more economical both as regards to the process employed and the manufacture.

These processes would therefore be equally convenient and agreeable in the manufacture of fine liquors; all that would be necessary is to have in stock tinctures, of the aromatic substances in most demand, and combine them as wanted, in the proportions necessary to make an agreeable mixture. Liquors, cordials, etc., thus prepared would gain much in perfume, taste and softness; moreover, age would not be so essential to them, and the use of tinctures would be more economical than that of spirits.

Notwithstanding these advantages, their usually deep color prevents them from being used for liquors which are required to be perfectly white, or which are to be colored at will. But, supposing that they are not on this account adapted for the making of fine liquors, they can, at least, be useful in the manufacture of spirits. All that has to be done is to make an extract of the required substance, and then distill it by means of a water-bath till nearly all the spirit has come off; what remains in the still is worthless.

The principal advantage of this method over the distillation of substances in their native state would consist in obtaining better products by only distilling the most delicate portions of these substances, which would require a less extensive apparatus for distilling. In order to thoroughly understand the properties of tinctures, it must be remembered that alcohol, whatever may be its strength, unless it be absolute, is also combined with a certain portion of water. Vegetables, on the other hand, are composed of essential oil, resin, salts, extractive coloring matter, etc., in different proportions some of which dissolve in water and others in alcohol. Thus, when any substance is macerated in any spirituous liquid, the alcohol only dissolves the essential oils and resins, the water dissolves the other principles to the fullest extent possible.

It is therefore evident, that if, other things being equal, a large quantity of the same substance is macerated in 90% alcohol, and in ordinary proof spirits, the first tincture will be much finer both in smell and taste, while, on the other hand, the other will be more highly charged with color. This simple example will serve to show that the strength of the spirit to be employed is not immaterial, and should be dependent on the nature of the tincture required. Tinctures prepared by simple maceration in the cold are better than those prepared by heat, but very hard substances require that assistance if the spirit employed is rather weak or a speedy result is required.

Tinctures prepared for the use of liquor manufacturers ought, for convenience of use to be saturated, as much as possible, and prepared with the spirits of wine, in order to be more odorous and less colored. As it is better to employ too much than too little of the aromatic substances, and the first maceration does not exhaust them, a weaker spirit may be poured over the marc to produce an inferior tincture, which, however, will still contain much of the aromatic principles.

It would be useful to specify positively the quantity of aromatic substances that can be exhausted by a given amount of spirit wines, but as that depends essentially on the quality of the substances employed, the degree of division, the strength of the spirit and the temperature maintained, only very vague figures could be given.

SPIRITS (INDUSTRIAL AND GENUINE SPIRITS)

Liquor in general, as used for drinking purposes, is a liquid manufactured by distilling fermented vegetable substances containing sugar, or starch transformed into fermentable sugar, or other similar substances. The result of the fermentation by the yeast organism is the splitting of the sugar into alcohol and carbon dioxide, with the formation also of by-products such as glycerin, volatile homologues of alcohol, fusel oil and some less important substances.

The raw spirit so obtained is purified, primarily because the first distillate is not strong in alcohol and must be rectified to a higher alcoholic strength, and secondly, because the impurities must be removed. Pure alcohol has of itself no special flavor, but it has a flavor in those cases where a natural content of higher alcohols is peculiar to certain kinds, as in the genuine brandies, like grain brandy, fruit brandy or wine brandy, rum, etc. The quality of industrial spirit depends on the content or absence of fusel oil esters and aldehydes, and for purposes of the distiller that containing the least quantity of such impurities is preferred.

The genuine brandies, as grain spirit, fruit spirit, arrac, wine brandy, rum, are those which are named according to the special materials from which they are made, thus industrial spirit is made especially from sugar, potatoes or maize (corn). Corn whiskey (grain whiskey) is distilled from mashed and fermented rye, wheat, barley, or even buckwheat. Its valuable constituents are small amounts of products with an agreeable taste. Grain liquors are drunk as delivered from the still, or aromatized.

The content of sugar, of every fruit makes the latter suited for fermentation, and in cases of high sugar content, as in cherries and plums, it is quite sufficient. In cases where there is insufficient sugar it is allowable to add sugar to the mash to increase the fermentable sugar before fermenting and distilling. Such fruit spirits are highly esteemed for beverages, and also as an addition to some kinds of liqueurs. Gentian root and juniper berries are also well adapted for the manufacture of brandies, because of their content of sugar. The strength of the alcohol varies, but it is usually desired to be about 5 to 7° underproof on the average. If higher degrees are manufactured, the dilution to lower degrees is allowed by adding distilled water.

RUM is a product of the fermentation of by-products of the sugar-cane industry. However, in the countries of production some unknown drugs are added to develop the special type of genuine rum, as it would be impossible to manufacture rum from cane sugar only. The product of distillation is colorless, but it is colored by caramel (burnt sugar) and stored for a long time for aging purposes.

ARRAC is made chiefly from the fermented juice of the palm, which yields most juice when the flower stems are cut. A juice rich in sugar, is thus obtained, and on fermentation yields a product called "Toddy"; this when distilled is, "Arrac." Sometimes mash is added, and certain vegetables to give the distillate the right type desired.

A product particularly well liked is that obtained by distilling wine, the genuine wine brandy, the raw material is used for cognac. Its quality depends upon the quality of the wine itself.

The distillation products of such fermentation from various raw materials, are called genuine brandies. If diluted with spirits of any origin they are generally diluted with industrial spirits. The mixture must then be declared as "cut." Any addition of foreign flavoring substances, as essences, volatile oils or ethers, are either prohibited, or the products must be declared as artificial. In cases where the natural products are imitated by essences, the products of such must also be declared as artificial.

As pointed out, pure spirit has no peculiar odor or taste other than those of the alcohol itself. Any particular taste desired must be imparted to the alcohol, and for this purpose vegetables or at least products of the vegetable kingdom, as volatile oils, are used.

The commonly known so-called "cold distillation" consists in the extraction of vegetable substances without distillation by treatment with alcohol, or by dissolving volatile oils in alcohol, which products are employed to give the spirit the peculiar simple or compound taste.

On the other hand the "warm distillation" is employed by really distilling vegetable substances. Which kind of distillation is to be preferred depends upon the nature of the raw materials, because many vegetable substances are to be used only because of their extractive matter, while others are valuable because of the volatile flavors they contain.

METHODS OF EXTRACTION

The extractive matter of vegetable products are formed in the plant juice of the living plant, and when the plant parts are dried and employed as drugs, the extractive matters when desired must be an ingredient of liquors.

The solubility of the various extractive matters differs. Most of them are soluble in the cold. Of course the solubility depends upon the heat, and is increased by this factor.

The advantage of the digestion is the shorter time required for solution, but, on the other hand, substances soluble when hot are often precipitated out on cooling, and often unnecessary substances are obtained in solutions made with heat which were better absent, and which require subsequent removal.

For these reasons cold solution is to be preferred to prevent any later cloudiness; moreover, heat often adversely affects the fineness of some aromatic matters, and hence the cold extracts are usually the finer as to taste.

In maceration, the drugs are covered with alcohol of any desired dilution and allowed to stand for some time with frequent stirring, and are then expressed. Digestion takes place when the drugs are warmed with the menstruum for sometime at 135° F., and this is repeated once or twice on the following days; then the liquid is pressed off. In both cases the result is a tincture of more or less concentration, according to the character of the drugs and the menstruum. Usually tinctures are made from 1 part drug to 5 parts of alcohol menstruum.

The better method is that of percolation and in all formulas calling for extraction, this is to be understood as effected by percolation. The method allows the exhaustion of the material to the utmost with but a minimum loss of alcohol. The concentration of the percolated products can be increased, and reaches its highest extent in the fluid extracts, of which one part by weight represents one part by weight of the drugs treated. For essences this concentration is not necessary, and usually one part of drug made to represent two parts of extract or essence suffices. In this method the ground drugs are packed in a percolator and moistened with alcohol. After three days the percolation is started, adding sufficient of the desired menstruum, and collecting the first run of percolation, which contains nearly all of the soluble substances, and which constitutes about 85% of the total amount of the expected extract. The percolation is then continued, but now using water to obtain a secondary percolate, which is then evaporated or distilled. For instance if 10 lb. drugs are percolated with about 25 lb. of diluted alcohol the result will be 17 lb. first percolate and 6 lb. secondary percolate, the latter being then evaporated down to 3 lb. and mixed with the first percolate to make a total of 20 lb.

Otherwise, after receiving the 85% first percolate, the secondary percolate is placed in the still, and, after the addition of water, distilled until a residue of 15% results. In the above case 17 lb. of first percolate are obtained, the secondary percolate is then distilled with sufficient water to yield 3 lb. of residue which is then mixed with the first percolate. The extract now contains also most of the volatile constituents of the drugs beside the soluble extractive matters.

To transfer the volatile flavors to beverages, the simplest method would appear to be to use the isolated volatile oils of commerce, which yield the same or even better service in many cases, than the drugs themselves. As is well known, volatile oils, consist of terpenes and special carriers of taste. The latter are relatively easily soluble in diluted alcohol, while the terpenes cause cloudiness in beverages, hence it is best to remove the terpenes. The terpenes are partially separated, and collect in the form of oily drops which are filtered off. But the simple dissolving is not economical, because the terpenes are a better solvent of the flavors than is diluted alcohol. The oils are not exhausted, and therefore the distillation of volatile oils with alcohol is the most rational method. This is carried out as follows: The volatile oils, or a mixture of any of them, are distilled into a Florence flask from which they are returned to the still by a return tube, and wherein the terpenes are separated; after the layer of terpenes no longer increases, the distillation is finished. The distillate contains no more terpenes, and is perfectly soluble even in alcohol of low strength. The terpenes are worthless for flavoring.

Instead of this method, the so-called terpeneless volatile oils are also used. Because of their concentration, their employment is quite different from that of the simple volatile oils. In some cases, the isolated flavors, such as carvone from the oil of caraway, and anethol from oil of anise seed, and others, are employed because of their solubility.

Even though the employment of volatile oils is more convenient and simple, the distillation of drugs gives the finer results. The volatile oils represent the proper taste of the drugs, but they are often changed by the heat of the distillation. On the other hand, if the drugs are distilled with alcohol the aromatic constituents are transferred more naturally, and therefore the so-called vegetable distillates are preferred as to quality of yield, as, for instance, in aromatic waters.

Instead of essences some like highly concentrated products, and in this case the compounds made from volatile oils serve well. These compounds often serve to fortify essence or liqueur. The use is the same as that of volatile oils in general.

BREWING OF BEER

Brewing is both an art and a science. Its beginnings, according to recently established findings date back to the Sumerians. The Egyptians in the twentieth century before Christ raised the art of brewing to its highest level.

Today we speak of modern brewing and modern breweries. This does not imply that the basic principles of brewing have changed, but rather that newer, better and more efficient machinery is now available for the production of beer. The result is that a better beer can be obtained in a shorter period of time, a beer of superior flavor and positive keeping quality.

In the earlier days of brewing in the United States there were many small breweries supplying a local demand so that the keeping quality of the brewers product was by no means as important as it is today. Later large shipping breweries came into being and this necessitated a more modern type of equipment and the production of a product which would stand up under the influence of both time and sudden changes of temperature.

From the above it is clear that the beer of today is made to meet modern demand and in many ways is superior to the beer brewed some fifty years ago. The public demands that the beer it consumes, if bottled, be put up in an attractive package, that it be brilliant and that it keep for a reasonable time under any condition without deterioration. It also demands that the beer be pure, clean in taste, free from adulteration and both brilliant and sparkling. The foam on beer should not only be ample but must possess good lasting qualities.

Fundamentally the materials entering into beer are the same today as they were centuries ago. The basic ingredients or raw materials are water, malted and unmalted cereal or cereal products, and hops. The water supplies the bulk of the beer (over 90%) the cereals supply both carbohydrates and nitrogenous substances the largest part of the former being transformed in the process of brewing by means of yeast, into alcohol and carbonic acid gas also known as carbon dioxide; the latter supply the beer with soluble proteins which give it body or "palatefulness" as the brewer calls it, and also a certain nutritive value. All of the carbohydrates derived from the malt or cereals are not transformed however into alcohol and gas, but there remains a residue of carbohydrates in the beer which is not fermentable but contributes to the foam-holding capacity and body of the beer. These unfermentable carbohydrates are gummy substances of a viscous nature such as the chemical compounds known as dextrines.

Malt is the most important raw material used in brewing. It supplies not only the carbohydrates and proteins for the beer, but contains the necessary bodies known as enzymes which although present in very small quantity bring about the dissolution of the starch and its conversion into sugar so that it may become fermentable, and also render soluble certain protein substances of the malt essential for the foam and body of the beer.

Malt for brewing is usually prepared from barley and in the earlier days of the brewing industry it was manufactured by the brewer on the premises. Today malting, or the making of malt, is a specialized industry of enormous size and great importance. The plants where malt is manufactured are known as malt houses.

Barley as it is received by the malt house is first cleaned and graded and then steeped for two about two days, during which time it absorbs water, becomes softened up, and swells considerably. When the grain has absorbed about 50% of water, it is transferred to germinating compartments, where it is kept for six days under rigid control of temperature and humidity. The temperature is usually held at about 60 degrees F., and air is kept saturated with moisture. In about 24 hours, the barley will have started to grow. Little rootlets can be seen sticking their toes out of the embryo at the lower end of the kernal and the acrospire sticks its nose out through the scutellum.

A certain amount of heat is developed during the germination and therefore, in order that too much heat be not developed, the barley is turned over and stirred up by a mechanical turning device which carries the grains that were on the bottom to the top of the pile. In five or six days, the acrospire, or sprout, will have grown nearly the full length of the kernel. The green malt, as it is now called, is transferred to kilns, where it is dried in order to stop growth. During the sprouting of the barley, enzymes are developed, and although the drying stops the growth of the barley, it does not destroy the enzymes.

The drying kilns are usually built in two or three tiers, one above the other. The moist sprouted barley, or "green malt," is loaded on the top tier of the kiln. It has a moisture content of about 40%. A strong current of warm, dry air is forced through the wet grain, thus lowering the moisture content. Then the malt is dumped on a lower stage, where it receives a still warmer air current, and in two days the moisture is brought down to between 3% and 6%, depending upon the type of malt that is desired. It is then stored and after a few weeks' rest is ready for use in the mashing process of the brewery.

From a chemist's standpoint, brewing consists in the process of extracting from ground malt and cereals the water soluble substances including the enzymes at favourable temperature, allowing the starch to be converted into fermentable sugar by means of the enzyme diastase and the nitrogenous substances rendered partially soluble by means of the enzyme peptase, both of which are contained in the malt. This process is know as mashing.

The intermediate stage in the manufacture of beer is what is known as "mashing." Mashing is the process by which the ground malt is agitated with water at certain definite temperatures to obtain a complete extraction of the grains. The liquid, which is obtained from the spent or extracted grains, is drained off using the malt husks supported on a perforated bottom as a filtering medium, and is known as "wort." This worth is then boiled with hops to impart hop flavor, to precipitate some of the protein substances which are undesirable in the finished beer and to effect both sterilization and concentration of the solution to the desired degree.

This hopped wort after cooling to the desired temperature, being subjected to aeration during the process, now enters upon the third stage of beer production known as fermentation.

Fermentation consists in the addition of yeast of the bottom fermenting type which must of course be of good purity. The process itself may be carried out in open or closed vessels which originally were fabricated from wood, but are rapidly being replaced by vessels or fermenters made of other materials, largely metals. The period of fermentation varies with the temperature and nature of the yeast, usually it is terminated at the end of from 8-10 days. The liquid becomes more or less clear and the yeast settles to the bottom; the evolution of carbonic acid gas ceases. The fermentable sugar has been converted into alcohol and carbonic acid gas and alcohol.

The beer is now ready for the clarification process either by filtration or prolonged storage. The carbonic acid content also needs adjustment which is accomplished by adding about 10% of beer in the early stages of fermentation and keeping in a closed vessel under regulated pressure or by passing commercial carbon dioxide gas into it or by passing the beer in finely divided condition through an atmosphere of carbon dioxide. The beer preferably after several weeks of storage, is filtered through a pulp filter and filled in trade packages (barrels) under pressure. The process is known as "racking." The beer may also be run into government tanks (known as such because they are gauged and controlled by internal revenue inspectors) and from there transferred to the bottle-house and bottled.

The outstanding differences between modern brewing practice and brewing of earlier days lie in the arrangement of the plant, modern machinery linked with more rapid production, the latter made possible also in part by modern brewing adjuncts such as refined corn products, syrups and sugars, and modern methods of merchandising.

In early days practically all breweries operated on the gravity plan and the cellars were underground. The introduction of pumps and the proper application of insulating materials no longer made this necessary.

Originally the metals employed for brewery equipment and the fabrication of brewery vessels such as kettles, mash-tubs, etc., were copper, brass, iron and possibly some nickel. Today all of the newer metals and their alloys play an important part, namely aluminum, chromium, stainless steel, nickel, etc.

Old time cellar equipment was entirely of wood which was either coated with varnish or prepared resins and the like. Gradually glass lined tanks were introduced and these offered many advantages. Today practically all of the newer metals are also being used in the fabrication of fermenters, storage vats, etc. A most recent development is the substitution of metal trade packages for the customary wooden ones. Some of these are coated on the inside with insoluble varnish or pitch to prevent contact of the beer with metal while others are fabricated of metals which are immune to the action of beer and have no influence on it.

Unlike other modern industries the brewing of beer although conducted today on strictly scientific principles, remains an art. This being the case it is but natural to expect that there should be practically no patented processes under which the brewer might be obliged to operate in the making of beer.

No outline of brewing would be complete, however, without mentioning two inventions which aside from pasteurization have contributed most to the science of brewing in the nineteenth century. The first of these was the practical application to brewing of "Collupulin" the trade name for certain proteolytic enzymes which under controlled conditions render the colloidal substances in beer permanently soluble and forever prevent the clouding or turbidity of beer as a result of chilling or extreme changes in temperature. This invention has made possible the characteristic brilliancy of present day beers.

The other invention deals with a system of brewing which differs in many respects from establishing practice. The interesting features of this process are the carrying out of the entire brewing process under sterile conditions; fermenting and aging the beer in a closed system, elimination of cellars and the substitution therefore of individually refrigerated vessels, use of the same vessel for fermentation, storage and carbonation, and through an ingenious invention hastening clarification and thereby permitting the brewer to turn out a fully aged beer in less than two weeks time. The structure and equipment of breweries operating according to this system is naturally quite different from that of the conventional plants. This system is known as the Nathan System has been adopted by brewers in different parts of the globe and the success of these plants has testified to its practicability.

In concluding this brief outline, the trend of progress and tendencies in modern brewing practice can be best visualized by contrasting in tabular form the old practices against the newer ones as follows:

Past Practice

Gravity System.

Cellars under ground.

Raw materials: Malt and hops. Malt, rice or corn and hops.

Lauter-tub.

Pulp filter for beer.

Brew-house. Copper and iron vessels.

Cellar. Coated wooden vats. Glass enamelled vats.

Gas. Natural gas produced as a result of fermentation preserved in beer by after-fermentation ("kraeusening") and bunging under pressure.

Fermenters. Open and closed.

No pasteurization.

Pasteurization adopted.

Time of production: About 3 to 4 months and longer.

Type of beer. Bottom fermentation, "lager."

Modern Tendencies

Abandoning gravity system.

Cellars above ground.

No cellars—unit refrigeration.

Raw materials: Malt, cooked or refined cereals and hops. Malt, refined cereals, corn syrups or sugar, and hops.

Filter press.

Pulp filter for beer.

Kieselguhr filter for beer.

Brew-house. Copper, stainless steel and aluminum vessels.

Cellar. Coated wooden vats. Aluminum vats, glass enamelled vats, stainless steel vats, concrete vats.

Gas. "Kraeusening" less popular. Most of beer carbonated artificially by means of saturators or gas injectors using the gas obtained and collected from fermentation or commercial CO_2 of high purity.

Fermenters. Largely closed.

Pasteurization.

Tendency toward methods which will eliminate pasteurization.

Time of production. About a month sometimes only about 10 days.

Type of beer. Bottom fermentation and some ale type.

Just a few words about the character of beer. Most of the American beers are of the "lager" type as contrasted with the English "ales." "Lager" is the German word for storage and implies that these beers are stored for some time after fermentation is complete. Lager beers are fermented with bottom fermentation yeast at low temperatures (close to freezing temperatures) fermentation lasts about one week in normal practice. Ales are fermented with so-called top-fermentation yeast, approximate temperature of fermentation is about 70 degrees Fahrenheit and fermentation is over in about three days.

There are various types of beers bearing names suggestive of the locality or country in which they were first brewed, such as Bavarian, Meunchner, Pilsner, Wuerzburger, etc. They differ in color, bitterness, aroma, amount of extract and alcoholic content. These characters of beer are determined by the following: (a) Nature of brewing water, (b) Type of malt used, (c) specific gravity or Balling (meaning percentage of solids or extract in the "wort" which is the designation given to the hopped aqueous infusion of malt and grains), (d) composition of the wort (it may be all malt or malt and cereal, etc.), (e) kind and amount of hops used (f) type of yeast (g) temperature and time of fermentation.

Reduced to its essentials the basis of the process of brewing is one of the controlled enzymatic and bacterial action, in which the reaction of the solution (beer) and the temperatures employed during the extraction of the malt with water, and later during the period of fermentation, play the most important part.

To understand and practice brewing the knowledge of higher mathematics is not essential. Calculations in the brewery are confined to simple heat calculations such as the mixtures of water of different temperatures and others involving the latent heat of ice and steam, calculation of the amount of solids in solution and those lost during fermentation by conversion into alcohol and carbonic acid gas, mensuration, specific gravity, etc. Most of the necessary calculations have now been reduced to table form and the alcoholic and extract content of beer at any stage of the fermentation can be read directly from the tables providing the hydrometer indication (Balling) of the original wort and the beer is known.

BEERS

Formula No. 1

(Botanic)

Ginger, 5 oz.; licorice, 2 oz.; hops, 1 oz.; horehound, 1 oz.; burdock, 1 oz.; gentian, 1 oz.; water 5 gal. Boil the herbs in the water one hour, add Spanish juice, and when dissolved strain through a cloth. When cooled to new milk, warm, add about a tablespoonful of yeast and set aside to work 12 to 14 hours, according to strength desired. Then bottle for use.

No. 2

(Dandelion)

Dandelion leaves, 3 oz.; ginger, 5 oz.; hops, 5 oz. Boil these in 5 gallons of water for an hour, then strain and boil again, adding 3 lbs. of brown sugar and 2 oz. of Spanish juice. When lukewarm, add a ¼ pint of brewer's yeast. After the liquor has fermented for 24 hours, bottle it.

No. 3

(Horehound)

1 oz. of horehound, 1 oz. of burdock leaves, 5 oz. of ginger, ½ oz. or hops, and the size of a hazel nut of gentian root. Tie all in cloth and boil in 5 gallons of water for an hour; then strain and again boil, adding 3 lb. of brown sugar and 2 oz. of Spanish juice. Ferment for 24 hours, then bottle.

No. 4

(Herb)

2 oz. of dandelion leaves, 5 oz. of ginger, ½ oz. of hops. Boil in 5 gallons of water for an hour, strain off and boil again, adding 3 lbs. of brown sugar, and 2 ozs. of Spanish juice. Ferment 24 hours, then bottle.

Chillproofing Beer

Formula No. 1

U. S. Patent 2,088,712

Papain	2–5 g.
Sodium Citrate	1 g.
Sugar	100 g.

Add to beer prior to final filtration and pasteurization.

No. 2

The following composition is used by the brewing industry for maintaining the clarity of beers at below freezing temperatures. The composition is made up of the following:

Pepsin (1–3,000)	69.5 g.
Papain	97.0 g.
Sugar (Confectioners)	2 lb. 3.7 oz.
Lupulin (Conc.)	53.0 g.

Stouts

Formula No. 1

(Hop)

Dandelion Leaves	2 oz.
Ginger	5 oz.
Hops	1 oz.

Boil in 5 gallons of water for an hour, strain off and boil again, adding 3 lb. of brown sugar, and 20 oz. of

Spanish juice. Ferment 24 hours, and then bottle.

No. 2
(Dandelion)

Treacle	3 lb.
Lump Sugar	3 lb.
Essence of Spruce	½ oz.
Essence of Dandelion	1 oz.
Burnt Sugar	1 oz.
Water	10 gal.

Boil all ingredients for 15 minutes, and add half a tablespoonful of yeast (or more) when lukewarm. Syphon next morning into bottles. If required darker, add more burnt sugar; if sweeter, more lump sugar.

Pale Dry Ginger Ale Extract

Oleo Resin Ginger	4 oz.
Lemon Oil	2 oz.
Lime Oil, Distilled	2 oz.

Dissolve the above in ½ gallon 95% alcohol. Allow to stand a few hours, then add slowly while agitating ½ gallon distilled water. This menstruum should stand a few days. Draw off the extract leaving the dregs behind then add a filtering medium, such as Filter-Cel, to the extract and filter. Four ounces of 95% alcohol should then be added to the clear extract as this will keep it clear and help it withstand temperature changes without affecting the solubility of the dissolved constituents. It will also dissolve in the syrup without any separation of the oils. The aroma and taste of this extract can be modified by varying the proportions of essential oils used. About 3½ oz. of this extract will be sufficient to flavor one gallon of syrup.

Stable Lemon Juice
U. S. Patent 2,215,334

Lemon juice is mixed with vinegar in such proportion that the acetic acid content of the mixture is between 1.5–3%.

Lemon Squash

Lemon Juice	1 gal.
Sugar Syrup, 60° Tw.	1 gal.
Essence of Lemon	¼ fl. oz.
Tincture of Lemon Peels	¼ fl. oz.

Orange or Grape Fruit Squash

Orange Juice	1 gal.
Sugar Syrup, 60° Tw.	1 gal.
Citric Acid	1½ ozs. wt.
Essence of Orange	¼ fl. oz.
Tincture of Orange Peels	¼ fl. oz.

Vegetable Milk (Soya Bean Milk)
U. S. Patent 2,078,962

Any of several hard white or yellow varieties of the soya bean may be selected and then after being cleansed such beans are soaked for a definite period of time depending upon the water temperature. The water must not be too cold nor too warm, but preferably varying between 60° F. and 75° F. The beans should remain soaking from 6 to 10 hours but it is important that this soaking should not continue too long as if soaked too long or in water too warm the taste is definitely affected by a slightly bitter flavor.

Of particular benefit is it to soak one pound of dried soya beans in eight pounds of water.

After desired soaking the beans are ground to a pulp in a manner whereby the entire cellular structure of the beans will be thoroughly exposed through the grinding mill so as to readily yield all of the contained food elements to be extracted. It has, therefore, been found of decided advantage to grind the soaked beans in a burr mill and during the grinding operation to constantly add a small stream of water to the beans. The beans should be ground to the finest possible state.

During the grinding operation the water added is such as to result in the formation of about twenty gallons of pulp for twenty-five pounds of beans. By adding water during the grinding operation a more effective recovery is obtained of the nutritious elements of the beans as the grinding under water thoroughly works the fibre of the bean to wash out the soluble protein, fats, and minerals from the pulp.

The saturated mass is then placed in a suitable kettle and stirred or agitated while being heated to the boiling point, such boiling being continued until the pulp has lost its viscosity or stickiness so that when separated the pulp comes out quite dry. During this heating operation fumes are passed off and at the same time the gum within the fluid forms upon the surface of the fluid and which matter is skimmed off.

After the fluid has been heated to the boiling point it is then strained through a very fine straining cloth to separate cellular residue from the milk allowing only the food particles in solution to pass through. This straining operation is preferably facilitated by the use of a centrifuge making twenty-five hundred revolutions per minute. After this straining operation there is added to the fluid the essential foodstuffs to make a balanced milk and these added foodstuffs preferably comprise a cereal sugar (seven pounds) and a vegetable fat (seven pounds) together with salt (three ounces). This mixture is then heated to a boiling point and during this heating and cooking the fluid is agitated. This step of the process requires very constant attention for it is this cooking step that prevents the functioning of the fat splitting enzyme and to the most effective extent drives off the bitter substances that are of a volatile nature. This step, therefore, requires an active boiling under conditions in which coagulum is not allowed on the surface of the milk and the cooking is continued for a period of time to cause the entire taste of the milk to be changed from a beany flavor to what may be termed a "nutty" flavor. The cooking operation also continues for a period of time sufficient to drive off all of the volatile substances therein affecting its taste. This cooking step occurs for a period from 30 minutes to an hour.

After this cooking step the milk is passed through a colloid mill, or viscolizer or homogenizer, for emulsification and splitting up of the oil and cellular capsules about the food granules. In this step the rotating type of mill is preferred as such type of mill exercises a shearing action on the small food particles, fraying them out into a very finely divided emulsion constituting a true colloidal mixture. This step also lightens the color of the product.

After proper cooling the milk after leaving the colloid mill is ready for bottling or such milk without cooling can be pumped into the hot air chambers of a milk powder machine and the milk reduced to a milk powder.

CIDER AND VINEGAR MAKING

Cider Making

Fruit to Use. Good cider can be made from nearly all varieties of apples, although some varieties are more desirable for this purpose than others. Juice from two or more varieties is frequently blended. Cider is better if it does not contain too many solids. It should not be too sweet but the acidity may be relatively high. The sweetness or sourness of the juice of a given variety depends upon its malic acid content rather than upon the amount of sugar it contains.

Second grade fruit is more generally used, but this should consist of only ripe, clean apples. Dirty or rotten fruit should never be used, unless it is washed and the rotten portions removed. Unripe fruit does not have sufficient sugar present to make satisfactory cider.

Grinding and Pressing. To properly prepare cider a cider mill and press are almost absolutely necessary. The fruit must be ground or crushed before it is pressed. The finer it is crushed the larger will be the amount of juice secured. When small mills are used it may be necessary to quarter the apples before they are ground.

There are two kinds of presses in general use, the barrel press and the press-cloth press. The first type consists of a slatted barrel (without head) into which the ground pomace falls directly from the grinder. A press block is fitted into the top and pressure applied. Pressures secured from such an outfit are not great enough to thoroughly extract the juice. Also unless the barrel is lined with some kind of cloth such as that from a grain sack the pomace works out through the cracks and makes the cider pulpy.

The press-cloth press consists of a series of loosely woven cloth squares and racks. A quantity of pomace is enclosed in a cloth and a rack placed on top of it. A series is thus made up and a pressing block placed on top. Ordinary pressure extracts the greater portion of the juice, clear of pulp. With this type of press it is possible to secure approximately three gallons of cider from each bushel of apples.

The pomace may be moistened, reground and pressed a second time, but cider secured in this way is not very desirable.

Storage. The freshly pressed cider should be stored only in wooden, earthenware or glass containers since the acids will corrode metals. Straining removes many of the larger pieces of pulp and if it is allowed to stand in a cool place many of the smaller particles will settle to the bottom. If a perfectly clear product is wanted a clarifying agent such as isinglass, white of egg, casein, etc., may be used but they are not extremely satisfactory. Heat may also be used for clarifying.

Cider is most desirable if it is used while still fresh. If, however, it is to be used later, pasteurization, refrigeration or a chemical preservative is necessary. If the juice is bottled and then heated to 175° F. for 10 minutes it will keep indefinitely. Temperatures very near the freezing point also prohibit the development of molds and bacteria. Such cider is nearly always concentrated before storage. Chemical preservatives such as benzoate of soda, salicylic acid, boric acid, etc., are also used to prevent fermentation but they are not to be recommended very strongly. They are used only when cider is stored in bulk. Benzoate of soda not to exceed one-tenth of one per cent in amount (one ounce to fifteen gallons) is allowed by law.

VINEGAR MAKING

Vinegar may be made from the juice of practically any of our fruits, but if apple cider is used it should contain at least 8% to 10% of sugar or the vinegar is liable to be low in acid content. Immature, decayed or over-ripe fruit, however, give less juice with a lower per cent of sugar.

Successful vinegar making depends upon the proper completion of two bacterial fermentations, namely, the changing of sugar in the cider into alcohol by alcoholic yeasts and the transformation of alcohol into acetic acid by acetic ferment. The first fermentation generally will take place spontaneously since yeast bacteria are nearly always present on the fruit. Acetic bacteria must generally be added. It may also be desirable to add a "starter" for the earlier stage.

Ordinary precautions of cleanliness should be taken at the time of pressing. The juice is generally allowed to stand a few days before it is put into barrels so as to eliminate thru settling, a great part of the sediment. Clean sterilized barrels are necessary. Old vinegar barrels must not be used unless they have been thoroughly sterilized with steam or boiling water. Fill the cask three-fourths full, turn onto the side and plug the bung with cotton or cover with muslin to keep out insects.

Alcoholic fermentation begins immediately after pressing and proceeds at a rate depending upon the temperature. Six months may be necessary to complete the process if the barrel is stored in a cool cellar but this time is greatly shortened if the temperature is 65° to 75° F. Frequently the process is hastened also by adding an active culture as a starter. A cake of fresh compressed yeast dissolved in a cup of water may be added to each five gallons of juice. Pure cultures may also be used. Vinegar or "mother" of vinegar must never be used during this stage of fermentation.

When this fermentation is complete—that is all sugar changed over into alcohol—the clear liquid should be siphoned or racked off and the cask cleaned. The barrel is then filled half full with "hard" cider and one-fourth as much old vinegar added. "Mother" of vinegar is also frequently used. This should be fresh and not the old tough, leathery material sometimes seen since the latter usually contains undesirable bacteria and even molds which affect the flavor of the resulting vinegar. Fresh "mother" of vinegar is secured by exposing a mixture of one-half vinegar and one-half hard cider to a temperature of 80° F. for a few days. The thin scum which forms on the surface is then transferred to the surface of the liquid in the large container.

Acetic fermentation takes place only in the presence of air. Hence the bung must not be corked. In many cases extra holes are bored in the ends of the barrel so as to allow better ventilation. All openings should be covered with muslin to keep out vinegar flies and other insects. After the acetic acid content reaches 4.5% to 5% the barrels should then be filled full and tightly corked to prevent deterioration of the vinegar by destructive ferments. It is sometimes clarified by the use of isinglass.

The acetic fermentation requires from three to eighteen months depending upon the temperature. Thus, it may take two years to get good vinegar from fresh cider in a cool cellar, while six months may be sufficient if the material is kept at room temperature.

Cider vinegar offered for sale should be made from pure apple juice, be free from all foreign substances such as drugs, etc., and contain by weight 1.6% or more of solids and 4% or more of absolute acetic acid. Vinegar made from any other fruit or grain must be appropriately labeled.

Use of Pure Cultures. So many failures have developed in the home manufacture of cider vinegar that gradually the use of pure cultures is developing. These are simply very active forms of the alcoholic and acetic bacteria. Their use insures the proper fermentations. The time necessary for good vinegar formation is also considerably lessened. They are accompanied with full directions for their use and may be secured for a small charge.

Vinegar Bees. These are frequently used in making vinegar from sweetened water or molasses. A solution of the "bees" is added and the material set aside to ferment. They consist of a mixture of various yeasts and ferments which usually produce vinegar. Undesirable organisms are always present, however, and frequently seriously injure the quality of the vinegar. Such cultures usually work very rapidly and produce vinegar in a short time if kept under conditions of high temperature. They are not as desirable as pure cultures.

Precautions. Many failures in vinegar making can be avoided by observing the following precautions.

1. Do not use unripe, rotten or dirty fruit. Immature fruit contains little sugar and much starch which causes a dark, slimy, undesirable product. Rotten or dirty fruit often introduces organisms which interfere with the proper fermentations.

2. Do not use old vinegar barrels. These introduce acetic bacteria too early, thus preventing or hindering the proper functions of the yeast.

3. Overcome a lack of proper ferments by use of yeast and "mother" of vinegar at the proper stages. Pure cultures also overcome such difficulties.

4. Do not cork the barrel tightly unless fermentation has proceeded as far as is desired. Acetic bacteria require the presence of oxygen. After the vinegar has become strong enough, the barrel should be filled full to prevent further changes, which would cause deterioration in the quality of the product.

5. Do not store at too low a temperature if quick results are desired. Cellar temperatures may prolong the fermentations for two years or even longer, while more heat may reduce them to three months or less.

CHAPTER FOUR

COSMETICS AND DRUGS

COLD CREAMS

Formula No. 1

(Greaseless)

Glyceryl Monostearate	10 g.
Glycerin	25 g.
Bentonite	2 g.
Water, A Sufficient Quantity to Make	100 g.

Sprinkle the bentonite upon 50 cc. of water and after it is thoroughly wetted, stir until a uniform magma results. Melt the glyceryl monostearate in the glycerin on a water bath and add to it the magma, warmed to the same temperature, and enough water to make the product weigh 100 grams. Perfume with a mixture of equal parts of rose oil and Ylang ylang. Stir until cool.

This cream will be a little off-white. By using "Duponal" 4 g. instead of bentonite a pure white cream will result.

No. 2

(Sahm's Type)

White Mineral Oil	237 cc.
Beeswax	93 g.
Paraffin Wax	31 g.
Water	237 cc.
Borax	4 g.
Perfume	to suit

Melt the beeswax and the paraffin in the mineral oil and heat to 82° C. Dissolve the borax in the water and heat to 82° C. Pour the water solution slowly and with constant stirring into the oil solution. When nearly cool add the perfume, and pour while still liquid into suitable containers.

No. 3

The following cold cream formula gives a lustrous product both on the surface and beneath the surface, is of somewhat the same texture as a beeswax cream and can be made in the neighborhood of five cents per pound. It is somewhat softer than the beeswax cream.

a.	Diglycol Stearate	7 oz.
	Beeswax	3 oz.
	Spermaceti	1 oz.
	Paraffin Wax	1 oz.
	Mineral Oil	30 oz.
b.	Borax	1 oz.
	Water	58 oz.

Melt *a* to 80° C., add *b* which has previously been heated to 80° C., to *a* slowly with constant stirring. When temperature has dropped to 50° C., add perfume with stirring and pour at 45° C. If a cream of greater consistency is desired, part of the mineral oil can be replaced with petrolatum.

Deodorant Creams

Formula No. 1

Glyceryl Monostearate	20 oz.
Glycerin or Yumidol	10 oz.
Hexamethylene Tetramine	5 oz.
Water	65 oz.

Heat all ingredients together to approximately 70° C., stir while cooling.

No. 2

Acimul	15 oz.
Glycerin	3 oz.
Spermaceti	5 oz.
Water	60 oz.
Titanium Dioxide	2 oz.
Aluminum Sulphate	15 oz.

Make up cream omitting the aluminum salts. When cream is cold, add salts stirring until smooth. Mill if convenient.

No. 3

Paraffin Wax	10 oz.
Mineral Oil	10 oz.
Deomul	15 oz.
Petrolatum	5 oz.
Aluminum Sulphate	10 oz.
Water	50 oz.

Heat waxes and oils to 70° C., add 30 parts water. Cool to 45° C., and stir in salt dissolved in 20 parts water.

Cleansing Cream

White Mineral Oil	280 g.
Spermaceti	80 g.
Glycosterin	80 g.
Diglycol Laurate (Neutral)	20 g.
Water	360 g.
Carbitol	40 g.
Perfume	5 g.

Bentonite Cosmetic Cream

For face cream, use bentonite and water in proportions of up to 25 per cent, incorporating such other materials as may be desired. The following formula yields a white, gelatinous, perfectly homogeneous, stable paste, and might be made the basis for experiment:

Zinc Oxide	10.00 g.
Glycerin	10.00 g.
Bentonite	1.25 g.
Water	100.00 g.

Bentonite is unsuitable for hair creams owing to the white film left on the hair.

Powder Cream

Glycerin	32.0 g.
Titanium Dioxide	5.0 g.
Talc	15.0 g.
Stearic Acid	12.0 g.
Triethanolamine	0.7 g.
Perfume	0.3 g.
Cetyl Alcohol	0.5 g.
Water	34.5 g.

White Cream

Ti-Tree Oil	10 g.
Lanette Wax SX	10 g.
Mineral Oil	29 g.
Glycerin	1 g.
Water	50 g.

Lime and Glycerin Cream

Almond or Peach Kernel Oil	35.00 g.
Glycerin	1.50 g.
Lemon Oil	1.25 g.
Lime Water, to make	80.00 g.

Emollient Cream

Glycerite of Starch	40 g.
Titanium Dioxide	2 g.
Vanishing Cream	58 g.

Foundation Cream

Stearic Acid	18.0 g.
Cetyl Alcohol	0.5 g.
Cocoa Butter	0.7 g.
Glycerin	8.0 g.
Potassium Hydroxide	1.0 g.
Titanium Dioxide	2.0 g.
Perfume	0.5 g.
Water	69.0 g.

Acid Creams

Formula No. 1

Glycol Distearate, Pure	14.0 g.
Mineral Oil	3.0 g.
White Beeswax	2.0 g.
Ceresin	1.0 g.
Lanolin	1.0 g.
Sodium Lauryl Sulphate	1.0 g.
Citrus Pectin	0.5 g.
Perfume	0.5 g.
Citric Acid	2.0 g.
Glycerin	6.0 g.
Distilled Water	69.0 g.

No. 2

Wool Wax	3.0 g.
Lanolin	8.0 g.
Stearyl Alcohol	2.0 g.
Petrolatum	37.0 g.
Glycerin	4.0 g.
Lactic Acid	1.5 g.
Distilled Water	44.5 g.

Vanishing Cream

Formula No. 1

Stearic Acid	12.5 g.
Sodium Carbonate	1.0 g.
Borax	6.0 g.
Glycerin	5.0 g.
Perfume	0.5 g.
Water	75.0 g.

No. 2

Triple Pressed Stearic Acid	20 g.
Diglycol Laurate (Neutral)	20 g.
Water	80 g.
Carbitol	7 g.
Perfume	0.65 g.

Industrial Hand Protection Creams

Formula No. 1

Stearic acid, 2½ oz.; white beeswax, 1 oz.; white soft paraffin, 2½ oz.; liquid paraffin, 1½ fl. oz. These are melted and emulsified with heated triethanolamine, 4 fl. drms., and boiling water to 24 fl. oz.; with this is incorporated magnesium stearate, 2 oz. This preparation is slightly alkaline which is probably not a drawback in its use since normal perspiration is slightly acid.

No. 2

(To protect skin from action of grease, paint, solvents, dirt and other materials detrimental to the skin.)

U. S. Patent 2,120,569

Sodium Soap	128 oz.
Waterglass	110 oz.
Glycerin	100 oz.
Potato Starch	2 oz.
Distilled Water	32 lb.
Cottonseed Oil	3 oz.
Perfume	to suit

No. 3

Petrolatum	140 g.
Glyceryl Tristearate	60 g.

No. 4

Beeswax	5.0 g.
Glyceryl Monostearate	12.5 g.
Lanolin	5.0 g.
Sodium Silicate	5.0 g.

Ammonium Hydroxide (10%)	0.5 g.
Petrolatum	72.5 g.

No. 5

Soap (Tallow or Sodium Stearate)	6.5 g.
Glycerin	28.0 g.
Sodium Silicate	18.5 g.
Water	47.0 g.

No. 6

The following preparation has a pH of 5.4 and is therefore recommended where there is prolonged contact of the hands with soapy water:

Beeswax	10.0 g.
Lanolin	5.0 g.
Glyceryl Monostearate	12.5 g.
Stearic Acid	2.0 g.
Petrolatum	75.5 g.

No. 7

The following preparation to waterproof the skin is recommended where there is prolonged contact with water:

Beeswax	10.0 g.
Lanolin	5.0 g.
Sulphonated Olive Oil (75%)	10.0 g.
Petrolatum	75.0 g.

Formulas 8, 9 and 10 are clean, non-greasy preparations that dry on the skin and do not rub off. Their use is indicated, therefore, in dry work, as a protection against dust-borne irritants, or when soiling materials by the protectives must be avoided. Formula 6 is smeared on the skin, while 7 and 8 are liquids and are applied with a brush or swab:

No. 8

Glyceryl Monostearate	12.0 g.
Beeswax	12.0 g.
Anhydrous Lanolin	6.0 g.
Cholesterol	1.0 g.
Sodium Silicate	5.0 g.
Ammonium Hydroxide, 10% Solution	0.5 g.
Water	to suit

Melt wax, glyceryl monostearate, lanolin and cholesterol in one pot. Add sodium silicate solution and ammonium hydroxide solution to water previously heated in another pot. Stir aqueous solution into the wax mixture.

No. 9

Mastic (NF)	20.0 g.
Myrrh	5.0 g.
Pyroxylin	3.0 g.
Castor Oil	2.0 g.
Acetone	to suit

No. 10

Polyvinyl Acetal Resin	5–10.0 g.
Castor Oil	2.0 g.
Acetone	to suit

Use the whole mastic, not the powder. Allow mastic to stand in acetone over night. Use supernatant fluid of the 20 per cent mastic in acetone solution as a solvent for the other ingredients.

No. 11

A thick paste that leaves an impervious waterproof covering:

Zinc Oxide	25.0 g.
Kaolin	25.0 g.
White Petrolatum	50.0 g.

This preparation affords more protection than any of the other formulae.

Hand Creams

Formula No. 1

(For Mechanics' and Painters' Hands)

Stearic Acid	18.00 oz.
Olive Oil	1.20 oz.
Glycerin	3.00 oz.
Caustic Potash	1.82 oz.
Water	74.88 oz.
Sodium Benzoate	.10 oz.
Pine Oil	1.00 oz.

Procedure: Heat stearic acid, olive oil, glycerin and sodium benzoate with 70 oz. water, to 190° F. Make solution of potash with balance of water. Filter caustic solution if not clear. Pour the potash lye into the hot mixture of oils and water, while agitating briskly. Continue to stir until cream becomes a translucent jelly. Add pine oil and fill into jars or cans.

No. 2

Glycosterin	40 g.
Diglycol Laurate (Neutral)	90 g.
Triple Pressed Stearic Acid	180 g.
Carbitol	40 g.
Diethylene Glycol	20 g.
Water	600 cc.
Perfume	5 g.

No. 3

(Non-Greasy)

Tragacanth	2.00 g.
Glycerin	5.00 g.
Borax	1.25 g.
Tincture of Benzoin	2.50 g.
Alcohol	4.00 g.
Distilled Witch Hazel	3.00 g.
Perfume	to suit
Water	81.75 g.

Absorption Base

Cholesterol	5 g.
Lanolin	20 g.
Mineral Oil	45 g.

Spermaceti	25 g.
Beeswax	5 g.

To incorporate the water the base is melted and the temperature maintained at about 45° to 50°. Water having the same temperature is then added in small portions with stirring until emulsification takes place, as evidenced by the formation of a white cream.

Hand Lotions

Formula No. 1

Camphor	3 oz.
Alcohol	2 pt.
Glycerin	2 pt.
Amaranth (10% Solution)	to suit
Perfume	to suit

For Chapped Hands

No. 2

Bay Rum	3	oz.
Glycerin	⅙	oz.
Phenol (88% Solution)	20	drops
Gum Camphor	¾	oz.
Alcohol	1	oz.
Borax	1/10	oz.
Castor Oil	10	drops
Water	1	oz.

Dissolve glycerin, camphor, phenol, borax, and castor oil in the alcohol; then add the Bay Rum, and finally the water. Shake well before using, and wash hands and apply before retiring for the night. One or two applications is usually sufficient for the most stubborn cases of chapped hands.

No. 3

Mineral Oil	50 g.
Camphor	2 g.
Diglycol Laurate	20 g.

Mix together until dissolved and add with good stirring

Water	120 cc.

Sun Tan Lotion

Formula No. 1

a.	Peach Kernel Oil	2 oz.
	Trigamine Stearate	10 oz.
	Methyl Stearate	4 oz.
	Cetyl Alcohol	1 oz.
b.	Sun Screen	as required
	Perfume	as required
c.	Water	184 oz.

Melt *a* to 160° F. and pour into *c* which has previously been heated to same temperature. Agitate thoroughly and add *b* when temperature has dropped to 130° F. Continue stirring until cool. Sun screen recommended, is "Angstrol."

No. 2

Quinine Hydrochloride	15 oz.
Zinc Oxide	5 oz.
Glycerin	10 oz.
Rose Water	70 oz.

No. 3

Beta-Methylaesculitin	3.00 oz.
Potash, Caustic	0.03 oz.
Glycerin	5.00 oz.
Alcohol	95.00 oz.
Terpeneless Oil of Lavender	0.50 oz.

Astringent Lotions

Formula No. 1

Acetic Acid	2.00 oz.
Zinc Sulphate	0.15 oz.
Alum	2.00 oz.
Glycerin	4.00 oz.
Menthol	0.08 oz.
Alcohol	20.00 oz.
Perfume	0.25 oz.
Water	71.52 oz.

No. 2

Aluminum Chloride	2.00 oz.
Boric Acid	1.00 oz.
Glycerin	4.00 oz.
Alcohol	15.00 oz.
Perfume	0.25 oz.
Water	77.75 oz.

Mildly Acidic Lotion

Diglycol Stearate	5.0 oz.
Stearic Acid	1.0 oz.
Cetyl Alcohol	2.0 oz.
Glycerin	4.0 oz.
Boric Acid	0.5 oz.
Distilled Water	87.5 oz.

Glycerin Lotion

Glycerin	32 oz.
Rose Water	32 oz.
Orange Flower Water	32 oz.
Alcohol	4 oz.

Linseed Lotion

Linseed	90 g.
Boric Acid	15 g.
Benzoic Acid	3 g.
Glycerin	50 cc.
Isopropyl Alcohol	150 cc.
Water, a sufficient quantity to make	1000 cc.
Perfume	to suit

Wash the linseed with cold water. Add the linseed, boric acid and benzoic acid to 800 cc. of water and allow the mixture to stand for 24 hours with occasional stirring. Strain and wash the strainer with enough water to make 800 cc. To the strained solution add the glycerin and the isopropyl alcohol. Perfume. This may be tinted if desired.

Beauty Milk

Mineral Oil	12.0 g.
Grapeseed Oil	6.0 g.
Cetyl Alcohol	1.0 g.
Triethanolamine	2.0 g.
Stearic Acid	5.0 g.
Glycerin	4.0 g.
Distilled Water	70.0 g.
Perfume	to suit

Acid Skin Milk

Acid complexion milks are of value in the treatment of faces chafed by the wind, hands reddened by "chapping," etc.—e.g.:

Olive Oil (Deodorized)	10 g.
Paraffin Wax	6 g.
Liquid Paraffin	5 g.
Petroleum Jelly	10 g.
Acimul	12 g.
Water	110 g.
Lemon Juice	3 g.
Preservative	to suit

Bath Milk

Triethanolamine	1 g.
Stearic Acid	5 g.
Glycerin or Diethylene Glycol	6 g.
Tincture Benzoin (6 per cent.)	8 g.
Acacia or Quince Seed Mucilage	8 g.
Perfume Compound	to suit
Distilled Water	72 g.

Bath Oil

Sulphonated Oil	75 g.
Perfume Oil	15 g.
Diethylene Glycol	10 g.

Distilled water may be added if desired, although a highly concentrated bath oil is usually to be preferred.

Electric Razor After Shave Lotion

Witch Hazel	2 fl. oz.
Glycerin	1 fl. oz.
Alcohol	½ fl. oz.
Menthol	2 gr.
Rose Water	to make 4 fl. oz.

Physically Balanced Rubbing Alcohol Compound

Water	77.00 oz.
Alcohol	20.00 oz.
Sodium Chloride	2.40 oz.
Calcium Chloride	0.06 oz.
Magnesium Chloride	0.06 oz.
Sodium Bicarbonate	0.01 oz.
Sodium Hydrogen Phosphate	0.01 oz.
Magnesium Sulphate	0.25 oz.
Tincture of Iodine	0.02 oz.
Pine Oil	0.50 oz.

This is superior to rubbing alcohol which irritates, dries and hardens the skin. It has good stimulating antiseptic deodorant and solvent properties.

Deodorant Skin Freshener for Men

Aluminum Chloride	1 lb.
Menthol	160 gr.
Lilac Concentrate	2 fl. oz.
Alcohol	to make 1 gallon

Hair Lotions

Formula No. 1

(Cholesterin)

Isopropyl Alcohol	66.0 g.
Glycerin	2.5 g.
Cholesterin	0.5 g.
Distilled Water	30.0 g.
Perfume	1.0 g.

No. 2

Alcohol (75%)	96.0 g.
Oleyl Alcohol	2.0 g.
Glycerin	1.7 g.
Perfume	0.3 g.

No. 3

(Lactic Acid)

Cologne Water	5. g.
Menthol	2 g.
Alcohol	500 cc.
Lactic Acid	2 g.
Glycerin	3 g.
Water	477 g.

No. 4

(For Dandruff and Greasy Hair)

Resorcin Monoacetate	3 cc.
Glycerin	10 cc.
Alcohol	77 cc.
Water	10 cc.

(Permanent Hair Wave Composition)

Formula No. 1

Methyl cellulose 50, glycerin 20, water 30, tincture benzoin 200, alcohol 120, larch turpentine 5 and perfume to suit.

No. 2

(Cloudy)

Ammonium Sulphoricinoleate	25 g.
Ammonium Sulphite	20 g.
Potassium Carbonate	5 g.
Sodium Bicarbonate	10 g.
Ammonia (Sp. Gr. 0.96)	3 g.
Water	to make 1000 cc.

Hair Lacquer

Glycerin	30 g.
Borax	25 g.

Tincture Benzoin	235 g.
Perfume	10 g.
Distilled Water	700 g.

Hair Bleach

A clear solution is being marketed as a hair bleach medium to which is added peroxide and ammonia, the latter being unnecessary in certain types of media. If two parts of peroxide and one-half part of ammonia is added to one part of diglycol laurate a heavy foaming paste-like emulsion results which is applied to the hair as a bleach. The addition of ammonia and peroxide is performed by the beauty operator. A less expensive product can be obtained as follows:

Diglycol Laurate	1 oz.
Potassium Palmolate	2 oz.
Mineral Oil, Light	1 oz.

or

Diglycol Laurate	1 oz.
Ammonium Linoleate	2 oz.
Mineral Oil, Light	1 oz.

In the case of the latter formula only peroxide is added because of the presence of the ammonium linoleate.

Greaseless Hair Groom

Glycerin	10 cc.
Water	82 cc.
Karaya Gum	2 g.

Stir until dispersed. Add solution:

Anisic Acid	0.1 g.
Alcohol	6 cc.

Shampoos

Formula No. 1

(Oily)

Most of the so-called oil shampoos contain very little unchanged oil, but derive their name from a viscous oily appearance. The basis is ordinarily sulfonated castor oil, as in the following: 55 parts of 100 per cent Turkey red oil, 5 parts of vaseline oil, 40 of water, and enough 25 per cent caustic soda solution, or better yet, triethanolamine, for clarification and neutralization.

No. 2

(Antiseptic Liquid)

Oleic Acid	7 g.
Ti-tree Oil	3 g.
Coconut Fatty Acid	12 g.
Triethanolamine	10 g.
Glycerin	2 g.
Water	66 g.

No. 3

(Dry Powder)

Coconut Oil Soap (Anhydrous)	30 g.
Sodium Carbonate, Monohydrate	45 g.
Borax	25 g.
Powdered Henna Leaves	a trace
Yellow Dyestuff and Perfume	to suit

No. 4

(Dry Spirit)

Green Soft Soap	75 g.
Alcohol	500 g.
Ammonia (.880)	5 g.
Distilled Water	500 cc.
Perfume	to suit

Dissolve the soap in the alcohol and add the perfume. Mix the ammonia with the water and gradually add the former solution. Stand aside one week and filter bright, using kieselguhr if necessary.

Liquid Face Powders

Formula No. 1

Colloidal Kaolin	7 g.
Bentonite	5 g.
Titanium Dioxide	5 g.
Glycerin	5 g.
Water	78 g.
Pigment or Color	to suit

No. 2

Colloidal Kaolin	10 g.
Titanium Dioxide	5 g.
Glycerin	5 g.
Water	80 g.
Pigment or Color	to suit

Liquid Rouge

Ammonia (0.880)	6 g.
Glycerin	12 g.
Distilled Water, to make	100 g.
Carmine No. 4	40 g.

Mascara

Formula No. 1

Glyceryl Monostearate	10 oz.
Triethanolamine	5 oz.
Stearic Acid	15 oz.
White Petrolatum	20 oz.
Beeswax	25 oz.
Gelatin	2 oz.
Water	13 oz.
Carbon Black	10 oz.

Make a solution of the gelatin in water add the triethanolamine. Melt the wax, glyceryl monostearate, petrolatum and stearic acid, add the pigment and then the hot gelatin solution. Mill to get a uniform product.

No. 2

10 per cent glyceryl monostearate, 5 per cent triethanolamine or tri-isopropanolamine, 15 per cent stearic acid, 20 per cent white petrolatum, 25 per cent white or yellow beeswax, 13 per cent water, 2 per cent gelatin and 10 per cent carbon black. Make the solution of gelatin, add amine and separately melt fats and waxes with pigment. Add water to fats.

Pad Cosmetics

(For Saturating Cloth Pads)

Formula No. 1

(Cleansing Emulsion Type)

Glycol Stearate	1.5 g.
Triethanolamine	0.3 g.
Glycerin	3.0 g.
Mineral Oil	2.0 g.
Alcohol	5.0 g.
Wetting Agent (Wetanol)	0.2 g.
Oleic Acid	0.7 g.
Spermaceti	0.5 g.
Water, to make	100.0 g.
Perfume and Preservative	to suit

No. 2

(Cleansing Lotion Type)

Alcohol	5 g.
Glycerin	5 g.
Detergent or Wetting Agent	1 g.
Water	89 g.
Perfume	to suit

Cuticle Remover

Caustic Potash	2.5 g.
Glycerin	18.0 g.
Perfume	0.5 g.
Water	79.0 g.

Cuticle Softener

Mineral Oil (100 sec.)	84 g.
Petroleum Jelly	15½ g.
Perfume	½ g.

Red Dye Oil Soluble to tint pink. (National "Oil Red O.")

This composition is applied with a swab of cotton or a small camel's hair brush, rendering the skin soft for its repositioning.

Nail Enamel

(For Use Under Nail-Tips)

French Patent 827,882

Glycerin	0.5 oz.
Ether	4.65 oz.
Zinc Oxide	15.0 oz.
Acetone	19.0 oz.
Amyl Acetate	18.0 oz.
Butanol	22.0 oz.
Celluloid	20.0 oz.
Olive Oil	0.5 oz.
Ultramarine	0.15 oz.
Lavender Oil	0.2 oz.

Finger Nail Lacquer

30 parts collodion wool, 4 parts polyglycol, 45 parts butyl acetate, 4 butyl alcohol, 10 toluol, 6 acetone, 1 castor oil.

Extract of Curcuma

(For Nail-Polish Removers)

Macerate turmeric, 5.0 grams, in ethyl acetate 150.0 cc. for 24 to 48 hours.

Filter.

Depilatories

Formula No. 1

(Pulling)

Canadian Patent 382,241

Rosin	60 oz.
Paraffin Wax	2 oz.
Olive Oil	7 oz.

Melt together and mix well. Apply in a fluid state.

No. 2

(Odorless)

U. S. Patent 2,199,249

454 grams of chemically pure stannous chloride is added to 450 cc. of water. Analysis of the resulting solution shows that it is 6.225 normal in tin, and 6.65 normal with respect to the free and combined hydrochloric acid, or a total of 12.875 normal for the combined reaction. Therefore, 1 cc. of the stannous solution will require 12.875 cc. of normal sodium hydroxide or alkali hydroxide to combine with the chloride radical and with the resulting stannous hydroxide.

For this purpose a 10% solution of sodium hydroxide is carefully standardized and found to be exactly 2.5 normal. It is, therefore, evident that 25 cc. of the tin solution requires 128.8 cc. of the 10% sodium hydroxide solution. These solutions are used in the following example.

10 cc. of triethanolamine are added to 128.8 cc. of the above 10% sodium hydroxide solution and the solution is then heated to 65° C. 25 cc. of the stannous chloride solution is then added and the solution heated to 80° C., with constant stirring. A clear solution of sodium stannite results and all of the reagents remain in solution except for a trace or small amount of impurities which are present in the reagents. The solution is made up to a volume of 175 cc. and filtered to

remove the traces of impurities and to leave a colorless sparkling filtrate. The pH value of this solution is 12.22. It is capable of removing very coarse hair in five minutes without irritating the skin, its alkalinity being relatively much less than that of solutions in which stability is sought by excess alkali such solutions generally having a pH value of 12.6 or twice the alkalinity of the above solution. The resulting stannite solution is then mixed with a suitable filler, such as kaolin and, upon filling into tubes or jars, remains stable and unaffected for long periods of time such, for example, as ten months or longer, without decomposition or deterioration. Other fillers, such as precipitated chalk or earthy materials, may be employed, but those are preferred which are inert as, for example, kaolin.

No. 3
(Cosmetic)
U. S. Patent 2,202,829

Rosin	10	oz.
Beeswax	⅔	oz.
Mineral Oil	6	oz.

To this is added any suitable perfume. In preparing the product, the rosin is first melted in the oil and then the wax in small pieces is added gradually to the heated mixture. Upon cooling, the mass is of the consistency of a smooth paste, which, when not perfumed, is practically odorless. This paste does not harden nor become lumpy, but retains its consistency practically indefinitely.

In using the depilatory, it is spread in a thin layer over a piece of cloth of sufficient size to cover the area where the hair is to be removed. The cloth should be relatively thin and somewhat stiff, and preferably waterproof. The cloth is then firmly applied over the skin where the hair is to be removed, with the coated side of the cloth against the skin. A piece of ice is then held against the uncoated surface of the cloth, or rubbed over the surface. When the skin is thoroughly chilled, which usually takes one minute, one end of the cloth is grasped in the fingers and the cloth quickly pulled or ripped from the skin. This procedure cleanly pulls out all of the hair covered by the paste by the roots, without breaking, and without appreciable pain or irritation.

Under the influence of the ice, the paste has become sufficiently hard and tacky to grip the hairs firmly. When skin from which the hair has been removed by this product is examined through a magnifying glass it is apparent that the shortest and finest hairs as well as the long coarse hairs have been pulled out and not merely broken at the surface of the skin.

If the ice or other chilling agent is placed in a metal drum, or other thermally conducting container, then it is not necessary that the cloth be waterproof.

Anti-Perspiration Soap
British Patent 506,903

3.5 to 5 parts by weight of chromium oxide, 1 to 2 parts by weight of hexamethylene tetramine and 1 part by weight of aluminum acetate are stirred into 100 parts by weight of molten soap and then the soap is allowed to harden into shapes of any desired configuration.

Perfumes
For Soap
Formula No. 1

Citronella Oil	200	g.
Rosemary Oil	200	g.
Terpinyl Acetate	350	g.
Kummel Oil	50	g.
Benzoin Resinoid for Soap	200	g.

About 0.2 per cent of this odor should be used. The natural soap odor is covered up and the only noticeable odor is fresh and faintly spicy. The odor can be improved by replacing part of the first three ingredients with bergamot oil and cedarwood oil.

No. 2
(Sweet Pea Blend)

Benzaldehyde	4½	oz.
Anisaldehyde	1	oz.
Iso-Eugenol	5	oz.
Benzyl Acetate	9	oz.
Lavender Oil	5	oz.
Geranium Oil	1	oz.
Hydroxy Citronellal	10	oz.
Bergamot Oil	2	oz.
Terpineol	2	oz.
Geraniol, Good	1	oz.

No. 3
(Ylang-Ylang Poppy)

Phenylethyl Alcohol	20	g.
Linalol	30	g.
Petitgrain (Terpeneless)	1	g.
Ylang-ylang	1	g.
Iso-Eugenol	46	g.
Acet*iso*-Eugenol	2	g.

No. 4
(Lavender)

A fresh stable lavender odor can

be secured with the following perfume formulas:

Formula No. 1

Lavender Oil	400 g.
Spike Oil	150 g.
Rosemary Oil	85 g.
Benzoin Infusion	100 g.
Artificial Musk	20 g.

No. 2

Lavender Oil	150 g.
Spike Oil	50 g.
Geranium Oil, African	125 g.
Bergamot Oil	150 g.
Coumarin	25 g.
Lemon Oil	50 g.
Musk Solution	20 g.

The second formula is particularly recommended for shaving soap. Both formulas are for 50–76 kg. of soap.

No. 5
(Lilac)

Muguet Robertet	2¼ g.
Alcohol, Phenylethyl	⅜ g.
Bromo Styrol	1⅜ g.
Musk Crystals (Art.)	¾ g.
Heliotropine	2¼ g.
Ylang-ylang Oil	3¾ g.
Methyl Phenyl Acetate	¼ g.
Coumarine	1¾ g.
Neroline	¾ g.
Narcissus	¾ g.
Geranyl Butyrate	¾ g.
Geraniol	¾ g.
Vert Violet	⅛ g.
Phenyl Acetic Aldehyde	½ g.
Geranyl Acetate	3 g.
Aldehyde C14 (10%)	10 g.
Terpineol	90 g.

No. 6
Musk (Conc.)

Ambrette (10%)	2 g.
Civet, Tincture	2 g.
Canada Snake Root Oil	½ g.
Vetivert	1½ g.
Lilac Oil	5 g.
Lily of the Valley Oil	5 g.
Chamomile German	⅛ g.

No. 7
Hair Treatment

Terpenyl Acetate	½ oz.
Mimosene	¾ oz.
Geraniol	1 oz.
Ambrette Solution	1 oz.
Art. Musk	1 oz.
Patchouli Oil	½ oz.
Benzyl Acetate	½ oz.
Citronella Oil	2 oz.
Cananga Oil	1 oz.
Indol (10%)	1 oz.
Terpineol	5 oz.
Pettigrain Oil	¼ oz.
Sandalwood Oil	½ oz.
Mace Oil	¼ oz.
Bornyl Acetate	½ oz.
Linaloe Oil	¼ oz.

No. 8
(Rose)

Coumarine	1 oz.
Guaiacwood Oil	1 oz.
Geranium Oil, Sur Roses	2 oz.
Benzyl Acetate	1 oz.
Geraniol Extra	5 oz.
Bois De Rose Oil	2 oz.
Terpineol	4 oz.

No. 9
Cheap Clover Perfume Base

Linalyl Acetate	8.00 g.
Amyl Salicylate	16.00 g.
Vanillin	8.00 g.
Musk Ambrette	4.00 g.
Aubepine	16.00 g.
Orange Terpenes	16.00 g.
Clover Oil	8.00 g.
Bay Oil	8.00 g.
Benzyl Acetate	16.00 g.
Benzylidene Acetone	0.16 g.

No. 10
(Peppermint Oil Substitute)
British Patent 507,257

Menthol, Synthetic	50 g.
Menthone	35 g.
Menthyl Acetate	12 g.
Menthyl Isovaleriante	3 g.

Shaving Creams
Formula No. 1

A shaving cream high in wetting power which should have a rapid softening effect on the beard is made from the following: 25 parts of white, amorphous stearic acid, with a titre of 54–55° C., 5 parts of bleached palm oil, 6 parts of Cochin coconut oil, 1 part of cetyl alcohol, 2 of triethanolamine, 19 of 50 per cent caustic potash solution, 6 of pure white glycerin with a specific gravity of 1.23–1.24, and 27 parts of water.

No. 2

Stearic Acid	38.0 g.
Coconut Oil	10.0 g.
Glycerin	5.0 g.
Caustic Potash (50° Bé.)	15.0 g.
Caustic Soda (8° Bé.)	30.0 g.
Sulphonated Castor Oil	2.5 g.

No. 3
(Penetrating)

Sodium Lauryl Sulphate	45.90 g.
Water	36.22 g.
Glycerin	15.75 g.
Stearic Acid	2.37 g.
Perfume	0.78 g.

No. 4
(Boric Acid)
U. S. Patent 2,148,286

Stearic Acid	50 g.
Lanolin	7 g.

Mineral Oil	6	g.
Triethanolamine	2	g.
Borax	2	g.
Water	240	g.
Gum Tragacanth	0.67–4	g.
Borac Acid	1	g.
Glycerin	1.5 –7	g.

No. 5
(Semi-Solid)

White, Amorphous Stearin	30.0	g.
Cochin Coconut Oil (or Fatty Acids)	8.0	g.
Caustic Potash (50° Bé.)	11.5	g.
Caustic Soda (38° Bé.)	3.5	g.
Glycerin	4.0	g.
Water	45.0	g.

No. 6

A shaving cream with satisfactory lather is made from 28 parts stearic acid, 8 parts Cochin coconut oil, 15 parts caustic potash 50° Bé., 6 parts glycerin sp. gr. 1.23, 3 parts triethanolamine and 40 parts water. This formula is based on an analysis of a well-known German product.

No. 7
(Powdered)

Cochin Coconut Oil	15	lb.
Stearic Acid (Triple Pressed)	87	lb.
Caustic Soda	7.46	lb.
Caustic Potash (88–92%)	11.60	lb.
Water	40.00	lb.
Talc or Starch	7.5	lb.

Procedure: Dissolve alkalis in the water, and allow to cool. Melt the oil and stearic acid in a nickel clad steel crutcher, by heating to 160° F. Add the lye slowly, while mixing, for about 20 minutes. Allow the batch to heat for one hour, when it may be withdrawn to frame. A test should be made for completeness of saponification. However, there should be about 2% of free fat remaining unsaponified. When cool, cut into bars, chip the soap, and grind, adding the 5 pounds of talc. The powder should be sifted through 150 mesh screen. Perfume with 1% lavender or lilac. The latter is pleasing to most men.

No. 8
(Brushless)

Glycosterin	40	g.
Diglycol Laurate (Neutral)	90	g.
Stearic Acid (Triple Pressed)	180	g.
Carbitol	40	g.
Diethylene Glycol	20	g.
Sulfatate (2% Solution)	100	cc.
Water	500	cc.
Perfume	5	g.

Tooth Paste
Formula No. 1
(Alumina)

Alumina Hydrate Gel	69.0	g.
Triethanolamine Lauryl Sulphate	0.3	g.
Colloidal Clay	20.0	g.
Glycerin (28° Bé.)	7.0	g.
Tragacanth	0.1	g.
Sodium Hydroxy Benzoate	0.1	g.
Perfume	0.5	g.
Water	3.0	g.

No. 2
(Hughes Type)

Dicalcium Phosphate	58.00	g.
Glycerin	17.61	g.
Water	21.60	g.
Alcohol	0.86	g.
Gum Tragacanth	0.86	g.
Saccharin	0.07	g.
Flavoring Oils	1.00	g.

No. 3
(Antiseptic)

Precipitated Chalk	35.0	g.
Tricalcium Phosphate	7.0	g.
Bentonite	2.0	g.
Foaming Agent (Wetanol)	5.0	g.
Gum Karaya	0.3	g.
Saccharin	0.5	g.
Ti-Tree Oil	3.9	g.
Glycerin	12.0	g.
Water	34.0	g.

No. 4
(Soapy)

Powdered White Soap	20.0	g.
Precipitated Calcium Carbonate	35.0	g.
Kaolin	3.0	g.
Glycerin	20.0	g.
Water	10.0	g.
Alcohol	10.0	g.
Saccharin	0.2	g.
Flavor	to suit	

No. 5
(Anti-Tartar)
British Patent 473,960

Sorbitol Citrate	0.5	g.
Distilled Water	2.5	g.
Aluminum Silicate	2.0	g.
Talc	8.0	g.
White Bole	15.0	g.
Kaolin	15.0	g.
Silica Gel	10.0	g.
Glycerin	47.0	g.

No. 6
U. S. Patent 2,172,743

Sodium Perborate	6	kg.
Talc	6	kg.
Tricalcium Phosphate	6	kg.

Soap	8 kg.
Saccharin	250 g.
Diethylene Glycol Diborate	56 kg.
Alcohol	8 kg.
Flavor	to suit

Tooth Filling

U. S. Patent 2,178,821

Gum Sandarac	3 lb.
Camphor	2 oz.
Methyl Salicylate	2 oz.
Thymol	2 oz.
Alcohol	2 qt.

The tooth is plugged with absorbent cotton saturated with above solution.

Tooth Bleach

Calcium Carbonate	250 g.
Sodium Perborate	15 g.
Sodium Soap	15 g.
Peppermint Oil	7 g.
Anise Oil	0.4 g.
Glycerin	to suit

Mouth Wash (Chlorothymol)

Formula No. 1

Citric Acid	0.1	g.
Tartaric Acid	0.1	g.
Benzoic Acid	0.1	g.
Boric Acid	2.0	g.
Glucose	0.5	g.
Glycerin	10.0	g.
Chlorothymol	0.033	g.
Eucalyptol	0.1	cc.
Thymol	0.07	g.
Menthol	0.045	g.
Alcohol	25.0	cc.
Distilled Water, To Make	100.0	cc.

No. 2

(Astringent)

Sodium Bicarbonate	12.5	g.
Borax	12.5	g.
Zinc Chloride	1.5	g.
Menthol	0.25	g.
Alcohol	25.0	g.
Glycerin	50.0	g.
Cinnamon Water	200.0	g.

No. 3

(Soapy)

Neutral Soap, Powdered	20.0	g.
Glycerin	90.0	g.
Peppermint Oil	6.0	g.
Wintergreen Oil	2.5	g.
Cinnamon Oil	1.0	g.
Clove Oil	0.5	g.
Alcohol	300.0	g.
Distilled Water	580.0	g.

Eye Lotions

Formula No. 1

Boric Acid	2.5	g.
Sodium Borate	3.0	g.
Glycerin	1.0	g.
Distilled Witch Hazel	5.0	g.
Distilled Water, To Make	100.0	g.

No. 2

(Astringent)

Zinc Sulphate	0.5	g.
Sodium Borate	32.0	g.
Boric Acid	16.0	g.
Glycerin	50.0	g.
Peppermint Water	75.0	g.
Rose Water	150.0	g.
Distilled Water, To Make	1,000.0	g.

No. 3

(Alkaline)

Sodium Bicarbonate	4.0	g.
Sodium Borate	4.0	g.
Sodium Chloride	4.0	g.
Glycerin	15.0	g.
Distilled Water, To Make	1,000.0	g.

Medicinals

Acne Lotion

Resorcinol Monoacetate	4	g.
Triethanolamine	1	g.
Glycerin	5	g.
Alcohol	35	g.
Water	55	g.

Active Skin Disinfectant

Alcohol	525	cc.
Acetone	100	cc.
Water	375	cc.
Tricresol	5	cc.
Mercuric Chloride	0.70	g.
Eosin Y	0.60	g.
Acid Fuchsin	0.08	g.

Chromic Acid Dermatitis Cure

Potassium Chlorate	1 oz.
Borax	1 oz.
Sodium Bicarbonate	2 oz.

Dissolve one tablespoonful of this mixture in two quarts of warm water, soak hands or parts affected for twenty minutes, dry, apply this salve:

Zinc Oxide Ointment	1 oz.	Mix together
Starch	1 oz.	
Vaseline	2 oz.	

If possible expose the parts afflicted to the open arc lamp rays for five minutes each day.

Tannic Acid Solution for Burns

(Will keep for 1 year at room temperature)

Potassium Chloride	0.42 g.
Calcium Chloride (Anhydrous)	0.84 g.
Salicylic Acid	1.00 g.
Sodium Chloride	10.50 g.
Tannic Acid	100.00 g.
Distilled Water To Make	1 l.

Ointment for Burns

Aluminum Naphthol-Disulphonate	2 g.
Ichthyol	4 g.
Phenol	2 g.
Lanolin	62 g.
Petrolatum	30 g.

Mercuric Nitrate Ointment

Mercuric Nitrate	11.34 g.
Nitric Acid	1.35 g.
Distilled Water	32.31 g.
Beeswax U.S.P.	5.00 g.
Cholesterol	1.50 g.
White Petrolatum	48.50 g.

Mix 11.34 g. of finely powdered mercuric nitrate with 1 cc. of water, preferably in a mortar, and add 1.35 g. of nitric acid, accurately weighed. Triturate in the mortar until solution is effected and add 31.31 g. of water, slowly and with constant stirring.

Melt the white petrolatum, the cholesterol finely powdered and the white wax in a suitable dish. Continue the heat until the temperature of the mixture is raised to 80° C., and the cholesterol has completely dissolved. Stir the mixture until it congeals. By trituration, slowly incorporate the aqueous solution of mercuric nitrate into the ointment base. Care should be taken to avoid contact with metallic instruments or containers.

Cod Liver Oil Ointments

Formula No. 1

Beeswax	10 g.
Spermaceti	10 g.
Cod Liver Oil	80 g.

No. 2

Beeswax, Yellow	20 g.
Petrolatum	50 g.
Cod Liver Oil	40 g.

No. 3

Cod Liver Oil	100 g.
Beeswax	20 g.
Glycerin	20 g.
Petrolatum	30 g.
Lanolin	30 g.
Water	50 g.

No. 4

Beeswax, Yellow	10 g.
Triethanolamine Stearate	10 g.
Lanolin	25 g.
Cod Liver Oil	75 g.

Mustard Gas (Bleach) Ointment

Bleaching Powder	50 g.
Petrolatum, White	50 g.

Grind together until uniform.

Poison Ivy Ointment

A vanishing cream base (potassium stearate) containing 10% sodium perborate or potassium periodate is an effective preventive against poison ivy dermatitis. It is recommended that it be rubbed well into the skin of the arms and face before exposure. At the noon hour it should be removed by washing with soap and water and a fresh portion applied before re-exposure in the afternoon. The cream must be freshly prepared and not used after 2–3 weeks since it deteriorates on storage.

Zinc Oxide Ointment

Zinc Oxide	100 g.
Talc	100 g.
Glycerin	100 g.
Water	100 g.
Bentonite	20 g.

Zinc Oxide Jelly

Zinc Oxide	10 g.
Glycerin	10 g.
Bentonite	6 g.
Water	100 g.

Prophylactic Ointment

Petrolatum	67 g.
Cholesterol	1½ g.
Calomel (Colloidal)	33 g.
Mercuric Cyanide	⅛ g.

Catheter and Syringe Lubricant

Tragacanth, Powdered	10 g.
Boric Acid, Powdered	30 g.
Lavender Oil	5 cc.
Glycerin	100 cc.
Irish Moss Decoction	900 cc.

Triturate the tragacanth and boric acid with the lavender oil and glycerin and gradually add the decoction. Sterilize by heating in an autoclave or by tyndallization and transfer to sterile collapsible tubes.

Suppository Base

Formula No. 1

Beeswax	1.5 g.
Cocoa Butter	4.5 g.
Cod Liver Oil	4.0 g.

No. 2

Triethanolamine Stearate	4 g.
Beeswax	3 g.
Cod Liver Oil	20 g.

Liniment or Rheumatic Cream

Formula No. 1

Raisin Seed Oil	9 g.
Methyl Salicylate	15 g.
Diglycol Stearate	15 g.
Water	61 g.

No. 2

Avocado Oil	10 g.
Methyl Salicylate	15 g.
Diglycol Stearate	22 g.
Water	60 g.

Heat diglycol stearate with oil at 70° C., until dissolved. While mixing add warm methyl salicylate and then pour mixture slowly with rapid mixing into water heated to 70° C.

Thermal Poultice

A poultice to produce local heat and sweating in cases of wounds, arthritis or pneumonia is compounded as follows:

Kaolin (Powdered)	500 g.
Boric Acid (Powdered)	50 g.
Peppermint Oil	1 cc.
Methyl Salicylate	1.5 cc.
Menthol	0.1 g.
Thymol	0.5 g.
Glycerin	450 g.

The boric acid and the kaolin are mixed and sifted, and then admixed with the glycerin. The whole is then heated at 120° C., for one hour, with occasional stirring. This heating should on no account be omitted, as its purpose is to destroy tetanus spores which may be present in the kaolin.

Allow to cool, and add the remaining ingredients, which have previously been mixed together. Mix the whole.

This poultice should be stored in small, airtight containers which are immersed in hot water for a while before application of the contents. After application the affected part should be covered with cotton-wool.

To avoid infringement of proprietary and pharmacopœial rights the product may not be sold, of course, as "Antiphlogistine" or as "Poultice of Kaolin."

Foot Powder

Boric Acid	4 oz.
Hexamethylenetetramine	4 oz.
Talcum Powder	4 oz.
Zinc Lactate	2 oz.
Zinc Oxide	2 oz.

All materials should be ground to a fine powder, then mixed thoroughly, and placed in a shaker with a perforated top for dispensing. Powder the inside of the shoes as needed.

"Athlete's Foot" Treatments

10% sodium propionate in 50% alcohol; a powder containing 15% sodium propionate in Venetian talc, and ointment containing 15% of sodium propionate in lanolin and petroleum jelly, and a solution containing all five acids in the strength of about 0.3% dissolved in 50% alcohol.

Alimentary Neutralizing Powder

Calcium, or Magnesium Phosphate	3.0 g.
Calcium, or Magnesium Carbonate	1.0 g.
Sodium Bicarbonate	4.0 g.
or	
Bismuth Subcarbonate	1.0 g.
Sodium Bicarbonate	5.0 g.

Non-Lumping Sodium Bicarbonate

German Patent 659,054

Add 5% of powdered bole to sodium bicarbonate to prevent lumping.

CHAPTER FIVE

EMULSIONS AND DISPERSIONS

Chinawood Oil Emulsion

1. Ammonium Linoleate Paste	12 g.
2. Water	60 cc.
3. Chinawood Oil	90 g.

Heat *1* and *2* to 60° C., and pour slowly into water heated to 60–70° C., while mixing vigorously.

Corn Oil Emulsion

1. Sorbitol Stearate	10
2. Corn Oil	40
3. Water	50

Method—Same as above.

Linseed Oil Emulsion

Linseed Oil	60 oz.
Aminostearin	5 oz.
Water	35 oz.

Warm together and mix vigorously. To thin down add Carbitol 6 oz.

Lard Oil Emulsion

1. Lard Oil	87
2. Oleic Acid	10
3. Trigamine	3
4. Water	100

Mix *3* and *4* and add slowly, with vigorous stirring to mixture of *1* and *2*.

Olive Oil Emulsion

1. Ammonium Linoleate Paste	19 g.
2. Water	60 g.
3. Olive Oil	80 g.

Allow *1* and *2* to stand overnight then stir slowly until dissolved. Add *3* slowly while mixing vigorously.

Pine Needle Oil Emulsion

Pine Needle Oil	1 g.
Mineral Oil	12½ g.
Diglycol Laurate	5 g.
Sulphonated Oil (Anhydrous)	2½ g.
Water	30 cc.

Mix vigorously with electric mixer.

Perilla Oil Emulsion

1. Perilla Oil	60 g.
2. Triethanolamine Oleate	5 g.
3. Water	35 cc.

Warm *1* and *2* together until dissolved and add slowly to *3* while mixing vigorously.

Methyl Salicylate Emulsion

1. Methyl Salicylate	50 g.
2. Glyceryl Monolaurate	10 g.
3. Water	40 g.

Dissolve *2* and *1* and add *3* to foregoing slowly while mixing vigorously.

Tar Oil Emulsion

1. Tar Oil	25 oz.
2. Potassium Abietate	15 oz.
3. Water	15 oz.

Warm *1* and *2* and mix until uniform. Add water slowly with vigorous agitation.

Diluted Tar Oil Emulsion

1. Tar Oil Emulsion (Above)	11 oz.
2. Water	89 oz.

Add *1* and *2* slowly with vigorous mixing.

Mineral Oil Emulsions

Formula No. 1

Part A:	Mineral Oil	50.0–70.0
	Oleic Acid	1.5
Part B:	Potassium Hydroxide (25% Solution)	1.5
	Water (Distilled)	47.0–27.0

Agitation of *Part A* is started and *Part B* slowly added. If the oil (petrolatum) is very viscous at room temperature, it should be warmed until it flows freely. The water in *Part B* should then be warmed to the same temperature before the two parts are mixed.

	No. 1	No. 2
Mineral Oil	57.5 g.	57.5 g.
Ammonium Oleate	—	5.0 g.
Trigamine Stearate	5.0 g.	—
Water	37.5 cc.	37.5 g.

Warm together until emulsifer melts and mix vigorously.

Crank Case (Waste) Oil Emulsion

Ammonium Linoleate	5 g.
Crank Case Oil (Waste Oil)	15 g.

Mix together and while mixing with high speed stirrer, run in slowly:

Water	80 cc.

Breaking Crude Oil Emulsion

A crude oil emulsion can be broken in 5-6 days by heating layer of water in bottom of tank to 65° C.

Stable Gasoline Fuel Emulsion

U. S. Patent 2,125,448

Triethanolamine	18 cc.
Oleic Acid	58 cc.
Butyl Cellosolve	20 cc.
Secondary Hexyl Alcohol	25 cc.
Water	75 cc.
Gasoline	750 cc.

Bituminous Emulsion

Melt 100 parts of bitumen, having a softening point of 45° to 50° C., and add 10.8 parts of rosin, and heat to 100–125° C. Then add 20 parts of kaolin (swollen in equal parts by weight with water), and 1.2 parts of sodium hydroxide preheated to 70° to 80° C. Raise the temperature of this mixture to 100° C., and dilute with water to produce an emulsion containing 20 to 25% of solids.

Road Surfacing Bitumen Emulsion

British Patent 493,898

Bitumen	35 lb.
Coal, Powdered	15 lb.
Water	50 lb.
Carragheen	1 lb.

Tar Asphalt Emulsion

Shale Tar	38.15 lb.
Water	49.60 lb.
Mexican Asphalt	7.63 lb.
Casein	1.15 lb.
Rosin	1.15 lb.
Potato Starch	0.76 lb.
Anthracene Oil	1.34 lb.

Ceresin Wax Emulsion

1. Ceresin Wax	16 oz.
2. Aminostearin	4 oz.
3. Water	80 oz.

Heat *1* and *2* to 85° C., and add slowly with vigorous mixing to the water at 90–100° C.

Carnauba Wax Emulsion

Carnauba Wax	260.00 oz.
Trihydroxyethylamine Oleate	48.50 oz.
Triethanolamine	28.00 oz.
Borax	11.11 oz.
Caustic Soda (50%)	2.22 oz.
Water	650.22 oz.

Ouricouri Wax Emulsion

Ouricouri Wax	13.2 oz.
Diglycol Oleate	2.5 oz.
Triethanolamine	2.2 oz.
Borax	1.0 oz.
Water	80.0 oz.

Melt wax and diglycol oleate at 80° C., and make solution of other ingredients at same temperature. Add latter to former slowly while mixing vigorously with electric stirrer.

Candelilla Wax Emulsion

Candelilla Wax	23 oz.
Ammonium Linoleate S	3 oz.
Water	232 oz.
Ammonia	2 oz.

Melt wax at 100° C. The ammonium linoleate is thinned by working in 30 cc. of water, a little at a time. The balance of water is heated to 95–100° C., and the ammonium linoleate solution is added to it. The whole is boiled and added to the melted wax, a little at a time, while stirring vigorously. Finally add the ammonia and stir until cooled to 50° C.

Rubber Resin Emulsion

1. Rubber Resin	40 g.
2. Ammonium Linoleate Paste	10 g.
3. Water	150 g.

Heat *1* and *2* until homogeneous and add water to it slowly with vigorous mixing.

Polystyrene Resin Emulsion

a.	Polystyrene Resin	7.5 g.
	Toluol	22.5 g.
	Octyl Acetate	6.5 g.
b.	Emulsifying Agent (Deceresol O T)	1.0 g.
	Diglycol Laurate	0.5 g.
	Water	12.5 g.
c.	Toluol	50.0 g.

Dissolve *a;* to this add *b* slowly while mixing vigorously, then add *c* and stir until uniform.

This gives a stable film-forming emulsion.

Ethyl Cellulose Emulsions

		Formula No. 1	No. 2	No. 3
1.	Ethyl Cellulose	5.0	5.0	5.0 g.
	Octyl Acetate	63.0	5.0	5.0 g.
	Toluol	63.0	63.0	63.0 g.
	Diphenyl Oxide	0.6	1.4	1.0 g.
	Dow Plasticizer No. 6	1.4	0.6	1.0 g.
2.	Deceresol O T	2.0	2.0	2.0 g.
	Water	13.0	13.0	13.0 g.

Add *2* to *1* slowly while mixing vigorously with an electrical mixer.

Methacrylate Emulsions

Formula No. 1

1.	Monomeric Methacrylate	25 oz.
2.	Dibutyl Phthalate	5 oz.
3.	Deceresol O. T. (10%) (Wetting Agent)	4 oz.
4.	Water	64 oz.
5.	Hydrogen Peroxide (30%)	3 oz.

Mix *1* and *2* and add slowly to mixture of *3*, *4*, and *5*, stirring well. Then pass through a colloid mill or homogenizer.

No. 2

1.	Monomeric Methacrylate	12.5 oz.
	Monomeric Styrene	12.5 oz.
2.	Dibutyl Phthalate	5.0 oz.
3.	Deceresol O. T. (10%)	4.0 oz.
4.	Water	64.0 oz.
5.	Hydrogen Peroxide	2.0 oz.

Use same method as in Formula 1.

Stearic Acid Emulsion

Stearic Acid	20 oz.
Gelatin	5 oz.
Tartaric Acid	3 oz.
Moldex (Preservative)	⅖ oz.
Water	172 oz.

Melt stearic acid at 80° C. and add slowly to other ingredients previously heated to 70° C. and dissolved.

Suspending (Dispersing) Insoluble Powders

Insoluble powders such as zinc oxide, sulphur, Neozone D, Zenite, dry powder colors and fillers are dispersed by grinding in water with a protective colloid and a dispersing agent. The presence of a small amount of fixed alkali in such a mixture is desirable.

Insoluble Powder	100.00 oz.
Casein	3.00 oz.
Preservative (Moldex)	0.25 oz.
Darvan (Dispersing Agent)	1.00 oz.
Sodium Hydroxide	0.10 oz.
Water	95.65 oz.

Heat the water to 175° F. and add 1 part of 29% aqua ammonia. Add slowly with rapid stirring 3 parts of casein and continue stirring until it is dissolved. Then add 0.1 part of sodium hydroxide. Next 0.25% of a preservative should be added. Darvan (1.0 part) is readily soluble in water and may be added to the solution alone or with the insoluble powders, 100 parts of which are next added. The mixture is then placed in a pebble mill having a capacity double the volume of the mixture and ground for about 24 hours or ground in a colloid mill for a suitable length of time. If dry color pigments are being dispersed, it is desirable to double the grinding time.

Carbon Black Dispersion

Carbon Black	100. oz.
Darvan	4. to 8. oz.
Water	563. to 599. oz.

If a thicker dispersion than results from the above is desired, it may be obtained by adding during the last hour of grinding 1.0 to 2.0 parts of casein in water solution.

The method used is similar to that for suspending insoluble powders.

Carbon Black Dispersant

Quebracho Powder (Finely Ground)	95.0 lb.
Soda Ash	5.0 lb.
Phenol	0.2 lb.

Mix and grind in a pebble mill.

Chapter Six

FARM AND GARDEN SPECIALTIES

Weed Killers

Formula No. 1

Sodium Bisulphate	25 lb.
Sodium Sulphite	5 lb.
Talc	70 lb.

No. 2

British Patent 477,586

Sodium Chlorate	6 lb.
Soda Ash	4 lb.

No. 3

Sodium Chlorate	6 lb.
Soda Ash	3 lb.
Sodium Acetate	1 lb.

No. 4

German Patent 678,538

Copper Nitrate	38 lb.
Sodium Silicate	25 lb.
Copper Sulphate	37 lb.

No. 5

U. S. Patent 2,094,366

Sodium Acetate	1–5 lb.
Sodium Chlorate	5–9 lb.
Water	224 lb.

This will give a product having a reduced rate of burning.

No. 6

Canadian Patent 379,721

Sodium Chlorate	15 lb.
Water	10 lb.
Ammonium Sulphate	6–15 lb.
Sodium Bisulphate	1 lb.

Borax to make a saturated solution.

Chlorate Type

No. 7

Sodium Chlorate	85 kg.
Sodium Carbonate	14.5 kg.
Dye, Water Soluble*	0.5 kg.

No. 8

Sodium Chlorate	70 kg.
Sodium Chloride	29.5 kg.
Dye, Water-Soluble	0.5 kg.

No. 9

Sodium Chlorate	70 kg.
Calcium Chloride	14.5 kg.
Magnesium Chloride	14.5 kg.
Dye, Water-Soluble	1 kg.

Use in very dilute aqueous solution.

When garments are stained by these solutions, they must be washed out immediately and thoroughly.

Control of Weeds in Cereal Fields

Calcium Cynamid (Unoiled)	1 lb.
Kanite Dust	4 lb.

Spray on foliage at rate of 400 lb. per acre.

Soil Fumigant and Weed Killer

U. S. Patent 2,156,789

paradichlorbenzol	10 lb.
Carbon Disulphide	90 lb.

Lawn Weed Poisons

Heal All—
  Iron (ferrous) Sulphate
Orchard Grass, Crab Grass—
  Ammonium Sulphate
Dandelions—
  Ammonium Sulphate
Plantain—
  Ammonium Sulphate
Canada Thistle—
  Sodium Chlorate
Bindweed—
  Sodium Chlorate
Quack Grass—
  Sodium Chlorate
Toadstools—
  Copper Sulphate, Bordeaux Mixture or Iron Sulphate

Dandelion and Plantain Eradication

Patience and proper application to the dandelion or plantain are necessary for success with any treatment. The following have all been highly recommended:

Pull the weed out by the roots in early spring just after the frost has lifted and rains have softened the ground.

Some authorities on lawn care recommend stabbing the plantain or dandelion plant at the crown so as to penetrate the root with a sharp prod, and then pouring in any *one* of the following:

Carbolic acid, kerosene, gasoline, hydrochloric acid, sulphuric acid, nitric acid.

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* To make the mixture visible on cloth, where it might cause ignition after some time, when dried.

When using acids, a long stay rod sharpened to a point makes an effective prod. If the acid bottle is fastened to the bottom of a stick of similar length, a large area may be quickly covered without tedious back bending.

Fruit Tree Sprays

Formula No. 1

Olein	20 kg.
Coal Tar Oil	70 kg.
Caustic Potash (24° Bé.)	19 kg.

No. 2

Talloil, Crude	22 kg.
Coal Tar Oil	70 kg.
Caustic Soda (36° Bé.)	9 kg.

No. 3

Talloil—Distillate	22 kg.
Coal Tar Oil	68 kg.
Caustic Potash (36° Bé.)	12.5 kg.

No. 4

Woolfat Fatty Acid, Crude	25 kg.
Coal Tar Oil	65 kg.
Caustic Potash (36° Bé.)	12 kg.

No. 5

Olein	20 kg.
Coal Tar Oil	65 kg.
Caustic Soda (36° Bé.)	9 kg.
Methyl Hexalin	5 kg.

No. 6

Talloil, Crude	20 kg.
Coal Tar Oil	62 kg.
Caustic Soda (24° Bé.)	15 kg.
Alcohol, Denatured	3 kg.

No. 7

Olein	5 kg.
Colophony	15 kg.
Coal Tar Oil	70 kg.
Caustic Soda (36° Bé.)	9 kg.

No. 8

Talloil, Crude	10 kg.
Colophony	10 kg.
Coal Tar Oil	65 kg.
Caustic Soda (24° Bé.)	15 kg.

No. 9

Talloil, Crude	15 kg.
Woolfat Fatty Acid	10 kg.
Coal Tar Oil	70 kg.
Caustic Soda (24° Bé.)	11.5 kg.

No. 10

Talloil, Crude	10 kg.
Woolfat Fatty Acid	10 kg.
Coal Tar Oil	70 kg.
Caustic Soda (36° Bé.)	8 kg.

No. 11

Colophony	20 kg.
Crude Montan Wax	5 kg.
Coal Tar Oil	60 kg.
Caustic Potash (40° Bé.)	12 kg.

Preparation:

Use iron or enamelled agitated kettles which are steamheated, or fired from below, and can be emptied at the bottom.

Heat 50% of the coal tar oils (or their blends) with the saponifiable materials (colophony, olein, talloil, montan wax, woolfat fatty acid) to about 80° C.

Thin the saponification lye with 50–100% of water in a separate kettle, low-degree-lyes being *more* diluted than high-degree lyes.

The thinned caustics are stirred into the hot oils. Boil. The saponification starts when the content of the kettle starts "rising."

Stir continuously, watch the heating in order to prevent the kettle boiling over.

As soon as the saponification is done, add the remainder of the coal tar oil, which is to be heated separately to 70° C. before.

When all is well mixed, boil for a second time, until the material is (nearly) clear. Too much water in the preparation makes it cloudy. In such a case boil further.

Test by cooling a sample, which should be clear, and show the right, well-bound consistency. If the cooled sample is gelatinous, water should be added.

No. 12

Coal Tar Oil (Carbolineum)	60 lb.
Talloil	25 lb.
Ammonia (sp.g.=0.96)	15 lb.
Water	10 lb.

Saponify at about 40–50° C. Should emulsify readily with 10 times the amount of water.

No. 13

Talloil	300 kg.
Caustic Soda (20° Bé.)	280–290 kg.
Tar Oil (Middle Frachon)	1,200 kg.
Crude Mineral Oil	200 kg.

No. 14

(For Apple Trees)

Nicotine Sulphate (40%)	1 pt.
Bentonite	5 lb.
Soybean Oil	1 qt.
Sodium Lauryl Sulphate	½ oz.
Water	100 gal.

No. 15

(For Apple Scabs)

Cotton Seed Oil	6 pt.
Copper Sulphate (10% Solution)	4½ gal.

Hydrated Lime	6 lb.
Water	100 gal.

No. 16

(For Tomato Leaf Miner)

Nicotine	¾ oz.
Soft Soap	½ lb.
Water	10 gal.

Miscellaneous Agricultural Sprays

No. 1

(Prickly Pear Eradication)

Spray a fine mist of

Arsenic Pentoxide	2.5–3 lb.
Sulphuric Acid	½–1 pt.
Water	1 gal.

This is poisonous to birds and animals.

No. 2

(Cyanide Type)

British Patent 457,828

Copper Cyanide	33 lb.
Gelatin	½ lb.
Water	66½ lb.

Grind in a colloid mill to form a base which is diluted for use.

No. 3

(Stock Emulsion)

Caustic Soda	1.3 lb.
Napthenic Acids	10–12 lb.
Mineral Oil	50–72 lb.

Dilute and mix with water as needed.

No. 4

(For Thrips on Peppers)

A 5% petroleum emulsion (made by adding 5 l. petroleum to 1 kg. laundry soap dissolved in 10 l. boiling water) is recommended against thrips.

No. 5

(For Gladiolus Thrips)

Tartar Emetic	4 lb.
Brown Sugar	16 lb.
Water	100 gal.

No. 6

(For Rose Thrips)

Tartar Emetic	2 oz.
Brown Sugar	7½ oz.
Water	3 gal.

Apply at five-day intervals.

No. 7

(Vegetable and Flower Insecticide)

Triamylamine	5 oz.
White Mineral Oil (Vis. 80–85)	85 oz.
Monoamylamine Oleate	10 oz.

One oz. of above mixture is diluted with 200–400 oz. of water.

No. 8

(For Potted Plants)

Nicotine, commercial (95%), 5 fl. oz.; soft soap, commercial, 2½ lb.; alcohol (95%), 80 fl. oz. For use, dilute with 160 volumes of water. A mildew spray is: Linseed oil, 12 fl. oz.; liver of sulphur, 2 lb.; cresol, 3 lb.; caustic potash, commercial, 1 lb.; water to make 1 gallon.

No. 9

(For Southern Buffalo Gnats)

Soap	8 oz.
Water	1 gal.

Boil and while mixing vigorously, add slowly

Pine Tar Oil (d. 1.065)	6 oz.

No. 10

(For Fruit Tree Borers)

Linseed Oil	10 qt.

Heat to 243° F. and add slowly while mixing well

Sulphur	30 oz.

Apply with brush.

No. 11

Sodium Arsenite	¼ lb.
Soluble Oil	1 qt.
Water	5 gal.

Apply by spraying.

No. 12

(For Peach Borers)

Cotton Seed Oil, Crude	1 gal.
p-Dichlorbenzol	2 lb.
Potash Fish Oil Soap	1 pt.
Water to make	5 gal.

Mix vigorously to emulsify.

For use mix 1 gal. of above with 3 gal. water and spray on lower part of trunk and on ground around tree. Put a few shovelfuls of earth over this.

No. 13

(For Codling Moths)

Non-Poisonous

Phenothiazine	3 lb.
Soap	½ lb.
Water	100 gal.

No. 14

Nicotine Sulphate (40%)	1 pt.
Bentonite	5 lb.
Soybean Oil	1 qt.
Wetting Agent (Wetanol)	½ oz.
Water	100 gal.

Mix well until emulsified.

No. 15

(For Pea Aphids)

Derris (4% Rotenone)	3 lb.
Sodium Lauryl Sulphonate	3 oz.
Water	100 gal.

Spray twice ten days apart.

Miscible Oil Spray Emulsions and Spreaders

Mineral oil 82.5, oleic acid 8.5, phenol 1.0, isoamyl alcohol 3.0, ethylene glycol monoethyl ether 1.5, caustic potash and water (1:1) 3.5. The formula for the emulsifier alone, which can be added to various insecticide liquids as required, contains: oleic acid 48.6, phenol 5.7, isoamyl alcohol 17.1, ethylene glycol monoethyl ether 8.6, caustic potash and water (1:1) 20. Amyl alcohol can be substituted for isoamyl alcohol, but the emulsifier is somewhat less stable; substitution of pine distillates requires special precautions. An emulsifier for miscible mixtures: oleic acid 32.5, cresol U.S.P. 32.5, "Yarmor" pine oil 10.0, caustic potash and water (1:1) 15.0 and kerosene 10.0. Fifteen percent of this emulsifier forms a miscible mixture which is stable on dilution with water. Phenol cannot be substituted for cresol in this formula. A combined spreader and emulsifier, contains: oleic acid (high sapon. no.) 25.0, cresol U.S.P. 15.0, caustic potash and water (1:1) 20.0, kerosene 5.0. It has high emulsifying and spreading powers. In some instances αterpineol can be substituted for yarmor pine oil, and London resin and pine tar oil (sp. gr. 1.035) for cresol. The formulas may be used with many but not all insecticide liquids; modifications are sometimes necessary.

Agricultural Spray Spreader and Sticker

Addition of ¼ lb. soybean flour per 100 gal. of spray is useful in promoting spreading and sticking.

Winter Treatment for Fruit Trees

While the actual damage done to fruit trees during the winter months by insect pests is very small compared with the havoc wrought among leaves, buds, blossoms and fruit, treatment should be just as efficiently carried out and should be regarded as an insurance against infestation and damage in the following year. Before successful or scientific treatment can be attempted it is as necessary to know what the remedies are to be used against as it is to know what is in them or how to make them. A knowledge of the life-history or metamorphosis of an insect is useful data, because it will indicate at what stage the pest can be easily attacked, and where it may be found. The life-cycle of a typical insect shows four distinct changes:—Egg (dormant), larva (active), pupa (dormant), and the imago (active). To know when the active stage takes place and the location, or to know where to find the dormant egg or pupa are aids to efficient attack. These four stages are not common to all insects, and with some the pupa is active. Imago simply means the adult insect: with moths the larval stage is called caterpillar, and the pupa a chrysalis; beetles and weevils—the larva is a "grub"; flies—the larva is a "maggot"; greenflies (aphides)—the larva is a "louse" and the pupa a "nymph." These distinctions are ones of convenience only.

The kinds of insects in which the complete transformation occurs are moths, beetles, two-winged flies, four-winged flies. Those in which there is no true pupal or resting stage are aphides and plant bugs, and thrips. Other pests are spiders and mites and eelworms. From October to March, or to indicate a safer period, from October to February, treatment resolves itself into the use of winter wash and grease bands against apple sucker, aphides, winter moth, caterpillars, magpie moth, on the apple, pear, plum, peach, gooseberry, currants and raspberry. These are the chief pests but if more thorough measures are contemplated, reference should be made to the annexed table, and, lastly, the use of soil insecticides should have the same attention as winter washes, because the soil, not only at the base but that area covered by the *spread* of a tree, is a harbourage for some of the stages, i.e., larvæ or pupæ.

Moths and Caterpillars

The moth itself does very little damage, but in order to lessen the numbers, banding with grease-bands to trap the wingless females which crawl up to lay eggs on the branches, should be done. Migrating caterpillars will be trapped also.

Grease bands are now made by fixing grease-proof paper bands to the trunks of trees and coating them with banding composition. It is impossible to prevent some of the female winter moths from reaching the branches, but coating the band both sides is thought to be a double safeguard, or two bands can be affixed. A good banding composition should be adhesive and remain tacky throughout the winter: it should not harden under frost or damage the bark.

A banding composition is practically a bird lime to which wood tar has been added, and the following is a suitable formula:—

Venice Turpentine	10 lb.
Rosin	20 lb.
Fish Oil	20 lb.
Turpentine	2½ lb.
Stockholm Tar	2½ lb.

There are many banding compounds on the market. The banding-paper should be strong grease-proof cut into strips 5 in. deep, and when in position on the tree there should be an overlap of about 1 inch. The band is usually attached with flour paste and tied in position with string, top and bottom, as tightly as possible: if there is a tree stake this must be done also. Banding of apple, pear and plum trees should be done if possible by October and kept on until the spring. The weight of banding composition for 100 trees of the following diameters is as follows if 5-in. bands are used: 2 in., 1½ lb.; 3 in., 4½ lb.; 4 in., 6½ lb.; 5 in., 7¾ lb.; 6 in., 9 lb.; 7 in., 10 lb.

Lime-Sulphur

Although primarily used to control moulds and fungi, lime-sulphur at a strength of 1—30 is used as a winter wash on dormant trees to prevent insect eggs from hatching. It is efficient to kill scale insects, and if used in late winter will lessen aphis attacks. If it is bought ready prepared it should have a specific gravity of 1.3, and although the usual dilution for winter use is 1—30, it may be used 1—20 to remove moss and lichen from neglected trees. For this purpose, however, caustic alkali wash is better.

Tar Distillate Washes

For use up to about the middle of February tar oil winter washes are replacing lime-sulphur for the control of aphides, caterpillars, and insect eggs. They are stated to cleanse trees of lichen and moss, and destroy eggs of the apple sucker. Spraying should be done when the trees are dormant, and should be completed by the middle of February for apple aphis; pear, plum, gooseberry should not be sprayed after the third week in January; peach and nectarine should not be sprayed after the second week in January. The strengths to use are as follows: Apple trees about 7½%, other fruit trees 5%. Some horticulturists use stronger solutions—e.g., plum, peach, bushes 5–6 %, apples 7½–10%. A tar-distillate wash should be applied with a spray to trunk, branches, twigs.

The starting point in the making of these sprays is "creosote oils" with a boiling range of 170°–300° C., although sometimes a higher boiling fraction is used (250°–350° C.). The emulsion should not break on dilution with water. Tar oils mixed with rosin soap give a product which forms an emulsion on dilution with soft water —e.g., rosin soap 15 parts, heavy tar oils 20 parts. The rate is about one quart for twelve average-sized trees. Soft water should be used to dilute the emulsion or "spreaders" may be used as gelatin, glue, sapamines, sulphonated wetting agents, sulphite lye, naphthenic acids.

Soil Insecticides

Banding will catch the winter moth, March moth, and mottled umber moth, and the second line of attack will be on the pupæ of those varieties, which winter in the soil. Removal of the top layer of soil to be buried deep, or baked, or allowing fowls to run in the orchard will diminish the numbers that reach maturity.

Naphthalene has been successfully used as a soil fumigant for killing pupæ, larvæ, and some adult insects injurious to fruit which live in the soil during the winter. At any time during the winter months it may be used, but for the winter moth, autumn is the best time. Most of the commercial soil fumigants consists of naphthalene ground up with ashes or clinker. A fairly pure product should be supplied, and tar oils should not exceed 3%. The following is the average composition of such an application:

Powdered Naphthalene	1 lb.
Ashes, or Lime	2 lb.

It should be dug in fairly deeply in and around the bole, and as far as the spread. Usually the rate is 1 lb. per 10 sq. yards.

Other products used include:

Formaldehyde (40%), one gallon diluted to 50 gallons with water and applied to every 10–18 sq. yards of soil.

Cresylic acid (97–99%), diluted 1–129. One gallon of acid will treat 18 sq. yards. A second application is made in 8–10 days after the soil has been turned.

Paradichlorbenzene. — The vapor readily permeates all types of soil and the powder should be fine enough to pass through a 12-mesh sieve. It should not be applied when the soil is wet. Weeds should be cleared away from the base of the trees, and the soil broken up to a depth of six inches. One ounce should be spread in a ring (1 to 2 in. wide) round the tree, and covered with soil.

Carbon Disulphide.—The vapor is heavy and inflammable, and is usually applied to the soil by means of an injector. The depth should be about 3 inches, and the injections made 12 inches apart. If an ordinary dibbler is used to make the holes, about 2 drachms of carbon disulphide should be poured in and the soil packed into the holes and left undisturbed.

Carbon Tetrachloride may be used in a similar manner to carbon disulphide.

Caustic Washes

Caustic wash destroys moss and lichens and fungi which grow on the tree, and which provide shelter for larvæ, etc. By destroying the lichens the pests are exposed to the weather, and are destroyed in that way or are eaten by birds. It will kill eggs if these are wetted. The following is a typical spray:

Caustic Soda (98%)	2 lb.
Water	10 gal.

Dry weather should be chosen for the spraying operations. For the destruction of hibernating caterpillars of the ermine moth caustic alkali emulsion is recommended. This is made as follows:

Soft Soap	20 lb.
Paraffin Oil	2 gal.
Caustic Soda	20 lb.
Water to	100 gal.

Make an emulsion of paraffin oil, soap, and about half the water: dissolve the caustic soda in the remainder and add the solution to the emulsion.

Incidence of Attack

From the following list the incidence of pests, though not the actual material damage, may be judged:

Apple: 1, 2, 3, 4, 5, 7, 8, 10, 14, 15, 17, 20, 22, 23, 28, 29, 30.
Cherry: 7, 14, 15, 22, 23, 28, 30.
Currant: 6, 9, 11, 21, 23.
Damson: 19, 23, 24, 25.
Gooseberry: 6, 11, 12, 16, 21, 23.
Loganberry: 27 (see also raspberry).
Peach: 4, 23.
Pear: 1, 4, 15, 20, 22, 23, 28, 30.
Plum: 6, 14, 15, 22, 23, 24, 25, 26, 28, 30.
Raspberry: 6, 9, 23, 27.
Strawberry: 9, 13, 18.

The numbers refer to the tabulated information regarding pest and stage of development, location, and treatment which can be carried out from October to February on dormant trees. It should be observed that treatment after February should be proceeded with with caution, and, according to the mildness of the season or early return of spring and the consequent state of development of the tree, the type of spray may have to be modified.

The tabulated information does not profess to be exhaustive, and is for the purpose only of indicating what measures can be adopted, exclusive of hand-picking, to lessen the damage in the ensuing year. There is no such thing as one pest—one remedy, and it will be seen that lime-sulphur applications (or a tar distillate wash), caustic washes, soil disinfestation, or combined use of these, provide treatment for many pests on many trees, or many pests on one tree.

Pest	Tree	Stage and Location	Treatment	No.
Apple blossom weevil	Apple Pear	Beetles up to end of March	Lime wash	1
Apple sawfly	Apple	Maggots in ground until end Feb.	Soil insecticide	2
Apple sucker	Apple	Eggs. Sept.-Nov.	Paraffin emulsion. Lime and salt wash	3
Blister moth	Apple Pear Peach	Chrysalis in crevices of tree	Lime-sulphur	4
Blue apple aphis	Apple	Eggs laid in autumn	Soft soap and nicotine. Paraffin emulsion	5

Brown scale	Currant Gooseberry Raspberry Plum	Larvæ	Lime-sulphur	6
Bud moth	Apple Cherry	Caterpillars in silken cases at base of buds	Caustic winter wash. Lime-sulphur in Feb.-March	7
Clouded drab moth	Apple	Chrysalis in soil until March	Soil sterilization	8
Cockchafer	Raspberry Currants Strawberry	Grubs in soil	Soil insecticide	9
Codling moth	Apple	Caterpillars in bark	Lime-sulphur	10
Currant lettuce aphis	Currants Gooseberry	Eggs on twigs	Caustic wash	11
Dot moth	Gooseberry	Chrysalis in soil Sept.-June	Soil sterilization	12
Eelworm	Strawberry	Soil and roots	Soil insecticide	13
Ermine moth	Apple Plum Cherry	Caterpillars on twigs in minute nests	Lime-sulphur. Caustic wash	14
Gold tail moth	Apple Plum Pear Cherry	Cocoons in crevices in bark	Caustic wash. Lime-sulphur in March	15
Gooseberry red spider	Gooseberry	All stages	Caustic wash. Paraffin emulsion in Feb.-March	16
Green apple aphis	Apple	Eggs laid on shoots in November	Nicotine wash in Oct.-Dec.	17
Ground beetle	Strawberry	Grubs	Soil insecticide	18
Hop aphis	Damson	Eggs at junction of small buds and branches	Lime-sulphur. Soft soap and insecticide in spring	19
Leaf blister mite	Pear Apple	Mites under bud scales	Lime-sulphur	20
Magpie moth	Currants Gooseberry	Caterpillars in dead leaves on ground	Tar distillate wash in October. Banding Jan.-April	21
Mottled umber moth	Apple Plum Cherry Pear	Moths come from soil. Oct.-Feb.	Banding. Soil sterilization	22
Mussel scale	All fruit	Eggs from November onwards	Paraffin emulsion. Caustic wash. Lime-sulphur	23
Plum curling aphis	Damson Plum	Eggs. Oct.-Nov.	Soft soap and insecticide. Caustic wash	24

Plum maggot	Plum Damson	Caterpillars	Oct. banding. Nov.-Dec. lime-sulphur	25
Plum fruit sawfly	Greengage Plum	Maggots in ground until end Jan.	Soil insectide	26
Raspberry beetle	Raspberry Loganberry	Pupæ in soil	Soot-lime	27
Winter moth	Apple Pear Cherry Plum	Chrysalis in soil until January	Banding. Lime-sulphur in March	28
Woolly aphis	Apple	Aphides and larvæ.	Paraffin emulsion. Caustic wash. Soil insecticide (carbon disulphide)	29
Wood leopard moth	Apple Plum Pear Cherry	Caterpillars bore into trunk	Inject carbon disulphide or insert potassium cyanide and plug holes	30

Codling Moth Control Bands

An excellent toxic mix for treating corrugated paper rolls for codling-moth control consists of 1 lb. of β-naphthol and 1½ pints of lubricating oil. The addn. of 4–6 oz. of crude paraffin to the above mix will produce a band that performs better during rainy or extremely hot weather. This formula will treat a 100-ft. roll of 2-in. paper at a cost of about 60 cents.

Lead Arsenate Spray Program for Codling Moth *

		Infestation		
Spray	*Time of Application*	*Light*	*Moderate*	*Severe*
Calyx	When last of petals'fall	3 lbs.	3 lbs.	3 lbs.
First cover	Mid-June	3 lbs.	3 lbs.	4 to 6 lbs.
Second cover	Late June	3 lbs.	3 lbs.	4 to 6 lbs.
Third cover	Mid-July	3 lbs.	3 lbs.	4 to 6 lbs.
Fourth cover	Early August		3 lbs.	4 to 6 lbs.
Fifth cover	Mid-August		3 lbs.	4 to 6 lbs.

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* Amounts mentioned for use in 100 gallons. To avoid possible arsenical injury, fresh hydrated lime equal in amount to that of lead arsenate is recommended.

Treatment of Home Orchards or Small Apple Plantings

The requirements for controlling the codling moth on a single tree or on 1,000 trees are essentially the same. The small grower may not be equipped to spray according to the methods customarily followed by commercial growers; however, in either case, the spray should be applied at the proper times. The liquid should be sprayed as a fine mist and one should endeavor to wet all surfaces of fruit and foliage. Those who depend on small spray equipment, such as a knapsack sprayer, bucket pump, or similar small-type machine, may simplify their spray operations by pruning to maintain low-headed trees. The following table will prove useful in preparing small quantities of spray materials.

Proportions Recommended for Small Quantities of Spray

Water	*Liquid Lime-Sulfur, 32° Baumé*	*Lead Arsenate*	*Hydrated Lime*
1 gallon	6 tablespoonfuls	2 tablespoonfuls	3 tablespoonfuls
10 gallons	1 quart	½ pint	¾ pint

For those who desire to dust rather than to spray, probably the most satisfactory material is known as 90–10 sulfur lead arsenate dust (9 pounds sulfur to 1 pound of lead arsenate). Generally speaking, dust mixtures are not as reliable as spray treatments and experience indicates the desirability of making applications at shorter intervals in order to secure a reasonable degree of protection. Dust mixtures adhere better when applied while dew is on the trees.

Fungicides

To guard against infection from apple scab, some consideration should be given to the use of fungicides in the spray program. Plant pathologists recommend liquid lime-sulfur in the delayed dormant, pink, and calyx sprays for protection during the early and more important infection periods. Lead arsenate is included in the preblossom sprays to reduce injury from insects that attack the foliage and blossom buds, and nicotine sulfate used in the delayed dormant application affords protection against aphids.

Generally speaking, apple scab is less active in the summer months and weaker fungicides, such as the wettable sulfurs, are substituted for the more caustic liquid lime-sulfur. During periods of extreme heat when temperatures are above 90° F. there is danger of spray-burn from sulfur residue. At such times it would be better to omit the fungicide rather than assume the risk of possible spray-burn.

Spreaders

A spreading agent is usually desirable to produce a smooth, evenly distributed spray deposit. Most prepared fungicides and several brands of lead arsenate contain spreading agents. Skim-milk powder (½ pound in 100 gallons) or soybean flour (1 pound in 100 gallons) may be used for this purpose in the cover sprays.

Spray Residue

To conform with the tolerance requirements established by the United States Department of Agriculture on lead and arsenic residues, provision should be made for cleaning fruit that has received two or more cover sprays containing lead arsenate. Information with regard to spray deposit and residue removal may be obtained from the Station.

Avoiding Spray Residue

In the lighter infested areas, principally the Hudson River and Lake Champlain sections, it is the general practice to substitute calcium arsenate (3 pounds in 100 gallons) for lead arsenate in the second and third cover sprays and thereby avoid a residue problem. When using calcium arsenate, special effort should be made to secure a brand that is safe for orchard use and 3 pounds of fresh hydrated lime are recommended with each pound of the arsenical to avoid spray injury.

Probably the most satisfactory method of combating the codling moth and at the same time avoiding a residue problem on early varieties, such as Duchess and Red Astrachan in western New York, is with an oil-nicotine program. Lead arsenate is used in the calyx and first cover sprays, followed in the next two applications with 3 quarts of summer oil emulsion and 1 pint nicotine sulfate in 100 gallons of water. To avoid possible spray injury the oil sprays should not be combined with sulfur or applied over sulfur residue. A period of about one month should elapse before it is considered safe to follow a sulfur spray with oil. When desirable to use a fungicide with an oil spray there are certain copper sprays available that are designed for this purpose. The oil-nicotine spray is also a very efficient spray for use on fall varieties in lightly infested orchards.

Codling Moth on Pears

In certain sections of western New York the codling moth is responsible for considerable damage to pears. Very little injury is caused by the first brood worms provided a petal fall spray containing lead arsenate is applied. During August when the fruit approaches maturity the second brood may cause excessive losses. An application of 3 quarts of summer oil emulsion and 1 pint nicotine sulphate in 100 gallons of water applied when side entrances are first noticeable (usually before the middle of the month), has proved a very effective treatment and at the same time avoids a residue problem.

Codling Moth Catchers

Add 0.2% benzoate of soda to usual cane-syrup baits.

Oriental Fruit Moth Control

Four late-season applications of oil dust should be made, starting about three weeks before harvest and ending two or three days before picking begins. Recommended formula for late-season dust: 60 pounds 300-mesh dusting sulphur, 15 pounds hydrated lime, 20 pounds 300-mesh talc, 5 pounds oil (Saybolt 104, 100° F., unsaturated).

Japanese Beetle Insecticide

Formula No. 1

Rosin	10 lb.
Caustic Soda	1 lb.
Fish Oil Soap	1 lb.

Boil together and add a water solution of

Corrosive Sublimate	1 lb.
Nicotine Sulphate	1 oz.

No. 2

Lead Arsenate	6 lb.
Menhaden Oil	1 pt.
Water	100 gal.

Mix well before use. Apply to ornamental plants about July 1st.

No. 3

Derris or Cubé Powder	4 lb.
Rosin Residue Emulsion	4 lb.
Water	100 gal.

No. 4

Dichlorethylether	1 oz.
Water	99 oz.
Wetanol (Wetting Agent)	0.1 oz.

Apply to soil every week when grubs are feeding near surface.

No. 5

Tetramethyl thiuram disulphide, 5 pounds, plus rosin residue emulsion, 1½ pounds, in 100 gallons of water provided outstanding protection as compared to the hydrated lime-aluminum sulphate treatment. Phenothiazine, 3 pounds, plus rosin residue emulsion, 1 pound, and derris, 4 pounds, plus rosin residue emulsion, 4 pounds, also ranked high in effectiveness when applied prior to heavy beetle invasions.

Japanese Beetle Control

Protection of Fruits and Leaves

Early Apples

Remove prematurely ripening and decaying fruits. The foliage can be protected by using a spray containing aluminum sulfate, 3 pounds; hydrated lime, 20 pounds; water, 100 gallons. Dissolve the aluminum sulfate in 2 gallons of water and make the lime into a thin paste. Put the solution of aluminum sulfate into the water in the spray tank, having the agitator running. When it is well mixed add the lime paste. Two or three applications of this spray combination may be required as follows: (1) Just before the beetles enter the orchard; (2) 7 to 10 days later; (3) just before most of the beetles occur.

Late Apples

If a regular spray application is to be made about July 1 use an approved fungicide and lead arsenate, 2 pounds in 100 gallons of water. Thereafter spray the upper third of the trees as often as needed to maintain the spray coating with 20 pounds of hydrated lime and 4 pounds of wheat flour in 100 gallons of water.

The lime-aluminum sulfate spray or one containing 6 pounds of acid lead arsenate and a suitable sticker in 100 gallons of water can be used as protective sprays. Four pounds of wheat flour to 6 pounds of lead arsenate are very satisfactory. Where no fruit cover spray is made early in July these sprays may be used when needed to keep the foliage and fruit covered.

Cherries

The cherry crop usually is harvested before the Japanese beetle appears in sufficient numbers to injure foliage or fruit. After the fruit is picked spray with lead arsenate, 6 pounds; flour, 4 pounds; and water, 100 gallons. Repeat in two or three weeks if necessary.

Early-ripening Peaches

Damage to July-ripening peaches can be avoided by spraying with a combination of derris powder (4 per cent rotenone), 3 pounds; rosin residue emulsion,* 3 pounds; and water, 100 gallons, if the orchard sanitation suggested under early apples is practiced. Start spraying as soon as the beetles get into the orchard. Apply later treatments every 7 or 10 days.

Late-ripening Peaches

Late-ripening peaches are not often damaged, although the leaves are often severely injured, resulting in poor quality fruits. The leaves on bearing and non-bearing trees can be pro-

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* A 50 per cent emulsion of rosin residue is prepared as follows: 4 pounds of casein is dispersed in about 45 pounds of water to which 12 ounces of ammonium hydroxide (sp. gr. 0.90) has been added; 50 pounds of rosin residue is added slowly with violent agitation, which is continued until the material becomes emulsified. This emulsion can be diluted without difficulty with hard, cold water. In preparing this spray, the rosin-residue emulsion is added to the water in the spray tank and a thin paste of the derris is poured into the mixture.

tected by a lime-aluminum sulfate spray. Because of objectional residue, no more than two applications should be made after July 15.

Plums

Spray early-ripening varieties with derris-rosin residue emulsion and late kinds with the hydrated lime-aluminum sulfate combination.

Grapes

Only the foliage needs protection. Spray thoroughly, using for each 100 gallons of water either 6 pounds of lead arsenate and 4 pounds of wheat flour or 20 pounds hydrated lime and 3 pounds of aluminum sulfate. Avoid excessive residue on the berries. Protect new growth as necessary. If an 8–12–100 bordeaux spray is used, add the lead to this spray. No flour is needed.

Small Fruits

Protect the foliage after the fruits are picked with either lead arsenate-flour, lime-aluminum sulfate, or hydrated lime.

Shade Trees

Apply 6 pounds of acid lead arsenate and either 4 pounds of wheat flour or 1½ pints of light pressed fish oil in 100 gallons of spray. If there is objection to using the lead arsenate where residences are likely to be stained, substitute the lime-aluminum sulfate mixture. Make a second application in two or three weeks.

Lawns

The grubs of the Japanese beetle cause very severe injuries to the fine grasses in lawns or on golf courses. Often the grass is completely killed. Established lawns can be surface treated with lead arsenate or poison worked into the soil when a new lawn is prepared for seeding.

To apply the poison in a dry form mix it with some inert substance, such as dry sand. Inorganic fertilizers should be avoided as diluents. Organic fertilizers are less harmful. Sand is used at the rate of 10 parts sand and 1 part lead arsenate. Spread the mixture over the grass evenly at the rate of 15 pounds of the arsenical to 1,000 square feet. Apply the poison in three treatments using 5 pounds of the lead arsenate for each. The times best suited for these applications are April, late July or early in August of one season, and April of the next.

New lawns may be grub-proofed before seeding by applying lead arsenate at the rate of 35 pounds to 1,000 square feet of surface. It should be mixed with the soil to a depth of 3 inches.

Control of Corn Borer

Control measures consist for the most part of cultural practices which aim to destroy the insect while it is in hibernation. The farm operations which are specifically of value or with slight modification can be adapted to corn borer control are as follows:

1. Cutting the Corn Low and as Early as Practical

The borers tend to migrate downward toward ground level as fall approaches. By low cutting and utilizing the corn for ensilage or as fodder for livestock, large numbers of borers are removed from the field and killed. Most farm manufacturers now provide low-cutting attachments for binders.

2. Burning Stalks

Corn stalks left standing in the field serve as hibernation quarters for many borers. These may be disposed of by breaking them off when the ground is frozen during the winter, raking together, and burning when dry. If the stalks are frozen they may be broken off by pulling an iron rail or heavy timber through the field. The United States Department of Agriculture has developed a sled-type corn shaver with a knife on each side which cuts the corn off at ground level. It is pulled by one horse and can be used either in the fall or spring. Uneaten pieces of cornstalks around the barnyard should also be gathered up and burned.

3. Clean Plowing

Plowing under cleanly the stubble and other debris left in the field is especially important. The depth of plowing should be such that the trash is not pulled to the surface by subsequent cultivation. Spring and fall plowing appear to be equally effective. Borers which are turned under in the plowing operation find their hibernating quarters untenable. In a short time they migrate to the surface of the soil in search of other shelter, such as pieces of stalk or other debris.

If they fail to find this they die from exposure or attacks from other insects and birds.

4. Delayed Planting

If the planting date is delayed until the first or second week in June, the crop may escape much of the full force of the corn borer's attack. Unfortunately this procedure is not a feasible control measure in many instances. It has no application in the zone where the two-brooded strain occurs. Furthermore, if anything is delayed too long, especially in the case of field and ensilage corn, there is danger of the crop failing to mature before frost. Neither is it desirable in some cases for market gardeners who depend on the early market for the disposal of their sweet corn.

To summarize, the success of cultural practices as a means of combating the corn borer depends on the completeness with which the various operations are carried out. Similarly, community effort is likely to be more productive of results than where the practices are carried out by only a few farmers.

Considerable experimental work has been done in an attempt to devise means of control through the use of insecticides. The cost of treatment has thus far precluded the adoption of such a procedure, especially for field corn. Recent tests indicated that spraying or dusting sweet corn may become feasible where the value of the crop is high. Insecticides showing the most promise include derris or cube, phenothiazine, and nicotine.

Elm Leaf Beetle Control

Spray Formula

The formula for an efficient spray mixture is as follows:

Lead Arsenate	6	lb.
*Menhaden Fish Oil	1	qt.
Summer Oil Emlusion	2 to 4	qt.
Water	100	gal.

A good application of the above spray mixture, especially covering the under surfaces of the leaves about the first or second week in June, will secure a high degree of control. This is aimed at the insect when the eggs are beginning to hatch and the young larvae are feeding on the leaves. Under ordinary conditions one thorough application of this spray will effectively curb the pest.

In cases where extreme infestation is known to exist, it may be desirable, for the first year, at least, to make two applications. The first may be applied near the middle or latter part of May, shortly after the adult overwintered beetles emerge from hibernation and the new leaves are developing. A second application should be made against the larvae during early June, as explained above. If the trees are thoroughly sprayed, these two treatments will be sufficient to protect the trees even though the overwintered beetles appear in large numbers and threaten a severe attack.

Destruction of Insects at Base of Tree

With outbreaks of extreme severity great numbers of the larvae may migrate in late July from the branches down the trunk and congregate either on the bark or about the base of the tree where they transform to pupae. When such a situation occurs the following contact spray may be aplied in a belated attempt to reduce the numbers of the insect:

Summer Oil Emulsion	2 gal.
Nicotine Sulphate	1 qt.
Water	100 gal.

While this treatment kills many of the insects, this procedure is not to be considered as a substitute for the treatment with arsenical sprays directed against adults or larvae earlier in the season.

Cabbage Root Maggot Control in the Seedbed

Screening

Covering the seedbed with cheesecloth of from 20 to 30 mesh is a sure method. Place cloth directly on the ground after seeding with a slack of a foot or more on each side of a 12-foot bed to compensate for growth of plants. The cloth may also be stretched over a framework of boards set on edge around the bed. Sagging in this case can be prevented by means of wire supports stretched the length of the bed beneath the cloth.

Corrosive Sublimate

Since screened plants may be sappy or spindling at the time of planting,

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* Menhaden fish oil is an efficient sticking agent but has an objectionable feature in that it possesses a disagreeable odor and for this reason the summer oil emulsion mentioned in the above formula may be substituted if desired.

many growers prefer to raise seedlings in open beds. Protection from maggot may be secured by repeated applications of 1 ounce of corrosive sublimate to 10 gallons of water. Various devices are used to apply the solution, but in any case the soil about the seedlings should be moistened to a depth of at least ¼ inch. The first application should usually be made as soon as the seedlings are well through the ground. Treatment should be repeated at intervals of a week or 10 days until a total of three applications have been made.

Calomel Suspension

Calomel may be applied in the same way and at the same dosage as corrosive sublimate and is equally effective. Since it is not soluble in water and settles rapidly, gum arabic should be used to hold it in suspension. Make a stock solution by dissolving gum arabic in boiling water at the rate of 1 ounce of gum to 8 ounces of water. Grind calomel thoroughly in mortar with gum solution to make a thick paste. Add paste to stated volume of water with enough gum solution to equal 1 ounce of gum for each ounce of calomel. Many growers use calomel at the rate of 3 or 4 ounces to each gallon of water. This procedure insures satisfactory control with a single application. If this method is used special care should be taken to prepare the seedbed before treating to guard against excessive run-off and to insure that the bulk of the material is absorbed by the soil adjacent to the plants. Mixtures of calomel and gum arabic are handled by the trade.

Seed Coated with Calomel

Moisten 1 pound of seed with 1½ ounces of the stock solution of gum arabic as described above. Thoroughly coat moistened seed with calomel, allowing from 1 to 1½ pounds of calomel to each pound of seed. Sow seed heavily, covering lightly with soil so that the calomel will be as near surface as possible. This is not as effective as the foregoing measures and should be used only where the insect is moderately destructive.

Maggot-free Localities

One of the simplest and most direct methods for avoiding maggot injury is to locate the seedbed at a distance from where cabbage or other host plants are grown extensively. Here only relatively few flies developing from wild host plants need be considered, and since beds handled in this way are usually several acres in size maggot injury is apt to be relatively unimportant. This method has been successfully used by large cabbage growers for many years, the chief drawback being the difficulty of finding suitable localities within a reasonable distance from the center of operations.

Control in the Field

Tar Pads

This method consists in the application of perforated pads of tar paper fitted about the base of newly set plants. Where the work is carefully done and too long an interval is not allowed to elapse after setting, control should be satisfactory; although for various reasons this is not as generally used as some of the other methods.

Corrosive Sublimate

A solution of corrosive sublimate as described under seedbed treatments is equally effective in protecting early plants after setting in the field. Here, as in the seedbed, three successive applications should be made starting 4 or 5 days after setting, if flies are active, and repeating at intervals of a week or 10 days until the schedule is completed. The dosage is from 2 to 4 ounces of solution per plant.

Calomel Suspension

Corrosive sublimate when used on early cabbage, even at a dilution of 1 ounce to 10 gallons of water, may under some conditions delay the harvesting date appreciably. For growers who may be prejudiced against the use of corrosive sublimate, calomel has proved a very useful substitute since it does not appear to retard growth even when excessive applications are made. A suspension of calomel may be used at the same rate and in the same way as corrosive sublimate, or by increasing the amount of calomel to 3 or 4 ounces in 10 gallons of water, as described for the seedbed, satisfactory control may be secured with but a single application.

Calomel Dust

Control may also be secured by applications of a calomel dust, 4% calomel in talc, gypsum, or hydrated lime as the carrier. The dust is applied to the base of the plant at the rate of approximately 75 pounds per acre. From one to three applications may be required, depending on the amount used at any one time. To be effective, the first application should be made as soon after the plants are set in the field as possible.

The Calomel Stem Treatment

A mixture of equal parts by weight of calomel and corn starch is sometimes dusted over the moistened stems of cabbage plants immediately before transplanting. This method of applying calomel, if carefully done, should result in greatly reducing maggot injury, but unfortunately, owing to the difficulty of maintaining a uniform coverage of the stems during the process of handling and transplanting, control by this method is seldom perfect.

Tobacco Dust

Liberal applications of finely ground tobacco dust placed at the base of the newly set plant have given excellent control of root maggot, although calomel suspension or corrosive sublimate treatment will probably be better suited to the average grower.

For information on seasonal activities or for more details regarding control methods, write to the Farm Bureau or to the Experiment Station.

Control of Spruce Gall Aphids

Control measures are directed against the overwintering insects on the bark. The date of application will vary with seasonal conditions, but in any event the material should be applied while the trees are dormant. If desired, treatment may be given either in the late fall after all the eggs have hatched, which is usually about October 1, or deferred until the latter part of April the following spring. These dates also apply to the control of this insect on Douglas fir. The selection of a spray mixture will depend primarily on personal choice, number and location of trees, ease with which materials may be procured and mixed, cost, safeness to the trees, and other factors. In the following table are listed formulas for various spray mixtures which may be used with safety and economy except possibly the oil spray.

Table for Dilution of Insecticides

Treatment	*Materials Needed to Make the Following Amounts of Spray Mixture*	
	100 gallons	1 gallon
Soap	10 pounds*	1⅔ to 2 ounces
Water	100 gallons	1 gallon
Nicotine Sulphate	1 pint	1 teaspoonful
Hydrated Lime or Soap	4 pounds	½ ounce
Water	100 gallons	1 gallon
Lime-Sulphur	2½ gallons	7 tablespoonfuls
Water	97½ gallons	1 gallon
Lubricating Oil Emulsion †	1 gallon	8 teaspoonfuls
Water	100 gallons	1 gallon
Miscible Oil	Dilute according to recommendations of manufacturer.	

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*Refers to soap on dry weight basis, such as laundry soap or soap chips. When using liquid soaps, increase the amount according to the percentage of soap solids in the mixture.

†Lubricating oils can be emulsified with the following: 1 pound of either calcium caseinate or lignin pitch, (Binderine or Goulac) to 100 gallons of water, or a 2–2–100 bordeaux mixture. Dissolve the emulsifier in 1/10 the total amount of spray mixture, pour in the oil, and agitate until thoroughly emulsified before adding remainder of water.

With respect to oil sprays it should be pointed out that, while they are very effective in the control of these aphids, their use entails some risk as regards injury to the foliage, which may or may not prove of a serious nature. In the case of trees with glaucous needles, such as Colorado blue, Koster blue, white, Sitka or Engelmann spruces, and Douglas fir, the bloom or waxy coating on the needles is removed by oil sprays. For these reasons oils are not generally recommended, particularly on choice trees in home plantings, parks, or similar situations. In nursery plantings, however, there may be occasions where oil sprays, if judiciously used, would prove entirely satisfactory provided treated trees are not offered for sale shortly thereafter.

Lime-sulphur imparts a visible residue which may be observed for several weeks, but gradually disappears as new growth develops without causing injury to the tree. In using this spray, which is probably as safe, efficient, and cheap as any, care should be exercised during treatment to prevent spray from drifting to adjacent buildings as lime-sulphur discolors painted surfaces. Under some circumstances this may prove an objectionable feature.

Nicotine-soap spray is also very effective in the control of these aphids, but affords best control when applied on quiet, warm days when the temperature is 60° F., or higher. If laundry soap is used it should be first dissolved in hot water before adding to the spray tank.

The number of eggs which may occur in a single bud varies from several to as many as a hundred or more. In about five days the maggots hatch from the eggs and by crawling in the natural opening about the pistil they enter the ovary. By the time that the blossom buds open the maggots have embedded themselves in the ovarian tissue and they continue feeding within the fruit for about 5 weeks. The mature maggot is about 1/7 inch in length and varies from creamy white to slightly orange in color. Most of the insects leave the fruit before it drops, escaping through holes eaten in the decayed spots and through cracks caused by shrinking and weathering. Upon dropping to the ground the maggots burrow into the soil to a depth of an inch or two, and during late summer they transform to pupae in which stage the winter is spent.

Control of Pear Midge

The pear midge is more difficult to deal with than many of the more common destructive fruit insects because of the brief period of time when effective control work can be done, and also through lack of familiarity of most pear growers with the pest and its habits. The object of the protective measures is to destroy the midge flies before any or an appreciable number of the eggs are deposited in the blossom buds. As has been explained, the insects lay their eggs for the most part during the period when the blossom buds have reached the stage of growth in which the green sepals have narrowly separated, thus revealing a trace of pink of the petals. In orchards subject to heavy infestation little difficulty will be experienced by an observant grower in detecting the flies on the trunks and larger limbs of the trees and on the buds or flying about the buds. The spray treatments are effective if well timed and experience has shown that with most growers the application should be planned with reference to the stage of blossom bud development as indicated rather than on observations of the flies themselves. If only a few flies are observed one cannot always be sure whether these are all that need to be considered or whether they are individuals which have appeared in advance of the main brood. Then, also, during some seasons and in some orchards it occasionally happens that the mass of the flies do not emerge until slightly after the buds have reached the stage of growth described. Orchards may vary greatly in the degree of infestation and in the rate of blossom bud development and sections of an orchard often vary in both of these respects.

To guard against mishaps from faulty timing because of the scarcity of flies or the tardy appearance of the flies, it is desirable to spray the trees when the more advanced blossom buds have reached the stage of development as illustrated, and if many flies make their appearance during the next two or three days a second application should be made as soon as possible. In general, the treatment applied when the more advanced buds show a trace of pink is sufficient to protect the pear crop. The second treatment is a supplementary or an emergency spray which is made only if the bulk of the flies emerge after the first application has been made. In spraying the orchard the sheltered portions should be treated first, and all parts of the tree, including the trunk and lower limbs, should be thoroughly wetted at a single operation. It is also good practice to spray the ground under the trees and to treat bushes and trees adjoining the pear orchard since the flies may be driven to them.

Spray Mixtures

Nicotine sulphate is the most satisfactory insecticide for combating the pear midge. This material may be used in various combinations of fungicides and insecticides as specified in the accompanying formulas. Commercial pear growers who are accustomed to follow the standard spray program as recommended by the Farm Bureau Spray Service will recognize the familiar spray materials known as lime-sulfur and bordeaux mixture. Their principal function in this instance is to serve as carriers of nicotine sulfate. Whatever merit these combinations may have for other pear pests such as scab, thrips, or psylla, it is important for the orchardist to keep in mind that in those plantings where midge is destructive, the treatment is designed particularly to combat this insect and that great care should be exercised in timing the spray operations.

The remaining formulas represent spray mixtures designed to combat the midge only. If a grower is following a spray program where oil and lime-sulphur are used interchangeably, a period of two or three weeks should be allowed before an application of one material is followed with a treatment of the other material; otherwise injury to the trees may develop. The formulas for spray mixtures are as follows:

	For Large Acreages	*For the Garden*
Lime-Sulphur	2½ gal. or 11 gal.	1 pt. or 2 qt.
Nicotine Sulphate	¾ pt.	½ oz.
Water	100 gal.	5 gal.
Summer Oil Emulsion (83% Oil)	2 gal.	4/5 pt.
Nicotine Sulphate	¾ pt.	½ oz.
Water	100 gal.	5 gal.
Soap	3 lb.	2½ oz.
Nicotine Sulphate	¾ pt.	½ oz.
Water	100 gal.	5 gal.
Copper Sulphate	2 lb.	1½ oz.
Hydrated Lime	10 lb.	8 oz.
Nicotine Sulphate	¾ pt.	½ oz.
Water	100 gal.	5 gal.
Hydrated Lime	10 lb.	8 oz.
Nicotine Sulphate	¾ pt.	½ oz.
Water	100 gal.	5 gal.

Control of Asparagus Beetle

In beds that are in production injury to the shoots by beetles and larvae may be greatly reduced by cutting all stalks promptly every 3 to 5 days. This entails keeping the beds free of all asparagus growth above ground during the cutting season. To obtain the greatest benefit from such a method it is necessary to have the beds well fertilized and the plants healthy and vigorous. Where this method is not possible injury may be prevented by spraying or dusting the tips thoroughly with derris mixtures during the cutting season to kill beetles and slugs.

Newly planted beds that are not being cut may be sprayed or dusted as in the case of older beds. If desirable, calcium arsenate or lead arsenate mixtures may be substituted for those having derris powder.

On the appearance of the second brood of beetles and slugs during July it may become necessary to spray or dust the plants again once or twice to control the infestation.

Sprays and dusts do not adhere readily to asparagus plants owing to the needlelike form of the leaves and the smooth glabrous nature of the stems, hence it is necessary to use a good sticker and a fine misty type of spray to attain satisfactory results. Dusting should be done under calm conditions when the foliage is wet.

Spray Mixtures

	For Large Acreages	*For the Garden*
Derris*	5 lb.	3 oz.
Skimmilk Powder	4 lb.	2½ oz.

***Powdered derris root of 4% to 5% rotenone content and 15% to 18% total extractives content; or, if derris is not available, substitute powdered cubé or timbo root of comparable analysis.**

Water	100 gal.	4 gal.
Lead or Calcium Arsenate	6 lb.	4 oz.
Skimmilk Powder	4 lb.	3 oz.
Water	100 gal.	4 gal.

Dust Mixtures

Derris	15 lb.	1 lb.
Clay or Talc	85 lb.	6 lb.
Lead or Calcium Arsenate	25 lb.	2 lb.
Hydrated Lime	75 lb.	6 lb.

Control of Peach Borer

The object of control measures is to destroy as many of the overwintering borers as possible before serious injury has been done. The use of paradichlorobenzene, commonly called "P. D. B.," is the most practical and effective method. The treatment should be made in the fall when most of the eggs have hatched and the borers are small and easily killed, but it should be applied before low temperatures prevail as the chemical is ineffective when the soil temperature drops much below 60° F. In New York during normal seasons the correct time will be found from the middle of August to the middle of September. When fall treatment has not been made and borer damage is serious, treatment may be made in May with fairly satisfactory results. Two methods of treatment are described below. The first of these, the "Crystal-Ring Method," has been in common use for many years. For a small acreage or a few trees in the home garden this method will prove more feasible. If directions for using the method are carefully followed, owners of commercial plantings will find the "Spraying Method" more satisfactory. This method is cheaper because it requires less labor and less material to do effective work. Furthermore, it is safe on peach trees of all ages and promises to displace the old laborious, expensive crystal-ring method, which is sometimes dangerous if the mounds are neglected.

Crystal-Ring Method

To make this application, level the surface of the soil about the base of the tree to a distance of 10 to 12 inches. Remove all weeds, sticks, stones, etc., within this area, but avoid disturbing the soil more than is necessary. In case there is an excessive amount of gum exuded about the base of the tree it should be removed. Should there be indications of borers just above the ground level, sufficient soil must be placed around the tree to bring the level of the soil up above the topmost borer gallery as the gas formed from the chemical is heavier than air. The paradichlorobenzene crystals are then distributed in a continuous ring or band *not less than 1 inch nor more than 2 inches* from the trunk of the tree. It is important that this part of the treatment be carefully done. If the chemical is placed too close to the bark of the tree, injury may result; if too far away, the treatment will not be effective. The following dosages should be used:

1 ounce for trees 6 years of age or older
¾ ounce for trees 4 or 5 years of age
½ ounce for trees 3 years of age

The amount of the chemical should be measured accurately, for an overdose may produce serious injury. This method is not recommended on trees less than 3 years of age. After the paradichlorobenzene is in place, cover the ring carefully with 5 or 6 inches of fine soil in a cone-shaped mound about the base of the tree and pack with the back of the shovel. Care must be exercised in covering the material that the "ring" is not displaced and crystals forced against the bark. The mound should be removed after 4 weeks.

Spraying Method

This method consists of the use of an emulsion of cottonseed oil containing dissolved paradichlorobenzene applied as a spray around the base of the tree and the lower part of the trunk. The formula for preparing the stock emulsion follows:

Cottonseed Oil	1 gal.
Paradichlorobenzene	2 lb.
Potash Fish-Oil Soap	1 pt.
Water to make	2 gal.

Dissolve 2 pounds of paradichlorobenzene crystals in 1 gallon of cottonseed oil. To do this in cool weather heat the oil to about 90° F., *before* adding the chemical. Stir the oil until the crystals entirely dissolve before proceeding further. Stir the resultant mixture into 1 pint of potash fish-oil soap and then stir in enough water to make 2 gallons. This stock emulsion may be stored for several days in a sealed drum. Each gallon of the stock emulsion should be diluted with 3 gallons of water immediately before making the treatment. The dosage and amount of material for trees of different ages are as follows:

Age of Tree	*Dosage*	*Amount of P. D. B. Carried*
1–2 years	¼ pint	⅛ ounce
3 years	½ pint	¼ ounce
4–5 years	1 pint	½ ounce
6 years and older	1½ pints	¾ ounce

No special leveling of the soil about the base of the tree is required to make this application, neither must one remove exuded gum or sticks and stones from about the base of the tree, nor is it necessary to build a soil platform to the level of the highest borer gallery. The diluted emulsion is sprayed on the lower part of the trunk and on the ground around the base of the tree in amounts to correspond with the above dosages. Either of two methods of applying the spray is available. First, a knapsack sprayer may be used. Time how long it takes to spray out the desired amount, then spray about the base of each tree for that length of time. Second, a power sprayer may be used if a regulating device is attached to measure the amount of spray applied to each tree.

The treated trees should have five or six shovelfuls of earth mounded about the trunk. In the case of trees treated by the spray method, the mounds may be allowed to remain all winter but should be pulled down in the spring. If treatment is made in the spring, leave the mounds up for 1 month.

Fly Paper Compositions

Formula No. 1

Rosin	14,000 g.
Gum Mastic	400 g.
Rapeseed Oil	6,300 g.

No. 2

Rosin	400 g.
Pitch	200 g.
Beeswax, Yellow	20 g.
Rapeseed Oil	250 g.

No. 3

Rosin, Pale	450 g.
Mineral (Machine) Oil	150 g.
Train Oil, Clear, Brown	100 g.

The ingredients of formula 1–3 are melted up and mixed well. The use of the non-drying oil causes stickiness, but if too much of it is used, the composition may easily become too liquid to stay on its base (ribbon, plate).

No. 4

Styrax

No. 5

a. Rosin	50–55 lb.
b. Spindle Oil or Rosin Oil	35–45 lb.
Turpentine, Venice or Honey	5-10 lb.

Melt *a* without overheating, add *b* carefully with continued stirring.

No. 6

a. Rosin, Medium Dark or Light	6.6 kg.
b. Beeswax, Yellow	0.3 kg.
c. Crude Rubber	5.0 g.
Spindle Oil	4.75 kg.

Melt *a*, add *b* and stir until it has melted up and mixed in—avoid overheating.

Meanwhile, prepare *c* by heating the oil to 100° C., and adding the rubber in small portions, until all of it has completely dispersed. Add this rubber solution to the melted *a* and *b*.

No. 7

a. Rosin, Pale	65 kg.
Crude Rubber, Finely Cut	0.5 kg.
b. Spindle Oil, Refined	35 kg.
c. Honey Perfume or Anise Seed Oil as desired	

No. 8

Oleic Acid	17
Rosin	59
Rubber	24

Macerate rubber and mill it into a solution of the rosin in the oleic acid. Apply warm.

No. 9

Another method of manufacture requires the use of solvent naphtha as the rubber solvent. About five times the volume of oleic acid is the necessary volume of naphtha.

Dissolve the rosin and oleic acid in the naphtha, then add the rubber which has been well macerated. Let stand for a day or two with occasional stirring. Evaporate off the naphtha and use as above. (It may be necessary to filter this mixture through a wire screen to remove the small amount of undissolved rubber.)

No. 10

Yellow Beeswax	2 lb.
Rosin	60 lb.
Rapeseed Oil	38 lb.

No. 11

Pine Resin, Refined	735 lb.
Ceresin	10 lb.
Non-Drying Fatty Oil or Mineral Oil	255 lb.

Perfume: Wax odor, honey odor or apple odor.

No. 12

Rosin Oil, Viscous	75 g.
Woolfat, Neutral	10 g.
Rapseed Oil	10 g.
Honey	5 g.
If desired a solution of	
Crude Rubber (crêpe)	1 g.
Spindle Oil, Refined	9 g.

can be added.

Dissolve the rubber at 100° C., in about 2 days.

Caterpillar Catching Bands

Formula No. 1

a.	Caoutchouc, Smoked Sheets	3 kg.
	Rapeseed Oil	17 kg.
	Spindle Oil	40 kg.
b.	Rosin	35 kg.
	Crude Montan Wax	5 kg.

Soak and peptize the rubber in the oils *a*, heat the solution and dissolve *b* in it. Stir till heavy and apply.

No. 2

Rubber Resin, Liquid	50 kg.
Rosin	50 kg.
Castor Oil	5–10 kg.

Melt together.

No. 3

a.	Rosin	350 lb.
	Beeswax, Yellow	10 lb.
	Pitch	60 lb.
	Linseed Oil	25 lb.
b.	Heavy Turpentine	15 lb.

Melt *a* and thin with *b* in the absence of open flames.

No. 4

Rosin	45 g.
Spindle Oil	30 g.
Rapeseed Oil	30 g.

Melt together at lowest possible temperature. Product should remain viscous and sticky for 4–5 months, and not change its consistency at increased temperature.

No. 5

(Claimed to remain sticky for about 3 months and not to freeze at low temperatures and not to "run" at high temperatures).

1.	Rosin Oil	9 g.
	Spindle Oil	20 g.
2.	Lime Hydrate	9 g.
	Spindle Oil	62 g.

Mix *1* and *2* separately until homogeneous, and stir *1* into *2* until the mass starts to become very heavy. Let stand for some days to allow complete saponification.

No. 6

a.	Naphtha Resin (Sirupy, Viscous Residue of Petroleum Distillation)	50 lb.
	Rosin	10 lb.
b.	Slaked Lime	30 lb.

Mix *a* in the cold by thorough stirring. Add in *b* and stir thoroughly until the mixture gets very heavy. Let stand for 10 hours before packing.

No. 7

Rosin or Coumarone Resin	7 kg.
Ceresin	0.5 kg.
Spindle Oil	2.5 kg.
Perfume:	
Apple Essence	100 g.

No. 8

a.	Talloil	220 kg.
	Mineral Oil	440 kg.
b.	Chalk, Finely Powdered	100 kg.
c.	Lime, Unslaked, Powdered	80 kg.
d.	Zinc Chloride (50% Solution)	100 kg.

Mix *b* into *a*. Neturalize slowly with *c*. When the mixture is homogeneous, work in *d*. Stir thoroughly, put into containers.

Bug Catcher

Formula No. 1

Colophony	60 kg.
Castor Oil	35 kg.
Ceresin	5 kg.

No. 2

Rosin, Waste	60 kg.
Rosin Oil, Crude	30 kg.
Colza Oil, Blown	10 kg.

These highly viscous compositions are put on strips of paper or textiles, and put around the menaced trees, sticky side turned outward.

Protective Coating for Fruit Trees

To protect trunks of young trees against rodents paint with following:

Raw Linseed Oil	10 gal.

Heat in large pot, with stirring to 350° F., then sift in slowly while stirring

Sulphur (300 mesh)	120 oz.

Stir till dissolved.

Control of Strawberry Insects

Strawberries are attacked by quite a number of pests. Among the most destructive are three species of pameras. These are bugs belonging to the chinch bug family. They are somewhat larger than the chinch bug but have the same "buggy" smell, and their habits are much like those of the chinch bug. These pameras vary from ⅛ to ¼ inch in length. The adult is dark brown or black, some with lighter markings on their wings. The young are yellowish brown and look a good deal like common red ants, except that they are quicker in their motions. These are sucking insects, so a heavily attacked plant will wilt in the middle of a hot day and finally die. If one scratches around the base of such infested plants he will see the adult and the young. They ordinarily scatter quickly in all directions as soon as the plant is disturbed.

Pameras are apt to get abundant in dry, warm weather, and if not controlled are capable of doing severe damage. The control measure for all three species is spraying with one of the pyrethrum compounds. Nicotine does not ordinarily give a good kill, especially if the weather is a little cool. In order to kill these insects with pyrethrum compounds they must be wet with the spray, since they are usually well protected under the leaves and in the bud of the plant. The best plan is for two men to work together, one gathering up the leaves of the plant in his hand and the other quickly spraying the soil around the plant and the plant itself. The man holding the leaves then drops them and the sprayer directs the spray into the center of the bush. These pyrethrum compounds are non-poisonous and leave no odor or taste, therefore can be used when the plants are in bearing.

Often the grower of strawberries will note that the leaves of the plants are being eaten full of small holes. He probably will find the cause of the trouble to be small black beetles. When disturbed they quickly jump and fly away. Because of this habit of jumping they are called flea beetles. On plants which have not come into bearing, the flea beetles can be controlled by spraying with lead arsenate, one pound to fifty gallons of water. It is necessary to put something into the water to make the insecticide spread over the leaves. For this purpose milk of lime can be used, but the best plan is to put the pound of lead arsenate into fifty gallons of bordeaux. The bordeaux itself is a repellent to these beetles and is useful in checking any fungus that may be present. It is necessary to do a thorough job of spraying for the beetles as they are cunning little pests, and if the entire plant is not covered they will quickly congregate on the unsprayed portion and destroy it. The arsenicals cannot be used when the strawberries start to bear. If the flea beetle is troublesome at that time one will have to depend on the pyrethrum compounds mentioned above, although they are not as effective as the arsenicals. Certain weeds of the spurge family, also the evening primrose, common hosts of the flea beetles, should be kept out of the strawberry patch and destroyed around the neighborhood.

If the strawberry plants lose their bright green luster, turn grayish and seem to be dying, the outer leaves quickly withering and dying, berries remaining hard, turning brown and dry, and failing to develop, your plants have probably been attacked by red spiders. These can be seen with the naked eye, mostly on the under sides of the leaves. They are not always a bright red color but may be yellowish or even greenish. They usually have a reddish tinge. Like most members of the spider family, these can be controlled with sulphur. All that is necessary is to dust sulphur on the plants in the middle of a good hot day. Sulphur will not hurt the plants, has no taste or odor, and therefore can be used at any time in liberal amounts.

As the weather gets dry and hot, thrips will become abundant in the bloom. These tiny insects, about 1/25 of an inch in length, are light yellow in color and are often responsible for putting a premature end to the shipping season. When they are abundant they will entirely destroy the bloom, if less abundant destroy only one side of the young berry, which will make a deformed, unsalable fruit. Or they may cause the entire fruit to turn brown and hard and fail to ripen. Thrips can be killed with nicotine. This can be put on as a spray with some spreader like bordeaux, soap, or calcium caseinate or it can be put on as a dust; finely ground tobacco dust. Thrips and red spiders often appear at about the same time of the year as they both multiply rapidly during hot, dry weather. Therefore, an excellent dust to apply at that time of the year is a mixture of half sulphur and half finely ground tobacco.

Avocado Tree Beetle Poison

Paint branches with

Formula No. 1

Soap	1 lb.
Carbolic Acid, Crude	½ pt.
Water	3 gal.

No. 2

Gasoline or Crude Oil	1 lb.
Axle Grease	6 lb.

Peanut Leafhopper Control

Spray three times at 21 day intervals with

Formula No. 1

4–4–50 Bordeaux Mixture

No. 2

Fine Sulphur Dust

Combating Green Leafhoppers

Control of orange spotting and mottle leaf is effected by spraying with

Hydrated Lime	150 lb.
Zinc Sulphate	24 lb.
Blood Albumin	12 oz.
Water	300 gal.

Sugar-Beet Nematode Control

Chloropicrin	5 kg.
Alcohol	2 kg.

Place in holes 1 ft. deep and 1⅓ ft. apart in infested fields. Also increases sugar yield 36.6%.

Control of Sod Webworms in Lawns

Formula No. 1

Pyrethrum Extract	1 oz.
Water	4 gal.

Apply 2 gal. per 20 sq. ft.

No. 2

Hard Soap	8 oz.
Water	1 gal.
Kerosene	2 gal.

Dilute with water 30 gal. and apply 2 gal. per 20 sq. ft.

Treatment and Prevention of Chigger Bites

After exposure the skin may be examined for active larvae preferably with a hand lens. However, they are so minute and they move so rapidly over the surface before attachment that it is difficult to capture them. The application of kerosene or 95% alcohol will kill the larvae rapidly. As soon as possible after exposure it is advantageous to apply a thick lather of soap to the affected parts allowing it to remain for 10 minutes or more before bathing. Even though the larvae are removed soon after attachment, usually enough of their secretion has been introduced to cause the characteristic itching lesion and for this there is no known specific remedy. The intense itching is temporarily relieved by ammonia or strong salt water, or a calomel-phenol lotion. Collodion containing metaphen applied to the lesions is recommended both to relieve itching and prevent infection. The sprinkling of stockings and underclothing with sublimed sulfur helps prevent infestation when exposure is necessary.

Control of Lawn Chiggers

Apply dusting sulphur at the rate of one pound per 1000 sq. feet, or 50 lb. to the acre. During the season, from May to August, three applications will usually suffice. The first should be applied as soon as the chiggers appear, and the others at two week intervals. If a heavy rain occurs after dusting, another application should be made as soon as possible.

Corn Worm Poison-Bait

Cane Sugar	15 lb.
Sodium Arsenite	1½ lb.
Water	2 gal.

Place in small containers around corn.

Cricket Poison-Bait

Calcium Arsenate or Barium Silicofluoride	1 lb.
Corn Meal	20 lb.
Molasses	1 lb
Water to moisten well.	

Cricket Extermination

Safrol	5 oz.
Paraffin Oil	91 oz.
Cresylic Acid	2 oz.
Trichlorethylene	2 oz.
Concentrated Extract Pyrethrum	4 oz.

Dissolve the extract in the paraffin oil, then add the other ingredients.

The preparation must be sprayed undiluted into the infested parts, since it is insoluble in water.

Locust Poison Bait

Bran	92 lb.
Brown Sugar	5 lb.
Arsenic, White	3 lb.
Coloring Matter	0.3 lb.

Snail Poison

Paris Green	1 lb.
Bran	20 lb.
Molasses	2 lb.

Water sufficient to moisten.

Poison for Slugs, Snails, Sowbugs

Formula No. 1

Methaldehyde	4 g.
Bran, Coarse	8–10 oz.

Moisten lightly with water and scatter in evening.

No. 2

Bran	3½ lb.
Arsenious Oxide	¼ lb.
Molasses	2 lb.

Mix intimately, with the addition of a little water if necessary, so that the product is but slightly moist and mealy. Scatter on the ground in garden where pests are working. To make up a stock of this, do not include the molasses or water until ready to be used.

Fly Poison

Formula No. 1

Soak figs in 5% calcium cyanamid solution. This attracts flies which are poisoned after eating fig.

No. 2

Molasses	10 oz.
Water	90 oz.
Calcium Cyanamid	2–3 oz.

For Manure

No. 3

Phenothiazine mixed with grain feed of cattle at the rate of 1.14 grams a day for each 100 pounds of live weight prevented the breeding and development of biting flies in the droppings of animals to which it was fed in experiments at the College of Agriculture, University of Illinois. Full-fed animals ate the treated grain reluctantly; those on pasture readily accepted three feeds of treated grain daily.

No. 4

Make a dust of equal weights of calcium cyanamid and road or rock dust and apply in thin layers every 6–8 inches in manure pile. Then soak with water. Amount of cyanamid (which is also a fertilizer) should be 1–1½% of weight of manure.

No. 5

Aqueous borax (1 kg. per 140 l.) is applied per cubic meter of dung heaps.

Rat Poisons

Substance	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Barium Carbonate	1	1	1	6	4 oz.	2	21 lb.	3½ oz.
Grated Cheese	1	..	..	..	..	..	..	½ oz.
Drippings	1	1	..	4	..	..	..	..
Tallow	..	..	..	..	..	..	22½ lb.	..
Fine Oatmeal	1	..	2	..	4 oz.	..	56 lb.	1 lb.
Rolled Oats	..	2	..	..	..	..	..	..
Aniseed Oil	..	..	..	..	5 drops	..	5 oz.	..
Castor Sugar	..	..	1	..	..	4	..	..
Meal	..	..	..	16	..	4	..	..
Salt	..	..	..	½	..	..	..	30 gr.

(1) Melt the fat and mix it thoroughly with the dry ingredients to form a thick paste.

(2) Prepare as for (1).

(3) Rub the ingredients through a fine sieve and mix well.

(4) Put down in pieces as large as a hazel nut.

(5) Mix with fat to form a paste.

(6) Thoroughly mix the ingredients. A bait is one dessertspoonful wrapped in a twist of tissue-paper.

Thallium sulphate is finding increasing use in rat poisons. The fatal dose is 25 mg. of thallium sulphate per kg.

It is a dangerous substance to handle and rubber gloves should be worn when preparing poisons containing this.

No. 9

Corn	50 kg.
Thallium Sulphate	650 g.
Hot Water	6 l.

Starch	300	g.
Glycerin	1	l.

No. 10

Dissolve in the minimum quantity of boiling water the thallium sulphate, add to this a mixture of starch mucilage and glycerin, and pour the viscid liquid over some grain which the rats have already shown a preference for. Sometimes a paste is sold made with manioc meal, and which must be spread on bread; other makers supply an aqueous solution of thallium sulphate with syrup of glucose, or a solid bait made with peanut butter in cubes, to be put down as they are or spread on biscuits. Thallium is a cumulative poison. The following formula is used in Netherlands Indies sugar plantations: Mix starch 9 g. with water 350 cc., and heat for 15 minutes; add successively glycerin 24 g., saccharin 2.8 g., thallium sulphate 10.4 g. (previously dissolved in hot water); to the mixture add, in small portions, 10.4 kg. of rice, and dry the whole rapidly. Glass or porcelain vessels should be used for preparing this. Two kilograms of this preparation is spread over an area of one hectare in portions of 10 gm. wrapped in waxed paper.

Red Squill

Liquid extract of red squill or powdered red squill may be used, and small baked "biscuits" containing the poison are usually wrapped in paper and put down.

No. 11

Red Squill Powder	20	kg.
Bread	30	kg.
Fat	30	kg.
Syrup	20	kg.
Aniseed Oil	to suit	

The average quantity of good squill required to kill a rat has been put at 0.3–0.4 g., and usually 40 g. should be used with every 100 g. of "mixture." The latter may be lard, or other fats, flour, minced meats, fruit, vegetables, and the paste obtained can be spread on toasted bread, meat, bacon, or divided into small cubes. The preparation of the bait by the uninstructed public should be simplified as much as possible. It is the haphazard putting down of poison which is so useless, and the intelligence of the rat is always a neglected factor. The average citizen who lays poison for the rat must surely rate the rat's intelligence far below his own, if the judging is based on what he does, or rather what he omits to do, and that is, take pains. The Pasteur Institute has stated that only 2 per cent of dead rats are actually discovered, and that to "de-rat" a locality satisfactorily, poison should be put down until the bait is left intact.

No. 12

(For Farm Rats)

Thallium Sulphate	1–1.5	lb.
Rolled Barley	50	lb.
Rolled Oats	20	lb.
Coconut Oil	14	pt.

Mix well, shape into "torpedoes," paraffin and coat with raw linseed oil.

No. 13

Flour	1 lb.
Plaster of Paris	1 lb.
Butyric Acid	sufficient to impart a definite odor

Mix well.

To use, leave exposed in a dry place so that the rats may reach it.

This mixture must be stored in well corked bottles and replaced at intervals during use as it hardens on standing.

No. 14

Boric Acid (Powdered)	40	gr.
Flour	3	oz.
Glycerin	1½	oz.
Water	to make 1	pt.
Prussian Blue	5	gr.
Lard or Tallow	6	oz.
Phosphorus	½	oz.
Carbon Bisulphide	½	oz.

No. 15

Barium Carbonate	21	lb.
Oatmeal (Powdered)	56	lb.
Tallow	22½	lb.
Salt	1¾	lb.
Aniseed Oil	5	oz.

Melt the tallow in a steam-jacketed boiler, add the barium carbonate, oatmeal and salt, stirring as each ingredient is added; finally incorporate the oil of aniseed. The whole should then be well mixed. The bait to be laid in small pieces about the size of a hazel nut.

No. 16

Barium Carbonate	3	lb.
Prussian Blue	80	gr.
Salt	1	oz.
Cheese (Grated)	5	oz.
Oatmeal (Powdered)	14	lb.

Mix well and rub the ingredients through a fine sieve.

No. 17

Barium Carbonate	1	lb.
Oatmeal (Powdered)	2	lb.

Sugar	2 lb.

Prepare as above.

No. 18

Barium Carbonate	1 lb.
Cheese (Grated)	1 lb.
Drippings	1 lb.
Oatmeal, Powdered	1 lb.

No. 19

Rat Biscuits

Barium Carbonate	1 lb.
Flour	2 lb.
Fat	1 lb.

Mix well and work in sufficient water to make a good stiff dough. Roll into sheets ¼ inch thick and cut into biscuits and bake in a very hot oven.

No. 20

Red Squill (Powdered)	1 lb.
Oatmeal (Powdered)	4 lb.

Mix well and add sufficient aniseed oil to give a faint smell to the bait.

No. 21

Red Squill (Powdered)	1 lb.
Oat or Maize Meal	2¾ lb.
Dripping or Tallow	1¼ lb.

Melt the fat and quickly pour on to the dry ingredients, which have been previously well mixed. Stir well until a stiff paste is produced, then add aniseed oil to give a faint smell to the bait.

No. 22

Red Squill (Powdered)	4 lb.
Grated Cheese	5 lb.
Fat	5 lb.
Oatmeal or Flour	6 lb.

Mix the ingredients into a thick paste and cut into pieces about the size of a walnut and bake lightly in a quick oven.

No. 23

Red Squill (Powdered)	1 lb.
Flour	2¾ lb.
Fat	1¼ lb.

Mix the squill and flour well together and knead in the fat, adding sufficient water to make a fairly stiff dough. Roll out into a sheet ¼ inch thick and cut into about 1,400 biscuits for each pound of squill powder used.

No. 24

Red Squill Bulbs	1 lb.
Water	2 lb.

Salicylic acid 2½ oz. to every 10 gallons.

Chop up the bulbs as finely as possible and place in an earthenware vessel. Boil the water and pour it on to the bulbs; stir in the salicylic acid and macerate for several hours. When cold, strain through fine muslin, pressing out as much liquid as possible. Pour into glass-stoppered bottles and store in a cool, dark place. The bait is made as follows: The liquid is mixed with an equal quantity of fresh milk which has been scalded and allowed to cool. Oatmeal may be added to make a thin porridge. Bread (finely divided) may be used in place of oatmeal, making a thin bread and milk mixture. A quantity of the bait is poured into a saucer or similar receptacle, which is placed near the rat holes and runs at night. Another method is to soak small squares of stale bread in the liquid squill. These can then be laid in the rat holes, using a wooden spoon for the purpose. Vessels containing water should be placed in the vicinity for the rodents to drink.

No. 25

Liquid Poison

(Not Toxic to Domestic Animals)

Red Squill Bulbs (Urginea maritima)	1 oz.
Distilled Water	2 oz.

Salicylic Acid, 2 oz. for every 10 gallons.

Chop the bulbs as finely as possible and place in an earthenware vessel. Boil the water, pour it over the bulbs and stir well. Add the salicylic acid, macerate for several hours, stirring occasionally. When cold, strain through fine muslin, pressing out as much liquid as possible. Pour into amber-coloured glass-stoppered bottles and store in a cool, dark place. Squill bulbs contain calcium oxalate crystals which irritate the human skin, so gloves should be worn when they are handled.

Directions for laying the bait should advise the purchaser to mix the liquid with an equal quantity of fresh milk which has been scalded and allowed to cool. Oatmeal or bread may be added, and a vessel containing water should be placed near the rat-run when the bait is laid.

Liquid squill, however, is not so efficient for the destruction of rats as the dry preparation, which is less expensive, more toxic, and keeps better.

There is no known poison capable of decomposing the body of a rat. It is preferable for the rodent to die in the open, and consequently water is left in vessels to entice it to leave its hole.

No. 26

Bread, Dried and Ground	65 g.
Pig Fat, Fresh	5 g.

Cod Liver Oil	20 g.
Red Squill, Powdered	10 g.

No. 27

Bread, Dried and Ground	37 g.
Glycerin	5 g.
Red Squill, Powdered	10 g.

No. 28

Potato Flakes, Ground	2 kg.
Cocoanut, Ground	0.4 kg.
Red Squill, Powdered	0.3 kg.
Anise, Triturated	0.13 kg.
Fish Meal	0.17 kg.

No. 29

Urginea Marittima—Bulbs cut into small pieces	4 kg.
Pig Fat	2 kg.
Potato Flour	1 kg.
Wheat Flour	1 kg.

Caution: The bulbs of urginea are poisonous and irritate the skin.

No. 30

For use in the open, where water is available, solid bait is preferable to liquid poison. A suitable formula is as follows:

Red Squill Powder	20
Bread	30
Fat	30
Syrup	20
Aniseed Oil	to suit

Rabbit and Rodent Fumigant

Australian Patent 19,147

Powdered Charcoal	20 oz.
Flowers of Sulphur	130 oz.
Potassium Nitrate	112 oz.
Sawdust	100 oz.

The above is ignited in holes or burrows which are closed.

Rat and Roach Pastes

Formula No. 1

Phosphorus	1 oz.
Starch	4 oz.
Flour	12 oz.
Glycerin	12 fl. oz.
Water	24 fl. oz.

No. 2

Red Squill	1 oz.
Fish Meal	10 oz.
Water	6 fl. oz.

Rub together to a paste and use at once.

No. 3

Thallium Sulphate	4 oz.
Water	9 pt.
Corn Starch	8 lb.
Corn Syrup	8 lb.
Glycerin	24 fl. oz.

Ant Eradication

Formula No. 1

Mix 1 oz. of tartar emetic with 8 oz. of sugar and pour a small amount on each ant hill. The grass is not disturbed and the ants disappear.

No. 2

A toxic mixture for ants which temporarily checks the growth of grass is made of equal parts of ethylene dichloride, carbon tetrachloride and carbon bisulphide.

No. 3

Saturate a sponge with a solution made up of 1 lb. of sugar and 125 grains of sodium arsenate in 1 quart of water. Fasten with a wire at the entrance of the nest.

No. 4

Remove sod over ant hill, flood with vigorously boiling water. Replace sod. Boiling water kills grass and should be kept away from cut edges.

No. 5

a. Dissolve 2 lb. of sugar in 2½ gills of water, add 1/10 oz. of tartaric acid, boil 30 minutes, and cool.

b. Dissolve 1/10 oz. of sodium arsenate in 4 teaspoonfuls of hot water. Cool and add 3⅓ oz. of honey. Mix *a* and *b* and place small pieces of cotton or sponge near ant nests.

Household Pest Control

Fleas

A dog or cat may be rid of fleas by the application of a level teaspoonful of derris powder to the skin along the back, neck, and the head.

Derris powder, whose effective agent is rotenone, may be diluted with talcum powder to reduce the rotenone content to 1 per cent.

Pyrethrum powder may be used where derris powder is not at hand.

Infested areas in houses and barns should be sprayed with creosote oil. Because of its odor and because it burns plants and animals, creosote oil, however, cannot be used in every case. Where fleas occur in living quarters, scatter flaked naphthalene over the floor of the infested rooms at the rate of 5 pounds per room. The room should be kept closed from 24 to 48 hours.

Sticktight fleas which are troublesome in the South can be controlled by spraying with creosote oil infested chicken houses and areas beneath buildings frequented by poultry or pet animals. The masses of fleas attached to poultry or pet animals may be treated with derris powder or carbolated vaseline.

Ants

Ant control must center on the destruction of the queen and the young in the nest itself. Where the ant colony can be located it may easily be destroyed with a tablespoon or so of carbon disulphide. When the worker ants appear from under the stones or between the bricks of a walk, their colonies may also be destroyed by pouring a tablespoon of carbon disulphide down the crack.

Where the nests are in woodwork, by means of a small syringe inject a tablespoon of carbon disulphide and then close the opening with plastic wood or putty. Where the ant galleries are widely separated it is desirable to make injections at intervals in the wood.

For unlocated ant colonies the use of baits, powder, sprays, or chemical barriers is recommended. No one preparation will do for all kinds of ants. Some ants eat one kind of poison but not another. Some eat only sweets, others eat only meats and grease.

Dusting sodium fluoride powder about window sills, drainboards, foundations, and other places where ants crawl sometimes drives them away.

Pyrethrum sprays can be used but they kill only the ants actually hit by the spray.

The use of poison baits is also recommended but the type of bait used depends upon the variety of the ant.

Silverfish

Silverfish are slender, wingless, scale-covered insects slightly more than ⅜ of an inch long. They are found in damp, warm basements, storerooms, and attics where they feed upon paper, book bindings, wall paper, rayon fabrics, and anything containing starch or sugar.

They may be controlled by the use of a poison bait made of 1½ cups of oatmeal ground to flour, ¼ teaspoon of arsenic, ½ teaspoon of granulated sugar, and ¼ teaspoon of salt. The mixture should be stirred up and then moistened. Dry the bait, pound into small bits, and scatter wherever the silverfish are found. Sodium fluoride may be substituted for arsenic in the formula.

Pyrethrum powder also may be used. This should be dusted or blown into the infested area. Another effective method is spraying with a saturated solution of paradichlorobenzene in carbon tetrachloride. If possible the room sprayed should be closed for 24 hours.

Centipedes

The house centipede, whose name indicates that it has 100 legs, but which has only 30 legs, is a harmless creature and a very efficient enemy of most household pests. It destroys no household goods or woolens and bites human beings only on provocation. Because of its terrifying appearance, however, most house authorities consider it an unwelcome visitor.

It can be best controlled by destroying all the individuals which make their appearance and by sprinkling fresh pyrethrum powder near water pipes or in store rooms where it usually secretes itself.

Bed Bugs

The bedbug infests furniture, clothing, baggage, walls, laundry. It is not known to be a disease carrier, but its bite frequently results in inflammation and welts.

The most efficient method of eliminating bedbugs is to employ a professional fumigator working under a license issued by the local health department.

Where this cannot be done bedbugs can be attacked by heating the room or the entire building to a temperature of 120 to 125 degrees. This temperature should be maintained for several hours. If this too is impossible, bedbugs may be attacked by a solution of pyrethrum in kerosene. This should be sprayed so that it comes in contact with the bedbugs. The best way to do this is to use a power sprayer. Filling the room with spray will not work.

An effective but tedious method is the application of kerosene, turpentine, benzene, or gasoline to cracks in bedsteads or to the other hiding places of the bugs. When doing this the windows should be kept open and all fire kept away. The infestation of furniture may be overcome either by fumigation or by liberal application of clear gasoline to the furniture in the open air.

Carpet Beetles (Buffalo Moths)

The carpet beetle, or buffalo moth, attacks household furnishings containing wool, hair, bristles, and other animal substances. Effective control of the carpet beetle will also eliminate moths since that insect infests the same places and eats the same food.

Stored clothes can be protected from them by sprinkling a pound of naphthalene or paradichlorobenzene between layers of thin paper placed at various levels in the clothing. The trunk should then be tightly closed. In tightly closed closets carpet beetles may be eliminated by sprinkling a pound of either of these substances for every 100 cubic feet of closet space.

Persistent spraying of a kerosene oil pyrethrum solution into the closets where these pests hide will also eliminate them. The spray, however, must come in contact with the carpet beetle.

Nailed-down carpets provide hiding places for these bugs. The best way to rout them out from under carpets is to carpet only within 12 or 18 inches of the wall. Then the rug may be lifted up and cleaned.

In cleaning carpets both sides should be vacuumed or swept. When stored, rugs should be thoroughly cleaned on both sides, well covered with naphthalene or paradichlorobenzene, rolled tightly, and then wrapped in unbroken paper so that insects cannot get to the carpet.

Infested furniture may be either fumigated or sprayed.

Cockroaches

Cockroaches destroy food, book bindings, fabrics, but even more important, they are disease carriers and pollute food over which they run.

To eliminate cockroaches trade at roach-free stores and watch all boxes or baskets of food and laundry brought into the house.

Fumigation by a professional fumigator is the most effective way of ridding the house of roaches. This method, however, is expensive and in infested areas is apt to give only shortlived relief.

Amateur exterminators should first fill up the cracks which lead to roaches' hiding places with putty, plastic wood, or plaster of Paris. Then sodium fluoride powder should be sprinkled along the back of shelfing and drainboards.

If possible blow the powder with a duster, bellows, or an electric power duster into the insects' hiding places. Sodium fluoride is poisonous, however, and should be kept out of food and away from children and pets.

Pyrethrum powder is a non-poisonous roach-killer and may be used in the same way. On exposure to air, however, it loses its effectiveness after a time.

Phosphorous pastes are useful. Spread the paste on a piece of cardboard and roll into a cylinder. Wrap around with a rubber band and then place it wherever the roaches have been destructive.

Sprays of kerosene oil and pyrethrum extract may be used also but it must be remembered that these kill only by contact.

Bed Bug Killing Powder

Alum, Powdered	80 kg.
Boric Acid, Powdered	10 kg.
Salicylic Acid	10 kg.

Powder very finely.

Bed Bug Spray

Formula No. 1

Carbolic Acid, Crystallized	10 kg.
Camphor	10 kg.
Thyme Oil	15 kg.
Alcohol	565 kg.
Carbon Tetrachloride	650 kg.

No. 2

Paradichlorbenzene	15 kg.
Naphthalene	25 kg.
Carbolic Acid	5 kg.
Thyme Oil	15 kg.
Carbon Tetrachloride	450 kg.
White Spirit	250 kg.
Alcohol	240 kg.

No. 3

Alcohol, Denatured	30 fl. oz.
Water	70 fl. oz.

Apply freely in cracks and crevices.

Sand Fly Spray

Laboratory and field tests show that 1 part of concentrated pyrethrum consisting of the extract from 20 pounds of pyrethrum in 1 gallon of refined kerosene and 20 parts of lubricating oil (S.A.E. 5) or 1 part of concentrated pyrethrum extract, 6 parts of kerosene and 12 parts of lubricating oil (S.A.E. 10) applied to door and window screens with a brush or rag, will repel or kill saltmarsh sand flies.

Insect Repellent Powder

A composition of naphthalene 5%, oil cedar leaf 1%, oil sandalwood 1%, linalyl acetate 2%, zinc stearate 8%, zinc peroxide 20%, and talcum 63%. This is used as a dusting powder.

Mexican Bean Beetle Dusting Powder

Derris or Cubé, Powdered (5%)	15 lb.
Talc, Powdered	85 lb.

Mosquito Repellent

Castor Oil	10 oz.
Thyme Oil	1 oz.
Pyrethrum Powder	1 oz.

Cattle Lice Remedy

Nicotine Sulphate (40%)	5 cc.
Water	1 gal.

Spray cattle with above and work in with a brush, using rubber gloves to protect hand.

Parasiticidal Fumigating Composition

Canadian Patent 374,905

Nicotine (98%)	82 oz.
Lubricating Oil, Light	2/5 oz.
Kerosene	13/16 oz.

INSECTICIDES

Calcium Arsenate

Formula No. 1

Suspend 6 lb. slaked lime in a barrel holding 20–25 gal. water. Lead steam in to bring to a boil. Then add slowly 4⅔ lb. arsenic oxide. Boil for 1½ hours. Allow to cool and stand until precipitate settles. Draw off upper layer of water. The suspension of calcium arsenate is now ready for use.

No. 2

British Patent 493,584

Norwegian Saltpeter	5 lb.
Arsenic Trioxide	6 lb.
Calcium Oxide	4 lb.

Heat at 600–800°

No. 3

U. S. Patent 2,029,264

Liberation of soluble arsenic by the action of atmospheric carbon dioxide is prevented by stirring freshly precipitated

Calcium Arsenate	150 kg.
Sodium Fluoride (0.4% Solution)	2,000 kg.

for ½ hour at 80° C.

No. 4

a.	Talloil (Sap. Val. 165)	30 kg.
b.	Caustic Soda (40° Bé.)	13.4 kg.
	Water	15 l.
c.	Alcohol, Denatured	8 l.
	Turpentine or Tetralin	15 kg.
	Petroleum	20 kg.
	Quinoline Base (or 10% Nicotine Soap)	5 kg.

Prepare *b*, heat to 100° C., add *a* with stirring. When homogeneous, let cool. To the cold soap, add *c*.

Use 5% of the compound in water for agricultural sprays and coatings.

No. 5

(For Nematodes)

Talloil	300 kg.
Caustic Soda (20° Bé.)	290 kg.
Alcohol	to thin
Turpentine or Tetralin	250 kg.
Carbon Disulphide	250 kg.

A 1–2% strong water-dispersion of this is sprayed over the fields in Fall after the ploughing.

No. 6

French Patent 835,743

Petroleum	500 cc.
Turpentine	210 cc.
Gasoline	50 cc.
Napththalene	55 g.
Camphor	10 g.

No. 7

(Volatile)

Hungarian Patent 120,313

Methyl Ethyl Ketone	28 kg.
Trichlorethylene	40 kg.
Paradichlorbenzol	32 kg.

This is used in closets, warehouses and other sealed spaces.

No. 8

(Briquette)

British Patent 489,198

Fluid Extract Pyrethrum	2 lb.
Sulphonated Lauryl Alcohol	10 lb.
Sugar	100 lb.

Mold into briquettes or cubes.

No. 9

U. S. Patent 2,189,730

Sulphur, Flowers of	1000 oz.
Sepia, Powdered	30 oz.

Mix and melt and pour into forms (while stirring) provided with a wick impregnated with solidified alcohol.

No. 10

(Copal Oil)

Copal Oil	500 lb.
Water	2000 lb.
Morpholine	20 lb.
Oleic Acid	45 lb.

Add the oleic acid to the copal oil, using stirring. Then add the morpholine, still using high speed stirring. Add the water slowly and keep up stirring during addition of water.

This copal emulsion when sprayed on Japanese beetles will prevent them from flying and kill them slowly.

No. 11

(Arachis Oil)

Arachis Oil	2.00 l.
Oleic Acid	0.75 l.

Ammonia	0.50 l.
Water	100.00 l.

The oil is mixed with the oleic acid. The ammonia is added to 2 l. of water. The oil mixture is added to the ammonia solution slowly with high speed agitation.

This emulsion will keep several days in a closed container.

Method of use. Pour the rest of the water into the emulsion while agitating. Use rain water or soft water. This is sprayed on the trees by means of a pressure spray. Especially effective for pear trees against "Diaspis" and "Aspidiotus ostrae formis."

No. 12
(Soil)

Powdered naphthalene, mixed in the proportion of 1 part of naphthalene to 2 parts of ashes or lime, is used as a soil insecticide. At the rate of about 1 pound per 10 square yards, this mixture is dug fairly deeply into the ground around the plants.

No. 13
(Agricultural Dust)

Lead arsenate is generally a better insecticide than calcium arsenate; but for dusting, either by duster or by aeroplane, the latter material must be used. Because of its lighter weight, it forms a much more evenly spreading dust.

No. 14
(Non-Poisonous Dust)

Ground Derris Root	15 oz.
Bancroft Clay	85 oz.

Mix thoroughly.

No. 15
(For Red Spiders)
U. S. Patent 2,068,742

The red spider is controlled by spraying with a mixture of a solution of selenium 3 oz. in aqueous calcium polysulphide 1 U. S. gal., with 700–800 gallons of 0.33% mineral oil emulsion.

Soil Disinfectant
Formula No. 1
Dutch Patent 46,874

Formaldehyde	200.0 oz.
Carbon Bisulphide	37.0 oz.
Sulphonated Castor Oil (75%)	1.4 oz.

Mix vigorously while cooling well. Apply 1.42 kg. per sq. meter of soil.

No. 2
U. S. Patent 2,110,943

To control fungi in soil and stimulate plant growth use ¼–3 oz. per sq. ft. of following:

Formaldehyde	3 oz.
Urcea	6 oz.

Mix well and grind to a fine powder.

No. 3

Urea 6 lb.

Is stirred into

Formaldehyde 16 lb.

Stir in

Sulphuric Acid 4 oz.

Stir until reaction is complete. Dry and grind to fine powder.

No. 4

Urea	6 lb.
Paraformaldehyde	6½ lb.

Grind together to fine powder.

FERTILIZER
Formula No. 1
(Insecticidal)
U. S. Patent 2,095,366

Humus, Unspent	40 oz.
Bone Meal	35 oz.
Blood, Dried	20 oz.
Copper Sulphate	5 oz.

No. 2
British Patent 489,567

Ground Phosphate Rock	600 lb.
Limestone	400 lb.

Heat to 60–65° C. and then mix in

Sulphur 20–80 lb.

No. 3
(Mixed)
U. S. Patent 2,067,931

Superphosphate	890 lb.
Ammonium Chloride	24 lb.
Ammonium Nitrate	45 lb.
Ammonia (50% Solution)	81 lb.

No. 4
Swiss Patent 201,192

Bone Meal	4.00 kg.
Ammonium Sulphate	1.60 kg.
Superphosphate (18% P_2O_5)	0.08 kg.

No. 5
(Synthetic)
Canadian Patent 388,481

Diammonium Phosphate	3 g.
Ammonium Sulphate	7 g.
Sodium Sulphate	3 g.
Potassium Nitrate	2 g.
Potassium Chloride	2 g.

No. 6
(Phosphate)
U. S. Patent 2,081,401

Calcium Superphosphate	890 lb.
* { Ammonium Chloride	34½ lb.
{ Ammonia	80½ lb.

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* Dissolve first and then mix well with superphosphate.

No. 7
(Flower)

Iron Sulphate, Powdered	40 lb.
Ammonium Chloride	50 lb.
Calcium Sulphate	60 lb.
Ammonium Phosphate	200 lb.
Potassium Nitrate	250 lb.

Use 2 oz. for 1,000 oz. of water.

Combined Weed Killer and Fertilizer
U. S. Patent 2,080,378

Caustic Soda	9 lb.
Sodium Nitrate	1 lb.
Water	21 lb.

Artificial Humus

Sugar	10 kg.
Hydrochloric Acid (0.2N)	100 kg.

Heat for 3 hours at 100° C.

Plant Growth Accelerator
British Patent 506,910

Bentonite	3 lb.
Water	100 lb.
Ammonium Linoleate	3 lb.
Paraffin Wax	10 lb.

To the above which has been emulsified by heating with vigorous stirring add β-Indolylacetic acid to give a concentration of 1 in 300,000 parts by weight.

Root Growth Stimulant
British Patent 514,250

β-Indolpropionic Acid	4.000 kg.
Anthraceneacetic Acid	0.005 kg.
Petrolatum	985.000 kg.
Fungicide	1–70.000 kg.
Calcium Chloride	Trace

Soil-less Growing Nutrient Solutions
Hints

Plants will not grow satisfactorily in too acid a medium. For most plants a pH of approximately 6.0 is about right. A very convenient means for determining the pH is Nitrazine Paper.

All the nutrients must be in soluble form to be suitable for use in this work.

At values higher than pH 7.0 the calcium and magnesium present in these solutions precipitate the phosphate in an insoluble form. All the formulæ given produce solutions with pH values close to 6.0.

The roots of plants must have air in order to grow.

	Formula No. 1	No. 2	No. 3
Superphosphate	165 g.	172 g.	172 g.
Sodium Nitrate	94 g.	141 g.	176 g.
Magnesium Sulphate	280 g.	420 g.	420 g.
Potassium Chloride	78 g.	117 g.	117 g.
Water	100 gal.	100 gal.	100 gal.

Iron, boron and manganese salts are to be added to above in amounts of 4 parts per million parts of solution.

No. 4

Calcium Nitrate	4 g.
Potassium Nitrate	1 g.
Magnesium Sulphate	1 g.
Potassium Mono or Di-Hydrogen Phosphate	1 g.
Water	1,000 cc.

No. 5

Calcium Nitrate	5 g.
Magnesium Sulphate	15 g.
Potassium Hydrogen Phosphate	18 g.
Water	1,000 cc.

No. 6
(Sand Culture Formula)

Ammonium Sulphate	30 g.
Potassium Phosphate Monobasic	57 g.
Magnesium Sulphate	114 g.
Calcium Nitrate	486 g.
Water	50 gal.

No. 7

Calcium Nitrate	9 g.
Potassium Nitrate	9 g.
Ammonium Hydrogen Phosphate	2 g.
Magnesium Sulphate	3 g.

To both of above add:

a. 5 cc. per gallon of 0.5% iron tartrate solution, twice weekly.

b. Manganese sulphate to give concentration of 0.5 parts per million of manganese.

c. Boric acid or borax to give 0.5 parts per million of boron.

d. Zinc, as zinc sulphate, to give .05 parts per million.

No. 8

Monopotassium Phosphate	7.1 g.
Calcium Nitrate	24.0 g.
Magnesium Sulphate	13.0 g.
Ammonium Sulphate	2.1 g.
Water	5 gal.

Add Solutions *A* and *B* to the above.

Solution A

3.2 grams of each of the following:
Boric Acid
Magnesium Sulphate
Zinc Sulphate

dissolved in 64 oz. of water to which add 0.7 g. copper sulphate.

Solution B

Iron Ammonium Citrate	0.8 g.
Water	16 fl. oz.

For use, add 10 cc. of solution *A* to each 5 gallons of nutrient solution and 20 cc. of *B* to each gallon of nutrient solution.

No. 9

Potassium Sulphate	6.7 g.
Magnesium Sulphate	8.7 g.
Double Superphosphates	10.2 g.
Potassium Nitrate	14.4 g.
Ammonium Sulphate	4.7 g.

For use during the winter months.

No. 10

Magnesium Sulphate	5.8 g.
Double Superphosphates	6.8 g.
Potassium Nitrate	19.1 g.
Ammonium Sulphate	5.8 g.

For use in moderately bright winter or spring weather.

No. 11

Magnesium Sulphate	2.9 g.
Double Superphosphates	2.8 g.
Potassium Nitrate	19.1 g.
Ammonium Sulphate	12.4 g.

For use when plenty of sunlight is available.

No. 12

Potassium Nitrate	5050 g.
Magnesium Phosphate	600 g.
Calcium Sulphate	770 g.
Ferric Sulphate	100 g.
Manganese Sulphate	20 g.
Sodium Borate	20 g.

Pulverize the last 3 chemicals very thoroughly and mix all salts together.

Potting Plants

In the first place, the pot must be perfectly clean. Never use a pot a second time without having washed it thoroughly inside and out, giving most attention to the inside.

After they have had a rest, carefully wash and dry them, and stack away ready for use. If this is properly and promptly done, you will always have pots ready to hand when required. Pots newly from the store should be thoroughly soaked, or left out in the rain. In all cases be sure that the pots are dry before using.

Drainage: The next and all-important matter is the drainage; this must be perfect, and the amateur cannot be too particular in his preparation. The mere placing of a piece of crock in the pot to "keep the soil from going through," as some express it, is not sufficient and frequently does more harm than good.

See that your pot is sound, thoroughly sweet and clean. Also have a supply of broken crocks equally sweet and clean. Do not assume that anything will do, for a tainted piece of old crock will contaminate the whole of the soil, and affect the well-being of the plant.

Do not throw a few pieces of broken pots into the bottom without care as to how they lie. These pieces of crock are placed for a definite purpose, *i.e.*, to run off all surplus water so that none will stay in the pot to sour the soil. Therefore, too much care cannot be taken to see that they are placed with the round side up, so that there is a clear run for all waste water.

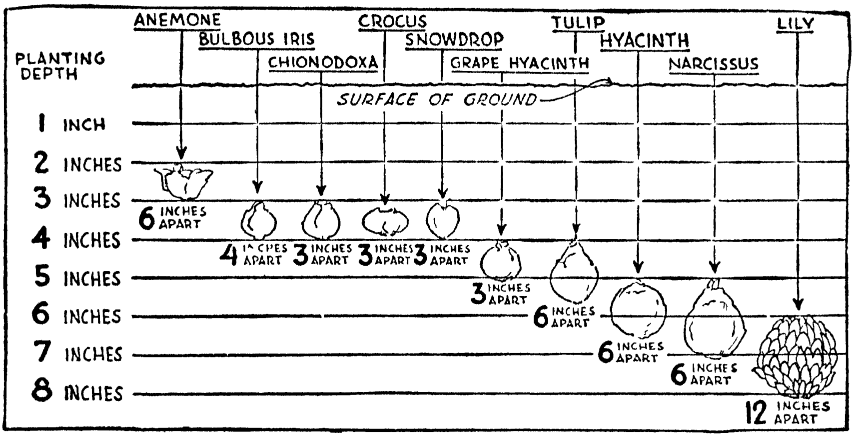
On top of these pieces of crockery place a little rough loam mixed with fiber and well-rotted grass roots and a few bits of charcoal. The latter will help to keep the soil sweet, and the fiber will supply the young roots with food and materially help along the growth of the plant.

Soil: The soil that is ideal for a plant will vary at different stages of the plant's growth. A well-balanced soil mixture for young plants and rooted cuttings is compounded as follows:

Use one part of good yellow loam, as full of fiber as possible; one part coarse, sharp sand, to be washed thoroughly before using; one part well decayed cow manure, and one part leafmold. Add to this a little powdered charcoal and mix all well together; you will then have a compost that will suit almost any plant in the first stage of growth.

Planting Bulbs

Some fall bulbs are not planted to a depth of four times their diameter. The madonna lily, usually a big bulb, should be planted only 3 or 4 inches deep. The crown imperial, a large bulb, wants shallow planting, about 2 inches. The beginner will find a chart of planting depths useful to refer to when the planting task is begun.



If the ground in which the bulbs are planted has been newly spaded, and is quite loose, the depths should be increased an inch or so, to allow for settling, and because of the increased effect of frost heaving on newly turned soil. Also, late planted bulbs, which have no opportunity to make roots before the soil freezes, may be set a little deeper, to protect them from frost action.

Tulips should be set 5 to 6 inches deep. Narcissi need about the same depth from the top of the bulb, but owing to the different shape and sometimes the much larger size, the base of the bulbs is usually deeper than the tulips. Snowdrops and scillas should go down about 2 to 3 inches. Crocuses should have 2 inches of soil over them. The erythroniums need about 4 inches of cover. So does Fritillaria meleagris. Anemones for cold frame planting need only an inch of soil.

The lilies need the deepest planting, and most of them can go as deep as 7 to 10 inches with good results. The distance apart is rather elastic, but in general 5 inches is the closest any of them should be planted.

Anti-cryptogamic Composition for Plants

U. S. Patent 2,138,733

Calcium Oxide	100 oz.
Copper Sulphate (Dehydrated)	2–3 oz.

Budding Cloth

Soak muslin in the following melted mixture for 15 minutes:

Beeswax	4 lb.
Rosin	1 lb.

Preserving Green Fodder

Treat fodder with following before ensilage:

Hydrochloric Acid		5–7 oz.
Glaubers Salt		5–7 oz.
Water	to make	100 gal.

Protecting Seeds From Birds

British Patent 513,843

Formula No. 1

Wheat Seed	200 lb.
Gas Carbon Black	1 lb.

No. 2

Wheat Seed	200 lb.
Talc	1 lb.
Gas Carbon Black	1 lb.

No. 3

Phenyl Mercuric Acetate	2½ lb.
Gas Carbon Black	50 lb.
Heavy Lubricating Oil	1 lb.
Talc	46 lb.

Mix together for half hour and then apply to

Oats	500 lb.

Birds will not eat such coated seeds.

Preventing Citrus Spoilage

Dip oranges in 6% aqueous borax at 43.3–46.1° C., within 3 hours after picking.

Fruit Coating Wax

U. S. Patent 2,153,487

Caustic Soda	6 oz.
Triethanolamine	20 oz.
Stearic Acid	42 oz.
Paraffin Wax	165 oz.
Carnauba Wax	55 oz.
Shellac	100 oz.

Water	2,000 oz.

Dilute above before use.

Grafting Wax

	Formula No. 1	No. 2
Beeswax	1 lb.	1 lb.
Linseed Oil	¼ pt.	½ pt.
Rosin	5 lb.	5 lb.
Powdered Charcoal	½ lb.	—
Fuller's Earth	—	½ lb.

Safety First in the Cowshed

Hydrochloric acid finds a new use in etching (roughening) cement floors in cowsheds. It was found that 25% commercial hydrochloric acid left on the floor for 20 minutes proved satisfactory, and that one 10-gal. carboy of undiluted acid was sufficient to treat 58 sq. yds.

Poison Cartridges for Animals

U. S. Patent 2,166,168

Potassium Cyanide	17 oz.
Magnesium Oxide	1 oz.
Capsicum	5 oz.

These are filled into cartridges and are fired into mouths of trapped animals to end their sufferings.

Feeding Hens for Hatchability

Formula No. 1

Ground Grains and Grain Products	69½ lb.
Fish Meal (65% Crude Protein)	12 lb.
Dry Skim Milk	5 lb.
Alfalfa Leaf Meal	8 lb.
Bone Meal	2 ib.
Ground Limestone or Ground Oyster Shell	2 lb.
Salt	1 lb.
Sardine or Cod Liver Oil	½ lb.

No. 2

Yellow Cornmeal	400 lb.
Wheat Bran	400 lb.
Flour Wheat Middlings	400 lb.
Ground Heavy Oats or Ground Barley	400 lb.
Meat Scrap (55% Protein)	200 lb.
Dry Skim Milk	200 lb.
Limestone or Oyster Shell Flour	40 lb.
Salt	10 lb.
Cod Liver Oil (When Confined)	20 lb.

No. 3

Ground Yellow Corn	500 lb.
Bran	500 lb.
Middlings or Shorts	500 lb.
Meat Scrap or Tankage	300 lb.
Dry Skim Milk	100 lb.
Alfalfa Leaf Meal	100 lb.
Salt	20 lb.

No. 4

Ground Corn	20 lb.
Bran	20 lb.
Flour Middlings	12 lb.
Ground Oats	18 lb.
Meat Scrap	10 lb.
Dry Skim Milk	10 lb.
Alfalfa Meal	5 lb.
Steamed Bone Meal	2 lb.
Cod Liver Oil	2 lb.
Salt	1 lb.

Oyster shell should be available to the laying flock at all times.

No. 5

Yellow Corn Meal	100 lb.
Wheat Bran	100 lb.
Wheat Middlings	100 lb.
Ground Heavy Oats	100 lb.
Meat Scrap (50% Protein)	50 lb.
Dry Skim Milk	50 lb.
Steamed Bone Meal	10 lb.
Table Salt	5 lb.

No. 6

Coarsely Ground Yellow Corn	20 lb.
Wheat, Coarsely Ground, or Wheat Middlings (Shorts)	20 lb.
Finely Ground Oats	20 lb.
Wheat Bran, Coarse	9 lb.
Meat Scraps, Medium (50–55% Protein)	20 lb.
Dry Skim Milk	5 lb.
Alfalfa Meal or Leaf Meal	5 lb.
Salt	1 lb.

1½ to 2 pints, or the amount suggested by manufacturers, of potent cod liver oil or sardine oil or their equivalents to each 100 pounds of mash when layers are confined indoors. Oyster shells or limestone grit before birds at all times; chopped alfalfa, clover, or soybean hay before birds at all times when available.

No. 7

Ground Yellow Corn	350 lb.
Wheat Bran	150 lb.
Ground Heavy Oats	100 lb.
Wheat Middlings	150 lb.
Meat Scrap*	50 lb.
Fish Meal*	50 lb.

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* In place of 50 pounds of meat scrap and 50 pounds of fish meal, one may use 100 pounds of meat scrap or 100 pounds of fish meal.

Dry Skim Milk	75 lb.
Alfalfa Meal	75 lb.
Calcium Carbonate[*]	10 lb.
Cod Liver Oil or its Equivalent[†]	15 lb.
Salt	5 lb.

No. 8

Ground Yellow Corn	300 lb.
Ground Wheat	300 lb.
Ground Oats	200 lb.
Millrun	540 lb.
Dehydrated Alfalfa	200 lb.
Meat Scrap (55% Protein)	130 lb.
Fish Meal (70% Protein)	130 lb.
Dry Skim Milk	100 lb.
Ground Oyster Shell	40 lb.
Bone Meal	40 lb.
Cod Liver Oil or Fish Oil or its Equivalent in Concentrated Vitamin D	40 lb.
Salt	20 lb.

No. 9

Ground Yellow Corn	100 lb.
Ground Oats	50 lb.
Ground Barley	50 lb.
Wheat Bran	100 lb.
Wheat Middlings	100 lb.
Alfalfa Meal	25 lb.
Meat Scrap	75 lb.
Dry Skim Milk	25 lb.
Salt	5 lb.

Add cod liver oil or sardine oil during fall and winter or whenever hens are confined to the laying house.

No. 10

Yellow Corn Meal	400 lb.
Ground Oats and Barley	300 lb.
Wheat Bran	200 lb.
Wheat Middlings	500 lb.
Dry Skim Milk	200 lb.
Meat and Bone Scrap	100 lb.
Fish Meal	100 lb.
Soybean Oil Meal	100 lb.
Steamed Bone Meal	20 lb.
Alfalfa Leaf Meal	100 lb.
Oyster Shell Flour	40 lb.
Cod Liver Oil or Sardine Oil	30 lb.
Salt	10 lb.

To be fed with grain feed. Protein 19%, fat 4%, fiber 6½%.

No. 11

Ground Yellow Corn	600 lb.
Ground Oats	200 lb.
Wheat Bran	200 lb.
Wheat Middlings	400 lb.
Dry Skim Milk	200 lb.
Alfalfa Leaf Meal	200 lb.
Meat and Bone Scrap	100 lb.
Fish Meal	100 lb.
Oyster Shell Flour or Ground Limestone	40 lb.
Concentrated Cod Liver Oil	10 lb.
Salt	10 lb.

To be fed with grain feed. Protein 19%, fat 4%, fiber 7%.

Iodine Nutrient for Goats

Dissolve 1 oz. of potassium iodide in 1 pt. of water. Take 1 oz. of this strong solution and add 1 qt. of water. Mix 1 oz. of the weak solution into the daily grain ration prepared for 12 kids weighing 12 to 15 lbs. For mature animals the dosage must be increased.

Milk Goat Ration

Formula No. 1

Crimped Barley	100 lb.
Crimped Oats	100 lb.
Scratch Feed	100 lb.
Bran	100 lb.
Shorts	100 lb.
Linseed Oil Meal	100 lb.
Dried Yeast	8 lb.

Use about 1 lb. per animal per feeding, altering the amount to meet the individuality of the animal.

No. 2

Crimped Oats	100 lb.
Crimped Barley	50 lb.
Oat Meal	25 lb.
Scratch Feed	25 lb.
Linseed Oil Meal	40 lb.
Dried Yeast	3 lb.

This is an excellent ration when fed with good alfalfa or clover hay.

Feeding goat rations dry or wet depends upon the individuality of the animals.

Kid or Lamb Meal

1. Corn 3 lb., Oats 3 lb., Wheat Bran 1 lb., Linseed Meal 1 lb.

2. Oats 5 lb., Corn 1 lb., Bran 5 lb., Linseed Meal 1 lb.

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[*] Calcium carbonate refers to finely ground oyster shell, ground limestone of high calcium content or some other good source of calcium. In addition to the calcium carbonate in the mash, it is recommended that a good source of calcium (coarse material) and an insoluble grit be supplied in hoppers at all times.

[†] The vitamin D requirements of laying hens are higher than that of chicks. When the consumption of scratch grain exceeds that of mash, cod liver oil or its equivalent should be added daily to either a moist mash or the scratch mixture at the rate of one-half pound to each 100 pounds of all feed consumed. There are various grades of concentrated cod liver oil on the market which are high in vitamin D potency. Follow the manufacturer's recommendations when using this type of product.

3. Equal weights of oats, bran, corn and ground barley.

Each formula must be prepared from finely ground grains.

Kid or Lamb Gruel

Gruel Desired	Water Required	Meal Required
1 qt.	1 qt.	3 oz.
2 qt.	2 qt.	8 oz.
3 qt.	3 qt.	12 oz.
1 gal.	1 gal.	16 oz.

Buck Feed Mixture

Formula No. 1

Ground Corn	300 lb.
Ground Oats	200 lb.
Wheat Bran	200 lb.
Linseed Meal	100 lb.

No. 2

Ground Oats	300 lb.
Wheat Bran	200 lb.
Ground Corn or Barley	100 lb.
Linseed Meal	100 lb.

Both mixtures have been used with success. Each buck should receive 1 to 4 pounds daily depending upon size and activity.

Grain Mixture for Dry Cows

Hominy Feed	1,000 lb.
Ground Oats	1,000 lb.
Wheat Bran	1,000 lb.
Oil Meal	500 lb.

Medium-Protein Grain Ration for Dairy Cows

(14–18% Protein)

Formula No. 1

Wheat Bran	1,000 lb.
Ground Oats	1,500 lb.
Hominy	2,000 lb.
Oil Meal	500 lb.

No. 2

Ground Oats	2,000 lb.
Corn Feed Meal	1,000 lb.
Ground Barley	1,000 lb.
Buckwheat Middlings	1,000 lb.
Gluten Feed	1,000 lb.
Oil Meal	500 lb.

High-Protein Grain Ration for Dairy Cows

(22–25% Protein)

Wheat Bran	1,000 lb.
Hominy	1,000 lb.
Gluten Feed	1,500 lb.
Oil Meal	1,000 lb.
Cottonseed Meal	500 lb.

Calf Feeding Grain Mixture

Wheat Bran	1,000 lb.
Ground Oats	1,000 lb.
Corn Meal or Hominy	1,000 lb.
Oil Meal	500 lb.

or

Red Dog Flour	2,500 lb.
Corn Meal	2,500 lb.
Ground Oats Groats	1,500 lb.
Oil Meal	1,500 lb.
Ground Malted Barley	1,000 lb.
Soluble Blood Flour	1,000 lb.
Salt	100 lb.
Precipitated Bone Meal	100 lb.
Precipitated Calcium Carbonate	100 lb.

Grain Mixture for Breeding Heifers

Gluten Feed	5,000 lb.
Ground Oats	5,000 lb.
Hominy Feed	5,000 lb.
Wheat Bran	4,000 lb.
Oil Meal	1,000 lb.

Cattle Salt Bricks

Soften clay with water until plastic. Mix in thoroughly an equal weight of salt. Put into wooden forms. First dry in shade and then in sun.

Cattle Feed Salt with Copper

Feed Salt	950 lb.
Ammonium Chloride	50 lb.
Copper Sulphate	25 lb.

Melt and cast into forms lined with paraffin.

Bird Food Cake

Hemp Seed, Whole	300 g.
Hemp Seed, Crushed	400 g.
Poppy Seed	100 g.
Millet, White	50 g.
Elder Berries, Dried	50 g.
Sun Flower Seeds	50 g.
Ant Eggs	50 g.
Beef Tallow	1,400 g.

Melt the tallow on the water bath, mix with the seeds and pour the whole into metal forms shortly before solidifying.

Increasing Natural Food for Fish In Ponds

Addition of the following increased fish production from 134–578 lb. per acre.

Ammonium Sulphate	40 lb.
Superphosphate (16%)	60 lb.
Muriate of Potash	30 lb.
Basic Slag or Calcium Carbonate	15 lb.

per acre

Detoxifying Castor Meal

The toxic effect of extracted castor oil meal can be removed fully by treatment at 140° C., for 60 to 90 minutes.

Chick Coccidiosis Treatment Feed Mixture

Dry Skim Milk	40 lb.
Wheat Bran	10 lb.
Yellow Corn Meal	30 lb.
Ground Barley	20 lb.

Keep this mash before the chicks until Coccidiosis disappears.

Worm Remedy (Chickens)

Formula No. 1

Castor Oil	6 g.
Chenopodium (American Worm-Seed Oil)	15 drops

Dosage per hen to be repeated at 2 week intervals.

No. 2

Steep 1 pound of ground tobacco stems and leaves in 1 quart of water for 1 hour. Mix this with ½ of the regular grain ration. Two hours later give ¼ of regular feeding of grain mixture mixed with water containing 1 pound of Epsom Salts per 100 hens. Repeat after 2 weeks.

Sheep Blowfly Dressing

Zinc Sulphate	10 oz.
Starch	4 oz.
Carbon Tetrachloride	8 oz.
Water	7 pt.

Hoof Salve

Zinc Oxide	3.75 lb.
Phenol	0.16 lb.
Pig Fat	30 lb.

Ring Worm Treatment for Calves

Thymol	1 dr.
Chloroform	1 oz.
Olive Oil	to make 4 oz.

This should be applied once each day to the ring worm.

Another treatment that has been used with very good success in the treatment of ring worm in calves is the use of a 2% solution of mercurochrome, which should be applied to the ring worms once each day. Use a small camel's hair brush.

Dehorning Ointment

Pine Tar	10 lb.
Tannic Acid	1 lb.

Smear the above ointment over the dehorned area when dehorning cattle during the summer.

Screw Worm Remedy

Chloroform	1 pt.
Gasoline	1 pt.

Pour the above mixture into the burrows of the screw-worm on the cattle. Chloroform, gasoline or carbon tetrachloride may be used straight or mixed in equal parts as a substitute for the above mixture.

Remove the dead maggots with forceps. Wash the wounds with a 2% carbolic acid solution. Paint the area with pine tar to repel flies, and with carbolic salve to insure healing.

Horse-Mule Colic Remedy

Administer 1 quart of soy or raw linseed oil, in which 1 ounce of turpentine has been mixed. Two to 4 ounces of soda in a quart of warm water sometimes relieves colic involving the stomach. It should be followed by oil in most cases. If horses have chronic, recurring colic, better have the local veterinarian treat for strangyles and bots. Horses free from worms suffer less from colic.

Horse Blistering Liniment

Castor Oil	1 oz.
Ammonia	1 oz.

Mix well until uniform and then add following, a little at a time with good mixing:

Turpentine	1 oz.

Kid Worm Dosage

A teaspoonful of 1% copper sulphate solution given to a kid after a 12 hour fast will remove worms. The dosage should be repeated after a 14 day interval.

Tonics and Condition Powders

Healthy animals do not need tonics or condition powders. If a tonic is needed the feeder should examine his methods. Plenty of good feed, fresh water, exercise, sunshine, pure air, with sanitary surroundings, should keep an animal in good health. The following formulas are suggested for all stock except hogs:

Formula No. 1

Glauber Salt	2 lb.
Soda (Baking)	1 lb.
Salt	1 lb.
Fenugreek	⅛ oz.
Linseed Meal	25 lb.

No. 2

Glauber Salt	5 lb.
Saltpeter	1½ lb.
Fenugreek	1 lb.
Gentian	2 lb.
Linseed Meal	50 lb.

For horses a heaping tablespoonful of one of these mixtures fed with the grain three times a day is sufficient.

Mineral Mixture for Hogs

In order to make sure that the hogs have plenty of mineral matter, a mineral mixture such as the following should be kept before them at all times:

Charcoal	75 lb.
Raw Rock Phosphate	3 lb.
Salt	6 lb.
Ground Limestone	6 lb.
Flowers of Sulphur	3 lb.
Pulverized Copperas	1 lb.
Glauber Salt	6 lb.

Calf Scours

Reduce feed one-half. If there is no improvement in 12 hours, give 1 teaspoonful of the following mixture three or four times daily, in milk: 1 oz. Subnitrate of Bismuth; ½ oz. Salol; 3 oz. Bicarbonate of Soda.

Lambs

Constipation is remedied by a teaspoonful of castor oil. White scours can be cured by giving one-fourth ounce of cooking soda, 1 ounce of sulphate of magnesia, and a pinch of ginger in a small quantity of flaxseed tea. The flaxseed tea is made by dissolving 1 teaspoonful of ground flaxseed in 1 pint of hot water. This should be followed in about four hours with 2 ounces of raw linseed oil.

Blackhead in Turkeys

Give birds which are most affected 10 drops Fluid Ipecac by mouth, three times daily for three days, twice daily for three days, then once daily for three days. For remainder of flock give 3 teaspoonfuls powdered Ipecac in poultry measure each day for three days.

Flies on Cows

Apply with brush or cloth, mixture of 1 gallon of water, 2 pints of sulphur and 1 pint of kerosene.

Spray for Cattle Lice

1 lb. Larkspur in 1½ gallons water. Boil down to 1 gallon.

To Kill Fly Eggs and Larvae

Dissolve 1 lb. Borax in 5 gallons water. Sufficient for 13 bushels manure.

Sheep-Worm Remedy

Two to 4 ounces of a 1 per cent copper sulphate solution is effective for stomach worms. Fast the animals 12 hours before treatment; and it is advisable to treat monthly during the summer.

Anthelmintic for Animals and Poultry (Worm Treatment)

Phenothiazine is the latest development for successful treatment of worms.

Phenothiazine may be administered in four different ways: as a powder, mixed with the feed; compressed into boluses or pellets; in gelatine capsules; or by drench, wherein a suspension of the powder is prepared with a dispersing agent. A method that may work very well with one class of live stock may not be as effective with another. For example, current reports indicate that sheep will not eat treated feed unless starved to it, which results in a loss of condition. Moreover, the effects may be erratic and less than desired in some cases, since vigorous feeders may be overdosed and heavily-parasitized animals, lacking appetite, may not get an amount sufficient for therapy. The bolus or capsule is therefore more advantageous in that each animal will receive a specified amount of the drug per dose. The drench, given via syringe, is also effective for the same reason.

With swine, the drug should be given only when the animals are sufficiently hungry, and should be mixed with three or four times its weight of dry, ground feed or a thick mass of slops. Room should be provided at the trough for all animals when treated in a group, and those of widely-varying sizes should be handled in separate groups. Administration of phenothiazine in boluses or capsules, or diluted, via stomach tube, is more effective here, too, for it assures each hog of the proper therapeutic dose.

Some horses will take treated feed and will show a marked reduction and even complete elimination of parasitic ova in the feces. The majority, however, will refuse the treated feed even after a 24-hour fast. Much better results may be obtained in administering a solution of the drug by stomach tube, or in powdered or compressed form by capsule. This would logically apply to cattle also.

In the treatment of poultry, since so little of the drug is required and the toxicity is practically nil, admixture with the feed is effective. Small tablets individually administered might give more uniform results, but for large-scale flock treatment the other is more practical.

Therapeutic Dosage

For Sheep

25 grams (approximately one ounce) for ewes and rams; 15 grams for lambs. A more exact dosage recommended is one-half gram phenothiazine per pound of body weight. It should be noted here that in areas where the grazing season is short only one dose may be sufficient; where this season is longer, or when the animal is obviously ill, two or more doses may be required. Subsequent treatments should be given at intervals of about two weeks. All animals should be treated as often as they show serious symptoms of infestation.

For Swine

In proportion to body weight, as follows:

Up to 25 lbs.	5 g.
25 to 50 lbs.	8 g.
50 to 100 lbs.	12 g.
100 to 200 lbs.	20 g.
200 lbs. and over	30 g.

For Horses

Approximately 50 grams are sufficient to treat a 1,000-pound animal.

For Cattle

From 50 to 80 grams per animal, or approximately .25 to .5 gram per pound of body weight.

For Poultry

.05 gram in capsule or .5 gram in feed for individual birds weighing from 1,400 to 2,000 grams.

Worm Remedy for Swine

Sal Soda	30 lb.
Epsom Salts	30 lb.
Sodium Chloride	30 lb.
Sulphur	10 lb.
Charcoal	40 lb.
Copperas	30 lb.

Place a few pounds of the above in a self-feeder and keep before the hogs at all times.

Then give 1 tablet per 100 pound of live weight in the grain mash. The tablet or capsule contains:

Calomel	10 grains
Santonin	10 grains
Areca Nuts	2 drams

Swine Abortion Remedy

1 grain of Potassium Iodide daily for 100 consecutive days.

Scours in Young Pigs

Feed dam ½ pound blood meal daily.

Curing Thrush in Hoof

Cut away all diseased frog. Take some oakum on the point of a nail and swab out all impurities in the cavity in centre of frog. Make it as clean as possible.

If the heel is narrow put in a spring, not too strong. That will let in some fresh air which is a good disinfectant, and will allow the frog to expand. Apply the calomel with a teaspoon handle until the cavity is half full, then plug cavity with oakum or cotton to keep the calomel in and all moisture out. A few applications about three days apart should cure any case of ordinary thrush. After curing use ointment and packing to restore the frog to a healthy condition.

Sheep Dips

Sheep dips may be divided into three classes. The first group may be composed chiefly of sulphur and sodium arsenate together with small amounts of sodium arsenite and arsenious sulphide.

Formula No. 1

Sulphur	64.35 g.
Sodium Arsenate	17.81 g.
Arsenious Sulphide and Sodium Arsenite	17.84 g.

No. 2

Sulphur	54.20 g.
Sodium Arsenate	14.38 g.
Sodium Arsenite, Etc.	31.42 g.

No. 3

Sulphur	62.51 g.
Sodium Arsenate	26.63 g.
Sodium Arsenite, Etc.	10.86 g.

No. 4

Sulphur	61.38 g.
Sodium Arsenate	26.16 g.
Sodium Arsenite, Etc.	12.46 g.

No. 5

Sulphur	37.56 g.
Sodium Arsenate	54.78 g.
Sodium Arsenite	7.66 g.

No. 6

Sulphur	61.48 g.
Sodium Arsenate	24.51 g.

Sodium Arsenite and Arsenious Sulphide	14.01 g.

No. 7

Sulphur	59.11 g.
Sodium Arsenate	33.97 g.
Sodium Arsenite	2.06 g.
Arsenious Sulphide	4.86 g.

Group II. Dips

In the second series are dips in the form of soft pastes also containing arsenic, and having in addition resinous soft soaps and in some cases coal-tar creosote and glycerin.

Formula No. 1

Sulphur	55.87 g.
Sodium Arsenate	24.42 g.
Arsenious Oxide	11.47 g.
Sodium Arsenite	2.64 g.
Cresylic Acid	5.60 g.

No. 2

Sulphur	8.55 g.
Sodium Arsenate	17.42 g.
Arsenious Sulphide	21.39 g.
Soft Soap	23.47 g.
Water	29.17 g.

No. 3

Sulphur	34.16 g.
Arsenious Sulphide	3.83 g.
Sodium Arsenate	34.70 g.
Arsenious Oxide	1.77 g.
Soap (Potash)	14.38 g.
Water	7.04 g.
Inert Material	4.12 g.

No. 4

Sulphur	45.27 g.
Sodium Arsenate	17.02 g.
Arsenious Acid	11.43 g.
Arsenious Sulphide	2.52 g.
Creosote	17.77 g.
Soap	5.32 g.
Water	0.67 g.

No. 5

Creosote	33.45 g.
Rosin	22.90 g.
Glycerin	5.82 g.
Soap (66%)	18.28 g.
Sodium Arsenate	16.60 g.
Sodium Arsenite	2.95 g.

Group III. Dips

In the third group of dips are black viscous liquids chiefly composed of creosote and soft soap.

Formula No. 1

Hydrocarbons	46.78 g.
Pyridine	2.36 g.
Cresylic Acid	21.67 g.
Rosin	5.39 g.
Soap	18.10 g.
Water	5.70 g.

No. 2

Hydrocarbons	39.30 g.
Pyridine	2.53 g.
Cresylic Acid	4.85 g.
Rosin	3.94 g.
Soap	38.34 g.
Water	11.04 g.

No. 3

Hydrocarbons	30.85 g.
Pyridine	3.86 g.
Cresylic Acid	6.85 g.
Rosin	18.03 g.
Soap	23.91 g.
Water	16.50 g.

No. 4

Hydrocarbons	58.06 g.
Pyridine	2.91 g.
Cresylic Acid	12.23 g.
Rosin	2.44 g.
Soap (Potash)	17.60 g.
Water	6.76 g.

No. 5

Hydrocarbons	42.89 g.
Pyridine	4.53 g.
Cresylic Acid	6.50 g.
Rosin	6.81 g.
Soap	29.87 g.
Water	9.50 g.

No. 6

Hydrocarbons	49.75 g.
Pyridine	3.00 g.
Cresylic Acid	5.80 g.
Rosin Fatty Acid	12.31 g.
Soap	22.63 g.
Water	6.51 g.

Preparation

A well-known soap creosote dip is made as follows: First make a solution of caustic soda consisting of 120 lb. caustic soda dissolved in 20 gallons of soft water. This can be made a day or so in advance. Then take 120 lb. coconut oil, 5 gallons of pine oil, 100 lb. resin, and melt the whole in an enamelled pan. When melted, add 320 gallons "D O" creosote oil, thoroughly mix and cool to 55° F. Then add the caustic soda solution previously made.

Other dips can be made as follows: Mix 25 lb. of flowers of sulphur with 12.5 lb. of good sieved quick-lime. Add water, and work it till a smooth cream without lumps is obtained. Transfer this cream mixture to a boiler and make up to 20 gallons with water. Boil and stir for half an hour. The liquid should now be red in color, but if it be of a yellowish shade, continue the boiling until a dark red color is obtained, keeping the volume at 20 gallons. After the whole has cooled down the volume is made up with water to 100 gallons.

The ideal dip should contain no

free alkali, as caustic alkali is especially harmful to the wool. Nor should crude tar products be used. All carbolic dips, whether made of pure carbolic or crude tar oils, can be made to emulsify with cold water if compounded with the proper proportions of paraffin oil and soap. The ingredients should be heated together in a boiler until the soap has entirely dissolved. If soft soap is used a fluid dip results. When a hard soap is employed the result is a paste dip, which will require hot water to dissolve it in the first place, and can then be diluted to the required strength with cold water.

Such dips have to be very carefully made with exact proportions, otherwise paste dips do not set firmly, and fluid dips will not emulsify properly. A very good dip working out at about 15 per cent tar acids and containing no free alkali or caustic to injure the wool, and suitable for summer or winter, consists of:

Tar Oil	39.30 g.
Paraffin Oil	31.00 g.
Lanolin	5.00 g.
Crude Cresylic Acid	3.70 g.
Soft Soap	21.00 g.

The tar oil used is that oil coming over between 180° to 220° C. and containing 20.25 per cent phenol. All the materials are mixed together in a boiler, and gradually heated until all the soap and lanolin have quite dissolved, and then boiled gently for a short time, cooled, and tinned up.

On similar lines a summer dip can consist of:

Tar Oil	41.80 g.
Paraffin Oil	33.50 g.
Crude Cresylic Acid	3.70 g.
Soft Soap	21.00 g.

and is made in the same manner as the former dip.

Waterproof Sheep Marking

Lanolin	30 g.
Benzine	15 g.
Chalk, Powdered	14 g.
Pigment	3–4 g.

Hot or cold water will not remove marking, but it may be removed by soap-alkali washing.

CHAPTER SEVEN

FOOD CONFECTIONERY

Tenderlite Marshmallow

Made with gelatin, for filling and topping layer cakes, enrobing cup cakes, and for snowballs to be topped with coconut, etc. Semi-cold process.

Gelatin	2 lb.
Water (Cold)	4 lb.
Water (Hot)	13 lb.
Sugar (Fine Granulated)	40 lb.
Standardized Invert Sugar	25 lb.
Corn Sirup	15 lb.
Flavor and Color	as desired

Soak the gelatin in the cold water. Heat the soaked gelatin carefully until fluid (about 140° F.).

In the meantime, prepare a sirup by dissolving the sugar in the hot water (heat to 190° F.) and adding to the dissolved sugar the standardized invert sugar and corn sirup. Stir the sirup until the standardized invert sugar and corn sirup are dissolved and then combine these with the fluid gelatin.

Beat the whole mass until of the consistency of marshmallow. Add the flavor and color to the marshmallow just before finishing the beating.

For molasses flavor, use 2½ lb. of open-kettle molasses—highest quality—for each 10 lb. of the total batch and reduce the standardized invert sugar by ½ lb., the sugar by 1½ lb. and the water by ½ lb.

For banana flavor, use about 4 oz. of ripe banana powder containing milk solids for each 10 lb. batch. Incorporate it in any way convenient—preferably first blended with about an equal weight of sugar.

Marshmallow Mix

British Patent 507,455

Glucose	20–40 lb.
Sucrose	60–80 lb.
Gelatin	2 lb.

70 lb. of above mixture is whipped with 30 lb. water.

Marshmallow Fluff (Stock)

Boil to 230° F., then remove from fire:

Corn Sirup	3 lb. 8 oz.
Granulated Sugar	3 lb. 8 oz.
Water	14 oz.

Add to the above, then place in a clean beating bowl:

Corn Sirup	2 lb. 8 oz.
Standardized Invert Sugar	1 lb.

Dissolve—add to above, then beat until stiff on *medium* speed:

Water	13 oz.
Egg Albumen, Tasteless	4½ oz.
Vanilla Extract (Pure)	½ oz.
Salt	¼ oz.
Cream of Tartar	¼ oz.

Fill into containers for storage. This fluff spreads easily. It never gets tough or rubbery.

Glyco-Gelatins Used in Jujubes, Pastilles, Etc.

One of the most important uses of glycerin in confectionery is in the manufacture of the so-called glyco-gelatins. These glycerine-containing preparations are used to make jujubes, pastilles and the like. The gelatin and glycerin base can be flavored and colored to suit a wide variety of requirements. The usual formula for these glyco-gelatins consists of:

Refined Gelatin	1 lb.
Glycerin	2½ lb.
Orange Flower Water	2½ lb.

Color, flavor or other ingredients may be added to this base as desired. Another glycerin-containing base which appears to combine the advantages of gum bases and glyco-gelatin bases, and which is claimed to be more suitable for certain special conditions, consists of:

Granulated Edible Gelatin	20 lb.
Glycerin	30 lb.
Sucrose	15 lb.
Tartaric Acid	3 lb.
Mucilage of Acacia, to	100 lb.

The glycerin, sucrose and acid are mixed with the mucilage and the granulated gelatin stirred in. After about three minutes, this is placed in a water bath and heated until the gelatin is completely dissolved, usually in about five minutes.

Basic Fondant

Basic fondant is a smooth cream fondant preparation which is used in nearly every department of the candy factory. Basic fondant is used in cast cream centers of all types, crystallized creams, fudge, cast caramels, nougat, coconut work, icings and grained or semi-chewing candies.

The following formula for basic fondant can be produced in large or small batches on any type of equipment, and it will produce a smooth, creamy textured fondant that may be stored for long periods without prematurely drying.

Granulated Sugar	80 lb.
Corn Sirup	20 lb.
Standardized Invert Sirup	10 lb.
Water	to dissolve the sugar

Heat all together stirring the batch occasionally until it boils, then wash down all grains of sugar that adhere to the inside of the kettle and boil the batch rapidly to 238–248° F. Cool the resulting sirup to 125–110° F., then beat into fondant.

For cast cream centers: Boil the basic fondant to 238–244° F.

For fudge, nougat, caramels and coconut work: Boil the basic fondant to 244–248° F.

Everton English Caramel Toffee

White Sugar	20 oz.
Brown Sugar	10 oz.
Glucose	34 oz.
Full Cream Condensed Milk	20 oz.
Hard Fat	12 oz.
Dairy Butter	4 oz.

The sugars and the glucose are boiled together—in this case with sufficient water to ensure solution—to a temperature of 300° F. A high-pressure pan, not necessarily with stirring device, is required for this part of the process. When this has been done, the boiled batch is transferred to a caramel vertical mixing pan and the other ingredients added. When homogeneity is attained, the batch should be tested for consistency. It may be necessary to cook it a little, but if this is found to be the case, later batches should be made with the sugar/glucose boiling taken correspondingly higher. The ideal state, and one which may require a slight adjustment to the quantities of milk and fats, as well as alteration to the boiling height, is reached when the addition of the cold, mixed ingredients brings back the whole batch to the state of a "first crack."

Incidentally, under certain conditions it is rather difficult to incorporate thoroughly the fat with the other ingredients — particularly a high-boiled batch—without artificial aid. The addition, during the mixing process, of 0.08 per cent. lecithin will ensure homogeneity. This is a tip worth noting.

English Caramel Toffee

Brown Sugar	34 oz.
Glucose	34 oz.
Full Cream Condensed Milk	20 oz.
Hard Fat	12 oz.

Washington Toffee

Sugar	10 lb.
Corn Syrup	10 lb.
Brown Sugar	10 lb.
Butter	3 lb.
Cream	2 gal.
Salt	2 oz.
Flavor	Vanilla or Rum

Cook approximately 260° F. Pour out on slab and spread to about ⅜ in. thickness. This is cut into sheets and stacked up with wax paper between the layers. Should be cut before cold. When cold, crack up the sheets with a mallet, and display the candy in these rough, cracked pieces.

Cast Caramels

Corn Sirup	60 lb.
Standardized Invert Sugar	15 lb.
Condensed Milk (40% Sugar Whole or Skim)	40 lb.
Hard Coconut Butter	5 lb.
Salt	6 oz.
Fine Granulated Sugar	15 lb.
75/25 Fondant—boiled to 244° F.	30 lb.
Flavor	as desired

Place the corn sirup, the standardized invert sugar, condensed milk, coconut butter and salt into a kettle equipped with double action stirrers. Turn the steam on partly, allow the batch to mix until the coconut butter is melted, add fine granulated sugar, mix well, then turn the steam on full and boil the batch as rapidly as possible to a medium firm ball. Turn off the heat, add the fondant gradually, mixing continuously until the fondant is completely melted. Add the flavor, mix well, then place the batch into the hopper of the depositor and cast into starch.

Note—Have the hopper of the depositor quite hot so as to keep the caramel sufficiently fluid while casting.

Frozen Confection Coating

U. S. Patent 2,133,586

Mix together approximately 300 parts of anhydrous dextrose, 50 parts of corn syrup, 2 parts of dextrose hydrate and beat the same to form a fine grained fondant; add to fondant 175 parts of 45% dextrose solution, 7½ parts of gelatin dispersed in 50 parts of water, and 20 parts of fat.

Pineapple-Coconut Bon Bons

Melt together 5 lb. granulated sugar, 5 lb. invert sugar, and cook to 238° F. Then add all the coconut (shredded or fine) which the liquid mass will take up.

Now take a No. 10 tin of crushed pineapple (about 7 lb.) and drain off the juice. Add 5 lb. granulated sugar. Cook off all the moisture and add to the coconut batch. You may need to add a little more coconut at this point.

Sugar a slab with granulated sugar and dump the batch onto it. Roll out thin (about ⅝ in.) and allow to cool. If you have an inverted stove, you can toast or brown the top of this rolled-out coconut batch. If you have toasted the batch, cut it into small squares.

Melt a pot of pink bon bon cream and dip these squares into it until the bottom and sides are covered, but not the top. If not toasted, the squares may be rolled into balls and completely dipped. The dipped pieces are fished out with a two-pronged fork and placed on wax paper, drawing the fork carefully from underneath.

Marzipan for Easter Eggs

Formula No. 1

Almond Paste	1¼	lb.
Fondant	12	oz.
Egg White	1	
Vanilla Extract	½	oz.
XXXX Sugar	1¼	lb.

Method: Cut up almond paste into small pieces and place in small machine kettle. Place fondant in small container and set container in double boiler of hot water, stir well with spatula and add egg white and vanilla; continue stirring until all are incorporated.

Add reduced fondant to the almond paste in machine kettle with machine running on low speed, using paddle or small dough hook. Incorporate thoroughly together. With machine still running on low speed, add the XXXX sugar gradually and continue until fully incorporated. Mix to a smooth-molding paste.

For the making of Marzipan Easter Eggs, this paste may be divided and colored in delicate pastel shades as desired, yellow, pink, orange, pale green, etc.

No. 2

Almond Paste	2	lb.
Glucose (Hot)	4	oz.
Egg White	1	
Vanilla Extract	½	oz.
XXXX Sugar	2½	lb.

Method: Cut almond paste into small pieces and throw into small machine kettle. Place glucose and egg white in small bowl and heat on low fire until a good heat is obtained, stirring continuously. Add vanilla.

Add this to the almond paste with machine running on low speed, using spatula or dough hook; continue mixing until smooth.

Add XXXX sugar with machine running on low speed, and mix to firm smooth molding paste.

The amount of sugar is approximate—if too stiff, add a little simple syrup.

When finished, divide in small pieces for the number of colors desired and color in delicate pastel shades.

Imitation Butter Cream Candy

Formula No. 1

Cook together sixty-five pounds of granulated sugar, thirty-five pounds of corn syrup and five pounds of invert sugar, using sufficient water to dissolve the sugar. Cook to 250° F. and when the batch has stopped boiling add from two to four pounds of coconut oil and stir in ten pounds of whole sweetened condensed milk and six ounces of fine grain salt. After the milk is incorporated, add thirty pounds of fondant made from seventy-five pounds of sugar and twenty-five pounds of corn syrup cooked at 244°

F. When the fondant is melted and mixed, add ten or twelve pounds of freshly beaten marshmallow and color and flavor as wanted. Cast in dry starch and let set at room temperature until fairly firm, then remove and brush off all the starch and glaze the candies. After glazing, leave the candies exposed until all of the solvent used in the glaze has evaporated.

No. 2

Put into a steam jacketed kettle, that is fitted with mixers, twenty pounds of corn syrup, twelve pounds of sugar, eight pounds of invert sugar, four pounds of coconut oil and four pounds of water and heat until the mixture is boiling, then add twenty-eight pounds of dried coconut and cook until the candy will form a fairly hard ball when tested in water that is cold but not fully chilled. After the batch has stopped boiling, add ten pounds of frappé, made with one pound of albumen to one hundred pounds of batch, and flavor to taste. Color may also be used if it is considered desirable to combine two or more colors. If a cut piece is wanted, spread the batch to the desired thickness and, when cold, cut and dust lightly with fine sugar, then coat with jelly and sugar, as suggested for the cast cream centers. If preferred, this candy may be wrapped or simply sugar-sanded.

Iced Hard Candy

The icing should be thin and the following mixture is used satisfactorily. Beat together until smooth, eight pounds of powdered sugar, one pound of "Nulomoline" and one pound of hot water. The addition of from three to eight per cent of hard coconut butter to this icing will make it less transparent and increase its gloss. To hasten the setting, add an ounce of gelatin to each pound of water. This icing may be applied by hand or with a machine made for that purpose. This icing may be used to advantage on other kinds of hard candies. Place the freshly iced candies into a fairly hot room to hasten the drying of the icing; but, in any case, do not attempt to pack the goods until they are fully dried.

Hard Candy Coconut Kisses

Formula No. 1

This formula is for making a grained (creamed) coconut candy that is often referred to as "Coconut Kisses." The first process is to melt eight pounds of invert sugar by heating to 150° F. with eight pounds of water. Add to this syrup thirty pounds of dried coconut (one-half fine and one-half medium shred), mix well and cover, without further heating, and let stand for an hour so that the coconut may become softened. Next cook twenty-five pounds of sugar and fifteen pounds of corn syrup, plus enough water to dissolve the sugar and, when the temperature of the batch reaches 255–260° F., pour it onto the prepared coconut and mix well, then add ten to fifteen pounds of fondant (made from 80 sugar, 20 corn syrup, 10 "Nulomoline"—cooked to 246° F.). After the fondant is added, flavor as wanted, mix the batch well, then form into desired shapes. When this batch is quite cool, it can be made into various shapes by using a rolled cream center machine.

No. 2

Chocolate flavored kisses are closely related to the candies made by the preceding formula, but they have greater tenderness and smoothness due to the use of a higher percentage of fondant. Prepare the coconut by heating together to 150° F. five pounds of water and thirty pounds of invert sugar. Without further heating stir in seventy pounds of medium shred dried coconut and mix well and cover. Let the mixture stand until the coconut is softened. Next cook together to 245° F. twenty pounds of sugar, six pounds of corn syrup and three pounds of water. When the batch stops boiling, stir into it sixty pounds of fondant (made the same as for preceding formula), ten pounds of liquor chocolate and two and one-half pounds of coconut oil, and mix until the batch is smooth. Next add thirty-three pounds of the prepared coconut, five pounds of frappé, four ounces salt and vanilla flavor. When the batch is firm enough for the kisses to hold their shape, place the batch in a depositor made for handling candies of this type and cast the kisses onto waxed paper. Let the kisses remain on the paper until they are sufficiently dry and firm to pack. These candies keep very well and when carefully packed they are quite attractive.

LIQUEUR CHOCOLATES

The manufacture of liqueur chocolates, by which is meant those having liquid or semi-liquid centers and having the flavor of various liqueurs, comprises several different processes, some applicable to the smallest factory and others only possible for the largest and best equipped plant.

At the outset it is well to note that, at any rate as far as the United Kingdom and the United States of America are concerned, the production of a genuine liqueur chocolate is illegal, owing to the prevailing Excise regulations which forbid the sale of sweetmeats containing alcohol. The various essence manufacturers are, however, well alive to the situation, and have produced ranges of flavorings which stimulate with fair accuracy the various well-known liqueurs, and it is on these that the manufacturer will have to rely.

The simplest process in the production of suitable centers for covering with chocolate consists in preparing a sugar solution of proper density, colored and flavored, possibly reinforced by the addition of a gum such as arabic, and casting this into starch molds in order to obtain a crust on the center sufficiently strong to permit of gentle handling. In some casse the crust is strengthened by crystallizing in cold syrup, and if the whole process is correctly performed, both the original crust and the outer crystallized layer subsequently redissolve after covering, leaving no trace of their existence.

The following is a suitable formula for the production of centers by this method:

Formula No. 1

Take a suitable quantity of white sugar and halve the batch. Syrup one half in water using 1 pint to 3 lb. sugar, and allow to cool, either covering the surface with paper or wetting it to prevent a crust forming. Boil the remaining half of the sugar with 1 pint water to 3 lb. sugar to 246° F. and add the cooled syrup from the previous operation. Add gum arabic solution composed of 5 parts of gum and 8 parts of water by weight at the rate of about 2 lb. solution per 100 lb. sugar in all, together with the necessary flavorings and colorings. Deposit in starch and dust over the tops, taking care to cover each impression completely. Stack in a cool place until the crust will permit of light handling (about 4 to 5 hours) when the deposits should be carefully turned over. Leave for a few hours and, when sufficiently strong, crystallize in cold syrup of 34° Baumé (at boiling point) for 8 to 12 hours. The centers are ready for covering as soon as drained and dried. The usual precautions for covering must be taken, otherwise trouble with bursting or weeping centers will be experienced, and the centers should be allowed to warm up in the covering room for a period or subsequent expansion will cause bursting and leakage.

No. 2

A second method, giving a flowing cream center and depending on the action of cream of tartar on ordinary fondant, is frequently employed. In this case the base consists of a soft fondant produced from white sugar and glucose in the proportions of 6 to 1, boiled to a temperature in the region of 235° F. The fondant should be well beaten, and it should be matured for some hours before use in closed vessels or under damp cloths. After maturing, the fondant should be warmed gently and carefully to soften it. Overheating is to be avoided. It should be remembered that fondant is a bad conductor of heat, so that it is easily possible to overheat the part in contact with the pan while the center of the mass is still soild and cold.

When the fondant is soft prepare a sugar syrup by boiling white sugar and cream of tartar in the proportion of 1 oz. of cream of tartar to 56 lb. of sugar. The syrup is then added to the fondant in equal proportion by weight together with the required flavors and colors, and at the same time glucose at the rate of 8 lb. per cwt. The chief point to watch in this method is the avoidance if possible of any reheating of the batch after all the ingredients are amalgamated, and the prior softening of the fondant base is generally sufficient to overcome this. In addition, the glucose may be warmed, together with the utensils if necessary. The batch should be deposited into good dry starch without delay, and left for a few hours before cleaning and covering.

No. 3

A third method consists in the use of ordinary fondant treated with an invertase which gradually softens the fondant after casting, but allows a sufficient margin for remolding and the subsequent chocolate coating. The process is protected, but a suitable invertase is available under licence for use in this particular connection. It is possible by this method to add real fruits, preserved in syrup, to the centers, and these, besides vastly improving the flavors obtained, assist still further in liquefying the fondant; centers may be obtained almost totally fluid after the necessary storage period has elapsed. Bursting or weeping occurring within two or three days from covering can generally be traced to some error in the purely mechanical aspect of covering, namely that for some physical cause the covering has been ruptured. Too cold centers, expanding as a result of their rising temperature after the chocolate covering is set, are a frequent source of trouble, as is excessive chilling to set the covering. Where molded work is under consideration the temperature of the molds at filling should be watched, and this should be kept as high as possible without detriment to the surface finish of the goods. In its second form the bursting or weeping does not usually appear for some little time after covering, probably from 10 to 15 days or more, and in this case it is fair to assume that some form of fermentation is the cause. A cure can usually be effected by speeding up the inversion process and getting quicker liquefaction of the center. When made, the density of the syrup fraction in the fondant is low enough to permit fermentation, and, until a sufficient amount of the solid sugar has entered into the syrup to make it concentrated enough, the danger continues.

No. 4

A fourth method of production depends on the use of molds in which partly finished hollow shells are made, to be filled and sealed off at a later stage in the proceedings. The sequence of operations may be carried out entirely by hand, or machines exist that will perform the whole process almost unaided. The molds at a suitable temperature are filled with melted chocolate and when a sufficiently thick shell has been formed the still liquid center is poured or shaken out, leaving the shell to be cooled and finally set. Alternatively, a pre-determined amount of chocolate is measured into the mold which is rotated in all directions until a film covering the entire surface is obtained, when it is cooled. The fillings are then inserted in the shells, which are sealed by the application of more liquid chocolate to the opening. This may be applied by hand or by mechanical deposition. It may be necessary in some cases to preheat the edge of the existing shell so that the sealing may unite properly with the main body.

Pop Corn Crisp

Sugar	5 lb.
Glucose	5 lb.

Cook to 260°-265° F., or "crack." Add a sufficiency of salt and stir in about 10 lb. fully popped corn. Transfer at once to slab. Chill first one side of batch, then the other, then spread to the desired thickness to cool. Flavor as desired.

Pop Corn Balls

Sugar	6 lb.
Glucose	4 lb.

Cook to 250°-254° F., or "medium crack." Stir in 15 to 20 lb. fully popped corn. Transfer at once to slab. Work into balls about six inches in diameter by hand as soon as cool enough to handle. In this recipe the corn is sometimes tinted with a weak aqueous solution of one color or another. Avoid overcoloring, though, and tint the corn before it enters the rest of the batch. Flavor with vanilla, orange, lemon, etc., as desired.

Transparent Lemon Oil Emulsion

Invert Sugar Syrup (80%)	60 lb.
Medium Fine Granulated Sugar	24 lb.
Water	16 lb.
Gelatin (180 Bloom—Min.)	4 oz.

The gelatin is dissolved in water, corn syrup added and the mixture heated until solution is complete. The invert syrup is then added and the whole thoroughly mixed. The refractive index of this solution should be approximately 1.4720. In the preparation of the emulsion, 20 ounces of terpeneless and 20 ounces of regular lemon oil are mixed with enough of the above solution to produce 10 gallons. This mixture is then homogenized and left standing for 18 hours which allows entrapped air bubbles to rise to the surface. Glass containers are filled from the bottom outlet of the emulsion container and tightly stoppered. The resultant emulsion will be practically transparent.

FOUNTAIN SUPPLIES

Chocolate Syrup

Formula No. 1

Liquor chocolate 1 lb., sugar 5¼ lb., water 2 qt. Bring to boil and hold at this temperature for 15 to 20 minutes. Strain while hot and when cold add: Tincture of vanilla 1 oz., glycerin 1⅓ oz. and water to make 1 gal. This syrup should be homogenized to retain the cocoa butter which occurs to the extent of 50% in the liquor chocolate. The glycerin is added to prevent a greasy smear on the glass ware.

No. 2

(Double Strength)

Cocoa	23	lb.
Sugar	105	lb.
Water	8	gal.
Sodium Benzoate, Dissolved in 1 Qt. of Water	5	oz.

Heat to 218° F. Then add:

Glycerin	¾	gal.

Cool, then add:

Vanilla Extract	4	pt.
or Vanillin, Dissolved in 1 Qt. of Hot Water	10	g.

Any cocoa may be used, but one of the less expensive types made from Accra or Bahia beans is best. From 5 to 10% of the beans should be roasted high, i.e., nearly burned.

Sodium benzoate dissolved in water, as directed, is an easy way to add this ingredient. The water in which it is dissolved is a part of the formula.

Glycerin is used here to prevent crystallization of sugars, but, if the price of glycerin is very high, corn syrup will do a fair job in its place.

Vanillin has more lasting properties if the chocolate syrup is served hot. This is desirable because the amount of benzoate permitted by law is not sufficient to prevent mold growth.

Caramel Syrup for Fountain Use

a.	Sugar (Granulated)	10	lb.
	Dry Milk Solids*	3¾	lb.
	Water	5½	lb.
	Stabilizer	10	g.
b.	Corn Syrup	10	lb.
c.	Salt	to taste	
	Vanilla	to taste	
	Butter	to taste	

Method

Mix the sugar and dry milk solids and stabilizer. Then gradually add the water, forming first a paste, then a semi-liquid mass.

Add *b* when batch commences to boil.

Cook batch until 218–220° F. Then add *c*.

Some candy makers prefer to add the corn syrup just before batch is finished. They claim batch is more tender than when added at beginning of boil.

Chocolate Fudge Base

Bitter Chocolate	30	lb.
Shortening	25	lb.
Vanilla Concentrate (16X)	2½	oz.
Corn Starch or Cocoa	2¼	lb.

Melt slowly and stir smooth. Heat to 130° F. and add:

Corn Syrup	20	lb.

Sugar Coloring

Sugar	100 lb.
Potassium Carbonate	20 lb.
Water	30 lb.

Boil in a copper kettle until the desired color has formed.

Disolve the resulting syrup hot in

Water	80 lb.
Alcohol, 90%	100 lb.

Let stand, filter.

Cane and Maple Syrup

Maple Syrup	15 gal.
Water	28 gal.
Corn Syrup	3 gal.
Sugar	435 lb.
Maple Flavor (Imitation)	2 oz.

Mix and heat to 219° F.

The maple syrup used is usually one of the dark grades. This product may also be made with maple sugar, using 8 lb. of sugar to each gallon of maple syrup, and making up the difference in volume with water.

Pineapple Syrup

Pineapple Juice	100 gal.
Sugar	1380 gal.
Sodium Benzoate (Dissolved in ½ Gal. Hot Water)	2 lb.
Pineapple Fruit Extract	400 oz.

Pineapple juice may be bought as such, or the juice may be strained from the fruit used for making crushed pineapple and used for syrup. Pineapple concentrate, cut to juice concentration with water, may also be

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*Contain not more than 1½% butter fat and not over 5% moisture.

used. Several extract houses put out true pineapple extracts that give very good results.

Fruit Acid

Citric Acid, Granular	24 lb.
Make Up With Water to	8 gal.

Crushed Pineapple, or Pineapple Topping

Crushed Pineapple, No. 10 Tins	60 cans
Fruit Acid	8 oz.
Sodium Benzoate in 2 Qt. Water	8 oz.
Sugar	300 lb.

Drain 23 gal. of juice from the crushed pineapple and store for later use in making pineapple syrup. Add acid and benzoate of soda to drained crushed pineapple, and stir until the sugar is all wet. Then heat to 180° F. with constant stirring.

Better results are obtained, both as to color and flavor, if Hawaiian pineapple is used. The grade known as "Confectioners in Juice" should be used.

SHERBETS AND ICES

Formula No. 1		No. 2	No. 3	No. 4	No. 5	No. 6	No. 7	No. 8	
Sugar (Cane)	32	25	28	21.5	18	34	28	21.5	lb.
Sugar (Corn)		7		6.3				6.3	lb.
Gelatin	6.4	3.20	7*	7*	5‡	6.90	8†	8†	oz.
Agar		3.20							oz.
Mix	7								lb.
Citric Acid	6.4								oz.
Water	6.4	67.56	Make up to 10 gal. (U.S.)	Make up to 10 gal. (U.S.)	48	65.29	Make up to 10 gal. (U.S.)	Make up to 10 gal. (U.S.)	
Fruit, etc.	As desired				As desired				

Sherbets

Formula No. 1

(Rhubarb)

Wash 10 pounds of rhubarb, cut into pieces about one-half inch long, and cook until soft (15 minutes). This makes enough for two seven-gallon batches of finished sherbet.

No. 2

(Cranberry)

Wash 10 pounds of berries with two quarts of boiling water. Allow berries to set in water for 2 minutes, then discard water. Cook with a gallon of water, add 25 pounds of sugar. Cook slowly until berries are soft (15 to 20 minutes). Strain through collander. This is enough to make five seven-gallon batches of finished sherbet. Use five gallons of mix and one-fifth of the above berries.

No. 3

(Green Gage)

Five gallons of sherbet mix, one gallon of pitted plums, two quarts ice cream mix.

No. 4

(Tomato)

Two gallons tomato juice, three gallons sherbet mix, a pinch of white pepper, one pint chopped celery, two quarts of ice cream (add just before drawing from freezer).

No. 5

(Water-Ice Mix)

Sugar	25 oz.
Gelatin	0.3 oz.
Pectin	0.3 oz.
Citric Acid	0.33 oz.
Flavor	to suit

Dissolve all but flavor in hot water. Flavor is added when cold.

Italian Ice Cream Mix

Powdered Starch or Cornflour	8 oz.
Powdered Sugar	8 oz.
Powdered Gelatin up to	½ oz.
Essence of Vanilla up to	¼ oz.

Color to tint.

This amount, about 1 lb., of mix is sufficient for 1 gallon of milk. The mix and milk are heated together to the boil, allowed to cool and then put into the freezer. Care must be taken that the mixture is not heated for too long a time or otherwise the gelatin tends to give an unpalatable flavor and odor. For a high-class custard ice the cornflour is omitted and powdered egg albumen used in its place.

Ice Cream Cold Mix

Milk Powder (Skimmed)	17½ lb.
Sugar	70 lb.

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* Three oz. agar and 2.5 oz. gelatin or pectin may be substituted.

† Three oz. agar and 3.5 oz. gelatin or pectin may be substituted.

‡ Five oz. pectin may be used.

Soya Bean Flour	7½ lb.
Gum Tragacanth	5 lb.

The resulting powder is used in the cold, first well mixing with a small quantity of the milk and then adding the rest of the milk and allowing to stand overnight.

Water Ice

These are simply a frozen flavored and colored syrup, but great care has to be taken regarding the density of syrup used or else a sloppy mass is obtained. If the sugar content is too high, freezing of the mixture of syrup and water is very difficult, or, in extreme cases, impossible, while if the sugar content is too low the mixture quickly freezes to a sloppy mass which easily liquefies when poured out.

The strength of the finished syrup should be about 21° Baumé. A typical syrup can be made as follows:

Water	6½ pt.
Sugar	2¼ lb.
Glucose	¾ lb.
Citric Acid, Powdered	1¼ oz.
Gelatin	1 oz.
Flavor	1 oz.
Color	to tint

FLAVORS

Producing Various Tastes

Sweet Taste

Saccharin, probably the sweetest substance known, has a threshold of taste[*] of 0.00007 to 0.00055 moles per liter, and the sweet taste may still be detected at a dilution of 1/80,000. It is 300–500 times as sweet as cane sugar. If, as is usually done, the sweetness of sucrose is taken as 100, the sweetness of saccharin may then be represented as 30,000–50,000. In decreasing order of sweetness we then have:

	Sweetness
Levulose (or Fruit Sugar)	173
Invert Sugar	123
Glycerin	108
Sucrose	100
Dextrose	74
Maltose	32
Corn Syrup	26

Salty Taste

Of all the salts which taste salty, the only one used to any extent in foodstuffs is sodium chloride, which has a threshold value of about 0.030 moles per liter, the salty taste being still perceptible in 0.18% solution. Table salt increases the palatability of foods, at least in the case of persons habituated to its use.

Mention should be made of monosodium glutamate, which is about 7 times as strong as table salt and has a flavor much like meat extract. This substance is obtained from the gluten of wheat, soy bean protein, beet molasses, fish protein, seaweed or glutamic acid. It is frequently used for giving a meat flavor to foods, particularly in the Orient, where Buddhists do not allow themselves to eat meat.

Bitter Taste

Bitter taste is, regarding its stimulating effect, similar to that of the aromatic substances, which it often accompanies. Pure bitter substances, however, have a decidedly disagreeable taste, although they strongly excite the appetite, whereby they increase the amount of food consumed and promote digestion. Through habituation to the use of bitters this effect may be lost.

Probably the most bitter substance gnown is brucine (the alkaloid from *nux vomica* and ignatia seeds) which is so bitter that its taste can still be detected when 1 part is dissolved in 200,000 parts of water. If quinine is considered to have a bitterness of 100, brucine may be said to have a bitterness of 1000–1250. It constitutes the bitter principle of grapefruit, and is so bitter that its taste can be detected when 1 part is dissolved in 50,000 parts of water.

		Bitterness
Naringin	(about)	500
Strychnine		320
Quinine		100
Caffeine		50
Theobromine		5

Sour Taste

The sour taste of foods is due to acids such as acetic, and the fruit acids, citric, tartaric, and malic, and to a lesser extent lactic acid. In general, the sour taste is refreshing and relieves the thirst. It is, however, limited in employment and is very often agreeable only when modified by sweet additions. The vast array of fruit flavors, for example, require as a background a taste in which sweetness

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[*] The minimum concentration point producing a taste sensation within half a minute to a minute is termed the "Threshold Quantity." This quantity, of course, varies with different substances.

and acidity are combined; and we have such expressions as "lemon juice brings out the flavor."

The threshold values of some acids are as follows:

	Moles per Liter
Acetic Acid	0.003
Hydrochloric Acid	0.0025
Tartaric Acid	0.00125

As regards the chemistry of sour taste, recent experiments indicate that:

(1). When compared in the form of 0.5% solutions, tartaric acid has the strongest taste, followed by lactic, citric, and acetic acid in that order. In this case, the acids fall into the order of pH, the acid with the lowest pH value having the most acid taste.

(2). The tastes of acids, when compared at the same pH values (3.5, 3.0, 2.5, 2.0) were not equal. In this case, acetic acid has the strongest acid taste, followed by lactic, citric, and tartaric in that order.

(3). It is possible to raise the pH value of solutions of these acids while maintaining approximately the same degree of acidity of taste, by buffering with the sodium salts of the acids concerned. The practical significance is that products can be produced having the strongly acid taste but at the same time free from the effects of over-inversion of sucrose caused by low pH values.

Synthetic Grape Essence

Formula No. 1

Chloroform	2 fl. dr.
Acetic Aldehyde	2 fl. dr.
Formic Ether	2 fl. dr.
Oenanthic Ether	10 fl. dr.
Wintergreen Oil	1 fl. dr.
Saturated Alcoholic Solution of Succinic Acid	3 fl. dr.
Tartaric Acid	5 fl. dr.
Glycerin	10 fl. dr.
Alcohol, Deodorized, Enough to make	16 fl. oz.

This may be colored with grape juice or it may be tinted purple by use of red and blue colors.

No. 2

Oenanthic Ether	1 fl. oz.
Formic Ether	1 fl. dr.
Acetic Aldehyde	1 fl. dr.
Grape Juice	4 fl. oz.
Glycerin	2 fl. oz.
Alcohol, Deodorized, Enough to make	16 fl. oz.

No. 3

Almond Essence	2½ fl. oz.
Oenanthic Ether	40 min.
Butyric Ether	2 fl. oz.
Acetic Ether	4 fl. dr.
Grape Juice	3 fl. oz.
Water	2 fl. oz.
Alcohol, Deodorized, Enough to make	16 fl. oz.

No. 4

Alcohol, Deodorized	60 fl. oz.
Grape Juice, Pure	20 fl. oz.
Oenanthic Ether	10 fl. oz.
Chloroform	3 fl. oz.
Aldehyde	2 fl. oz.
Glycerin	2 fl. oz.
Wintergreen Oil	1 fl. oz.

No. 5

Oenanthic Ether	10 fl. oz.
Formic Ether	2 fl. oz.
Methyl Salicylic Ether	1 fl. oz.
Chloroform	2 fl. oz.
Aldehyde	2 fl. oz.
Succinic Acid	5 av. oz.
Tartaric Acid	5 av. oz.
Glycerin	10 fl. oz.
Alcohol, 95%, to make	½ gal.

No. 6

Alcohol	3 gal.
Methyl Anthranilate	5 oz.
Amyl Valerianate	6 dr.
Extract Rose (14 oz. Rose to ½ gal. Alcohol)	1 qt.
Oenanthic Ether	10 dr.
Amyl Butyrate	4½ dr.
Amyl Acetate	2 dr.
Butyric Ether	2 dr.
Water	3 gal.
Red Color Liquid	2 oz.

Use to:
1 gallon Simple Syrup.
1 ounce of above Extract.

Artificial Prune-Juice Essence

Ethyl Acetate	30 cc.
Ethyl Benzoate	20 cc.
Ethyl Oenanthate	10 cc.
Amyl Alcohol	4 cc.
Amyl Acetate	2 cc.
Amyl Butyrate	2 cc.
Essential Almond Oil	3 cc.
Cinnamon Oil	1 cc.
Clove Oil	1 cc.
Vanilla Extract	1 cc.
Alcohol	200 cc.

IMITATION FRUIT FLAVORS

Black Currant

Cyclohexanyl Butyrate	50 g.
Methyl Cinnamate	40 g.

Aldehyde C_{16}	0.5 g
Resinodor of True Vanilla	1 g.
Portugal Oil	3 g.
Petitgrain Neroli Oil	1 g.
Orris	0.5 g.

Strawberry

Ethyl Cinnamate	50 g.
Cyclohexanyl Butyrate	50 g.
Isobutyl Valerianate	5 g.
Methyl Benzoate	2 g.
Vanilla Resinodor	0.5 g.

Raspberry

Cyclohexanyl Butyrate	90 g.
Amyl Formiate	2 g.
Ethyl Benzoate	2 g.
Amyl Acetate	3 g.
Aldehyde C_{14}	1 g.
Vanillin	1 g.

Grenadine

Cyclohexanyl Valerianate	30 g.
Amyl Acetate	15 g.
Ethyl Butyrate	10 g.
Ethyl Benzoate	10 g.
Amyl Butyrate	10 g.
Ethyl Salicylate	10 g.
Vanillin	1 g.

Red Currant

Cyclohexanyl Valerianate	90 g.
Ethyl Benzoate	2 g.
Propyl Propionate	2 g.
Amyl Acetate	1 g.
Propyl Acetate	1 g.

Pear

Ethyl Cinnamate	50 g.
Butyl Acetate	10 g.
Geranyl Butyrate	20 g.
Amyl Formate	5 g.
Propyl Propionate	2 g.
Geraniol	5 g.

Peach

Cyclohexanyl Butyrate	60 g.
Ethyl Cinnamate	15 g.
Benzyl Butyrate	15 g.
Aldehyde C_{14}	3 g.
Isobutyl Salicylate	3 g.
Amyl Butyrate	8 g.
Geranyl Formate	2 g.

Apple

Cyclohexanyl Acetate	40 g.
Cyclohexanyl Valerianate	12 g.
Amyl Valerianate	20 g.
Amyl Formate	3 g.
Geranyl Acetate	20 g.
Geraniol	15 g.

The above compound oils are soluble in alcohol in the proportion of 8 oz. to 1 gal., when they will yield an ether, of which 1 to 2 oz. is sufficient to flavor 10 gal. of liquid or 50 lb. of sugar.

It is also possible to make up "Saccharome-Powders" by mixing 8 oz. of compound oil to 10 lb. of fine sugar powder.

Each oz. of such saccharome will flavor 50 lb. of boiled sugar or 10 gal. of water or syrup.

Synthetic Apricot Flavor

Anisic Aldehyde	10 g.
Aldehyde C_{14}	100 g.
Amyl Acetate	150 g.
Iris Concrete (10% Solution)	50 g.
Bitter Almond Essence	50 g.
Ionone (10% Solution)	10 g.
Jasmine Absolute Solution	1 g.
Vanillin	50 g.
Ethyl Caprorate	50 g.
Ethyl Caprylate	65 g.
Ethyl Acetate	100 g.
Amyl Butyrate	50 g.
Amyl Valerianate	50 g.
Eugenol	5 g.
Alcohol	285 g.

Synthetic Pomegranate Flavor

Iso-Eugenol	15 g.
Vanillin	40 g.
Lemon Essence	40 g.
Sweet Orange Essence	30 g.
Amyl Acetate	50 g.
Ethyl Acetate	125 g.
Ethyl Caprylate	10 g.
Amyl Valerianate	125 g.
Aldehyde C_{14}	50 g.
Rose Essence	1 g.
Jasmine Essence	1 g.
Iris Essence	3 g.
Amyl Butyrate	30 g.
Alcohol (95%)	480 g.

To 800 parts of this composition, are added:

Lemon Oil	50 parts
Cognac Oil	50 parts
Alcohol (95%)	100 parts

Use this for 1:1000 essences.

Synthetic Raspberry Flavor

Amyl Acetate	125 g.
Amyl Butyrate	25 g.
Rose, Synthetic	20 g.
Methyl Benzoate	10 g.
Nitrous Ether	40 g.
Ethyl Acetate	150 g.
Ethyl Butyrate	20 g.
Amyl Butyrate	35 g.
Amyl Valerianate	35 g.
Methyl Cinnamate	5 g.

Phenyl Ethyl Alcohol	50 g.
Alcohol (95%)	375 g.

This is used without dilution for essences of 1/1000 strength. For essences of 1:250 use it as follows:

Raspberry Flavor (above)	250 g.
Alcohol (95%)	500 g.
Glycerin	100 g.
Rose Water	150 g.

Strawberry Flavor, Imitation

Formula No. 1

(Concentrated)

Orris Oil	2	fl. oz.
Neroline	1	fl. oz.
Vanillin	2	fl. oz.
Ionone	¼	fl. oz.
Amyl Acetate	4	fl. oz.
Palergonic Ether	8	fl. oz.
Butyric Ether	24	fl. oz.
Alcohol	3	gal.
Rhatany Extract	2	fl. oz.
Strawberry Juice	6	pt.

No. 2

Yara Yara (10% Solution in Benzyl Benzoate)	30 g.
Amyl Acetate	100 g.
Aldehyde C_{14}	50 g.
Iris Concrete (10% Solution)	25 g.
Bitter Almond Essence	10 g.
Rose Essence	3 g.
Jasmine Essence	1 g.
Ionone	1 g.
Bourbonal	10 g.
Alcohol (95%)	375 g.
Glycerin	200 g.

Use straight for in 1:1000 dilution; for a 1:250 essence use as follows:

Strawberry Flavor (Above)	250 gr.
Alcohol (95%)	550 gr.
Glycerin (28° Bé.)	100 gr.
Water	100 gr.

Cherry Flavor, Imitation

Formula No. 1

Eugenol	5 g.
Cognac Oil	10 g.
Cinnamic Aldehyde	10 g.
Benzoic Aldehyde	95 g.
Coumarin	20 g.
Ethyl Caprylate	20 g.
Amyl Acetate	80 g.
Ethyl Acetate	80 g.
Bourbonal	50 g.
Caramel Color	50 g.
Black Current Ester	5 g.
Rose Essence	5 g.
Sweet Orange Essence	50 g.
Lemon Essence	400 g.
Iris Essence (1/70)	50 g.
Vanillin	30 g.
Amyl Acetate	100 g.
Amyl Formate	50 g.
Amyl Butyrate	100 g.
Alcohol	190 g.
Ponceau Color	to suit
Bordeaux Color	to suit

No. 2

Coumarin	½	fl. oz.
Oil Ylang Bourbon	½	fl. oz.
Aldehyde C_{14} (10%)	1	fl. oz.
Rue Oil	½	fl. oz.
Benzyl Acetate	1	fl. oz.
Amyl Butyrate	1	fl. oz.
Acetic Ether	4	fl. oz.
Bitter Almonds Oil F.P.A.	2	fl. oz.
Butyric Ether	7	fl. oz.
Alcohol	1½	gal.
Water	2½	gal.
Cherry Juice	1	pt.

Imitation Vanilla Flavor

Ethyl Vanillin	3	oz.
Coumarin	½	oz.
Vanillin	12	oz.
Alcohol	½	gal.
Water to make	1	gal.

Maple Essence

Vanilla Extract	1	gal.
Coffee Extract	8	oz.
Malt Extract	20	oz.
Licorice Extract	4	oz.
Lovage Oil	50	drops
Guaiac, Tincture	4	oz.
Alcohol	8	oz.
Water	8	oz.

Essence Peau de Espange

(Concentrated)

Cinnamon Oil	2½	dr.
Tr. Castoreum	½	oz.
Sandalwood Oil	⅜	dr.
Rose Oil	⅜	dr.
Neroli Petit Oil	⅜	dr.
Pink Blossom Oil	45	min.
Clove Oil	5	min.
Nutmeg Oil	45	min.
Lavender Flower Oil	2	dr.
Verbena Oil	½	dr.
Lemon Oil	1	dr.
Bergamot Oil	1	dr.
Benzoic Acid	⅛	oz.
Coumarin	⅛	oz.
Musk (Art.)	¼	oz.
Rose Geranium Oil	¾	oz.
Patchouli Oil	80	min.
Vetivert Oil	40	min.
Muguet	¼	oz.

Sarsaparilla Oil

Wintergreen Oil	1	fl. oz.
Sassafras Oil	1	fl. oz.
Anise Oil	½	fl. oz.

Pistachio Oil

Amyl Acetate C.P.	4	fl. oz.
Bitter Almonds Oil	5	fl. oz.
Orange Sweet Oil	6	fl. oz.
Acetic Ether	9	fl. oz.
Butyric Ether	5	fl. oz.
Alcohol	1¼	gal.
Distilled Water	67	oz.

Tobacco Flavor

Formula No. 1

Clove Oil	⅛
Ginger Oil	¼
Cinnamon (Ceylon) Oil	⅛
Acetic Ether	4
Maple Flavor	10
Fl. Ext. Guarana	15
Sugar Coloring	25

No. 2

Valerian Oil	0.5
Clove Oil	4.5
Cassia Oil	1.2
Walnut Flavor	10.0
Sebacic Ether	0.6
Vanillin	1.5
Coumarin	2.0
Maple Flavor	3.5
Acetic Acid	1.0
Alcohol	75.0

No. 3

Walnut Flavor	3
Caramel	3
Maple Flavor	94

No. 4

Cinnamon Oil	1
Eugenol	3
Pimento Oil	2
Mace Oil	1
Calamus Oil	1
Lovage Oil	80
Formic Ether	40
Vanillin	40
Coumarin	20
Maple Flavor	300
Sugar Color	200

No. 5

2 oz. Tonka bean ground to the consistency of flour, 4 oz. licorice root ground to same.

Dissolve in spirits of rum about a quart and a half and spray the cut tobacco, cover again and let it stand in bulk for at least one day, two days would be better.

It is very important that the water be boiled and that the entire casing formula be boiled thoroughly, for if this is not done the tobacco is very apt to mold.

BAKERS' PRODUCTS

BAKERS' BREADS

Hearth Bread and Hard Rolls

Bread Wash

Rice Flour	1¾	lb.
Sugar	3	oz.
Shortening	4	oz.
Lukewarm Water	1	qt.
Yeast	4	oz.

Let set 30 minutes before using. Temperature about 90° F. Salt to taste.

French Bread, Roll Wash

Egg Whites	1	pt.
Salt	2	oz.
Water	½	pt.

Standard Roll

Several kinds of rolls can be made out of this formula, such as poppyseed roll, caraway seed roll, crescents, etc.

Dough

Hard Patent Flour	100	lb.
Water	60	lb.
Sugar	2	lb.
Salt	2	lb.
Shortening	2½	lb.
Milk Powder	2	lb.
Malt Extract	6	oz.
Yeast	3	lb.

Temperature of dough 82° F. Mixing time of dough 12 to 15 min. at 65 r.p.m. Fermentation time, fold over at 30 min.; punch in one hour, punch again in 45 min.; to bench in 15 min.

Bran Bread and Roll

Take 25 lb. of the above dough and add 3 lb. bran and 3 lb. water, remix and use same time procedure.

Kaiser Rolls

Hard Patent Flour	50	lb.
Water	24	lb.
Yeast	1	lb.
Salt	14	oz.
Malt	1	lb.
Sugar	½	lb.
Shortening	1	lb.

Dough temperature 80° F. Dough mixing time 12 minutes at 65 r.p.m. Dough fermentation time: first punch 1¾ hours; second punch, 1 hour; to bench in 15 minutes. These rolls are made by hand and machine, baked on hearth as a rule.

Famous Hard Rolls and Hearth Bread

Hard Patent Flour	100	lb.

Water (Variable)	56 to 58 lb.
Yeast	2 lb.
Sugar	1 lb.
Salt	2 lb.
Yeast Food	4 oz.
Shortening	1 lb.
Malt	½ lb.

Dough temperature, 80° F. Dough mixing time, 12 to 15 minutes; first punch, 1 hour and 40 minutes; second punch, 40 minutes; to bench in 20 minutes.

Hearth Baked Filled Sweet Goods

Water	14 lb.
Sugar	2 lb.
Yeast	½ lb.
Hard Patent Flour	25 lb.
Salt	½ lb.
Whole Eggs	1¼ lb.
Shortening	2 lb.
Yeast Food	½ oz.

Dough temperature, 82° F. Dough mixing time, 12 to 15 minutes on low speed. First punch, 2 hours; let raise full and take to bench in about 1 hour. The following filling is suggested:

Brown Sugar	2 lb.
Ground Nuts	1 lb.
Cinnamon	¼ oz.
Butter	8 oz.
Sifted Cake Crumbs	4 oz.

Cream together, thin down with a little milk. Roll out a piece of dough about 18 inches wide. Spread filling, fold three times, then cut in strips.

French Dough, Big Holes

White Sponge	80 lb.
Hard Patent Flour	25 lb.
Yeast Food	8 oz.
Sugar	12 oz.
Salt	1¼ lb.
Shortening	2 lb.

Temperature of dough, 80° F.; dough fermentation time, 10 minutes; mix 10 minutes at 65 r.p.m. Take any white sponge that has a good fermentation, add the other ingredients after mixed. Let rest 10 minutes. Put into any shape. It is mostly used for short Vienna bread or rolls.

French Bread and Rolls

Hard Patent Flour	24 lb.
Water	14 lb.
Salt	6 oz.
Sugar	12 oz.
Shortening	1½ lb.
Yeast	12 oz.
Egg Whites	1 qt.

Temperature of dough, 80° F.; dough fermentation time, 2 hours, 30 minutes; first punch, 1½ hours; second punch, 30 minutes; third punch, 30 minutes; to bench in 15 minutes. Bake in good moist steam. Wash after taking out of oven with the following mix:

Egg Whites	1 pt.
Salt	2 oz.
Water	½ pt.

French Bread and Rolls

Sponge

Hard Patent Flour	60 lb.
Water	34 lb.
Malt	1 lb.
Yeast Food	3 oz.
Yeast	3½ lb.

Dough

Hard Patent Flour	40 lb.
Water	21 lb.
Malt	½ lb.
Salt	3 lb.
Sugar	2 lb.
Shortening	3 lb.
Egg Whites	2 lb.

Temperature of sponge, 78° F.; temperature of dough, 81° F.; sponge fermentation time, 4 hours; dough fermentation time, none; mix sponge 5 minutes at 65 r.p.m.; mix dough 7 minutes at 65 r.p.m.

Hearth Hard Bread

Sponge

Flour	74 lb.
Water	45 lb.
Yeast	2 lb.
Yeast Food	½ lb.
Malt	½ lb.

Dough

Flour	37 lb.
Potato Flour	6 lb.
Water	17 lb.
Sugar	3 lb.
Lard	4½ lb.
Salt	2 lb.

Temperature of sponge, 77° F.; temperature of dough, 80° F.; sponge fermentation, 5 hours; dough fermentation, 30 minutes; mix sponge 5 minutes at 65 r.p.m.; mix dough 8 to 10 minutes at 65 r.p.m.; makes about 170 loaves at 18½ oz.

Sour French

First Sponge

Ripe Dough	3 lb.
Water	3 lb.
Flour	3 lb.
Yeast	1 oz.

Time, 10 hours; temperature, 80°. Add to first sponge:

Second Sponge

Water	6	lb.
Flour	7	lb.

Time, 4 hours; temperature, 80° F.

Add to second sponge:

Third Sponge

Water	12	lb.
Flour	12	lb.

Time, 4 hours; temperature, 80° F.

Dough

Water	34	lb.
Strong Flour	75	lb.
Salt	1¾	lb.
Yeast	10	oz.

Temperature 81°.

To machine in 30 to 45 minutes. Can be made up by hand. Cut dough time 15 minutes.

Korn Krust Bread

Sponge

Hard Patent Flour	62	lb.
Yellow Corn Meal	3	lb.
Yeast	2½	lb.
Water	40	lb.
Malt	8	oz.

Dough

Hard Patent Flour	35	lb.
Water	15	lb.
Shortening	2	lb.
Salt	2¼	lb.
Sugar	2½	lb.

Temperature of sponge, 76° F.; temperature of dough, 81° F.; sponge fermentation, 4 to 4½ hours; dough fermentation, 15 minutes; mix sponge 5 minutes at 65 r.p.m.; mix dough 8 to 10 minutes at 65 r.p.m.

When the loaf leaves the molder roll it over wet cloth; then roll it in yellow corn meal. Proof same as any hearth bread. Can be made by hand or machine.

Jewish Egg Bread
(Straight Dough)

Malt	1½	lb.
Sugar	7	lb.
Yeast	1¾	lb.
Yeast Food	2½	oz.
Water	54	lb.
Hard Patent Flour	100	lb.
Salt	1¾	lb.
Whole Eggs	4½	lb.
Vegetable Oil	5½	lb.

Dough temperature, 82° F.; dough mixing time, first punch 2 hours; let raise full and to bench in about 1 hour.

Cracked Wheat

Sponge

Water	55	lb.
First Clear Flour	65	lb.
Cracked Wheat	25	lb.
Yeast	3	lb.
Yeast Food	8	oz.
Malt	1	lb.
Shortening	2	lb.
Salt	4	oz.

Dough

Water	10	lb.
First Clear Flour	35	lb.
Sugar	5	lb.
Salt	2	lb.

Temperature of dough, 80° F.; temperature of sponge, 72° F.; sponge fermentation, 4 hours; dough fermentation, 15 minutes. Mix sponge 5 minutes at 65 r.p.m.; mix dough 8 minutes at 65 r.p.m. The malt used is diastatic of a 60° litner value. The formulas are for straight flow production machine made hearth bread.

Old-Fashioned Vienna Bread

Sponge

Hard Patent Flour	65	lb.
Water	40	lb.
Yeast	2½	lb.
Yeast Food	6	oz.
Malt	12	oz.
Shortening	2	lb.
Salt	4	oz.

Dough

Hard Patent Flour	35	lb.
Water	16	lb.
Sugar	3	lb.
Salt	2	lb.

Temperature of sponge, 72° F.; temperature of dough, 80° F.; sponge fermentation, 4 hours; dough fermentation, 15 minutes. Mix dough 8 minutes and sponge 5 minutes at 65 r.p.m. This formula is made for hand method of make-up.

Old-Fashioned Potato Bread

Sponge

Hard Patent Flour	75	lb.
Water	50	lb.
Yeast	2	lb.
Yeast Food	6	oz.
Malt	12	oz.
Shortening	3	lb.
Salt	4	oz.
Potato Flour	5½	lb.

Dough

Hard Patent Flour	25	lb.
Sugar	3	lb.
Salt	2	lb.

No Water

Temperature, sponge 72° F.; dough, 80° F.; fermentation, sponge, 4 hours; dough, 15 minutes; mix dough 8 minutes; sponge 5 minutes at 65 r.p.m. Soak the potato flour at least 10 hours before using, then add to the sponge. Use 3 lb. of water per lb. of potato flour. In both the sponge and dough use hard patent wheat flour.

The wash for the potato bread is applied.

Rice Flour	5 lb.
Water	5 lb.
Yeast	3 oz.
Sugar	1 lb.
Shortening	4 oz.

Salt To Taste.

This formula is made for hand method of make-up.

American Style Rye

Sponge

Water	46 lb.
First Clear Flour	42 lb.
Medium Rye Flour	33 lb.
Yeast	2½ lb.
Yeast Food	6 oz.
Malt	12 oz.
Shortening	2 lb.
Salt	4 oz.

Dough

Water	8 lb.
First Clear Flour	25 lb.
Dark Syrup	5 lb.
Salt	2 lb.
Caraway Seed	3 oz.

Temperature, dough 80° F.; sponge, 72° F.; fermentation, sponge, 4 hours; dough, 15 minutes. Mix sponge 5 minutes, dough 8 minutes at 65 r.p.m. The malt used is diastatic of a 60° litner value. The formulas are for straight flow production machine-made hearth bread.

Bavarian Rye Bread

Sponge No. 1

(22–24 hour sour)

Dark Rye Flour	10 lb.
Water	8 lb.
Yeast	3 oz.

Sponge No. 2

Dark Rye Flour	25 lb.
Water	30 lb.
Clear Flour	20 lb.
Yeast	1¼ lb.

Dough

Water (Variable)	22–25 lb.
Medium Rye	10 lb.
Salt	1¾– 2 lb.
Clear Flour	35 lb.

Temperature, first sponge, 77° F.; second sponge, 78° F.; dough, 80° to 81° F.; fermentation, first sponge, 22 to 24 hours; second sponge, 4 hours; dough, 20 to 30 minutes. Mix first sponge by hand; second sponge, 5 minutes; dough, 8 minutes at 65 r.p.m. Caramel color and ground or whole caraway seed may be added if desired. This dough for flavor is always made by using the sponge method.

Russian Rye

Sponge No. 1

Water	4 lb.
Dark Rye Flour	4 lb.
Sour Starter	3 lb.

Let set for 4 hours; temperature, 78° F.

Sponge No. 2

Dark Rye Flour	12 lb.
Water	12 lb.

Let set for 4 hours; temperature, 78° F.

Sponge No. 3

White Rye Flour	24 lb.
Water	24 lb.
Yeast	1¼ lb.

Let set for 2½ hours; temperature, 78° F. This sponge should set until it starts to recede in the trough. Then add the dough ingredients.

Dough

Water	20 lb.
First Clear Flour	60 lb.
Salt	1½ lb.
Yeast	8 oz.
Shortening	2 lb.
Malt	1¾ lb.
Sugar	1 lb.
Caraway Seed (Whole)	1¾ oz.

The malt is diastatic of a 60° litner value. Mix sponges by hand. Mix the first one, then add the ingredients as listed in the next sponge, etc. Mix the dough in a slow-speed mixer for 6 minutes (speed of mixer 32 r.p.m.) Temperature of the dough, 80° F. Let the dough set for 15 minutes to recover before scaling at the divider.

When making open sliced loaves, scale the pieces 2 lb., after baking slice and divide into two 1 lb. loaves. Must be wrapped by hand to receive the best results. When making Bohemian rye, scale pieces at the divider in 1 lb. loaves. This is a machine formula.

Russian Pumpernickel

(Using day-old bread)

Sponge No. 1

Sour Starter Ripe Dough	4 lb.
Dark Rye Flour	3 lb.
Water	3 lb.

Let set 5 hours; temperature, 77° F.

Sponge No. 2

Dark Rye Flour	10 lb.
Water	8 lb.

Let set 4 hours; temperature, 77° F.

Sponge No. 3

Yeast	½ lb.
Water	18 lb.
Pumpernickel Flour	15 lb.

Let set 4 hours; temperature, 77° F.

Dough

Water	84 lb.
Clear Flour	150 lb.
Caraway Seed	1 lb.
Yeast	2 lb.
Salt	6 lb.
Stale Bread Soaked About Two Hours; Then Drain Off the Water	20 lb.
Caramel Color for Color	

Let set 1 hour; very stiff dough; temperature, 78° F.

Mix the sponges by hand. Mix the first one, then add the ingredients as listed in the next sponge, etc. Mix the dough in a slow-speed mixer or on low speed 6 minutes. Temperature of dough, 80° F. Let dough set 1 hour before scaling. This bread is baked in long and round loaves. It can also be baked in pans.

SPECIALTY BREADS

Brown Sugar Bread

Flour (Variable)	13¼ lb.
Water (Variable)	1 gal.
Yeast	4½ oz.
Salt	3½ oz.
Peeled Potatoes	1 lb.
Yeast Food	1 oz.
Powdered Skim Milk*	8 oz.
Brown Sugar	1 lb.
Shortening	8 oz.

Method

Boil potatoes in part of the water; when well cooked, mash, add water in which they were boiled. Allow potatoes to cook and mix dough in regular manner, adding potatoes last. Deduct potato water from the total water. Dough temperature, 80° F. Time: first punch, 1 hour 40 minutes; second punch, 40 minutes; take in 20. Oven temperature, 425° F.; baking time, 35 minutes; no steam. May be converted to sponge dough if shop conditions require.

Cinnamon Bread

Flour (Variable)	13 lb.
Water (Variable)	1 gal.
Yeast	6 oz.
Shortening	1½ lb.
Powdered Skim Milk (Or Equivalent)	
Salt	3 oz.
Yeast Food	½ oz.
Sugar	2 lb.

Method

Make up dough in usual manner. Roll up same as for cinnamon rolls. Wash with water instead of greasing, before adding cinnamon mixture. Cut off into 18-oz. pieces, or run through make-up equipment in regular way, taking loaf from molder after sheeting and before it strikes reverse roller. Throw on bench, apply cinnamon and roll up. Dough temperature, 80° F. Time: first punch 2 hours, second punch, 45 minutes; take in 20 minutes. Scale 9-lb. pieces for 10 loaves. Roll up as for cinnamon rolls and cut to pan size. Time recovery in proofer, 15 minutes; time in proof box 55 minutes. Oven temperature, 375° F. Baking time, 35 minutes; no steam. May be converted to sponge dough if desired.

Cinnamon Mixture

Sugar	1 lb.
Good Grade Cinnamon	2 oz.

Pimento Cheese Bread

Flour (Variable)	13 lb.
Water (Variable)	1 gal.
Yeast	4 oz.
Shortening	8 oz.
Powdered Skim Milk (Or Equivalent)	8 oz.
Dehydrated Cheese	1¼ lb.
Canned Pimentos (Chopped)	1⅞ lb.

Method

Mix dough in the regular manner. Dough temperature, 80° F. Time: first punch, 1 hour 40 minutes; second punch, 40 minutes; take in 20 minutes. Very attractive in pullman pan. Give fairly short proof. Oven temperature, 450° F.; baking time, 40 minutes; no steam. Will have excellent oven spring. May be run as a sponge dough if desired.

Prune Bread

Flour (Variable)	9 lb.
Fine Ground Whole Wheat	4 lb.
Water (Variable)	1 gal.
Yeast	6 oz.
Powdered Milk (Or Equivalent)	8 oz.
Granulated Dry Prunes	3¾ lb.

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* Or equivalent in other milks.

Salt	4	oz.
Yeast Food	½	oz.
Malt	2	oz.
Sugar	4	oz.
Shortening	10	oz.

Method

Mix dough in usual way. Add prunes after dough is about three fourths mixed and mix until fully developed. It is not necessary to soak the dry prunes before using. Instead of dried granulated prunes, 6¼ lb. of dried pitted prunes may be used. Dough temperature, 80° F. Time: first punch, 1 hour 40 minutes; second punch, 45 minutes; take in 15 minutes. May be run as sponge dough if desired. Oven temperature, 375° F.; baking time, 45 minutes.

Sweet Crust Raisin Bread

Flour (Variable)	12	lb.
Water (Variable)	1	gal.
Yeast	8	oz.
Salt	4	oz.
Malt	2	oz.
Powdered Skim Milk (Or Equivalent)	6	oz.
Butter	2	oz.
Lard	4	oz.
Honey	2	oz.
Whole Milk Powder	1	lb.
Raisins	12	lb.
Sugar	6	oz.

Method

Mix dough in regular manner, excluding raisins. When fermented, return dough to mixer and add raisins which have been soaked 10 minutes in warm water and thoroughly drained. Wash top with egg wash before placing loaves in oven. By adding raisins after dough is fermented there seems to be better volume and better interior and exterior.

Dough temperature, 78° F. Time: dough 45 minutes, then return for remixing, adding raisins; take in 10 minutes after remixing. May be run as sponge if desired. Oven temperature, 375° F.; baking time, 50 minutes; no steam.

Raisin and Date Bread

Flour (Variable)	13	lb.
Water (Variable)	1	gal.
Yeast	1	lb.
Salt	3	oz.
Sugar	12	oz.
Powdered Skim Milk (or Equiv.)	8	oz.
Shortening	12	oz.
Dates (Chopped)	2½	lb.
Nut Meats (Chopped)	10	oz.
Raisins	7½	lb.

Method

Raisins and dates should be washed in warm water, not soaked; just thoroughly washed unless unusually dry. Cut dates in three pieces, mix dough in usual manner, holding all of the fruit out until dough is thoroughly mixed. Add fruit and mix just enough to incorporate. When baked, wash tops lightly with thin water icing immediately when coming from the oven. Dough temperature, 80°. Time: first punch, 1 hour; take in 20 minutes. May be run as sponge if desired. Oven temperature, 375°; baking time, 55 minutes; no steam.

Sesame Egg Twist Bread

Flour (Variable)	13	lb.
Water (Variable)	1	gal.
Yeast	5	oz.
Salt	4	oz.
Egg Yolks	10	oz.
Powdered Skim Milk (or Equiv.)	10	oz.
Yeast Food	¾	oz.
Malt	2	oz.
Sugar	12	oz.
Shortening	14	oz.

Method

Cream shortening, sugar and egg yolks, then add other ingredients and mix as for any straight dough. Dough temperature, 80° F. Time: first punch, 1 hour 30 minutes; second punch, 45 minutes; take in 15 minutes. May be run as sponge if desired. Scaling weight, two 9-oz. pieces twisted for 1-lb. loaf. After twisting dip in milk solution and roll in sesame seed before panning. Oven temperature, 450° F.; baking time, 35 minutes. Use small amount of steam at finish of baking. Suggested pans, 1 lb., bottom 10 x 4 in.; outside, top 10½ x 4½ in.; inside depth, 3 in. Milk solution should be 1 part of unsweetened evaporated milk to 2 parts of water.

Old-fashioned Potato Bread

Flour (Variable)	13¾	lb.
Water (Variable)	1	gal.
Yeast	4	oz.
Peeled Potatoes	1¼	lb.
Salt	4	oz.
Sugar	4	oz.
Shortening	4	oz.

Method

Boil potatoes in part of the water; when well cooked, mash and put through a sieve and add water in which boiled. Be sure to weigh the water that was drained from potatoes and later added, deducting this from total amount used. Allow potatoes to cool thoroughly. Mix dough in regular manner, adding potatoes last. Dough temperature, 80° F. Time: first punch, 1 hour 50 minutes; second punch, 45 minutes; take in 20 minutes. Time in proof box, 50 minutes. May be run as sponge if desired. Oven temperature, 450° F.; baking time, 55 minutes; no steam. Pans should be 18 x 26-inch bun pans. Make up loaves six to seven inches long and place in bun pans, two loaves end to end, five in a row the length of the pan. After loaves are panned, dust tops lightly with the following mixture: 1 lb. salt, 1 lb. white or medium rye flour and 2 lb. white flour.

Preserved Bread
French Patent 842,122

For making preserved bread, 1 part by weight of leaven is treated with 5 parts by weight of water containing 0.5% sodium sulphate, 2.5% sodium chloride and 0.2% sodium carbonate. The treated leaven is mixed with 6 parts by weight of flour and made into a dough with 5 parts by weight of water containing the salts already mentioned, in the same proportions, and with 0.15 part by weight of a softener which may be glycerin or an edible fat. The dough is placed in a cool oven, at 140 to 158° F., and baked at approximately 480° F.

Dark Rye Bread Composition
U. S. Patent 2,009,274

Rye bran is stirred to a thin paste with water, allowed to swell, dried on a roller dryer at 180° F. for 2–10 minutes, and ground to a powder, which is mixed with a rye meal dough for production of dark rye bread.

Bakers' Bread Quick Dough
(One-hour dough)

Dissolve in the mixer:	
Water	55 lb.
Salt	2 lb.
Sugar	5 lb.
Pure Lard or Other Shortening	3 lb.
Mildly-Diastatic Malt	1 lb.
Yeast Food	4 oz.
Milk Powder	5–6 lb.
Add:	
First Patent Flour	100 lb.

Give a few revolutions in mixer. Then add 3 lb. yeast dissolved in 5 lb. water.

Mix thoroughly. Have the dough at 82° F. Give one full rise, which will take 45 minutes to 1 hour. Take to the bench. Scale, round, and mould quickly, so that the dough does not get too much additional age. It is beneficial to this dough to add either 1 quart of 90-gr. vinegar, to furnish the primary acidity, or 4 oz. of cream of tartar substitute. This helps develop the dough in a shorter period of time; however, as with all quick doughs, do not allow the dough to get too old.

At 82° F. this dough will be ready in 45 minutes to an hour. Give slightly shorter proof than usual, because the loaf should kick well in the oven. If using a low-speed mixer, mix the dough 20 to 25 minutes. For a high-speed mixer, 8 to 10 minutes is sufficient.

With all of these quick doughs, the ingredients of the dough are called upon to do, in a short time, what ordinarily takes much longer to perform. For that reason, slight changes are made.

The salt is frequently variable, depending on the type of water in the locality. In some cases, the salt may be brought up to 2½%, for additional flavor; however, if the water contains a high amount of minerals it is likely to have a very bucky dough, the cell structure will be harsh, and the loaf may shrink. 2% of salt is considered the safest amount to use.

In these quick doughs, a few degrees of temperature one way or another play a very important part, and this probably accounts for the differences in temperature given in some of the publications.

British Digestive Biscuits

Soft Flour	140 lb.
Wheat Meal	140 lb.
Sugar	50 lb.
Glucose	10 lb.
Fat	60 lb.
Chinese Barrel Eggs	1⅛ gal.
Soda	2½ lb.
Tartaric Acid	1⅛ lb.
Ammonia	½ lb.
Milk	to suit

Improved Dough
German Patent 633,464

10 g. of the following mixture is added per 100 kg. of flour:

Hydrogen Peroxide (30%)	93 g.
Phosphoric Acid	7 g.

Hot Plate Goods

Hot Plates as used in Britain for the preparation of so-called *Hot Plate Goods* are constructed in a series of four sections. The heat is supplied by electricity, or gas, through pipes running underneath the *plates,* with thermostatic controls at each of the four-foot sections and regulated by girls who are trained to operate and bake the different goods manufactured during a day's schedule. Each girl is given a chart indicating the respective degrees of heat required for baking the particular type of goods desired. A girl can operate four of these four-foot sections nicely.

When manufacturing *Hot Plate Goods* one must observe to use only first class ingredients. A high grade cake flour is desirable for texture and color, and also a good grade of baking powder should be used. There is nothing that will ruin the sale of these goods more than cheap ingredients.

On a large production scale it is good practice to always have on hand a large quantity of self-rising flour, as this avoids a lot of wasted time.

A recipe for 100 lb. of flour: Mix 100 lb. of high grade flour with 4 lb. 12 oz. of baking powder; sift three times to insure a thorough mixing. Now take some melted shortening and with cloth wipe over Hot Plate. This is imperative to avoid sticking to Hot Plate, applying to all goods baked on Hot Plates. Bake at 300 to 350°. It must also be noted that all goods washed on top must be baked dry side down and baked to a nice light brown, then turned over and baked to a golden color.

Scotch Pancakes

Flour	5	lb.
Shortening	1	lb.
Baking Powder	2	oz.
Salt	1	oz.
Sugar	1½	lb.
Eggs	1	lb.
Milk	3	lb.

Cream shortening, salt and sugar, add eggs and milk and beat thoroughly; then add the flour and baking powder. Beat to the consistency of thick cream. Drop from a Savoy bag and tube on the slightly greased Hot Plate. Bake slightly brown.

Molasses Scones

Cake Flour	8¼	lb.
Sugar	1	lb.
Light Molasses	1	lb.
Salt	1	oz.
Soda	2	oz.
Cream of Tartar	2	oz.
Shortening	2	lb.
Milk	3½	lb.
Nutmeg	¼	oz.

Method of Mixing

Add sugar, salt, molasses, soda and cream in bowl with shortening; add milk and nutmeg and thoroughly stir; add flour and cream of tartar, mix all together and weigh off on bench at 8 or 9 oz. Round up and pin out round and cut in four with scraper. Put on pans close together. Wash with milk and eggs on top carefully, so that wash does not run down on sides. Let stand about 15 minutes.

English Sultana's Scones

Prepared Flour	8	lb.
Sugar	1½	lb.
Shortening	1	lb.
Sultana Raisins	1¼	oz.
Salt	2	oz.
Milk	4½	lb.

Same procedure as Molasses Scones.

Cream Scones

Prepared Flour	6	lb.
Sugar	1¼	lb.
Butter and Shortening	1½	lb.
Salt	¾	oz.
Milk	3	lb.

These can be scaled off at either 3 lb. 6 oz. or 4 lb. 8 oz. to the press and rounded up on the bench, pinned out from 2 to 2½ in. in circumference, washed on top and baked in the usual manner.

Scotch Sultanas

Prepared Flour	6	lb.
Butter	1	lb.
Sugar	1½	lb.
Eggs	1	lb.
Sultana Raisins	1	lb.
Milk	3	lb.

Same procedure.

Midlothian Oatcakes

Midlothian Oatmeal	4	lb.
Pastry Flour	1½	lb.
Shortening	½	lb.
Bicarbonate of Soda	1	oz.
Cream of Tartar	¼	oz.
Salt	2	oz.
Milk, as desired	3 to 4	lb.

Mixing Method

Rule shortening soda and salt together in bowl, add milk, then flour and oatmeal and mix to a pliable dough. Weigh off at 8 oz., round up and pin out round and cut with scraper into four parts. Bake both sides to a nice color.

Scotch Bannocks

Flaked Oatmeal	4 lb.
Cake Flour	2 lb.
Salt	1 oz.
Baking Powder	2 oz.
Butter, High Grade	2 lb.
Sugar	8 oz.
Milk	3 lb.

Use same procedure as for Midlothian Oatcakes. They are usually sold by weight.

Fig Bars, Bakers'

Flour	20	lb.
Powdered Sugar	8½	lb.
Honey	1¼	lb.
Butter	2	lb.
Vegetable Shortening	2	lb.
Eggs	1¼	qt.
Ammonia	¾	oz.
Soda	2	oz.
Salt	1½	oz.
Milk (Variable)	2	qt.
Vanilla Extract	1¼	oz.

Method

Cream the sugar and shortening and add the honey and eggs slowly. Then add the flavor. Sift in the ammonia and salt, and after these ingredients have been incorporated add the milk. Blend the flour and soda, add and mix just long enough to obtain a nice, smooth dough. Roll the dough into thin sheets and divide into strips of the required size. Put a ribbon of fig filling down the center and fold the sides over so as to make a bar. Put onto sheet pans, seal down, wash with a little milk and bake at 400° F.

A very nice fig bar can be made by replacing the white flour with whole wheat flour. Handle in the same way as the conventional bars.

Cheese Filling

Cottage Cheese	5	lb.
Butter	½	lb.
Flour	½	lb.
Whole Eggs	1½	lb.
Salt	¼	oz.
Dry Milk Solids	2	oz.
Lemon Flavor	to taste	
Egg Whites	1½	lb.
Sugar	1½	lb.
Water (Approx.)	1	lb.

Put cheese through coarse sieve. Rub cheese, butter, and flour together. Add egg yolks, salt, dry milk solids, and lemon flavor. If sugared yolks are used instead of whole eggs, cut weight of eggs to 1 lb.

Beat egg whites and sugar to stiff meringue and add to mixture. Quantity of eggs used will determine quantity of water needed to give filling the desired consistency. Stir well before pouring into cheese cake pan. Sprinkle with cinnamon.

When desired, layer of spiced and sugared dry bread crumbs can be substituted for the layer of basic sweet dough in bottom of baking pan.

Bake at medium heat, (300° to 350° F.). If oven is too hot the cheese filling will crack. Cracking may be prevented by drawing cake from oven when partially baked and piercing skin on cake surface to let out the excess moisture.

Baker's Puff Paste
Formula No. 1

Spring Wheat Flour	3	lb.
Butter	8	oz.
Cold Water	24	oz.
Yolks of Eggs	6	
Lemon Juice	½	oz.
Salt	½	oz.
Firm Butter	2½	lb.

First, be sure that the butter is absolutely of firm, waxy texture and free from excessive water, and used in a thoroughly refrigerated condition. It must not be excessively hard and brittle, but pliable for rolling, yet cold and firm. If half butter and half stearin product is used, then see to it that they have been previously blended together and are thoroughly refrigerated.

Flour also should have been previously weighed and the 8 ounces butter rubbed into it, and then chilled in refrigerator for a period.

Add chilled water, yolks, and lemon juice to the mix and gather together into clear dough. On no account toughen this dough. (It is an old opinion that this dough should be toughened and banged about on the bench. This is an absolute fallacy. No good purpose is accomplished by this method—it simply tends to toughen the dough and produces a tougher product.)

Set this dough in refrigerator for a short period to give a little. Now take out and roll on bench to about 30 by 20 inches. Place the butter in small pieces over exactly two-thirds of the surface, bring the uncovered section half way over the butter surface, and then bring the remaining butter covered surface on top of this. Press neatly and firmly togther and then proceed to give the first turn. Roll out to 30 by 20 inches and fold in thirds again, and then repeat the second time.

Set away in refrigerator overnight. Give two turns next morning, and set away again for 1 hour. Then repeat, giving the last two turns (a total of six), and set away for 1 hour again before working off into pastries.

NOTE: When pastries are made up, they should be set aside in refrigerator for a period of 30 to 60 minutes before baking. To bake puff pastries too soon after making up is a sure way to invite toughness and shrinkage.

No. 2

Chopped-in Method

Spring Wheat Flour	2	lb.
Cake Flour	2	lb.
Firm Refrigerated Butter	4	lb.
Yolks of Eggs	10	
Water	36	oz.
Cream of Tartar	½	oz.
Salt	½	oz.

Chop butter into flour in even small pieces the size of a walnut in shell. When all butter is chopped set away in refrigerator for a period of 2 hours. Measure water and yolks and also set in refrigerator.

Take from refrigerator, add water, yolks, etc., and mix carefully. Simply gather together—on no pretense try to mould or work this dough. Gather it together with even greater care than when mixing a short dough.

When all ingredients are absorbed together, set on bench and square off sides into a square piece. Then immediately roll out to 30 by 20 inches or thereabouts, fold over in thirds similar to previous batch, then repeat with a second turn.

Set this away in refrigerator for 2 hours at least. Then give another two turns, and set away for 1 more hour, then finish with two more turns, making a total of six, and put back in refrigerator before using.

If desired, this also can be made overnight with two turns, and finished off next morning as previously described.

No. 3

Spring Wheat Flour	2	lb.
Cake Flour	2	lb.
Butter (Rub Well Together)	12	oz.
Cold Water	36	oz.
Yolks of Eggs	10	
Lemon Juice	¾	oz.
Salt	½	oz.
Firm Butter	3¼	lb.

Follow same rules as given for No. 1 formula.

Keep the batch covered at all times between turns with a clean damp towel or cloth, and never allow the surface to become dry and develop a hard shell.

Chocolate Cold Cream Pie

Place the following ingredients in the kettle on the stove:

Water	3	qt.
Sugar	3	lb.
Cocoa	12	oz.

The cocoa content may be increased or decreased, or chocolate may be substituted, in any proportion you desire, depending on the color you wish to obtain and how pronounced a chocolate flavor you prefer. It is impossible to insure the same results to everyone by specifying a certain amount of cocoa or chocolate, because the many brands being used are not uniform in strength. The 12 ounces specified in this formula, however, should produce a filling rich in flavor and color. If more of a milk chocolate flavor and color are desired, it will be necessary to reduce the amount given to about 8 ounces.

Next, add to the sugar-and-water mixture

Glucose	1	lb.
Salt	1	oz.

Next, dissolve 1 pound 10 ounces cornstarch in 1 quart water, and when the mix on the stove comes to a boil add this starch solution, stir rapidly, and cook well until clear. This forms an extremely heavy paste. The amount of cornstarch used may seem excessive, and would be entirely too much in the ordinary type of filling; but, although at this stage of preparation our mix is in the form of a heavy paste, you will find no evidence of this starch in the completed filling.

When the mix has cooked to a thick, clear paste, remove from the kettle immediately and place in a container. So long as you can allow sufficient time for the mix to cool, the type of container is not important.

Place cooked paste in pan, smooth

it out and immediately cover with waxed paper, pressing this down on the surface of the mix. If waxed paper is not available, greased paper will serve the same purpose, but the covering must be done immediately and the paper must lie across the cream filling tightly. This is done to prevent the mix from forming a tough skin, which in turn would cause a lumpy filling. Of course, this could be prevented by using a colander if one is a part of your equipment; and if a colander is used on your cake machine you would not necessarily have to cover your mix with waxed paper, as this colander would break up the skin and remove all the small lumps. As a safety measure and to assure the best results, however, always use the wax paper, being sure to place this on the hot mix at once.

Allow this heavy paste to become thoroughly cold. This is important.

The next step is to place the cold paste in the cake machine, and with the paddle beater beat until smooth. Any speed on the machine may be used. After the mix is broken down and begins to hold together, turn the machine into high speed for a minute or so in order to insure a thoroughly smooth paste.

Next, beat 1½ pints egg whites with 1½ pounds sugar, adding half the sugar to the egg whites when you start to beat them. Beat to a dry stiffness, and then add the remainder of the sugar and allow to beat only enough to dissolve this second half of the sugar.

When this has been done, add the beaten egg whites to the chocolate mix in the cake machine with the paddle beater, being sure to mix the egg whites in thoroughly. It will be necessary to scrape the bowl down once or twice during this operation, as this mix has a tendency to stick to the sides of the bowl, and scraping must be done to insure a thorough incorporation of the egg whites and a uniform color. Beat the egg whites into the chocolate mix in first or second speed, but do not use high speed for this purpose. Next add 1 ounce vanilla and ⅝ pint cream.

Chocolate Icing Paste (Bakers')

Glucose	60	lb.
Cocoa	20	lb.
Caramel Color	½	lb.
Glycerin	5	lb.
Syrup	10	lb.
Vanillin	½	oz.
Water	5	pt.

Chocolate Icing

Cocoa	60	lb.
"Crisco" (Shortening)	40	lb.
Vanillin	2	oz.
Salt	¾	lb.

To each pound of icing add 2 pounds 4X sugar and ½ pint boiling water. Mix and use hot. Keep hot for use in a double boiler.

Bakers' "Cream"

(Used in Cream Buns and Eclairs)

Margarine	2	lb.
Meringue	4	lb.
Gelatin	1	oz.

These are whipped up and then mixed with one pint of cream.

Sugar Paste for Bakers' Molds

Gum Tragacanth	2 oz.
Water	1 pt.
Powdered Sugar and Corn-Starch in Proportions of 80% Sugar and 20% Starch.	As Needed.
Certified Blue Color	A Few Drops

Soak the gum tragacanth in the water for 24 to 30 hours. Press the soaked gum through a very fine sieve or cloth and mix with the sugar-cornstarch combination until a stiff paste is obtained. A few drops of blue coloring will have a tendency to improve the color. Be careful to add this only a drop at a time as the slightest bit too much will give the paste a bluish cast that is undesirable.

This paste may be colored with water soluble colors that are used for icing purposes.

Doughnut Glaze

4X Sugar	10	lb.
Water	1	qt.
Honey, Warm	8	oz.
Salt	½	oz.
Vanilla Extract	½	oz.
Gelatin, Best	½	oz.

Melt the gelatin in the water. Add the warm honey to this and heat in a double boiler until real hot. Add this combination to the other ingredients, which have been well blended, and stir until smooth. Do not beat this glaze. Keep in a hot water bath to insure fluidity and dip the hot doughnuts into it.

Meringue or Marshmallow Powder

Powdered Egg Albumin	75 lb.
Gelatin, Best Grade	90 lb.
Tapioca Flour	135 lb.

Three ounces of above mixture is "dissolved" in 1 pint luke-warm water. Beat semi-stiff. Add 2½ pounds 4X sugar and ¼ ounce vanilla extract. Beat until stiff.

Sweetened Cocoa Powder Soluble in Cold Milk

Dissolving sweetened cocoa or chocolate powders in cool or cold milk is usually difficult without aid of vigorous mechanical agitation.

To overcome this difficulty and give a powder which can be stirred in easily with a spoon, U. S. Patent No. 2,-179,130 specifies the following procedure.

Add 50 lb. water to 100 lb. high purity crystalline dextrose in a closed, jacketed kettle and heat with stirring until a temperature of 230° to 280° F., preferably 240° F., is reached for the removal of excess water.

By pouring the hot syrup into a hot steam jacketed mixer upon 25 lb. of cocoa powder and mixing at the hot syrup temperature, the cocoa particles are partially gelatinized and covered with a syrup coating. When the steam has been turned off and mass cooled to about 180° F., flavoring such as vanillin is added and mixed into the mass preliminary to emptying into sugar pans where crystallization of the sugar entraps the cocoa particles.

After 24 to 48 hours, the solid cakes are broken up and ground until all particles will pass through a 30 mesh or finer screen. The resulting powder will contain about 3% to 5% moisture but will not become sticky or cake and will contain about 1 part cocoa to 4 parts dextrose.

If sucrose or maltose is made a part of the sugar content, a reduction in sugar ratio will have to be made to get the same level of sweetness as given by the dextrose. Should a product of high sweetness be wanted a product having the ratio of 1 part cocoa to 9 parts sugar can be satisfactorily made by the same procedure.

Edible Dusting Powder
U. S. Patent Serial Number 130,689

An edible dusting powder for doughnuts, pies, cakes and fatty pastries, comprise an edible powder vehicle, and an edible fat mixture covering the particles of said powder, said fat mixture comprising 35 to 25 parts of vegetable stearine, 55 to 73 parts of incompletely hydrogenated vegetable oil of melting point from 94° to 110° F., and from 10 to 2 parts of oleo oil prepared from animal fat and having a melting point at roughly 94° F. and a congealing point of 64° F.

Cinnamon Substitute
German Patent 668,073

Cinnamic Aldehyde	10–25 g.
Eugenol	1 g.
Powdered Nut Shells	1000–4000 g.

Prepared Doughnut Flour
A Dry Blend for New England Hand-Cut Doughnuts or Crullers

Mix together thoroughly:

	Large Batch
*Fine Granulated Sugar	110 lb.
Salt (Prepared Fine)	5 lb.
Nutmeg (Fine Grind)	2½ lb.
Mace (Fine Grind)	1¼ lb.
Salad Oil	15 lb.
Powdered Turmeric	½ oz.
Add slowly while mixing:	
*Flour Blend	370 lb.
Dry Milk Solids (Less than 1% Fat)	25 lb.
Sodium Bicarbonate	3¾ lb.
Cream of Tartar	3¾ lb.
Phosphate	3¾ lb.
Powdered Egg Yolk	20 lb.

To Fabricate: Allow approximately 7 ounces (variable) of water to each 1 lb. of dry blend flour. Cut and handle as usual. Cook at 385° F.

Note: Moisture requirements may be stabilized as flour varies by using 1% to 3% of corn flour or potato flour so that the amount of water the baker uses in the mix will remain constantly uniform. The baker should have the dough as soft as can possibly be handled when rolling and cutting by hand to produce a more tender, fluffy doughnut.

Total levening may be increased for a more fluffy doughnut.

Leaven for Bread
French Patent 825,033

Bakers' Yeast	40–50 kg.
Alcohol, Pure	14–20 kg.
Sucrose	13–19 kg.

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* Flour blend is most important. A protein of 8.5 to 9.0% has produced a satisfactory doughnut with this blend.

d-Glucose	5–11 kg.
Vegetable Oil or Fat	14–20 kg.

This leavening acts slowly and is useful for mixes that are kept for a relatively long time before baking.

Improving Yeast

British Patent 493,030

Yeast freed from wort is treated with 0.12–1% sorbitol laurate. Cutting, wrapping, color and water retentive properties are improved.

Increasing Yeast Production

U. S. Patent 2,174,543

One part of ethanolamine to 12,000 parts of culture medium increases rate of growth and total yield.

Self-Rising Buckwheat Flour

Monocalcium Phosphate	3.500 lb.
Sodium Bicarbonate	1.625 lb.
Salt (Fine Grain)	1.500 lb.
Buckwheat Flour	65.000 lb.
White Flour	28.375 lb.

Self-Rising Biscuit Flour

Monocalcium Phosphate	3.500 lb.
Sodium Bicarbonate	1.625 lb.
Salt (Fine Grain)	1.500 lb.
Winter Wheat Flour, First Quality	93.375 lb.

Pancake Flours

Formula No. 1

Mixed Type

Soft Wheat Clear	35 lb.
Buckwheat Flour	35 lb.
Corn Flour	15 lb.
Rice Flour	15 lb.
Powdered Skimmilk	3 lb.
Cane Sugar	3 lb.
Salt	2.25 lb.
Bicarbonate of Soda	2 lb.
Mono-Calcium Phosphate	2.4 lb.

No. 2

Buckwheat Type

Buckwheat Flour	50 lb.
Corn Flour	15 lb.
Soft Wheat Clear	35 lb.
Powdered Skimmilk	3 lb.
Salt	2.25 lb.
Bicarbonate of Soda	2.25 lb.
Mono-Calcium Phosphate	2.75 lb.

Flour Improver

Formula No. 1

British Patent 491,569

Cooked Potatoes	7 lb.

Mix with following solution:

Calcium Dihydrogen Phosphate	62 lb.
Calcium Sulphate $2H_2O$	10 lb.
Ammonium Chloride	8 lb.
Salt	20 lb.
Water	Sufficient to Dissolve

Mix well and spray dry.

This increases gas production, strengthens gluten, improves crust and keeping quality of bread.

No. 2

British Patent 452,483

Calcium Acid Phosphate	0.20000 lb.
Ammonium Sulphate	0.02800 lb.
Potassium Bromate	0.00050 lb.
Potassium Iodate	0.00040 lb.
Sodium Metavanadate	0.00006 lb.
Salt	0.08000 lb.
Flour	0.09110 lb.

Flour Bleach

One of the best flour bleaches consists of the application of ½ oz. chloramine per bbl.

COMPOSITION OF COMMERCIAL BAKING POWDERS

Ingredients	*Formula* *No. 1*	*No. 2*	*No. 3*	*No. 4*
Sodium Aluminum Sulphate	20.0	——	20.0	13.5 oz.
Monocalcium Phosphate	14.0	32.0	15.0	17.5 oz.
Sodium Bicarbonate	29.0	28.0	28.0	28.0 oz.
Redried Corn Starch	37.0	40.0	37.0	41.0 oz.

BAKING POWDERS FOR INCREASING DOUGH VISCOSITY

U. S. Patent No. 2,000,160

Formula	No. 1	No. 2	No. 3	No. 4	No. 5	No. 6	No. 7	No. 8	No. 9
Sodium Bicarbonate	26.73	26.73	26.73	26.73	25.00	25.00	37.50	26.73	26.73 lb.
Tartaric Acid	5.97	....	....	....	....	....	....	....	.... lb.
Potassium Bitartrate	44.90	....	....	....	....	50.00	....	....	.... lb.
Gum Karaya	22.40	35.07	39.84	47.59	25.00	25.00	12.50	42.97	40.07 lb.
Monosodium Phosphate	....	38.20	....	....	50.00	....	....	....	.... lb.
Monocalcium Phosphate	....	....	33.43	....	....	....	37.50	4.62	13.28 lb.
Sodium Aluminum Sulphate	....	....	....	25.68	....	....	....	25.68	19.92 lb.
Sodium Acid Pyrophosphate	....	....	....	....	....	....	12.50	....	.... lb.

DAIRY PRODUCTS

Iowa Blue Cheese

Clean, well cared for milk is necessary. Unless it is available the manufacture of the cheese should not be attempted. High quality milk permits better control of the composition and physical properties of the curd, and the normal sequence of curing changes is more likely to occur in cheese from good milk.

At the dairy plant, acidity, methylene blue reductase and fermentation tests will be found particularly useful in selecting suitable milk.

The milk used averages 3.34% fat. To it is added cream to raise the average fat content to 3.79%. A normal milk with 3.8% to 4.2% fat has also been used with success.

Pasteurization of the milk for Iowa Blue Cheese has not proved advantageous.

Ripening the Milk

After the milk has been placed in the usual American cheese vat, ordinary lactic cheese starter for ripening the milk is added at the rate of 1.5% to 2%. The acidity is permitted to develop until .19 to .20 of 1% has been reached, which will usually require from 1 to 1½ hours. At the end of the ripening period the Marshall rennet test will show 1¼ to 1½ spaces. It is essential that an active and rapid lactic acid-producing starter be used. An inactive or slow culture will not facilitate satisfactory drainage, and the composition of the cheese cannot be controlled.

When cream is added to raise the fat content of the milk, enough is added to raise the fat percentage approximately .4 of 1%. This increase in the ratio of fat to casein has not appeared to cause any special difficulty in obtaining a sufficiently open cheese or satisfactory drainage. The setting temperature of 84° F. is lower than commonly used for most varieties of cured cheese, but this lower temperature seems to aid in the production of the desired body and texture.

Setting the Milk

When the acidity test shows .19 to .20 of 1%, the rennet extract is added at the rate of 3 fluid ounces or 90 cubic centimeters per thousand pounds of milk. The rennet is first diluted with 20 times its volume of cold water. Just before the rennet extract is added, the milk is set in motion. Thorough mixing of the diluted rennet extract should continue for 1 or 2 minutes to insure uniform distribution. It will be noted that no color is added since it is desired to have the finished cheese as white as possible. The veining with the blue mold then shows up in sharp contrast against the uncolored cheese.

Curdling Period

A relatively long curdling period is used which will usually consume 1¾ to 2 hours. During this time the milk thickens, then curdles completely and becomes progressively firmer, more brittle and inelastic. Beads of whey will stand out on the surface of the curd, gradually verging into larger areas until the entire surface will be covered with a thin film of clear whey. The curd is now ready to cut. Sometimes in the case of milk slightly riper than usual, the curd will shrink away from the lining of the vat before it is ready to cut.

Cutting the Curd

With the ½-in. wire curd knives the curd is cut into cubes by means of a horizontal cut lengthwise followed by a vertical cut across the vat and finishing with a longitudinal cut with the same knife. Following this the whey will separate rapidly and the curd begin to settle out. An acidity test of the whey taken immediately after the cutting is completed will commonly show .14 to .15 of 1% of acid. Lower acidities have frequently been followed by difficulty in drainage.

Firming the Curd

Following the completion of the cutting operation the curd is left undisturbed for about 15 minutes. At the end of this period it is stirred gently to prevent matting and this operation is repeated at intervals of a few minutes for the next half hour. Fifty minutes after cutting, the temperature of the curd is raised 2° or 3° F. by dipping out a pail of whey and heating this to a temperature of 170° to 180° F. by injecting steam directly into it. Enough whey can easily be heated in this manner to raise the curd temperature sufficiently without danger of the curd matting in the bottom of the vat. It also avoids too much heat being applied, which might occur if steam is admitted into the jacket to heat the curd. This hot whey should be added carefully to the vat and then be thoroughly distributed with the wooden curd fork.

Dipping the Curd

The firming temperature of 86° to 87° F. will slightly toughen the curd in a few minutes, and the acidity by this time will have reached .18 to .19 of 1%. This slight toughness prevents too much breaking up of the curd on the cloth to which it is now to be transferred. When this slight toughening has proceeded for about 15 minutes, some of the whey is drawn off through the vat gate, and one-half of the curd is transferred by means of curd scoops or flat sided curd pails to a nearby drain vat. In the bottom of this vat is placed a rack over which two of the Swiss cheese cloths are spread. Drainage of the curd is assisted by raising and lowering the corners of the cloths occasionally, but too much manipulation will cause unnecessary breaking of the curd and losses of cheese solids. After 15 to 20 minutes the curd becomes a slightly tough, lumpy, porous mass. There will be very little free whey passing from it.

Hooping the Curd

The hoops used in this work were the so-called Muenster style mold. They are of heavy tinned-steel, round, 7½ inches in diameter, open at both ends, with 6 rows of twenty ⅛ inch holes drilled in the side for drainage. If the room is not sufficiently warm, it is well to dip the hoops in hot water just before using them. The curd may have cooled a degree or two during drainage before being placed in the hoops. The hoops may be placed on boards or directly upon a draining table, and each hoop filled one-fourth full with the pulpy, irregular curd.

Upon this first layer of curd is dusted a light layer of the prepared mold powder, using a pepper box. Following this a second and third portion of curd is added, and upon each mold powder is sprinkled lightly. The last fourth of the curd needed to fill the hoop is placed over the third layer of mold so that the hoop is filled with alternate layers of curd and mold powder. In the cheese made in this laboratory .06 to .07% of mold powder gave excellent results. Marre states that .01% of mold powder is advisable, while Mateson reports little advantage in using 2 grams as compared with .2 gram per cheese. Unless suitable laboratory facilities are available it will probably be more satisfactory to obtain the mold powder from a reliable laboratory than to attempt to prepare it in the dairy plant.

The curd is not packed in the hoop nor is any follower nor weight used. If the correct physical condition of the curd is obtained and the temperature is favorable, the surface of the cheese will close up reasonably well, but the cheese will remain rather open through the interior. The closing of the surface is desirable as it gives a smoother, cleaner appearance to the finished cheese and reduces losses during curing, but the open interior is necessary for proper mold growth. If difficulty is experienced in obtaining a smooth, well closed surface, the cheese after draining 20 minutes may be surrounded with a small square of cheesecloth dipped in warm water. This procedure will insure a well closed surface, but this precaution has not generally been necessary in the college laboratory. Curd remaining in the whey still in the vat is now transferred to the cloths. This curd will have firmed somewhat during the draining and filling of the first lot of curd so that drainage of the remainder will require less time. Fat losses in the whey have averaged .25 of 1%.

Draining the Cheeses

After 20 to 30 minutes in the hoops the cheeses are turned to smooth the upper surfaces and to facilitate drainage. A special draining room need not be used in this work, but the cheeses are placed on cloths in the drain vat in the making room and their temperature held between 75° and 80° F. Usually there are five turnings of the cheeses at increasing intervals of time during the afternoon. It is important that the temperature be held sufficiently high to facilitate drainage, but not so high that the open texture is lost. The high drainage temperature permits the curd to drain sufficiently so that it may be salted within 24 hours after it is made. During the drainage period the weight of curd decreases to 3.02 pounds of cheese per pound of fat, based on the records of approximately 8000 pounds of cheese. The cheese will show 45% to 46% of moisture when it is ready to salt.

Salting

The salting of this type of cheese presents perhaps one of the major problems from the standpoint of producing uniform quality. A combination of brine and dry salting has been used to obtain the more than 4% of salt desired in the final product. Following drainage the cheeses are held at a temperature of 75° to 80° F. overnight, and are then placed in a wooden salting tank containing a saturated solution of butter salt. The temperature is kept near 55° F. The cheeses are sprinkled lightly with dry salt on the exposed surface and the next day are turned over in the brine and the upper surface again lightly dry salted. At the end of the second day in the brine the cheeses are removed and dry salted rather liberally on all surfaces. This dry salting is repeated in 48 hours. At the end of another 48 hours the cheeses are rinsed off with clear water. The salting operation covers a period of 6 days. During the first two days the cheeses are in brine and the last four they are dry salted. During the salting period the surface of the cheeses becomes very firm but shows little evidence of surface growth. The hardness of the surface is not due to air drying but to the effect of the salt. Samples of good quality imported blue cheese have been analyzed which showed as high as 5.7% salt. Good blue cheese probably will not be obtained if the salt content is insufficient. It is important that a carefully prepared sample shows a salt content somewhat above 4.0% upon completion of the salting process. During the salting period the cheese continues to lose weight, producing 2.89 pounds of salted cheese per pound of fat as compared with 3.02 pounds of cheese per pound of fat at the beginning of the salting process. The acidity of the brine will rise with use. It should be kept below .3 of 1% acidity by the addition of proper amounts of milk of lime made from clean, unslaked, lump lime.

Punching the Cheese

At the end of the salting period excess salt is rinsed from the cheese surfaces and when the surplus moisture has disappeared the cheeses are skewered.

The proper growth of the flavor-producing mold culture requires that a certain amount of air in addition to that present when the curd is placed in the hoops be admitted during the curing process. This additional air is provided by skewering or pricking the cheese in about 50 places with a ⅛-inch diameter needle. These openings are evenly distributed over the flat sides of the cheese. Not only will this permit better growth of the mold in the many natural openings in the cheese but a luxuriant growth is frequently obtained along the line of puncture. If large quantities of cheese are to be made, a special machine should be used for punching in order to economize on labor and produce more uniform results.

Curing

The cheeses are placed on edge on special racks for the curing period, which will approximate two months. During this period the temperature of the curing room in which the cheeses are placed is held at 45° to 48° F. and the humidity above 90% of saturation with slight or moderate air circulation.

The rooms used for the cheese are insulated with 4 inches of cork and provided with a floor drain and cold water connections. The cooling is effected by means of wall brine coils on one side of the room. High humidity and a slight air movement are produced by a fine water spray located at the top and discharging into a galvanized iron cylinder 6'x1'6" open at both top and bottom and extending within a foot of the 8-foot ceiling and ending 1 foot above the floor not far from the drain. A fine spray of water passing downward through the cylinder humidifies and circulates the air, the excess water passing onto the floor and down the drain. Manual adjustment of a valve on the water line regulates the humidity and to some extent the air circulation. A difference of around 1° F. between the wet and dry bulb thermometer readings is maintained. The correctness of the curing conditions is also to some extent determined by observing the sequence of fermentations on the cheese surfaces, the appearance and stickiness being used as evidences of the desired curing room conditions.

During the first 3 or 4 weeks following the pricking of the cheese a blue-gray mold develops in patches over the surface, sometimes almost covering the cheese. Some sticky surface-growth is mingled with the mold, but the mold should predominate. At this stage, the surface mold and bacterial growth is removed by immersion in cold water in a vat for ½ to 1 hour which will soften the surface sufficiently so that a stiff brush may be used to render the cheese white before replacing it in the curing room. During the second period of 3 or 4 weeks under curing room conditions, the reddish brown sticky surface-growth will almost entirely displace the mold-growth which predominated during the first month. This reddish brown layer will probably need to be removed twice during the curing process. Its development is an evidence of a normal cheese and, to some extent, of suitable curing conditions. If, however, it becomes too vigorous the surface of the cheese softens too deeply, and large losses result. High temperatures and infrequent removal favor too luxuriant growth. The removal of the surface growth with the brush is responsible for some loss of weight during curing. The high humidity of the curing room largely prevents evaporation of moisture from the cheese so that little loss of weight occurs on this account. The total loss of weight from the time the cheese is placed in brine until it is enclosed in foil amounts to 9.67%.

Placing in Foil

After 8 or 10 weeks in the curing room the first removal of surface growth takes place and the white cheeses are inclosed in pure block tin foil as soon as surface moisture has largely disappeared. The foil should be pressed upon the surface of the cheese with the hands so that there will be close contact between the foil and cheese. The foil should bear the brand and other information, in which case the sheets of foil will be interleaved with tissue paper. This paper may be used to handle the cheeses so that the outside surface of the foil may be kept entirely clean. A yield of 2.72 pounds of cured cheese per pound of fat at the time the cheese is inclosed in foil is obtained.

The cheese should be held at least 1 month in foil at a temperature below 45° F. for short periods, or nearer 32° F. for a storage period of some months. During this ripening period in foil more of the characteristic peppery flavor develops and the cheese becomes sweeter, losing certain raw curd characteristics which have not entirely disappeared at the time the cheese is inclosed in foil. The total time from making to selling for a mild cured cheese will be 3 or 4 months.

RICOTTO CHEESE

Heat fresh sweet whey in a boiler to 180–190° F. for about 30 minutes. Add sour whey until the albumin flakes out like snow flakes. Maintain the temperature until the albumin gathers at the surface. Dip into molds or cloth with strainer dipper.

Rub pressed curd with salt. Ricotto may be consumed fresh or after several weeks.

Sometimes 10 per cent of skim milk or whole milk is added to the whey to increase the cheese yield.

The sour whey is prepared by setting whey (pasturized at 180° F. for 5 minutes) at 98° F. with a culture of Lactobacillus Bulgaricus added for 12 to 14 hours. The sour whey preferably should titrate over 1 per cent expressed as lactic acid using tenth normal caustic soda in the titration with phenolphthalein as the indicator.

SEMI-HARD CHEESES

These cheeses range in moisture from 40–45 per cent. They have a limburger like flavor, and a texture similar to a soft brick cheese.

Formula No. 1

Use milk with 3.5 per cent of fat; pasturize to 143½° F. and hold for 30 minutes. Cool to 86° F. Add ½ per cent of Lactic culture and ½ per cent of Lactobacillus helverticus culture, and if a slightly colored cheese is desired, add 1 ounce of color per 1000 pounds of milk. Add rennet at the rate of 5 ounces per 1000 pounds of milk.

Cut curd after steeping 30 minutes, then stir for 30 minutes without heating. Dip rapidly into brick cheese molds. Have the dipped curd 4 to 6 inches in depth, resulting in a 2 inch thickness of the finished cheese. Press for 8 to 10 hours under 10 pounds of pressure.

After a day rub cheese lightly with salt, and then place cheese in a 20 per cent salt brine for 48 hours.

Cure cheese at 85 relative humidity and 60° F. for three weeks. Rub cheese freely while in curing. Wrap cheese and place in storage at 40° F.

No. 2

This method is like the above only acid is allowed to develop before the rennet is added. An increase in "acidity" from .02 to .04 is desired.

No. 3

A similar cheese is made by setting

the milk as in No. 1 except that the setting temperature is 83° F. and the setting period 1½ hours. After cutting the curd, it is stirred for 5 minutes and heated to 98° F. in 15 minutes. It is dipped as soon as 98° F. is reached. Pressing, salting and curing are much like methods 1 and 2.

Taub White Cheddar Roquefort Blend

Grind 25 pounds of white cheddar cheese, and mix with 25 pounds of 40% high quality cream. Add 5 pounds of well cured imported French roquefort. Add 5 ounces of salt and 5 ounces of finely ground agar. Mix and heat to 165° F. and hold for 20 min. Cool to 120° F. and homogenize at 3000 pounds pressure.

When it is difficult to dissolve the white cheddar cheese, 1% to 2% of sodium citrate may be added.

To make an aged in wine product, 3% of wine may be added just before homogenization. Sauterne or port wines may be used for this purpose.

Strong Flavored Cheddar Cheese Blend

Use 40% fat content cream and add 5% of dry skim milk and ¾% of salt. To this add an equal amount of strong cheddar cheese, and 2 pounds of Roquefort cheese per 100 pounds of the cream-cheddar mixture. Heat to 160° F. and hold for 20 minutes. Cool to 130° F. and homogenize into final package at 3000 pounds pressure. One ounce of cheese color per 100 pounds of the mix may be added if more color is desired.

Trappist Type Cheese

Formula No. 1

The milk is standardized to 3.5% of fat and heated to 88° F. Commercial cheese color is then added at the rate of 1 ounce per 1000 pounds of milk. One-half to 1% of commercial starter is added. An acidity range from no increase to 0.04% increase follows. Rennet is added at the rate of 5 ounces per 1000 pounds. After 30 minutes the curd is cut and stirred for an additional 30 minutes. The curd is then rapidly transferred with a strainer dipper to the molds. When a cheese 2 inches in thickness is desired, the fresh curd is placed at a depth of 4 inches in the molds.

After several hours, pressure not to exceed 5 pounds is applied for 8 hours. During this period the cheeses are turned frequently.

On the following day two salting methods are followed with like success. Some of the cheeses are rubbed with salt on two successive days. Others are rubbed once with salt and then placed in a salt bath for 24 hours. The salt bath is prepared by dissolving 18 pounds of salt in 82 pounds of water.

A limited number of these cheeses may be cured at 54° F. for 6 weeks. The majority may be cured at 60° F. for 3 to 4 weeks and then placed in cold storage. The cheese can be successfully held for 3 months at 32° to 40° F. A temperature of 60° F. is used almost entirely in this work.

During curing the cheeses are turned frequently and rubbed by hand. Those which develop green or black mold growth are washed with a mild salt solution prepared by dissolving 2 ounces of salt in a gallon of water.

This procedure, slightly modified, produces a milder flavored cheese. The milk is heated to 110° F. After the above-mentioned amounts of color and culture are added, rennet at the rate of 6 ounces per 1000 pounds of milk is added. The curd is cut after 10 to 20 minutes. In a like period much of the whey is removed and the curd is dipped into the molds. The cheese is turned freely during drainage. No pressure is applied, and the cheese is removed from the molds after 4 hours of draining.

It is possible to salt these cheeses successfully by submerging in the brine for 18 hours. It is also possible to place these cheeses in brine soon after the draining period, or 12 to 36 hours after the close of the pressing period.

These cheeses cure well at 54° and 60° F. and a relative humidity of 85. However, it is also possible to cure them by placing in a 40° F. room with a humidity below 90. These cheeses are mild in flavor, but in the main resembled the cheese made by the first-described process.

No. 2

This method gives the best results with very fresh sweet raw milk. The milk is treated as for method 1, except that no starter is used. The amount of rennet is reduced to 3 ounces per 1000 pounds of milk and the setting time ranges from 60 to

90 minutes at 84° F. The curd after cutting was rapidly heated to 95° to 108° F. and then dipped into the molds. The cheese is pressed for 4 hours with a pressure of 5 pounds or less.

Salting, curing, and handling procedures are like those used for cheeses made by method 1.

No. 3

Milk similar to that used in methods 1 and 2 is used. The acid before setting is allowed to increase from 0.02% to 0.04%. One-half to 1% of commercial starter is added. The milk is set for 30 minutes at 86° F. After cutting the temperature is raised to 96° to 100° F. The curd is dipped rapidly. A pressure of 10 pounds is applied for 6 to 8 hours.

It is possible to salt these cheeses in brine or by rubbing with salt. It is desirable to start them at a curing temperature ranging from 63° to 68° F.

Italian Type Cheese

In the manufacture of Italian type cheese clean wholesome and sweet milk is used to which is added about 2.5% of starter. The milk is heated to a temperature of 85° F. and held at that temperature until the acidity is .20% to .22%. Rennet is then added at the rate of 2¼ ounces per 1000 lb. of milk and coagulated about 25 minutes. The cutting time is determined as in the making of cheddar cheese. The curd is cut with horizontal and vertical knives.

The curd is cooked to a temperature of 110 for about an hour being heated slowly at first taking between 30 to 40 minutes to reach the cooking temperature. The acidity of the whey is about 0.3 when the curd is drained. One and one-half lb. of salt is added per 1000 lb. of milk. After salting the curd is placed into hoops; in order that the cheese will have smooth sides it is best to use cloth in the hoop.

After pressing for 24 hours the cheese is placed on the shelf and dry salted after three days and again at the end of seven days. The cheese surfaces are rubbed with oil when the cheeses become dry. It is preferable in making this type of cheese to standardize the milk to a fat content ranging from 2.5% to 3.0%.

This cheese may be sold under a variety of names but it is most commonly referred to as Romano type cheese.

Cheddar Cheese—Wine Blend

For making this blend aged cheddar cheese is mixed with 20% butter. Three per cent disodium phosphate is added and the mixture is heated while being agitated to 145° F. At this point 4 ounces of Port wine are added for each five pounds of mixture. The mixture can be poured directly into the final package.

Limburger Cheese—Kümmel Blend

To prepare this blend 40% of Limburger cheese is heated in a mixing kettle with 60% of medium strong American cheese. When the mixture reaches a temperature of 145° Kümmel is added at the rate of 2 ounces per five pounds of mixture.

Preserving Process Cheese

Process cheese can be preserved in most cases if held at 85–90° C. for 15 minutes. Cheese made with mixtures of skim milk cheese which has not been ripened must be heated to 115° C. to prevent deterioration. These facts prove that preservatives are unnecessary.

Cheap Lemon Cheese

Wheat Flour	6	lb.
Maize Flour	6	lb.
Water	2¾	gal.

Mix well up and let stand overnight. Next day put in a steam pan:

Cold Water	3	gal.
White Sugar	60	lb.
Glucose	12	lb.

Boil up to 245° F., shut off steam and add flour and water well stirred up, and add 1 gallon of lemon juice and 6 well-whipped eggs, and 4 lb. of margarine. Stir well and bring to the boil, then add yellow color to taste, simmer gently for 15 minutes. Pass through a fine hair sieve, and add 2½ oz. of essence of lemon. Stir well in and fill.

Cheap Lemon Curd

Water	4	qt.
Cornflour	1¼	lb.
Flour	1	lb.
Rice Flour	2	oz.
Lump Sugar	10	lb.
Unsalted Margarine	2	lb.
Eggs	6	
Leaf Gelatin	¼	lb.
Glucose	6	lb.

Butter Essence	1	oz.
Egg Yellow Powder	⅛	oz.
Lemon Oil	2	oz.
Tartaric Acid	2	oz.

Soak the gelatin in cold water for 1 hour. Boil the egg color in 1 gill water. Dissolve the tartaric acid in 1 gill water. Mix the sifted flour, cornflour and rice flour in 3¾ quarts of water, and pass this mixture through a hair sieve into a copper bowl. Add the sugar, margarine and eggs to this, and beat up gently until boiling, stirring it well to prevent it from burning. After boiling for a few minutes add the gelatin, which should have been drained free from surplus water. Mix this gelatin well in and continue the boiling. Then add the glucose and bring again to the boil. Now the butter essence is mixed in, then the prepared egg yellow color and lemon oil. When all these ingredients are well amalgamated into the batch, take it from the fire and add the tartaric acid solution. Stir this well in and leave the mixing to cool (slightly stirring it occasionally) before transferring it to sterile jars. This mixing makes about 30 lb. of lemon curd. Care should be taken to follow the method as set out here and to stir well from the bottom to prevent burning if you have no steam boiler. Watch that it does not flow over the top of the bowl when the gelatin and glucose are added. Total time of boiling not to exceed 15 minutes.

Honey Whey

To 3 gallons of skim milk at a temperature of 86° to 90° F. add about 6 c.c. of liquid rennet extract. The extract should be diluted with about one-quarter pint of cold water and stirred into the milk. Allow the milk to stand until a firm curd develops (about 30 minutes). Cut or break the curd into pieces about 1 inch in size. Heat the curd to 145° F. by placing the containing vessel in hot water. Stir gently several times during the heating and hold until the curd shrinks and the clear whey is obtained. You should obtain approximately 2.5 gallons of whey. Strain the whey through a fine mesh cloth and remove small curd particles. Boil the whey to one-third its volume, add 9 pounds of cane sugar and continue boiling until a thick syrup is obtained. Soak 1 ounce of gelatin in 1 pint of cold water for 10 minutes and dissolve by heating to 140° F. Stir the gelatin into the mixture, cool and serve.

Devonshire Cream

According to reliable information Devonshire cream should contain clots, have a sweet flavor, and also a slightly scorched flavor.

Devonshire cream is made from rich milk, containing large fat globules, that is set in a cooler for a period of 12 hours. The pans used should be about 18 inches in diameter and 6 to 8 inches deep. After the setting period the milk is slowly heated to 180° to 185° F. The temperature is raised at the rate of about 2 degrees per minute. When the thick brownish clots have formed they are skimmed off and stored.

Whipped Butter

The process consists in softening the butter to a temperature of about 80° or 90° F. (warmed to the point where it has a consistency of thick gravy but shows no indication of oiling off). It is then placed in the mixing bowl of a motor driven whipper and whipped to about twice its volume.

Whipped Cream Substitute

Formula No. 1

Five hundred parts of skimmilk are boiled and then 20 parts of flour mixed with 20 parts of water are added. The mixture is stirred and refrigerated so as to cool gradually to 40° F. When ready to use add 25 parts of sugar and vanilla. Wheat or corn flour can be used. Syrup may be substituted for sugar using 40 parts. This preparation made in small or large amounts can be whipped and used as a dressing or substitute for whipped cream when whipped thoroughly.

No. 2

To produce a 32% fat synthetic whipping cream, use 1 lb. 10 oz. of emulsifying type shortening, 2 lb. 15 oz. water, 8 oz. dry milk solids and not over 1½% fat.

To produce a half and half cream made from half uncultured butter and half emulsifying type shortening, use 1 lb. 14 oz. uncultured butter, 1 lb. 10 oz. emulsifying type shortening, 1 lb. dry milk solids not over 1½% fat, 5 lb. 9 oz. fresh water.

Synthetic "Cream" for Confectionery

German Patent 670,549

"Cream" for use in making confectionery of various kinds can be made without consuming much actual cream. The preparations are based on train oils, preferably whale oil, which are moderately hydrogenated (hardened) and then emulsified in water. The emulsion may be blended with a smaller quantity of milk or buttermilk, and it is well to add also a small proportion of glycerin.

As an example, a whale oil is used which has been hydrogenated until its melting point is about 30° C. (86° F.) A blend is made from 10 lb. of this hardened fat, 5 lb. of buttermilk, 1.5 lb. of sugar and 12 oz. of glycerin. The resulting emulsion is stirred thoroughly while passing in air, to form a creamy product.

Margarine

Formula No. 1

U. S. Patent 2,173,203

1. Glycerol Monostearate	85 lb.
2. Coconut Oil (76° F. Titer)	800 lb.
3. Cotton Seed Oil, Winterized	125 lb.
4. Cultured Milk	50–55 gal.

Melt *1*, *2* and *3* and mix: churn with milk, temper, work and salt.

No. 2

U. S. Patent 2,089,470

Soya Bean Lecithin (60–65%)	100 lb.
Glyceryl Distearate	100 lb.
Melt together and mix in	
Water, Hot	100 lb.
Add and mix in	
Water, Warm	500 lb.

One lb. of above is added to 100 lb. plastic margarine.

No. 3

U. S. Patent 2,156,036

Sodium Alginate	0.15 lb.
Cottonseed Oil	80.00 lb.
Buttermilk	16.35 lb.
Salt	3.00 lb.
Sodium Benzoate	0.50 lb.

The cottonseed oil and buttermilk are churned together at a temperature of about 90° F. and the mixture then sprayed into a vat containing ice water. The floating mixture of oil and buttermilk is picked up and transferred to a worker table on which the excess water is reduced to about 12%. In the subsequent blending action, about 3 lb. of water in which the sodium alginate and sodium benzoate have been dissolved is added, while the salt is added in dry form.

Dairy Product and Stabilizer

U. S. Patent 2,211,209

Select Irish Moss (Pulverized)	20 lb.
Ordinary Irish Moss (Pulverized)	20 lb.
Glyceryl Mono Stearate	9 lb.
Tri Sodium Phosphate	8 oz.

The process of making the stabilizer is as follows:

The two grades of Irish moss, the glyceryl mono stearate, and the trisodium phosphate with the addition of 10 times their weight of water are heated in a mixing kettle. Preferably, the heating is done by direct steam injection which adds to the moisture content and also serves as an agitator to insure complete admixture of the ingredients. The temperature is brought to the boiling point and held at that degree for approximately 30 minutes during which time the steam circulates through the batch, the odor of the Irish moss being carried off in the escaping steam.

The batch is then pumped to an atmospheric double drum drier or its equivalent, and all but approximately 1% to 6% of its moisture content is removed. Where a drier of the type described is employed, the moisture is, of course, removed by the heated rolls. The material comes off the drier in flake form, and it is then pulverized which makes it ready to be incorporated in the dairy powder from which the chocolate milk and other dairy products are made.

Chocolate Milk Powder

Powdered Stabilizer (Made as above described)	100 lb.
Powdered Sugar	200 lb.
Cocoa Powder	561 lb.
Salt	18½ lb.
Vanillin	2 lb.

These ingredients are thoroughly mixed in any suitable powder mixer.

This thoroughly mixed powdered product is then ready for sale to the trade and when added to milk in the proper proportions, produces a stable chocolate milk beverage.

Mayonnaise

Formula No. 1

Egg Yolk (Fresh)	12 lb.
Sugar	2½ lb.
Mustard Flour	1 lb.
Salt	1 lb. 7 oz.
Onion Juice (Fresh)	2 oz.

Paprika	¾	oz.
Pepper (White)	¾	oz.
Oil (Salad)	13	gal.
Vinegar (100 grain, White)	4	qt.
Water	2	qt.

For this mayonnaise, always use fresh egg yolks. If you cannot purchase fresh yolks, then break your own fresh eggs and separate the yolks.

Mustard flour is available at most spice houses, and is made especially for mayonnaise.

Onion juice, in this formula, is pressed from freshly ground onions.

Oil is purified corn oil. Other salad oils may be used if desired.

The yolks are thrown into the beater bowl. Set beater at high speed. Beat the yolks until they are well broken up which requires about a minute.

Next, add sugar, mustard flour, salt, paprika and pepper, and beat until creamed. This will require from 2 to 5 minutes, depending on the percent of egg white that adheres to the yolks. The more whites, the longer the time required and also the less desirable.

Now start the oil slowly at first, and then add at the rate of 1 gal. per minute, until 9 gal. have been added.

The beater is then run on slow speed while 1 qt. of vinegar and 1 qt. of water are added and thoroughly mixed in.

Now run beater on high speed and slowly add remainder of oil at the rate of 1 gal. every 2 minutes. Shift beater to slow speed, and then add the remainder of the vinegar and water.

Shut off beater. Scrape down sides of bowl. At slow speed, mix entire batch for 2 minutes longer. Long beating of the entire mix tends to make the mayonnaise thinner.

No. 2
(Modified)

Salad Oil	20	lb.
Egg Yolk	2	lb.
100-Grade Pectin (Citrus)	1½	oz.
Sugar	4¾	oz.
Salt	4¾	oz.
Mustard	2½	oz.
Concentrated Lemon Juice	3	oz.
Water	14	oz.
Vinegar	20	oz.

Salad Dressing
U. S. Patent 2,170,147

In this process the milk and/or the cream is homogenized, and placed into a stainless steel steam-jacketed kettle agitating it slowly and constantly. Before placing the starch into the milk, a pound of dry gelatin or locust bean gum, or ¾ lb. powdered tragacanth, is added. The gum forms a protective colloid for the lacteal fluid globules, so as to prevent curdling of the milk proteins, or coagulation of milk albumen when heated to 185° F. as subsequently required by the process.

To 100 gallons of milk the aforesaid amount of gum or gelatin is added and uniformly dispersed, then 240 lb. of sugar, and 68 lb. of starch are added, and after several minutes of agitation, the steam is turned on and the contents cooked at a temperature of 185° F. for about 5 minutes, when a sufficient amount of edible acetic acid is added to the mixture so that the quantity is equal to 2.2% computed on the moisture content of the milk. Both acid and salt are added when the starch paste is cooled to below 140° F. Then after cooling to about 90° F. the paste mixture is drawn off into a stainless steel blender with agitator, where it is mixed with a mayonnaise base previously prepared from eggs or gum, and oil, and spices. The ideal oil content of the finished dressing is about 35% of the weight of the total composition.

Salad Cream

Whole Egg	100	lb.
Pale Malt Vinegar (24 grain)	14	gal.
Tarragon Vinegar	7	gal.
Olive Oil	14	pt.
Unsweetened Condensed Milk	1¾	gal.
Sugar	14	lb.
Mustard	12	lb.
Salt	5	lb.

Raise the vinegar, sugar and salt to 180° F. in pan and pass through a sieve. Mix the oil and mustard. Beat the eggs for half an hour in a warm beater. Add the oil and mustard. Then add the sugar, vinegar and salt, and finally the tarragon vinegar. Heat gently to 175° F. and continue beating for about an hour. Add the condensed milk and pass through a homogenizer. Afterwards fill.

Chop Suey

Chop suey for sale in tins or artificial casings may be made by the following formula. Fat beef trimmings should be used, free of sinew. The better the beef, the better the chop suey.

Grind 100 lb. of fat beef trimmings through the ½-in. plate. Place the ground meat in a jacketed kettle and add 3 qt. of boiling water with 2 lb. of salt and 4 oz. paprika. Braise in the kettle, stirring the product with a large paddle or agitator until half done.

Next add the following seasoning ingredients:

Celery Seed	4 oz.
Cardamon	½ oz.
Cayenne	¼ oz.
Ground Anise Seed	¼ oz.

Continue cooking until the chop suey is about three-quarters done and then add 8 lb. of onions, chopped in the silent cutter to about the size of a dime. Water chestnuts and bamboo sprouts may be eliminated and wax parsnips substituted. When the meat is nearly done add 2 qt. of thin soya sauce and 2 qt. thick soya sorghum sauce.

Allow the fat to come to the surface after adding the sauces. Fat will rise if agitation is discontinued for about 3 minutes. Then stir in 7 lb. of wheat flour on top of the grease with a wire stirrer. Then mix the flour and grease into the meat and cook for an additional 15 minutes. The chop suey is then cooled to 135° F. and stuffed into artificial casings or molded in pans like chili.

Veal may be used in this formula if 18 lb. of rendered beef fat or 20 lb. of ground beef suet is added to provide the necessary fat. Lean beef trimmings may also be used if supplemented with fat or suet.

The consumer dissolves 1 lb. of this concentrated chop suey in 1½ cups of boiling water. The consumer may add fresh chopped celery, bean sprouts and green pepper to the chop suey mixture. Neither peppers nor celery should be cooked more than half through.

The processor who makes the chop suey may purchase bean sprouts and Chinese noodles in small cans and merchandise them in combination with his own product. Bean sprouts are very tender and watery and are almost lost in the chop suey after they have been added to it.

Chop Suey Loaf

A chop suey loaf with an appetizing golden brown color can be made from the following ingredients:

Fresh Lean Pork Trimmings	10 lb.
Lean Veal Trimmings	10 lb.
Fresh Beef Suet	8 lb.
Chopped Onions	15 lb.
Chopped Celery	10 lb.
Rice	7 lb.

Fry the fresh beef suet until rendered and remove the cracklings. Cut fresh pork and veal trimmings into ½-in. cubes and fry with rendered fat until tender and a good brown.

Add chopped onions and celery and following seasoning ingredients with ½ lb. of gelatin dissolved in 7 lb. of water:

Salt	½ lb.
Sugar	½ lb.
Worcestershire or Soy Sauce	1 pt.

Boil or steam rice until it is fluffy and well done. When onions and celery are tender, add cooked rice to meat-vegetable mixture and stir thoroughly.

Onions and celery should not be cooked until they fall apart; they should be underdone rather than overdone. This is one of the secrets of Chinese method of cooking chop suey. If desired, other vegetables such as canned bean sprouts and water chestnuts may be added to the chop suey mixture just before it is removed from cooking kettle.

Pour mixture in cooked loaf containers and put in cooler to chill and set overnight. Remove from containers next morning and dip loaves in a light gelatin solution and stuff in artificial casings. Hold in cooler at 45° to 50° F. until shipped.

The consumer can prepare chop suey from this loaf by putting it in frying pan, adding an equal amount of water and cooking it until heated through.

Pectin Jam

When using pectin in jam manufacture it is advisable to add it to the boil prior to adding the whole of the sugar. If the addition of pectin is left to the last, pre-gelation sometimes takes place, which will give a poor set to the jam. When using dry pectin it is usual to mix the pectin with a portion of the total sugar, so as to prevent clumping when adding to the liquid boil. Although boiling pectin with acid and sugar for a short time does not seriously affect the jelly strength, too long boiling should be avoided.

To obtain a jam which will neither crystallize nor grain, the presence of a certain amount of invert sugar is necessary. Some manufacturers will use invert sugars as such, others resort to long boiling of the jam, which is not conducive to good color, while others add an invert syrup to the jam boil. This syrup is prepared by boiling a cane sugar solution with tartaric acid, after which a certain proportion of this syrup based on its degree of inversion is added in replacement of some of the cane sugar, due allowance being made for the water in the syrup.

As stated previously, maximum jellying is obtained if the sugar concentration is at 65%, the acid 0.3% in the case of tartaric acid of 0.45% if citric acid, but due allowance must be made for the natural acidity of the fruit. A practical formula for strawberry jam, both for full fruit and lower fruit standards, follows. The sugar here is shown as cane sugar but, as mentioned, the manufacturer can easily invert a proportion of this sugar and thus reduce boiling time. Allowance must then be made for the water used in the syrup and a correspondingly lesser quantity employed in the jam.

Strawberry Jams

	Full Fruit Standard		Lower Fruit Standard	
Fresh Strawberries	66	lb.	30	lb.
Water	2½	gal.	3½	gal.
Sugar	100	lb.	100	lb.
100- Grade Citrus Pectin	9	oz.	16	oz.
Tartaric Acid	4	oz.	5	oz.
or				
Citric Acid	7	oz.	8	oz.
Approximate Yield	156	lb.	150	lb.

Flavored Gelatins

British Patent 490,557

A batch is made up by combining 54 lb. glucose with 21 lb. cane sugar, 9 lb. powdered gelatin and 9.5 lb. citric acid. Orange extract may be added, or any other desired flavoring matter, and permissible food colors may be used for color effects. The procedure is to dissolve the sugar in one solution and the other ingredients in another solution, the two being combined as needed. The product can be in tablet form.

American Agar

The dried, baled sea moss as delivered by the fishermen is washed with fresh water in open vats for 24 hours to eliminate most of the ordinary marine salts. It is then transferred by crane in iron dump baskets to one of five closed digesters, in which it is digested under steam heat for 6 hours in a fairly concentrated agar liquor prepared from the nearly-spent weed of a previous batch. Following a modified countercurrent principle, the weed receives two more extractions, 8 and 12 hours, respectively, first with dilute solution and finally with water.

The hot agar liquors, so prepared, are treated with both charcoal and "Filter-Cel," and filtered at about 30 pounds pressure in an ordinary filter press. The clarified material congeals readily to a firm jelly upon return to room temperature. A variety of congealing containers has been used, but in any case the agar gel is fed with the aid of a pump to a shearing machine. The gel is received into standard ice cans in the form of short rods or similar fragments of pulp. This part of the process deviates from the Japanese method, where the jelly is extruded from a hand pump in a macaroni-like form and is not cut up. As a result the finished Japanese product occurs in long strips instead of fine flakes as in American production.

The cans filled with jelly are frozen in brine tanks in the manner common to commercial ice production. A 300-pound cake, so prepared, contains about 3 to 6 pounds of agar.

The cakes of frozen jelly are cut up finely in a rotary ice crusher, and the granular mass cautiously thawed in a stream of water leading to the washing and filtering apparatus. Care is taken to keep the temperature well below 10° C. throughout this thawing process. A rotary filter of special design handles the sludge of disintegrated pulp and rejects the considerable quantity of soluble material. The pulp still retains a quantity of water, which no doubt would retain salts; but the washing with fresh water dialyzes out most of these salts. The cutting up of the jelly, disintegration by expansion of ice crystals, and crushing of the ice blocks all combine to give an unusually fine state of division in the agar pulp. In this situation the process of dialysis is most effective, and the final product thus exceptionally free from soluble impurities.

A special dehydrator has been developed to handle the moist agar pulp. Two aluminum cylinders, 35 feet high and 3 feet in diameter, receive the wet flakes from a screw conveyor. An upward hot-air blast agitates the heavy pulp particles until they are light enough to rise over the top of cylinder No. 1. They then fall through a fabric pipe to cylinder No. 2, where the dehydration is finished. The final commercially dry agar is a fluffy mass of extremely low apparent density. The flakes roll and warp into crinkled masses which are very readily dispersed in hot water when desired for use.

For some applications even these agar flakes are too coarse, and a part of the product is ground and sifted to granular powders of varying fineness. On account of the toughness of agar, this operation is not so readily accomplished as with salts.

Quality of Product

A real filtration of viscous agar liquor is practicable only with modern pressure equipment. The American agar is thus free from sticks, sand, etc., which may escape the relatively coarse screens of the oriental factories. Equally important is the effective thawing and washing process, in which the frozen jelly is drained so effectively that it loses the seaweed taste characteristic of so much of the old-world product.

On the other hand, the best No. 1 agar from Japan has whiter appearance than the American product. This is due to the long period of sun bleaching, and the relative freedom from so much contact with iron vessels. American agar is grayish in tint. The whiteness of the oriental product is attained, however, at the expense of some chemical deterioration—probably hydrolysis if nothing else. The American product thus has a higher jellying power, and will absorb more water.

Meatless Soup Flavoring

Carrots	10 lb.
Chives	1 lb.
Celery Bulbs	5 lb.
Celery Leaves	1 lb.
Cabbage	1 lb.
Salt	50 lb.

The vegetables are minced and boiled up with 40 lb. of water for 1 hour, and pressed out. After concentrating in vacuo, filter, add salt. If required use preservative.

Soup Cubes

Celery Salt	1 lb.
Salt	67 lb.
Soup Flavoring	25 lb.
Edible Tallow	7 lb.

Instead of soup flavoring, yeast extract or meat extract can be used.

The resulting homogeneous mix is molded into dies.

Soup and Gravy Sauce

Onion Extract	4 oz.
Garlic Oil	25 mg.
Celery Oil	250 mg.
Parsley Oil	50 mg.
Dill Oil	25 mg.
Mace Oil	100 mg.
Thyme Oil	250 mg.
Paprika Oleo Resin	1 g.
Cinnamon Oil	25 mg.
Allspice Oil	100 mg.
Mono Sodium Glutamate	2 oz.
Salt	6 oz.
Caramel Color	2 oz.
Water	to make a gal.

Mix all the oils with the salt. Then add the mono sodium glutamate and mix well. Dissolve the caramel color in part of the water; then add the flavored salt to the water. Finally add the onion extract and sufficient water to make one gallon. This concentrate may then be dispensed from a regular shaker type bottle. A dash or two in soup or gravy will be sufficient.

Processing of Strawberries in Sulphur Dioxide Solution

The strawberries, as packed for shipment, shall contain not more than .20 and not less than .13% total sulphur dioxide, and not more than .15 and not less than .10% calcium bisulphite.

A solution containing 6% total sulphur dioxide, including that from the bi-sulphite, is recommended for stock purposes. In making this solution, slaked lime or calcium bi-sulphite only shall be employed.

As an example of the application of the foregoing the following is appended:

Eight pounds of hydrated lime containing not less than 95% calcium hydroxide is added to 40 gallons of water, thoroughly mixed with 25½ pounds of sulphur dioxide gas; 9 pounds of this stock solution is employed to each 40 gallon barrel of fruit. Estimating the fruit at 350 pounds per 40 gallon barrel this would give a total sulphur dioxide concentration of åpproximately 1320 parts per million of which 1000 parts would be estimated as in the form of calcium bi-sulphite. The privilege of employing calcium bi-sulphite as purchased is extended. The manufacturer may further increase the total sulphur dioxide concentration to 2000 parts per million and the proportion of sulphur dioxide as calcium bi-sulphite to 1500 parts per million as intimated above.

It is further recommended that the following precautions be employed:

Only oak barrels free of taint, well washed and sterilized should be employed. All barrels should be coopered water tight.

In filling, it is recommended that a small quantity of the stock solution shall be added first and that alternate layers of solution and berries shall be added and agitated as filling proceeds. Upon the complete filling of the barrel with berries and solution to the chimes the barrel shall be headed, coopered and rolled to further bring about a complete distribution of the solution. The bung is then removed and the barrel completely filled with water, care being taken that no overflowing is permitted which would bring about a dilution of the solution through loss. The bung is then replaced and secured water tight.

All fruit to be employed shall be sound, free of spoilage and shall be hulled and properly washed.

Preventing Discoloration of Cut Fruit
U. S. Patent 2,093,865

Spray or dip in

Thiocarbamide	0.2 g.
Water	1.0 l.

Soya Bean Nut Substitute
U. S. Patent 2,083,853

Soak beans in water to remove outer skins and to partially soften them. Heat in oil at 175–190° C. for 4–5 min. and keep at 120–135° C. in the oil for 10–15 min. The beans acquire a nut-like consistency and are free from objectionable taste.

Concentrated Emergency Ration
U. S. Patent 2,176,086

Bitter Chocolate (54% Cocoa Butter)	160
Sugar	160
Skimmed Milk, Powdered	70
Oat Flour, Raw	30
Cocoa Butter	30
Flavor With Vanilla	to suit

Vanilla Sauce Powder

Rice Starch	25 g.
Corn Starch	25 g.
Dried Egg	5 g.
Vanilla Sugar	10 g.

Cooking Salt
U. S. Patent 2,175,955

Sodium Carbonate	5 lb.
Trisodium Phosphate (Anhydrous)	7 lb.
Sodium Sulphate (Anhydrous)	10 lb.
Sodium Chloride	78 lb.

This accelerates hydrolysis, preserves natural color and lessens shrinkage.

Rhubarb Juice

Rhubarb juice may be obtained by cold pressing fresh juicy rhubarb, but to obtain a juice of the full rhubarb flavor, of good color, and of desirable consistency, the stalks should be blanched or heated before pressing. This is best accomplished in a steam blancher or exhauster. Commercially a continuous type of exhauster such as is used for canned vegetables can be used. The crushed stalks should be placed evenly in shallow corrosion-resistant trays and placed in the previously heated blancher and heated until the stalks are tender but not mushy. Too short a blanch will not tenderize the stalk, but too long a blanch will cause trouble in that the rhubarb becomes mucilaginous which will cause serious clogging of the press cloths. The right length blanch will vary with the maturity of the stalks and will have to be determined for different conditions. A minute to a minute and a half has been found to be sufficient under conditions studied.

The stalks are now pressed while hot in a rack and cloth hydraulic press, lining the ordinary apple press cloths with double muslin cloths. The inner muslin cloths should be folded loosely, while the outer cloth should be fairly tight, so that pressure applied will be carried by the outer cloth. Add any previously expressed juice to the juice obtained in press. Yields as high as 75 per cent by weight may be obtained.

This expressed juice will have a typical rhubarb flavor, will be fairly viscous and cloudy, and the color may be deep red, dependent, of course, on the variety of rhubarb used. It may be pasteurized and bottled or canned in this condition, but since it contains oxalates, it should be treated in order to remove these objectionable components. To do this, heat the juice to 165° F. in a stainless steel or aluminum steam-jacketed kettle or in a double boiler, and add slowly with constant stirring 0.3 per cent of precipitated chalk (calcium carbonate). Hold the juice at this temperature until frothing has subsided (about 10 minutes), remove any surface scum or foam, and run the juice into hot jugs or carboys, filling full, and closing immediately with paraffined corks. After cooling, store in a cool place away from the light. The juice keeps well and can be held as long as desired.

In a few weeks most of the calcium oxalate will have settled to the bottom of the jugs or carboys. As soon as this has happened, the juice can be carefully siphoned off. This may then be centrifuged to remove any calcium oxalate still in suspension, and then sweetened and pasteurized. The addition of sugar should be governed by the acidity of the juice and individual taste. One pound of sugar per gallon of juice is approximately the right amount.

Pasteurization

Pasteurization may be accomplished by heating the juice to the desired temperature in a double boiler or steam-jacketed kettle. A somewhat better product is obtained if pasteurization is conducted in a flash pasteurizer. Cans or hot bottles should be filled full with juice at 170° F., closed immediately, inverted, and after 3 minutes, cooled in water. Cans or colored bottles are preferred to plain bottles since exposure to the light accelerates the change of the red color to brown. The cans should be enamel lined of the type recommended for rhubarb juice by the can manufacturers.

Tracing Markings on Eggs

Dates, country of origin, brands and other markings on eggs are often fraudulently removed by hydrochloric acid or solutions of sodium chlorite.

To detect this fraud, place a drop of 0.001 N Picric Acid on egg for ½ min. and then wash off. If no yellow stain remains markings have been removed as above.

Froth Control in Yeast Production

In making yeast with the aid of a molasses mash as nutrient, excessive frothing can be prevented by judicious application of certain anti-frothing agents.

One example is oleic acid which is effective only in emulsified form. In this emulsion the extremely fine globules, smaller than 1 micron (0.001 millimeter) in diameter, are not effective, but in the size range from 1 to 10 microns the emulsion tends to prevent frothing. The petroleum distillate known as "solar oil" is not in itself a frothing agent, nor is the sulfonated mineral oil product called "Petrov catalyst," but when solar oil and Petrov catalyst are used together they act as an effective anti-frothing agent in molasses mashes for yeast propagation.

Systematic investigation of this combination agent should reveal ways to make it even more effective. From the best information now available it seems best to use 2 parts of Petrov catalyst to 1 part of solar oil, about 0.048 and 0.024 grams per liter.

Anti-Foam for Beet Mash Fermentation

Woolfat, Neutral	20–25 kg.
Spindle Oil, Refined	80–75 kg.

VITAMIN "A"

Requirement	Quantitative requirement of Vitamin A is indefinitely known. According to Stepp: Minimum requirement—1 mg. carotene. Optimum requirement—3 to 5 mg. carotene.

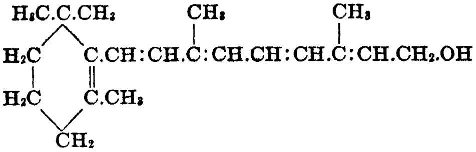
Formula Chemistry

No chemical name yet adopted.

beta-Carotene (pro-Vitamin A, with alpha-carotene, gamma carotene and crypto-xanthin. Has been isolated as naturally occurring substances but not synthesized).

STRUCTURAL FORMULA:

Vitamin A



Carotene Absorption

Carotene is poorly absorbed in the presence of (1) fever and (2) diarrhea. In such cases the fish liver oils must be used.

Rapid Absorption of Vitamin A

The speed of absorption of Vitamin A is amazing. In 3 to 6 hours after administration, the larger part of the assimilated vitamin is already stored in the liver.

Body Storage

95% of the Vitamin A in the body is stored in the liver, the remainder in the lungs and kidneys.

Liquid Petrolatum

Liquid petrolatum interferes with the absorption of Vitamin A from the intestinal tract in animals.

Liquid petrolatum should not be used as a vehicle for Vitamin A.

Diabetes

The metabolism of carotene is interfered with in diabetes.

Gastro-Intestinal Tract

The effects of deficiency of Vitamin A on the gastro-intestinal tract are rarely emphasized. The effect is serious epithelial degeneration in long continued deficiencies.

Carotene and Vitamin A in the Blood

Carotene and Vitamin A in the blood, are present only in the serum, not in the corpuscles. With increasing age the carotene content of the serum increases, while Vitamin A content decreases. (The ability of the body to convert carotene into Vitamin A may decrease with advancing years.)

Infections

Much evidence has accumulated to show that resistance to infections is reduced in children suffering from deficiencies of Vitamins A and D.

Prostatitis

Experimental results indicate that metaplasia and inflammation of the prostate, in humans, probably are due to Vitamin A deficiency.

Renal Calculi

In experimental Vitamin A deficiency, keratinization of the epithelium of the renal pelvis occurs, and frequently urinary calculi develop, of the calcium phosphate type.

C. C. Higgins showed that Vitamin A causes disintegration and solution of calculi produced experimentally.

Synthesis

Vitamin A has been synthesized.

VITAMIN "B_1"

Requirement

Excess carbohydrate in the diet increases the "B" requirement.

Minimum requirement of crystalline form of "B"—0.7 to 1.0 mg. (according to Stepp).

Salters estimates it to be 0.5 mg. daily.

Vorhaus—Williams & Waterman estimate it to be 1 mg. daily. Also they state that at least 10 mg. daily are needed to overcome a deficiency.

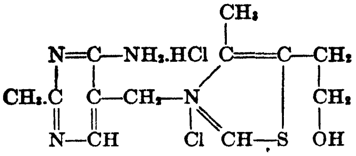
Formula Chemistry

Vitamin B has been isolated in crystalline form.

Formula—$C_{12}H_{18}O_2N_4S_1$ thiamin chloride, thiamin hydrochloride.

STRUCTURAL FORMULA:

Vitamin B_1



"B" acts like a co-enzyme substance, intervening in the chain of reactions in the metabolism of carbohydrates.

There has been no significant advance in the knowledge of the physiologic activity of Vitamin B.

Body Storage

Occurs mainly in the liver and myocardium (same concentrations) also in kidneys (½ as much as in liver), and in brain (⅕ as much as in the liver).

Clinical Uses of Crystalline Vitamin B

Crystalline Vitamin B has been used clinically in:
- Diabetes (increases carbohydrate tolerance)
- Polyneuritis
- Parathesias
- Anorexia
- Hypotonicity of gastro-intestinal tract, without apparent etiology.
- "Alcoholic" polyneuritis
- Beri-Beri (Specifically due to extreme deficiency of "B").

Clinical results indicate that Vitamin B deficiency is much more common than was formerly thought.

Gastro-Intestinal Disorders

Vitamin B_1 deficiency produces:
- Disturbances in gastro-intestinal motility.
- A cessation of hydrochloric acid production.
- Atony of the gastro-intestinal tract.
- Tendency to inflammatory processes of intestines.

"B" Low in Foods

Vitamin B is not abundant in most of our common foods. Our fresh foods contain about 1 international unit per gram.

VITAMIN "C"

Requirement

Infant. The normal "C" intake of infants during the first few weeks of life is approximately 40 to 50 mg. per day.

Requirements, in terms of crystalline form of cevitamic acid are:
- Infants—2.5 mg. daily
- Adults—10 to 20 mg. daily

Minimum dose of cevitamic acid, daily, as a preventive of Vitamin C avitaminosis is 20 to 30 mg. daily for an adult.

Body Cannot Synthesize "C"

More evidence appeared to show that infants, or women during gestation, cannot synthesize their own Vitamin C.

"C" Destruction Refrigeration

Most vegetables lose their Vitamin C rapidly if held at room temperature, after harvesting.

Refrigeration greatly reduces this rate of loss (higher temperatures accelerate processes of oxidation, lower temperatures decrease it).

Chemical Properties

Odorless.

White or whitish-yellow crystalline powder.

Formula—$C_6 H_8 O_6$

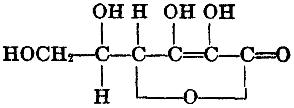
Solubility—freely soluble in water, acetone, acetic ether, etc.

Stability—Oxidizes on exposure to air and light.
Has high reducing power.
Remarkable property—oxidation of the acid is reversible.
"C" has been synthesized.
Svirbly and Szent-Györgyi found that 0.5 mg. of cevitamic acid has the potency of 1.5 cc. of lemon juice .

Structural Formula

STRUCTURAL FORMULA:
of Ascorbic Acid.

Vitamin C



Oxygen Carrier

Vitamin C, through its ability to undergo reversible oxidation probably acts as an oxygen carrier in cellular metabolism.

Storage

Vitamin C is stored in the (1) Small intestines (walls), (2) in the liver, (3) Adrenal cortex, (4) Corpus luteum, (5) anterior lobe of the pituitary gland and (6) aqueous humor and lens of the eyes.

Function in Intestinal Walls

The Vitamin C in the intestinal walls seems to have the function of detoxication and protection of the intestinal tract.

Test for "C" Content of Foods

The chemical method of testing the "C" content of foods is the method of titrating with sodium 2:6 dichlorobenzenone indophenol. This is a sensitive method. (Jour. Nutrition, 12:405, Oct. 1936).

Moderate Deficiencies

There is a wide zone of Vitamin C deficiency without the appearance of scurvy, wherein physiologic processes are subnormal and resistance to bacterial invasion is lowered.

Normal Content of Blood

Normal "C" content of blood is between 0.7 and 1.2 mg. per 100 cc. of blood. The Vitamin C intake of the diet will vary these values as much as 50%.

Cevitamic Acid Effect on the Blood

Effects of cevitamic acid on blood and blood forming organs:

1. Decreases permeability of blood vessels.
2. Improves blood coagulation.
3. Increases serum albumin by action on plasma proteins.
4. Increases number of platelets, by action on bone marrow.

Hemophilia Purpura

Case reports indicate that cevitamic acid is worthy of trial in:
Hemophilia
Purpura

Thrombin

The results of studies point out the relation between thrombin and coagulation and the fact that "C" promotes activity of thrombin when it is diminished, and inhibits it when it is normal.

Coagulation

The coagulation time is shortened after the injection of cevitamic acid in people with *Hemorrhagic diathesis*, including hemophilia.

Anemia

Vitamin deficiency in relation to blood:

1. Reduced number of blood platelets
2. Anemia (macrocytic).

Gynecologic Hemorrhages

Cevitamic acid has been used with success in gynecologic hemorrhages.

Intravenous Injections of Cevitamic Acid

The cevitamic acid preparations can be used intravenously if prepared in this manner—dissolve the desired quantity in sterile water and neutralize with ½ its quantity of sodium bicarbonate (solution has pH of about 7)—make the preparation just before it is to be used, so as to avoid loss of effectiveness.

When Oral Administration of Cevitamic Acid Is Less Effective

The oral administration of cevitamic acid is less effective in people with anacidity. The reasons are (1) the more rapid oxidation decomposition of cevitamic acid in the more alkaline intestines, and (2) to the capacity of their pathologic intestinal flora to destroy Vitamin C.

Cevitamic Acids and Bland Diets Food Allergy

Cevitamic acid can be safely used in patients with:

Gastric ulcers.
Duodenal ulcers.
Ulcerative colitis.

Where the use of citrus fruit and fibrous vegetables is prohibited—used with fine results—can also be taken by child or adult who has an allergy toward citrus fruits.

Rheumatic Fever

Experimental work offers evidence that "C" deficiency in conjunction with infection may be an important factor in rheumatic fever. Comparable lesions are found in cardiac valves, myocardium and joints.

Vitamin "C" deficiency may afford the basis for hemorrhagic manifestations seen in rheumatic fever.

Others contend that "C" deficiency is not a necessary etiological factor in rheumatic fever.

Tuberculosis

Vitamin C is indicated in Tuberculosis because:

1. "C" raises general resistance.
2. "C" plays an important part in processes of immunization.
3. Various forms of hemorrhagic diathesis often are curable by Vitamin C therapy.

The more severe the tubercular process, the greater is the Vitamin C deficiency.

A protective effect of Vitamin C against tuberculous infections has been described repeatedly.

In "C" deficiency, animals have a decreased tubercular resistance.

Results seem to indicate that in active tuberculosis, there is a decreased excretion of Vitamin C in the urine.

Generalized tuberculosis develops more rapidly in chronically vitamin deficient animals, than in non-scorbutic animals, injected with tubercular bacilli.

Healthy persons need 20 to 30 mg. of Vitamin C daily, but a tubercular patient's requirement, according to the severity of the disease is 60 to 200 mg. daily.

When oral administration causes undesirable reactions, or in those with anacidity, use intravenous administration.

Start with a dosage of cevitamic acid of 200 to 300 mg. daily, for the first week, then gradually cut down the dosage to 100 mg. daily, which is approximately the average daily requirement of the tubercular patient.

Human Milk

Human milk furnishes 4–7 mg. cevitamic acid per 100 cc., which is 5 times as much as is found in an equal quantity of ordinary cow's milk, and is 1-10th as much as is contained in lemon juice.

Vitamin C content of human milk varies from 0.012 mg. (on poor diet) to 0.108 mg. per cc. (on adequate diet). On an adequate diet the average was about 0.080 mg. of cevitamic acid per cc.

The "C" content of human milk depends on the quantity of Vitamin C in the maternal diet.

Cow's Milk	Vitamin C in cow's milk is highest in summer, when the cows are on fresh green pasturage. Cow's milk is not a potent source of C and cannot be depended on as the sole source of Vitamin C.
Vitamin C Destruction in Milk	Vitamin C in milk is destroyed by: 1. Standing, exposure to light, air, and heat. 2. Usual home boiling of milk. 3. Contact with copper utensils (copper catalyzes oxidation destruction).
Amount of Milk to Meet the Body's Requirement	For optional protection from "C" deficiency, these quantities of milk are needed *daily:* (approximate estimates) Adult (60 kgm. weight) ....1 liter Pre-school child ....4 liters Nursing infant ....2 liters
Immunity Diphtherial Toxins	Vitamin C may bear a relationship to immunological processes, since guinea pigs well fortified with "C" were able to resist the effects of diphtheria toxins, and in vitro, this toxin was inactivated by cevitamic acid.
Intercellular Material	The fundamental importance of Vitamin C is in the formation of intercellular material (in all structures).
Infantile Scurvy	Cevitamic acid is a valuable remedial agent in infantile scurvy. Dosage of cevitamic acid, in case reports of infantile scurvy (Barlow's disease), ranged from 20 to 60 mg. daily, dissolved in the food and ingested orally.
Diabetic Glycosuria	A diet of high Vitamin C foods (which are also low in carbohydrate content), or cevitamic acid, has been shown to reduce the glycosuria of diabetes.
"C" Deficiency and Convalescence	Vitamin C avitaminosis, in cases of low general resistance influences the time of recovery from various diseases, by tending to delay this time.
Urinary Excretion of Cevitamic Acid	A normal individual excretes between 15 and 28 mg. per 24 hours, when on an average normal diet. An organism *oversupplied* with Vitamin C excretes excess in the urine, the first day. If a person has a *Vitamin C deficiency,* the system will utilize much of the ingested vitamin, and but small quantities will appear in the urine.
In Pregnancy	In *pregnancy,* the urinary excretion is diminished due to the increased demands. In patients with high temperatures, there is great "C" excretion especially at the onset.
Cevitamic Acid Urinary Excretion in Relation to Urinary pH	Comparable amounts of Vitamin C given orally such as orange juice and cevitamic acid resulted in similar urinary excretion curves. Cevitamic acid administered intravenously, was excreted more rapidly and more completely than when given orally. Urinary output is almost twice greater than when given orally. Heretofore unexplainable variations in the urinary cevitamic output, under experimental and clinical tests are now partially explained. Alterations in the urinary pH have a definite effect on the Vitamin C content of the urine. The amount of "C" found is consistently less when the reaction is in the alkaline range. When urine is markedly acid, the "C" content is higher.
Tolerance Test for "C" Deficiency	A measured amount of "C" is given a person and its excretion in the urine quantitatively estimated. A person whose system is well supplied with Vitamin C will

excrete a large part of the ingested vitamin in the urine, where it is measured. This test, when fully developed, holds promise of being the best for clinical purposes.

Technique of making quantitative determinations of cevitamic acid in the urine—see current medical section of Amer. Med. Ass'n. Jour., 107:394, Aug. 1, 1936.

VITAMIN "D"

Rat Tests

Vitamin D values (potencies) for humans are determined by tests on rats rather than on chickens, as the reaction of humans parallels that of rats.

Minimum Vitamin D Intake

Approximately 135 U.S.P. units of "D" daily, will prevent rickets, but does not permit best growth, nor best calcium and phosphorus retentions.

Best Vitamin D Intake

400 U.S.P. units are adequate for calcium retention and for good growth in infants.

Pro-Vitamin D

Ergosterol, and recently cholesterol, have been shown to possess pro-Vitamin D potency.

Calciferol is the Vitamin D_2. The pro-Vitamin D_3, 7 hydroxy-cholesterol when activated is Vitamin D_3. Both are identified, but not synthesized.

Several Forms of Vitamin D

Vitamin D may exist in any one of several forms.

The weight of evidence supports the conclusion that all forms of Vitamin D (of animal or plant origin), including irradiated milks, are of equal efficacy for humans.

Regular Use of Vitamin D Product

Adults, as well as children, are benefited by supplementing the regular diet with extra Vitamin D.

Optimum (or even adequate) Vitamin D requirement cannot be met by any commonly used food.

Symptoms of Overdosage

Vitamin D is the only vitamin in which overdosage is known to produce toxic effects.

The investigator, Bills, lists these symptoms which arise from overdosage:

1. Nausea
2. Vomiting
3. Diarrhea
4. Frequent urination
5. Headaches
6. Tenderness of teeth and gums
7. Pains in muscles and joints
8. Muscular weakness
9. Hazy memory

Grades of Vitamin D Milks

The Vitamin D potencies of grades of "D" milks:

Ordinary irradiated milk ....135 U.S.P. units per quart.
Fortified Vitamin D milk ....400 U.S.P. units per quart.
Metabolized Vitamin D milk..430 U.S.P. units per quart.

Non-Irradiated Milk

Natural, non-irradiated cow's milk has practically no Vitamin D content during the winter. In the summer when the cow is exposed to a lot of sunlight, the "D" content of her milk rises but still is low. Entirely inadequate to supply the Vitamin D needs of the system.

Vitamin D Milk in Premature Infants

Vitamin D milk, when used in routine feeding as the sole rachitic substance has been shown to be inadequate for the complete protection of the premature infant against rickets.

Yeast Milk vs. Irradiated Milk

Taking equal unitage strength, irradiated milk is nearly 10 times as effective as yeast milk, in the prevention of rickets.

Cream

Practically all of the anti-rachitic potency of irradiated milk resides in the cream.

Calcium Retention in Pregnancy

Recent studies emphasize the importance of "D" for adequate calcium retention in pregnancy, particularly in our larger cities and industrialized sections, where the usual effectiveness of solar irradiation is diminished.

Growth

"D" is an important factor in growth to the extent that it aids in absorption, assimilation, retention and utilization of calcium.

Recent work indicates that rickets prevention can no longer be considered the only criterion of adequacy of Vitamin D intake.

Linear Growth

The quantity of Vitamin D needed for best growth is substantially more than is needed solely to prevent rickets.

It seems logical to assume that Vitamin D is the chief factor affecting the rate of linear growth, for growth in length depends primarily on skeletal growth. "D" increases the amount of calcium available for formation of new bone.

Infant Growth

Infants given 340 to 400 U.S.P. units of Vitamin D daily grow at a rate definitely more rapid than those of recent standards.

Those taking 60 to 135 U.S.P. units of "D" grow at the same rate as indicated in recent standards. Exposure to sunlight increased the rate of growth of this latter group.

Chronic Arthritis

Of 20 patients with chronic arthritis, treated with massive doses of Vitamin D, 12 (60%) were benefited. Daily dosage was 150,000 U.S.P. units, and more (reported by Vrtiak and Lang). This agrees with the findings of Dreyer and Reed, who treated 67 patients suffering from arthritis, of various types. Improvement was obtained in 44 cases (65%).

Psoriasis

Case reports on 3 patients with psoriasis, who were given haliver oil with viosterol. The skin cleared up in about 60 days. Dosage—2 capsules (3 minims each), daily, for 2 months.

Hyper-Irritability of Gastro-Intestinal Tract

The hyper-irritability of gastro-intestinal tract may be due to calcium and Vitamin D deficiencies. It has been established that a large number of patients suffering from gastro-intestinal disorders are not victims of organic lesions. Laboratory experiments with excised muscles and nerves show that increased irritability may be caused by disturbance in ratio of calcium to sodium and potassium in the perfusing fluid (Vitamin D deficiency causes calcium imbalance).

Capillary Resistance

Recent work has shown that Vitamin D promotes capillary resistance. It may be more important than Vitamin C in maintaining capillary resistance.

Hay Fever

Vitamin D has been used in massive doses in hay fever, with beneficial results. Since about 1930, beneficial results have been reported from the use of cod liver oil and viosterol, in allergic conditions. The relief was seemingly due to a relation to the potassium-calcium ratio, which became lower and less fluctuating under Vitamin D therapy.

Skin Absorption

Ointments containing cholesterol, after irradiation, contain Vitamin D, which is absorbed through the skin and induces a measure of anti-rachitic activity (by no means adequate).

Dworzak found that in women who showed signs of having had rickets, the onset of menstruation came later, than in women free from signs of rickets. Women whose history revealed the severest cases of rickets, showed the greatest delay in onset of sexual functions.

Blood

"D" helps promote blood clotting in cases of bleeding tendencies, due to controlling calcium metabolism. Calcium important in processes of blood clotting.

Resistance to Infections

Much evidence has accumulated to show that resistance to infections is reduced in children suffering from deficiencies of Vitamins A or D (confirms previous conclusions).

Infantile Rickets

Vitamin D prevents rickets, a well known fact.

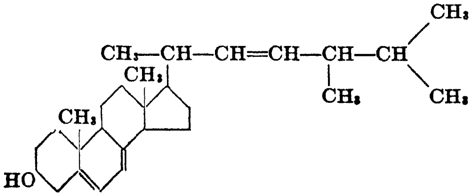
Infant's liver will store Vitamin D if there have been adequate amounts in the maternal diet. This storage affords the infant protection from rickets.

Rickets in very young infants is due to:

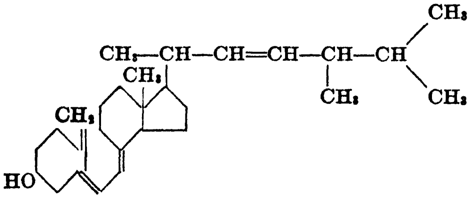
1. Too frequent pregnancies of the mother.
2. Prolonged lactation (without adequate "D" intake).
3. Maternal dietary deficiencies (didn't provide a storage in the infant's liver during the fetal state).
4. Poor health in mother during pregnancy.

Use Vitamin D preparation in prematurely born infants to protect from rickets.

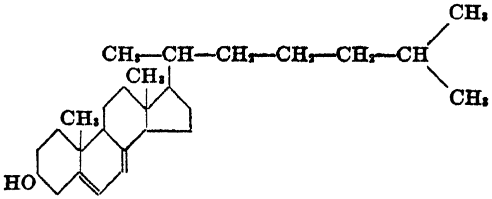
Vitamin D values in natural, non-irradiated milk, from different breeds of cows, vary from 3.1 (winter) to 43.8 (mid-summer) U.S.P. units per quart. At least 135 U.S.P. units are needed daily to prevent rickets.



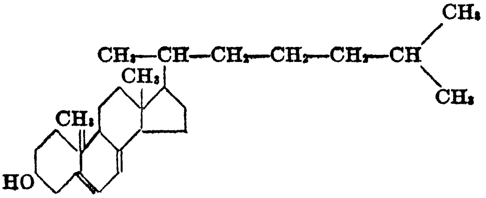
Ergosterol pro-vitamin D_2



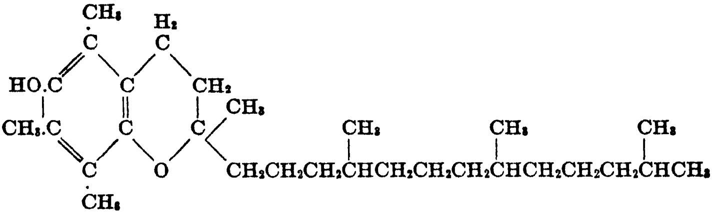
Calciferol vitamin D_2



7-dehydro-cholesterol pro-vitamin D_3



Activated 7-dehydro-cholesterol vitamin D_3



Vitamin E (α-Tocopherol)

VITAMIN "E"

Vitamin E has recently been synthesized and consists of alpha-, beta-, and gamma-tocopherol. For several years it was believed that Vitamin E was concerned specifically with reproduction. A definite relationship between an adequate intake of Vitamin E and the normality of the cross-striated musculature of the body has now been established. Characteristic muscular atrophy occurs in widely divergent animal species when Vitamin E is withdrawn from their diets. Restoration occurs following the intramuscular injection of synthetic alpha-tocopherol (Vitamin E). Synthetic alpha-tocopherol has a beneficial effect on occasional persons with amylotrophic lateral sclerosis. The injection of 500 milligrams of alpha-tocopherol in sterile oil is effective, at least temporarily, in relieving neuro-muscular symptoms, roaring sensations in the ears, anorexia, and insomnia of selected persons with malnutrition but without clinical evidence of pellegra, beriberi, or riboflavin deficiency. Clinical studies of the therapeutic effect of Vitamin E are still somewhat in an experimental stage and until further work is done the administration of this substance is warranted only under controlled conditions.

VITAMIN "G"

Requirement

Minimum—1 mg. lactoflavin (according to Stepp).
Optimum—3 to 5 mg. lactoflavin.

"G" Consists of 2 Fractions B_6

Chemically, closely related to the pigment group of flavines.
Vitamin G seems to consist of 2 fractions, viz.:

1. **One of which is a flavine.**
2. **The other is the pellagra-preventive factor.**

Vitamin B_6 of the B complex may be identical with the anti-pellagra factor of Vitamin G.

Minimum Intake Prevents Cataracts

Experimentally, only a small quantity of "G" is needed to prevent the development of cataracts, but like Vitamin D, of which only a minimum amount is required to

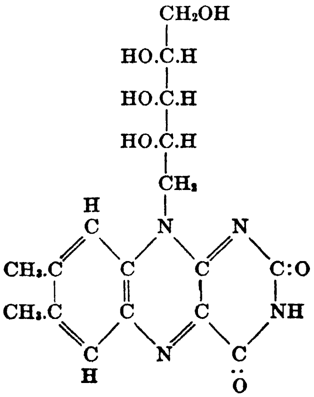
prevent rickets, much greater amounts are needed for good health.

Relation of Growth to Cataract Production There is an inverse relation between growth and appearance of cataract, in regard to Vitamin G nutrition, i.e., the greater the growth the lower the incidence of cataract in rats. This indicates that, experimentally, growth is a measure of the cataract-preventive properties of the diet.

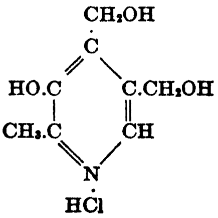
Hyperglycemia Cataract Experimentally in rats, cataract may be produced by presence in the blood of large percentages of lactose or galactose. This type of cataract is easily distinguishable from Vitamin G deficiency cataract, with the ophthalmoscope.

Vitamin G is more correctly called Vitamin B_2, or riboflavin, Vitamin B_6 is called Pyxidoxine.

Vitamin B_2 (Riboflavin)



Vitamin B_6 (Pyridoxine)



VITAMIN "B_4"

B_4 as a necessary constituent of the diet is rapidly gaining recognition.

The chick is used in the experimental studies.

B_4 deficiency produces a nutritional paralysis in chicks.

Was discovered several years ago, nothing was known of it.

B_4 is a part of the B complex (B_1, B_2 (G), B_3, B_4, B_5, B_6, etc.).

CHOLINE

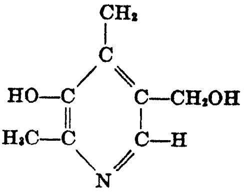
The discovery of what is reported to be a new vitamin, to which has been affixed the name of choline. Said to be essential to liver functioning, and claims are advanced that it may be an important factor in controlling those cases of non-pancreatic diabetes, which are due to abnormality of the glycogenic functions of the liver. Reported to occur in these foods—meat, egg yolk, and yeast.

Pyridoxine, Vitamin B_6

The symptoms responding favorably to vitamin B_6 are extreme nervousness, insomnia, irritability, cramping pains in the stomach, weakness, muscular rigidity, and difficulty and awkwardness in walking. This vitamin, when administered in large amounts, produced a slight reticulocytosis in persons who have macrocytic anemia associated with pellagra or pernicious anemia in relapse. Vitamin B_6 is not an anti-pernicious anemia factor or the extrinsic factor. Improvement has been noted following the intravenous administration of vitamin B_6 to patients with idiopathic epilepsy and to persons with amyotrophic lateral sclerosis. Myasthenia gravis showed pronounced improvement within 24 to 48 hours after the injection of vitamin B_6.

It has been reported that vitamin B_6 relieves rigidities and weakness in certain cases of paralysis agitans (Parkinson's syndrome), in cases of parkinsonism of at least four years' duration, eight of which were arteriosclerotic and three postencephalitic. Within a few minutes rigidity was decreased significantly and the patients were able to walk without the usual stiffness. These preliminary observations indicate that rigidity in some cases seems to be decreased and that vitamin B_6 should have more careful study. Some persons with Parkinson's syndrome may have an associated vitamin B_6 deficiency, for resemblance of the rigidity and awkwardness in the walking observed in patients suffering from either disease prompted administration of B_6 to those with Parkinson's syndrome.

Many more studies are necessary before conclusive statements can be made concerning the effect of this vitamin on persons with various diseases. It must be emphasized that a sedative effect of vitamin B_6 may be responsible, in part at least, for the rapidity with which symptoms are relieved and that the administration of this vitamin is warranted only under controlled conditions.

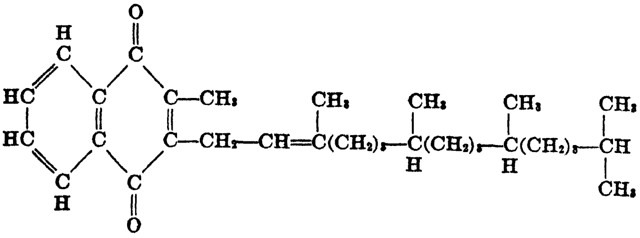


Vitamin B_6 (Pyridoxine)

Vitamin K

Vitamin K, a fat-soluble vitamin, is essential for the maintenance of a normal concentration of prothrombin in the blood. Certain hemorrhagic tendencies are due to a low plasma prothrombin resulting from a vitamin K deficiency. Absorption of this fat-soluble vitamin is dependent on the presence of bile in the intestine rather than on the adequacy of vitamin K in the diet. Lowered prothrombin concentration may occur in conditions in which extensive intestinal lesions interfere with absorption or in conditions in which bile is excluded from the intestine by obstruction of the common bile duct. The administration of vitamin K will restore the normal prothrombin level. Bile salts must be given with the orally administered vitamin in cases in which bile is not present in the intestines; otherwise the vitamin will not be absorbed. Recent work indicates that newborn infants have a vitamin K deficiency in the first few days of life and that the administration of vitamin K will prevent and cure hemorrhagic diathesis in at least many cases of "hemorrhagic disease of the newborn."

Vitamin K has been determined and synthesized as 2-methyl- (with or without 3-phytyl) -1,4-naphthoquinone.

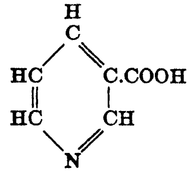


Vitamin K
2-methyl-3-phytyl-1,4-naphthoquinone
(phytyl group [lower right] may be replaced by H)

Nicotinic Acid
(Vitamin P-P)
Pellagra Preventive Factor

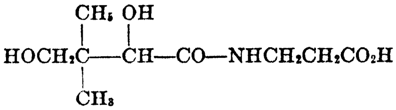
The administration of adequate amounts of nicotinic acid, or compounds acting similarly, to persons with acute or relapsed pellagra will cause fading of the fiery red lesions of the mucous membranes and striking improvement in the Vincent's infection associated with it, revive the appetite and restore normal alimentary function, sometimes with a return of gastric hydrochloric acid, increased strength and feeling of wellbeing, and restore to normal deranged mental functions, provided they result from pellagra and are not of too great chronicity. In cases of subclinical pellagra these synthetic chemical substances will relieve indigestion, diarrhea, burning of the tongue and stomach, burning and itching of the skin, dizziness, forgetfulness, confusion, insomnia and the symptoms of the initial nervous syndrome. Nicotinic acid will also cause disappearance of the abnormal ether-soluble red pigments which are present in the urine of pellagrins, increase the content of the blood and urine of both normal persons and persons who have a deficiency of nicotinic acid amide.

Nicotinic acid



Pantothenic Acid

The structure of pantothenic acid (the chick antidermatitis factor) has been determined and early in 1940 its synthesis was accomplished. No information is available regarding the possible toxicity of pantothenic acid. To normal persons at least 100 mg. may be injected intravenously without producing a reaction or causing a significant change in the blood pressure, pulse or respiration. The pantothenic acid content of the blood is increased soon after injection but returns to its previous level within 24 hours. The pantothenic acid content of the blood of persons having severe deficiency diseases, such as pellagra, beriberi and riboflavin deficiency, is from 23% to 50% lower than in normal persons and that with a rise in the pantothenic acid content there is a simultaneous increase in the riboflavin content of the blood. The patients with an abnormally low concentration of pantothenic acid in the blood have also had less than normal in the urine. These observations suggest that pantothenic acid is important in human nutrition.



$$HOCH_2\overset{\overset{\textstyle CH_3}{|}}{\underset{\underset{\textstyle CH_3}{|}}{C}}—\overset{\overset{\textstyle OH}{|}}{C}H—CO—NHCH_2CH_2CO_2H$$

Pantothenic acid

Miscellaneous Factors

Various factors under study, with growing or lessening importance.	Grass-juice factor Vitamin P (citrin) Vitamin T (?) Vitamin F (?) Gizzard factor Anti-encephalomalacia factor Vitamin H (?)

SUMMARY ON VITAMINS

Old Names	Preferred Names
Vitamins Now Synthesized	
Vitamin A	No chemical name yet adopted.*
Vitamin B_1	Thiamin chloride or thiamin hydrochloride.
Vitamin B_2	Riboflavin.
Vitamin B_6	Pyridoxine.
Vitamin C	Ascorbic acid.
Vitamin E	α–, β–, and Υ–tocopherol.*
Vitamin K	No chemical name yet adopted.*
Pellagra preventive	Nicotinic acid and nicotinic acid amide

Vitamins Not Yet Synthesized

Vitamin B_4
Vitamin B_2
Vitamin D_3
Vitamin H

---

* Naturally occurring compounds having the vitamin activity.

MEAT PRODUCTS

Mince Meat

A 100-lb. batch of good mince meat may be prepared from the following formula:

Formula No. 1

Solid Fresh Apples, Peeled and Cored	25	lb.
Good Brown Sugar	30	lb.
Seedless Raisins	20	lb.
Washed and Picked Currants	8	lb.
Lean Beef, Cooked and Free of Sinews	10	lb.
Beef Suet, Defibrinated	5	lb.
Fine Salt	¼	lb.
Mace	¼	lb.
Cinnamon	¼	lb.
Lemon Peel Juice	1¼	lb.

The beef and suet should be chopped fine and mixed with 3 oz. of fine salt and 1 pt. of brandy, also enough sweet cider to make the mass of desired consistency. In mixing add chopped apples gradually, then some cider, then sugar, raisins, currants, meat, salt, spices, suet, brandy and more cider.

The following formula for a small batch of mince meat has proved very popular:

No. 2

Beef Suet	8	lb.
Lean Trimmed Boneless Beef	16	lb.
Raisins	5	lb.
Currants	1	lb.
Citron	1	lb.
Candied Lemon Peel	1	lb.
Molasses	1	qt.
Chopped Apples	1	gal.
Cinnamon	1	teaspoon
Cloves	1	teaspoon
Allspice	1	teaspoon
Salt	⅛	cup
Hard Cider	1	gal.

Materials are handled in same manner as in first formula. In larger scale production quantities given above can be increased proportionately.

A formula for making a very desirable product is as follows:

No. 3

Choice Beef	80 lb.
Prime Beef Suet	80 lb.
Good Apples	160 lb.
Citron	40 lb.
Lemon Peel	20 lb.
Candied Orange Peel	20 lb.
Stoned and Cleaned Layer Raisins	80 lb.
Picked and Washed Currants	80 lb.
Stemmed Seedless Raisins	80 lb.

Beef should be simmered until tender, cooled off over night and then chopped. Suet should be shredded, defibrinated and chopped and apples pared, cored and chopped. Citron, lemon and orange peel should be chopped fine.

These ingredients should be thoroughly mixed and following additional materials added:

Ground Nutmegs	80	pieces
Coarsely Ground Cloves	10	oz.
Coarsely Ground Cinnamon	1¼	lb.
Coarse Mace	10	oz.
Salt	3	lb.

and Juice and Rinds of 80 Oranges and 80 Lemons.

Chop the batch again and mix it thoroughly. When mixed, cover mass with 10 gal. each of sherry and brandy mixed, allowing spirits to permeate mass thoroughly for two to four days. A wooden receptacle with a drawoff cock at the bottom is used for holding product. Draw off superfluous liquid for further use. Spread mince meat on perforated racks and drain well. Use no pressure.

Keep mince meat covered with heavy clean muslin while draining and when ready place it in packages. Resultant product should be high class, both in quality and flavor. If desired the product can be processed in glass jars. When this is done the mince meat should not be so thoroughly drained, only superfluous liquid being removed.

Take plenty of time in mixing this product and allow added liquor to soak mass thoroughly before draining.

Beef Bologna

Boneless Beef Chucks	70 lb.
Very Fat Boneless Steer Plates	30 lb.

Processing

Beef chucks should be strictly fresh, and should be cured for 24 hours with

Salt	3 lb.
Sodium Nitrate	2 oz.

Per 100 lb. of Meat.

Grind through 1-in. plate. Put in mixer and mix for 2 minutes; a little water may be added while mixing. Put in cooler at 38 to 40° F. and cure for 5 days.

Steer plates are boned and cut into pieces about 6 in. square and thoroughly mixed with

Salt	3 lb.
Sugar	8 oz.
Sodium Nitrate	2 oz.

Per 100 lb. of Meat.

Plates are then packed solid into a meat truck and moved into a cooler at 38° to 40° F., where they are held for 5 days, or until fully cured. When cured, chucks are ground through ⅛-in. plate. The boneless steer plates are likewise ground through the ⅛-in. plate.

Put ground beef chucks in the chopper, adding ice while chopping. Chop about 3 minutes, then add:

Season with

Ground White Pepper	6 oz.
Ground Nutmeg	2 oz.
Ground Coriander	2 oz.
Ground Allspice	1 oz.

Now add ground steer plates and continue chopping until very fine. Up to 25 lb. of ice can be added. Stuff into beef middles, beef rounds or corresponding sizes of artificial casings.

Smoke at 120° F. for 1 hour, or until sausage is thoroughly dry, then gradually raise to 145° F. until a good color is obtained.

Cook bologna in beef middles 45 minutes to 1 hour, and beef rounds 30 minutes at 160° F. Inside temperature of sausage should be 145° F.

Spray with cold water. Sausage should be lukewarm when removed from the shower, as it thus develops a better color. Then hang at a natural temperature for 1 hour. Hang in cooler at 50° F. to chill before packing.

Lebanon Bologna

The meat formula for Lebanon bologna is 100% lean boneless chucks. Chucks are carefully trimmed and all tendons, tallow and blood clots are removed. The meat is cured before use. Chopping and grinding operations are very similar to those used for regular types of bologna. No crushed ice is used. The following seasonings or any other bologna seasoning formula may be used:

Ground White Pepper	7 oz.
Ground Coriander	1 oz.
Ground Mustard	1 oz.
Ground Nutmeg	1 oz.
Ground Ginger	1 oz.

The product is stuffed in cap-end beef bungs and wrapped with twine to support the casing. A hanger is tied on open end of the bung to facilitate hanging on smokesticks.

In Pennsylvania plants the product is smoked in large wooden smokehouses, well-ventilated and about 25 feet high. It is held at the lowest possible temperature for from 5 days to two weeks, using hardwood sawdust only. The length of time in the smokehouse depends largely on weather conditions. Lebanon bologna is similar to summer sausage in this respect. Summer sausage smokehouses are sometimes used for its manufacture.

The smokehouses used by firms specializing in Lebanon bologna are constructed without a firepit in the bottom. The fire pit is located underground, some distance from the smokehouse, the smoke traveling underneath the earth from pit to smokehouse. This insures the slow cold smoke which is necessary for desired results.

Manufacturers of this product in and around Lebanon work very swiftly. Cured meat is put through the grinder, stuffed and placed in the smokehouse within 15 minutes.

Kosher Salami

The meat used in this product must be from kosher cattle. The following meats are used:

Boneless Beef Chucks	75 lb.
Boneless Brisket Fat	25 lb.

Seasoning and curing ingredients:

Salt	3 lb. 4 oz.
Sodium Nitrate	3 oz.
Garlic Flour	2 oz.
Ground White Pepper	5 oz.
Broken White Pepper	2 oz.
Coriander (Not Too Fine)	6 oz.
Sugar	6 oz.

Grind beef through ⅛-in. plate and the brisket fat through the 3/16-in. plate. Dissolve salt, sodium nitrate and other seasoning ingredients in 2 qt. of ice water. Mix well and pour over the ground meat. Then mix for 3 minutes.

Spread the meat mixture 8 in. thick on a table in the cooler at 38–40° F. for 48 hours. At the end of that time take to silent cutter and allow meat to remain in cutter until it revolves seven or eight times.

Stuff in beef weasands, cut 20 in. long. Stuff good and tight so there will be no air in the sausage. Hang sausage on trucks in dryroom for 24 hours at 50–55° F. Then hang in smokehouse for about 12 hours. The temperature should be at 120° F. for the first 8 hours and 155° F. for the final 4 hours.

Hang the product in dryroom at 50–55° F. but without much draft, otherwise the product will shrivel. If sausage does shrivel it should be dipped in boiling water for 2 seconds and hung back in dryroom. This sausage can be used in 10 or 15 days.

"Beer" Salami

Only cured meats should be used in making beer salami. It should be finished in the smokehouse and not cooked.

Formula No. 1	
Cured Bull Meat or Beef Chucks	50 lb.
Cured Pork Blade Meat	50 lb.
Cured Regular Pork Trimmings	50 lb.
No. 2	
Cured Beef Trimmings, Not Too Fat	100 lb.
Cured Regular Pork Trimmings	50 lb.
No. 3	
Cured Beef Trimmings, Not Too Fat	110 lb.
Cured Regular Pork Trimmings	30 lb.
S. P. Ham Fat	10 lb.

Seasoning Ingredients		
Ground Pepper	10	oz.
Mace or Nutmeg	3	oz.
Mustard Seed	1½	oz.
Garlic	¾	oz.

Grind beef through ⅛-in. plate. Place in mixer and add pork (whole) and seasoning and mix for 1 minute. Grind the mixture through the ¼- or ⅜-in. plate. After grinding, mix over again for a short time. One-half to 1 gal. of water may be added to No. 2 and No. 3 formulas. Mix together until mass is of perfect consistency.

The meat mixture should be stuffed in beef middles or in corresponding artificial casings. After stuffing, place in the cooler and hold overnight at not under 38° F. Let the sausage stand at room temperature for about 2 hours the following morning to take the chill out. Then place in the smokehouse, beginning with a temperature of 80° F. Raise the temperature gradually over 5 hours time until an inside sausage temperature of 153° F. is reached.

After finishing, cool off in cold water or shower. Then place in a steam cooker for 1 minute or dip in hot water.

This sausage should not be placed in a cooler. Use a sausage truck, covering it with heavy paper all around so that one side of the cover can be raised to remove sausage from the truck. Place where there is no draft. After drying wipe off with a clean cloth and some lard or olive oil to give a real shine.

Beer salami should be made twice a week in order to insure a product with good outside and inside appearance.

Mettwurst, Swedish

In making this sausage extremely sanitary conditions must prevail throughout and meats must be carefully selected for best results. Swedish mettwurst is smoked but need not be given a long period in the dryroom. Following formula and directions will make a nice product if handled according to instructions.

Boneless Chucks, Trimmed	60	lb.
Frozen Regular Pork Trimmings or S. P. Ham Fat	30	lb.
Beef Tripe, Cooked	10	lb.
Seasoning:		
Salt if Ham Fat is Used	3	lb.
Salt if Frozen Pork		
Beef Tripe, Cooked	10	lb.
Granulated Sugar	4	oz.
Sodium Nitrate	2	oz.
Ground White Pepper	8	oz.

Grind boneless chucks and beef tripe through 7/64-in. plate of the hasher. Weigh meats off in proper proportions and put boneless chucks and beef tripe on rocker block and rock for about 10 minutes, adding seasonings. Then add pork trimmings or ham fat and rock all together for an additional 10 minutes, making a total rocking time of about 20 minutes for 100 lb. of meat, giving a medium fine cut.

Then place meats in cooler at a temperature of 36–40° F. and spread on shelving pans or boards for 48 hours minimum or 72 hours maximum time, carefully kneading meat by hand on shelving pans to exclude air. At end of this period take meats to mixing machine, and mix for about 3 minutes. Then stuff.

This product is stuffed in beef rounds, cut 18 in. long. The casings must be carefully inspected to see that they are in good condition and fully cured before using. This product may also be stuffed in artificial casings.

Product must be packed into the stuffing machine tightly. Pressure must not be too high to avoid breakage; 80 lb. pressure is plenty for stuffing this sausage. Stuff casings to full capacity so they will be as plump as possible and puncture thoroughly to prevent air pockets. Hang on trucks, carefully spreading so product does not touch, and put in cooler at a temperature of 36–40° F. for about 24 hours. Then deliver to the smokehouse.

After sausage is carefully hung start a slow cold smoke, using hardwood sawdust only. Carry temperature of house for first 24 hours at from 70–72°., until entire surface of casing is dry.

Gradually give the product a little more heat and finish off at about 90° for a few hours, or until desired color is obtained. When sufficiently smoked, remove from smokehouse and place upon trucks where product will not be exposed to draft. When truck is full, cover with burlap and deliver to the dryroom, which is held as near 48° F. as possible.

Hang close together for the first few hours, so that product may come down gradually from smokehouse to dryroom temperature without wrinkling or shriveling. Then carefully spread in hanging sections, being careful that sausages do not touch. Hang burlap around product in sections in a curtain form to prevent too much air circulation or draft.

The product made on this formula may be shipped strictly fresh within 24 hours after delivering to the dryroom.

Mettwurst Beef

Boneless Chucks, Trimmed	60 lb.
Frozen Regular Pork Trimmings or S. P. Ham Fat	30 lb.
Beef Tripe, Cooked	10 lb.
Seasoning and curing ingredients:	
Salt (When Ham Fat is Used)	3 lb. 10 oz.
Salt (When Pork Trimmings Are Used)	4 lb.
Sugar	4 oz.
Sodium Nitrate	2 oz.
Ground White Pepper	8 oz.

Grind boneless chucks and beef tripe through 7/64-in. plate of hasher. Weigh meats in proper proportions and put boneless chucks and beef tripe on rocker block and rock for about 10 minutes, adding seasoning. Then add pork trimmings or ham fat, as the case may be, and rock all together for from 5 to 10 minutes, making a medium fine cut.

Put meats in cooler at a temperature of 36–40° F. and spread on shelving pans or boards for 48 hours minimum or 72 hours maximum. Carefully knead meat on pans by hand to exclude air. At end of 48 to 72 hours remove meat from pans to mixing machine and mix for about 3 minutes. Then deliver to stuffing machine.

This product is stuffed in beef rounds, cut 18 in. long, or in similar manufactured casings. Beef casings should be inspected carefully to see that they are in good condition and fully cured before using.

Product must be stuffed tightly into stuffing machine, but do not use too much air pressure or there will be breakage. Eighty pounds on stuffing machine is generally sufficient for this type of sausage. Stuff casings to full capacity, securing as plump a product as possible. Puncture casings thoroughly to prevent air pockets between casings and meat.

After stuffing hang on trucks, being careful to spread sausage so that they do not touch, and put in cooler at a temperature of 36–40° F. for about 24 hours. The product is now ready for the smokehouse.

After the product is hung carefully, start a slow, cold smoke, using hardwood sawdust only. Carry temperature of house for first 24 hours at from 70–72° F. or until a good color is obtained and entire surface of casing is thoroughly dry.

Gradually give the product a little more heat, and finish off at about 90° F. for a few hours or until the desired color is obtained. When sufficiently smoked, remove from smokehouse and place on trucks, where product will not be exposed to draft. When truck is full, cover with burlap and place in dryroom.

Hang close together for the first few hours, so that the product may cool down gradually from smokehouse to dryroom temperature without wrinkling or shriveling. Then carefully spread in hanging sections so that product does not touch, and hang burlap around product to prevent too much air circulation or draft.

Mettwurst made by this formula is not intended to be dried, but may be shipped or sold strictly fresh within 24 hours after it has been delivered to the dryroom.

Knackwurst

Knackwurst is a variation of the frankfurt and wiener type of sausage which is popular in some localities.

Knackwurst, sometimes called knoblauch, is popular in some sections and in most communities there is at least a small demand for it. A sausage manufacturer making wieners or frankfurts should have small difficulty in producing knackwurst since many packers use the same meat formula, adding about 2 oz. of garlic for each 100 lb. of meat.

The product is stuffed into beef rounds and tied off with string about 2 in. in length, without cutting the casing at any point into single lengths. The stuffed sausage is cut only when it is necessary to make a specified weight in packing.

Knackwurst is smoked and cooked in the same manner as wieners. It requires a longer time to cook because of the size of the casing, but 10 minutes at 170° F. should be sufficient.

Liverwurst, Cooking and Smoking

Cook water should be 180° F. before sausage is put in and allowed to drop to 160–165° F., at which temperature it should be maintained. Large hog bungs or manufactured containers (5 to 7 lb. capacity) will cook in about 2½ hours. A testing thermometer may be inserted at the end of this time and should register 150° F. Size of the sausage container governs length of time product should be cooked, but above temperature is correct for a properly cooked product.

Some sausage makers chill sausage thoroughly and place it in cooler over night and smoke next morning. In this case, the sausage is usually wet or moist. Being extremely cold, it could not be smoked successfully in a cool smoke as it would take many hours to dry it and would turn out with black and dark blotches on the surface. Smoking with heat would do the same thing and cause dark rings under the skin.

Liver sausage should be chilled in running water until it is lukewarm (soft), then placed in a warm house for about one hour. It may be colored if desired before putting in the smokehouse.

Bockwurst

Good Fresh Veal	50 lb.
Fresh Regular Pork Trimmings	50 lb.

Grind veal and pork through ¼- or ⅛-in. plate to reduce size. Put veal in silent cutter and cut for 1 to 2 minutes with some ice before adding pork, enough salt to season and the following:

Ground White Pepper	6 oz.
Sugar	4 oz.
Ground Mace	1½ oz.
Ground Cloves	1 oz.
Chopped Parsley	6 oz.
Lemon Extract	1½ oz.
Onion Powder	1 oz.
Chives	6 oz.
Dry Milk	3 lb.
Raw Eggs	1 doz.

Cut materials all together for about 2 minutes, but not so long that grease comes out of pork. Some ice may be added during the process. Parsley and chives must be held out until last revolutions of cutter if they are to be distinguishable. Some processors add seasoning materials in mixer rather than in silent cutter. Another seasoning formula for bockwurst calls for:

Sugar	8 oz.
Powdered Sage	¾ oz.
White Pepper	7 oz.
Thyme	¾ oz.
Cardamon	½ oz.
Onion Powder	3 oz.
Parsley	6 oz.
Dry Milk	3 lb.

Bockwurst is stuffed in sheep casings and linked in 6-in. lengths. Store in the cooler at 32–43° F. Bockwurst is also stuffed in artificial casings to make 1-lb. consumer packages similar to pork sausage.

This product is very perishable and must be disposed of within a short time after manufacture.

Frankfurts

Relative availability and cost of different meats must, to some extent, determine what the sausage manufacturer's meat formula is to be. For an A-1 frankfurter use the best obtainable meats, paying particular attention to binding qualities.

Many packers use a 60 per cent beef and 40 per cent pork formula, while others use as high as 80 per cent beef, believing that beef holds color somewhat better than pork in frankfurters.

Some of the meats with good binding qualities are "hot" bullmeat, cold bullmeat, beef chucks and trimmings, veal trimmings, pork shoulders, lean pork trimmings and pork cheeks. Materials with poor binding qualities should be avoided or used sparingly. Necessity for adding considerable quantities of ice with some beef results in relatively high yields. In general, the longer trimmings are held before using, the poorer their binding qualities. This is particularly true of frozen meats.

Particular attention should be paid to the preparation of trimmings. Boneless bullmeat or boneless chucks should be trimmed free of gristle and blood clots. Regular pork trimmings must be reasonably lean and all gristle, pulp, etc. should be removed.

Meats may be cured in several ways. They may be put through the 1-in. plate of the grinder and then mixed with 2½ lb. of fine salt, 2 oz. granulated sugar, 2 oz. dextrose (corn sugar), 2 oz. nitrate of soda, ¼ oz. sodium nitrite for each 100 lb. of meat. Trimmings may then be held at 38° F. until cured. A straight nitrate formula may be used, if desired, with the addition of a little "second" pickle to hasten development of color.

Trimmings may also be cured by the emulsion method, in which they are chopped fine with water and curing ingredients and then held for 12 to 24 hours in shallow pans at 38° F. If sodium nitrite is used with this method the meats may be used without holding for cure.

Preparation of emulsion from hot bull meat must be given close attention. This work is usually done at the end of the day's business in the sausage room, and as many men as possible are employed to handle it. The hot bulls must be boned out rapidly, cut into small pieces, rushed through the grinding machine and then direct to the silent cutter.

If the bull meat is good dry bologna meat, it will absorb its own weight in crushed ice. Therefore, when chopping weigh off 100 lb. of ground warm bull meat, and gradually add as much crushed ice as the meats will absorb—anywhere from 75 to 100 lb. of crushed ice. Then add 2 lb. of salt and 2 oz. of nitrate of soda, but do not add seasoning, sugar or cereal during the chopping process.

Spread thinly in tubs or pans, and put in the cooler immediately to chill. Allow to remain there over night in a temperature around 34–36° F.

The following day the bull meat may be removed from the cooler as wanted at the silent cutter and chopped again, together with the other ingredients used in the standard formula, adding the necessary amount of crushed ice again. Then add seasoning during the chopping process.

If the meat is handled as here described, it will show a decidedly better and more lasting color than cold bull meat does.

Every precaution should be used to see that the freshly chopped bull meat is not piled deep in a truck, where it will heat and become gassy after the chopping process. It should be spread thin and given opportunity to chill thoroughly.

Handling of cold bull meat is somewhat different. Grind through 1-in. plate and place in mixer, using 360 lb. of ground bull meat for one mixing. Add 10 lb. salt, 2 lb. granulated sugar, and 12 oz. nitrate of soda.

Mix with meats until the cure is evenly distributed, then empty into an open tierce and pour 2 gal. of No. 2 (half strength) ham pickle over the meats in the tierce, and allow to remain in curing temperature of 36–40° F. for 5 days.

If the meat is not used at the expiration of this time, tight heads must be put in the tierce to check the cure. It is also a good idea to transfer to lower temperatures to check the cure, if there is no prospect of using promptly.

Some sausage manufacturers have been successful in curing in the casing while the sausage is held overnight before smoking. Beef trimmings are ground and then placed in silent cutter, with pork and curing ingredients and spices. Mixture is thoroughly chopped, mixed and stuffed in casings. It is held in the cooler for about 12 hours to cure before smoking.

Boneless Bullmeat	60 lb.
Pork Trimmings (95% Lean)	20 lb.
Regular Pork Trimmings	20 lb.

After the meats are cured, they are chopped in the silent cutter with the following seasoning ingredients:

Ground White Pepper	6 oz.
Ground Coriander	2 oz.
Ground Nutmeg or Mace	1 oz.
Dextrose-Cane Sugar Mixture	4–8 oz.

Meat for Frankfurters

First Grade

Formula No. 1

Boneless Beef Chucks	60 lb.
Regular Pork Trimmings	40 lb.

First Grade

No. 2

Beef Trimmings	20 lb.
Pork Trimmings	20 lb.
Boneless Beef Chucks	30 lb.
Pork Cheeks	30 lb.

Second Grade

No. 3

Cured Beef Trimmings	40 lb.
Cured Beef Cheeks	55 lb.
Cooked Beef Tripe	50 lb.
Fresh Pork Shoulder Fat	15 lb.

Second Grade

No. 4

Cured Beef Trimmings	40 lb.
Cured Beef Cheeks	50 lb.
Cooked Beef Tripe	45 lb.
Fresh Pork Shoulder Fat	15 lb.

First Grade

No. 5

Cured Regular Pork Trimmings	30 lb.
Cured Pork Cheeks	40 lb.
Cured Beef Chucks	40 lb.
Cured Beef Trimmings	40 lb.

First Grade

No. 6

Regular Pork Trimmings	60 lb.
Boned Beef	40 lb.

Second Grade

No. 7

Beef Cheeks	80 lb.
Pork Cheeks	20 lb.
Cheek Trimmings	10 lb.
Beef Tripe	10 lb.
Pork Trimmings	20 lb.
Sweet Pickle Trimmings	10 lb.

Second Grade

No. 8

Beef Trimmings	30 lb.
Pork Trimmings	30 lb.
Pork Cheeks	25 lb.
Beef Tripe	15 lb.
Pork Hearts	10 lb.

Veal Frankfurters

Fresh Veal	50 lb.
Regular Pork Trimmings	50 lb.

Chop veal the same as beef, using plenty of ice but no water, except as suggested below. The pork is ground through ⅛-in. plate.

The meat is cured with ½ oz. nitrite of soda dissolved in 1 qt. water. Nitrite and following seasonings are added to the veal during the chopping process:

Seasoning:

Sugar	8 oz.
Salt	2½ lb.
Pepper	7 oz.
Mace	2 oz.
Ground Caraway	½ oz.
Coriander	3 oz.
Ground Celery Seed	¾ oz.
Cardamon	¾ oz.

After veal has been chopped and seasoned the ground pork is added to it. Meat is then chopped together until it reaches a temperature of about 65° F.

The mixture is then stuffed in wide sheep casings and hung over night in the cooler. On removal the frankfurters are hung for an hour or two at normal temperatures and then smoked.

Griddle Franks

Sausage manufacturers have a demand for a "frankfurt for the griddle" from lunch stands and restaurants. The main difference between the formula for this product and any other frankfurt is that there must be sufficient fat to keep the sausage from sticking to the hot plate. To make such a frankfurt use about

Boneless Bullmeat	60 lb.
Pork Cheek Meat	20 lb.
Pork Trimmings (Not Too Lean)	20 lb.

Seasoning formula given previously may be used in making this product. Stuff in medium sheep casings.

The sausage manufacturer should remember these points:

Sweating of frankfurter can usually be traced to too low cooler temperatures, too short a time in the smokehouse or packing the product while still warm.

Sliming usually follows sweating, since the moist surface of the sausage provides a good field for bacterial growth. Careful handling after cooking and maintenance of sanitary conditions in sausage rooms and coolers will prevent bacterial infection of the product.

Shriveling is caused by understuffing or exposure of the stuffed product to sudden changes in temperature. Sheep casings are especially susceptible to shriveling.

Interior discoloration of the sausage is generally due to contamination of the meat, development of which may be traced to "short" or under-cured materials, heating during processing, poor sausage room conditions and low interior temperatures during cooking and smoking.

Kosher Type Frankfurters

Formula No. 1

Bull Beef	40 lb.
Veal	25 lb.
Beef Brisket Fat	35 lb.

No. 2

Bull Beef	70 lb.
Brisket Fat	30 lb.

No. 3

Beef Trimmings	75 lb.
Brisket Fat	25 lb.

Bull beef, beef trimmings and veal must be free of veins and sinew as well as fats yielding tallow. Beef fat added to product must be of a resistable character such as brisket fat. Fats yielding tallow should not be used at all in manufacture of frankfurts. Preliminary preparation of these meats is as follows:

Cure, Style No. 1—Beef and veal must be well chilled, cut in ½- and 1-lb. pieces, salted in suitable containers, using for 100 lb. of meat:

Salt	36 oz.
Sugar	6 oz.
Sodium Nitrate	3 oz.

Meat and curing materials must be well mixed before putting into containers. A temperature of 40° F. is suitable for curing meats in 5–8 days. Cure of all bologna and frankfurt meats must be perfect, as it is not possible to "smoke" a color to sausage as many believe.

Cure, Style No. 2—Beef and veal must be chilled for about 24 hours at 34° F. After chilling, about 4 lb. of crushed ice and same amount of curing materials as given in Cure No. 1 are added to each 100 lb. of meat. Mix meat, ice and curing materials well. Meat is then ready for first chopping through ⅛-in. plate.

Chopping.—This is the most important step in manufacturing. It cannot be repeated too often that chopped meat must be kept cool, and that knives and plates must be sharp to produce a "real cut" to overcome separation of meat. Proper chopping leads to success—improper chopping in the other direction. Chop the beef and veal, then put in mixer and add a little water and mix about 2 minutes.

Run meat into a container and put it in cooler at 40–42° F. for 36–48 hours. Never start to make frankfurters until convinced that meat is fully cured. Otherwise there will be trouble getting right color in the smokehouse.

If the cure and color of meat is satisfactory, chop again through fine plate, then put in silent cutter for final workout. Start silent cutter and work into the meat all crushed ice permissible. It is possible to tell in silent cutter whether or not sausagemaker is successful in handling the batch. If wall of bowl holding meat in silent cutter stays free of a fat coat and remains shiny, the sausagemaker has won and sausage will come out of the smokehouse a perfect product. If a coat of fat begins to cover bowl of silent cutter, the product will never be first rate.

Seasoning.—At the same time the ice or water is added, add the seasoning, using for 100 lb. of meat:

White Pepper	6 oz.
Paprika	1 oz.
Onion (or 1 oz. Garlic)	8 oz.
Ginger	2 oz.
Mace or Nutmeg	2 oz.
Enough salt to make a total of 44 oz. or 2¾ lb. to each 100 lb. of meat	

As 36 oz. or 2¼ lb. of salt is used when meat is put in cure, only 8 oz. should be added at this time.

While working beef and veal in silent cutter, there is time for chopping of brisket fat, using second fine plate. Brisket fats must have been chilled previously for 24 hours at 34° F. Run some crushed ice through machine with brisket fat. Add to each 65 lb. of mixed beef and veal 35 lb. of brisket fat, and chop in silent cutter until fat pieces are fine enough.

The mixture is then stuffed in sheep casings or manufactured casings. The product is then ready to go into the smokehouse.

Smokehouse must be kept very hot, for product must be cooked thoroughly there, as this is only cooking kosher frankfurters receive. If meats were properly cured in preparing, frankfurters should be done in 1 hour in smokehouse. Quick smoking insures a tender skin on franks, while slow smoking makes it tough.

Remove franks from smokehouse when done and chill in cold water from 7 to 10 minutes. This is done to prevent wrinkling. Then shower frankfurters with boiling water for 4 seconds to remove any grease on casings and for a quicker drying. Frankfurts so showered will hold up better, and will not become slimy as quickly as frankfurters taken out of cold water.

Minced Ham Loaf

Heavy hams may be used for making minced ham loaf. The packer may also use hams which because of bruises, rough skins, etc., are not used as a regular or skinned hams. Take 100 lb. of cured ham trimmings, not more than 80 per cent lean. Grind through the 3/16-in. plate and put in the mixer. Add the following seasoning:

White Pepper	5	oz.
Sugar	8	oz.
Ground Celery	1	oz.
Ground Cloves	¾	oz.
Cinnamon	½	oz.

Mix spices thoroughly and add to ground meat in mixer. Be sure seasoning is well distributed. Then mix in 5 tablespoons of maple extract dissolved in 1 pt. of cold water.

Press minced ham mixture into molds lined with parchment paper and put the lid on as tightly as possible. Cook for 3 to 3¾ hours at a temperature of 160 to 165° F. Cool and put into chill room until following day.

Then take loaves out of molds and sprinkle with granulated sugar on all sides. Care should be taken to see that the sugar is sifted on uniformly. Place in an oven at 550° F. for 6 minutes. Remove from oven and put 4 slices of pineapple in a row on the smooth surface, being sure that pineapple is thoroughly drained so that juice will not run down and spoil sugar coating. Put either red or green cherries in the center of each slice of pineapple. Sprinkle loaf again with granulated sugar and place in oven for 8 to 10 minutes until sugar browns. Then put back in cooler.

The oven should be hot when sugared loaves are put in as otherwise they will crack and come apart. However, the loaves should not be browned too much. This loaf may also be made of cured pork trimmings but should not be called a minced "ham" loaf but rather a meat or sausage loaf.

Improved Sausage

U. S. Patent 2,060,160

Addition of ¼–1% agar-agar, to the sausage mix, hinders water loss during smoking and cooking and prevents subsequent casing wrinkling.

Pork Sausage Flavors

For each 100 lb. of meat use:

Formula No. 1

Salt	2	lb.
Refined Corn Sugar	7	oz.
Nutmeg	2	oz.
Jamaica Ginger	½	oz.
Rubbed Sage	1½	oz.
White Pepper	6–7	oz.

No. 2

Salt	2	lb.
Refined Corn Sugar	6	oz.
Black Pepper	3	oz.
Jamaica Ginger	2	oz.
White Pepper	1	oz.

No. 3

Salt	2	lb.
Refined Corn Sugar	6	oz.
Mild Chili Pepper	1	oz.
Black Pepper	2	oz.
Rubbed Sage	3–4½	oz.

About ¾ oz. savory and ¼ oz. cardamon may be added to No. 1 and 2 formulas with good results. Some processors prefer to use only white pepper in pork sausage because of the darkening which results from the use of black pepper.

Pork Sausage

Pork sausage is highly perishable under the most perfect conditions. Therefore, there should be no delay in its progress from the hasher to the consumer's table. Trimmings should not be allowed stand around at sausage room temperature before hashing, but should go into the machine while fresh and cold.

Knives and plates of the hasher should be very sharp and should be thoroughly chilled before processing the meat. Dull knives and plates crush the meat and discolor it. Their action raises the temperature of the meat and thus encourages bacterial growth and spoilage.

Meat is commonly ground through the 3/16-in. plate of the hasher. Some sausage manufacturers like to put the meat through the 3/16-in. plate twice, but if this is done the meat should be rechilled between the first and second grinding.

Ground meat should be transferred quickly to the mixer, where seasonings are added and thoroughly mixed with the meat. Some operators add a little ice water at this point, although others believe that no water should be used.

Stuffing.—Bulk sausage may be packed immediately after mixing, or the sausage meat may be transferred to the stuffer. If the product is to be stuffed into narrow or medium sheep or narrow hog casings, these should be soaked in cold water and thoroughly chilled. They should not contain water when stuffed, however, since this discolors the meat.

The sausage should not be allowed to lie on the table after stuffing and linking, but should be sprayed with cold water and hung on sticks about an inch apart.

After dripping momentarily the sausage on sticks should be moved to a cooler at 34° F. to chill and dry on the surface. There should be proper circulation of air in the cooler. After packing in cartons the sausage is held in a dry cooler at a temperature of not over 36° F.

Some packers put their bulk pork sausage into 1-lb. artificial casings. Such packaged pork sausage is attractive looking and is easily handled by the retailer. The housewife can slice it into patties and fry it just as she would regular bulk sausage.

Fresh pork sausage should stop only briefly in the packer's cooler and should be placed in the meat dealer's hands as soon as possible. Only as much sausage as can be easily disposed of in the period between manufacture should be made at one time.

Sausage should be kept cold on the delivery truck. The packer should encourage the retailer to stock only as much as he can sell, and to keep it under as good conditions as possible in the retail store.

Fresh pork sausage requires fresh pork trimmings, those from the previous day's kill being the most desirable. Frozen trimmings should not be used. There are several sources of good fat and lean trimmings in the hog carcass, among which may be mentioned the loin, back fat, ham butt, shoulder and blade. Pork cheek meat should not be used.

Between 50 and 75 per cent lean meat may be used in the formula, depending on available materials, the sausage maker's custom and the preference of consumers. In general, however, there should be enough lean so that it predominates in the mixture. The gray or whitish color of a sausage containing too much fat does not appeal to the housewife, nor does she become a repeat customer for a product which fries away in the pan.

Careful selection of trimmings is necessary if the texture, appearance and taste of the meat are to be uniform and delicious. However, flavor depends to a large extent upon the seasonings used. Plain ground meat and sausage differ in the flavor which is given the latter by the use of spices, herbs and salt. These are not put in the product to camouflage it but to make it delicious and appealing.

Consumers in different localities have their flavor preferences and also their dislikes and the wise sausage maker will conform to the desires of his public. It may take some research and testing among a cross-section of that public to determine just what it does want. But once consumer preference has been determined the sausage manufacturer should stick to that seasoning formula until there are real indications that a change is desirable.

The sausage manufacturer can produce an appetizing product with any of the following seasoning formulas, varying them to fit in with preferences in his own locality.

Per 100 lb. of meat:

Formula No. 1

Flake Salt	2	lb.
Granulated Sugar	7	oz.
Nutmeg	2	oz.
Jamaica Ginger	1½	oz.
Rubbed Sage	1½	oz.
White Pepper	6–7	oz.

No. 2

Flake Salt	2	lb.
Granulated Sugar	6	oz.
Black Pepper	3	oz.
White Pepper	1	oz.
Jamaica Ginger	2	oz.

No. 3

Flake Salt	2	lb.

Granulated Sugar	6 oz.
Mild Chili Pepper	1 oz.
Black Pepper	2 oz.
Rubbed Sage	3–4½ oz.

Smoked Pork Sausage

Strictly Fresh Pork Trimmings (85% lean and 15% fat)	100 lb.
or:	
Cured Lean Pork Trimmings	60 lb.
Cured Regular Pork Trimmings	20 lb.
Cured Lean Beef	20 lb.

The latter formula is especially suitable for making a jacketless smoked pork sausage, since the lean beef is chopped slightly to act as a binder.

Local preference largely dictates seasoning to be used in this product. Some sausage manufacturers use:

White Pepper	6 oz.
Rubbed Sage	2–3 oz.

Other classes of trade prefer only salt and pepper as seasoning, while 1 oz. ground nutmeg and ½ oz. ground ginger is also used by some.

Pork is ground through 5/32- or ¼-in. plate. Place meat in mixer and add seasoning and also 3 oz. sodium nitrate, 2½ lb. of salt, 4 oz. granulated sugar and 4 oz. dextrose (corn sugar) for each 100 lb. of meat. A very small quantity of ice may be added and the whole mass should be thoroughly mixed for about 5 minutes.

The meat is stuffed in medium hog casings and linked in double links, 3½ in. in length or longer. Sausage is hung on racks and showered with cold water to remove grease and sediment from outside of casings, and is then taken to cooler and spread on trucks or in hanging sections to hang overnight at 38° F. Product is removed from cooler next morning and allowed to remain in natural temperature for about 2 hours.

Put in the smokehouse at 115 to 120° and maintain this temperature for 3 to 4 hours. The product does not require a heavy smoke. Place in storage cooler at 45 to 50° and hold for at least 3 hours until thoroughly chilled before packing. This product should be manufactured only as needed.

Jacketless Type.—This product was especially developed for summer sale, but has proved successful in all seasons. Cured pork is ground through the ⅛-in. plate. Beef should be chopped slightly for binding and is then added to the pork in the mixer. Mix with seasoning but with no additional moisture.

Stuff the mixture in 1⅛-in. artificial casings and link off in 4½-in. lengths. Smoke in a cool house for 3 hours at 130° F. and then cook at 160° for about 10 minutes. Cooking is usually done in a steam house to prevent smearing. Sausage should be placed before a fan following cooking to dry off the casing.

The product must not be ground too fine or cooked too much to prevent pork from becoming smeary and spoiling its appearance. Casings should not be removed or sausage packed until just before shipment.

Liver Sausage

Fresh Pork Cheek Meat (1 hour)	15 lb.
Pork Livers (45 minutes)	50 lb.
Sweet Pickle Ham Fat (20 minutes)	15 lb.
Pickled Pork Under Lips or Snouts (1½ hours)	20 lb.

Blood Sausage

Pork Rind	10 lb.
Pickled Ham Fat	10 lb.
Pickled Snouts	35 lb.
Pickled Lips	12 lb.
Hog Blood	20 lb.
Fresh Tripe	12 lb.
Flour	1 lb.

Cook the materials excepting the blood in separate net bags and remove when tender. Cube the ham fat. All other materials are hashed and mixed together in a truck. The ham fat, necessary spices, and the liquid blood are added and the batch is mixed. Dip the material into the casing or container (cap end beef bungs). Then cook again after stuffing.

Goose Liver Sausage

Goose liver sausage is a delicacy which is made regularly by only a few processors. In one popular formula, pork livers as well as goose livers are used. Take 5 lb. of very light-colored fresh pork livers and remove all the veins and sinews. Cut livers in slices and scald slowly so they stay soft and white.

Put blanched livers through finest plate of grinder with a little onion;

add 10 lb. of well-cooked side pork and put it twice through grinder with liver. To this mixture add 5 lb. diced goose liver and following seasoning:

Salt	75 g.
White Pepper	7½ g.
Pimiento	1¼ g.
Mace	2½ g.
Cinnamon	2½ g.
Thyme	1¼ g.

To avoid breaking up goose liver, the pork and pork liver may be mixed with seasoning and a layer of this material placed in a receptacle. A layer of diced goose liver is then spread over it and further alternate layers of ground meat and goose liver added. Mixture is then filled into hog bungs, cut off to form short sausage.

Cook sausage for 30 to 45 minutes at 170° F. When well cooked, dip in cold water and chill thoroughly. Hang up the product and allow it to dry off. Smoke on the following day to a pleasing yellow color.

Liver-Bacon Sausage

Hog Livers	40 lb.
Cured Beef Trimmings	8 lb.
Fresh Regular Pork Trimmings	52 lb.
Cured Smoked Belly Trimmings	15 lb.
Seasoning:	
Salt	2 lb. 1 oz.
White Pepper	5 oz.
Nutmeg	2 oz.
Ground Celery Seed	1½ oz.
Cardamom	¾ oz.

In addition 3 or 4 drops of lemon oil may be added by stirring it into a half pint of water and mixing with meat in chopper. Three dozen eggs may also be added. These give the product a very fine texture and also add to its flavor.

Smoked trimmings for this product are prepared by taking about 60 lb. of cured belly trimmings, spreading them on a large screen and placing them in the smokehouse. They are given a heavy smoke for about 3 hours at a temperature of 110° F. Remove from smokehouse and cool on screen. After cooling, place trimmings in chill room and hold for future use. Belly trimmings must not be hard so they should be placed in a container after they have been processed. Then they will not get dry and tough.

Grind liver, beef and fresh pork trimmings through fine plate. Be sure all meats are cold. Then put in chopper and chop as long as possible without causing meat to become warm. Remove to mixer when well chopped and add 15 lb. of smoked belly trimmings which have been ground through ¼-in. plate.

Stuff mixture in large bungs or in manufactured casings. Let the product hang in natural temperatures after stuffing for about an hour so it does not go into cook tank while extremely cold. Have water in tank at a temperature of 170° F. This temperature will drop 5 to 10° when sausage goes in. Cook from 1¾ hours to 2 hours and 10 minutes, depending on size of bung. Product must have an inside temperature of not less than 137° F.

Cool moderately and place in a cool smokehouse over night until the sausages are nice and dry. They may then be colored or left a yellow smoke color.

Old-Fashioned Bologna Sausage

This formula calls for 50% hearts and 50% pork and beef cheeks, although other trimmings may be used if economically available. Meats are cured in 62° salometer pickle, with 1 lb. of sodium nitrate added for each tierce. Meats are held in this pickle for 14 hours, removed and drained overnight before chopping in the silent cutter.

To each 100 lb. mixture add, when about half chopped,

Black Pepper	10 oz.
Ground Cloves	6 oz.
Coriander Seed	2 oz.
Saltpeter	4 oz.

After meat is mixed well and chopped very fine, stuff in beef middles 12 to 14 in. long. These, when stuffed, form the necessary rings. Smoke and then cook in water at about 160–170° F. for about 30 minutes, or until fairly hard. Hang the sausage in a cool dry place and when cold wipe well with a damp cloth, or a cloth saturated with cottonseed oil.

Under present federal inspection regulations it is necessary for the cooked sausage to reach an inside temperature of 137° because of the pork contained and because it is to be eaten without further cooking.

Ring or Big Bologna

Regular pork trimmings, beef hearts, cheek meat and any other fresh meat available may be used in making this product. Grind meats through the ⅛-in. plate with 3 oz. of sodium nitrate per 100 lb. of meat. Hold in cooler for 24 to 48 hours to cure.

Put meat in silent cutter with 10 oz. black pepper, 6 oz. allspice, 2 oz. ground ginger and 2 oz. ground coriander. Chop finely and stuff as in previous formula to make rings or in large beef casings or manufactured casings. Smoke and cook as usual. When large casings are used, a longer time will be required to cook, but the temperature of the water should not be higher than 170° F.

Sausage in Oil

Beef Cheeks	50 lb.
Beef or Pork Hearts	20 lb.
Ox Lips	10 lb.
Palate Meat	10 lb.
Pork Cheek Meat	10 lb.
Seasonings and other ingredients:	
Binder Flour	2–3 lb.
Salt (if meats are fresh)	¾ lb.
Nitrate of Soda (if meats are fresh)	3 oz.
Ground Black Pepper	1 oz.
Ginger	2 oz.
Cayenne Pepper	2 oz.

It is not essential to cure the meats; either cured or fresh meats may be used. Grind all meats and binder flour through ⅛-in. plate of hasher; then put in mixer and mix thoroughly for about 5 minutes, adding not to exceed 10 lb. of crushed ice to every 100 lb. of meat. Also add the seasoning when mixing.

After meat is thoroughly mixed, stuff in medium hog casings or sheep casings and link in 40-in. lengths. After product is stuffed, allow it to hang at natural temperature until thoroughly dried off. Then take to smokehouse and smoke either with hardwood or gas and hardwood sawdust.

Start temperature at about 150 to 160° F. for the first two hours, and, when the desired smoked color is obtained, gradually raise smokehouse temperature for the next hour or hour and a half up to 170 to 180° F. The product must be thoroughly baked in the smokehouse. When finished remove from smokehuse. Cooking in water may be omitted but allow sausage to remain at natural temperatures until thoroughly cool and dry. Do not put this smoked product in cooler temperatures.

This product is packed on a basis of 17 lb. of sausage to every can. In other words, fill the cans to full capacity with sausage, and then fill with hot oil at a temperature of 120° F. Either refined cottonseed oil or deodorized corn oil may be used.

The cans are heated for two hours in an open vat of water at 200° F. or in or above a vat of heated oil between 200 and 212° F. This satisfies the requirement for a 160° temperature in the cans. Retorts may be used for processing this product after putting in cans. The product should be processed at about 2 lb. steam pressure.

Tomato Sausage

The manufacturing instructions given here should be carried out carefully, and the fact borne in mind that the product is highly perishable.

Fresh Lean Pork Trimmings	50 lb.
Fresh Retrimmed Veal	20 lb.
Fresh Cracker Meal	5 lb.
Jowl Fat, Free of Rind	15 lb.
Tomatoes	6 No. 3 cans
Seasoning:	
Salt	2½ lb.
Sugar	6 oz.
White Pepper	6 oz.
Jamaica Ginger	2 oz.
Nutmeg	2 oz.

Dissolve the salt and seasoning in ice water.

Chop the meat through the ⅜-in. plate of an Enterprise hasher, then add the seasoning and ice water and the 6 No. 3 cans of tomatoes.

Put the chopped meat and seasoning in the mixer and mix for 2 minutes. Then spread in piles 8 in. thick on a table or in pans in the cooler and leave over night. Temperature of the cooler must be 36° F.

The next morning take the meat to the silent cutter, add 2 lb. crushed ice and the 5 lb. of cracker meal. Chop for 5 minutes, but be careful not to get the meat warm in the chopper.

Then take to the stuffer and stuff in medium sheep casings, 4½ to 5 in. long. Do not stuff too tight, but about like regular pork sausage.

Hanging.—Then hang on trucks, being careful that the sausages do not touch, and put them in the drying cooler at about 42° F. After they are dry put them up in 5- and 10-lb. buckets and put back in the cooler at 36° F.

This sausage must be sold fresh. Don't have too much on hand.

This product should be fried in butter over a slow fire. No sage should be used, as it destroys the tomato flavor.

Black Leona Sausage

Black Leona is made entirely from beef, generally from chucks. These are trimmed out and cut in small pieces about the size of an egg. Cure with a mixture composed of 3 lb. of salt and 2½ oz. of sodium nitrate per 100 lb. of meat. Mix thoroughly and place in the cooler to cure in 10 to 12 days.

When meat is cured, grind it through the fine plate and chop in the silent cutter, not too fine. The following seasonings are then added:

Black Pepper	6 oz.
Coriander	2 oz.
Nutmeg	1 oz.
Cloves	1½ oz.

Stuff the meat and seasoning mixture in beef weasands or beef middles. Let them hang on a truck overnight and then smoke with a cold damp smoke for about 3 days. After 3 days, let the smokehouse go up to 120° F. for 8 hours and the product will be finished. It is then cooked for 1 hour and 45 minutes at 155° F. The resulting sausage will be a good "black" Leona.

Cervelat Sausage

The following formula may be used in making a cervelat which can be sold at a very reasonable price. It can be made at any season of the year without special equipment. It is stuffed in manufactured casings or beef middles.

Beef Trimmings	50 lb.
Beef Cheeks	10 lb.
Beef Hearts	20 lb.
Ox Lips	10 lb.
Fat Pork Trimmings or S. P. Ham Fat	10 lb.

Grind beef trimmings and hearts through 7/64-in. plate. Grind beef cheeks and lips through same sized plate twice. Grind pork trimmings or S. P. ham fat through ⅛-in. plate once. Put all meats together in mixer and add following curing materials and seasoning:

Salt	3½ lb.
Granulated Sugar	8–10 oz.
Black Pepper	8 oz.
Nitrate of Soda	3½ oz.

Mix for about 6 minutes. Meat is then placed in cooler and spread in layers not over 8 in. thick, making sure that it is packed compactly and that there are no air pockets. It is held at a temperature of 36 to 38° F. for about 48 hours. Cover the meat with oil paper if there is condensation in the cooler. After withdrawing meat from cooler put it through mixer for about 2 minutes.

Stuff the mixture in narrow to medium beef casings or manufactured casings. If beef casings are used the wide ends should be thrown out. Stuff to full capacity to avoid shriveling of product. Take care to avoid air pockets in filling the stuffer with meat.

Place stuffed sausage in cooler and let it hang there overnight or 24 hours if possible. Remove from cooler and hold in natural temperatures for 2 to 3 hours. Then dip in brine of 100° strength at a temperature of 200° F. One stick is dipped at a time and is held in hot brine for 3 seconds.

Sausage is then placed in a smokehouse and smoked with a slow cold smoke, using hardwood sawdust. Temperature should be 75 to 80° F. for the first 36 hours with ventilators closed. Then temperature is gradually raised to 90 to 100° for about 6 hours or until product is firm and shows good color.

Take sausage out of smokehouse and hang close together on trucks or bank in natural temperatures where there is no draft which might cause wrinkling. Product should hang for about 24 hours before shipping.

Pork trimmings used in making this sausage must be strictly 100 per fat, free from lean muscle or tissue. If any lean pork is included in this formula, then handling of either the pork before it goes into the sausage or the sausage itself must comply with government regulations relating to pork to be eaten withut further cooking.

Cervelat

To make an all-beef cervelat, about 30% of fat should be used. This should be trimmed from the brisket or other outside portion.

Grind the lean beef through the fine plate twice and the fat through the ⅛-in. plate once. The fat should be very cold and the knives and plates very sharp so it will not mash.

The meat should be about three-quarters cured before it is stuffed and should hang for two days after it is stuffed in a temperature of about 42° F. Smoke for 48 hours, finishing at a temperature of about 112° F.

Faggots (Luncheon Sausage)

Very good quality faggots may be produced from the following formula:

Fresh Lean Beef	30 lb.
Fresh Lean Veal	30 lb.
Pork (50% Fat and 50% Lean)	40 lb.

Chop beef and veal through 5/16-in. plate and pork through the 1/4-in. plate.

Seasonings and other ingredients:

Salt	3	lb.
Sodium Nitrate	3	oz.
Sugar	6	oz.
White Pepper	6	oz.
Coriander	2	oz.
Nutmeg	2	oz.
Jamaica Ginger	3	oz.
Cardamon	1/2	oz.

Put meat, spices, salt and sodium nitrate in the mixer for 4 minutes with 2 gallons of ice water. Spread in cooler overnight on shelves, making the layers 8 in. thick. Take to the cutter the next morning, first making sure that the knives are sharp.

Chop fine but do not allow the dough to become warm. Have a bucket of ice water handy and sprinkle some water on the cutter and over the dough to keep the meat from getting too warm. However, too much water should not be added to the meat. Chop for about 5 minutes.

Stuff, but not too tightly, in medium sheep casings or small hog casings. Link in pairs 6 in. long, twisting the ends carefully so that the meat does not drop out. Hang on smoke sticks.

Smoke until the casing has acquired a golden color, then cook at 160° F. for 25 minutes. Be sure that the sausage is under the water throughout the cooking process. Hang in the dry room at 50–55° F. to cool off until the next day when the faggots are ready for market.

This product should not be made in very large quantities. It should move out through retailers rapidly.

Summer Sausage

It is possible for the packer to make both soft and fresh summer sausage without special equipment. The fresh product is usually cooked for a short time, while soft summer sausage is smoked but not cooked. Because the latter product is not cooked, some manufacturers make it entirely of beef materials, adding only about 10% S. P. ham fat.

This restriction of material is unnecessary if pork muscle tissue used in making soft summer sausage is handled in accordance with government regulations relating to use of pork in sausage to be eaten without further cooking. Thus, pork trimmings called for in following meat formula must have been frozen at a temperature of 5° above zero F. or lower for at least 20 days.

Meat ingredients for fresh or soft summer sausage:

Beef Chucks, Free of Sinews	55 lb.
Frozen Pork Trimmings	45 lb.

If the packer does not wish to use pork muscle tissue he may adopt the following formula:

Beef Trimmings	50 lb.
Beef Cheeks	10 lb.
Beef Hearts	20 lb.
Ox Lips	10 lb.
Pork Fat Trimmings or S. P. Ham Fat, (100% Fat)	10 lb.

The pork-beef formula is handled as follows: Grind beef chucks twice through fine plate and put in mixer. Grind pork trimmings through 1/8-in. plate and add to beef. Pork and beef are mixed thoroughly with

Sodium Nitrate	3 oz.
Salt	3 lb.
Sugar	8 oz.
White Pepper	5 oz.
Coriander	2 oz.
Nutmeg	1 oz.

Spread the meat out in thin layers in the cooler and hold for 48 to 72 hours.

The 90% beef formula is handled somewhat differently. Beef trimmings and hearts are ground through 7/64-in. plate. Grind cheeks and lips twice through 7/64-in. plate and ham fat through 1/8-in. plate. Put all meats together in mixer, add curing and seasoning ingredients and mix for 6 minutes. Pack compactly into pans and hold in cooler for 48 hours at 36–38° to cure.

After curing, the meat from either formula is placed in the mixer with 4 oz. of whole pepper and 1 pt. of flavoring, compounded as follows:

Distilled Water	2	qt.
Vinegar	2	qt.

Maple Flavor	5	oz.
Clove Oil	50	drops
Lemon Oil	34	drops
Sugar	2¼	lb.

Mix vinegar and water and heat to 212° F. Add sugar, lower the fire and let it remain at 185° for about an hour. Then add clove oil, lemon oil and maple flavor. Remove from fire and cool. This seasoning can be put in large bottles and kept on hand for use in various kinds of sausage. It may be omitted from the above formula if desired.

Soft Summer Sausage

Stuff either of above meat mixtures tightly into large beef rounds, narrow to medium beef middles or manufactured casings. Dip in 100° brine at a temperature of 200° F., one stick at a time, while counting three.

Sausage then goes to smokehouse where it is held at a temperature of 75–80° for 36 hours, with ventilators closed. Temperature is then raised to from 90–100° for about 6 hours, or until product is firm and shows good color. Some operators smoke at a little higher temperature.

After smoking, the product is banked in natural temperatures, free from draft, and left hanging for 24 to 48 hours before shipment.

Fresh Summer Sausage

Meat from either of the previously mentioned formulas should be stuffed in hog bungs, stuffing to full capacity to avoid shriveling. Sausage is then hung in cooler for 24 hours.

Product is then smoked at temperature of 75–80° for 42 to 48 hours, using a slow cold smoke with ventilators closed. Temperature is then raised to 90–100° for about 6 hours, or until product is firm and shows good color.

After smoking, fresh summer sausage is cooked for 20 minutes at 175° F.

Another meat formula that may be used for manufacture of these products is as follows:

Beef Chucks	33	lb.
Beef Hearts, Washed and Trimmed	34	lb.
Frozen Pork Trimmings	33	lb.

It is very good practice to run all of above meats through 1-in. plate and spread them out in a layer not over 3 in. thick for about 24 hours in a dry cooler, so they will be cold and dry before they are ground more finely. This seems to make a much better and more solid sausage. After this preliminary treatment, beef chucks are ground twice through fine plate; beef hearts twice through fine plate, and pork trimmings through ⅛-in. plate.

Pepperoni Sausage

Make a careful choice of meats for use in pepperoni. A high grade product may be used with the following ingredients:

Pork Trimmings, Reasonably Lean	50	lb.
Beef Trimmings, Trimmed	30	lb.
Selected Regular Pork Trimmings	20	lb.

Meats for pepperoni should be coarse cut. Grind lean and regular pork trimmings through ¼-in. plate and beef trimmings through ⅛-in. plate. Then put the ground beef on the rocker and rock for about 5 minutes.

Seasoning.—Add pork trimmings and the following seasoning ingredients:

Salt	3⅜	lb.
Granulated Cane Sugar	2	oz.
Dextrose (Corn Sugar)	2	oz.
Nitrate of Soda	2	oz.
Cayenne Pepper	8	oz.
Pimiento	8	oz.
Whole Aniseed	4	oz.
Peeled Garlic	½	oz.

Pork trimmings, beef and seasonings are rocked together for an additional 10 minutes. This makes a total rocking time of 15 minutes.

Place the chopped meat on shelving pans in the cooler at a temperature of 38–40° F. The meat should be in layers not over 10 in. thick and should be kneaded well in order to exclude air as far as possible. Carrv the meat on pans in the cooler for 48 hours minimum and 72 hours maximum time.

At close of holding period meat should be mixed for about 3 minutes in the mixer and then taken to the stuffer.

Use selected narrow hog casings or corresponding artificial casings for this product. Stuff full length of the strand of casing with meat. Then break the casing off, making allowance for enough casing to loop over each end where the casing is broken. Then twist in the center, which gives a 10-in. length on both links. It is necessary to remove a little meat from the broken end of each casing, so that there will be about ½-in. of casing to fold up against side of the sausage link.

Puncture casing thoroughly on stuffing bench to prevent air pockets in product. Then remove to cooler and allow to hang for 24 hours before taking to dry room.

Air conditioning has solved the problem of controlled, year-round drying in many sausage plants. Such equipment should be installed wherever it is desired to manufacture a considerable quantity of constant quality product, independent of weather conditions. However, each air conditioning installation has its individual operating characteristics and it is impossible to prescribe general rules to fit all plants. Pepperoni may be prepared in the old type room, however, if care is used.

The pepperoni is placed on the hanging sections in the dry room and spread carefully so that the sausages do not touch, and so that there will be free circulation of air. Select outside sections, hanging in one section and skipping the next. In this way there will be plenty of ventilation all around the product.

Dry room temperatures should come within a range of 46–53° F., the best temperature being 48°. The dry room should be equipped with steam coils on the floor and side walls. There should also be windows, fans if possible, and overhead ventilation to provide for the venting of old air. If possible, a relative humidity of 55–65% should be maintained.

Operate the floor and side coils occasionally. The heat, combined with proper air circulation, will dry the pepperoni slowly and from center outward. Do not dry this product rapidly as this will result in case hardening. It is then impossible for the air to penetrate through the shell and dry the center of the sausage.

Where the hanging sections are of considerable height it will be found that sausage on the upper part of the sections dries more rapidly than that hanging on the lower rails. It is good practice to transfer the product to another hanging section, placing the sausage which was formerly on the bottom, at the top, and vice versa. In this way all product will dry evenly.

If weather and dry room conditions are such that mold appears on the sausage during the drying process, the mold must be washed off, either by hand with water and a brush, or through a summer sausage washing machine. Then re-hang on sections and carry there till dry. This condition rarely arises when air conditioning is used.

The dry room must be kept under careful supervision of a trained operator. The temperature of the room must be regulated and the windows, doors and ventilators opened and closed according to temperature and humidity conditions. If the dry room is carried at higher temperatures than specified, there is danger of the pork fat rendering out from the heat and turning rancid. All the conditions necessary for producing a good sausage are interdependent and must be controlled intelligently.

If it is impossible to market the pepperoni when fully dried, it is best to transfer it to dry, cooler temperatures of 40–42° F.

If pepperoni is stuffed in casings not more than 1⅜ in. in diameter, it need not be held in the dry room more than 15 days, provided that 20 days have elapsed from the time curing ingredients were added to the meat.

Strassburger Sausage

Fresh Pork Liver	40	lb.
Fresh Regular Pork Trimmings or Skinned Jowls	30	lb.
Cooked and Cubed Pork Liver	15	lb.
Cooked and Cubed Back Fat	10	lb.
Lean Veal	5	lb.
For seasoning use:		
Salt	3	lb.
Onions or 3 oz. Onion Powder	1½	lb.
White Pepper	6	oz.
Mace	2	oz.
Marjoram	1	oz.
Cardamom	1	oz.

Scald raw hog liver and grind with veal through ⅛-in. plate. Place liver in silent cutter and chop for a short time. Add regular pork trimmings, after they have been ground, and chop all together in silent cutter with seasoning added. After liver, veal and trimmings have been chopped in silent cutter the meat is placed in mixer with cooked diced liver and back fat. If desired, about 4 lb. of peeled pistachio nuts may also be added at this time. Put mixture in stuffer after materials have been thoroughly intermingled.

Stuff sausage meat in artificial casings, or if in hog bungs (narrow ends), about 8 in. long to about half capacity, so product does not burst in cooking. If stuffed in bungs tie sausage in center of each piece to form pairs. Cook for 40–45 minutes at 170° F., or until temperature at center of sausage is brought up to at least 140° F. The product is then chilled in cold water and hung in cooler to set or first given a very light smoke.

When Strassburger liver sausage is stuffed in plain transparent or opaque artificial casings it should be cooked for 70 minutes at 160° F. and should then be chilled in ice water. Product is hung in cooler overnight to set and may be sold on the following day.

If a lasting pink shade is desired in this sausage, about ⅛ oz. nitrite of soda dissolved in water may be added to meats in silent cutter.

Strassburg Sausage

Beef	30 lb.
Veal	30 lb.
Lean Pork	20 lb.

Mix the beef and veal and chop the mixture fine. Then add the lean pork trimmings and chop until the mixture is moderately fine. Cut up 20 lb. of pork fat into small pieces and mix with the other meats. Then add the following seasoning and curing ingredients:

Salt	3½ lb.
Nitrate of Soda	2½ oz.
Sodium Nitrite	¼ oz.
White Pepper	7 oz.
Good-Sized Fresh Crushed Nutmegs	20

The entire mixture is then chopped until the fat is cut into small dice. Mix in enough ice water to make the mass moderately soft. Stuff in beef middles or similar artificial casings and allow the sausage to hang for three or four hours before smoking.

If preferred the sausage may be placed in hot smoke at once and smoked to the required color. It is then cooked for 15 minutes and hung up to cool. After thorough cooling it is scalded in boiling water for 10 to 15 seconds. This latter treatment is to keep the casings smooth and tight.

Berliner Sausage

Pork and Beef.—One formula is as follows: 85 lb. of 90% lean cured pork trimmings, 15 lb. fresh beef.

Grind pork trimmings through ¾-in. plate and chop beef. Put in mixer and add following seasonings:

Pepper	6 oz.
Sugar	8 oz.
Ground Cloves	¾ oz.
Cinnamon	½ oz.

If desired for flavor, 5 tablespoons of mapleine may be dissolved in 2 qt. of ice water and added to meat. Seasonings and meat should be thoroughly mixed. If necessary a small amount of salt may be added on account of the fresh beef. This probably will not be required if pork has had the regular cure.

Pork and Bull Meat. — Another standard meat formula is as follows:

Dry Cured Lean Pork Trimmings	75 lb.
Dry Cured Bull Meat	25 lb.

When bull meat is put in cure it is ground through 7/64-in. plate of the hasher. Unless pork trimmings are quite large they are not ground. If it is necessary to reduce the size, put them through 1-in. plate. This is done just before they go into cure. Grinding to this size makes it easier to stuff the product into bladders if such containers are used.

Put cured pork trimmings and bull meat into mixer and mix thoroughly for 5 minutes. After mixing take to stuffing bench.

Stuffing procedure is about the same for either of formulas given here. Berliner may be stuffed in large artificial casings, beef bungs or beef bladders. It is necessary to have a large-sized horn for this class of product, regardless of the container used, to secure best results. Neither beef bladders nor artificial casings should be stuffed to full capacity, since there may be some expansion.

If bladders are used the necks are split to fit the horn. As soon as they are stuffed and taken from the horn, run two wooden skewers through neck end of bladder from opposite sides. Then tie with twine underneath skewers and wrap with twine around and lengthwise to support casing. If wire molds are used twine will not be necessary.

Smoking and Cooking. — Product may be hung in cooler overnight after stuffing and then held at natural temperatures for 2 or 3 hours after removal in the morning. It should be rinsed off with scalding water, so it will be dry and clean when ready for smoking. Start smoking at about 120° F., holding it at this temperature for about an hour. Heat should be raised to 145° for the second hour in the smokehouse. Sometimes the product is smoked a total of 3 or 4 hours.

Product is then placed in the cooking tank with water at 155° F. It should be cooked for 4 to 6 hours, depending on size of the container. Temperature should be held at 160° during the last hour. After removing from the cooker, rinse with hot water and sprinkle with cold water for 3 to 5 minutes.

After partial cooling at natural temperatures for 2 to 3 hours the Berliner may be placed in the cooler at 45–50°.

This sausage may be varied by adding chopped pimientos and 7 lb. cubed pork fat to each 100 lb. of meat. If desired, half the batch could be handled in this way by removing half from the mixer before the garnish is added.

German Bologna Sausage

Beef	40 lb.
Veal or Pork	20 lb.
Back Fat	20 lb.
Flour	10 lb.
Sausage Meal	10 lb.
Seasoning:	
Salt	1¾ lb.
Sodium Nitrate	3 oz.
White Pepper	10 oz.
Coriander Ground With Salt	3 oz.

After cutting all meats into 2-in. squares, put into silent cutter and chop very fine. Scald flour and add it slowly with sausage meal. Other ingredients are incorporated in same manner except back fat which should be previously prepared by cutting into ½-in. squares with the fat cutter. Back fat is added during last revolutions of cutter.

Stuff in beef casings and simmer (not boil) for 3 hours in a jacketed kettle. If desired, this bologna may be colored.

Thuringer Sausage

Fresh Lean Veal or Young Boneless Beef Chucks, Free From Sinew	20 lb.
Fresh Extra Lean Pork Trimmings	50 lb.
Fresh Back Fat	30 lb.

Grind veal or chucks through ⅛-in. plate of the grinder. Chop in silent cutter, adding 5 lb. of ice. Chop medium fine with 8 oz. of salt. Grind extra lean pork trimmings and back fat through ¼-in. plate. Mix all meat ingredients together and add following seasonings:

Salt	1¾ lb.
Ground Nutmeg	2 oz.
Ground White Pepper	6 oz.
Whole Caraway Seed	2 oz.

Mix for 2 minutes.

Stuff mixture in medium hog casings and link in pairs, 4 to 6 in. long. Hang on clean sticks and put in cooler. Thuringer made by this formula is not smoked. It is a fresh sausage like pork sausage and is usually fried and served with red cabbage.

Thuringer Summer Sausage

It is possible to make a Thuringer summer sausage to be sold fresh. It should not be confused with fresh Thuringer or Cervelat sausage. A good formula is as follows:

Lean Boneless Chucks (Retrimmed)	80 lb.
Back Fat or Shoulder Fat (All Fat)	20 lb.

If any lean meat is left on back fat the sausage would have to be frozen in order to comply with government regulations governing use of pork in a sausage to be eaten without cooking. It is therefore best to leave out all lean pork and use only beef and back fat or shoulder fat entirely free of lean.

Grind beef once through ⅛-in. plate of grinder. Back fat should be cut in small pieces, about the size of an egg. The following seasoning is then added:

Salt	3 lb. 6 oz.
Sugar	8 oz.
Ground White Pepper	8 oz.
Sodium Nitrate	2 oz.

Spread this seasoning all over ground beef and chop once more through the ⅛-in. plate of the grinder.

Put in mixer and mix for 2 minutes. Shelve and hold in cooler from 48 to 72 hours at 38–40° F. Then mix again for 1 minute. This makes it more pliable and easier to stuff.

Stuff in export or sewed hog bungs or manufactured casings and hold in cooler for 48–72 hours. Then hold at room temperature for 4–5 hours. Smoke for 24 hours at 80–100° F. Take from the smokehouse and hang in the dry room at 55–60° F. for 24 hours. The sausage is then ready for sale.

This formula should not be used for a sausage that is to be fully dried. It is a fresh Thuringer summer sausage.

Vienna Style Sausage

Formula No. 1

Meats:	
Fresh Beef Chucks or Bull Meat	60 lb.
Fresh Pork Cheek Meat	20 lb.
Fresh Regular Pork Trimmings	20 lb.
Seasoning:	
Salt	3 lb.
Ground White Pepper	6 oz.
Sodium Nitrate	2 oz.
Ground Coriander	2 oz.
Ground Nutmeg or Mace	1 oz.
Granulated Sugar	8 oz.

No. 2

Meats:	
Boneless Bull Meat or Chucks	70 lb.
Reasonably Lean Pork Trimmings	30 lb.
Seasoning:	
Salt (if all meat is fresh)	3 lb.
Sugar (if meat is fresh)	½ lb.
Sodium Nitrate (if all fresh meat used)	3 oz.
Ground White Pepper	6 oz.
Pimientos	2 oz.
Ground Nutmeg	1½ oz.
Peeled Garlic	¼ oz.

Boneless bullmeat or boneless chucks should be trimmed free from gristle or blood clots. Regular pork trimmings must be at least 65% lean. They should be carefully inspected and all gristle, pulp, etc., should be removed.

Grind beef chucks or bull meat through ⅛-in. plate and pork trimmings through 1-in. plate of hasher. After weighing off proper proportion of beef, put in silent cutter and chop for about 2 minutes, gradually adding crushed ice to keep meat cool. Add pork cheeks and chop for about 1 minute additional; then pork trimmings and seasoning and chop all together for 5 more minutes.

The man operating the chopping machine must use judgment in adding all crushed ice that meat will absorb, but must not use an excessive quantity. After meats are chopped, take to mixer and mix for about 3 minutes so that seasoning will be evenly distributed.

Product is stuffed in artificial casings, sheep casings or in hog casings. Sheep casing are linked off 5 in. long and hog casings 4 in. long. The casings should be stuffed to full capacity and punctured while stuffing to prevent air pockets in finished product. Be sure that sausage is linked uniformly.

Workers must avoid mixing scrap meat with casings on stuffing bench. Scrap meat must be handled promptly and mixed with other stock in truck. Do not let meat remain long enough on stuffing bench to risk deterioration.

When product is stuffed and hung on truck it is taken to a cooler where it is held at 36–40° F. Carefully spread sausage on trucks, trolleys or hanging sections. Let it hang in cooler over night so meat will cure in casings and develop a good, lasting color on finished product.

Next morning, move sausage from cooler to smokehouse and carefully spread it so pieces do not touch each other. Smoke at 115–120° F. for about 30 minutes, or until casings are thoroughly dry. Gradually raise temperature to 160–170° for about 1½ hours, or until proper color is obtained. When product is smoked, avoid delays between smokehouse and cooking tank. This is especially desirable when product is stuffed in sheep casings as these will shrivel or wrinkle if exposed to draft.

Cook for about 5 to 7 minutes depending on size of casing, at a temperature of 165–170°. Spray product with cold water on removal from cooking vat. This is to prevent shriveling. It is advisable to hang sausage at natural temperatures for about 2 to 3 hours, where there is no draft, to allow it to chill and develop color.

Then put in cooler at 45–50° F. for further chilling before packing. Product must not be packed warm as it is likely to slime and mold.

A good grade of Vienna sausage is customarily used for canning. Product is stuffed differently from regular Vienna sausage. Sausage may be stuffed in links about 3 feet long, smoked for 1 hour at 135°, then for 30 minutes at 170° with plenty of smoke.

After removal from smokehouse, sausage should be hung until thoroughly chilled. It is then cut to required length to fit into can with regular rotary cutter. This is done at high speed by placing a number of sausages crosswise on a cylinder form, with a number of circular knives or a cylinder ribbed with notches and small stationary knives in the holder above, that matches the groove through the ribs.

Sausages are then placed in small cans and put through a steam exhaust to raise temperature to 165–170° F. Cans are capped and cooked for 1¼ hours at a temperature of 237°. Cans should then be removed and cooled as quickly as possible so product will not be overcooked.

Brine used in these cans is about 18–20° strength. If placed in cans at about 200°, with sausages at about 100°, processing may be expedited without use of a steam exhaust. This higher temperature of the brine may speed up processing but sausage does not cut so well hot as when cool.

Polish Sausage

Fresh Boneless Chucks, Trimmed	30 lb.
Fresh Extra Lean Pork Trimmings	40 lb.
Fresh Pork Cheek Meat	10 lb.
Fresh Reasonably Lean Regular Pork Trimmings	20 lb.

Seasoning for each 100 lb. of meat:

Salt	2 lb. 12 oz.
Granulated Sugar	8 oz.
Sodium Nitrate	2 oz.
Ground White Pepper	6 oz.
Ground Coriander	2 oz.
Peeled Garlic	2 oz.

Grind boneless chucks and pork cheeks through ⅛-in. plate of hasher. Grind lean and regular pork trimmings through ½-in. plate of hasher. Put all meats together in mixer, adding seasoning and about 20 lb. ice, and mix for about 3 minutes.

After mixing take the sausage meat to the stuffing machine and stuff in medium or wide hog casings or in 2¼ x 20-in. artificial casings. Puncture hog casings thoroughly when stuffing and link off about 6 in. in length. Casings must be stuffed to full capacity.

Hang at once on a sausage truck, and when filled take to sausage cooler at a temperature of 36–40° F. Carefully spread on truck or hanging sections, and keep in cooler for at least 12 hours, so that meat will cure in casings.

Remove from cooler on following day and hang in natural temperatures for 2 or 3 hours. Then place in smokehouse at 130° F. for the first hour. Gradually raise temperature to 150° for the second hour and to 160–170° for the third hour, as this product should be given considerable heat in the smokehouse.

Remove sausage when sufficiently smoked and place it in cook tank for 5–10 minutes at 160°. Cooking time depends on size of casings. When the sausage is cooked, remove it from the tank and shower with cold water. It should hang at natural temperatures to partially cool before delivery to the storage cooler.

The finished product should always be carried in a sausage storage cooler at a temperature not lower than 45–50°. It is very important that manufacture be regulated according to sales volume, as the trade purchasing this sausage likes a strictly fresh-made product.

Polish sausage in artificial casings is handled in a similar manner, except that it is smoked 30 minutes at 130°; gradually raised to 140° and smoked for 1 hour or more thereafter. Cook in water for 40 minutes at 160°, shower and place in cooler.

Another formula in which all cured meats are used, is as follows:

Meats:

Cured Beef Trimmings	50 lb.
Cured Pork Cheeks	50 lb.
Cured Pork Trimmings	50 lb.

Grind beef through ⅛-in. plate; pork cheeks through ⅜-in. plate; pork trimmings through ⅜-in. plate. Chop beef trimmings in the silent cutter, adding 20 lb. of chopped ice.

Seasoning:

Ground White Pepper	9 oz.
Ground Nutmeg	3 oz.
Ground Garlic	3 oz.
Rubbed Marjoram	3 oz.

Mix all meats together for 3 minutes. Five per cent of cereal may be added if desired. Stuff in hog casings in links 8–10 in. long. Smoke at 130–140° for 2 hours, until a nice brown color is obtained. Then cook for 30 minutes at 160° F.

Shower sausage with cold water and hang in natural temperature for 1 hour. Remove to sausage cooler and hold at 45–50°.

Polish Bologna

This meat formula may also be used for making Polish bologna. Stuff in beef middles or artificial casings. Smoke as above and cook for 1 hour at 160° F.

Galician Sausage

Fresh Boneless Chucks, Trimmed	20 lb.
Extra Lean Pork Trimmings	50 lb.
Extra Lean Pork Cheeks	20 lb.
Regular Pork Trimmings	10 lb.

Grind boneless chucks and pork cheeks through the ⅛-in. plate. Grind lean and regular pork trimmings through the ½-in. plate. Place all meats in the mixer, add about 10 lb. of ice water, and mix for about 4 minutes with the following seasoning ingredients:

Flake Salt	3 lb.
Nitrate of Soda	2 oz.
Peeled Garlic	5 oz.
Ground White Pepper	6 oz.
Ground Coriander	2 oz.

After mixing, the sausage meat is stuffed in beef rounds, cut 36 in. long, which are tied on one end with twine. Casings are stuffed to full capacity and open ends tied off. Product is linked in the center, so that it will hang over the smoke stick in pairs.

Hold in cooler overnight at 36–40° F. Let sausage hang at natural temperature for an hour or two the next morning, and then place in the smokehouse. Temperature of 130° is maintained for the first 30 minutes, and is gradually raised to 160° for the second hour. At this time sausage should show good color.

Then raise smokehouse temperature to as near 300° as is safe, and hold it for about 20 minutes, so the product will bake thoroughly. Remove from smokehouse and let sausage hang at natural temperature, exposed to draft. Wrinkling is desirable in this product.

While Polish sausage is usually cooked in water at 160°, consumers who buy Galician sausage will not be satisfied with product which has been water-cooked. It must be baked in the smokehouse, and naturally dries out very rapidly after smoking. Galician sausage is usually found hanging on racks or from ceilings of stores in foreign settlements, where there is a very ready sale for it.

Roumanian Sausage

Meat ingredients:

Fairly Lean, Cured Pork Trimmings	100 lb.

Seasoning:

Ground Coriander	1 oz.
Chopped Garlic	2 oz.
White Pepper	5 oz.
Ground Ginger	1 oz.
Sugar	4 oz.

Mix trimmings with seasoning and grind through ⅛-in. plate.

Stuff ground meat tightly in large hog casings and hang in cooler for 24 hours. Then put sausage in smokehouse and give it a cold smoke for 24 hours, raising the temperature gradually after that period to 145° F. Inside temperature of the product should reach 137° F. This is very important as Roumanian sausage is sometimes eaten without further cooking.

On removing the sausage from the smokehouse, push them together on smokestick and dip them up and down 5 times in a barrel of boiling water which contains a water bucket full of salt and one of vinegar. This will shrink the casing and prevent development of mould. Product should be ready for sale 24 hours after it is put in cooler.

Some processors sprinkle a few juniper berries over sawdust in smokehouse to further improve flavor of this sausage.

Swiss Club Sausage

Swiss sausage was originally made in Zurich, Basel and St. Gall, Switzerland, being very popular in those cities. In Switzerland it is made as follows:

Fat Pork Trimmings	45 lb.
Lean Pork Trimmings	40 lb.
Beef Trimmings	15 lb.

The meat is cut into pieces about the size of an egg and the following seasoning is added:

Salt	2½ lb.
Sugar	4 oz.
White Pepper	6 oz.
Cardamon	1 oz.
Mace	2 oz.
Sage	1 oz.

Grind meat and spices through finest plate of grinder; then mix ingredients thoroughly in the mixer. When taken from the mixer the product is stuffed in wide sheep casings or small hog casings, linked and hung in a warm smoke for 1 hour, or long enough to develop a nice smoked color.

An American sausage manufacturer's formula for making a Swiss club sausage is as follows:

Fresh Veal	55 lb.

Lean Beef Trimmings	45 lb.
Salted Back Fat, Cut in Cubes	15 lb.

Chop beef and veal through the ¼-in. plate. After chopping place meat in mixer and mix for 3 minutes with ice water in which following spices have been dissolved:

Salt	2¾ lb.
Sodium Nitrate	2 oz.
Sugar	4 oz.
White Pepper	6 oz.
Coriander, Ground Fine	4 oz.
Nutmeg	2 oz.
Jamaica Ginger	1 oz.
Mace	1 oz.

Place mixed meat in a truck in a layer about 8 in. thick and put in a cooler at 38–40° F. At end of about 48 hours the meat is put in silent cutter and chopped for 2 minutes, back fat cubes being added just before meat is taken out of chopper. Product is then stuffed in sheep casings or small hog casings and linked in pairs about 6 in. long.

This sausage may be marketed immediately after coming from the stuffer or it may be smoked in the same manner as frankfurts.

Swedish Potato Sausage

Trimmed Beef Flanks, Medium Fat	50 lb.
Pork Trimmings, Half Lean and Half Fat	50 lb.
Peeled Raw Potatoes	40 lb.
Onion	8 pieces

The trimmed beef flanks, pork trimmings, potatoes and onions should be ground through the ⅛-in. plate of the grinder. Put in the mixer and add the following seasoning:

Salt	3 lb.
Ground White Pepper	8 oz.
Ground Allspice	2 oz.

Mix all ingredients thoroughly for 3 minutes. Stuff in well selected beef round casings free from scores or in corresponding artificial casings. If there are weak spots in the beef round casings they may break during cooking. The casing should be cut 16 in. long and stuffed like round bologna.

Owing to the ingredients, potato sausage will turn dark if it is exposed to the air. It is necessary, therefore, to keep the air from it. This is done by keeping the sausage in a weak salt water brine. Care should be taken to see that the sausage is covered with the brine at all times.

Swedish potato sausage is not cooked, but sold fresh. The consumer cooks it in the home, where it should be served piping hot.

Mexican Calabassa Sausage

Cured Fat Beef Trimmings	40 lb.
Cured Pork Cheeks	30 lb.
Cured Regular Pork Trimmings	30 lb.

Meats are ground through the ⅛-in. plate with 2 lb. of onions and mixed thoroughly with the following seasoning ingredients:

Chili Pepper	1 lb.
Ground Coriander	3 oz.
Ground Ginger	2 oz.
Nutmeg	2 oz.
Paprika	8 oz.
Celery	1 oz.
Sugar	8 oz.

If desired, one No. 3 can of pimientos can also be ground with the meat and onions.

After mixing, stuff the sausage meat in beef rounds, making each sausage weigh 8 oz. to 1 lb. Smoke for 2½ hours at a medium temperature. Cook for 30 minutes at 140° F., or until the inside temperature of the product has reached 137° F.

Fresh Farmer Sausage

Fresh Lean Boneless Chucks or Beef Trimmings	60 lb.
Fresh Pork Trimmings, (About 50% Lean)	40 lb.

Run beef through ⅛-in. plate of the grinder. Spread pork trimmings on top and grind all together through ¼-in. plate with following seasoning and curing ingredients:

Ground White Pepper	6 oz.
Salt	3 lb.
Sodium Nitrate	3 oz.
Granulated Sugar	4 oz.
Dextrose (Corn Sugar)	4 oz.

After the final grinding, put the meats in the mixer and mix for 2 minutes. Deliver to the cooler and spread on boards or shelves in layers not over 8 inches thick. Hold in the cooler at 38° F. for 48 hours or until thoroughly cured.

Stuff solidly in beef middles cut 16 in. long or in corresponding artificial casings. Middles should be pricked to prevent air pockets. Smoke for 8–12 hours at a temperature not exceeding 90° F. During last 2 hours temperature in smokehouse may be raised to 100°.

When the smoking is finished the product is sprayed with hot water for 1 minute. It is held at room temperature until partially cooled and is then moved in well ventilated cooler at 50°. It is ready for sale after it has been chilled.

This product is known as fresh or soft farmer sausage and is different from regular or dry farmer sausage, which is stuffed in beef casings or hog bungs and dried for 5 or 6 days. *Fresh farmer sausage should be cooked by the consumer.*

Mortadella Sausage

Extra Lean Pork Trimmings	75 lb.
Fresh Veal or Beef Trimmings	18 lb.
Fresh Back Fat	7 lb.

Another meat formula, for making an especially fancy product, is as follows:

Lean Meat From Bruised Hams	55 lb.
Lean Beef	30 lb.
Pork Jowls or Neck Fat	15 lb.

Grind beef and lean pork called for in either of the above formulas separately through ⅛-in. plate. The jowl or back fat is cut into ½-in. cubes. Put lean beef or veal in silent cutter and chop from 2–3 minutes and then add lean pork. Chop beef and pork together for an additional 2 or 3 minutes, or until meat is very fine.

Put chopped meat in mixer and add cubed fat and following curing and seasoning ingredients:

Salt	3¼ lb.
Sodium Nitrate	3 oz.
Sugar	8 oz.
Gelatine	6 oz.
Ground White Pepper	3 oz.
Pistachio Nuts	6 oz.
Peeled Garlic	1 oz.
Curacao	10 oz.
Alcohol	6 oz.

The mortadella ingredients are mixed for about 3 minutes, or until the mass is stiff and tacky. Spread on pans or shelves in cooler in layers about 6 in. deep and hold at 38° F. for 24–48 hours, or until cured.

Stuff in medium or small dried or salted beef bladders, or corresponding artificial casings. Dried bladders should be soaked in luke warm water for 1½ hours, changing water twice before using bladders. Stuff bladders to full capacity; put two wooden skewers through neck end of each bladder, and tie one end of string around neck of bladder underneath wooden skewer. Then wrap string around bladder lengthwise and crosswise. Tie other end of string around neck of bladder again, forming a loop to hang on smokestick. Use 6-ply jute twine for this purpose. It is important that size of bladders should be uniform. If bladders run irregular in size, grade for size on stuffing bench after stuffing and hang on separate sticks and cages preparatory to processing in steam house.

Hold stuffed sausage in cooler at 38° F. for 24 hours and then put in steam house or smokehouse. This product is not smoked, but is heated through in the smokehouse.

Heating. — Start heating process with temperature of about 80° F. in the house. Raise this temperature gradually over first 12 hours to 120°, and during next 12 hours to 155–160°. This degree of heat should be held for several hours, or until internal temperature of product reaches 140°. Time required for finishing will depend on size of casings.

Some processors give this product a light smoke and handle it in a somewhat shorter time. The mortadella is smoked until fairly dry, and then cooked at 160° for 6 hours, or it is smoked beginning with 130° for 3 hours and then finished at 160° for 3 more hours.

When the mortadella is taken out of the steam or smokehouse it is sometimes wrapped in cloth to prevent too rapid cooling.

If a regular dry mortadella is desired the product must be held in dry room for about 5 weeks. When placed in dry room sausage should be hung in sections, carefully spreading pieces so they do not touch. There should be good air circulation, but no draft. After the first 2 weeks the product will stand considerable ventilation.

Chorizos Dry Sausage

Special Lean Pork Trimmings	33 lb.
Neck Bone Trimmings	33 lb.
Fat Pork Trimmings	34 lb.

One-third veal or beef chucks may be substituted for the lean pork trimmings if desired. Less costly meats, such as cheeks, may be used in making less expensive grades of sausage than the formula given above.

Grind pork trimmings through the ⅜-in. or ¼-in. plate. If beef is used, grind it through the ⅛-in. plate. Place meats in mixer and add ½ pint white wine vinegar with the following curing ingredients:

Salt	3 lb.
Sodium Nitrate	2 oz.
Nitrite of Soda	¼ oz.
Sugar	6 oz.

Shelve the meat in the cooler at 38° F. until fully cured. Remix with the following seasoning which should be passed through a sieve to secure an even mixture:

Garlic Powder	¼ oz.
Ground California Red Sweet Pepper Pods	8 oz.
Chili Powder	6 oz.
Ground California Hot Red Pepper Pods	4 oz.

Stuff the meat in narrow or medium wide hog casings, wide sheep casings, or corresponding artificial casings and link sausage in 4-in. lengths. Links should be tied off with string and sausage then hung on smokesticks to dry. If the chorizos is to be sold fresh it may be shipped soon after stuffing.

When the sausage is to be smoked and dried it should be hung in the dry room at 54–58° F. for 10 days after stuffing. Then give it a light cool smoke. After smoking, bank the sausage closely in dry room at approximately 54–58° for 24–36 hours. Product should then be spread out to dry for 14–21 days.

Mosaic Sausage

Some processors use veal trimmings as the basic meat in making this sausage while others use extra lean pork trimmings. One formula calls for:

Veal Trimmings	75 lb.
Regular Pork Trimmings	10 lb.
Diced and Scalded Back Fat	8 lb.
Diced Cooked Hearts	7 lb.
Peeled Pistachio Nuts	2 lb.
Pimentos (28 oz. Size)	3 cans
Binder	4 lb.
Relish or Chopped Sweet Pickles	2 lb.

Grind veal trimmings through ⅜-in. plate and again through ⅛-in. plate with:

Salt	3 lb.
Sugar	8 oz.
Nitrite of Soda	¼ oz.
Sodium Nitrate	2 oz.

Veal is then placed in silent cutter and chopped with binder and following seasoning ingredients:

Ground White Pepper	6 oz.
Ground Ginger	1 oz.
Ground Mustard	2 oz.
Onion Powder	2 oz.
Cardamom	1 oz.

Add ice to veal in cutter, then put in ground regular pork trimmings and chop all until meat is of correct consistency.

Put meat mixture in mixer with diced fat, hearts, pistachio nuts, pimentos and relish. Other ingredients may also be added to dress up the sausage and give it an unusual appearance. Mix all materials thoroughly and stuff in beef bungs or in corresponding artificial casings. Hang product in cooler overnight or for a period long enough for development of color.

Cook sausage next morning for 3 hours at 170° F. and chill in cold water for at least 30 minutes. Mosaic sausage is smoked lightly until dried off and is then placed in cooler until shipped.

Another method of handling the sausage is to smoke it lightly on morning after stuffing. It is then cooked for 2–3 hours at 160–170° F. and chilled.

Quick Cure for Sausage

Sodium Nitrate	3 lb. 2 oz.
Sodium Nitrite	10 oz.
Dextrose	11 lb. 4 oz.

Dissolve the above ingredients in 5 gallons of water. Use 1 quart of this mixture to 100 lb. of sausage material.

Philadelphia Scrapple

The following formula is for manufacture of *Philadelphia* scrapple on a small scale. Quantities can be increased as desired if made on a large scale.

Pork Head Meat	25 lb.
Beef (Plate Beef of Good Quality Including All The Fat)	25 lb.
Snouts	37½ lb.
Pork Rinds	12½ lb.

An especially high quality product can be made if a larger proportion of head meat is used in formula with a smaller quantity of snouts. Some manufacturers use all pork and no beef and quality is equally satisfactory. Boil all meats together until soft, or approximately three-quarters of an hour, in a jacketed kettle. Then grind meat through ¼-in. plate.

Skim broth left from boiling, filling kettle in which scrapple is made about one-third full with broth. Then put in meat. Add 35 to 38 lbs. of corn meal, half yellow and half write, first thoroughly mixing corn meal in a portion of warm broth. This will prevent lumps in meal. Always have agitator in kettle running or man stirring while putting in corn meal, and until scrapple is done.

After meat and meal are in the kettle add following seasoning:

Salt	8¾ lb.
White Pepper	7 oz.
Mace	1¼ oz.
Nutmeg	1¼ oz.
Clean Sage	4 oz.

This seasoning will vary with consumer demand. In some sections only salt and pepper are wanted; in others, only salt, pepper and sage. Such balanced seasonings also yield a product with consistently the same flavor.

If mixture of meat and corn meal is not of proper consistency—which should be as thick as mush—add more broth or corn meal as case may be. Cook mixture 2½ to 3 hours, according to weather conditions. If weather is cold, 2 hours will do. When scrapple has cooked for about 2 hours, or is nearly done, sprinkle 1½ lbs. of rye flour over contents of kettle and let it mix in. This makes it fry brown and crisp.

After mixture is thoroughly cooked it may be packaged. Some packers put their scrapple up in 1⅞x11-in. manufactured casings. This makes an attractive and handy package which the housewife can slice easily. The scrapple is placed in stuffer, stuffed in casings and tied off in regular manner. It is then washed off with warm water followed by cold water and placed in cooler to chill. It can be squared by placing cased pieces of scrapple close together in cooler and placing a weighted board on top of them.

It may also be poured in 1- or 2-lb. molds. After chilling, scrapple is removed from molds, wrapped in parchment or grease-proof paper and placed in a carton.

Scrapple

Pork Head Meat	100 lb.
Beef Trimmings	100 lb.
Snouts	150 lb.
Pork Rinds	50 lb.

Cook in nets in steam jacketed kettle and remove as meats become tender. Grind or hash the meats, skim the fat off the cook water and replace the meats. Add 150 pounds of corn meal—half white and half yellow, or enough to thicken. Boil 2 to 3 hours while agitating in order to prevent the formation of lumps. By first mixing the corn meal with some broth the formation of lumps will be avoided. Add the spices after cooking, place in pans or forms and allow to cool.

Luncheon Meats

Dry Cured Pork Trimmings	85 lb.
Dry Cured Pork Cheek Meat	15 lb.

Before the trimmings go into cure they should be carefully trimmed to remove all gristle and blood clots. Cured trimmings may be used whole or ground through the 1-in. plate. No seasoning is added. The transparent artificial casing adds much to eye appeal of this product and because it is generally printed with the packer's name and trade mark it is an important factor in building consumer good will and demand for a quality product.

After grinding, meat may be stuffed in manufactured casings or muslin bags. The product is cooked 3½ hours at 170° F., or 4 hours at 160° F. If stuffed in casings it is ready for sale as soon as fully chilled.

If stuffed in muslin bags, rinse off with warm water to remove sediment or grease from cooking. Then hang product at room temperature until bag is thoroughly dry. Use paraffin wax of 118–120° melting point and bring the paraffin up to 175°. Dip the bagged product momentarily in the wax, holding it there during a count of "three." In some cases the product is dipped in the wax twice.

Handle very carefully after dipping, so as not to break paraffin coating on outside of bag. Hold in a cooler at 45 to 50° until shipped. Manufacture of this product should be regulated closely according to volume sold, so that it will always be strictly fresh.

A spiced luncheon meat can be made with addition of mustard seed, pepper and mace to taste.

Canned Pork Luncheon Meat

Dry Cured Pork Trimmings	85 lb.
Dry Cured Pork Cheek Meat	15 lb.

High grade trimmings should be used for the purpose. They may be cured whole or ground through the 1 in. plate and thoroughly mixed with the following curing ingredients:

Salt	3½ lb.
Sugar	1 lb.
Nitrate of Soda	2 oz.

for each 100 lb. of meat.

Pack solid in a tierce and cure for from 5 to 8 days at a temperature of 38° F. At the end of curing period the trimmings can be put through silent cutter, but this luncheon meat should not be cut too fine. About 10 to 15 lb. of ice may be added at this time.

Product is seasoned with ground mustard seed, pepper and mace to taste.

After cans are filled and weighed they may be closed under a mechanical vacuum with a vacuum closing machine. If desired, cans may be exhausted in a conventional steam exhaust box, should this equipment be available, although it is not as desirable as a closing machine. Exhaust period should be long enough to obtain a closing temperature of 165 to 170° F. After closure, the cans should be processed without delay.

Standard vertical or horizontal retorts are generally used for processing. The process generally used for the 404 x 309 can is 150 minutes at 240° F., or 110 minutes at 250° F.

Pressure cooling of the cans after processing will not be necessary if a good vacuum has been established in the closed cans, either by thermal or mechanical means.

A period of 8 to 10 minutes is generally used to bring the retort to processing temperature. A fairly slow blowdown period should be used to prevent undue straining of cans. All cans should be water-cooled after processing, either by immersion or spraying.

Pork Butts, Dry Cure

Following ingredients are used for each 100 lb. of meat in dry curing this product:

Salt	2¾ lb.
Granulated Sugar	1½ lb.
Sodium Nitrate	4 oz.

Mix ingredients together thoroughly. Sprinkle a layer of mixture over bottom of the curing container.

Green product may then be dipped in 100° salometer strength plain pickle. If desired the dry curing mixture may be applied to butts by tumbling them in a mixer with the cure. Or butts may be thoroughly rubbed with cure after they have been wetted with plain pickle.

Next, place a layer of butts in curing container and sprinkle with cure. Follow this process through successive layers. Pack tightly in boxes and press down with a tight lid. The meat is held at a temperature of 36 to 38 degrees F. during the curing process which lasts about 15 to 21 days.

Smaller cuts like butts are sometimes placed on wire mesh trays for smoking. Butts are often smoked in stockinette in strings of five or six. Product handled in this manner is especially well-shaped. Butts are smoked from 16 to 18 hours at 100 to 110 degrees F. Or they may be started at 110 degrees F. and carried at this temperature until outer surface is dry and then raised to 135 degrees. Only about 12 hours smoking is required under this method.

After butts are thoroughly cool they are packaged in transparent wrap, parchment or some other attractive covering.

Liver Loaf

Beef livers can be used in making liver loaf, but pork livers are better, if available. If beef livers are used they should be cut into slices 2 inches thick and soaked in mild salt water to draw out blood. When ready to use, scald liver until it is practically cooked. Then grind and mix with rest of meat. This method of handling beef liver will improve the color considerably.

As in making liver sausage, the problem of color is sometimes troublesome for the liver loaf manufacturer.

If customers like a pinkish liver loaf (secured through use of sodium nitrite) there should be no color difficulty. But if they like a light yellow loaf that fades to a greyish white on cutting, the packer should avoid using beef, beef liver and pork cheeks. Fresh pork livers and pork jowls turn out a good product. Sometimes a small quantity of cooked beef tripe is used to whiten the liver meat mixture.

Fresh Livers	50 lb.
Fresh Pork Jowls	25 lb.
Fresh Regular Pork Trimmings	25 lb.

Seasonings and other ingredients:

Salt	3 lb.
White Pepper	2 oz.
Ginger	4 oz.
Onion Powder	7 oz.
Binder flour	3 to 6 lb.

Preparing Meats.—If pork livers are used they should be scalded 10 minutes at 212° F. The jowls are cooked for one hour at 210° and the regular pork trimmings for 30 minutes at 210°. Cooked meats are then ground through ⅛-in. plate, weighed off in proper proportions and put in silent cutter. Chop all together, adding seasonings and other ingredients. Chop for about 4 minutes.

Smooth-cutting loaves that have attractive appearance and do not dry out can be obtained through use of binder flour. Such flour is also an economical ingredient for use in loaves.

To this meat mixture add the hot meat liquid saved from cooking jowls and trimmings, or from cooking hog rinds and pig feet (if available), using about 20 lbs. of liquid to each 100 lbs. of meat. Take mixture to cooler and allow to partially cool. Meats and liquid should be thoroughly mixed and spread not more than 4 in. thick in cooler for 2 or 3 hours.

Liver loaf may be packaged in artificial casings, with or without a back fat liner. When a liner is not used the loaf mixture is stuffed into a 3¾ x 15 in. casing The casing is tied and inserted in a loaf or ham retainer and cooked at 160° for 3½ hours. Cool in ice water, drain water from retainer and place in cooler overnight to set. Remove from retainer—the product being ready to ship.

Raw back fat for lining artificial casings may be cut the day before used and placed in cooler overnight to set. After casings with fat liner have been stuffed they are placed in retainers, cooked for 3 to 3½ hours at 165°. Loaves are then chilled for 45 minutes in cold water and placed in cooler overnight in tilted position so water will run off.

Liver loaves may also be processed in pans with back fat liner. The meat is pressed in with a paddle and back fat folded over on top. Then fasten on top and cook for 1½ to 2 hours at 160 to 170°. When thoroughly cooked, the loaves are allowed to chill fully in pans before removal. They are wrapped only as needed.

Livers and trimmings should be strictly fresh and no old products should be included at any time. The loaf can be varied by adding cubes of cheese, pimientos, bright colored vegetables, pistachio nuts, spinach and similar products. Such ingredients add to tastiness and appearance of the loaf when cut.

Liver Cheese Loaf

Fresh Pork Livers	35 lb.
Fresh Lean Pork Trimmings	45 lb.
Fresh Lean Pork Cheek Meat With Surplus Fat Trimmed Off	20 lb.

Use of cheese in this formula is optional. Livers are soaked in cold water for two hours before using. Grind pork cheeks through fine plate of hasher. Grind lean pork trimmings through ¼-in. plate of hasher. Then take raw pork livers (whole) and raw pork cheeks (ground) and chop in silent cutter for about 6 minutes, adding seasoning and not more than 10 lb. crushed ice. Following seasonings are used:

Salt	2 lb. 12 oz.
Peeled Onions	2 to 4 lb.
Ground White Pepper	6 oz.
Ground Ginger	2 oz.
Granulated Sugar	4 oz.
Ground Nutmeg	1 oz.
Ground Cloves	½ oz.
Cracker Meal	5 lb.
Quality Flour	5 lb.

Lean pork trimmings (ground) are then added in cutting machine and meats are all chopped together for an additional 2 minutes. Then add 5 lb. cracker meal and 5 lb. flour, and chop all together just long enough to thoroughly mix the cracker meal and flour with chopped meats.

When mixture is removed from the cutter it should be placed in a clean truck. If desired, cheese cut in about ½-in. cubes can be added at this time and mixed with chopped meat in truck by hand. When product is thoroughly mixed, fill it in tins of about 6 lb. each. Before filling meat in tins be sure to grease inside of tins—sides, ends and bottoms—with lard so the meat will not stick or burn.

Then place loaves in the oven at a temperature of 250° F. for the first hour; gradually raising the temperature to 300° for next two hours and to 350° for a final half hour to finish off. The loaf should be baked in about 3½ hours. Remove from oven and empty out of tins, saving grease from each container.

Place loaves in a truck or on a table and apply hot sugar water with a brush over the top of each loaf to develop the color. Then allow product to remain at natural temperatures for a few hours, if possible, before placing in the cooler, as delivery direct to the cooler may bleach the color. Finally place the loaves in the cooler to chill over night.

Roast Beef Loaf

Fresh Beef, Chunks of White Fat, No Sinew	100 lb.
Onions, Finely Ground	2 lb. 10 oz.
Granulated Gelatin	2 lb.

Grind beef through 1½-in. plate and place in jacketed kettle with onions and enough water to cover. Cook for 4 to 5 hours, or until beef is tender. Water may be added during cooking but there should be some thickening of the liquid into a gravy near the end of the process.

Draw off liquid when meat is nearly ready. Mix liquor with gelatin and insert a steam line into this mixture in order to break up lumps of gelatin. Pour the gravy-gelatin mixture back onto the meat and stir thoroughly. Add following seasoning ingredients:

Tomato Ketchup	3 lb. 5 oz.
Worcestershire Sauce	2 oz.
Salt	2 lb.
Decorticated Black Pepper	4 oz.
Skim Milk Powder	3 lb.

Cook for an additional 15 minutes, stirring constantly. An agitator is of considerable aid.

Drain off gravy from meat after cooking is finished and save it. Stuff the meat into molds and add gravy to each mold. Do not press lids on molds as to do so will squeeze out the gravy. Allow molds to set overnight. Remove from molds the next day and stuff in cellulose casings.

Corned Beef Hash Loaf

Corned Beef Trimmings, Without Much Fat	60 lb.
Boiled Potatoes	40 lb.

Corned beef trimmings are cooked at 212° F. in a jacketed kettle until the meat is tender. Meat is ground through the ¼-in. plate when cooked. Potatoes are cooked with skins on. They should be cooked through, but not so that they are soft or mealy and therefore break apart when handled. Peel potatoes and cut out any dark spots. Cut into ½-in. cubes and handle carefully.

Put ground corned beef in mixer and add the following materials:

Chopped Onions	5 lb.
Ground White Pepper	5 oz.
Salt	1 lb.
Gelatin Dissolved in 6 lb. Water	8 oz.

Mix thoroughly and then add the cubed potatoes. Mixer is run just long enough to distribute potatoes through the mass, but not long enough to mash them.

Place corned beef hash mixture in meat loaf containers without the pressure lid. Top of loaf is smoothed and product is then transferred to cooler, where it is held overnight to set. Remove from containers next morning and dip in a light gelatin solution. Loaves are stuffed in artificial casings and held at a temperature of 45 to 50° F. until sold.

This loaf can be sold for slicing in the retail meat or delicatessen store or can be put up in family 2-lb. or 3-lb. sizes for sale to consumers. It was a prize-winner in the recent Tee-Pak meat loaf contest.

Jellied Beef Loaf

To make spiced pressed beef or jellied beef use the lean beef from chucks, rounds or rumps. Cure in same manner as corned beef, using a 65° pickle. Do not cut pieces of meat too large as they should cure within 8 to 10 days. Old cured beef is not satisfactory in making a good spiced loaf.

After meat is cured, soak it in cold water for two to three hours, wash off clean, and place it in cooker. It should be cooked for about two hours at 210° F. After cooking, cut meat into strips about 1 in. thick. If a press is used, place meat in layers in press and when it is full pour gelatin water over it. Do not pour in too much gelatin but just enough so that press can be closed down tight.

Place in cooler overnight. The next morning open press and if more gelatin is needed, cover the beef with additional gelatin water and let it stand until well set.

To make gelatin water for this product, use 1 lb. of gelatin to 6 lb. of hot water and mix well until all gelatin is melted.

A little allspice and cloves may be sprinkled on meat, according to taste, when it is placed in press. Spices may also be added to curing pickle which will give product a good spicy flavor. Ready prepared seasonings or specially prepared seasonings as manufactured by reputable firms will assure convenience and uniformity in making this product.

If pressed beef is to be plain, omit the spices but process in the same manner.

Italian Meat Loaf

Boneless Beef Chucks	50 lb.
Regular Pork Trimmings	40 lb.
Pork Livers	10 lb.
Spaghetti	20 lb.
Crustless Stale Bread	10 loaves
Onions	3 lb.

Beef chucks are ground through ¼-in. plate and put in silent cutter with bread and onions. Chop partially and then add pork trimmings and liver. Chop as smooth as possible and have the dough quite stiff when it is finished so that it will make a solid loaf. Put in mixer and add spaghetti which is prepared as follows:

Place whole pieces of spaghetti in a jacketed kettle full of hot water and cook until it is about half done. Remove from the hot water and chill in cold water. Drain well before adding with seasoning to the meat mixture.

Seasoning

Salt	3 lb.
Sugar	6 oz.
Sodium Nitrate	2½ oz.
Celery	½ oz.
Nutmeg	1 oz.
Grated Roman Cheese	1 lb.
Anise	4 oz.
Pimientos	3 28-oz. cans.

Line meat loaf molds with cloth and caul fat. Fill meat to top of molds and fold cloth, first cutting away extra caul fat. Press covers down tight and cook in water for 3 hours at 160° F. for a 4-lb. loaf. After cooking, chill in molds until following morning. Dip loaves into a thin gelatin solution after removing from mold and stuff in artificial casings.

Spanish Meat Loaf

Spanish meat loaf is similar to ordinary meat loaf, except that an unusual and spicy seasoning formula is used. A 100-lb. meat formula may contain 100 lb. of pork trimmings, 85 per cent lean; or 100 lb. beef and pork cheek meats; or any of the following:

Beef Trimmings	40 lb.
Pork Cheek Meat	40 lb.
Tripe	20 lb.

Lean Pork Trimmings	50 lb.
Lean Cheek Meat	25 lb.
Beef or Pork Hearts	10 lb.
Caul Fat	15 lb.

Cheek Meat	55 lb.
Beef or Pork Hearts	30 lb.
Caul Fat	15 lb.

Cereal or soya flour may be used with any of these meat formulas.

Curing materials and seasoning for any of these meat combinations are:

Salt	3 lb.
Sugar	½ lb.
Nitrate of Soda	3 oz.
Coriander	3 oz.
Nutmeg	1 oz.
Red or Cayenne Pepper, according to strength	2 to 4 oz.

Green and red peppers or pimientos and pickles may be used with these meat formulas. They add to the unusual taste of the loaf and give it greater sales appeal in appearance as well as in flavor.

Glazing Meat Loaves

A dip or glaze for veal loaves or any kind of meat loaves is made of:

Gelatin	2¼ lb.
Sugar	2 lb.
Boiling Water	14 lb.

Mix thoroughly and allow to cool partly before using. Have the loaves very cold when they are dipped. Mixture should be kept at a temperature of 130 to 140° F., or just hot enough so the operator can handle the loaves without discomfort.

If desired, a few cloves may be boiled in the water, but they should be removed before the gelatin and sugar are added. After dipping, loaves are replaced on the truck and returned to chill room.

Where a red coloring is desired on the loaf, paprika is added to the boiling water until the desired shade of red is secured.

Chicken and Ham Paste

Beef	3 lb.
Veal	2 lb.
Bacon	4 lb.
Sausage Rusk	3 lb.
Ham Rind	3 lb.
Bone Stock	7 lb.
Chicken	1 lb.
Farina	1 lb.

Color and flavor to taste.

The meats are first cooked in water for a sufficient length of time to take off the shrinkage. They are then minced and chopped in the usual manner. The liquid ingredients are added during the latter process and also the soaked rusk and farina. The proportion of chicken can be increased if it is available, but, generally speaking, the cost is against such a procedure.

Practically any cereal will take up the liquid portion of the meat, but the one most usually employed is meat rusk. This will readily absorb two and a half times its own weight of moisture and produce a stiff paste. Farina also has the same property, but in addition it acts as a binding agent. Rice is sometimes employed for this purpose and also gives excellent results.

Suitable modifications of the above formula can be made to meet factory conditions. The final recipe used will depend on the quantity and type of residues that are available.

Mexican Style Tamales

Medium Fat Beef Trimmings	50 lb.
Medium Fat Pork Trimmings	50 lb.

Grind through a one-sixteenth inch plate.

Cook the beef in 1½ gallons of water while stirring. When about half done add the pork and 2½ lb. of salt and cook until fairly tender. Then add

Good Chili Pepper	2½ lb.
Coriander	5 oz.
Paprika	1 lb.
Celery	2 oz.
Ground Cumin Seed	6 oz.
Oregano	3 oz.

These spices are thoroughly ground and mixed with enough red peppers to give the desired flavor (5 oz. of ground red pepper is suggested).

When the meats are tender stop the agitation and add 8 lb. of specially processed flour. Stir until smooth. Two gallons of tomato puree may be added at the end. Cool and transfer to molds.

Meat Puddings

Scotch White Pudding

A formula for making Scotch white pudding is as follows:

Formula No. 1

Fine Oatmeal	10 lb.
Beef Suet	7 lb.
Ground White Pepper	2½ oz.
Fine Powdered Salt	2 oz.

Free suet from all skin and stringy matter, then chop into pieces about ¼-in. square. Mix all ingredients together thoroughly and fill loosely into narrow or medium hog casings or beef casings, as preferred. Tie into circular shape and cook in boiling water for 30 minutes. When casings are stuffed they should be pricked to let out air. After cooking, they are hung up to stiffen.

No. 2

Fine Oatmeal	10 lb.
Finely Chopped Suet	7½ lb.
Finely Chopped Onions	2½ lb.
Salt	10 oz.
Ground Black Pepper	2½ oz.

English Black Pudding

To 1 pint of hog blood add rather more than a half pint of boiled double cream, ¾ lb. of caul fat cut into rather small pieces and 4 large onions chopped and fried in a little butter. Season with pepper and salt. Boiled grits or rice in amounts necessary for the proper consistency are added.

Mix well and stuff in bladders or hog middles, allowing plenty of room for tieing them into lengths of about 6 in., where casings are used. Have water at the boiling point, remove from fire and add puddings. Allow them to remain in hot water until they become firm to the touch. They are kept in water only long enough to set the mixture. When taken out, they are hung up in chill room to cool.

Black puddings are liable to become slimy or moldy if kept a few days. This can be overcome by dipping puddings in a strong salt water solution at a temperature of about 120° F. When cold and dry they should be wiped with a cloth which has been partially soaked in salad oil.

Pastrami

Beef of high quality is the base for manufacture of good pastrami. The shoulder clod of kosher cattle may be used for the Jewish trade; otherwise, the rib or tender parts from the hindquarters are used, particularly the round. If plate beef is used it will not require so long to cure and smoke.

The meat is boned, cut into 6- to 7-lb. pieces and trimmed so that fat covering is not too heavy. It is held in the cooler for 24 hours before curing. The very best sanitary conditions must prevail in making pastrami. The curing vat must be absolutely sweet and clean before any meat is put in it.

A dry curing mixture is made up in the proportion of 3½ lb. of sodium nitrate for each 100 lb. of salt. About 5 lb. of this mixture is used for each 100 lb. of meat. Bottom of the curing vat is sprinkled with the cure and a layer of meat is then packed on top. Cover this layer with curing mixture and sprinkle some ground black pepper and ground garlic on top of it. Then put in another layer of meat, treating it in same manner as first layer, and continue this building-up process until the vat is full. The pieces should be packed compactly. After 24 hours weighted wooden covers are put on the meat.

The meat now begins to form its own brine, which should cover the top layer. Any shortage in brine should be repaired with 65° plain pickle. The meat should be left in cure for 60 days at 38 to 40° F., without overhauling. If overhauled it is difficult to get it repacked as compactly as is desirable. This product must not be over-salted as it is not soaked after curing.

Remove meat from vat after curing and rub each piece with a spice mixture consisting of 65 per cent black pepper, not too fine, and 35 per cent allspice. Another spice mixture used for this purpose consists of:

Ground Coriander (not too fine)	60%
Allspice	25%
White or Black Pepper	
Garlic Flour	15%

Hold the meat overnight after rubbing with the spice mixture. Next morning put a hanging string in each piece and hang about four pieces to the smokestick.

Place in smokehouse where product is roasted through at a temperature of 320° F. About 6 to 7 hours may be needed to complete the treatment. Because of the high temperature used, specially designed smokehouses, or smoke-roasting houses, are desirable. These are about 5 ft. deep, 3 ft. wide and 12 ft. high. The heat is furnished by a gas heating system on the floor. There should be at least 6 ft. between the fire and the meat.

Smoked Turkey

The fowl is carefully dressed. The viscera are removed and bird is hung in a refrigerator to chill to 38 to 34° F. The wings are removed.

Following curing mixture is compounded:

Salt	3 lb.
Nitrate of Soda	8 oz.
Granulated Sugar	12 oz.

The turkey is rubbed inside and out with 1 lb. of this mixture. It is then placed in a large jar or container and allowed to stand for about 24 hours at 38° F. Balance of curing mixture is dissolved in 2 gallons of boiling water. After cooling this pickle to 40°, pour it over turkey, using enough to cover the bird. Hold in pickle for approximately seven days.

Remove bird from brine and soak it in lukewarm water for 15 minutes. Fowl is wiped dry with a clean cloth and hung for about three days at a temperature of 40°. Turkey is then ready to smoke. It is split open and stout twine tied around legs and neck.

Smoking

Use a dense smoke produced from applewood, hickory chips, sawdust or other hardwood. Smokehouse temperature should be held between 90 and 100°. Avoid strong drafts which may dry out muscles of the fowl.

The turkey should be smoked from 48 to 60 hours, depending on smokehouse and degree of smoking desired. Bird is hung for seven days after removing from the smokehouse to age the meat and develop tenderness and flavor.

Smoked turkey may be eaten without cooking. It also may be roasted or fried. If cooked the fowl should be parboiled for 30 minutes, then roasted.

Farm Curing of Meat

Cautions—

1. Kill and dress carefully.
2. Cool thoroughly before curing.
3. Do not cure meat when frozen or tainted.

4. Have vessels for curing tight and clean.

Corning Beef

Select the cheaper cuts of beef; plate, rump, brisket, etc., preferably of fat animals. Cut into convenient sized pieces. Use 8 lb. of salt to 100 lb. of beef. Sprinkle ¼ in. of salt over the bottom of barrel. Pack meat 5 or 6 in. in thickness over this. Alternate salt and meat layers, keeping a layer of salt for the top. Let stand overnight and add 4 lb. of sugar, 2 oz. of baking soda and 4 oz. of saltpeter dissolved in 1 gal. of tepid water.

Three gallons more of water should be sufficient to cover this quantity. Weigh down so meat will be entirely under the brine. Meat should be in brine from 28 to 40 days to secure thorough corning.

Keep in a cool place to avoid fermentation.

If brine becomes ropy, turn off, wash meat and add fresh brine.

Dried Beef

Round is usually used, the inside being considered the choice cut. Cut the round lengthwise of the grain so that the muscle fibers may be cut crosswise when sliced for table use.

Proportions:

One hundred pounds of beef, 5 lb. of salt, 3 lb. of granulated sugar, and 2 oz. of saltpeter. Mix thoroughly together.

Rub meat on all surfaces with a third of the mixture and pack it in the jar. Allow to remain for three days. Take out and rub with another third of the mixture, putting top pieces on the bottom. Allow to remain three days and rub on remaining mixture and let stand three days. Do not remove liquid but repack in the liquid each time.

Remove from pickle, smoke and hang in dry attic or near the kitchen fire. Use any time after smoking.

Brine-cured Salt Pork

Rub each piece of pork with fine salt and pack closely in a barrel. Let stand overnight.

Make brine, using 8 lb. of salt, 2½ lb. of sugar, 2 oz. of saltpeter and 4 gal. of boiling water for each 100 lb. of meat. Pour over meat when cold. Weigh down to keep under brine. Allow 4 days cure for each pound in hams and shoulders and 3 days for bacon and small pieces. When cured take out, wash in lukewarm water and hang in smokehouse.

Dry-cured Pork

For 100 lb. of meat use:

Salt	7 lb.
Sugar	2½ lb.
Saltpeter	2 oz.

Mix the ingredients, rub one-third of mixture over meat, pack and let stand for three days. Rub another third and let it stand three days. Rub with rest of mixture and pack to cure. Allow 1½ days cure for each pound the pieces average.

Curing pork and meat to be smoked:

Salt	7 lb.
Sugar	3 lb.
Black Pepper	2 oz.
Red Pepper	2 oz.

Mix ingredients and rub on meat; pack and leave for 6 to 7 weeks, then smoke.

Pork Sausage

Pork	40 lb.
Beef	10 lb.
Salt	1 lb.
Pepper	3 oz.
Sage	3 oz.
Water	5 pt.

Grind meat through the coarse plate. Spread out on table and spread on the seasoning. Put through fine plate and add water and mix as bread dough until water is completely absorbed.

Vinegar Pickled Meats

Tongues

Most calf and beef tongues are sold fresh or canned but lamb tongues and hog tongues as a rule are not much used in this way. Such find a ready outlet as vinegar pickled tongues. The tongues must first be soaked in strong pickle overnight in order to loosen the saliva and coating which may then be readily rubbed off. The salt is rubbed lightly over the tongues and the larger ones are pumped with pickle and then immersed in a cover pickle. A popular formula calls for 70° salometer brine to which has been added 30 lb. of sugar and 8 lb. of sodium nitrate per 100 gal. of pickle. If a quicker color is desired the nitrate may be reduced to 4 lb. and nitrite of soda to the amount of 8 oz. may be added. The tongues are packed loosely in vats of wood or concrete or in tierces and are overhauled at 5, 10, and 15 days. Beef tongues cure in 30 days when nitrate alone is used but the time is reduced to about 20 days when nitrite is added. Sheep and calf tongues will cure in about half the time required for beef tongues.

After the tongues are cured they are scalded in hot water, skinned, and cooked in open vats of water 3 to 4 hours (or less in the case of the smaller tongues) at a water temperature of 170°–180° F. After the cook the tongues are removed and immersed in cold water to chill them. They are then packed in tierces in 45 grain vinegar and held for about 3 weeks. Then they may be repacked for shipment. The addition of bay leaves and coriander or cloves and allspice add to the appearance of the product especially when it is put up for retail consumption in glass.

Vinegar used for pickled products is generally white vinegar of 90 gr. strength. "Grain" is determined by the number of grains of potassium bicarbonate that are required to neutralize the acetic acid in one troy ounce of vinegar. The figure for grain can be changed to per cent by multiplying by 0.125 since each grain of the bicarbonate is equivalent to 0.125 per cent of acetic acid. The 90 gr. vinegar is diluted with an equal volume of water to make 45 gr. vinegar.

Tripe

Vinegar pickled tripe is another product which is favored by many. In preparing it the cattle paunches are trimmed free of adhering fat, an incision is made and the paunch contents are removed. The paunch is then cut wide open while being sure that the honeycomb is not cut. It is then spread out with the inside up on a cone-shaped table and is thoroughly washed. A water spray placed above the cone is directed onto the tripe while an operator scrubs it thoroughly with a brush, the cone meanwhile revolving. At its lower edge the cone has a shield to protect the operator as well as to form a trough to catch the water. The washing is continued until the water removed by squeezing is as clean as the fresh wash water itself.

The scurf and mucous membrane are then removed by placing in a revolving washer which is partly filled with hot water to which has been added a small amount of sal soda, soda ash, bicarbonate of soda, trisodium phosphate or other such detergent. Slaked lime is also used in addition. This solution is kept at a temperature of 150° F. by means of a thermostat as the temperature is important. The number of pieces used must be controlled since too many prevent proper cleaning and too few may result in damage. The speed of the machine must also be properly controlled. The paunches are run through one water at 150° F. for five minutes. After this the water is drained off, the detergent and more water are added, and the machine run for 10 to 15 minutes. Again drain, refill with water at 110°–125° F. and run the cleaner for 2 to 3 minutes. The last water is removed and the tripe is removed. It should be recleaned by hand if necessary. The tripe is then put into cold water until it is ready to cook.

The cooking is done at 170° F. for 2 to 4 hours at the end of which time the tripe should be so tender that a finger can easily be pushed through the heavy seams. The cooked tripe is chilled in cold water, placed on a table, the seams are opened up, the fat is trimmed off and the skin that remains is scraped off. Next the tripe is chilled in water at 32° F. and again drained. From this, plain, honeycomb, and pocket tripe may be prepared. The latter is honeycomb tripe left in pocket form. The prepared tripe is next placed in 45 gr. vinegar pickle for 10 to 15 hours, at the end of which time it is removed, packed in containers and covered with 45 gr. vinegar and held at 45° to 50°. At this storage temperature the tripe will absorb about 40 per cent of its weight in vinegar.

Pigsfeet

Another product put up in vinegar is pigs feet. For this, the best of the front feet are selected, which are smooth and white in color and which have been well spread out in a chill room. When ready for curing they are placed in 100 salometer brine to which is added 1 lb. and 10 oz. of sodium nitrate (or 2½ oz. of nitrite of soda) per every 800 lb. of feet. A safe ratio of pickle to feet is 5½ gal. to every 100 lb. of feet. This means about 44 gal. to 800 lb. The need for nitrate or nitrite is small in the case of pigs feet and this fact accounts for the small amount recommended. The feet cure in about 8 days.

At the end of the cure the skin is slit with a knife the full length of the foot along the median line to allow the skin to shrink during cooking without breaking. The feet are best cooked in a steam jacketed kettle with a false bottom which prevents contact with the hot kettle. The feet are covered with cold water and this is then brought to a boil and skimmed. After 12 minutes of boiling the steam is shut off, the lid of the kettle is tightly closed and the cooking is continued at 180° F. The feet should not be disturbed during cooking. At the end of 3 hours the feet may be tested to see if they are done, and if they are not the cooking is continued until the feet are tender. This may require 6 to 8 hours. The meat should be tender but should not fall off the bones.

When done the hot water is run off by adding cold water to thoroughly chill the feet and to make the fat and loose particles float off without sticking to the feet. When firm enough the feet are removed, drained, split lengthwise with a cleaver fastened in a frame or by means of a special machine, or boned out if they are to be used for boneless pigs feet. In the boning out process *all* of the bones must be removed.

When split or boned-out, the feet are covered with 45 gr. vinegar in vats or tierces, about 250 lb. going into a tierce and 1200 lb. in a 1500 lb. curing vat, and held at 38° F. for at least fourteen days. When held longer they should be given enough 22½ gr. vinegar (say at the end of 30 days) to cover them well.

The finished product may be packed in various sized wooden containers from tierces to kits, but for a fancy article the feet are packed in glass with bay leaves and cloves, and allspice and pimento or sweet peppers may be added. By careful placing of the meats and the seasonings a very attractive package can be turned out. About 25 gr. vinegar is used in covering the packed product but the feet in gallon jars generally get 50 gr. vinegar.

Pigsfeet may sometimes gelatinize in the vinegar pickle. This is apt to occur when the feet are not thoroughly chilled after cooking, if the finished product is stored in a warm room, or if it has been too thoroughly cooked. Pigsfeet tidbits are handled in a similar manner as the boneless pigsfeet. The tidbit is a small piece of meat which is cut from the forward and upper end of the hind feet.

Souse in Packages

Formula No. 1

A very good grade of souse can be made entirely from pickled front pigs' feet. Or, if desired, small quantities of S. P. pork snouts, tongues and lips may be used with the pigs' feet.

Feet must be cooked at the boiling point until they are absolutely tender so that the bones can be removed easily. Before cooking the skin should be cut with a sharp knife for the full length, on a straight line from between toes to shank. If the skin is cut as described it will be free from breaks.

After feet have been cooked and boned—the latter operation while they are still hot—the boneless meat should be chopped by hand or put through the head cheese cutter.

Save the water in which the feet are cooked. When feet are removed from the cook kettle skim the grease from the top of the cooking water and then turn the steam on again, boiling for another hour. Strain the liquor through cheese cloth when it is removed from the kettle. This jelly water may be added to a like amount of gelatin solution in baking pan souse but its use is not recommended when a very clear product is desired, such as is stuffed in artificial casings.

Gelatin Solution

Such a jelly may be made by dissolving 1 lb. of commercial gelatin in 3 to 4 qt. of water, to which 1 qt. of 90 proof vinegar, 4 oz. sugar, 1 oz. salt and a pinch of cayenne pepper have been added. Jelly water should be hot when ready for use.

Mix the chopped meat with about 1½ gal. of chopped sweet mixed pickles, previously squeezed out in a strong cloth to remove as much moisture as possible. Then add one-half of a No. 3 can of chopped pimientos, a small amount of chopped fresh parsley and, if desired, 2 or 3 oz. of whole mustard seed. Pickles, parsley and pimientos may be omitted from the formula if desired but they add much to the flavor and appearance of the product.

The meat mixture is placed in 3¾ x 20 in. artificial casings. The casings are filled nearly full of meat and hot gelatin solution is then poured in. Slant the casings as the solution is added as this will allow air to come up on one side and escape and there will be no bubbles in the product. Tie off casings tightly and wash off in warm water which contains enough vinegar to cut the grease on the surface of the casing.

Place in molds to form a rectangular product or leave round. Place in the cooler overnight to chill and set.

About the same procedure should be used with souse which is molded without casings. The gelatin water is poured over the cooked meat in the container and allowed to seep down through meat. If gelatin solution and meat are mixed together and then filled into casings or molds, the hot jelly stirred up with meat is likely to draw out some of the meat juice, making a cloudy product.

No. 2

Pickled Pig Snouts	50 lb.
Pickled Pig Skins	20 lb.
Dry-Cured Beef Trimmings	20 lb.
Tripe	10 lb.

Cooking and Cutting

All meats should be cooked in nets so that they may be easily removed from kettle. Cook snouts and skins together for about two hours at 210° F. in a steam-jacketed kettle. Beef trimmings are cooked for about an hour and tripe for about 2½ hours in an ordinary cooking vat at boiling temperature.

Pig snouts may be chopped by hand, machine ground through 1-in. plate or head cheese cutter. Beef trimmings are ground through ¼-in. plate of hasher and skins through ⅛-in. plate. The procedure outlined in the first formula, both as to stuffing and adding pickles, pimientos, etc., may then be followed if desired.

No. 3

S. P. Pork Snouts	25 lb.
S. P. Pork Tongues	30 lb.
S. P. Pork Cheeks	15 lb.
S. P. Ham Trimmings	15 lb.
S. P. Pork Lips	15 lb.

All meats are cooked in separate nets until tender. Tongues and lips will require 3 to 3½ hours cooking; the other meats approximately 2 hours. The meats are ground through 1-in. plate or through head cheese cutter.

Add 5 lb. sour pickles cut into ¼-in. cubes and 2½ lb. of chopped red peppers and 4 oz. of dry pepper spice. Stuffing procedure used in the first formula may also be followed in this case.

Ready prepared seasonings or specially prepared seasonings are used in part in flavoring souse.

Dried Beef

Dressed cattle should be handled speedily from the killing floor to the chill room and should be chilled quickly. Carcasses should not remain too long in the cooler, as aging will interfere with proper curing. It is as important to chill beef correctly as it is to chill hogs properly to avoid trouble in curing pork.

The dressed cattle should be cut in a refrigerated room. This description will cover handling from the point where the stripper round has been cut out.

The stripper round includes the pieces known as inside and outside hams and knuckles. Knuckle is separated by cutting through knuckle joint from under the round, loosening meat around shank bone, and pulling knuckle away. Round is then turned over and a cut is made a half inch below the gam. It is then split along the center down to the bone, dividing it into an inside and outside. Excess fat is trimmed from the inside and outside hams.

The resulting three pieces are known as a beef ham set. The knuckles range from 6 to 14 lb. in weight; outsides, from 6 to 14 lb., and the insides, from 8 to 19 lb. Best quality dried beef is made from the insides and poorest from outsides. The 12-lb. pieces are considered the best weight.

Use of meat hooks and triers on beef ham sets should be avoided. These leave tears or openings in which soaking water may lodge, resulting in a grey-streaked product.

Beef should not be placed in cure until the internal temperature has reached 34° F. Insides, outsides and knuckles are cured separately.

Hams are cured in clean, dry vats or tierces. Tierces should be tested for tightness and lined with cheesecloth before filling. Sprinkle the beef cuts lightly with salt and pack carefully, so that there will be proper circulation of the pickle. About 286 lb. of beef is packed in a tierce.

Formula for curing pickle varies in different plants. A good basic formula calls for 15 lb. sugar and 6½ lb. nitrate of soda to 100 gal. of 78° salometer salt solution at 35 to 38° F. Another good formula is based on a 78° salometer salt solution containing 44 lb. of sugar and 9 lb. of nitrate of soda per 100 gal. Pickle is chilled to 38° F. and 5 to 5½ gal. are used for each 100 lb. of meat cured.

If the product is packed in tierces, the tierce is headed up when the meat is well covered with the pickle. Where beef hams are cured in vats, the meat is kept down in the pickle by the use of cross slats fastened inside the vats just below the top edge. These are slipped out when the product is overhauled.

Overhaul hams or roll tierces on the 10th, 25th and 40th day in cure. If tierces are used, see that they are properly headed up and kept full of pickle. If more pickle is needed, it should be the same strength as the original solution. Overhaul tierces by rolling and shaking to separate the cuts and move them about in the pickle.

If dark spots appear on the meat, they are usually the result of packing too tightly or using an insufficient amount of pickle. Sometimes they result from careless overhauling or failure to overhaul; sometimes they result from unsanitary handling.

Time of cure is about 7 days to the pound. Heavy insides require 75 to 85 days; heavy outsides, 65 to 75 days; knuckles, 65 to 70 days, and lighter sets, 10 days less. Knuckles cure most slowly because of the covering of skin.

If product is not used at cured age, transfer to freezer. Each tierce should be inspected to see that hoops are tight. Have all hoops redriven if loose and use hoop fasteners after they have been redriven. Be sure that each tierce is full of pickle. Beef hams may be frozen before or after curing, but it is not considered good practice to freeze, cure and then refreeze.

Barbecued Beef

Dig a trench about 40 in. deep and 3 ft. wide, the length depending on the quantity of beef to be barbecued. A trench 10 ft. long will accommodate about 400 lbs. of beef. Allow about 5 ft. additional for every 200 lbs. of meat. In digging the trench throw the dirt back far enough so there will be room to walk around the pit.

Start a fire at the bottom of the trench with kindling. Gradually add larger pieces of wood and keep the fire burning as rapidly as possible until a bed of live coals 15 to 18 in. thick has accumulated in the bottom of the pit. Hard dry wood (oak or hickory is preferred) should always be used for the fire. The pieces should not be too large. The chunks of wood must all be thoroughly burned so they will char and break. If the chunks are not sufficiently burned to break into coals they should be thrown out of the pit.

Level the coals off as evenly as possible. About 3 hours is usually required to get a good bed of coals. Cover the coals with sand to a thickness of about 1½ in. This should be clean, fairly coarse sand and must be dry. The sand may be dried out while the fire is burning so that it is hot when the time comes for its use. It may be dried on a piece of sheet iron on one end of the trench. The sand must be put on the coals quickly after a good bed has been accumulateb.

The beef to be barbecued should be cut into chunks of as near 2) lb. each as possible. Wrap and tie each piece in two thicknesses of cheese cloth and one thickness of burlap. Old gunny sacks may be used for this purpose if they are clean.

Have the beef cut and wrapped by the fire when the sand is spread on the coals. Without delay, place the wrapped pieces of beef on the sand. Cover and seal the trench immediately after the beef has been placed in it so that there will not be any loss of heat. Sheet iron makes the most convenient covering but boards may be used. All cracks should be tightly sealed with mud or sand to prevent escape of steam.

The beef should be placed on the fire about 10 hours before it is to be served. It may be put in the pit even earlier for after 10 hours there will be little heat in the coals and the beef may be left in its oven without harm. The trench should not be opened while the beef is cooking. It is not necessary to turn the meat.

The meat may be salted to taste after carving but no sauce or other seasoning is necessary. Sauce is used as a swab, however, when meat such as pork or lamb is barbecued over coals.

This method of barbecuing beef has been tested and approved by the American Hereford Cattle Breeders' Association.

It is generally figured that 100 lb. of beef will serve about 300 people at an outdoor gathering.

Roman Bacon

Thin sides of hogs, commonly known as "scalawags," are used in manufacture of Roman bacon. After meat is thoroughly chilled it should be skinned and cured in same manner as dry cured bacon. Cure should be mild, using 3¼ lb. of salt per 100 lb. of meat instead of 3½ lbs.

In addition to salt the following seasonings are used:

Ground Cinnamon	1½	oz.
Brown Sugar	10	oz.
Garlic	¾	oz.
Maple Flavor	4	tbsp.

Chop garlic with salt and sugar so that no juice will be lost. Rub bacon with this mixture, roll it up like a jelly roll and wrap tight with a large soft cord. Pack in boxes for cure, same as dry cured bacon. About same length of time in cure is required.

When bacon is cured it is washed off and dried. Then it may be stuffed either in beef bungs or manufactured casings and taken to smokehouse. If stuffed it must be heated in smokehouse to an inside temperature of 137° F. to conform with federal inspection regulations.

This is a very good way to use flabby thin sides. The product is very salable after it becomes known for it is reported to be "more than delicious."

Bacon Squares

Bacon squares are made from the jowl, which is carefully trimmed, squared and flattened out. If given a good cure this cut will make an economical and tasty piece of meat for slicing, frying or cooking with vegetables. These squares usually weigh from 2 to 4 lbs. after they are cured and smoked.

The product may be given either a dry or sweet pickle cure. As the cuts are small they cure a great deal faster than larger ones and there is no occasion to overhaul them. If given a sweet pickle cure the following mixed cure for bellies may be used:

Sodium Nitrate	4	lb.
Nitrite of Soda	6	oz.
Sugar	18	lb.

68° Salometer per 100 gal.

If a dry cured product is desired, use the following ingredients for each 100 lb. of meat:

Salt	3	lb.
Cane Sugar	1¼	lb.
Dextrose	1¼	lb.
Nitrite of Soda	¼	oz.
Sodium Nitrate	2	oz.

Each piece of meat is well rubbed with the mixture, a little is spread on the bottom of the curing boxes and additional amounts are spread between each layer of meat as it is packed and again over the top layer before the lid is put on the box. Dampening the squares with a small amount of pickle or sprinkling a little pickle in the cure will aid in getting the cure to stick to the meat.

Whether pickle or dry cure, the curing should be done at about 38° F. and pieces should be cured in from 10 to 25 days, depending on size. These butts or bacon squares are sometimes cured by packing them in with dry cure bellies, using them to fill up any empty spaces in the box.

The squares, after being removed from cure, are soaked, washed and put in the smokehouse. Bacon squares are usually placed on wire mesh trays flesh side down. They are smoked from 12 to 15 hours.

Dry Curing Hams

Hams may be dry cured either on a platform or in curing vats, as preferred. There is a little less handling if hams are piled on a platform in the curing cellar. The curing mixture consists of

Salt	70	lb.
Sugar	25	lb.
Saltpeter	5	lb.
or		
Nitrate of Soda	4	lb.

These ingredients are thoroughly mixed before using.

Be sure that hams to be cured are well chilled and that bone temperature is not above 38° F. Rub face and ends with nitrate of soda and lay on boards for 24 hours. Then rub well with curing mixture. Lay hams on platform close together, skin side down, three to four rows high.

Some of the curing mixture should

be sprinkled over each layer of hams. When pile is finished, cover with canvas or heavy paper to shut out the air.

After 5 days curing, rub each ham again with mixture and restack. Continue cure for 10 days, then rub and restack again. Let them remain for 12 more days, rub and re-stack as before and leave until cured. The same method of handling is used for curing in vats or tierces.

Curing and Smoking

Following is the curing time for different average weights:

8–10 lb. hams cure in 40 days.
10–12 lb. hams cure in 45 days.
12–16 lb. hams cure in 55 days.
14–16 lb. hams cure in 60-65 days.

When hams are cured and ready to smoke, soak them for 6 to 8 hours in cold water. Then wash in hot water and hang on smoke trees. They should be allowed to dry fully before going into the smokehouse. Smoke hams slowly at about 85 to 90° F. for the first 12 hours, then raise temperature to 115°. They should be smoked for 24 to 36 hours.

Country Style Ham

After ham has been properly trimmed and shaped, a light sprinkle of salt is rubbed over the entire piece, rubbing it in well at hock and knee joint and at the butt ends. The meat is then held in the cooler at 36 to 38° F. overnight. It is claimed that this light salting opens up the pores and aids curing.

Mix together 7 lb. fine salt, 5 lb. sugar and 4 oz. saltpeter or sodium nitrate. This will be sufficient for 100 lb. of meat. Divide the mixture into three equal parts.

Next morning remove the hams from the cooler and rub with one portion of the curing mixture. Rub the meats thoroughly, especially around the joints. The hams are than put in a box or laid on a shelf in a cooler or cool room. They are over-hauled on the fifth day and rubbed with a second one-third of the curing mixture. This process is repeated in 5 or 6 days when final third of mixture is applied. Meat is then allowed to remain without further overhauling until cured.

Hams are cured 2 days for every pound in each piece. After curing they are soaked for 30 minutes to remove excess salt and improve appearance. They should be allowed to drip and dry before smoking.

A long, cool smoking period is necessary to secure the best flavor. When the desired color is obtained after smoking the hams are thoroughly cooled in the smokehouse. They are then wrapped in heavy paper, placed in a paper sack and hung in a cool dry room until ready for consumption.

Some producers of country cured hams finish smoking with sassafras wood, which is added after the hams have the desired color. This gives a distinctive odor and flavor. Others smoke with green apple wood which is said to give a good flavor.

Hams are smoked for a week to 10 days, or until a rich brown color is obtained. Meat side of the hams is sometimes coated with a mixture of sorghum molasses and brown sugar to which some cayenne pepper is added. Hams are wrapped, placed in a cloth sack and hung in a cool dry place. Such hams will keep for a considerable length of time.

Asphalt Dipped Hams

Hams should not be wrapped and dipped in asphalt when hot (as immediately after smoking) as this provides ideal conditions for the growth of mould. If wrapped while hot, moisture continues to escape from the meat into the space between ham and paper, producing the damp condition conducive to mould. Smoked meats will also mould if they have been insufficiently dried in the smoking process.

Hams should be cooled before packaging in a smoked meat hanging room in which the temperature may be held from 55 to 60° F. and the humidity around 70 per cent and not over 80. Hams may also be wiped with cheese cloth immediately before they are packaged. Cooling will also control the seepage.

Some packers prepare their hams for dipping by a little more elaborate method. A piece of muslin is placed over the shank extending down over the butt on the face of the ham. The ham is then wrapped in a sheet of glassine paper, then in a sheet of gray ham paper, after which it is placed in a stockinette bag and tied so that it can be hung from butt with shank down. It is then dipped in melted asphalt.

Kosher "Ham"

Kosher ham made of mutton leg is cured in a good mild sweet pickle, usually of about 65 to 70° strength. Length of curing period depends on size of the leg, but it is usually around 30 days. When taken out of cure it is thoroughly scrubbed, allowed to dry off and then smoked.

This product has a distinctive and delicious flavor, not unlike that of smoked ham, and is tender and sweet. As in the manufacture of any other meat product, it is important that the mutton leg be thoroughly chilled and in first-class condition when it goes into cure.

Norske mutton leg is a somewhat similar product, made with a leg from a good wether or sheep, cut off at the pin bone. It is cured in 65° pickle for 20 to 25 days. A few cloves, some allspice and 3 or 4 garlic onions are sometimes added to the pickle to give the mutton a fine flavor. When cured the mutton leg is washed in warm water and hung in the smokehouse. It is smoked slowly for three or four days and then hung in an airy room to dry.

Polish Fresh Ham

Use a 12–14 lb. green ham, removing bone, skin and surplus fat. Leave about ½ to ¾ in. of fat on the ham. Make up a mixture of salt, ground pepper and a small amount of garlic. Rub some of mixture on inside of ham where bone has been removed.

Put ham in a ham retainer and cook for 4 to 5 hours at 165° F. Remove from cook vat and hold in cooler overnight, still in the retainer. Remove from retainer next morning and rub outside of ham thoroughly with above seasoning mixture.

Put ham in bake oven and bake from 1½ to 2 hours at 250 to 300° F. After cooking and cooling, ham should be held in a storage temperature of 45 to 50° until sold. This product should be moved promptly.

German Style Ham

Hams with a pink meat color and weighing about 18 lb. are chosen for curing. They are long cut, with some of the loin end on. Hip bone should be removed. Hams are cured with a mixture of 25 lb. of salt and 4 oz. of sodium nitrate, or a prepared curing mixture. This mixture is rubbed into the ham, particularly the skin side, for about 5 min. Press some of mixture into leg bone at cut. Place hams in vat and add enough of curing mixture on each layer so that all parts are lightly covered with it. When vat is full it should be covered with boards with a weight on top.

Curing will take 28 days at not less than 38° F. Repack three times during this period, so that top layer goes on bottom. Rub hams over again at each repacking. At end of 28 days take hams out of vat and lay on floor in same temperature for 14 days, sprinkling curing mixture very lightly between each layer.

After curing wash hams in warm water and hang in dry-room for two to three days. Then smoke in a very cold smokehouse for not less than 6 weeks. In Germany these hams are sometimes smoked for 6 months.

Careful handling in cure will yield a tender product. Packers preparing this type of ham for the first time should cure only a small batch. In this way they can watch smoking and curing closely.

Italian Ham

There are several points for the packer to consider in planning the manufacture of Italian ham. In the first place, such ham must bring a good price, since the long curing and drying process results in about a 35 per cent shrinkage in weight. Moreover, the product is a part of the packer's inventory for a longer time than a regular ham, and requires more handling.

It is important to choose good lean hams of 12–16 lbs. average which are entirely free from bruises. They should be fine-grained, even in texture and have a smooth skin. The fat covering should not be more than 1 to 1¼ in. thick. The shank is left extra long on such hams, the foot being cut off just below the dew claws. The aitch bone is carefully removed at the joint so as not to mutilate the ham.

The government requires that certain regulations be followed in the preparation of Italian hams, considering them as pork which is customarily eaten without cooking. When the refrigerating treatment is used for hams they are frozen and held in freezers for not less than 20 days at a temperature not higher than 5° F.

The following dry curing materials and seasonings may be used for each 100 lb. green weight of hams:

Salt	3 to 4	lb.
Cane Sugar	1¼	lb.
Dextrose (Corn Sugar)	1¼	lb.
Nitrite of Soda	¼	oz.
Sodium Nitrate	2	oz.
White Pepper	5	oz.
Black Pepper	2	oz.
Allspice	8	oz.
Nutmeg	2	oz.
Mustard Seed	½	oz.
Coriander	½	oz.

Hams should be cured in a dry cooler at a temperature of 36 to 38° F. on a platform about 12 in. off the floor. The platform is sprinkled with the curing mixture. Hams should be thoroughly rubbed with the mixture, the operator being careful to see that face and ends are well rubbed. Place the hams flat on the platform with the skin side down. Pile them four high, always skin side down. Sprinkle some of the mixture over each layer. The pile should be covered with canvas to exclude air.

Overhaul the pile in 10 days and place the top hams on the bottom. Rerub each ham with some of the curing mixture. Overhaul a second time in another 12 days and rub again. The hams need not be disturbed again during the balance of the curing period. Fresh hams will cure in 45 to 50 days and frozen hams in 40 to 45 days.

Hams handled in this manner will come out flat and dry. If, after curing, still flatter hams are desired they should be laid on planks, and planks and a weight placed on top of them. A thickness of about 2 in. is considered desirable. Some prosciutto specialists put the hams in pressure molds during the cure and they are thus compressed into the desired flat form.

After the hams have been cured they may be soaked for a short time in water at 80 to 95° F. This soaking should continue only long enough to soften the skin. They are then scrubbed vigorously with a soft fibre brush, so that they will not show salt when they come out of the steam house.

Use ordinary twine for stringing, but do not force it through the meat. Instead, make a double loop and encircle it around the shank and tie a knot in it.

Hams are then placed in the steam house and allowed to remain there for about 48 hours. Temperature of the steam house should not be less than 130° F. This is gradually raised to 140° and kept there for two hours, when it is dropped to 120° for eight hours. From 120° the temperature is gradually reduced, so that when the hams are ready to come out of the steam house the temperature should be from 95 to 105°.

To insure firmness the hams should hang outside of the steam house to cool off from four to eight hours.

Following this they are rubbed on the meat side with black and white pepper, about equal parts. This should be done very carefully to avoid getting any pepper on the skin. The meat side of the ham should look almost black when this treatment has been completed.

The hams are then held for 30 days at a temperature of from 70 to 75° and humidity of 65 to 75.

Prosciutto produced in the packinghouse by this method is very similar to that which has been made for centuries in Italian homes. The Italians eat the ham cold, but Americans may fry it or warm it up. The flavor is more pronounced and distinctive than that of Virginia ham, which more closely resembles it than any other American product.

Virginia Style Hams

The methods given here are some of those used by Virginia curers and farmers in making Virginia style and Smithfield type hams. It will be noted that the formulas and processes are individual, rather than scientifically standardized. Each is probably the result of much experimentation on the part of some curer or farmer who wanted to turn out a ham with certain qualities. With some experimentation it should be possible to adopt these cures to the more or less standard procedure used in modern meat packing plants.

For a dry cure, rub the fleshy surface of each ham thoroughly with sodium nitrate, using 1 tablespoon to a 15-lb. ham, varying the amount according to the size. Then pack away for four to six hours, with the flesh side up, in order to give the sodium nitrate time to penetrate. Then take up, rub well with salt and pack away, using plenty of salt.

The hams should remain packed in plenty of salt for six weeks, when they are taken up, washed well and when nearly dry about one teaspoonful of black pepper is sprinkled over the fleshy surface. They are smoked lightly on damp days with hickory chips. When about nine months old they are ready for use. These hams usually range in weight from 10 to 18 lbs.

When the hams are packed away for cure they should be pressed into plump, symmetrical shape while they are still soft. They should never be packed more than two or three feet deep, as the weight of the meat will press them out of shape.

A pickle cure for Virginia hams is as follows: Salt the hams lightly for one or two days to bring out the blood. Then to each 100 lb. of hams use

Salt	8 to 10 lb.
Sodium Nitrate	2 oz.
Brown Sugar	2 lb.
Red Pepper	1 oz.

To this add four or five gallons of water. Strength of brine is measured by its ability to float a fresh egg. Hams are then placed in a barrel or tierce and mixture poured on until hams are fully covered. After remaining in this brine for from four to six weeks they are smoked gently for several weeks with hickory chips. Hams are left hanging for some time after they are smoked, then wrapped in paper and put into a bag and rehung. After six months or more, they are ready for use.

Smithfield Type Hams

Preparation of the Smithfield type ham by some Virginia curers, is as follows:

Flesh side is sprinkled with fine sodium nitrate until hams are white as though covered by a moderate frost. Three or four pounds of sodium nitrate is used for each 1,000 lb. of meat. Then salt immediately with the best of fine salt, covering the entire surface. Pack hams in bulk, not deeper than three feet.

In ordinary weather they should remain in this bulk for 3 days. Then break the bulk and resalt with fine salt and again pack in bulk. Each ham should remain in the bulk one day for each pound the ham weighs. Hams are then taken up and thoroughly cleaned by washing in warm water. When nearly dry rub the entire surface with fine black pepper. They are then hung and gradually and slowly smoked for 30 to 40 days with hickory or red oak. When smoking is completed, re-pepper and bag. Hams are usually allowed to hang 9 to 12 months before being used.

Making Fancy Product

A method which is reported to turn out an especially fancy product is as follows:

Only lean hams should be used. Hams are long cut, with aitch bone sawed down or removed. Mix 2 lb. of sugar with 3 oz. of sodium nitrate for 100 lb. of meat, and rub each ham well on meat side with this mixture. Rub skin side and shank with salt and sprinkle a handful of salt over the meat. Then wrap in a piece of heavy unbleached muslin large enough to enclose the ham. Lay on a platform or on the floor of the dry salt curing cellar, meat side up, with salt all around the ham, for 10 days.

If it is desired to have the hams flat, press down with a board or plank for a few days or a week. Add more salt inside the muslin at the end of 10 days, wrap again, and hold until cured. This will take from 30 to 40 days, according to size. Take hams out of cloths at end of curing period, soak in cold water for 2 hours, and wash with warm water and brush. Hang up to dry for two days. Then rub all over with ground black pepper and hang in an airy room for 10 days. Smoke lightly for two or three weeks.

Hang up away from flies to dry further after smoking. Hold for several months or until sold. Hickory or sassafras wood should be used for smoking this product.

New England Style Ham

This product is stuffed in cellulose "bung" casings, beef bungs or in muslin bags, which are later paraffined. Formula and method of handling the meat is same for each kind of container up to time of smoking and cooking. For a 100-lb. batch of the meat use:

Dry Cure Lean Pork Trimmings	85 lb.
Dry Cure Boneless Bull-Meat or Boneless Chucks, Trimmed	15 lb.

A good selection of pork trimmings, about 95 per cent lean should be used. Best trimmings are from blade bones, face and cushion bruised hams and heavy shoulders. Other cuts may be used for trimmings when prices warrant. Grind pork and beef separately through 1-in. plate of hashing machine.

Cure pork and beef separately, using the following formula for each 100 lbs. of green meat:

Salt	2½ lb.
Granulated Sugar	8 oz.
Sodium Nitrate	3 oz.

Mix hashed lean pork with proper amount of curing ingredients in the mixer for about 2 minutes. Then pack in an open tierce and pour ½ gal. of No. 2 ham pickle (50° strength and must be sweet) over top of meat packed in open tierce.

Meat is cured in five days with this formula at 35 to 38° F. If not used within 8 days, a tight head should be put in tierce to exclude air and check deterioration. Beef is ground and cured in same manner as pork.

After boneless beef is cured it should be ground through ⅛-in. plate of the hasher, then put in silent cutter and chopped for about 3 minutes, adding enough ice to keep the meat cool. Beef is then added to cured pork trimmings and two meats are placed in the mixer and mixed together for 3 minutes.

Product is then ready for stuffing. If "bung" cellulose casings are used the meat is stuffed in them and smoked for 2½ hours. Start with 110° F. dense smoke, gradually increasing the temperature so it will be 160° for the last half hour. Cook at 160° for 2½ hours, remove and cool in cold water for 30 minutes.

If casings are used, the meat is stuffed into beef bungs, cut 18 in. long, using all cap end bungs. Medium-sized beef bladders may also be used. Product is then taken to smokehouse and smoked 1½ hours at 120° F. Gradually raise temperature to 130° for the next hour, and to 140° for the last hour.

After the 3½ hour smoke, the product is taken to the cook tank and cooked from 2½ to 3½ hours, depending on the size of the container, at 160° F. When cooked, shower with cold water for about 5 minutes. Let hang in natural temperatures for two to three hours to partially chill before placing in storage cooler.

If meat is stuffed in muslin bags, product is smoked for about two hours at a low temperature. Some producers, however, do not smoke the bag product. Cooking time and temperature are same as for casing product. As soon as bags are removed from the cook tank, they should be rinsed off with warm water to remove all grease. The product should hang at natural temperatures until the bag is thoroughly dry.

Bags are then dipped in paraffin wax of 118 to 120° F. melting point, the wax being brought to a temperature of 175° before product is dipped. After a momentary dip the waxed bags are raised up and hung on a rack directly over dipping tank. The wax dries quickly. Too much ice should not be used in making product that is to be bagged. Excess moisture is likely to work through the bag and cause wax to blister.

Removing Sex Odor From Hog Meat

First remove submaxillary and parathyroid glands which contain concentrated odor. The rest of odor is removed by 6-8 weeks pickling in following brine:

Salt	25.00 %
Sodium Nitrate	0.25–1%
Sugar	0.2 –2%
Water to make	100 %

Liquid Seasoning for New Engla Style Baked Beans

Fruit Fine Sugar	6 lb.
Fine Salt	20 lb.
Ground White Pepper	2½ lb.
Powdered Ginger (Best Grade)	1¼ lb.
Yellow Mustard Flour (Best Grade)	2½ lb.
Onion Powder	3 lb.
Sodium Alginate	8 oz.
Sodium Bicarbonate	1 lb.

Mix dry and add to 50 lb. best grade molasses. Heat to 212° F. Shut off heat. Add additional 50 lb. best grade molasses. Stir thoroughly. Bottle hot.

A 4 oz. bottle is a suitable package for use with 1 lb. of dry beans with 8 oz. of salt pork.

Prepared Pork and Bean Seasoning, New England Style (Concentrated)

"Fruit Fine" Sugar	6 lb.
Fine Salt	20 lb.

Ground White Pepper	2½ lb.
Powdered Ginger (Best Grade)	1¼ lb.
Powdered Yellow Mustard	2½ lb.
Onion Powder	3 lb.
Acid-Free Cornstarch	7 lb..
Sodium Bicarbonate	1 lb.

Mix dry. The product is hygroscopic and will cake if it becomes moist. Package in moisture proof envelopes, containing directions for household use. Insert 1 or 1½ oz. per envelope. Partial consumer directions: 1 or 1½ oz. of concentrated flavoring to each lb. of dry beans, plus 2 to 4 oz. brown sugar (or best grade of molasses), plus 8 oz. salt pork per lb. of dry beans. Household recipe will comfortably fill 3 to 3½ pint bean pot. Additional details on household recipe available on request.

Modifications

For complete seasoning, add to the foregoing batch 75 lb. of No. 8 or No. 9 soft sugar (brown). Package 3 or 4 oz. of product for use with each lb. of dry beans.

Pork and Beans with Tomato Sauce

It is important that the beans should be of good quality, young, and undamaged. Old beans never cook sufficiently soft to make an ideal product, and damaged beans almost invariably show discoloured patches. The small white navy beans as grown in Japan or California are very suitable for canning.

There are two methods commonly adopted for preparing the beans; in one method they are soaked in hot water, in the other, in cold weak brine. When the hot-water method is employed, the beans are placed in a container and covered with water at 175° F.; they are allowed to remain in the water until it is just above room temperature. The water is then drawn off and replaced by two washings with cold water. The beans are then removed from the vessel in which they have been soaked and cooled, and placed in a blanching machine. This consists of a horizontal stainless steel cylinder, about 12 ft. long and 18 in. in diameter, fitted with a revolving screen. The machine is filled with water to a depth of about 20 in., the water being maintained at boiling point by means of a steam coil, or with live steam. The beans are poured into the screen through one end of the cylinder, and the screen, slightly inclined, revolves through the hot water, the beans traveling towards the outlet, where they are caught in wire baskets and conveyed to the filling machines.

In the cold water process, 1 cwt. of the beans are placed in a vessel (after washing to remove extraneous dirt), and covered with 10 gal. of water containing 2 per cent. common salt. Soaking is continued for 12 to 14 hours (old beans will take double this time), and for the highest grade of finished product the beans should be subjected to a second soaking for a period of about 4 hours in a fresh lot of weak brine of the same strength (2 per cent.).

Drain off the surplus liquor, and for every 1,000 lb. of soaked beans add 100 lb. of the sauce made as follows:—

Tomato Pulp	300 lb.
Water	100 lb.
Salt	5 lb.
Sugar, Granulated	18 to 20 lb.
Mustard	½ lb.
Pepper, Ground White	½ lb.

Sufficient Caramel Color to give the sauce a suitable brown color.

Season with 2 oz. of allspice or cinnamon; a small quantity of mace may also be added if desired. Some packs also contain an onion flavour, which may be added if desired in the form of desiccated onion, about 4 oz. to the above quantity of sauce. The flavour of the product can, of course, be varied to meet the demands of the particular market.

Place the tomato pulp and water in a steam jacketed vessel, raise the temperature to boiling point, add the sugar and salt, reduce temperature below boiling point, and add the spices and the caramel. If it be found that the sauce is not sufficiently thick to adhere to the beans (after processing), add to the sauce 2 lb. of cornflour, previously mixed to a thin paste with cold water.

About ¾ oz. of sliced fresh or salt pork is sufficient for a one-pound can. If salt pork is to be used, it is made by soaking a belly of pork in 20 per cent. salt solution for 24 hours.

The slice of pork having been placed in the can, this is now filled about three-quarter full with the soaked beans, and the sauce, prepared as above, is used to top up the can, leaving about one-sixteenth of an inch head space. The cans should then be given at least 20 to 25 minutes exhaust in the hot chamber, after which they are immediately closed and processed. It must be carefully noted that, if the beans have not had sufficient soaking, the processing times given below may be sufficient to bring about sterility without thoroughly cooking the beans, which will remain hard and unpalatable. If this condition is remedied by prolonging the process, then the remainder of the materials in the can will be overcooked, and the pack spoiled. Attention to the correct soaking of the beans is therefore important.

Process

For 1 lb. cans, 10 minutes up to 248° F., 60 minutes at 248° F., 10 minutes down to atmospheric pressure; then cool as rapidly as possible. For a 2 lb. can, increase the processing time by 10 minutes.

Fish and Sea Food

Canning Sardines—French Method

According to a definition by the Bureau of Fisheries, U. S. Dept. of Commerce, any small fish of the herring family, properly prepared, can be called sardines.

In Europe the pilchard, sprat and bristling are canned; in Maine the young herring; in California the Pacific sardine, a species of pilchard.

When the fish are taken to the factory they are spread on large tables and sprinkled with a little salt. The women who remove the heads and viscera either stand or sit, and perform their work with great rapidity. They hold the fish in the left hand and with the right hand press the knife into the back and side of the head of the fish, using the right thumb for a counter pressure. The head is pulled or torn off, rather than cut, and the esophagus, stomach, and most of the intestines go with it. The body drops into one basket, the refuse parts into another. The refuse is disposed of to farmers for fertilizing their fields.

Immediately after evisceration the fish are sorted by size into large tubs (half oil barrels holding 250 liters) containing a brine strong enough to float a potato. Here they are left for half an hour to an hour, depending on their size, quality, and the condition of the weather. They are then placed in small wicker baskets and taken to the yard, where they are washed in either fresh or salt water (salt preferred) while in the baskets, each basket being put through two waters. This washing, which takes but a few seconds. removes from the fish any undissolved salt, loose scales, and dirt.

Drying, which is the next step, is preferably done in the open air, and a large part of the product is so treated. For open-air drying the fish are arranged by hand, one by one, in wire baskets or trays holding about 150 fish of medium size, placed on wooden frames or flakes. The baskets are 16 or 18 inches long, 9 inches wide, and 3½ inches deep; are made of coarse wire with a polygonal mesh two-thirds or three-fourths inch in diameter, and have a long bridle-like wire handle on each side by which they are suspended on the flakes, each bridle having at its middle a loop or ring which interlocks with its fellow. The distinctive feature of this wire tray is its division into about 7 crosswise compartments, V-shaped in section, the spaces being pointed at the bottom and open above. The divisions are of coarse wire, and one side of the V forms a wider angle with the basket bottom than the other. Against the more oblique side the sardines are placed in regular rows, with their tails upward, so as to promote the escape of water from the abdominal cavity. By means of the loop in the handle some of the baskets are hung on the frames, somewhat above the head; others are rested on lower frames. Wooden baskets or trays are used in some places.

The sardines remain out for a variable time, depending on their size, the state of the atmosphere, etc. The usual time in favorable weather is one hour.

In damp foggy, or rainy weather (especially in autumn), the sardines must be dried indoors by artificial heat, and drying ensues much sooner than in the open air. Some factories, not being provided with driers, are unable to operate in such weather. In most of the factories—especially those more recently constructed—artificial heat is supplied in a special drying chamber by means of steam pipes, but in some of the older canneries the wire baskets are suspended from a wire lattice under which are small charcoal furnaces.

From the drying flakes the fish are

taken in the same wire baskets to the cooking room and immersed in boiling oil, in open vats of various sizes and construction. As the fish are quite dry, much of the oil is taken up in cooking and has to be replaced from time to time by fresh oil. The immersion in oil usually lasts about two minutes, but depends on the size of the fish and is best gauged by experience. When the caudal fin will break easily, the fish are said to be cooked enough. The baskets are then removed to a table or platform with an inclined metal top, where the surplus oil is allowed to drain from the fish. After a few minutes the baskets are taken to the packing room, where they are hung on wooden frames over metal-top tables for further draining and cooling. The oil which drips off here is in some places used in soap making.

The sardine manufacturers employ two kinds of oil in their canning operations—olive oil and arachide or peanut oil; and small quantities of sesame oil have at times been used.

While it is reported that the manufacturers knowingly handle only the oils named, it is understood that cottonseed oil, being tasteless and cheap, is used by the French oil dealers for adulterating both olive and peanut oil.

French olive oil is used with the best quality of canned sardines. Fish packed in it will remain in good condition ten years or longer, and are reported to be better the second year after packing than earlier.

Arachide oil is extensively employed. It is made in Bordeaux, Fecamp, and Marseilles from peanuts imported from India, Senegal and other parts of Africa, and other countries.

Peanut oil is largely used to meet the American demand for a low-priced sardine. Most of the cheaper French sardines exported to America are packed in peanut oil, which is practically tasteless.

A canner may fry his sardines in peanut oil and fill the cans with olive oil, or vice versa; or one oil, with or without the admixture of cottonseed oil, may be used throughout the process.

There are various other ingredients with which or in which the sardines are packed to give them flavor or piquancy. Some of the very best goods are prepared with melted butter of good quality instead of oil; these are mostly for special French trade. Tomato sauce, pickles, and truffles are also used. With all of these the sardines are packed precisely as when oil is employed and in cans of the same sizes. Only relatively small quantities of such goods are prepared.

When the fish reach the packing room, the women who had been cutting will probably have finished that task and are seated at a table ready to take up the packing of the sardines in tin boxes; they carefully place the fish in the cans, and then pass them along to another set of women who fill the boxes with oil from a faucet or with other materials used with the sardines — tomato sauce, mustard, truffles, etc.

In some countries (United States) the trade demands that the blue back of the sardines be uppermost when the box is opened; while for other countries (France, Belgium) the white belly should be uppermost. The position of the fish when the top of the can is removed by the consumer is reversed in packing, as what is the bottom of the can from the packers' standpoint is in reality the top.

With most of the oil sardines a small quantity of spices is used in order to impart a flavor. The usual ingredients for each can are 1 or 2 cloves, quarter or half of a laurel leaf, and a small piece of thyme; these are put in the can before the fish, so that they will be on top when the can is opened. The fresh leaves of tarragon (estragon) are sometimes used.

Sardines are packed in tin boxes of a large variety of sizes and shapes, some of which are well known to the American public, while others do not enter into the general trade here. Among the kinds which have received special designations are the "quart bas," "quart haut," "demi," "huiteme," and "triple." The "quart" can is the standard. It ordinarily contains 12 to 14 fish, but sometimes as many as 20 and sometimes only 6 or 8. The "demi" is twice as large as the "quart," and "huiteme" is only half as large; while the "triple" contains 12 times as much as the "quart." Lozenge-shaped and boat-shaped cans (which are protected by patent) are also employed by a few companies;

and some factories put up fish in glass vessels. The standard wooden cases in which the cans are packed and sent to market contain 100 "quarts," 200 "huitemes," 50 "demis," etc.

Sealing the bottoms on the cans—the next step in the preserving process—is one of the few things done by men. Soldering appliance of various types are used in the different factories. The most convenient, timesaving, and modern soldering iron would appear to be that which is kept constantly heated by gas. The handle of the iron is pierced by two pipes, one conveying gas and the other air for admixture with the gas; and the gas is ignited in the head of the iron in such a way as to keep the soldering edge continually at a white heat. The free movement of the iron is effected by rubber tubes connecting it with the main supply pipes extending lengthwise under the table at which the solderer works. While being closed the can is held in a frame on a small turn table moved by the foot of the solderer. The cover is applied so as to force out the air, and at the same time a good deal of oil escapes. The soldering begins in this oil, at the middle of one end of the can, and is continued around by the revolution of the turn table rather than by the movement of the iron.

From the soldering table the cans are taken to another room in which they are placed in large square iron vessels, open at the top and holding several thousand "quart" cans. The vessels are then immersed in boiling water for two hours. This accomplishes a fourfold purpose: (1) The cooking of the fish is completed; (2) the bones are softened; (3) the bacteria in the oil and fish are killed, which would otherwise produce putrefaction; (4) the presence of leaks in the cans is disclosed.

After cooling, the cans are placed in dry sawdust and stirred from time to time; this absorbs the oil and moisture on the surface and renders the cans clean and ready for packing.

There is a comparatively small proportion of the fish prepared as "boneless sardines," which are rendered "boneless" by bending the caudal peduncle until the backbone breaks, and then drawing out the vertebral column with special tweezers or pincers. Fish intended for this purpose require more prolonged drying (2 to 3 hours), so that the muscular tissue may separate more completely from the vertebrae. Only fish 60 mm. long or over are made "boneless," and of even the larger fish only a small quantity is so treated. The best sardines are not so prepared, as they are fresher when they reach the cooking room, having required only one-half or one-third the time for preparation up to that stage. The "boneless" fish, while undergoing the additional drying, are deteriorating. The removal of the backbone adds about 6 per cent to the value of the fish.

Canning Maine Sardines

In order to save time during transportation, salt is sprinkled liberally throughout the mass of the fish as they are placed in the hold of the boat, the amount varying from 1 to 2½ sacks, of about 190 pounds each, to the hogshead, according to the length of time it takes to reach the cannery and the quality of the fish, as judged by the boatman. Or a strong brine, made by adding the proper proportion of sea water to the fish, and salt may be used. The addition of dry salt draws out from the fish enough water to form a pickle, which sometimes is pumped off and at other times allowed to remain. As a rule, when the sea is rough no water is added, and the pickle formed by the addition of salt is pumped off during the voyage, so that the fish may be carried in practically a solid bulk, thus preventing damage to them from the rolling of the vessel.

At the cannery the fish are hoisted from the boat into long chutes down which they are conveyed by a stream of running water into tanks in the pickling room. If the fish have been long enough in salt during the trip to the cannery, they are simply passed through tanks containing very weak pickle. If they have not been sufficiently pickled during transportation, they are held in tanks filled with strong brine for from one to two hours.

In a few canneries the fish are beheaded as soon as they are taken from the boats, but, as a rule, the whole salted fish are bailed from the pickling tank into the receiving trough of the flaking machine. The traveling apron of the machine extends from the floor above into the pickling room below. Carried along by the traveling apron to this machine, the sardines are distributed, more or less evenly, depending upon the manner in which the machine is operated, on the flakes, square or rectangular wire frames, about 3 by 1½ feet, securely bound around the edge with a 1-inch galvanized metal band. Several of the canneries putting out a superior quality of sardines distribute, or flake, the fish by hand, thus securing a very even distribution on the flakes, a most important factor in the production of quality in the pack. The flakes carry the fish through the rest of the canning process until they are ready to be placed in the cans.

From the flaking machine the flakes are passed, on racks mounted on wheels, or, in a few cases, suspended from a track on the ceiling, to the steam chest. Here the fish are subjected to treatment with live steam for from 10 to 15 minutes.

The racks containing the steamed flaked fish are next taken to the drying chamber, where they are brought to the proper degree of dryness by one of several methods. Three types of driers are in use at the present time: the tunnel or "air" drier; the kiln or "oven" drier; and a combination of the kiln drier with a "Ferris wheel." In the tunnel drier, which method has practically superseded the once popular Ferris wheel device, as well as the old-fashioned kiln drier, the air, heated by being passed over steam coils, or by waste flue gases, is blown or drawn over the racks of fish. Where the kiln drier or Ferris wheel drier is still in use a glowing bed of anthracite coal supplies the heat.

In canneries where the sardines are fried in oil, the fish, after having been flaked, either by hand or by a well-operated machine, are dried in the usual manner, without, however, having been put through the steam chest, transferred to frying baskets which are immersed in hot oil, cooked, cooled, and packed in cans. From this point the procedure is the same as for the steamed fish.

From the driers the racks are taken to the packing room, where women first remove the heads of the fish by cutting with scissors ("shearing"), or, if the sardines are small, by snipping them off with the fingers ("snipping"). The fish are then packed in the cans. In most canneries the filled cans are placed in rectangular pans, with a capacity of 25 cans each, the pans being then stacked in tiers and carried on trucks to the sealing machine. In others the cans are passed directly to a traveling belt which carries them to the oiling and sealing machines.

In plants where the oiling device is not attached to the sealing machine the cans are taken from the packing room to an automatic machine, which can be set to deliver a definite amount of oil to each can. Twenty-five cans may be filled with oil each time a pan containing this number passes through it. Similar oiling machines are sometimes operated by a hand lever.

In many canneries, however, the oiling device is attached to the sealing machine, making it possible to accomplish these two steps in one operation.

At the sealing machine the covers are placed on the cans filled with sardines and oil and passed through the rolls. Three different types of machines are in use for closing sardine cans. The machines in most general use are equipped with rolls which travel around the projecting edges of the can and the lid as it fits over the can, crimping the edges of the can and the lid together and at the same time compressing them. Another type of machine seals the lid on by direct compression. The can is held firmly between jaws which close together, crimping the lid upon the cans. The third method hermetically seals the cans by the use of solder, which is placed upon the edge of the can. The lid and can are then passed, by means of a mechanical device, under heated rolls.

The sealed cans are processed in tanks of boiling water for one and three-fourths to two and one-fourth, sometimes two and one-half hours, according to the individual packer's idea of the time necessary for sterilization. One or two canneries employ retorts for sterilization. These are cast-iron cylindrical or rectangular steam-heated kettles with tightly fitting covers or doors, the contents of which can be heated under pressure.

After processing the cans are removed from the tanks, dried, and partially cleaned by mixing them with sawdust and shoveling sawdust over them. They are then sent to the storage room below and allowed to cool, after which each can is tested and then packed in a shipping case, or, as it is termed by the trade, "shock."

As already stated, the cans used for packing sardines in oil are designated, according to their size, as quarter oil, high-quarter oil, and half oil, while those used for packing sardines in mustard sauce are called quarter mustard and three-quarter mustard. The average net content of the quarter oil and quarter mustard can is 3¼ ounces, and of the three-quarter mustard, 10 ounces.

Russian Pickled Sardines

As soon as practicable after being removed from the water the fish are placed in strong brine contained in suitable casks. It is desirable that this be done while the fish are yet alive, so as to remove any possibility of putrefaction starting in. There they remain for about ten days, depending on the size of the fish and state of the weather, or until thoroughly struck. The fish are then scaled, beheaded, eviscerated, and cleansed in clear water, after which they are placed on sieves or other suitable receptacles for draining. After draining for several hours the fish are spread upon tables and assorted according to their size, each size being packed separately in kegs, with a mixture of certain preservatives combined with flavoring substances. The preservative substances are vinegar, allspice, and chile pepper, or their equivalents. The flavoring substances are sliced onions, bay leaves, horse-radish, cloves, ginger, coriander seed, and capers or their equivalents. When all are used, the following is about the usual proportion for every 120 pounds of fish: Vinegar, 2 gal.; allspice, 1½ lb.; sliced onions, 4 lb.; sliced horse-radish, 2 lb.; bay leaves, 1 lb.; cloves, ½ lb.; ginger, ½ lb.; chile pepper, ½ lb.; coriander seed, ½ lb.; capers, 2½ oz.

The fish are packed in kegs of unifrom size, containing about 7 lb. A small quantity of vinegar and a thin layer of the other ingredients are placed in the bottom of the keg, and a layer of fish, placed upward, are put in and gently pressed down. Another small quantity of vinegar and thin layer of the other ingredients are then put in and another layer of fish, and so on until the keg is full, when a small quantity of vinegar is poured over the whole and the keg headed up. In order that the fish may be well flavored they should be prepared some days before being placed on the market. This length of time varies, according to the temperature, from about four days in summer to three or four weeks in winter. When properly prepared the fish will keep a year or longer without spoiling.

The fish are either shipped in the barrel in which they are being salted, or, as is more commonly the case, they are packed in shipping barrels after being dressed. In packing, each layer of fish is sprinkled with dry salt. On arrival in New York City they are subjected to the same treatment described above.

Norwegian Method

The fish are placed in vinegar weakened by the addition of 25 per cent of water, and to which a particle of salt has been added. In this bath the fish remain for about 24 hours, when they are removed and the vinegar drained off. Some persons place the fish for 12 hours in vinegar which has not been weakened with water, the important point being that they must be taken out before the skin becomes flabby. The fish are then carefully packed in kegs or jars with the following preservatives and spices, the quantities given being sufficient for 80 herring: Fine salt, 1 lb.; powdered sugar or sometimes brown sugar, 1 lb.; black pepper, ½ oz.; bay leaves, ½ oz.; saltpeter, ½ oz.; sandal, ¼ oz.; cloves, ⅛ oz.; ginger, ⅛ oz.; Spanish hops, ⅛ oz. Others use the following spices: Salt, 1 lb.; sugar, ½ lb.; allspice, 1 oz.; pepper, 1 oz.; cloves, ½ oz.; Spanish hops, ½ oz. In this mixture the herring should be left for at least two months being using and if the brine should leak off, additional brine made of Luneburg salt should be added; and under favorable conditions the product will keep for years.

Canning Tuna Fish

Three species of tuna are used for canning on the coast of southern California. The form in greatest demand is the albacore or long-finned tuna (Germo alalunga) all white meat. The others are the yellow-fin tuna (Germo macropterus) meat slightly pink, and the blue-fin or leaping tuna (Thunnus thynnus). Small quantities of the latter, meat slightly dark, are taken on our Atlantic coast from New Jersey northward where it is commonly known as horse-mackerel. The following species should not be confused with the true tunas: Striped tuna or skip-jack (Gymnosarda pelamis) meat quite brown in color sometimes referred to as little tuny, bonito tuna or ocean bonito; the bonito or bonita (sarda chilensis) meat reddish and the yellow-tail (Seriola dorsalis) which is sometimes erroneously called yellow-tailed tuna.

Fish are rinsed with cold water. Some canneries are content with simply one rinsing while others insist upon thorough washing and the removal of all blood clots that may be left in fish, feeling that careful washing both inside and out yields a better product when canned.

The eviscerated fish are placed in wire baskets backs up and bellies open.

The baskets are loaded into trucks and rolled into the cookers where they are cooked in live steam under from 1 to 2½ lb. pressure for 1½ to 3½ hours depending upon the size of the fish. A small pressure is used to insure permeation of steam to all parts of the cooker. Some canners contend that a long cook tends to make the fish lighter in color and to make it flake well. Others maintain that a long cook makes the fish hard and there is a loss of natural fish flavor. A great amount of oil and body juices are cooked out of the fish.

The cookers are usually iron chambers about four feet long, into which the steam is introduced from perforated pipes running lengthwise of the box. The pipes are on the sides and top and bottom of the cooker to insure a uniform cook. During the cooking the condensed steam and the liquors from the cookers are drained into open tanks where the oil is allowed to rise to the top and later floated off and barreled. The oil is saved but the liquors are thrown away.

When the fish are removed from the cooker they are put into chilling rooms and allowed to stand usually overnight in the open until cooled. After cooling the fish are carried to tables where the head, bones, and skin are removed and saved for fertilizer. In all cases the canners separate the dark meat from the light. This operation is necessary because of the public's preference for the light meat. The light meat is put on a sectioner which cuts it into lengths to fit the cans. These cutters vary in construction from elaborate cutting devices to the simple revolving disc-knives. Some canners cut the steamed fish by hand.

The sectioned tuna goes to the packing tables, where it is packed into the cans which have previously been run through a salting machine and about one-eighth of an ounce of salt added to the can. After filling, the cans are moved to an oiling machine where a definite amount of olive oil or cottonseed oil is added. In many canneries this is done by hand, the amount varying from one-eighth to three-quarters of an ounce. The scraps from the packing table are packed and sold as scrap tuna.

After the cans are packed they are exhausted. After exhausting the cans are sealed.

After sealing the cans are retorted for from 55 minutes to 2 hours at from 238° F., to 243° F. Where open water baths are used the cans are subjected to boiling water for from 2 to 4 hours.

In the retorts, which are horizontal steel cylinders, 56 inches in diameter and varying from 10½ feet to 21 feet in length, the sealed cans are handled on flat cars. The cans are filled into heavy iron baskets, 37½″ x 37½″ x 2½″, seven baskets piled on a car and the whole rolled into the retort. Most canneries use retorts 16 feet in length with a capacity of 60 cases of 48 one-pound flat cans, 110 cases of 48 one-half pound cans, 200 cases of 48 one-quarter pound cans. The temperature of the retort is maintained by automatic regulating valves.

After retorting the cans are removed, cooled with a spray of cold water, labeled and cased for shipment.

Canning Kippered Herring (Alaska)

When the herring are delivered at the cannery, usually at night or early in the morning, they are spread on the floor in a thin layer and sprinkled with salt, where they remain until such time as the cannery workers are ready to clean them. The fish are then placed on tables and dressed by cutting off the head and removing the viscera. After being cleaned in this manner, they are immersed for a short time in a tank of salt solution. The herring are then taken to the smoking room and hung by the tails on sticks studded on both sides with rows of sharpened nails. These sticks when filled with fish are placed side by side and tier above tier in the smokehouse where they are exposed to alder wood smoke overnight. During the process all surplus moisture has drained from the body cavity and surface of the fish, and the natural oil commences to appear. While in this condition, they are packed by hand in 1 lb. oval cans, 1½ in. deep, 7½ in. long, and 4½ in. wide. Each can holds from five to eight fish. The cans are then sealed without the addition of any oil or dressing and are cooked about two hours by immersion in boiling water heated by steam.*

Curing Herring (Scotch Method)

Herring to be used for Scotch cure must be strictly fresh and absolutely free from red feed or soil. The hold of the carrying boat should be divided into compartments so as to avoid pressure and heating of the fish. No ice should be used on herring intended for this cure. They must be packed immediately after being unloaded.

A small knife is used in removing the gills and gib. If properly gutted the gall, gutbag, liver, etc., are removed, leaving nothing but the milt or roe in full herring. Two operations are usually required.

Contrary to other methods of curing, herring cured Scotch style are NEVER WASHED in water or pickle before being packed.

Selecting or Culling and Grading

This depends entirely upon the run and season of the year. The usual selections of milt or roe herring are classified as follows:

Size	Number per 250 lb. Scotch-style barrel
Large fulls, not less than 11¼ in. when cured	600/650
Fulls, not less than 10¼ in. when cured	700/750
Matfulls, not less than 9¼ in. when cured	800/850
Matties, not less than 8½ in. when cured	950/1000

Herring over 11½ in. are termed *extra large*. Empty fat herring (not spents or slinks) are termed matjes, and should never be packed with full herring. Select and pack them separately as they do not require as much salt as full herring. A quarter of an inch is usually allowed for shrinkage of herring in cure, and the fresh herring before gutting should be that much longer than the sizes listed. As the herring are gutted they are also selected or graded into selecting tubs placed conveniently back of, or to the side of the gutter, each size or selection being dropped into a separate tub. A barrel cut in half will make two good selecting tubs.

After enough herring of any one selection have been gutted or pipped they should be ROUSED or DREDGED IMMEDIATELY and packed into barrels or half barrels, as the case may be. The gutted herring from the selecting tubs are placed in the Rousing Tub (a salmon cask cut in half will make two proper sized rousing tubs) in which they receive a heavy covering of fine salt and must be thoroughly mixed with this salt by hand. This is really a very important part of the Scotch cure, for if plenty of salt is first thrown over the herring and then thoroughly and carefully worked by hand, the entire surface of the gutted herring is evenly covered with salt which will adhere to them while they are being packed into the barrel.

For rousing or dredging, very fine or half-ground salt is used. For packing and laying, which will be described later, fine salt should never be used. Liverpool No. 2 Fishery salt, half-ground Spanish salt, or half-ground double washed California salt will give good results. Never use very coarse salt.

The standard Scotch barrel is made of staves about ¾ in. thick, 30 in. high, the head of the barrel is 19 in. in diameter. The barrel is bound with three or four wooden quarter hoops, and with galvanized or iron hoops on the ends. The barrel has a liquid capacity of 32 U. S. gal. and holds about 250/260 lb. net fish. Before packing barrels should first be soaked and tested for leaks.

For the guidance and protection of the curer and packers, each barrel should have the number of the packing crew (consisting of two cutters and one packer), date and selection marked plainly on the bottom end of the barrel. The following example,

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*It is better to retort the canned product with steam at 240° F. for 1½ hours.

Lafulls
Aug. 10/7
250 lbs. net

indicates that the barrel contains large full herring, packed August 10th by crew No. 7. The 250 lb. net refers to the approximate net weight of the fish. The law requires the weight to be marked on each package.

Salting, Packing and Laying

Herring intended for Scotch cure are never washed before being gutted and salted, and are NEVER REPACKED. They are cured in the original barrel and in their own blood pickle. No salt is sprinkled in the bottom of the soaked and tested barrel when packing or laying herring. If the fish have been properly roused, enough salt will stick to them. Care should be taken when lifting the herring from the rousing tub not to carry any of the loose or surplus salt into the barrel, as this makes a non-uniform salting and packing. In laying or packing large herring, take one roused herring, place it straight against the side of the barrel, BACK DOWN, then place two others in front of the first, their heads touching the stave, one to the right the other to the left. Keep them straight on their back, always have belly up, and have the herring close together. Now place the fourth herring in the middle of the two, then two others, one to the right the other to the left, with heads resting against the staves. Alternate the position of the middle herring so that the head of the first points to the right, while the second middle herring faces the left. Continue to pack in this fashion across the barrel, paying particular attention to not getting the herring on a slant or irregular in the row, otherwise one side of the herring will get more salt than the other. The space at the side of the barrel caused by the meeting of the heads of the herring must be filled out by placing two herring over the heads of those making the hollow. Place these two fish (known as HEAD HERRING) so that their heads point in opposite directions. This leaves an even surface for each of the succeeding tiers.

Salt is then sprinkled over the entire tier. The amount depends upon the season of the year, quality and size of the herring. A safe rule to follow is to never entirely cover the bellies of the fish of each tier, but give them enough salt to almost cover the bellies, with the exception of extra large herring, especially those with milt or roe, which require more salt. Scotch cured herring when THOROUGHLY CURED (say after the fourteenth day) should be FREE of undissolved salt. Remember that large herring require more salt than small ones, fat herring more than those of poorer quality, milt or roe fish more than fat empty ones of the matje quality. (Slinks or spents do not come under the matje selection.) Milt herring require more salt than roe fish and remain softer than the spawn herring. When the first tier has been packed and salted, continue to pack the second tier *by crossing the first tier at right angles,* keeping the fish belly up. Prevent the lines from curving as this spoils the appearance of the pack. Salt as before and continue packing, salting and crossing each tier until the barrel is full. A little more salt may be added to the tier in the center of the barrel as this helps to keep up the strength of the pickle.

On the following or second morning it will be noticed that the herring have settled somewhat as the salt has caused shrinkage. Take some fish from another barrel of the same day's selection, pack and cure, and again fill your barrel, using the same quantity of salt as before. Head the barrel and place on its side for eight or ten days. Herring in this condition are known as "Seasticks."

Some of the curers prefer to have the herring make their own pickle, while others help right after the gutted fish have been packed into barrels by adding full strength pickle. During warm weather and when curing extra large herring, and especially these with milt or roe, the latter method is advisable for it enables the pickle to strike the bone immediately so that the herring begin to cure immediately from the inside and outside as well. Extra large fat herring and especially those with milt or roe should remain in cure or seastick somewhat longer than the other selections. In this condition they are slack in the barrel which allows the salt and pickle to strike the fish evenly and freely.

The barrel which has been lying on its side for nine or ten days (seastick period) is again put on end, head up. The head is taken out and a bunghole bored in the center of the barrel. Select a good wide stave for this. The pickle is then drained as far down as the bunghole and poured over the top tiers two or three times. This removes any foreign substance, scales, or free salt, and leaves the herring in a bright condition. Replace the bung temporarily. This draining of the pickle again causes the herring to settle, necessitating several additional tiers. For this purpose a barrel of the same day's selection, pack and cure is dumped into the rousing tub, where the herring receives the only washing in the Scotch curing method, and that in their own original blood pickle, which should be dark brown (not reddish). As the fish should be thoroughly cured for the final filling only a very small quantity of salt is sprinkled over each additional tier. The top tier should be even with the top of the stave or above the croze or chime, and each herring must be pressed into proper shape by hand so as to make a very neat appearance. NO SALT WHATSOEVER SHOULD BE USED ON THE TOP OF THE TOP OR LAST TIER. With herring of the smaller selection, three instead of two head herring will be required to properly fill out the space formed by the heads of the other herring resting against the staves. The head of the barrel is now "jumped in." This pressing flattens the herring so that no space is noticeable between any of the fish of the top tier. Some of this pressure may be relieved if necessary by again withdrawing the bung until the head is in the croze, after which replace the bung temporarily and draw tight the iron hoop and later the wooden quarter hoops which should then be tacked down in one or two places. Place the barrel on the side and fill with full strength or 100 per cent pickle through the bung hole. Drive the bung in tight and head the barrel once more for branding.

Wash the head of the barrel and allow it to dry. Then mark name of packer, trademark, cure selection and place of cure on the head of same. The law requires the approximate net weight of the herring to be marked on each package. This is usually stamped on the bottom end; 250 lb. net for barrels and 125 lb. net for half barrels.

Don'ts

In curring herring Scotch-style, observe the following don'ts:

Don't misbrand.

Don't pack herring with red feed or soil, drowned or old herring. Always remove gutbag, liver, gall, etc., but not the milt or roe.

Don't wash your gutted or fresh herring before salting or packing, and never repack herring cured Scotch style.

Don't pack herring flat. Keep them straight on their back and do not allow the tiers to become curved or irregular.

Don't expose fresh or cured fish to the heat.

Don't use cheap or poor salt, or leaky barrels.

Don't oversalt, and don't cure too lightly. Salt and pickle are your only preservatives.

Don't sprinkle salt on the bottom of your barrel before packing, or on the top of the final tier of herring.

Don't send out slack packages. Fill the barrel properly, and not before the herring are thoroughly cured, for that is one way of getting a slack barrel.

The Norwegian Cure of Herring

The largest quantity of herring in Norway is caught in the fjords by seines, and kept barred until what food the herring may contain is worked out in the natural way before they are taken up, dressed, and salted. As a rule the herring are salted in the vicinity of the places where they are caught, so that they can be put in salt almost alive, which is of the utmost importance in order to obtain a good article. In this way they have an advantage over the Scotch, who have to go far off the coast for their herring and can not get them in salt before they reach the shore, which often takes a long time. They have an advantage over the Dutch, because, although they salt their herring on board of their vessels soon after they are caught, still they may have been dead several hours in the nets before they are hauled on board, and at all events none of the herring taken in drift-nets or other nets can be deprived fully of the injurious food they may contain, as they can when barred in a seine. When brought to the shore or salting places from the seine, the herrings are gibbed in this way. That a triangular piece of the throat, large enough to admit the heart and the pectoral fins to be removed, is cut out by means of scissors made for that purpose, or by a small knife (some also use the fingers). This cut should be made deep enough to divide the large blood veins, situated close to the neck bone, in order to remove the blood they contain. Sometimes, also, the gills are removed, especially on the full herring caught in the spring.

Generally a large enough crew is employed to admit the gibbing and the salting to take place at the one time. On account of the herring caught in seines being always mixed, every gibber has got placed before him or her so many barrels or tubs as the herring are to be sorted (from three to five); and, according as they are gibbed, every herring is also at the same time, by the gibber, sorted and placed in the various barrels or tubs to which they belong. The salter then takes the herring and packs them in new barrels, which have lately been soaked in sea water, slantwise on their back, with one-fourth barrel of St. Ybes salt to 1 barrel of herring. The herring are packed loosely, one lies across the other the whole barrel through. The uppermost layers are packed sometimes slantwise back up. Some packers put from 1½ to 2 gallons of pickle (made of one-fourth barrel of salt to 1 barrel of sea water) on the herring soon after it is salted, and head up the barrels immediately. Others, again, let the barrels remain unheaded for one day before they fill them with pickle. Before the barrels are headed up a layer or two of herring are generally put into the barrels in order to fill up the empty room caused by the shrinkage of the herrings. By putting the pickle on the herring soon after they are packed the salt dissolves quicker and saturates the herring more speedily, so that the contents of the stomach (provided the food is liberated) hardly has any injurious effects upon the durability of the herring. After the barrels are headed up they are broached in the head and blown into by means of a brass pipe containing a valve, which is put down in the hole, and, if found tight, the hole is plugged up as soon as the air has escaped; if not, they are made tight in the places where they are leaky, and blown over again before they are stowed down on board the vessels.

After reaching the port of shipment and before being exported the herring are repacked and the barrels filled with the original pickle which was formed first; and if this does not hold out, new pickle is made to supply what is wanting. As a rule the herring are repacked in such a way that out of 4 barrels salted in the fishing-places from 3¼ to 3½ barrels of herring are obtained when packed for shipment. They never, as a rule, pack their herring as light as the Scotch or Dutch do, except the herring is specially to be put up in such style.

Qualities of good herring.—Concerning the nature of the fresh herring, it is required, in order to obtain a good article, that the herring also possess certain qualifications, such as sufficient size and maturity, fleshiness, and fatness. A lean, dry, dismembered or half-rotten herring can never give a good article, even it is cured ever so well. A small herring, which has not reached the full state of maturity, fetches only small prices in the markets. Of much importance is also the development of the sexual organs. If these are in a far advanced state, the herring loses in fatness and flavor. These should be firm and the whole flesh penetrated with a certain quantity of fat. Large amounts of fat around the blind-gut is a sign of the herring being fat right through the flesh. As a rule, ocean herring (such herring as pass most of the time in the ocean, and only approach the coast for reproductive purposes) are considered superior to the herring that keep themselves close to the coast or in the bays all the time. Of these herring, again, those which are caught in deep water are better than those caught in shoal water. A first-class herring is known by its small head, short and plump body; is broad across the back and plump toward the tail, and has got a great depth from the back to the abdomen, which gives this well-rounded shape.

Importance of early salting.—In order to obtain a good article of salt-cured herring it is necessary that the herring be liberated from its food and put in salt as soon as possible after being brought out from the water. Even if the quality is ever so fine, a good article can never be had if it is not properly treated during the whole cure. The Scotch herring can not get the official crown brand except they are salted at least twenty-four hours after being brought out from the sea. As a rule the curers do not care about herring which is more than twenty-four hours out of the sea before they are landed, and only take those at a low figure. In Holland, even a distinction is made between herring which are taken out first and those which are taken last from the nets. The cure of herring on board the fishing crafts commences, therefore, if circumstances allow, soon after the nets are hauled in. To leave the herring exposed to the hot sun while being conveyed to the salting-place, or to leave the herring in the nets until the shore is reached, if the catch has taken place a long distance off the shore, is objectionable.

Best salt for herring.—In regard to what kind of salt is the most suitable for salting herring, it is difficult to give any one sort the preference. The choice of salt depends much upon how the herring is going to be cured, and upon the size and quality. The main thing is that the salt is clean, and that it is used in proper quantities. Fine and watery salt melts quicker, but gives weaker pickle. In cases where it is of importance to form pickle speedily, fine salt is preferable, while coarse salt is better for use in filling and repacking, or when the herring is intended for export to hot climate, or to be kept in stock for any length of time. The Scotch curers use Liverpool salt, the Dutch, Light Cadiz or Lisbon salt, while the Norwegians use St. Ybes salt. It is of much importance, as formerly stated to put the herring in salt as quickly as possible, if a first-class article shall be obtained. For this reason the Scotch, as the herring is landed, sprinkle it heavily with salt in bins or vessels made for that purpose, before it is gibbed and gutted. Generally they use 1 barrel of Lisbon or coarse Liverpool salt (or sometimes both mixed) to about 10 barrels of herring. By this means the herring keep their scales better and brighter, and can also be handled better and quicker when they are afterwards gibbed and gutted. The Hollanders roll their herrings in trays filled with fine Liverpool or St. Ybes salt as soon as they are gibbed and gutted, before they pack them in barrels; and this work is done very precisely. In Norway no sprinkling with salt, as a rule, is used before the herrings are gibbed or packed in barrels, but instead thereof they have to use more salt in packing than the Scotch and Dutch. The sprinkling of herring with salt as soon as they are landed or brought on board of the vessels is considered also to improve the flavor of them very much.

Packing herring.—In packing the herring in barrels it is recommendable not to pack them too tight before they have shrunk in the salt, and also to pack herring of the same size and quality right through the whole barrel. The packing is performed differently among different nations. In Norway the herrings are packed slantwise on their back, while the Scotch and Hollanders pack them fully on their back. By this last mode (which no doubt is the best) the herring get a more round and thick appearance in the pack; and it has also this advantage, that the pickle has got a better chance to get in and saturate through the abdominal cavity of the gutted herring. After the herring has shrunk in the salt the barrels are filled up again and put away, but care is taken that the herring is not packed too hard. As long as the barrels are left to remain still there is no need of hard packing, but when they are to be shipped it is recommendable to repack the herring so tight that they do not move about, even if the barrels are handled ever so roughly, so that the receiver may be exempted from filling the barrels again after they have reached their place of destination.

Herring barrels.—The quality of barrels used for salting herring in is of much importance in order to obtain a desirable product. If too soft wood is employed, the pickle will work through the staves, the herring become dry, and be damaged within a short time. Among the foliferous wood in Europe the populus (poplar) is considered least answerable, and among the conifers the spruce or fir are less suitable than the red pine wood, because the former is generally knotty and more ready to get saturated with pickle or water. Good hard and clean spruce, which is cut fresh and has not been soaked in water, may compete with the pine when it gets properly seasoned. The Hollanders use mostly barrels made of oak; the Scotch use barrels of birch or beech, and the Norwegians use barrels of spruce and red pine wood. Staves made of birch are brittle and apt to twist. In Scotland the regulations for making herring barrels are that the staves shall be not less than half an inch thck and not wider than 6 inches, except the oak staves, which may be 7 inches wide, and that the bottoms should be at least of the same thickness as the staves, and none of the pieces of which it consists be made wider than 8 inches. The usual thickness of the staves in the Scotch herring barrels are from nine-sixteenths to ten-sixteenths of an inch, and the bottoms are generally made three-fourths of an inch thick. In Holland there was a law passed enacting that a herring barrel should be manufactured of at least 13 staves (which makes every stave on an average of 5⅛ inches wide), and that no stave should be less than three-eighths of an inch in thickness. In Norway the staves, as a rule, are made five-eighths of an inch thick, and the barrels are mostly made by macihnery. Scotch barrels are generally full banded for export to hot climates in the summer time. They are also furnished with an iron hoop on each end. The Dutch barrels are furnished with 18 to 20 hoops, divided 5 or 6 on each end and 4 on each side of the middle, while the Norwegians have only 12 to 16, divided 3 and 3 or 4 and 4.

If the barrels are made of fat spruce or red pine, and also of oak, the herring will take a flavor from the barrels, which some people like very much, but others, again, do not care for. Some people, again, value the Dutch herring very much on account of the taste of flavor they receive from the barrels. To keep the barrels from shrinking, it is recommended to put a little pickle in them while they are kept in stock.

Improved Salting of Herring

1. Careful handling of fish before salting.—Two precautions are particularly important under this head, namely, to avoid bruises and to avoid warmth. Bruises promote decomposition of fish in the same way that they cause fruits to rot. Therefore, fish should not be forked, walked on, squeezed when taken from nets, nor packed deep in boats, boxes, or barrels, and care should be exercised to see that they are not crushed or bruised by large chunks of ice. Warmth, as every fisherman knows, hastens decomposition. It is best to put the fish in finely crushed ice immediately after capture, but if not so treated they should be kept as cool as possible and should be salted with the least possible delay. It is well to remember that fish are of about the same temperature as that of the water from which they come, and, therefore, fish taken from warm water should be handled more expeditiously than those from cold water. Fish should be shielded from direct sunlight and should not be allowed to dry, as the skin shrinks and loses its luster if dried.

2. Thorough cleaning, especially removal of all blood.—It has been found in the case of river herring that blood spoils at a much lower temperature than flesh. These fish can be salted at from 90° to 100° F. or higher if the blood is all removed, while those containing blood will sour if salted at 65° F. In cool climates the blood may be left in the fish if desired, as it imparts a distinct flavor, for example, in the Scotch method of curing herring. But in warm climates, where conditions are unfavorable at best, there is no choice but to remove every trace of blood as well as all entrails and roe and the head. To do this it is necessary to behead the fish, take out entrails, scrape the kidney out (the bloody strip lying under the backbone), and wash the fish thoroughly. (A 20-penny wire nail, the head of which has been sharpened with a file, makes a convenient instrument for scraping out the kidney.) Large fish may be split through the back and laid open. The washing should preferably be done by rousing the fish in a brine of about the strength of sea water, but it may be done in cold fresh water. In the case of alewives or river herring, the washing operation should also serve to remove scales by vigorous rousing. It may seem that if the blood spoils at 65° F. the meat of the fish would not necessarily be ruined. But the taint of spoiled blood is sufficient to make the entire fish unfit for food. It is also probable that the presence of blood may initiate a kind of decomposition of the fish.

3. Use of salt of a high degree of purity.—This is the most important factor in salting fish in warm climate; yet some people are inclined to question the truth of this statement. Fishermen generally have no first-hand way of knowing whether or not any particular lot of salt is pure, as neither the looks of salt nor the claims of advertising matter are always reliable indications of purity. By purity is meant not cleanliness, but the scarcity of foreign substance in the salt. Salt may be highly impure, yet perfectly white and very fine and clean, for the two most objectionable impurities, lime and magnesium salts, are white like salt. On the other hand, salt may be dirty or colored, and yet if lime and magnesium salts are absent may penetrate and preserve the fish.

It is, therefore, necessary to have a salt of a very high degree of purity; that is, with less than 1 per cent of total impurity. There are grades of salt, on the market, containing a total of less than one-tenth of 1 per cent impurity. These salts are especially suitable for salting fish by this method. Chemical analysis is the only reliable guide to purity; most reliable dealers are able to give the correct analyses of their brands of salt, and these figures should be required before purchase. The figures for sodium chloride (pure salt) should be 99 per cent or over—the higher the better, 99.96 per cent sometimes appearing. The figures for calcium (lime) and magnesium salts should be as low as possible. It makes little difference whether they are sulphates or chlorides, and any salt in which calcium and magnesium taken together are more than 1 per cent should be looked upon with suspicion for salting fish in warm climates.

The presence of moisture does not cause the salt to be unsuitable. If moisture is present, as it usually is, allowance should be made for it; pure salt (sodium chloride) and moisture added together should exceed 99 percent.

Calcium and magnesium in salt, even in small quantities, greatly retard penetration, so much so that in warm weather the fish may spoil before the salt strikes through. But in cold weather in northern climates salt containing considerable quantities of these substances may be used successfully. It will be noted by those who use highly purified salt that the fish do not become white and firm as they do with ordinary Turks Island, Trapani, or other crude salt. The lime and magnesia have a hardening effect on the fish and they whiten the flesh by coagulating it, as heat whitens the white of an egg. Nevertheless the somewhat yellowish, soft fish, produced in pure salt is equally as well preserved as the hard fish in crude salt, is milder and richer in flavor, and soaks out more quickly. This may be somewhat difficult to intoduce in a market that has been accustomed to a hard, white fish, but the consuming public should not be long in discerning the superiority once the purer fish is distributed.

4. Application of salt in the dry condition.—In the case being considered, where the greatest speed of penetration is necessary, the dry salt must be used, for, applied this way, it penetrated much faster than brine. Again, the fisherman fortunately located in a cool country may follow his discretion, but the fishermen who work under the handicap of a warm climate will find it necessary to use the salt dry.

About 35 pounds of salt to each 100 pounds of fish is sufficient, if well distributed. The fish should be rolled in the salt (which should be fine grained), the belly cavities filled, and the fish packed backs down in tubs so as to hold the salt until it dissolves. These tubs may be made by sawing barrels in two in the middle. A weight should be placed on the fish to keep them from floating, but not sufficient to press or crush the fish. If barrels are used they should not be filled at first, as the pressure will be too great on the fish at the bottom, but after the fish are struck through barrels may be packed full.

The reason for using dry salt is not difficult to see. It is the brine or salt immediately in contact with the fish that acts on the fish. If brine is used, the water coming from the fish dilutes it and it rapidly becomes less effective unless the fish are continuously stirred; but if dry salt is used, the water coming out of the fish immediately becomes saturated with salt, so that the brine in contact with the fish is saturated at all times.

If the brine is warm, the fish may be struck through in less than 24 hours, but ample time should be allowed. It appears that the warmer the brine, the faster it penetrates; and also the faster the fish spoils; there should, therefore, be some temperature which would give the most rapid penetration without excessive decomposition, but this temperature has not been determined. One soon learns to tell by the appearance of the fish after it is broken through the backbone whether or not it is struck through.

5. *Shipping or storage of fish in brine.*—If for immediate market the fish may be taken from the brine and shipped at once. This involves draining off the brine, applying some more dry salt, packing the fish in sugar barrels or other containers, and shipping. In this condition the herring are excellent, but will not keep long, as the fat will rust and become rancid. In case the fish are to be held for a period of weeks or months, it will be necessary to keep them under brine at all times for the purpose of excluding air which causes the fat to rust. They should be allowed to remain in their original brine, strong, tight barrels being used. The barrels should be quite full of fish, and there should be a slight excess of undissolved salt. The barrel should be tightly headed, turned on its side, and nearly filled with brine through the bunghole, leaving slight space for expansion, and then •bunged up. It should be stenciled or otherwise marked to show the nature and net weight of the contents. In very warm climates there is need for investigation of storage conditions under which salt fish can be kept successfully; until the subject is investigated it is recommended that if fish are to be kept for any considerable time they be placed in cool storage.

Brine-Salted Herring

In the vessel fishery, as the herring are removed from the nets they are placed on deck and water is soused over to remove loose scales, blood, etc., and sometimes salt is sprinkled over them. They are next placed in hogshead tubs with about 3 pecks of salt to the barrel of fish scattered among them, when they are covered with brine and left standing for four or five days, or until they are struck. It is important that the salting be done as soon as practicable after the fish are removed from the water, and in the meantime they should be protected from the sun. After being struck, the fish are repacked in market barrels, where they remain for twenty-four hours for settling, when the barrels are topped up by adding a few struck fish to each barrel. It requires about 330 salted fish to fill a barrel, the number of fresh herring required being about 300. In packing the fish in the barrel, they are usually placed with backs slanting upward. Occasionally, however, those in the lower half of the barrel are placed back down, and sometimes a few upper and lower layers are carefully placed and the middle portions arranged with less care. After the barrel has been topped up it is filled with brine, headed, and stored in the hold. On arrival at port, if it appears from sounding that some of the pickle has leaked out, more is added through a hole bored in the bilge and the hole plugged up, when the barrel is ready for branding and marketing. Sometimes at the port the fish are repacked, so as to insure full weight and good fish, new brine being made, if necessary, but if the old pickle is clear it is used over again.

To determine the proper amount of salt required for curing herring requires considerable skill and experience, and the quantity varies according to the conditions of the fish, the season of the year, etc. If too much salt be used the fish will soon become hard and dry, with greatly diminished flavor, but if the quantity of salt be insufficient the fish will become tainted and unfit for food within a short time. During warm weather more salt must be used than when the temperature is low, and then small herring require less salt than thick or large ones. As a general rule, about 5 pecks of salt are required for curing each barrel of herring.

In pickling on shore, the fish on their arrival are dumped into tanks or wash barrels of sea water, from which they are at once removed with a brail net, the fish being rinsed up and down at the same time, and placed in a pickling butt or vat with about 3 pecks of salt scattered among each 200 pounds of fish and a heap placed on top. In two or three days a workman with high rubber booots passes over the butts, treading on the heaps of fish to separate them if massed together. Or, in some localities, the masses are separated by stirring them with a spudger, consisting of a thick board 10 inches long and 2 or 3 inches wide, nailed in the center to a wooden handle. The fish remain in the butts eight or ten days, being examined occasionally and more salt being added to keep the pickle sweet. After being thoroughly struck, the fish are removed with dip nets and placed on a packing table, whence they are packed in the market barrels, 200 pounds to each barrel, sometimes with backs up and sometimes with bellies up, according to market demands, about half a bushel of salt being scattered among them during the process of packing. The barrels are then headed and a hole bored in the bilge, or head, and sufficient strong brine added to fill the barrel; the hole is then plugged and the barrel is ready for shipment. It is important that the herring be packed so tight in the barrel that their relative positions are not disturbed in handling the barrel, thus removing the scales and breaking the fish. There is little decrease in weight in pickling herring, 211 pounds of fresh fish making a barrel of 200 pounds of round herring.

Gibbed and Split Herring

Although most of the herring taken on the New England coast are salted round, some of them are either gibbed or split before being salted.

After evisceration the fish are immersed in tubs of salt water for a couple of hours to allow the blood to be soaked from them, when they are packed in butts or tight barrels, back down, with the stomach cavities filled with salt and with a layer of salt sprinkled between the layers of fish, about 3 pecks of salt being used for each barrel of fish. When properly struck the fish are repacked in the same manner as the round herring above described. In packing in the barrel some fishermen place them on their backs and slightly inclined to one side. Others place them fully on the back. The latter appears to be the better method, as it gives the herring a more round and thick appearance and the pickle has a better chance at the abdominal cavity.

Smoked and Pickled Herring

Pickling.—When the fresh herring, intended for smoking, are landed at the salting sheds, they are immediately put into the pickling tanks, which have first been partially filled with a weak pickle. The pickle is made of salt water with about 1½ bushels of Liverpool salt or a smaller quantity of Cadiz or other coarse salt in each tank. The salt is stirred in the water until it is wholly dissolved. If the fish are poor the water is sometimes used without the salt being added. The quantity of fish which is at first put into the tank is generally from 2 to 3 hogsheads, or enough to be of sufficient weight to rest or, as the fishermen term it, "ground" on the bottom. A light layer of salt, or about one-half bushel, is then distributed over them, after which another layer of fish of from 1 to 2 barrels is put in. This is again covered with a layer of salt rather heavier than the first, being from 1 to 1½ bushels. The remainder of the fish, necessary to fill the tank is then put in and covered with from 3 to 5 bushels of salt. Each tank when filled contains 4 hogsheads of fish, and the quantity of salt used on them varies from 6 to 9 bushels, according to their size and fatness and the condition of the weather. It is also necessary to have the greater part of the salt at the top of the tank, so it will not work down through the fish and lodge at the bottom without being dissolved. In that case the fish at the bottom are liable to become too salt and those at the top not salt enough. For smoking purposes the fish are pickled in a round condition as they come from the water. When hogsheads are used instead of tanks the quantity of fish and salt in each layer is regulated to correspond with the capacity of the hogshead.

The small herring are generally allowed to remain submerged in the pickle from 24 to 36 hours, and the larger ones, especially if they are very fat, about, 48 hours and sometimes a longer period. If the herring are small and not fat, the length of time required for them to "strike" may not exceed from 12 to 15 hours. Fish will also absorb salt more readily in warm than in cold weather, and if they have been caught a few hours before being salted they do not require so long a time in pickle as when immediately taken from the water.

When the fish have been properly

"struck" or salted, if the weather is fine, so as to afford them an opportunity to dry before being put in the smoke-house, they are taken out of the pickle; but it sometimes happens that the weather is rainy, and they have to remain in pickle much longer than would otherwise be necessary. As a result they become more or less oversalted. In such cases, when favorable weather returns they are taken out and put in tubs of salt water to be freshened or "soaked out." Newfoundland and Magdalen herring, which are heavily salted on board the vessel when caught, invariably require to be treated in this manner before being smoked. Generally about four tubs of water are used, which are in succession filled with fish. As soon as the last tub is filled the fish are taken out of the first one, and then out of the others in regular order, each tub being at once refilled with other fish, and this process is continued until all the oversalted fish have passed through the water, remaining there only long enough to secure the desired result. If the quantity of fish is large the water in the tubs is changed whenever requisite. It is customary to use salt water for nearly all purposes. The fishermen and smokers claim that fresh water has a tendency to make the gills of the herring tender, and more liable to break and allow the fish to fall from the sticks after being hung in the smoke-house. They also think that the salt water makes the flesh of the fish more firm and not so apt to become soft after being smoked. The salting sheds are, therefore, sometimes furnished with steam pumps for obtaining the necessary supply of salt water.

Herring are also salted in considerable quantities, in both a round and split condition, to be packed in barrels. In the process of pickling them for this purpose more salt is used and they require to remain a longer time in the pickle. When salted round, the fish are put into the tank in thin layers, each of which is covered with a layer of coarse salt, the quantity of salt being increased toward the top of the tank until the last layer is about 2 bushels. The quantity of salt required to each tank of fish is 10 bushels or more. They are then allowed to remain in the pickle from 6 to 10 days. If the fish are to be split before being salted, they are first put into the tanks in pickle round, and are then taken out almost immediately and laid on the tables to be split or dressed. They are split down the belly, gilled, and eviscerated. The heads and tails are not removed and the roes are left in. They are then washed in salt water and returned to the tanks in strong pickle.

The first layer is about 2 hogsheads, after which about 2 barrels are put in at a time, and each layer is well covered with salt. The fish are allowed to stand two or three days and are then stirred with a spudger, an implement made of a thick piece of board a few inches wide and about 10 inches long and nailed in the center to the end of a wooden handle. After being "broken up" they are given a layer of salt and allowed to stand about five days longer. While the fish are being cured the pickle is closely watched, and whenever necessary more salt is added to keep it "sweet" or in good condition. Great care is taken to keep the fish completely submerged with pickle. Boards supporting heavy weights are frequently laid on them for that purpose. The quantity of salt required for split herring does not differ materially from that used when pickling them in a round condition. After the fish are thoroughly cured they are taken out of the tanks and packed in barrels for shipment.

Stringing.—When properly salted, the fish are taken out of the pickle to be strung on herring sticks, preparatory to being hung in the smoke-house. This is done with ordinary dip nets, or "wash nets." As the fish are dipped out they are washed or rinsed in the brine with the nets, after which the pickle is allowed to run off of them and they are laid on the stringing tables. The dipping and stringing proceed simultaneously.

The work is performed very rapidly. The herring is taken with its back in the palm of the right hand, the stick being held by the blunt end in the left hand; the left gill-cover is then raised by a movement of the right thumb and the pointed end of the stick is inserted and passed through the mouth, the fish being moved down to its proper place. The work is often done by reversing this order, the fish being taken in the left hand and the stick in the right hand, but in either case the herring when strung hang on the stick with their backs toward the stringer.

Draining and drying. — After the herring have been strung on the sticks they are washed in a trough of clean salt water and hung on the herring horses. They are then carried out into the open air, where they are allowed to remain until the water drains off of them and they have become sufficiently dry to hang in the smoke-house. The time required for drying varies according to the condition of the weather, but is usually from one to several hours. The drying not only hardens the gill covers and prevents the fish from falling from the sticks in the smoke-house, but it also improves their quality when smoked. The work of stringing and drying the herring is generallv done in the fore part of the day and in the afternoon they are hung in the smoke-house. If the weather is not fine it is sometimes necessary to dry the fish in the smoke-house, after leaving them in the open air long enough for the water to drain from them. When this method is resorted to the doors and windows are opened to give a free circulation of air and fires are kept burning until the drying is completed.

Filling the smoke-house. — The smoke-house is not usually filled all at one time, and it often happens that the work occupies several weeks. The herring are taken care of as fast as they are obtained from the weirs, the time required to fill the smoke-house depending somewhat on the abundance and constancy of the supply. If the supply is steady, the work progresses as rapidly as herring can be prepared; otherwise the period may be extended to three or four weeks, and perhaps longer.

When the herring have been sufficiently dried in the sun they are carried on the herring horses to the smoke-house, where the sticks are placed in the "Bays," their ends resting on the scantlings or beams on either side of each "bay." The work of "hanging" the herring requires the services of at least two men, and if a larger number are engaged in it they work in pairs. One man stands in the "bay," with his feet on the beams, while the other stands on the ground or floor and hands the sticks of herring up to him, two at a time, keeping the sharp end of the stick downward so that the herring will not slip off. The sticks are made long enough to reach across the "bay" and to nearly the center of the beams which support them at either end.

The lower part of the "bays" is usually filled first. The fires are then kindled and the herring smoked until they acquire a good color. When this is effected the fires are allowed to go down, the doors and ventlators are opened to let out the smoke, and the herring are shifted to a place nearer the top of the smoke-house. The lower part is then ready to receive another lot of fish. This preliminary smoking occupies from about twelve to fifteen hours. The work is continued in this manner until the smoke-house is filled. Two smoke-houses are very often filled at the same time. In that case, after the top of the house has been filled by shifting the herring, the lower part is completed by putting about three tiers of herring in each house on alternate days. When two houses are filled together, the work can be done in almost as short a time as would be required to fill one alone.

The object of putting the herring into the house by degrees, instead of all at one time, were that practicable, is to insure their becoming thoroughly dry before being finally subjected to the smoke, and also to smoke them more evenly and secure a greater uniformity of color. If a large body of fish were put into the smoke-house at once they would gather dampness and great difficulty would be met with in preventing them from spoiling. To fill a smoke-house holding 20,000 boxes of herring, in a proper manner, requires at least two weeks, and a somewhat longer period if two such houses are filled at the same time. The length of time also varies according to the size of the smoke-houses. Small houses may sometimes be filled in a few days.

After the smoke-houses have been filled the additional length of time required to complete smoking the herring is about three weeks. Regular herring are placed as close together on the sticks as possible without touching each other, the gill-covers generally keeping them far enough apart. The sticks, when hung, are placed about 3 inches from each other. Bloaters, owing to their larger size, need to be farther apart, both on the sticks and in the smoke-house, to allow the smoke to circulate more freely among them. They are usually hung by themselves at the bottom of the smoke-house, and while smoking are given all the heat they will bear. The "soft bloaters," which are intended for domestic use, and to be held on hand only a short time, are smoked about ten days, while the "hard bloaters" require to be smoked from three to four weeks. The smoke-house is closed while the herring are being smoked and the fires are constantly tended and kept burning in a smouldering manner, so as to produce the greatest amount of smoke.

Fires and woods. — The fires for smoking the herring are built on the ground at equal distances apart over the entire area of the smoke-house. The wood used is of various kinds, but white birch is generally preferred; driftwood, which has been soaked with salt water, is also used. The main consideration is to have wood that will burn slowly and produce an abundance of smoke. The fires are kept burning very slowly, the smoke-house being visited every few hours during the night as well as the day. If too much heat is generated the herring are soon damaged and may be completely spoiled.

Packing and herring.—The fish are not generally taken from the smoke-house until it is necessary to pack them for shipment. In the meantime, to prevent them from gathering dampness, the smoke-house is left open during the day and occasionally fires are kindled. When the time arrives for shipping them they are removed from the smoke-house to a shop or packing room, where they are assorted into grade according to their size and quality and packed in the herring boxes.

The principal grades, exclusive of "bloaters," are the "medium-scaled," "lengthwise," and "No. 1." Another grade, called "tuck-tails," are also packed to some extent. The medium-scaled herring derive their name from the now obsolete custom of removing the scales before "striking" them in pickle. They are considered to be of a more desirable size and quality and sell at a higher price than any other grade of regular herring. It is customary to divide them into two sizes, known as large and small medium herring. They are packed crosswise of the box, and each box contains from 30 to 35 of the large and from about 45 to upwards of 50 of the small size, or an average of about 45 of the two combined. The lengthwise herring are larger than the medium-scaled, and receive their name from being packed lengthwise of the box. Each box contains from 15 to 18 fish of this grade. The tuck-tails, which are also crosswise herring, are so called from the fact that being longer than the width of the box, the tails have to be tucked or bent over when they are packed. There are usually from about 20 to 22 in each box. The grade known as "No. 1" are the smallest and least valuable quality of herring and frequently sell for not more than 5 cents per box, each box containing from 60 to 75 fish. The "bloaters" are larger than the regular herring and are packed crosswise of the box, each box containing 100 fish. The number of regular herring to the box varies considerably, according to the size of the fish, and the dealers frequently indicate the size of the grade desired by stating in their orders the number to be packed in a box.

The fish for salting, when taken from the tanks, are rinsed or "washed out" in the pickle with the "wash nets" and laid on tables, from which they are packed in the barrels. The packer first scatters about a pint of salt over the bottom of the barrels and then closely packs the fish in single layers, each of which is covered with a pint or more of salt. When the barrel is two-thirds full, the quantity of salt to each layer of fish is increased to about 2 quarts. The barrel, when filled, is left unheaded for several days or a week for the fish to settle. About a half bushel of Cadiz or other coarse salt is used in packing a barrel of round herring and a larger quantity is required for split herring. When the fish have settled, the barrels are headed, and a hole is bored in the head or bilge, as the case may be, and strong pickle is poured in through a funnel. The barrel, being full of fish, will only hold about two buckets of pickle. The rule is to make the pickle strong enough to float a salted herring. It requires about 1½ bushels of Cadiz or 3 bushels of Liverpool salt to a hogshead of salt water. After a time the staves of the barrel become soaked with pickle and more pickle is added, as it is necessary for the barrel to be completely filled. The holes are then plugged and the fish are ready for shipment.

Bloaters

Salting.—If fresh herrings have to be dealt with, the usual method of curing is to rouse them well with dry salt upon a brick or pavement floor, turning them over with a wooden shovel during the process of salting, and leaving them overnight in the salt. In the morning they are washed through light pickle, and hung on spits or tenters.

Hanging. — Spits are rounded wooden rods, about 4 feet long, about the thickness of a man's finger, and sharpened at one end. As the wood is apt to get blunted, tin cones with sharp points are often fixed upon the points of the spits during the process of spitting. Occasionally iron rods are used for spits, and these are much thinner than the wooden ones. To spit herrings, either for bloaters or reds, enter the sharp end of the spit below the gill cover of the fish, and push it out through the mouth. Hang the spits in the kiln—an ordinary kipper kiln—in the same way as the tenters of kippers.

Pickling.—Curers who make preparations for doing a large business in bloaters usually have vats or tanks, large enough to contain great quantities of fish, constructed on their premises—sometimes below the floors of their stores. When herrings are plentiful and cheap, these vats are filled with roused herrings (usually sea-salted), which are then floated in pickle, and afterwards drawn out and smoked at the curer's convenience. A regular supply is thus assured for a considerable time, even although prices of fresh herrings should rise or the fishing come to an end.

Smoking.—Bloaters are smoked in much the same way as kippers, but a fire of hardwood billets is usually preferred to chips and sawdust. The soft fuel gives rather more color than is desirable, as bloaters should be dried rather than colored in the smoke. Eight hours light smoking will generally make the fish ready for market.

Packing. — Bloaters are packed across the box with heads all to one side till the tier is complete; then two or four herrings with their heads to opposite ends of the box are laid lengthwise across, the tails of the fish in the tier. The second tier is packed across the box like the first, but with the heads of the fish to the opposite side of the box, that is, over the tails of the fish in the lower tier. Herrings are laid over the tails of the fish again, and so on till the box is full.

A Small Kiln.—The fishmonger who may be left with a balance of fresh herrings unsold — or anyone who wishes to prepare a few dozen bloaters—may, instead of dry-salting, immerse the herrings in strong clean pickle, and leave them in it overnight. In the morning the fish will be ready for hanging. It should be distinctly understood that the smoking of fish does not depend upon the size of the kiln. All round the Scotch coast, for instance, there may be seen small smoke-houses, in which the fishermen's wives smoke haddocks to perfection. They are generally rough wooden buildings, often put together by the fishermen themselves, perhaps 4 feet square and 6 feet or 7 feet high, with bars at opposite sides and suitable intervals for supporting the spits or tenters. Dwarf walls of stones or clay inside may protect the wooden walls from the fire. Even a large cask, with both ends out and a few holes bored in each quarter for ventilation, may be converted into a kiln fit to smoke a few dozen bloaters. In this case it is necessary to put the fire in an iron vessel, and to spread a sack or other heavy covering over the cask during the process of smoking.

Mild Curing, Pickling, Dry Salting and Smoking Salmon

For mild curing the fresh fish must be given greater care in handling than is the case with any other process. Care must be exercised to see that the flesh of the fish is not bruised or broken, and in order to make sure of this the handlers usually pack several fish in one box, with cracked ice over and around them if the weather is warm. As soon as a box is filled, it is put in the hold, where the boxes are stacked one upon another, but prevent more weight than is represented inside one box coming upon any one fish.

In dressing, the head is removed, care being taken to leave as much of the bony structure of the head as possible to assist in holding the side of the hooks when it is being smoked later on; the fish is then split down the belly to the vent, the entrails removed, when a cut is made on either side of the blood clot in the back, and the fish passed to the "washer," who holds the fish on its back in a slot on the table under a spray of water, and removes the membrane of the skin which covers the inside of the backbone and inside of which a good deal of thick blood lies, by means of a large spoon or some similar form of scraper. A knife should not be employed. Some curers do not remove the fins at this state, while others do.

The body is then scored along the sides with a small knife, care being used to cut the skin only; this allows the salt to penetrate more freely and thus assist the process of cure. A specially prepared eccentric wheel is sometimes used for this purpose, which makes a series of small cuts varying from half an inch at the tail to 1½ inches long at the shoulder, and from 2 to 3 inches apart.

The fish is now ready for the splitter, who turns it on its back with the open belly toward him and forces the shoulder down on a sharp pointed nail, so the fish will not slip during the operation. A crosscut is first made across the root of the tail to the bone, but no deeper. Then the knife is entered at the vent, immediately above the bone, and a cut, which should go no farther back than the middle of the backbone, is drawn down to the crosscut already made. Then raising the lug with his left hand, the splitter enters the knife at the shoulder above the bone, and with one sweep from head to tail, separates the entire side. This is the more easily done if the fins have been previously removed. If the work is perfect, there will be no flesh left on the bone, but a line of fat will show down the center of the side. This improves the appearance of the fish and adds to the value.

In order to remove the bone from the remaining half of the fish, the splitter inserts the knife under the bone, about the vent, and draws down toward the tail, but care must be taken, as before, not to go farther back than the spine. The splitter now takes the fish off the nail, holding it by the lug, his left thumb resting on the upper, or inside of the fish, and his fingers on the lower, or skin side. The tail is now pointing away from the splitter, who enters his knife carefully under the backbone, and with one dextrous outward sweep separates the bone from the fish right down to the root of the tail. When abreast of the crosscut, however, he turns the knife sharply downward, and cuts off the fish the same as on the other side. As with the first half, no flesh should be left adhering to the bone, and the line of fat should show down the center. In other words, the two sides should be exactly alike.

The sides are dipped into cold water in the dress tank, and are then laid, skin side down, on the table with the thin or belly edge toward the front. A man then removes any blood remaining in the veins on the inside of the fish by pressing it away from him toward the back of the fish, either with his fingers or with a spoon. If the blood is not squeezed out in this way the salt will harden during the process of curing, and the flesh will become dark in color. The sides are then dipped in a tank of weak brine and crushed ice to give them a final washing, but should on no account be left to soak in the brine. Upon removal, they are again scraped to insure the removal of all the blood from the veins.

Great care must be used in handling the newly split sides, as they are very tender and may be easily broken or bruised. In lifting them by the lug or collar-bone, the curer should have his fingers to the inside and his thumb to the outer or skin side; otherwise the skin may be broken.

The sides are then taken to the salter, who lays them, skin side down, on a salting table on which has been dumped a quantity of dairy salt, and gently rubs the flesh with the salt, lifts it up with only such salt as will adhere to it, and places it in the tierce.

The tierces in which the salmon sides are packed are stout casks made of fir or spruce, bound with six strong galvanized hoops. They contain about 800 pounds of fish, but when full of pickle the gross weight of cask and content is between 1,100 and 1,200 pounds. A plug hole is bored in the head of the tierce.

Two or three handfuls of salt are thrown over the bottom of the tierce, then a layer of salmon sides, skin down, and two or three handfuls of salt are sprinkled over them. In packing two sides of fish, crossed head and tail, are packed close to opposite sides of the tierce, the back or thick part of each side being placed close up against the side of the tierce. Other sides of fish are packed from the sides toward the center of the tierce, napes and tails alternately, the back of each side being drawn halfway up and resting on the side already laid. When complete, the layer should be perfectly level, and this depends a good deal on how the last or center piece is laid. Salt is sprinkled between each layer in the manner and quantity noted above and the process continued until the tierce is full. The tiers should be crossed in packing. The top layer should be placed with the skin up and have extra salt put on. From 85 to 100 pounds of salt are used to 800 pounds of fish.

The tierce is then headed up, after which pickle is poured in until the tier is quite full. This pickle may be made with the same salt as is used for rousing and sprinkling the fish. Perfectly clear water should be provided and broken ice should be added in liberal quantities, if the weather is warm. Before using, the pickle should be strained through a fine sieve or a clean cloth to remove froth and sediment. A centigrade saltmeter is used by most mild curers. The pickle is made to a strength of at least 90°, but it usually weakens to about 70° during the first 10 days of cure, whereas after repacking it should not readily come below 85°, and it should retain that strength for a long time.

When tierces have been filled with pickle they are rolled inside a cold-storage room, with a temperature of 35 to 38° F., where they may be tiered two tiers high. Very little variation in the temperature is allowable, as it would start the oil or fat in the flesh, allowing it to escape into the brine.

Unless the tierces are kept quite full of pickle the sides of fish are apt to be broken when the cask is rolled about. The tierces must be examined frequently to see that they are full of brine, as there are always small leaks, while the staves absorb more or less moisture. Furthermore, if the tierces were allowed to leak, ugly yellow spots would show on parts of the fish that were left dry. Thus it is of the utmost importance, both during the two or three weeks allowed for pining and also after repacking, to see that they are kept full of pickle. Several gallons of pickle may be absorbed by each cask during the first two or three weeks of cure.

The actual shrinkage during the two or three weeks in which the fish lie in the first packing may be reckoned at 30 per cent. Fat, well-conditioned fish, especially those caught when well on their way to the spawning grounds, shrink more—sometimes up to 35 per cent.

After holding the fish in storage for at least 20 and not more than 90 days they are taken out of the tierces. Each side of fish should be lifted out carefully, as described above, and sponged with a large sponge until all salt and slime are entirely removed, leaving only a clean, red side of fish. Either pure ice water or ice pickle may be used for this washing, but it will depend entirely on the quality and condition of the fish. Soft, poor fish would require pickle, but good firm fish may be washed in clean ice water.

The sides are then weighed and graded accordingly, 6 to 8 pounds, 8 to 10 pounds, and so on, being the grades. Sides of 11 pounds and over are called large fish and "L" is marked on the side of the tierce. Some curers grade their sides from 8 to 11 pounds and class them as medium and mark then "M"; smaller sides are termed small and are marked "S."

After the sides have been graded they should be counted and repacked, the defective sides, such as thin-bellied, torn or broken, being put by themselves. Fish which are considered perfect are called No. 1; those which do not come up to that standard are termed No. 2, and are marked accordingly; while fish that have any taint or sourness are marked "T." In repacking, the sides of fish should be replaced as nearly as possible in their original position, those curved in shape being placed against the sides of the cask and straight pieces laid in the center of the tier. No salt is used in repacking, but as soon as the tierce is filled, the head put in, and the air test applied it is laid on its bilge and filled up with ice-cold pickle made to a strength of 90° salometer (90 per cent saturation) that can be made from fresh or salt water, whichever is handiest and cleanest, half-ground salt being used. There will be about 830 pounds of fish on an average in the tierce after repacking, and some

14 gallons of pickle may be required to fill the case up. They are then put back into cold storage and pickled at the bilge daily for at least a week. If kept for any length of time, they would, of course, have to be tested regularly — a tap with a hammer would do—and any leakage promptly rectified. If properly cured, the fish should keep in good condition for months in cold storage, provided the casks are sound and kept full of pickle.

On the head of each tierce are put the following marks: Initials of packer or packers; initials of place where packed; number of tierce (consecutive); number of sides in tierce, the tare, and the gross weight (weight of pickle not counted); quality of fish (I, II, or T); and size of fish (L., M. or S.).

If of first quality, no mark is necessary, but second-quality and tainted fish have to be noted.

Pickling

In dressing salmon for pickling the head is removed, the fish split along the back, the cut ending with a downward curve on the tail. The viscera and two-thirds of the backbone are removed, and the blood, gurry, and black stomach membrane scraped away. The fish are then thoroughly scrubbed and washed in cold water. They are next placed in pickling butts with about 15 pounds of half-ground salt to every 100 pounds of fish. The fish should be laid in a tier, flesh side up, and the salt well sprinkled over it, repeating until the tank is full. Several boards are then laid across the fish and these are weighted down with large stones in order to keep the fish submerged in the pickle which will form. The fish remain here about one week, the brine being held at about 90°. They are then removed, rubbed clean with a scrub brush, and repacked in market barrels, one sack of salt being used to every three barrels of 200 pounds each. About 40 to 52 red salmon, 25 to 35 coho salmon, 70 to 80 humpback salmon, 10 to 14 king salmon, and 25 to 30 dog salmon are required in packing a barrel of pickled salmon.

A few salteries also pack "bellies." This product is merely the belly of the fish, which is the fattest portion and as most of the packers throw away the rest of the fish, thus causing a very large waste of choice food, this method has come under the ban of the law in some of the coast States and in Alaska. As a result, but few "bellies" are packed now, and most of these only when some economic use is made of the remainder. Humpback salmon furnish the major part of the "belly" pack.

In preparing salmon bellies, the operator first cuts off the two pectoral fins, and then removes the head, care being taken to follow the curve of the body until the backbone is reached, which should then be severed straight across. With the smaller salmon the fish is then turned on its back, and the operator inserts his knife in the body just above the backbone and cuts down through the body, the knife coming out just in front of the vent. If properly done, the cut will come close to the upper wall of the stomach. With large king salmon it is sometimes necessary to make the cut first on one side, then turn the fish over and make the cut on the other side. The belly is then laid flat on the cutting table and the membrane at one end cut so the belly will lie flat. The bellies are then washed and salted the same as hard-salted salmon.

When bellies are cut, the backs are saved and either dried in the open air, without salt, or else pickled.

With large kings, the operator, after the belly has been cut out, scrapes the inside of the remainder of the carcass. The knife is then inserted under the backbone at the end nearest the tail, and it is cut away with as little flesh as possible adhering to it. The blood is then scraped off, the fish thoroughly washed, and then salted the same as the whole fish.

Smoking

The smoking of salmon is virtually a continuation of the pickling, as the fish must be pickled before being smoked, the main purpose of the pickling being to preserve them until the time arrives for smoking, which may be weeks or months after the fish are caught. For smoking the salmon are taken out of the barrel and soaked until as much of the salt as possible is removed. They are then put into the smokehouse and subjected to the heat and smoke of a fairly hot fire for about two days in order that they may be thoroughly dried and hardened. Exposure to a smoldering fire (alder wood is a favorite fuel) for about three days completes the process.

For shipment smoked salmon are packed in wooden boxes, oil paper being placed between the fish.

In the manufacture of smoked salmon, the mild-cured product is most in demand. The necessary quantity of sides is taken from the cold-storage and placed in large tanks filled with fresh water. In these they are soaked over night, the water being changed several times, depending upon the salinity of the fish, the variation of which depends upon the length of time the product has been held in storage, those held longest absorbing the most salt.

After soaking, the sides are taken from the tanks, piled on tables, and allowed to drain as much as possible. They are then taken one at a time, laid flesh side down, and a bacon hanger, which is made of wire and has six or more points bent at right angles to the frame, terminating at the top in a hook, is pressed firmly into the flesh on the skin side and at the upper end of the side. They are then hung up on a round stick, which later is then set in position in the smokehouse, each end resting upon supports on the side. The fish are placed so that no two of them will touch. When the smokehouse is full, a small fire of any nonresinous wood is then built underneath to dry them, the ventilator in the top being left open so the moist air can escape. The fires should not be allowed to become too hot; the object is to give the fish smoke rather than heat, as in the latter case they would become partially cooked. For a mild cure, for ready consumption, from 8 to 10 hours, according to the condition of the fish, should be sufficient. If immediate sale should not be possible, the fish must be kept in a cold-storage room with a temperature of about 240° F.

In sections where the products move slowly into consumption, a harder smoking is wanted. In this event, they are held over the fire until dried, which would depend upon climatic conditions, but probably around two days. After the fish have dried sufficiently, the fire is smothered with sawdust, which produces a dense smoke, giving the sides their color. During the latter period the ventilator is partly closed, but must be watched to prevent the fish from sweating.

When thoroughly smoked the sides are removed from the smokehouse, taken off the hanger, and each side wrapped in paper, then packed in wooden boxes holding each 30 pounds.

Kippered salmon.—On the Pacific coast practically all of the kippered salmon is prepared from frozen white-meated king salmon, which on account of the color of the flesh is not much in demand. It is, however, fully the equal in both flavor and food value, of the red-meated kings. It is not absolutely essential that the fish be first frozen, as the fresh fish may be kippered after dressing, but the latter is always a little soft when so prepared, owing to an excess of moisture, which is largely removed in freezing. Fresh salmon is available only part of the year, so it is found most convenient to freeze and store the stock and work it up when needed throughout the year.

Before freezing, the fish have been dressed, so when thawed in cold-running water, it is only necessary to split and cut them into pieces of a pound or less, these being about 6 inches long, or perhaps 3 inches broad, depending upon the part of the fish the piece is taken from, and place them in a tank of strong brine to season for several hours. They are then dipped in a harmless vegetable coloring, similar to that used by the butchers for coloring sausage; this gives the outside of the product a red color, a concession to popular prejudice.

From the coloring tank, the pieces are placed on a tray with wood frame and bottom of one-half inch square meshed wire; care is taken that the pieces do not touch each other.

The tray is then slipped into a rack which will hold a number of these, placed one above the other, and this rack is then run on a track into the smokehouse.

A medium fire is then kindled which dries and slightly smokes the pieces from 16 to 18 hours.

When they reach a proper stage the fire is enlarged, but great care must be exercised in order to prevent their being overheated, and this is done by means of the damper at the bottom of the smokehouse and the ventilator at the top. The fish are baked in this manner from 25 to 35 minutes, the thermometer showing from 250° F. to 270° F. of heat.

When the cooking is completed the cars are pulled out and the fish allowed to cool, after which each piece is wrapped in a square of parchment paper and packed in a box or basket which holds 10 pounds.

The product is quite perishable, and if it can not be used at once, when of course it is at its best, must be placed in cold storage. The packer endeavors to turn out daily only the amount he can market that day.

Beleke.—A smoked product, known locally as "beleke," is put up at Kodiak, Alaska, from red and coho salmons. Steelhead trout are the best for this purpose, but are not often utilized owing to their scarcity in this region. In preparing "beleke" only the backs of the fish are used, the belly part being cut out and pickled separately. The backs are divided into three grades, according to size, viz., "small," "medium," and "large." They are first put into a brine, the "large" being put in first, followed by the "medium" and "small," at intervals of one hour each, so that all will be cured at about the same time. The coho backs being the largest, are kept in the brine from 19 to 20 hours, while the red salmon backs, which are smaller, remain in the brine only about 16 hours. After being thoroughly salted the backs are removed from the brine and rinsed in fresh water, then hung in the air for about 24 hours to dry and to allow a thin skin to form on the outside. They are then hung in the smokehouse, in the presence of a little fire of cottonwood or alder. On dry days the gable windows are thrown open and the wind allowed to pass through while the smoking is going on. The smoking must be done slowly, two weeks being devoted to it.

Canning Salmon

Dressing

A number of the small canneries still use the old hand method of dressing the fish, and in such places the selection of the butchering or dressing gangs is of prime importance. Two men constitute a "butcher's gang," and the number of these gangs is dependent upon the output of the plant. Boys place the fish, with the head out, upon the cutting tables. One man cuts off the heads, and is followed by another who removes the fins, tails, and viscera. The offal is thrown into a chute, whence it passes into the water under the cannery or into a scow moored underneath, while the dressed fish is transferred to a tank of water, to be scaled, washed, and scraped. It is then passed to another tank of water, where it receives a second washing, scraping, and final brushing with a whisk-like broom, which removes any offal, blood, and scales that were overlooked in the first washing, after which it is removed to large bins on either side of the cutting machine.

The most useful cannery inventions in recent years have been of machines for doing the work of the dressing gangs. The one commonly known as the "Iron Chink," removes the head, tail, and fins and opens and thoroughly cleans the fish ready to cut into pieces for the cans. By the use of these machines the dressing gang is almost entirely done away with, dispensing with 15 to 20 men. This same machine is now so arranged that the fish after dressing are also "slimed"; i.e., the thick mucus covering the skin removed, and the inside of the fish cleaned.

The usual method of cutting the salmon is by a machine. This is generally a large wooden cylindrical carrier, elliptical in shape, thus having a larger carrying capacity. Ledges or rests on the outside the length of the carrier are wide enough to hold the fish, and are slit in cross section through the ledges and outer casing to receive the gang knives. The latter are circular, fixed on an axle at the proper distances apart, and revolve at the highest point reached by the carrier and independently of the latter. The carrier and gang knives are set in motion, each revolving on its own shaft. As a rest on the carrier comes to a horizontal position, men stationed at the fish bins lay a fish on each ledge as it passes. Thence it is conveyed to the revolving gang knives and, after being divided, passes through on the downward course, sliding off the rest into the filling chute. The knives in these machines are so arranged as to cut the fish transversely in sections the exact length of the cans to be filled.

The rotary cutter shunts the tail pieces to one side, and these are carried by means of a chute to baskets. The tail pieces are generally canned separately. As the tail portion is much smaller, with less meat, it can not be placed in the cans with the middle and head sections without detracting from their value, but if packed under a distinct and separate label, as is now done, there is no reason why the tails should not supply the demand for a cheap grade of fish.

In some of the smaller canneries, especially in those packing flat cans, the gang knives are worked by hand. In this case, the knives are not circular, but elongated or semicircular in shape, tapering at the outer ends. They are mounted on an axle having a large iron lever at one end, and when this lever is raised the ends of the gang knives are thrown up and back. The fish is then placed in position under them and the lever pulled forward, the knives, with a scimitar-like movement, dividing the fish.

Every can of salmon is seasoned with one-fourth of an ounce of salt, which, to insure uniformity, is added by mechanical means. A table is used, in the top of which are holes equal distances apart. On the underside of the top is a sheet-iron plate, with an equal number of holes, which slides in a groove at the sides, and is worked either by a hand or foot lever. Just below is an open space large enough to accommodate a tray holding 36 or 48 cans. A workman stands in front of a table and slides a tray of cans into the open space. He then throws a quantity of salt upon the table and immediately scrapes this off with a thin piece of wood, each hole being filled in the operation, and the salt being prevented from falling through by the iron plate underneath. The lever is then pressed, the iron plate moves forward until the holes in it are directly under the holes in the table top, when the salt drops through into the cans. This operation can be repeated four or five times in a minute. Most canneries now use a small salter attached to the filling machine and this deposits the required amount in the can as it is passing by on its way to be filled.

Most canneries now use filling machines for all sizes of cans, although a few, more particularly those packing flat and odd-sized cans, still fill by hand.

The filling machine consists of a chute with a belt to which are attached wire racks about 4 inches apart, set at an angle to prevent the salt from spilling out, into which the salted cans are fed from the floor above and pass into the machine. At the same time the divided sections of salmon pass down another chute into the mouth of what looks like a hand coffee mill. They pass through here down a smaller chute and are forced by two dogs into a receptacle through which the plunger, or filler, passes. Here the plunger comes opposite the open mouth of the empty can, which when it reaches this point is caught by a clasp or hook and held in front of the plunger, which is immediately thrust forward through a chamber filled with salmon, cutting the fish longitudinally and at the same time filling the can. The next movement forces the can out upon the table. When running at full speed, one of these machines will fill about 80 cans a minute.

On being released by the clamp and rolling upon the table they are righted by a workman and pushed onto an endless belt, upon which they pass into the weighing machine. If of the proper weight, they pass through this machine, but if below the required weight the cans are shunted to one side, where workers add the quantity of fish needed, a supply of small bits being kept at hand for this purpose. Generally the cans overrun in weight, frequently as much as 2 or 3 ounces. Occasionally a can is weighed on a small balance scales in order to see that the machine is in perfect adjustment.

After passing the weighing machine, any bones and scraps of flesh which may be sticking out of the can are clipped away by workers armed with scissors.

In the hand method the fillers stand on each side of a long table with a trough running down the middle from end to end. This is filled with the cut pieces of salmon, and the fillers, usually women and children, put large pieces into the cans at first and then smaller pieces to occupy the vacant spaces.

From the weighing machine the cans pass to the clinching machine, which attaches the top of the can loosely to the body in such a way that it allows the air in the can to escape, yet prevents the fish from coming in direct contact with the steam of the exhaust box. Also the water resulting from the condensation of steam, which accumulates in the exhaust box, is kept from entering the can and thus bleaching the flesh.

In many plants the cans are washed by jets of water or steam directed against them in a closed box as they are passing from the clincher to the exhaust box.

The cans then pass into a steam exhauster, consisting in one type of a box about 30 feet in length, in which are three endless-chain belts running side by side. Under and over each belt are steam coils, and under each of the lower coils are single pipes, which through small holes throw jets of live steam upon the coils, creating an intense heat. The cans pass along the first belt, are then transferred to the second belt, on which they return to the entrance of the box, whence they pass to the third belt, and continuing along this to the end, pass out to the double seamer, the whole operation occupying from 5 to 15 minutes, preferably 15. One style of exhauster has 10 ovals formed by the pipe, and the cans pass along these from side to side of the exhauster until discharged at the far end. Another type is formed of a long tube through which the cans pass and are heated by perforated steam pipes. Upright exhausters, in which the cans travel along a spiral, are also in use. By this means the contents of the can are heated and the greater part of the air exhausted, which is the object of the first cooking in the retort under the method formerly in general use. In Alaska, where 1-pound tall cans form the bulk of the pack, the cans are exhausted at a temperature from 206° to 212° F., 210° F. being the favorite.

Leaving the exhauster the cans pass to the double seamer, which fastens the cover on tightly with a double seam or crimp. It should be stated that no solder is used in attaching the top on the can, the curled flanges of the cover being coated around the outer edge, with cement or other sealing fluid to take its place. Solder, however, is used in joining the side seam of the can, this being done when the can is manufactured. The cans then leave the machine on an endless conveyor, pass through a machine which washes the outside of the cans, and thence to the men who transfer them to the coolers, which are immediately placed upon the trucks and run into the retort for the one cooking they are to receive. By the use of these cans the soldering machine used in the old-style method is done away with. It also does away with the first cooking and the subsequent venting and soldering, a saving both in labor and time consumed.

The cooking processing time varies in each district and sometimes for each species. In Alaska 1-pound tall reds, cohos, chums, and pinks are generally cooked from 90 to 120 minutes, at 12 to 18 pounds pressure and at a temperature of 242° to 248° F. One-pound flats and half-pound cans are generally cooked about 10 minutes less time. Owing to their larger bones, king salmon are generally cooked from 10 to 20 minutes longer than the other species; steelhead trout also.

On Puget Sound 1-pound tall sockeyes, cohos, and pinks are generally cooked for 90 minutes at a pressure of 10 pounds and at a temperature of 240° F. Halves and 1-pound flats are generally cooked at the same temperature but only for 80 minutes. Chum talls are generally cooked for 105 minutes at a pressure of 10 pounds, and at a temperature of 240°; while spring or king salmon are cooked for 120 minutes at a pressure of 10 pounds and at a temperature of 240° F.

It is the custom of all canneries, no matter what the system to allow about 5 minutes at the beginning of the cooking to work up the required heat of the retort, and when cooking is completed there is a like period for reducing the temperature and pressure before opening the doors. The cooking times given above are exclusive of the two 5-minute periods noted here.

It should be distinctly understood that the processing times noted are only approximate. The condition of the fish, the weather, whether hot or cold, rainy or dry, etc., all must be taken into account. The canner can not go far astray, however, if he keeps generally within the narrow margins noted above. In the early days much secrecy and mystery was thrown around the cooking, and the work was carried on in a separate room, known as the "bathroom," under lock and key. The first cooking was done in common tubs. The early retorts were made of wood. Later, round iron kettles were substituted, nearly one-half consisting of cover, and round crates were used for holding the cans. At the present time only rectangular horizontal iron or steel retorts are used, and access to these is had by means of miniature railroad tracks.

Pickling Sablefish (Black Cod)

Remove the head and fins, split in halves down the back and belly, gut and cut out the backbone. Wash thoroughly, being particular to scrape out the blood and tissue along the back. Some curers split the fish down the back only, leaving the two halves united by the belly walls as is done with mackerel and salmon. In either case the market demands the removal of the backbone.

Place a layer of salt on the bottom of an 800-pound tierce, or any other suitable tight container, and on this place a layer of fish flesh side up, sprinkle salt and add another layer of fish flesh side down and repeat until the tierce is filled. It is stated by a curer who has had much success with this product that about 100 pounds of salt is used to each 200 pounds of fish, a larger quantity than is employed in salting salmon.

The salt and moisture from the fish form a strong brine in which the fish should be kept until "struck" (approximately five days to a week). The fish are then carefully packed in layers in 200-pound barrels, a little salt being sprinkled over each layer and the barrel is filled with strong brine and headed. None but tight barrels should be used, and if there should be any leakage it should be made good by adding strong brine through the bunghole.

Salting and Drying of Cod and Other Salt Water Fish

The principal fish dried in this country all belong to the Cod family. They are Cod, Haddock, Pollock, Hake and Cusk. The methods described are applicable to them all, although they differ somewhat in their behavior, Pollock tending to turn dark, and Hake being able to stand higher, temperatures without burning. Conditions differ much along the coast, so that it is impossible to give very definite directions, the methods having to be modified in detail according to local conditions or circumstances prevailing at the time.

Bleeding

Blood in the cured fish is objectionable from two standpoints. It darkens the flesh whenever it remains, and so interferes more or less with getting the whiteness that is so desirable. It is also more prone to decomposition than is the flesh, and so may give an objectionable flavor to parts of the fish where it occurs, that otherwise would be quite good.

Bleeding is best done by cutting the throat. It must be done before the fish begins to get stiff and the blood ceases to run, otherwise it will be useless, and immediately after the fish are taken from the water. This is done by the Norwegians and accounts largely for their generally good-looking fish.

Throating and Ripping

The fish's head is seized by the left hand and its back is rested on the edge of the tub or table. With a strong sharp-pointed knife the throat is cut across just behind the gills. The knife is introduced at this opening and the belly ripped by a single stroke continuing through the vent hole and close along the left side of the anal fin for a short distance. Some have the bad practice of carrying the knife up the side at the last. This produces the so-called "silver" condition, part of the flesh alongside the fin being left attached when splitting is done instead of going with the side to which it belongs. This causes a waste of part of the flesh and is to be avoided.

Beheading

A cut is made up each side to the back just behind the gills and it is then possible to break the head from the body, by pressing down on both with the back of the edge of the tub or table.

Cutting

The belly is opened with the one hand, and all guts are loosened and pulled out with the other. The liver is separated and put into a tub, while the remainder goes into the gurry box.

Splitting

For this operation the regular splitting knife that can readily be bought in the trade should be used. The body of the fish is placed against a cleat fastened to the table or splitting board. From the cut made in ripping the knife is carried upwards and backwards so as to separate the flesh of the left side cleanly from the backbone all the way to the tail. The cut should not go toward the back as to make the fish thin there when spread out. The backbone is then cut through about two-fifths of its length forward from the tail by a downward and forward motion, seized just in front of the cut with the left hand, and stripped up cleanly bv means of the knife from the flesh of the right side. The point where the backbone is cut through should be just far enough back to avoid leaving a blood spot. This is three joints back of the vent. In this way the main portion of the backbone is removed and very little flesh with it. The backbone in the back part of the tail is left in. A cut should be made into the part of the backbone that remains to let any blood there may be escape. The sounds are sometimes removed from the backbones and dried separately to the sold for isinglass.

Washing

A good supply of running water is very desirable, but if still water is used, it should be changed frequently to prevent its getting so dirty as to fail to clean the fish properly. Blood, slime, pieces of liver, etc., should be removed in this way, especial care being taken at the neck and near the part of the backbone that is left, as well as near the fins. Sea-water is preferable to fresh water for washing, as the latter tends to soften the fish. The fish should be well drained from the wash water before salting.

White-Naping

The belly is lined with a dark inner skin. This does not come away in gutting and splitting, but it is to be seen on the napes of the split fish. If it is removed, the dried fish have a better, whiter appearance, and are usually worth more. This black inner skin can readily be stripped or rubbed off, and this process is known as white-naping.

Salting.

Salt is used to preserve the fish from spoilage, which would otherwise occur before the fish could be thoroughly dried. Salt acts by removing water, thus partially drying the fish. The less salt used the better, but there should be no risk run of spoilage. The larger and thicker the fish, the more salt required.

The warmer the weather the faster the salt strikes in. Except on the Northern part of our Coast no attempt should be made in warm weather to light salt the fish. They should be heavily salted and held for drying until cooler weather comes.

There are a number of kinds of salt on the market. Undoubtedly the purest salt makes the best fish. Certain impurities, however, make it whiter, and this is often desired, but these impurities, lime and magnesia (as in Turk's Island salt), settle on the surface of the fish and must be removed by thorough washing. Also the solar salts, as compared with mined salts, contain the organisms that produce reddening of the cod and for that reason are better not used if the growth of the red organism is not prevented otherwise.

Kench Salting

After the fish are washed and drained, each in turn is placed on the kench or pile with the flesh side or face up and a quantity of salt then sprinkled over it. The kenches are built up regularly, the fish being laid flat, head against the tail with the skin down. The pickle, which forms by the salt withdrawing water from the fish, is allowed to drain away, thus removing most of the moisture from the fish. It should be seen that there is good drainage from the bottom of the pile. This makes a drier product, which is better for export to hot climates. This method is more usual for salting done aboard vessels.

As the pickle accumulates at the bottom of the vessel, it must be frequently pumped out. If it is not sweet it is an indication that the fish are in bad condition, and have been improperly kenched. They should be repiled. Also, if the fish have been a long time aboard the vessel, rekenching will be necessary, at least when they are landed.

In kench cure the salting is not as uniform as in pickle cure, and much greater care must be exercised to ensure a satisfactory product. Hollow kenching is apt to produce sour fish and should never be practiced.

Pickle Salting

The fish are salted in tubs, special vats, or in large barrels, often called butts. They are placed flat in the butts with the flesh side up and salt is put over each layer. Those of the top layer should have the skin side up, for the purpose of protecting the flesh from dust, etc. Salt should be placed in quantity on top of all, and more added as the fish sink and pickle forms.

Water-Horsing

When the fish have been thoroughly salted, and it is purposed to dry them, they are taken from the kenches or buts and cleaned by washing with salt water or brine. As this is the final washing, especial care should be taken to see that all fragments of the black membrane and all blood spots are removed.

If the salt contains much lime and magnesia, the deposit therefrom on the surface of the fish must be thoroughly removed by brushing if a good quality of fish is to be obtained. The use of purer salt lessens the labor at this stage and gives a fish with a smoother surface, as less rubbing is necessary.

The fish should then be piled in kenches, preferably on a concrete floor, sometimes with weights on top to aid in expressing the pickle which drains away. The fish dry out to a certain extent and get into a condition for more rapid drying on the flakes, and also the pressure tends to make the surfaces smooth. Repiling assists in drying and tends to prevent spoiling if the fish remain long in the kenches. Care should be taken to keep the fish rounded up in the middle of the water-horses, thus allowing the pickle to run off more freely.

Drying

The ordinary method of drying is in the open air on what are known as flakes. The extent of the drying depends upon the market for which they are intended, those going to hot climates requiring to have much more of the moisture removed. The flakes are designed to give rapid drying. They are wooden racks of lattice-work made of triangular inch strips of wood spaced about three inches and held together by a frame. These wooden ones have been practically superseded by those made of wire netting stretched and fastened to frames. The flakes are on supports, which hold them about thirty inches from the ground or the building on which they are placed, so as to permit of a very free circulation of air underneath. Drying on rocks or on beaches is in every way inferior to drying on flakes, and is very apt to spoil the fish from dirt, ground-water, or sun-burn.

The best fish are obtained when drying takes place at low temperatures, as in the spring and autumn. Cold dry weather is much better than hot moist weather. The rate of drying depends upon the dryness of the air and the extent to which it circulates. In hot weather there is danger of "burning," which reduces the value from 25% to 50%. The danger point lies between 80° and 90° F., for the temperature of the fish, not of the air. Free circulation of air about the fish tends to prevent this, and it also hastens drying. The fish may need to be protected from the sun on very hot days and to be taken care of during wet weather. During the later stages of drying the fish are placed periodically in large piles. This intermittent piling causes the fish to "sweat," that is, it permits the moisture of the interior to work out to the surface, whence it evaporates in the later drying. Without the "sweating" the fish are apt to become very dry on the surface, and yet sufficient moisture remains inside to later soften the fish.

Cleanliness

The best quality of fish cannot be produced unless all the things with which the fish come in contact are kept clean. All implements and utensils, the boats, the fish houses and the flakes should be kept sweet and clean. Unless this is done, the fish will be inferior in quality, frequently in such a way as not to be apparent until they are cooked.

The flesh, slime, blood and juice of the fish go bad very quickly, and if not thoroughly removed will give a bad odor. Such rotting material, even in small quantities, not only infects the good fish, causing them to spoil more rapidly than they otherwise would, but also gives them directly a bad flavor.

Protection from Mechanical Injury

The best fish are those handled the least. The flesh of fish is much more delicate than that of the cow, sheep, pig, etc., and should be handled much more carefully. The fish are easily broken by pressure, if placed in large piles. The use of forks in handling the fish is extremely objectionable unless the tines of the fork are never permitted to pierce anything but the head which is to be discarded. Holes through the flesh injure the fish in appearance and are avenues along which spoilage will take place very rapidly.

Rough handling of fresh fish, such as throwing them so that they land heavily, results in bruising, which gives a bad appearance when cured. Fresh fish should be carried, not thrown about.

Protection From Heat

High temperatures, particularly in the fishing craft or stage before the fish have been salted, are ruinous to the quality of the product. Bacteria, that cause decomposition, are present on the surface of the fish, in the mouth, over the gills, and in the gut. They grow much more rapidly at higher temperatures, and fish can be kept much longer without danger of sufficient growth of bacteria to spoil them, if only the temperature is kept down. It is very essential, therefore, to keep the fish in the coolest place possible, protecting them from the sun, and not putting them in large piles, where the inner ones will heat. Fish, when allowed to remain for any length of time in an open boat or on the deck of a fishing schooner exposed to the sun, are certain to turn out of inferior quality.

No Delay in Handling Fish

As indicated above, the lower the temperature, that is, the colder the fish are kept, the longer the time they can be held with safety. No matter what the temperature, however, the sooner they are put under salt the better the product. Bad fish cannot be made good; insofar as they have spoiled, they cannot be restored. The result of partial spoiling is illustrated by the Scotch method of grading dried fish. The best fish have the black lining of the body cavity removed, that is, have been white-naped. They are called "White Wings." If somewhat stale fish are white-naped, they show a bluish color, and are called "Blue Wings." The stale fish, however, are usually not white-naped, and are then known as "Black Wings."

Best Method of Processing Fresh Fish When Delay Unavoidable

After the fish have been headed, gutted, and rinsed in clean cold water by the fishermen, they are weighed and then dumped into tubs or vats containing a light pickle, care being taken to use as cold water as it is possible to provide. When the day's catch has thus been taken care of, which means the prevention of a considerable portion getting soft before it could be got under salt, the fish are taken out of the light pickle, split, thoroughly cleaned of blood spots, white-naped, rinsed in cold water and put under salt, either in kench or in pickle vats or tubs with the necessary amount of salt to produce a heavy or light salted article as required.

Soft fish will slightly harden up under the above process, and can then be split with less fear of injury. The light pickle tends to whiten the fish as more or less blood is drawn out by the salted water. For this reason some fish handlers recommend always leaving the splitting and salting until the following morning, no matter what is the size of the day's catch. Saturday's catch can be held over Sunday by slightly increasing the quantity of salt used in the water into which the fresh fish are dumped.

Before taking the fish out to split, it is best to wash away the pickle, which has soaked out the blood. This can be done by sending water into the tub toward the bottom and letting it run away over the top.

Reddening of Fish

Under certain conditions salt fish become what is known to the trade as "Red." This is owing to the growth on the surface of the fish of certain organisms that are found in nearly all sea salt. They need for their growth plenty of salt and warmth. Red is only to be feared with heavily salted fish that are permitted to become warm. Light salted fish never turn red. When fish have been put under heavy salt, care should be taken that the storeroom is kept cool by good ventilation. If mined salt, free from the red organism, is used, and if the curing plant is also made and kept free from the red organism, the red is not to be feared.

When red has developed, it can usually be washed off and further reddening prevented by the application of powdered boracic acid.

Brine-Salted Cod and Haddock

In pickling cod or haddock the fish are dressed, split, washed, and salted in butts with about 2 pecks of salt to the 100 pounds of fish. . . . When orders are received, the fish are removed from the butts, cleaned with brushes, and placed in tight barrels 200 pounds to the barrel, face side up, except the top layer, which is placed back up, the fish being bent to follow the curve of the barrel, pressure being applied, if necessary to place the 210 pounds in the package. It is important that the fish be not repacked until thoroughly struck through, otherwise the fish will be marked with yellow spots caused by contact of the imperfectly cured fish with one another. Coarse Trapani salt is placed at the bottom of the barrel and over each layer of fish, about 1 peck of salt being used to each barrel of fish. The barrel is then headed and strong brine is added through the bunghole, when the package is ready for shipment. The gross weight of a barrel of codfish, including barrel and pickle, approximates 325 pounds.

It requires about 430 pounds of round cod or 290 pounds of split fish to make a barrel of 200 pounds pickled.

Smoked Haddock or Finnan Haddie

To make a good product of finnan haddie requires experience, as well as much care and attention, especially in the pickling and smoking. When received at the curing-house the fish have usually been split down the belly to the vent and eviscerated, as if prepared for the fresh-fish market. They are first beheaded and washed thoroughly with a stiff brush, all the black membrane lining the abdominal cavity being removed. They are next split down to the tail and a cut made along the right side of the backbone so that they will lie out flat, and the rough edges of the backbone are removed. They are then immersed in strong salt brine, made of Liverpool, Cadiz, or Trapani salt, for 1 or 2 hours, according to the weather and the temperature, as well as to the size and condition of the fish and the particular flavor desired, the exact length of time for pickling being learned only by experience.

On removal from the brine they are fastened to the sticks from which they are suspended in the smokehouses, the napes being stretched out flat and pierced by two small iron spikes or nails fixed in the smokesticks. These sticks are about 1½ or 2 inches square at the end and 4 feet long, 3 fish being usually hung from each. The sticks with the fish attached are placed on frames for a few hours to allow the moisture to dry from the fish, when they are suspended in the smokehouse, which is generally like those used in smoking herring, the sticks being placed in tiers, one above another, with space between to allow the smoke to circulate. A fire of hard wood, usually oak, is started over the floor of the smoking kiln and allowed to burn from 8 to 18 hours, when sawdust is applied, smoldering the fire and producing a dense smoke, which thoroughly impregnates the fish. In smokehouses with a low ceiling the smoking can be completed in 4 or 5 hours. In smokehouses no wood is used, the curing being effected by burning hardwood sawdust, rock maple or beech being preferred, and the temperature is kept as high as practicable without burning the fish which are placed high up in the bays. The time of cooking or smoking depends on the condition of the fish, temperature of the air, and the probable time to elapse before consumption, but never exceeds one night.

When the smoking is completed the fish are removed from the smokehouse and placed on racks for cooling, and when thoroughly cooled they are packed in boxes containing from 20 to 400 pounds each, but mostly 50-pound boxes, and shipped to the trade, usually by express. Only enough are cured at a time to supply the immediate demand, as it is important that they reach the retail dealers in good condition. During warm weather they will keep only a few days, but when the weather is cool they will, under ordinary conditions, keep from 10 days to 2 or even 3 weeks. If it is desirable to keep them longer they must be smoked much harder.

The season for finnan haddie begins in October and lasts until the following April. 100 pounds of round fish yield about 55 pounds smoked.

Curing Mackerel

According to European and American methods the mackerel is cut along the backbone from the mouth to the end of the tail, while in Japan the head is left untouched, the fish being cut only from the shoulder to the end of the tail. This method of cutting is called "opening the shoulder." The gills and internal organs are then removed, the fish are carefully washed and sprinkled with salt, a convenient number are placed in a box, a basket, or a mat, and are wrapped in a coarse mat to be carried to market.

Sometimes market conditions necessitate keeping the mackerel after they have been salted for a week or so before they are marketed, in which case the salting is done in a large tank or barrel, and more salt is used, the fish and salt being placed in alternate layers. The amount of salt required differs according to the season of the year, the freshness of the fish, the distance of the market, and the length of time the fish will be kept, and generally between 20 and 40 per cent of the total weight.

Dry Salting—European and American Methods

One other method of curing mackerel in Japan is known as dry-salting, or more accurately salting and drying. In this method after the fish have been sprinkled with salt, they are left overnight and are then dried in the sun. Fish cured in this way have a lower market value, but will keep longer than salted fish.

Brine-Salted Mackerel

The methods of salting as here given relate especially to fish taken by purse seines.

When the fish are removed from the seine by means of a large dip net they are thrown on deck; or, if the catch be large, they are placed in a "pocket" or "spiller," rigged along the side of the vessel, where they can be kept alive until the crew have time to dress and salt them.

For dressing the fish, the crew is divided into working gangs of three men each, one of whom splits and the other two, known as "gibbers," gill and eviscerate the fish. Each gang of men is provided with a splitting board from 6 to 10 inches wide and with two wooden trays about 3 feet square and 6 inches deep, which are generally supported on the tops of barrels. Some crews especially in the hand-line fishery, have only two men in each splitting gang, the splitter or some one else getting the barrels, filling them with water, and otherwise aiding the gibber. The splitter with his left hand, which is usually covered with a cotton mitten for protection as well as to prevent the fish from slipping, takes the fish around the center of the body, with the tail toward him and splits it down the back on the left side of the backbone from the head to the tail, so that it will lie open and flat after the viscera have been removed, the knife being held by the fingers and guided by the thumb sliding along the upper side of the fish. On splitting each fish he tosses it to the tray of the gibber, who, with hands covered with gloves to protect them against the bones, opens the fish with a jerk, causing it to break lengthwise along the lower end of the ribs if it is fat, thus making a crease on each side. He removes the viscera and gills and throws the fish open and face down, into a barrel partly filled with clean salt water, in which the blood is soaked from the fish, whence they are called "wash barrels." There the fish remain until the splitting is finished, which may be 6 or 8 hours or even longer after the first fish have been split. Then the deck is cleaned up, and the men proceed to salting.

If the men have time they "plow" or ream the fish, making a cut in the abdominal cavity on each side near the backbone, in imitation of the natural cracks or breaks which occur in fat fish, thus giving the fish a fat appearance.

In salting, the mackerel are emptied from the wash barrels upon the deck and rinsed by throwing buckets of water over them. A man places them, a few at a time on a gib tub containing a half bushel or more of No. 2 Liverpool salt, while another man, taking a fish in each hand, rubs the flesh side of the fish in the salt and, with the back of one fish against the flesh of the other, places them in the sea barrel with the flesh side down, except that the two or three bottom layers or tiers have the flesh side up. Formerly it was customary to place all the fish with flesh side up, but this has been abandoned. The salt is carried in the hold in barrels that are subsequently used for packing the mackerel. Liverpool salt is used almost wholly, Cadiz and other coarse salts having a tendency to tear and give a ragged appearance to the mackerel. It is quite important that every portion of the surface of the fish be in contact with the salt, and care should be taken not to leave finger marks where the fingers or thumb cover portion of the fish during the process of salting and prevent the access of salt.

On arrival at port the barrels of mackerel are removed and placed on the wharf or in a storehouse until opportunity arises for repacking them, which may not be for months. Then the top of the barrel is removed, the brine poured off and discarded, the fish emptied out, several barrels at a time, into a culling crib or box of planed boards with slat bottom and usually 5 feet long, 3 feet wide, and 8 to 10 inches deep, placed on legs about 3 feet high. The fish are there culled into the several grades recognized by the trade and thrown into two weighing tubs, each holding about 100 pounds, which rest on a beam scale. These tubs have wooden staves and have the bottom perforated with inch holes to permit drainage, or, better still, a rope network bottom, and are bound with two iron hoops and have an iron handle on each side. The diameter of the tub is 24 inches at the top and the height is about 15 inches. When the proper weight of fish is placed in the tubs the fish are removed to a packing crib, somewhat similar to the culling crib, and usually 38 inches long, 26 inches wide, and 14 inches deep, where they are packed in barrels or smaller packages, the various grades being kept separate from each other and placed in different packages.

In packing, a small quantity of salt is sprinkled in the bottom of the barrel, next two or more layers of fish, with the flesh side up and succeeding layers of fish with the back up. Over each layer of fish a large handful of salt is sprinkled, about 35 pounds being used for each barrel of fish, which is required by law to contain 200 pounds of mackerel, exclusive of the weight of the pickle; while half, quarter and eighth barrels must contain proportionate quantities. The total shrinkage on salt mackerel from the round to the marketable state is about 33 per cent. After being filled the barrel is headed and moved to some appropriate place on the wharf or in the storehouse, where it is "pickled"; that is, a hole is bored in the side or head of the barrel and as much brine as the barrel will contain is poured in. This brine should be made quite strong, at least of 95° salometer test, and it is conveniently introduced by means of a water bucket with a copper nozzle in the bottom, forming a funnel, the end of which is placed in the hole made in the side of the barrel, a vent on the side permitting the air to escape. The hole is then plugged up and the barrel turned on end and branded. The branding kettle most commonly used is of stout sheet iron, cylinder shaped, 9 inches in diameter and 12 inches high. A rod with a wooden handle at the top passes through the center of the kettle and furnishes the means for handling it. A charcoal fire is made in the kettle and when the brand, usually made of brass at the bottom, is sufficiently heated, the barrels are stamped with the legal inspection marks. Because of leakage and evaporation it is frequently necessary to add additional pickle to the barrel after it has stood several days, the deficiency being noted by the sound produced by striking the barrel with a stick.

Smoking Mackerel and Flounders

Mackerel

The fresh mackerel are cured in very nearly the same way as lake herring, except that usually they are not split, being prepared round. The fish are first struck in brine, in which they remain for 12 or 14 hours, then removed and opened at the vent with the point of a knife to let the pickle in the abdominal cavity escape. They are next put on smokesticks, drained and dried for 2 or 3 hours, and placed in the smokehouse, where they are subjected to a gentle smoke for 4 to 5 hours, until properly colored, when fires are built and the fish cooked for a couple of hours, as in case of ciscoette or lake herring.

In preparing salt mackerel for smoking, the fish are cleaned and the dark stomach membrane removed, when they are soaked in fresh water for 6 to 12 hours, or in some localities from 15 to 24 hours, according to the size and the degree of saltiness. On completion of the soaking they are washed, strung on rods or smokesticks, drained, and hung in the upper part of the smokehouse and subjected to a gentle smoking for 5 to 15 hours at a low temperature.

Flounders

The small flounders weighing half a pound or less are used, and these are eviscerated, pickled with brine in butts for about 2 hours, strung on smoke rods, drained, and cold smoked for 8 to 10 hours. Sometimes these fish are hot-smoked for half an hour or so after the color has been set by the cold-smoking.

Smoking Halibut

A dressing or fletching gang consists of two men, and there are four gangs to the vessel. Each being provided with a strong gaff hook having a garden-spade handle, they place the halibut on a slanting cutting board on its dark side. One of the fletchers then thrusts a thin knife, about 16 inches long and 1½ inches wide, into the body of the fish near the base of the dorsal fin through to the backbone, the blade being held horizontally, and cuts close to the ribs, removing a broad streak from one-half of the upper side of the fish. The fletcher on the opposite side of the table makes a cut similar to the above, separating the whole upper half of the fish from the backbone and the ribs. Two gashes are then cut in the fletch, one at each end, by means of which it is removed from the cutting board. The other side of the fish is then treated likewise, making two fletches from each halibut. Formerly in fishing near Iceland, when all the fins were saved, the fletching knife was entered not so close to the fins, and when the fletches were removed the fins were cut off. During the four or five years preceding 1898 few of the fins were saved on account of their large size and fatness.

The whole fletches are at once salted in kenches in the vessel's hold, in the same manner as codfish, with the skin side down and a layer of Trapani salt over each layer of fish, 8 or 9 bushels of salt being used to each 1,000 pounds of fish. The whole fletches are supposed to hold the pickle better than if they were cut in smaller pieces, and consequently weigh more. After remaining about 15 days they are rekenched, during which time the surplus salt is shaken off. To avoid compression some fishermen place the fletches in large 400-pound boxes and pile the boxes on top of each other. On reaching port the fish are removed from the vessel's hold and placed back down, with salt, in kenches 3 feet high in the fish-house, where they may remain for a year or more without further handling. It is not unusual for smokehouses at Gloucester to have half a million pounds or more of salted halibut on hand at one time. When it is necessary to hold them over during July and August, the appearance of the fish is improved if they are kept cool, and for that purpose one of the halibut smokers at Gloucester has a small ammonia refrigeration plant, with suitable cold chambers connected, where the temperature is kept about 45° or 50° F.

The fresh halibut received at the smokehouses from the market vessels are cut in small fletches and salted in butts, back down, similar to those used for salting codfish, with about 5 bushels of Trapani salt scattered among 1,000 pounds of fish. There they remain from one to two weeks, when they are removed and salted in kenches similar to those on the vessels; or they may be scrubbed, soaked, water-horsed, and smoked at once; but this is not usually done, because of the desirablity of working off the old stock. It is important that the fletches be thoroughly salted, otherwise the smoked product will be liable to spoil quickly.

When the market demand warrants their use, the fletches are removed from the kenches, washed thoroughly in fresh water with corn brooms or bristle brushes, and soaked in water for 3 or 4 hours. The water is then changed and they are again soaked for about the same length of time. This soaking is necessary in order to remove the coating of salt from the fish and to soften its fiber so that the smoke may penetrate the flesh. On completion of the soaking they are water-horsed, skin side up, for 5 or 6 hours with weights on top. They are next placed on flakes similar to those used in curing codfish, where they are exposed to the sun's action for about 24 hours, which may extend through several days, the fish being placed in small piles and covered with flake boxes during the night or rainy weather. After the drying the fletches are cut in small pieces, from 2 to 6 pieces to the fletch with a gash in each piece where the flesh is thin and the skin appears tough.

The fletches are then strung on smooth, round, hard-wood sticks about 2 feet long and ¾ inch in diameter, or, as at Boston, small iron or steel rods 3⅓ feet long, the sticks passing through the splits or gashes cut in the fletches, and from 5 to 7 pieces to each stick 2 feet in length, and 8 to 12 pieces to those 3⅓ feet long, each piece being 2 or 3 inches from the adjacent ones to permit the smoke to pass freely among them. The sticks with the fletches attached are then passed into the smokehouse.

Smoked Sturgeon

On removal from cold storage the fish are thawed by exposure to air of moderate temperature, being turned once or twice during the operation, or, better still, by immersing them in water of medium temperature. They are then treated exactly as though received fresh from the fishermen. They are cut into suitable chunks, 2 or 3 inches wide and weighing 1½ or 2 pounds, the width varying according to the thickness of the meat. These chunks are then brine-salted in barrels or hogshead butts, about 5 pounds of No. 2 salt to 100 pounds of fish being sprinkled among the chunks and sufficient brine of about 85° strength added to cover the fish.

Some smokers, however, use no dry salt, depending entirely on very strong brine in which the fish remain from 6 to 16 hours, according to the temperature and strength of the brine as well as the size of the pieces. One very successful smoker uses dry salt without brine during the summer, and in the winter uses brine only of about 98° salometer test in order to economize time, since it takes about 18 hours to strike the fish in dry salting, whereas 10 hours are sufficient for striking in brine. In general, dry-salting is preferred, since its tendency is to make the flesh harder and firmer. In some localities the trade requires very light, salted fish, and they remain in brine only 15 to 20 minutes, being stirred about during the immersion.

On removal from the pickle the pieces of flesh are strung on steel or iron rods about one-third of an inch diameter and 3 feet long, the rod passing through the thin part of the chunk and 8 or 10 chunks being strung on each rod. They are at once dipped in fresh water to remove surplus salt, slime, etc. In some establishments the pieces are soused in fresh water immediately on removal from the pickle. In case the fish have been salted only 15 or 20 minutes they are not dipped or rinsed. After draining for a few moments, or, better still, drying in the open air for several hours, they are suspended in the lower part of the smokehouse from 4 to 6 feet above the fire, where they are exposed to a gentle smoke with doors open anywhere from 1 to 5 hours, according to the weather and the flavor of the product desired. When the weather is sultry it requires twice as long as when it is clear. Then the doors or dampers are closed and a hot hickory, maple or oak fire is built and the fish cooked from 1 to 2 hours, care being taken that it does not become too hot and melt or fall from the rods. On completion of the cooking process the meat is allowed to cool, either by opening the door of the smokehouse or by removal to the open air, when it is ready for the trade.

While the foregoing are the methods in general use, yet many smokers have special processes of their own. One of the most successful smokers on the Great Lakes operates as follows: The small pieces of flesh, 1½ to 2 pounds in weight, are first rubbed with No. 2 packer's salt and put in tight barrels with salt sprinkled among them, about 20 pounds of salt in all being used to each 100 pounds of fish. In about 7 or 8 hours, when the fish are saturated with the salt, they are removed, rinsed in two waters, strung on wire hooks, and suspended from the smoke-sticks. After draining for an hour they are placed in the smokehouse in 2 or 3 rows, 5 to 7 feet above the floor, and subjected to a hard-wood smoke for 7 or 8 hours at an even temperature.

One hundred pounds of dressed sturgeon yields from 63 to 70 pounds smoked, and the product usually keeps one or two weeks under ordinary conditions.

Brine-Salted Shad
Kennebec River Process

The shad are first beheaded and split along the belly; eviscerated, and about 6 inches of the upper portion of the backbone removed. They are next washed thoroughly, some curers washing them in two waters, allowing them to soak five or six hours in the second washing. After the soaking the end of the tail is sometimes cut off.

The shad are then ready for salting. In this operation a layer of salt is placed in the bottom of a barrel or butt, and this is followed by successive layers of fish and salt, the former with the backs down, about a bushel of salt to each 200 pounds of split fish. It is desirable to rub the salt over the face or flesh side of the shad before placing in the barrel. In a few days the fish in the top layer are turned backs up and a weight is put on them to keep them beneath the pickle, and a small quantity of salt placed over all to strengthen the weak pickle floating at the top. The shad may remain in the pickle a month or more, but usually two weeks or even less is sufficient time for the curing. On removal they are rinsed off in the pickle, culled if the quantity warrants, weighed in lots of 200 pounds each, and packed backs down in tight barrels, with salt scattered at the bottom of the barrel and over each layer of fish, about half a bushel of salt being used for each barrel.

Liverpool salt is used almost exclusively, for striking or curing and for repacking. Trapani salt is objectionable, as its coarse grains lacerate the smooth surface of the shad. After 200 pounds of fish have been placed in the barrel, the latter is filled with strained pickle from the curing or first packing and the head is put on, when the barrel is ready for branding and shipment; or, better still, after the barrel is headed and its contents have settled somewhat it is turned on its side and additional pickle added through the bung.

The Chesapeake Process

On the tributaries of Chesapeake Bay the roe shad are rarely salted, on account of the demand for them in the fresh-fish markets, and as a rule it is only during a glut in those markets that the bucks or males are salted. In preparing the fish the heads and tails are cut off, and the fish cut down the back to the tail and thrown in tubs or vats of water where they soak for an hour or so, the blood within the backbone being scraped out with a knife in the meantime, when the water should be renewed or the fish placed in other tubs. Upon completion of the washing and soaking, the fish are drained and put in vats with dry Liverpool salt at the bottom, and over each layer of fish, and on top. Every 12 hours thereafter for 7 days the fish are stirred with a pole, to separate them from each other and to have all portions uniformly salted, thus avoiding spots caused by salt burning.

On the eighth day the fish should be removed, drained and packed in barrels. First is placed a sprinkling of Turks Island salt, then a layer of shad, backs down, then a sprinkling of salt and another layer of fish, backs up, and so on until the barrel is full; and after the fish have settled for a day or so the barrel is topped up with other fish and then filled with strong pickle made of Liverpool salt, when it is coopered and stored ready for market.

Brine-Salted Mullet

As soon as removed from the seines and carried ashore the mullet are dressed. This consists of splitting them down the back and underneath the backbone from the head to the tail, so that the fish will lay out flat, and removing the viscera, stomach membrane, and gills. On the coast of Florida, where the mullet are very large, the heads are removed, and sometimes the backbones, but this is not the case on the Carolina coasts. A horizontal gash is sometimes cut in the thick portion of the flesh on the side in which the backbone is left, in order that the brine may easily penetrate it. The fish are next immersed in tubs or barrels of clean salt water and soaked for about half an hour and the blood and slime washed off. They are removed one at a time and salted with the hand, the salt being rubbed both inside and outside. Then they are usually placed, flesh side up, in old boxes or barrels of any description that are clean, with salt sprinkled over each layer of fish. Generally this work is done by the fishermen and their assistants, and on the North Carolina coast they take them to market in two or three days and sell them to the packers, who are usually wholesale grocers or dealers in fresh and salt fish, by whom the mullet are at once repacked. In other localities, and especially on the west Florida coast, the repacking is generally done by the fishermen.

In repacking, the mullet are removed from the first package and placed in layers, with the face or inside of the fish up, in new white pine barrels, 100 pounds being put in each package. In order to permit the brine to easily permeate the contents of the barrel, the fish of one layer are sometimes placed at right angles to those in the layer below. Strong brine of not less than 95° test, or, as usually determined by the fishermen, strong enough to float a mullet, is then poured in until the barrel is full, when the barrel is coopered and set aside and sold to the trade. In some cases, instead of making new brine, the pickle resulting from the first salting is boiled in large kettles, strained, cooled, and poured over the fish, and dry salt is frequently sprinkled over each layer of fish as they are placed in the barrel. It requires half a bushel of salt to strike and pickle 100 pounds of mullet. The decrease in weight by dressing, when only the viscera and gills are removed, approximates 15 per cent, and the decrease in weight by curing is about 10 per cent.

Dry-Salting Mullet, Channel Bass, and Kingfish

Mullet

Dressing begins as soon as the fish are landed at the station, which is generally within a few minutes after they are removed from the water. In splitting each fish is taken in the left hand with the tail toward the splitter, and by means of a knife it is opened along the left side of the backbone from the head to the tail, in much the same way that mackerel are split. All viscera are then removed and a gash or "score" is cut along the right side of the fish, which contains the backbone, in order that the salt may the more readily penetrate the flesh. In some localities the heads of mullet are removed before the fish are split. When roe-mullet are taken the roe bags are carefully removed while the fish are being eviscerated and are salted separately. The blood and black stomach membrane adhering to the napes are then scraped away and the fish are thrown into a trough of clean salt water, where they remain for a few minutes and are thoroughly washed, all particles of blood being carefully removed. On removal from the washing tank or barrel the fish are rubbed thoroughly with salt, Liverpool salt being most commonly used. They are next piled up under cover in kenches, with a sprinkling of salt between each layer, with the backs placed downward, as is the case with greencod, so as to retain the dissolved salt. These kenches are ranged in regular order, with the heads of the fish outward, and extend 3 to 4 feet in height. In some localities, after the salting and before kenching, the two sides of the fish are brought together again, leaving the fish in natural shape, with the abdominal cavities filled with salt.

When a large haul of mullet has been made the work of dressing and salting must be rushed to prevent the fish from becoming tainted; and in warm weather, especially during August, if the fish are not salted within a few hours after landing they are apt to become discolored or to rust. The fish remain in these kenches until they are to be placed on the market, which may not be for three or four months.

In preparing for shipment the salted mullet are placed in boxes or tied up in bundles. No uniform style or size of package is used, resulting naturally in much confusion and inconvenience to the trade. Some fishermen simply bundle the mullet in such a way that the skin side is outward, while others cover the bundle with a single layer of matting or palmetto leaves. When carefully prepared these fish are of excellent quality, except that those cured during the warm weather of July and August sometimes rust.

The following method of curing mullet is recommended to those who wish a really choice product without regard to the cost of preparation:

The fresh fish are cut along the central part and eviscerated. They are next soaked for two hours or so in salt water, beheaded and split down the back, and the backbone removed. Four or five cuts are then made transversely across each half of the fish on the inner surface, and the fish are packed in dry salt, where they remain for about one week. On removal they are washed to remove the slime, undissolved salt, etc., and then suspended in the shade, where they are allowed to dry for five or six weeks. Each fish is then sprinkled with fine table salt and carefully wrapped with waxed or paraffin paper to exclude the air, and suspended in a well-ventilated room, where it may be kept for several months under favorable conditions.

Channel Bass

Each fish is split down the belly and eviscerated, the head is cut off with a hatchet or large knife, the backbone is removed, and the fish split in halves. Each half or fletch is then scored lengthwise from the napes to the tail on the flesh side, the cuts being about 2 inches from each other and penetrating the flesh to the skin. The fletches are washed free from blood, etc., and placed in barrels or vats with dry salt sprinkled in abundance among them and with strong brine poured over them. When sufficiently cured the fish are removed from the pickle and placed in the open air on boards, benches, or any convenient place for drying. Care must be taken to shield them from rains, and they should be placed under cover at night to protect them from heavy dews. When sufficiently dried they are stored in a cool, dry place until marketed.

The reduction in weight through dressing amounts to about 50 per cent, and through curing and drying about 33 per cent additional, making the dried weight about 35 per cent of the round weight. The only market is among the coast people—among the fishermen and their neighbors on the mainland. They sell for 8 to 15 cents per side, or 15 to 30 cents per fish, an equivalent of 1 to 2 cents per pound.

Kingfish

If the fish are not disposed of the first day after being caught, they are lightly salted and dried in the sun, in which condition they will keep for a week or two, and if the weather is favorable they will probably keep a week longer, and if quite thoroughly dried the fish will keep a much longer period. Generally the fisherman is a man of very little means and has no capital to work with; consequently the supply of salt which he is able to buy is very small. The salt used is from the Bahama Islands. The fish are laid on a box or bench and the thick part of the fish cut transversely, nearly through to the skin, at distances of 1 to 1½ inches apart. After the fish have been prepared in this way, the fisherman takes a small amount of salt and carefully sprinkles it over the entire surface of the fish and into the cut so as to make sure of their being properly cured. He is very careful not to waste the salt by scattering it about otherwise than on the fish. If the fish are to be sold in a few days, they are not exposed to the sun; but if to be kept for a longer period it is necessary to have some of the moisture taken out by the direct rays of the sun.

Canning Codfish Balls

For 100 pounds of salt codfish, 125 pounds of potatoes, 10 pounds of raw onions and 13 pounds of pure beef tallow are required. The fish are soaked in tepid water to remove the salt and then reduced to a pulp; the potatoes are boiled, skinned, and mashed; and these ingredients are warmed and mixed thoroughly with the chopped raw onions and beef tallow, adding 6 ounces of pepper or other suitable flavoring condiments. While the ingredients are being mixed they are chopped as fine as practicable by machinery. The warm mixture is then placed in 1-, 2-, or 3-pound cans and sealed. The cans and contents are boiled at a very high temperature for 2 or 3 hours. On cooling and labeling the product is ready for market.

Japanese Fish Sausage and Kamaboko

The white meat of fish, from which the bones have all been removed, is carefully washed in clean water and, after the surplus water has been pressed out, is ground as fine as possible in a meat chopper. It is then worked, a little at a time, through a colander to remove the coarser fibers, when it is ready for the addition of the flavoring materials. A pint of "mirin," 2 ounces of sugar, and salt to taste (these being the quantities used with 20 pounds of fish) form a common flavoring mixture. Mirin is a sweetish alcoholic beverage brewed from glutinous rice and fortified with distilled sake. In place of mirin some use the liquor brewed from "konbu," a species of Laminaria. "Aji-no-moto," a Japanese proprietary preparation, gives a relish preferred by many. As kamaboko prepared with mirin is said to deteriorate in warm weather, even when canned, the other flavorings named or condiments to which the American public is more accustomed would probably be more suitable for Kamaboko made in the United States.

The flavoring materials are added

gradually while the fish is being worked on a kneading board with broad-bladed flexible knives somewhat in the manner of an artist mixing colors with a palette knife. The result is a smooth paste of the consistency of cream cheese. When the fish is of a variety that does not give a constant paste, it is necessary to add a little starch or rice flour dissolved in water.

The paste is then spread on boards of various sizes according to the size of the loaf desired. Boards 5 by 2¼ inches take a 1-pound loaf; 6 by 2¾ inches, a 1½-pound loaf, and 7 by 3¼ inches, a 2½-pound loaf. The paste is spread on the boards in thin layers until the required thickness and weight are attained, so that the loaf may retain its even texture and not become lumpy and crumbly when steamed.

The loaves are steamed for an hour and a half to three hours, according to size of the loaf, and are packed in cans as soon as removed from the steam ovens. If intended for local consumption, they are placed in cold water to chill as rapidly as possible, after which they are sometimes coated with egg-yolk and browned in an oven by way of improving the appearance.

The fish held in highest esteem for kamaboko is "kisu" (Sillago japonica). Others often used are "mutsu" (Scombrops Chilodipteroides), "pera" (the Labridae), "tanago" (Anchilognathus intermedius), "kamasu" (sphyroena japonica), "karei," or sole "aji," or horse mackerel, and several varieties of shark and cuttlefish which, however, are generally mixed with one of the tenderer varieties named above. Varieties of fish having an excess of oil are least esteemed. Very tough fish is usually pounded in a mortar to separate the meat from the gristle before being ground.

The Freezing and Cold Storage of Fish

Freezing Fish (Ottesen Method)

The principle of this method is simple and easily understood. The fish are not frozen in the ordinary way in air, but in a strong solution of common salt in water, which is cooled to a very low temperature and in which the fish to be dealt with are immersed. The freezing point of a solution of salt depends upon the degree of saltness; the more salt the lower the freezing point. A solution with 3 per cent of salt (like sea water) freezes at about —2.6° C. (27.3° F.); a solution with 6 per cent of salt will freeze at about —4.6° C. (23.7° F.), and one with 12 per cent of salt at about —8.7° C. (16.3° F.). A solution with from 17 to 20 per cent of salt may be colled down to from 10.4° to 6.8° F. without freezing and it is a solution of this kind which is used (instead of cooled air) to rob the fish of the heat it contains and freeze it. The apparatus consists essentially of an insulated iron vat or container, and may be made of various dimensions, in which the salt solution is contained. The cooling of the solution is accomplished by means of a central spiral, or "worm" of iron tubing, in connection with the ammonia refrigerating machine, and the solution is kept in constant movement bv a central revolving propeller. Large fish may be hung in the solution; the smaller are placed in baskets of wire netting.

The great value of the method appears to lie in the very rapid freezing of the fish. The complete freezing of herrings (in wire baskets) takes half an hour; sprats ("brisling") take less; fish such as haddocks are frozen through in an hour, and the largest cod from two to three hours. In the ordinary method of freezing in air the time taken would be from twenty-four to thirty or even fifty hours. Cod of from 5 to 6 pounds is frozen in one and a half and two hours with a salt solution at —15° C. (5° F.), whereas in air-freezing the time would be from thirty to thirty-six hours. At the temperature stated the process takes only one-twentieth of the time required in air-freezing at —7° C. (19.4° F.). The saving in time is obviously of importance in itself. An ordinary Ottesen apparatus can freeze ten tons of fish in twenty-four hours. The chief value, however, of the rapid freezing of the fish is that the fish is preserved and thaws out in a condition practically the same as fresh fish.

Ice Glazing for Frozen Fish

U. S. Patent 2,093,069

A flexible non-cracking film (melting at 0.5° to 2.1° C.) is produced by ice glazing with

Sodium Hydrogen Phosphate. $12H_2O$	3.0

Sodium Sulphate	3.8
Boric Acid	2.5
Water	90.7

Keeping Fish Fresh

Fresh sea fish can be kept in excellent condition for 3–6 days longer than untreated fish by immersing in 0.3% hydrogen peroxide for 10 minutes. Fish should be treated as soon as possible and immediately before packing in iced containers. In the case of fillets add 5% salt to treating liquid.

Miscellaneous Brine Salting

All along the coast of the United States a small local business is carried on in pickling fish for use during the winter in the homes of fishermen and their neighbors. Among the species thus prepared are bluefish, squeteagues or sea trout, channel bass, croakers, perch, sheepshead, Spanish mackerel, striped bass, black bass, hogfish, etc. There is no uniform method of pickling, the fish being dressed, slated and packed according to the fancies and convenience of the curers, and the product rarely goes on the general market. In general, the fish are dressed by removing the head and viscera, and are split down the back or sometimes the belly, so as to lie out flat. They are next washed and soaked until the blood is removed and then covered with salt and placed in barrels, first a sprinkling of salt and then a layer of fish, and so on until the barrel is filled. Then brine is poured in to fill the interstices and the barrel is headed and coopered.

Large fish having soft fins, small scales, and thin skin should be scaled but not skinned. Remove the head, split down the belly to the vent, and remove the viscera. Make a cut on each side of the backbone inside of the body cavity, cut the bone in two as far back as it can be reached, and remove the cut-off portion, then make a deep cut along one side of the backbone for the remainder of its length and remove the tail. If the fish are too large to go into the container, cut them to the proper length. The cheeks and the portion between the jaws, including the tongue, of many large fishes are excellent when boiled, and they may be preserved by removing the eyes and gills and packing the heads, after splitting them lengthwise, in the same container with the rest of the fish.

Slender fish, such as mackerel, whiting, large herring, etc., should be split down the back to one side of the backbone for the entire length, the belly walls not being cut. The backbone need not be removed. Smaller fish of the same character need not be split but should be carefully eviscerated. Coarse-scaled, thick-skinned, spiny-finned fishes like black bass, perch, etc., should be skinned, and unless large and thick-meated need not be split.

Having dressed and thoroughly washed the fish in water containing a little salt, taking particular care to remove the blood near the backbone, cure them as follows:

Place a layer of coarse salt on the bottom of a tight keg, barrel, or other suitable vessel, and on this spread a layer of fish, one deep, sprinkle salt thickly over these, add another layer of fish, and repeat until the barrel is full or the supply of fish exhausted. The salt and the moisture from the fish will make a strong brine in which the fish should be left for a week or 10 days. At the end of that time remove the fish, thoroughly wash them, repack in the barrel, and cover with a freshly made brine strong enough to float a fresh egg. After a week this brine should be drawn off and the barrel filled with a saturated brine, that is, one in which a little undissolved salt will remain on the bottom of the vessel, after the solution has been subjected to prolonged stirring. Do not re-use the old brine. The barrel or keg should then be headed and stored in a cellar or the coolest place available. If there should be any leakage which may be discovered by the sound made when the barrel is struck with a stick at various heights, it should be made good by adding strong brine through a bunghole. If the receptacle can not be filled at once, the fish may be preserved by placing on top of them a cover made of a barrel head or of pieces of wood cleated together to fit the container and weighting it with a clean stone or other heavy article which will not be affected by the salt. The success of the operation will depend on using fresh fish, exercising care in the salting and the proper mixing of the brine, and on keeping the barrel tight and the fish covered with strong brine.

FISH EGGS

Fish Eggs for Food

The roes or eggs of fish are among the most valuable of the miscellaneous food products of the fisheries. The most important are the roes of the sturgeon, mullet, herring, shad, whitefish, cod and haddock. Some of these eggs are sold to the consumers while fresh, especially the eggs of shad, river herring, whitefish, and haddock. In pickling sea herring the roes are usually left in the fish and no special treatment is applied to them. The eggs of the sturgeon, mullet, and of a few other species are nearly always removed from the fish and separately prepared, and it is to the treatment of those that the present chapter more particularly relates. Sturgeon eggs are salted in brine and sold under the name **caviar.** . . . Mullet roes are dry-salted or pickled in brine all along the United States coast from North Carolina to Florida. The Indians of the Northwest coast dry considerable quantities of roe from various species of fish, the product being stored for winter use, when it is pounded between two stones, immersed in water, and beaten with wooden spoons into a creamy consistency, or it is boiled with sorrel and different dried berries and molded in wooden frames into cakes about 12 inches square and 1 inch thick."

Mullet Roes

Dried mullet roes are prepared along the southern coast from North Carolina to Florida, inclusive, in a manner quite similar to the drying of mullet. The roes utilized are from the matured females which have not begun spawning, for as the spawning time approaches the eggs soften and burst the surrounding membranes or roe bags, when they are useless for salting or drying. Nothing but firm roes should be used for salting, and soft roes, roes from fish which have been caught some hours, as well as roes from roe bags half emptied should, if used at all, be salted separately.

In removing them care should be taken to avoid breaking the roe bags or injuring or bruising the eggs, but they should be free from portions of the surrounding viscera. If the tubs in which the roes are gathered have holes through which the water can run off, some salt is saved, and a better product is secured, the water making the roes soft are less liable to keep. The roes still in the roe bags are then placed in boxes or barrels with salt sprinkled among them, or in some cases they are placed in brine, where they remain for ten or twelve hours, but the former method is preferred. An excess of salting must be avoided, since it causes the egg-sacs to break and the eggs are ruined on exposure to the sun and to pressure, or they become dark and brittle. If properly treated a good article can be made of roes that have become somewhat soft by salting it immediately on removal from the fish, by using more salt than for the firm roe, or by resalting it. Medium grain salt is preferred for salting. Coarse salt should be avoided, since it is liable to become imbedded in the roe membrane and give it a burnt look. About 1 peck of Turks Island or Liverpool salt to 160 pounds of eggs usually gives the best results.

On removal from the salt the roes are spread out on boards and exposed to the sun for about one week, being taken in at night to prevent the moisture and dews from falling on them, and every morning they are turned over to thoroughly aid in drying them. Care must be taken to prevent them from becoming wet after the drying has begun, and upon the first indication of a rain they should be placed under shelter. Sometimes after one day's exposure other boards are laid on top of the roes so as to slightly compress them. When properly cured, they are 4 to 8 inches long, 2 to 4 inches wide, and one-half to two-thirds of an inch thick, and vary in color from a yellowish brown to dark red, according to the freshness of the roe, carefulness of handling, degree of saltness, and length of drying. The roes are then sent en masse to market in baskets, boxes, or the like, and sold from 40 to 60 cents per dozen, according to the size and carefulness in curing.

Bolarge

In Italy, the hard roes of mullet are converted into cakes termed bolarge or bolargo, which are prepared by washing and sprinkling with salt and pressing between two boards.

This may be smoked or sun-dried and is considered a good appetizer to promote thirst.

Salted Shad Roes

A small quantity of shad roes are brine salted in North Carolina, Virginia, and Maryland each year, these being so prepared only when the state of the fresh fish market or the transportation facilities makes it necessary to pickle the female fish. The roes are removed from the fish in dressing the latter, care being taken not to cut or injure the roe bags. As soon as practicable thereafter they are washed by stirring them with the hands in tubs of water, and are then placed in tubs of strong brine with dry Liverpool salt sprinkled among them and at the top. Every 12 hours during the ensuing 5 days the roes are gently stirred to separate them from each other and to have them uniformly salted. The sixth day they are removed from the pickle, drained and placed in suitable packages, with dry Turks Island salt sprinkled at the bottom, through the roes, and at the top. The package should then be filled with strong brine made of Liverpool salt. A variety of packages are used, the most convenient being 20 pound kits.

Cod Caviar

For the preparation of cod caviar the Norwegians use the whole ovaries of the cod which are salted in barrels, and mostly in the Lofoden winter fisheries. The roe must be salted whole without injuring or breaking the enveloping membrane, and must not be salted too much, just sufficient to impart a nice orange-red color. When the salted ovaries are removed from the barrels they are first thoroughly washed several times in fresh water, and then hung on wires or ropes in the open air, but protected from too strong sunshine. After they have dried for about 24 hours they are taken down for smoking. For this purpose they are hung in the same way in the smoking-house on sticks or rods or put on frames covered with old nets or wirework and cold-smoked for two or three days, or until they become of a dark-brown color. After smoking, the enveloping membrane or skin of each roe sack is torn and removed, and the eggs packed in good, tight barrels, which are then tightly closed and placed in a normally cool place for a month or six weeks. At the end of that period the eggs begin to ferment somewhat, which may be detected by the swelling of the barrel. It is well not to wait too long, but to examine the barrels every week, or so, and as soon as fermentation has begun a sufficient quantity of salt should be put into the roe, to prevent the product from spoiling.

By the fermentation the roe receives a slight acid flavor and a taste resembling that of fermenting beer or wine, and this fermentation must be stopped by adding salt at a definite point, which is to be learned by experience only. The salt used to stop the fermentation must be of the very best quality, and if the roe seems to be dry a little good French olive oil is added to moisten the product. After the roe has been thoroughly mixed with the salt it is put in 1 pound glass bottles that are sealed with cork stoppers.

Salmon Caviar

For making caviar the eggs should be as fresh as possible, and in order to make sure of this the salmon, all species, except the sockeye and coho, are utilized in Siberia; the chum eggs make the best caviar. They are taken alive, if possible shortly after coming from the water, killed and bled, the belly opened up and the roe taken out. This work can best be done on work and living scows anchored close to the fishing camps. The roe is placed upon a stand, the top of which is formed of a small-meshed galvanized iron wire screen. On the underside is arranged a zinc-lined trough. The operator gently rubs the mass of eggs back and forth over the screen, the mesh of which is just large enough to let the eggs drop through, and, as they are separated from the membrane by the rubbing, they fall through into the trough and are thence drawn off into the tubs by means of a sliding door at the end of the trough.

After all the roe has been separated the tub is removed and a certain proportion of salt (the sturgeon caviar makers employ the best Luneburg, Germany, salt in this work, while some of the Siberian makers of salmon caviar use No. 2 Berkshire salt from England) is added to the roe, after which the mass is mixed with the hands. The most delicate part of the whole operation is in the manner of mixing. No direct rule can be given for doing this portion of the work, as the condition of the roe regulates the time consumed and the manner of handling. It requires practical experience to become proficient, but this should be an easy matter for one used to handling salted products. The sturgeon caviar makers use about 11 pounds of salt in preparing a keg of caviar.

After the salt has been added the mass of eggs first dries up, but in a few minutes the strength of the salt draws from the eggs their watery constituents and a copious brine is formed, which can be poured off when the tub becomes too full. In Siberia the caviar makers put the eggs into a brine solution of 19 to 22 per cent Baume immediately after they come from the trough. The salted eggs are then poured into very fine-meshed sieves which hold about 10 pounds each. In the caviar house are arranged long, sloping boards with narrow strips nailed on each side. On these the sieves are placed and left here from 8 to 20 hours in order to thoroughly drain.

The Siberian caviar makers hasten the operation by putting the eggs into a brine solution as noted above, leave them there for from 25 to 45 minutes, then place them in bags and subject them to heavy pressure, after which they are packed. While this method occupies less time, it is not thought the resulting product is as good as that prepared by the slower method outlined above.

The eggs are then transferred to small casks (holding about 135 pounds). The sturgeon caviar makers use oak or pine casks, but some of the Siberian makers say that oak casks turn the salmon caviar black. The casks are steamed before use in order to prevent any possible leakage. It is especially necessary that the kegs or barrels used be air-tight as otherwise the product will spoil. Barrels such as used in packing salt salmon are rarely ever tight enough to hold caviar. The casks are covered and allowed to stand until the gas escapes and the eggs settle. The vacant space caused by the settling is then filled, the cask headed up and put in a cool place until ready for shipment

The Siberian salmon caviar makers use a small quantity of "preservaline" in each keg for the purpose of aiding in preserving them, as cold storage facilities are quite primitive as yet in that country, and it is the addition of this powder which forms the mysterious part to the uninitiated. No preservative would be needed in Alaska, however, as the kegs could be shipped in cold storage along with the mild cured salmon.

Several establishments are putting up these eggs in jars and hermetically sealed cans for use as bait in sport fishing.

Seal Oils

The oil may be at once extracted, or the blubber may be stored for a more convenient season, especially if the weather be cold, as it is much easier to extract the oil during warm weather. If the blubber is stored, it should be in well ventilated apartments, so arranged that the oil forced out by compression and warmth may run into suitable reservoirs. In the best-arranged storage rooms the reservoirs are oak-wood casks, lined with lead in some instances, with capacity for a thousand or more gallons. These are placed at intervals in the floor, which is so inclined as to cause the oil to flow into the receptacle. The oil which flows under these circumstances is usually clear, sweet, and of prime quality.

There are several methods of extracting the bulk of the oil from the blubber, the one adopted depending to some extent on the proposed use of the product and also on the amount of capital available for equipment and the quantity of blubber to be handled. The methods may be divided into three principal classes, viz., (1), by maceration exposed to solar heat, (2) by cooking in open kettles, and (3) by the application of steam.

The simplest method of extracting the oil is by exposing the minced blubber in a mass to the weather. The blubber is heaped up in large tanks and when the temperature is suitable—clear, pale oil flows from the mass. As putrefaction advances and the cellular texture is destroyed, the mass yields oil of a reddish yellow and then a dark brown color, with somewhat disagreeable odor and flavor, owing to the decomposition products evolved. When the oil ceases to flow, usually at the end of two or three months, the mass of fat is boiled in water with the fleshy or fat-lean portions. During this boiling the oil rises to the surface and is skimmed off. The residue is evaporated by pressure and drying, and is used for fertilizer. This was formerly the usual method employed in rendering seal oil in Newfoundland, but during the last twenty-five or thirty years the steam process has been generally adopted.

In treating a small quantity of blubber for extraction of the oil it is usually more convenient to mince it finely and cook it in a kettle over a fire. The oil rises to the surface and is skimmed off and placed in casks or other suitable receptacles. This is the method commonly employed by the shore hunters whose catch is small.

At the large sealing ports, the oil is usually rendered by means of steam. The minced blubber is exposed to the action of steam in large inclosed tanks. The oil flowing therefrom passes through pipes into large reservoirs, of which there are usually three or more, the overflow from the first passing into the second, and the overflow from the second into the third. This furnishes the first quality of steam-refined oil. By pressing the steamed blubber, a second quality of dark-brown oil is obtained.

The steam process of rendering has the advantage of rapidity in operation, also the oil is free from disagreeable odor and is of superior burning qualities. However, for use in mines the sun-extracted oil is preferred, especially that of young seals, owing to its greater freedom from smoke, the odor being of little consequence to miners. According to Mr. Carrol, oil from old seals is more smoky than that from young ones; it is also of greater specific gravity, and when the blubber of both are rendered together, the young seal oil comes out first.

Seal oils vary in specific gravity from 0.915 to 0.930 at 50° F. According to Brannt, they are composed principally of glycerides or physetoleic acid, of palmitic, stearic, and a small quantity of oleic acid and traces of butyric acid, valerianic acid, etc. They show a slight acid reaction when fresh, the acidity increasing with age. Instead of the albuminous substances present in vegetable oils, the seal oils contain a small quantity of glue which can be precipitated with tannin and metallic salts. They are very slightly soluble in alcohol, and require almost an equal volume for solution in either. Mixtures of equal volumes of nitric and sulphuric acids produce a reddish color, quickly changing to brown. The adulteration of seal oils is detected principally by the incomplete saponification of resin oil by the adulterant, and by the degree of solubility in alcohol if other blubber oils are employed.

In addition to the pure oils there are several well-known compound seal oils on the markets, the best known being the "three crowns." Greenland "three crowns" is a mixture of several varieties of blubber oil, chiefly seal oil, or rather seal-oil foots, and small quantities of whale and walrus, combined with oil from shark livers, the fluidity and low specific gravity of the shark oil imparting the special qualities to this compound. Swedish "three crowns" oil is a compound of various seal oils with herring oil.

The principal use for seal oil is for burning in miners' lamps, and it is also employed in currying and to a very small extent for miscellaneous purposes, especially fiber-dressing.

SHELL FISH

Canning Oysters, Clams, Clam Broth and Clam Chowder

In canning oysters be sure they are absolutely fresh, have not "soured" and contain no oysters that are spoiled. It is therefore best to open the oysters by hand and absolutely reject any oysters where the shell is partly open, as this is a sign that the oyster in this particular shell is dead and unfit for use. Rinse the oysters to be sure no pieces of shell or grit are put into the cans. Pack 16 ounces of oyster meat in a No. 2 can and fill with boiling brine (made in the proportions of ¼ pound of salt to 5 quarts of water) to within ½ inch from the top of can. Cap and exhaust 10 minutes at boiling temperature (212° F.). This may be done by placing the cans in the steam pressure canner (with boiling water in bottom of retort). Keep it boiling, put on the lid but leave the petcock open, so steam escapes. Tip and process:

No. 2 cans 35 minutes at 240° F. or 10 pounds of steam pressure.

Clams

If the clams are muddy, wash before opening. After opening, discard all broken or discolored clams. Do not can the clams unless they are absolutely fresh. Weigh out the amount of solid meat, after draining, that is to go in each can (about 8 ounces of meat for a No. 1 can, 16 ounces for a No. 2 can). Fill the can to within ½ inch from the top of can with a hot brine made by boiling 1 pound of salt to 5 gallons of water. Cap and exhaust 10 minutes at boiling temperature (212° F.) tip and process.

No. 1 cans 30 minutes at 240° F. or 10 pounds of steam pressure.

No. 2 cans 40 minutes at 240° F. or 10 pounds of steam pressure.

Note:—Use only inside-lacquered cans.

Clam Broth

Open large fresh clams and place them in a kettle with all their liquid. Add enough cold water to cover the clams. Add a few stalks of celery. Place on the fire and let boil for 10 minutes. Season with salt and pepper to taste and add a tablespoon of butter for each 50 to 60 large clams. Strain and fill hot into inside-lacquered cans. Cap, tip and process:

No. 2 cans 40 minutes at 250° F. or 15 pounds of steam pressure.

Canning Oysters

When the oysters are brought in, they are delivered directly to a steaming car. This consists of a steel crate 28 inches wide, 19 inches deep, and 8 feet long, mounted on wheels. Each car will hold 5 barrels of 2½ bushels each. As soon as the cars are filled, they are wet down thoroughly with the hose so as to remove any adherent mud or dirt.

The cars are run into a steam box and heated to expedite the shucking. The live oyster shell is held tightly closed and can only be opened by one capable exerting considerable force. Dropping oysters into boiling water will cause the shell to open and the meat is removed easily. The steam boxes are of a length and size to accommodate three cars. Steam is used at a pressure of 10 pounds and is maintained for 5 minutes. The cars are removed to the air to cool. The oysters should be steamed long enough so that they will not shrink in the subsequent processing but not so long as to cause them to become crumby.

The shucking of the oysters is done directly from the cars. The meats are placed in small measures and the shells are thrown on the floor where they can be raked on the conveyor. The meat is removed with a short heavy-bladed knife.

The oysters are washed, then transferred to the filling tables. The filling is done by weight and a brine added to complete the fill. The brine is composed of two pounds of salt to 10 gallons of water.

The cans are exhausted for 5 minutes and processed at 240° F. for 12 minutes for No. 1 cans and 15 minutes for No. 2 cans. They are cooled at once.

S. R. A. No. 3 of the Bureau of Chemistry, covering the weight of oyster meat required in cans of various sizes, is given below:

Size of Can Diameter Inches	Height Inches	Weight of Drained Oysters "Cut-out" Ounces
$2\frac{11}{16}$	$2\frac{3}{4}$	3
$2\frac{11}{16}$	$3\frac{9}{16}$	4
$2\frac{11}{16}$	4	5
$3\frac{3}{8}$	$3\frac{15}{16}$	8
$3\frac{3}{8}$	$4\frac{9}{16}$	10

Canning Soft Clams

The clams are dug on the flats with pronged hoes or forks. They are washed, usually with sea water, and then brought to the canning factories, where they are hosed thoroughly, placed in steam chests, and steamed from 10 to 20 minutes, according to the ideas of the individual canners. Some packers process their packs in modern up-to-date steam chests, built on the order of retorts, with shelves on which the clams are placed, and with arrangements for collecting the juice at the bottom. Others find that barrels or rectangular wooden boxes with a hole in the bottom through which a steam pipe passes, serve their purposes very well. The steamed clams are thrown on large tables, where girls "snap" out the clams and remove the mantles or dark membranes which surround the meats. The meats are then washed in sea water, if unpolluted water is obtainable, or in salt water made by adding salt to fresh water. The necks are next snipped off with scissors by girls, and the clams are washed again, usually in a cylindrical cradle, and in sea waters, in prepared salt water or in fresh water, depending on the ideas of the canner. Usually it is done in salt water. After this second washing, the clams are thrown on tables and packed into cans by girls. Each can is weighed and the proper quantity of clams put in. The cans are then filled with liquor. Sometimes this liquor is clam juice, obtained from the steam box. In this case the first portion of the juice containing most of the dirt and sea water is permitted to run to waste until it becomes milky. The milky juice obtained from then on to the end of the process is strained through a heavy cotton bag and then diluted with an equal volume of water. Sometimes the liquor is sea water, if the cannery is situated where the sea water is unpolluted and of proper salinity, but most of the canners make up a brine of desired strength from fresh water and salt.

The filled cans are sealed in the usual way and processed at from 240° to 244° F., usually for 30 minutes. Some companies can the excess juice, diluting it with an equal volume of water and processing for 20 minutes.

Canning Shrimp and Crab Meat

Shrimp

Shrimp should be used when absolutely fresh, as they deteriorate very quickly. They may be peeled or left with the shell on until cooked. In either way they are boiled in salt water, 1 pound of salt to a gallon of water. Do not put shrimp into the water until it is boiling. If to be packed wet, boil from 5 to 6 minutes. If they are not peeled before boiling, drain through a colander and sprinkle with salt. This will harden the meat and they can be more easily peeled. Shrimp should be packed into inside-lacquered tin cans and may be packed wet or dry.

Wet pack.—After shrimp are boiled and peeled pack into cans and fill with a weak brine to within ½ inch from the top of the can. (Brine: 1 level teaspoon of salt to a quart of boiling water). Cap,· exhaust 5 minutes, tip and process:

No. 1 cans—12 to 15 minutes at 240° F. or 10 pounds steam pressure.

No. 2 cans—20 to 30 minutes at 240° F. or 10 pounds steam pressure.

Dry pack.—After shrimp are boiled and peeled, as above mentioned, pack dry into cans, adding no liquid. Cap, exhaust 8 minutes, tip and process:

No. 1 cans—60 minutes at 240° F. or 10 pounds of steam pressure.

No. 2 cans—90 minutes at 240° F. or 10 pounds of steam pressure.

Note.—In case inside-lacquered cans can not be had, the shrimp can be put up in ordinary tin cans lined with parchment paper at sides, bottom and top. They may also be put up in small glass jars.

Drying Shrimp

After shrimp are boiled and peeled as above stated, they may be spread on cheese cloth spread over the wire bottom of the evaporating trays and dried at a temperature of from 110° F. to 130° F. When thoroughly dry they may be packed in dry, clean glass jars, or in parchment paper-lined boxes.

Crab Meat

In a large kettle put 5 gallons of water to which has been added ½ pound of bicarbonate of soda (common baking soda). When boiling rapidly put in the live crabs and boil quickly for 20 minutes. Remove crabs and wash them in cold water. Pick out all meat, being careful not to include the shells in leg and claw joints. Wash the meat in a weak brine (1 ounce of salt dissolved in 3 quarts of water). Drain and pack in inside-lacquered No. 1 flat cans. Cap and exhaust 8 minutes, tip and process:

No. 1 flat cans 45 minutes at 250° F. or 15 pounds of steam pressure.

As soon as time of processing is up, let out the steam quickly, open the canner and plunge the cans immediately into cold water, as crab meat otherwise will become discolored. On this account, unless cooled immediately after canning, glass jars can not be utilized for the canning of crab meat.

Canning Shrimp

When the shrimp are brought to the dock they are stored in ice until ready to use. The ice makes the peeling easier and is necessary to prevent spoilage. The removal of the head and shell is known as "peeling" the shrimp, and this is done for all canned shrimp. The head and thorax break from the heavy tail with ease and a slight squeeze will separate the fleshy portion from the shell. This work is done rapidly; the pay for peeling is about one cent per pound. The peeled shrimp are thoroughly washed in two or more changes of water and are then ready for blanching. The blanching consists in boiling the shrimp in salt water, which is done by suspending them in a wire basket in the boiling brine. The time of the blanch is usually about four minutes for the wet pack and five minutes for the dry pack. The salt in the brine is in the proportion of about one pound per gallon of water. Up to the time the shrimp go into the blanch they are white or slightly gray in color; the boiling in the brine causes them to become bright pink or red.

The shrimp are turned out upon trays having wire netting. As soon as cool they are filled into cans by hand, each can being weighed. The shrimp are all packed in either No. 1 or No. 1½ cans, the former having 5 and the latter 8¾ ounces for dry packs and 5¾ and 9¾ ounces for the wet packs. There is no attempt at grading.

Shrimp are put up in what are known as dry and wet packs. In the dry pack no liquor is added, while in the wet pack brine is used. The process for dry shrimp is one hour at 240° F. or four hours at 212° F. for No. 1 cans, and 75 minutes at 240° F. and four hours at 212° F. for No. 1½ cans. For wet packs the process is 8 to 10 minutes at 240° F. for the small cans and 12 to 14 minutes for the large cans.

The fill of 5 and 8¾ ounces in the No. 1 and No. 1½ cans has the appearance of being light weight or slack filled. Experience has shown, however, that close filling causes matting of the shrimp and an unsightly appearance. The wet-packed shrimp are preferred by those who are familiar with the fresh article. They have better texture, odor and taste than the dry packed. A barrel of good shrimp will pack about 190 No. 1 cans or 100 cans of No. 1½.

Shrimp Drying

A large portion of the shrimp caught in Barataria Bay and adjacent waters is marketed in dry form. Large wooden platforms are erected on which the green shrimp are spread out and sun-dried.

The drying platforms are erected near the water's edge, being made of cypress wood. They are built up on posts, standing 8 or 10 feet above the ground. One of the largest platforms on the bay is 230 feet long by 180 feet wide and has a capacity of about 1,000 baskets of green shrimp at one time, or 100,000 pounds. The floor of the platform, instead of being level, is gently undulating, having an ocean wave effect, the waves being about 2 feet in height and separated by a distance of about 30 feet from crest to crest.

A portion of the shrimp caught is placed on ice boats and taken and sold to the markets or canning factories. But when there are no ice boats available, or when the shrimp taken are too small for canning purposes or when they are taken in such large quantities that the canning factories cannot handle them, they are brought to the drying platform.

The shrimp are brought directly to the platform in the fishing boats, uniced. They are washed at the time of unloading. One man holds a dip-net into which another man shovels the shrimp. When the dip-net is full, it is lifted over the side of the boat and dipped up and down in the water several times, after which the contents of the dip-net are dumped into the receptacle in which they are transported on a small railway track to the boiling kettles.

The kettles for boiling are about 9 feet long, 3 feet wide, and 2 feet deep, the bottoms and lower halves of the sides being made of copper, and the upper halves of the sides being made of cypress wood. Wooden doors fastened on with hinges serve as covers during the boiling process. Beneath the kettles are fire boxes closed in with brick, wood being the fuel used.

To each kettle of water, from 10 to 20 quarts of salt is added, depending on the weather, damp weather requiring more salt than dry weather. After the water has been brought to a boil, the shrimp are dumped in,—about 900 pounds to each kettle full. They are then boiled for from ½ to ¾ of an hour. The method of judging whether the shrimp have been boiled long enough is to hold one up to the light and note the shrinkage of meat within the shell. The meat shrinks away from the back towards the legs. A clear space of about ¼ of an inch between the back and the meat indicates sufficient cooking. Before each boil, the same quantity of salt is added to the water; and after the fifth or sixth boil, the water in the kettle is entirely renewed and the process repeated.

After the shrimp have been boiled for a sufficient length of time, they are dipped from the kettles into wheelbarrows by means of a large dip-net, and after draining for about fifteen minutes, are hauled to the drying platform and dumped. Workmen now spread them out in a thin layer not more than 2 or 3 inches thick with long wooden rakes. The thickness of the shrimp on the platform depends upon the quantity on hand at any one time, and they are never spread on the platform to the maximum depth unless the amount of shrimp on hand makes it necessary. The rakes are about 18 inches wide and have about 12 wooden teeth 2½ inches long. Several times each day the shrimp are worked over with these rakes to facilitate drying. The method of turning the shrimp over is a peculiar one and requires a certain amount of dexterity on the part of the operator. Beginning at the outer edge of the shrimp, the workman holds the rake in a vertical position directly in front of him. The teeth of the rake are drawn under the shrimp until he has a rakeful, and then by a peculiar twist of the handle, the entire rakeful of shrimp are given a little toss which turns them over in mid-air, and they fall to the platform a little to one side of the position they occupied before being picked up by the rake. This leaves a clear working space in front of the workman, who immediately takes a short step forward and turns over another rakeful, never having to step on the shrimp. In this manner he continues to work his way back and forth across the platform until the entire pile has been turned. The frequency with which the shrimp are turned during the day depends upon their thickness. Where they are three inches thick, turning is required about every 20 minutes.

Every night, the shrimp are pushed and swept onto the ridges in long windrows. A-shaped "horses" are placed astride each windrow of shrimp and covered with tarpaulins to keep off rain and dew. The tarpaulin must be so placed as to provide an opening at each end of the windrow to allow perfect ventilation, otherwise the shrimp become heated and spoil. If the drying process is sufficiently well advanced, the "horses" may be dispensed with and the tarpaulins spread directly over the shrimp, but in the earlier stages, ventilation is absolutely indispensable and the "horses" must be used.

If the weather is good, the drying process can be completed in from one to two days, depending somewhat on the thickness of the shrimp on the platform. If a rain should appear to be coming up, the shrimp are pushed onto the ridges and covered with tarpaulins. No matter how hard it rains, they will not get wet, since the falling water all drains away for the ridges. As soon as the rain passes over and the sun comes out, the shrimp are again spread out and the drying process continues. It frequently happens, however, that a long period of wet and cloudy weather catches the men with a platform full of shrimp that are still quite green, and which spoil on their hands before favorable weather returns. But if the drying process is well advanced at the time the rainy weather appears, the shrimp can be stored in the warehouse and kept for many days, being returned to the platform and finished off upon the return of clear weather.

After the drying process has been completed, comes what is known as "dancing the shrimp." Large wooden "pushers," made of a piece of plank 3 feet long, 6 inches wide, and attached to a wooden handle and operated like a rake, are used to push the shrimp into large round piles. The wooden "pushers" are followed by bristle push-brooms which sweep the platform absolutely clean. The men now tie clean cloths or clean sacks about their shoes and proceed to tramp the shrimp, going around and around the pile in a sort of a slow trot. This tramping or "dancing" process results in separating the heads and shells and legs from the meat, reducing them to what is known as "bran."

After being thoroughly "danced," the shrimp are ready for sifting. A sifter is about 3 feet wide, 10 feet long, and 6 inches deep, consisting of a cypress wood framework with a coarse wire screen bottom of about ¼-inch mesh. It is set up on end with a sort of easel or step-ladder effect, leaning back from the perpendicular about 30 degrees. It is stationed near the pile of "danced" shrimp. A workman now begins shovelling the shrimp against the top of the screen. As it rolls down the screen, the bran falls to the floor beneath the sifter, while the meat continues to the bottom and accumulates in a pile on the platform in front of the sifter. The lower end of the sifter is open, so that the meat may roll directly from the screen onto the platform.

No amount of "dancing" will detach every particle of shell from the meat, and so some firms give it a still further cleaning by placing it in sacks and beating with boards, after which it is again sifted. This produces a higher grade of meat which commands a somewhat better price. However, some platforms prefer the cheaper price to the additional labor of beating in sacks and give the meat no further cleaning beyond thoroughly "dancing" and screening.

The shrimp meat is packed in large sugar barrels, about 230 pounds to the barrel. The "bran" is put up in burlap sacks and sold as fertilizer, about 30 sacks to the ton.

From a basket of shrimp, weighing 105 pounds, the dryers obtain from 12 to 14 pounds of meat. It has been found that the amount in weight of "bran" secured from a given quantity of shrimp is always practically the same as the weight of the meat.

Drying Sea Mussels

Briefly, this consists in freezing the flesh, and drying it, while still in the frozen condition, in a vacuum. At this low temperature chemical changes practically cease and with the extraction of moisture a very stable substance is secured which will withstand all ordinary temperatures. Mussel flesh treated by this method shows remarkable properties. It retains the color and form of the fresh material; it is light and porous and can be easily crushed between the fingers. In air-tight bottles it may be preserved indefinitely.

Canning Lobsters

The lobsters are first boiled in a large vat or kettle about 20 minutes, after which they are heaped on large tables, usually with the backs up, care being taken to have the bodies more or less straightened out. The boiling is frequently done in the afternoon, in order that the lobsters may have sufficient time to cool during the night. The next morning certain men, designated as "breakers" break off the claws and tails from the bodies, throwing the latter with the refuse, for the reason that, though the carapace contains some good meat, it is difficult to extract and clean it. The sweetbreads, however, are generally saved. The claws are then split by the "crackers," using a small hatchet or cleaver, which opens them so that the meat can be readily taken out. Formerly the tail was split in a similar manner to the claws, but at present the meat is punched out from the tail by means of a small "thole" pin, or other suitable pointed implement. The meat is next thoroughly washed in water, the tin cans filled and weighed to insure uniformity, and then covered and cleaned, after which they go to the scalers, who solder the covers down. Next comes the bathing, the most difficult part of the process. The cans are immersed in boiling water for about an hour, when they are taken out and "vented," a small hole being punched in the cover to release the air, after which they are scaled again and boiled for 2 hours longer. They are afterwards allowed to cool, tested to insure their being tight, and then scoured, painted, and labeled. If the cans are boiled in a retort, say at a steam pressure of 15 pounds to the square inch, which is equivalent to 250° F., the time of boiling is reduced about one-half.

Canning and Pickling Sea Mussels

The mussels when taken from the collecting boats are rapidly picked over by hand to eliminate any dead or unhealthy ones which may be present, as well as the coarse adhering debris. Then they are placed in a cleaning apparatus. . . . It consists of a rectangular box 2 by 2 by 3 feet, which revolves on its long axis. The ends of the box are of solid yellow pine and are firmly held in place by four pairs of braces 3 feet long, 2 inches wide, and ½ inch thick. Three sides of the box are inclosed with ¾ inch mesh galvanized wire netting. The fourth side has a door 8 inches wide, running the length of the box. The door is clamped firmly in place by means of a lever, which is swung over it. The rest of the side is filled in with parallel strips of wood placed one-half inch apart. The projecting ends of the axis rest on the walls of a trough 1½ feet deep, in which there is running sea water. A crank at one end serves as a means to rotate the cage.

About one bushel of mussels is placed in this cleaning apparatus, which is set in rotation at the rate of 30 revolutions a minute for fifteen minutes. The treatment cleans off from the shell all clinging sea weeds, sand, and debris, besides breaking open the shells of dead mussels and washing away the injurious substance contained within them. In the experimental work this method of cleaning mussels proved very effective. For cleaning on a commercial scale the device may easily be constructed on larger dimensions and operated by means of steam or water power.

After this treatment the mussels are removed and rinsed off with clean water. They are placed in a chest and subjected to live steam for from five to ten minutes, or until the shells begin to open. They are next emptied out into shallow pans to cool and the natural liquor which has escaped into the chest is preserved in a separate dish. As soon as they are cool enough to be handled, the mussels are shucked and the horny "beard" removed, the meats and liquor being preserved in separate dishes.

While the liquor taken from the steam chest and that taken from the mussels during the process of shucking is filtering through a fine-meshed cloth, the mussel meats are packed in glass jars or bottles. The filtered liquor is brought to a boil and 2 ounces of salt are added for each gallon. The jars containing the meats are then filled with the boiling liquid and sealed. To insure complete sterilization, the sealed jars are placed in a steam chest and subjected to 5 pounds pressure for fifteen minutes. They are allowed to cool down slowly and when the temperature has fallen to about 100 degrees F. they are removed and set aside for future use.

For those wishing to can mussels for use in their own homes and who lack the facilities described in this process, they may do so by modifying the method in the following way: After thoroughly cleaning the outsides of the mussels by means of a stiff-bristled brush, rinse them in clean water and place them in a large closely-covered kettle with a little water covering the bottom—about one cup of water to each gallon of mussels. Place on the stove and bring to a boil, continuing the cooking for about fifteen minutes or until the top shells have opened. Pour out the liquor that has collected in the bottom of the kettle and preserve it in a separate dish from the mussels. Shuck the mussels, being careful to remove the byssus or horny tuft of threads growing out from the base of the foot. While the liquor is filtering through a fine-meshed cloth pack the meats in pint or half pint glass jars of the ordinary household type. To each quart of the filtered liquor add one heaping teaspoonful of salt and bring it to a boil. Pour the boiling liquid over the mussel meats, filling the jars to the brim, and then quickly clamp or screw on the lids. The jars should next be placed in a large vessel, such as a wash boiler, containing boiling water, and left to boil for at least half an hour. At the end of this time the vessel with its contents should be removed to the back of the stove and allowed to cool. As soon as convenient the jars may be removed and the tops tested to see that they are sealed air tight. Treated in this manner, the mussels ought to keep for many months and preserve their natural flavor. When desired for use on the table they may be prepared according to almost any of the methods employed in preparing the fresh mussels for food.

Pickling

The process for preservation by pickling involves the use of vinegar and spices in various proportions according to individual fancies.

After thoroughly washing the mussel shells in the cleaning apparatus already described, the mussels are placed in a steam chest for about ten minutes, or until the shells have opened. They are then shucked, the liquor and meats being preserved in separate vessels. Care should be taken to see that the horny filament or "beard" is removed from the base of the foot. For each quart of natural liquor there is added 1 pint of vinegar, ½ ounce of allspice, ½ ounce of cinnamon, ¼ ounce of salt, and 1 small red pepper. The mixture is allowed to simmer upon the stove for fifteen minutes and is then poured over the meats. After standing about twenty-four hours the meats are removed from the spiced liquor and are neatly packed in bottles or fruit jars. The liquor after being filtered through a fine-meshed cloth, to remove the undissolved spices and sediment that is formed, is heated to boiling and poured over the meats until the jars are brimming full. The jars are sealed air tight and placed in a steam chest, where they are subjected to 5 pounds steam pressure for fifteen minutes.

After this treatment they will remain in a good state of preservation for about two years. If the pickled mussels are desired for immediate consumption, it is not necessary to seal them up in jars. They may be kept a week or more in open tubs without deteriorating.

Additional Notes on Pickling Mussels

Vinegar and spices used in excessive quantities will cause pickled mussels to burn the throat and to have a bitter taste. These ingredients vary so in strength, and individual tastes vary also to such a degree, that it is impossible to recommend a formula that will suit every one.

An excellent pickled mussel of mild flavor can be made by putting the shucked mussels in vinegar alone, one part of 20-grain vinegar to two parts of water. White vinegar is preferred by many to the brown, as it is less likely to turn the mussels dark. Pickled mussels will keep several days in open tubs, but if they are to be preserved longer it will be necessary to sterilize them in hermetically sealed jars. If a spicy flavor is desired, one can begin bv adding very small amounts of the different spices until he gets the flavor desired. Pieces of spice and peppers should not be sealed up with the canned pickled mussels, as the strength imparted to the mussels continues to increase to a point where they become too "hot" to be eaten.

If the method of preservation with diluted vinegar alone does not give a well-flavored mussel, the trouble should be looked for in the quality of the mussels used.

Using About Half a Peck of Mussels

Clean and steam in the usual way. Take out the meats and place in a bowl with one carrot and two onions sliced very thin, 10 grains of whole white pepper, three cloves, one-fourth ounce of salt, 10 grains of allspices, one small red pepper if any handy, one-half pint of good vinegar, one-half pint of mussel liquor, and two tablespoonfuls of olive oil, one clove of garlic. They are ready to eat after a few hours.

Canning Squid

Squids or calamaries for canning in Spain are first thoroughly cleaned and washed, care being taken not to burst the little sac of black liquid they contain. The raw fish is then placed in layers in shallow tin cans similar to those used for sardines, covered with fresh, pure olive oil and the lid soldered. The can is then placed in boiling water to cook for from 10 to 20 minutes. When cool they are ready for use.

Chapter Eight

INKS

Duplicating Ink

Formula No. 1

Canadian Patent 382,180

Crystal Violet	11.0 lb.
Magenta	5.0 lb.
Brilliant Green	13.5 lb.
Chrysoidine	15.5 lb.

Grind together to fine powder and then disperse in following melted mixture.

Beeswax	4 lb.
Eleostearin	6 lb.
Mutton Tallow	26 lb.
Lard Oil	4 lb.

No. 2

Paraffin Wax, Hard	3 kg.
Montan Wax, Bleached, St.	3 kg.
Violet Blue	5 kg.
Milori Blue	6 kg.
Montan Wax, Crude	15 kg.
Lampblack	20 kg.
Mineral Oil	32 kg.

No. 3

Methyl Violet Base	5 kg.
Oleic Acid	10 kg.
Montan Wax, Bleached, St.	10 kg.
Montan Wax, Crude	60 kg.
Petrolatum	90 kg.

Must be ground in color mill.

Stencil Ink

Prussian Blue	2 kg.
Lampblack	1 kg.
Gum Arabic	3 kg.
Glycerin	sufficient

Mix the powders and make into a suitable paste with glycerin.

Typewriter Ribbon Ink

Formula No. 1

Methyl Violet Base	1½
Alkali Blue Toner	1
Oleic Acid	16

Dissolve by warming cautiously and good mixing.

Add

Carbon Black	5
Motor Oil (20 S.A.E.)	2

Run through high speed 3–5 roller ink mill, several times, until smooth.

No. 2

Carbon Black	10
Petrolatum	40

Grind together until uniform. Then work in the following solution:

Nigrosine Base	1⅔
Oleic Acid	3⅓

Grind again until smooth.

No. 3

(Black)

U. S. Patent 2,160,511

Diglycol Laurate	15 lb.
Tricresyl Phosphate	15 lb.
Nigrosine Base	9 lb.
Carbon Black	6 lb.

This ink when applied to ribbon does not deteriorate like inks made without diglycol laurate.

Stamp Pad Ink

Formula No. 1

Aniline Dye	10–20 g.
Glycerin	600 g.
Water	200 g.
Alcohol	200 g.

No. 2

(Quick Drying)

Butyl carbitol, which is the monobutyl ether of diethylene glycol, is as efficient as alcohol in promoting rapid absorption by paper of the ink to which it is added, and since its B.P. is 222° C., it is almost involatile. Best composition was found to be 40% glycerol, 40% water, 20% butyl carbitol, by volume. A pad so impregnated can be left open for weeks without losing its quick-drying properties.

No. 3

U. Patent 2,144,104

Mineral Oil, White	100 oz.
Diglycol Laurate	100 oz.
Aniline Dye	8 oz.

White India Ink

Shellac	20 g.
Borax	8 g.
Water	300 g.
Lithopone or Titanium Dioxide	40–50 g.

Writing Ink
(Non-Corrosive & Non-Settling)
U. S. Patent 2,088,006

Gallic Acid	10 g.
Iron Sulphate, Hydrated	15 g.
Tartaric Acid	1 g.
Water	1 l.
Soluble Dye	3½ g.

Water Soluble Aniline Ink

Manila DBB	50 lb.
Water	200 lb.
Caustic Soda	4.5 lb.
Ammonia (28.3% NH_3)	1.1 lb.
National Methylene Blue SP	0.5 lb.

Procedure: Dissolve the resin in 150 parts of water containing the caustic soda and ammonia. Dissolve the dye in 50 parts of water. Add the solution of dye to the solution of manila. A clear, glossy ink will result.

Quick-Drying, Non-Penetrating Inks
Formula No. 1
U. S. Patent 2,132,468

Alcohol	7–90 lb.
Ethyl Cellulose	1 lb.
Dye, Alcohol Soluble	½–1½ lb.

No. 2
(Water-Soluble)

Glycerin	100 g.
Gum Arabic	50 g.
Water-Soluble Dye	10 g.

No. 3
Canadian Patent 374,102

Crude plantation rubber is heated in a kettle with an air-cooled reflux condenser to about 250–60° C., withdrawn and cooled. The ink consists of liquefied rubber 100, ink black 50, petrolatum 10, Montan wax 4 and castor oil 15 parts by weight.

No. 4

Dye	5 lb.
Water	15 lb.
Zein	10 lb.
Alcohol (95%)	75 lb.

No. 5
(Intaglio)
British Patent 513,247

Gilsonite	15–33⅓%
Petroleum Naphtha (85–95%) Acetone (5–15%)	85–66⅔%

Multigraph Inks
Formula No. 1
(Blue)

Aniline Blue	8 lb.
Acetic Acid (30%)	1 lb.
Glycerin	5 lb.
Alcohol	15 lb.
Water	70 lb.

No. 2
(Green)

Malachite Green	15 lb.
Glycerin	15 lb.
Alcohol	15 lb.
Water	50 lb.

No. 3
(Red)

Fuchsin	10 lb.
Alcohol	10 lb.
Glycerin	10 lb.
Water	55 lb.

No. 4
(Violet)

Methyl Violet	10 lb.
Alcohol	10 lb.
Water	70 lb.

No. 5
(Black)

Nigrosin	4 lb.
Alcohol	85 lb.

No. 6

Clay, White	250 lb.
Neuburg Chalk	50 lb.
Infusorial Earth	50 lb.
Acid Ammonium Fluoride	25 lb.
Hydrofluoric Acid	25 lb.
Water	600 lb.

Rubber gloves and goggles must be used!

No. 7

For windows in metallic frame, use Formula No. 6, but replace the water by:

Copper Sulphate	25 lb.
Methyl Cellulose Mucilage (1:15)	175 lb.
Water	400 lb.

Photomechanical Inks
Autographic Transfer Ink

This is used for writing upon plain paper with a pen, said writing later transferred to a litho stone or metal plate:

Marseilles Soap	10 oz.
Acetic Acid	1 lb.
Glycerin	20 lb.
Water	100 lb.
Shellac	12 oz.
Tallow	10 oz.
Yellow Beeswax	12 oz.
Mastic	5 oz.
Asphaltum	4 oz.
Lampblack	3 oz.
Water	125 oz.

Tusche

This is another lithographic drawing material, intended for use with pen or brush on either stone or metal surfaces. Tusche must be soluble in water, and should flow fine and clean from the pen. Commercially, the material is supplied in both solid and liquid form, the following formula being a typical one for the solid variety:

Yellow Beeswax	2 oz.
Mutton Tallow	2 oz.
Marseilles Soap	6 oz.
Shellac	3 oz.
Lampblack	1½ oz.

Benday Ink

This is really a form of transfer ink, used in conjunction with shading mediums (stippling films) in the process known as "bendaying." Ink for this purpose may consist of:

Tallow	1 oz.
Wax	3 oz.
Shellac	4 oz.
Soap	2 oz.
Asphaltum	4 oz.
Canada Balsam	1 oz.
Carbon Black	1 oz.

For use, reduce with castor oil to a working consistency.

Developing Inks

By this is indicated those inks applied to exposed bichromated albumen images, either in photoengraving or photolithography. The purpose of the ink in both processes is to render the developed colloid image plainly visible; in photoengraving, the ink serves the further purpose of creating an acid resist (augmented by application of etching powders to the tacky ink surface) to permit the image to be etched into relief. Developing inks for photoengravings are sometimes known as "starting inks," and are applied with a roller. The constituency of the ink is relatively simple:

Good Letterpress Ink	1 lb.
Beeswax	1 lb.
Thin Litho Varnish	4 oz.

Inks for "developing" bichromated albumen images in photolithography are fluid in nature, and provide the grease foundation necessary in litho printing. They are employed by swabbing the solution on the exposed image with a rag or sponge, avoiding the application of excess ink:

Transfer Ink	½ lb.
Black Litho Ink	½ lb.
Engraver's Etching In	1 lb.

The above should be ground in about 32 ounces of oil of turpentine, to which is added 40 drops of oil of lavender. For use, thin to the consistency of cream with rectified turpentine.

Photolitho Transfer Ink

For inking up images on photolithographic transfer paper, the following is recommended:

Palm Oil	1 lb.
Beeswax	1 lb.
Asphaltum	2 lb.
Burgundy Pitch	2 lb.
Black Litho Ink	8 lb.
Litho Varnish	2½ lb.

The ink is applied with a composition roller, and, if desired, may be thinned with oil of turpentine.

Etching Inks

In this category are included the various inks sometimes used in photoengraving for etching images on zinc, copper or brass surfaces. For practical purposes, the inks usually are classified as *hard, soft, finishing* and *rolling up* inks, each with a different degree of final consistency.

Hard Etching Ink

As its name implies, this is a hard, strong ink, used where exceptional acid resistance is desired:

Litho Ink (Black)	1 lb.
Beeswax	7 oz.
Powdered Asphaltum	5 oz.
Rosin	5 oz.
Black Wax	3 oz.

The *black wax* specified in the above formula consists of:

Asphaltum	2 oz.
Beeswax	5 oz.
Stearic Acid	5 oz.
Spermaceti	10 oz.

Or, equal quantities of beeswax, rosin and tar may be melted and thoroughly mixed, then used as a substitute for "black wax."

Soft Etching Ink

Preferred for delicate work and used in the French etching process (gillotage), this comprises:

Russian Tallow	6 oz.
Yellow Beeswax	5 oz.
Asphaltum	2 oz.
Black Litho Ink	1 oz.
Thin Litho Varnish	1 oz.

Finishing Ink

An ink sometimes used by etchers in cleaning up the plate (removal of shoulder) in the last stage of etching:

Black Litho Ink	2 lb.

Beeswax	1 lb.
Rosin	10 oz.

Add sufficient turpentine to give the desired consistency. The ink is applied to the *warm* plate with a composition roller, which is manipulated over the plate in all directions until the surface of the etched relief design is thinly but thoroughly covered with ink.

Rolling Up Ink

As originally used in the French etching process, this was employed in conjunction with the use of etching powders, and the plate first moistened with gum arabic solution before application of the rolling up ink. Modern practice dispenses with the etching powder and gum treatment in favor of direct application of ink to the partially etched images, the ink acting as an acid resist in the process of attaining additional depth in halftone etching. The aim is to obtain pyramid-shaped dots in the halftone etching, thus facilitating stereotyping or electrotyping. The following formula is a representative one for rolling up ink:

Letterpress Ink	1 lb.
Asphaltum	4 oz.
Rosin	3 oz.
Beeswax	3 oz.
Turpentine	10 oz.

Before application of the ink, heat the plate, and use a composition roller in applying a smooth film of ink to the plate.

Photogravure Inks

Blue I

Steel Blue (Milori Blue)	8 kg.
Reflex Blue 8G	1 kg.
Litho Varnish	1.5 kg.
Rosin Solution (Composed of 150 kg. Albertol 116Q, very dark, or 213Q, 40 kg. toluol, 45 kg. xylol and 15 kg. benzol)	60 kg.
Magnesium Carbonate	8 kg.
Aluminum Hydrate	4 kg.
Xylol For Thinning	26 kg.

Blue II

Milori Blue	10 kg.
Aluminum Hydrate	20 kg.
Rosin Solution (Composed of 150 kg. Albertol, 116Q Normal or 213Q Normal, 40 kg. toluol, 45 kg. xylol and 15 kg. benzol)	58 kg.
Litho Varnish	5 kg.
Hydrogenated Naphtha	3 kg.
Xylol for Thinning	16 kg.

Red

Very Dard Resin Solution (60 kg. Albertol 116Q Very Dark, and 40 kg. Benzol)	30 kg.
Xylol	10 kg.
Aluminum Hydrate	10 kg.
Red Lake Pigment	4 kg.
Hansa Red G	1 kg.
Boiled Linseed Oil	2 kg.
Litho Varnish	1 kg.
Hydrogenated Naphtha	2 kg.

Red Intaglio Printing Ink

Resin Solution (3 parts Copal Ester to 2 parts Xylol)	25 kg.
Red Lake Pigment	5 kg.
Magnesia	8 kg. 0.2 kg.
Hydrogenated Naphtha	1.5 kg.
Xylol	2 kg.

Other lake pigments may be used according to the shade required: for yellow, hansa yellow G or IOG or a special light chromo yellow; for black intaglio printing inks, a mixture of oil black and gas black; for red, a lithol red GK and BK or hansa red G.

Brown Intaglio Printing Ink

Carbon Black	17 kg.
Gilsonite	42 kg.
Toluol	50 kg.
Xylol	25 kg.
Sudan Brown	0.25 kg.

An olive-green ink can be very easily prepared from the foregoing by simply adding milori blue.

Textile Priting Ink

U. S. Patent 2,213,006

Nitrocellulose (less than 80 vis.)	10
Pigment	15
Carbitol	16
Cellosolve	16
Naphtha	28

Fabric Marking Ink

Copper Sulphate	20 g.
Dextrin	10 g.
Aniline Chloride	30 g.
Glycerin	6 g.
Distilled Water	100 g.

Mix in the order given.

Finger Print Ink

Glycerin	112 g.
Ferric Chloride	10 g.
Carbon Black (Colloidal)	1 g.
Acetone	90 g.

Ink for Printing on Wet Lumber

Starch	90–100 g.
Glycerin	8– 16 g.
Vinegar	60– 70 g.
Aniline Color	to suit

Celluloid Ink

Ink for writing on pyroxylin or celluloid is composed of a 25% solution of acetic acid to which a very small amount of methyl-orange has been added. This ink writes a pleasing red and may be used on safety as well as on the inflammable type of celluloid, with an ordinary steel pen. Most water-soluble dyes can be used in place of methyl-orange.

Ink for Cellulose Acetate

U. S. Patent 2,165,522

Glycol Monoacetate	85–95%
Glycerin	5–15%
Pigment	to suit

Permanent Glass Marking Ink

An effective and permanent glass marking ink is made by mixing equal parts of chromic oxide with powdered lead borate, and stirring into a mixture of equal parts of water, alcohol and glycerin. The amount of the liquids depends on the consistency desired.

After applying the ink with a pen and allowing it to dry, the glass is warmed in the yellow flame of a Bunsen burner, then heated to red heat in a blue flame. The glass is finally allowed to cool, using the yellow flame to lower the temperature gradually.

The ink is green, and cannot be used on heavy cast glass equipment such as dessicators, battery jars, reagent bottles or the like.

Glass Etching Ink

Ammonuim Fluoride, Tech.	3 kg.
Barium Sulphate, Tech.	1.5 kg.
Hydrofluoric Acid, Concentrated	3 kg.

Work with rubber gloves. Do not get on skin. This is weighed and mixed (with a wooden spatula) in a lead dish. Save in a leaden storage vessel after standing over night and stirring up again.

Shake well before each use. Use a steel pen on degreased glass surface.

The etched part may be colored by rubbing with soft metal (copper, tin).

Matt Etching Powder for Glass

Barium Sulphate	50 g.
Ammonium Fluoride	50 g.
Water	to form heavy milk

Dip the glass to be etched into this milk for 1–2 minutes. Vessel must be of lead or covered well with paraffin, or of rubber or gutta percha. The glass must be completely free of grease.

Ink for Porcelain

Formula No. 1

To 10 cc. of water is added 2 cc. of water glass (silicate of soda, N brand, quartz quality). Stir and make just acid to litmus paper with 1:1 nitric acid. Then add 15 cc. of a saturated solution of potassium dichromate.

In writing with the above mixture, use a clean steel pen point and allow the ink to dry evenly on the porcelain. Then, with the full heat of a Bunsen burner directed on the writing, ignite for 5 or 10 minutes. Dark green figures will result that will not burn off and will not dissolve in boiling concentrated hydrochloric acid. If the ink should jell after standing for a period of time, it can be made usable readily by the addition of 5 cc. of water and vigorous stirring.

No. 2

a.	Rosin	4 g.
	Borax	7 g.
	Water	30 g.
b.	Alcohol, Denatured	30 g.
c.	Nigrosin	as desired
	Water	20 g.

Boil *a* until saponified. Cool, mix with *b* and add *c.*

Invisible Ink

Formula No. 1

A solution of mercurous nitrate applied with a feather quill or similar applicator on white writing paper produces marks which, when dry, are invisible. A small amount of stronger ammonia water is then placed in the bottom of a large glass jar which becomes filled with ammonia gas in a suitably moist condition. Upon placing the paper with the invisible writing within this jar for a few seconds and then withdrawing it, it will be found that the writing comes out in a distinct and permanent black color.

Writing done with a thin aqueous solution of starch or with water in which rice has been soaked remains invisible until brought out by the application of iodine. It is also stated that writing done with a solution of quinine hydrochloride can be photographed, but is not visible to the human eye.

No. 2

Cobalt Chloride	3 oz.
Water	64 oz.
Glycerin	1 oz.

No. 3

U. S. Patent 2,083,372

Cellulose Nitrate (Pyroxylin)	0.25– 5%
Cellosolve Acetate	99.75–95%

When applied to paper and dried it is invisible, but becomes visible on being wetted.

Burnishing Ink

Formula No. 1

Montan Wax, Crude	6.5 lb.
Rosin	1 lb.
Stearic Acid (Titer 53/54° C.)	0.5 lb.
Potassium Carbonate	1 lb.
Water	100 lb.
Nigrosin Solution (12% in water)	30 lb.

The wax, rosin, and stearic acid are melted together, and added to the boiling potash carbonate solution with stirring. The finished cooled emulsion is dyed with the nigrosine solution.

No. 2

a. Potash Carbonate	0.5 kg.
Rosin	2 kg.
Paraffin Wax	3 kg.
Marseilles Soap	4 kg.
Montan Wax, Crude	15 kg.
Water	65 kg.
b. Borax	7 kg.
Shellac	20 kg.
Water	75 kg.
c. Nigrosin, Water Soluble	6 kg.
Water	25 kg.

Mix the three solutions (emulsions) after making them up separately.

Ink Eraser

Formula No. 1

1. Dextrin	5 lb.
2. Gum Tragacanth	5 lb.
3. Gum Sandarac	15 lb.
4. Pumice, Powdered	75 lb.

Dissolve 1 and 2 in minimum amount of water and then mix in other ingredients; place in forms and dry.

No. 2

U. S. Patent 2,164,035

Lithopone	728 gr.
Whiting, English	353 gr.
Plaster of Paris	533 gr.
Gelatin	728 gr.
Pumice, Powdered	87 oz.

Wet thoroughly; mix until uniform; press into forms and dry.

Removing Ink Spots

For the "blue-black" inks, the reagents used remove only the temporary dye, not the iron tannate. For these, it is suggested that permanganate be used to remove the temporary dye. This should be followed with oxalic acid (10%) to discharge the permanganate and dissolve the iron tannate. Washing with weak ammonium hydroxide will insure against harmful effects of the acid reagents on the fabric or paper.

	Type of ink				
Reagent	Permanent blue dyestuff	Permanent red dyestuff	Permanent black dyestuff	Logwood	Temporary dye of blue-black
Sodium Pyro-Phosphate (Saturated)					Good
Sodium Hydro-Sulfite (10%)	Good				
Sodium Bi-Sulfite (10%)	Good				Good
Sodium Hypo-Chlorite (10%)	Good	Good	Complete	Complete	

Sodium Perborate (5%)	Complete				Good
Acid Permanganate (10%)	Complete	Complete	Complete	Complete	Complete
Acid Permanganate (5%)	Complete	Complete	Good	Complete	Complete
Acid Permanganate	Complete	Good	Good	Complete	Complete

CHAPTER NINE

LEATHER, SKINS, FURS

Dehairing Hides
Chrome Leather
Paddle Liming

Hides (Soak Weight)	1000	lb.
Hydrated Lime	80–100	lb.
Dimethylamine Solution (40%)	10–12½	lb.
Water	approx. 475	gal.

The lime liquor is prepared in the usual manner, omitting any addition of sodium sulfide and the dimethylamine added. After mixing thoroughly by running the paddle for a few minutes, the soaked hides are entered. The paddle is run for 10 minutes and the hides left in the liquor for 3 days (about 72 hours), running the paddle two or three times a day for three-minute periods.

Temperature during liming should be around 70° F.

The usual string of soak and liming pits is used and the regular system of cleaning the vats is maintained. The lime is fed in the customary amounts, omitting the addition of sulfide.

The addition of dimethylamine is made to the tail lime. It is simplest to make the first addition on a day when this has been cleaned. When the fresh lime is made up (without sulfide), add

12½ lb. dimethylamine solution (40%)

for each 1,000 lbs. soak weight of hides in the incoming pack. On each succeeding day, as a fresh pack is entered, strengthen the tail lime with the usual amount of lime and by the addition of

4 to 6 lb. dimethylamine solution for each 1,000 lb. soak weight

This system of strengthening is followed until the tail vat is again cleaned, when the first pack in the new tail is again given

12½ lb. dimethylamine solution for each 1,000 lb. soak weight

and the strengthening carried on, as before, for succeeding packs.

When the first pack is moved into the second lime, add to the second lime

6 lb. dimethylamine solution per 1,000 lb. soak weight.

Thereafter no further addition of dimethylamine to the second lime is necessary until it is cleaned, when the 6-lb. dose should be added to the new second lime liquor.

No addition of dimethylamine is required in the third or following limes.

On the first round, sulfide is present in the third, fourth and fifth limes. As these are cleaned, omit the addition of sulfide to the new lime.

Detergent for Hide Hair
Hungarian Patent 120,156

Sheep Tallow	32	kg.
Sal Soda	40	kg.
Borax	5	kg.
Water Glass	14	kg.
Glycerin	6	kg.
Potassium Carbonate	5	kg.

Removal of Wool from Sheepskins

Soak skins in water solutions of mixed enzymes (*e.g.*, batinase) at 40° C. The wool comes off undamaged.

Persian Leather Chrome Liquors
Formula No. 1

Bichromate	180	lb.
Vitriol	100	lb.
Water	60	gal.
Glucose	70	lb.

No. 2

Bichromate	100	lb.
Water (Hot)	20–30	gal.
Vitriol	100	lb.
Glucose	60	lb.
Make up to	100	gal.

Stripping Persian Leather

Buffed Persians	100	lb.
Sulfated Fatty Alcohol	1½	lb.
Borax	½	lb.
Water (90° F.)	50	gal.

The Persians can be drummed in

this liquor for 20 or 30 minutes and subsequently well washed in running water. The leather is now ready for the retannage.

Vegetable Tanning of Hides and Skins

German Patent 642,484

Broken up tobacco plant stems or their extracts are used in tanning. For example: pickled goat skins or sheepskins are tanned with a pure 2–3° Bé. solution of tobacco extract in a drum during 3 days. The leather is then fat liquored and treated in the usual manner.

Synthetic Tanning

Formula No. 1

British Patent 494,871

Crude Naphthalene Sulphonic Acid	15 lb.
Water	7 lb.
Urea	5 lb.
Formaldehyde (30%)	10 lb.

Mix well and then add

Crude Cresol Sulphonic Acid	40 lb.

and heat to 70° C. Cool and add

Formaldehyde (30%)	10 lb.

After reaction is complete, solubilize with caustic soda solution.

No. 2

British Patent 496,898

Sulphite Cellulose Waste Liquor (d 1.32)	188 lb.
Caustic Soda (33%)	22 lb.

Heat at 120° C. for 3 hours: cool to 60° C., and treat with

Phenol-Formaldehyde Condensate	33 lb.

The phenol-formaldehyde condensate is made as follows

Phenol	94 lb.
Formaldehyde	50 lb.
Water	200 lb.
Hydrochloric Acid	3 lb.

Boil together until reaction is complete.

No. 3

German Patent 642,728

A solution of 1,480 kg. phthalic anhydride is prepared by dissolving the latter in a solution of 800 caustic soda, diluting it to 12,000 kg. and adding gradually and under agitation a solution of 510 kg. anhydrous iron chloride in 5,000 kg. water. Into this solution are immersed 5,000 kg. calf skins and the whole is drummed to complete tanning. The goods are then rinsed, fat liquored with a fishoil emulsion and finished in the same manner as chrome leather.

Softening Emulsion for Pigskin and Russia

Parrafin Wax	36–50%
Fish Oil	54–36%
Soap	8– 9%
Ammonia	½– 2%

Emulsify by warming to 100° C. and mixing vigorously. Impregnate leather at 50–60° C. in a drum.

Stiffening Leather

Sodium Borophosphate (Abopon)	80 oz.
Water	20 oz.

Heat to 90°–95° C. and immerse leather for ½ hour. Drain and dry.

Old Leather Freshner

(Book Covers)

Beeswax	1 oz.
Cedarwood Oil	1 oz.
Lanolin (Anhydrous)	8 oz.
Naphtha, Dry Cleaners	12 oz.

Melt wax and lanolin, add cleaning solvent (fire hazard!) and stir until cool. Add the oil of cedarwood while mixture is cooling and pour into bottles for storage.

Shake before using. Treat leather thoroughly, but do not allow mixture to reach the leaves of the books. Avoid use on calfskin, which is better handled with milk followed by vaseline.

Leather Cleaner

A good leather cleaner may be made from milled soap 6 parts, water 100 parts, ammonia (26° Bé.) 6 parts, glycerin 14 parts and ethylene dichloride 7 parts.

Removing Oil From Leather Belting

The running side is laid up and the surface well rubbed with a cloth soaked in gasoline. Time is allowed to dry and then the treatment is repeated one or more times. This will remove the oil and the belts can be recemented. Mills using this method have found it very efficacious.

Leather Finishes

U. S. Patent 2,191,654

Formula No. 1

Egg Albumin	1½
Casein Solution	3
Borax	¾
Shellac Solution	4
Water	to make 1

Pigment of the desired color and amount to give suitable covering power.

The casein solution is prepared by adding the casein to an equal quantity of water, the resulting solution being neutralized or made slightly alkaline with borax. The shellac solution is prepared in the proportion of 2 oz. of shellac to 16 oz. of water, the resulting solution being made neutral or slightly alkaline with borax. The casein and shellac solutions, together with the egg albumin and the remaining amount of borax are thoroughly mixed together with the required amount of water to make 1 gal., the mixing being of sufficient intensity and duration to form an emulsion. Into this emulsion the pigment, if used, may be gradually added with stirring. Titanium oxide, for example, may be used as the pigment and for the treatment of white work 3 lbs. of the oxide is first ground in a suitable oil such as castor oil to give a suitable dispersion of the pigment in the oil. The ratio of pigment to oil should range preferably between two parts of pigment to three parts of oil. The pigment dispersion is then added to the emulsion and the whole is thoroughly and uniformly blended by ordinary mixing processes. If desired, this composition may be further modified by the addition of from 5–15% of a water emulsion of a wax such as hydrogenated castor oil wax, carnauba wax or the like.

No. 2

Another kind of leather finish may be prepared by mixing 33⅓ parts of casein into 66⅔ parts of water. To this solution, with stirring, is added an equal volume of an aqueous solution containing 7% triethanolamine. The stirring is continued for a sufficient time to insure adequate emulsification.

No. 3

An aqueous resin emulsion is prepared according to the following formula:

n-Butyl Methacrylate (Monomer)	25.0
Benzoyl Peroxide	0.2
Water	74.0
Sodium Lauryl Sulphate	0.8

The above ingredients are placed in a closed kettle provided with a jacket and agitator. Rapid agitation is applied for a time cycle of sufficient duration to provide emulsification. The resulting emulsion is heated to 60–90° C. for approximately two hours or until polymerization of the methacrylate monomer is effected.

A mixture consisting of 3 parts of either of the conventional type of albuminous-water-dispersed leather finishes No. 1 or No. 2 fortified with 2 parts of the methacrylate resin emulsion No. 3 is uniformly blended. This emulsion coating composition is sprayed or brushed upon a leather surface. Two or three coats are usually applied, each coat being allowed to dry at room temperature or force-dried at an elevated temperature before the application of the succeeding coat. Other methods of application are also utilized, such as swab coating or brush operations.

Finishing Russia Leather

The glossy finish of Russia leather can be obtained by the use of:

Carpenter's Glue	46.5	g.
Casein Solution (10%)	155	cc.
Nigrosine, Water-Sol.	8	g.
Wax Emulsion	100	cc.
Blood	340–385	cc.
Water	to make 1	l.

The wax emulsion consists of 10 grams wax, 2 grams potassium carbonate and 1 gram soap. Soap and potassium carbonate are dissolved in hot water and then added to molten wax. The whole is heated to uniform mass and water is added to bring the volume to 100 cc. The casein solution is prepared from 600 grams casein, 150 cc. of 10% ammonia and the volume is brought with water to 4.5 liters.

The finish is prepared by dissolving glue in 200 cc. hot water, adding 3.5–4.5 grams alizarin oil, and nigrosine dissolved in 100 cc. hot water and finally cooling the mixture and adding other components. Formula for the finish of polished spots on the leather:

Carpenter's Glue	85	g.
Casein Solution (10%)	85	cc.
Nigrosine	50	g.
Alizarin Oil	8.5	g.
Water	to make 1	l.

Casein Leather Finish Fixer

A casein paint is sprayed on and then covered with a fixing composition consisting of 10 parts of a 10% casein solution, 50 parts of blood, (or 25 parts of albumen and 25 parts of blood), 15 parts of a 5% wax emulsion, 20 parts of a 5% linseed oil extract and 20 parts of 10% shellac solution. The solution is mixed with an equal quantity of formaldehyde (1:9) before use.

Dyeing Napped Leathers

Formulas are for 100 lb. Leather

Light Leather Tan

Mordant: Drum the leather in 30 gallons of warm water with
Bleached Sumac Extract 3 lb.
for one hour and then change the water. Run up the drum with 30 gallons of fresh water at 125° F., and drum the leather with the dyestuff.

1st Dyebath:
Resorcine Brown 6 lb.
Drum for one hour and then add
Formic Acid 2½ pt.
Drum for ½ hour, then wash well and change the water for fresh water at 125° F.

2nd Dyebath:
Bismark Brown ½ lb.
Auramine ½ lb.
Drum for ½ hour, then change the water and finish off with

3rd Dyebath:
Resorcine Brown 6 lb.
Drum the leather in this for ½ hour and then wash well and fat liquor.

Light Tan

Mordant:
Bleached Sumac Extract 3 lb.
Drum for one hour and change the water.

1st Dyebath:
Resorcine Brown 6 lb.
Diphenyl Fast Red B. 1 lb.
Drum for one hour and add:
Formic Acid 2½ pt.
Drum for ½ hour and change the water.

2nd Dyebath:
Bismark Brown R. 3 oz.
Chrysoidine R. (Conc.) 4½ oz.
Acetic Acid 1 pt.
Drum for ½ hour and then change the water.

3rd Dyebath:
Resorcine Brown 6 lb.
Diphenyl Brown BBN. 1 lb.
Drum for one hour then add:
Formic Acid 2 pt.
Drum for a further period of ½ hour, wash well and fat liquor.

Rich London Tan

Mordant:
Bleached Sumac Extract 3 lb.

1st Acid Dyebath:
Acid Leather Dark Brown G. 3 lb.
Resorcine Brown 3 lb.
Drum for one hour and add:
Formic Acid 2½ pt.
Drum for a further half-hour, wash well and change the water.

Basic Dyebath:
Bismark Brown R. ½ lb.
Acetic Acid 2½ pt.
Drum for ¾ hour, wash well and change the water.

2nd Acid Dyebath:

Deep Red-Brown

Mordant:
Bleached Sumac Extract 3 lb.

1st Dyebath:
Acid Leather Brown ER. 1 lb.
Milling Red 4 lb.
Drum for one hour and add:
Formic Acid 2 pt.
Drum for a further ½ hour, wash well and change the water.

2nd Dyebath:
Acid Leather Brown ER. ¼ lb.
Milling Red 1 lb.
Drum for ½ hour, wash well and fat liquor.

Brilliant Wine Red

Mordant:
Bleached Sumac Extract 3 lb.
Drum for ½ hour and change the water.

1st Dyebath:
Deep Bordeaux Extra 4 lb.
Drum for one hour, and add:
Formic Acid 2 pt.
Drum for a further ½ hour, wash well and change the water.

2nd Dyebath:
Rhodamine ½ lb.
Acetic Acid 1 lb.
Drum for ¾ hour, wash well and fat liquor.

Light Bluish Purple

Mordant:
Bleached Sumac Extract 3 lb.
Drum for one hour and change the water.
Dyebath, Bordeaux 2B. 4 lb.
Drum for one hour, add:
Formic Acid 2 pt.
Drum for ½ hour, wash well and fat liquor.

Navy Blue Velvets (Purplish Shade)

Mordant:
Bleached Sumac Extract 2 lb.
Drum for one hour and change the water.

1st Dyebath:
Leather Navy Blue GR. 4 lb.
Drum for one hour and then add:
Formic Acid 2 pt.

Drum for a further ½ hour, wash well and change the water.

2nd Dyebath:

French Black	1 lb.
Acetic Acid	2 pt.

Drum for ¾ hour, wash well and change the water.

3rd Dyebath:

Leather Navy Blue GR.	4 lb.

Drum for ½ hour, wash well and fat liquor.

Deep Navy Blue

Mordant:

Bleached Sumac Extract	3 lb.

Drum for ½ hour and change the water.

1st Dyebath:

Leather Navy Blue GR.	5 lb.

Drum for one hour and then add:

Acetic Acid	2 pt.

Drum for ½ hour, wash well and change the water.

2nd Dyebath:

French Black	3 lb.
Acetic Acid	1½ pt.

Drum for one hour, wash well and change the water.

Leather Navy Blue GR.	6 lb.
Naphthalene Yellow PDS.	1 lb.
Xylene Fast Green	1 lb.

Drum for one hour, add another 2 pints of formic acid, drum for another ½ hour, wash well and fat liquor.

Protective Coating for New Shoes

Talcum	40–50 lb.
Glycerin	30–40 lb.
Water	10–20 lb.

Shoe Leather Impregnant

Italian Patent 277,180

Peanut Oil	500 g.
Linseed Oil	500 g.
Musk	5 g.
Canada Balsam	5 g.

Leather Impregnant

Italian Patent 278,855

Water	10 kg.
Soap	1.5 kg.
Soda Ash	1.5 kg.
Rosin	0.1 kg.
Dye	To Suit

Shoe Sole Impregnation

Italian Patent 279,345

Leather, Powdered	20 lb.
Celluloid	21.5 lb.
Acetone	50 lb.
Tricresyl Phosphate	8.5 lb.

Shoe Sole Finish

German Patent 648,254

Water	5 kg.
Calcium Oxide	1 kg.
Casein	2 kg.
Rubber Solution	2 kg.
Latex	30–40 kg.
Filler (Rubber Waste)	25–50 kg.

Mothproofing Hide Drench

German Patent 595,849

The following drenching solution for hides also renders them mothproof:

Cooking Salt	11 g.
Sulphuric Acid	2–3 g.
Nicotine	0.05–0.005 g.
Oxalic Acid	1 – 0.8 g.
Water	86 – 85.2 g.

Waterproofing Leather

Impregnate leather with emulsion at 45° C.

Fish Oil	36.5–54.5 lb.
Alizarin Oil or Pine Oil	0– 4.0 lb.
Paraffin Wax	36.0–50.0 lb.
Diglycol Stearate	7.5–10.0 lb.
Ammonia	0.5– 2.0 lb.

Weatherproofing Leather Harness

Formula No. 1

Beeswax	20 lb.
Paraffin Wax	5 lb.
Varnish	75 lb.

No. 2

Benzol	20 lb.
Paraffin Wax	5 lb.
Stearin	3 lb.
Color	to suit

Artificial Leather

When loosely felted papers or napped, soft filled fabrics are impregnated with latex they increase substantially in strength and take on many of the characteristics of leather. Such materials may be surface coated with nitro-cellulose or other plastic materials and embossed in leather grains to give excellent simulations of various kinds of leather. They are used widely in shoes, novelties, notebooks and luggage. Other artificial leathers employ ground leather, wool and rayon fibers bound together with latex.

When a sheet is made from loose fibers, it may be formed from a concentrated, uncoagulated paste of compounded latex and fibers which are dried, pressed and vulcanized. It may be formed also by causing compounded latex to coagulate on the fibers in dilute suspension and subsequently filtering the liquid through a screen.

If the base material is a preformed sheet of absorbent paper or a heavily napped fabric, it is impregnated with the latex composition, dried, pressed and vulcanized.

A suitable latex composition for application with paper and other fibers is shown below:

Rubber (From 60% Latex)	100.00
Fibers	50.00
Tepidone	1.00
Dispersed Antox	2.00
Sulphur	2.00
Clay	100.00
Color Pigment	0.50
Aquarex D	3.75
Zinc Oxide	5.00

Cure: 30 minutes at 220° F.

The flesh side of leather can be simulated by dusting the back of a latex impregnated fabric or paper with ground cork or leather. A suitable spreading composition to serve as the binder for the cork or leather dust is as follows:

Rubber (From 60% Latex)	100.0
Sulphur	1.5
Zinc Oxide	2.0
Latac	0.5
Dispersed Antox	2.0

Cure: 30 minutes at 212° F.

This compound may be used also for impregnating the napped fabric or paper.

Pre-Felting Treatment for Furs

French Patent 823,245

Formula No. 1

Hydrochloric Acid	15 kg.
Hydrogen Peroxide	7 kg.
Alcohol	8 kg.
Water	70 kg.

No. 2

Sulphuric Acid	7 kg.
Ammonium Persulphate	4 kg.
Potassium Chlorate	5 kg.
Acetone	8 kg.
Water	76 kg.

Fur Carroting Solutions

British Patent 493,959

Formula No. 1

Water	70 lb.
Hydrochloric Acid	15 lb.
Hydrogen Peroxide	7 lb.
Alcohol	8 lb.

No. 2

Sulphuric Acid	7 lb.
Ammonium Persulphate	4 lb.
Potassium Perchlorate	5 lb.
Acetone	8 lb.
Water	76 lb.

No. 3

Sulphuric Acid	7 lb.
Acetic Acid	1 lb.
Quinoline	3 lb.
Alcohol	10 lb.
Ammonium Persulphate	3 lb.
Water	76 lb.

No. 4

Phosphoric Acid	7 lb.
Hydrochloric Acid	2 lb.
Sodium Sulphate	2 lb.
Pyridine	3 lb.
Ammonium Persulphate	4 lb.
Potassium Perchlorate	6 lb.
Water	78 lb.

CHAPTER TEN

LUBRICANTS, OILS, FATS

Lubricant and Sealer

German Patent 657,795

a. Castor Oil	50 g.
Collodion Solution (4%)	195 g.
b. Flake Graphite	14 g.
Talcum	15 g.

a. Mixed together. *b.* Stir in thoroughly. A paste of fine honeycomb-like structure results, containing channels filled with oil.

Cogwheel Lubricant

Ceresin	5 lb. each
Talc	
Boiled Linseed Oil	
Blown Rape Oil	
Woolfat, Crude	40 lb.
Graphite	40 lb.

Collector Lubricant (for Electric Motors)

Paraffin Wax (56/58° C.)	19 kg.
Tallow, Neutral	14 kg.
Woolfat, Neutral	40 kg.
Graphite, Flocks, Finest	31 kg.

Put only a thin layer of the mixture on the collectors, after removing the brushes and using a dry woolen rag.

Motor Cylinder Lubricant

French Patent 838,901

Olive Oil	10.0 kg.
Castor Oil	1.0 kg.
Mineral Oil	0.5 kg.
Benzene	0.5 l.
Ozokerite	2.0 kg.
Mica (Powdered)	0.2 kg.
Acetone	0.2 kg.

Rubber Shackle Lubricant

A simple mixture of two parts alcohol to one part of glycerin is a recommended lubricant. The alcohol evaporates after the solution is applied by the usual oil-can method, leaving the glycerin which acts as the anti-friction agent.

Aluminum Drawing Lubricant

1. Diglycol Stearate	10 oz.
2. Paraffin Wax (145° F.)	60 oz.
3. Water, Boiling	400 oz.

Melt *1* and *2* and to it add *3* slowly with vigorous mixing.

Wire Rope Lubricant

U. S. Patent 2,129,422

An amber colored lubricant for metallic cables permitting easy inspection of the same comprises a quick setting adhesive mixture including petroleum oil of a viscosity of the order of 160 seconds Saybolt at 210° F. in the proportion of at least 87% together with stearic acid soap, rosin and rubber cement in the respective ratio of 7:4:2, this composition being fluid at a temperature of the order of 240° F.

Sulphurized Lubricant

U. S. Patent 2,160,577

A lubricant consists of the following ingredients in substantially the following proportions by weight, namely, 200 parts of white lead, 50 parts of an ingredient selected from the group consisting of elemental sulphur, sulphurized lard oil, sulphurized fish oil, sulphurized corn oil and sulphurized cottonseed oil, 51 parts of an oil selected from the group which consists of mineral oil, rapeseed oil, cottonseed oil, corn oil, lard oil, sperm oil and whale oil, and 9 parts of an ingredient selected from the group consisting of hexachlorethane, chlorinated naphthalene, chlorinated diphenyl, chlorinated petroleum compounds and tri-cresyl phosphate.

Dry Brittle Lubricant

U. S. Patent 2,089,506

Petroleum Jelly	18
Mineral Oil	18
Mica, Flaked	5
Paraffin Wax	59

Extreme Pressure Lubricant

British Patent 496,717

Mineral Oil (Redwood Viscosity 40 sec. 200° F.)	100 lb.

Dichloroethylether	1 lb.
Water	1 lb.

Oilless Lubricant

British Patent 513,325

Glycerin	100 lb.
Sodium Linoleate	100 lb.
Glue	1 lb.
Graphite	10 lb.

Oil-Drilling Machinery Lubricants

For Threads	
Suet	6 lb.
Caustic Soda	1 lb.
Graphite	50 lb.
Machine Oil	43 lb.
For Pulleys	
Suet	20 lb.
Talcum	3 lb.
Caustic Soda	2 lb.
Spindle Oil	75 lb.
For Ropes and Chains	
Suet	12 lb.
Caustic Soda	1½ lb.
Graphite	5 lb.
Cylinder Oil	81½ lb.

Low Pour Point Lubricating Oil

U. S. Patent 2,076,153

5% of the following mixture is added:

Diethylene Glycol	2–15%
Castor Oil Fatty Acids	15%
Aluminum Stearate	70%

Soluble Oil

Formula No. 1

Aerosol OT	2 oz.
Diglycol Laurate	28 oz.
Mineral Oil (Carnation, White)	170 oz.

No. 2

Naphthenic Acid	14 lb.
Oleic Acid	11 lb.
Spindle Oil or Refined Gas Oil	50 lb.
Caustic Soda (24° Bé.) About	12.5 lb.
Alcohol, Denatured	12.5 lb.

Water-Soluble Oils

Formula No. 1

Machine Oil	70 lb.
Naphthenic Acid	20 lb.
Caustic Soda (d. 1.30)	6 lb.
Glycerol	4 lb.

No. 2

Naphthenic Acid	20 lb.
Caustic Potash (d. 1.45)	18 lb.
Water	12 lb.
Machine Oil	50 lb.

No. 3

Naphthenic Acid	20 lb.
Caustic Soda (d. 130)	10 lb.
Machine Oil	40 lb.
Water	30 lb.

Emulsified Cylinder Oil

Cylinder Oil	50 kg.
Water	50 kg.
Quick Lime	0.015–0.02 kg.

Use saturated or superheated steam for emulsifying.

Steel Quenching Oil

Mineral Oil	85 lb.
Birch Tar	15 lb.

This is best used at a temperature of 100° C.

Cutting and Cooling Oil

U. S. Patent 2,165,436

Mineral Oil	50–60%
Sulphurized Lard Oil	1–20%
Diethylene Glycol	½– 3%
Water	½– 3%
Mahogany Soaps	1–30%
Rosin	½–10%
Caustic Soda	⅗ %

Cutting Oils

U. S. Patent 2,162,454

Formula No. 1

Five gallons of commercial mixed coconut oil fatty acids, three and one-half gallons of a light paraffin oil are mixed together thoroughly at room temperature or slightly above and then seventy fluid ounces of commercial aqua ammonia (28% NH_3) are gradually stirred into said mixture. The ammonium soaps of the mixed coconut oil fatty acids form when the aqua ammonia is introduced and, after all of it has been stirred in, stirring may be continued for a few minutes and the product is then ready for use as a cutting oil base, the exact manner of use being described hereinbelow.

No. 2

One hundred and eighty-three (183) parts of commercial ammonium laurate in paste form are dissolved in three hundred and sixty-six (366) parts of a mineral oil and one hundred and eighty-three (183) parts of pine oil, all parts being by weight, and the mixture is warmed slightly until the ammonium laurate dissolves. Approximately one and one-half (1½) pounds of the resulting base are incorporated into fifteen gallons of a sulphurized cutting oil to produce a finished cutting oil ready for use.

No. 3

Two hundred (200) parts of a mineral oil are mixed with one hundred (100) parts each of mixed coconut oil fatty acids and pine oil and warmed slightly to aid in effecting solution of the fatty acids. Fifteen (15) parts of aqua ammonia (24.3% NH_3) are then stirred into the oleaginous mixture until a homogeneous mass results. All parts, as above described, are by weight. The resulting cutting oil base is then dispersed in lard in amounts of 2% to 4%, by weight, of the completed product.

Dubbing Oil

Neatsfoot Oil	50
Tallow	20
Cod Oil	30

Sulphonated Whale Oil

Sulphonated whale oil is prepared by treating 1000 kg. of oil with 250 kg. of concentrated sulphuric acid, 66° Bé. The acid is added so slowly that this amount requires 10–12 hours. The mixture is stirred throughout this time and the temperature kept at about 20° C. In no circumstances should it be allowed to exceed 25° C. Since there is a strong tendency for the temperature to rise, cooling must be carried out with cold water.

After all the acid has been added, the material is allowed to stand overnight. Next morning the temperature is tested; if it is below 20° C., the batch is warmed with stirring to 25°–30° C. and 600–700 kg. of soft water warmed to 30°–40° C. are stirred in immediately. The mass is allowed to stand for two days and the acid water drawn off. The sulphonated oil is neutralized with a mixture of 35 kg. of ammonia, sp. gr. 0.91, and an equal amount of denatured alcohol. The mass is stirred slowly until it becomes clear. About 1,250 kg. of sulphonated whale oil are obtained with a fat content of about 78.5 per cent.

Technical Olive Oil Substitute

Mineral Oil, White	85–88
Diglycol Laurate	15–12

This is useful as a lubricant for spun rayon, worsteds and mercerized cotton.

Dehydrated Castor Oil
(Paint Vehicle)
Formula No. 1

In the production of synthetic drying oils from castor oil by dehydration it has been found that sulphuric acid is a particularly active catalyst. Only about 1 part of acid to 200 parts of oil is needed, and the dehydration can be effected in 30 to 40 minutes at 300–320° F., with a final temperature rise to 535° F. The entire process of converting castor oil to a drying oil takes only about 6 hours. Overheating must be avoided; if the temperature rises above about 535° F. the yield becomes less, the color of the product darkens and its quality as a drying oil is impaired.

No. 2

Heat castor oil, free from fatty acid, with 1–2% ascanite at 220–230° C. for 1 hour. This oil dries more rapidly than linseed oil.

Rifle Cleaner Oil

Mineral Oil	85 lb.
Triethanolamine Oleate	8 lb.
Triethanolamine	1 lb.
Amyl Alcohol	6 lb.

Brick Press Oil
British Patent 514,328

Mineral Oil	98.00
Sulphonated Mineral Oil	1.50
Ammonia	0.05
Water	0.45

Dewaxing Mineral Oil
U. S. Patent 2,132,355

The oil is mixed with following solvent and chilled to 15° F. or lower, then filtered.

Isopropyl Ether	40–50%
Methyl Ethyl Ketone	20–35%
Dioxane	20–35%

Crude Mineral Oil De-Emulsifier
U. S. Patent 2,175,699

Glyceryl Monoricinoleate	2 oz.–2 lb.
Kerosene	1 gal.

The amount of this reagent varies with the nature of the oil being treated and the time allowed for separation of water. In some cases heating may be desirable to hasten separation.

Oil Decolorizer
U. S. Patent 2,076,545

Slaked Lime	20 lb.
Silica	30 lb.
Magnesium Chloride	40 lb.
Water	250 lb.

Heat for 2 hours in an autoclave at 227° C.

Palm Oil Bleaching

Bleaching with bichromate, as of palm oil, is carried out as follows: The oil is first melted, then cooled to about 50° C. and put into a lead container. For 1,000 kg. of oil, about 12 kg. of sodium or potassium bichromate are dissolved in a little warm water. This solution is added to the oil with stirring, then 50 kg. of concentrated hydrochloric acid added. The mixture is stirred for about a half hour. After this operation the oil has a dirty green color. Stirring is discontinued and 25 per cent of boiling water is sprayed onto the oil and the mixture allowed to settle. After about 2 hours the oil is ready for other treatment as desired. If it should still be green it can be transferred to another vessel and treated again with 10 per cent of fresh water and 0.1 per cent of hydrochloric acid. The mixture is boiled for 10 minutes and allowed to settle.

Grease Base

(Insoluble in water and in alcohol, but soluble in ether, chloroform and oils)

a. Machine Oil, Pale	26 kg.
Cylinder Oil, Dark	5 kg.
b. Yellow Soft Soap (50% fatty acid)	8 kg.

Heat *a* to 280° C. (not higher, to avoid fire hazards). Add *b* in very small portions, waiting each time until the foaming subsides (4 minutes). Pour hot after 2 hours standing.

Work outdoors, or under a hood.

Grease (Drop Point 70° C.)

Caustic Soda, Technical (38° Bé.)	3 kg.
Montan Wax, Crude	15 kg.
Mineral Oil, Dark	82 kg.

Lubricating Grease

British Patent 507,980

Formula No. 1

A lubricating grease comprises mineral oil and 10 to 40 per cent of a mixture of sodium and barium soaps. The mixture of soaps is from 10 to 1 parts of sodium soap to 1 part of barium soap. The soaps are preferably soaps of saturated fatty acids such as stearates. In an example, 425 parts by weight of stearic acid and 500 parts by weight of a mineral lubricating oil of viscosity 200 seconds Saybolt at 100° F. are thoroughly mixed in a grease kettle at 140–150° F. When the acid is completely melted and dissolved, 25 parts by weight of barium hydroxide in approximately saturated aqueous solution are stirred in. The temperature is then raised to about 360° F. while 62 parts by weight of sodium hydroxide (30 per cent aqueous solution) are stirred in. When saponification is complete and water substantially completely eliminated, the product is cooled to about 200° F. and is worked at that temperature for two or three hours. The grease has the following composition: 2.75 per cent of barium stearate, 21.25 per cent of sodium stearate and 76 per cent of mineral oil. Specification 469,889 is referred to.

No. 2

Light Colored

Lime Hydrate, Powdered	5 kg.
Oleic Acid	10 kg.
Montan Wax, Doubly Bleached, St.	25 kg.
Spindle Oil, Pale	80 kg.

No. 3

Dark

Rapeseed Oil or Deodorized Train Oil	5 kg.
Caustic Soda, 10%, Technical	10 kg.
Crude Montan Wax	25 kg.
Mineral Oil (sp. gr. 0.910)	260 kg.

No. 4

British Patent 496,331

Steam Refined Cylinder Oil	51.5 lb.
Heat to 160° F. and add	
Cotton Seed Oil Pitch (M. P. 86° F.)	3.0 lb.
Stir well and add	
Tallow Fatty Acids	29.9 lb.
Prime Tallow	20.0 lb.
Mix and add	
Caustic Soda (40° Bé.)	6.75 lb. (dry NaOH)

Raise temperature gradually from 160–225° F. and then rapidly to 500° F. Maintain this temperature for 30–60 minutes and withdraw from bottom into molds.

Carriage Lubricating Grease

a. Rosin Oil	17 kg.
Gas Oil	30 kg.
b. Lime Hydrate	6 kg.
Oil Soluble Blue	1 kg.
Barium Sulphate	20 kg.
Gas Oil	26 kg.

Mix *a* together and add the well mixed suspension *b*. Stir thoroughly.

Wire Rope Grease

Woolfat, Crude	60 lb.
Graphite	40 lb.

This is thinned to the desired consistency with tallow or linseed oil, according to the season.

Friction Grease

Tallow	2 lb.
Ochre	3 lb.
Mineral Oil	4 lb.
Natural Woolfat	10 lb.
Rosin	10 lb.

Rope Grease

Rosin, Dark	10 lb.
Soft Soap, Yellow	24 lb.
Neutral Woolfat	25 lb.
Linseed Oil, Raw	30 lb.

Water Wheel Grease

Woolfat, Crude	10 lb.
Rosin	10 lb.
Viscous Machine Oil	80 lb.

Belt Adhesion Grease

Cumarone Resin	35–40 kg.
Montan Wax, Bleached, Nova	5–10 kg.
Train Oil	55 kg.

Protective Grease for Airplane Engines

Used on inside and outside engine surfaces.

Formula No. 1

Butanol	10
Aluminum Stearate	10
Triethanolamine	6½
Lard	73½

No. 2

Lubricating Oil	98
Triethanolamine Oleate	1½
Triethanolamine	½

Axle Grease

Petroleum Acid Sludge	30 lb.
Topped Crude Oil	30 lb.
Calcium Hydroxide	15 lb.
Water	25 lb.

Anti-Rust Grease for Tools

Lanolin	50 g.
Petrolatum	50 g.
Mineral Spirits	5 g.

Mix until uniform.

Leather Grease

Scale Wax (50/52° C.)	8 lb.
Montan Wax, Bleached	7 lb.
Woolfat	10 lb.
Train Oil, Pale	50 lb.
Spindle Oil, Distilled	25 lb.
Oil Soluble Dye	1–2 lb.

Horse Hoof Grease

Formula No. 1

Paraffin Wax	10 lb.
Woolfat	30 lb.
Spindle Oil	20 lb.
Cresylic Acid Emulsion	1 lb.

No. 2

Hog Fat	40 lb.
Cod Liver Oil	20 lb.
Beef Tallow	15 lb.
Woolfat	5 lb.
Bone or Charcoal	5 lb.
Potash Soap	5 lb.
Water	10 lb.

No. 3

Train Oil	10 kg.
Woolfat, Crude	15 kg.
Montan Wax, Crude	20 kg.
Mineral Oil, Dark	50–55 kg.
Preservative	0.2–0.5 kg.
Nigrosin, Oil Soluble	1 kg.

Horse Hoof Healing Grease

Ceresin (58/60° C.)	15 lb.
Cresylic Acid Emulsion	10 lb.
Spindle Oil, Refined	75 lb.

Improved Stopcock Grease

Ordinary stopcock grease may be greatly improved by melting and adding a little finely powdered graphite with stirring. The graphite makes for better lubrication and longer service. It also insures against the "freezing" of stopcocks, for after the grease film is so thin as to no longer provide lubrication, the graphite remains to allow slippage of the glass surfaces.

Preventing Discoloration of Higher Fatty Acids

U. S. Patent 2,162,542

Add about 0.005–0.01% oxalic acid to fatty acids like linseed fatty acids to prevent discoloration.

CHAPTER ELEVEN

MATERIALS OF CONSTRUCTION

Safety Glass

Formula No. 1

French Patent 826,548

Sheets of glass are cemented with

Cellulose Acetate	58.0 g.
Triphenyl Phosphate	8.4 g.
Methyl Phthalate	12.6 g.
Triacetin	21.0 g.

No. 2

U. S. Patent 2,103,883

Two sheets of glass are laminated with following:

Cellulose Acetate	100
Dimethyl Phthalate	46
Carbitol Acetate	30

Quartz Glass, Synthetic

U. S. Patent 2,077,481

A glass transmitting light like quartz and stable to irradiation is made by fusing the following at 1300° C. in a quartz crucible.

Potassium Carbonate	13.77 g.
Potassium Nitrate	6.71 g.
Calcium Carbonate	8.93 g.
Barium Carbonate	3.22 g.
Magnesium Carbonate	18.53 g.
Boric Acid	31.04 g.
Alumina	28.80 g.
Diammonium Phosphate	48.70 g.

Inside Frosted Bulbs

Formula No. 1

U. S. Patent 2,137,683

Subject the interior surface of a glass bulb to an etching solution including in approximately the following proportions, by weight, water 9.3%, ammonium bifluoride 23.4%, a 60% solution of hydrofluoric acid 46.8%, ammonium bicarbonate 14.6%, and soda ash 5.9%, for less than two minutes at a temperature of about 47° C.

No. 2

U. S. Patent 2,122,512

Interior of bulb is given 3 treatments of about 2 sec. each with

Ammonium Bifluoride	**33 lb. 3 oz.**
Hydrofluoric Acid (60%)	10 l.
Sodium Bisulphite	11 lb. 10 oz.
Sodium Fluoride	11 lb. 1 oz.
Molasses	12 l.
Water	6 l.

while flowing water at 63° C. on outside. Wash out etching solution with water under pressure.

Ultra Violet Transmitting Glass

British Patent 498,177

Silica	60–75%
Beryllium Oxide	0–5 %
Sodium and Potassium Oxides	3–25%
Calcium Oxide	3–25%
Nickel	0.02–0.4%

Opalescent Fluorescent Glass Batch

British Patent 492,960

Silica	100 lb.
Dolomite	10 lb.
Potassium Carbonate	25 lb.
Sodium Carbonate	5 lb.
Borax	5 lb.
Boric Acid	11½ lb.
Stannous Chloride	6 lb.
Lithium Carbonate	2 lb.
Magnesium Phosphate	1½ lb.
Cryolite	6 lb.

Fluorescent Glass

British Patent 492,960

Silica	100 lb.
Magnesium Carbonate	10 lb.
Calcium Carbonate	10 lb.
Potassium Carbonate	25 lb.
Borax	5 lb.
Soda Ash	5 lb.
Boric Acid	11½ lb.
Lithium Carbonate	2 lb.
Magnesium Phosphate	1½ lb.
Aluminum Fluoride	3 lb.
Sodium Fluoride	3 lb.
Stannic Chloride	6 lb.

The fluorescent effect is enhanced by repeated heating and cooling of the glass.

Ruby Glass Batch

British Patent 522,634

The following gives a uniform color in open pots without careful control of the atmosphere:

Sand	110.00
Potassium Carbonate	10.00
Soda Ash	40.00
Calcium Oxide	13.00
Alumina	35.00
Cuprous Oxide	0.25
Stannous Oxide	0.32
Sodium Cyanide	1.25

Cutting Fine Glass Tubes

To cut very slender, thin-walled glass tubes, use the freshly broken edge of a coarse single crystal of carborundum. The blue-black, lustrous crystals, just as taken from the manufacturer's furnace, and often exhibited by the manufacturer in advertising, are used.

Ceramic Insulation

British Patent 478,794

Soapstone	85 lb.
Spinel	4 lb.
Clay	6 lb.
Barium Oxide	4 lb.
Calcium Carbonate	1 lb.

Electrical Insulation and Refractory

British Patent 500,057

Bauxite	20 lb.
Kaolin	10 lb.
Quartz (0.15 m.m.)	70 g.
Make into a paste with	
Phosphoric Acid (d. 1.7)	30 cc.

Apply to windings and dry at 100° C.

Porcelain Insulator Putty

Magnesia	28 oz.
Magnesium Chloride (d 1.20)	44 oz.
Porcelain, Powdered (900 Mesh)	28 oz.

Use within 2 hours as it hardens in 2–3 hours. When dry varnish surface.

Insulating Refractory

Good for patchwork or handmade insulating refractory.

	By Volume
Insulating Brick Grog ¾″ to fines	80%
Lumnite Cement	20%

Mix with water and work into form with a trowel.

Insulating Material

	By Weight
Lumnite Cement	75%
Expanded Mica Granules	25%

Work up with water and trowel in place.

Non-Hygroscopic Insulation

British Patent 492,420

Fibrous material is impregnated with

Oxidized Abietic Acid	100 oz.
Acetone	75 oz.
Mixed with	
Cellulose Acetate	100 oz.
Acetone	400 oz.

Electrical Resistors and Electrodes

British Patent 513,265

For Extrusion	
Flour	13
Lampblack	62
Water	25
For Rolling Into Sheets	
Flour	27
Carbon	45
Casein Glue (15%)	28

Cover with powdered silicon and heat at 1,800–2,500° C.

Electric Insulation

U. S. Patent 2,204,288

A felted coherent insulation is formed containing mixed intertangled fibers as follows:

Spun Glass	50
Asbestos Fibers	25
Cotton	15
Silk	10

High Dielectric Ceramic Insulation

U. S. Patent 2,069,903

Titanium Dioxide	70
Zirconium Dioxide	20
Clay	5
Magnesium Carbonate	2

Fire at 1,350–1,600° F.

Insulating Binder for Mica

U. S. Patent 2,210,704

Ethyl Cellulose	5–20%
Chlorinated Diphenyl	1–10%
Shellac	to make 100%

Refractory Resistant to Oxidation

British Patent 492,215

Graphite	43 lb.
Silicon Carbide	20 lb.
Dextrin	2.52 lb.

As a bond for above use 33 lb. of following mix

Copper Oxide	6.1 lb.
Silica	14.2 lb.

Felspar	10.6 lb.
Calcium Carbonate	2.5 lb.
Plastic Clay	66.6 lb.

High Temperature Furnace Cements

Formula No. 1

Grog	80
Fire Clay	18
Dextrin	2

No. 2

Grog (0.5–2 m.m.)	77
Fire Clay	18
Sugar Syrup	5

No. 3

Grog (Fragments)	67
Fire Clay	17
Coke Dust	16

No. 4

Sand	65
Graphite	26
Soda Ash	1
Sodium Silicate	8

No. 5

Fire Clay	31
Sand	66
Sulphite Liquor	3

Porcelain and Glass Cement

Powdered Litharge	180 gr.
Fine White Sand	180 gr.
Plaster of Paris	180 gr.
Powdered Rosin	60 gr.

Enough linseed oil (with a little drier added) should be used to mix the ingredients into a paste, which is allowed to stand for about 4 hours. The broken edges, quite clean and free from grease, are given a thin coating of the cement and the parts bound tightly together with adhesive tape. The claim is made that objects so repaired will break in a new place before the cemented portions will separate.

It would also be well to paint the cemented joint after drying with melted beeswax or paraffin.

Refractory Molding Composition

U. S. Patent 2,218,623

Sand (Finely Ground)	100
Lime, Hydrated	20
Water	24
Rosin	½

Ceramic Patching Cement

U. S. Patent 2,102,237

Grog	70
Clay, Hard	20
Clay, Plastic	10
Sodium Aluminate	1

Refractory Patching Material

	By Weight
Ground Clay	60%
Gainster	15%
Grog ¼" and Fines	25%

Mix with water and trowel in place.

Refractory Panel Board

U. S. Patent 2,195,881

Portland Cement	300 g.
Diatomaceous Earth	700 g.
Magnesium Hydrate	200 g.
Bentonite	150 g.
Asbestos Fibers	250–300 g.

This gives a board of low specific gravity with high resistance to crazing, spalling and disintegration up to 2000° F.

Porcelain Glaze

Fire at Cones 12 to 14

Beryl	36.6
Whiting	15.3
Clay	11.3
Flint	36.8

Tint with small percentages of chrome oxide or chrome stains.

Conversion of Bright to Matte Glaze

To convert a bright glaze to a high fire matte type glaze add 5 to 10% Magnesium Silicate or Zircopax.

Colors on Glazes for Decorative Ceramics

Decorative ceramic ware in Czechoslovakia is usually made from potter's clays and limy loams with additions of chalk or lime marl. The stannic glazing used is fired at 800–1000°. The following colors are generally used: yellow, potassium acid antimonate and zinc oxide; coral red, 30 parts of lead monoxide plus 10 of silicon dioxide (to 100 parts of the flux are added about 60 parts of the chromium red); blue, cobalt oxide and zinc oxide fused at 1000°; green, copper oxide fused in a lead flux or chromium oxide in a lead-borax flux; turquoise, chromium and cobalt oxides (only about 1 to 1.5% of this compound is added to the flux); and brown, 3 parts of manganese dioxide plus 2 parts of zinc sulphate.

Steel Mill Chill Mold Glaze

Formula No. 1

Quartz Sand	65 lb.
Clay	10 lb.
Foundry Graphite	25 lb.

No. 2

Quartz Sand	70 lb.

Refractory Clay	30 lb.

Dry well and paint on molds using sulphite liquor as a vehicle.

Glazing Frit

British Patent 494,060

Lead Oxide	73.0 lb.
Silica	23.5 lb.
Titanium Dioxide	3.5 lb.

Fuse together for frit.

Lead-Free Ceramic Glaze

French Patent 830,994

Formula No. 1

Zinc Oxide	37.00 kg.
Borax	55.73 kg.
Boric Acid	6.20 kg.
Calcium Carbonate	7.00 kg.
Sodium Nitrate	5.00 kg.

No. 2

Zinc Oxide	41.00 kg.
Borax	55.73 kg.
Boric Acid	6.20 kg.
Barium Carbonate	14.00 kg.
Sodium Nitrate	5.00 kg.

Low-Fire Glazes for Roofing Tiles

Formula No. 1

Bluish Green

*Frit	55
Feldspar	47
Quartz	10
Cupric Oxide	4½
*Frit Batch Consists of	
Borax	38
Feldspar	5
Soda Ash	12
Limestone	14
Kaolin	4
Quartz	27

No. 2

Bluish Green

Borax	50–40
Soda Ash	10
Feldspar	20
Quartz	15
Limestone	5
Copper Oxide	3–4

Floor Tiles

British Patent 517,137

Magnesite (Ground Calcined)	79
Wood Flour	21
Magnesium Chloride Solution (d 1.17)	70
Acetic Acid (20%)	2

Mix together to a uniform dough and tamp into molds. Press and dry.

Roofing Granules, Non-Efflorescing

U. S. Patent 2,081,609

Method of preventing efflorescence on the surface of colored roofing granules.

To each ton of granules used, the following formulas have been found to give satisfactory results for granules having a slate and a quartz base:

Formula No. 1

For a Slate Base

Frit	40 lb.
Pigment	18 lb.
Sodium Silicate	10 lb.
Barium Carbonate	15 lb.

No. 2

For a Quartz Base

Borax	20 lb.
Whiting	9 lb.
Barium Carbonate	5 lb.
Sodium Nitrate	5 lb.
Soda Ash	6 lb.
China Clay	1 lb.
Pigment	14 lb.

With reference to Formula No. 1, varying amounts of frit and frits of different composition may be used. The same may be used on granules of different material. The frits used have been of low fusing point, and have either been of the lead base type or high soda type, carrying some amounts of cryolite or fluospar as additional fluxing agents.

Plastic Roofing Material

U. S. Patent 2,072,686

Formula No. 1

Wood Chips	175 lb.
Water	100 lb.
Lime	3½ lb.
Asphalt, Oxidized (m.p. 220–235°)	175 lb.

No. 2

Shredded Waste Paper	220 lb.
Water	110 lb.
Rosin	15 lb.
Lime	5 lb.
Asphalt, Oxidized (m.p. 100°)	220 lb.

Mothproofing Building Board

U. S. Patent 1,884,367

Coal tar creosote incorporated in fiber building board renders it rotproof, waterproof and termite proof. A pulp composition suggested is

Fiber	1,000 lb.
Resin Size (Bone Dry Basis)	20 lb.
Creosote	50 lb.
Water	about 50,000 lb.

This is mixed and pressed out into boards which are especially desirable as a lining for mothproof closets.

Plaster Mothproof

U. S. Patent 1,620,587

A plaster composition repellent to moths or domestidae has the following composition:

Aromatic Cedar Dust	64	lb.
Gypsum Hard Wall Plaster	33	lb.
Pure Red Oxide (Or Other Coloring Matter)	2	lb.
Creosote of Wood Tar	0.90	lb.
Cedar-Leaf Oil	0.10	lb.

Synthetic Building Board

British Patent 487,101

Cork, Sawdust or Peat, Powdered	50	qt.
Latex, Concentrated	10	qt.
Cement	30	qt.
Water	10	qt.

Stir until uniform and put in molds.

Cement Asbestos Board

British Patent 497,136

Cement	25–40%
Asbestos	50–65%
Magnesia	2–10%
Bentonite	2–10%

Waterproofing for Cement and Stucco

U. S. Patent 2,167,300

Soap	5	lb.
Varnish	2½	lb.
Naphtha	7½	lb.
Alcohol	15	lb.
Water	70	lb.

Dissolve soap in water and add slowly with vigorous mechanical mixing to mixture of remaining materials.

Waterproofing for Cement Floors

U. S. Patent 2,148,113

Coal Tar	76	lb.
Rosin	10	lb.
Carnauba Wax	1	lb.
Pine Tar Oil	1	lb.
Solvent Naphtha	4	lb.
Asbestos Fiber	8	lb.

Warm together and mir until uniform. Apply hot.

Plaster Wall Hole Plug

British Patent 492,885

Plaster of Paris	95	oz.
Glycerin	5	oz.

Moisten with water, before using. It sets to a dense structure of sufficient plasticity to hold nails, screws, etc.

Mason's Mortar Cement

U. S. Patent 2,164,871

Ground Portland Cement Klinker	47%
Gypsum	3%
Precipitated Calcium Carbonate	30–47%
Clay	20–30%

Artificial Wood or Stone

French Patent 823,444

Paper Pulp	67	kg.
Casein	10	kg.
Potassium Silicate, Syrupy	10	kg.
Sodium Silicate, Syrupy	5	kg.
Calcium Carbonate	2	kg.
Rosin	2	kg.
Kaolin	2	kg.
Magnesium Oxide	2	kg.

Mix well in a kneading machine with a minimum amount of water.

Artificial Stone

British Patent 497,125

Kieselguhr	140	lb.
Slaked Lime	75	lb.
Asbestos	10	lb.

Mix the above with following emulsion

Rosin	10	lb.
Caustic Soda	4	lb.
Ammonia	5	lb.
Water	500	lb.

Mix above together well and add

Water	1300	lb.

Mold and harden with steam.

Preserving Adobe Structures

U. S. Patent 2,137,247

The method of preserving objects made of adobe and like granular porous materials consists in impregnating at least the surface thereof, without the production of a glossy surface, with a clear colorless liquid consisting of a solution of a vinyl acetate resin in acetone and toluene in the ratio of approximately 10 grams of vinyl resin to 55–60 cc. of acetone per percent of solution desired, the solution being made up to approximately 1000 cc. with toluene.

Sand Faced Brick

British Patent 499,527

Apply following to one or two faces of brick before burning:

Clay	13	cu. ft.
Sand	54	cu. ft.
Water	33	cu. ft.

Bricklaying Bitumen Emulsion

British Patent, 489,373

Bitumen	50	lb.
Water	48.48	lb.
Gum Arabic	0.50	lb.
Chalk	1.02	lb.

Melt the bitumen at 100° C. and after boiling other ingredients together add in a thin stream while stirring vigorously.

Repairing Concrete Floors

Unless there is considerable vibration on the floor, waterproof it by first cutting out the crack into a V-shaped groove to a depth of at least 2 inches. Sweep water over the newly cut concrete, removing all loose particles of cement and sand. Prepare a stiff and waterproof mortar by mixing together 1 part portland cement and 2 parts clean, sharp sand, and wet down with a solution of 1 part liquid waterproofing and 8 parts water. Immediately before filling the grooves with this new mortar, brush over the clean, damp surfaces a slush or bonding coat made by stirring into a solution of 1 part liquid waterproofing and 3 parts water enough portland cement to form a thick, creamy cold water paint. While this cement wash is still damp, apply the new mortar and trowel it to a smooth finish.

In a similar way the ruts and holes in a concrete floor can be cut out to a depth of 1.5 inches below the finished floor and new patches applied, which will adhere to the underlying concrete, be waterproof, hard, and dustproof. Patches of this type harden overnight so that the repairs can be made on Saturday afternoon and Sunday or during a similar shutdown.

Removing Mortar from Bricks

Thick deposits of mortar can usually be removed with a wire brush. Mortar that is embedded in the rough brick surface can be removed with a solution of muriatic (hydrochloric) acid—about 20 parts water to 1 part acid. Partly fill an enamelled pail with water, and slowly pour the acid into the water. Wear rubber gloves when handling the acid and when applying the solution to the brick, to protect your skin. The strength of the solution needed to dissolve the mortar spots can, of course, be altered by adding more or less acid to the solution.

Using a fibre (not bristle) brush, apply the acid solution to the mortar spots, allow it to act for a few minutes, then rinse the areas with clear water flushed on with a garden hose.

Keep three things in mind on jobs like this: (1) Use rubber gloves and extra care in handling acids; (2) always add the acid to the water, never pour water in the acid; (3) don't allow the acid solution to remain so long on the brick that it eats into the mortar courses in which the bricks are laid.

Colored Slag Cement

Slag	85 lb.
Clinker	15 lb.
Gypsum	10 lb.

Color with any of the following using amount given for each:

Ochre	15 lb.
or Bauxite	15 lb.
or Minium	10 lb.
or Chromium Trioxide	10 lb.
or Ultramarine	10 lb.

Petroleum Well Crevice Cement

Pumice, Powdered	10–20%
Cement	90–80%

Porcelain Flowers

To make ceramic flowers, work up ordinary clay slip with honey and a very small amount of salicylic acid.

Porcelain Cloth or Ribbon

To make thin ribbon or cloth effect on porcelain articles, take ordinary porcelain body, wet and work in a little sodium alginate solution. Knead properly and press out into ribbon form.

Improving Kaolin Suspension

Add 1% aqueous sodium silicate solution (d. 1.35–1.39) to kaolin suspension to keep finest particles in suspension and to get improved separation.

Dental Imbedding Mass

U. S. Patent 2,054,894

Calcium Sulphate (½H_2O)	30 g.
Fine Quartz Sand	60 g.
Oxalic Acid	⅕ g.
Citric Acid	⅕ g.

This gives a mold of high thermal expansion and hardness.

Wood Preservative

Formula No. 1

Ascu (Patented)

White Arsenic Oxide	1 lb.
Copper Sulphate	3 lb.
Potassium Dichromate	4 lb.

Soak or pressure treat wood with 4–8% solution of above. Generally

¼–½ lb. of above per cu. ft. of wood is recommended.

No. 2

U. S. Patent 2,152,160

Sodium Fluosilicate	0.8 lb.
Zinc Chloride	0.8 lb.
Water	98.4 lb.

No. 3

Coat top and bottom (above and below ground) with

Sodium Fluoride	90 lb.
Dinitrophenol	17 lb.
Starch	8 lb.
Water	To Make Paste

No. 4

Ammonia (sp.g. 0.880)	1 kg.
Hard Soap	1 kg.
Montan Wax, Doubly Bleached, A	5 kg.
Paraffin Wax, Hard	5 kg.
Alcohol	20 kg.
Water	68 kg.

Dyeing Wood

British Patent 482,407

Soak wood in paraffin oil for 1–2 minutes. Paint or draw on it with a water dye solution containing 15 g. caustic potash per liter.

Filler for Gum Wood

To 3 qt. of benzine add 1 qt. of linseed oil and 3 lb. of filler tinted to match the stain.

Ground Wood Flooring

British Patent 521,404

Finely ground waste wood (1 l.) is impregnated with paraffin wax (100–200 g.) and then kneaded with 50% casein solution (300 cc.) before application. An optional addition is kaolin (100–200 g.) and rubber latex (600 cc.)

Chapter Twelve

METALS AND METAL TREATMENT

Aluminum Finishes

Aluminum in its natural form has a pleasing appearance, but the metal surface may be improved for some applications by such mechanical processes as polishing, buffing, hammering, sandblasting, satin finishing or burnishing. These finishes may serve the purpose of blending the metal into an appropriate decorative scheme, or may simply form the foundation for other decorative or protective finishes.

As in the case of most processes, the quality of the finish will depend largely on the skill of the operator. However, the shape of the metal article and the nature of the alloy will also be determining factors. Hence, the actual plant practices prescribed here may have to be modified somewhat to accommodate any particular alloy or shape.

In order to avoid ambiguity the various operations of mechanical surface finishing are classified and defined according to the system used in general by the trade.

1. Grinding: Operations involving the use of a bonded abrasive wheel.

2. Polishing: Those operations involving the use of "set-up" wheels, belts, or discs. Abrasive is attached to the periphery of the wheel or to the surface of the belt or disc, by means of glue. The polishing operations are further subdivided as follows:

Roughing: Coarse abrasives (60–100 mesh). No lubricant used.

Greasing or Oiling: Finer abrasives (120–400 mesh). Lubricant is used. The greasing operations are sometimes further divided and known as greasing, grease fining, grease finish and grease coloring, depending upon fineness of abrasive.

3. Buffing: The expression "cutting down" is sometimes used. In this procedure abrasive is applied to a sewed muslin wheel from a cake compounded of tripoli and other abrasives with a binder which supplies the lubricant.

4. Coloring: Sometimes termed "color buffing." This procedure differs from the above in that unstitched muslin wheels are used, and the abrasive is finer.

By means of these mechanical finishes, the surface is freed from irregularities or scratches produced during casting or fabrication and, if desired, is brought to a high luster.

The mechanical equipment, both hand and automatic, for use on aluminum is of the same general type as that employed for other metals. In its selection, certain fundamentals should be observed. Equipment must be of ample capacity, and sturdily constructed to withstand heavy and continuous service. It should be set up on a solid foundation to eliminate vibration. Polishing wheels must run true and must be properly balanced. The composition and construction of these wheels and their speed are variables that are discussed later.

Grinding

Large castings, which cannot be held against an ordinary wheel, demand special methods of handling to prepare them for final finishing procedures. Portable, rotary air grinders, developing 5,400 r.p.m., and set up with cup-grinding wheels, are used for breaking down the "as-cast" surfaces. These rough grinding operations are necessary for preparing castings for sandblasting. Surface irregularities, if not removed in the initial treatment, become more prominent and more expensive to remove in later operations. For flat surfaces, and particularly for removing any appreciable amount of metal, phenolic-resin-bonded, silicon-carbide, cup-grinding wheels (6" x $2\frac{3}{16}$" x $\frac{1}{8}$") with No. 24 to No. 50 grit are satisfactory.

Rough grinding is preferably done dry but tallow or lard oil, if applied with care, may be used when necessary. In cases where oil and grease are present in excess, they can be removed by preheating the casting to a temperature of 400° F. to 600° F. for approximately one-half hour.*

Detrimental depressions in the surface of a casting, resulting from sand holes and porosity, may require welding. The welded areas can be blended into the surface of the casting by means of a cup wheel or by means of a disc sander as described under "Roughing." Welding may cause discoloration in castings that are oxide coated by the Alumilite** process. This can be minimized by heating the casting to between 900° F. and 960° F. for 1 hour to 5 hours prior to sandblasting and finishing by the Alumilite process.

Polishing

Roughing: The coarse polishing operation, known as roughing, is employed as a preliminary step in polishing very uneven or deeply scratched surfaces. Sand castings always receive this treatment. Portable equipment such as described under "Grinding," is sometimes used on large castings. Instead of a cup-grinding wheel, flexible carborundum paper discs are used. These discs are about 9 inches in diameter and vary in coarseness of abrasive, 24 mesh to 80 mesh, depending upon the nature of the work.

Die castings and fabricated articles do not necessarily require the roughing operation unless their surfaces are unusually rough or marked.

For roughing, a wheel made of pieces of muslin or canvas glued or cemented together is needed. Other materials, such as wood faced with leather, sheepskin, felt or flannel can be used. In general, the weight and grade of the material and the method of joining the pieces influence the wheel's flexibility which is important in the polishing of curved surfaces.

Regardless of material chosen for the wheel, the facing procedure is the same. A layer of glue is applied, in which No. 60 to No. 100 emery or fused aluminum oxide abrasive is embedded. Careful application of glue and abrasive will prevent many polishing troubles. Both the composition and application of the glue should be determined by up-to-date recommendations of abrasive grain suppliers and manufacturers.

The diameter of the wheel may range from 6 inches to 20 inches, and its thickness from 1½ inches to 3½ inches, depending on the area of the work to be finished. The wheel should have a peripheral speed of about 6,000 feet per minute. Slower speeds tend to tear the abrasive out of the glue while higher speeds cause excessive heating which may break down the glue. A lubricant such as tallow or a mixture of tallow and lard oil may be used on the wheel to reduce the heating. This must be done with care, however, in order to avoid driving the lubricant into the pores of castings and spotting the surface by seepage in some later finishing operation.

Greasing: This finishing treatment, sometimes known as oiling, is a refinement of the roughing procedure, and similar to it except that a lubricant is always used on the wheel. Sand castings are invariably given this greasing treatment after being roughed. Die castings are given it as the first polishing operation. Fabricated articles that have been roughed on a rag or canvas wheel require it as a preliminary operation before buffing. For the greasing process, a felt wheel, or sometimes a sheepskin wheel, faced with No. 100 to No. 220 emery is used. This is a softer wheel and a finer abrasive than is required for roughing. The felt wheel has the advantage of uniform density and contains no sewed or cemented seams. Selection of the proper grade of felt must be made since several degrees of hardness are available. For example, a soft, pliable grade is desirable for finishing irregular surfaces. Wheel speeds and dimensions are much the same as those used for roughing, and are based on similar considerations. The lubricant is important as a means of reducing the danger of burning, and may be tallow, oil, beeswax or tallow compositions. A single wheel greasing operation is generally sufficient. A higher polish may be obtained, however, by the use of a wheel faced with No. 100 emery followed by treatment with a second wheel faced with No. 220 emery.

Buffing

Buffing is the next finishing operation used on an aluminum surface when the objective is to bring out the high luster of the metal. It differs from roughing and greasing in that the abrasive is embedded in a grease binder and rubbed on instead of being glued to the face of the wheel. The

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*This method cannot be applied in the case of heat-treated castings, because of the adverse effect on their mechanical properties and dimensions.

**Patented process for producing oxide finishes.

selection and proper application of the most suitable abrasive for the work is important.

Tripoli powder is by far the most common of the buffing agents. Chemically it is high in silica and its value as an abrasive lies chiefly in its physical structure. The grains are soft and spongy, and free from sharp crystalline cutting edges. They crush down in buffing to present fresh polishing surfaces. Tripoli powder is available in several degrees of fineness. Fine-grained material is preferred in that it produces a brighter finish. Purity and uniformity of grain size are also essential to secure satisfactory work.

The abrasive powder is mixed with a grease base and molded in a cake. Cakes in which tripoli powders of various degrees of fineness are incorporated may be purchased from suppliers. The abrasive cake is pushed against the wheel as it revolves. The heat generated softens the binder and the abrasive becomes attached to the wheel. This procedure must be repeated frequently.

The wheels are run at a higher speed than that used in the earlier finishing operations in order to hold the edges of the buffing wheel close to the work. It is possible to increase the speed of the wheel because of the decrease in heating effects. Buffing wheels should have a peripheral speed of 7,000 to 7,500 feet per minute.

Difficulties Encountered in Buffing: The difficulties frequently encountered in buffing are the formation of pits, surface roughness, and buffing clouds. These difficulties may be corrected by attention to one or more of the following factors:

Hardness of buff
Buffing compound
Peripheral speed
Pressure against buff

The harder the buff the better the cutting qualities which will produce a smooth surface. However, there is greater tendency to form pits or cloudy or streaked areas. Hardness in a buff results from:

Material of high thread count.

Close spirals in stitching and short stitches.

Few or no spacers between discs, and few or no spacers between sections.

High peripheral speed.

The softest buffs, such as used in coloring, are made from material having low thread count. The only stitching is around the arbor hole—just enough to hold the sections together. As many as four spacers may be used between discs, and between sections. The spacers referred to are generally 3-inch to 4-inch discs, and may be of paper.

Where pitting and clouding difficulties exist, attention should be directed toward softening of the buff. The type of buff, in which all the cloth is exposed to the cutting surface on a bias, provides a soft buff.

The buffing compound should be selected for the particular job on the basis of test. Abrasives used in buffing compounds vary considerably in hardness and cutting properties. The grease binders are also varied, depending upon melting point desired. With decrease in the melting point of the binder there is less danger of pitting and overheating, and a decrease in luster, but the cutting quality and tendency toward cloudiness are increased. A greater amount of lubricant is needed for buffing aluminum than for harder metals.

Typical Polishing Procedures

Article	Operation	Wheel	Composition
Sheet Cooking Utensils	1. Buffing	Sewed muslin buff	Tripoli
	2. Coloring	Open muslin buff	Soft silica
Screw-Machine Products	1. Greasing	Felt or sheepskin	No. 180 or flour emery
	2. Buffing	Sewed muslin buff	Tripoli
	3. Coloring	Open muslin buff	Soft silica
Die Castings	1. Greasing*	Glued rag wheel	No. 100 emery
	2. Greasing*	Felt wheel	No. 150 emery
	3. Buffing	Sewed muslin buff	Tripoli
	4. Coloring	Open muslin buff	Soft silica
Sand Castings	1. Roughing	Glued rag wheel	No. 70 to No. 100 emery
	2. Greasing	Glued rag wheel	No. 100 to No. 220 emery
	3. Buffing	Sewed muslin buff	Tripoli
	4. Coloring	Open muslin buff	Lime

*May omit one or both.

High peripheral speeds increase effective buff hardness and improve cutting qualities, but increase the tendency for pitting and formation of cloudy areas.

High pressure against the buff increases the cutting rate, but also increases the tendency for pitting and cloud formation. In general, pressures used in polishing or buffing aluminum or its alloys are less than those used for harder metals.

All of these factors are important, but in addition thereto, the operating technique gained through experience, observation and instruction is an essential requirement.

Coloring

The final operation of the finishing procedure is known as coloring. Actually, the metal surface does not change noticeably in color, but takes on a characteristic luster and high gloss. Preparation by cleaning in benzine and drying in sawdust precedes coloring. It is frequently found desirable in preparing a surface for finishing by the Alumilite process to give the article a light caustic etch between the buffing and coloring operations. The chemical treatment removes embedded abrasive which, if allowed to remain, tends to produce surface discoloration during electrolytic oxidation. The coloring is done on open muslin or flannel wheels, similar to the buffers. They may have spacers between them to make them softer, and a peripheral speed of 7,500 to 8,000 feet per minute is used. The abrasive is soft silica mixed with a grease base.

Finishing Sequences

This discussion of finishing materials and procedures gives general directions for surfacing aluminum. To finish any particular aluminum article, however, the specific details of the process must be worked out experimentally, bringing into consideration the nature of the metal, the surface and the desired finish. The table on page 16 indicates some of the variations in method required to produce the same kind of finish on different forms of aluminum.

High-lighted Finish

Very attractive effects may be obtained on aluminum articles by the process known as high lighting, which gives the raised portions of the surface one type of finish, while the recesses receive another. Such decorative treatment has been widely employed on refrigerator evaporator doors. The background is sandblasted and the high-lighted areas buffed by the following sequence of operations

1. Raised areas are protected by some covering such as adhesive tape, a rubber mask or heavy paint, while the background is sandblasted. (See "Sandblasting.")
2. The article is given a caustic treatment to prepare the sandblasted background for later finishing by the Alumilite process.
3. The background is protected by taping or painting while the high lights are buffed.
4. An Alumilite finish is applied as a final operation to protect permanently the entire surface.

The technique for high lighting castings has been worked out in considerable detail for architectural applications. Generally the work is done by means of rotating abrasive wheels for irregular castings, and for flat articles a belt sander is used.

Wheels used are the standard 6-inch to 12-inch sewed muslin discs, glued together to give the required thickness and faced with No. 60 to No. 120 emery. The normal precautions in setting up such a wheel should be observed, and the glue should be allowed to dry thoroughly before use. Each new wheel should be broken down with a file to reduce the heavy cutting action of the fresh emery. Polishing wheels of this type are employed in connection with horizontal air grinders operated at from 3,400 r.p.m. to 4,400 r.p.m. If larger wheels are used, the speed may be reduced to maintain the same peripheral speed. Wheels with No. 120 emery are used with tallow. Wheels with No. 180 emery are commonly employed with a greaseless polishing medium. If more lustrous finishes are desired, the surfaces may be buffed with a muslin or felt wheel and a compound such as tripoli. A buffed surface may be given a still higher luster by coloring.

Where plain flat surfaces must be high lighted absolutely smooth and free from ripples, the belt sander is used. Cloth belts of Nos. 80, 120, 140 and 180 emery are employed in the order given, depending on the texture desired. No. "O" tallow and a small amount of machine oil are required as a cutting lubricant, or a thin paste of paraffin and turpentine also makes a satisfactory compound. A belt-sanded surface may also be buffed with muslin wheels and tripoli if a lustrous finish is desired.

Scratchbrush Finish

A coarse-lined finish may be obtained by the application of a rotating wire brush to the aluminum surface. Fineness of the finish may be regulated by the size of wires used in the brush. Wire wheels 10 inches in diameter, made up of wires 0.015 inch in diameter, revolving about 2,000 r.p.m., are generally satisfactory. Wires may be composed of brass, stainless steel, nickel or German silver.

Dirt and grease must first be removed from the aluminum surface by rubbing it with air-slacked lime. Then it is held lightly against the edge of the revolving wire brush until the desired roughening is attained. On castings, the scratchbrush finish is applied, preferably after a fine sandblast, but if the surface is exceptionally rough, it may be necessary to use the medium sand. The method of application for castings is identical with the procedure for other forms of aluminum with the exception of wheel speed, which is reduced to 450 r.p.m. to 600 r.p.m. for best results. Higher wheel speeds result in excessive tearing of the metal surface and subsequent lack of uniformity in the final finish. As the wheels are used, they gradually accumulate oxide and metallic aluminum particles and must be cleaned frequently. This can be done by using a pumice stone or soft brick. As the wheel wears, the wires also become bent and dull, necessitating frequent reversal of the direction of rotation.

Satin Finish

Satin finish is a modification of the scratchbrush finish obtained by treatment of the metal with a finer wire-brush wheel or by abrasives. It imparts a soft, smooth sheen with lower reflectivity than a highly polished surface. The soft effect results from the tiny parallel lines scratched on the metal. Various effects may be obtained by changing the angle of contact of the surface with the wire brush. Wires of 0.002 inch to 0.005 inch in diameter are most often used; the finer the wire, the finer the texture of the finish. Some difficulty may be experienced in applying this finish uniformly to large areas.

For some surfaces, like the inside of cooking utensils, the same kind of satin finish may be obtained without the use of the wire brush. The object may be rotated in a chuck while holding an oily abrasive cloth firmly against the surface as it revolves. A further rubbing with steel wool dipped in oil and emery powder and a final cleaning with a rag while the article is still revolving gives a bright silvery finish. Steel wool lubricated with soapy water or greaseless polishing compounds can also be used to satin finish aluminum very satisfactorily.

To produce a satin finish on castings, their surfaces must first be polished as described under high lighting. After the use of the No. 180 emery, the surfaces are buffed with muslin or felt wheels with greaseless polishing compound. Various grades of greaseless compounds give a coarser or finer finish, depending upon the grain size of the abrasive contained in the compounds. A very fine satin finish may be obtained by using a rotary fiber brush or rubbing by hand with a paste made of pumice and oil.

If the surface of the casting, after the basic polishing operations with No. 120 and No. 180 emery, is buffed with a muslin or felt wheel and emery cake, a satisfactory base for a wire-brush satin finish is obtained. On large flat surfaces, a fine, mild sandblast before wire brushing is quite essential to maintain a uniform satin appearance. Before using the wire brush, the prepared surface must be thoroughly cleaned of grease and dirt with a suitable solvent or by means of preheating for ½ hour at 400° F. to 600° F.*

A 6-inch diameter wire brush made of nickel, stainless steel or German silver wires 0.004 inch to 0.010 inch in diameter and operated at 450 r.p.m. to 600 r.p.m. is used to give the desired satin appearance. As with the regular wire-brush finish, these wheels should be cleaned frequently.

A finish closely approximating the true satin finish can be obtained with a belt sander when surface conditions permit the use of this equipment. By using belts of Nos. 80, 120, 180 and 240 emery and a belt speed of from 2,400 to 3,000 feet per minute, a finely cut surface is produced. By hand

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*This method cannot be applied in the case of heat-treated castings because of the adverse effect on their mechanical properties and dimensions.

finishing with pumice or steel wool and kerosene, a still finer finish is obtained.

Hammered Finish

Hand-hammered aluminum has a finish closely resembling that of hand-wrought silver. It finds its best applications in novelties and giftware. It can also be given an appearance similar to that of antique hand-hammered metals. Such effects may be obtained on aluminum by several methods, a common one being to heat the material to be so finished in a smoky coal fire and perform the forging operations while the work is covered with a fine layer of soot. Part of the black deposit is hammered into the surface, giving an effect suggestive of wrought iron. Often the raised portions are high lighted by going over them with emery cloth or steel wool. Sometimes the article is held in a smoky flame and the excess soot removed by rubbing with fine steel wool as a finishing operation.

Fluting

Fluting consists of rolling parallel lines into the surface of the sheet. This makes an inexpensive and attractive surface for some purposes, but it can only be applied at the mill. It is effective in hiding the structural markings of metal that is subsequently to be given an Alumilite finish.

Sandblasting

Sandblasting is a rapid and inexpensive method for finishing aluminum. It gives a uniform matte surface, appropriate for some articles. But the plain, sandblasted surface, because of its roughness, will in time collect and retain dirt. Therefore, in some cases, it may be desirable to protect the sandblasted surface by a lacquer or a clear varnish coating, making it easy to maintain the finish by washing. Likewise, the sandblasted surface may be given an Alumilite finish, if desired.

A wide range of blasting materials is available and lends different color effects to the aluminum surface. Washed silica sand is probably the most commonly used abrasive, although in some cases steel shot, pulverized silicon, carborundum sand or other materials may be employed. Silica sand and steel shot impart a light gray color; pulverized silicon, a light blue cast; and carborundum sand, a dark gray. Because metal abrasives leave particles on the aluminum surface that form discoloring products of oxidation, they are not favored. The use of four grades of silica sand is described in detail below.

The coarse sandblast finish is obtained by using crushed silica rock of 6 mesh to 20 mesh. Since it breaks down slowly during the blasting, new sand should be added to keep it at the required grit to insure uniform finish. The sand is used with a ⅜″ x 3″ or ½″ x 3″ chill-cast-iron nozzle, with air pressures of from 30 pounds to 90 pounds per square inch. For small, light work, the ⅜-inch nozzle and 30 pounds to 90 pounds air pressure are employed, while for large, heavy work the ½-inch nozzle and 50 pounds to 90 pounds air pressure are most satisfactory. The lower pressures decrease to some extent the roughness produced by the sand. Higher pressures than those indicated should not be used, because of the excessive warping produced. During the blasting, the nozzle is held at from 12 inches to 20 inches from the work and at an angle of 60° to 90° with the surface. The distance from nozzle to work depends upon whether the article has an irregular or plain surface, the irregular surface requiring a shorter distance. Motion of the nozzle in blasting should be in parallel lines extending the full length of the work. The sandblast nozzle should be discarded when the size of the nozzle hole has increased to such an extent as to change the nature of the blasted surface.

The grade of sand used for the medium sandblast finish is washed silica sand of from 40 mesh to 80 mesh. This sand likewise breaks down with use and more must be added from time to time to replace that which is lost through dusting, and to keep the cutting action uniform. The nozzles, which may be ¼″ x 5″, ⅜″ x 3″, or ½″ x 3″, are generally operated at air pressures of 30 pounds to 90 pounds per square inch, depending on the type of work. Air pressures lower than 30 pounds per square inch may be used in some cases, but with increased blasting time. Higher pressures roughen the work excessively and cause unnecessary warping. For this type of blast, the nozzle is held approximately 8 inches to 14 inches from the surface; otherwise manipulation is the same as for coarse sandblasting.

For a fine sandblast finish, a silica sand having a fineness from 100 mesh to 200 mesh may be used. In order to provide a uniform flow, it has been found necessary to add to each 400 pounds of fine sand, 100 pounds of somewhat coarser sand. If this is not done, the fine sand has a tendency to clog in the nozzle and prevent uniform flow. The addition of this coarser material has no detrimental effect. The size of nozzle used with this sand is either ¼″ x 5″ or ⅜″ x 3″ at an air pressure of 30 pounds to 75 pounds per square inch. Other considerations are the same as for medium sandblast.

A sandblast finish comparable to that obtained with the fine sand may also be obtained with flint shot sand that has been partially broken down with use. A ½″ x 3″ cast-iron nozzle is most satisfactory, operated at 30 pounds to 80 pounds per square inch air pressure.

In applying sandblast finishes to sheet, it is sometimes necessary to use lower pressures to avoid warping of the metal. For certain work a very fine sandblast has proved desirable. In such cases, the blasting material is 200 mesh or finer. The nozzle is ½″ x 3″ and the nozzle-to-work distance is 8 inches to 12 inches. The air pressure is approximately 45 pounds per square inch.

If the sandblasted surface is to serve as a foundation for an Alumilite finish and a light color is desired, it should be immersed in a caustic solution (see "Frosted Finish," page 292); otherwise, the surface will have a non-uniform, dark-gray appearance.

The sandblasting of aluminum requires much the same equipment as that used for other metals. There must be a sandblast chamber, which is a closed room fitted with an exhaust system and a hose for the blast. The room may also be equipped with some method of conveying the work past the operator or the automatic blasting machinery. The abrasive can be introduced into the column of compressed air by gravity, suction or by mixing directly under pressure. The method chosen for getting the abrasive to the metal depends on the purpose for which the metal is being prepared. The workman should be protected against dust by suitable appliances.

There are four principal factors which determine the texture of the sandblasted surface and it is only through control of these factors that uniformity may be obtained. These factors are: (1) air pressure, (2) rate of introducing sand, of which nozzle size is a factor, (3) grade of sand or abrasive, and (4) nozzle-to-work distance and angle. Once these conditions are selected, they should be adhered to carefully so that a uniform finish is secured.

Tumbling and Burnishing

Burnishing has no cutting action; it removes no metal, but instead applies pressure to the projecting points or particles and flattens or spreads them out. Ball burnishing produces a finish entirely satisfactory for many articles. It also gives a superior finish and appearance to many products where low selling price forbids employment of hand labor. Ball burnishing cuts the cost of handling and is a finishing process that, according to size of article, allows operation upon hundreds of separate pieces at the same time.

Burnishing produces a bright, fairly smooth surface by the action of steel shot rubbing against the parts. It is accomplished by tumbling the work together with steel shot in a wood-lined barrel. Soap and water are added for a lubricant. The size of shot to be used will depend upon several factors. Small balls are more effective but more easily lost. Heavy shot has a tendency to damage small articles, so the size and shape of the pieces affect the choice. For general work 5/32-inch steel balls are quite satisfactory, although numerous other shapes such as cones, pins, slugs, "pebs," and discs may be used for special purposes. The balls used for burnishing need not be perfectly round; even a flat spot is not objectionable. To burnish well, the balls must be hard and as smooth as it is possible to make them. The ratio of shot to parts should be about two to one by volume.

Work which has been previously cleaned by washing or dipping is placed in the barrel in the above proportion of shot. The barrel is filled about two-thirds full of cold water, and for a barrel approximately 8 inches wide by 30 inches in diameter, about 4 ounces of soap flakes or burnishing soap are added. The barrel is rotated at about 25 r.p.m. to 35 r.p.m. for approximately one-half hour, then opened, the dirty water removed, and the barrel rinsed. Fresh water and soap are then added in the same proportions as for the first operation.

The time of the second rotation will depend on the size of the part, the finish desired, whether or not dipping was used before burnishing, and whether or not a full load is to of burnishing:

The following factors must be considered in setting up a standard time for burnishing:

1. Small size screw-machine parts are usually made from small bars. The surface of a small bar is generally better than that of a large one. Consequently, less time is required to get a good finish on small parts than on large ones.

2. With a small charge, the pieces will be in contact primarilv with the shot, and more efficient burnishing will be obtained. Pieces which have sharp corners or threads will have a tendency to burr in burnishing, so the burnishing must be restricted in amount to prevent a heavy burr, rounded corners or damage to the threads.

3. Parts which have been dipped will take somewhat longer to obtain a bright surface than parts which have a machined surface. This results from the roughening of the surface by the dip and the fact that the machined surface itself is somewhat bright.

4. The longer the burnishing time, the brighter will be the resulting finish. Consequently, for parts where a very fine finish is desired, burnishing time two or three times longer than normal will be required.

5. As a general rule, the total time of burnishing should average about one and one-half hours; that is, one-half hour in the first tumbling and approximately one hour after rinsing and cleaning the barrel.

No lead should be allowed in the barrel as it tends to coat the shot and is transferred to the pieces, giving a dull, leaden appearance to the work. The barrels should be made of hard wood, since pine or similar soft woods are not suitable for use. Steel shot may become coated with aluminum dust, thus reducing its burnishing efficiency. A change of water is made during the burnishing operation to minimize this difficulty. However, if the shot becomes coated with aluminum, washing it in a caustic solution will remove the coating without affecting the steel.

After burnishing, parts without recesses or threads may be dried and further brightened by tumbling in hard wood sawdust for approximately 15 minutes to 20 minutes. It is necessary to use hard wood, as the pitch in soft wood may affect the surface finish of the parts. Threaded parts or similar pieces should be dipped in benzine and washed in hot water. The excess water is then blown off, and the parts placed on a steam table to dry.

Chemical Finishes

Another type of finish used for aluminum involves the use of various chemical treatments. These produce low-cost, protective and decorative finishes resistant to corrosion, but not particularly resistant to abrasion. Such finishing methods include the frosted finish, reflector finish, chemical etching and Alrok* finishes.

Frosted Finish

The frosted finish for aluminum has an attractive silvery appearance like that of finely etched glass. It is useful for finishing small or intricately shaped articles not adapted to machine methods. Since it is not permanent, however, and fingerprints easily, it usually needs a further protection such as an Alumilite* finish. The frosted finish is used together with the Alumilite finish on refrigerator trays, and is likewise applicable to many other products.

The first step in the frosting of aluminum is to etch in a hot caustic soda solution. This operation may be carried out in a wide range of conditions depending on the gauge of the metal and the finish required. Immersion for 1 minute in a 15 per cent sodium hydroxide solution at 160° F. to 180° F. is frequently employed, although the concentration may vary from 2 per cent to 25 per cent, and the bath may be heated to boiling. The etching process is greatly accelerated at the boiling temperature, but the caustic may dry in streaks causing stains. To overcome this difficulty in special applications, some manufacturers use a 5 per cent caustic

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* Patented process.

soda solution, followed immediately by immersion in a 2 per cent solution. The second solution is too weak to attack the surface of the aluminum in a short time, and therefore eliminates to some degree the problem of staining. Both the alkali concentration and the bath temperature must be kept reasonably uniform.

After the etching, the metal is rinsed in clear, cold water. If the time between these two steps is kept at a minimum, the caustic dries more uniformly and the danger of staining is minimized. Cold water is preferable to hot water because it, too, lessens discoloration.

The third step is to immerse in strong nitric acid to neutralize any sodium hydroxide left on the surface. A satisfactory solution is made by mixing 2 parts of concentrated nitric acid with 1 part of water. However, concentrations as low as 10 per cent are sometimes used. This part of the process removes the colored film left on the surface by the caustic solution and leaves the metal with a clean, frosted finish.

Again the article is rinsed in clear, cold water and lastly dried on a steam table. Extreme care should be used to prevent watermarks. In some cases air is used in drying.

When aluminum alloys which contain substantial amounts of silicon are to be frosted, it is necessary to add hydrofluoric acid to the nitric acid. One part of concentrated hydrofluoric acid to 8 parts of concentrated nitric acid is a good proportion to use. For alloys 51S and 53S 1 part hydrofluoric and 4 parts nitric acid are added to 56 parts of water. The article to be finished is held in the caustic solution from 2 minutes to 3 minutes, washed in water, then dipped in nitric acid for 15 seconds to 30 seconds, and again washed in water and dried. The hydrofluoric-nitric acid mixture must be used cold. If it becomes too warm during use, it produces a yellow coating which is difficult to remove.

In the case of alloy sheet, particularly that which has been heat treated, the caustic solution does not remove the stains incident to manufacture. The stains can be removed, however, by immersion for 1 minute in a cold solution containing 1 part each of nitric and hydrofluoric acids in 98 parts of water. This is followed by a rinse in cold water and a dip in cold, strong nitric acid.

Diffuse Reflector Finish

An etched surface having high reflectivity and good diffusing quality for light can be produced chemically. For lighting fixtures used indoors, plain etched reflectors are used with good results. However, when exposed outdoors, the accumulation of dirt on the roughened surface, together with any superficial atmospheric attack may cause substantial loss in reflection efficiency.

Two different procedures are available for etching. In one a solution containing 5 per cent sodium hydroxide and 4 per cent sodium fluoride at a temperature of about 180° F. is used for the first step. After rinsing, the article is immersed in a cold nitric acid solution made up of equal parts of nitric acid and water. The other procedure, less widely used, consists of first etching the aluminum surface with a dilute solution of hydrofluoric acid and then treating with a cold, strong nitric acid solution.

Etching

Designs may be readily etched in an aluminum surface. Extensive use of this process is being made in the manufacture of aluminum signs, name plates for motors, vacuum cleaners, etc., and dials for speedometers, vacuum gauges and the like.

In this type of engraving, the areas which are not to be etched are protected by means of a "resist," which will withstand the action of the solution. To form this "resist" the desired design is printed on the aluminum surface with etching ink, the moist surface dusted with 200 mesh asphaltum powder, the surplus shaken off, and the remaining powder removed from the uninked areas with talcum powder. The asphaltum powder is then fused by heating to a temperature of 360° F. to 420° F.

The surface of the article with the protected design is then activated in a 10 per cent solution of hydrofluoric acid, and rinsed. After that it is subjected to the action of a solution which etches the metal in the unprotected parts and engraves the design on the surface. Various etching solutions may be used, but the one which has found greatest favor for action

PRACTICES FOR APPLYING CAUSTIC ETCHED FINISHES

Step	ARTICLE TREATED					
	Cooking Utensils	Refrigerator Trays with Alumilite Finish	High Silicon Alloys	Screw-Machine Products 2S, 3S, 11S and 17S	Screw-Machine Products 51S and 53S	Alloy Sheet (Heat-treated)
1.	15% NaOH* 160° F.-180° F.	5% NaOH 160° F.	15% NaOH 160° F.-180° F.	2%-3% NaOH 180° F.-195° F. Two short dips	2%-3% NaOH 180° F.-195° F. Two short dips	15% NaOH 160° F.-180° F.
2.	Rinse	2% NaOH 160° F.	Rinse	Rinse	Rinse	Rinse
3.	Conc. Nitric Acid Hot	Rinse	8 parts Conc. HNO_3,** 1 part HF—Cold	Conc. Nitric Acid Cold	1 part 48% HF *** 4 parts Conc. HNO_3 56 parts water 2 to 3 min.—Cold	1 part HNO_3 1 part HF 98 parts water
4.	Rinse	Alumilite Finish	Rinse	Rinse	Rinse	Rinse
5.	Dry on Steam Table		Dry on Steam Table	(For 17S repeat series of steps 1 to 4 inc.)	Conc. HNO_3 15-30 sec.	Conc. HNO_3 Cold
6.				Blow with Compressed Air	Rinse	Rinse
7.				Dry on Steam Table or Burnish	Blow with Air and Dry on Steam Table or Burnish	Dry

* Caustic Soda. ** Nitric Acid. *** Hydrofluoric Acid

on aluminum contains iron chloride and hydrochloric acid. Hydrochloric acid alone may be used effectively in certain cases. However, if the aluminum is not uniformly clean, the attack of this acid may result in a streaked appearance. It is desirable, therefore, to clean the surface with nitric-hydrofluoric acid. If the hydrochloric acid is saturated with sodium chloride, a smoother etch is obtained. The action may be accelerated by adding small amounts of cobalt or nickel chloride to the acid solution. Sometimes the work is dipped in stannous chloride solution (3 per cent to 10 per cent) at about 86° F. for a minute or so. This deposits tin on the aluminum surface. The article is then rinsed and etched as has been described. By these procedures, fine lines can be etched to a substantial depth without loss of definition.

After the work has been etched to a suitable depth, it is removed and rinsed. The background may then be colored with black nickel, enamel, colored Alumilite finishes, or left plain. The "resist" is then removed by suitable organic solvents.

For etching, it is desirable to employ special "etching" sheet.

Electroplating on Aluminum

Decorative electroplates on aluminum, such as bright chromium, nickel and oxidized copper, are used primarily for ornamental purposes. They add nothing to the resistance of aluminum to corrosion; in fact the plated material has lower resistance to corrosion than plain aluminum if there is any lack of continuity in the coating. Such electroplates, while they are perfectly satisfactory where the corrosion conditions are not too severe, may not be satisfactory for continuous outdoor exposure.

Chromium applied directly on aluminum has several desirable characteristics. The coatings are ornamental, have high resistance to abrasion and resist alkaline solutions particularly well. However, they are not very satisfactory against atmospheric corrosion.

Zinc electroplated on aluminum has no adverse effect on the metal's resistance to corrosion, and has been used to improve the electrical contact characteristics of the aluminum surface.

Zinc Plating

Zinc is plated on aluminum in a thin layer from a special cyanide solution.

Plating may then be continued in any plating bath that is suitable for plating on zinc. Where zinc alone is the metal coating, the plating is quite resistant to corrosion, but when other metals such as nickel or copper are applied over the preliminary zinc coating, the product does not resist corrosion well, but is likely to blister or peel on exposure to moisture, because of the difference in electrolytic solution potential between these metals and aluminum.

Heat treatment, so that the coating will alloy itself with aluminum, may be used to make copper, plated over the zinc "flash," more resistant to corrosion, but this procedure has the disadvantage of adding to the cost and in some cases may affect the temper of the alloy.

Plating on aluminum after a cyanide zinc "flash," except for zinc alone, can be recommended only for a limited type of service. Such deposits would be quite satisfactory for indoor use, and can be considered durable where such service conditions are fairly dry.

The zinc alone, on the other hand, has been used to resist certain types of corrosion. Such a deposit has also been employed for radio shield cans to effect a special type of contact between the chassis and the can.

The plating procedure for applying the preliminary zinc layer is as follows:

1. Clean the metal surface by a short immersion in a cleaner containing 1 ounce to 3 ounces per gallon each of sodium carbonate and trisodium phosphate. The cleaner is used at a temperature of 180° F. to 200° F.
2. Rinse in clear, cold water.
3. Treat for 1 minute in 5 per cent hydrofluoric acid at room temperature. The etching effect of this solution appears necessary for good adhesion of the plate.
4. Rinse in clear, cold water.
5. Apply a thin coating by plating from 1 minute to 10 minutes at a current density of 1 ampere to 5 amperes per square foot, in the following bath:

Zinc Cyanide	4 oz. per gal.
Sodium Cyanide	4 oz. per gal.
Ammonium Hydroxide (sp. gr. 0.90)	4 oz per gal.
Peptone	⅛ oz. per gal.

6. The plating may then be continued in solutions suitable for plating on zinc, such as cyanide-copper, nickel or acid-zinc.

If zinc alone is the coating metal, it is usually best to continue the plating in an acid bath because of the greater speed of plating, and because the acid bath does not attack the aluminum through the coating.

Chromium Applied Directly on Aluminum

Thin chromium plates can be readily applied directly to aluminum from an ordinary chromium bath at about twice the usual current density used for plating over nickel. For cleaning, a short treatment in the alkaline cleaner, already mentioned for zinc plating, followed by immersion in hydrofluoric acid, is all that is required. A slight attack of the aluminum appears necessary in securing an adherent deposit. With certain of the casting alloys, an additional treatment in nitric and sulfuric acids, or nitric and hydrofluoric acids, is required to whiten the surface. The chromium invariably comes from the bath with a dull gray color. When plated from a hot solution (118° F.), the chromium is lighter in color than when plated from a cold solution (80° F.), but the deposit from the cold solution is much more readily polished to a high luster. This finish is not quite equal in brightness to chromium over nickel, but has numerous applications. Not all chromium polishing compounds are equally satisfactory for polishing this finish. Tests of the materials of the various manufacturers will indicate the most suitable compound.

Nickel Plating

A preliminary nickel plate may be employed as a foundation for any other plate. Chromium applied over buffed nickel is brighter and more attractive than when it is applied directly to the aluminum.

The nickel plate should be applied to a specially roughened aluminum surface. It is not sufficient simply to produce an irregular surface such as might result from sandblasting. It is necessary to produce a roughened surface in which the irregularities and pits are undercut into the aluminum, so that the coating electrodeposited in these undercut openings will be satisfactorily keyed or anchored to the surface. A structure of this character is produced with special etching reagents. The reagent dissolves certain portions of the surface selectivity, and the number, character and placing of these openings are greatly affected by the composition and temper of the metal or alloy which is being etched.

Procedure employed for applying the nickel·

1. Alkaline Cleaning: A very good cleaner has equal amounts of the following constituents:

Sodium Carbonate	1 oz. to 3 oz. per gal.
Trisodium Phosphate	1 oz. to 3 oz. per gal.

This cleaner is used at 180° F. to 200° F. If the concentration of the cleaner is appreciably above the recommended value, subsequent plates may be hard to buff; however, the strength of the cleaner should be as high as possible to insure rapid and complete removal of grease, without affecting the plate.

2. Rinse: After cleaning, the metal is rinsed in clear, cold water.

3. Acid Cleaning: Generally, it is advisable to follow the alkaline cleaning by an acid cleaning. This is most readily accomplished by treating for 10 or 15 seconds, in a 5 per cent hydrofluoric acid solution, made up of 1 part of 50 per cent hydrofluoric acid to 9 parts of water. The proper timing, temperature and strength of acid for this acid cleaning should be established and should be adhered to as changes will affect the later etching of the surface. If the etching solution is, however, the one containing strong nitric and hydrofluoric acids, this hydrofluoric acid cleaning is unnecessary and may be omitted.

4. Rinse: The metal is again rinsed in clear, cold water.

5. Roughening of the Surface: The choice of solution used to roughen the surface before plating depends on the aluminum alloy being plated. Three commercially used etching solutions are:

Nickel Solution—For commercially pure aluminum (2S) sheet

Nickel Chloride ($NiCl_2.6H_2O$)	36 oz.
Hydrochloric Acid (sp. gr. 1.18)	0.2 gal.
Water	1.0 gal.
Temperature	90° F.
Time of Treatment (Approximate)	15 sec.

Manganese Solution—For aluminum alloy sheet and other wrought materials

Hydrochloric Acid (sp. gr. 1.18)	⅓ gal.
Water	⅔ gal.
Manganese Sulphate	½ oz.
Temperature	90° F.

Time of Treatment:
(Approximate) 15 sec. to 30 sec.

Acid Solution—For Castings

Nitric Acid (sp. gr. 1.43)	2 fl. oz.
Hydrofluoric Acid (48%–52%)	1 fl. oz.
Temperature	5° F. to 80° F.

Time of Treatment:

Die Castings	15 sec. to 30 sec.
Permanent-Mold Castings	30 sec. to 90 sec.
Sand Castings	60 sec. to 120 sec.

The time of treatment in each of these solutions must be carefully determined by experiment, as this is the most important step in the plating procedure. This is accomplished by plating a series of specimens etched for different lengths of time and then bending or breaking them. A good deposit does not flake off under this treatment. If the time of etching is too short, the deposit does not adhere, while if it is too long, the deposit is rough and cannot be readily buffed.

In the etching treatment the two most important factors to control are the temperature and the acidity. Since even slight changes in the temperature cause a considerable change in the time which is required for best results, temperature should be held constant or the time of treatment should be varied to correct for temperature changes. The acidity should be kept nearly constant as possible. Where a solution is being used continually, more frequent replacements of the acid consumed in etching the aluminum are necessary.

The gauge of metal being treated is also a factor that affects the etching time. Thin sections are acted upon more rapidly than thick ones, probably because they tend to heat more readily, there being a smaller weight of metal to absorb the heat of reaction. Hard-rolled sheet generally requires greater care in etching than soft metal.

Occasionally metal will come from the manganese etch with a dark film on the surface caused by the alloying constituents. This can be brushed off or removed by treating in concentrated nitric acid or a nitric and sulfuric acid mixture.

There are also differences among the alloys; 51S being the most readily plated. 17S-T alloy is readily plated in the form of screw-machine products, but often gives trouble in sheet form because of metal streaks.

The containers for the acid etching reagents should be lead-lined and should also be painted with a mixture of 1 part beeswax to 4 parts paraffin. This is particularly necessary above the solution line, where the attack of the lead takes place.

6. *Rinse:* The metal is rinsed in clear, cold water. A double rinse is desirable for keeping acid out of the plating bath.

7. *Nickel Plating:* Various nickel baths may be used for plating aluminum. A bath which has been used considerably in the past is as follows:

Nickel Sulphate	19 oz. per gal.
Magnesium Sulphate	10 oz. per gal.
Ammonium Chloride	2 oz. per gal.
Boric Acid	2 oz. per gal.
Temperature	90° F. to 95° F.
Current Density	15 amp. per sq. ft.
pH (Colorimetric)	5.8–6.0

More recently the following bath has been used with excellent results:

Nickel Sulphate	45 oz. per gal.
Nickel Chloride	2.28 oz. per gal.
Boric Acid	4 oz. per gal.
Current density	30 amp. per sq. ft.
pH (Potentiometric)	2.0–2.5
Temperature	140° F. to 150° F.

To overcome a tendency toward pitting frequent additions of hydrogen peroxide are necessary (0.053 oz. of 30 per cent solution of hydrogen peroxide per gallon of electrolyte; the hydrogen peroxide should be diluted with water before adding to the bath). An excess should be avoided, for it results in embrittlement of the deposited nickel and reduces throwing power.

The deposited nickel should be smooth and velvety in appearance, and readily buffed to a high luster. The usual lime buffing compositions may be used.

Heat treatment of nickel-plated aluminum parts affords a distinct improvement in adhesion of the nickel deposit. For the common wrought alloys, a heat treatment of 6 hours at 300° F. is suggested.

For a deposit on aluminum that must stand moderate outdoor service, a thickness of at least 0.001 inch is recommended. Generally, the thicker the deposit, the more resistant to corrosion it will be.

Other Metals on Aluminum: As has been mentioned earlier, the nickel deposit may serve as the foundation for a variety of other plates. Certain observations are warranted in connection with the metals most commonly plated.

Chromium may be readily applied over nickel from the ordinary chromium baths now being used commercially. Experience indicates that a deposit of about one and one-half minutes is advisable. Longer plating times may raise a few tiny blisters on a small percentage of the plated articles, particularly if the nickel is thin. Tests have indicated that these articles are satisfactory in resistance to corrosion.

Copper may also be readily applied over the nickel from either a cyanide or an acid bath. Generally, the acid bath is better, for it has less tendency to undermine the plating.

Brass may be applied to the nickel, but because of the tendency for some cyanide baths to undermine the plating, particularly good nickel plating is needed.

Silver, as well as numerous other metals, may be readily applied to the nickel.

Colored or oxidized finishes may be obtained on these deposits by the usual procedures. In a few instances, where the coloring solution is strongly alkaline, it is advisable to reduce the strength of the alkali.

Black Nickel: Black nickel plating may be applied directly to aluminum. Such a finish is commonly used on the etched background of aluminum name plates. The coating is sufficiently durable for interior service, but is not of much value outdoors. A typical black nickel solution which may be employed on aluminum is:

Nickel Ammonium Sulphate ($NiSO_4.(NH_4)_2SO_4.6H_2O$)	8 oz. per gal.
Zinc Sulphate	1 oz. per gal.

Sodium Sulphocyanate	2 oz. per gal.

Nickel anodes are used in the solution. The voltage is about 1 volt, and the current density 1 ampere to 2 amperes per square foot. The solution is kept nearly neutral by the use of zinc carbonate.

Tests of Deposits

It cannot be overemphasized that the successful plating of aluminum can only be accomplished when regular and severe tests of the quality of the plate are made at frequent intervals. This is necessary because it is so easy to obtain deposits on aluminum which have a nice appearance, but, nevertheless, are of little value. Regular checks on the adhesion and resistance to corrosion of the coatings should be made at frequent intervals.

Anodic Oxidation of Aluminum

Formula No. 1

British Patent 494,054

Treat in following bath:

Sulphuric Acid	1 oz.
Ammonium Sulphate	0.1 oz.
Water	3 oz.

at 5–15° C. at 10–15 volts for 14–45 minutes.

No. 2

British Patent 487,406

Use following at 100° C. for 25 minutes at 2 amp./sq. dm.

Oxalic Acid	300 g.
Ethylene Glycol	1 l.

No. 3

British Patent 489,220

Acetic Acid	15.9–20%
Sulphuric Acid (d. 1.84)	15%

Run at 21–32° C. with current density 10–30 amp./sq. ft.

Opaque Protective Aluminum Coating

British Patent 491,618

Ammonium Thallium Oxalate	12 g.
Citric Acid	15 g.
Borax	15 g.
Glycerin	20 g.
Water	8 l.

Use at 68° C. at 120 volts with initial current density of 3.5 amp./sq. dm. Continue until the current density drops one half.

Coloring Anodized Aluminum

British Patent 488,952

The anodized layer is treated in following bath:

Soledon Jade Green Paste	5 g.
Water	100 cc.
Acetic Acid (30%)	½ g.

Treat 10 minutes at 60° C. and develop with

Sodium Nitrite	1 g.
Hydrochloric Acid	1 g.
Water	1000 cc.

for 5 minutes.

Aluminum Reflectors

Formula No. 1

British Patent 489,169

Pure aluminum sheet is cleaned, polished and anodized in 1¼% aqueous boro fluoric acid for 10–12 minutes at 10–20 amp./sq. ft. then dipped in a solution of

Sodium Carbonate	20 g.
Sodium Dichromate	15 g.
Water	1 l.

at 70–90° for 2 minutes then anodize in 15% sulphuric acid at 72° for 8 minutes at 12–14 amp./sq. ft. and then impermeabilized in water at 75–80° for 15 minutes and dried in a steam oven.

No. 2

British Patent 523,475

Brighten electrolytically, wash, oxidize anodically, wash and treat with

Caustic Soda	1
Soda Ash	5
Sodium Silicate	½
Water	93½

This produces a reflective surface resistant to mechanical and atmospheric attack.

Designs on Aluminum

British Patent 492,838

Anodically oxidize the aluminum and print or paint design with

Linseed Oil	40
China Copal	20
Lead Oleate	40

When dry dye entire piece with direct or acid wool dye. Then treat with caustic potash solution to saponify and form a soap which spreads to fill all pores.

Etched Name Plates

The first step is to make a drawing on cardboard, in black ink, of everything that is to appear on the raised surface of the nameplate. This includes both the lettering and any design, trade mark, etc., that is to stand out on the plate. This drawing is photographed, and the picture is then multiplied so that a number of images appear on the negative—the exact number being determined by the size of the plate which is to be etched and from which the individual plates will be stamped during production.

Using this negative, the positive is made on a sensitized zinc lithographic plate, which is then treated and inked up in the regular lithographic manner and put on a lithographic offset press. A special ink is required for this printing, and the exact proportion of the constituents of this ink, is dependent upon the nature of the metallic surfaces which are to be printed; usually they contain a variable amount of wax and no drier.

After the plates receive their printed impressions, they are dipped into an asphaltum powder and the excess asphaltum powder is removed by dipping the plate into talcum powder. Thus the asphaltum powder adheres only to the inked portion of the design. The plate is then baked at about 325° F. for three to four minutes, or until the asphaltum powder reaches its melting point and combines with the solids of the ink to form a hard-drying resist. This baking temperature is also dependent upon the nature of the metallic plate; in some cases it might have to be lowered; in others it could be raised.

The backs of the plates are then coated (painted) with a gasoline solution of asphaltum, and allowed to air dry. This prevents the acid from attacking the back of the plate.

The plate is then ready for the etching process which, in the case of a brass plate, would be done with a ferric chloride solution, generally in a concentration which will give a Baume reading of about 40°. To operate the etching solution, requires a thorough knowledge of its working properties in order to obtain the best results.

Experience can best teach the exact routine necessary for success. The operator regulates the acidity of the solution so that a uniform scum deposits on the etched surface. If the surface comes out crystalline, sodium chlorate should be added. A brown powder deposit appearing on the plate, indicates too much sodium chlorate; it is necessary to eliminate this brown scum by the addition of hydrochloric acid to the solution. The plate is given about a 7-minute etch in this solution and is then dipped in a bichromate cleaning solution, consisting of equal parts of sulphuric acid and sodium bichromate (by weight) in a concentration of about 8 oz. of this mix per gallon of water.

Each kind of metal requires different etching, blackening and cleaning. If the raised ground is to be a different color from that of the natural metal, the sheet plate must be given a metallic deposit or plating before the printing operation. This may be silver, copper, nickel, etc., and the exact nature of the raised ground, whether it is to be buffed, polished, scratch-brushed, etc., must also be accomplished before printing the plate. For the etching, plating and coloring operations, there exists an almost infinite number of formulas, and only experience can teach how the best results may be obtained.

The Black Background

The plate is now ready to receive a black background, which makes the brass figures and letters stand out clearly. This is usually done by dipping the plate for 10 to 15 minutes in an ammoniacal copper solution made by dissolving copper carbonate in ammonia and diluting with water. The plate is then washed in water, dried, and the resist removed with gasoline. A clear perspiration-resistant lacquer is then sprayed over the surface. This completes the work on the large plate; it is then ready to be taken to the punch press department and cut up into individual plates. This operation may be performed either with shears or discs, depending upon the size and shape of the small plate.

Clear Lacquer Coating

Another procedure is: When the plate is dried, after coming from the acid-cleaning solution and before the acid-resist is removed, a complete spray cover coat of special flexible lacquer enamel is applied. This lacquer should be first reduced to a proper applying consistency with reducer as recommended (about 75% to 100%). The plate is then allowed to air-dry a minimum of one hour. Of course longer drying time will not interfere with the succeeding operations.

One thing that should be mentioned at this time is the cleaning solution used preceding the application of the enamel. In many cases a chromic acid solution is used. This is mixed in the plating room by using sodium-bichromate and sulphuric acid in the required amount of water. The concentration of this solution and the proportion of acid in it will have a bearing on the adhesion of the lacquer. Therefore, if proper adhesion is not secured, a check should be made of these solutions. This type of cleaning solution is applied to brass metal. It is my opinion that no difficulty will result with either zinc or aluminum.

The plate is then soaked in a naphtha solution to which is added 15% of a lacquer solvent. If the lacquer thinner as used contains a high proportion of gasoline or similar derivatives, it is recommended that 20% be added. The plates are soaked in this mixture from 15 minutes to one hour, or until touching the highlights of the plate causes the enamel to readily become loose. The concentration of the lacquer solvent is not sufficient to actually dissolve the film, but it does work itself through the pores of the film, softening the acid resist present on the highlights. When the plates come from this solution, the highlights can be readily freed of the enamel by a rigid strip of celluloid. The plates are then washed in a clean naphtha solution and dried in sawdust.

After the plate has been dried and freed of sawdust, a spray coating of a clear flexible and perspiration-resistant lacquer is applied. This clear should be reduced to proper applying consistency and with the proper recommendation of reducer. The type of clear lacquer should possess unusually good adhesion to the metal surface (zinc, brass, aluminum and steel plates) and good properties as regards flexibility. A hard and tough film is desired.

A system that involves pigmented and clear lacquer should necessarily be secured from one source, as well as the reducer. Such coatings as applied should permit of stamping, cutting, forming and drawing without rupturing the film. Of paramount importance, adhesion and resistance to petroleum distillates should be considered.

If the lacquer does not possess adhesive qualities, the scraping operation that removes the enamel from the highlights will cause the enamel to peel. Many enamels also lose their plasticiser when in contact with this solvent mixture, thus destroying the life of the film. Oil resistance of lacquer enamels, as applied to the name-plate industry, should likewise receive consideration. When the plate is cut and formed on presses, the lubricating oil that is picked up should not affect the film.

Often difficulty is experienced in the formulation of a black lacquer to be used on etched aluminum plates. Black pigmented lacquer coatings cause more difficulty than other pigmentations, and may influence a chemical reaction. If this difficulty (adhesion over the resist) is encountered, it may be overcome by washing off the resist before the black coating is applied. The absorption of lacquer coatings over the etched surface is another minor problem encountered.

The depth of the etched surface is another factor to consider. In some cases the temperature of the etching solution has considerable bearing on the smoothness of the plate. Regulated and controlled temperatures of an aluminum etching solution is considered important. It is difficult to make a definite recommendation for etching aluminum.

Metal Etching Stop-Off

Formula No. 1

Wax	4 oz.
Rosin	2 oz.
Pitch	1 oz.

This coating is used as a general stop-off material and is made by melting the above mentioned quantities of materials in a kettle, after which are added 4 oz. of finely powdered asphalt. The following stop-off is also recommended particularly as being very hard and possessing good resistance to strongly acid etching solutions:

No. 2

Black Pitch	1 oz.
Japan Wax	2 oz.
Rosin	1 oz.
Dammar, Gum	1 oz.

To the above mentioned quantities, melted together in a kettle, is added 1 oz. of turpentine.

For etching, an entire series of etchants are available but usually dilute solutions of nitric acid are used on metals other than gold or platinum. Strong acids are not suitable because of the lifting of the stop-off material by the evolution of gas resulting in non-uniform and dull etching.

Etchants for Iron and Steel

Usually dilute solutions of nitric acid (10 to 30%) or 30 parts of alcohol and 64 parts of acetic acid with 10 parts of concentrated nitric acid are used. The alcohol and acetic acid are mixed, allowed to stand for about one hour, after which the nitric acid is added. An acid-free etchant is composed of equal parts of a half concentrated solution of potassium bisulphate and potassium nitrate with the addition of some ammonium chloride.

Etching Aluminum and Its Alloys

Hard aluminum is more suitable for etching than soft material as sharper etchings result with the hard material. A good etchant is composed of a 10 to 15% hydrochloric acid solution which has been saturated with sodium chloride.

Some firms use an etchant composed of 100 grams of alcohol, 50 to 100 grams of iron chloride with 1% saccharic acid. If the production of fine lines and shadows on aluminum is desired, the following etching process may be used: the aluminum is immersed about 1 minute in a warm solution (30° C.) of stannous chloride, 30 to 100 grams per liter, in which a thin tin coating deposits upon the surface. The pattern now can be etched into the surface with the above-mentioned hydrochloric acid etchant since this etching solution does not attack the tin but does, however, readily attack the aluminum.

Etching of Copper and Brass

Usually dilute nitric acid solutions are used but for bulk etching, the following solution is recommended:

Water	50 oz.
Sulphuric Acid	30 oz.
Potassium Chloride	5 oz.
Concentrated Nitric Acid	15 oz.

In place of the hydrochloric acid, iron chloride solutions are occasionally used.

Etching Nickel Silver and Nickel

Nitric acid solutions may be used. The following has proved to be valuable for etching nickel silver: Iron chloride solutions with the additions of hydrochloric acid and potassium chloride, 170 grams of nitric acid, 320 grams of water with 30 grams of potassium bisulphate. A higher content of hydrochloric acid raises the solubility of nickel resulting in strong gas evolution to which the protective coating offers insufficient resistance.

For etching Zinc, dilute solutions of nitric acid are used; for Tin, nitric acid, for Lead an iron chloride solution to which has been added sodium acetate. During the etching of tin and lead, insoluble reaction products are formed which must be removed by vigorous washing.

Etching of Gold and Silver

The etching as well as the matting of gold and silver is done chiefly by electrolytic means. An etching solution of either 2% silver nitrate or 2% nitric acid is used in which the parts to be etched are made the anode. For chemical etching of silver, 24° nitric acid is used, and for gold, aqua regia which is 1 part of concentrated nitric acid and 3 parts hydrochloric acid.

To Etch Designs on Monel

The preparation of etched Monel name-plates, identification tags, or novelties is accomplished directly through wax or varnish resists, or photographically with sensitized gelatin tissues. By either method the results are comparable. The choice usually depends on the intricacies of design or sharpness of detail desired.

Graduations, numbers, or geometric patterns may be cut readily through the bees-wax or the film resists, where the only tools required are an etching pen, a sharpened pin or needle, or a pantograph. The photogravure carbon tissue process makes it possible to reproduce accurately those complex designs recorded on photographic film. A so-called "double-transfer" method is employed for Monel, whereby the developed image on carbon tissue is brought into direct contact with the metal before actual etching is started.

A most satisfactory etching solution for use with either method is that made up from 50° Bé. iron perchloride solution. The 50° Bé. solution will contain 53% by weight ferric chloride (iron perchloride), or 6.765 lb. of the salt made up to one gal. with water. This solution is used at room temperature, applied directly over the resist or carbon tissue with a smooth felt swab. Two minutes is required for cutting to 0.001 in. or 0.0015 in., a depth satisfactory for most purposes where all but the highest contrast is desirable. After two minutes the iron perchloride solution softens carbon tissue, so that the etching should then be stopped by rinsing with anhydrous alcohol. The alcohol rinse is desirable with wax or varnish resists to prevent undercutting.

Deep Etch for Aluminum

Copper Chloride	81.1 g.
Ammonium Bromide	16.0 g.
Hydrochloric Acid, Conc.C.P.	14.2 cc.
Calcium Chloride Solution (40° Bé.)	to make 1 qt.

This is a controlled etch for aluminum since its action produces no undercut. The depression produced has almost straight walls, closing in slightly at bottom.

Metal Etchant

U. S. Patent 2,177,751

An etching bath containing nitric acid and urea which reduces fuming, extends life and increases bite. The urea should be at least 0.3 parts by weight per 100 parts by weight of 100% nitric acid.

Nitric Acid	9–10% or higher
Urea	0.32 parts by wt. to 100 parts of 100% nitric acid

Aluminum Etching Solution

Ferric Chloride	100 g.
Alcohol (90%)	200 g.
Oxalic Acid	1 g.

Rinse well with water after etching.

Aluminum Etching for Mirrors

British Patent 496,613

Treat aluminum (free from copper) with following:

Caustic Soda	50 g.
Copper Sulphate	5 g.
Ammonia (29%)	30 g.
Water	1 l.

for 3 minutes at 60° C. Rinse in 50% nitric acid to remove copper stain and rinse well.

Silver Etching

Decorative designs can be etched on silver with chlorine free nitric acid. For matt effects, use the acid at 24° Bé. strength; for deeper etching, use 18° Bé. acid. Another mordant for silver is:

Nitric Acid	1 oz.
Hydrochloric Acid	1 oz.
Water	12 oz.

Other suggested etching agents for silver are chromic acid or the analogous mixture of potassium bichromate with sulphuric or nitric acid, or a mixture of dilute sulphuric acid with potassium permanganate.

Steel Etching

Steel is more difficult to etch than zinc or copper; the action is somewhat dependent on the structure of the steel, the carbon constituency of which introduces an uncertain factor. A simple acid bath for steel is:

Nitric Acid	1 oz.
Water	8 oz.

Another etching solution for steel comprises:

Glacial Acetic Acid	4 oz.
Absolute Alcohol	1 oz.
Nitric Acid (1.28)	1 oz.

The acetic acid and alcohol are mixed and allowed to stand for half an hour, the nitric acid then added very gradually, and the solution applied to the plate from one to fifteen minutes.

An iodine solution has been recommended for etching steel:

Iodine	2 oz.
Potassium Iodide	5 oz.
Water	40 oz.

Spencer's Mordant is also employed for steel etching. Two solutions are prepared:

A

Nitric Acid, C.P.	5 oz.
Distilled Water	5 oz.
Metallic Silver	1 oz.

B

Nitric Acid, C.P.	5 oz.
Distilled Water	5 oz.
Mercury	1 oz.

The two solutions are prepared separately, then mixed together and stored in a glass-stoppered bottle. When ready for use, the mixture is diluted with an equal quantity of distilled water.

No effect takes place if the solution is simply poured on the steel plate: galvanic action must first be generated by bending a strip of zinc so that one end comes into contact with a spot of bare steel and the other end dips into the solution on the steel surface. This starts the action of the acid immediately, when the zinc can then be laid aside, as the acid will continue to corrode the steel until the solution is exhausted.

Zinc Etching

Nitric acid is the most general mordant for zinc, being used in proportions ranging from 1 part acid to 8—12 parts water.

Gamble stated the following the solution did not require agitation during etching, and that it was good for fine line work on zinc:

Sulphuric Acid	12 oz.
Potassium Nitrate	4 oz.
Water	40 oz.

The potassium nitrate should be dissolved in the water and the acid then gradually added until bubbling ceases.

For deep etching zinc plates, the following have been suggested in preference to plain nitric acid baths:

Water	40 oz.
Sulphuric Acid	4 oz.
Nitric Acid	2 oz.

(For hard zinc, use up to 25% of strong sulphuric acid); or

Hydrochloric Acid	10 oz.
Nitric Acid	2½ oz.
Water	40 oz.

Electro-Tinning
The Sodium Stannate Bath
Equipment Required

Steel tanks are preferable, wood and most plastics are liable to attack by the alkali present. Heating is best carried out by internal steel steam-heating coils.

Electrical equipment is as for other plating processes.

Plating Solution

The bath is essentially a solution of sodium stannate containing a little free caustic soda; the presence of sodium stannite is detrimental and must be avoided. The preferred concentration of the various dissolved salts depends on the operating temperature and/or the cathode current densities chosen.

	oz. per gal.
Sodium Stannate	9 –16
Caustic Soda	1½–2½
Sodium Acetate	2½–5
An initial addition of Hydrogen Peroxide (100 vol.) or Sodium Perborate	1/16

To make the solution. Fill the plating bath about two-thirds of its depth with water at about 160° F. (71° C.), add the sodium stannate, and when it is completely dissolved add the caustic soda. Before adding further ingredients, fill up the bath to its working level and check the bath concentration for tin and free caustic soda as described below. When these have been adjusted add the sodium acetate and oxidizing agent and the bath is ready for use.

Cathode Current Density

Values from 10 to 25 amps. per square foot are in use; 15 amps. per square foot is normal. Higher values must be accompanied by higher bath temperatures, and the caustic content should be adjusted. Little savings in the time for plating any given thickness is achieved by using current densities greater than 25 amps. per square foot, however, as the cathode efficiency falls off, and control becomes more difficult.

Anode Current Density

The operating current density, once the film is established as described below, should be about twice that used at the cathodes, i.e., the anode area, calculating only the surfaces facing the cathodes, should be about half the cathode area. The anode efficiency under such conditions varies between 75 per cent and 95 per cent according to the current density employed. It is very important that the conditions are such that the tin is dissolved in the quadrivalent, stannate, form. When this is occurring, the anodes are filmed with a greenish-yellowish coating. The appearance is very characteristic and is easily recognized. If the anodes remain a clean gray color, or are coated with a thin loosely adherent film of dark particles, the current density is too low and the anodes will dissolve rapidly as stannous tin, and rough spongy deposits will be produced. Should the current density rise too high, oxygen is given up at the anodes and little or no tin is dissolved, and the anode surface becomes at first brown, and later is covered with a highly insoluble black oxide film which is difficult to remove except with strong mineral acids. The deposit will remain satisfactory for a time but will be of decreasing thickness, for the efficiency will decrease as the solution is depleted of tin.

To obtain the proper film on the anodes the following procedures are used:

1. Where the anodes are kept permanently in the solution:

On commencing to plate, an excessive current density is applied for the first minute or so. This current is 1½ to 2 times that used for the fully loaded vat. The film will form rapidly and its completion will be noted by the experienced eye. As a check it will be noted that the voltage has risen suddenly about 2 volts and the ammeter has fallen correspondingly. Once the film is formed the current may be dropped to the normal operating density.

2. Where the anodes are lifted out of the solution when the bath is not in use:

In this case the work is loaded into the vat first and then the anodes are slowly lowered into the solution with the normal current switched on. As the anodes enter the solution, the first portions receive a high current density and immediately film over, and then, as the anodes are progressively immersed, the films spread over their whole surfaces.

The behavior of the tin anodes is easily understood when it is realized that there is a critical range of anode current density below which the tin dissolves as stannite, and above which the anode becomes filmed. The critical density varies directly with the free caustic soda content and with the temperature. Its value also increases slightly with increasing stannate concentration but is decreased by the presence of sodium carbonate. Continue application of current densities higher than the critical will gradually cause complete passivity of the anodes, but if the current is lowered after the anodes have become filmed, continuous dissolution of tin as stannate is assured.

Bath Voltage

A six-volt source of current is usually adequate as the voltage drop across the busbars is normally about four volts.

Bath Temperature

The bath is commonly worked at 75° C. (167° F.).

Free Caustic Soda

If the free caustic content drops, the bath is liable to precipitate insoluble hydroxides of tin, and as carbon dioxide from the air is absorbed into the bath to form sodium carbonate, it is advisable to check the free caustic content at least twice weekly as described later, as it is best to keep its content within ± 1 gram per liter of the quantity recommended.

With operation prolonged over several months, excessive quantities of sodium carbonate will accumulate in the bath, and should be removed. This can be done by allowing the bath to cool. If a tray of iron or nickel gauze is immersed in the bath before and during cooling, large crystals of $Na_2CO_3 10H_2O$ form on the tray and can easily be removed.

Practical Hints and Expedients

Occasionally practical platers add to the bath organic agents such as lactic acid (6 gm. per liter), tin resinate (¼ gm. per liter), or rosin (¼ gm. per liter), the purpose being to improve the color of the deposit. Such additions must be made with great caution, as they do not disperse readily throughout the bath and may give rise to a patchy appearance on the deposits. There is also a tendency to reduce the cathode efficiency when first added.

The Stannous Chloride-Caustic Potash Bath

Making the Solution

The first step is to dissolve stannous chloride in a solution of caustic potash, typical baths being:—

1. For Hot Operations:

Stannous Chloride	2 oz. per gal.
Caustic Potash	8 oz. per gal.
Glue or Gelatin	1/12 oz. per gal.

2. For Room Temperatures:

Stannous Chloride	6 oz. per gal.
Caustic Potash	16 oz. per gal.
Glue or Gelatin	1/12 oz. per gal.

Cathode Current Density

Up to about 5 amps. per square foot, fair deposits are possible, beyond this, "burning" occurs at corners or edges with the formation of spongy growths.

The solution deposits 2.1 gm. of tin per amp.-hour, and will produce a deposit of 0.001 in. in 95 minutes at 5 amps. per square foot.

Bath Voltage

The voltage across the bath should be about 0.5 volt for the hot bath and still less for the cold bath.

Bath Temperature

The solution No. 1 given above should be worked at 60° C. or hotter.

For room temperatures the stronger solution No. 2 is recommended.

Free Caustic Potash

This should not fall below 30 gm. for the hot solution and 50 gm. for the cold solution. The amount is not very critical but too low a content will tend to cause passivity of the anodes.

Anodes

The anodes should be of pure tin. The effective area should be twice that of the cathodes, or over. They should dissolve in a non-polarized condition, and should show a grey etched appearance when working. If the anodes become polarized the voltage will rise from, say, 0.5 volt to 2 volts or over. If this happens the current should be stopped for a few minutes to allow the film to dissolve away. If this fails to prevent polarization again, the anode area should be increased, or more potash should be added to the solution.

Maintenance of the Solution

Although this bath is more suitable for short term use where it can be discarded when impoverished, the following steps can be taken to prolong its life:

(1) Fresh addition agents should be introduced after a few days as their effect (especially that of glue or gelatin) tends to wear off, with the production of spongy growths at corners and edges.

(2) The stannous tin content should not fall below 5.5 gm. of tin per liter in the warm bath and 11 gm. in the cold bath, and is, preferably, maintained as near as possible to the original value, particularly in the cold solution.

Lack of divalent tin will cause loose spongy deposits no matter how much additional agent be present, and as there is a steady loss due to oxidation by the air, frequent additions of stannous chloride have to be made. These additions are essential despite the electrical efficiency of both anodes and cathodes being practically 100 per cent. In addition carbon dioxide from the air neutralizes some of the caustic potash, and this has to be made good.

As a result, the bath gradually becomes choked with potassium stannate, potassium chloride, and potassium carbonate, and it is not worth while, and indeed difficult, to dissolve fresh ingredients. Hence it is usually economic to discard the bath if it stands for any considerable time.

Acid Tin Plating Solution

Sulphuric Acid total *	13.5 oz. per gal.
Tin (Dissolved Anodically)	4.8 oz. per gal.
Cresol Sulphonic Acid	16 oz. per gal.
Gelatin	⅓ oz. per gal.
Beta-Naphthol	⅙ oz. per gal.

The solution is prepared by filling the tank about half full of water and adding cautiously the required amounts of sulphuric and cresol sulphonic acids. The volume is made up nearly to the required level and tin is dissolved anodically into the solution. For the dissolution, the cathodes are immersed in porous pots—they may be strips of any suitable metal, e.g. steel or tinplate—and the pots should be filled with dilute sulphuric acid (say 10 per cent). The dissolution is continued till the required 30 gm. per liter of tin has dissolved. This takes 13.5 amp.-hours for each liter of plating solution—60 amp.-hours per gallon. The current density on the tin anodes should not exceed 20 amps. per square foot, as above this they tend to become passive. If the solution is not clear it is advisable to filter at this stage, otherwise precipitated tin compounds will tend to absorb the beta-naphthol addition, when made, and remove it from the solution.

Addition Agents

The gelatin, dissolved in hot water, is then added and the solution well stirred. Finally the beta-naphthol is dissolved in a small quantity of alcohol,† and added very slowly to the solution with constant stirring. A slight precipitate may form on adding

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*Free sulphuric acid after dissolving the tin should be about 60 gm./liter.

†Industrial spirit or propyl or butyl alcohol may be used, but ordinary methylated spirit is not suitable. Alternatively beta-naphthol may be dissolved in *boiling* water, but is only soluble to the extent of about 0.5% and this method is therefore rather clumsy except for quite small baths.

these addition agents. If so the solution should be filtered, or allowed to stand for 24 hours to let the precipitate settle out.

N.B.—The solution should be kept in a clear state during use.

Lysalbio acid—an addition of 1 gm. per liter may be used in the place of gelatin. It has a longer life than gelatin but is much more expensive.

Cathode Current Density

For general plating purposes without agitation, the bath should be worked at current density of 10 amps. per square foot (at around 20° C.). Above 10 amps. per square foot the deposits tend to "burn"—i.e. become rough or produce growths at the corners or edges. If agitation is employed, current densities above 10 amps. per square foot may be used. Agitation of the cathodes is preferable to air agitation of the solution, as the latter slightly facilitates oxidation. The cathode efficiency is practically 100 per cent, and at 10 amps. per square foot 0.001-in. coatings are deposited in 50 minutes.

Anode Current Density

Cast anodes of pure tin should be used. The anode area should be approximately the same as the cathode area, though the actual area is not important provided the current density at the anodes does not exceed 20 amps. per square foot.

The anodes may produce a slight metallic slime at their surface as they dissolve, which contaminates the bath and produces rough deposits, and may also render the coatings rather porous. It is advisable therefore to enclose the anodes in bags; woven glass is ideal, or bags made of woollen materials, e.g. flannel, may be used. (Woollen materials may dissolve very slightly in the solution and give products which affect the appearance or ductility of the coatings to a slight extent.) Cotton materials are definitely unsuitable.

The anodes should always be kept in the solution, as the presence of metallic tin helps to retard oxidation of the solution during idle periods.

Bath Voltage

Freshly prepared solutions should work at 0.6–0.9 volt at 10 amps. per square foot (the distance between the electrodes slightly affects the voltage drop). As the effect of the addition agents wears off the voltage drop decreases, and when it has dropped by 0.2 volt, fresh additions should be made.

Bath Temperature

The bath works best about 20° C., but the temperature is not critical.

Filtration

Precipitates may occur from three sources: (1) slime from the anodes if these are not enclosed in bags; (2) slow precipitation of the addition agent; (3) basic tin compounds formed through oxidation, particularly if the cresol sulphonate content is low.*

If precipitates are allowed to contaminate the bath they may cause rather porous deposits. For this reason periodic clarification is required. In some cases continuous filtration may be advantageous, on the other hand the bath can sometimes be kept in a clear state by allowing any precipitates to settle out.

For continuous filtration, a simple method is to use an air left delivering into a lead box with a perforated bottom on which is laid a pad, 2 in. in thickness, of glass wool. A suspension of kieselguhr in water is poured on the glass wool to form a filter bed, and a perforated lead plate is placed on top to prevent disturbances of the kieselguhr.

Maintenance of the Solution

(1) Tin Content. As the anode and cathode efficiency are both practically 100 per cent, the bath maintains its composition (except for addition agents) over long periods of time. The only losses which occur are from "drag out," and slow oxidation of the stannous sulphate. The efficiency of the anodes is normally slightly greater than of the cathodes, and this offsets losses of stannous sulphate. Again, the actual concentrations of tin and acid needed in the bath are not at all critical. Reasonable limits are:

Tin (stannous), 20–35 gm. per liter.

Free sulphuric acid, 40–70 gm. per liter.

Cresol sulphonic acid, 70–120 gm. per liter.

It is therefore only necessary to check the tin and acid content at long intervals. Stannous sulphate, if needed,

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*Plain solutions of stannous sulphate in sulphuric acid oxidise very rapidly in air and become quite cloudy on standing for a day or two. The presence of cresol sulphonic acid reduces the rate of oxidation so that over a period of 6 to 12 months only a very small proportion of the stannous sulphate is removed from the solution by oxidation and precipitation.

should be added by anodic dissolution, using cathodes in porous pots.

(2) Acid Content. There is no simple method of controlling the free sulphuric and sulphonic acids separately; but an estimate of total free acid is sufficient for control purposes. If the acid content is low, fresh acids should be added in the proportions originally used — i.e. 5 parts cresol sulphonic to 3 parts sulphuric acid (by weight).

(3) Addition Agents. The deposition of smooth coatings from this bath is entirely dependent on the use of addition agents. Without these the solution merely deposits a mass of loose crystals of tin. Gelatin, alone, has very little smoothing action, while beta-naphthol is practically insoluble in the solution unless a protective colloid such as gelatin or lysalbic acid is present. The success of the bath is therefore dependent on the combination of the two addition agents.

The action of the addition agents gradually deteriorates, and fresh additions are required from itme to time (say, at intervals of 2 months or even longer, less frequent additions are needed if lysalbic acid is used instead of gelatin). The deterioration is chiefly due to: (1) gradual decomposition of gelatin in acid solution, and (2) absorption of the addition agents by precipitated basic tin compounds.

Control is fairly simple as their deterioration can be noted by the following factors: (*a*) voltage across the bath; (*b*) grain size of the deposits; and (*c*) "covering power" of the solution.

(*a*) The voltage across the bath decreases as the addition agents wear off. Freshly prepared solutions should work at about 0.6–0.9 volts, at 10 amps. per square foot (according to the distance between the electrodes). Fresh additions should be made before the voltage drops by more than 0.2 of a volt.

(*b*) Freshly prepared solutions give fine grained deposits. As the additions wear off the grain size visibly increases.

(*c*) "Covering power" tests provide the most accurate method of control. Fresh additions should be made if the solution does not cover at 2 amps. per square foot.

For renewals the following amounts are suitable:

	oz. per gal.
Gelatin	1/6
or Lysalbic Acid	1/12
Beta-Naphthol	1/12

If precipitates form on making these additions, the solution may be allowed to stand till it clears (say, for 24 hours), or it may be filtered.

Covering Power

An important feature of the bath is its ability to "cover" the surface of the cathodes within a short space of time. This property depends on the addition agents in the solution and the current density of deposition. With insufficient addition agent the tin is not deposited uniformly over the whole of the cathode, and with thin deposits, the tin may form only a network of crystals between which the base metal is visible. The trouble is most noticeable at low current densities and in practice less than 5 amps. per square foot should be avoided.

It will, therefore, be realized that a covering power test will provide a good method of controlling the addition agents. The control test is performed by electrolyzing a sample of the bath in a suitable small vessel. For instance, tin anodes may be used on each side of a cathode consisting of a copper sheet 4.8 in. by 3 in., suitably cleaned—say, by degreasing and dipping in nitric acid. The cathode is plated with a current of 0.4 amp. for 12 minutes (i.e. at 2 amps. per square foot to produce a 0.00005-in. coating). If the covering power is satisfactory, the copper will be completely covered by tin; if not, copper will be visible in patches (viewed either by direct observations or through a hand glass), and addition agents should be added to the bath.

(Alternatively to removing a sample of the bath, the test may be performed in the plating tank, the copper test piece being connected to the bus bar through a sliding resistance and ammeter.)

Miscellaneous Methods

Stannate Bath with Insoluble Anodes

The plating of the interiors of kettles, pans, teapots, tubes, etc., requires a special technique. The vessels can be filled up with the sodium stannate solution and maintained at the plating temperature by standing on a hotplate or in a shallow hot bath, but the anodes sometimes present a difficulty.

It is desirable, when possible, to use tin anodes which should be of about half the area to be plated. They must be inserted with the current switched on so as to make and maintain a satisfactory film.

In many cases, however, it is impossible to get satisfactory conditions for tin anodes and insoluble anodes of nickel or iron are used. For example, in a tube an iron wire can be utilized on which beads or other insulators are strung. Working in this way, satisfactory deposits can be obtained, but the solution is depleted of tin and has to be regenerated.

For regeneration suitably filmed tin anodes can be used but the common method of surrounding the cathodes by porous pots should be avoided as the pots are attacked in the alkaline solution. A satisfactory expedient is cathodes made of a short loop of metal tubing through which cold water is circulated. Under conditions of high current density combined with cold cathodes, practically no tin is deposited, the cathode product being almost entirely hydrogen, and the tin content of the bath is rapidly replenished.

Stannous Ammonium Oxalate Bath

The oxalate bath is simple to prepare; it is suitable for doing odd batches of plating, but can be worked only at low-current densities.

The solution is as follows:

Stannous Oxalate	50 gm. per liter
Ammonium Oxalate	60 gm. per liter
Oxalic Acid	15 gm. per liter
Gelatin or Peptone	2½ gm. per liter

The stannous oxalate is dissolved in a solution of ammonium oxalate and the free oxalic acid and gelatin or peptone are added subsequently.

The working temperature is 20° C.; tin anodes dissolve freely; cathode current efficiency is practically 100 per cent. The preferred current density is 5 amps. per sq. foot; at greater densities the deposits tend to burn, while at less than 2.5 amps. per sq. foot deposits tend to be porous. The throwing power is only moderate and the bath is not recommended for plating articles of intricate shape.

The *p*H of the bath should be kept around 3.5. Additions of oxalic acid should be made from time to time, as the *p*H tends to rise during use and if *p*H is greater than 4.0 insoluble tin compounds will be precipitated.

Tinning

U. S. Patent 2,072,229

The cleaned metal surface is fluxed with zinc chloride or zinc ammonium chloride and then brushed with

Stannous Chloride	4 g.
Potassium Boro Tartrate	1 g.

then treated with zinc dust to deposit the tin.

Silver Plating Mirrors

In a new silver plating method a 0.5% solution of invert sugar is used as a reducing agent instead of formalin. The solution is prepared by mixing equal volumes of 1% solution of silver nitrate and potassium hydroxide and adding to the mixture a strong solution of ammonia (10 g. of silver nitrate plus 17–18 cc. of 25% solution of ammonia). The silver solution and the reducer are mixed in a 2:1 ration and are immediately poured over the mirror.

Silver Plating on Steel

The steel is prepared for plating by the usual cleaning procedures, followed by an acid dip consisting of 15 seconds immersion in 10% hydrochloric acid at 90° C. Better adherence is obtained on steel containing over 0.1%, if an anodic treatment in 80% sulphuric acid or a cathodic treatment in 10% hydrochloric acid is used instead of the dip. The acid treatment is necessary for good adherence; it probably removes the oxide film and roughens the surface. Good adherence can not be obtained without a strike. Either a copper or a silver strike could be used. The cathode must be connected to the current before being immersed in the strike, and the current density used must be sufficient to produce vigorous gassing. The composition of the strike is not critical, but for any strike the current density and time must be so chosen that the specimen is completely covered with a silver deposit that must not be spongy.

A satisfactory strike is 1.9 g./l. of silver cyanide, 17.9 g./l. potassium cyanide, 3.2 gl./l. potassium carbonate, at 6–20 amp./$dm.^2$ current density, and for 1/5 seconds. Instead of using a strike, the steel could be immersed in a 2% gelatin solution and then plated. The results compared favorably with those obtained with the silver strike. The silver plating bath had the following composition:

Silver Cyanide	26.3 g./l.
Potassium Cyanide	46 g./l.
Potassium Carbonate	37.5 g./l.
Free Cyanide	13 g./l.

Current density is 0.4 amp./dm.^{2}.

A bath in which the potassium carbonate was replaced by sodium chlorate was tried, but it gave a bright, brittle deposit.

Silver Plating for Steel Cans

Typical Bath Compositions and Conditions

No. 1

Cathodic Cleaner

	g./l.	oz./gal.
Trisodium Phosphate	15	2.0
Sodium Carbonate	15	2.0
Sodium Metasilicate	7.5	1.0
Sodium Hydroxide	3.8	0.5

Liquid Soap (0.1 cc./l or 0.013 fl. oz./gal.)

Current density–20 amp./sq. ft.

Temperature–(95–100° C.)

No. 2

Acid Pickle

Hydrochloric Acid (22 Bé.°)	180	24
Or	150 cc./l.	19.6 fl. oz./gal.

Temperature–Room temp. (23–27° C.)

Time–2 min.

No. 3

Copper Plating Bath, Rochelle Salt Type

Cuprous Cyanide	30	4.0
Sodium Cyanide	38	5.0
Rochelle Salts	45	6.0
Sodium Carbonate	30	4.0

Current density–23 amp./sq. ft.

Temperature–(60–70° C.)

Agitation–moving cathode, overall velocity 5 ft./min. pH–12.2 (60 min. equivalent to approximately .001″)

No. 4

Nickel Strike (Wood's Bath)

Nickel Chloride	240	32
Hydrochloric Acid (22 Bé.)	145	19.5
Or	123 cc./l.	16 fl. oz./gal.

Current density–30 amp./sq. ft.

Temperature–room temperature (23–27° C.)-

Agitation–none

g./l. oz./gal.

No. 5

Silver Strike

Silver Cyanide

6.5 0.9 (0.8 to oz./gal.)

Potassium Cyanide

68 9.0

Current density–15 amp./sq. ft.

Time–10 seconds

Temperature–room temperature

Current should be on before plate introduced

Agitation–none

No. 6

Silver Plating Bath

Silver Cyanide

35 4.7 4.3 to oz./gal.

Total Potassium

37 5.0

Free Potassium Cyanide

19 2.5

Potassium Carbonate

38 5.0

Current density–6 amp./sq. ft.

Temperature–room temperature

Agitation–moving cathode, overall velocity 5 ft./min.

Cathode efficiency approx. 100% (60 min. equivalent to 0.001″)

No. 7

Nickel Plating Bath (Watt's Bath)

Nickel Sulphate	200	27
Nickel Chloride	45	6
Boric Acid	30	4

Current density–25 amp./sq. ft.

Temperature–(38–42° C.)

Agitation–moving cathode, overall velocity 5 ft./min.

pH of solution–5.3

One hour equivalent to .001″

No. 8

Composition of Ferroxyl Gel Used In Testing for Porosity

Potassium Ferricyanide	5 g.
Potassium Ferrocyanide	0.5 g.
Sodium Chloride	10 g.
Agar	5 g.

Distilled water to make one liter of solution.

Black Chromium Plating

An electrolyte containing between 250 and 400 grams per liter of chromic acid with 5 cc. per liter of glacial acetic acid, is the most suitable for depositing black chromium. The temperature should be kept below 75° F. and a current density between 750 and 1000 amperes per sq. ft. is necessary. The black deposits contain about 75% metal and 25% oxides of chromium.

Brass Plating

Copper Cyanide	3.6 oz./gal.
Zinc Cyanide	1.2 oz./gal.
Sodium Cyanide	7.5 oz./gal.
Soda Ash	4.0 oz./gal.
Ammonia (28°)	.01 oz./gal.

Free sodium cyanide is kept at 1.5–2.5 oz./gal. Brass deposit about same color as cast brass. Use c.d. 2–5 amp./sq. ft. At 105° F. 15 amp./sq. ft can be used. Keep pH between 9.8–12.5 by addition of caustic soda.

Brass Plating Brighteners

Formula No. 1

Arsenic Trioxide	¼ oz.

Dissolved in aqueous caustic soda

Above per 100 gal. at bath

No. 2

Phenol

0.05–0.1 oz. per gal. of bath

No. 3

Lead Salts	0.00–1 oz./gal.

Pewter Finish on Brass

Pewter finish can be imitated by slightly scouring the brass and then nickel plating, and for an old pewter appearance, the white nickel is black nickel plated and relieved. A better match for color, however, is obtained by plating in a tin solution or a solution containing a combination of lead and tin. Tin deposits can be darkened by brushing with a solution of:

Copper Acetate	1 oz. per gal.
Ammonium Chloride	½ oz. per gal.
Water	1 gal.

Wipe dry and lacquer.

Non-Poisonous Copper Silvering Solution

Silver Nitrate	20 g.
Sodium Chloride	10 g.
Sodium Thiosulphate	40–50 g.
Water	1000 cc.

Copper Plated Silver Mirrors

British Patent 490,159

Deposit a faint blush layer of silver on glass in the usual way. Wash and immerse in following for 30 minutes:

Copper Sulphate	4 g.
Rochelle Salt	15 g.
Caustic Soda	6 g.
Formaldehyde	100 cc.
Water to make	1 l.

Brush-plating Solutions

Nickel

Nickel Sulphate	400 g.
Glauber's Salt	300 g.
Boric Acid	30 g.
Water	1 l.

Run at 10 volts and 12 amps. at room temperature or 18 amps. at 60° C. Keep pH at 4.5.

Copper

Copper Sulphate	200 g.
Sulphuric Acid (1.84)	50 g.
Water	1 l.

Use at 10 volts and 35–40 amperes.

Bright Plating Zinc Bath

British Patent 490,145

Zinc Cyanide	10 oz.
Sodium Cyanide	9 oz.
Sodium Hydroxide	10 oz.
Sodium Hyposulphite	¼ oz.
Water	1 gal.

Alkaline Copper Plating

Formula No. 1

Copper sulphate and monoethanolamine together do not form a satisfactory bath; addition of sodium oxalate is necessary. A typical bath is

Copper Sulphate ($CuSO_4\ 5_2HO$)	76–149 g./l.
Monoethanolamine	77–151 g./l.
Sodium Oxalate	25– 50 g./l.

Recommended operating conditions are: Current density, 3–11 amp./dm.^{2}; temperature, 20–30° C. Copper does not deposit on iron by displacement. The deposits are bright, smooth, and adherent and the cathode and anode current efficiencies are nearly 100%. This bath has lower throwing power than baths containing di- and triethanolamines.

No. 2

A copper sulphate solution (50 g./l. of $CuSO_4 . 5H_2O$) containing ethylenediamine (42.5 g./l.) does not deposit Cu on Fe by immersion and gives satisfactory electrodeposits. The best deposits are obtained at 50° C. with current densities of 0.4–3 amp./dm.^{2}. Anode and cathode current efficiencies are about 100%.

Electrolytic Bronze Plating

The electrolyte is prepared from the following aqueous solutions:

a. Potassium Copper Cyanide	200 g./l.
b. Stannic Chloride, Anhydrous	250 g./l.
Potassium Hydroxide	300 g./l.

to which 4–5 parts of water and 5–10 grams of potassium cyanide per liter are added.

Tin, copper and carbon anodes are used in parallel, high current density favoring tin deposition; high temperature promotes deposition of copper. Agitation of the electrolyte is advantageous. A suitable bath consists of 120 cc. of *a*, 80 cc. of *b*, and 800 cc. of water, used at 80° C. with current density at the steel cathode and tin and copper anodes of 5, 15, and 1 amp./dm.^{2}, respectively.

White Brass Plating

	Preferred oz./gal.	Allowable Variations oz./gal.
Zinc Cyanide	8	8 to 10
Copper Cyanide	2.25	1.85 to 2.4
Sodium Cyanide	8	11 to 13
Caustic Soda	8	8 to 11
Sodium Sulphide	0.05	0.05 to 0.1

For Bright White Brass small amounts of addition agents as are commonly used for other bright plating processes are employed

Operating Conditions

Anodes, 72%Zn—28%Cu
Temperature, 20°—80° C.
E. M. F., 1 to 3 volts
Maximum anode current density 10 A./S.F. at 25° C.
15 A./S.F. at 80° C.
Anode efficiency, 80–100%.
Cathode current density at
25° C.—10 to 40 A./S.F.
40° C.—10 to 60 A./S.F.
80° C.—10 to 100 A./S.F.
Cathode efficiency, 60-90%.

Bright White Brass—The bath must be operated at room temperatures and at current densities of 10 to 25 A./S.F.

Antimony Plating

Antimony Trioxide	60	g./l.
Hydrofluoric Acid (48%)	114	g./l.
Aloin	0.25	g./l.
Clove Oil	0.012	g./l.

A rubber or lead lined tank should be used because ceramic materials would be attacked by the fluorides in the solution. The bath operates with almost 100% cathode efficiency at current densities up to 7 amps./ft.^{2} and soluble anodes can be used with the bath as they dissolve with high efficiency in this solution. Without addition agents the deposits are coarsely crystalline but with the above-mentioned addition agents, the deposits are finely crystalline, smooth and gray. The recommended quantities are sufficient for a 12-hour run after which 0.25 grams of aloin must be added.

Anodic Treatment of Magnesium

British Patent 498,626

Metal is treated at 20–80° C. at 1–100 amp./sq. ft. in following:

Potassium Dichromate	10 lb.
Chromium Sulphate	2 lb.
Water	88 lb.

Anodic Oxidation of Copper and Brass

The copper or brass is made the anode in a solution of

Caustic Soda	15 g.
Water	85 g.
Ammonium Molybdate	0.1–3 g.

Using a current density of 0.005–0.01 amp./sq. Cm. for 2–15 minutes at 80° C.

Coating Metals with Lead

British Patent 520,581

The metal is cleaned and dipped in following molten mixture:

Zinc Chloride	40
Ammonium Chloride	58
Sodium Chloride	2

then into molten lead and then quenched.

Galvanizing Composition

U. S. Patent 2,101,816

a.	Zinc	50
	Lead	15
	Tin	35
b.	Zinc Chloride	60
	Ammonium Chloride	40

65 of *a* is mixed with 35 *b*.

Pre-Treatment of Stainless Steel for Plating

British Patent 493,518

Immerse in following to pre-coat:

Copper Sulphate	5 g.
Hydrochloric Acid	100 g.
Water	1 l.

Preparing Aluminum for Plating

U. S. Patent 2,162,787

Immerse in following solution for ½–1 minute at 92–95° C.

Ferrous Chloride	40–60 g.
Hydrochloric Acid	40–40 cc.

Then wash thoroughly.

Electrolytic Cleaning of Brass

Immerse in following solution at 6–7 amp./sq. cm. at 60–70° C.

Caustic Soda	15 g.
Soda Ash	10 g.
Disodium Hydrogen Phosphate	5 g.
Dextrin	0.3 g.
Water	1 l.

Removing Traces of Cyanide from Plated Goods

Dip in following solution for ½ hour:

Potassium Tartrate	4–5 g.
Sulphuric Acid	1–1.5 g.
Water	1 l.

Coloring Cadmium

The most common means of producing black deposits on cadmium are the lead acetate-sodium thiosulphate bath also used for producing certain antique finishes on brass and nickel, and the copper sulphate-potassium chlorate bath.

.The former bath has a composition as follows:

Lead Acetate	⅛ oz.
Sodium Thiosulphate	12 oz.
Water	1 gal.

Temperature 140°–200° F.

Tank—earthenware or cement-lined steel produces a uniform although powdery black which is not in itself very adherent.

The softness and looseness of the black deposit makes it rather difficult to handle when high-lighting operations on a wheel follow. This dip is suitable for producing a pewter finish on cadmium on flatware or articles which are free from ornamentation and lowground. It may also be used in producing French gray. A wet brushing on a steel wheel with powdered pumice stone (2F) is generally the procedure followed although resort is sometimes made to hand rubbing with steel wool and pumice. A coating of clear lacquer is essential to preserve the finish and prevent smudging and handling scratches which would otherwise ruin the not too adherent film.

Copper Sulphate-Potassium Chlorate Bath

Copper Sulphate	2 oz.
Potassium Chlorate	3 oz.
Water	1 gal.

Temperature 140°–200° F.

Tank—earthenware or cement-lined steel.

This solution produces deposits quite similar to those from the first-mentioned solution in that deposits are loose from both baths, powdery and non-adherent. The copper-sulphate-potassium chlorate bath gives deposits that differ in having a deeper black color and are free of the bluish-gray tinge common in "sugar of lead" dips. This dip can be used with moderate success in producing wrought iron and Swedish iron effects. The fact that the film is soft and easily scratched means that the work has to be carefully handled to prevent scratches which allow the white cadmium to show through. The deeper shades of black which can be made with this dip give the greater contrast with the base plate required by the wrought iron or Swedish iron type of finish.

Recent modifications of this bath through additions of sodium chloride (salt) have made possible the obtaining of highly satisfactory deposits with much improved adhesion. The exact value of sodium chloride when added to the mixture is not known. The difference in adhesion before and after adding is, however, readily apparent. Earthenware or cement-lined steel tanks prove satisfactory containers for the solution

Copper Sulphate	2 oz.
Potassium Chlorate	3 oz.
Sodium Chloride	3 oz.
Water	1 gal.

Temperature 140°–200° F.

If the cadmium deposits are uniform and bright, a certain amount of lustre is evident in the deposit as it comes from the bath. The solution can be used cold; however, best results are obtained if the work is immersed in a hot solution (140°–200° F.) for one or more brief periods of 2–5 seconds each. Work can be dried by the use of hot water, sawdust, or in a hot-air dryer.

Further small additions of acid (sulphuric or hydrochloric) enough to dissolve any basic salts produced, tend to leave an adherent gray coating under a loose black deposit. This gray is quite suitable for pewter and French gray finishes as it is considerably more adherent than the coatings obtained from the lead acetate-sodium thiosulphate bath.

Brown on Cadmium

A rich warm brown on cadmium which shows off the silvery whiteness of the metal when highlighted is easily produced by the potassium dichromate-nitric acid bath.

Potassium Dichromate	1 oz.
Nitric Acid (36° Bé.)	½ oz.
Water	1 gal.

Temperature 140°–160° F.

The finishes known as Stratford

silver, Sheffield silver and Argentine have the authentic antique silver appearance when highlighted artistically. The use of cadmium plate instead of silver makes possible the use of this finish in many places especially where silver itself cannot be used due to high material cost. The bath when heated to a temperature of 140°-160° F. is fairly quick acting. Pale yellows are obtained almost instantly. It requires 2-4 minutes for a reddish brown color similar to that of mahogany. Deeper shades can be produced on prolonged immersion up to 6-8 minutes.

Oxidizing Sterling Silver

The most satisfactory stop-off for plating on Sterling from the viewpoint of resisting cleaners, dips and cyanide solutions, is black asphalt, dissolved to the desired consistency in a suitable solvent such as turpentine. For improved adherence of the stop-off, a mixture of spar varnish and the above is also used, one good ratio being 5 parts by volume varnish to 1 part asphalt (thinned to about che same consistency as the varnish). Such stop-offs should be baked about 250°-300° F. after application, for at least 4 hours, after which they will withstand, without peeling, brief immersion and cleaning in alkaline solutions (with or without mild currents). They may be removed by washing in hot turpentine or in acetic ether (ethyl acetate).

For oxidizing Sterling, acid solutions of either tellurium, selenium or platinum are used. Sulphur oxidizers (such as sodium sulphide or polysulphide) are not generally employed. Of these oxidizers, the platinum is best, giving shades from deep black to soft gray as desired and being most permanent, resisting to a marked degree even continued immersion in cyanide solutions. The latter property is not held any too well by the selenium and tellurium, nor are the blacks which are obtained in the latter two cases as "pure," tending somewhat to the brownish hue. However, for the deeper tones, the platinum solutions become expensive, and only when grays are satisfactory does the cost approach that of tellurium and selenium. Of all three, probably tellurium is favored for general purposes.

The following formulae are illustrative of good oxidizing solutions, although the practice varies widely.

Formula No. 1

Tellurium Oxide	2 oz.
Concentrated Hydrochloric Acid	1 qt.
Water to make	1 gal.

The tellurium is dissolved by continued heating with about half the acid. After cooling, the remaining acid and water are added.

No. 2

Two oz. of selenium metal are dissolved by heating in 1 to 2 pints of cencentrated hydrochloric acid, to which small additions (about an ounce each) of nitric acid are cautiously made to accelerate the reaction. When dissolution is complete and no more red-brown fumes are liberated, the solution is cooled and 8 oz. of copper sulphate, previously dissolved in a quart of water, are added. The whole is then diluted with water to 1 gal.

Both of the above-mentioned solutions should be used at temperatures of 150° to 175° F. The work should be clean and hot before immersion into the solution. After a few seconds immersion, the work should be thoroughly rinsed in water and preferably also in a neutralizing solution (for example, of soda ash), after which it is ready for relieving.

The platinum oxidize may be made by dissolving 1 dwt. of platinum metal in about an ounce of aqua regia. This requires continued heating for about a day, for example on a sand bath about 150° to 175° F. The resulting solution may then be diluted as desired. The more concentrated solutions give the deepest blacks and in the shortest times, but usually appreciable dilution is necessary to reduce the cost. For example, the above may be diluted to 1 gallon, the resulting color being gray and only obtained very slowly. Its action and appearance may be improved appreciably, and to a satisfactory state, by adding to it about 4 oz. of ferric chloride.

Cream for Preventing Silver Tarnish

U. S. Patent 2,144,642

Carnauba Wax	4½ lb.
Stearic Acid	18 oz.

Melt together at 100° C. and to this add slowly, with vigorous stirring the following boiling mixture:

Triethanolamine	5 fl. oz.
Water	4 gal.

Apply on silver and wipe off leaving a very thin film.

Coloring Steel Black

Dip in following heated to 120° F.

Caustic Soda	400 g.
Potassium Nitrate	10 g.
Sodium Nitrate	10 g.
Water	1 l.

Brightening Dip for Cadmium

U. S. Patent 2,154,455

A bright dip for cadmium comprises hydrogen peroxide and sulfuric acid, the ratio of peroxide to acid being about four to one.

Bright Pickling of Steel

Bright surfaces on steel are produced, according to a new pickling process, by the action of colloidal ferri-compounds in the pickling solution; these colloids form spontaneously if the solution, e.g., sulphuric acid, is kept at a pH value of 1.8–2.8, i.e. about 0.1–0.001% acid, and at 70° C. Materials pickled in this manner keep longer in storage and can be galvanized more satisfactorily.

Brightening Dip for Zinc

U. S. Patent 2,154,451

A bright-dip for zinc comprises an acidic hydrogen peroxide solution with a pH from about pH 0.5 to pH 3.5.

Brightening Nickel Surfaces

U. S. Patent 2,145,518

The method of brightening nickel surfaces on objects having a nickel coating, comprises making the object to be treated the anode in a bath heated to a temperature between 85 and 140° F. and containing water and such quantity of sulphuric acid that the specific gravity of the bath measured with an areometer lies between 45 and 62° Baumé, and supplying an electric current to the anode of a strength lying between 280 and 560 amperes per square foot of anode surface.

Coloring Brass Blue

A blue color can be obtained on brass by using a solution of sodium thiosulphate and lead acetate. Suggested quantities are 124 grams of thiosulphate and 38 grams of acetate for each liter of solution. The thiosulphate and the acetate are dissolved separately, each in a half-liter of water, and the two solutions are mixed just before use. Temperature of the bath should be about 60° C. A yellow-gold color is produced first and is followed by the blue in about one half minute.

Gun Metal Finish on Brass

The brass is polished, buffed, washed, lightly scoured using water and pumice, nickel plated, black nickel plated, lightly scoured, again black nickel plated, lightly scoured, rinsed, dried and lacquered. In scouring the black nickel deposit, use a soft steel section wheel and little pumice.

Black Nickel Plating Bath

Powdered Arsenic	2 oz.
Ammonium Carbonate	2 oz.
Double Nickel Salts	12 oz.
Aqua Ammonia (26%)	32 oz.
Water	1 gal.

Add Cyanide to clear.

Depositing Gold on Glass and Textiles

British Patent 497,240

Apply the following solutions:

Gold Diethyl Bromide	0.18 g.
Alcohol	32.00 g.

Dissolve and add following solution:

Sodium Ethylate	0.073 g.
Alcohol	1. 1 pt.

for ½ hour.

Paraffin wax may be used as a resist.

Pickling German Silver

Formula No. 1

Sulphuric Acid	1–3 oz.
Nitric Acid	3–1 oz.

No. 2

To get a uniformly dull surface

Sulphuric Acid	4.5 l.
Potassium Dichromate	1.25 kg.
Water	4.00 l.

Use at room temperature. For marked scaling use at 50°–60° C.

No. 3

To get a bright surface

Sulphuric Acid	3.00 kg.
Nitric Acid	1.00 kg.
Hydrochloric Acid	0.02 kg.
Water	2.00 kg.

Inhibitor for Steel Pickling

U. S. Patent 2,071,989

Corn Syrup is evaporated to 60% solids and then heating for 2 hrs. at 120–125° C. with 10% sulphur.

Corrosion (Pickling) Inhibitor
Dutch Patent 47,784

The addition of 0.033 g. benzyl thio cyanate per 100 cc. 20% sulphuric acid inhibits corrosion almost completely.

Pickling Bath for Metals
British Patent 488,656

Undecenoic Acid	10%
Acetic Acid	5%
Hydrochloric Acid	15%
Butyl Alcohol	70%
Trioxymethylene	0.3–3%

Copper Pickling Solution

Copper Sulphate	124 g.
Sulphuric Acid	97 g.
Water to make	1 kg.

Use at 60° C.

Brass Pickling Solution

Zinc Ammonium Chloride	400 g.
Water	1 kg.

Use at 65° C.

Copper Tinning Pickling Solution
Sulphuric Acid 5–10% used cold

Chrome Steel Tinning Pickling Solution

To "wet" chrome steels first pickle in 5% sulphuric and then in 20% cold nitric acid.

Inhibitor for Alkaline Precious Metal Cleaning
U. S. Patent 2,098,744

Sodium Cyanide	1
Rosin	8
Borax	31

Pickling Monel, Nickel and Inconel

Nickel and its alloys are susceptible to surface injury during heating if oil or grease from the last mechanical operation, or accumulated dirt from storage, is not removed before the metal is heated for forging or annealing. Many lubricants contain sulfur, and the pigment in marking paint is generally a sulfide, such as zinc sulfide—a constituent of lithopone. These sulfur compounds are particularly active in destroying the smoothness of the metal surface. In fact, most foreign matter will "burn" into the surface at high temperatures and cause difficulty in cleaning.

In heating furnaces, especially forge shop furnaces that operate at very high temperatures, the metal is apt to come in contact with slag, cinder, sulfur-bearing scale, silica, roof spallings, and other substances that attack nickel and nickel-bearing alloys and make cleaning by pickling difficult, if not impossible. To avoid this source of difficulty, the work is supported on rails or plate and kept entirely clear of the furnace bottom. Covers of flat steel sheets are placed over the metal if the roof spalls.

Inconel is particularly sensitive to these conditions, and this usually explains the patches of scale that remain on some work after most of the metal surface has been pickled to clean white metal. These patches resist all efforts to remove them, unless pickling is carried to the point where the clean metal is badly etched and over-pickled.

Grease, oils, fats, and other lubricants from drawing, spinning, or cupping operations can be removed before pickling by standard cleaning methods. Uniform descaling or cleaning cannot be expected unless the parts are thoroughly free of oil or grease. Soluble oils and soaps are removed with hot water; tallow, fats, and fatty acid combinations with a hot 10 to 20 per cent soda ash or caustic soda solution; mineral oils and greases are freely soluble in carbon tetrachloride, gasoline, kerosene, and other solvents, but a film remains that must be removed by a final dip in hot Oakite or 10 per cent caustic solution.

In making up the following formulae, the ingredients should be added in the order given. Care must be exercised, especially in the formulae containing sulfuric acid, to pour the acid slowly into the water to avoid the possibility of acid burns through excessive heating.

When metals are in pickling baths, obnoxious and sometimes toxic fumes are liberated. Positive ventilation is necessary for the protection of workmen. This may be accomplished by ventilating hoods over the pickling bath or by arranging the work so that the fumes are carried off by a controlled draft.

In these instructions, the following classification is made of the relations between the character of the metal surface resulting from the last heating and cooling operation and the pickling procedure to be used:

White surface free of oxide or scale

(a) Bright annealed white metal

requiring removal of tarnish by flash pickling.

(b) Bright annealed oxidized metal requiring removal of layer of reduced oxide, followed possibly by flash pickle to brighten.

Black or dark colored surface requiring removal of adherent oxide film or scale.

Removal of Tarnish by Flash Pickling

Drawn and spun shapes, cold headed rivets, cold drawn wire, and other cold worked products finished with a white surface by annealing in a strongly reducing sulfur-free atmosphere, and either cooling out of contact with oxygen, or quenching in a 2% alcohol solution.

In cleaning the products included in the above group, bright dipping, or flash pickling, is used to remove tarnish and dullness and give the parts a bright, lustrous, pure white appearance. Flash pickles should be contained in crocks, glass, or ceramic vessels. Their action is rapid and care must be exercised to prevent over-pickling and etching. They are used at ordinary room temperatures, but unless they are slightly warmed in cold weather the action may be unduly slow.

The best results are obtained by warming the parts by a dip in hot water, then into the acid for a few seconds, followed by a hot water rinse and a second dip, if necessary. Badly tarnished metal may require up to three minutes to clean, but lengthening the pickling time should be done cautiously by frequent returns to the pickle.

These pickles work well even when nearly saturated with metal salts. They should be dumped and fresh solutions made up when salts begin to crystallize out on the side of the container. The fumes from these strong acid combinations are obnoxious and they should be used either under a hood or in a well ventilated location.

Monel

Two dips are required for Monel, as follows:

Formula No. 1

Water	1 gal.
Nitric Acid (38° Bé.)	1 gal.
Common Salt	½ to ¾ lb.

No. 1A

Water	1 gal.
Nitric Acid (38° Bé.)	1 gal.

Clean thoroughly in Formula No. 1, rinse in hot water, and follow with a rapid dip, not over five seconds, in Formula No. 1A. Rinse and dip in dilute ammonia (1 part aqua ammonia to 50 parts of water, by volume), and dry by dipping in steaming water or by rubbing in sawdust.

Nickel

Water	1 gal.
Sulphuric Acid (66° Bé.)	1½ gal.
Nitric Acid (38° Bé.)	2¼ gal.

Allow to cool for several hours and then add common salt ¾ lb.

The rate of action of the above flash pickle may be retarded by decreasing the sulfuric acid to any quantity between 1½ gal. and ½ gal. and the nitric acid between 2¼ gal. and 1¾ gal. The formula, as written, gives the best results under average conditions.

Warm parts by dipping in hot water and immerse in the pickle for 5 to 20 seconds, which is usually sufficient to brighten nickel. Follow this with a rinse in hot or cold water, a neutralizing dip in dilute ammonia, and dry by dipping in steaming water or rubbing in sawdust.

Inconel

It is not possible, under the conditions applying in the average shop, to bright anneal this alloy to give the white surface obtainable with Monel and nickel, due to the high affinity chromium has for oxygen. Chromium is oxidized in the presence of carbon dioxide and water vapor. Flash pickling is accomplished only after a descaling pickle, which will be described later under the heading "Removal of Oxide Film or Scale."

Removal of Reduced Oxide

Forgings, hot rolled shapes, hot rolled wire in coil, and other hot worked products that are necessarily oxidized, but prior to pickling have been heated in a strongly reducing, sulfur-free atmosphere, and cooled out of contact with air or by quenching in 2 per cent alcohol solution.

This group includes all large productions requiring cleaning after hot work prior to further processing by cold rolling, cold drawing, cold forging, and other cold operations; also hot worked products requiring annealing and cleaning before shipment, such as rivets.

At annealing temperatures, the oxides on nickel and high nickel alloys, excepting the chromium-bearing alloys, readily give up the oxygen to hydrogen, carbon monoxide, and hydrocarbons, and there remains on the surface of the metal a spongy, more or less lightly adherent layer which on nickel consists of metallic nickel, and on Monel a mixture of metallic nickel and copper.

Unfortunately for ease of pickling, Inconel does not respond as nickel and Monel do to a complete reduction of the oxide. The oxide scale is selectively reduced under the usual reducing heating conditions to a mixture of metallic nickel and chromic oxide. The color of the surface ranges from the characteristic chrome green of chromic oxide to dark brown.

Since Inconel is not bright annealed under the conditions applying in the average shop, the instructions for pickling are given under "Removal of Oxide Film or Scale."

The following methods are recommended for large scale production in plants fully equipped for pickling. The acid mixtures are more destructive to tank and rack equipment than pickles used for steel or copper. Wood tanks have an average life of about four weeks in the pickle used for nickel, and a considerably longer life in the weaker Monel pickle. Acid brick-lined cement tanks are much more economical than wood. Racks, crates, wire hooks, and all handling equipment used in and out of these acids should be made of a special manganese nickel alloy.

Monel hot rolled, bright annealed sheets, drawn sheet products, and other forms having very thin films of deoxidized metal.

Water	700 gal.
Sulphuric Acid (60° Bé.)	690 lb. (49 gal.)
Sodium Nitrate (Crude)	140 lb.
Add water to make total	1000 gal.

Acidity at start 8–10%, when dumped 3½–5%.

Baumé at start 6°–8°, when dumped dumped 21°–28°.

Temperature 180°–190° F.

Time 20 to 30 minutes.

Scrubbing mechanically or by hand with pumice advisable.

Monel or nickel hot rolled, bright annealed strip in coil, small drawn or pressed shapes, stampings, and other products not conveniently scrubbed.

Water	700 gal.
Sulphuric Acid (60° Bé.)	2100 lb. (148 gal.)
Sodium Nitrate (Crude)	750 lb.
Sodium Chloride	700 lb.
Add water to make total	1000 gal.

Acidity at start 15–18%, when dumped 3½–4%.

Baumé at start 8°, when dumped 25°–30°.

Temperature 180°–190° F.

Time 20 to 60 minutes.

Monel or nickel hot rolled, bright annealed rods, forgings, wire rod in coil, tubing, etc.

Water	700 gal.
Sulphuric Acid (60° Bé.)	1600 lb. (113 gal.)
Sodium Nitrate (Crude)	1800 lb.
Sodium Chloride	1200 lb.
Add water to make total	1000 gal.

Acidity at start 9–10%, when dumped 2–3%.

Baumé at start 10°–12°, when dumped 20°–22°.

Temperature 180°–190° F.

Time 30 to 90 minutes.

Nickel hot rolled, bright annealed sheets, drawn sheet products, and other forms having a very thin film of deoxidized metal.

Water	700 gal.
Sulphuric Acid (60° Bé.)	1200 lb. (85 gal.)
Sodium Nitrate (Crude)	340 lb.
Sodium Chloride	690 lb.
Add water to make total	1000 gal.

Acidity at start 10–12%, when dumped 3½–5%.

Baumé at start 6°–8°, when dumped 21°–28°.

Temperature 180°–190° F.

Time 30 to 90 minutes.

The acidity can be tested with "pickle pills" available from several sources. Additions of acid, sodium nitrate and common or rock salt should be made in the proper proportions to maintain the acidity recommended above.

These pickling solutions work better after they have been in use a while. In making up new solutions, a portion of the spent acid, about 2 per cent by volume, is added to give normal action at the start.

After pickling, the material is thoroughly washed in cold water and the remaining trace of acid is neutralized in:

Water	980 gal.
Aqua Ammonia (26–28%)	20 gal.

The above pickling procesess may be used for the occasional small lot job, using ceramic vessels, wood barrels, or even butter tubs heated and agitated by injecting live steam through a rubber hose.

Removal of Oxide Film or Scale

Hot forgings, hot headed bolts, all hot rolled and hot formed products, and annealed pieces cooled in the air that require the removal of the oxide film or scale.

The oxide film formed on metal that has been properly heated is from oxidation due to contact with the air after the work is drawn from the furnace. Inconel, as previously mentioned, is an exception. Superficial oxidation of chromium will occur during heating in average furnace atmospheres. In all cases, the film is extremely thin and tightly adherent. It has a glossy appearance dark to black in color.

The perfection of heating yielding the thin films described above is found in but few shops, and all gradations of scaling to the complete ruination of the metal from sulfur or oxygen attack are given the pickling room for cleaning. Obviously, pickling cannot correct wrong heating practices.

The following procedure will yield good results on oxidized metal carrying a thin to moderately thick and tight oxide scale.

Monel

Hydrochloric Acid (30° Bé.)	1 gal.
Water	2 gal.
Cupric Chloride	½ lb.

Temperature 180° F.

Time 20 to 40 minutes.

The cupric chloride may be omitted if it is not available. However, its use considerably speeds up the action in loosening the scale.

Contain in an acid brick-lined tank, ceramic vessel, or earthenware crock. Heat by injection of live steam; rinse in hot water and dip in the following solution.

Water	1 gal.
Sulphuric Acid (66° Bé.)	0.1 gal.
Sodium Dichromate	1.1 lb.

Temperature 70°–100° F.

Time 5 to 10 minutes.

Rinse in cold water and neutralize in 1 per cent ammonia.

Nickel

Formula above, as for Monel. The nickel oxide is more resistant and the time must be increased to 1 to 2 hours. Usually no brightener is required for nickel, but when desired, rinse in hot water after the hydrochloric acid pickle and dip for a few seconds in Formula No. 2. Rinse in cold water and neutralize in 1 per cent ammonia.

Inconel

It is not possible to bright anneal Inconel in the average industrial annealing equipment because of the readiness with which chromium, in the presence of carbon monoxide or water vapor, forms an oxide layer that is very difficult to reduce. Differences in heating and cooling conditions result in a rather wide variation in the characteristics of the oxide layer formed, and as a consequence, in the ease with which it may be removed by pickling.

Incompletely burned furnace gases that, because of a content of carbon monoxide, are reducing to nickel and Monel will produce on Inconel a scale having the characteristic green color of its principal component, chromic oxide. During air cooling there may be sufficient oxidation of nickel to change the color to dark brownish green, or even to black.

In oxidizing furnace atmospheres, the scale formed is a mixture of nickel and chromic oxides, black in color and generally rough in texture. This latter type of scale is removed more readily by acid pickling, but annealing under conditions favoring its formation is not recommended. Unfortunately, close control of scaling is not possible in an oxidizing atmosphere and the metal may be damaged considerably by excessive oxidation. Furthermore, the surface after subsequent descaling may be rough, spongy and open, which would require expensive grinding and polishing to obtain a presentable appearance.

It is far better to avoid excessive oxidation, and to deal with the thin chromic oxide type of scale film, than to attempt to save pickling time with the thick black scale, at the expense of finishing operations. The heating furnace atmosphere, therefore, should be adjusted to give an excess of combustile gases and thereby be reducing in nature. Subsequent air cooling of the annealed material is the usual practice.

Separate instructions have been prepared for annealing practice and should be consulted for details.

Alkaline-Acid Pickling

The preferred method of pickling, which leaves a highly satisfactory, smooth surface, involves first a soaking for two hours in an alkaline solution of potassium permanganate followed by immersion for about one hour in an acid solution, such as is used for the pickling of Monel. The work should not be rinsed between these two treatments, but after the acid pickling it should be rinsed with cold water and then, to neutralize remaining traces of acid, with a two per cent by volume solution of 26°–28° Bé. ammonia in water.

The alkaline permanganate bath, which may be held in a steel tank heated by a steam coil or by live steam, is operated at temperatures of 180° to 190° F. Its compositions is as follows:

Sodium Hydroxide	18 oz.
Sodium Carbonate	18 oz.
Potassium Permanganate	7 to 11 oz.
Water	1 gal.

The acid pickling solution, which can be kept in a wooden tank, but preferably in a wood, concrete or steel tank lined with acid-proof brick set in sulphur, is operated at a temperature of 180° F. maintained by passing in live steam through a lead pipe. The composition is as follows:

Sulphuric Acid (66° Bé.)	16 oz.
Sodium Nitrate	8 oz.
Copper Sulphate or Copper Nitrate	1½ oz.
Water	1 gal.

For the relatively heavy oxide scale that results from excessive oxidation during heating and cooling in the air, the time required in the acid pickle may be as much as one hour, but in order to avoid "coppering" it should be kept to the minimum necessary.

For the occasional cases where available annealing equipment permits cooling in a reducing atmosphere, the resulting light scale may be removed by dipping in the acid pickle for only a minute or two. In such cases, the time in the alkaline permanganate bath also may be reduced, but not to less than one hour.

Paste Pickles

Paste pickles are used for large pieces such as hot rolled plate, fabricated tanks, etc., or where suitable facilities for pickling in tanks are not available.

These pastes fume badly and must be applied in a well ventilated location. Ordinarily it is not inconvenient either to provide ventilation or to find a place where a draft of air will carry the fumes away from the workmen. If ventilation cannot be provided, the fuming will be reduced materially by diluting the acids used in the following formulae with ¼ to ⅛ volume of water. This will increase the descaling time somewhat.

The following proportions of absorbent solids to liquids have been found to give a smooth creamy consistency that spreads well with a brush and remains on vertical and overhead surfaces. Variations may be found in the amount of liquid the Fullers' earth will absorb due to variations occurring in the manufacture of this material. If it is found that the mixture is too thin on adding the quantity of liquid given in the formulae, an addition of lampblack should be made to give the proper consistency.

Monel hot rolled plate, forgings, tanks, drawn shells, etc.

Lampblack	1	lb.
Fullers' Earth	10	lb.
Hydrochloric Acid (20° Bé.)	3	gal.
Nitric Acid (38° Bé.)	½	pt.
Cupric Chloride	1 to 2	lb.

Place the lampblack and Fullers' earth in a 5 gallon crock, butter tub, or similar container (smaller or larger container if proportions other than the above are used). Mix the acids and dissolve the cupric chloride in a separate crock or glass container. Pour the liquid over the powder and mix thoroughly. If a thinner consistency is wanted, add hydrochloric acid in small quantities.

The paste is used at ordinary room temperatures, but action may be slow at temperatures under 70° F. Better results are obtained in the winter if the work is warmed to about 100° F.

The paste is applied with a long-handled whitewash brush for large surfaces, or an ordinary paint brush for smaller work.

The removal of the black oxide on Monel requires 20 to 60 minutes.

Wash off with a hose and scrub with sand or pumice. In cold weather cold wash water will cause Monel to tarnish badly. This is prevented by spreading a creamy lime paste directly on the pickle and thoroughly mixing to neutralize the acid. A cold water wash may then be used. The lime is unnecessary if hot water is available for washing.

Nickel hot rolled plate, forgings, tanks, drawn shells, etc., and nickel-clad steel plate, tanks, etc.

Use above formula and follow the procedure given for Monel. A longer time is required to descale nickel—2 to 4 hours or longer—depending upon the thickness and the nature of the scale. Nickel does not tarnish with cold water washing; hence, the lime spread may be omitted.

Inconel hot worked and annealed parts carrying the green or the black oxide, Inconel-clad plate, tanks, etc.

Most oxidized Inconel work requires a hydrochloric acid paste to loosen the scale, as:

Lampblack	1 lb.
Fullers' Earth	10 lb.
Hydrochloric Acid (20° Bé.)	3 gal.
Cupric Chloride	2 lb.

Time—to 3 hours.
Temperature 70°–100° F.

This is followed by:

Lampblack	1 lb.
Fullers' Earth	10 lb.
Nitric Acid (38° Bé.)	2¾ gal.
Hydrochloric Acid (20° Bé.)	¼ gal.

Temperature 70°–100° F.
Time—15 to 60 minutes.

Wash thoroughly and scrub with pumice and water.

Pickling Heavily Scaled Work

Pickling is sometimes expected to make presentable work that has been grossly mistreated during heating as by the use of an oxidizing furnace atmosphere, high sulphur-bearing fuels, or improperly designed furnaces that allow an inflow of air over the hearth. The scale will have a dull spongy appearance; fine hairline cracks may be present, and patches of scale may break away from the surface. The underlying metal is rough and cannot be brought to an attractive finish by any pickling method. Sandblasting or grinding is probably the most suitable procedure, followed by one of the flash pickles. An alternative is a soak in the hydrochloric acid pickle, followed, if brightening is necessary, by a flash dip.

Removing Discoloration From Automatic Screw Machine Parts

Monel acquires a brown discoloration at high production speeds due to the formation of sulphur compounds by reaction with sulphur-base coolants. This discoloration may be removed easily to give a white surface.

Degrease to remove all traces of coolant and immerse in:

Water	1 gal.
Sodium Cyanide	½ to 1 lb.

Temperature 70°–100° F.
Time 5 to 30 minutes.

Contain in a crock of 1 to 5 gallons capacity, depending on quantity of parts to be cleaned. Handle parts in a perforated Monel or woven wire dipping basket. Rinse thoroughly in hot water, if available, to hasten drying, or in cold water followed by shaking or tumbling in sawdust to dry.

Caution

Cyanide is a deadly poison and shops not regularly using cyanide solutions should keep the solution and stock of cyanide salt under lock and key. Under no conditions allow acid from pickling operations or other sources to be carried into the solution. Acid will liberate hydrocyanic acid gas, probably the most lethal industrial substance.

Coppering

Coppering will occasionally occur on Monel, nickel and Inconel during pickling operations unless proper steps are taken to avoid it. In order for copper to deposit on these metals, it is necessary for the copper ions in the solution to be in the cuprous form, or to pass from the cupric to the cuprous form during the cementing process. Consequently, any agents added or present in the pickling bath that tend to maintain the cupric state will be helpful in preventing coppering. The oxidizing agents, such as nitric acid and ferric chloride, promote the pickling reaction and become depleted as pickling goes on. As the pickling bath becomes aged, the concentration of copper ions builds up and that of the oxidizing agents decreases. Both of these results favor coppering over such areas where the reducing effect of the metal exceeds the oxidizing power of the bath.

When coppering takes place in pickling Monel and other high nickel alloys containing an appreciable amount of copper, small additions of nitric acid or ferric chloride are made to prevent it. Nickel has greater reducing capacity than Monel and, consequently, requires a greater concentration of oxidizing agents to prevent coppering in solutions containing copper salts. For this reason, nickel cannot be pickled in a solution used for Monel without the addition of a considerable quantity of nitric acid or ferric chloride.

Patches of copper plate out on Monel whenever steel comes in contact with the metal wet with acid. Steel tongs, used in handling the work out of the pickle, are the usual source of coppered areas. Obviously, this is presented by providing tongs, wires, or other handling devices that are made of Monel or nickel.

Coloring Nickel and Nickel Alloys

British Patent 523,751

Black on nickel, chromium, iron alloys heat at 1010–1200° C.

Blue black on nickel copper alloys heat at 840–1040° C.

Brown on nickel heat at 816–980° C.

Blue black on nickel manganese alloys heat at 930–1010° C.

Preventing Oxidation on Small Tools and Instruments

There are certain classes of instruments and tools where the ordinary method of protecting them by means of a film of oil leaves much to be desired, this being especially true of draftsman's and other similar tools where the presence of oil may cause more or less smearing of drawings, etc. It is of course first essential to remove any existing corrosion or tarnish either by chemical or abrasive process, before anything can be applied to protect the surface from the atmosphere, from perspiring fingers, etc.

After all traces of oxidation have been removed, a very thin coating of paraffin can be applied, through the medium of a bath in benzol. A small piece of paraffin is shaved into the benzol bath, and just a little kerosene mixed in. The articles to be protected are submerged in this until the benzol enters all crevices, then they are withdrawn and placed on the rack until the benzol evaporates, leaving a hardly noticeable film on the tools as a protection, and one which is not smeary.

Rust Preventive Coating

Formula No. 1

U. S. Patent 2,080,299

a. Mix 2 parts by weight of dicetyl phosphate with 98 parts by weight of a medium viscosity lubricating oil.

b. Mix 2 parts by weight of dilauryl phosphate with 98 parts by weight of a medium viscosity lubricating oil.

N. B. The former product is made by reacting cetyl alcohol with phosphorus pentoxide, and the latter by reacting lauryl alcohol with the same pentoxide.

When either of the above solutions are applied to bright iron or steel surfaces rusting is prevented for long periods of time.

No. 2

Phosphoric Acid	0.55	l.
Pyrolusite	0.9	kg.
Water	32	l.

Treat the iron surface with above hot solution.

No. 3

British Patent 494,963

Heat Tung Oil 200 gals. for 15-20 min. at 340° C. until it approaches gelatinous stage and then add sardine oil 20 gal., cool and then add whale oil 60 gal., sardine oil 200 gal. and ½% by volume of manganese cobalt drier.

No. 4

U. S. Patent 2,127,202

Salt	2	oz.
Chromic Acid	1	oz.
Cresylic Acid	.01	oz.
Water	96.99	oz.

Metals are treated with this prior to painting to prevent rusting.

Corrosion Preventive

U. S. Patent 2,182,992

Degras	10 lb.
Sodium Salt of Oil Soluble Sulphonic Acids.	10 lb.

Preventing Metal Corrosion in Water

British Patent 491,023

The following is dissolved in water to give a 1% concentration:

Formula No. 1

Potassium Chromate	22 lb.
Potassium Dichromate	78 lb.

No. 2

Potassium Chromate	12 lb.
Potassium Dichromate	86 lb.
Sodium Chlorate	1 lb.
Sodium Chlorite	1 lb.

Non-Corrosive Coating for Magnesium

German Patent 636,912

Magnesium or its alloys is treated in the following bath:

Glycol	98 kg.
Potassium Fluoride	1 kg.
Potassium Acid Phosphate	$\frac{3}{4}$–$\frac{8}{10}$ kg.
Potassium Silicate	$\frac{8}{10}$ kg.

Protecting Magnesium Articles

French Patent 830,839

The article is treated with the following:

Disodium Hydrogen Phosphate	100 g.
Potassium Dichromate	40 g.
Soda Ash	30 g.
Boric Acid	25 g.
Phosphoric Acid (36° Bé.)	30 g.
Water	1000 cc.

Radiator Corrosion Inhibitor

U. S. Patent 2,060,138

Cyclohexylamine	.41 lb.
Soap	1.23 lb.
Alcohol	4 gal.
Water	45 gal.

Auto Radiator Rust Remover

U. S. Patent 2,135,066

β β Dichlorethyl Ether	8.4 fl. oz.
Kerosene	3.6 fl. oz.
Trisodium Phosphate	50 g.

Rust Remover

Formula No. 1

Sodium Hydroxide	750 g.
Sal Soda, (Crystals)	875 g.
Potassium Permanganate	10 g.
Water	12 l.

For cleaning off dirt, oil, colors and the like, the addition of a little glycerin to the solution is recommended. Since they keep well, the mixed dry materials may be stored and added to the water just prior to use. The rust dissolves after a few minutes in the solution and can be wiped off. The metal underneath is not corroded and possesses a thin coating which protects it from rust for a short time. The glycerin addition does not affect the derusting action.

No. 2

U. S. Patent 2,070,487

Solution A

Mix 32 parts by weight of octadecyl alcohol with an equal weight of cetyl alcohol. To this mixture add, slowly and carefully, 25 parts by weight of concentrated sulfuric acid (Sp. gr. 1.84). Allow to cool.

Solution B. 33% Phosphoric Acid in Water

Mix 3% of A with B, and heat the mixture to 120°F for about 4 hrs. A semi gelatinous product is formed. This is applied to the rusty surface and left for about 1 hour, then washed off with water, leaving the iron or steel surface bright.

No. 3

German Patent 676,149

Iron is treated with:

Oxalic Acid	1.6 kg.
Aluminum Sulphate	3.3 kg.
Sodium Bisulphite	12.0 kg.
Water	100.0 l.

Preventing Corrosion of Embedded Metal

British Patent 481,606

Metal, to be buried in earth or encased in masonry is protected by a cloth wrapping soaked in a 2½-5% potassium dichromate or potassium permanganate solution which is then dried and impregnated with petrolatum at 160° F. and finally loaded in a hot petrolatum bath containing a mineral filler.

Protecting Boiler Tubes Against Corrosion

The tubes are painted with following:

Bakelite Lacquer	1000 g.
Kaolin	200 g.
Aluminum Powder	50 g.
Alcohol	150 g.
Mineral Pigment	50–60 g.

After painting, heat tubes to 120-150° C. to polymerize Bakelite. 4-6 coats and bakings are given each tube. The coefficient of heat transfer is scarcely changed. Such coatings are stable to 250° C.; withstand blows of 50-60 kg./sq. cm.; have Brinell number of 35-40.

Reducing Brine Corrosion

To reduce corrosion of iron pipes carrying Salt brine add

Potassium Dichromate	3.6 g.	per liter
Caustic Soda	1.0 g.	of brine

For Calcium Chloride brines the potassium dichromate is reduced to 2.25 g. per liter.

Chrome Pickle (Mordancage) for Magnesium Castings

What is known as chrome pickle in this country and mordancage in France is the customary sodium dichromate and nitric acid solution for coating magnesium alloy castings to protect them against industrial atmospheres and sea water. This consists of 1½ lb. sodium dichromate and 1½ pints of nitric of 1.4 sp. gr., to 1 gallon of solution. The casting usually is given a dip lasting from ½ min. to 2 mins. This produces a complex protective coating of the sparingly soluble chromic chromates which is both porous and a good foundation for paints or other coatings.

Stripping for Tin Plate

The following solutions rapidly dissolve tin late with very little attack on steel.

Formula No. 1

Iron Chloride	10–14 oz.
Water	1 gal.

No. 2

Acetic Acid (56%)	40–60 fl. oz.
Water	1 gal.

No. 3

Copper Sulphate	18–21 oz.
Water	1 gal.

Remove object from solution as soon as stripping is completed and wash well with water.

Protective Blanket for Galvanizing Baths

U. S. Patent 2,092,595

Granulated carbon (4-12 mesh) is activated by heating with steam at 900-1000°C. and then impregnated with ½-3 times its weight of boric acid.

Mold lining for Stainless Steel Castings

French Patent 841,357

Quartz (Finely Divided)	500
Fire Clay	180
Charcoal (Pulverized)	
Heat to 500° C.	10 g.

The temper liquid consists of

Sodium Silicate	85
Water	1000

Oxide Coated Cathodes

British Patent 514,849

Cores of nickel, tungsten or platinum are coated with following suspension:

Barium Carbonate	100 g.

suspended in following solution:

Nitrocellulose	60 g.
Acetone	200 g.
Diethyl Carbonate	125 g.
Alcohol	20 g.
Diethyl Oxalate	850 cc.

Aluminum With Large Reactive Surface

British Patent 490,795

Pure aluminum sheet 2 mm. thick is rolled to 0.2 mm., annealed in air at 270° C., cleaned by scratch brushing and pickled in aqueous hydrochloric acid for 16 hours at 10–15° C. A loss of 45% by weight with dimensional change results. It may be used as a gas filter or in flashlight photography if soaked in aqueous potassium chlorate.

Heat Stable Photo Cathode Silver Layer

Wash glass with soap and water, then with distilled water. Slowly heat glass to 500° C. and then cool slowly. Fill tube with

Water	3 parts

and one part of each of following solutions:

(1)

Sugar	90 g.
Distilled Water	1000 cc.
Nitric Acid (d. 1.42)	4 cc.
Alcohol	175 cc.

(Allow to stand for 10 days before use)

(2)

Silver Nitrate	20 g.
Caustic Soda	10 g.
Distilled Water	300 cc.

Ammonia (An amount just insufficient to dissolve precipitate)

Silvering takes place in about 3 minutes. The silver coating is not affected by heating in vacuo to 450° C.

Regeneration of Spent (Nickel) Catalysts

Nickel catalyst precipitated on clay is regenerated by heating a 350-400 kg. batch for 30-40 minutes with sufficient sodium hydroxide (density 1.06) to saponify half the fat, and then with aqueous sodium hydroxide (density 1.26) to saponify 20-40% of the remaining fat at 90-95° for 1.5-2 hours. The product is treated with 350-400 liters of sodium oxychloride of density 1.04 (active chlorine 1.4%) and 350-400 liters of water at 60° for 1 hour.

After diluting with 2.5-4 volumes of water the mixture is brought to the boil, settled for 3-4 hours and the supernatant fat and soap solution are siphoned off. The catalyst is stirred with 4-5 volumes of water at 80-85°, neutralized with sulphuric acid, filtered off, washed until neutral, dried, and reactivated in hydrogen at 450°. The loss of nickel during recovery is 6-10%.

Wiping Solder

U. S. Patent 2,191,624

Tin	30–40%
Arsenic	0.02–0.15%
Lead to make	100%

Hard Solder

Formula No. 1

U. S. Patent 2,149,103

Silicon	1%
Phosphorus	4–5%
Copper	58–68%
Zinc to make	100%

No. 2

U. S. Patent 2,196,034

Zinc	65
Aluminum	30
Silicon	5

This forms a hard solder melting at about 500° C.

Liquid "Solder"

Heavy Clear Lacquer	57.5 g.
Benzol	23.0 g.
Aluminum Powder	19.5 g.

Mix until uniform.

Hard Solder for Copper Bus Bars

Copper	80 oz.
Silver	15 oz.
Phosphorus	5 oz.

This melts at 705°.

Brass Solder

German Patent 660,308

Copper	58–68%
Silicon	1%
Phosphorus	1–5%
Zinc to make	100%

Soft Soldering of Monel, Nickel and Inconel

Soft soldering is one of the oldest of the commonly used methods of joining. Its usefulness for joining the strong, corrosion resisting materials, Monel, nickel and Inconel, is limited to those applications where soft solder is not corroded readily. Soft solder is inherently of low strength, and usually dependence for strength must be placed on riveted, lock seamed or spot welded joints, with the soft solder acting only as a sealing medium. The process is limited usually to joints in sheet metal not more than .050 in. or .062 in. thick, because other processes yield stronger joints in these and heavier gauges.

The composition and melting points of soft solders commonly used on Monel, nickel and Inconel are given in Table I. Of these the 50-50 and the 60-40 tin-lead solders are used most widely. The trade uses the 60-40 rather than the eutectic 63-37 composition. Pure tin is justified only where corrosion conditions demand its application.

Table I

Commonly Used Soft Solders *

Their Melting Points and Shear Strengths

	Temperature of Complete Liquefaction	Complete Solidification	Shear Str'th p.s.i.
Pure Tin......	450°F.	450°F.	2865
63–37 Tin-Lead	359°F.	359°F.	6230
50–50 Tin-Lead	414°F.	359°F.	5740
40–60 Tin-Lead	460°F.	359°F.	4975

Only those soft soldering fluxes known to the trade as "acid" fluxes are recommended for use with Monel, nickel or Inconel. Rosin is not suitable since its cleaning action is too mild. The proprietary or "cut acid" fluxes commonly used for copper are adequate for the soft soldering of Monel and nickel, but a somewhat stronger flux is required with Inconel because of its chromium oxide film. In general, proprietary soft soldering fluxes are to be preferred largely because of convenience.

All traces of flux should be removed after the soldering operation has been completed.

Surfaces of metal parts to be soft soldered must be clean and free of any surface oxide or other discolora-

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* International Tin Research & Development Council.

tion. Foreign material, such as oil, must be removed. Oxide or other tarnish can be removed mechanically with emery cloth or by light grinding, or chemically by pickling. Wherever possible, the surfaces to be joined should be "pretinned" to insure complete bonding during the final soldering or 'sweating in' operation. "Pretinning" is done with the solder to be used for the joint and not necessarily with pure tin as the term would seem to indicate. With untinned edges the solder may not penetrate throughout the joint.

The heat necessary for the soldering operation is supplied by a soldering "iron" (really a soldering copper), city gas-air torch or oxy-acetylene torch. Because the transfer of heat through the high nickel materials is slower than through copper, it is necessary to use either a hotter or a slightly larger soldering copper than that regularly used for similar jobs in copper.

Soldering & Testing Milk Cans

It is necessary to hammer out all dents and have the can body in perfect condition before it is given the tin coat. Wooden mallets, special rolls and special tools are used for removing these bends and dents.

In the retinning plants where production is large, the old cans are soaked in a metal soaking pot and the old bottoms dissolved loose, the solder going into this rough metal pot. These old cans to be retinned are then put through a cleaning solution and pass through the regular steps that the new dairy cans pass through. All the cans are hot-dip tinned with the bottoms removed. A full production schedule may be from 800 to 1200 cans a day.

No matter what size of plant, if a high quality retinning job is expected, the old cans must be taken apart. This is because of greases from the contents of the cans getting down into seams and openings.

Soldering is done in the usual manner with a small soldering iron and heating furnace for the iron. The usual soldering flux is used and when the bottoms are in, they are then passed over to the testing department, next to the soldering benches.

The testing department consists of 7 compartments made of steel. Each compartment is 15″ wide by 20″ long by 30″ deep. A one-half inch steam line heats the water. The cans that pass inspection are given a beautiful bright finish by polishing with gasoline and whiting. They are finally wiped with a very soft rag until perfectly clear and bright and then packed or wrapped in heavy brown wrapping paper to protect the finish.

Brazing Solder

U. S. Patent 2,142,673

	Per cent
Cadmium	0.05 to 5
Nickel and/or Cobalt Silicide	.1 to 10
Phosphorus	0.05 to 2

Brazing Solder

U. S. Patent 2,073,077

Tin	15 lb.
Phosphorus	5 lb.
Copper	80 lb.

Aluminum Solder

Formula No. 1

U. S. Patent 2,167,678

Bismuth	10 lb.
Zinc	42 lb.
Tin	22 lb.
Lead	23 lb.
Cadmium	2.95 lb.
Silver	0.05 lb.

No. 2

U. S. Patent 2,059,497

Cadmium	25 oz.
Silver	7½ oz.
Aluminum	7½ oz.

No flux is necessary.

No. 3

French Patent 839,765

Tin	67.38 kg.
Zinc	28.71 kg.
Silver	2.61 kg.
Lead	1.20 kg.
Antimony	0.04 kg.

No. 4

(Hard)

U. S. Patent 2,196,034

Zinc	65%
Aluminum	30%
Silicon	5%

Solder for Leads of Discharge Lamps, Rectifiers, Etc.

German Patent 665,005

Formula No. 1

Iron	60 g.
Tantalum	40 g.

No. 2

Nickel	62 g.
Tantalum	38 g.

No. 3
German Patent 665,006

Iron	80 g.
Silicon	20 g.

No. 4

Cobalt	87 g.
Silicon	13 g.

No. 5

Nickel	89.3 g.
Silicon	10.7 g.

No. 6

Iron	86.8 g.
Titanium	13.2 g.

No. 7

Iron	84 g.
Zirconium	16 g.

No. 8
German Patent 665,301

Nickel	51 g.
Molybdenum	49 g.

No. 9

Cobalt	63 g.
Molybdenum	37 g.

No. 10

Iron	62 g.
Molybdenum	38 g.

No. 11

Cobalt	55.5 g.
Tungsten	45.5 g.

No. 12

Cobalt	58 g.
Chromium	42 g.

Solders for Vacuum Tubes

British Patent 487,263

Formula No. 1

Nickel	56 oz.
Iron	33 oz.
Phosphorus	11 oz.

No. 2

Nickel	51 oz.
Molybdenum	49 oz.

Telephone Cable Wiping Solder

Lead	32.75
Tin	67.15
Arsenic	0.10

Soldering Fluxes

I. Inorganic Fluxes

Acids

a. Hydrochloric Acid
b. Hydrofluric Acid
c. Orthophosphoric Acid

Salts

a. Zinc Chloride
b. Ammonium Chloride
c. Zinc Ammonium Chloride
d. Miscellaneous, e.g. magnesium, calcium and aluminium chlorides

II. Organic Fluxes

Organic Acids

a. Oleic
b. Stearic
c. Palmitic
Obtained from fats such as tallow, lard, palm oil
d. Lactic

Amines and Amides

a. Aniline
b. Acetamide
c. Ethylene diamine
d. Urea

Rosin fluxes

a. Rosin (Resin, or colophony)
b. Special patented rosin-base fluxes

Miscellaneous

a. Naphthalene tetrachloride
b. Mannitol and derivatives

The inorganic acids and salts are, in general, excellent for eliminating oxide films and exposing a clean, etched metal surface, and are quite stable under soldering conditions, but they are more or less corrosive and any excess should be carefully washed away to prevent subsequent trouble from corrosion. Phosphoric acid is an exception, as in some cases decomposition products are formed which resist further corrosion. The eutectic mixture of zinc and ammonium chlorides (about 3 parts zinc chloride to 1 part ammonium chloride) is particularly useful where a low melting flux is needed, as the mixture melts at 179° C. (354° F.) which is far below the melting point of zinc chloride alone (262° C. or 504° F.). A mixture of 10 parts zinc chloride and one part ammonium chloride is a very popular and widely used flux.

Non-Corrosive Fluxes

Organic fluxes are, as a class, weaker fluxes than the inorganic acids and salts, and any corrosion products formed are slower in their action. The organic acids are easily decomposed, yet some, like benzoic acid, are quite active for a limited time. Amines and amides are useful for quick spot soldering operations, since they are fairly active and either decompose quickly to comparatively harmless residues or volatilize completely. Rosin, the best known and most widely used organic flux, is only mildly active but is unusual in leaving a non-corrosive residue which is non-conductive and forms a hard solid shell over the soldered joint, impervious to air and moisture. Some patented rosin-base fluxes attempt to combine the speed of an active acid flux with the protection of a rosin residue. As an example, a rosin flux containing 1.5 per cent aniline hydrochloride and 1.5 per cent solvent, such as glycerin or ethylene glycol, is said to release sufficient hydrochloric acid by decomposition to speed the fluxing action yet be comparatively non-corrosive.

Recent Developments

Among the new fluxes which show promise are mannitol, sorbitol and soluble derivatives of these materials. Mannitol is insoluble in most common organic solvents but can be used as a suspension or as a solution of one of its derivatives. Its non-corrosive, non-toxic nature is very desirable for some applications. Laboratory tests indicate it to be more effective in general than most other organic fluxes, but less effective than zinc chloride. Some work has been done on the use of vapor fluxes such as hydrogen chloride, but they have not yet proved to be economically feasible. Of real practical importance, however, is the use of organic wetting agents to increase the wetting power of solder fluxes. This has formed the basis of many patent and secret formula fluxes.

The Choice of a Flux

Various considerations determine the choice of flux for commercial soldering operations. A strong flux, like zinc chloride, is used for many purposes such as dip soldering of radiator cores, and bit soldering of brass, copper, bronze, zinc, tinplate, terneplate and iron. Rosin is used particularly in the electrical industry and can-making industry for joining tinplate, copper connections, etc. Tallow has a time-honored record for fluxing lead joints, block tin and pewter. Hydrofluoric acid is sometimes necessary to flux cast iron. A saturated solution of zinc chloride in 50 per cent hydrochloric acid is frequently recommended for soldering stainless steel, nickel and monel metal.

By the choice of suitable solvents or carriers most of the inorganic and organic fluxes may be prepared in cake, paste or liquid forms or as a core within solder wire. Commercial paste fluxes commonly consist of zinc chloride as an emulsion in vaseline or similar grease. Frequently solder powder is suspended within the flux in a grease or paste medium.

Soldering Flux

French Patent 835,830

Formula No. 1

Rosin	80 g.
Shellac	14 g.
Benzoylsalicylic Acid	6 g.

No. 2

Rosin	90 g.
Phthallic Acid	10 g.

No. 3

British Patent 484,988

Rosin	80 oz.
Butylchloral Hydrate	20 oz.

No. 4

British Patent 492,990

Rosin	5–15
Phosphoric Acid	60–80
Ammonium Chloride	5–15
Glycerin	5–10
Tallow	15–30

The rosin is melted at 120° C and then the other materials are mixed in.

No. 5

(Soft)

British Patent 494,906

Rosin	90 oz.
Maleic Acid	10 oz.

No. 6

U. S. Patent 2,089,095

Formamide	204
Water	10
Zinc Chloride	20

No. 7

(Non-Corrosive)

Mannitol	5–25 g.
Carbon Tetrachloride	93¾ g.
Alcohol	6¼ g.

This forms a suspension which is shaken occasionally.

No. 8

(Neutral Liquid)

Zinc Chloride, Tech. Free of Iron	6.2 kg.
Ammonium Chloride	4.3 kg.
Water	40 kg.
Ammonia about (Spec. Grav. 0.91)	1 kg.

The ammonia is added last with shaking or stirring, until a remaining precipitate forms. Let settle; decant or filter.

No. 9

(For Aluminum)

U. S. Patent 2,179,258

Sodium Fluoride	1– 3%
Ammonium Chloride	12–25%
Zinc Chloride	74–87%

No. 10

(Paste)

An aqueous solution containing 3 lb. zinc chloride and 6 oz. ammonium chloride per gallon (300 g. zinc chloride and 37.5 g. ammonium chloride per liter) is added to hydrous lanolin in an amount approximately equivalent to 10 per cent of zinc chloride in the final mixture. An intimate mixture of these constituents is readily obtained by stirring at about 50° C. (122° F.), and since the mixture stiffens considerably on cooling there should be little likelihood of separation after storage.

No. 11

Flux (For Galvanized Iron)

U. S. Patent 2,160,195

A surface treatment and fluxing composition for solder bonding on steel surfaces having protective coatings of zinc and like metals thereon, comprises approximately 9½ pounds of stannous chloride, approximately 3 pounds of zinc chloride and approximately 3 per cent of ammonium chloride dissolved in water to provide an aqueous solution having a density of approximately 70 degrees Bé at room temperature.

No. 12

Canadian Patent 390,843

Petrolatum	70.0
Ammonium Chloride	4.5
Zinc Chloride	16.8
Stannous Chloride	5.0
Water	3.7

Galvanizing Bath Flux

British Patent 483,672

Zinc Oxide	10 lb.
Aluminum Oxide	2 lb.
Zinc	6 lb.
Ammonium Chloride	82 lb.

Tinning Flux for Chrome Steel

Zinc Chloride	90
Hydrochloric Acid	10

Flux for Casting Malleable Iron

Coke Dust	60
Lime	20
Silica Sand or Fluorspar	10
Rock Salt	10

Arc Welding Fluxes

Formula No. 1

U. S. Patent 2,141,928

Iron Oxide	60 to 70%
Feldspar	15 to 25%
Talc	5 to 15%
Sodium Carbonate (Anhydrous Basis)	Up to 7%

No. 2

U. S. Patent 2,141,929

Cryolite	56 to 64%
Feldspar	22 to 18%
Talc	11 to 9%
Calcium Carbonate	11 to 9%

No. 3

U. S. Patent 2,141,928

Manganese Dioxide	13 to 19%
Feldspar	20 to 11%
Ilmenite	27 to 39%
Ferro-Manganese	24 to 16%
Kaolin	Up to about 6%
Ferro-Titanium	10 to 8%

No. 4

U. S. Patent 2,150,000

Titanium Dioxide	4 lb.
Iron Oxide	1 to 5 lb.
Sodium Carbonate	2 lb.
Silica	1 lb.

Hydrated lime, up to 5 per cent of the above ingredients.

No. 5

Borax	50
Potassium Chloride	25
Sodium Chloride	25

No. 6

Cryolite	50
Ammonium Chloride	25
Sodium Chloride	25

The electrodes are covered with a very thin film of sodium silicate of lowest water content. They are then dipped 2-3 times into the powdered flux to give a coating 0.6-1 m.m. thick.

Aluminum Welding Flux

British Patent 513,695

Potassium Fluoride	30–40%
Potassium Sulphate	2– 5%
Potassium Chloride	20–30%
Sodium Chloride	4– 8%
Zinc Chloride	7–15%
Ammonium Chloride	10–18%
Stannous Chloride	3– 8%
Lithium Chloride	3– 8%

Mix with sufficient water to make a paste.

Zinc Welding Flux

British Patent 487,597

Ammonium Chloride	65%
Zinc Chloride	25%
Sodium Chloride	4%
Lithium Chloride	3%
Potassium Fluoride	3%

Stainless Steel Welding Flux

Formula No. 1

Titanium Dioxide	3%
Fluorspar	30%
Marble	48%
Ferro-Manganese	8%
Ferro Chrome	3%
Sodium Silicate	8%

No. 2

British Patent 496,711

Cryolite	60 lb.
Talc	10 lb.
Calcium Carbonate	10 lb.
Felspar	13 lb.
Clay	5 lb.
Chromium	4 lb.
Ferro-Titanium	25 lb.
Blue Asbestos	10 lb.

Arc Welding Flux for Mild Steel

British Patent 497,510

Titanium Dioxide	4 lb.
Iron Oxide	4 lb.
Soda Ash	2 lb.
Silica	1 lb.
Slaked Lime	½–5%

Flux for High Speed Mild Steel Welding

U. S. Patent 2,150,000

Titanium Dioxide	4 lb.
Iron Oxide	1–5 lb.
Soda Ash	2 lb.
Silica	1 lb.
Slaked Lime	5%

Copper Welding Flux

British Patent 519,912

Boric Acid	62.5
Potassium Chlorate	17.5
Iron Carbonate	12.5
Glucose	7.5

Powders for Autogenic Welding

For Iron or Steel

Borax	6 lb.
Ammonium Chloride	2 lb.
Potassium Ferrocyanide	1 lb.
Rosin	1 lb.

For Cast Iron

Boric Acid	25 lb.
Sodium Chloride	30 lb.
Potassium Ferrocyanide	27 lb.
Rosin	8 lb.

For Steel on Steel

Boric Acid	41.5 lb.
Sodium Chloride	35 lb.
Potassium Ferrocyanide	15.5 lb.
Soda Ash	8 lb.

Electrode for Arc Discharge Valves

U. S. Patent 2,151,567

Thorium	5.0%
Silver	68.4%
Copper	26.6%

Aluminum Welding Powder

German Patent 677,568

Aluminum Powder	5%
Tin Powder	7–10%
Cadmium Powder	12–15%
Phosphorous Powder	0.8– 2%
Zinc Powder to make	100%

Bronze Welding Electrode

Russian Patent 51,964

Bronze electrodes are covered with paste made of following:

Carborundum, Powdered	50–60%
Barium Carbonate	10–25%
Aluminum, Powdered	15–25%

Arc Welding Electrodes

British Patent 490,403

Welding rods of iron or steel are coated with:

Iron Powder	80 oz.
Salt Solution (5%) Sufficient to make a paste	
Rice Flour	20 oz.

Arc Welding Wire

British Patent 487,003

Iron or steel alloy wire containing 0.2% aluminum is cored with

Calcium Oxide	68%
Potassium Carbonate	3%
Sodium Carbonate	2%
Magnesium Oxide	5%
Magnesium Dioxide	5%
Manganese Trioxide	8%
Titanium Dioxide	5%
Manganese	6%
Molybdenum	3%

Arc Converter Electrode

British Patent 496,033

Silver	72 oz.
Copper	28 oz.
Barium or Thorium	5 oz.

Welding Electrode Coating

U. S. Patent 2,052,699

Wood Flour	13 oz.
Titanium Dioxide	12–16 oz.
Sodium Silicate $[\mathrm{NaO}:\mathrm{SiO_2}\ (1:3)]$	42 oz.

Core Wash for Metal Castings

Molasses	1 pt.
Graphite	10 lb.
Sulfatate (Wetting Agent)	1 lb.
Water to make	5 gal.

Dipping core in the above prevents stringing and drip and gives a clean core. Finished cores may be racked at once for firing and will give a smooth hard finish.

Foundry Core

Canadian Patent 377,325

Sugar	0.5 lb.
Gelatin	0.5 lb.

Sand	99.0 lb.

Moisten with water; form core; bake.

Sand Core Oil for Cast Iron Molding

Stearin Pitch	49 lb.
Lime Hydrate	1 lb.
Benzol	50 lb.

Cast Iron Cements

Formula	No. 1	No. 2	No. 3
Iron Filings	95	98	84
Ammonium Chloride	3	1	10
Sulphur	2	1	6

The ingredients are mixed to a paste with water immediately prior to use. One drop of concentrated sulphuric acid in the mix helps to start the reaction; hardening takes place over a few days.

No. 4

The following is claimed to be rapid setting and to provide a water and fire resisting cement.

Iron Filings	12
Gypsum	12
Gum Arabic	12
Silica Flour	64

No. 5

Iron Cement for Boiler Use

Iron Filings	33
Ferrous Sulphate	17
Vinegar	50

No. 6

For Miscellaneous Iron Vessels

Powdered Iron	72
Plaster of Paris	10
Gum Arabic	8
Whiting	8
Sal Ammoniac	2

No. 7

For Iron Castings

Iron Filings	75.0
Plaster of Paris	12.0
Whiting or Chalk	5.0
Gum Arabic	5.0
Carbon Black	0.5
Portland Cement	2.5

No. 8

Iron filings made to a paste with water glass is a simple mixture but of limited application.

The following two are each mixed to a paste with vinegar before use.

	No. 9	No. 10
Iron Filings	77	74
Lime	19	11
Salt	4	—
Sal Ammoniac	—	2
Sand	—	13

No. 11

This is mixed to a paste with water as required.

Iron Filings	60
Lime	30
Red Lead	6
Potash Alum	3
Sal Ammoniac	1

No. 12

This is likewise mixed with water before use.

Iron Filings	55
Fine Clay	22
Salt	6
Borax	6
Manganese Dioxide	11

Founding Magnesium Alloys

Melt the alloy under flux of

Magnesium Chloride (Anhydrous)	60 lb.
Sodium Chloride	40 lb.

Use 1 lb. of flux to 8-12 lb. metal. This flux removes oxides and impurities before puddling.

Melting up Light Metal Scrap

British Patent 494,850

Degrease, dry and add to bath of metal in an iron lined furnace at temperature slightly above melting point of scrap and cover with following flux

Sodium Chloride	45 lb.
Sodium Fluoride	5–10 lb.
Potassium Chloride	35–44 lb.
Aluminum Chloride	6–10 lb.

Keep at 580-620° C.

Light Metal Melt Cleaner

British Patent 485,698

Briquettes of the following composition sink below surface and cleanse molten metal:

Lead, Powdered	75 lb.
Cryolite	15 lb.
Ammonium Chloride	9 lb.
Lithium Chloride	1 lb.

Purifying Mercury

Place dirty mercury in thick walled bottle and cover with a cold saturated solution of potassium permanganate. Shake vigorously. Color will change to green or brown and a heavy sludge will form. If after ½ minute shaking the color of the permanganate is still present,* decant and wash with water a number of times. Add a little dilute nitric acid; shake well; wash and dry.

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*If at this point permanganate color has changed, add more permanganate.

Care of Gold Leaf Signs

Do not wash over a new gold leaf sign until the varnish protecting coat is thoroughly hardened, usually a week or more.

In washing over gold window signs, use only clear water and a soft cloth or chamois, wiping carefully to prevent scratching.

To insure long life, signs should be inspected and touched up, and revarnished if necessary at regular intervals of twelve months or so.

The best paint and varnish, gold leaf (burnished gold is 23-karat) is used.

Don't wash over back of sign with Bon-Ami, ammonia, Gold Dust or other preparation.

Don't wash window while it is steaming, frosted, or frozen.

Don't wash over sign with rubber window washer.

Don't paste gummed labels or stickers on back of lettering.

Don't swat flies on sign.

Removing Metal Obstructions From Wells

U. S. Patent 2,152,306

Metal obstructions are eaten away by the following fluid:

Hydrochloric Acid	22–35%
Nitric Acid	2– 7%
Copper Chloride	1– 4%
Water to make	100%

Watch Compensation Spring Alloy

Formula No. 1

U. S. Patent 2,151,197

A hairspring for time pieces having temperature compensating properties for a monometallic balance within the range from approximately 40° F. to approximately 90° F., and resistance to permanent deformation substantially as great as a hardened and tempered steel spring of the same dimensions, is made from an alloy having substantially the following composition:

Nickel	35.00%
Manganese	3.35%
Silicon	5.39%
Iron to make	100%

No. 2

U. S. Patent 2,099,474

The following alloy has a high elastic limit and a variable elastic modulus.

Nickel	36.0
Chromium	4.5
Manganese	3.0
Silicon	4.0
Titanium	0.1
Iron	52.4

Disintegrating Bird Shot

U. S. Patent 2,167,828

Lead	99–96%
Magnesium	1– 4%

This shot, when swallowed by birds, disintegrates and prevents lead poisoning.

Resistance Wire for Blasting Caps

British Patent 480,307

Platinum	80 g.
Rhodium	15 g.
Ruthenium	5 g.

Electric Contact Alloy

U. S. Patent 2,163,354

Osmium	2.5%
Tungsten to make	100%

Non-Corrosive Soldering Iron Tip

U. S. Patent 2,126,559

Beryllium	0.4%
Cobalt	2.6%
Copper	97.0%

Rapid Hardening Palladium Alloys

Formula No. 1

Palladium	40 oz.
Silver	50 oz.
Gold	6 oz.
Tin	4 oz.

Formula No. 2

Palladium	25 oz.
Silver	65 oz.
Platinum	2 oz.
Gold	5 oz.
Copper	4 oz.
Zinc	3 oz.

Quench the above from 950° C. and reheat at 450° C. for up to 30 hours.

Platinum Substitute

U. S. Patent 2,074,996

Formula No. 1

Palladium	95 g.
Nickel	5 g.

No. 2

Palladium	92–97 g.
Nickel	8– 3 g.

No. 3

Palladium	84–95 g.
Nickel	16– 5 g.

Rayon Spinneret Alloy

Canadian Patent 389,747

Palladium	49
Platinum	25

Gold	25
Osmium	1

Tips for Gold Pen Points

U. S. Patent 2,074,474

Formula No. 1

Tungsten	80 g.
Columbium	10 g.
Palladium	8 g.
Iridium	2 g.

No. 2

Tungsten	65 g.
Columbium	10 g.
Palladium	15 g.
Ruthenium	10 g.

Oil Absorbent Metal Bearing

British Patent 491,415

Iron	76 oz.
Copper	20 oz.
Antimony	2 oz.
Graphite	2 oz.

The above as powders are sintered and compressed.

Graphited Aluminum Bearing

British Patent 505,159

Aluminum Shavings	98.5 lb.
Graphite	1.5 lb.

Compress into billets and extrude at 600° C.

Porous Bearing Metal

British Patent 495,824

Fill mold with sponge iron and press at 2 tons/sq. cm. Sinter in inert or reducing atmosphere for two hours at 1200° C.

Orange Colored Reflector

British Patent 491,223

Copper	90.05%
Aluminum	9.95%

Heat the copper alone to 1160° in a pot; withdraw from heat, cool to 950° and add aluminum (heated to 150°) with stirring.

Age Resistant Zinc Alloy

British Patent 490,706

This is suitable for deep-drawing sheets by cross rolling

Copper	5.0%
Aluminum	0.2%
Zinc	94.8%

Aluminum Alloy for Cooking Utensils

U. S. Patent 2,150,219

Zinc	1½–2½%
Magnesium	2 –3 %
Silicon	¼– ¾%
Aluminum to make	100%

Alnico Type Permanent Magnet

Patented

Aluminum	12 lb.
Nickel	20 lb.
Cobalt	5 lb.
Carbon	0.15 lb.
Manganese + Silicon	0.4 lb.
Iron to make	100 lb.

Removal of Aluminum from Alloys

British Patent 523,303

Melt and stir with

Soda Ash	42.5
Salt	17.0
Potassium Chloride	25.5
Caustic Soda	15.0

Non-Tarnishing Dental Filling Alloy

British Patent 515,516

Tin	25
Copper	6
Zinc	2
Silver	67

The above powdered alloy is immersed in the following solution at 40–50° C.

Potassium Cyanide	10.0
Mercuric Cyanide	6.6
Water	500.0

and then drained, washed and dried.

Dental Filling Alloy

Tin	5 lb.
Lead	8 lb.
Bismuth	8 lb.

Dental Filling Alloy

German Patent 668,868

Aluminum	99.08 g.
Iron	0.40 g.
Copper	0.25 g.
Silicon	0.19 g.
Titanium	0.08 g.
Zinc	Trace g.

Hardening Gold and Silver Alloys

British Patent 490,561

Repeatedly heat in tallow or oil bath at 194–206° after repeatedly cooling to -18 -23° and then immerse in boiling soap solution until desired hardness is attained.

Hardening Copper

British Patent 486,121

Cool metal to -12.2° C. and then immerse successively in tallow at 115.6° C. for 20 seconds and boiling soap solution to remove tallow. Cool to room temperature. Repeat process until required hardness is reached. On second treatment tallow bath temperature is raised to 138° C. and in subsequent treatments raise temperature by 5.6° C. each time.

Case Hardening Steel

British Patent 487.841

Potassium Ferrocyanide	2.5 –3.9 lb.
Phosphorus, Red	0.15–0.2 lb.
Brown Coal Coke, Powdered	50 lb.
Defatted Dry Bones, Powdered	50 lb.

Use at 950°.

Hardening Steel Wires

British Patent 504,328

Wires are heated to 1000° C. and quenched to about 500° C. in a fused bath of

Potassium Dichromate	63 lb.
Potassium Chromate	37 lb.

Metal Heat Treatment

U. S. Patent 2,148,664

Calcium Chloride	45%
Barium Chloride	30%
Sodium Chloride	20%
Lithium Chloride	5%

Use at 410–900° C.

Steel Annealing Compositions

Formula No. 1

Gum Arabic, Waste, Powdered	2.5 kg.
Sodium Chloride	15 kg.
Potash Nitrate	22.5 kg.
Animal Charcoal, Powdered	30 kg.
Potassium Ferrocyanide Powdered	30 kg.

Mix without grinding, as it may catch fire.

No. 2

Potassium Ferrocyanide	10 lb.
Water	90 lb.

Low Carbon Steel Carburizing Bath

U. S. Patent 2,175,417

Sodium Cyanide	40.00
Strontium Chloride	20.00
Sodium Carbonate	10.00
Sodium Chloride	20.40
Potassium Chloride	5.00
Sodium Fluoride	4.55

Anti-Cementation Pastes

The following is useful in protecting metal surfaces against cementation:

Cuprous Chloride	500
Red Lead	200

Bakelite Solution (4:1 in alcohol) Sufficient to make a paste.

Annealing Monel and Nickel

The operation consists of placing the parts in a molten salt mixture of chlorides or carbonates or mixtures of the two, the temperatures ranging from 1250 to 1500° F. A salt mixture composed of 56 per cent sodium carbonate and 44 per cent sodium chloride (by weight), which melts at about 1180° F., can be used up to temperatures of 1500° F. Because of the intimate contact between the materials to be annealed and the hot salts, the parts attain quickly the temperature of the bath. After 20 to 60 minutes the parts may be then withdrawn, quenched in water and flash pickled to remove traces of adhering salts and oxidation.

The operation cannot be used for bright annealing. Final flash pickling is necessary always if a soft, bright annealed article is desired. The following flash pickling solution, used at 70 to 100° F. in earthenware, glass or ceramic containers, is satisfactory:

Water	1 gal.
Sulphuric Acid (66° Bé.)	1½ gal.
Nitric Acid (38° Bé.)	2¼ gal.

Allow to cool and add ¼ lb. of common salt.

One precautionary measure should always be taken. The operator should ascertain that the bath is sulphur-free. This can be accomplished by exposing thin strips of Monel or nickel in the molten salt for 4 to 6 hours, then removing, quenching and finally bending to determine the presence or absence of intergranular surface checking.

Salt baths containing sulphur may be freed from this harmful impurity by treatment with a 25% finely ground charcoal—75% borax mixture (by volume). These substances should be added to the molten salts and stirred intermittently for about 4 hours. The completeness of the removal of sulphur can be determined by the exposure test previously described. The presence of the small amount of borax in the bath will assist in the removal of small particles of adhering salt upon quenching and flash pickling.

Sodium Chromate from Chrome Ore

Chrome Ore, Pulverized	100 lb.
Calcium Oxide	10–20 lb.
Caustic Soda	75 lb.

Mix and roast at 550–750° C. under oxidizing conditions. Leach out soluble chromate with water.

Making Metallic Manganese
British Patent 523,552

Manganese Oxide	300
Aluminum, Granulated	100
Manganese	8

Ignite to melt.

Cuprous Oxide

Copper, Powdered	400 g.
Copper Oxide, Powdered	500 g.

Heat at 400–500° C. for 10–12 hours in absence of air. The finished product is 99.54% cuprous oxide.

Flotation Agent for Oxide Ores
Formula No. 1
U. S. Patent 2,069,365

1. Soda Ash (10% solution	71.0 lb.
2. Oleic Acid	57.1 lb.
3. Cresylic Acid	28.7 lb.
4. Sodium Silicate (10% solution)	71.0 lb.

Add 1 to mixture of 2 and 3 and to this add 4 mixing until uniform. Use 2 lb. per ton of ore.

No. 2
U. S. Patent 2,164,063

Oleic Acid	45.1 lb.
Kerosene	40.6 lb.
Soda Ash	5.5 lb.
Sodium Silicate	8.8 lb.

Mix to form a jelly which is miscible with water.

Copper Ore Flotation
British Patent 497,513

Ore containing 6.3% copper is floated at 34° C with

Soda Ash	1.5 lb.
Palmitic Acid	300.0 lb.
Then add	
Magnesium Sulphate	275 lb.

The dirty froth is removed. Raise the copper oxide by adding 300 g. pine oil per ton.

Abrasive Wheels

Grinding wheels and other abrasive articles are made with latex as the binder for the abrasive material.

Formula No. 1

Carborundum Grains	300
Rubber (from Latex)	100
Sulphur	20
Accelerator 808	2

Cure: 2 hours at 287° F.

To the latex mix made from this formula is added a solution of zinc acetate or other coagulant, the mass being stirred until it has a cheese-like consistency. It is then molded to shape, dried and vulcanized to the hard rubber stage. Similar compositions, sometimes containing 25 parts of long fiber asbestos in addition, may be extruded or calendered as well as molded.

Emery cloth or paper can be made from the formula shown to which glue or casein is added to make the binder more adhesive. It is then spread on fabric or paper, dried and vulcanized in dry heat.

Formula No. 2

Diamond Powder	7 oz.
Synthetic Sapphire	2 oz.
Alum	1 oz.
Clay	2–4 oz.
Glycerin	3 oz.
Glue Size	4 oz.

These are molded together and burnt at 1000–1500° F.

Abrasive for Polishing Hard Metals
U. S. Patent 2,129,377

Silica, Powdered	1250 oz.
Alumina	750 oz.
Tripoli	250 oz.
Petroleum Jelly	250 oz.
Ceresin Wax	25–250 oz.
Tar or Asphalt	25–250 oz.

Melt last three materials and stir in powders and mix until uniform.

Flexible Abrasive Sheet
U. S. Patent 2,191,803

A textile is coated with the following in which granular abrasive is embedded:

Dry Glue	45–75
Glycerin	45–15
Water	5–15
Linseed Oil	1–5

Abrasive Composition
British Patent 496,771

Diamond Powder	7 oz.
Synthetic Sapphire	2 oz.
Alum	1 oz.
Clay	2.5 oz.
Glycerin	3 oz.
Glue Size	4 oz.

Mold and burn at 1000–1500°.

Water Soluble Abrasive Paste for Valves

Soft Soap	12 lb.
Water, Hot	50 lb.
Oleic Acid	1.5 lb.
Quartz Flour	3 lb.
Carborundum, Finest Powder	17 lb.

Buffing Compound for Abrasive Wheel

U. S. Patent 2,078,876

Formula No. 1

Oleostearin	19.05 lb.
Stearic Acid	3.81 lb.
Triethanolamine	0.95 lb.
Tripoli and Flint Powder	76.19 lb.

No. 2

Stearic Acid	14.600%
Beef Tallow	10.150%
Triethanolamine	0.013%
Aluminum Oxide, White	75.237%

Buffing and Polishing Composition

U. S. Patent 2,055,220

Formula No. 1

Stearic Acid	25 oz.
Sodium Sulphate	75 oz.

No. 2

Stearic Acid	20 oz.
Tallow	5 oz.
Borax, Fused Powdered	25 oz.
Sodium Sulphate	50 oz.

Articles buffed with the above are readily cleaned with alkali solutions.

Tripoli Buffing Stick

Double Pressed Stearic Acid	30 oz.
Edible Tallow	25 oz.
Paraffin Wax	25 oz.
Tripoli Flour	20 oz.

A buffing or polishing paste may be made, using the above formula with the addition of a small amount of turpentine and of water, to bring to the consistency desired.

Polishing Composition

Gum Tragacanth	0.20 g.
Water	63.15 g.
Alkali Metal Salt of a Sulphated Alcohol Having More Than 8 Carbon Atoms (Wetanol)	0.50 g.
Glycerin	5.65 g.
Diatomaceous Earth	12.25 g.
Neutral Oil (Mineral)	17.00 g.
Amyl Acetate	0.25 g.
Formaldehyde	1.00 g.

Metal Polish

Dissolve 5 parts curd soap in 40 parts water, adding 20 parts of a 5 per cent methyl cellulose slime. Then add 15 parts kieselguhr, 10 parts tripoli and 10 parts denatured alcohol.

Metal Cleaner

Sal Soda (Crystals)	4 kg.
Sodium Hydroxide	250 g.
Glycerin	125 g.
Potassium Manganate	16 g.
Hot Water	120 l.

Protective Coating for Aluminum and Other Metals

Paraffin Wax	4
Diglycol Stearate	1
Flexo Wax C (Amorphous Petroleum Wax)	2
Water	40

Heat together and mix with high speed agitator until uniform emulsion is formed.

Apply by spraying or brushing.

This coating is particularly useful in protecting refrigerator parts as it is odorless, non-inflammable, tenacious and flexible at low temperatures.

CHAPTER THIRTEEN

PAINTS, ENAMELS, VARNISHES, LACQUERS

White Traffic Paint

Note: On all traffic paint formulae, quantities are percentages by weight unless otherwise indicated.

Formula No. 1

Gum Vehicle	40–35
Pigment	60–65
Volatile Matter	50
Non-Volatile Matter	50

Pigment

Lithopone	60
Siliceous Material	20
Zinc Oxide	20

The gum vehicle may consist of a 36 gallon varnish made by cold cutting Pale East India resin or Batu resin and China wood oil. For example:

Batu Scraped or Pale East India	78 lb.
China Wood Oil	222 lb.
Toluol	300 lb.

No. 2

Gum Vehicle	41–39
Pigment	59–61
Volatile Matter	20–21
Non-Volatile Matter	80–79

Pigment

Lithopone	55–60
Siliceous Material	32–30
Zinc Oxide	12–10

Vehicle

East India Batu Gum	50
Solvent	50

The gum vehicle may consist of a 36 gallon varnish made by cold cutting Pale East India resin or Batu resin and China wood oil.

No. 3

Gum Vehicle	58.0
Pigment	42.0
Volatile Matter	31.2
Non-Volatile Matter	68.8

Pigment

Titanium Barium Pigment	100

Vehicle

Manila DBB	34.7
Solvent	65.3

Solvent

	% Vol.
Raw Tung Oil	17.6
Normal Butyl Alcohol	16.4
Acetone	32.2
Denatured Alcohol No. 1	32.4
Amyl Acetate	1.3

No. 4

Gum Vehicle	35–33
Pigment	65–67

Pigment

Lithopone	55–60
Siliceous Material	32–30
Zinc Oxide	10–12

The gum vehicle may be a 36 gallon varnish made by cold cutting Pale East India resin or Batu resin and China wood oil.

No. 5

Gum Vehicle	58–55
Pigment	42–45
Volatile Matter	35–38
Non-Volatile Matter	65–62

Pigment

Titanium Barium Pigment	100

Vehicle

Manila DBB	35–37
Solvent	65–63

Solvent

	% Vol.
Raw Tung Oil	17
Normal Butyl Alcohol	17
Acetone	32
Denatured Alcohol No. 1	34

No. 6

Gum Vehicle	40–35
Pigment	60–65

Pigment

White Lead	2
Magnesium Silicate	24
Titanium Barium Pigment	52–50
Zinc Oxide	22–24

The gum vehicle may be a 36 gallon varnish made by cold cutting Pale East India resin or Batu resin and China wood oil.

No. 7

Gum Vehicle	42–38
Pigment	58–62
Volatile Matter	23–25
Non-Volatile Matter	77–75

Pigment

Siliceous Material	29–31

Titanium Barium Pigment	51–49
Zinc Oxide	19–21

The gum vehicle may be a 36 gallon varnish made by cold cutting Pale East India resin or Batu resin and China wood oil.

No. 8

Gum Vehicle	58–55
Pigment	42–45
Volatile Matter	35–38
Non-Volatile Matter	65–62

Pigment

Titanium Dioxide	30
Barium Sulphate	70

Vehicle

Manila DBB	35–37
Solvent	65–63

Solvent

	% Vol.
Raw Tung Oil	15
Normal Butyl Alcohol	17
Acetone	34
Denatured Alcohol No. 1	34

No. 9

Gum Vehicle	40–35
Pigment	60–65

Pigment

Lithopone	68–70
Siliceous Material	32–30

The gum vehicle may be a 36 gallon varnish made by cold cutting Pale East India resin or Batu resin and China wood oil.

No. 10

Gum Vehicle	58–55
Pigment	42–45
Volatile Matter	35–38
Non-Volatile Matter	65–62

Pigment

Titanium Dioxide	24–25
Barium Sulphate	76–75

Gum Vehicle

Manila DBB	35–37
Solvent	65–63

Solvent

	% Vol.
Raw Tung Oil	15
Normal Butyl Alcohol	17
Acetone	34
Denatured Alcohol No. 1	34

No. 11

Vehicle

Batu Scraped	78 lb.
China Wood Oil	222 lb.
Hi-Flash Naphtha	300 lb.

Pigment

Lithopone	540 lb.
Siliceous Material	270 lb.
Zinc Oxide	90 lb.

Dissolve the resin in the hi-flash naphtha. Add the oil. Add the pigment and grind.

A very heavy non-flowing paste is obtained.

No. 12

Vehicle

Pale East India Resin	78 lb.
China Wood Oil	222 lb.
Hi-Flash Naphtha	300 lb.

Pigment

Lithopone	540 lb.
Siliceous Material	270 lb.
Zinc Oxide	90 lb.

Dissolve the resin in the hi-flash naphtha. Add the oil. Add the pigment and grind.

A heavy, flowing paint is obtained.

No. 13

Manila DBB	200 lb.
China Wood Oil	50 lb.
Butanol	60 lb.
Denatured Alcohol (SD No. 1)	130 lb.
Acetone	130 lb.
Titanium Dioxide	100 lb.
Barium Sulphate	320 lb.

The oil length of the vehicle is 2 gallons.

Dissolve the resin in the vehicle, which consists of the China wood oil, butanol, alcohol and acetone.

Grind the titanium dioxide and barium sulphate in about 33% of the vehicle. Then add the remainder of the vehicle.

No. 14

Shellac	30
Ammonium Bisulphate	4½
Water	65½

Dissolve together and add slowly with vigorous mechanical mixing

Linseed Oil	30

then mix in until uniform

Lithopone	380

Yellow Traffic Paint

Formula No. 1

Gum Vehicle	58–55
Pigment	42–45
Volatile Matter	35–38
Non-Volatile Matter	65–62

Pigment

Chrome Yellow	60–70
Titanium Barium Pigment	40–30

Vehicle

Manila DBB	35–37
Solvent	65–63

Solvent

	% Vol.
Raw Tung Oil	15
Normal Butyl Alcohol	17
Acetone	34
Denatured Alcohol	34

No. 2

Gum Vehicle	73–70
Pigment	27–30
Volatile Matter	44–47
Non-Volatile Matter	56–53

Pigment

Chrome Yellow	100

Vehicle

Manila DBB	35–37
Solvent	65–63

Solvent

	% Vol.
Raw Tung Oil	15
Normal Butyl Alcohol	17
Acetone	34
Denatured Alcohol No. 1	34

No. 3

Gum Vehicle	40–35
Pigment	60–65

Pigment

Lithopone	45–50
Siliceous Material	30–20
Normal Lead Chromate	23–28

The gum vehicle may be a 36 gallon varnish made by cold cutting Pale East India resin or Batu resin and China wood oil.

No. 4

Gum Vehicle	35–33
Pigment	65–67
Volatile Matter	20–21
Non-Volatile Matter	80–79

Pigment

Lithopone	30–33
Siliceous Material	32–30
Zinc Oxide	10–12
Normal Lead Chromate	28–23

The gum vehicle may be a 36 gallon varnish made by cold cutting Pale East India resin or Batu resin and China wood oil.

No. 5

Gum Vehicle	70–73
Pigment	27–30
Volatile Matter	44–47
Non-Volatile Matter	56–53

Vehicle

Manila DBB	35–37
Solvent	65–63

Solvent

	% Vol.
Raw Tung Oil	15
Normal Butyl Alcohol	17
Acetone	34
Denatured Alcohol No. 1	34

Light Yellow Traffic Paint

Gum Vehicle	70.0
Pigment	30.0
Volatile Matter	37.6
Non-Volatile Matter	62.4

Pigment

Chrome Yellow	40
Lithopone	60

Vehicle

Manila DBB	34.7
Solvent	65.3

Solvent

	% Vol.
Raw Tung Oil	17.6
Normal Butyl Alcohol	16.4
Acetone	32.2
Denatured Alcohol No. 1	32.4
Amyl Acetate	1.3

Medium Yellow Traffic Paint

Gum Vehicle	70.0
Pigment	30.0
Volatile Matter	37.6
Non-Volatile Matter	62.4

Pigment

Chrome Yellow	35
Lithopone	65

Vehicle

Manila DBB	34.7
Solvent	65.3

Solvent

	% Vol.
Raw Tung Oil	17.6
Normal Butyl Alcohol	16.4
Acetone	32.2
Denatured Alcohol No. 1	32.4
Amyl Acetate	1.3

Orange Traffic Paint

Gum Vehicle	70
Pigment	30
Volatile Matter	44–46
Non-Volatile Matter	56–54

Pigment

Chrome Yellow	70
Titanium Barium Pigment	20
Asbestine	10

Vehicle

Manila DBB	35–37
Solvent	65–63

Solvent

	% Vol.
Raw Tung Oil	15
Normal Butyl Alcohol	17
Acetone	34
Denatured Alcohol No. 1	34

Asbestos Shingle Paint

Priming Coat

White Lead	100 lb.
Lead Mixing Oil	2½ gal.
Linseed Oil *	2½ gal.
Liquid Drier	½ pt.
Quantity of Paint	8 gal.

Coverage (200 sq. ft. per gal.) 1600 sq. ft.

Second Coat

White Lead	100 lb.
Lead Mixing Oil	4 gal.
Quantity of Paint	7 gal.
Coverage (400 sq. ft. per gal.)	2800 sq. ft.

Third Coat—Flat Finish

White Lead	100 lb.
Lead Mixing Oil	4 gal.
Quantity of Paint	7 gal.
Coverage (600 sq. ft. per gal.)	4200 sq. ft.

Third Coat—Gloss Finish

White Lead	100 lb.
Linseed Oil*	3 gal.
Liquid Drier	1 pt.
Quantity of Paint	6¼ gal.
Coverage (600 sq. ft. per gal.)	750 sq. ft.

The white-lead specified in the above formulas may be either heavy paste or all-purpose soft paste. If heavy paste is used in the gloss finish third coat, add 1 quart of turpentine. These formulas are for white paint. If a tinted paint is wanted, add the proper colors in oil. Most painters prefer to tint the undercoats a shade darker than the coat that follows. For a white finish coat, raw umber may be used in the undercoats, about a half pint per hundred pounds of white-lead.

There are three special requirements which must be followed in painting asbestos shingles:

First

The shingles must be absolutely dry when the priming coat is applied. Asbestos shingles are very porous, and this permits rapid penetration of moisture. It is particularly important to keep moisture from getting behind the shingles so as to prevent future injury to the paint film.

Second

The paint in all coats must be well brushed into the surface, with special attention paid to the ends and edges of the shingles.

Third

At least one week's good drying weather should be allowed for each coat to dry and harden properly before the next coat is applied.

If the foregoing directions are faithfully followed, there is no reason why there should be any hesitation about taking a job of painting a house overcoated with asbestos shingles.

In conclusion it should be added that, in painting asbestos-shingled dwellings, the usual white-lead and linseed oil paint should be applied to the wood trim, sash, window and door frames, cornice, and porch floors, ceilings, railings, etc. As a rule, the outside woodwork mentioned will need only two coats if the work has previously been painted and the old paint film is still in fair shape.

How to Paint Asbestos Shingles

From a painting standpoint, asbestos shingles present no greater problem than do other building materials somewhat similar in composition. Good results depend largely on good materials and good workmanship. And, in this instance, good workmanship includes particularly: certainty that the surface is completely dry before priming; proper mixing and brushing out of the paint to insure complete sealing; and an adequate drying time between coats.

Asbestos shingles are made from Portland cement and asbestos fibres. The ingredients are mixed with water and pressed into thin slabs. A second pressing operation produces a textured surface which simulates the raised grain of natural weathered wood.

In common with other building materials made from Portland cement—specifically, concrete, stucco and mortar—asbestos shingles retain a certain amount of alkali on their surface for several months after manufacture. This alkali must be neutralized before an oil base paint can be applied. If the shingles are more than three months old, the surface will have been neutralized naturally by the carbon dioxide in the air and no further treatment is required. However, if the shingles are new and must be painted immediately, the surface should be made non-reactive by washing with a solution containing two pounds of zinc sulphate to a gallon of water.

Asbestos shingles are one of the most porous materials used in exterior building construction. In some recent laboratory tests, they were found to absorb anywhere from one and a half to three gallons of water per one hundred square feet of surface. This unusual porosity is the principal factor

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*If boiled oil is used, omit drier.

to consider from the paint standpoint. It determines how the paint should be mixed and how and when it should be applied.

The following formulas provide the proper type of paint for asbestos shingles. The priming coat (containing both linseed oil and lead mixing oil) and the second coat are designed to seal the surface completely, thus preventing oil absorption from the third coat, a common cause of spotting and early chalking. Three coats of paint should always be specified for unpainted asbestos shingles.

Before applying the priming coat, there should be absolute certainty that the surface is dry. The safest procedure is to paint only after a week of clear, non-humid weather. The priming coat should be brushed well into the surface and special attention be paid to the ends and edges of the shingles where later moisture-absorption may cause trouble. As a major portion of the primer will soak into the surface, at least a week of drying time should be allowed before the second coat is applied. The second coat should be given several days—a week, if possible—to dry and harden before the top coat is applied.

To sum up, asbestos shingles provide a readily "paintable" surface. The only special precautions to insure good results are: (1) neutralization of surface alkali on new shingles; (2) application of paint which will seal properly on a completely dry surface; (3) thorough brushing out of the paint to insure adequate sealing; and (4) adequate drying time between coats.

Pitch Paints

By following this formula, a paint can be produced that has admirable covering qualities suitable for painting brick walls, barns, roof, fence and structural irons, etc. Should the finished product be a little hard in brushing, an addition of pure turpentine or linseed oil will overcome same. This paint leaves no brushing marks.

Soft Brown Pitch	420 lb.
Ester Gum (Optional)	50 lb.
Driers	1 lb.
Fish Oil (Optional)	5 to 10 gal.
Varnoline	120 gal.

Melt the pitch and ester gum to liquid state (run heat to about 500/550° F., until drier is taken up). This pitch may foam after reaching 300° F., but can be fought down.

The solvent and fish oil are then added to this mixture while still hot. A heavy or light base can be produced by regulating the amount of solvent though 120 gallons should be satisfactory. An addition of 10% solvent naphtha is sometimes desirable.

This produces a paint oil into which color can be ground. The finished paint can be made more lasting, though not as light colored, if 60 pounds of Gilsonite selects is added to 420 pounds of pitch.

Drying

When making the paint, it is well to grind in 1 to 2 lb. of cobalt linoleate drier to every 50 gallons of paint. The paint should set in a few hours. The drying, of course, can be regulated by the addition or subtraction of drier.

Colors

So as to retain maximum gloss, a minimum amount of pigment and filler of low absorption should be used.

Red

Any red oxide will do. About 1 to 1½ lb. red oxide and 1½ lb. of filler (China clay or fluffy asbestine, asbestine preferred) to a gallon of base should produce a fairly light red paint.

Green

A pound mixture of chrome green and chromium oxide and 1 lb. of filler are added to a gallon of base. The lightness of color can be regulated by the amount of chrome green used.

Gray

First grind 3 lb. titanox or 1 lb. titanium dioxide to 1 gallon paint oil and then add lampblack ground in oil to get desired shade.

Putty or Fawn Color

Grind about 3 lb. titanox to 1 gallon paint oil.

Other colors ranging from colonial yellow and light blue to black are also obtainable.

Casein Water Paints
(Distemper or Tempra Paints)
U. S. Patent 2,146,126
(Formula No. 1)

Water	78.5 lb.
Collodial Clay	3.0 lb.
Casein	16.0 lb.
Caustic Soda	2.5 lb.
Zinc Oxide	120–140 lb.

No. 2

Dehydrated Castor Oil	33.41 lb.
Lithopone	39.81 lb.

Casein	3.31 lb.
Phenol	0.06 lb.
Ammonium Hydroxide	23.41 lb.

Mix well until uniform; dilute before using.

No. 3

Shellac	30 lb.
Ammonium Bisulphate	4.5 lb.
Water	65.5 lb.

Mix until dissolved and then add

Linseed Oil	30 lb.

Emulsify with electric mixer and add

Lithopone	380 lb.

No. 4
(White)

Casein	5 kg.
Hydrated Lime	5 kg.
Whiting	40 kg.
Borax	50 g.
Ultramarine	100 g.

No. 5

Casein	1 kg.
Calcium Oxide or Hydroxide	1 kg.
Pigment Color	5–8 kg.

This mixture should be stored dry and made up with water to the desired consistency just before application. The pigment may be added immediately or later, if so desired.

No. 6
(Plastic Wall)
French Patent 837,490

Casein	12.50 kg.
Plaster	30.00 kg.
Lime	12.50 kg.
Lithopone	13.75 kg.
Asbestos	21.75 kg.
Glue, Strong	10.00 kg.

Make into a creamy paste with water directly before use.

No. 7

Casein	700 g.
Slaked Lime	2000 g.
Chalk or Ochre	10,000 g.
Dextrin	800 g.
Soap Powder	800 g.

No. 8

170 g. casein soaked in 500 g. water; 30 g. of ammonia (28° Bé.); 300 g. water with a small amount of calcium hydroxide and prepared chalk. Then add 170 g. boiled linseed oil.

No. 9
Canadian Patent 381,692

Titanium Dioxide	4.25 lb.
Lithopone	15–45 lb.
Barite	5–50 lb.
Whiting	2–60 lb.
Magnesium Silicate	3–25 lb.
China Clay	2–40 lb.
Mica, Silver	2–15 lb.
Casein	8–15 lb.
Italian Talc	3 lb.
Borax	1–3 lb.
Sodium Fluoride	1–4 lb.
o-Phenylphenate	1–3 lb.

Casein Paint Plasticizer

Oleic Acid	20 g.
Alcohol	50 g.

Heat to 60° C., and add

Caustic Potash (10% Alcoholic Solution)

sufficient to neutralize the phenolphthalein, then add

Glycerin	20 g.

then add

Tar, Neutral	100 g.

Heat to 120° C. to drive off volatile matter.

Casein Binders for Water Paints

(Formula No. 1)

Lactic Acid Casein	80 lb.
Soda Ash	8 lb.
W.W. Rosin, Powdered	5 lb.
DiSodium Phosphate, Powdered	5 lb.
Zinc Silico Fluoride	2 lb.

This is dissolved in sufficient hot water before use, and the pigments containing lime are mixed with the resulting solution.

No. 2

Lactic Acid Casein	80 lb.
Bleached Montan Wax (Chips)	5 lb.
Borax, Powdered	6 lb.
TriSodium Phosphate, Powdered	7 lb.
Zinc Silico Fluoride, Powdered	9 lb.

No. 3

a. Lactic Acid Casein	18 lb.
Water	36 lb.
b. Soft Soap	2 lb.
Borax	2 lb.
Ammonia, Concentrated	1 lb.
c. Water	41 lb.

a is stirred together and allowed to soak for 12 hrs.

Make solution of *b* in hot *c*, and stir *a* into this.

No. 4

a. Lactic Acid Casein	20 lb.
Water	40 lb.
b. Bleached Montan Wax	3 lb.
Stearic Acid	2 lb.
Borax	3 lb.
Ammonia, Concentrated	2 lb.
Water	30 lb.

Soak *a* for 12 hours. Mix with the hot soap solution *b*.

No. 5

Lactic Acid Casein	21 lb.
Borax	5 lb.
Soft Soap	5 lb.
Turpentine	9 lb.
Water	60 lb.

Casein, borax, and 40 lb. of water are heated with stirring until dissolved, and a solution of the soft soap in the balance of the water is added.

When stirred almost cold, the turpentine is mixed in.

For use, mix with 25 lb. of lime hydrate.

No. 6
(Waterproof, Oilproof)
U. S. Patent 2,131,750

Casein	100 g.
Borax	18 g.
Stearic Acid	24 g.
Zinc Chloride	5.7 g.
Ammonia	100 cc.
Latex (68%)	214 g.
Water	500 g.

Water-Paint Binder

Capillary (Sugar) Syrup	100 g.
Water, Distilled	80 g.
Borax	8 g.
Caustic Soda (25%)	Until Weakly Alkaline
Turkey Red Oil	2 g.
Butanol	2 g.
Parachlormetacresol	1 g.

Distemper Paint From Oil Seed Waste
British Patent 496,171

Sesame seed cake with or without bleaching is softened by immersion in water and formulated as follows:

Softened Sesame Oil Cake	10 lb.

Grind with

Cresol	1.7 lb.
Gum Arabic	2.5 lb.
Glue	3 lb.
Borax	1.3 lb.
Chalk	80 lb.

Waterproof Floor Coating
British Patent 504,124

Cork Ground	5
Sand	1
Cement	2
Asphalt Emulsion	5
Asbestos Fibers	2
Water	2

Water Resistant Zein Composition
U. S. Patent 2,134,769

A novel water-resistant coating is now obtainable from a corn by-product. This comprises a solution mixture containing the following substances in proportions as follows: zein 100 oz., paraffin wax 4 oz., 94% methyl alcohol 270 fl. oz., benzol 130 fl. oz.

Bituminous Coating for Road Rock
U. S. Patent 2,086,968

Asphalt	40–65%
Naphtha, Petroleum	30–55%
Kerosene	5–15%
Tar, Naphtha	4–10%

Warm together until dissolved.

Black Tire Finish
(Formula No. 1)

Vegetable F Wax	30
Ammonium Stearate (Anhyd.)	20
Water	175
Trigamine	2
Friction Black Pulp	14
Manila Gum	10
Water	40
Varnolene	15

No. 2

Gilsonite	20
Acrawax B	20
Paraffin Wax	40
Candelilla Wax	20
Carbon Black	6
Twitchell Base	5
Varnolene	190

Finish for Synthetic Rubber

Casein	60 kg.
Petrolatum	6 kg.
Stearic Acid	10 kg.
Glycerin	40 kg.
Ammonia	3.6 kg.
Formaldehyde	9 kg.
Water	To Suit

Water Shellac, Concentrated Fluid

Shellac	35 g.
Monoethanolamine	10 g.
Cellosolve	10 g.
Water	45 g.

Warm together at 75° C. while mixing.

Shellac, Water Soluble

1. Dissolve 100 grams of shellac in 200 cc. of methyl acetone

2. Add, with vigorous shaking, 10 to 15 cc. of triethanolamine, and let stand for 24 hours.

3. Add, with stirring, water to any required dilution (up to 3 or 4 liters).

Improving Gloss of Shellac Films

The use of varying proportions of the following improves gloss and flexibility of shellac films:

Tributyl Citrate	60
Diacetin	40

Soluble Rosin

a.	Wood Rosin	70 g.
b.	Caustic Potash (45% Solution)	20 g.
	Water	10 g.

Heat *a* and *b* separately to 95° C. and add *b* to *a* slowly with good mixing until uniform.

Fire Retardant Paint

Of the many formulations that have been prepared and tested, the most satisfactory ones developed to date are linseed oil paints containing finely ground borax. Although these paints will not protect wood effectively against exposure to high temperatures, they do afford considerable resistance to the spread of small fires.

Paints containing white lead as pigment have given the best results, but effective paints have also been prepared using either titanium or zinc sulfide pigments. Typical formulas of paints found fire retardant are:

(Formula No. 1)

Pigment (Basic Carbonate White Lead)	41.0 g.
Borax	32.0 g.
Raw Linseed Oil	22.8 g.
Turpentine	3.6 g.
Japan Drier	0.6 g.

No. 2

Pigment (Titanium-Calcium)	30.0 g.
Borax	35.0 g.
Raw Linseed Oil	30.8 g.
Turpentine	3.6 g.
Japan Drier	0.6 g.

Pigment (Lithopone)	24.0 g.
Borax	39.5 g.
Raw Linseed Oil	32.3 g.
Turpentine	3.6 g.
Japan Drier	0.6 g.

To secure maximum fire protection, heavy applications, at least 8 gallons per 1000 square feet (3 or 4 thick coats), are required. At this rate, a gallon will cover about 125 sq. ft. This is about twice the amount of paint ordinarily applied in painting woodwork. Coatings of ordinary thickness undoubtedly possess considerable fire retardance and would provide satisfactory protection against comparatively weak fires.

These paints are not satisfactory for exterior use because rain bleaches out the water-soluble borax and the degree of fire retardance decreases with exposure.

Although the white lead-borax paint has been found to retain its fire retardant effectiveness after 30 months' exposure to different interior humidity conditions, much additional information is needed to perfect this type of paint for all uses. The paint does not retain its whiteness indoors, but turns yellow. Reduction of the yellowing tendency can probably be accomplished by modification of the vehicle.

The inclusion of a chemically active ingredient, as borax, in a paint is unorthodox from a paint manufacturing standpoint, but observations on paints kept in a can for one year have not shown any observable deterioration and the painting properties and fire retardance of such a paint after storage were the same as those of a freshly prepared paint. This type of paint is still in the development stage, and much additional work needs to be done to determine its limitations and to perfect it. Its use is recommended only where resistance to fire is of greater importance than other properties.

No. 3

British Patent 495,436

Magnesium Oxide	80 lb.
Titanium Dioxide	10 lb.
Barium Sulphate	10 lb.

Stir into

Magnesium Chloride Solution (d 1.18–1.29)	100 lb.

just before use.

Heat Resistant Metallic Paint

Melt 5 oz. clean pale dammar and 2 oz. hard elemi gum with 10 oz. soda. The hardened melt is powdered and dissolved in 60 oz. naphtha, then pigmented with bronze powder as desired. Some aluminum bronzes will fail at red heat, but bronze tinctures made as described herewith will remain intact even after the Bunsen burner test.

Non-Inflammable Airplane Paint

Chlorinated Rubber	200 lb.
Toluol	300 lb.
Tricresyl Phosphate	30 lb.
Xylol	300 lb.
Tributyl Phosphate	20 lb.
Iron Oxide	100 lb.

Waterproof Paint

U. S. Patent 2,143,387

A waterproof roof coating composition characterized by resistance to cracking and checking at temperatures as low as about 32° F. and to creeping and running when hot, comprises 75 to 85 parts asphalt and 25 to 15 parts of oil free mineral oil wax having a melting point above 140° F. and being so plastic that the wax may be bent sharply without shattering at temperatures below 32° F. dissolved in petroleum distillate.

Wash Proof Paint

Chlorinated Rubber	30 lb.
Varnish	7 lb.
Hydrogenated Naphthalene	15 lb.
Xylene	40 lb.
Benzene	10 lb.
Pigment	as desired

Washable Wall Coating

U. S. Patent 2,127,818

Titanium Dioxide	50.0 oz.
Glue	3.5 oz.
Acetic Acid, Glacial	2.2 oz.
Sodium Acetate	0.5 oz.
Aluminum Sulphate	0.8 oz.
Water	43.0 oz.

Sound Insulating Paint

(Formula No. 1)

Soft Petroleum Bitumen	39.5 lb.
Waste Rubber	11.8 lb.
Wood Flour	5.5 lb.
Gasoline	33.2 lb.
Kerosene	10.0 lb.

No. 2

Soft Petroleum Bitumen	44.6 lb.
Boiled Linseed Oil	6.7 lb.
Wood Flour	5.6 lb.
Gasoline	33.1 lb.
Kerosene	10.0 lb.

Paint for Bituminous Articles

Formula No. 1

Pigment (Lithopone e.g.)	150 lb.
Shellac	45 lb.
Methylcyclohexylphthalate	20 lb.
Castor Oil	2 lb.
Alcohol	150 lb.
Butyl Alcohol	3 lb.

No. 2

Shellac	25 lb.
Cashew Nut Oil	15 lb.

Heat 1 hr. at 120° C.; cool and add

Alcohol	60 lb.
Pigment (Lithopone e.g.)	100 lb.
Cobalt Linoleate	⅛ lb.

Anti-Corrosive Ship Bottom Paint

Oiticica Oil	145 lb.
Shellac	120 lb.
Denatured Alcohol	390 lb.
Pine Oil	80 lb.
Drier	5 lb.
Iron Oxide	170 lb.
Zinc Oxide	160 lb.

Stove Paint

a. Gum Arabic, or Dextrin	1 lb.
Water, Hot	45 lb.
b. Nigrosin, Water-Soluble	2 lb.
Hard Soap	7 lb.
c. Graphite	45 lb.

Make dispersion *a* by stirring the gum into the hot water. Add the dye and soap *b* while the dispersion is hot.

The graphite *c* is ground with the hot mixture—but may also be ground up with a part of the water, and the suspension is then added to the solution of gum and soap.

The finished paint is poured in open-headed cans, where it is allowed to solidify. Stiffer paints are obtained by the use of more soap.

Dulling Gloss of Painted Walls

Dissolve 1 lb. of ordinary laundry starch, 4 oz. of soap flakes and 1 oz. of powdered alum in plain cold water. Use just enough water to dissolve these three ingredients. Then pour boiling water into this solution until it becomes somewhat thick. Allow the batch to cool and then, if necessary, add a little more water to reduce the solution to brushing consistency.

Brush this mixture onto the walls and stipple immediately with a regular wall stippling brush. This should effectively kill the gloss now on the walls.

Re-Polishing Gloss Paint

U. S. Patent 2,125,237

Lithopone	61.5 lb.
Aluminum Silicate	8.8 lb.
Cooked Linseed Oil	9.2 lb.
Flatting Varnish	20.1 lb.
Beeswax	0.4 lb.

When this paint has lost its gloss after exposure it may be polished to give a semi-gloss finish.

Gasoline Storage Tank Paints

Primers

(Formula No. 1)

Polymerized Linseed Oil	53.75 lb.
Naphtha	40.88 lb.
Drier, Oil	5.37 lb.
Aluminum Powder	14.00 lb.

No. 2

Oxidized Linseed Oil	60.66 lb.
Naphtha	33.34 lb.
Drier Oil	6.00 lb.
Aluminum Powder	14.00 lb.

Oil Paints
(Formula No. 1)

Linseed Oil	29 lb.
Ochre	2 lb.

No. 2

Linseed Oil	25 lb.
White Lead	141 lb.
Carbon Black	25 lb.

No. 3

Linseed Oil	99 lb.
White Lead	205 lb.

Two-Coat Exterior Paint System

The two-coat system for exterior painting on wood, concrete and brick has received a great deal of well deserved attention during the past two or three years.

This system depends on a special type primer which controlls penetration.

The following is a formula for such a primer.

Titanium Barium Pigment	375 lb.
Basic Carbonate of White Lead	375 lb.
Magnesium Silicate	250 lb.
Litharge	10 lb.
Heat Treated Oil (70% Non-Volatile) (Body X)	117 lb.
5 Gal. Chinawood Oil Ester Varnish (60% Solids)	61 lb.
Blown Linseed Oil	28 lb.
Raw Linseed Oil	194 lb.
Mineral Spirits	173 lb.
Cobalt Napthenate Drier (6%)	3 lb.

This gives an excellent exterior first coat for old or new work.

This primer with one finish coat of first grade exterior house paint gives a finished paint job equal in appearance and durability to a three coat job where the regular house paint is reduced and used as a prime coat.

This special primer will very often eliminate paint failures due to checking, cracking and peeling.

Waterproof Window Lettering Paint

Cumar	3½ lb.
Nitrobenzol	1 pt.
Dye, Oil Soluble, of the required shade.	
Benzol, enough to make one gal.	

Dissolve the dye in two quarts of benzol, add the cumar and stir until dissolved. Add to this the nitrobenzene, and then dilute with benzol so as to make one gallon.

To use, wash and dry the glass. Then apply this paint with a sign-painter's brush.

Weather Resisting Paint

Glue	500 g.
Sodium Silicate	500 g.
Caustic Soda (sp. gr. 1.34)	20 g.

Window Glass Paint
(Formula No. 1)

Casein	10 g.
Calcium Hydrate (Powdered)	15 g.
Chalk (Powdered)	15 g.
China Clay	5 g.
Ultramarine Blue	60 g.
Trisodium Phosphate	1.5 g.
Parachlor-Metacresol	0.4 g.

Add water to consistency desired before use.

No. 2
(Indoor)

Cane Sugar	8
Water	20
Ultramarine Blue (or Green)	20

The sugar is dissolved in pure distilled water, the pigment moistened and soaked with part of the solution to form a uniform paste which is then thinned out with the rest of the solution.

Air-Raid Black Out

Windows are coated with a light fast transparent green paint and electric bulbs or lamp globes with orange or red transparent paint. This prevents escape outside of any light.

Aluminum Paint
U. S. Patent 2,068,966

Kerosene	38 lb.
Asphalt Emulsion (60–70% Solids)	20 lb.
Sodium Oleate (5% Solution)	20 lb.
*Aluminum Paste	22 lb.

Mix in above order.

Non-Gelling Aluminum Paint

An aluminum paint which does not cake in the container, and can readily be applied by brush, has a vehicle consisting of 32 parts by weight ester gum dissolved in 50 parts V.M.&P. naphtha, in which 1 part hydrogenated castor oil wax is dissolved by heating. When the mixture is cool, 17 parts of aluminum bronze powder are added. Thorough agitation to produce a

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*The aluminum paste is made from

Aluminum Powder	70 lb.
Kerosene	30 lb.

smooth, uniform product completes the process. This paint, when applied and allowed to dry on a cold surface, gives a satin or matt finish which is retained in large measure even when heat is applied after drying. Full gloss is obtained by application directly to a hot surface.

Chlorinated Rubber Paint

Chlorinated Rubber	200
Toluol	300
Tricresyl Phosphate	30
Xylol	300
Tributyl Phosphate	20
Iron Oxide	100

Superior Acid and Alkali Resisting Paint (N.B.)

Coal Tar Pitch (140°)	2.89 lb.
Xylene (Unrefined)	2.89 lb.
Benzol	1.24 lb.
Silica Black, Grade A	1.07 lb.
Chlorinated Rubber	0.165 lb.

The weights given will make one gallon of paint.

N.B. The above paint when applied to iron pipe has been tested in comparison with three of the best commercial paints for over 200 hours in 2% acid, 2% alkali and saturated salt solution and found the best. It can therefore be recommended as a superior product.

Starch Wall Paint (Protective)

Formula No. 1

Whiting	25 lb.
Starch	1¼ lb.
Caustic Soda	1 oz.
Sodium Salicylate	¼ oz.
Water to make	7 gal.

The caustic soda is added to about 2 gallons of water, and the above amount of starch is then stirred in making certain that all of the starch particles have been thoroughly wetted with water. The mixture is then heated over a direct fire with continued stirring until the starch granules burst, and then for about 10 minutes longer. Regardless of the type of starch, it is preferable not to heat the water hotter than 170° F. The sodium salicylate preservative is then added. The three additional gallons of water may now be added with stirring to obtain a smooth clear solution after which the whiting together with colored pigments for tinting purposes may be added. The outstanding advantage of this formulation for interior paper or plaster walls, is that the coating may be readily washed off with warm water after a year or so, and a new coating applied immediately.

No. 2

Pigment 3½ to 5 lb. per gal.

The pigment may consist of whiting, silica, asbestine barytes, lithopone, gypsum, etc., and colored pigments to tint.

Vehicle 6½ to 10 oz. per gal.

The vehicle may consist of starch, dextrin, casein, gum arabic, glue, resin or drying oil emulsions, etc.

Preservative 2 to 4 gm. per gal.

The preservation may be sodium benzoate, sodium salicylate, thymol, chrome alum, potassium dichromate, sodium ortho-phenyl phenate, sodium penta chlor phenolate, etc.

Fluorescent Paints

Fluorescent paints are quite easily prepared. A light colored lacquer, slightly thinned with alcohol, provides a good fluorescent base. The chemistry student will find an interesting diversion to prepare the paint, repeatedly trying samples under the black light rays to obtain the desired shade.

A good red fluorescent paint may be prepared by dissolving about one-eighth of a gram of rhodamine B. in 3 cc. of ethyl alcohol and mixing the dissolved dye into four ounces of lacquer. If this does not produce enough color, a little more dye may be used. The dye should be entirely dissolved before it is stirred into the lacquer.

An orange paint may be made by dissolving a small amount of rhodamine 6G in alcohol and mixing it with a larger amount of eosine. A few trials under the lamp will give the desired shade.

A yellow colored paint may be obtained by dissolving equal amounts of eosine and fluorescein dye in alcohol and mixing the two colors into a few ounces of lacquer. In the three colors mentioned above, lighter or darker shades may be obtained by varying the amounts used.

A bright blue may be obtained by mixing finely powdered sodium salicylate into lacquer. The chemical will not dissolve and is therefore in suspension. This paint must be stirred before using.

A strong fluorescent green paint may be prepared by stirring finely powdered anthracene into a thin solution of cellulose acetate dissolved in acetone. This paint will also be in suspension and must be stirred before using. A different shade of green may be prepared by dissolving a small amount of primiline in alcohol and mixing the dissolved dye into lacquer.

The light sensitive liquids may be used to make cloth fluorescent. After immersing the goods in the dye solution the material should be allowed to dry. In incandescent light the treated cloth will present a drab appearance that is changed entirely in the black light. A solution of fluorescein sprayed on white cloth will produce a beautiful effect under the cold light rays. An ordinary fly sprayer will serve for this purpose.

The spray method provides an excellent way of making invisible signs. Letters may be cut out of heavy paper and attached with thumb tacks to a piece of porous wall board. The entire board should then be sprayed with a solution of anthracene in benzol or carbon disulphide.

Invisible Ink.

Esculin may be used as an invisible writing fluid. White paper or cloth treated with this liquid will be blank in ordinary light and visible under short wave light.

Tungstate Fluorescent Salts

Strontium Tungstate

Strontium Chloride	17.15 g.
Sodium Tungstate	9.00 g.
Sodium Chloride	16.00 g.

Use only most highly purified salts. Mix and fire in a platinum crucible at bright red heat, for 1 hr. Cool ½ hr. and extract with boiling water. Dry the residue. This fluoresces greenish-blue under X-Ray.

Cadmium Tungstate

Cadmium Chloride	19.9 g.
Sodium Tungstate	9.0 g.
Sodium Chloride	16.0 g.

Treat as above but use a silica crucible. Product is a brown powder that fluoresces yellow-green under X-Ray.

Calcium Tungstate

Calcium Chloride	12 g.
Sodium Tungstate	9 g.
Sodium Chloride	16 g.

Treat as above. Fluoresces blue-violet under X-Ray.

Lead Tungstate

Lead Chloride	30.5 g.
Sodium Tungstate	9.0 g.
Sodium Chloride	16.0 g.

Treat as above. Fluoresces yellow under X-Ray.

Barium Tungstate

Barium Chloride	22.6 g.
Sodium Tungstate	9.0 g.
Sodium Chloride	16.0 g.

Treat as above. Fluoresces yellow-green under X-Ray.

Zinc Tungstate

Zinc Chloride	14.5 g.
Sodium Tungstate	9.0 g.
Sodium Chloride	16.0 g.

Treat as above except that it is extracted with a strong ammonium chloride solution instead of water, to prevent hydrolysis. Fluoresces milky-blue under X-Ray.

Phosphorescent Zinc Sulphide

British Patent 492,923

Zinc Sulphide	1000 g.
Sodium Chloride	50 g.
Cuprous Chloride (Dissolved in Alcohol	0.1 g.
Zinc Carbonate	30 g.

Maintain at glowing temperature for 2 hours.

Luminous Paints

The manufacture of luminous paints, while specifically adapted to the characteristics of the pigments used, is more or less uniform for all paints, one of the chief factors applying to all of them being the experience that satisfactory results can be obtained only if *pure* chemicals are employed. Indeed, some of the manufacturers base their methods of fabrication on a degree of purity of their chemicals equal to that required for the determination of atomic weights which can be attained only by application of the most scientific processes of manufacture known to chemical science. It is for this reason that in spite of the modest prices of the crude raw material the manufacturing cost of the paints, and the prices of the finished products are much higher than those of practically any other pigment or paints. These prices are still further increased where for the manufacture of certain luminous paints rare minerals, such as thorium compounds or even radium compounds, are required, or where difficulty accessible materials, such as uranine ($C_{20}H_{10}O_5Na_2$) an organic dye, must be employed to attain maximum results. The prices charged for these paints are different in the various countries, of course, depending on the raw materials available, etc. A pound of luminous paint containing no radium compounds will cost anywhere from 10 to 20 dollars in Germany, for instance, while paints containing radium compounds may cost more than $200.

Two groups of luminous substances are usually recognized, *i.e.*, those which derive their luminosity or phosphorescence from the exposure to radio-active rays, ultraviolet rays or mercury light, and those obtaining the luminosity from exposure to ordinary daylight or some ordinary artificial light, such as electric light, etc. In the case of the luminous paints the latter type prevails almost exclusively.

Recent investigations have proven that luminescence of these substances is due to disturbed crystallization and the production of these masses must therefore be carried out in such a way as to disturb crystallization in the nascent state. This effect is obtained by employing suitable additions on one hand and the heating of the mixtures to suitable temperatures on the other, the period of heating being an important factor. The degree of temperature required for this purpose depends on the character of the materials used in the manufacture of the luminous paints and may range from red to white heat, while the duration of heating at these maximum temperatures may vary from a few minutes to a number of hours.

The heating treatment is generally carried out in fire-clay furnaces or in steel barrel furnaces lined with fireclay although special types of furnaces, such as the Roessler furnace give better and more reliable results. It is very important that during the heating process (which is effected for sintering purposes) air is admitted to the heated materials, best results being obtained with a blower. If a fireclay furnace is used for this purpose, a fireclay cone is placed on the grate which is surrounded by fireclay mortar, and a clay crucible is placed on top. Hessian fireclay crucibles fitted with a lid are best suited. The inside walls and bottom of the crucibles as well as the lower side of the lid are lined with magnesium oxide mortar well mixed with water, mortars of maximum life and efficiency containing small percentages of waterglass of collodial silicic acid.

Lining of the fireclay crucibles used for this purpose should never be omitted. While the magnesia exerts no direct influence on the heating process proper it facilitates the removal of the finished mass of reaction from the crucible and eliminates the danger of its contamination with particles torn out of the crucible walls. Charcoal or coke is used as fuel. The finished luminous mass is permitted to dry uncovered in the crucible. The lid is then put in place, luted air tight with magnesia paste and the crucible cooled rapidly by means of cool air currents.

The luminous masses thus produced are stored in tightly closed glass bottles. It is advisable, in the case of most substances of this type, not to grind them too finely as this may cause an appreciable reduction of luminosity, although this does not apply to all masses generally.

Luminous paints can be subdivided into two general groups, *i.e.*, those containing zinc sulphide as the luminous substance and those free from zinc sulphide. The first group again can be grouped into luminous masses of the type of the old Sidot's Blend, which is rendered luminescent by radio-active substances and in those energized by exposure to ordinary light.

Zinc sulphide is not the only substance exhibiting luminescence. It is possible, for instance, to produce the following luminous pigment: Zinc chloride is dissolved in a minimum of distilled water, less than 1 per cent of maganese sulphate is then added, and the mixture boiled. An equal quantity of sodium silicate is added to the boiled solution and the mixture evaporated down to dryness, the precipitate being heated to red heat. On cooling to room temperature, this mass exhibits a green luminescence, while if zinc sulphate is used instead of zinc chloride, the product sheds a red light. It appears from this that it is not the zinc sulphide but the zinc itself which is characterized by the property of luminescence, although this property is brought out only through the agency of some zinc compounds, not by all of them. It is difficult to explain, however, why the color of luminescence exhibited by zinc sulphate is different from that of zinc chloride.

Another method of production of luminous paints is the following: Equal parts by weight of zinc sulphate and sodium acetate are dissolved in hot water and hydrogen sulphide is conducted through the solution until all metal has been precipitated in the form of sulphide. After complete settling of the zinc sulphide the supernatant solution is siphoned off, the precipitate decanted with hot water, filtered off, washed and dried on the water bath. 200 parts by weight of the dry zinc sulphide thus obtained are moistened uniformly with a solution consisting of 20 grams of magnesium chloride, 10 grams each of calcium-, strontium- and barium chloride and 200 cubic centimetres of distilled water. Previous to adding this solution to the dry zinc sulphide it is mixed with 10 cubic centimeters of an ammonium tungstate solution containing 0.04 grams of ammonium tungstate (or 0.4 per cent). The moist mixture of the zinc sulphide with the above described solution is then evaporated to dryness on a hot water bath and the residue is placed into a Hessian crucible and heated to red heat within about one hour, maintaining this heat for 30 to 40 minutes. It is then permitted to cool to room temperature in the crucible. The annealed mixture now contains water-soluble and insoluble parts. The former are removed by decanting and washing with distilled water, and the resulting zinc sulphide is finally evaporated to dryness on a hot water bath. This substance exhibits a strong green luminescence, and the tungsten acts the part of an exciter metal, or an activator.

The quantities above stated are ratio quantities throughout, of course, and can be multiplied as required as long as the ratios indicated are maintained. The process, and most of the other modern processes of production of luminous pigments may appear rather complicated, but it is absolutely necessary to adhere to the prescriptions in order to obtain the conditions required for the disturbed crystallization in the nascent state necessary for perfect luminescence.

Strontium sulphide is another pigment frequently used in the production of luminous paints, one of the most well known paints of this type in Central Europe being "Permaphan," which is characterized by a comparatively high degree of resistance against water and by the fact that it may be rendered highly luminescent by a relatively small amount of light, although the amount of energizing light required for this pigment is considerably larger than that needed by certain zinc sulphide preparations such as the so-called "Clarophan." If the strontium sulphide paints are duly exposed to light, however, their luminosity will continue for about 8 hours. The strontium sulphide preparations of this type are produced as follows: 10 parts by weight of strontium oxide, 8 parts of sulphur and 2 parts of pure starch are thoroughly mixed. This mixture is treated with 2.5 per cent potassium sulphate, 5 per cent of a bismuth nitrate solution and 10 per cent of a thorium nitrate solution (both of the two latter solutions are 0.5 per cent alcoholic solutions containing a trace of nitric acid). The mixture is dried and heated to yellow heat for about 25 minutes, the product emitting a green luminescence.

Attention is called to the fact that the sulphur employed in the above mixture must be absolutely pure as even traces of impurities may deteriorate the intensity and degree of the luminescence produced. It is most advisable, therefore, not to use the solid, or powdered, pure sulphur obtained in the market, or even specially sublimed sulphur, but to produce it fresh from carbon bisulphide. It is also necessary to employ pure rice starch exclusively as other types of starch such as potato starch will never yield satisfactory results.

If instead of strontium oxide, barium oxide is used, with only 3 parts of sulphur and 1 per cent of calcium sulphate, and if this mixture is heated to white heat for 35 minutes, a pigment of yellow luminescence is obtained.

A pigment of blue luminescence is produced as follows: 5 parts by weight of calcium oxide, 10 parts of sulphur and 2 parts of starch are carefully mixed. 15 parts of this basic mixture are then mixed with 0.25 parts each of sodium sulphate and potassium sulphate. This mixture is treated with 5 per cent of a bismuth nitrate solution and 10 per cent of a thorium nitrate solution (both solutions being 0.5 per cent alcoholic solutions containing a trace of nitric acid). The product is now heated to white heat for 15 minutes, the pigment thus obtained yielding the blue luminescence above referred to.

The colors of the luminescences exhibited by the above pigments can be influenced considerably by the type of exciter metal used in the mixtures.

Exciters of this kind are, besides the metals indicated above, mercury, manganese, copper and lead. Mercury and copper yield green luminescence, manganese golden yellow emission and lead blue-green light.

A very peculiar effect on the properties of luminous paints is exerted by lithium, which is employed in a manufacturing process devised in France (French Patent No. 799,802). While it is ordinarily quite difficult to grind the masses to a degree of fineness necessary to obtain a maximum degree of luminescence, a comparatively slight addition of lithium will permit of finest grinding without impairing the degree of luminescence (it has been mentioned above that numerous paints should not be stored for any length of time in a finely ground condition even if enclosed in air tight bottles as this would reduce the luminosity). The deterioration of the luminescence is due to an impairment of the crystalline structure, and as this phenomenon depends on a certain type of crystal lattice, a reduction of luminescence is bound to occur if the lattice is disturbed. If, however, a strongly electropositive element such as lithium is added, the luminescence effect is increased to such an extent as to render pulverization practically harmless.

Best results are obtained if a mixture of different lithium salts are added, such as mixtures of lithium carbonate, -sulphate, -fluoride and phosphate, the amounts added ranging from 1 to 25 per cent of the final contents of barium, calcium or strontium salts in the luminous mixtures. These lithium salts are converted into lithium sulphide under the influence of the extreme heat of the calcination so that the chemical-luminescent effect of the sulphide is added to that of the basic luminescents. The French process above mentioned provides for the addition of a magnesium salt, particularly of magnesium oxide, -carbonate or -sulphate to disturb crystallization. Good results may under certain conditions be obtained with mixtures of these magnesium salts. It is believed that the magnesium compounds prevent the formation of regular crystals by deforming the crystal lattice, besides rendering the finished product more easily pulverized, while the pulverized material retains its high degree of luminescence in spite of its fine state of division. A number of metals can be used as exciters.

Luminous paint mixtures containing lithium include the following: 20.7 grams of strontium hydroxide, 8 grams of sulphur, 1 gram of magnesium oxide, 3 grams of sodium carbonate, 1 gram of lithium sulphate and 6 cubic centimeters of a colloidal bismuth solution are thoroughly mixed, dried and calcined, the product exhibiting a blue-green luminescence. Another mixture consists of 50 grams calcium oxide, 50 grams strontium oxide, 15 grams sulphur, 5 grams of rice starch, 5 grams lithium carbonate, 0.25 grams each of sodium and potassium sulphate and 5 cubic centimeters each of a 0.5 per cent solution of bismuth and rubidium nitrate. This mixture is carefully dried on a hot water bath and then calcined at high temperatures for 45 minutes. The product emits a green luminescence.

An English process (English Patent No. 410,347) provides for the production of luminous or phosphorescent materials by a process including one furnacing only, from the carbonates of strontium, calcium, magnesium, lithium, rubidium and small quantities of a "phosphorogen" and a "luminophore" or flux. Suitable phosphorogenes are the nitrates of bismuth, vanadium, rubidium, and erbium as well as copper sulphate and lead acetate. Luminophores are the sulphates of sodium, magnesium and cadmium as well as magnesium chloride. A luminous mixture of this type is produced as follows: Strontium-, calcium- or magnesium carbonate, or suitable mixtures of these salts, are dissolved in a little hydrochloric or nitric acid. Very small amounts of phosphorogen and luminophore are then added and the metals precipitated in the hot mixture by introducing hydrogen sulphide. The precipitate is separated and dried. The dry mass is treated with suitable quantities of lithium or rubidium carbonate and 1 per cent of a substance containing carbon, such as, for instance, starch. The final mixture is calcined for 1–1½ hrs. at 600–900° C. This can be used as a luminous pigment and added to suitable lacquers to form luminous lacquers.

Attention has already been called to the fact that luminous pigments including particularly the sulphides, are strongly influenced by moisture (humidity) and other atmospheric effects. In the case of the sulphides this is due to the hydrolyzing influence of water on these compounds which is bound to destroy the luminescent effect. In order to combat this unfavorable influence of the atmosphere, substances have been developed which are imbedded in the luminous pigments. A substance of this type is quinine sulphate, the principle of an English process (Patent No. 402,777) which prevents, or retards hydrolysis, or in other words, prevents the splitting up of the phosphorescent molecule into simple and non-phosphorescent bodies. The preparation is effected so that the completely dehydrated quinine sulphate is dissolved in 40 times its own quantity of glycerin and triturated with 60 parts by weight of liquid paraffin and the necessary amount of sulphides to form a paste. By suitably mixing this mixture with nitrocellulose solution or oleic acid, lacquers or paints are produced.

In special cases, activation can be effected by means of the elements belonging to the group of the rare earths or of radioactive substances. For instance, 240 grams of phosphorescent zinc sulphide are treated with 5 grams of quinine sulphate and activated with a solution of 0.25 milligrams per 1 cubic centimeter of meso-thorium bromide in distilled water and diluted to 10 cubic centimeters. Nine cubic centimeters of a 10 per cent solution of thorium sulphocarboleate are then added to this mixture which is finally evaporated to dryness. The finishing treatment is carried out as indicated above.

According to another English process (Patent No. 400,068) polymerized aromatic hydrocarbons from the group consisting of polystyrene, polymerized vinyl naphthalene, polymerized vinyl tetrahydronaphthalene and a homologue of any of them are employed as imbedding agents for luminous substances. These compositions are claimed to possess an extraordinarily long life. An example of a mixture of this type is the following: 0.25 kilogram of polystyrene is dissolved in a mixture consisting of 0.25 kilogram each of toluene, xylene and butyl acetate. 40 grams of tricresyl phosphate are then added as softener and, finally 1 kilogram of luminous pigment such as strontium sulphide activated with bismuth or rubidium. The product is a luminous varnish suited for covering walls, glass, paper, metals, etc. Titanium white or lithopone paints form suitable primers for these varnishes.

Luminous pigments not based on sulphides usually exhibit a higher degree of durability. The following are some of the most satisfactory types:

It has been found (German Patent No. 582,401) that luminous substances based on a silicate or carbonate are not subject to deterioration by crushing, i.e. these materials can be ground to infinitesimal size, or even to a colloidal state, without losing their luminescence. They are also insensitive to the action of water. Rare earths are used as activators. For instance, 0.001 gram of gadolinium (in form of the nitrate), 1.03 grams of zinc fluoride, 1.56 grams of potassium fluoride and 1.80 grams of silicic acid are thoroughly mixed and heated for one hour to 1100 degrees Centigrade (2000° F.). Another approved mixture consists of 0.001 gram of yttrium, 0.01 gram of pure sodium chloride and 1 gram of barium chloride. This mixture is heated for 20 minutes to 960° C. (1760° F.). These pigments exhibit luminescence on exposure to ultraviolet light, X-rays, cathode rays and radium emission.

English Patent No. 447,202 relates to the excitement of luminescence by an electric discharge. Here zinc silicate is a luminous material of this type. The pigment is prepared as follows: 2 mols of zinc oxide are intimately mixed with 1 mol of silicic acid, the mixture triturated with water to form a paste and sufficient magnesium chloride solution added to have 0.1 to 0.5% of magnesium in the final product. The complete mixture is dried at 150° C. (300° F.), and ground. The dry powder is then sintered for one hour at 1100° C. (2000° F.), and this product can be ground to minutest size. Vehicles for painting are glycerin, water glass, boric acid, etc.

Modern development of luminous pigments also includes weatherproof pigments of the type $xAl_2O_3 + yMO$. (German Patent No. 590,256 and English Patent No. 403,233.) The letter M in the equation stands for calcium, magnesium, beryllium and zinc while suitable exciter metals are manganese, cobalt, nickel, rubidium, bismuth, etc. A prime condition for the successful production of these luminous substances is absolute purity of all the raw materials entering the manufacturing process. It is absolutely necessary in the first place that aluminum oxide does not contain more than 0.002 per cent of iron and not more than 0.0001 per cent of copper. For the mixing ratio x : y of the basic substances that of the natural spinels (for instance, $3Al_2O_3 + MgO$) is most advantageous. Heating of the mixture is by introducing it into the hydro-oxygen flame of a so-called Verneuil furnace, the operating temperatures amounting to 1000 to 2000° C. (1800 to 3600° F.). As natural pure alumina is procured only with difficulty, it is advisable to start with alums, one approved method of operation being as follows: 76.7 grams of purest calcium oxide are ground together with 207 grams of ammonia alum. 20 grams of lithium carbonate and 10 grams each of sodium and potassium sulphate are then added, with 0.3 gram of metallic bismuth to serve as exciter metal. These substances are thoroughly mixed and held at a temperature of 1200° C. (2200° F.), for 10 minutes, the resulting product exhibiting a blue luminescence.

In a number of luminous substances boric acid, or its borates respectively, are used as basis of the pigment, while a process basing on these substances carbon is employed as activator (German Patent No. 415,204). For instance, 5 grams of borax, 10 grams of ammonium chloride and 5 to 10 grams of tartaric acid are intimately mixed and heated in a closed vessel to 1000° C. (1830° F.) for 1 hour. After cooling the mixture and washing out the soluble constituents the resulting mass is dried at 100° C. (212 F.). The activating coal used in this process thus is derived from the tartaric acid decomposed by heat within the closed vessel.

A luminous pigment of maximum luminescence which can be clearly observed even in daylight has been developed. (German Patent No. 407,944). If 1 gram of uranin is mixed with 1.2 grams of terephthalic acid or 0.9 gram of oxynaphthenic acid, the mixture diluted with distilled water to 1 liter and this solution mixed with a boric acid solution at a ratio of 1 to 1000 and the product dehydrated and calcined, the resulting body exhibits the luminous power indicated.

To insure good life of a luminous paint it is essential that the luminous pigment be not affected by the vehicle, solvent or surface on which it is applied. All materials which liberate acids or are reactive under conditions of use must be eliminated. Even the materials given in the following formulae must be tested and only suitable grades used.

Vehicles

Chlorinated Rubber

Most chlorinated rubbers show a fairly strong acid reaction, caused by the presence of small quantities of hydrochloric acid.

Chlorinated rubber from different sources shows great divergencies in the amount of hydrochloric acid liberated under test conditions. If this material should be chosen as a binding agent, it is essential that an alkaline pigment should be incorporated in order to neutralize this acid.

Like most products containing large quantities of chlorine, chlorinated rubber shows a high absorption of ultra violet light with consequent discoloration on exposure. This high absorption in the ultra violet means so much less energy left for activation of the luminous pigment.

A suitable formula for a medium is as follows:

Chlorinated Rubber (Medium Viscosity)	35 lb.
Dibutyl Phthalate	10 lb.
Xylol	55 lb.

Coumarone Resins

These are very suitable media but unfortunately they yellow on exposure to light. Some coumarone resins when mixed with luminous pigments and the film exposed on a panel in a weathering rack give, after a short period, a curious crocodile skin effect on the surface. The softer coumarone resins may be used alone but the harder types should be plasticized.

Coumarone resins are compatible with dammar and with polystyrol but not with vinyl resins.

The following formula will be found satisfactory:

Neville Resin R 3	40 lb.
Plasticizer 63	11 lb.
Toluol	28 lb.
Zylol	21 lb.

Cyclohexanone Resin

This resin is probably one of the best that may be employed in making luminous paint. It is water white, does not discolor, has good adhesion and durability with excellent water resisting properties. The following formula is recommended:

Cyclohexanone Resin	55 lb.
Xylol	45 lb.

Dammar

From the earliest times this resin has been recommended as a medium for luminous paints on account of its low acidity, good color and high solubility in aromatic hydrocarbons. It suffers from the defect of solvent retention, giving a long period of stickiness. This may be overcome by the incorporation of some pure neutral zinc resinate. The following formula may be used:

Dewaxed Dammar	40 lb.
Neutral Zinc Resinate	10 lb.
Toluol	50 lb.

Neutral Esterified Copal

By the correct method of esterification it is possible to produce an esterified copal with a negligible acid value. This dissolved in white spirit or in xylol produces an excellent medium in the presence of a little plasticizer. The yellowish color is of course a defect.

Methyl Methacrylate

These expensive resins are attractive on account of the fact that they have a high transmission in the ultra violet but many are acid and liable to attack the pigment. A preliminary test should be run.

Polystyrol

This resin is highly recommended as a medium for luminous pigments. It is quite soluble in xylol and similar aromatic hydrocarbons and has good water resistance together with high transmission of ultra violet. The following formula should be used:

Polystyrol	33 lb.
Xylol	67 lb.

Plasticizers

The plasticizers should be selected with the same care as the resin. Information on the light transmitting power of plasticizers is as meager as that on the light transmitting powers of resins. All the phthalates, that is diamyl, isobutyl, dibutyl, diethyl and dimethyl, though passing most of the visible spectrum usually show a strong absorption in the ultra violet. Dibutyl phthalate, though it shows a strong selective absorption on approaching 2900A is useful as it protects materials such as chlorinated rubber from discoloration by light.

Chlorinated compounds such as chlorinated paraffin wax and chlorinated diphenyl again show strong ultra violet absorption but are ideal plasticizers from the point of view of neutrality. Special liquid coumarone resins, (*e.g.*, Plasticizer 63) are also highly recommended.

Solvents

Acid solvents or solvents which are liable to form acids by disassociation or hydrolysis should be rigorously excluded. These include all esters and many others. Ketones are sometimes satisfactory and some of the alcohols. The most satisfactory solvents are undoubtedly neutral cyclic or paraffin hydrocarbons such as xylol, toluol, benzine, white spirit. Neutral carbontetrachloride may even be employed to advantage. It should be noted that immersing the pigment in the solvent alone is not always a reliable test. The pigment should be incorporated with the actual medium it is intended to use. Since the attack is generally of a chemical nature, loss of light emitting properties is usually accompanied by a visible color change of the luminous pigment.

Suspending Agents

Luminous pigments, especially the earth type are heavy powders, readily wetted by the medium, and therefore tend to settle out quickly to a dense mass on the bottom of the container. This almost dry settle is extremely difficult to stir up and a suspending agent should therefore always be incorporated with such pigments. Suitable suspending agents are bentonite, devolite, micro-talc and aluminum stearate. The proportion to employ depends upon the nature of the medium as well as on the ratio of medium to pigments. Typical amounts may be found in the formulae which follow latter.

Driers

Since most oils are quite unsuitable for use with phosphorescent pigments, the question of driers is not likely to arise. Almost every type of drier is unsuitable for use in conjunction with luminous pigments, since chemical reaction is liable to occur. It has been stated that zinc naphthenate in spite of its acid nature, may be used with safety with fluorescent pigments.

Moisture

Most finely divided powders are hydroscopic. Luminescent strontium sulphide picks up water very readily from the atmosphere and should always be kept in a tightly stoppered container.

It is important that all the constituents of the paint should be dry, since small quantities of water induce hydrolysis promoting the formation of acids. Moreover in a number of media traces of water will cause a progressive increase in viscosity and quite frequently the whole mass will set up to an irreversible gel.

Storage

All luminescent pigments should be protected from the action of the atmosphere. Fluorescent pigments are also best stored in amber bottles to protect them from possible photolysis. Phosphorescent paints should not be stored in lead lined drums. Even soldered seams must not be used unless thoroughly protected by a coat of special lacquer since solder contains lead.

Undercoating

In order to obtain maximum brilliance from a luminous paint, it should be applied, *e.g.*, a white surface, a bright metal surface or a mirror. The most satisfactory results are generally obtained with a white undercoating made on a cellulose or synthetic resin basis. Lead and antimony pigments must never be used. Even non-chalking titanium oxides which contain small quantities of antimony oxides should be excluded. The following two undercoatings have been found in practice to give excellent results, the second one being particularly recommended, as it possesses excellent flow, adhesion and durability.

Bodied Perilla Oil	13 lb.
Cyclohexanone Resin in Xylol (50% Solution)	12 lb.
Titanium Oxide (Pure)	18 lb.
Barytes	56 lb.
Curgon Drier No. 300 (50%)	.4 lb.

The pigment and extender are ground into the oil thinned with a little resin solution. The balance of the resin solution and the driers are then added.

Medium

Synolac Resin S.B. 150	33 lb.
White Spirit	66 lb.
Curgon Drier No. 300 (50%)	1 lb.

Pigment

Zinc Oxide	42 lb.
Barytes	42 lb.
Titanium Oxide (Pure)	14 lb.
Benzoic Acid	2 lb.

The pigment is ground into the thick medium and then thinned out to make the finished undercoating using the following proportions:

Medium	15 lb.
Pigment	70 lb.
White Spirit	15 lb.

Proportion of Phosphorescent Powder

The amount of phosphorescent powder which can be added to a gallon of medium varies greatly, but in general 5–6 lbs. are employed, though amounts up to 10 lbs. per gallon are commonly used. As already explained the powder is to some extent self-activating and the greater the amount of powder in the medium the higher the intensity and duration of the afterglow.

Grinding

It is desirable during the mixing of phosphorescent powders that only porcelain or glass should be allowed to come into contact with the powder, since metals are generally attacked by the metallic sulphides which are the principal constituents in these powders.

Proportion of Fluorescent Powder

Only a relatively low concentration of fluorescent pigment in the medium is necessary in order to obtain brilliant results under the black lamp.

Luminous Pigment Pastes

The production of the correct medium and the incorporation of the luminescent powder into such a medium is a matter which necessitates extreme care and many users therefore prefer to use luminescent powders in the form of pigment pastes which are diluted with a suitable media and are then ready for use.

The advantages of luminous pigment pastes are as follows:

1. Most sulphide phosphors are susceptible to atmospheric oxidation and to attack by moisture in the air with liberation of sulphuretted hydrogen. The pigment in luminous pigment paste is permanently protected against atmospheric attack, being embedded in a neutral medium.

2. Luminous pigment pastes are easier to store than when in the powder state.

3. No grinding is necessary. It has already been pointed out that grinding tends to destroy phosphorescence.

4. During handling no objectionable dust particles are liberated to float about in the air and contaminate other products.
5. Odor is negligible.
6. The uniformity from batch to batch is high.
7. Setting which usually is pronounced with the heavy alkaline metal phosphors is greatly delayed by the use of a special method of incorporation.

The following is a typical phosphorescent pigment paste:

Luminophore	80 lb.
Plaz Plasticizer	13 lb.
Xylol	7 lb.

An excellent luminous paint can be made up from the paste according to the following formula:

Luminophore Paste (as above)	80 lb.
Cyclohexanone (50% Solution)	47½ lb.
Aluminium Stearate in Resin in Xylol (10%)	47½ lb.

Finishing a Protecting Coat

If a clear finishing coat is used it is advisable that the clear coating should be a solution of one of the clear media detailed previously, for ordinary cellulose or oil finishes are liable slowly to attack the luminous paint film underneath. A coat of clear lacquer over the luminous paint, though it gives a great measure of protection and insures the life of the paint system, is a disadvantage from the point of view of luminosity, since it acts as a filter retarding excitation and filtering out some of the light emitted by the phosphor. It is unfortunate that most luminescent pigments are attacked by water, especially the acid rain water of cities, and it is doubly unfortunate that practically all varnish coatings absorb small quantities of moisture. Coarse luminous pigments are more difficult to protect than fine ones though generally the coarser the powder the greater the luminosity. Coarse pigments project above the general level of the film and receive inadequate protection. Each little coarse particle is eroded forming a centre for attack and ingress of water.

Durability of Luminous Paints

The life of a luminous paint system shows even greater variation than that of an ordinary paint.

Activation

After the descriptions which have been given it is almost superfluous to point out that phosphorescent paints are activated by exposure to sunlight for one or two minutes or to artificial light for a rather longer period. They then continue to glow with gradually decreasing intensity over a long period and are immediately reactivated by a renewed exposure to light. The process of reactivation may be continued indefinitely.

Paint Systems and Application

Luminous paints may be applied to wood, metal, paper, card, fibre, rubber and canvas, provided the correct paint medium and paint system are employed. Wood should first be filled and then a coat of white undercoating applied, such as that given in the second example above. Metal should be primed with a coat of clear neutral lacquer. Paper or card provided it is reasonably free from acid may be coated direct with the luminous paint. The usual method of application is by brushing but spraying or dipping is also used. If the luminous pigment is very coarse a special nozzle may be necessary. Experiments are now being carried out with the hot spraying of luminescent pigments in conjunction with powdered resins and with neutral shades of shellac. The method is that used by the London Shellac Research Bureau, see "The Hot Spraying of Shellac," Bulletin No. 5, and produces a very adhesive, glossy, thick coating without the use of solvents.

Printing Ink: Silkscreen

Both fluorescent and phosphorescent powders may be used for printing ink adopting the method used for bronze powder, *i.e.*, the luminous powder is dusted on the surface of a sticky lead-free white printing ink. The silk screen process may be employed with great advantage, using any of the media detailed above. It is probable that the silk screen process is one of the best methods for the repetition decorative application of luminescent pigments.

Luminous Pigment Paints

Formula No. 1

Gum Arabic Solution 1:15	10 g.
Zinc Sulphide Pigment	20 g.

No. 2

Gum Arabic Solution 1:15	17 g.
Zinc Sulphide Pigment	20–30 g.

This is sufficient for 25 gcm. surface.

No. 3

Gum Arabic Solution 1:15	20 g.
Calcium Sulphide Pigment	10 g.

Not durable. Can only be mixed shortly before use.

No. 4

Earth Alkali Sulphide	10 g.
Lacquer (see above)	10 g.

No. 5

Zinc Sulphide Pigment	10 g.
Lacquer	20 g.

No. 6

Violet Pigment	2 g.
Lacquer	2 g.
or	
Blue Pigment	2.4 g.
Lacquer	2.4 g.

No. 7

Zinc Sulphide Pigment	2 g.
Lacquer	4 g.

No. 8

To Impregnate Cloth or Paper

Earth Alkali Sulphide	1 g.
Dammar-Xylol	5 cc.
Xylol	5 cc.

No. 9

On horizontal surface: Put on an adhesive, such as waterglass (1.3–1.4 spec. gr.) and spread the pigment in thin layer. Dry a little and dust with luminous pigment.

No. 10

Gelatin, white	25 g.
Water	125 cc.
Glycerin	2.5 cc.
Luminous Pigment	90 g.

Soak gelatin in water, add the glycerin, heat with stirring to obtain solution.

Add the pigment with good stirring, cool with stirring and let solidify to a jelly. Dilute with water before use.

Luminous Moldings

Formula No. 1

Waterglass	10 cc.
Pigment	1 g.
Barium Sulphate	1 g.

Pour into fat-covered form, dry at 100° C.

No. 2

Pigment	1
Paraffin	10

No. 3

German Patent 300270

Pigment	1
Rubber Solution	50

To be put on rubber, after having spread a film of a colorless or light rubber solution on the object.

Luminous Stones

German Patent 187,194

Melt together cautiously.

Potassium Nitrate	40
Pigment	10

Luminous Pigment Paints

Preparation of Non-Acidic Resins for the Lacquers:

Dissolve the resin (e.g. Dammar) in benzol, add alcoholic potash solution, until very slightly alkaline (determine saponification value of the resin before), heat up on water bath; separate the resin by shaking out with water in a separatory funnel; evaporate the benzolic resin solution on the steam bath after treating with calcium chloride, anhydrous.

Plasticizers for Luminous Paints

1. Bleached linseed oil, 2–5% of the weight of the dry resin. No driers!

Vehicles for Luminous Paints

Formula No. 1

Dammar, Dehydrated	10 g.
Tetralin	12 g.

No. 2

Dammar, Dehydrated	10 g.
Benzol	10 g.

No. 3

Dammar, Dehydrated	10 g.
Benzol	10 g.
Bleached Linseed Oil	0.5 g.

No. 4

Dammar	200 g.
Sodium Carbonate	60 g.
Benzine	80 g.

Melt resin and carbonate together, cool, powder, and dissolve in the benzine. Let stand and settle, take off the clear solution.

No. 5

Dammar	250 g.
Benzine or Petroleum Ether	1 l.
Sodium Hydroxide Solution, 10%	250 g.

Shake the resin-solution with the alkali for 10 minutes, syphon off the resin-solution and let stand to clear.

No. 6

Dammar	40 g.
Turpentine	to make 100 g.

Melt the dammar cautiously over open fire, let cool, crack up and grind. Dissolve this remelted resin in enough turpentine to yield 100 g.

No. 7

Melt dammar on a gentle fire in an enamelled kettle, and add 10% of the weight of sodium carbonate.

Keep the melted mixture at 130–140° C. for 2–3 hours, cool slightly (should not become too viscous) and have the soda settle out. Pour off into containers and let solidify.

Crack up the solidified resin and use

Resin	100 g.
Benzine or Benzol	200–300 g.

to obtain solution (no heat!).

Let stand and settle over a layer of sodium carbonate.

The following three vehicles have been tested and found satisfactory for luminous paints:

No. 8

Chlorinated Rubber (Medium Viscosity)	35
Dibutyl Phthalate	10
Xylol	55

No. 9

Dammar, Dewaxed	40
Zinc Resinate, Neutral	10
Toluol	50

No. 10

Polymerized Vinyl Acetate	33.3
Toluol	20.7
Alcohol	22.7
Benzyl Alcohol	13.3

Luminescent Coating for Mercury Vapor Lamps

British Patent 521,796

Zinc Oxide	60
Silica	40
Beryllium Oxide	2
Manganese Dioxide	4
Lithium Chloride	½

Dry and fire at 1000–1100° C.

Conductive Coating for Electron Discharge Devices

British Patent 519,983

Graphite	165 g.
Bentonite	45 g.
Water	1 l.

Grind together in a ballmill; apply dry and bake.

Fluorescent Liquids

An excellent red liquid may be prepared by dissolving a small amount of rhodamine B. in water. This may be used to dye cloth. It gives a strong fluorescence with a suitable short wave light source.

An orange colored liquid may be obtained by dissolving a small amount of eosine in water.

A strong yellow-green fluorescent liquid may be prepared by dissolving fluorescein dye in water.

Primiline will give a good blue-green fluorescent liquid when the dye is dissolved in water. The liquid itself is not very fluorescent, but when cloth is dipped in the solution the material gives a beautiful blue-green color in black light.

Esculin produces a liquid which gives a splendid blue fluorescence. The liquid itself is colorless in ordinary light. In ultraviolet light, however, the solution is blue, and cloth treated with it is very striking in appearance.

In preparing these liquids only a very small quantity of dye is necessary. One twenty-fifth of a gram is usually sufficient to prepare one liter of solution. It is better to use a small quantity of the dye, adding more if necessary. When too much is used the solution as well as the treater cloth will be too dark and will not give a bright fluorescence. Small pieces of cloth (white cotton or rayon) may be dipped in the solution and tried under the lamp. In this way one will soon learn to obtain the desired shade. It should be clear that all tests must be carried out in a dark room as ordinary light destroys the effect of the black light on the fluorescent material.

Phosphorescent Material

U. S. Patent 2,131,557

A method of producing phosphorescent material comprises mixing dry "hydrated calcium oxide" 49–53 with dry barium hydroxide 25.6–29.6 parts, adding water and stirring to form a thin paste, adding to the paste slowly and with constant stirring, a solution of 0.05–0.07 parts of nickel nitrate, further successively adding a solution of sugar 3.5–4.5, and of lithium nitrate 1–2 parts, evaporating to approximate dryness, while stirring, powdering, adding powdered sulphur 14–18 parts, grinding and mixing and heating the mixture in a reducing atmosphere for about 3 hours at a temperature of about 900° C.

Fluorescent Material

British Patent 498,370

Calcium tungstate containing 3.5–6.5% lead tungstate.

Fluorescent Screen

British Patent 475,582

The following gives a white light from cathode-ray tubes.

Cadmium Tungstate	40–70%
Zinc Boride	60–30%
Zinc Silicate	less than 10%

X-Ray Shielding Compound
U. S. Patent 2,162,178
Formula No. 1

Polyvinyl Acetate	27 g.
Dibutyl Phthalate	24 g.
Diglycol Laurate	9 g.
Lead Powder (Fine Dust)	750 g.
Acetone	69 g.

The compound is prepared by dissolving the vinyl derivative in the acetone or a similar suitable solvent, then stirring in the other ingredients, pour into a shallow receptacle, preferably of glass, and allowing the acetone to evaporate. The following formula shows preferred variations in the proportions of the above-mentioned ingredients:

No. 2

Polyvinyl Acetate (Binder)	6 to 30%
Dibutyl Phthalate (Plasticizer)	3 to 15%
Diglycol Laurate (Tempering or Stickiness Modifying Agent)	1 to 5%
Lead Powder (Fine Dust)	50 to 90%

To mix these ingredients acetone in approximately 7% of their volume is preferably added.

High Gloss Dammar-Alkyd Architectural White Enamels
Formula No. 1

Titanium Dioxide	4.000 lb.
Zinc Oxide (Green Seal)	0.534 lb.
Antimony Oxide	0.800 lb.
Alkyd Resin Solution (45% Non-Volatile)	11.960 lb.
Batavia Dammar A/E Solution in Mineral Spirits (50% Non-Volatile)	0.540 lb.

Plus soluble driers as recommended by the manufacturer of the specific alkyd resin used. This resin may be one similar to rezyl 880, rezyl 869 or glyptal 2466.

Add enough mineral spirits to the alkyd resin used to make it 45% non-volatile by weight.

Make a paste with the pigments and about 2.9 lbs. of the alkyd resin solution. Grind the paste. Add the remainder of the alkyd resin solution and then the 50% dammar solution.

The effect of the dammar is to decrease discoloration and in many cases to increase the gloss.

No definite drier proportions can be recommended here because each manufacturer has a different recommendation for his specific alkyd.

No. 2

Titanium Dioxide	4.000 lb.
Zinc Oxide (Green Seal)	0.534 lb.
Antimony Oxide	0.800 lb.
Alkyd Resin Solution (45% Non-Volatile)	11.960 lb.
Batavia Dammar A/E Solution in Mineral Spirits (50% Non-Volatile)	1.080 lb.

Plus soluble driers as recommended by the manufacturer of the specific alkyd resin used. This resin may be any one similar to rezyl 880, rezyl 869, or glyptal 2466.

Add enough mineral spirits to the alkyd resin used to make it 45% non-volatile by weight.

Make a paste with the pigments and about 2.9 lbs. of this solution. Grind the paste. Add the remainder of the 45% non-volatile solution of the alkyd resin and then add the 50% dammar solution.

The effect of the dammar is to decrease discoloration and in many cases increase the gloss.

No definite drier proportions can be recommended here because each manufacturer has a different recommendation for his specific alkyd.

Low-Cost White Enamels
Formula No. 1

Vehicle

Twenty-five gal. oil length after processing resin.

Congo No. 18 Pale Straw Nubs	83.3 lb.
Linseed Oil, Refined, Unbodied	125.0 lb.
Petroleum Thinner	225.0 lb.

Plus driers equivalent to 0.5% lead, 0.02% cobalt, 0.01% manganese as metals on the weight of oil present.

Heat the resin in an open kettle to 650° F. in about one hour and hold until there is a clean drip from the panel, and there is no foaming. Add the linseed oil and reheat to 600° F. and hold until desired body is obtained. Allow to cool to 400° F. Add the petroleum thinner and driers. The non-volatile content will be about 45%. The yield will be about 55 gallons.

Enamel

Titanox A	2 lb.
Above Vehicle	0.938 gal.

Grind the titanox A in enough of the vehicle to make a satisfactory paste for grinding. To the ground paste add the remainder of the vehicle. Strain.

The yield will be one gallon of enamel.

No. 2

Vehicle

Twenty-five gal. oil length after processing the resin.

Congo No. 18 Pale Straw Nubs	83.3 lb.
Linseed Oil, Refined, Unbodied	125.0 lb.
Petroleum Thinner	276.0 lb.

Plus driers equivalent to 0.5% lead, 0.02% cobalt, 0.01% manganese.

Heat the resin in an open kettle to 650° F. in about one hour and hold until there is a clean drip from the paddle, and there is no foaming. Add the linseed oil and reheat to 600° F. and hold until desired body is obtained. Allow to cool to 400° F. Add the petroleum thinners and driers. The non-volatile content will be about 40%. The yield will be about 63 gallons.

Enamel

Titanox A	2 lb.
Above Vehicle	0.938 gal.

Grind the titanox A in enough of the vehicle to make a satisfactory paste for grinding. To the ground paste add the remainder of the vehicle. Strain.

The yield will be one gallon of enamel.

No. 3

Vehicle

About 12.7 gal. in oil length after processing the resin.

Hard Dark Amber Congo	133 lb.
China Wood Oil	97.5 lb.
Petroleum Naphtha	39 gal.

Plus driers equivalent to 0.5% lead, 0.02% cobalt, 0.01% manganese as metals based on the weight of oil present.

Heat the congo to 650° F. in about 1½ hours, and hold it at that temperature until foaming has stopped and it is soluble in oil. Allow the resin to cool to about 450° F. Add the oil. Heat to 560° F. in about ¾ hour and hold for body. Allow to cool to 400° F. and add the petroleum naphtha and driers. If the vehicle or enamel is to be baked, it is not necessary to use driers.

The weight loss on processing the resin is about 25%.

The vehicle thus prepared will be 12½ gallons in oil length, 45% non-volatile content by weight and will give a fast drying, high gloss enamel. It will dry tack free in one to two hours and hard in about four hours.

Bobbin Enamel

Shellac	120 lb.
Alcohol	180 lb.

Mix until dissolved and then add

Castor Oil	1 lb.
Pigment	20 lb.
Toluol	2 lb.

Quick Drying Red Oxide Enamel

Chlorinated Rubber (10 cps.)	15 lb.
Toluol	20 lb.
Solvesso No. 2	25 lb.
Rezyl No. 869-1	22 lb.
Iron Oxide	18 lb.

Alkali Resisting Black Enamel

Chlorinated Rubber (20 cps.)	8 lb.
Solvesso No. 2	50 lb.
Rezyl No. 387-4	40 lb.
Carbon Black	2 lb.

Enamelling of Iron

Formula No. 1

Cleaned iron articles are dipped in

Nickel Sulphate	60.0 g.
Boric Acid	1.8 g.
Water	1.0 l.

for 30 min. at 70-80° C. Wash in ½% soda ash solution and then in ⅛% trisodium phosphate solution and dry at 100-150° C.

The following mixture, 50 parts, is ground and made into a paste with water, 40 parts, applied to iron and baked at 870-890° C.

Sand	25.1 g.
Borax	32.9 g.
Felspar	20.2 g.
Soda Ash	7.0 g.
Potassium Nitrate	3.8 g.
Fluorspar	3.3 g.
Zinc Oxide	2.1 g.
Antimony	5.6 g.
Clay	4.0 g.
Zirconia	4.0 g.

No. 2

The process of enamelling requires a more or less elaborate equipment. The black or raw metal shape or sheet as it comes into the enamel department has grease, oil, dirt, and so on gathered by the press, lathe or drill which must be removed. A boiling caustic solution in a steel or lead lined tank is used and requires about 10 to 15 minutes. The pieces are then lowered into an adjoining tank of flowing clean water, raising and lowering the crate several times to assure a good rinsing. The next and important step is the "pickling" of the pieces which are now lowered, in the same crate, into a sulphuric acid solution of 5 to 6% strength, or a muriatic acid solution of 11 to 12%. The former used hot at 150° F., while the latter is used cold. The time required is about 10 to 20 minutes. When properly pickled, the crate is again lowered into the next rinse tank, after which it is lowered into a neutralizer tank for 3 to 5 minutes at 150 to 160° F. and finally the crate is quickly rolled into a steam heated drier. With the aid of a roller conveyor, the crate is brought to the inspector's section, where the pieces are looked over and passed on to the applier's department. An overhead trolley and electric hoist are used to move the crates along the line from cleaner to dryer.

The porcelain enamel used is composed of borax, feldspar, quartz, soda ash, fluorspar, bone ash, cryolite, oxide of tin, manganese, iron, cobalt. Two typical formulas are as follows:

For the base coat,

Borax	120 lb.
Soda Ash	32 lb.
Saltpeter	48 lb.
Fluorspar	48 lb.
Quartz	60 lb.
Manganese Oxide	18 lb.
Iron Oxide	1 lb.
Cobalt Oxide	1 lb.

In the mill to each 100 lb. of frit,

Clay	8 lb.
Carbonate of Magnesia	6 oz.
Water	40%

For a white cover coat is mixed the following:

Borax	132 lb.
Soda Ash	26 lb.
Cryolite	100 lb.
Fluorspar	3 lb.
Feldspar	130 lb.
Quartz	130 lb.
Saltpeter	6 lb.

In the mill to each 100 lb. of frit,

Clay	6 lb.
Tin Oxide	8 lb.
Water	30%

For making colored enamels, oxides of whatever color is desired are used. The oxides are added to the mill in the proportion to produce the correct shade.

Porcelain Enamel Patching

Bleached Rosin	35 lb.
Gelva (Viscosity 2.5)	45 lb.
Titanium Dioxide	20 lb.

Melt rosin and Gelva. Then stir into this mixture sifted titanium dioxide. Pour into molds to harden.

To use, warm part to be repaired, apply the end of the stick of above material and then smooth with a hot knife blade, screw driver or soldering iron.

Part of the dioxide may be replaced by colored pigments to make a tinted mixture.

Use and Care of Paint Brushes

Before using a new brush, clean out any loose bristles by striking the bristles back and forth against spread fingers. Then dip the brush into the material you are about to apply and work it out on a board before beginning the job.

Dip the brush just far enough in the paint pot, which should not be more than one-half or two-thirds full, so that after touching the end lightly against the inside of the can it will carry paint to the job without dripping. Don't wipe the brush on the edge of the pail, for the paint will dry there, and will later pick up the dried paint skins with the brush and transfer them to the surface being painted.

Paint with the broad side of the brush; otherwise the brush will wear into a point and be ruined. When using a round or oval brush, hold it always in one position for the same good reason. Sash tools, which are made to use edgewise, are the exception to this general rule.

The paint or other material will spread more easily, and the job will be smoother, if the handle of the brush is held at all times perpendicular to the surface being painted, thus using the ends of the bristles and not the sides.

Brushes used in a full oil paint may be laid out flat on a board for a few days without danger of hardening or spoiling them. Brushes used in flat and semi-gloss paints should be either washed out or suspended in the paint itself to a depth of about one-fourth inch above bottom of ferrule. If a thinner, such as linseed oil or turpentine, is available, suspend the brush in that. If the brush is not to be used for some time, wash with a solvent, then with soap and water, and put away for future use.

In the case of varnish brushes, if

the brush is to be used next day, suspend it in varnish, making sure the bristles are completely covered. If the brush is not to be used for some time, clean it thoroughly with turpentine and keep it in raw linseed oil. Before using again, however, make sure that it is thoroughly washed in turpentine.

VARNISHES

Bakelite-Linseed Oil
Formula No. 1

Bakelite Resin BR No. 254	100	lb.
Linseed Oil (Nonbreak)	20	gal.
Mineral Spirits	23½	gal.
Toluol	3⅛	gal.
Cobalt Nuodex (6%)	⅜	gal.

Bakelite-Soybean Oil
No. 2

Bakelite Resin BR No. 254	100	lb.
Soybean Oil (Nonbreak)	20	gal.
Mineral Spirits	23½	gal.
Toluol	3⅛	gal.
Cobalt Nuodex (6%)	⅜	gal.

Ester Gum-Linseed Oil
No. 3

Ester Gum	100	lb.
Linseed Oil, Alkali-Refined	20	gal.
Mineral Spirits	20	gal.
Cobalt Nuodex (6%)	⅜	gal.

Ester Gum-Soybean Oil
No. 4

Ester Gum	100	lb.
Soybean Oil, Alkali-Refined	20	gal.
Mineral Spirits	20	gal.
Cobalt Nuodex (6%)	⅜	gal.

Bakelite-Soybean Oil
No. 5

Bakelite Resin BR No. 254	100	lb.
Soybean Oil, Alkali-Refined	20	gal.
Mineral Spirits	23½	gal.
Toluol	1½	gal.
Cobalt Nuodex (6%)	⅜	gal.

Bakelite-Soybean Oil
No. 6

Bakelite Resin BR No. 254	100	lb.
Soybean Oil (Nonbreak)	20	gal.
Mineral Spirits	23½	gal.
Toluol	¾	gal.
Cobalt Nuodex (6%)	⅜	gal.

Bakelite-Tung Oil
No. 7

Bakelite Resin BR No. 254	100	lb.
Tung Oil	20	gal.
Mineral Spirits	23½	gal.
Toluol	7½	gal.
Lead Nuodex (16%)	1¼	gal.
Manganese Nuodex (4%)	⅝	gal.

Bakelite-Linseed Oil
No. 8

Bakelite Resin BR No. 254	100	lb.
Linseed Oil, Vacuum-Bodied to Q Viscosity	20	gal.
Mineral Spirits	23½	gal.
Toluol	11¾	gal.
Lead Nuodex (16%)	1¼	gal.
Manganese Nuodex (4%)	⅝	gal.

Ester Gum-Tung Oil
No. 9

Ester Gum	100	lb.
Tung Oil	20	gal.
Mineral Spirits	35	gal.
Lead Nuodex (16%)	1¼	gal.
Manganese Nuodex (4%)	⅝	gal.

Ester Gum-Soybean Oil
No. 10

Ester Gum	100	lb.
Soybean Oil, Alkali-Refined	20	gal.
Mineral Spirits	23½	gal.
Cobalt Nuodex (6%)	⅜	gal.

Ester Gum-Soybean Oil
No. 11

Ester Gum	100	lb.
Soybean Oil (Nonbreak)	20	gal.
Mineral Spirits	23½	gal.
Cobalt Nuodex (6%)	⅜	gal.

Bakelite-Tung Oil
No. 12

Bakelite Resin BR No. 254	100	lb.
Tung Oil	20	gal.
Mineral Spirits	25	gal.
Toluol	10	gal.

Cobalt resinate solution—equivalent to 0.01% cobalt metal based on combined weight of resin and oil.

Bakelite-Soybean Oil
No. 13

Bakelite Resin BR No. 254	100 lb.
Soybean Oil (Nonbreak)	20 gal.
Mineral Spirits	22 gal.

Cobalt resinate solution—equivalent to 0.07% cobalt metal based on combined weight of resin and oil.

Bakelite-Perilla Oil
No. 14

Bakelite Resin BR No. 254	100 lb.
Perilla Oil (Nonbreak)	20 gal.
Mineral Spirits	25 gal.

Cobalt resinate solution—same as varnish No. 2.

Ester Gum-Tung Oil
No. 15

Ester Gum	100 lb.
Tung Oil	20 gal.
Mineral Spirits	45 gal.

Cobalt resinate solution—same as varnish No. 1.

Ester Gum-Soybean Oil
No. 16

Ester Gum	100 lb.
Soybean Oil, Alkali-Refined	20 gal.
Mineral Spirits	20 gal.

Cobalt resinate solution—same as varnish No. 2.

Ester Gum-Perilla Oil
No. 17

Ester Gum	100 lb.
Perilla Oil, Alkali-Refined	20 gal.
Mineral Spirits	25 gal.

Cobalt resinate solution—same as varnish No. 2.

Cooking Procedures

Each varnish is cooked similarly by placing all the oil and usually all the resin in the varnish kettle and heating to the desired string from a cold plate. In varnish No. 9 and varnish No. 12, 25% of the resin is withheld for use as a chillback. The mineral spirits is added at 400° F., and the drier or mixture of driers is added at room temperature. The toluol is added to the bakelite varnishes at room temperature to obtain the desired viscosity.

Varnish
(Formula No. 1)
(4 gal. Length)

Modified Alkyd Resin	100	lb.
Varnish Makers Soybean Oil	2	gal.
Bodied Linseed Oil, Viscosity Q	2	gal.
Semi-Aromatic Petroleum Solvent (Xylol Substitute Fraction)	18½	gal.
Zinc Resinate Solution (Zinol)	1	gal.

Heat the resin and the soybean oil to 400° F. and hold at that temperature until the resin is all melted, as indicated by a clear pill on a glass plate. Add the linseed oil and slowly raise the temperature to 500° F., hold at 500° F. until a clear pill on glass is obtained. Let the batch cool to 420° F., reduce and add the zinc resinate solution.

No. 2
(8 gal. Length)

Modified Alkyd Resin	100	lb.
Tung Oil	7	gal.
Heat Bodied Linseed Oil, Viscosity Q to Z	1	gal.
Lead Linoleate (18% Lead)	1¾	lb.
Mineral Spirits	25	gal.
Cobalt Naphthenate Solution (4% Cobalt)	¾	lb.

Heat resin and tung oil rapidly to 580–590° F. Check quickly with the linseed oil. Cool by watering the outside of the kettle to 500° F. while constantly stirring the batch. Add the lead linoleate, cool to 450° F. and reduce and add cobalt drier.

No. 3
(8½ gal. Length)

Modified Alkyd Resin	85	lb.
Lead-Calcium Resinate	15	lb.
Tung Oil	8½	gal.
Litharge	4¼	lb.
Zinc Sulphate	2	lb.
Dipentene	7	gal.
V M & P Naphtha	21	gal.
Cobalt Drier (4% Cobalt)	2¼	lb.
Lead Drier (16% Lead)	2¾	lb.

Heat 3½ gal. of tung oil with the lead-calcium resinate to 510° F. Add 3½ gal. of tung oil and heat to 540° F. Then add the litharge mixed with the remaining 1½ gal. of tung oil, sprinkle in the zinc sulphate, and add the modified alkyd resin. Reheat to 500° F. Hold the temperature at 500°

F. for about 20 minutes (or until a hard pill is obtained on a cold glass plate). Cool to 420° F. and add the thinners and the drier solutions.

The lead-calcium resinate is sometimes called "French Rosin"; it is made in this manner:

Rosin	100 lb.
Lead Acetate	8 lb.
Hydrated Lime	5 lb.

Melt the rosin to 450° F. and hold that temperature while sprinkling in the lead acetate. Stir well while holding the temperature at 450–460° F. until a clear pill on a glass plate indicates that the lead is thoroughly dissolved. Then slowly sprinkle in the lime, when all in the kettle heat to 500° F. and hold at 490–500° F. until a drop on glass is clear. The resinate may be then poured into pans to cool, after which it is ready for use.

No. 4

(10 gal. Length)

Modified Alkyd Resin	100	lb.
Tung Oil	8	gal.
Bodied Linseed or Perilla Oil, Viscosity Z	2	gal.
Lead Linoleate (18% Lead)	2½	lb.
Mineral Spirits	24	gal.
Dipentene	2	gal.
Cobalt Drier (4% Cobalt Content)	15	oz.

Heat the resin and the tung oil together to 400° F. Hold at 400° F. until the resin is completely dissolved, then heat rapidly as possible to 565–570° F. (the temperature must not go higher). Remove from the fire and allow to cool to 510° F., replace over the fire and hold at 510° F. until a slight string forms by one of the last few drops dripping from the paddle; this should require about 35 to 45 minutes. As soon as the string is formed check immediately with the linseed oil, then add the lead linoleate. Cool to 425° F. and add the thinners. When the varnish is cold add the cobalt drier solution.

BAKING VARNISHES

Formula	No. 1	No. 2	No. 3	No. 4	No. 5	No. 6
Oil Length (gallons) ..	8	8	12.8	12.8	20	25
Thermally Processed Congo Resin	227 lb.	227 lb.	227 lb.	227 lb.	151 lb.	151 lb.
China Wood Oil	142 lb.	......	227 lb.	170 lb.	181 lb.	242 lb.
Kettle Bodied Soya Bean Oil	......	142 lb.	......	57 lb.	60 lb.	60 lb.
Kettle Bodied Perilla Oil	......	......	......	......	......	......
Sunoco Spirits	365 lb.	363 lb.	450 lb.	449 lb.	388 lb.	448 lb.
PROCEDURE	Heat resin and oil to 560° F. in about 1¼ hours. Hold for about 7 minutes. Allow to cool to 400° F. Thin with the Sunoco Spirits.			Heat the resin and China wood oil to 580° F. in about 1¼ hours. Hold for body if necessary and check with the soya bean oil. Allow to cool to 400° F. Thin with Sunoco Spirits.		
BAKING SCHEDULE	1 hour at 225°–260° F. ½ hour at 300° F.	1 hour at 225°–260° F. ½ hour at 300° F.	1 hour at 225°–260° F. ½ hour at 300° F.	1 hour at 225°–260° F. ½ hour at 300° F.	1½ hr. at 225° F.; 1 hr. at 260° F.; ½ hr. at 300° F.	1 hour at 225°–260° F. ½ hour at 300° F.

BAKING VARNISHES

Formula	No. 7	No. 8	No. 9	No. 10	No. 11	No. 12
Oil Length (gallons)	20	12.8	25	8	8	12.8
				Kauri Brown No. 3	Kauri Brown No. 3	Kauri Brown No. 3
Thermally Processed Congo Resin	151 lb.	227 lb.	151 lb.	227 lb.	227 lb.	227 lb.
China Wood Oil	181 lb.	170 lb.	242 lb.	142 lb.	......	227 lb.
Kettle Bodied Soya Bean Oil	......	......	......	......	142 lb.	......
Kettle Bodied Perilla Oil	60 lb.	57 lb.	60 lb.	......	......	......
Sunoco Spirits	387 lb.	450 lb.	448 lb.	365 lb.	363 lb.	450 lb.
PROCEDURE	Heat the resin and china wood oil to 580° F. in about 1¼ hours. Hold for body if necessary and check with the perilla oil. Allow to cool to 400° F. Thin with Sunoco Spirits.			Heat resin and oil to 560° F. in about 1¼ hours. Hold for about 7 minutes. Allow to cool to 400° F. Thin with the Sunoco Spirits.		
BAKING SCHEDULE	1½ hr. at 225° F.; 1 hr. at 260° F.; ½ hr. at 300° F.	1 hour at 225°–260° F. ½ hour at 300° F.	1 hour at 225°–260° F. ½ hour at 300° F.	1 hour at 225°–260° F. ½ hour at 300° F.	1 hour at 225°–260° F. ½ hour at 300° F.	1 hour at 225°–260° F. ½ hour at 300° F.

Formula	No. 13	No. 14	No. 15	No. 16	No. 17	No. 18
Oil Length (gallons)	12.8	20	25	20	12.8	25
Thermally Processed Congo Resin	227 lb.	151 lb.	151 lb.	151 lb.	227 lb.	151 lb.
China Wood Oil	170 lb.	181 lb.	242 lb.	181 lb.	170 lb.	242 lb.
Kettle Bodied Soya Bean Oil	57 lb.	60 lb.	60 lb.	......	......	......
Kettle Bodied Perilla Oil	......	......	......	60 lb.	57 lb.	60 lb.
Sunoco Spirits	449 lb.	388 lb.	448 lb.	387 lb.	450 lb.	448 lb.
PROCEDURE	Heat the resin and China wood Oil to 580° F. in about 1¼ hours. Hold for body if necessary and check with the soya bean oil. Allow to cool to 400° F. Thin with the Sunoco Spirits.			Heat the resin and China wood oil to 580° F. in about 1¼ hours. Hold for body if necessary and check with the perilla oil. Allow to cool to 400° F. Thin with the Sunoco Spirits.		
BAKING SCHEDULE	1 hour at 225°–260° F. ½ hour at 300° F.	1 hour at 260° F.; ½ hour at 300° F.	2 hours at 225° F.; 1 hour at 260° F.; ½ hr. at 300° F.	1 hour at 260° F.; ½ hour at 300° F.	2 hours at 225° F.; 1 hour at 260° F.; ½ hr. at 300° F.	2 hours at 225° F.; 1 hour at 260° F.; ½ hr. at 300° F.

DAMMAR-MALEIC RESIN VARNISHES

(15 Gallon Oil Length)

	Formula No. 1	No. 2	No. 3
Batavia Dammar A/E	10 lb.	20 lb.	40 lb.
Maleic Anhydride Resin	90 lb.	80 lb.	60 lb.
China Wood Oil	12 gal.	12 gal.	12 gal.
Kettle Bodied Linseed Oil	3 gal.	3 gal.	3 gal.
Mineral Spirits	27 gal.	27 gal.	27 gal.
Toluol	6 gal.	6 gal.	6 gal.

Driers ....Equivalent to 0.5% Lead and 0.02% Cobalt as metals on the weight of oil.

Heat the resins and China Wood oil to 560° F. Hold for body if necessary. Allow to cool. Thin and add driers.

25 Gallon Varnishes

	Formula No. 4	No. 5	No. 6
Batavia Dammar A/E	10 lb.	20 lb.	40 lb.
Maleic Anhydride Resin	90 lb.	80 lb.	60 lb.
China Wood Oil	20 gal.	20 gal.	20 gal.
Kettle Bodied Linseed Oil	5 gal.	20 gal.	20 gal.
Mineral Spirits	37 gal.	37 gal.	37 gal.
Toluol	8 gal.	8 gal.	8 gal.

Driers ....Equivalent to 0.5% Lead and 0.02% Cobalt as metals based in the weight of oil.

Heat the resins and China Wood oil to 560° F. Hold for body if necessary. Allow to cool. Thin and add driers.

KAURI OIL VARNISHES

In all these varnishes the first step is to first process the Kauri. This is done as follows:

Heat the Kauri resin to 625° F. in about 1–1¼ hours. Hold at 625° F. until there is no more foaming and the resin is oil soluble (about ½–1 hour). Using this processed resin as a starting point, the following varnishes may be made:

	Formula No. 1	No. 2	No. 3
Thermally Processed Kauri	100 lb.	100 lb.	100 lb.
China Wood Oil	8 gal.	20 gal.	30 gal.
Kettle Bodied Linseed Oil	...	5 gal.	5 gal.
Mineral Spirits	25 gal.	45.5 gal.	57.5 gal.

Driers ....Equivalent to 0.5% Lead, 0.02% Cobalt as metals on the weight of oil present.

	Heat resin and oil to 580° F. Hold for body. Allow to cool. Thin and add driers.	Heat resin and CWO to 560° F. Hold for body. Add the linseed oil. Allow to cool. Thin and add driers.	Heat resin and CWO to 540° F. Hold for body if necessary and check with linseed oil. Allow to cool, thin and add driers.
Drying Time	1 hr.	4–6 hrs.	6–8 hrs.
Uses	Rubbing Varnish	Floor Varnish	Spar Varnish

Congo-Cumar Varnish

Congo Resin	50 lb.
Cumar W.	50 lb.
Litharge	1 lb.
China Wood Oil	27 gal.
Varnish Linseed Oil	5 gal.
Mineral Spirits	40 gal.
Hi-Flash Naphtha	10 gal.

Plus driers containing 0.06 lb. Cobalt and 0.12 lb. Manganese as metals.

Heat the Congo to 675° F. and hold until completely fused. Remove from fire. Add the mixture of China wood and linseed oil previously heated to about 300° F. Heat up to 565–575° F. with stirring. Add the Cumar. Body at 500–525° F. Allow to cool, thin and add driers.

This varnish will dry in about 4–6 hours to a very glossy finish.

Dammar-Oil Varnish

Formula No. 1

(5-Gal. Oil Length)

Batavia Dammar	71 lb.
China Wood Oil	28 lb.
Toluol	57 lb.
Petroleum Thinner	68 lb.

Plus driers equivalent to 0.5% Lead, 0.03% Cobalt as metals on the weight of oil present.

Heat the oil to 400° F. Sift in the resin. Heat the mixture to 540° F. Allow to cool to 300° F. Add the toluol, then the petroleum thinner and then the driers. This procedure is to be followed in all the succeeding dammar-oil varnishes.

This varnish is clear. It will dry in 2 hours.

No. 2

(5-Gal. Oil Length)

Batavia Dammar	71 lb.
Kettle Bodied Linseed Oil	28 lb.
Toluol	57 lb.
Petroleum Thinner	68 lb.

Plus driers equivalent to 0.5% Lead, 0.03% Cobalt as metals on the weight of oil.

This varnish is clear. It will dry in about 7 hours, though the film will not be hard.

No. 3

(10-Gal. Oil Length)

Batavia Dammar	71 lb.
Refined Soya Bean Oil	56 lb.
Petroleum Thinner	125 lb.

Plus driers equivalent to 1.0% Lead, 0.06% Cobalt, 0.01% Manganese as metals based on the weight of oil present.

This varnish is cloudy. It will dry in 6–8 hours, though the film will be soft.

No. 4

Batavia Dammar	71 part
Diamond K Soya Bean Oil	56 part
Toluol	52 part
Petroleum Thinner	63 part

Plus driers equivalent to 1.0% Lead, 0.06% Cobalt, 0.01% Manganese as metals on the weight of oil present.

This varnish will dry in about 10 hours though the film will be soft.

No. 5

(10-Gal. Oil Length)

Batavia Dammar	71 lb.
China Wood Oil	56 lb.
Petroleum Thinner	93 lb.
Toluol	26 lb.

Plus driers equivalent to 0.5% Lead and 0.03% Cobalt as metals on the weight of oil present.

This varnish is cloudy. It will dry in about 2 hours.

No. 6

(10-Gal. Oil Length)

Batavia Dammar	71 lb.
Kettle Bodied Linseed Oil	56 lb.
Petroleum Naphtha	125 lb.

Plus driers equivalent to 1.0% Lead, 0.06% Cobalt, 0.01% Manganese as metals based on the weight of oil present.

This varnish is very cloudy. It will dry in about 5 hours, though the film will be soft.

No. 7

(25-Gal. Oil Length)

Batavia Dammar	71 lb.
Kettle Bodied Linseed Oil	140 lb.
Toluol	120 lb.
Petroleum Thinner	150 lb.

Plus driers equivalent to 1.0% Lead, 0.06% Cobalt, 0.1% Manganese on the weight of oil.

This varnish is very cloudy. It will dry in about 10 hours, though the film will be soft.

No. 8

(25-Gal. Oil Length)

Batavia Dammar	71 lb.
China Wood Oil	140 lb.
Toluol	120 lb.
Petroleum Thinner	150 lb.

Plus driers equivalent to 0.5% Lead and 0.01% Cobalt as metals on the weight of oil.

This varnish is clear and will dry in about 4 hours.

No. 9

(40-Gal. Oil Length)

Batavia Dammar	71 lb.
Kettle Bodied Linseed Oil	224 lb.

Toluol	175 lb.
Petroleum Thinner	195 lb.

Plus driers equivalent to 1.0% Lead, 0.06% Cobalt, 0.01% Manganese as metals on the weight of oil present.

This varnish is very cloudy. It will dry in about 24 hours, though the film will be soft.

No. 10

(40-Gal. Oil Length)

Batavia Dammar	71 lb.
China Wood Oil	224 lb.
Toluol	175 lb.
Petroleum Thinner	195 lb.

Plus driers equivalent to 0.5% Lead, 0.02% Cobalt as metals on the weight of oil present.

This varnish is clear. It will dry in about 4 hours.

No. 11

(55-Gal. Oil Length)

Batavia Dammar	36 lb.
China Wood Oil	155 lb.
Toluol	110 lb.
Petroleum Thinner	130 lb.

Plus driers equivalent to 0.5% Lead, 0.02% Cobalt as metals on the weight of oil present.

This varnish is slightly cloudy. It will dry in about 4 hours.

No. 12

(5-Gal. Oil Length)

Batavia Dammar	71 lb.
Alkali Refined Perilla Oil	28 lb.
Toluol	57 lb.
Petroleum Thinner	68 lb.

Plus driers equivalent to 0.5% Lead, 0.03% Cobalt as metals on the weight of oil.

This varnish is slightly cloudy. It will dry in about 7 hours.

No. 13

(5-Gal. Oil Length)

Batavia Dammar	71 lb.
Refined Soya Bean Oil	28 lb.
Toluol	57 lb.
Petroleum Thinner	68 lb.

Plus driers equivalent to 0.5% Lead, 0.03% Cobalt as metals on the weight of oil.

This varnish is cloudy. It will dry in about 7 hours, though the film is not hard.

Black East India Oil Varnishes

Formula No. 1

(20 Gal. Oil Length)

Black East India Bold Scraped	100 lb.
Linseed Oil	20 gal.
Mineral Spirits	36.7 gal.

Plus driers — 0.06% Manganese, 0.02% Cobalt, 0.8% Lead on weight of oil present.

Heat the resin alone to 600° F. and hold until foaming has ceased. Add the linseed oil, pre-heated to 400° F. Heat the mixture to 600° F. and body at 600° F. to the desired viscosity. Allow to cool. Thin and add driers.

The drying time of this varnish is about 8 hours.

No. 2

(25 Gal. Oil Length)

Thermally Processed Congo	113 lb.
China Wood Oil	221 lb.
Glycerin	4.4 lb.
Sunoco Spirits	334 lb.

Plus driers equivalent to 1.0% Lead, 0.04% Cobalt and 0.02% Manganese, based on the weight of oil present.

Heat the resin, oil and glycerin to 520° F. in about 40 minutes. Hold at 520° F. for maximum body (about 5 minutes—beware of gelling of china wood oil). Allow to cool to 400° F. Add the Sunoco Spirits and driers in order.

This varnish dries in about 4 hours. It is gas-proof after the film has dried for 2 hours but is not gas-proof after only 1 hour of drying in air.

No. 3

(25-Gallon Oil Length)

Black East India Bold Scraped	100 lb.
China Wood Oil	8⅓ gal.
Kettle Bodied Linseed Oil	16⅔ gal.
Mineral Spirits	47 gal.

Plus driers equivalent to 1.0% Lead, 0.03% Cobalt, 0.02% Manganese as metals based on the weight of oil in the varnish.

Heat the resin and china wood oil to 580° F. in about 1 hour. Add the linseed oil. Reheat to 560° F. Allow to cool to 400° F. and thin with the Mineral Spirits. Add the driers.

This varnish will dry in 8–12 hours.

Varnish With Pale East India Resin

20-Gallon Oil Length

Pale East India Gum	100 lb.
China Wood Oil	16 gal.
Kettle Bodied Linseed Oil	4 gal.
Mineral Spirits	40 gal.

Plus driers equivalent to 0.5% Lead, 0.02% Cobalt and 0.01% Manganese as metals based on weight of oil present.

Heat the resin with half the China wood oil to 580° F. in about 1¼ hours. Hold at 580° F. until the resin is thoroughly incorporated in the oil. Add the remainder of the China wood oil and heat to 560°–570° F. Hold for body and check with the linseed oil. Allow to cool to about 400° F. and add the mineral spirits and driers.

This varnish will dry in about 4 hours. It may be used as a floor varnish, and as a grinding vehicle.

Congo Oil Varnish

Formula No. 1

(25-Gallon Oil Length)

Ordinary Ivory Congo Sorts	100 lb.
China Wood Oil	20 gal.
Linseed Oil	5 gal.
Varnolene	45 gal.

Plus driers equivalent to 0.5% Lead, 0.01% Cobalt and 0.01% Manganese as metals based on the weight of oil present.

Keep cover on kettle during processing of resin.

Heat resin to 600° F. and hold until foaming settles. Heat to 650° F. and hold until foaming subsides and resin is oil soluble. Allow to cool to 450° F. Add the China wood oil and heat to 560° F. Hold for body and add the linseed oil. Allow to cool to 450° F. Thin with Varnolene and then add driers.

No. 2

(15 Gallons Oil Length)

Hard Dark Amber Congo (Congo No. 11)	100 lb.
China Wood Oil	15 gal.
Varnolene	33 gal.

Plus driers equivalent to 0.5% Lead, 0.01% Cobalt, 0.01% Manganese as metals based on the weight of oil.

Keep cover on kettle during processing of resin.

Heat resin slowly to 600° F. in about 1 hour. Hold until foam settles. Heat to 650° F. and hold until the foaming subsides and the resin is oil soluble. Allow to cool to about 450° F. Add the China wood oil. Heat to 560° F. Hold for maximum body and cool, using water on the outside of the kettle if necessary. Add the Varnolene and then the driers.

No. 3

(25 Gallons Oil Length)

Congo No. 11 (Hard Dark Amber Congo)	100 lb.
China Wood Oil	20 gal.
Linseed Oil	5 gal.
Varnolene	45 gal.

Plus driers equivalent to 0.5% Lead, 0.01% Cobalt and 0.01% Manganese as metals based on the weight of oil present.

Keep cover on kettle during processing of resin.

Heat the resin to 600° F. in about 1 hour. Hold until foam settles and raise to 650° F. Hold until foaming subsides and resin is oil soluble. Allow to cool to about 450° F. Add the China wood oil. Heat to 560° F. Hold for maximum body. Add the linseed oil. Allow to cool to 400° F. and add the Varnolene and driers.

No. 4

(25 gallons Oil Length)

Congo No. 11 (Hard Dark Amber Congo)	100 lb.
China Wood Oil	20 gal.
Linseed Oil	5 gal.
Varnolene	45 gal.

Plus driers equivalent to 0.5% Lead, 0.01% Cobalt and 0.01% Manganese as metals on the weight of oil present.

Keep cover on kettle during processing of resin.

Heat the resin to 600° F. in about 1 hour. Hold until foam settles. Heat to 650° F. and hold until foaming subsides and resin is oil soluble. Allow to cool to 450° F. Add 5 gallons of China wood oil. Reheat to 560° F. and continue this procedure until all of the oil has been added, including the linseed. Cool quickly to about 450° F., using water on the outside of the kettle if necessary. Add the Varnolene and then the driers.

This method of cooking gives greater gas-proofness.

Congo Oil Varnish With Heat Reactive Phenolic Resin

(25 gallons Oil Length)

Hard Dark Congo (Congo No. 11)	90 lb.
Heat Reactive Phenolic Resin	10 lb.
China Wood Oil	20 gal.
Linseed Oil	5 gal.
Varnolene	45 gal.

Plus driers equivalent to 0.5% Lead, 0.01% Cobalt and 0.01% Manganese as metals based on the weight of oil present.

Keep cover on kettle during processing of resin.

Heat Congo slowly to 600° F. in about 1 hour. Hold until the foam settles. Raise to 650° F. and hold until foaming subsides and until the resin is oil soluble. Allow to cool to 400° F. Add the heat reactive phenolic resin and mix thoroughly. When foaming has stopped, add the China wood oil. Heat to 560° F. and hold for body. Add linseed oil, allow to cool to 400° F. Add the Varnolene and driers.

This varnish will dry in 4 hours and is an excellent general utility varnish.

Congo Rubing Varnish

Formula No. 1

(10 Gallons Oil Length)

Congo No. 13 (Dark Sorts, Bold)	100 lb.
China Wood Oil	10 gal.
Varnolene	27 gal.

Plus driers equivalent to 0.5% Lead, 0.01% Cobalt and 0.01% Manganese as metals based on the weight of oil.

Keep cover on kettle during processing of resin.

Heat the resin slowly to 600° F. in about 1 hour. Keep cover on the kettle. Hold at this temperature until foam settles. Raise temperature to 650° F. Hold until foam subsides. Total cooking time is 1½ hours. Cool to below 450° F. Add the China wood oil. Heat to 560° F. Hold until a cold drop can be rolled into a non-tacky pill. Cool to 400° F. and add the Varnolene and then the driers.

No. 2

(12 Gallons Oil Length)

Congo No. 13 (Dark Sorts Bold)	100 lb.
Linseed Oil	7 gal.
China Wood Oil	5 gal.
Varnolene	30 gal.

Plus driers equivalent to 0.5% Lead, 0.01% Cobalt and 0.01% Manganese as metals based on the weight of oil.

Keep cover on kettle during processing of resin.

Heat resin to 600° F. in about 1 hour. Hold until foam falls. Heat to 650° F. Hold until foaming subsides and resin is oil soluble. Total cooking time is about 1½ hours. Add 5 gallons of linseed oil. Allow to cool to 400° F. Add the China wood oil. Heat to 560° F. and hold until a cold drop may be rolled into a soft pill. Add 2 gallons of linseed oil, then cool to 450° F.

Natural Resin Oil Varnishes With Heat Reactive Phenolic Resin

(10 Gallons Oil Length)

Thermally Processed Kauri, Congo or Pontianak	80 lb.
Heat Reactive Phenolic Resin	20 lb.
China Wood Oil	10 gal.
Petroleum Thinner	32 gal.

Plus driers equivalent to 0.5% Lead and 0.02% Cobalt as metals based on the weight of oil present.

Keep cover on kettle during processing of resin.

Heat the thermally processed natural resin and 5 gallons of China wood oil to 400° F. in about 20 minutes. Add the phenolic resin. Raise the temperature to 400° F. Hold for 20 minutes. Heat to 560° F. and hold for 10 minutes. Add the remainder of the China wood oil. Hold at 465° F. for 20 minutes. Allow to cool to 400° F. and add the thinner and driers.

This varnish will have a viscosity of about "D" of the Gardner-Holdt Viscosity standards, a color of 5-6 of the Gardner color standards, will dry to recoat in 4 hours and can be rubbed lightly overnight.

Congo-Pontianak Oil Varnish

(15 Gallons Oil Length)

Congo No. 11—Hard Dark Amber Congo	75 lb.
Pontianak Bold Scraped	25 lb.
China Wood Oil	15 gal.
Varnolene	33 gal.

Plus driers equivalent to 0.5% Lead, 0.01% Cobalt and 0.01% Manganese based on the weight of oil present.

Keep cover on kettle during processing of resin.

Heat the mixture of resins to 600° F. in about 1 hour. Hold until foam settles. Heat to 650° F. and hold until foaming subsides and resin is oil soluble. Allow to cool to 450° F. Add the China wood oil. Heat to 560° F. Hold for maximum body. Cool to 400° F. using water on outside of kettle if necessary. Add the Varnolene and then the driers.

Flat Varnish

Congo Oil Gloss Varnish	100 lb.
Celite No. 165	25 lb.

Grind the Celite loosely in the varnish with a roller mill.

The finished varnish appears clear and transparent.

Flat Batu Oil Varnish and Semi-Gloss Varnish

(20 gallons Oil Length)

Batu Unscraped	150 lb.
China Wood Oil	239 lb.
Mineral Spirits	60 gal.

Plus driers equivalent to 0.5% Lead, 0.02% Cobalt and 0.01% Manganese as metals based on the weight of oil present.

Heat the resin alone to 450° F. very slowly (about 45 minutes). Hold at 450° F. until all the resin is melted. Add the oil and heat to 480° F. Allow to cool to 400° F. and add the mineral spirits and driers.

This varnish dries flat, hard and flexible overnight.

Semi-gloss varnishes may be obtained by blending this flat varnish with a high gloss Congo varnish or other high gloss varnishes. The resulting gloss will depend on the relative amounts of flat and gloss varnishes in the blended varnish.

Cooked Flat Oil Varnish

Formula No. V-154

(8 gal. Oil Length)

Batu Bold Scraped	108 lb.
Kettle Bodied Linseed Oil	62.4 lb.
Mineral Spirits	162.4 lb.

Plus driers equivalent to 0.5% lead, 0.02% cobalt, 0.01% manganese as metals based on the weight of the oil present in the varnish.

Heat the batu bold scraped to 450° F. in about 1 hour. Hold at 450° F. until the resin is all melted. The loss in weight is about 7.5%. Add the linseed oil. Heat the oil and resin to 500° F. as quickly as possible. Allow to cool. Add the mineral spirits. Add the driers.

The varnish is 8 gal. in oil length and 50% in non-volatile content. It will dry to a flat finish.

Floor Varnishes

Formula No. 1

(15 gal. Oil Length)

Hard Dark Amber Congo	100 lb.
China Wood Oil	12 gal.
Kettle Bodied Linseed Oil	3 gal.
Mineral Spirits	27 gal.

No. 2

(20 gal. Oil Length)

Hard Dark Amber Congo	100 lb.
China Wood Oil	15 gal.
Kettle Bodied Linseed Oil	5 gal.
Mineral Spirits	33 gal.

Heat the resin to 650° F. in as short a time as possible. Hold at 650° F. until all foaming has ceased and until there is a clean drip from the paddle. Allow to cool to about 550° F. Add the China wood oil. Heat to 560° F. and hold for body. Add the linseed oil. Allow to cool to 400° F. and add the mineral spirits. Add driers equivalent to 0.5% lead, 0.02% cobalt and 0.01% manganese as metals based on the weight of oil present.

Both varnishes will dry within 4 hours.

No. 3

(25 gal. Oil Length)

Hard Dark Amber Congo (Congo No. 11)	133 lb.
China Wood Oil	20 gal.
Kettle Bodied Linseed Oil	5 gal.
Mineral Spirits	47 gal.

Plus driers equivalent to 0.05% lead, 0.02% cobalt, 0.01% manganese as metals based on the weight of oil present.

Heat the Congo resin to 650° F. in about 1 hour and hold until there is no more foaming and until there is a clean drip from the paddle. Allow it to cool to about 500° F. and add the China wood oil. Heat to 560° F. and hold for body if necessary. Check by adding the linseed oil. Allow to cool to 400° F. and add the mineral spirits. Add the driers. This varnish will dry to touch in about 4 hours and hard in about 8 hours.

Crystal Finish Varnish

(26 gal. Oil Length)

Congo	100 lb.
China Wood Oil	164 lb.
Kettle Bodied Linseed Oil	40 lb.
Petroleum Thinner	305 lb.

Plus driers equivalent to 0.25% lead and 0.01% cobalt as metals on the weight of oil.

Keep cover on kettle during processing of resin.

Heat the Congo to 650° F. in about 1¼ to 1½ hours. Hold at 650° F. until foaming has subsided and until the resin is oil soluble. Allow to cool to about 540° F. Add the China wood oil. Heat to 550° F. and check immediately with the linseed oil. Add the thinner and driers.

Bake this varnish in a fouled oven to obtain a crystal finish.

Manila Varnish With Heat Reactive Resins

(25 gal. Oil Length)

Hard Bold Manila Pale	90 lb.
Heat Reactive Phenolic Resin	10 lb.
China Wood Oil	20 gal.
Linseed Oil	5 gal.
Varnolene	45 gal.

Plus driers equivalent to 0.5% lead, 0.01% cobalt, .01% manganese as on the weight of oil present.

Keep cover on kettle during processing of resin.

Heat the Manila resin to 650° F. in about 1 hour. Allow to cool to 400° F. Add the phenolic resin. When foaming ceases, add the China wood oil. Heat to 560° F. Hold for body. Add the linseed oil. Allow to cool to 400° F. Add the Varnolene and the driers.

This is an excellent general utility varnish, being much lighter in color than a Congo-phenolic resin varnish. In other respects, it gives the same results as a Congo-phenolic resin varnish.

Gas-Proof Natural Resin-Oil Varnish

(26 gal. Oil Length)

Hard Dark Amber Congo	100 lb.
Glycerin	5.5 lb.
China Wood Oil	164 lb.
Kettle Bodied Linseed Oil	40 lb.
Petroleum Thinner	305 lb.

Plus driers equivalent to 0.5% lead, 0.02% cobalt as metals based on the weight of oil present.

Heat the resin to 650° F. in as short a time as possible and hold until there is no more foaming and the resin is oil soluble. Allow to cool to about 560° F. Add the China wood oil and glycerin. Heat to 560° F. Hold for maximum body (about 10 minutes). Add the linseed oil. Allow to cool.

This varnish will set to touch in about 1 hour and dry in about 4 hours to a gas-proof, glossy, water resistant film.

Congo-Modified Phenolic Oil Varnish

(25 gal. Oil Length)

Hard Dark Amber Congo (Congo No. 11)	200 lb.
Modified Phenolic Resin	200 lb.
China Wood Oil	680 lb.
No. 0 Bodied Linseed Oil	120 lb.
Varnolene	1200 lb.

Plus driers equivalent to 0.4% lead, 0.03% manganese and 0.0088% cobalt as metals on the weight of oil present.

Heat the Congo resin in the kettle without a cover to 650° F. in about 1 hour. Hold at 650° F. for about 1 hour (until resin is oil soluble). Add the China wood oil preheated to 400° F. and then the modified phenolic resin. Heat to 560° F. and hold for body if necessary. Add the linseed oil. Allow to cool to about 450° F. and add the Varnolene and then the driers.

This varnish will dry in about 4–6 hours and is recommended as a floor varnish, and as a varnish for outdoor use.

Boea-Oil Varnish

Formula No. 1

(8 gal. Oil Length)

Boea Medium Dark	1000 lb.
China Wood Oil (620 lb.)	80 gal.
Varnolene (1950 lb.)	300 gal.

Plus driers equivalent to 0.4% lead, 0.03% manganese, and 0.01% cobalt as metals on the weight of oil present.

Heat the resin in kettle with cover to 625° F. in about 1 hour. Remove from fire for about 15 minutes, the resin cooling to about 518° F. Heat to 610° F. and hold for 1 hour. Remove cover. Remove from fire. Add China wood oil preheated to 400° F. Heat to 580° F. and hold for body. Allow to cool to about 400° F. Add the Varnolene and then the driers.

This varnish dries dust free in 1 hour and tack free in about 3 hours to a very glossy film, which is also gas-proof. It has a viscosity of "G" and a color of "16" on the Gardner viscosity and color standards, respectively. It is very water resistant.

It is useful as a furniture and rubbing varnish.

No. 2

(15 gal. Oil Length)

Boea Medium Dark	1000 lb.
China Wood Oil	120 gal.
No. 00 Pale Bodied Linseed Oil	30 gal.
Varnolene	340 gal.
Crystalline Lead Acetate	17.2 lb.

Plus manganese and cobalt driers equivalent to 0.03% manganese and 0.01% cobalt as metals based on the weight of oil.

Heat the resin in a kettle with cover to 625° F. in about 1 hour. Hold for about 1 hour (until the resin is oil soluble). Add the China wood oil preheated to 400° F. Heat to 560° F. Add the linseed oil and then the lead acetate. Hold for body at about 518° F. Allow to cool and add thinners.

This varnish dries dust free in about 1 hour and tack free in about 3 hours. Its film is gas-proof and very glossy. It has a viscosity of "E" and a color of "17" on the Gardner viscosity and color standards, respectively. It is very water resistant.

This varnish would be useful as a furniture varnish and floor varnish.

No. 3

(25 gal. Oil Length)

Boea Medium Dark	1000 lb.
China Wood Oil	200 gal.
No. 00 Pale Bodied Linseed Oil	50 gal.
Varnolene	460 gal.

Plus driers equivalent to 0.4% lead, 0.03% manganese and 0.01% cobalt as metals on the weight of oil present.

Heat the resin in kettle with cover to 625° F. in about 1 hour. Hold at 625° F. for about 1 hour (until resin is oil soluble). Remove the cover. Add the China wood oil preheated to 400° F. Heat to 560° F. Add the linseed oil. Hold for body at 518° F. Allow to cool to 450° F. Add the Varnolene and then the driers.

This varnish will dry dust free in about 1 hour and tack free in about 3 hours. It has a viscosity of "G" and a color of "15" on the Gardner-Holdt viscosity and color standards, respectively. The varnish film is very glossy and very water resistant.

This varnish is useful as a floor varnish.

Black East India Oil Varnish

(8 gal. Oil Length)

Bold Black Scraped East India	1000 lb.
China Wood Oil	80 gal.
Varnolene	300 gal.

Plus driers equivalent to 0.4% lead, 0.03% manganese and 0.01% cobalt as metals based on the weight of oil present.

Heat the resin in a kettle with a cover to 610° F. in about 1 hour. Remove from fire for about 10 minutes, the resin cooling to about 482° F. Heat to 625° F. and hold for about 1 hour. Remove the cover. Add the China wood oil preheated to 400° F. Heat to 560° F., hold for body. Allow to cool to 450° F. Add the Varnolene and then the driers.

This varnish will dry dust free in about 1 hour and tack free in about 4 hours. Its film is gas-proof, very glossy and very water resistant. The varnish has a viscosity of "E" and a color greater than "18" (18+) on the Gardner viscosity and color standards, respectively.

This varnish is useful as a furniture and rubbing varnish.

Congo Oil Rubbing Varnish

(8 gal. Oil Length)

Hard Dark Amber Congo (Congo No. 11)	1000 lb.
China Wood Oil	80 gal.
Varnolene	300 gal.

Plus driers equivalent to 0.4% lead, 0.03% manganese and 0.01% cobalt as metals on the weight of oil present.

Heat the resin in a kettle without cover to 650° F. in about 1 hour. Hold for about 1¾ hours (until resin is oil soluble). Remove from fire. Add the China wood oil. Heat to 560° F., hold for body, and allow to cool to about 420° F. Add the Varnolene and then the driers.

This varnish dries dust free in about 1 hour and tack free in about 3 hours. Its film is gas proof, very glossy and very water resistant. The varnish has a viscosity of "F" and a color of "18" on the Gardner viscosity and color standards, respectively.

Congo-Oil Varnish

Formula No. 1

(15 gal. Oil Length)

Hard Dark Amber Congo (Congo No. 11)	1000 lb.
China Wood Oil	120 gal.
No. 00 Pale Linseed Oil	30 gal.
Varnolene	340 gal.
Crystalline Lead Acetate	17.2 lb.

Plus additional driers equivalent to 0.03% manganese and 0.01% cobalt as metals on the weight of oil present.

Heat the resin in a kettle without cover to 650° F. in about 1 hour. Hold at 650° F. for about 1 hour (until resin is oil soluble). Add the China wood oil preheated to 400° F. Heat to 560° F. Add the linseed oil and then the lead acetate. Hold at about 518° F. for about ½ hour. Allow to cool to 480° F. Add the Varnolene. Then add the manganese and cobalt driers.

This varnish has a viscosity of "E" and a color of "17" on the Gardner viscosity and color standards, respectively. It dries dust free in about 1 hour and tack free in about 3 hours. Its film is gas-proof, very glossy and very water resistant.

This varnish is useful as a floor and furniture varnish.

No. 2

(25 gal. Oil Length)

Hard Dark Amber Congo (Congo No. 11)	1000 lb.
China Wood Oil	200 gal.
No. 00 Pale Bodied Linseed Oil	50 gal.
Varnolene	460 gal.

Plus driers equivalent to 0.4% lead, 0.03% manganese, and 0.01% cobalt as metals based on the weight of oil.

Heat the resin in a kettle with cover on the kettle to 650° F. in about 1 hour. Hold at 650° F. for about 1 hour (until resin is oil soluble). Add the China wood oil, preheated to 400° F. Heat to 560° F. Add the linseed oil. Hold at 518° F. for body. Allow to cool to about 450° F. and add the thinner.

This varnish has a viscosity of "G" and a color of "15" on the Gardner viscosity and color standards, respectively. It dries dust free in about 1 hour and tack free in about 3 hours. Its film is very glossy and very water resistant.

This varnish is useful as a floor varnish.

Black East India Oil Varnishes

Formula No. 1

(15 gal. Oil Length)

Bold Black Scraped East India	1000 lb.
China Wood Oil	120 gal.
No. 00 Pale Bodied Linseed Oil	30 gal.
Varnolene	340 gal.
Crystalline Lead Acetate	17.2 lb.

Plus additional driers equivalent to 0.03% manganese and 0.01% cobalt as metals on the weight of oil present.

Heat the resin in a kettle, with the cover on, to 610° F. in about 1 hour. Remove from fire and allow to cool to about 500° F. Heat to 625° F. Hold for 1 hour. Remove the cover. Add the China wood oil preheated to 400° F. Heat to 560° F. Add the linseed oil and lead acetate. Heat to 518° F. and hold for body. Allow to cool and add the Varnolene and the manganese and cobalt driers.

This varnish has a viscosity of "E" and a color greater than "18" (18+) on the Gardner viscosity and color standards, respectively. It dries dust free in about 1 hour and tack free in about 4 hours. Its film is gas-proof, very glossy and very water resistant.

This varnish is useful as a floor and furniture varnish.

No. 2

(25 gal. Oil Length)

Bold Black Scraped East India	1000 lb.
China Wood Oil	200 gal.
No. 00 Pale Bodied Linseed Oil	50 gal.
Varnolene	460 gal.

Plus driers equivalent to 0.4% lead, 0.03% manganese and 0.01% cobalt as metals on the weight of oil.

Heat the resin in a kettle with a cover on to 610° F. in about 1 hour. Remove from fire, allowing the resin to cool to about 480° F. Heat to 625° F. and hold for one hour. Remove the cover. Add the China wood oil preheated to 400° F. Heat to 560° F. Add the linseed oil. Hold for body at 518° F. Allow to cool to about 450° F. Add the Varnolene and then the driers.

This varnish has a viscosity of "G" and a color of greater than "18" (18+) on the Gardner viscosity and color standards, respectively. It will dry dust free in 1 hour and tack free in about 4 hours. Its film is very glossy and very water resistant.

This varnish is useful as a floor varnish.

Congo-Phenolic Resin Oil Varnish

(10 gal. Oil Length)

Hard Dark Amber Congo (Congo No. 11)	450 lb.
100% Phenolic Resin	150 lb.
China Wood Oil	594 lb.
No. 0 Bodied Linseed Oil	108 lb.
Varnolene	654 lb.
Toluol	648 lb.

Plus driers equivalent to 0.4% lead, 0.03% manganese and 0.0088% cobalt as metals on the weight of oil.

Heat the Congo resin in the kettle without cover to 650° F. in about 1 hour. Hold at 650° F. for about 1 hour (until resin is oil soluble). Add the China wood oil preheated to 400° F. and then the phenolic resin. Hold at 450° F. until the desired body is attained. Add the linseed oil, then the Varnolene and then the driers.

This varnish will dry in about 4 hours. Its film is gas-proof, has excellent gloss, is very hard, and has excellent adhesion and weather resistance.

This varnish would be useful as a furniture and rubbing varnish.

Oilcloth Varnish

(30 gal. Oil Length)

Batavia Dammar A/D	100 lb.
China Wood Oil	8 gal.
Heavy Bodied Pale Soya Bean Oil	22 gal.
Mineral Spirits	54 gal.

Plus driers equivalent to 0.5% lead, 0.03% cobalt, 0.01% manganese as metals based on the weight of oil present in the varnish.

Heat the China wood oil alone to 300° F. and sift the dammar into it. Heat the mixture to 520° F. Hold heat at 520° F. for body. Check with the soya bean oil. Further heating for a short time may be necessary for complete clarity. Allow to cool to about 350° F. and add the mineral spirits and then add the driers.

After being applied to the oilcloth, the varnish will give a satisfactory film if baked at 165° F. for 2 to 3 hours. It will be light in color with very good color retention, high gloss, and will be flexible.

Swimming Pool Varnish

(15 gal. Oil Length)

Thermally Processed Hard Dark Amber Congo	75 lb.
Thermally Processed Pontianak Bold Scraped	25 lb.
China Wood Oil	15 gal.
Mineral Spirits	34 gal.

Plus driers equivalent to 0.5% lead, 0.03% cobalt and 0.01% manganese as metals based on the weight of oil present.

Heat the resins and oil to 540° F. Allow to cool to 400° F. Add the mineral spirits and the driers in order.

The varnish will dry in 4–6 hours.

At the end of 168 hours, a film of this varnish showed very little effect after being immersed in a solution of sodium hypochlorite of the same strength as used in swimming pools.

Varnishes for Hat and Fabric Finishes

Formula No. 1

Manila Loba DK	416 lb.
Petroleum Benzine	45 gal.
Denatured Alcohol SD No. 1	55 gal.
Butanol	4 gal.

Agitate the above materials until all the resin is dissolved. Allow to stand for several days. Draw the clear liquid from the top and strain out the floating bark. his solution is customarily thinned three to one with a thinner similar to the solvent.

This varnish is cheap and has extra high stiffening qualities.

No. 2

Manila Loba DK	416 lb.
Toluene	78 gal.
Denatured Alcohol SD No. 1	22.9 gal.
Butanol	3.1 gal.

Agitate the above materials until all the resin is dissolved. Allow to stand for several days. Draw the clear liquid from the top and strain out the floating bark.

This varnish is better and glossier than the above.

Hat and Fabric Varnish

Manila Loba DK	4.50 lb.
Toluene	0.75 gal.
Denatured Alcohol No. 1	0.22 gal.
Butanol	0.03 gal.
Blown Castor Oil	0.05 gal.

Agitate the above materials until solution of resin is complete. Allow to settle for several days. Draw off clear liquid from the top and strain out the floating bark.

This varnish is elastic and works well in the hat block and gives a good gloss.

OVERPRINT VARNISHES

Formula	No. 1	No. 2	No. 3	No. 4	No. 5	No. 6	No. 7
Batavia Dammar A/E	5850 lb.	5400 lb.	6300 lb.	5850 lb.	6300 lb.	7200 lb.	1800 lb.
China Wood Oil	520 gal.	520 gal.	346 gal.	520 gal.	930 gal.	808 gal.	115.5 gal.
KPO "B" Linseed Oil	115.5 gal.	173 gal.	231 gal.	115.5 gal.	....	....	....
Kerosene	397 gal.	397 gal.	219 gal.	434 gal.	497 gal.	497 gal.	109 gal.
Cobalt Drier Solution (6%)	675 lb.	675 lb.	135 lb.	270 lb.	472 lb.	54 lb.	68 lb.
Paraffin Wax (High M.P.)	71 lb.	71 lb.	35 lb.	69 lb.	157 lb.	193 lb.	34 lb.
Oil Length Gallons	8.9	9.6	5.5	8.9	14.8	11.2	6.4
Drying Time (Hours)	4	4	2½	2½	4	3½	2½
Gloss	High	High	High	High	Good	High	Good

PROCEDURE: Heat the resin and oil to 450° F. Add the kerosene, then the drier, and then the paraffin wax.

PROPERTIES: These varnishes dry to water white, flexible films with maximum marproofness.

Formula	No. 8	No. 9	No. 10	No. 11	No. 12	No. 13	No. 14	No. 15
Batavia Dammar A/E	1350 lb.	1350 lb.	1350 lb.	1350 lb.	1350 lb.	1350 lb.	900 lb.	5850 lb.
China Wood Oil	173 gal.	...	...	...	...	...	...	520 gal.
KPO "B" Linseed Oil	....	173 gal.	173 gal.	173 gal.	173 gal.	173 gal.	231 gal.	115.5 gal.
Kerosene	100 gal.	100 gal.	100 gal.	100 gal.	100 gal.	100 gal.	100 gal.	400 gal.
Cobalt Drier Solution (6%)	304 lb.	68 lb.	135 lb.	135 lb.	135 lb.	304 lb.	203 lb.	270 lb.
Paraffin Wax (High M.P.)	....	17 lb.	...	18 lb.	35 lb.	...	18 lb.	69 lb.
Oil Length Gallons	12.8	12.8	12.8	12.8	12.8	12.8	25.6	10.9
Drying Time (Hours)	2½	16	16	16	16	24+	24+	4
Gloss	Good	High	High	High	Good	High	High	High

PROCEDURE: Heat the resin and oil to 450° F. Add the kerosene, then the drier, and then the paraffin wax.

PROPERTIES: These varnishes dry to water white, flexible films with maximum marproofness.

No. 16

(12½ gal. Oil Length)

Batavia Dammar A/E	41	lb.
Kettle Bodied Linseed Oil	41	lb.
Carnauba Wax	8	lb.
Kerosene	6.5	lb.
Cobalt Drier Solution (6%)	3.5	lb.

Heat the oil, resin and wax to 520° F. Allow to cool to 400° F. Add the kerosene and drier.

No. 17

(18 gal. Oil Length)

Batavia Dammar A/E	36.4	lb.
Perilla Oil	51.5	lb.
Carnauba Wax	4.4	lb.
Kerosene	6.1	lb.
Cobalt Drier Solution (6%)	1.6	lb.

Heat 31.1 parts of dammar, 22.1 parts of perilla oil, and the carnauba wax to 540° F. Add the remainder of the dammar and oil. Allow to cool to about 400° F. and add the kerosene and drier.

Non-Flame Varnish for Thin High-Speed Printing Inks

Manila DBB	400	lb.
Solox	400	lb.
Turkey Red Oil	100	lb.
Ammonia (Sp. Gr. 0.910)	60	lb.
Triethanolamine	40	lb.
Water	1000	lb.

(1) Dissolve the triethanolamine in the water; (2) Dissolve the turkey red oil in the solox. Stir in and dissolve the Manila DBB. Heat the solution to 60° C. Add the ammonia using high speed stirring. The temperature will drop to about 50° C. Add the solution of triethanolamine in water preheated to 50° C., using high speed stirring. When this solution has cooled somewhat, add a solution of 300 parts of turkey red oil in 1200 parts of water, still using high speed stirring.

This is a vehicle for Intaglio printing inks. It is non-poisonous and non-inflammable.

Electrical Insulation Varnish

Manila Loba B	50	lb.
Solox	40	lb.
Butanol	10	lb.
Hercolyn	25	lb.

Mix all materials together and agitate until complete solution results. Strain.

The finished material has a viscosity of "J" on the Gardner-Holdt viscosity standards and a color of "5" on the Gardner color standards. The material is allowed to air dry for 30 minutes and then baked at 240° F. for 2–2½ hours.

Dipping Varnishes

(12½ gal. Oil Length)

Formula No. 1

Ester Gum	100	lb.
China Wood Oil	12½	gal.

Procedure: Run gum and oil to 500° F. Hold 40 minutes for body. Reduce.

Body: D-E, Gardner-Holdt
Color: 5 L, Hellige
Sp. Gr.: .9012

No. 2

(25 gal. Oil Length)

Ester Gum	100	lb.
China Wood Oil	25	gal.

Procedure: Run gum and oil to 500° F. Hold 25 minutes for body. Reduce.

Body: E, Gardner-Holdt
Color: 4, Hellige
Sp. Gr.: .8900

No. 3

(37½ gal. Oil Length)

Ester Gum	100	lb.
China Wood Oil	37½	gal.

Procedure: Run gum and oil to 500° F. Hold 17 minutes for body. Reduce.

Body: E, Gardner-Holdt
Color: 4 L-4, Hellige
Sp. Gr.: .8866

No. 4

(12½ gal. Oil Length)

Ester Gum	75	lb.
Pure Phenolic Resin	25	lb.
China Wood Oil	12½	gal.

Procedure: Heat China wood oil and ester gum to 400° F. Pull off fire and add phenolic resin. When all melted, heat to 500° F. Hold 25 minutes for body. Cool with water on outside of kettle to 375° F. Reduce.

Body: E at 77° F.
Sp. Gr.: .890

No. 5

(25 gal. Oil Length)

Ester Gum	75	lb.
Pure Phenolic Resin	25	lb.
China Wood Oil	25	gal.

Procedure: Heat China wood oil and ester gum to 400° F. Pull off fire and add phenolic resin. When all melted, heat to 500° F. Hold 18 minutes for body. Cool with water on outside of kettle to 375° F. Reduce.

Body: C at 77° F.
Sp. Gr.: .884

No. 6

(37½ gal. Oil Length)

Ester Gum	75	lb.
Pure Phenolic Resin	25	lb.

China Wood Oil	37½ gal.

Procedure: Heat China wood oil and ester gum to 400° F. Pull off fire and add phenolic resin. When all melted, heat to 475° F. Hold 33 minutes for body. Cool with water on outside of kettle to 375° F. Reduce.

Body: B-C at 77° F.

Sp. Gr.: .880

No. 7

(12½ gal. Oil Length)

Pure Phenolic Resin	100 lb.
China Wood Oil	12½ gal.

Procedure: Heat China wood oil to 350° F. in 15 minutes. Pull off fire and add one-half of the phenolic resin, which dissolves in about 15 minutes. (During this period of time the heat drops to 220° F.) Place on fire and run to 350° F. in 7 minutes and pull off the fire. Add the remainder of the phenolic resin, which dissolves in about 10 minutes, the heat dropping to 240° F. Place on fire and run heat to 350° F. in 13 minutes, and then to 400° F. in an additional 5 minutes. Turn heat off and reduce immediately.

Body: C-D

Sp. Gr.: .890

No. 8

(25 gal. Oil Length)

Pure Phenolic Resin	100 lb.
China Wood Oil	25 gal.

Procedure: Heat China wood oil to 350° F. in 25 minutes. Pull off fire and add phenolic resin, which dissolves in 10 minutes, the heat dropping to 270° F. Heat to 500° in 25 minutes. Turn heat off and reduce immediately.

Body: C

Sp. Gr.: .884

No. 9

(37½ gal. Oil Length)

Pure Phenolic Resin	100 lb.
China Wood Oil	37½ gal.

Procedure: Heat China wood oil to 350° F. in 25 minutes. Pull off fire and dissolve the phenolic resin in 10 minutes, the heat dropping to 270° F. Put on fire and run heat to 500° in 30 minutes and hold at 500° for 20 minutes. Cool to 450° F. and reduce.

Body: C

Sp. Gr.: .879

No. 10

(12½ gal. Oil Length)

Fused Congo	100 lb.
China Wood Oil	12½ gal.

Procedure: Run resin and chinawood oil to 560° F. in 42 minutes and hold 18 minutes. Cool and thin at once.

Body: 4.8 seconds G-H

Sp. Gr.: .8830

No. 11

(25 gal. Oil Length)

Fused Congo	100 lb.
China Wood Oil	25 gal.

Procedure: Run chinawood oil and 1.5 lb. fused congo to 560° F. in 35 minutes. Check with 0.5 lb. fused congo. Cool to 450° F. in 3½ minutes. Hold for body at 450° F. for 19 minutes. Cool and thin at once.

Body: E (GH)

Sp. Gr.: .8689

No. 12

(37½ gal. Oil Length)

Fused Congo	100 lb.
China Wood Oil	37½ gal.

Procedure: Run chinawood oil and resin to 560° F. in 36 minutes. Cool with water to 450° F. in 5 minutes. Hold for body at 450° F. for 13 minutes; cool and thin at once.

No. 13

(25 gal. Oil Length)

Alkali Refined Linseed Oil	25 gal.
Pure Phenolic Resin	100 lb.
Apco 125	45½ gal.

Procedure: Heat the oil and resin to 560° F. in 50 minutes. Hold 1½ hours. Allow to cool to 450° F. in 30 minutes and thin.

Viscosity: C+

Sp. Gr.: .893

Color: 6 L

Non-volatile: 49.7 per cent

No. 14

(37½ gal. Oil Length)

Alkali Refined Linseed Oil	37½ gal.
Pure Phenolic Resin	100 lb.
Apco 125	58½ gal.

Procedure: Heat the oil and resin to 560° F. in 50 minutes. Hold at 560° F. for 2¾ hours. Allow to cool to 450° F. in 30 minutes and thin.

Viscosity: C

Sp. Gr.: .887

Color: 6 (On paint and varnish comparator)

Non-volatile: 50.6 per cent

No. 15

(37½ gal. Oil Length)

China Wood Oil	37½ gal.
Pure Phenolic Resin	100 lb.
Apco 125	63 gal.

Procedure: Heat oil and resin to 450° F. in 30 minutes. Hold 1⅙ hours at 450° F. and thin.

Viscosity: C

Sp. Gr.: .870

Color: 4 L

Non-volatile: 48.8 per cent

As driers use naphthenates of lead and cobalt.

Manjak Varnish

Best results are obtained by cooking on a basis of 5 gallons raw linseed oil to 100 pounds Manjak.

If a longer oil varnish is desired then the addition of up to ten gallons raw oil cooked for several hours at 500° F. can be added separately. It should not be cooked with the Manjak. In other words, the Manjak *handle best* on the basis of 100 lb. to 5 gallons raw oil—no more, no less.

Another dependable formula is as below:

Varnish Linseed Oil (Raw)	20 gal.
Manjak	250 lb.
Litharge	5 lb.

Procedure: Heat to 610° F., then drop to about 580° F. and add the drier.

Thinners: Turpentine and benzine can be added to secure body desired.

Standard Varnish

Prepared Rosin	70	lb.
Ester Gum	30	lb.
Chinawood Oil	35½	gal.
Perilla Oil	9½	gal.
Litharge	8	lb.
Mineral Spirits	58	lb.
Lead Naphthenate	1	lb.
Cobalt Naphthenate	1	lb.
Actual Yield	110	gal.

Procedure: Run the gum and 4½ gal. of perilla oil and 5 gal. of chinawood oil to 585° F. Then add the balance of the chinawood oil 5 gal. at a time until all in, running the heat up to 580° F. after the addition of each 5 gal. of chinawood oil. After the last addition, sprinkle in the litharge, stir well and heat to 575° F. Add the balance of the perilla oil, cool to 450° F. and thin.

The *prepared rosin* used in the formula is made as follows:

WW Rosin	100 lb.
Glycerin	5 lb.

Procedure: Run the rosin to 500° F., add the glycerin and heat to 515° F. Hold 20 min. Cool and dump into pans to harden.

The driers used are of the naphthenate type made as follows:

Lead Naphthenate Drier

24% Lead Naphthenate	6.65 qt.
Mineral Spirits	4.35 qt.

Cobalt Naphthenate Drier

6% Cobalt Naphthenate	4.95 qt.
Mineral Spirits	6.05 qt.

Water-Bound Varnish
British Patent 495,488

Sodium Silicate	2	lb.
Soap	½	lb.
Pale Boiled Linseed Oil	¼	lb.
Water (Boiling)	1	gal.

Mix very thoroughly. A little alum may be added to increase water resistance.

Varnish for Preserving Oil Paintings
U. S. Patent 2,162,225

Ethyl Cellulose	60	lb.
Linseed Oil, Boiled	20	lb.
Copal	7½	lb.
Castor Oil	7½	lb.
Methyl Salicylate	5	lb.

Warm together gently and stir until uniform.

Wood Oil Cabinet First Coating Varnish

Kauri No. 2	100 lb.
Medium Rosin	100 lb.
Litharge	4 lb.
China Wood Oil	10 gal.
Sugar of Lead	10 lb.
Turpentine	30 gal.
Benzine	30 gal.

Melt the kauri and rosin, then add the litharge slowly and stir it in well until it is thoroughly dissolved.

Then add the China wood oil and remove the kettle from the fire, then add the sugar of lead and stir until it is dissolved. Then cool and thin, first with the turpentine and then with the benzine.

Water Proof Wood Oil Varnish
No. 1738

M. Rosin	75	lb.
China Wood Oil	36	gal.
M. Rosin	25	lb.
Red Lead	4	lb.
Wood Turpentine	60	gal.
Naphtha 54°	10	gal.
Concentrated Varnish Drier No. 1007	1¼	gal.

Melt 75 lb. rosin in the wood oil, run to about 350° F. and sprinkle in the red lead, about a pound at a time stirring constantly.

Very little frothing will occur with this small amount of red lead, therefore, continue raising the heat slowly to 510° F. or 520° F. then pull from the fire.

The temperature should rise to

about 575° F. it being essential that the temperature rises to at least 565° F. after the kettle is off the fire.

When the temperature of 565° F. or 575° F. has been attained, add the remaining 25 lb. of rosin, previously broken into small pieces and stir until dissolved.

The addition of the rosin will start the temperature downward, therefore, allow to cool to 400° F. and thin with the turpentine.

When cooled to 300° F. or lower, follow with the benzine, then add the concentrated varnish drier and stir well.

This varnish is maple in color: has a good luster; and dries in 7–8 hours. It stands a high baking heat; and is extremely waterproof.

It is, however, not neutral, consequently can not be used as a mixing varnish with lead and zinc pigments.

Wood Oil Baking Varnish for Tin

Light Manila Chips	75 lb.
Water White Rosin	75 lb.
Litharge	2 lb.
Raw China Wood Oil	15 gal.
Turpentine	10 gal.
Benzine	14 gal.
Coal Oil	1 gal.

Melt the manila and rosin together and when they are melted add the litharge. Immediately after the litharge is dissolved add the wood oil and hold at a temperature on the fire of 450° F. for one hour.

Then thin by first adding the turpentine, then the coal oil, and then the benzine.

This is not an air drying varnish, but is used where a clear transparent baking is required and bakes in 4 hours at from 275–300° F.

"Thermo Baking" Varnish
No. 1734

Water Proof Rosin No. 784	100 lb.
China Wood Oil	26 gal.
Litharge	10 lb.
Soya Bean Oil	4 gal.
Kerosene 46°	4 gal.
Naphtha 54°	66 gal.
Concentrated Varnish Drier No. 1007	1 gal.

Melt the rosin in 25 gal. of the wood oil, meantime mix the litharge with the remaining 1 gal. of wood oil and as soon as the rosin has melted add it to the mixture in the kettle and stir well.

After the litharge is in, raise the temperature to 580° F. pull from the fire, allow to rise to 590° F. then "chill-back" with the 4 gal. of soya bean oil and stir well.

The time generally taken to raise the temperature of the mixture to 580° F. after the litharge is in, is approximately 1 hour, the object being to get a certain desired body.

After "chilling back" with the cold soya bean oil allow to stand, with frequently stirring, until cooled to 480° F. then thin with the kerosene.

When cooled to 320° F. follow with the naphtha and finally add the concentrated varnish drier, stirring constantly.

A much paler varnish may be made by sprinkling in the litharge after "chilling back" with the soya bean oil.

This varnish is especially designed for baking enamels and color varnishes carrying a large quantity of paste paint.

It will stand baking at any temperature up to 220° F. and "recovers" from the water test better than any of the rosin wood oil varnishes.

The varnish carries 31.53% oil.

Kerone Baking Varnish
No. 1772

High Lime Rosin No. 751	100 lb.
Manganese Dioxide	2 lb.
China Wood Oil	36 gal.
Drying Wood Oil No. 963	4 gal.
Litharge	8 lb.
Kerosene 46°	36 gal.
Naphtha 54°	36 gal.

Melt the rosin in the wood oil to 350° F. and sprinkle in the manganese dioxide, about ½ lb. at a time, stirring constantly.

After the manganese is in, raise the heat slowly, i.e., during about 30 minutes, to 480° F., stirring frequently.

By the time the temperature is up to 480° F. the manganese will have been taken up, therefore, as soon as the temperature of 480° F. has been reached, increase the heat and run quickly to 565° F. then pull the kettle from the fire.

Allow to stand until the temperature raises to 590° F. then immediately "chill back" with the 4 gal. of drying wood oil, No. 963 and stir well.

The cold wood oil will check the rise in temperature, therefore, allow to cool down to 565° F. then commence sprinkling in the litharge, about 1 lb. at a time allowing a litharge to remain on the surface of the hot mixture for about half a minute before stirring.

All of the litharge should be in by the time the heat is down to 500° F. and should be taken up by the time the temperature is down to 450° F., if stirred frequently.

When cooled to 450° F. thin with the kerosene, and when further cooled to 450° F. thin with the kerosene, and when cooled to 300° F. or lower follow with the naphtha.

This varnish contains 35.25% oil.

Long Oil Baking Varnish

No. 1762

Adamant Rosin No. 796	100 lb.
China Wood Oil	24 gal.
Prepared Wood Oil No. 963	8 gal.
Kerosene 46°	4 gal.
Naphtha 54°	64 gal.

Melt the Adamant rosin in the 24 gal. of wood oil, run quickly to 595° F. and pull from the fire.

As soon as the kettle is off the fire, immediately "chill back" with the 8 gal. of prepared wood oil, No. 963 and stir vigorously.

Allow to stand, with frequent stirring, until cooled to 450° F. then thin with the kerosene.

When cooled to 300° F. follow with the naphtha.

It will be noticed that no drying salts are in this varnish, except those in the rosin consequently the varnish requires about 18 hours to all dry, but it bakes fairly hard in 1 hour at 180° F. to 200° F. without discoloration.

By adding 1 gal. of conc. varnish drier No. 1107 to the above 104 gal. of varnish, it air-dries in 5–6 hours, but is worthless as a baking varnish, the drier causing it to wrinkle and become flat.

All quick drying varnishes containing more than 24 gal. of oil per 100 lb. of rosin, wrinkle and flat on baking.

H. V. Kerone Baking Varnish

No. 1764

Plain Hard Rosin No. 750	100 gal.
China Wood Oil	40 gal.
Manganese Sulphate	8 lb.
Lead Acetate Pulv.	8 lb.
Slaked Lime	1 lb.
Kerosene 46°	40 gal.
Naphtha 54°	40 gal.

Melt the rosin in the wood oil, add the manganese sulphate, stir well then run quickly to 540° F. or to a sufficient temperature so that when the kettle is off the fire the heat will rise to 580° F. and not above 595° F.

Pull from the fire at 540° F. and allow to stand, with frequent stirring until the highest temperature has been attained, and the heat then begins to fall.

When the temperature has fallen 10°, stir vigorously, and while the heat is falling to 550° F., stir very frequently, i.e., once every 5 minutes.

As soon as the thermometer registers 550° F. commence adding the pulverized lead acetate and the slaked lime, previously mixed together about 1 lb. at a time, sprinkling it on the surface of the hot mixture, allowing it to remain until effervescence, due to combined water in the lead acetate, ceases, then stir. Repeat the additions of lead and lime until all in, then allow to cool to 500° F. and thin with the kerosene.

When cooled to 300° F. follow with the naphtha.

This varnish is pale in color; has a good gloss and dries in 10–12 hours.

It is designed as a baking varnish, and may be baked at 150° F. for 2 hours or at 180° F. for 1 hour.

After baking it is impervious to water.

Hard Grinding and Baking Varnish

No. 1700

Glycerin Rosin No. 756	100 lb.
China Wood Oil	24 gal.
Litharge	2⅛ lb.
Manganese Borate	⅝ lb.
Heavy Naphtha 48°	48 gal.

Melt the glycerin rosin in the wood oil and run to 400° F. then sprinkle in the litharge and manganese borate, previously mixed together.

Stir constantly while adding the drying salts, and, if necessary whip down the foam.

When the driers are all in, raise the heat to 520° F. or to a sufficient temperature so that when the kettle is pulled from the fire the heat will rise to 565° F. but not above 575° F.

As soon as the temperature begins to fall, put the kettle back on the fire, bring the heat to 560° F. and cook at this temperature for about 10 minutes, then pull from the fire, allow to cool to 450° F. or 400° F. and thin with the heavy naphtha.

This varnish is pale in color; flows and levels perfectly; is absolutely neutral to lead and zinc pigments; dries on glass in about 5 hours, and becomes as hard as flint.

It is used as a grinding varnish, and will stand baking at any temperature up to 240° F. without much discoloration.

Durable Baking Varnish
No. 1721

M. Rosin	100 lb.
Slaked Lime	6 lb.
China Wood Oil	24 gal.
Honey Oil No. 907	8 gal.
Kerosene 46°	4 gal.
Naphtha 54°	56 gal.
Conc. Varnish Drier No. 1007	1 gal.

Melt the rosin, with the lime on top, in the wood oil and run to 590° F. pull from the fire and immediately "chill back" with the honey oil stirring well.

The addition of the cold honey oil will drop the temperature to about 570° F. or 560° F. at which point, commence adding the litharge, about 1 lb. at a time, stirring very frequently and beating down the foam is necessary.

All of the litharge should be in by the time the temperature is down to 520° F., and will be taken up when the heat is down to 480° F.

Thin at 480° F. with the kerosene, and when cooled to 330° F. follow with the benzine, then add the concentrated varnish drier, and stir for about 5 minutes.

This "true body" varnish is pale in color; not very heavy in body; has a brilliant luster, and dries in 8–10 hours.

It carries 33.41% oil by weight.

The varnish is designed for baking, but is also used as a mixing varnish, and as an architectural varnish.

It is, however, too long in oil for baking enamels and baking color varnishes, but bakes by itself nicely.

Baking Varnish
No. 1723

Plain Hard Rosin No. 750	100 lb.
China Wood Oil	20 gal.
Red Lead	8 lb.
Soya Bean Oil	4 gal.
Kerosene 46°	4 gal.
Naphtha 54°	56 gal.
Conc. Varnish Drier	1 gal.

Place the rosin in the kettle, add the china wood oil, then the red lead.

Melt the rosin in the oil, running the heat to 400° F. without stirring then stir thoroughly to mix the red lead with the oil and rosin, after which, run quickly to 580° F. and pull from the fire.

Immediately add the 4 gal. of cold soya bean oil, all at once, and stir well.

Addition of the cold soya bean oil will start the temperature downward and the oil will take on body while cooling down, therefore, to prevent excessive bodying stir frequently while the mixture is cooling to 450° F. at which point, thin with the kerosene.

When cooled to 300° F. follow with the benzine, then add the concentrated varnish drier.

This varnish is designed especially for enamel and varnish colors.

It contains 27.44% oil and will not wrinkle with enamel paste colors.

It air dries in about 8 hours; has a brilliant luster, and is medium light in color.

It may be baked at 160° F without discoloration.

Air Drying and Baking Shellacker
No. 1750

Plain Hard Rosin No. 750	100 lb.
Manganese Dioxide	2 lb.
China Wood Oil	20 gal.
Magnesia Oil No. 856	4 gal.
Wood Turpentine	8 gal.
Heavy Naphtha 48°	28 gal.
Oleated Naphtha No. 1507	2 gal.

Melt the hard rosin, with the manganese dioxide on top, then run *quickly* to 540° F. and pull from the fire.

Allow to stand until the temperature is up to about 580° F. then immediately "chill back" by adding the cold magnesia oil, stirring vigorously.

Stir frequently, say every 5 minutes, while cooling down to 450° F. at which point, thin with the turpentine and follow immediately with the heavy naphtha.

When perfectly cold add the oleated naphtha and mix well by stirring.

This varnish is quite heavy in body and is intended to be thinned to a lacquer consistency for use.

It dries in 8–10 hours with a high luster and in time becomes as tough as whale bone.

It can be baked at 300° F. for 2–3 hours without impairing the toughness, but at temperatures above 150° F., it takes on a amber color.

The varnish contains 34.60% oil.

Thinned to lacquer consistency with heavy "907" thinner, No. 1508 it is used for varnishing shells and other similar war munitions.

Automobile Finishing Varnish
No. 1909

Bxstor Kauri	600	lb.
Strong (1500) Rosin No. 770	270	gal.
Calcutta Linseed Oil	255	gal.
China Wood Oil	20	gal.
Red Lead	3½	lb.
Litharge	11¼	lb.
Rubbing Oil No. 894	7	gal.
Turpentine	260	gal.
Naphtha 54°	16	gal.
Conc. Varnish Drier No. 1007	1½	gal.

Fuse the kauri, with the rosin on top, to 650° F. or until as thin as water, i.e. until it drips from the stirring rod like hot oil, then pull from the fire and add the calcutta and china wood oils previously mixed together and heated to 450° F.

Pour the hot oils through the funnel in the cover, stirring constantly. When all of the oil is in remove the cover, put the kettle back on the fire and heat to 575° F.

Cook at 550–575° F. for 20–30 minutes, or until the proper body has been obtained, then pull from the fire.

Allow to cook to 550° F. then sprinkle in the red lead and litharge previously mixed together, and stir very frequently while the mixture is cooling to 500° F. at which point add the 7 gal. of cold rubbing oil and stir well. When cooled to 440° F. thin with the turpentine and when the temperature is down to 300° F. or lower, add the benzine and follow with the CONCENTRATED Varnish Drier.

This varnish contains 40.5% oil and is one of the most durable automobile varnishes ever put on the market.

It is also an excellent railway finishing varnish.

W. O. E. Coach Varnish
No. 184

K. Rosin	100	lb.
China Wood Oil	33⅔	gal.
Litharge	3	lb.
Manganese Borate	2	lb.
Benzine	64	gal.

Melt the rosin and wood oil together, run to 600° F. and allow to cool to 575° F. Again run to 600° F. and cool to 575° F. as before. Repeat twice more (a total of four heats) then cool to 420° F. add the litharge and when the froth is down put in the borate and cook at 450° F. until taken up.

Cool to about 250° F. and thin.

Special Elastic Manila Coach Varnish
No. 115

K. Rosin	100	lb.
Dry Slaked Lime	7½	lb.
Wood Oil	25	gal.
Linseed Oil	5	gal.
Litharge	5	lb.
Manganese Resinate	2	lb.
Turpentine	60	gal.
Turpentine Substitute No. 43	30	gal.

Heat the wood oil quickly to 580° F. and the moment it begins to thicken add the rosin, all at once, stir until well mixed then sift in the lime and cook at 580° F. to 600° F. for 5 or 10 minutes. Pull from the fire, add the cold linseed oil, allow to cool to 400° F. add the litharge and run to 500° F. and add the manganese resinate slowly until all in, then cook half an hour at 500° F.

Cool to 350° F. and thin.

Extra Manila Coach Varnish
No. 142

Manila Chips	50	lb.
Water White Rosin	50	lb.
Prepared Linseed Oil No. 317	12	gal.
Prepared Wood Oil No. 118	6	gal.
Turpentine	30	gal.
Turpentine Substitute No. 43	20	gal.
White Tungate Drier	1	gal.

Fuse the manila and rosin together and run to 620° F. Mix the two oils, heat to 450° F. and pour into the fused gum.

Cook for 1 hour at 480° F. cool to 400° F. thin with the turpentine then with the turpentine substitute. Add the drier last.

Cheap Wearing Coach Varnish
No. 153

Kauri No. 2	85	lb.
Pale Rosin (Hard)	15	lb.
Wood Oil	16	gal.
Lead Tungate	½	lb.
Turpentine	5	gal.

Turpentine Substitute No. 43	35 gal.

Fuse the kauri, and the rosin and run to 500° F. Add the wood oil, previously heated to 350° F. and run to 550° F. Cool to 400° F. add the drier and run to 480° F. Cook for 3 or 4 hours, cool to 350° F. and thin.

Wood Oil Exterior Water-Proof Varnish

This formula produces a low price exterior varnish that will stand water or weather exposure. It is safe to be sold as an exterior varnish and splendidly adapted to mix with higher grade exterior varnishes.

Raw Wood Oil	60 gal.
Light Rosin	150 lb.
Litharge	40 lb.
Borate of Manganese	4 lb.
Turpentine	50 gal.
Benzine	40 gal.

The wood oil must first be heated to 450° F. and this should be done slowly, then dump the rosin into the kettle. After the rosin and wood oil are thoroughly melted together and the temperature is in the near neighborhood of 400° F. add the borate of manganese, then immediately commence to add the litharge which should be done slowly while the batch is being well stirred.

After the litharge is all in let the heat increase to 550° F. and hold at this heat about 40 minutes or until the bath takes a good stiff body which requires about 40 minutes at this temperature, then cool and thin.

Wood Oil Agricultural Coach Varnish

This varnish is identical to above with the exception that straight benzine is used for thinning and no turpentine, but all other proportions are the same as is also the way of making the varnish.

Extra Agricultural Coach Varnish
No. 92

K. Rosin	100	lb.
Dry Slaked Lime	7½	lb.
Heavy Linseed Oil	10	gal.
Litharge	5	lb.
Wood Oil	35	gal.
Turpentine	60	gal.
Turpentine Substitute No. 43	30	gal.

Melt this rosin, add the lime and run to 500° F. Add the linseed oil to cool down, sprinkle in the litharge and run to 480° F. Cook until the litharge is taken up, then add in 5 gal. portions of the wood oil, not letting the heat get below 400° F. When all of the wood oil is in, run to 480° F. to 500° F., and cook for 1 hour. Cool to 350° F. and thin.

Implement Coach Varnish
(Quick-Drying)
No. 98

K. Rosin (Hard)	100	lb.
Wood Oil	25	gal.
Heavy Boiled Oil (Kellogg's)	5	gal.
Litharge	10	lb.
Manganese Resinate	2½	lb.
Petroleum Distillate	15	gal.
Benzine	60	gal.

Melt the rosin and wood oil together and run to 450° F. add the litharge in small portions and slowly raise the heat to 500° F. Add the cold, heavy linseed oil and again heat to 500° F. Add the manganese resinate and run to 550° F. Cook 1 hour, or until of the proper body, then cool to 320° F. and thin with the distillate, follow with the benzine.

H. W. Implement Coach Varnish
No. 183

Hard Rosin	100	lb.
China Wood Oil	40	gal.
Litharge	2½	lb.
Manganese	2½	lb.
Benzine	80	gal.
H. V. Drier No. 20	⅝	gal.

Heat the wood oil to 550° F. and as soon as it begins to string add the rosin all at once. When melted and the temperature is down to 475° F., stir in the litharge and cook until taken up, then add the manganese sulphate and cook at 475° F. until that is taken up, after which run to 500° F. and allow to cool to 300° F. or 250° F. and commence thinning. Add the H. V. drier last.

Neutral Implement Varnish
No. 1704

Water White Rosin	100 lb.
Slaked Lime	6 lb.
China Wood Oil	40 gal.
V. M. Linseed Oil	5 gal.
Litharge	7 lb.
Red Lead	3 lb.
Naphtha 54°	84 gal.
Concentrated Varnish Drier No. 1007	1 gal.

Put the rosin in the kettle with the lime on top, then pour in the 40 gal. of china wood oil.

Heat to 540° F. or to a sufficient temperature so that when the kettle is off the fire, the heat will rise to 580° F. but not above 590° F.

The moment the temperature reaches 580° F. add the 5 gal. of cold linseed oil and stir well.

With the kettle off the fire, the addition of cold linseed oil will start the temperature down, and as soon as the heat has fallen to 550° F. commence adding the litharge and red lead, previously mixed together, about a pound at a time.

Stir frequently while adding the lead salts, and occasionally while the mixture is cooling down to 320° F. at which point, thin with the benzine.

Add the concentrated varnish drier last and stir well.

This varnish is exceedingly pale in color, is gas proof, has a good luster, and dries in 8 to 19 hours.

It does not thicken or liver with lead and zinc paints, consequently may be used in varnish colors.

It is a durable exterior varnish and is designed for use on agricultural implements, etc. Viscosity 70° F. = 23.44.

Acid-Proof Grinding Varnish
No. 1727

China Wood Oil	15 gal.
Red Lead	16 lb.
First Run Rosin Oil	5 gal.
Heavy Naphtha 48°	20 gal.
Naphtha 54°	20 gal.
Concentrated Varnish Drier No. 1007	1 gal.

Mix the red lead with the china wood oil, then heat to 575° F. stirring very frequently.

If frothing occurs at 350° F. to 450° F. whip down or pull the kettle from the fire.

However, very little frothing occurs unless the oil is heated too quickly at the start.

As soon as a temperature of 575° F. has been attained pull the kettle from the fire and add the cold, thick rosin oil, a little at a time, stirring constantly until all in.

Allow to cool to about 525° F. then put the kettle back on the fire and cautiously raise the heat to 550° F.

Pull from the fire as soon as a temperature of 550° F. has been attained, then allow to cool to 450° F. and thin with the heavy naphtha.

When cooled to 300° F. follow with the benzine, add the concentrated varnish drier last and stir well.

This varnish is used as a grinding medium with graphite and other acid pigments.

The paint so produced is water and acid proof.

This varnish contains 10.87% oil.

Acid-Proof Varnish

China Wood Oil	15 gal.
Red Lead	16 lb.
First Run Rosin Oil	5 gal.
Heavy Naphtha 48°	20 gal.
Naphtha 54°	20 gal.

Heat the wood oil to about 250° F., sprinkle in the red lead, about 2 lb. at a time, stir constantly and continue to raise the heat slowly to 420° F. or 450° F. by which time all of the red lead should be in.

When the froth has somewhat subsided, heat as quickly as possible to 520° F., and pull from the fire.

Allow to stand, with frequent stirring until the temperature rises to 570° F. then "chill back" with the cold rosin oil and stir very frequently until the mixture cools down to 550° F.

Finally allow to cool to 450° F. then thin with the heavy naphtha and when cooled to 300° F. or lower, follow with the benzine.

Add the Kauri drier last and stir thoroughly.

Remarks:

This varnish withstands a 20% solution of sulphuric acid.

It is generally used as a mixing varnish with graphite for coating electric battery acid cells.

The rosin oil is the acid-resisting constituent.

Kauri Mixing Coach Varnish
No. 120

Kauri Seeds	80 lb.
K. Rosin	20 lb.
Dry Slaked Lime	2 lb.
Linseed Oil	15 gal.
Wood Oil	5 gal.
Red Lead	2½ lb.
Manganese Borate	½ lb.
Turpentine	15 gal.
Benzine	12 gal.

Fuse the kauri, add the rosin, sift in the lime and run to 500° F. Add the linseed oil, previously heated to 400° F. mix well and cook about 10 minutes at 450° F. Pour in the cold wood oil, add the red lead and borate and run to 550° F.

Cook at 500° to 550° F. for half an

hour, cool to 320° F. thin first with the turpentine, and then with the benzine.

Pale Quick-Drying Wood Oil Varnish
No. 175

Water White Rosin	100	lb.
Lead Acetate	10	lb.
Dry Slaked Lime	5	lb.
Calcium Chloride	2½	lb.
Wood Oil	20	gal.
Pale Manganese Oil	5	gal.
Wood Turpentine	15	gal.
Benzine	35	gal.

Melt the rosin, sift in the lime and run to 500° F. Cool to 300° F. add the sugar of lead, follow with the calcium chloride and cook at 300° F. to 320° F. until combined, then add 5 gal. cold wood oil, run to 400° F., then add 5 gal. again and run to 450° F. Again add 5 gal. of the wood oil. Now run to 500° F. pull from the fire and slowly add the cold manganese oil. Replace on the fire and cook 30 minutes at 500° F. Cool to 350° F. add the turpentine and follow with the benzine.

Pale Elastic Varnish
No. 86

K. Rosin	100	lb.
Dry Slaked Lime	6¼	lb.
Heavy Linseed Oil	5	gal.
Litharge	5	lb.
Wood Oil	25	gal.
Wood Turpentine	5	gal.
Kerosene Oil	70	gal.
Strong Varnish Drier No. 20	1	gal.

Melt the rosin, add the lime flour and run to 500° F. Now pour in the cold heavy linseed oil, sprinkle in the litharge and cook at 480° F. until taken up, then slowly add the cold wood oil and run to 600° F. Cook about half an hour, cool to 350° F. and thin. Add the varnish drier last.

W. O. K. Olein Varnish
No. 132

Pale Rosin (Hard)	100	lb.
Linseed Oil	30	gal.
Wood Oil	45	gal.
Litharge	8	lb.
Red Lead	2	lb.
Kerosene Oil	20	gal.
Benzine	100	gal.

Melt the rosin and wood oil together and run to 600° F. Cool down with 10 gal. of the cold linseed oil, then run to 550° F. Again cool down with 10 gal. of the oil, allowing the heat to drop to 450° F. then add the litharge and run to 500° F. Cool down once more with 10 gal. of the cold oil, add the red lead and run to 480° F. Cook until stringy, then cool to 350° F. and thin with the kerosene following with the benzine.

M. or 1000 Rosin Varnish

Special Hard Rosin	100	lb.
Wood Oil	20	gal.
Wood Turpentine	5	gal.
Benzine	27	gal.
Strong Varnish Drier	1	gal.

Melt the rosin and wood oil together and run to 600° F. Allow to cool to 450° F. and cook 1 hour to 1½ hours.

Cool to 300° F., thin with the turpentine and then the benzine.

English Body Varnish (Short Oil)

Kauri	100	lb.
Linseed Oil	20	gal.
Wood Oil	5	gal.
Litharge	4	lb.
Manganese Borate	1	lb.
Turpentine	30	gal.

Fuse the kauri, add the linseed oil, previously heated to 450° F. stir well, then add the cold wood oil, mix thoroughly, sprinkle in the litharge and run to 500° F. Cook at 450° F. to 480° F. until it strings well (about 3½ hours) then cool to 320° F. and thin.

Wood Oil Varnish for Making Varnish Stains

Melt 160 lb. of light rosin and heat to 425° F. then stir in 10 lb. of air slacked lime. When the lime is all taken up and the temperature between 500° F. and 510° F., then add 1 qt. of glycerin and stir the glycerin in well, then add 12 lb. of white sugar of lead and when this is thoroughly in, add 20 gal. of raw China wood oil and heat to 560° F., but hold only about 10 minutes at this heat. Then when the batch is cool enough, thin with 40 gal. of benzine.

Household Varnish
No. 1761

H. H. Glycerin Rosin No. 975	100	lb.
China Wood Oil	24	gal.
Prepared Wood Oil No. 964	8	gal.
Kerosene 46°	4	gal.
Naphtha 54°	64	gal.

Melt the glycerin rosin in the 24 gal. of wood oil, run quickly to 595° F. stirring frequently, then pull from the fire, and immediately "chill back" with the 8 gal. of prepared oil, No. 964.

Add the thick prepared oil as fast as possible and then stir until thoroughly mixed.

Allow to stand, with frequent stirring until cooled to 450° F. at which temperature, thin with the kerosene.

When further cooled to 300° F. follow with the benzine.

This varnish is medium pale in color; has a good luster; dries in 4 to 6 hours, and becomes very hard and tough.

It contains 32.17% oil.

It is too long in oil for a *furniture varnish*, but answers nicely for wood work in houses, trunks, boxes, floors, etc.

This is the varnish which is generally colored with oil-soluble dyes in imitation of mahogany, walnut, etc.

Waterproof Quick-Drying Trunk Varnish

No. 1756

Pale Manganese Rosin No. 763	100 lb.
China Wood Oil	32 gal.
Litharge	16 lb.
Prepared Wood Oil, No. 964	4 gal.
Naphtha 54°	80 gal.

Melt the manganese rosin in the wood oil, run rather quickly to 570° F. and pull from the fire.

Allow the temperature to rise to 580° F. then immediately "chill back" with the 4 gal. of prepared wood oil and stir well.

The addition of the 4 gal. of cold oil will start the temperature downward, therefore, when the temperature gets down to about 55° F. commence adding the litharge, about 2 lb. at a time.

Stir constantly, while adding the litharge and beat down the foam if necessary.

After the litharge is in, allow to cool to 330° F. stirring very frequently.

Thin at 300° F. with the benzine, then allow to stand until the lead sulphate settles out.

This varnish when first made is very turbid or "milky" due to the suspended lead sulphate, but this settles out in about 24 hours leaving the varnish bright and clear.

This varnish is medium pale in color; has a good luster, and dries free from dust in 5 hours.

It contains 31.24% oil, consequently is durable. It is also fairly waterproof.

It is used for trunks; as an interior architectural varnish, and as a general utility varnish.

Single "C" Stearate Varnish

No. 1962

Stearate Rosin No. 794	100 lb.
China Wood Oil	24 gal.
Drying Wood Oil No. 963	4 gal.
Litharge	8 lb.
Naphtha 54°	80 gal.

Melt the stearate rosin in the 24 gal. of China wood oil, then run to 575° F. and pull from the fire.

The stearate rosin will cause excessive foaming at a high heat, *i.e.*, above 500° F., therefore, whip down the foam if necessary.

As soon as the kettle is off the fire "chill back" with the 4 gal. of drying wood oil, stir well, then commence adding the litharge, about a pound at a time, stirring constantly.

After the litharge is in, stir frequently while cooling to 420° F. at which temperature, thin with the kerosene.

When cooled to 275° F. follow with the benzine then add the concentrated varnish drier and mix thoroughly.

This varnish is medium pale in color; dries in about 9 hours, and becomes intensely hard.

The varnish contains 23.39% oil, and 0.21% aluminum stearate.

It is used as a mixing and grinding varnish, and will stand baking at 200° F.

Washburn's "Sub Thermo" Varnish

No. 1747

Water White Rosin	130	lb.
Slaked Lime	3½	lb.
Manganese Dioxide	½	lb.
China Wood Oil	35	gal.
V. M. Linseed Oil	4	gal.
Soya Bean Oil	3	gal.
Litharge	15	lb.
Kerosene	5	gal.
Heavy Naphtha 48°		

Put the rosin in the kettle with the slaked lime and manganese on top.

Heat slowly to 500° F. with frequent stirring, then pull from the fire, and allow to cool for *30 minutes*.

After cooling for half an hour, put the 35 gal. of China wood oil in the kettle and put back on the fire.

Heat rather slowly, *i.e.*, during about 45 minutes, 580° F. then pull from the fire.

Allow to stand until the temperature is up to 595° F. then pull from the fire, then immediately "chill back" with the 4 gal. of linseed oil and follow with the 3 gal. of soya bean oil, stirring vigorously.

The addition of the cold oils will cool the mixture down to about 580° F. at which point, commence adding the litharge, about 3 lb. at a time.

Stir constantly while adding the litharge and beat down the foam if necessary. After the litharge is all in, stir frequently while the mixture is cooling to 480° F. then thin with the kerosene and follow with the heavy naphtha.

This varnish is extremely pale in color; levels and flows perfectly; has a high luster; dries in 6 to 8 hours, and is impervious to water.

Waterproof Near Spar Varnish
No. 1774

M. Rosin	100 lb.
China Wood Oil	36 gal.
Drying Wood Oil No. 963	4 gal.
Kerosene 46°	16 gal.
Naphtha 54°	64 gal.
Concentrated Varnish Drier No. 1007	2 gal.

Melt the raw rosin in the 36 gal. of China wood oil, then run quickly to 570° F. and pull from the fire.

Allow to stand until the temperature is up to 590° F. then immediately "chill back" with the drying wood oil, No. 963 and stir well.

The addition of the 4 gal. of prepared wood oil will check the rise in temperature, therefore, as soon as the temperature begins to fall, stir for about a minute, then allow to stand for 4 minutes, after which, stir again, repeating the stirring every 5 or 10 minutes while the mixture is cooling to 450° F. at which point, thin with the kerosene.

When cooled to 300° F. or lower, follow with the benzine then add the concentrated varnish drier and stir well.

The body of this varnish can be regulated according to the time allowed for cooling, and the temperature at which it is thinned with the kerosene. Thinning at 500° F. gives a much thinner varnish than when thinned at 400° F.

This waterproof varnish is designed as a finishing coat and must not be used as a mixing varnish, as it "livers" with nearly every kind of pigment.

Medium Spar Varnish
No. 1733

Pale Ester Gum	100 lb.
China Wood Oil	33 gal.
Litharge	6 lb.
Manganese Oil, No. 913	1 gal.
Wood Turpentine	64 gal.

Melt the ester gum in the China wood oil, run to 525° F. or to a sufficient temperature so that when the kettle is pulled from the fire the heat will rise to 550° F. but not above 575° F.

As soon as the kettle is off the fire sprinkle in the litharge, about a pound at a time.

Stir constantly while adding the litharge, and if there is any indication of the wood oil "jellying" add the manganese oil with about 4 gal. of the turpentine, which later on is to be used for thinning.

When cooled to 400° F. thin first with the turpentine containing the manganese oil, then follow with the remaining turpentine.

This varnish is pale in color; extra pale if made in an aluminum kettle; has a high luster; dries in about 6 hours, and is very waterproof.

If wanted to dry quicker, add half a gallon of concentrated varnish drier No. 1007.

If it wrinkles on drying, it means that the varnish needs more thinning.

This is an extra fine waterproof spar varnish.

Durable Valspar Varnish
No. 1730

Ester Gum (Acid No. 16 or Less)	100 lb.
China Wood Oil	32 gal.
Litharge	8 lb.
Red Lead	4 lb.
Honey Oil No. 907	4 gal.
Wood Turpentine	24 gal.
Naphtha 54°	40 gal.

Put the ester gum in the kettle, mix the litharge and red lead, sprinkle on top of the rosin, then pour in the wood oil.

Raise the heat to 560° F. stirring frequently, then pull from the fire.

Allow the temperature to rise to 580° F. then "chill back" with the honey oil and stir well.

Allow to cool to 450° F. then thin with the turpentine, when cooled to 330° F. follow with the benzine.

This varnish is of a medium-amber color; has a brilliant luster; dries in 14 to 16 hours, and becomes intensely hard.

With an ester gum having an "acid figure" below 16 the varnish is absolutely impervious to water and will stand submersion in fresh and salt water for two weeks or more without turning white.

This varnish contains 34.45% oil.

It is used on spars, boats, refrigerators, front doors, wagons, railway cars, and as an architectural finish. It is absolutely neutral to lead and zinc pigments.

Congo Spar Varnish
No. 1904

Congo (Fused) No. 783	75 lb.
Lead Resinate No. 782	45 lb.
China Wood Oil	34½ gal.
Manganese Oil No. 913	½ gal.
Wood Turpentine	50 gal.
Texaco Spirits	50 gal.

Put the fused Congo, lead resinate and China wood oil in the kettle and heat to 560° F. then pull from the fire.

Run the heat up quickly and pull from the fire as soon as the thermometer registers 560° F.

The temperature of the mixture will probably rise to about 590° F., therefore, stir well to prevent excessive bodying, and if necessary cool down quickly by turning the water hose on the kettle as it is essential that the mixture be cooled down to 525° F. before it has time to "thicken," *i.e.*, begins to become "stringy."

As soon as the mixture has cooled to 525° F. thin with 10 gal. of turpentine containing the half gallon of cold manganese.

When this is in, thin with the rest of the turpentine, then follow with the Texaco spirits.

This variety of spar varnish is made to stand the action of boiling water, but the same result may be obtained by blending 3 parts of ester spar with 1 part of any medium oil Congo varnish.

One Hour Spar Varnish
No. 1713

Spar Rosin No. 766	100 lb.
China Wood Oil	32 gal.
Pale Manganese Oil	4 gal.
Manganese Borate	64 lb.
Pale Manganese Oil No. 867	4 gal.
Litharge	60 lb.
Kerosene 46°	8 gal.
Wood Turpentine	80 gal.
Naphtha 54°	72 gal.

Heat the wood oil and rosin quickly to 580° F. add the 4 gal. of the cold manganese oil and immediately pull the kettle from the fire, the heat will drop to about 570° F. at which point, commence adding the manganese borate, about 4 oz. at a time, stirring very frequently and whipping down the foam if necessary.

When the borate is all in, allow the mixture to stand until cooled to 540° F. stirring frequently, then put the kettle back on the fire, raise the heat quickly to 560° F. add the remaining 4 gal. of cold manganese oil and at once pull from the fire. The heat will drop to 550° F. at which point commence adding the litharge, about 2 lb. at a time, stirring constantly. The object is to get all of the litharge in by the time the heat is in falling temperature. Stir very frequently while cooling to 475° F. by which time all of the litharge should be taken up. When cooled to 460° F. thin with the kerosene, and then follow with the turpentine. When cooled to 330° F. or lower, add the benzine.

This varnish dries in 1 hour and is hard in 5 hours. It does not mix perfectly with raw linseed oil, but will mix with shellac varnish.

It will stand dilution with turpentine to any extent, but an excess of benzine throws out the gum, etc.

Standard Navy Spar Varnish
No. 90

Pontianak	100 lb.
V. M. Linseed Oil	25 gal.
China Wood Oil	5 gal.
Litharge	3 lb.
Manganese Resinate	2 lb.
Turpentine	40 gal.

Fuse the gum, add the linseed oil, previously heated to 450° F. Mix well and cook for 15 minutes at 480° F. then add the cold wood oil, sprinkle in the litharge and run to 500° F.

When dissolved, run to 480° F. and cook 1 to 1½ hours.

Cool to 320° F. and thin.

Navy Spar Varnish
No. 104

Pontianak	100 lb.
V. M. Linseed Oil	25 gal.
Wood Oil	5 gal.
Litharge	3 lb.
Turpentine	40 gal.

Fuse the gum, add the linseed oil, previously heated to 450° F. cook for half an hour at 480° F. add the cold wood oil, mix well, sprinkle in the litharge and run to 550° F.

Cool to 480° F. and cook 1½ hours, then allow to cool to 320° F. and thin.

"A" Marine Spar Varnish
No. 1702

Pale Spar Rosin No. 766	75 lb.
China Wood Oil	42 gal.
Pale Spar Rosin No. 766	25 lb.
Litharge	7½ lb.
Manganese Borate	½ lb.
V. M. Linseed Oil	8 gal.
Naphtha 54°	80 gal.

Melt 75 lb. of the rosin with the wood oil, run to 580° F. pull from the fire and immediately add the remaining 25 lb. of rosin previously broken in small pieces. The addition of the cold rosin will cause excessive foaming at this high temperature, therefore, beat down the foam and stir until the rosin is in solution.

The cold rosin will check the heat which, otherwise, would have risen to about 640° F. to 650° F.

Allow the mixture to stand until the temperature has fallen to 575° F., then commence adding the drying salts, previously mixed together, about a half pound at a time. Sprinkle the drying salts on the surface of the hot oil, allow to remain for about 1 minute, then stir well, and beat down the foam if necessary.

The drying salts will be taken up in a few minutes at this high temperature, therefore, as soon as they are all in, stir for 5 minutes.

Allow to cool to 320° F. and thin with the benzine.

If desired, the cold linseed oil may be added before the introduction of the drying salts, in which case, they will be "taken up" more slowly.

This exceedingly pale varnish contains 52½ gal. of oil. It has a brilliant luster; dries dust free in 8 hours, and will stand submersion in water for weeks.

Long Oil Varnish
No. 1718

Pale Spar Rosin No. 766	50 lb.
Manganese Sulphate	8 lb.
China Wood Oil	42 gal.
Pale Spar Rosin No. 766	25 gal.
V. M. Linseed Oil	8 gal.
Pale Spar Rosin No. 766	25 gal.
Heavy Naphtha 48°	80 gal.
Concentrated Varnish Drier No. 1007	1 gal.

Melt the 50 lb. of rosin with the manganese sulphate in the 42 gal. of wood oil and run to 540° F., then add 25 lb. more of rosin and stir until dissolved.

When dissolved raise the heat to 590° F. and pull the kettle from the fire.

"Chill back" immediately with the 8 gal. of cold linseed oil, stir well, then add the remaining 25 lb. of rosin and stir until in solution.

The chilling back with the cold oil; then with the rosin will lower the temperature to about 540° F. to 520° F. Stir frequently and allow to cool to 350 F., at which point, thin with the heavy naphtha.

Add the concentrated varnish drier last, and stir well.

This pale, long oil varnish contains 52 gal. of oil per 100 lb. of rosin.

It is pale in color; possesses extra "fullness," has a good luster; dries in 10 to 12 hours, is very waterproof and very durable.

It is designed as a boat varnish, *i.e.*, deck varnish.

Implement Spar Varnish
No. 1722

M. Rosin	100 lb.
Red Lead	8 lb.
China Wood Oil	32 gal.
Soya Bean Oil	4 gal.
Naphtha 54°	64 gal.
Concentrated Varnish Drier No. 1007	2 gal.

Melt the rosin, with the red lead on top, in the wood oil and run to 580° F.

Pull from the fire and add the cold soya bean oil, all at once.

The addition of cold soya bean oil will start the temperature downward, therefore, while cooling to 330° F. stir quite frequently to prevent excessive bodying.

When cooled to 330° F., thin with

the benzine, then add the concentrated varnish drier.

This varnish is fairly pale in color; has a fine luster; dries in about 7 hours, and is impervious to water.

It is used as an implement varnish on small machines, and as an interior architectural varnish.

Its oil content is 34.79%, consequently it is a durable outside varnish, but it is too long in oil for a baking varnish.

Exterior Marine Varnish
No. 1719

Water White Rosin	80	lb.
China Wood Oil	44	gal.
Water White Rosin	20	lb.
Litharge	8	lb.
Honey Oil No. 907	4	gal.
Heavy Naphtha 48°	72	gal.
Concentrated Varnish Drier No. 1007	1	gal.

Melt the 80 lb. of rosin in the wood oil, run to 595° F. pull from the fire and add the remaining 20 lb. of rosin.

Stir until the rosin is in solution, then "chill back" with the 4 gal. of honey oil and stir until thoroughly mixed, by which time the heat will be down to about 570° F. or 569° F.

Now, add the litharge about a pound at a time, stirring constantly and beating down the foam if necessary.

After the litharge is all in, stir occasionally while the mixture is cooling to 450° F. at which point, thin with the heavy naphtha.

Add the concentrated varnish drier last and stir well.

This pale varnish has a high luster; good fullness; is extremely waterproof, and dries in about 8 hours.

It is designed for use on water pails, fire buckets, row boats, oars, spars, and other articles, subjected to fresh and salt water.

Elastic Navy Spar Varnish
No. 91

Borneo Gum	100	lb.
Wood Oil	5	gal.
V. M. Linseed Oil	22	gal.
Litharge	2½	lb.
Lead Resinate	1½	lb.
Turpentine	40	gal.
Turpentine Substitute No. 43	5	gal.

Fuse the gum, add the linseed oil, previously heated to 450° F., cook well together, then pour in the cold wood oil. Add the litharge, run to 550° F. cool to 400° F. add the lead resinate and raise the heat to 480° F. and cool 1 or 2 hours.

Cool to 350° F. and thin.

Cheap Spar Varnish
No. 1773

Pale Ester Gum	100	lb.
China Wood Oil	32	gal.
Drying Wood Oil No. 963	4	gal.
Heavy Naphtha 48°	80	gal.
Concentrated Varnish Drier No. 1007	1	lb.

Melt the ester gum in the China Wood Oil then run quickly to 520° F. or a sufficient temperature so that when the kettle is off the fire the heat will rise to about 565° F., but not above 575° F.

With the kettle off the fire, allow to stand with very frequent stirring until the temperature reaches 565° F., then immediately add the 4 gal. of cold wood oil No. 963, and stir vigorously.

Stir very frequently while cooling, as quickly as possible down to 450° F. at which point, thin with the heavy naphtha, then add the drier.

If the oil and gum be heated to 565° F. before the kettle is pulled from the fire, the heat will rise so fast and high that the 4 gal. of cold oil will not check the rising temperature. Much stirring is needed while the heat is rising from 520° F. to 565° F. and more after the temperature begins to fall. Should there be a tendency of the mixture to "string" while cooling down, thin at once with the heavy naphtha, no matter what the temperature may be.

This varnish is pale in color; has a high luster; flows and levels nicely; is neutral in character, dries in 6 to 8 hours, and becomes intensely hard.

The varnish may be used as a mixing and grinding varnish, and as a universal varnish for interior and exterior work. The above varnish carries 30.91% oil.

"Sealer" Varnish
No. 1707

High Lime Rosin No. 751	25	lb.
China Wood Oil	25	gal.
High Lime Rosin No. 751	75	lb.
Litharge	6¼	lb.
Cobalt Linoleate	¾	lb.
Turpentine Substitute	37½	gal.
Heavy Naphtha 48°	37¼	gal.

Melt the 25 lb. of rosin in the 25 gal. of wood oil, run to 525° F. not over 540° F. and pull from the fire.

The moment it begins to "string" on glass, add the remaining 75 lb. of rosin and stir well.

The addition of cold rosin will start the temperature downward, therefore, when cooled to 475° F. or 460° F. sprinkle in the litharge, about a pound at a time, and stir well.

When all of the litharge is in, put the kettle back on the fire and heat slowly to 520° F. or to a sufficient temperature so that when the kettle is off the fire the heat will rise to about 560° F. *not above* 570° F.

With the kettle off the fire, allow to cool down to 450° F., then add the cobalt linoleate and stir for about 5 minutes, after which allow to stand for 5 minutes, then thin with the turpentine substitute and heavy naphtha.

This "sealer" varnish resembles a thin pale, elastic quick-drying glass oil, and is used as a "sealer" on iron filler, rough-stuff, etc., also as a "blend" in making "first coaters" for wood.

Railway Finishing Varnish
No. 136

Kauri No. 1	100 lb.
Linseed Oil	25 gal.
Wood Oil	5 gal.
Litharge	4 lb.
Manganese Tungate	2 lb.
Turpentine	5 gal.
Turpentine Substitute No. 43	5 gal.

Fuse the gum, add the oil, previously heated to 450° F., run to 550° F. and add the cold wood oil, cool down to 400° F. add the driers and run to 500° F. Cool to 480° F. and cook 3½ hours. Allow to cool to 350° F. and thin.

Rubbing Varnish
No. 1905

Pale Congo Gum	200 lb.
Pale Ester Gum	40 lb.
Lead Resinate No. 782	16 lb.
Manganese Rosin No. 759	1 lb.
China Wood Oil	20 gal.
Wood Turpentine	40 gal.
Texaco Spirits	24 gal.

Place the Congo gum in the kettle and heat to 550° F. with cover off the kettle.

Pull from the fire, allow to stand, *i.e.*, "sweat" for 15 minutes, then put the cover on the kettle and run onto the fire.

Heat to 650° F. for about 5 minutes, then pull from the fire and add the cold wood oil, through a funnel in the cover. Add the wood oil slowly and stir well while mixing.

By the time all of the wood oil is in the temperature will be down to about 450° F. at which point, add the ester gum, then put back on the fire and heat slowly to 545° F.

Now, pull from the fire, allow to stand for about 5 minutes, then add the lead and manganese resinates and stir until dissolved.

Allow to cool slowly to 400° F. without stirring, then thin with the turpentine and follow with the Texaco spirits.

Care should be taken not to have the mixture cool too fast before thinning, otherwise the oil will not body sufficiently, furthermore, the brilliancy will depend upon the thickness of body.

Wood Oil Rubbing and Polishing Varnish

Kauri No. 2	150 gal.
Raw China Wood Oil	12 gal.
Calcined White Sugar of Lead	12 lb.
Turpentine	25 gal.
Benzine	12 gal.

The China wood oil in this batch should be heated to 250° F. and then hold in readiness for the melted gum. When the kauri is properly melted, add the heated wood oil and stir together in the usual manner. Take the temperature which should be about 510° F. Either off or on the fire then add the sugar of lead and when it is thoroughly dissolved, thin the batch as soon as it is possible to do so.

This formula produces a fine full bodied, quick-drying and rubbing varnish that is safe to use for the highest grade work.

Kauri Manila Quick Rubbing Varnish
No. 94

Kauri Chips	40	lb.
Ex. Manila	35	lb.
K. Rosin (Hard)	25	lb.
Prepared Linseed Oil, No. 318	8	gal.
China Wood Oil	2	gal.
Lead Resinate	2½	lb.
Turpentine	25	gal.
Turpentine Substitute No. 43	5	gal.

Fuse the gums together, add the linseed oil previously heated to 450°

F., run to 500° F. cool to about 450° F. add the cold wood oil, then stir in the lead resinate and run to 550° F. Cook about 2 hours at 500° F. to 550° F., cool to 350° F. and thin.

Quick Rubbing Varnish
No. 1093

Pontianak No. 1	400 lb.
Strong "1500" Rosin No. 770	120 lb.
Litharge	6 lb.
China Wood Oil	42 gal.
Heavy "Alinco" Oil No. 853	15 gal.
Rubbing Oil No. 894	6 gal.
Naphtha 54°	184 gal.
Concentrated Varnish Drier No. 1006	1 gal.
Calcutta Linseed Oil	6 gal.

Fuse the Pontianak and rosin together, to 550° F. or higher if necessary. Cover should be on the kettle while fusing tre gums, it being essential that the gum be fused or melted to an "oil-drop" i.e., until it drips from the stirring-rod thin hot oil.

Meantime, in a separate kettle, heat in the 42 gal. of China wood oil with 15 gal. of heavy "Alinco" oil to 400° F. and as soon as the gums are properly fused, add the hot oils, through a funnel, slowly and stir until the gum and oil are "together," i. e., perfectly combined.

The addition of the oil will reduce the temperature to about 450° F. or 480° F. therefore, as soon as the oil is all in, remove the cover from the kettle, then heat quickly to 550° F. and pull from the fire. Allow to stand until the heat is up to 575° F. and then chill back with the 6 gal. of cold rubbing oil, added all at once. If this does not check the heat then use the 6 gal. of Calcutta oil also, but do not use it unless it is necessary, as extra flowing and leveling properties are obtained by adding the Calcutta oil after thinning. After the heat has been checked and the temperature begins to fall, add the litharge and stir for about 5 minutes.

When cooled to 350° F. thin with benzine, then add the concentrated varnish drier, and follow with Calcutta oi, providing it has not been used for chilling back.

Wood Oil Pale Rubbing Varnish

This varnish is to be made in two batches.

M. Rosin	275 lb.
Soda Ash	9 lb.
Dissolved in 1 gal. water.	
Water	1 gal.
Air Slaked Lime	15 lb.

The rosin is treated in an iron kettle. First melt the rosin and run to 520° F. and then add the soda ash and stir it in well, then immediately add the lime and stir that in well also.

This rosin is to be taken out of the kettle hot and used as follows:

Place 100 lb. of the treated rosin in a copper kettle and with it 100 lb. of hard manila. Then melt the treated rosin and manila together which will require about 600° F. and when they are thoroughly mixed together, add 9 gal. of China wood oil and 2 gal. of raw linseed oil. Stir this batch together well.

Now add to the batch 10 lb. of lump brown sugar of lead and stir until the lead is thoroughly dissolved. Allow the batch to stand in the kettle until it is cool enough to thin and then thin it with 25 gal. of turpentine and 35 gal. of low gravity benzine.

Extra Hard Rosin Varnish
No. 1717

Water White Rosin	100 lb.
Zinc Sulphate (Crystals)	4 lb.
Sodium Bicarbonate	2 lb.
China Wood Oil	4 gal.
Pale Manganese Oil No. 867	2 gal.
Wood Turpentine	6 gal.
Heavy Naphtha 48°	10 gal.
Concentrated Varnish Drier No. 1007	1 gal.

Melt the rosin, with the zinc sulphate and bicarbonate of soda on top to about 320° F. The combined water in the zinc sulphate causes excessive frothing, therefore, hold at 320° F. to 350° F. until frothing ceases or nearly so, then run to 580° F. pull from the fire and add the cold wood oil, stirring thoroughly.

At about 540° F. the sulphuric acid from the zinc sulphate is driven off, consequently if a light colored varnish is wanted, an aluminum kettle should be used.

The addition of the cold wood oil will drop the temperature to about 540° F., therefore, put the kettle back on the fire, run to 565° F. add the cold manganese oil and again pull the kettle from the fire and stir thoroughly.

Allow to cool to 400° F. and thin with the turpentine, when cooled to

320° F. follow with the benzine, then add the concentrated varnish drier.

This varnish, if made in an aluminum kettle, is very pale in color and dries in about 4 hours with a high luster.

It is exceptionally hard, and may be used as a rubbing varnish, but is designed especially for blending with pale, short-oil rubbing and polishing varnishes.

Two-Day Congo Rubbing Varnish
No. 1926

No. 2 White Congo	90	lb.
Hard Water White Rosin No. 750	10	lb.
China Wood Oil	6	gal.
V. M. Linseed Oil	2	gal.
Litharge	1½	lb.
Wood Turpentine	15	gal.
Heavy Naphtha 48°	10	gal.
Concentrated Varnish Drier No. 1007	¼	gal.

Directions:

Fuse the Congo with the rosin, cover off the kettle, quickly to 625° F., then pull from the fire and allow to "sweat," *i.e.*, stand for 5 minutes then put back on the fire and run to 650° F.

Again pull from the fire, let stand for 5 minutes, put the cover on the kettle, replace on the fire and once more heat to 650° F., then pull from the fire and add the mixed oils, previously heated to 450° F.

Pour the hot oil, in a fine stream, through the funnel in the cover and stir slowly until all of the oil is in, then remove the cover, allow to cool to about 480° F. and sprinkle in the litharge.

Replace the kettle on the fire, raise the temperature to 520° F. and cook for 15 to 20 minutes, stirring very frequently, then pull from the fire, allow to cool to about 450° F. and thin, after which put in the concentrated varnish drier and stir thoroughly.

Remarks:

This excellent rubbing varnish is very pale in color; flows and levels perfectly and dries hard enough to rub with pumice and water in 48 hours without "sweating out."

This is one of the best two-day rubbing varnishes on the market.

Pale Two-Day Rubbing Varnish
No. 93

Congo Gum	70	lb.
Water White Rosin (Hard)	30	lb.
Bleached Linseed Oil	8	gal.
Wood Oil	2	gal.
Litharge	2½	lb.
Turpentine	25	gal.
Turpentine Substitute No. 43	5	gal.

Fuse the Congo and rosin together, running to 480° F. to 500° F., add the linseed oil, previously heated to 400° F., mix well, allow to cool to 400° F., add the litharge and run to 550° F.

Cook for 2 hours at 550° F. to 575° F., then allow to cool to about 450° F. add the wood oil and run to 600° F. Cool to 350° F. and thin.

Hard Congo Rubbing Varnish
No. 1915

Pale Congo Gum	100	lb.
China Wood Oil	10	gal.
Pale Ester Gum	25	lb.
Litharge	4	lb.
Wood Turpentine	20	gal.
Texaco Spirits	10	gal.
Pale Manganese Oil No. 867	¾	gal.

Fuse the Congo gum with the cover off the kettle, then put the cover on, run to 650° F. and pull from the fire.

Allow to stand, *i.e.*, to "sweat" for about 15 minutes, replace the kettle on the fire, heat to 675° F. and again pull from the fire.

Repeat the operation if the gum is not liquid, otherwise, the two fusions will be sufficient.

Now, add the cold China wood oil in a fine stream, through a funnel in the cover, and stir constantly until all of the oil is in.

Remove the cover, add the ester gum, stir well, put the kettle back on the fire, heat slowly to 545 F. and again pull from the fire.

Sprinkle in the litharge, about a pound at a time, stir constantly while adding the litharge, and frequently while cooling to 400° F. at which point, thin with the turpentine, then follow with the Texaco spirits, after which, add the quart of manganese oil and stir well.

The addition of the manganese oil is to promote flow and quick leveling properties to the varnish.

This varnish is pale in color; dries quickly and is hard enough to suit such purposes.

Hard Congo Rubbing Varnish
No. 1913

Pale Congo Gum	100	lb.
M. Rosin	10	lb.
China Wood Oil	5	gal.
V. M. Linseed Oil	1	gal.
Lead Resinate No. 782	5	lb.
Wood Turpentine	35	gal.
Pale Manganese Oil No. 867	¼	gal.

Fuse the Congo gum in a copper kettle, with the cover off, to 550° F., then pull from the fire, put the cover on, replace the kettle on the fire and run to 675° F.

Pull from the fire and let stand until a clear drop is obtained. If, after standing for 10 minutes, the gum is not perfectly liquid, put the kettle back on the fire and again heat to 675° F., then pull from the fire.

Meanwhile, in another kettle, melt the 10 lb. of rosin in the 5 gal. of wood oil and the 1 gal. of linseed oil and run to 350° F., then pull from the fire and pour the mixture, through a funnel in the cover, into the fused Congo in the copper kettle, stirring slowly while adding the hot oil to the fused gum.

After the oil is in, put the copper kettle back on the fire, run to 575° F., pull from the fire, and stir occasionally while cooling to 460° F. at which point, cautiously thin with the turpentine, then add the quart of heavy manganese oil.

The manganese oil imparts flowing and leveling properties to the varnish.

This pale rubbing varnish contains approximately 6 gal. of oil per 100 lb. of gum.

Congo Rubbing Varnish
No. 1911

Congo Gum	150	lb.
M. Rosin	30	lb.
Pulverized Lead Acetate	4½	lb.
China Wood Oil	13	gal.
Kerosene 46°	2½	gal.
Wood Turpentine	14	gal.
Heavy Naphtha 48°	20	gal.

Directions:

Fuse the Congo and rosin in open kettle to 625° F., then pull from the fire and allow to cool to 550° F.

Put back on the fire and heat quickly to 625° F., then pull from the fire and allow to cool to 550° F. again.

Now, put the cover on the kettle, replace on the fire, heat to 675° F., hold for 2 minutes, then pull from the fire and add 10 gal. of the wood oil, previously heated to about 300° F. pouring the oil in a fine stream through the funnel in the cover.

Mix well by stirring, then remove the cover and allow to cool to 525° F. at which point add the remaining 3 gal. of wood oil and mix well.

Again put the kettle on the fire, heat to 550° F., pull from the fire, allow to cool to 525° F. and sprinkle in the pulverized lead acetate a little at a time, to prevent excessive foaming.

After the lead acetate is in and foaming ceases, put the kettle back on the fire, and heat to 540° F. then pull from the fire, allow to cool to 500° F. and thin with the kerosene, following with the turpentine and heavy naphtha.

Rubbing Varnish
No. 1908

Kauri J. M. 15	150	lb.
Strong "1500" Rosin No. 770	60	lb.
Plain Lead Oil, No. 890	5½	gal.
China Wood Oil	1½	gal.
Red Lead	1	lb.
Wood Turpentine	43	gal.
Naphtha 54°	32	gal.
Concentrated Varnish Drier No. 1007	½	gal.

Fuse the kauri and rosin together, with cover on the kettle, running the heat to about 600° F., then pull from the fire and allow to stand for 5 minutes.

Now put the kettle back on the fire and heat to 650° F. holding it at this temperature until the melted gum drips from the stirring rod like hot oil, then pull from the fire and add the mixed oils, previously heated to 480° F., stirring well.

Remove the cover from the kettle, replace on the fire and cook for about 1 hour at 500° F. to 520° F. then pull from the fire, allow to cool to 440° F. and thin with the turpentine.

When cooled to 320° F. follow with the benzine.

Add the concentrated varnish drier last and stir well.

This short-oil varnish is of a medium-amber color; dries quickly, and has a high luster.

It is used chiefly as a mixing varnish in varnish colors and making enamels.

Black Auto Rubbing Varnish
No. 2014

a.	Kauri Brown Chips	75	lb.
	Rosin	25	lb.
	V. M. Linseed Oil	5	gal.
	China Wood Oil	2½	gal.
	Litharge	5	lb.
	Red Lead	2½	lb.
	Wood Turpentine	35	gal.
	Naphtha 54°	15	gal.
b.	Ivory Black	45	lb.
	Black Toner	5	lb.

Melt the kauri with the rosin, cover on the kettle, and when liquid enough, insert the thermometer. Raise the heat to 575° F. stirring occasionally, hold at 565° F. to 575° F. until the melted gum drips from the stirring rod like hot oil, then pull from the fire, add the China wood oil and linseed oil, previously mixed together and heated to 400° F. through the funnel in the cover, stirring slowly.

After the oils are in, remove the cover, put the kettle back on the fire and cook at 550° F. for 30 minutes, then pull from the fire and add the mixed drying salts in small portions, stirring constantly. The drying salts should be in by the time the temperature is down to 520° F. and the mixture should be stirred frequently while cooling to 450° F. at which point, thin with the turpentine, and when cooled to 300° F. follow with the benzine.

After the varnish is finished and is cooled, grind the dry black pigments in 15 gal. of the varnish, then regrind and mix the black paste with the remaining 50 gal. of the varnish.

This black varnish contains 10.38% oil.

White Rosin Polishing Varnish
No. 1708

Water White Rosin	100	lb.
Slaked Lime	6	lb.
Pulverized Lead Acetate	8	lb.
Manganese Borate	2	lb.
China Wood Oil	16	gal.
Wood Turpentine	8	gal.
Naphtha 54°	32	gal.

Place the rosin on the bottom of the kettle, then cover the surface with the slaked lime.

Next, mix the pulverized lead acetate with the manganese borate, then place the mixture on the lime near the middle.

Melt the rosin to about 400° F. without stirring, unless it foams strongly, in which event, stir just enough to keep the foam down.

After a temperature of 400° F. has been reached stir very frequently and continue raising the heat slowly to 550° F., then pull the kettle from the fire and add the cold wood oil, a little at a time, so as not to "freeze" the mixture.

Stir constantly, and as soon as the wood oil is in, put the kettle back on the fire and heat quickly to 520° F. or to a sufficient heat so that when the kettle is pulled from the fire the temperature will rise to 565° F. and not above 575° F., then allow to cool to 420° F. and thin with the turpentine.

When cooled to 300° F. follow with the benzine.

This pale colored, medium-oil, quick drying varnish is designed especially for blending with short-oil Congo, kauri and manila varnishes to produce "pale polishing" and "pale furniture varnishes."

Extra Superior Polishing Varnish A.
No. 95

Pale Pontianak Gum	80	lb.
Pale Rosin (Hard)	20	lb.
Wood Oil	6	gal.
Lead Tungate	1	lb.
Turpentine	27	gal.

Fuse the Pontianak and while fusing treat the wood oil in another kettle as follows:

Heat the wood oil to 300° F. add the lead tungate in small pieces and when dissolved, run the oil quickly to 550° F. and add the rosin all at once and when this has dissolved, empty into the fused Pontianak and cook at 500° F. for an hour or two.

Cool to 400° F. and thin.

Extra Pale Manila Polishing Varnish
No. 113

Pale Manila Gum	85	lb.
Pale Rosin (Hard)	15	lb.
Wood Oil	7½	gal.
Litharge	2½	lb.
Turpentine	25	gal.
Petroleum Distillate	5	gal.

Fuse the Manila, add the rosin and as soon as melted, add the wood oil previously heated to 450° F. Sprinkle in the litharge, run to 480° F., and cook 1 to 2 hours, cool to 350° F. and thin.

Wood Oil Kauri Mixing Varnish

M. Rosin	240	lb.
No. 3 Kauri Gum	50	lb.
Black Oxide of Manganese	6	lb.

Air Slaked Lime	16 lb.
Raw Linseed Oil	7 gal.
Raw China Wood Oil	18 gal.
Coal Oil	5 gal.
Benzine	70 gal.

To be made in an iron kettle. Melt the rosin and kauri together and when they are melted together add the manganese. At 450° F. add the lime, heat to 570° F. and then add the linseed oil and then the wood oil. Then increase the heat to 525° F. and hold at this temperature for about 1½ hours. When ready to thin add the 5 gal. of coal oil and then the 70 gal. of benzine.

White Oil Mixing Varnish
No. 1789

Water White Rosin	64 lb.
China Wood Oil	64 gal.
Slaked Lime	16 lb.
Soya Tungate Oil No. 991	32 gal.
Naphtha 54°	128 gal.

Put the rosin in the kettle, pour in the wood oil, then sprinkle the lime on the surface of the oil.

Heat to about 300° F. without stirring, then stir very frequently while heating to 450° F. or to a sufficient temperature so that when the kettle is off the fire the heat will rise to 475° F. but no higher.

With the kettle off the fire, allow to stand until the temperature is down to 400° F. stirring frequently, then replace the kettle on the fire, and again run to 475° F.

Pull from the fire, allow to cool to 440° F. as before, then put the kettle back on the fire and heat quickly to 475° F. at which point pull from the fire and immediately "chill back" with the 32 gal. of soya tungate oil, adding about 5 gal. at a time and stirring constantly.

When the soya tungate oil is all in, put the kettle back on the fire and once more bring the heat to 475° F.

At this point, test for body, and if a sample on glass "strings" well when touched with the finger, the cooking is finished, and the kettle removed from the fire.

Allow to cool to 300° F. and thin with the benzine.

This very pale, quick leveling varnish dries slowly by itself but is intended as a mixing varnish only.

It is neutral in character as the slaked lime is in excess and much of it will be found on the bottom of the kettle as a white residue.

No. 40 Mixing Varnish
No. 1759

High Lime Rosin No. 751	550 lb.
China Wood Oil	69 gal.
H. B. Linseed Oil	30 gal.
Slaked Lime	2 lb.
H. B. Linseed Oil	5 gal.
Litharge	8 lb.
Cobalt Linoleate No. 823	7 lb.
Heavy Naphtha 48°	248 gal.

Melt the rosin in the 69 gal. of wood oil and the 30 gal. of heavy bodied linseed oil, then sprinkle in the 2 lb. of slaked lime and stir well.

Run quickly to 550° F. stirring frequently, then pull the kettle from the fire.

Allow to stand until the temperature is up to 580° F., then immediately "chill back" by adding the remaining 5 gal. of linseed oil, and stir well.

The addition of the cold linseed oil will start the temperature downward, therefore, wait until the heat is down to 565° F., then sprinkle in the litharge, about 2 lb. at a time, stirring constantly.

After the litharge is in, stir frequently while the mixture is cooling to 480° F. at which point, add the cobalt linoleate, in small portions and stir until dissolved, also stir occasionally while the mixture is cooling to 400° F. at which temperature, thin with the heavy naphtha.

The 2 lb. of slaked lime and the 8 lb. of litharge are used to neutralize the free acid in the oils.

This varnish contains 27.25% oil.

Extra Pale Mixing Varnish
No. 1716

Water White Rosin	100	lb.
Caustic Soda	1	lb.
Water	1	gal.
Lead Acetate	7½	lb.
Slaked Lime	5	lb.
Manganese Borate	2½	lb.
China Wood Oil	30⅝	gal.
Wood Turpentine	72	gal.
Heavy Naphtha 48°	8	gal.
Concentrated Varnish Drier No. 1006	1	gal.

First dissolve the caustic soda in the water, then add the lead acetate and stir until dissolved.

Next, melt the rosin to about 400° F. pull the kettle from the fire and cautiously add the alkaline lead solution, about a quart at a time. The addition of the liquid will cause violent frothing, therefore, allow the foam to subside before adding more liquid.

When all in, and foaming ceases, or nearly so, put the kettle back on the fire and heat gently until every trace of water is off, then run quickly to 500° F. and pull from the fire.

Sprinkle in the slaked lime, stir well, put the kettle back on the fire and heat to 550° F., then again pull from the fire. Now, add the cold wood oil in small quantities and mix thoroughly by stirring. When all in, sprinkle in the manganese borate, a little at a time, and stir well, then put the kettle back on the fire and heat to 540° F. or to a sufficient temperature so that when the kettle is off the fire the heat will rise to 565° F. not above 580° F.

After pulling the kettle from the fire, allow to cool to 450° F., then thin with the turpentine and follow with the heavy naphtha.

Add the concentrated varnish drier last and stir well.

Pale Neutral Mixing Varnish

No. 1771

Water White Rosin	100 lb.
Slaked Lime	4 lb.
Lead Acetate	8 lb.
Zinc Stearate	1 lb.
China Wood Oil	30 gal.
Caustic Soda	3 lb.
Kerosene 46°	16 gal.
Naphtha 54° (Benzine)	64 gal.

Melt the rosin, with the lime and lead acetate on top, to about 350° F. without stirring, by which time the combined water in the lead acetate will have been driven off.

After the water is off, stir frequently and raise the heat to 480° F., then pull from the fire, and stir in the zinc stearate.

Allow to cool to 400° F., then put the kettle back on the fire and run to 500° F. at which point again pull from the fire.

Now, add the China wood oil in a fine stream and stir until thoroughly mixed. The addition of the cold wood oil will cause the temperature to drop to about 320° F., therefore, as soon as the wood oil is in, add the caustic soda, a little at a time, stirring constantly and beating down the foam.

When frothing ceases, put the kettle back on the fire and heat slowly to 540° F., then pull from the fire.

The temperature will rise to about 565° F. or 575° F., and then begin to fall, therefore, stir frequently while the temperature is rising, and also until the mixture cools to 500° F. at which point, thin with the kerosene.

When cooled to 300° F. or lower, follow with the benzine.

This varnish is extra pale in color; neutral in character, and dries in about 4 hours.

Pale "Two-Hour" Varnish

No. 1748

Strong Drying Rosin No. 762	100 lb.
China Wood Oil	48 gal.
Red Lead	8 lb.
Litharge	16 lb.
Glycerin	¼ gal.
Wood Turpentine	24 gal.
Naphtha 54° (Benzine)	80 gal.

Melt the rosin in the wood oil, then run *quickly* to 550° F. or to a sufficient heat so that when the kettle is off the fire, the temperature will rise to 575° F. or 580° F., but *not above 590° F.*

After the kettle is off the fire, allow to stand until the temperature has fallen 10°, then commence adding the red lead and litharge previously mixed together. Add about 2 lb. of the drying salts at a time, sprinkling them on the surface of the hot mixture, allow to remain for about half a minute, then stir for a minute. Continue in this way until all of the lead is in, then stir frequently, while the mixture is cooling down to 489° F. at which point pour in the glycerin and stir well for a few minutes.

When cooled to 450° F. thin with the turpentine, and when the temperature is down to about 320° F. follow with the benzine.

This varnish is fairly pale in color; is neutral to lead and zinc; has a good luster, and dries on glass in 2 hours.

It is used principally for "blending."

If it is made with less turpentine than stated above, the thinners eventually separate from the gum and oil.

Pan Coast No. 10 Mixing Varnish

No. 1758

High Lime Rosin No. 751	200 lb.
China Wood Oil	75 gal.
Fish Oil	20 gal.
Slaked Lime	2 lb.
Fish Oil	5 gal.

Litharge	8 lb.
Cobalt Linoleate No. 823	12 lb.
Kerosene 46°	30 gal.
Heavy Naphtha 48°	250 gal.

Melt the rosin in the 75 gal. of wood oil, mixed with 20 gal. of fish oil, and run quickly to 540° F. or to a sufficient temperature so that when the kettle is off the fire, the heat will rise to 575° F. but not above 595° F.

Meantime, while the temperature is rising, as soon as the thermometer registers 500° F., sprinkle the 2 lb. of slaked lime on the surface of the mixture, and stir well, also stir frequently while the kettle is on the fire.

When the kettle has been pulled from the fire, allow to stand until the temperature is up to 575° F., then "chill back" with the remaining 5 gal. of *cold* fish oil and stir well, after which wait until the heat is down to 565° F. then sprinkle in the litharge, about 2 lb. at a time, stir constantly while adding the litharge and very frequently while the mixture is cooling to 480° F. at which temperature add the cobalt linoleate and stir until dissolved.

Allow to cool to 450° F., thin with the kerosene, then follow with the heavy naphtha.

The 2 lb. of slaked lime and the 8 lb. of litharge are used to neutralize the free acid in the oils.

This varnish contains 27.50% oil.

"1380" Neutral Mixing Varnish
No. 1786

Water White Rosin	100 lb.
Slaked Lime	47 lb.
China Wood Oil	40 gal.
C. N. Linseed Oil	5 gal.
Litharge	7 lb.
Red Lead	3 lb.
Varnoline	5 gal.
Naphtha 54°	80 gal.
Concentrated Varnish Drier No. 1005	1 gal.

Place the rosin in the kettle, sprinkle with the lime on top, and then pour in the 40 gal. of wood oil.

Heat quickly to 545° F. and pull the kettle from the fire.

Allow the kettle to stand until the temperature rises to 575 F. stirring very frequently.

When the temperature of 575° F. has been reached, add the 5 gal. of cold linseed oil, all at once, and stir vigorously.

Now add the litharge and red lead, previously mixed together, about 2 lb. at a time, stirring constantly.

After the driers are all in, stir very frequently while the mixture is cooling to 520° F.

When cooled to 450° F. thin with the varnoline, and when down to 375° F. to 350° F. follow with the naphtha, then add the concentrated varnish drier.

Varnoline is a special heavy naphtha, and sold as a turpentine substitute.

This pale, medium heavy bodied, neutral varnish is very similar to neutral implement varnish No. 1704.

It contains 34.82% oil.

Neutral Manila Mixing Varnish
No. 141

Manila Chips	100	lb.
Prepared Linseed Oil No. 309	14	gal.
Wood Oil	7	gal.
Dry Slaked Lime	7½	lb.
Sugar of Lead	2½	gal.
Turpentine	10	gal.
Benzine	40	gal.

Fuse the manila, add the linseed oil, previously heated to 500° F. and mix well, cooking at about 480° F. for 15 to 20 minutes, then pour in the cold wood oil and cool to 400° F., add the sugar of lead, then the lime and run to 550° F. Allow to cool to 480° F., cook 1 hour, cool to 350° F. or 375° F., thin with the turpentine then with the benzine.

Long Oil Mixing Varnish
No. 134

K. Rosin	100 lb.
Dry Slaked Lime	5 lb.
Litharge	10 lb.
Manganese Borate	1 lb.
Zinc Sulphate (Dry)	4 lb.
Wood Oil	20 gal.
Manganese Oil	10 gal.
Petroleum Distillate	10 gal.
Benzine	40 gal.

Heat the wood oil quickly to 580° F. and the moment it begins to thicken, add the rosin, all at once. Run to 600° F.–620° F. add the cold manganese oil and cool to 400° F. Now add the litharge, manganese borate and the zinc sulphate, and when done foaming run to 500° F. and cook 2 hours. Cool to 320° F. and thin.

Kauri Wood Oil Mixing Varnish
No. 1939

Kauri Chip or Seeds	100	lb.
M. Rosin	33	lb.
Slaked Lime	3	lb.
China Wood Oil	20	gal.
Litharge	10	lb.
Wood Turpentine	40	gal.
Texaco Spirits	20	gal.

Fuse the kauri, with the cover on the kettle, to 640° F. Heat slowly at first to about 460° F. without stirring.

At 460° F. to 480° F. the gum will "swell" and rise in the kettle, therefore, at about 460° F. commence to stir, and stir occasionally while the temperature is rising to 600° F., then frequently while the heat is rising to 640° F. at which point the kauri should be thin as water and the "oil drop" clear.

Pull from the fire at 640° F. or as soon as the melted gum drips from the stirring paddle like hot oil.

Allow to stand until the heat is down to about 590° F., then remove the kettle cover, add the rosin in small portions, and stir until dissolved.

Now pour in the wood oil, in a fine stream, and mix well by stirring, then put the kettle back on the fire and heat to 450° F. or 475° F. at which point, sprinkle in the lime and stir well.

After the lime is off the fire, commence adding the litharge, about a pound at a time, stirring constantly and whipping down the foam if necessary.

Thin at 450° F. with the turpentine then follow with the Texaco spirits or heavy naphtha (48°).

"East India" Hard Mixing Varnish
No. 1910

M. Rosin	64	lb.
East Indian Gum	16	lb.
Slaked Lime	2	lb.
Zinc Oxide C. P.	2	lb.
China Wood Oil	2	gal.
M. Rosin	24	lb.
Litharge	16	lb.
Kellogg H. B. Oil	8	gal.
Kerosene 46°	8	gal.
Heavy Naphtha 48°	64	gal.

Melt the 64 lb. of rosin and the 16 lb. of East India gum with the slaked lime and zinc oxide on top, in the China wood oil.

When the heat is up to about 450° F. the gums will have melted, therefore, stir frequently and continue the heat up to 590° F., then pull from the fire and add the remaining 24 lb. of rosin.

The addition of the cold rosin will cause the mixture to froth strongly, but the froth is easily beaten down.

When the temperature begins to fall and the heat is down to 560° F. commence adding the litharge, about 2 lb. at a time, stirring constantly until all of the lead is in, also stir frequently while cooling to 525° F. at which point, add the Kellogg H. B. oil previously mixed with the kerosene.

Add the oil-kerosene mixture a little at a time to prevent excessive foaming, and when all in, follow with the heavy naphtha.

This mixing varnish is of a medium amber color; has a high luster; is neutral in character; dries in 5 to 6 hours, and is durable.

It contains 34.54% oil.

Cheap "Two-Hour" Blend Varnish
No. 1744

Strong Drying Rosin No. 762	100	lb.
China Wood Oil	48	gal.
Red Lead	8	lb.
Litharge	16	lb.
Glycerin	¼	gal.
Wood Turpentine	8	gal.
Heavy Naphtha 48°	24	gal.
Naphtha 54°	72	gal.

Melt the rosin in the wood oil, run to 560° F. or to a sufficient temperature so that when the kettle is off the fire the heat will not rise above 590° F.

After the kettle is off the fire, allow to stand with frequent stirring, until the temperature reaches 580° F. or 590° F. and then begins to fall.

As soon as the temperature has fallen to 575° F., commence adding the drying salts, previously mixed together, sprinkling about 2 lb. at a time.

Allow the driers to remain on the surface for about a minute, then stir thoroughly.

All of the drying salts should be in by the time the temperature is down to 525° F. and should be taken up when the heat of the mixture is down to 475° F. at which point add the glycerin in a fine stream and stir vigorously for 2 or 3 minutes.

When cooled to 460° F., thin with the turpentine and follow with the heavy naphtha.

When cooled to 330° F. or lower, add the naphtha.

This varnish is of a pale-amber color; has a good luster; dries on a glass in 2 hours, and is neutral to lead and zinc pigments.

It is used as a "blend" in furniture and other quick-drying varnishes.

B. & T. Kauri Mixing Varnish
No. 1938

Kauri Chip or Seeds	80	lb.
M. Rosin	20	lb.
Slacked Lime	2	lb.
V. M. Linseed Oil	15	gal.
China Wood Oil	5	gal.
Red Lead	2½	lb.
Manganese Borate	½	lb.
Turpentine	15	gal.
Heavy Naphtha	12	gal.

Place the rosin on the bottom of the kettle, then add the kauri gum, put the cover on the kettle and run on to the fire.

Heat slowly, *i.e.*, during 1 to 1½ hours, to 500° F. stirring occasionally after a temperature of 460° F. has been attained at which point, the gum "swells" and rises in the kettle.

When a temperature of 500° F. has been reached, run quickly to 500° F., then hold at this heat until it drips from the stirring paddle like thin hot oil, or water.

The moment this point is reached pull kettle from the fire and commence adding the two oils, previously heated to 400° F., pouring the hot oil through a funnel in the cover. Add the oil, a dipperful at a time, stirring slowly until all of the oil is in, then remove the cover, and replace the kettle on the fire.

Heat to 550° F. stirring frequently, then pull from the fire, sift in the slaked lime, mix well, then put the kettle on the fire, and cook at about 550° F. for half an hour, or until the mixture becomes thick and "stringy." Finally, pull from the fire, sprinkle in the drying salts, previously mixed together, a little at a time, and stir very frequently, while the mix is cooling to 450° F. at which point, thin with the turpentine and follow with the heavy naphtha.

"Sancote" Reducing Varnish
No. 1787

Water White Rosin	605	lb.
Slaked Lime	30	lb.
China Wood Oil	62	gal.
H. B. Linseed Oil No. 855	18	gal.
H. B. Linseed Oil No. 855	5	gal.
Litharge	17	lb.
Cobalt Linoleate No. 823	6¼	lb.
Heavy Naphtha 41°	159	gal.
Heavy Naphtha 48°	159	gal.

Melt the rosin with the lime on top, in the 62 gal. of wood oil and the 18 gal. of heavy linseed oil, run quickly to about 565° F. and pull from the fire. Allow to stand until the temperature rises to 585° F., then immediately "chill back" with the 5 gal. of cold heavy linseed oil, and stir well.

Also stir frequently while cooling to 550° F., at which point sprinkle in the litharge about 2 lb. at a time, stirring constantly.

When the litharge is all in, and the heat is down to 480° F., add the cobalt linoleate in small portions and stir until dissolved.

This pale varnish is used as a reducer for San-a-cote paints, thus retaining a high luster.

This varnish carries 19.46% oil.

"Pearl" Mixing Varnish
No. 1715

Strong "1500" Rosin No. 770	500	lb.
China Wood Oil	12½	gal.
Heavy Naphtha 48°	33	gal.
Naphtha 54°	83	gal.

Melt the rosin with the China wood oil and run to 560° F. or to a sufficient temperature so that when the kettle is pulled from the fire the heat shall rise to about 575° F. but not above 595° F.

With the kettle off the fire, allow to cool down to 450° F. then thin with the heavy naphtha.

When cooled to 320° F. or lower, follow with the naphtha.

This short-oil mixing varnish is fairly pale in color; has a most brilliant luster, and dries in 2 or 3 hours.

It is used in cheap paints, and as a blend with other varnishes.

B. B. Paint Mixing Varnish
No. 1732

M. Rosin	100	lb.
Slaked Lime	4	lb.
Manganese Dioxide	4	lb.
Litharge	16	lb.
China Wood Oil	32	gal.
Boiled Linseed Oil	8	gal.

Kerosene 46°	16 gal.
Naphtha 54°	80 gal.

Mix the slaked lime, manganese dioxide and litharge together and sprinkle on top of the rosin, then add the China wood oil.

Heat slowly to about 350° F. stirring frequently. At about 320° F. the mixture will begin to foam and will rise quite high in the kettle by the time the heat is up to 350° F., therefore, whip down the foam and hold at 350° F. to 400° F. until foaming ceases then raise the temperature to 550° F. and pull from the fire.

Allow to stand until the heat is up to 580° F. at which point, hold for 10 minutes by which time the temperature will begin to fall. If it does not fall "chill back" with the commercial boiled oil and stir well.

The object aimed at is to hold at 575° F. to 585° F. until an extra heavy body is obtained and then chill back with the boiled oil.

When cooled down to 480° F. thin with the kerosene, and at 300° F. follow with the naphtha.

This varnish is intended as a grinding mixture for dry pigments in the production of cheap paints for paper, etc.

T Mixing Varnish
No. 1712

Strong "1500" Rosin No. 770	100 lb.
Red Lead	2½ lb.
China Wood Oil	41 gal.
Wood Turpentine	100 gal.
Naphtha 54°	50 gal.
Concentrated Varnish Drier No. 1006	1¼ gal.

Melt the rosin in the wood oil and run to 520° F. or to a sufficient temperature so that when the kettle is pulled from the fire the heat will rise to 565° F. but not above 580° F.

When the kettle is off the fire, allow to stand, stirring occasionally until the temperature begins to fall, and when the heat is down to about 540° F., add the red lead, about half a pound at a time, and stir for 5 minutes, or until the lead is taken up.

When cooled to 420° F. thin with the turpentine and when the temperature is down to 300° F. or lower, follow with the naphtha.

Add the concentrated varnish drier last and stir thoroughly.

This varnish is maple in color; has a good luster; is very water proof and dries in 8 to 10 hours.

It is used as a mixing varnish in grinding paints, varnish colors, enamels, etc., but is not absolutely neutral to lead and zinc pigments.

"B" Mixing Varnish
No. 1711

Strong "1500" Rosin No. 770	100 lb.
Red Lead	4 lb.
China Wood Oil	41 gal.
Heavy Naphtha 48°	40 gal.
Naphtha 54°	100 gal.
Concentrated Varnish Drier No. 1006	1¼ gal.

Melt the 80 lb. of rosin, 41 gal. of China wood oil and run to 540° F., pull from the fire and add the remaining 20 lb. rosin, stirring until the rosin dissolves.

The temperature will be checked to a certain extent by the addition of the cold rosin, but will probably rise to 565° F. to 570° F., then begin to fall.

The main object is to attain a final heat of 565° F. without excessive "bodying," therefore, heat to a sufficient temperature, *i.e.*, 540° F. or less at the start, and stir very frequently.

Allow to cool to 420° F. and thin with the heavy naphtha when cooled to 300° F. or lower, follow with the naphtha, then add the concentrated varnish drier and stir thoroughly.

This varnish is pale in color; has a good luster; is very waterproof, and dries in 6 to 8 hours.

It is used as a mixing varnish, in grinding paints; varnish colors, enamels, etc., but is not absolutely neutral to lead and zinc pigments.

Mixing and Reducing Varnish
No. 1726

China Wood Oil	8 gal.
Honey Oil No. 907	2 gal.
Japan Rosin No. 753	50 lb.
Japan Rosin No. 753	50 lb.
Caustic Soda	1 lb.
Lead Acetate	4 lb.
Naphtha 54°	32 gal.

Heat the mixed oils to 580° F. and the moment they begin to "string" *i.e.*, jelly to thicken, pull the kettle from the fire and add half (50) lb. of the Japan rosin, all at once, and stir until dissolved.

The addition of the cold rosin, which should previously be broken into small pieces, will stop the "jellying" of the wood oil, and cool the mixture down to about 520° F.

Allow to stand until the temperature is down to about 500° F., then commence adding the caustic soda and lead acetate solution, made by previously dissolving the caustic soda and lead acetate in a gallon of hot water.

Add the solution slowly, a little at a time, as it causes excessive frothing.

When all in, and foaming ceases, put the kettle back on the fire and heat to 520° F., then pull from the fire, add the remaining 50 lb. of Japan rosin and stir until dissolved.

When cooled to 330° F. thin with the benzine.

This pale, quick drying varnish has a high luster; is neutral to lead and zinc pigments, and may be baked at 160° F. dry heat, or at 200° F. steam heat.

It is used as a mixing and reducing varnish for varnish colors and enamels.

Heavy Quick-Drying Mixing Oil Varnish
No. 1788

Water White Rosin	50	lb.
Slaked Lime	5	lb.
Manganese Borate	2	lb.
China Wood Oil	50	gal.
Litharge	2	lb.
Heavy Naphtha 48°	50	gal.

Put the rosin in the kettle, pour in the wood oil, then sprinkle the slaked lime and manganese borate on the surface of the oil, but do not stir.

Put the kettle over the fire, heat to about 300° F. without stirring, then begin to stir, and stir very frequently, *i.e.*, about every 5 minutes while raising the heat to 500° F. or to a sufficient temperature so that when the kettle is off the fire and the heat will rise to 525° F. but not to go above 540° F.

Pull from the fire at 500° F., allow to stand until the heat reaches its maximum, then begins to fall.

When the temperature has fallen about 5 degrees, sprinkle in the litharge and stir well.

After the litharge is in, put the kettle back on the fire and cook at 500° F. for 5 to 10 minutes, or until a sample on glass "strings" well when touched with the finger.

When the desired body has been obtained, pull from the fire, allow to cool to 450° F. and thin with the benzine.

This maple colored varnish is practically a heat treated wood oil, cooked at a low temperature.

It is used as a mixing and grinding liquid.

This mixture carries 51.08% oil.

Heavy Gloss Mixing Varnish
No. 1767

Strong "1500" Rosin, No. 770	200	lb.
Red Lead	2½	lb.
China Wood Oil	15	gal.
Excelsior Rubbing Oil No. 894	5	gal.
Wood Turpentine	36	gal.
Naphtha 54°	12	gal.
Concentrated Drier, No. 1006	½	gal.

Melt the rosin in the 15 gal. of China wood oil, then run quickly to 565° F. and pull from the fire.

Allow the temperature to rise to 590° F., then add the 5 gal. of cold rubbing oil No. 894 and stir well.

The "chilling back" with the cold rubbing oil will at once check the rise in temperature, therefore, allow to stand, with frequent stirring, until the heat is down to 565° F. at which point, sprinkle in the red lead, allow to remain on the surface of the hot mixture for about a minute, then stir for 1 or 2 minutes.

Stir every 5 or 10 minutes, the more the better while the mixture is cooling to 450° F. at which point, thin with the turpentine.

When cooled to 300° F. or lower, follow with the benzine, then add the concentrated drier, and stir for about 5 minutes.

This varnish is fairly pale in color; has a brilliant luster, and dries in 6 to 8 hours.

It is used as short-oil mixing and grinding varnish.

The varnish carrier is 22.72% oil.

Gloss-Oil Mixing Varnish
No. 1768

Strong "1500" Rosin, No. 770	300	lb.
China Wood Oil	7½	gal.
Heavy Naphtha 48°	27	gal.
Naphtha 54°	42	gal.

Melt the rosin to about 500° F., pour in the wood oil, raise the heat slowly to 450° F., then run quickly to 550° F. and pull the kettle from the fire.

When off the fire the temperature will probably rise to about 575° F. and then begin to fall.

Also stir frequently while the mixture is cooling to 480° F. at which point thin with the heavy naphtha.

When cooled to 300° F. follow with the naphtha.

This varnish is medium pale in color; has a very high luster, and dries very quickly.

It is used in cement undercoats; in cheap varnish colors; in barrel paints, and as a general, short-oil blending varnish.

The mixture contains 7.33% oil.

English Mixing Varnish

No. 1766

Strong "1500" Rosin No. 770	100	lb.
High Lime Rosin No. 751	100	lb.
Red Lead	6¼	lb.
Excelsior Rubbing Oil No. 895	10	gal.
China Wood Oil	102	gal.
Wood Turpentine	175	gal.
Heavy Naphtha 48°	25	gal.
B. Concentrated Drier, 1006	5	gal.

Melt both rosins in the China wood oil, then run quickly to 550° F. and pull from the fire.

Allow the temperature to rise to 580° F. and then immediately "chill back" with the 10 gal. of cold rubbing oil, No. 891.

Stir well, allow the temperature to fall to 560° F., then commence adding the red lead, about a pound at a time, stirring very frequently.

After the red lead is in, stir about every 5 minutes while the mixture is cooling to 450° F. at which point thin with the turpentine.

When the turpentine is all in, follow with the heavy naphtha, stir vigorously, then add the concentrated varnish and again stir thoroughly.

This varnish is pale in color; has a good luster, and dries in 10 to 12 hours.

It is used exclusively as a mixing and grinding varnish.

The varnish contains 32% oil.

East India "Quick-Drying" Varnish

No. 1927

M. Rosin	75	lb.
No. 1 East India Nubs	75	lb.
V. M. Linseed Oil	6	gal.
China Wood Oil	6	gal.
Slaked Lime	2⅝	lb.
Smith's Japan Rosin, No. 761	12	lb.
Kerosene 46°	3	gal.
Heavy Naphtha 48°	15	gal.
Naphtha 54°	42	gal.

Melt the rosin and the East India gum together; run to 590° F., pull from the fire and add the cold mixed oils in the fine stream, stirring constantly until all of the oil is in. The addition of the cold oils will lower the temperature considerably and possibly chill some of the gum, therefore, replace the kettle on the fire and heat to 500° F.

Hold at 500° F. until the mixture shows clear and bright on glass, then sprinkle in the lime, add the Japan rosin No. 781, stir well, and run to 530° F.

Pull from the fire, allow to cool to 480° F. and thin with the kerosene. Follow with the heavy naphtha, and when cooled to 300° F. or lower, add the naphtha.

This varnish is of a medium-amber color; neutral in character, and dries quickly.

It contains 14.58% oil.

The varnish is used in "gloss paints" and for blending.

Wood Oil Mission Finish

This varnish is made by taking 5 gal. of formula No. 20 flat varnish and dissolving into it with gentle heat 25 lb. of japan wax and then adding 30 gal. of turpentine.

This produces a quick drying, perfectly flat varnish, that is suitable for the very best grades of mission finish work.

Long Oil True Body Varnish

No. 1735

M. Rosin	100	lb.
Slaked Lime	2	lb.
Litharge	12	lb.
China Wood Oil	32	gal.
V. M. Linseed Oil	4	gal.
Soya Bean Oil	4	gal.
True Body Varnish	16	gal.
Kerosene 46°	4	gal.
Naphtha 54°	60	gal.
Concentrated Varnish Drier No. 1007	1	gal.

Melt the rosin with the lime and litharge on top, and run to 500° F. then commence adding the China wood oil, about 5 gal. at a time stirring well.

Continue raising the temperature and adding the wood oil, the object being to add the oil in such a way that the rosin does not chill too much.

As soon as all of the wood oil is in, run quickly to 590° F. and pull from the fire.

Allow to stand until the temperature rises to 615° F. then immediately chill back with the 4 gal. of linseed oil, stir well, and then add the cold soya bean oil. The addition of the cold oils should drop the temperature about 20° but it is advisable to let the mixture stand, stirring occasionally, until the temperature is down to 500° F. at which point, thin with the kerosene, then follow cautiously with the 16 gal. of varnish. The addition of varnish causes excessive frothing, therefore, proceed carefully.

Finally when cooled to 300° F. or lower thin with the naphtha and then add the concentrated varnish drier.

This varnish contains 39% oil.

It may be reduced with an equal volume of benzine without losing its luster.

Indurated Japanese Varnish
No. 1720

Raw M. Rosin	80 lb.
Zinc Carbonate	2 lb.
Manganese Borate	1 lb.
China Wood Oil	40 gal.
Raw M. Rosin	20 lb.
Red Lead	15 lb.
Kerosene 46°	8 gal.
Heavy Naphtha 48°	64 gal.

Place the 80 lb. of rosin in the kettle with the zinc carbonate and manganese on top, then pour in the wood oil.

Heat rather slowly to 580° F. without stirring, then pull from the fire, stir thoroughly and add the remaining 20 lb. of rosin, stirring constantly until dissolved.

The heat will now be down to about 565° F. at which point, commence adding the red lead, about 2 lb. at a time, stir constantly while adding the red lead, and beat down the foam if necessary.

If all of the red lead is not taken up by the time the heat is down to 480° F. put the kettle on the fire and cool at 480–500° F. for a few minutes, or until the lead is taken up, then pull from the fire and thin at 480° F. to 500° F. with the kerosene, and when cooled to 450° F. or 420° F. follow with the heavy naphtha.

This medium pale varnish has a high luster; dries in 8–10 hours; and is exceptionally waterproof.

It is used for waterproofing paper articles and as an anti-rust water varnish for aeroplane wires.

The zinc carbonate is used as a "hardener" for both the rosin and oil.

Hard Quick Drying Japan Varnish
No. 1729

M. Rosin	140 lb.
Slaked Lime	7 lb.
China Wood Oil	7 gal.
Cobalt Resinate No. 822	1 lb.
Strong Borate Oil No. 861	5 gal.
White Oil Drier No. 1011	4 gal.
Heavy Naphtha 54°	8 gal.

Place the rosin in the kettle, sprinkle the lime on top, then pour in the China wood oil.

Heat medium quickly to 565° F. then pull from the fire.

Allow to stand, with occasional stirring, until the thermometer registers 580° F. then add the 2 gal. of cold borate oil and mix well.

The addition of cold oil will check the rising temperature, but will not lower it to any extent, therefore, allow to cool to about 550° F. then add the cobalt resinate and stir until dissolved.

When cooled to 480° F. thin with the heavy naphtha, then add the white oil drier.

Finally, when cooled to 250° F. add the benzine.

This varnish is of a high amber color; has a brilliant luster; and dries in 3–4 hours.

It is used for "blending" and as a cheap interior finish.

It contains 20.66% oil.

Lead resinate may be used in place of the cobalt resinate if desired.

Wood Oil Interior Waterproof Finish

Rosin	150 lb.
Raw Linseed Oil	10 gal.
Raw China Wood Oil	13 gal.
Litharge	13 lb.
Red Lead	10 lb.
Air Slake Lime	20 lb.
Turpentine	25 gal.
Benzine	40 gal.

Place in a copper kettle. Heat the rosin and oils together to 375° F. then add the litharge, and then the red lead, increase the temperature to 450° F. and then add the lime. Then allow the heat to increase to 500° F. and hold at this temperature for about ½ hour, then cool and thin.

Waterproof Wood Finish Varnish
No. 157

Wood Oil	8 gal.
Ceresin Wax	1 lb.
L. & M. Tungate Drier No. 37	2 gal.
Benzine	2 gal.

Heat the wood oil to 240° F. and add the wax in small pieces, when dissolved run to 350° F.

Cool to 200° F., add the drier, then thin with the benzine.

Raw Rosin Carnauba Varnish
No. 1736

Raw M. Rosin	100 lb.
China Wood Oil	20 gal.
Soya Bean Oil	4 gal.
Carnauba Wax	1 lb.
Kerosene 62°	4 gal.
Naphtha 54°	48 gal.
Concentrated Varnish Drier No. 1007	1 gal.

Melt the rosin in the china wood oil; run to 570° F. and pull from the fire.

Allow to stand until the temperature registers 580° F. then chill back with the 4 gal. of cold soya bean oil and stir well.

The soya bean oil should be added all at once and the stirring continued until the temperature begins to fall.

When the temperature has dropped 20° add the carnauba wax, stir until dissolved, then allow to stand with frequent stirring, until cooled to 500° F. at which point thin with the kerosene.

After the kerosene is in, stir frequently while cooling to 330° F. then thin with the naphtha and finally add the concentrated varnish drier.

This varnish is fairly pale in color; has a good luster; dries in about 8 hours; and is extremely waterproof.

It is not neutral; consequently it must not be used with lead and zinc pigments.

It is designed especially for refrigerator cars; bath room wall and kitchen wood work, but it is not long enough in oil for a floor varnish.

Interior "Catch" Varnish
No. 1765

High Lime Rosin No. 751	100 lb.
China Wood Oil	30 gal.
Litharge	7½ lb.
Cobalt Linoleate	1½ lb.
Texaco Spirits	30 gal.
Heavy Naphtha 48°	60 gal.

Melt 25 lb. of the rosin in the 30 gal. of wood oil and run to 525° F., in no case above 550° F.

Hold at 525° F. until a sample of glass begins to "string," *i.e.*, when touched with the finger a string about 3 inches long is obtained.

Watch very carefully, for at this point the wood oil is apt to "jelly" or thicken all at once, therefore, as soon as the oil begins to "string" pull the kettle from the fire and immediately add the remaining 75 lb. of rosin, previously broken into small pieces.

The addition of the rosin will prevent "jellying" and at the same time lower the temperature.

Stir as well as possible to dissolve the rosin, then put the kettle back on the fire, heat to 500° F., add the litharge slowly, about a pound at a time, stir frequently, and run quickly to 550° F. or a sufficient temperature so that when the kettle is off the fire the heat will rise to 575° F., but not above 590° F.

When off the fire, allow to cool to 450° F., add the cobalt linoleate, stir until dissolved, or until the heat is down to 425° F.

When cooled to 400° F. add the thinners.

This varnish is light in color; has a fine luster, and dries in about 8 hours.

It is used as an architectural interior finish.

Crysotile Interior Finish
No. 155

K. Rosin (Hard)	100 lb.
Wood Oil	15 gal.
Manganese Oil	5 gal.
Litharge	5 lb.
Heavy Boiled Oil (Kellogg)	5 gal.
Turpentine	40 gal.

Heat the wood oil quickly to 575° F., and the moment it begins to gelatinize, add the rosin, all at once. Cook until the rosin dissolves then add the cold manganese oil and cool to 420° F. Sprinkle in the litharge run to 492° F., add the heavy boiled oil and cook 1½ to 2 hours at 475° F. Cool to 320° F. and thin.

Chinese Brilliantine (Varnish)

China Wood Oil	40 gal.
High Lime Rosin No. 751	50 lb.
High Lime Rosin No. 751	50 lb.
Soya Bean Oil	8 gal.
Red Lead	4 lb.

Kerosene 46°	8 gal.
Naphtha 54°	112 gal.
Concentrated Varnish Drier No. 1007	2 gal.

Melt 50 lb. of the rosin with the wood oil, run to 500° F. and add the remaining 50 lb. of rosin.

Stir until the rosin dissolves, meantime continue raising the heat, running the temperature up to 600° F. as quickly as possible.

The mixture will froth strongly, therefore, beat down the foam, and the moment the thermometer registers 600° F. add the cold soya bean oil all at once, pull from the fire and stir well.

The addition of cold soya bean oil will start the temperature downward, the usual drop being about 10 or 15 degrees per 8 gal. of cold oil.

After the kettle is off the fire, allow the heat to drop to about 565° F. at which temperature, thin the kerosene.

When cooled to 320° F. follow with the naphtha.

This varnish is very pale in color; dries on glass in about 5 hours and has a most brilliant luster.

It is designed especially as a "pale architectural interior finish" and can be used on light colored woods, on light colored paints, and on bronze or gold leaf.

"A" Insulating Varnish
No. 176

Kauri (Australian) Gum	100 lb.
Wood Oil	6½ gal.
Castor Oil	6½ gal.
Turpentine	20 gal.

Fuse the gum, add the wood oil (previously heated to 350° F.), mix well and then add the cold castor oil in a fine stream, gradually raising the heat to 450° F.

When all is in, run to 520° F., cool to 350° F. and thin.

Extra Pale Flat Grinding Varnish
No. 1752

a. Pale Drying Wood Oil No. 963	8 gal.
Wood Turpentine	8 gal.
b. Stearate Jelly No. 1506	4 gal.
Wood Turpentine	8 gal.

Directions:

a. Thin the 8 gal. of drying wood oil No. 963, with the 8 gal. of turpentine and stir until thoroughly mixed.

b. Thin the 4 gal. of heavy stearate jelly No. 1506 with 8 gal. of turpentine.

Add the turpentine in small portions, stirring constantly, continuing the agitation until the mixture is free from lumps.

Best results are obtained by "churning."

Finally, allow the two mixtures, *a* and *b* to stand for about half an hour, then pour *a* into *b* and stir until thoroughly mixed.

Allow this mixture to stand for about half an hour, then strain through cheese cloth.

This peculiar varnish is quite turbid and resembles thick cream, but a brush coat is transparent.

The varnish begins to "flat" in about an hour, and dries in 6 to 8 hours with a "dead flat" surface.

It contains 3.07% aluminum stearate, and 30.98% oil.

"Flat grinding varnish" is used in conjunction with other grinding liquids for producing flat and half flat paints also as a mixture in flat wall finishes.

Extra Pale Slow Drying Gloss Wall Liquid
No. 1780

Water White Rosin	100 lb.
China Wood Oil	32 gal.
Soya Bean Oil	16 gal.
Slaked Lime	8 lb.
V. M. Linseed Oil	4 gal.
Kerosene 46°	16 gal.
Naphtha 54°	48 gal.
Concentrated Varnish Drier, No. 1007	2 gal.

Melt the rosin in the China wood and soya bean oils, and run to 500° F., then pull the kettle from the fire and sprinkle the slaked lime on the surface of the mixture, but do not stir for a minute or two, as the lime causes excessive frothing.

After standing for a couple of minutes, stir the lime down into the hot oil, and if the "head" (foam) rises too high, whip down and replace the kettle on the fire and raise the heat slowly to 550° F. stirring very frequently and whipping down the "head" when it rises too high.

Frothing will have ceased by the time the heat is up to 550° F., therefore, when this temperature has been attained cook at 550° F. for 15 minutes, then pull from the fire.

Allow to cool to 450° F. then thin with the kerosene, when cooled to 300° F. or lower, follow with the naphtha, then add the concentrated varnish drier, and mix well.

This long-oil varnish is pale in color;

levels nicely, and dries in 8 to 10 hours.

It is used both as a grinding and mixing varnish. It is also used as a mixing varnish in gloss mill white paints.

This varnish carries 43.53% oil.

Extra Hard Grinding Varnish
No. 1785

Glycerin Rosin No. 756	100	lb.
China Wood Oil	24	gal.
Litharge	2⅛	lb.
Manganese Borate	⅜	lb.
Zinc Resinate No. 812	4	lb.
Heavy Naphtha 48°	32	gal.
Naphtha 54°	16	gal.

Melt the glycerin rosin in the wood oil and run to about 400° F., then sprinkle in the litharge and manganese borate, previously mixed together.

Stir constantly while adding the drying salts, and when all in, raise the heat to 520° F. or to a sufficient temperature so that when the kettle is off the fire the heat will rise to 565° F. but not above 575° F.

With the kettle off the fire, see that the temperature reaches 575° F., then allow to stand, with frequent stirring, until the temperature drops to 450° F. at which point, sprinkle in the zinc resinate and stir for about 5 minutes, after which replace the kettle on the fire and cook at 450° F. for 20 or 30 minutes until the varnish becomes sticky.

Thin at 425° F. with the heavy naphtha, and when cooled to 300° F., follow with the naphtha.

This varnish is exactly like No. 1700 except that it contains zinc resinate as a hardening agent.

It has a brilliant luster; flows and levels nicely; dries in 8 to 10 hours, and becomes intensely hard.

The varnish contains 31.05% oil.

Elastic Grinding Varnish
No. 1701

Glycerin Rosin No. 756	100	gal.
China Wood Oil	48	gal.
Litharge	7	lb.
Manganese Borate	1	lb.
Soya Bean Oil	8	gal.

Melt the glycerin rosin in the wood oil and run to 420° F., then sprinkle in the litharge and manganese borate, previously mixed together.

When the drying salts are all in, raise the heat to 593° F. and immediately add the cold soya bean oil, stir well, and pull from the fire.

Allow to cool to 420° F., stirring frequently while the temperature is falling.

When cooled to 420° F. or 400° F. thin with heavy naphtha.

This varnish is maple in color; medium heavy in body; levels and flows nicely; is neutral in character, and dries in about 8 to 10 hours.

It is used exclusively as a grinding medium for all colored pigments designed as pastes for varnish colors and colored baking enamels.

Wood Oil Furniture Varnish
No. 177

Water White Rosin	100	lb.
Lead Acetate	10	lb.
Slaked Lime	7	lb.
Wood Oil	6½	gal.
Lead Manganese Linoleate	1	lb.
Wood Turpentine	7	gal.
Benzine	8	gal.

Melt the rosin, add the sugar of lead, sift the lime and cook at 350° F. until the lead is taken up, then run to 500° F. and cook 15 minutes. Heat the wood oil to 350° F. for 30 minutes, then add the linoleate and cook 2 hours at 320° F.

Pour the hot wood oil into the melted rosin and run to 600° F. Cook about 30 minutes, cool to 320° F. and thin.

Quick-Drying Furniture Varnish
No. 1933

High Lime Rosin No. 751	75	lb.
Kauri No. 1	25	lb.
Heavy "Alinco" Oil No. 853	4	gal.
China Wood Oil	2	gal.
Wood Turpentine	11	gal.
Naphtha 54°	22	gal.
Concentrated Varnish Drier No. 1007	½	gal.

Melt the rosin and kauri together in an open kettle, then run to 525° F. and cook for about 20 minutes or until the melted gum drips from the stirrer like hot oil.

When thoroughly melted, pull the kettle from the fire and add the two oils previously mixed together and heated to 300° F.

Add the hot oils in a fine stream, stirring constantly, and when all in, put the kettle back on the fire and heat rather slowly to 580° F. stirring very frequently.

As soon as the temperature of 580° F. has been reached, pull from the fire and allow to cool to 450° F. stirring about every 5 minutes while the mixture is cooling down.

Thin at 450° F. with the turpentine, and when cooled to 300° F. follow with the benzine, then add the concentrated drier and stir for 4 or 5 minutes.

This varnish is medium pale in color; neutral in character; has a brilliant luster and dries quickly.

It is used as a "high grade" furniture varnish, and as a "blend" for hardening rosin-wood oil floor varnishes.

It carries 12.91% oil.

Full Luster Furniture Varnish
No. 149

Pale Rosin (Hard)	70	lb.
Prepared Mariola No. 53	10	lb.
Pale Kauri Seeds	10	lb.
Zinc Resinate	10	lb.
Manganese Resinate	2½	lb.
Red Lead	7½	lb.
Hard Z.M.L. Oil No. 348	5	gal.
Wood Oil	10	gal.
Turpentine	12	gal.
Benzine	35	gal.

Put the gums and the wood oil in the kettle and melt together, add the zinc and manganese resinate and cook at 400° F. to 450° F. until taken up, then run to 600° F., add the cold hard oil and allow to cool to 400° F., then sprinkle in the red lead and run to 480° F. Cook for 2 hours at 450° F. to 480° F., cool to 350° F. and thin.

Wood Oil Waterproof Floor Varnish

Manila Chips	50	lb.
Medium Rosin	150	lb.
Litharge	40	lb.
Lime	18	lb.
Turpentine	40	gal.
Benzine	50	gal.
China Wood Oil	45	gal.

Melt the rosin first and heat to 500° F. Then add the Manila and stir until it is dissolved. This is best done in an open copper kettle.

When the rosin and Manila are mixed together thoroughly, add the litharge slowly and stir it in well. When the litharge is all in, commence to add the lime slowly. After the lime is all in, add the wood oil and hold at a temperature of about 400° F. for 1 hour, then cool and add the thinner.

The batch should be made in a kettle that will hold at least 200 gal.

Crustacote Floor Varnish
No. 1703

China Wood Oil	36	gal.
Plain Hard Rosin No. 750	100	lb.
Linseed Oil V. M.	4	gal.
Litharge	7	lb.
Red Lead	3	lb.
Naphtha 54°	64	gal.
Concentrated Varnish Drier No. 1007	1	gal.

Melt the rosin in the wood oil and then run quickly to 580° F., pull from the fire and immediately "chill down" by adding the 4 gal. of linseed oil, all at once.

This chilling back will check the heat and start the temperature downward, therefore, stir well, and as soon as the heat has dropped 10 degrees, commence adding the litharge and red lead, previously mixed together, about a pound at a time, stirring constantly.

All of the lead should be in by the time the heat is down to 540° F. and will be taken up when the mixture has cooled to 330° F.

It is advisable to stir frequently while the varnish is cooling down to 330° F., the object being to prevent excessive bodying.

Thin at 330° F. or 320° F. with the benzine, then add the concentrated varnish drier and stir well.

This floor varnish is pale in color; is medium heavy in body, and dries dust free in 8 hours.

It is hard enough to walk on after drying overnight. It will not scratch, crack, or flat, and will not turn white with water.

It contains 37.48% oil, and is durable enough for an exterior varnish. Viscosity–22.04.

"Window Frost" (Flake Varnish)
No. 1746

China Wood Oil	8	gal.
Zinc Stearate No. 814	1	lb.
A. S. Turpentine No. 1509	8	gal.
Wood Turpentine	4	gal.

Mix the dry zinc stearate with the wood oil, heat to 400° F. and cook at this temperature for 3 hours.

Do not let the temperature rise above 420° F. but endeavor to hold it between 400° F. to 415° F. for the specified time.

At the expiration of the above time, *i.e.*, 3 hours, add the thinners.

Aluminum stearate may be used in place of the zinc stearate if desired, but the varnish will be less opaque.

This varnish dries with a crystalline or flake surface resembling frosted glass. It carries 41.56% oil and is durable.

Transparent Flat Varnish

No. 1753

a. Drying Wood Oil No. 963	4 gal.
Wood Turpentine	8 gal.
Mixing and Reducing Varnish No. 1726	4 gal.
b. Heavy Stearate Jelly No. 1506	4 gal.
Wood Turpentine	8 gal.

a. First, thin the 4 gal. of drying wood oil, No. 963 with the 8 gal. of turpentine.

Let stand for about 10 minutes, then add the mixing and reducing varnish No. 1726 and mix thoroughly, by stirring after which allow to stand for about half an hour.

b. Thin the 4 gal. of heavy stearate jelly with the gal. of turpentine, adding the turpentine in small portions and stirring constantly until the mixture is free from lumps, allow to stand for about half an hour to clarify.

Finally pour *a* into *b* and stir until thoroughly mixed, after which let stand for about an hour, then strain through two thicknesses of cheese cloth.

This flat-varnish is pale in color, and transparent. It begins to "flat" in about 30 minutes, and dries in 4 to 5 hours with a beautiful "flat-rub" surface. The varnish contains 3.11% aluminum stearate, and 18.63% oil.

It is used exclusively as an "interior flat varnish."

Increased flatness and great durability is obtained by increasing the percentages of drying oil.

Increasing the percentage of stearate jelly also produces more flatness, but decreases durability and retards drying.

Flat A. M. Finish

No. 108

Australian Nubs	80 lb.
Mariola	20 lb.
Plaster of Paris	2 lb.
Wood Oil	10 gal.
Flat Turpentine	40 gal.

Melt the mariola and as soon as the water is off, add the Australian nubs and run to 450° F.; sprinkle in the plaster and run to 520° F. Add the wood oil slowly and again heat to 520° F., then allow to cool to 320° F. and thin.

Flat Wood Oil Varnish

No. 167

Egg Shell Gloss

a. China Wood Oil	50 gal.
Manganese Resinate	15 lb.

Heat the wood oil to 350° F., cook for 2 hours, then add the resinate in small portions and cook at 320° F. to 350° F. for two hours.

b. Water White Rosin	100 lb.
Dry Slaked Lime	7½ lb.
Heavy Wood Oil	2 gal.
Lead Linoleate	10 lb.
Turpentine	15 gal.

Melt the rosin and wood oil together, sift in the lime and run to 520° F. Cool to 350° F., add the lead linoleate in small pieces, stir constantly and cook for 1 hour at 350° F., then thin.

Mix 3 parts of *a* with 1 part of *b*.

"M" Flat Wall Liquid

High-Lime Rosin No. 751	100 lb.
Slaked Lime	4 lb.
Pulverized Lead Acetate	8 lb.
China Wood Oil	40 gal.
Soya Bean Oil	8 gal.
Manganese Sulphate	8 lb.
Kerosene 46°	40 gal.
Naphtha 54°	80 gal.
White Enamel Drier No. 1038	2 gal.

Put the rosin in the kettle, cover the surface with the slaked lime, follow with the lead acetate, then pour in the China wood oil.

Heat quickly to 400° F. without stirring, then raise the heat slowly to 590° F., stirring very frequently.

The moment the temperature is down to 540° F. pull from the fire and immediately add the 8 gal. of cold soya bean oil all at once and stir well.

Allow to stand until the temperature is down to 540° F., then sprinkle in the manganese sulphate, a little at a time, stirring constantly and for about 5 minutes after all of the manganese is in.

When cooled to 480° F., thin with the kerosene, and when cooled to 300° F. or lower, follow with the naphtha after which add the white oil drier.

This flat wall liquid contains 30% oil. It is medium light in color; flows freely and levels nicely; it dries on glass in 6 hours with a high luster.

This liquid is used for grinding flat wall paints, varnish colors, cheap tinted enamels, etc.

Flat Congo Finish
No. 107

Congo Rosin	100	lb.
Wood Oil	12	gal.
Flat Turpentine	36	gal.

Fuse the gum to a thin liquid, add the cold wood oil slowly a little at a time, and run to 520° F.

Do not cook any length of time, but pull from the fire and let cool to 350° F. then thin.

Waterproof Wood Oil Varnish B.
No. 1739

M. Rosin	75	lb.
China Wood Oil	36	gal.
M. Rosin	25	lb.
Red Lead	4	lb.
Heavy Naphtha 48°	10	gal.
Naphtha 54°	50	gal.
Concentrated Varnish Drier No. 1007	½	gal.

Melt the 75 lb. of rosin in the China wood oil, run to 530° F. and pull from the fire.

Allow to stand until the temperature is up to 575° F. or 580° F., then add the remaining 25 lb. of rosin, previously broken into small pieces and stir until dissolved.

The addition of the rosin will start the temperature downward, therefore, allow to cool to 450° F., then sprinkle in the red lead, about a pound at a time, and stir well.

After the red lead is in, stir frequently while the mixture is cooling to 400° F., at which point, thin the heavy naphtha.

When cooled to 400° F. or lower, follow with the benzine, then add the concentrated varnish drier and stir for about 5 minutes.

This varnish is pale in color; has a high luster; dries in about 8 hours, and is very waterproof. It is, however, not neutral in character, consequently cannot be used as a mixing varnish with lead and zinc pigments.

It is used chiefly as an exterior finishing varnish.

Special Ester Gum Spar Varnish
No. 1794

Ester Gum	100	lb.
China Wood Oil	40	gal.
Wood Turpentine	16	gal.
Heavy Naphtha 48°	48	gal.
Concentrated Varnish Drier, No. 1007	½	gal.

Melt the ester gum in the China wood oil, then run to 525° F., but not higher.

If the mixture is heated, not too fast, to about 500° F. and the kettle pulled from the fire, the temperature will probably rise to just about 525° F.

In any event, the temperature must not exceed 535° F.

When the kettle is off the fire and a temperature of 525° F. has been attained, allow to stand until the heat drops 5 degrees, then stir frequently while the mixture is cooling down to 400° F., at which point thin with the turpentine and follow with the heavy naphtha, after which add the drier.

By cooking the oil and gum at 525° F. for 10 to 20 minutes and allowing to cool slowly to 400° F. the mixture can be made to take 80 gal. of the thinner.

This varnish is pale in color; flows and levels nicely; has a good luster; dries in 6 to 8 hours, and is waterproof but unfortunately is not gas proof.

By regulating the quantity of thinner any desired body can be obtained for thickening other spar varnishes which are too thin.

This exterior durable varnish contains 37% oil.

Ester Gum Body Varnish
No. 150

Light Ester Gum	100	lb.
Lime (Flour)	2¼	lb.
Pale Manganese Oil	18	gal.
Wood Oil	18	gal.
Turpentine	56	gal.

Mix the oils together with the gum and heat to 400° F., sift in the lime and run quickly to 520° F., cool to 450° F. and cook 3 hours until stringy, then cool to 350° F. and thin.

Low Acid Ester Gum Spar Varnish
No. 1795

China Wood Oil	32	gal.
"Chill Back" Oil No. 878	4	gal.
Pale Ester Gum	50	lb.
Pale Ester Gum	50	lb.
Heavy Naphtha	80	gal.
Concentrated Varnish Drier No. 1007	½	gal.

Heat the China wood oil quickly to 520° F. or to a sufficient temperature so that when the kettle is off the fire the heat will rise to 565° F. but not above.

As soon as a temperature of 565° F. has been attained or less, if there is any indication of "stringing," chill back with the cold oil No. 878 stir vigorously, then immediately add 50 lb. of ester gum, previously broken into small pieces, and stir until dissolved.

The above treatment will start the temperature down quickly; and, if the stirring be continued, there will be very little danger of "jellying" while the mixture is cooling to 450° F., at which point, thin with the heavy naphtha, then add the drier.

This varnish is pale in color; flows and levels well; dries in about 8 hours; has a brilliant luster; and becomes intensely hard.

It is neutral in character; gasproof; impervious to water; and does not "skin over" in the can.

Ester Gum Furniture Rubbing Varnish
No. 1793

Ester Gum	90 lb.
Lead Resinate No. 782	9 lb.
Manganese Resinate No. 780	1 lb.
China Wood Oil	10 gal.
Wood Turpentine	10 gal.
Heavy Naphtha 48°	20 gal.

Melt the ester gum in the China wood oil, then run quickly to 550° F. or a sufficient temperature so that when the kettle is off the fire the heat will rise to 565° F. but not above 575° F.

With the kettle off the fire, allow to stand until the heat rises to 565° F. then add the two resinates, previously broken into small pieces and stir until dissolved.

Also stir very frequently while cooling to 425° F. at which point, thin with the turpentine, then follow with the heavy naphtha.

This varnish is medium light in color; has a high luster; dries quickly and becomes intensely hard.

It may be used as a furniture varnish, and as an interior hard oil finish. It is also used as a quick rubbing varnish.

This varnish contains 20.55% oil.

Wood Oil Varnish for Gloss Carriage Paints

M. Rosin	300 lb.
Soda Ash	11 lb.
Water	2 gal.
Manganese Borate	12 lb.
Air Slaked Lime	15 lb.
Sugar of Lead	10 lb.
China Wood Oil	18 gal.
Benzine	60 gal.

After the rosin is in the kettle dissolve the soda ash in the water and add it to the rosin. Now melt the rosin and boil it until it is clear, then add the borate of manganese, then raise the heat to 500° and then add the lime and stir in well.

Then remove the kettle from the fire and add the sugar of lead and allow it to dissolve, then add the China wood oil and run the kettle back on the fire, and heat to 550° F. and then remove the kettle from the fire and thin with the benzine when cool enough to permit doing so safely.

Pale Neutral Enamel Varnish
No. 1714

Water White Rosin	100 lb.
Slaked Lime	8 lb.
Pulverized Lead Acetate	16 lb.
China Wood Oil	32 gal.
V. M. Linseed Oil	4 gal.
Litharge	8 lb.
Wood Turpentine	16 gal.
Naphtha 54°	80 gal.

Melt the rosin, with the lime and lead acetate on top, and heat to 400° F. without stirring, the mixture will froth strongly until the combined water is off.

When a temperature of 400° F. has been reached, pull from the fire, stir well, then add the cold wood oil, a little at a time. Stir at first as much as possible before the rosin chills then add the remaining wood oil if any, and put the kettle back on the fire.

Heat to 525° F. or to a sufficient temperature so that when the kettle is off the fire the heat will rise to 580° F.

With the kettle off the fire, wait until the temperature of 580° F. has been reached then "chill back" with the 4 gal. of cold linseed oil, added all at once. Stir briskly and when the temperature starts to drop, commence adding the litharge, about 2 lb. at a time, stirring very frequently and beating down the foam when necessary.

After the litharge is all in, stir frequently while the mixture is cooling to 425° F. at which point thin with the turpentine. When cooled to 325° F. follow with the naphtha.

This varnish is extremely pale in color; heavy bodied; neutral to lead, zinc and other pigments; and dries on glass in 3–4 hours.

It is used as a grinding varnish and as an enamel mixing varnish, either alone or with dammar varnish.

Pale Extra Hard Enamel Varnish
No. 1781

Water White Rosin	100 lb.
Slaked Lime	8 lb.
Pulverized Lead Acetate	8 lb.
China Wood Oil	8 gal.
Zinc Resinate No. 812	4 lb.
Kerosene 46°	4 gal.
Wood Turpentine	4 gal.
Naphtha 54°	24 gal.

Melt the rosin, with the slaked lime and lead acetate on top, to about 400° F. without stirring, then stir carefully, as there is much foaming while the combined water and acetic acid in the lead acetate is being driven off.

Meantime, continue raising the heat slowly, stirring frequently, and when foaming ceases, or nearly so, run quickly to 550° F. and then pull the kettle from the fire.

As soon as the kettle is off the fire, add the China wood oil in a fine stream stirring constantly.

After the wood oil is in, allow to cool to 450° F., stirring very frequently while the mixture is cooling down. When the temperature is down to 450° F. sprinkle in the zinc resinate and mix well, then replace the kettle on the fire and cook at 450° F. for 15 min. stirring very frequently.

After cooking for 15 min., pull from the fire and thin with the kerosene, then follow with the turpentine. When cooled to 300° F. or lower, thin with the naphtha.

This pale enamel varnish flows and levels perfectly; dries in about 4 hours with a brilliant luster; and becomes intensely hard.

The varnish carries 16.09% oil.

Heavy White Enamel Varnish
No. 1782

Water White Rosin	100 lb.
Slaked Lime	8 lb.
Pulverized Lead Acetate	8 lb.
China Wood Oil	8 gal.
Zinc Resinate No. 812	4 lb.
Kerosene 46°	4 gal.
Wood Turpentine	4 gal.
Naphtha 54°	16 gal.

Melt the rosin, with the slaked lime and lead acetate on top, to about 350° F. without stirring.

The evolution of combined water and acetic acid in the lead acetate causes excessive foaming, this therefore, is the object of not stirring at first.

When a temperature of 350° F. has been attained, stir cautiously, then raise the heat to 550° F. stirring very frequently.

At 550° F. pull the kettle from the fire, add the cold wood oil, in a fine stream, stirring constantly until the oil is in, then frequently while the mixture is cooling down to 450° F. at which point sprinkle in the zinc resinate and mix well.

After the zinc resinate is in, replace the kettle on the fire and cook at 450° F. for 30 minutes, stirring frequently, then pull from the fire, allow to cool to 400° F. with occasional stirring, and thin with the kerosene, following with the turpentine.

When further cooled to 300° F. thin with the benzine.

This heavy bodied varnish is pale in color; levels perfectly; has a brilliant luster; and dries in 4–5 hours. It is also neutral in character. It is used in cheap household enamels, and floor paints.

The varnish carries 18.49% oil.

Enamel Furniture Varnish
No. 146

Pale Rosin	100 lb.
Dry Slaked Lime	5 lb.
Litharge	10 lb.
Pale Manganese Oil	2 gal.
Wood Oil	8 gal.
Wood Turpentine	10 gal.
Benzine	25 gal.

Melt the rosin, sprinkle in the litharge a little at a time and cook at 300° F. until taken up, then sift in the lime and run to 500° F. Add the cold manganese oil, then the wood oil in portions of about 1 gal. each, keeping the temperature at about 450° F. When all of the oil is in, run to 600° F.

Cool to 350° F., add the turpentine and finally the benzine.

Enamel Varnish
No. 1728

Water White Rosin	170	lb.
Slaked Lime	7	lb.
Zinc Oxide	5	lb.
China Wood Oil	22½	gal.
Litharge	9	lb.
Heavy Naphtha 48°	60	gal.

Put the China wood oil in the kettle, then stir in the slaked lime and zinc oxide, after which add the rosin, preferably broken in small pieces.

Heat to about 400° F. or until the rosin melts with very little stirring, but after the rosin has dissolved stir very frequently while raising the heat to 590° F.

The addition of cold linseed oil will start the temperature downward, therefore, as soon as the heat is down to 560° F., sprinkle in the litharge, about a pound at a time, stirring constantly.

After the litharge is in, stir occasionally, say once every 10 minutes, while the mixture is cooling to 440° F., at which point thin with the heavy naphtha.

If this varnish is made in an aluminum kettle it will be pale enough in color for white enamel.

It has a high luster; dries in about 8 hours and is extremely hard.

It is used for golf ball enamels and other enamels where hardness and luster are desired features.

Wood Oil White Reed Dipping Varnish

Water White Rosin	375	lb.
Zinc Oxide	½	lb.
Air Slaked Lime	17	lb.
White Sugar of Lead	12	lb.
Raw China Wood Oil	13	gal.
Turpentine	15	gal.
Benzine	30	gal.

To be made in a clean copper kettle. First melt the rosin and heat to 475° F. Then add the lime and stir in thoroughly and heat slowly to 550° F. Now remove from the fire and add the sugar of lead and stir until it is dissolved. Then add the ½ lb. of zinc oxide and immediately add the China wood oil and stir well. Next add the turpentine as soon as possible and then the benzine.

Wood Oil Dipping Varnish for Chairs, Etc.

Light Rosin	150	lb.
Lime	7½	lb.
Litharge	10	lb.
Raw China Wood Oil	40	gal.
Benzine	40	gal.

Melt the rosin and run to 300° F. Then add the litharge and increase the heat to 450° F. and then put in the lime.

At 475° F. add the China wood oil and run once to 500° F. and then cool and thin.

Wood Oil Varnish for Cement Paints

Rosin	160	lb.
Air Slaked Lime	8	lb.
Sugar of Lead	6	lb.
China Wood Oil	30	gal.
Benzine	35	gal.

Melt the rosin and run the heat to 400° F., then add the lime and at 460° F. put in the sugar of lead and stir until it is all taken up, then add the China wood oil and heat to 500° F. and hold for one half hour at this temperature, then cool and add the benzine.

This liquid is intended to be used as the thinner for pigments ground in linseed oil, used in making cement paints.

Portland Varnish
No. 156

Pale Rosin	100	lb.
Wood Oil	20	gal.
Manganese Oil	5	gal.
Pine Oil	2½	gal.
Petroleum Distillate	45	gal.
M. & L. Tungate Drier No. 37	1	gal.

Melt the rosin and wood oil together and run to 600° F., add the cold manganese oil and cook 1 to 1½ hours, at 510° F. Cool to 320° F., add the pine oil, then thin with the distillate. Add the drier last.

Concrete Liquid for Cement Paints
No. 1792

China Wood Oil	40	gal.
Bleached Linseed Oil	10	gal.
Water White Rosin	50	lb.
Heavy Naphtha 48°	60	gal.

Heat the 40 gal. of China wood oil to 525° F., then pull the kettle from the fire, and commence adding the rosin, previously broken into small pieces.

Add a shovelful of rosin at a time and stir well until dissolved.

When all of the rosin is in, add the 10 gal. of linseed oil.

Put the kettle back on the fire, run to 470° F., stirring frequently, then again pull from the fire.

Cool down quickly to 300° F. with the hose, spraying the cold water on the lower half of the kettle.

Distribute the water as evenly as possible on all sides of the kettle, as too much water in one place may crack the kettle at the rivets.

When cooled to 300° F. to 425°F. thin with the heavy naphtha.

This varnish is pale in color; flows and levels nicely, and is very waterproof.

It is not neutral in character, and dries slowly.

It is used exclusively in cement paints.

The varnish contains 46.87% oil.

ETHYL CELLULOSE COMPATIBLE VARNISHES

Formula No.	1	2	3	4	5	6	7	8
Durez 550	75.0	75.0	8.99	8.99	25.0	25.0	25.0	25.0
Teglac 15	....	....	....	....	....	....	....	....
Staybelite A-1 Ester	....	....	26.9	26.9	75.0	75.0	75.0	75.0
Heat Bodied Perilla + 10% Tung Oil	93.75	....	34.5	....	....	....	....	....
Heat Bodied Perilla Oil	....	....	....	....	....	....	....	....
Archer-Daniels-Midland Oil No. 631	....	93.75	....	34.5	....	....	....	....
Tung Oil	....	....	14.0	14.0	39.0	39.0	39.0	39.0
C Body Varnish Grade Linseed Oil	....	....	....	....	....	39.0	78.0	156.0
Heat Bodied Linseed Oil	....	....	....	....	....	....	....	....
Heat Bodied Soya Bean Oil	....	....	....	....	....	....	....	....
Linseed Oil Fatty Acids	31.25	31.25	11.5	11.5	....	....	....	....
Xylol	133.4	133.4	64.0	64.0	139.0	178.0	217.0	295.0
Oil Length (Gallons)	21	21	21	21	5	10	15	25
% Solids in Varnish	60%	60%	60%	60%	50%	50%	50%	50%
10% Ethyl Cellulose Solution	200.0	200.0	96.0	96.0	139.0	178.0	217.0	295.0
Ethyl Cellulose	20.0	20.0	9.6	9.6	13.9	17.8	21.7	29.5
Xylol (added with Ethyl Cellulose)	144.0	144.0	69.1	69.1	100.1	128.2	156.2	212.4
Butanol (added with Ethyl Cellulose)	36.0	36.0	17.3	17.3	25.0	32.0	39.1	53.1
% Solids after adding Ethyl Cellulose Solution)	41.2%	41.2%	41.2%	41.2%	36.7%	36.7%	36.7%	36.7%
Drier Content (Based on Oil)								
% Pb as Metal	0.5%	0.5%	0.5%	0.5%	0.5%	0.5%	0.5%	0.5%
% Co as Metal	0.003%	0.003%	0.003%	0.003%	0.003%	0.003%	0.003%	0.003%
% Mn as Metal	0.003%	0.003%	0.003%	0.003%	0.003%	0.003%	0.003%	0.003%
Drying Time of Varnish (Tack Free)	48 hr.	48 hr.	14 hr.	24 hr.	5 hr.	22 hr.	26 hr.	55 hr.
Drying Time of Varnish + Ethyl Cellulose (Tack Free)	21 hr.	21 hr.	7 hr.	8 hr.	2 hr.	9.5 hr.	10 hr.	10 hr.
Notes on Varnishes Before Adding Ethyl Cellulose	Oil and resin run to 250° C. in 20 minutes. Cooled to 200° C. and thinned with Xylol. Linseed fatty acids added by cold-cut process.		All ingredients mixed by cold-cut process.		Oil and resin run to 300° C. in 25 min. Cooled to 200° C. and thinned.		Tung oil and resin run to 290° C. in 20 minutes. Chilled back with linseed oil and run rapidly to 300° C. No hold. Cooled to 200° C. and thinned.	

ETHYL CELLULOSE COMPATIBLE VARNISHES—*Continued*

Formula No.	9	10	11	12	13	14	15	16
Durez 550	100.0	100.0	100.0	100.0	100.0	100.0	100.0	75.0
Teglac 15	....	....	....	....	....	....	....	25.0
Staybelite A-1 Ester	....	....	....	....	....	....	....	...
Heat Bodied Perilla + 10% Tung Oil	....	....	....	....	....	....	....	...
Heat Bodied Perilla Oil	120.0	100.0	90.0	....	....	....	....	...
Archer-Daniels-Midland Oil No. 631	....	....	....	....	....	....	....	...
Tung Oil	....	20.0	30.0	....	105.0	100.0	....	100.0
C Body Varnish Grade Linseed Oil	....	....	....	....	....	48.0	....	48.0
Heat Bodied Linseed Oil	....	....	....	....	....	....	117.0	...
Heat Bodied Soya Bean Oil	....	....	....	120.0	....	....	....	...
Linseed Oil Fatty Acids	....	....	....	....	12.0	12.0	29.0	12.0
Xylol	220.0	220.0	220.0	220.0	217.0	260.0	246.0	260.0
Oil Length (Gallons)	15	15	15	15	15	20	18	20
% Solids in Varnish	50%	50%	50%	50%	50%	50%	50%	50%
10% Ethyl Cellulose Solution	220.0	220.0	220.0	220.0	217.0	260.0	246.0	260.0
Ethyl Cellulose	22.0	22.0	22.0	22.0	21.7	26.0	24.6	26.0
Xylol (added with Ethyl Cellulose)	158.4	158.4	158.4	158.4	156.2	187.2	177.1	187.2
Butanol (added with Ethyl Cellulose)	39.6	39.6	39.6	39.6	39.1	46.8	44.3	46.8
% Solids after adding Ethyl Cellulose Solution	36.7%	36.7%	36.7%	36.7%	36.7%	36.7%	36.7%	36.7%
Drier Content (Based on Oil)								
% Pb as Metal	0.5%	0.5%	0.5%	0.5%	0.4%	0.4%	0.4%	0.4%
% Co as Metal	0.003%	0.003%	0.003%	0.003%	0.01%	0.01%	0.01%	0.01%
% Mn as Metal	0.003%	0.003%	0.003%	0.003%	0.05%	0.05%	0.05%	0.05%
Drying Time of Varnish (Tack Free)	22 hr.	31 hr.	22 hr.	more than 1 week	1 hr. 40 min.	21 hr.	48 hr.	5 hr.
Drying Time of Varnish + Ethyl Cellulose (Tack Free)	9 hr.	10 hr.	10 hr.	72 hr.	40 min.	7 hr.	23 hr.	2.5 hr.
Notes on Varnishes Before Adding Ethyl Cellulose	Oil and Resin run to 300° C. in 25 minutes. Held 10 minutes. Cooled to 200° C. and thinned.	Oil and resin run to 300° C. in 25 minutes. Cooled to 200° C. and thinned.		Oil and resin run to 300° C. in 25 minutes. Held 20 minutes. Cooled to 200° C. and thinned.	Oil and resin run to 300° C. in 25 minutes. Cooled to 200° C. and thinned.		Oil and resin run to 300° C. in 25 minutes. Held 20 minutes. Cooled to 200° C. and thinned.	Oil and resin run to 235° C. Chilled back with linseed and linseed fatty acids. Run to 275° C. Cooled to 200° C. and thinned.

ETHYL CELLULOSE COMPATIBLE VARNISHES—*Continued*

Formula No.	17	18	19	20	21	22	23
Bakelite BR254	100	100	75	50	25	75	50
Ester Gum	...	...	25	50	75	..	..
Neville Resin R-3	...	...	..	..	..	25	50
Teglac 15	...	...	..	..	..	..	..
Super Beckacite 1001	...	...	..	..	..	..	..
Amberol ST 137	...	...	..	..	..	..	..
Amberol 801	...	...	..	..	..	..	..
Tung Oil	117	100	100	100	100	100	100
C Body Varnish Grade Linseed Oil	...	48	48	48	48	48	48
Linseed Oil Fatty Acids	...	12	12	12	12	12	12
Xylol	217	260	260	260	260	260	260
Oil Length (Gallons)	15	20	20	20	20	20	20
% Solids in Varnish	50%	50%	50%	50%	50%	50%	50%
10% Ethyl Cellulose Solution	217.0	260.0	260.0	260.0	260.0	260.0	260.0
Ethyl Cellulose	21.7	26.0	26.0	26.0	26.0	26.0	26.0
Xylol (added with Ethyl Cellulose)	156.2	187.2	187.2	187.2	187.2	187.2	187.2
Butanol (added with Ethyl Cellulose)	39.1	46.8	46.8	46.8	46.8	46.8	46.8
% Solids after adding Ethyl Cellulose Solution	36.7%	36.7%	36.7%	36.7%	36.7%	36.7%	36.7%
Drier Content (Based on Oil)							
% Pb as Metal	0.4%	0.4%	0.4%	0.4%	0.4%	0.4%	0.4%
% Co as Metal	0.01%	0.01%	0.01%	0.01%	0.01%	0.01%	0.01%
% Mn as Metal	0.05%	0.05%	0.05%	0.05%	0.05%	0.05%	0.05%
Drying Time of Varnish (Tack Free)	1 hr. 40 min.	5 hr.	2 hr.	2 hr.	2 hr.	2 hr.	2 hr.
Drying Time of Varnish + Ethyl Cellulose (Tack Free)	40 min.	3 hr.	1.5 hr.	1.5 hr.	1.5 hr.	1 hr. 5 min.	1.5 hr.
Notes on Varnishes Before Adding Ethyl Cellulose	Oil and resin run to 235° C. Held to end of reaction. Cooled to 200° C. and thinned.	Tung Oil and resin run to 235° C. Held to end of reaction. Linseed oil and linseed fatty acids added as chill-back. Run to 250° C. Cooled to 200° C. and thinned.	Tung oil and Bakelite BR254 heated to 235° C. Held to end of reaction. Chilled back with additional resin, linseed oil and linseed fatty acids. Run to 250° C. Total heating 25 minutes. Cooled to 200° C. and thinned.				

ETHYL CELLULOSE COMPATIBLE VARNISHES—*Continued*

Formula No.	24	25	26	27	28	29	30	31
Bakelite BR254	75	50	75	50	75	50	75	50
Ester Gum	..	..	..	..	..	..	..	..
Neville Resin R-3	..	..	..	..	..	..	..	..
Teglac 15	25	50	..	..	..	..	..	..
Super Beckacite 1001	..	..	25	50	..	..	..	..
Amberol ST 137	..	..	..	..	25	50	..	..
Amberol 801	..	..	..	..	..	..	25	50
Tung Oil	100	100	100	100	100	100	100	100
C Body Varnish Grade Linseed Oil	48	48	48	48	48	48	48	48
Linseed Oil Fatty Acids	12	12	12	12	12	12	12	12
Xylol	260	260	260	260	260	260	260	260
Oil Length (Gallons)	20	20	20	20	20	20	20	20
% Solids in Varnish	50%	50%	50%	50%	50%	50%	50%	50%
10% Ethyl Cellulose Solution	260.0	260.0	260.0	260.0	260.0	260.0	260.0	260.0
Ethyl Cellulose	26.0	26.0	26.0	26.0	26.0	26.0	26.0	26.0
Xylol (added with Ethyl Cellulose)	187.2	187.2	187.2	187.2	187.2	187.2	187.2	187.2
Butanol (added with Ethyl Cellulose)	46.8	46.8	46.8	46.8	46.8	46.8	46.8	46.8
% Solids after adding Ethyl Cellulose Solution	36.7%	36.7%	36.7%	36.7%	36.7%	36.7%	36.7%	36.7%
Drier Content (Based on Oil)								
% Pb as Metal	0.4%	0.4%	0.4%	0.4%	0.4%	0.4%	0.4%	0.4%
% Co as Metal	0.01%	0.01%	0.01%	0.01%	0.01%	0.01%	0.01%	0.01%
% Mn as Metal	0.05%	0.05%	0.05%	0.05%	0.05%	0.05%	0.05%	0.05%
Drying Time of Varnish (Tack Free)	15 hr.	20 hr.	2.75 hr.	3 hr.	2 hr.	2.75 hr.	2 hr.	2 hr.
Drying Time of Varnish + Ethyl Cellulose (Tack Free)	2 hr.	2 hr. 15 min.	1.5 hr.	1.5 hr.	1.5 hr.	1.5 hr.	1.5 hr.	1.5 hr.

Notes on Varnishes Before Adding Ethyl Cellulose

Tung oil and Bakelite BR254 heated to 235° C. Held to end of reaction. Chilled back with additional resin, linseed oil and linseed fatty acids. Run to 250° C. Total heating 25 minutes. Cooled to 200° C. and thinned.

Tung oil and all resin heated to 235° C. Held to end of reaction. Chilled back with linseed oil and linseed fatty acids. Run to 250° C. Total heating 25 minutes. Cooled to 200° C. and thinned.

Tung oil and Bakelite BR254 heated to 235° C. Held to end of reaction. Amberol 801, linseed oil, and linseed fatty acids added as chill back. Run to 250° C. Total heating 25 minutes. Cooled to 200° C. and thinned.

ETHYL CELLULOSE COMPATIBLE VARNISHES—*Continued*

Formula No.	32	33	34	35	36	37	38	39	40
Lewisol 2	100	...	...	...	...	...	...	...	...
Teglac 15	...	100	...	...	...	...	...	...	100
Super Beckacite 2000	...	...	100	100	...	...	...	...	...
Ester Gum	...	...	...	...	...	...	100	...	...
Amberol ST 137	...	...	...	...	...	...	...	100	...
N Rosin	...	...	...	...	100	...	...	...	...
Vinsol	...	...	...	...	...	100	...	...	...
Tung Oil	39	...	88	...	100	117	...	58	58
Heat Bodied Perilla Oil	...	120	...	...	..	...	...	...	...
Heat Bodied Linseed Oil	...	...	...	117	...	...	...	...	...
C Body Varnish Grade Linseed Oil	78	...	...	...	48	...	...	...	...
Blown Linseed Oil	...	...	...	...	...	...	117	30	30
Linseed Oil Fatty Acids	...	...	29	29	12	...	29	14	14
Tung Oil Fatty Acids	...	...	...	...	...	...	...	15	15
Xylol	220	220	217	246	260	...	246	...	...
Solvesso No. 2	...	...	...	...	...	217	...	...	...
Varsol	...	...	...	...	...	...	...	...	145
Hi-Flash Naphtha	...	...	...	...	...	...	...	...	58
Butanol	...	...	...	...	...	...	...	...	14
Oil Length (Gallons)	15	15	15	18	20	15	18	15	15
% Solids in Varnish	50%	50%	50%	50%	50%	30%	50%	50%	50%
10% Ethyl Cellulose Solution	220	220	217	246	260	217	246	217	217
Ethyl Cellulose	22	22	21.7	24.6	26	21.7	24.6	21.7	21.7
Xylol (added with Ethyl Cellulose)	158.4	158.4	156.2	177.1	187.2	156.2	177.1	156.2	156.2
Butanol (added with Ethyl Cellulose)	39.6	39.6	39.1	44.3	46.8	39.1	44.3	39.1	39.1
% Solids after adding Ethyl Cellulose	36.7%	36.7%	36.7%	36.7%	36.7%	26%	36.7%	36.7%	36.7%
Drier Content (Based on Oil)									
% Pb as Metal	...	0.5%	0.4%	0.4%	0.4%	0.4%	...	...	...
% Co as Metal	...	0.003%	0.01%	0.01%	0.01%	0.01%	...	...	...
% Mn as Metal	...	0.003%	0.05%	0.05%	0.05%	0.05%	...	...	...
Drying Time of Varnish (Tack Free)	...	22 hr.	5 hr.	48 hr.	24 hr.	remains tacky			
Drying Time of Varnish + Ethyl Cellulose Tack Free	...	9 hr.	1 hr. 15 min.	23 hr.	15 hr.	20 hr.			
Notes on Varnishes Before Adding Ethyl Cellulose	Oil and resin run to 300°C. in 25 minutes. Cooled to 200°C. and thinned.	Oil and resin run to 275°C. in 25 minutes. Held 20 minutes. Cooled to 200°C. and thinned.	Oil and resin run to 300°C. in 25 minutes. Cooled to 200°C. and thinned.	Oil and resin run to 300°C. in 25 minutes. Held 20 minutes. Cooled to 200°C. and thinned.	Tung oil and rosin run to 235°C. Linseed and linseed fatty acids added as chill-back. Run to 275°C. Total heating 25 minutes. Cooled to 200°C. and thinned.	Vinsol and half the oil heated slowly to 225°C. until foaming ceases. Additional oil added and run to 300°C. Cooled to 200°C. and thinned.	All ingredients run to 300°C. in 25 minutes. Held 20 minutes. Cooled to 200°C. and thinned.	Amberol ST 137, tung oil and tung oil fatty acids heated to 235°C. until reaction ceased. Linseed and linseed fatty acids added as chill back. Run to 250°C. Cooled to 200°C. and thinned.	Tung oil, resin and tung oil fatty acids heated to 235°C. Chilled back with linseed and linseed fatty acids. Run to 275°C. Cooled to 200°C. and thinned.

Ethyl Cellulose Varnish Thinner

Solvesso No. 2	84.5 lb.
Xylol	6.15 lb.
Hi-Flash Naphtha	6.15 lb.
Butanol	3.2 lb.

Nitrocellulose Rubber Varnishes

Nitrocellulose and chlorinated rubber do not form a homogeneous mixture when simply blended together in solution, but can be satisfactorily blended in the presence of a drying or non-drying oil if the chlorinated rubber is first dissolved in the oil by gentle heating. A method for dissolving the chlorinated rubber is given, as follows:

To 200 grams of linseed stand oil, heated to 110° C., are gradually added 100 grams of chlorinated rubber with stirring and the temperature raised gradually to 135° C., the whole operation requiring about an hour. A non-drying oil, such as castor oil, may also be used, except that in this instance the temperature must be raised much more gradually and the heating continued for a longer time.

A solution of these oil-chlorinated rubber products is said to be miscible with a solution of nitrocellulose in common solvents to form a lacquer or vehicle which dries to a homogeneous film. The finished products are said to be much more adhesive to any surface than coatings made from either component alone. Important applications for the finished products are seen in quick drying printing inks especially.

Coating for Wood and Iron
Indian Patent 23,417

a.	Cumarone Resin	12,000 g.
	Asphalt	12,000 g.
	Montan Wax	100 g.
b.	Water	1,400 g.
	Methyl Cellulose Dispersion	800 g.
c.	Latex	3,600 g.
	Soda Ash Solution (3.25%)	100 cc.

BATU-CHLORINATED RUBBER VARNISHES

Materials	Formula No. 1	No. 2	No. 3	No. 4
Batu Bold Scraped....	80 lb.	80 lb.	80 lb.	80 lb.
Chlorinated Rubber ..	2 lb.	2 lb.	2 lb.	2 lb.
Superb Linseed Oil...	30 lb.	20 lb.	30 lb.	..
China Wood Oil	..	10 lb.	10 lb.	10 lb.
Refined Soya Bean Oil	..	..	..	30 lb.

All dry by evaporation of solvent. Films are soft after 24 hours, but harden after several days to very hard, flexible films.

Materials	Formula No. 1	No. 2	No. 3	No. 4
Toluol	150 lb.	200 lb.	200 lb.	200 lb.
Hi-Flash Naphtha....	50 lb.	..	..	..
Remarks	Semi-Flat	Semi-Flat	Flat	Flat

Moistureproofing Varnish

Sorbitol Alkyd Resins	1.5 lb.
Colorless Paraffin Oil	0.21 lb.
Paraffin Wax	0.42 lb.

Dissolve in 1 gal. Toluol

This mixture gives a coating which, when dried, is odorless. It may be used for coating glassine paper, etc.

Electrical Insulating Varnish

Bitumen	80 lb.
Rosin	10 lb.
Linseed Oil	5 lb.
Drier	5 lb.

Cook together and mix till uniform.

Anti-Mold Varnish for Books

Turpentine	105 cc.
Castor Oil	56 cc.
Alcohol	840 cc.
Shellac	217 g.
Camphor	35 g.
Mercury Bichloride	2.1 g.

Dissolve the finely ground shellac in a portion of the alcohol, about 500 cc., which should be at room temperature and not hot. To this solution dissolve the castor oil dissolved in turpentine. Allow the mixture to stand overnight to precipitate gums and then filter. To the clear filtrate, add the camphor and bichloride dissolved in the remainder of the alcohol. Varnish books, etc. on dry day.

Seaplane Varnish

The constituents are cooked for 20 minutes at 230° C. to 235° C., and the driers added after bodying. The varnish is gas-proof, dries in about 6 hours and has a viscosity of about K on the Gardner-Holdt scale:

Raw Oiticica Oil	65	lb.
Raw Tung Oil	35	lb.
Phenolic Resin XRB.254	50	lb.
Turpentine	110	lb.
Naphtha	40	lb.
Cobalt Naphthenate (6%)	1½	lb.

Cheap Iron Varnish

Benzine	5.9 lb.
Linseed Oil (Boiled)	0.3 lb.
Gilsonite	3.8 lb.

A comparatively cheap steel and iron varnish has the following composition:

Pit Coal Tar Pitch	5.5 lb.
Hydrate of Lime	0.05 lb.
Benzol	4.45 lb.

Attention is called to the fact that the latter mixture cannot be mixed with oil or benzin additions.

VEHICLES FOR FAST DRYING WHITE DRUM PAINTS

Materials	Formula No. 1	No. 2	No. 3	No. 4
Pale East India Bold	100 lb.	100 lb.	..	..
Batavia Dammar A/E	..	..	100 lb.	100 lb.
Bodied Linseed Oil	16 lb.	..	16 lb.	..
China Wood Oil	..	16 lb.	..	16 lb.
Petroleum Thinner (Low Boiling Range)	..	..	116 lb.	116 lb.
Oil Length—Gallons	2.05	2.05	2.05	2.05
Toluol	116 lb.	116 lb.	..	..

Grind the resin to small pieces. Mix all ingredients, including driers by cold cutting. Driers added are equivalent to 0.5% lead and 0.02% cobalt as metals on the weight of oil present.

All the vehicles will dry within 1 hour. Numbers 3 and 4 are lighter in color and much clearer than the others.

Any petroleum thinner may be used with a boiling range of 200° F.–275° F.

Varnish Vehicles

Vehicle No. 1—Ester Gum Varnish

This is a 35 gal. ester gum/chinawood/perilla varnish. The composition is as follows:

Pale Ester Gum	100	lb.
Chinawood Oil	20	gal.
Perilla Oil	15	gal.
Mineral Spirits	45	gal.
6% Cobalt Naphthenate	2	pt.
16% Lead Naphthenate	6	pt.
Approximate Yield	94	gal.

The varnish contains 75% by weight of solids.

Vehicle No. 2—Alkyd Resin

This is a standard short oil resin consisting of 54% glycerol phthalate and 46% of drying oil.

Some physical properties are as follows:

Solids	50%
Mineral Spirits	50%
Viscosity (Gardner-Holdt)	P-R
Acid Number	3–5
Color	2L-2
Specific Gravity	0.96

Vehicle No. 3—Pure Phenolic Resin Varnish

This is a 25-gal. varnish the resin portion of which consists of straight phenolic resin. The composition is as follows:

Non-volatile		60.3%
Phenolic Resin	34%	
Tung Oil	33%	
Linseed Oil	33%	
	100%	
Volatile		39.7%
		100.0%

Some properties are as follows:

Viscosity	M
Specific Gravity	0.94

Varnish Primer

Basic Lead Chromate	30.4 lb.
Red Lead	15.6 lb.
Asbestine	11.8 lb.
50 Gal. Spar Varnish	32.3 lb.
Mineral Spirits	9.9 lb.

Mill White Vehicle

40 Gallons in Oil Length

Batavia Dammar A/E	100 lb.
China Wood Oil	13 gal.
Heavy Bodied Soya Bean Oil	37 gal.
Mineral Spirits	79 gal.

Plus driers equivalent to 0.5% lead, 0.03% cobalt and 0.01% manganese as metals based on the weight of oil present in the varnish.

Heat the China wood oil alone to

300° F. Sift in the dammar. Heat to 520° F. and hold for body at that temperature. Add the soya bean oil. Further heating may be necessary for a short time for complete clarity. Allow to cool to 400° F. and add the mineral spirits. Then add the driers.

This vehicle is very light in color, is excellent as regards color retention, and will dry satisfactorily overnight.

Paint Driers

(1) Cobalt Resinate

A very stable, blue liquid drier, miscible with paint materials, can be made from 84 parts by weight rosin, 18.5 parts cobalt hydroxide, and 20 parts of a liquid such as kerosene, coal-tar naphtha, etc. These ingredients are heated gradually up to 190–200° C., or until reaction is complete and all the water formed is driven off. After being allowed to cool to about 160° C. the product is thinned with petroleum naphtha, coal-tar naphtha, etc.

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(2) Zinc Naphthenate

A basic zinc naphthenate containing about 16% zinc is made by slowly heating 20 parts zinc oxide with 86 parts naphthenic acid (acid value about 250). The reaction, which begins at about 70° C., is completed between 130° and 140° C.; heating is continued until all water formed is removed. It is claimed that by using suitable proportions of materials a product of even higher zinc content can be obtained, which dissolves in paint solvents to form a clear solution.

Manganese Cobalt Drier

Manganese Dioxide	1 lb.
Cobalt Acetate	3 lb.
Oleic Acid	5 gal.

Heat, while mixing, at 49° C. until acetic acid is completely driven off.

Cobalt-Drier
No. 1033

China Wood Oil	25 gal.
Boiled Linseed Oil	10 gal.
Litharge	18 lb.
Wood Turpentine	50 gal.
Cobalt Resinate	50 lb.

Put the China wood oil and the commercial boned linseed oil in the kettle, stir well, then heat to 430° F. and pull from the fire.

Commence adding the litharge, about 2 lb. at a time stirring constantly and beating down the foam if necessary.

When all of the litharge is in, put the kettle back on the fire and heat slowly to about 450° F. for 1 hour, or until all of the lead is taken up, then pull from the fire and add the cobalt resinate, a scoopful at a time, stirring until dissolved.

The addition of the cold resinate will drop the temperature to about 400° F. therefore, when all of the resinate is in, put the kettle back on the fire and cook at 400° F. for about 3 hours, then pull from the fire and thin with the turpentine.

This high grade, expensive drier, is of a medium amber color, but unlike the lead and manganese driers, does not impart a decided brown color to oil, varnish and paint.

It is a most powerful drier and is intended for use in mixed paints, drying oils, etc.

Cobalt Resinate Drier
No. 1026

V. M. Linseed Oil	14 gal.
China Wood Oil	10 gal.
Cobalt Resinate, No. 822	100 lb.
Wood Turpentine	10 gal.
Naphtha 54°	100 gal.

Heat the 14 gallons of linseed oil to 575° F., hold at this temperature for 1 hour, then add the cold wood oil and stir thoroughly. The addition of the cold wood oil will drop the temperature to about 320° F., therefore, bring the heat up to 325° F. and pull the kettle from the fire.

Now, add the cobalt resinate in small quantities, stirring constantly until all of the resinate is in, then put the kettle back on the fire, raise the heat to 410° F. and cook at this temperature for 4 hours, stirring frequently.

Pull from the fire and thin with turpentine. When cooked to 300° F. follow with the naphtha.

This cobalt resinate drier may be made with all benzine thinner if desired.

As it imparts a blue cast to varnish, paint, etc., it is especially suitable for pale varnishes and white enamel.

As a rule 1 lb. of cobalt, figured as metal, is equivalent to 3 or 4 lb. of lead.

For use, 3 gal. of the drier are to be used with every 40 gal. of "Oil Content" in a varnish; and 1 gal. of drier for every 25 gal. of "Oil Content" in an enamel.

The particular feature claimed for cobalt driers is that they cease to induce oxidation after the varnish or paint film is dry.

Elastic Cobalt Drier
No. 1041

V. M. Linseed Oil	15 gal.
China Wood Oil	10 gal.
Cobalt Linoleate No. 823	90 lb.
Wood Turpentine	110 gal.

Heat the 15 gal. of linseed oil to 575° F., hold at this temperature for 1 hour, then add the 10 gal. of cold wood oil, stir well, and pull the kettle from the fire.

The addition of the cold wood oil will reduce the temperature to about 320° F.

Now, add the cobalt linoleate in small portions and stir well to promote solution.

After all of the cobalt linoleate is in, it will be found that much of it is undissolved, therefore, put the kettle back on the fire and heat slowly to 410° F.

Cook at 400–420° F. for 4 hours, pull from the fire and immediately thin with the turpentine.

This expensive liquid-drier is designed especially for drying enamel oils and elastic white enamels.

It carries 18.10% oil and about 0.75% cobalt, figured as metallic cobalt.

The quantity used for drying oil, varnish, etc., is as follows:

All oils, except soya bean oil, 4 gal. of liquid drier per 50 gal. of oil; soya bean oil requires double the quantity.

For varnishes, use 1 gal. of liquid drier for every 8 gal. of oil in the varnish.

Rosin Cobalt Liquid Drier
No. 1042

Water White Rosin	100 lb.
Slaked Lime	6 lb.
Cobalt Acetate	12 lb.
V. M. Linseed Oil	4 gal.
China Wood Oil	4 gal.
Wood Turpentine	16 gal.
Naphtha 54°	32 gal.

Melt the rosin to 350° F. sift about half of the lime on the surface of the melted rosin, but do not stir.

Continue raising the heat, and when a temperature of 450° F. has been attained, sift the remaining lime on the surface of the rosin, but do not stir.

After the lime is in, run to 550° F. hold about 5 minutes then pull from the fire, and stir frequently while the rosin is cooling to 500° F. at which point, sprinkle the cobalt acetate on the surface of the rosin, but do not stir.

Replace the kettle on the fire, heat to 510° F. and hold between 510° F. and 520° F. until the acetic acid fumes are off, then add the cold linseed and wood oils, previously mixed together, in a fine stream, stirring constantly. The addition of the cold oils will lower the temperature greatly, therefore, raise the heat to 410° F. and cook at 410° F. for 4 hours, then pull from the fire and thin with the turpentine.

When cooled to 300° F. follow with the naphtha.

This liquid drier is pale in color, and possesses good drying properties.

For drying oils, use 10% liquid drier.

For drying varnishes, use 10% drier on oil content of varnish, thus, for a varnish containing 30% of oil, 3% of drier is sufficient.

Cobalt Acetate Liquid Drier
No. 1025

V. M. Linseed Oil	14 gal.
China Wood Oil	10 gal.
Cobalt Acetate	35 lb.
Wood Turpentine	20 gal.
Naphtha 54°	100 gal.

Heat the 14 gal. of linseed oil to 575° F., hold at this temperature for 1 hour, then add the cold wood oil and stir well. The addition of cold wood oil will drop the temperature to about 320° F., therefore, bring the heat up to 325° F., then pull the kettle from the fire and commence adding the cobalt acetate, a little at a time, stirring constantly and beating down the foam.

The addition of the cobalt acetate causes excessive frothing due to the escape of combined water and acetic acid. When all of the cobalt acetate is in, and frothing ceases, put the kettle back on the fire and heat to about 500° F. or to a sufficient temperature so that the oil can be held at 520° F. for 4 hours, which will free it from all traces of acid acetic.

As soon as the acetic acid is off, the wood oil will begin to thicken, therefore, if there is any signs of "stringing," pull from the fire and thin at once with the turpentine, otherwise heat for the specific length of time, then pull from the fire, allow to cool to 450° F. and thin with the turpentine. When cooled to 330° F. or lower, follow with the naphtha.

For drying varnishes, use 3 gal. of drier to every 40 gal. of "oil content" in the varnish.

For drying paints use 1 gal. of drier to every 25 gal. of "oil content."

Cobalt drier imparts a blue coloration, manganese a pinkish and lead driers an amber yellow color.

Soya Bean Drier
No. 1060

China Wood Oil	16 gal.
Litharge	16 lb.
Violet Rosin No. 797	100 lb.
Wood Turpentine	24 gal.
Naphtha 54°	48 gal.

Heat the China wood oil to about 300° F. then add the litharge, sprinkle in about 2 lb. at a time, stirring constantly and beating down the foam.

Usually there is very little frothing with litharge and wood oil even on a rising temperature.

After the litharge is all in, raise the heat slowly to about 450° F., stirring constantly to prevent the litharge from settling on the bottom of the kettle.

When a temperature of 450° has been attained, then run quickly to 565° F. or to a sufficient temperature so that when the kettle is off the fire, the heat will reach 575° F. at which point, commence adding the violet rosin, previously broken into small pieces. Stir constantly to hasten the melting of the rosin, and stir frequently while the mixture is cooling down to 450° F. at which point thin with the turpentine.

When cooled to 500° F. or lower, follow with the naphtha.

This drier has a brownish purple color, but does not discolor soya bean oil.

The drier is designed especially for drying soya bean oil, using 3.5 or 10% drier, by volume, with the soya bean oil.

Pale Liquid Drier "A"
No. 1014

Water White Rosin	100 lb.
Slaked Lime	8 lb.
Lead Acetate (Pulv.)	8 lb.
China Wood Oil	4 gal.
Manganese Borate	1 lb.
Naphtha 54°	48 gal.
Kerosene	46 gal.

Melt the rosin with the slaked lime and pulverized lead acetate on top.

The evolution of acetic acid and the liberation of the combined water in the lead acetate will cause violent foaming, therefore, heat slowly, raise the heat slowly to 450° F. and cook at this temperature until the odor of acetic acid is gone.

From 15 to 20 minutes cooking is sufficient to drive off the acetic acid.

Now stir the manganese borate into the 4 gal. of wood oil then pour it in a fine stream into the melted rosin and stir until thoroughly mixed.

Raise the heat slowly to 540° F. stirring frequently and beating down the foam if necessary, then pull from the fire and allow to cool to 450° F. at which temperature, thin slowly with benzine.

This liquid drier is practically colorless. It dries on glass in about 10 minutes.

It is designed especially for drying and thinning light colored mixed paints.

Strong White Oil Drier (S-63)
No. 1017

M Rosin	100 lb.
Slaked Lime	8 lb.
Lead Acetate (Pulv.)	16 lb.
China Wood Oil	8 gal.
V. M. Linseed Oil	2 gal.
Litharge	24 lb.
Manganese Borate	4 lb.
Soya Bean Oil	2 gal.
Wood Turpentine	8 gal.
Naphtha 54°	64 gal.

Melt the rosin with the lime and lead acetate on top, but do not stir until the temperature is up to 480° F. then stir frequently while raising the heat to 540° F.

Now pull from the fire, add the cold China wood oil and stir until thoroughly mixed, then add the cold linseed oil and again mix thoroughly.

Allow the mixture to cool down to about 350° F., then put the kettle back on the fire, and commence adding the litharge and borate previously mixed together.

Add a spoonful, about 2 lb. at a time, stir constantly and beat down the foam if necessary.

Continue raising the heat very slowly until all of the drying salts are in, then run to 450° F. and cook for about 30 minutes at any temperature between 450° F. and 480° F., or until the manganese borate is taken up, known by the "head" or froth ceasing to rise in the kettle.

It is especially designed for drying mixed paints. One part of the japan dries 9 parts of raw linseed oil in 5 hours.

Pale Oil Drier
No. 4

Water White Rosin	100	lb.
Sugar of Lead	2½	lb.
Dry Slaked Lime	5	lb.
Raw Linseed Oil	10	gal.
China Wood Oil	25	gal.
Litharge	20	lb.
Manganese Resinate	15	lb.
Benzine	150	gal.

Melt the rosin, add the sugar of lead, run to 500° F. Stir in the lime and hold about 15 minutes, or until taken up.

Add the oil, stir well and allow to cool to 400° F., stir in the litharge and when the froth is down, run to 480° F.

When the lead is taken up, allow to cool to 400° F. and gradually add the manganese resinate. Cook at 450° F. until stringy, then cool to 300° F. and thin first with the distillate then benzine.

Strong Combination Drier
No. 35

a.	K. Rosin	50	lb.
	Black Oxide of Manganese	2½	lb.
	Linseed Oil	5	gal.
b.	Water White Rosin	50	lb.
	Sugar of Lead	10	lb.
	Dry Slaked Lime	2½	lb.
	Wood Oil	5	gal.
c.	Wood Turpentine	5	gal.
	Benzine	20	gal.

a. Melt the rosin, add the manganese and cook at 300° F. not above 320° F. until the black mass takes on an amber color, then add the oil and run to 450° F.

b. Melt the rosin, add the lead and lime and run to 500° F., cook 5 minutes and add the wood oil, then cook 10 minutes longer.

Ladle *b* into *a*, run to 480° F., cook to a stiff pill.

Cool to 320° F. and thin.

Liquid Drier
No. 34

a.	Rosin	60	lb.
	Manganese Dioxide	7½	lb.
	Kerosene	2½	gal.
	Benzine	10	gal.
b.	Rosin	50	lb.
	Dry Slaked Lime	2½	lb.
	Litharge	5	lb.
	Wood Oil	2½	gal.
	Benzine	10	gal.

a. Melt the rosin and sift in the manganese, keeping the heat at 300° F. (in no case above 320° F.). Stir continually and as soon as the black begins to clear and thicken, draw from the fire and thin.

b. Melt the rosin, add the lime and litharge, run to 500° F. and cook about 15 minutes, add the cold wood oil, cook 15 minutes longer draw from the fire, cool to 300° F. and thin.

Mix *a* and *b* then tank until settled.

Japan Drier
No. 1036

M. Rosin	100	lb.
Slaked Lime	4	lb.
Manganese Dioxide	4	lb.
Litharge	8	lb.
China Wood Oil	4	gal.
Litharge	8	lb.
Kerosene 48°	4	gal.
Naphtha, Refined	40	gal.

Melt the rosin, with the lime and manganese dioxide and half of the litharge, i.e., 8 pounds, on top and run to 480° F.

Pull from the fire, add the China wood oil in a fine stream and stir thoroughly.

Put the kettle back on the fire, and heat slowly to 480° F. meanwhile adding the remaining 8 lb. of litharge, about a pound at a time.

Stir constantly, while adding the litharge and beat down the foam if necessary.

After the litharge is in, and frothing ceases, run quickly to 550° F. and pull from the fire.

Allow to cool to 450° F. and thin with the kerosenes, then add the paraffin oil and stir well.

When cooled to 320° F. follow with the benzine.

This cheap drier is of a medium-amber color; is neutral in character; and undergoes no alteration on standing in the can for several months.

One part of the japan dries 9 parts of raw linseed oil in 4–5 hours.

Elastic White Oil Drier
No. 1011

H. Rosin	100 lb.
Slaked Lime	6 lb.
V. M. Linseed Oil	16 gal.
Manganese Dioxide	4 lb.
Litharge	32 lb.
China Wood Oil	8 gal.
Naphtha 54°	64 gal.

Melt the rosin to 500° F., pull from the fire, sprinkle in the lime and whip down the foam.

Put the kettle back on the fire, heat to 560° F., add the cold linseed oil in a fine stream and mix well.

Heat will drop to about 480° F. at which point, sprinkle in the manganese dioxide, stirring constantly.

When the manganese is all in, raise the heat slowly to about 540° F. or to a sufficient temperature so that when the kettle is pulled from the fire the heat will rise to about 560° F. and not higher than 570° F.

With the kettle off the fire, and watching the termometer, wait until the temperature *falls* 10°, then commence adding the litharge, about 2 lb. at a time, stirring constantly and beating down the foam. Usually there is little or no frothing at a high heat when adding litharge on a "falling *temperature.*"

When the litharge is all in, add the cold wood oil, stir well then put the kettle back on the fire and run to 500° F. or a sufficient temperature so that when the kettle is off the fire the heat will not rise above 525° F. Stir constantly, allow to cool to 330° F. and thin.

This drier is medium pale in color, long in oil, and dries on glass in about 2 hours. One part of drier dries 9 parts of raw linseed oil in 6 hours. It does not "split" on dilution with benzine, and will not "liver." It is used as a grinding japan and for drying oil, varnish and paint.

Hard, Wood Oil Soap for Tungate
No. 831

Caustic Soda	1½ lb.
Cold Water	2 gal.
China Wood Oil	1 gal.
Hot Water	2 gal.
Hot Water	2 gal.
Hot Water	2 gal.

Dissolve the caustic soda in the 2 gal. of cold water, by stirring.

After the soda has dissolved the solution will be hot, therefore add the China wood oil, mix to an emulsion by stirring vigorously, then run the kettle onto the fire, and heat to boiling, stirring frequently. Boil for about 10 minutes then pull from the fire and allow to cool over night.

The next morning, put the kettle on the fire, and as soon as it begins to melt, add 2 gal. of hot water and heat to boiling. Boil briskly for exactly 1 hour, beating down the froth, or pulling the kettle from the fire to allow the froth to subside.

After boiling for an hour, add another 2 gal. of hot water, stir well, then boil for half and hour, after which add the final 2 gal. of hot water, boil for 10 or 15 minutes, then pull the kettle from the fire and add sufficient hot water to make the total volume of hot liquid soap up to 8 gal.

When cold, the soap will be solid white mass.

In making soap, the more stirring it gets, the quicker saponification takes place.

Soya Manganese Tungate
No. 869

China Wood Oil	36 gal.
Soya Bean Oil	12 gal.
Manganese Dioxide	36 lb.

Put the two oils in a large kettle, one of at least 200 gallon capacity then stir in the manganese dioxide.

Cautiously raise the heat to 320° F.

Mixture will start to bubble at about 420° F. and frothing increases and stirring as low down as possible with the "whip" to hasten the escape of gas.

About 45 minutes should be taken to raise the heat from 420–450° F. it usually takes 30 minutes due to the excessive frothing.

After 450° F. has been reached the froth may be heated down more easily, therefore, whip down and then run to 460° F. and hold for 20 minutes, at the end of which time, most of the frothing will have ceased. When frothing ceases, run quickly to 470° F. and pull from the fire; heat will probably rise to 480° F. which temperature should not be exceeded.

The above oil is dark-amber in color, fairly heavy in body, and dries in about 4 hours.

This rapid drying manganese oil is used with red lead rosin to produce cheap japan driers, and with gilsonite in the production of air-drying blacks and black baking japans.

Manganese Tungate No. 62

Precipitating Manganese Tungate

Having both the soap and manganese solutions boiling hot, run the soap solution, in a fine stream, into the manganese solution, stirring constantly while the striking process is going on.

After all the soap solution is in, test some of the supernatant liquid placed on a piece of white paper with two or three drops of phenolphthalein solution for a colorless reaction.

If a pink color reaction results, then the soap is in excess and more of the manganese solution must be added.

When the precipitation is complete, allow to cool, then draw off the supernatant liquid, add 20 or 30 gallons of clear water and heat to boiling, the object being to wash out any soap or free manganese chloride which may be present.

Finally, draw off the wash water and transfer the sticky mass to a barrel and allow to dry and harden.

If preferred, the tungate may be transferred to a kettle and the adhering water driven off at a gentle heat. When perfectly cold the tungate will be hard and somewhat brittle, consequently may easily be removed from the kettle.

Theoretically, 1 lb. of soap unites with 0.3438 lb. of manganese chloride and results in the production of 1.0156 lb. of manganese tungate.

Practically, 1 lb. of China wood oil should produce 1.0996 lb. of manganese tungate, or 1 gallon of wood oil should produce 8.60 lb. of tungate.

Precipitated Manganese Tungate

a.	China Wood Oil	16 gal.
	Caustic Soda	24 lb.
	Water	32 gal.
	Hot Water	16 gal.
b.	Manganese Chloride	40 lb.
	Hot Water	20 gal.

a. Disolve the caustic soda in 32 gallons of water, contained in an iron tank having a capacity of about 200 gallons and fitted with a steam pipe for blowing in live steam.

Heat the caustic soda solution to boiling, then add the China wood oil, stir well, and continue the boiling for about 30 minutes, then allow to cool over night.

Next morning break up the solid cake of soap, then heat to boiling by blowing in live steam.

Now add 32 gallons more of hot water and boil for about 30 minutes.

Finally, add enough hot water to make the total volume of soap up to 128 gallons.

A previously made mark on the side of the tank is used to designate the final volume.

Approximately, 8 gallons of this soap will contain 1 gallon of China wood oil.

b. The manganese chloride solution is made by dissolving the 40 pounds of manganous chloride in 20 gallons of hot water.

Lead Tungate (Kettle Process)

No. 802

China Wood Oil	50 gal.
Litharge	100 gal.

Heat the wood oil to 500° F. and pull the kettle from the fire. Heat will probably rise to 540° F.

As soon as the kettle is off the fire, commence adding the litharge about 2 pounds at a time, sprinkling it on the surface of the hot oil.

Stir very frequently, whip down the foam if necessary, and continue the additions of litharge until about half of it is in. If, by the time, the temperature has fallen much below 500° F., put the kettle back on the fire and heat to 520° F., then pull from the fire and again feed in the litharge as before.

Finally, when all the litharge is in, put the kettle on the fire and heat to 540° F. or to a sufficient heat, so that when the kettle is pulled from the fire the ultimate temperature of the tungate will rise above 595° F.

After removing from the fire, allow to cool over night. The next morning, put the kettle on the fire and heat to 450° F. or 480° F. to liquefy the nearly solid oil, then transfer to the tank.

China wood oil will not "jelly" at any temperature when 2 pounds of litharge per gallon of oil are present.

Liquid "lead tungate" is a powerful drying oil, it is used in prepared rosins, varnishes, japans and prepared oils.

The quantity generally used ranges from 2–20%.

Cheap Liquid Drier
No. 1010

a.	M. Rosin	100 lb.
	Manganese Dioxide	10 lb.
	Kerosene 46°	4 gal.
	Naphtha 54°	16 gal.
b.	M. Rosin	100 lb.
	Slaked Lime	4 lb.
	Litharge	16 lb.
	China Wood Oil	4 gal.
	Kerosene 46°	4 gal.
	Naphtha 54°	32 gal.

a. Melt the rosin to about 320° F. sprinkle in the manganese dioxide, stir well, and cook at 320–350° F. for an hour, or until a sample on glass shows a transparent amber-color free from greenish-black specks, then run to 450° F. pull from the fire and thin with the kerosene.

When cooled to 350° F. or 330° F. follow with the naphtha.

b. Melt the rosin, with the slaked lime and litharge on top, run to 550° F. add the cold wood oil, stir well, then pull from the fire.

Allow to stand for about 5 minutes, stirring frequently, then thin with the kerosene.

When cooled to 330° F., or lower follow with the naphtha.

c. When the two batches are finished, mix (a) with (b) and stir well thoroughly mixed, and then tank for two or three days to allow the mixture to clarify.

This liquid drier is of a medium-amber color, but 3% of it does not discolor white mixed paint.

It dries on glass in 5–10 minutes, using 1 part of drier to 9 parts of raw linseed oil, in 6 hours.

It mixes perfectly with raw oil, and is neutral to lead, zinc and other pigments.

Hard Kauri Drier
No. 1031

Manganese Resinate No. 760	66 lb.
K. Rosin	10 lb.
Kauri Seeds	9 lb.
China Wood Oil	1 gal.
Red Lead	4 lb.
Wood Turpentine	7 gal.
Naphtha 54°	13 gal.

Melt the manganese resinate, rosin and kauri with the China wood oil and run to 550° F. stirring very frequently.

Hold at 550° F. until all is in solution and free from lumps, then pull from the fire.

As soon as the temperature begins to fall, commence adding the red lead, a little at a time, stirring constantly until all in, then stir frequently while cooling to 420° F. at which point, then with the wood turpentine, and when cooled to 300° F. or lower, follow with the naphtha.

This japan drier is of a dark-amber color; dries in about 10 minutes and becomes intensely hard.

It is used for drying floor paints, and in the preparation of Rough-Stuff and dark colored fillers.

O. K. Varnish Drier
No. 1039

M. Rosin	100 lb.
Slaked Lime	4 lb.
Red Lead	25 lb.
V. M. Linseed Oil	20 gal.
Litharge	25 lb.
Manganese Dioxide	30 lb.
China Wood Oil	5 gal.
Wood Turpentine	25 gal.
Heavy Naphtha 48°	75 gal.

Melt the rosin to about 400° F., sift in the slaked lime, stir well, then commence adding the red lead, about 2 pounds at a time, stirring very frequently.

Continue raising the heat slowly to 480° F. and endeavor to get all of the red lead in by the time the temperature is up to 480° F. then run to 500° F. and pull from the fire.

Now add the linseed oil, previously heated to 350° F. and stir until thoroughly mixed, then put the kettle back on the fire and hold at 425–450° F. while adding the litharge, about 2 pounds at a time, stirring constantly and beating down the foam.

After the litharge is in, cook at 425° F. for 30 minutes, then pull from the fire, allow to cool to 400° F. and commence adding the manganese dioxide, about a pound at a time, until about 10 lb. has been added, then put the kettle back on the fire and hold to 420–440° F. while feeding the remainder of the manganese in small portions, stirring constantly and whipping down the froth. From 2–3 hours cooking at 440° F. will be required to take up the manganese, after which, raise the heat to 480° F. pull from the fire and immediately add the cold wood oil. Stir well, put the kettle back on the fire and cook at

450° F. for 10 minutes, then pull from the fire and thin.

Pale Japan Gold Size T
No. 17

Pale Kauri or Congo	100 lb.
Prepared Linseed Oil No. 321	25 gal.
China Wood Oil	5 gal.
Red Lead	20 lb.
Litharge	5 lb.
Turpentine	90 gal.

Fuse the gum, add the two oils previously heated to 450° F. mix well and commence adding the driers, a very small quantity at a time, meanwhile allowing the heat to drop to about 400° F.

After the driers are in and frothing ceases, run to 460° F. and cook to a stiff pill or until stringy.

Cool to 45° F. and thin.

Pale Japan Gold Size B
No. 18

Pale Kauri or Congo	100 lb.
Prepared Linseed Oil No. 321	25 gal.
Wood Oil	10 gal.
Red Lead	20 lb.
Litharge	5 lb.
Petroleum Distillate	25 gal.
Benzine	100 gal.

Fuse the gum, add the two oils previously heated to 456° F. mix well, then allow to cool to 400° F.

Sprinkle in the driers, stir until frothing ceases, then run to 450° F. and cook to a stiff pill.

Cool to 300° F. and thin.

Beaver Sizing Japan
No. 1016

Manganese Resinate No. 760	100 lb.
China Wood Oil	16 gal.
Paraffin Oil (20° Bé.)	1 gal.
Red Lead	16 lb.
Naphtha 54°	96 gal.

Melt the manganese resinate in the China wood oil, run to 540° F., or sufficient temperature so that when the kettle is pulled from the fire the heat will rise to about 580° F. and not above 590° F.

After the kettle is off the fire and the heat has fallen to 565° F., add the 1 gallon of paraffin oil, stir well, then commence adding the red lead, about 2 pounds at a time, stirring constantly and whipping down the foam if necessary.

When all of the red lead is in stir for 10 minutes longer, then test on glass to see if the lead is taken up.

If the red lead is not all taken up by the time the temperature has fallen to 330° F., put the kettle back on the fire, raise the heat to 480° F., and again pull from the fire. The heat will probably rise to about 520° F., at which point, thin with the naphtha.

This japan by itself dries on glass in about 2 hours, but remains "tacky" for several hours longer, due to the presence of paraffin oil.

One part of the japan dries 9 parts of raw linseed oil in 6 to 7 hours.

This drier is designed to assist in the drying of paraffin oil, rosin and paraffin wax mixtures.

Zinc Manganese Oil Japan Lt.
No. 28

Linseed Oil	20 gal.
Wood Oil	10 gal.
Zinc Sulphate	10 lb.
Manganese Resinate	15 lb.
Manganese Sulphate	30 lb.
Manganese Borate	5 lb.
Petroleum Distillate	30 gal.

Heat the oils to 300° F. add the zinc sulphate and run to 500° F. now add the resinate slowly and let the temperature drop to 350° F. then add the manganese sulphate and run to 480° F. Cook until taken up, cool to 300° F. slowly stir in the borate and hold until done foaming, then cook 3 or 4 hours at 350–400° F. Cool to 300° F. and thin.

Let the borate settle out, the filter.

Pale Agricultural Japan B.
No. 16

Rosin	100 lb.
Dry Slaked Lime	5 lb.
Prep. Wood Oil No. 369	65 gal.
Red Lead	50 lb.
Zinc Resinate	65 lb.
Manganese Resinate	10 lb.
Petroleum Distillate	25 gal.
Benzine	150 gal.

Melt the rosin, add the lime and run to 500° F., then add the cold oil, mix well, sprinkle in the zinc resinate and cook for about half hour at 420° F.

Next add the red lead, run to 450° F. hold half an hour stirring constantly, then add the manganese resinate and cook 4 or 5 hours at 450° F. Cool to 300° F. and thin.

Light Turpentine Japan
No. 23

Pale Rosin	100 lb.
Dry Slaked Lime	2½ lb.
Sugar of Lead	5 lb.
Glycerin (dissolve	16 fl. oz.
Borax together)	2 oz.
China Wood Oil	5 gal.
Litharge	5 lb.
Manganese Dioxide	5 lb.
Red Lead	5 lb.
Turpentine	25 gal.

Melt the rosin, add the lime and sugar of lead and run to 500° F. Cook about 15 minutes, then add the glycerin-borax solution mix well, and pour in the cold wood oil, which will cool it down to about 400° F.

Now commence adding the three driers (previously mixed together) a small portion at a time, to prevent excessive foaming.

Cook to a stiff pill, cool to 350° F. and thin.

Wood Oil White Japan for Paint Manufacturing

Water White Rosin	50 lb.
Refined Linseed Oil	12 gal.
China Wood Oil	12 gal.
Litharge	50 lb.
White Sugar of Lead	50 lb.
Turpentine	45 gal.
Benzine	45 gal.

Place the rosin, linseed oil and China wood oil in the kettle together and heat to 310° F. then add the litharge and stir it in thoroughly, allowing the heat to increase until 500° F. is reached and then hold at this temperature for one hour.

Then pull the kettle off the fire and add the sugar of lead and stir it until it dissolves, then run the kettle on the fire and increase the heat to 560° F. and hold for half an hour at this heat, then cool and thin.

H & M Floor Paint Hardener
No. 1008

Japan Rosin No. 753	210 lb.
Manganese Resinate No. 760	60 lb.
China Wood Oil	54 gal.
Japan Rosin No. 753	30 lb.
V. M. Linseed Oil	6 gal.
Litharge	10½ lb.
Red Lead	4½ lb.
Heavy Naphtha 48°	120 gal.

Melt the 210 lb. of japan rosin and the manganese resinate in the 54 gal. China wood oil and run to 545° F. or to a sufficient heat so that the temperature will rise to 565° F. or 570° F. when the kettle is pulled from the fire.

As soon as the kettle is off the fire, add the remaining 30 lb. of japan rosin, stir until dissolved, then pour in the 6 gal. of linseed oil and stir well.

The heat will now be down to about 530° F. at which point add the litharge and red lead, previously mixed together, about 2 lb. at a time, stirring constantly during the addition of the lead drying salts and for about 5 minutes after they are in.

All the lead should be taken up by the time the heat is down to 350° F. at which point, thin with the heavy naphtha.

If the lead salts are not taken up by the time the mixture has cooled to 350° F. put the kettle back on the fire and cook at 450° F. for a few minutes.

This japan drier is designed especially for drying and hardening floor paints, fillers, etc.

Iron Filler Japan
No. 1009

Glycerin Rosin No. 750	100 lb.
China Wood Oil	16 gal.
Iron Filler Oil No. 880	8 gal.
Naphtha 54°	64 gal.

Melt the glycerin rosin in the wood oil, run to 570° F. pull the kettle from the fire add the "iron filler oil" and stir until thoroughly mixed.

The addition of the 8 gallons of cold oil will drop the temperature 10°, but allow to stand until cooled to 500° F. then put the kettle back on the fire and heat slowly to 550° or to a sufficient temperature to keep the oil at 550° F. and not above 560° F.

Cook at 550° F. for 5–10 minutes, then pull from the fire, allow to cool to 320° F. and thin with the naphtha.

This japan drier is of a medium-amber color, and dries on glass in about 3 hours.

It is very elastic, tough and extremely hard.

Mixed with raw or boiled linseed oil it forms an exceptionally fine grinding liquid for iron fillers; rough-stuff; wood-filler; carriage puttiers; surfacers; R. R. coach primers; and automobile paint.

The japan contains 26.72% oil.

"Excelsior" White Grinding Japan
No. 1061

Water White Rosin	32 lb.
China Wood Oil	32 gal.
Slaked Lime	2 lb.
Litharge	32 lb.
Wood Turpentine	16 gal.
Heavy Naphtha 48°	32 gal.

Put the rosin in the kettle, pour in the wood oil, then sprinkle the lime on the surface of the oil.

Heat to about 300° F. without stirring, then stir well and pull the kettle from the fire.

Now commence adding the litharge, about 2 pounds at a time, stirring constantly.

When all of the litharge is in, put the kettle back on the fire and heat slowly to 450° F. but do not let the temperature rise, above 460° F.

Cook at 450° F. with very frequent stirring, for 30 minutes or until the litharge is taken up, and a sample on glass is nearly solid but not hard.

Intermittant heating, i. e., heating to 450° F. cooling to 420° F. repeated for 3 or 4 times, will hasten the solution of the litharge, if the mixture is stirred about every five minutes.

Finally, when the cooking is finished, pull the kettle from the fire, allow to cool to 400° or 350° F. and thin with the turpentine, then follow with the heavy naphtha.

This japan contains very little rosin, and loses practically nothing on grinding.

It dries out flat with pigments and is an exceptionally strong binder.

It may be used straight for grinding, if desired.

The japan carries 39.53% oil.

White Grinding Japan (Hard)
No. 29

a.	Pale Rosin	80 lb.
	Pale Kauri	19 lb.
	Burgundy Pitch	1 lb.
b.	Calcium Acetate Solution—Sugar of Lead	10 lb.
c.	Pale Manganese Oil	15 gal.
	Wood Oil	5 gal.
d.	Wood Turpentine	50 gal.
	Petroleum Distillate	10 gal.

Place the calcium acetate liquor in the kettle along with the sugar of lead. Heat until dissolved, then add the rosin and pitch boil off the water and run to 450° F. then add the kauri and run to 520° F. Add the mixed oils previously heated to 450° F. and cook to a stiff pill.

Cool to 350° F. and thin.

"Eureka" White G & M Japan
No. 1024

China Wood Oil	32 gal.
Slaked Lime	8 lb.
Lead Acetate Pulv.	32 lb.
Water White Rosin	200 lb.
Manganese Sulphate	8 lb.
Litharge	32 lb.
Wood Turpentine	32 lb.
Naphtha 54°	96 gal.

Stir the slaked lime and pulverized lead acetate into the cold wood oil, then cautiously raise the heat slowly to about 150° F. at which point the mixture will begin to froth strongly, therefore, stir frequently and beat down the foam. Possibly the kettle may have to be pulled from the fire to allow the foam to subside, but it will not last very long and by the time the heat is up to 300° F. the frothing will be over.

At about 320° F. the turbid mixture will begin to clear up, and by the time the heat is up to 480° F. the oil will be quite clear.

As soon as a temperature of 480° F. has been reached, pull from the fire and add the 200 lb. of rosin in small quantities, stirring slowly until dissolved.

The addition of the cold rosin will drop the temperature to about 420° F., therefore, put the kettle back on the fire, stir in the 8 lb. of manganese sulphate and raise the heat to 460° F., then put kettle back from the fire.

As soon as the heat begins to fall, commence adding the litharge, about 2 lb. at a time, stirring constantly and beating down the foam when necessary.

When all of the litharge is in, put the kettle back on the fire and cool at 450–480° F. for 20 to 30 minutes, or until the lead is taken up, then pull from the fire, allow to cool to 420° F. and thin with the turpentine. When cooled to 300° F. follow with the naphtha.

No. 1 Baking Japan

V-8 Refined Stearine Pitch	2 lb.
Soya Bean Oil or Soft Cottonseed Pitch	1 lb.
Metallic Manganese	.05%
Cobalt	.005%
Varnoline	to suit

The percentage of drier is to be figured on the total weight of Pitch and Oil used. Baking time 30–40 minutes at 400–450° F.

No. 2 Baking Japan

V-8 Pitch	40%
Varnoline	60%

Add a small percentage of cobalt and manganese in liquid or paste form.

This produces a baking black that will bake in about 1½ hours at 400° F. If the japan comes out a little too brittle, then the addition of a little soft cottonseed pitch or soya bean oil should be added.

No. 1 Air-Drying Black

V-8 Pitch	2 lb.
Bodied China Wood Oil	1 lb.

Add a small percentage of cobalt and manganese in liquid or paste form.

GILSONITE SELECTS—A quicker baking and harder drying black can be obtained by incorporating some of this material in the above formulations.

Water Proof Rosin
No. 784

M. Rosin	100	lb.
Lead Acetate	4	lb.
Caustic Soda	1	lb.
Hot Water	6	gal.
Glycerin	¼	gal.
Slaked Lime	4	lb.
China Wood Oil	2½	gal.

Put the 6 gallons of water in the kettle and heat to boiling then add the caustic soda. Stir until dissolved and follow with the lead acetate.

When the lead acetate has dissolved, add the glycerin, mix by stirring, then add the rosin, which should be broken into small pieces, or driven off and stir constantly.

The rosin under this treatment at first assumes a wax like condition, but as soon as the water is off it melts and becomes transparent; therefore, when this condition has been reached, raise the heat to 500° F., pull from the fire and sprinkle in the slaked lime.

Replace the kettle on the fire, run to 540° F. and add half a gallon of the wood oil. Stir well and continue raising the heat, adding half a gallon of wood oil every 10° rise in temperature so that the last portion of oil is put in at 580° F.

When a temperature of 580° F. has been reached, stir vigorously, pull from the fire, allow to cool to 480° F. and pour into the cooling-box.

This rosin is practically a kettle-made "ester gum" and is very waterproof.

It is used exclusively for waterproof baking varnish.

Toughener for Rosin
No. 56

China Wood Oil	10 gal.
Manganese Resinate	10 lb.

Heat the wood oil to 350° F. cook 1 hour, then add the resinate, a little at a time, and heat slowly to 400° F. Hold about 15 minutes then allow to cool.

For use; add 1 gallon of the above to 100 lb. of lime treated rosin.

Tough Elastic Rosin
No. 51

a.	Rosin	100	lb.
	Zinc Sulphate	7½	lb.
	Dissolve		
b.	Common Salt	2½	lb.
	Trisodium Phosphate	½	lb.
	Hot Water	3	gal.
	Mix		
c.	Dry Slaked Lime	2½	gal.
	Wood Oil	5	gal.

Melt the rosin, run to 300° F. and add the zinc in small portions. When all is in and the moisture expelled, cook at 400° F. until the zinc combines then cool to 300° F. and slowly add solution *b*, stirring well until the water is off, after which add *c* and run to 520° F. Cook half an hour or until clear.

Heavy Wood Oil Rosin Gum
No. 947

Water White Rosin	100 lb.
China Wood Oil	17 gal.

Melt the rosin in the China wood oil, run to 350° F. and hold at this temperature for 6 hours, then pull from the fire and pour into a barrel.

If the mass should be too thick to pour or ladle out, raise the heat at the end of the 6 hours cook at about 420° F. and it will then be liquid enough to pour.

This mixture, when cold, is a thick sticky mass, it is pale in color; has a good luster, and dries fairly well.

It is used for imparting body and a high luster to varnishes the subsequent cooking producing a glass like luster and rendering the varnish, more waterproof.

Red Lead Rosin
No. 758

H. Rosin	100 lb.
Slaked Lime	2 lb.
Red Lead	16 lb.
China Wood Oil	4 gal.

Melt the rosin, run to 510° F. sprinkle in the lime, stir well and whip down the foam if necessary.

Continue the heat up to 550° F. then pull from the fire and commence adding the red lead, a little at a time, as it froths strongly.

Stir well, whip down the froth, and when all of the red lead is in, put back on the fire and heat to 550° F. it is all right, therefore, and then pull from the fire.

The heat will probably go to 580° F. but as long as it does not rise above 595° F. it is all right, therefore, pull the kettle off the fire at a sufficient temperature so that the heat will not rise above 595° F.

When cooled to about 480° F. pour into the cooling box.

This rosin is exceedingly tough, and possesses strong drying properties.

It is used almost exclusively in black baking japans.

Pale Spar Rosin
No. 766

Water White Rosin	100 lb.
Slaked Lime	5 lb.
China Wood Oil	2½ gal.

Melt the rosin and run to 510° F. pull from the fire, sprinkle in the lime, stir well and whip down the foam if necessary.

Put the kettle back on the fire and raise the heat to 580° F. during which time add the China wood oil, a half gallon at a time, every 2 or 3 minutes and stir well.

All of the oil should be in by the time the heat is up to 580° F.

When the oil is all in and the proper temperature has been attained, pull the kettle from the fire, allow to cool to 480° F. and pour into the cooling-box.

This pale colored and extraordinary tough rosin is used chiefly in the manufacture of spar varnish.

It is used with Congo, Kauri, and other hard gum, linseed oil varnishes, and also in wood oil varnishes.

As every 100 lb. of the rosin contains 2 gallons of wood oil this must be taken into consideration when this rosin is called for in a varnish formula.

Synthetic Varnish Resin
U. S. Patent 2,081,154

Glycerin	300 g.
Phthalic Anhydride	300 g.
Linoleic Acid	300 g.
Maleic Acid	15 g.

Heat at 190° C. and then at 230° C. to give a resin soluble in toluol.

Wood Oil Baking White Enamel Liquid

Light Rosin	20 lb.
Dammar Gum	200 lb.
Zinc Resinate	10 lb.
Raw China Wood Oil	6 gal.
Turpentine	24 gal.
Benzine	11 gal.

First place the rosin in the bottom of the kettle, then the dammar, and then 18 gallons of turpentine. Now dissolve these over a slow fire with gentle heat. After they have dissolved, add the 10 lb. of resinate and stir until it is dissolved. Then remove the kettle from the fire and add the China wood oil, then add the 6 gallons of turpentine and the 11 gallons of benzine.

Air Drying White Enamel Liquid

Light Rosin	380 lb.
Water	6 gal.
Caustic Soda (70%)	11 lb.
Air Slaked Lime	20 lb.
White Sugar of Lead	10 lb.
Raw China Wood Oil	10 gal.
Benzine	47 gal.

Dissolve the caustic soda in the water and have ready, then melt the rosin, add the caustic solution to the rosin and boil until the rosin becomes clear again.

Now heat to 475° F. and add the lime and stir it in well, allow the heat to increase to 500° F., and add the wood oil and increase the heat then to 550° F. Then add the sugar of lead, stir it in thoroughly and remove from the fire and thin.

Extra Pale White Enamel Oil
No. 960

Honey Oil No. 907	32 gal.
China Wood Oil	16 gal.
Lead Acetate Pulv.	15 lb.
Cobalt Acetate	1 lb.
Magnesia	¼ lb.
Turpentine (Gum)	24 gal.

Mix the honey oil and the China wood oil together in the kettle then heat quickly to 540° F. and pull from the fire.

Allow to stand, stirring frequently,

until the temperature rises to its maximum point, i. e., 560–575° F. and then begins to fall.

As soon as the temperature has fallen 10° commence adding the lead and cobalt acetates, previously mixed together. Add about a pound at a time, stirring vigorously and beating down the foam before adding another portion of drying salts.

The evolution of acetic acid and combined water in the drying salts causes excessive foaming, therefore, be careful that the mixture does not boil over.

After the drying salts are in, sprinkle the magnesia on the surface of the hot oil and stir slowly for about 5 minutes then occasionally while the mixture is cooling to 450° F., at which point, thin with the turpentine.

Should the oil start to "string" i. e., jelly, while the temperature is rising, commence adding the drying salts, as the acetates prevent the oil from jellying.

This pale, quick drying oil, is designed especially for white and delicate tinted enamels, and is intended as a grinding oil for zinc oxide and lithopone.

Quick-Drying Resinate Wood Oil
No. 948

China Wood Oil	32 gal.
Manganese Resinate No. 780	20 lb.
Lead Resinate No. 782	100 lb.
Wood Turpentine	90 gal.

Heat the China wood oil quickly to 500° F. or to a sufficient temperature so that when the kettle is off the fire the temperature will rise to 540° F. or 550° F. but not above 550° F.

At this temperature (550° F.) the wood oil will begin to "string" or "jelly" very soon, therefore, as soon as the thermomenter registers 540° F., or there is any indication of "jellying," add the lead resinate and stir vigorously, then follow with the manganese resinate.

The addition of the cold resinates will prevent jellying and start the temperature downward.

Stir constantly until the fused resinates dissolve, then frequently while the mixture is cooling to 400° F. at which point thin with the turpentine.

The fused resinate should be broken into small pieces about the size of a hickory-nut, or smaller, otherwise, the resinates will not dissolve soon enough to check the "jellying."

This mixture is practically a "lighting resinate drier," and is designed especially for use in quick drying varnishes, gloss oils and japans.

Polishing Oil
No. 908

China Wood Oil .	30 gal.
M. Rosin	30 lb.
M. Rosin	30 lb.
Kellogg's Varnish Oil (Linseed Oil)	5 gal.
Kellogg's Varnish Oil (Linseed Oil)	25 gal.
Litharge	15 lb.
Manganese Resinate (Ppt.)	3 lb.

Heat the wood oil and 30 lb. of rosin to 500° F. and pull from the fire, the temperature will rise to 525° or 540° F. but must not go above 540° F.

Allow to stand until it starts to "string" from the stirring rod, then immediately add the remaining 30 lb. of rosin, all at once, and stir until dissolved. As soon as the rosin is in solution add 5 gallons of the cold linseed oil and again stir. The additions of rosin and linseed oil will lower the temperature and probably cause the rosin to "freeze" on the sides and bottom of the kettle, therefore, put the keetle back on the fire and heat sufficiently to melt the rosin and clear up the mixture, then add the remaining 25 gallons of cold linseed oil in small portions and stir until thoroughly mixed. When the oil is all in, raise the heat to 400° F. pull the kettle from the fire and sprinkle in the litharge, about 2 pounds at a time, stirring well and whipping down the froth when necessary.

When all of the litharge is in and the "head" i. e., froth is well down, replace the kettle on the fire cautiously run to 530° F. or 540° F., so that the temperature will rise to 560° F., and not above, when the kettle is off the fire.

With the kettle off the fire, allow to cool to 500° F. or 480° F. and stir in the manganese resinate, then let cool over night.

This oil is used exclusively for polishing varnishes.

Mixing Wood Oil for Paint

Melt 100 lb. of M. Rosin and run to 500° F. Then add 100 lb. of oxide of calcium or air slaked lime and stir this in the rosin thoroughly. Then allow the rosin to cool to 400° F. At 400° F. put the kettle back on the fire and add 5 gal. of wood oil, stir this in thoroughly and then add 25 gal. more of wood oil. Allow the temperature to increase to 440° F. and then add 70 gal. of wood oil stirring well together and let the temperature increase to 460° F. Hold at this temperature for 30 minutes, then remove from the fire and cool and then thin with 80 gal. of benzine.

This varnish is remarkably tough, elastic, quick drying and is a mixing varnish.

Mixing Wood Oil for Floor Paints

M. Rosin	300 lb.
Litharge	8 lb.
Red Lead	4 lb.
Black Oxide of Manganese	5 lb.
Air Slaked Lime	15 lb.
Benzine	62 gal.
Raw China Wood Oil	12 gal.

Use an iron kettle for this batch, melt with the rosin and run to 300° F. and add the manganese, then the red lead, and then the litharge. Increase the heat to 500° F. and then add the lime stirring it in thoroughly. When the lime is all in remove from the fire and add the wood oil stirring in well and then thin with the benzine.

Wood Oil Flat Liquid for Making Flat Wall Paints

Wood Oil	10 gal.
Varnish Oil (Refined Linseed Oil)	50 gal.
Air Slaked Lime	8 lb.
Coal Oil	15 gal.
Benzine	125 gal.

It requires about 6 hours to make this batch in a copper kettle. The oils are to be heated first to about 600° F. and held at this temperature for about 4 hours. Then remove the kettle from the fire and allow the batch to cool to 475° F., then commence to add the lime slowly and let the heat increase while doing so to 540° F.

The lime will cause the oil to take on a very considerable body. After the lime is all in, allow the batch to cool to about 315° F. and add the coal oil stirring it in well and then adding the benzine.

This preparation is a complete liquid for flat wall paints and can be used for grinding the pigment as well as thinning them for use.

Prepared Paint Oil (Cheap) No. 900

Formula No. 1

Plain Hard Rosin No. 750	100 lb.
China Wood Oil	40 gal.
Soya Bean Oil	40 gal.
Kerosene 46°	50 gal.
Conc. "41-B" Drier, No. 1006	5 gal.

Melt the rosin in the mixed China wood and soya bean oils, stir thoroughly, then run to 540° F., or to a sufficient heat so that when the kettle is pulled from the fire the temperature will rise to 590° F.

It is essential that the final heat be not less than 575° F., nor more than 600° F., therefore, be governed accordingly, the object being to obtain a sufficient "body" so that when thinned the mixture will have a consistency or viscosity similar to commercial boiled linseed oil.

After the kettle is off the fire, allow to cool to 480° F., then thin with the kerosene.

When cooled to 300° F., follow with the benzine.

Add the concentrated drier last and stir well.

This is an excellent substitute for boiled linseed oil. It possesses good flowing qualities, dries in about 8 hours, has a good luster, and is durable.

No. 2

No. 901

H. Rosin	100 lb.
V. M. Linseed Oil	150 gal.
China Wood Oil	100 gal.
Wood Turpentine	83 gal.
Naphtha 54°	83 gal.
Conc. "41-B" Drier No. 1006.	

Melt the rosin in 100 gal. of the linseed oil and 100 gal. of China wood oil, mixed together, holding out 50 gal. of linseed oil for use later on.

Raise the heat to 540° F. or to a sufficient heat so that when the kettle is pulled from the fire the temperature will rise to 580° F.

As soon as the temperature of 580° F. has been reached, add 25 gal. of the reserved cold linseed oil and mix thoroughly by stirring, then put the kettle back on the fire and raise the heat quickly to 540° F. and immediately add the remaining 25 gal. of cold linseed oil, stir well and pull the kettle from the fire.

The temperature will now be down to about 400° F. and the mixture may now be thinned with the turpentine.

When cooled to 300° F. or lower,

follow with the benzine, then add the concentrated drier and stir well.

This oil is fairly pale in color, flows freely, levels quickly has a good luster and dries in about 8 hours.

It is used as a substitution for bleached linseed oil in exterior gloss white house paints.

Paint Oil

Formula No. 1

No. 930

M. Rosin	100 lb.
Slaked Lime	8 lb.
China Wood Oil	40 gal.
V. M. Linseed Oil	10 gal.
Petroleum Distillate	132 gal.

Place the rosin in the kettle, with the lime on top then add the China wood oil.

Heat slowly, i.e., during 2 hours, to 575° F. then pull from the fire and immediately "chill back" with the 10 gal. of cold linseed oil, stirring well.

The addition of the cold linseed oil will drop the temperature about 10 degrees, therefore, allow to stand until the thermometer registers 525° F. then put the kettle back on the fire and slowly bring the heat up to 540° F., at which point, again pull from the fire.

The temperature will rise to about 550° F. or 560° F. and then begin to fall, therefore, allow to stand until the heat is down to 320° F. at which point, then with the petroleum distillate.

This prepared oil should have about the same viscosity as raw linseed oil, consequently the mixture should be bodied up sufficiently by cooking until it will take the required quantity of thinner.

No. 2

Fish Oil	46.0 lb.
China Wood Oil	16.0 lb.
Sugar of Lead	2.0 lb.
Manganese Borate	5.0 lb.
Petroleum Turpentine Substitute	35.5 lb.

Run in the fish and China wood oil, add the lead and the borate, heat to 450–475° F. for 2 hours, cool and then add the petroleum turpentine substitute.

This oil is suitable for any grade of work.

No. 3

F. Rosin	175 lb.
Lime	10 lb.
Raw Linseed Oil	5 gal.
Fish Oil	10 gal.
Black Manganese Oxide	10 lb.
Litharge	5 lb.
Benzine	100 gal.

Heat the rosin to 400° F. and add the lime and stir it in well. After the lime has been taken up by the rosin add the linseed oil and the fish oil, then the manganese and then the litharge and run the temperature up to 450° F. and hold it for 1 hour between 450° and 475° F. Then cool it and thin with the 100 gal. of benzine.

The lime hardens the rosin and the oil is bodied so that it takes up the benzine. This is a very good formula which will dry with a hard film.

No. 4

Linseed Oil	50 gal.
Red Lead	10 lb.
Litharge	10 lb.
Slaked Lime	10 lb.
Benzine	150 gal.

Heat 50 gal. of linseed oil to between 575° and 600° F. for 4 hours and then cool it to 350° F.

Then add the red lead, the litharge and the lime; then heat again to 500° F., cool sufficiently and add the benzine.

No. 5

Water White Rosin	58.8 lb.
Hydrated Lime	2.0 lb.
Petroleum Spirits	39.2 lb.

Heat the rosin to 350° F. then add the lime and heat for ½ hour, cool and then add the petroleum spirits or varnolene.

This is a good formula to mix with other oils. It will give a gloss to them. Alone it is not of much value.

Prepared "Varnolette" Wood Oil

No. 931

China Wood Oil	50 gal.
Varnolette Rosin No. 788	22 lb.

Heat the oil to 300° F., pull from the fire and add the "varnolette" rosin.

Stir well, then replace the kettle on the fire and heat to 425° F. stirring very frequently.

Cool at 425° F. for 10 minutes, stirring frequently then pull from the fire and allow to cool.

Any desired "body" may be obtained by continuing the cooking at 425° F.

This prepared wood oil possesses strong drying properties and eventually becomes very hard.

It is used as a "sizing oil" as a "chill-back" oil, and as a regular varnish oil in furniture varnishes.

Like all undercooled wood oils it has a tendency to "skin over" and to dry more or less flat.

When made into a varnish, however, the extra cooking imparts to it a most brilliant luster.

"Chill Back" (Gas Proof) China Wood Oil
No. 878

China Wood Oil	100 gal.

Heat the wood oil slowly to 392° F. then pull from the fire and note the rise in temperature.

The temperature will rise to 430° or 440° F. according to the rapidity of heating, but the essential point is to heat the oil so that when pulled from the fire the temperature will rise above 392° F. but not go higher than 480° F.

The oil should be stirred frequently while the kettle is on the fire and several times after it is off the fire.

Do not run the kettle out of doors, but allow it to cool slowly overnight.

This oil is exceedingly pale in color, not very heavy in body and dries in 6–8 hours, without a "frosty" surface.

It is used exclusively for "chilling back" varnishes made entirely of China wood oil and rosin.

For instance, in a formula calling for 100 lb. of rosin and 64 gal. of wood oil, the rosin would be melted in 48 gal. of ordinary raw wood oil, the heat run to 590° F. and as soon as the kettle is off the fire the high temperature should be checked at once by adding 16 gal. of the prepared "chill-back" wood oil, the resultant varnish remains "gas-proof" whereas, by using raw wood oil for chilling back, it is not "gas-proof."

Heavy Body Oil

V. M. Linseed Oil	70 gal.
Litharge	8 lb.
China Wood Oil	20 gal.
V. M. Linseed Oil	10 gal.

Heat the 70 gal. of linseed oil to about 240° F., stir in the 8 lb. of litharge and heat slowly to 500° F. stirring very frequently.

Now, add the 20 gal. of cold wood oil and mix well by stirring.

The addition of cold wood oil will chill the mixture down to about 475° F.

Raise the heat to 575° F. and cook at 575–595° F. until the oil just begins to show a slight "string" as it drips from the stirring paddle, then pull from the fire and add the remaining 10 gal. of linseed oil, stir thoroughly for about 5 minutes, then allow to cool over night.

This oil is heavy bodied and somewhat similar to the Kellogg H. B. Oil.

It is pale in color and possesses good drying qualities.

It is used as a varnish oil and in the preparation of various paint oils.

Special Bodied Oil
No. 987

China Wood Oil	16 gal.
V. M. Linseed Oil	48 gal.

Mix the two oils together, then heat medium slowly to 565° F.

When a temperature of 565° F. has been attained, regulate the fire so that the oil may be cooked at 565–570° F. for 3 hours, stirring occasionally, i.e., about every ½ hour.

If any skins form on the surface of the hot-oil skim them off, do not stir the skins into the oil as it will cause discoloration.

After the oil has been cooked at 570° F. for 3 hours, pull the kettle from the fire and allow to cool over night.

In making this oil there is some danger of the wood oil "jellying" toward the end of the operation, therefore, stir more frequently during the last hour's cooking.

When finished, the oil should be very thick, but not solid.

In the event of actual "jellying" dump in 25 lb. of rosin at once and stir well. This will save the mixture, but do not use the rosin otherwise.

This heavy bodied oil is used chiefly in varnishes and grinding oils.

It is similar to Honey Oil, No. 907.

Haskin's Japan Oil
No. 891

V. M. Linseed Oil	25 gal.
Soya Bean Oil	5 gal.
China Wood Oil	20 gal.
Litharge	40 lb.
Manganese Dioxide	10 lb.

Heat the mixed oils to 450° F., hold at 450° F. for about 40 minutes, then raise the heat quickly to 500° F. and pull the kettle from the fire.

Now commence adding the litharge in small quantities, about 2 lb. at a time, stirring very frequently and whipping down the foam if necessary.

All of the litharge should be in by the time the heat is down to 440° F.

Put the kettle back on the fire and

run to 520° F. (no higher) then pull from the fire and add the manganese dioxide in small quantities, stirring constantly, and whipping down the foam if necessary.

After the manganese is in, put the kettle back on the fire and heat slowly to 500° F. thin frequently and whip down the foam.

As the temperature rises the foaming increases, therefore, proceed cautiously.

When a heat of 500° F. has been attained, pull from the fire and allow to cool over night.

This oil is light amber in color; is heavy and very thick; and possesses string drying properties.

It is used exclusively for making cheap, strong resinate driers.

Hard High Luster Japan Oil
No. 911

M. Rosin	100 lb.
Slaked Lime	4 lb.
Litharge	16 lb.
China Wood Oil	32 gal.
Kellogg's H. B. Oil	16 gal.
Strong W. V. Manganese Oil	8 gal.
Kerosene 46°	4 gal.
Naphtha 54°	80 gal.

Place the rosin in the kettle with the lime and litharge on top, then add the China wood oil.

Heat rather slowly, i.e., during 40 minutes, to 480° F., stirring very frequently, then run to 580° F. pull from the fire and add the 16 gal. of heavy-bodied linseed oil and stir thoroughly while the temperature is falling to 540° F.

When the heat is down to 540° F., replace the kettle on the fire and raise the temperature to 560° F., then pull from the fire and "chill back" with the 8 gal. of cold manganese oil and stir well.

Allow to stand until the heat is down to 500° F. then thin with the kerosene.

When cooled to 310° F. follow with the benzine.

This japan oil resembles boiled linseed oil in color and viscosity, but dries quicker, and has a high luster.

It contains 40.33% oil, consequently is as durable as the ordinary agricultural implement varnishes.

It is used in freight car, barn, warehouse wagon and other cheap paints.

Waterproof High Luster Grinding Oil
No. 912

V. M. Linseed Oil	32 gal.
China Wood Oil	16 gal.
Litharge	16 lb.
Soya Bean Oil	8 gal.

Mix the linseed and China wood oil together and heat to 300° F. then stir in the litharge.

Raise the heat slowly, i.e., during 1½ hours, to 575° F. and stir very frequently to prevent the litharge from burning on the bottom of the kettle and the oil from skimming on the top, both of which cause darkening of the oil.

Very little frothing will occur with the litharge, due to the large quantity of oil present. Furthermore there is no danger of the wood oil "jellying," as the presence of 1 lb. of litharge per gallon of wood oil overcomes this trouble.

When a temperature of 575° F. has been attained, hold at 575° F. exactly 15 minutes, then pull from the fire, "chill back" with the 8 gal. of cold soya bean oil and stir thoroughly.

Also stir quite frequently while the oil is cooling down to about 400° F.

This waterproof, high luster oil possesses strong drying properties. It has a color similar to boiled linseed oil, dries with a brilliant gloss; is not particularly heavy in body; and has good flowing and leveling qualities.

It is used as a paint grinding oil; as a "chill back" oil in boat varnishes; and as a hard oil in rubbing varnishes.

Varnoleate Grinding Oil
No. 967

M. Rosin	100 lb.
Slaked Lime	4 lb.
Manganese Dioxide	3 lb.
Red Lead	2 lb.
China Wood Oil	30 gal.
V. M. Linseed Oil	4 gal.
Kerosene 46°	50 gal.

Melt the rosin, run to 500° F., pull the kettle from the fire and sprinkle in the slaked lime, stir well and whip down the foam if necessary.

Replace the kettle on the fire, run to 560° F. and again pull from the fire.

Now add the 4 gal. of linseed oil, stir well, then pour in the cold China wood oil, a little at a time, the rosin "chills" then put the kettle back on the fire and heat to 400° F. stirring until the mixture is well liquid, then pull from the fire and sprinkle in the red lead, following with the manganese dioxide stirring constantly.

After the drying salts are in, put the kettle back on the fire and heat slowly to 450° F., stirring very frequently and beating down the foam if necessary.

When the driers are taken up and the moisture ceases to froth run quickly to 520° F. or to a sufficient temperature so that when the kettle is off the fire the heat will not rise above 585° F. preferable not above 575° F.

When the kettle is off the fire stir frequently while cooling to 500° F. at which point then with the kerosene, and when cooled to 300° F. following with the benzine.

This oil is medium light in color; heavy bodied, and dries in 10–12 hours.

The mixture contains 35.13% oil.

Submarine Grinding Oil
No. 887

Menhaden Fish Oil	32 gal.
Manganese Dioxide	6 lb.
China Wood Oil	16 gal.
Litharge	24 lb.
K. Rosin (raw)	50 lb.
Japan Wax	2 lb.
Kerosene 46°	48 gal.

Put the maganese dioxide in the cold menhaden oil, stir well, then raise the heat slowly to 560° F.

At about 320° F. the manganese dioxide will begin to give off oxygen, and at 420–480° F. the mixture will froth strongly, therefore, proceed cautiously.

When a temperature of 560° F. has been reached, usually in 2–3 hours, pull from the fire and add the cold wood oil, stir until thoroughly mixed, by which time the heat will have dropped to 460° or 440° F.

Now begin adding the litharge, about 2 lb. at a time, sprinkling it on the surface of the oil, allowing it to remain for ½ minute, then stir for a minute.

Whip down the form if necessary, before adding more litharge, then continue the additions until all of the litharge is in.

Put the kettle back on the fire, raise the heat to 480° F., pull from the fire and add the 50 lb. of rosin, a little at a time, stirring constantly until the rosin is in solution. The addition of rosin will cause some foaming as all of the litharge will not have been taken up.

When frothing ceases, put the kettle back on the fire, heat to 480° F. and cook at 480–520° F. until the litharge is taken up, then pull from the fire, add the japan wax, stir for 2 or 3 minutes and thin with kerosene.

This dark-colored, waterproof oil, is used in roof paints, freight car, and smokestack paints.

Reinforced Quick Drying Grinding Oil
No. 923

China Wood Oil	64 gal.
V. M. Linseed Oil	32 gal.
Litharge	16 lb.
Caustic Soda	2 lb.
Aluminum Stearate	4 lb.
Honey Oil No. 907	32 gal.
Heavy Naphtha 48°	64 gal.
Conc. Varnish Drier No. 1007	2 gal.

Mix the 64 gal. of China wood oil with the 32 gal. of V. M. Linseed oil, then stir in the litharge, caustic soda and aluminum stearate.

Heat quickly, with frequent stirring, to 575° F. and then pull from the fire.

Immediately "chill back" with the honey oil, adding the oil in a fine stream and stirring constantly.

The addition of a cold honey oil will drop the temperature to about 540° F.

Allow to stand until cooled to about 400° F. then thin with the heavy naphtha and follow with the concentrated varnish drier.

This oil is pale; has a brilliant luster, and dries in 2–3 hours.

It is used for reinforcing short-oil varnishes, and as a quick-drying oil.

The mixture contains 69.52% oil.

Prepared "450" China Wood Oil
No. 925

China Wood Oil	32 gal.
Litharge	16 lb.
V. M. Linseed Oil	8 gal.
Wood Turpentine	8 gal.
Texaco Spirits	24 gal.

Mix the litharge with the cold wood oil, then heat slowly, i.e., during about 30 minutes to 450° F. stirring very frequently to prevent the litharge from burning on the bottom of the kettle.

Very little frothing will occur, but the oil must be stirred every three or four minutes, and it is essential that the temperature does not rise above 450° F.

Cook at 450° F. for 20–30 minutes, or until the litharge is taken up, then run quickly to 480° F. and pull from the fire.

The moment the kettle is off the fire, "chill back" with the cold linseed oil and stir well.

If at any time the oil should start to "jelly," and the linseed oil, all at once, and stir vigorously. Jellying seldom occurs, however, as the litharge prevents the wood oil from becoming solid.

After the linseed oil is in, allow to cool to 400° F. and then thin with the turpentine, then follow with the Texaco spirits.

This prepared wood oil is of a pale amber color; is slightly thicker than raw linseed oil and dries in 2–3 hours with a slightly wrinkled surface.

It is used for grinding light and dark pigments; for making oilproof machinery paints, and especially for making flat varnishes.

It carries 57.53% oil.

Pale Quick Drying Japan Grinding Oil

No. 978

Strong "1500" Rosin No. 970	70 lb.
Heavy "Alinco" Oil No. 853	30 gal.
China Wood Oil	7½ gal.
Slaked Lime	7½ lb.
Kerosene 46°	90 gal.
Naphtha 54°	75 gal.
"B" Concentrated Drier, No. 1006	15 gal.

Melt the rosin with the wood oil and 25 gal. of the heavy-bodied linseed oil reserving 5 gal. for "chilling back" later on.

When the rosin has melted, or at a temperature of about 400° F. commence adding the slaked lime, about a pound every 5 minutes, stirring frequently.

Continue raising the heat, and endeavor to have all of the lime in by the time the temperature is up to 500° F. but continue the heat up to 550° F. stirring very frequently, then pull from the fire, and "chill back" with the 5 gal. of heavy Alinco oil, and stir thoroughly.

The addition of cold oil will check the rise in temperature, therefore, stir frequently while the temperature is falling to 500° F. at which point, thin with the kerosene.

When cooled to 300° F. or lower follow with the benzine, then add the concentrated drier and stir for about 5 minutes.

Tank for a few days to allow the slight residue of lime, etc., to settle out, and for the oil to brighten.

This "oil substitute" is pale in color; resembles raw linseed oil, and dries in 8–10 hours.

It is absolutely neutral and may be used for mixing and grinding light-colored pigments.

The mixture contains 20.62% oil.

Neutral Varnish Oil

No. 910

M. Rosin	100 lb.
Slaked Lime	6 lb.
China Wood Oil	40 gal.
V. M. Linseed Oil	5 gal.
Litharge	7 lb.
Red Lead	3 lb.
High Lime Rosin No. 751	125 lb.
Heavy Naphtha 48°	130 gal.
Conc. Varnish Drier, No. 1007	1 gal.

Melt the rosin, with lime on top, in the wood oil and run to 570° F.

Pull from the fire, stir until the temperature rises to 580° F., then "chill back" with the 5 gal. of cold linseed oil.

Allow to cool down to 550° F., then add the 125 lb. of high lime rosin, in small quantities, and stir until the rosin has dissolved or nearly so.

Now, put the kettle back on the fire and raise the heat to a sufficient temperature so that when the kettle is off the fire the temperature shall rise to 550° F.

With the kettle off the fire, and as soon as the temperature begins to fall, commence adding the litharge and red lead, previously mixed together about 2 lb. at a time. Stir very frequently while cooling to 475° F. and occasionally while cooling to 400° F. at which point, thin with the heavy naphtha, then follow with the concentrated drier.

This prepared oil is extremely light in color; has a high luster; is neutral in character, and dries in 6–8 hours.

It has the same body as boiled linseed oil and is used as a grinding and mixing oil.

It has an "oil content" of 24.24%, and may be used as a baking varnish if desired.

"Kero-Tung" Mixing Oil
No. 905

Strong Drying Rosin No. 762	75 lb.
Manganese Resinate No. 760	25 lb.
China Wood Oil	4 gal.
Kerosene 46°	32 gal.

Melt the strong drying with the China wood oil, run to 540° F. and pull from the fire.

The heat will probably rise to 570° F. or thereabout, but in any event, at the moment the temperature starts to drop, add the manganese resinate, previously broken into small pieces.

Stir until the resinate dissolves, or nearly so, then put the kettle back on the fire and raise the heat to 480° F. or to a sufficiently high temperature so that when the kettle is pulled from the fire the ultimate heat will rise to 520° F. but not above 550° F.

After the kettle is off the fire, allow to cool to 480° F. then thin with kerosene.

This oil resembles commercial boiled linseed oil.

It dries over night, and the film is tough and hard. It is very waterproof.

"Kero-tung" oil is used as a grinding oil for dark colored oxides, and as a mixing liquid for brown, dark red, green and black mixed paints.

It is also used for thinning dipping paints.

"Honey Oil" (For Varnish)
No. 907 (Grinding Oil)

V. M. Linseed Oil	40 gal.
China Wood Oil	6 gal.
V. M. Linseed Oil	4 gal.

Mix the 40 gal. linseed oil with the 6 gal. China wood oil and stir thoroughly.

Heat the mixed oils to 575° F. and hold at this temperature until the oil drips heavy from the stirring rod, i.e., until it thickens just under the "stringing" point.

Usually 2½–3 hours cooking at 575° F. are required to produce the desired body.

When the proper body has been obtained, add the remaining 4 gal. of cold linseed oil, stir well, and then pull the kettle from the fire.

After the kettle is off the fire, stir for a few minutes, then allow to cool over night.

This beautiful, exceedingly pale oil has a body like honey, and possesses good drying properties.

It is used as a "grinding oil" for white enamels; and then thinned with an equal volume of turpentine or benzine produced as superior artist's oil.

It is also used in pale, quick leveling hard gum varnishes, especially in Congo short-oil varnishes.

Dry Castor Oil (Paint Vehicle)
Formula No. 1

Heat castor oil with 6–8% kaolin at 275–80° C. until required viscosity is reached.

No. 2
(Dehydrated)
British Patent 520,508

Castor oil is heated at 315° C. for 1½–2½ hours in presence of 0.5–0.8% cobalt chloride. The latter should be first dried and then dissolved in alcohol.

Flat Stearate Quick Drying Mixing Oil
No. 924

China Wood Oil	32 gal.
V. M. Linseed Oil	16 gal.
Aluminum Stearate	44 lb.
Litharge	16 lb.
V. M. Linseed Oil	16 gal.
Heavy Naphtha 48°	16 gal.

Mix the 32 gal. of wood oil with 16 gal. of linseed oil, then stir in the aluminum stearate and the litharge.

Heat rather fast, i.e., during about 30 minutes, to 450° F. stirring very frequently.

Pull from the fire and allow to stand until the temperature is up to 480° F. and the litharge is taken up, then "chill down" with the remaining 16 gal. of cold linseed oil.

Stir frequently while cooling to 400° F., or lower, then thin with the heavy naphtha.

It is essential that the heat does not exceed 490° F. and that all of the litharge is taken up.

Should the mixture show a tendency to "string" at any time, pull from the fire and add the final 16 gal. of cold linseed oil, all at once.

This oil is very quick-drying and "wrinkles" by itself, but with pigments it dries perfectly and is extremely waterproof.

It contains 80% oil.

Used only as a mixing and grinding oil with dry pigments for the production of flat, waterproof paints.

Special Quick Drying Oil
No. 939

M. Rosin	100 lb.
Prepared Wood Oil	20 gal.
Varnolette Rosin, No. 788	20 lb.
Litharge	20 lb.
Heavy Alinco Oil, No. 853	20 gal.
Texaco Spirits	20 gal.
Naphtha 54°	80 gal.

Melt the 100 lb. of rosin in the wood oil, run to 450° F. and pull from the fire.

Now add the 20 lb. of varnolette rosin and stir until dissolved, then replace the kettle on the fire and commence adding the litharge, about 2 lb. at a time, stirring very frequently and beating down the foam if necessary.

Gradually raise the heat to 450° F. and cook at this temperature for 30 minutes, then pull from the fire and add the heavy Alinco oil, stirring from 4–10 minutes to insure a perfect mixture.

When cooled to about 400° F. thin with the Texaco spirits and when the temperature is down to 300° F. or lower, follow with the benzine.

This quick drying oil is in reality a varnish. It is used principally as a "blending" liquid.

Quick Drying Boiled Oil
No. 994

V. M. Linseed Oil	72 gal.
China Wood Oil	36 gal.
Manganese Borate	5 lb.
Red Lead	27 lb.

Put the two oils in the kettle, mix well by stirring; then heat to 375° F. and pull from the fire.

Put the manganese borate and red lead in a 5-gal. bucket, mix well together; then take out about 2 gal. of the hot oil and pour into the drying salts.

Pour only a little of the hot oil onto the driers at first as the borate will froth strongly, stir well, then add more of the hot borate and lead mixture.

When the drying salts are saturated and frothing ceases, commence adding the paste to the hot oil in the kettle, about 1 qt. at a time, stirring constantly and beating down the froth if necessary.

After the driers are all in, replace the kettle on the fire and heat slowly to 530° F. stirring frequently and beating down the foam if necessary.

Should the "head" i.e., foam, rise too high, pull the kettle from the fire and whip down the foam, then replace on the fire and continue the cooking.

Cook at 530° F. for 1 hour then pull the kettle from the fire and allow to cool over night.

This quick drying oil is of a pale amber color and dries with a remarkable tough film.

It is used principally as a varnish oil for hard gum varnishes, but may also be used as a grinding oil for pigments.

Pale Heavy Drying Wood Oil
No. 963

China Wood Oil	45 gal.
M. Linseed Oil	5 gal.
Litharge	8 lb.

Mix the two oils, heat quickly to 420° F. and pull the kettle from the fire.

Allow to stand until the temperature reaches 480° F. as a maximum and then begins to fall.

As soon as the temperature has fallen 5° commence adding the litharge, about 2 lb. at a time.

Sprinkle the litharge on the surface of the hot oil, allow to remain for about 1 minute, then stir briskly for about 2 minutes repeating this process until all of the litharge is in.

All of the lead should be in by the time the temperature is down to 440° F.

Now, replace the kettle on the fire and heat slowly to 450° F.

Cook at 450–470° F. (not above 475° F.) for about 30 minutes, or until all of the litharge is taken up, then pull from the fire and allow to cool.

This prepared oil is light in color; heavy bodied, but liquid enough to run; and dries in 6–8 hours with a dull transparent surface.

It is used chiefly in flat exterior varnishes; as a "chill-back" oil, and in small quantities for producing glass-like enamel varnishes.

Electric Drying Oil
No. 875

Heavy "Alinco" Oil No. 852	20	gal.
China Wood Oil	30	gal.
Manganese Sulphate	8	lb.
Glycerin	5¼	lb.
Litharge	8	lb.

Mix together the heavy Alinco and China wood oils, heat to 320° F., add the manganese sulphate, stir well, then run the heat up to about 480° F. so that when the kettle is pulled from the fire the heat will rise to 520° F.

As soon as the temperature reaches 520° F. add the glycerin a little at a time, as the glycerin causes violent foaming.

Stir well while adding the glycerin, and when all in, commence adding the litharge in small portions, about 1 lb. at a time, stirring constantly.

The litharge should be all in by the time the temperature is down to 450° F. and a sample of the oil on glass, when cold, should be so thick that it will barely flow.

If the proper body has not been obtained by this time, put the kettle back on the fire and heat to 480° F., then pull from the fire and allow to settle and cool.

The residue of lead sulphate may be discarded.

This oil is thick and heavy, and very turbid in appearance but on beating becomes clear.

It will not "liver" with lead and zinc pigments, nor with red lead. It dries very rapidly.

It was designed especially for neutral grinding japan, but is now used in many "pale driers" and in several varnishes, also as a grinding oil.

Dry Oil for Congo Varnish
No. 937

China Wood Oil	30	gal.
M. Rosin	30	lb.
M. Rosin	30	lb.
V. M. Linseed Oil	5	gal.
V. M. Linseed Oil	25	gal.
Red Lead	15	lb.
Manganese Resinate	2½	lb.

Melt 30 lb. of rosin in the China wood oil run quickly to 540° F. and pull from the fire.

Immediately add the remaining 30 lb. of rosin and 5 gal. of cold linseed oil, and stir until the rosin has dissolved.

The addition of the rosin and the cold linseed oil checks the rise in temeprature and prevents the wood oil "jellying."

Now, add the remaining 25 gal. of linseed oil, replace the kettle on the fire and heat to 400° F., then add the red lead, about 2 lb. at a time, stirring very frequently and beating down the foam if necessary.

Hold between 400° and 450° F. for a few minutes until frothing ceases, then run to 540° F. or a sufficient temperature so that when the kettle is off the fire the heat will rise to 565° F. but not above 575° F. then all to cook to 500° F., and stir in the manganese resinate.

This is a good drying oil; has a high luster and is medium light in color. It is principally used in Congo varnishes.

Wood Oil Bronze and Aluminum Liquid

M. Rosin	100	lb.
Caustic Soda (70%)	2	lb.
Raw Linseed Oil	2	gal.
Raw China Wood Oil	2	gal.
Water	4	gal.
Benzol	12	gal.
Benzine	13	gal.

Use an iron kettle. Place the caustic and the water in the kettle first and dissolve the caustic with gentle heat, then add both the linseed oil and the wood oil and stir well together and then add the 100 lb. of rosin.

Boil the batch now until the rosin comes perfectly clear again and thin first with the benzol and then with the benzine.

This liquid is safe to use with any grade of bronze or aluminum powders. It will not turn green when used with bronze nor will it effect the color of it. It is safe to sell for such work as picture frames, radiators and etc.

Baking Gloss Oil
No. 110

Pale Rosin (Hard)	100	lb.
Litharge	5	lb.
Wood Oil	10	gal.
Turpentine Substitute No. 43	20	gal.

Melt the rosin, sprinkle in the litharge and cook at 300–320° F. until it combines, then pour in the wood oil and run to 600° F. Cool to 480° F. and cook 30 minutes, then allow to cook slowly to 320° F. and thin.

Baking Gloss Oil
No. 1612

M. Rosin	100	lb.
Slaked Lime	5	lb.
China Wood Oil	8	gal.
Litharge	8	lb.
V. M. Linseed Oil	2	gal.
Kerosene 46°	5	gal.
Naphtha 54°	20	gal.

Melt the rosin, run to 420° F., pull from the fire, sprinkle in the lime and stir down the foam.

Put the kettle back on the fire, run to 575° F., pull from the fire and add the cold wood oil, about 1 gal. at a time, stirring until well mixed.

When all in, put the kettle back on the fire and heat to 585° F., then add the 2 gal. of cold linseed oil and again pull from the fire.

Stir until the temperature has fallen to 510° F., then add the litharge about 1 lb. at a time, stirring very frequently and whipping down the foam if necessary.

All of the litharge should be taken up by the time the heat is down to 400° F. at which temperature thin with the turpentine.

When cooled to 300° F. follow with the benzine.

This gloss oil is practically a short-oil varnish. It contains about 22% oil, and is used by itself, and as a "blend" with long oil varnishes for baking.

Anti Rust Waterproof Oil
No. 971

Raw M. Rosin	100 lb.
Red Lead	16 lb.
Manganese Dioxide	4 lb.
China Wood Oil	32 gal.
Menhaden Fish Oil	8 gal.
Beeswax	1 lb.
Kerosene 46°	16 gal.
Wood Turpentine	32 gal.
Heavy Naphtha 48°	16 gal.

Melt the rosin to about 320° F., pull the kettle from the fire and sprinkle in the driers, previously mixed together, well stirred in to the melted rosin. When the red lead and black oxide are all in, put the kettle back on the fire and cook at 350° F., to 400° F. for 15 minutes, or until a sample on glass shows a transparent amber color.

As soon as the drying salts are taken up pull the kettle from the fire and heat quickly to 575° F. stirring frequently and beating down the foam if necessary. *As soon* as the temperature reaches 575° F. pull from the fire and immediately "chill back" with the 8 gal. of fish oil. Stir very frequently while the mixture is cooling to 480° F. at which point, add the beeswax, in small pieces, and stir until dissolved.

When the wax has dissolved, thin first with the kerosene then follow with the turpentine and heavy naphtha.

This waterproof oil is of a medium amber color; has a good luster, and dries in 8–10 hours.

It contains 35.71% oil. The oil is used as an anti-rust, waterproof varnish on metals and as a paint grinding oil.

Core Oil Compound
No. 182

Rosin	100 gal.
Wood Oil	20 gal.
Kerosene (42° Bé.)	40 gal.

Heat the wood oil quickly to 500° F. then carefully to the gelatinizing point (540–580° F.) and the instant it begins to string, empty in the rosin, all at once, stir well and run to 650° F.

Cook for 15–30 minutes at 600–650° F., then allow to cool to 350° F. and thin.

The above produces a *cheap rosin varnish.*

Wood Stains
Modern Woodstains

Modern woodstains are fairly well standardized and are essentially solutions of synthetic organic dyes. The choice of dyes and of solvents to use is dependent upon the particular specifications of fastness, costs, and methods of application. The antique, repair, and hobby shops undoubtedly still make up numerous specialty stains. However, for use in large-scale production there have been evolved four distinct types of stains, and practically all industrial staining is now done with these standard type products.

These four major types of woodstains are the "Water-Soluble," "Oil-Soluble," "Spirit-Soluble," and the so-called "Non-Grain-Raising" stains. Typical practical formulas are given in tables III, IV, V and VI.

Water Stains

Water-soluble stains are 1% to 3% solutions (1⅓–4 oz. per gal.) of dyes in water. The addition of 0.5% of "Alpha-sol-OT" paste or other suitable wetting agent increases the penetration, uniformity, and depth of shade. The dyes used vary with the particular application. For toys, fruit containers, and other short-lived articles the basic dyes are used. These are tinctorially strong and very bright in hue, but are fugitive to light and tend to rub. For furniture and interior woodwork the faster-to-light acid dyes and sap brown are used. It has been found that by using properly proportioned blends of dyes practically all the popular mode shades can be obtained. Table III shows typical formulas.

Water-soluble woodstains tend to penetrate into the wood and dry quickly. Accordingly they require skill to brush them onto large areas without showing laps and streaks. Light sapwood streaks often require touching up with a preliminary, or else a retouching, application of stain with a nearly dry brush. In general these stains yield clear, uniform, transparent effects. Many have but little tendency to bleed into top coats of varnish, and the varnish brings out their full beauty of color. Many are resistant to fading. At the same time, their comparatively low price and the low cost of their vehicle, water, increases their economic importance.

Oil Stains

Oil stains for wood are of two types. One type consists of suspensions of earth pigments, such as Van Dyke brown, siennas, and umbers, in drying oils, often thinned with benzene or coal-tar light oils. The second type, known as the "penetrating oil stains," are 1% to 3% solutions of dyes in a 5% to 10% varnish solution.

Oil stains dry slower, so require less skill in their application than do water stains. They have but little tendency to raise the grain of the wood, and therefore the preliminary spongings and sandings needed with water stains are unnecessary with oil stains. Those made with earth pigments are not very transparent, nor do they penetrate the surface deeply, but they are fast to light and do not bleed into top coats. The penetrating oil stains are bright, transparent, and penetrate well, but are less fast to light and require sealing with a thin shellac coat to prevent bleeding into top varnish or lacquer coats. Despite the labor-saving features of oil stains the high cost of their solvents limits their use.

Oil stains are particularly useful in refinishing furniture, floors, and interior trim, and for the inside surfaces of drawers, cabinets, and the like. They are therefore particularly useful to repair and handicraft shop operators. For formulas see table IV. Excellent methods for imitating woods by the use of oil stains have been developed.

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Spirit Stains

Spirit stains are alcoholic solutions of dyes, used with or without spirit-soluble resins present. Frequently these are colored with the powerful, bright, but light-fugitive basic dyes. There are available somewhat duller, fast-to-light, alcohol-soluble dyes, recently developed, but their high cost limits their use. By using mixtures of glycols or glycol ethers and alcohol some of the acid dyes can be dissolved. There have been developed some very useful specialty spirit or spirit-water stains that are fast to water, are similar to the basic dyes in hue and are a little faster to light.

Spirit stains dry quickly, so are somewhat difficult to apply evenly to large areas. They tend to penetrate some old finishes. They are much used for toys, and for cabinet interiors. See table V for formulas.

Non-Grain-Raising Stains

The most recently developed type of woodstains are the so-called "non-grain-raising" stains. These consist of selected dyes dissolved in mixtures of volatile solvents that include glycols, glycol ethers, hydrocarbons, lacquer acetates, and alcohols. The dyes are first dissolved in the glycol, glycol-ethers, and alcohols, then the diluent liquids are added. These latter are usually benzine, toluene, xylene, acetone, or acetates, but undoubtedly a small amount of benzine or naphtha may be added also. The presence of these diluents appears to minimize the raising of the wood grain. For formulas see table VI.

If these stains are formulated chiefly of alcohols and glycol ethers and applied by spraying, then from 5% to 20% of water may be used in the formula without excessive grain-raising effects. It should be noted that some of these mixtures are patented.

The large-scale production methods used today are chiefly spraying and dipping procedures. The stain is applied by spraying onto the wooden article which is mounted on a revolving table in well-ventilated booth. Each booth is screened from those adjacent to prevent specking other work by "tramp" colored fog. If a dipping method is used, the whole article or a definite portion of it is dipped into a vat of stain for a few seconds, lifted, drained, and excess stain wiped off. Frequently forced drying methods are used. It is not uncommon practice today for some factories using these methods, to stain, fill, varnish, and ship an article the same day.

Using the Formulas

The tabulated formulas given herewith may be used in two ways. One of these is that outlined in the parenthetical notation above the tabulations; that is, the proper amount of each dye is weighed out, and the dyes specified are dissolved in the proper amount of the appropriate solvent, or each dye may be dissolved in a portion of the total amount of vehicle and the resulting solutions mixed. This is the method employed in preparing or using the proprietary stains. In the second method, stock solutions of the individual dyes are prepared—all at the same concentration—then these solutions are mixed in the proportions indicated in the formulas.

Further, as the practical craftsman well knows, the final shade obtained with any formula depends to some extent upon the tinctorial value of the dyes used, the self-shade and the absorption characteristics of the wood, and the temperature of the solutions when applied. For example, a transparent dyestain will not produce the same final appearance on a soft, white wood as on a hard, dark-brown wood. Accordingly, when a piece is made from both light and dark shades of wood the stainer often uses solutions of the individual dyes for touching up the lighter areas to shade after the preliminary staining; or to match shades of various pieces presenting differences in the wood, he may increase or diminish the proportion of an individual dye in the formation of various lots of the stain.

TABLE I
Blending Formulas for Water-Soluble Woodstains

(**Quantities in the table are pounds** of each dye to be used in a total of 10 gallons of water; the dyes may be dissolved together, or separately in aliquot portions of the solvent and the several solutions mixed)

Color Index No.	Dye	Red Mahoganies				Brown Mahoganies				Rose-wood	Cherries		Cedar
185	Calcocid Scarlet 3 RN, Concentrated	4	.3	..	...	..	..	..	..	..	....	...	...
10	Calcocid Yellow S	..	1.1	..	...	..	..	..	0.2	..	....	...	...
252	Calcocid Scarlet MOON	..	0.6	..	...	..	..	..	..	..	....	...	...
88	Calcocid Bordeaux BXL	..	..	1.4	...	..	..	..	..	1.8	0.244	0.39	...
865	Calcocid Nigrosin WSB	..	..	0.2	...	1.3	1.8	1.0	2.4	1.8	0.200	0.33	0.32
151	Calcocid Orange Y, Extra Concentrated	..	..	2.4	...	2 2	1.1	2.0	1.4	0.4	0.556	0.28	0.68
179	Calcocid Rubin AW	..	..	..	2.32	..	..	..	..	..	....	...	...
161	Calcocid Orange 2R	..	..	..	1.64	..	1.1	..	..	..	....	...	...
865	Calcocid Nigrosin WSJ	..	..	..	0.04	..	..	..	..	..	....	...	...
79	Calcocid Scarlet 2 RB	..	..	..	...	0.5	..	1.0	..	..	....	...	...
620	Calcomine Yellow 2 G	..	..	..	...	..	..	..	..	..	....	...	...
138	Calcocid Yellow MXX Concentrated	..	..	..	...	..	..	..	..	..	....	...	...
5	Calcocid Green B	..	..	..	...	..	..	..	..	..	....	...	...

Color Index No.	Dye	Light Wal-nut	Dark Wal-nut	Golden Oak	Light Oak	Flemish Oak	Weathered Oaks		Fumed Oak	Ant-werp Oak	Bog Oak	Dark Green	Ebony	Maple
185	Calcocid Scarlet 3 RN, Concentrated	..	..	....	...	...	...	...	...	...	..	...	..	...
10	Calcocid Yellow S	0.8	..	....	0.20	...	...	...	...	...	..	...	..	...
252	Calcocid Scarlet MOON	..	..	....	...	...	...	...	...	...	..	...	..	...
88	Calcocid Bordeaux BXL	..	..	0.005	...	...	0.66	...	...	...	..	...	..	...
865	Calcocid Nigrosin WSB	0.8	0.6	0.020	0.35	0.75	0.46	1.48	1.10	0.76	..	0.48	..	0.20
151	Calcocid Orange Y, Extra Concentrated	..	0.1	0.075	0.18	0.05	0.88	0.12	0.30	0.12	..	0.24	..	3.16
179	Calcocid Rubin AW	..	..	....	...	...	...	...	...	...	..	...	..	0.64
161	Calcocid Orange 2R	0.4	..	....	...	...	...	...	...	...	..	...	..	...
865	Calcocid Nigrosin WSJ	..	..	....	...	...	...	...	...	...	..	...	4	...
79	Calcocid Scarlet 2 RB	..	..	....	...	...	...	...	...	...	..	...	..	...
620	Calcomine Yellow 2 G	..	0.3	0.400	...	0.20	...	0.40	0.60	...	..	...	..	...
138	Calcocid Yellow MXX Concentrated	..	..	....	0.27	...	...	...	...	0.12	..	...	..	...
5	Calcocid Green B	..	..	....	...	...	...	...	...	...	1	3.28	..	...

TABLE II

Blending Formulas for Penetrating Oil Stains

(Quantities in the table are ounces of each dye to be used in a total of one gallon of vehicle; the dyes may be dissolved together, or separately in aliquot portions of the vehicle and the several solutions mixed)

Dye	Red Ma-hog-any	Light Br'n Ma-hog-any	Dark Br'n Ma-hog-any	Rose-wood	Light Cherry	Medium Cherry	Dark Cherry	Light Walnut	Medium Walnut	Dark Walnut	Golden Oak	Light Oak	Dark Oak	Brown Oak	Weath-ered Oak	Green Oak	Maple
Oil Black 8603	1.4	..	..	1.75	..	...	0.27	0.90	1.00	1.80	..	0.25	0.88	1.6	1.92	1.12	0.30
Oil Orange 7078 (C. I. 24)	0.4	2	1	0.25	0.5	0.5	0.05	0.02	0.88	...	0.2	0.45	0.58	0.4	0.08	...	1.40
Oil Yellow 7463	..	..	..	0.25	..	0.30	0.55	1.04	0.06	0.45	0.8	0.30	0.54	..	...	0.44	...
Oil Red N-1700	..	..	3	2.75	1.5	0.65	0.13	0.04	...	0.75	..	...	...	..	...	...	0.28
Oil Blue B-5199	..	..	..	...	..	...	...	...	...	...	..	...	...	..	...	0.44	...

TABLE III

Spirit and Water Stains for Toys and Fruit Crates

(Quantities in the table are parts per 100)

Color Index No.	Dye		Water-fast								
		Red	Yellow	Blue	Red	Orange	Yellow	Green	Blue	Violet	†Black
...	Dyebryte Red C	4	..	..	...	...	.....	...	....	....	...
...	Dyebryte Yellow N-4336	..	2	..	...	...	.....	...	....	....	...
...	Dyebryte Blue N-4338	..	..	4	...	...	.....	...	....	....	...
677	*Calcozine Magenta RTN	..	..	..	1	...	.....	...	....	....	...
20	*Calcozine Orange Y	..	..	..	...	1	.....	...	....	....	...
655	*Calcozine Yellow OX	..	..	..	...	...	0.5	...	....	....	...
662	*Calcozine Brilliant Green G	..	..	..	...	...	.....	1	....	....	...
720	*Calcozine Blue B	..	..	..	...	...	.....	...	0.5	0.5	...
680	*Calcozine Violet, Extra Concentrated	..	..	..	...	...	.....	...	....	0.5	...
864	Nigrosin SSBHS	..	..	..	...	...	.....	...	....	....	2
...	Alcohol	60	60	60	...	...	.....	...	....	....	100
...	Water	40	40	40	100	100	100.0	100	100.0	100.0	...

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* Soluble in water, alcohol, or any mixture of water and alcohol, but best dissolved by first pasting with an equal weight of concentrated acetic acid, then thinning out with the vehicle.

† To be filtered.

TABLE IV

Blending Formulas for Non-Grain-Raising Stains

(Quantities in table are ounces of each dye to be used in a total of one gallon of vehicle; the dyes may be dissolved together, or separately in aliquot portions of the vehicle and the several solutions mixed)

Dye	Red Mahogany	Brown Mahogany	Rosewood	Cherry	Cedar	Walnut	Oak	Flemish Oak
Calcolac Red B	1.3750	.....	0.54	0.675	....	0.25	.....	.....
Calcolac Scarlet M	....	0.6875	...	....	0.050	...	.....	.....
Calcolac Orange Y	1.0625	1.4375	...	....	1.625	...	0.9000	0.8625
Calcolac Yellow MY	.....	.....	...	....	....	...	0.4875	0.3375
Calcolac Blue-Black X	0.0625	0.3750	...	....	....	...	0.1125	0.3000
Calcolac Light Yellow 3G	.....	.....	1.86	1.425	....	1.75	.....	.....
Calcolac Black BWS	.....	.....	0.60	0.400	0.825	0.50	.....	.....

Staining Wood for Piano Keys

Formula No. 1

Boil 2 lb. of logwood chips in 1 gal. of water; or, in place of the logwood chips, use 2 oz. of logwood (solid) extract. Immerse the wood in this solution for at least 15 minutes; then drain off and allow to dry in a good circulation of air. Immerse in a second solution consisting of 4 oz. (¼ lb.) of green copperas (sulphate of iron), or of sulphate of copper, to 1 gal. of water. Similarly, remove and allow to dry in a warm well-lighted place—but the drying should not be hastened by artificial heating.

Finally, pass the wood through an alkaline solution made by dissolving ½ lb. of sal soda into 1 gal. of water. After passing through this third solution, the articles should be rinsed in clear water to clean them thoroughly.

No. 2

For selected hard maple the data is: Into 1 gal. of distilled water, dissolve by boiling, the following:

Permanganate of Potash	12 oz.
Copper Sulphate	4 oz.
Iron Sulphate	4 oz.

Heat this solution to 160° F., and immerse the wood for 15 minutes; when dry, re-immerse and dry again. There will be a precipitation of the excess chemical salts on the surface when dried, and this must be thoroughly removed by rubbing with a dry cloth, before recoating. Now, into 1 gal. of distilled water, dissolve 12 oz. of aniline hydrochloride. Heat this solution to the boiling point; then apply two dip coats as before, each time allowing the wood to dry thoroughly. The ebony black color does not appear at once, but develops in a few hours.

Fumed Wood Finish

First make a stain as follows: Mix together 1 lb. of burnt umber and 1 lb. of raw sienna and about a level teaspoonful of burnt soenna (all oil colors). Thin gradually and thoroughly with ½ gal. of boiled linseed oil and ½ gal. of turpentine. Apply the stain and immediately wipe with rags or waste, finishing a door or window as you go.

When the stain is dry (next day) daub doors with quick drying black, preferably ground in coach painter's japan. Use very little, about one daub to each panel, but apply it irregularly, using the thumb, not a brush. Blend at once with blender or dry rag. When the entire room is finished the first piece will be hard enough to proceed with the next coat.

Tint white lead to a light gray, just off white, and thin with turpentine only, adding a small amount of drier. Coat the entire surface of the door or window and wipe immediately with rags, finishing a piece at a time. The next day give three coats of liquid wax, polishing each coat.

The floor can be finished as follows: Make the ground stain the same as the stain used for the trim, leaving out the burnt sienna. Brush on without lapping for there will be no wiping, daubing or gray-white painting on the floor. Apply four coats of wax —the kind that needs no polishing.

The foundation effect may be made, if desired, by using crude bichromate of potassium dissolved in water instead of the oil stain. Be sure to use bichromate and not permanganate of potassium; the permanganate will make a golden oak. Bichromate will give almost a perfect imitation of genuine ammonia fumed oak or pine as the case may be.

The genuine fuming is done with the fumes of ammonia placed in a shallow vessel such as a saucer. Take a small box and seal all cracks with paper, then get a piece of new wood that is thoroughly cleaned, place it about 6 in. from the floor. Place a saucer half full of ammonia underneath. Now place the prepared box over the piece of wood and the ammonia. Let the wood stay in the box for 24–48 hours then remove it.

Marbelizing Wood

The first operation is to coat the surface with a white lacquer primer-surfacer. When thoroughly dry, prepare a mixture of glycerin thinned 10% with water. Spatter this fixture on the white lacquered surface with a spray gun that has a spattering nozzle attachment, or by some hand process—for instance by using a whisk broom. Then use the whisk broom, your finger or a piece of cloth to spread the spattered liquid to the grain effect desired. By various skillful motions and a little care, some wonderful marble patterns can be produced.

The next operation is to spray a light coat of any color (dark green, for example) according to the color effect desired. When this coat has dried thoroughly, wipe the surface with a rag saturated with water; this operation will remove the glycerin solution and leave a wonderful marble pattern effect.

If any other tonings with various colors are desired they should be applied transparently, so as not to disturb the marble grain pattern produced. When thoroughly dry, a finish coat of clear lacquer can be applied.

Wood Primer

Casein	100 g.
Caustic Soda	3.5–4.5 g.
Phenol	4.5–5.5 g.
Pigment	300–600 g.
Alizarin Oil	20–40 g.

As a base for paint and lacquer this prevents blistering and swelling of veneer finish.

Non-Grain Raising Wood Stain

U. S. Patent 2,137,830

Methyl Alcohol	100 cc.
Dye, Sufficient to Saturate Alcohol	
Urea	1.50 g.
Formamide	2.80 g.
Ammonium Formate	0.50 g.
Sodium Nitrate	0.01 g.

Wood Preservative & Stain

U. S. Patent 2,175,115

Crude Pine Rosin	50
Pine Tar, Dehydrated	70
Pine Oil (Low Boiling)	90

Light Fast Pigment Stain

U. S. Patent 2,137,794

Ten pounds of pigment ground in oil, three gallons of naphtha, 1 quart of water, twenty and one-half ounces of a sulphonated oil, five and one-half ounces of paraffin oil, four and three-fourths ounces of soap, and approximately one-half pound of water stain powder are mixed together.

White Pickled Finish on Birch Wood

Maple, birch and cherry, being close-grained fine-textured woods, it is necessary to blend the white on the surface to obtain a finish that is not "smeary" or which will not obscure the grain. Here are two formulas that will produce clean-cut finishes:

Zinc Oxide Ground In Oil	20 oz.
Linseed Oil (Boiled)	1 pt.
Cobalt Drier	1 oz.
Gasoline or Benzine	1 gal.

Mix thoroughly. Brush or spray a thin coat over the surface. Wipe off the excess with tow or rags. Now is the time to leave the amount of white on the surface that will appear in the final finish. Before the coating becomes too tacky, a soft brush should be used to blend the remainder to a uniform surface. More or less zinc oxide may be used, according to the opacity desired. Finish with lacquer or shellac.

Another is more expensive but makes a much better finish. The wood is sandblasted to produce pores equal to walnut or oak. Zinc oxide is employed to color natural filler that is used in the consistency necessary to fill ordinary porous woods. Finish the usual way.

Black Stain for Wood Laboratory Desk Tops

The usual stain for laboratory desk tops consists of a solution of potassium chlorate and copper sulphate in water which is applied as hot as possible. A day later this is followed by a solution of aniline hydrochloride applied as hot as possible. Finally, the tops are rubbed down with linseed oil. Much dissatisfaction has been found with this procedure and a better one has been obtained.

Solution No. 1

Potassium Permanganate	20 g.
Copper Sulphate	20 g.
Water	1 l.

Heat to about 60–70° C. and apply to clean desk top, and follow immediately with solution No. 2.

Solution No. 2

Hydrochloric Acid (Sp. Gr. 1.2)	150 cc.
Aniline	150 cc.
Water	700 cc.

Heat to about 60–70° C. and apply over No. 1.

When the desk top is dry it may be rubbed with linseed oil in the usual manner.

The procedure has several advantages:

1. It saves time.
2. It always produces a good black, whereas the old method often produced a dirty green.
3. It is not necessary to keep solutions near boiling temperatures thus doing away with bumping.
4. It requires less material in solution No. 1.

Graining on Metal

In most cases the metal cleaning process remains the same; namely, sandpaper for rust spots, followed by a benzine wash for removing grease and dirt. Chemical cleaners, soluble in water or in petroleum products, are widely used and it is for the finisher to decide which material and method best suits his particular product to be cleaned and finished.

Priming; Filling

It is important to immediately protect the cleaned metal surface with a suitable primer before rust sets in, especially in cases where the metal has been rinsed in water and oven dried. Years ago, a good metal primer had to be baked three hours at 275° F. Today a one-hour baking, or even less, will fulfill all requirements—that is when primed with fastbake materials.

Many products require filling—for example at welding spots and seams, etc. One and more often two coats of filler, knifed on, are necessary—each coat being baked and then sanded down smooth by hand or by machine. The surface is then dusted off and made ready for the graining undercoat. In most cases one coat of graining undercoat is sufficient; for oak and maple imitation, generally two coats will be necessary.

Mechanical Graining

More concerns than ever are now using graining plates from which the workman transfers the inked design by means of a soft composition roller from the plate to the product to be grained. A special graining ink is on the market for this method. For some manufacturers whose products are of various sizes and forms, and for some who do custom work, the old hand graining method still prevails.

Hand Graining

For walnut imitation proceed as follows: Mix a stain, starting with:

Turpentine	2 oz.
Boiled Linseed Oil	1 oz.
Drier	a few drops

Into this mixture Van Dyke brown is added until the right shade. The stain is brushed on very thin and even, so that the undercoat shows through.

On a palette place a small can partly filled with turpentine. Nearby have a small quantity of drop black and also a little burnt umber. With an overgrainer 2-in. wide, dipped lightly into turpentine and black on the palette, put in the figures or the crotch grain. The remaining grain, that is to say the side parts, is done with a 4-in. overgrainer; a little Van Dyke brown or burnt umber can be worked in here and there. The dark veins are drawn in with one point of the overgrainer dipped into a little black. When slightly set, the grain is softened with a mottler and then blended with a blender. Pores are optional. After baking on these graining colors, one or two coats of fastbake varnish are applied. Some products require rubbing and polishing; others get just one coat of semi-gloss varnish.

Circassian Walnut Graining

Circassian walnut is a very beautiful wood, and is not easy to imitate—unless the grainer is experienced in this work. The graining colors will consist of drop black, carmine red and burnt sienna for imitation graining in water colors or distemper colors. When applied to the ground coat and intermingled to produce the grained effects, these three strong colors will show up from five to eight different colors.

Mix enough color to grain six large steel burial vaults at a time. Apply the graining color with a sponge, blocking out the general direction of a true Circassian walnut grain. Always keep the sponge well filled with drop black, as this is the predominating color; use less of the carmine red and burnt sienna. Drop black is the backbone of color for Circassian walnut; carmine red and burnt sienna are used as toning colors.

Then follow with a fitch brush and blend lightly. Use a badger blender to soften the hard appearance of the color.* A mottler brush, wet with graining colors, is used to produce the characteristic mottled effects. A little drop black may be used for making the darker lines or veins. As a rule the dark lines in Circassian walnut where they are very pronounced, are thin and they should be carried down to the edges of the sap wood with a badger blender.

American Walnut Graining

For graining American walnut, use water colors which come in dry form. The colors can be mixed as they are used. The main tools required are: a large sponge, a badger blender, a few

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* The fitch brush is a small brush used to draw the fine lines on the work. The badger blender is used for blending the work.

grouting tools, a flat frisco bristle liner, a large mottler and a piped over-grainer. The colors to use are Van Dyke brown, ivory, black, burnt umber and burnt sienna. Have two pots, one full of clear water in which the tools must be occasionally dipped to clean them, and the other containing a small quantity of graining color. The graining color is made up of the following:

Ivory	2 oz.
Black	2 oz.
Van Dyke Brown	4 oz.
Burnt Umber	2 oz.
Bolted Whiting (tablespoonful)	1 oz.

Mix in ½ gal. of water.

After the surface of the baked ground coat has been sanded with No. 6/0 flat sandpaper, and has been dusted off and wiped with a clean rag, dip the sponge into the graining color and go over the burial vault with a very thin coat of this graining color; it is really a stain coat. At this stage of the process I make it a point to have several dry colors on a piece of plate glass which is about 12-in. square. Then, with a wet sponge, pick up some of the color and apply it to the stained surface to imitate characteristic walnut grain, including burl walnut.

Here is where the artistic sense and skill in a man comes into play. On some of the work it is best to use a different sponge for each color, but some excellent tones and natural effects can be produced by drawing two or three colors onto the wet sponge and applying them expertly to the stained surface. When these have been applied in this manner blend them with a badger blender in the same direction. Then dip the frisco liner into some prepared Van Dyke brown and draw the fine lines in the same direction as the wood grain has been laid out. Sharp contrasting colors are to be used if anything like a true reproduction is expected. Avoid muddy effects, faded colors and "off colors."

Water colors are best for good imitations and after the grained surface has been varnished or lacquered, only an expert can detect the fact that the finished article is not made of the genuine natural wood.

It takes considerable practice to master this free-hand method of graining, and it requires some studying to learn how to mix and handle the dry water-colors. In this work it isn't a matter of how many colors you can put on, but how many different but true under-tones you can produce. Once the technique is mastered, this method of graining is very rapid and not expensive.

Mahogany Graining

For imitating true mahogany color and grain on the proper mahogany ground coat, use the following water colors: Van Dyke brown, crimson lake, drop black and burnt sienna. As soon as the colors have been applied with sponges (as described in connection with walnut graining) take a mottler and break the lines here and there. While the graining color is still wet, use a badger blender to give the crosswise "feathered grained" effect which is characteristic of true mahogany. After the preliminary graining colors are dry, go over the surface and overgrain with the same graining color; stipple the work all over and blend very lightly so the stippling will not look too coarse.

Paint & Varnish Remover

Formula No. 1

Canadian Patent 374,988

Water (Boiling)	3 qt.
Irish Moss	1 lb.
Methyl Alcohol	12 oz.
Fullers' Earth	12 oz.
Caustic Soda	4 lb.
Caustic Potash	4 lb.

No. 2

Paint and varnish removers thickened with methyl cellulose, do not leave behind deposits which interfere with the proper drying and hardening of paint or varnish films subsequently applied.

The following formulation is cited as typical: 100 g. of methyl cellulose are allowed to swell in 500 g. of methylene chloride. After dilution with 800 parts of denatured alcohol, the mixture is dissolved in 500 parts of toluene, containing 200 parts of paraffin (50°/52° C.). Silica or silicates may be added to increase the abrasive action, the article states.

No. 3

Whiting	as desired
Fusel Oil	1 kg.
Benzol	6 kg.
Acetone	5 kg.
Tetrahydro Naphthalene	3 kg.
Solvent Naphtha	3 kg.

No. 4
(Non-Inflammable)
German Patent 655,454

Rubber	0.5 g.
Paraffin Wax	4.5 g.
Methylene Chloride	40.0 g.
Sulfonated Mineral Oil	2.0 g.
Acetone	25.0 g.
Water	28.0 g.

Dissolve the sulfonate in water; mix this solution with acetone.

Add the water-acetone solution to the previously prepared solution of rubber and paraffin in methylene chloride, stir, and mill.

No. 5

The following formula is for the removal of oil paints: 3 oz. paraffin, 30 oz. methanol, 25 oz. acetone, 20 oz. benzol, 15 oz. carbon tetrachloride and 10 oz. xylene. This is prepared by dissolving the paraffin in a mixture of benzol, carbon tetrachloride and xylene and adding the methanol and acetone to the mixture. On cooling, these two latter constituents precipitate the paraffin and give the product the consistence of paste. An inflammable remover for oil paints or chlorinated rubber paints consists of 15 oz. paraffin (40/42° C.), 45 oz. benzol, and 40 oz. toluene. This can be made thicker by the addition of levigated chalk, etc. Thicker, non-inflammable removers for the same purpose are prepared according to the formula: 15 oz. paraffin (40/42° C.), 45 oz. carbon tetrachloride or trichlorethylene, 20 oz. benzol and 20 oz. methylene chloride. A liquid remover, which is inflammable, for oil varnishes, cellulose lacquers and spirit varnishes consists of: 50 oz. acetone, 20 oz. butyl acetate 85%, and 30 oz. isopropyl alcohol. An inflammable remover for oil paints, chlorinated rubber paints, cellulose esters and spirit varnishes can be made as follows: 30 oz. acetone, 30 oz. methylcyclohexanone, 20 oz. alcohol and 20 oz. tetralin, and a non-inflammable one of the same type with 40 oz. carbon tetrachloride or ethylene trichloride, 10 oz. tetralin, 40 oz. methylcyclohexanone, and 10 oz. methanol. The following is a remover which is not quite so harsh as those containing both solvents and alkalis: 4 oz. olein, 20 oz. benzol, 20 oz. carbon tetrachloride or ethylene trichloride, 20 oz. alcohol, 16 oz. ammonia (.910) and 20 oz. water.

Restoring Whitened Shellac or Varnished Surfaces

Allow to dry out and then wash lightly with alcohol.

LACQUERS, SOLVENTS, PIGMENTS, MISCELLANEOUS

NATURAL RESIN-ETHYL CELLULOSE LACQUERS

Formula	No. 1	No. 2	No. 3	No. 4	No. 5	No. 6
Ethyl Cellulose (L.V.)	10 lb.	10 lb.	10 lb.	10 lb.	10 lb.	10 lb.
Thermally Processed Boea	5 lb.	5 lb.	5 lb.	10 lb.	10 lb.	10 lb.
Dibutylphthalate	..	1.5 lb.	..	..	2 lb.	..
Raw Castor Oil	..	..	2.25 lb.	..	..	3 lb.
Butanol	36 lb.	36 lb.	36 lb.	36 lb.	36 lb.	36 lb.
Xylol	24 lb.	24 lb.	24 lb.	24 lb.	24 lb.	24 lb.
Flexibility (Mandrel)	Br.	Fl.	Fl.	Br.	Br.	Br.
Adhesion (Mandrel)	P	P	P	P	P	P
Gloss	P	F	F	P	F	F
Sanding	G	F	F	G	G	G
Rubbing	G	G	G	G	G	G
Discoloration	sl.	sl.	sl.	Mod.	Mod.	sl.

Abbreviations Used in Tabulations of Natural Resin-Ethyl Cellulose Lacquers

G—Good
F—Fair
P—Poor
B—Bad

sl. —slight
v —very
Br.—Brittle
Fl.—Flexible
Ex.—Excellent

NATURAL RESIN-ETHYL CELLULOSE LACQUERS

Formula	No. 7	No. 8	No. 9	No. 10	No. 11	No. 12
Ethyl Cellulose (L.V.)	10 lb.	10 lb.	10 lb.	10 lb.	10 lb.	10 lb.
Dewaxed Batavia Dammar	5 lb.	5 lb.	5 lb.	10 lb.	10 lb.	10 lb.
Dibutylphthalate	..	1.5 lb.	..	..	2 lb.	..
Raw Castor Oil	..	..	2.25 lb.	..	..	3 lb.
Toluol	48 lb.	48 lb.	48 lb.	48 lb.	48 lb.	48 lb.
Alcohol	12 lb.	12 lb.	12 lb.	12 lb.	12 lb.	12 lb.
Flexibility (Mandrel)	Fl.	v.Fl.	v.Fl.	Br.	Br.	Br.
Adhesion (Mandrel)	P	F	F	P	P	P
Gloss	G	G	G	G	G	G
Sanding	F	P	P	G	P	P
Rubbing	F	F	F	F	P	P
Discoloration	v.sl.	v.sl.	v.sl.	sl.	sl.	sl.

Formula	No. 13	No. 14	No. 15	No. 16	No. 17	No. 18
Ethyl Cellulose	10 lb.	10 lb.	10 lb.	10 lb.	10 lb.	10 lb.
Elemi	5 lb.	5 lb.	5 lb.	10 lb.	10 lb.	10 lb.
Dibutylphthalate	..	1.5 lb.	..	..	2 lb.	..
Raw Castor Oil	..	..	2.25 lb.	..	..	3 lb.
Toluol	48 lb.	48 lb.	48 lb.	48 lb.	48 lb.	48 lb.
Alcohol	12 lb.	12 lb.	12 lb.	12 lb.	12 lb.	12 lb.
Flexibility (Mandrel)				Br.	v.Fl.	v.Fl.
Adhesion (Mandrel)				P	Fl.	Fl.
Gloss				G	G	F
Sanding				F	P	P
Rubbing				P	P	P
Discoloration				None	None	None

Formula	No. 19	No. 20	No. 21	No. 22	No. 23	No. 24
Ethyl Cellulose (L.V.)	10 lb.	10 lb.	10 lb.	10 lb.	10 lb.	10 lb.
Kauri Gum—Pale	5 lb.	5 lb.	5 lb.	10 lb.	10 lb.	10 lb.
Dibutylphthalate	..	1.5 lb.	..	..	2 lb.	..
Castor Oil	..	..	2.25 lb.	..	..	3 lb.
Butanol	36 lb.	36 lb.	36 lb.	36 lb.	36 lb.	36 lb.
Xylol	24 lb.	24 lb.	24 lb.	24 lb.	24 lb.	24 lb.
Flexibility (Mandrel)	v.Fl.	v.Fl.	v.Fl.	Br.	Br.	Br.
Adhesion (Mandrel)	F	G	G	P	P	P
Gloss	G	G	G	Ex.	Ex.	Ex.
Sanding	G	G	F	G	G	G
Rubbing	G	G	G	G	G	G
Discoloration	None	None	None	v.sl	v.sl	None

Formula	No. 25	No. 26	No. 27	No. 28	No. 29	No. 30
Ethyl Cellulose	10 lb.	10 lb.	10 lb.	10 lb.	10 lb.	10 lb.
Manila WS	5 lb.	5 lb.	5 lb.	10 lb.	10 lb.	10 lb.
Dibutylphthalate	..	1.5 lb.	..	..	2 lb.	..
Raw Castor Oil	..	..	2.25 lb.	..	..	3 lb.
Butanol	36 lb.	36 lb.	36 lb.	36 lb.	36 lb.	36 lb.
Xylol	24 lb.	24 lb.	24 lb.	24 lb.	24 lb.	24 lb.
Flexibility (Mandrel)	Fl.	v.Fl.	v.Fl.	Br.	Br.	Br.
Adhesion (Mandrel)	F	F	F	P	F	F
Gloss	G	G	G	Ex.	Ex.	Ex.
Sanding	G	F	P	G	F	P
Rubbing	G	G	G	G	G	G
Discoloration	None	None	None	v.sl.	v.sl.	v.sl.

Formula	No. 31	No. 32	No. 33	No. 34	No. 35	No. 36
Ethyl Cellulose	10 lb.	10 lb.	10 lb.	10 lb.	10 lb.	10 lb.
Manila Loba A	5 lb.	5 lb.	5 lb.	10 lb.	10 lb.	10 lb.
Dibutylphthalate	..	1.5 lb.	..	..	2 lb.	..
Castor Oil	..	..	2.25 lb.	..	..	3 lb.
Butanol	36 lb.	36 lb.	36 lb.	36 lb.	36 lb.	36 lb.

NATURAL RESIN-ETHYL CELLULOSE LACQUERS

Xylol	24 lb.	24 lb.	24 lb.	24 lb.	24 lb	24 lb.
Flexibility (Mandrel)	Fl.	Fl.	Br.	Br.	Br.	Br.
Adhesion (Mandrel)	P	P	F	F	F	F
Gloss	Ex.	Ex.	Ex.	Ex.	Ex.	Ex.
Sanding	G	F	F	G	G	G
Rubbing	G	G	G	G	G	G
Discoloration	None	None	None	None	v.sl.	v.sl.

MANILA LOBA A-ETHYL CELLULOSE

Formula	No. 37	No. 38	No. 39	No. 40	No. 41	No. 42
Ethyl Cellulose	10 lb.	10 lb.	10 lb.	10 lb.	10 lb.	10 lb.
Manila Loba A	10 lb.	10 lb.	10 lb.	10 lb.	10 lb.	10 lb.
Aroclor 1254	1 lb.	2 lb.	3 lb.	..	..	..
Baker's No. 16 Pale Blown Castor Oil	..	..	..	1 lb.	2 lb.	3 lb.
Butanol	48 lb.	48 lb.	48 lb.	48 lb.	48 lb.	48 lb.
Xylol	32 lb.	32 lb.	32 lb.	32 lb.	32 lb.	32 lb.
Flexibility (Mandrel)	Fl.	Fl.	v.Fl.	Fl.	Fl.	Fl.
Adhesion (Mandrel)	P	P	F	P	P	P
Gloss	F	F	G	G	G	Ex.
Sanding	G	F	P	F	F	P
Rubbing	G	G	G	G	G	G
Discoloration	v.sl.	sl.	Mod.	v.sl.	v.sl.	v.sl.

Formula	No. 43	No. 44	No. 45	No. 46	No. 47	No. 48
Ethyl Cellulose	10 lb.	10 lb.	10 lb.	10 lb.	10 lb.	10 lb.
Manila Loba A	10 lb.	10 lb.	10 lb.	10 lb.	10 lb.	10 lb.
Beckolin	1 lb.	2 lb.	3 lb.	..	..	..
Raw Castor Oil AA	..	..	..	1 lb.	2 lb.	3 lb.
Butanol	48 lb.	48 lb.	48 lb.	48 lb.	48 lb.	48 lb.
Xylol	32 lb.	32 lb.	32 lb.	32 lb.	32 lb.	32 lb.
Flexibility (Mandrel)	Br.	Br.	Fl.	Br.	Fl.	Fl.
Adhesion (Mandrel)	P	P	P	P	P	P
Gloss	Ex.	Ex.	G	Ex.	Ex.	Ex.
Sanding	G	F	P	G	F	P
Rubbing	G	G	G	G	G	G
Discoloration	v.sl.	v.sl.	v.sl.	v.sl.	v.sl.	v.sl.

Formula	No. 49	No. 50	No. 51	No. 52	No. 53	No. 54
Ethyl Cellulose	10 lb.	10 lb.	10 lb.	10 lb.	10 lb.	10 lb.
Manila Loba A	10 lb.	10 lb.	10 lb.	10 lb.	10 lb.	10 lb.
Diamylphthalate	1 lb.	2 lb.	3 lb.	..	..	..
Dibutylphthalate	..	..	..	1 lb.	2 lb.	3 lb.
Butanol	48 lb.	48 lb.	48 lb.	48 lb.	48 lb.	48 lb.
Xylol	32 lb.	32 lb.	32 lb.	32 lb.	32 lb.	32 lb.
Flexibility (Mandrel)	Fl.	Fl.	v.Fl.	Fl.	v.Fl.	v.Fl.
Adhesion (Mandrel)	P	P	G	P	G	G
Gloss	G	G	G	G	Ex.	Ex.
Sanding	G	F	P	F	P	P
Rubbing	G	G	G	G	G	G
Discoloration	v.sl.	v.sl.	v.sl.	v.sl.	v.sl.	v.sl.

Formula	No. 55	No. 56	No. 57	No. 58	No. 59	No. 60
Ethyl Cellulose	10 lb.	10 lb.	10 lb.	10 lb.	10 lb.	10 lb.
Manila Loba A	10 lb.	10 lb.	10 lb.	10 lb.	10 lb.	10 lb.
Diphenylphthalate	1 lb.	2 lb.	3 lb.	..	..	..
Hercolyn	..	..	..	1 lb.	2 lb.	3 lb.
Butanol	48 lb.	48 lb.	48 lb.	48 lb.	48 lb.	48 lb.
Xylol	32 lb.	32 lb.	32 lb.	32 lb.	32 lb.	32 lb.
Flexibility (Mandrel)	Fl.	v.Fl.	v.Fl.	Fl.	Fl.	Fl.

MANILA LOBA A-ETHYL CELLULOSE

Adhesion (Mandrel)	P	P	F	P	P	P
Gloss	F	F	F	Ex.	Ex.	Ex.
Sanding	G	F	P	G	F	F
Rubbing	G	G	G	G	G	G
Discoloration	sl.	Mod.	Mod.	v.sl.	v.sl.	v.sl.

Formula	No. 61	No. 62	No. 63	No. 64	No. 65	No. 66
Ethyl Cellulose	10 lb.	10 lb.	10 lb.	10 lb.	10 lb.	10 lb.
Manila Loba A	10 lb.	10 lb.	10 lb.	10 lb.	10 lb.	10 lb.
Ketonone E	1 lb.	2 lb.	3 lb.	..	..	..
Tricresylphosphate	..	..	..	1 lb.	2 lb.	3 lb.
Butanol	48 lb.	48 lb.	48 lb.	48 lb.	48 lb.	48 lb.
Xylol	32 lb.	32 lb.	32 lb.	32 lb.	32 lb.	32 lb.
Flexibility (Mandrel)	Br.	Br.	Fl.	Fl.	Fl.	Fl.
Adhesion (Mandrel)	P	P	P	P	P	P
Gloss	Ex.	Ex.	Ex.	Ex.	Ex.	Ex.
Sanding	G	G	P	G	F	P
Rubbing	G	G	G	G	G	G
Discoloration	v.sl.	sl.	sl.	sl.	Mod.	Mod.

	No. 67	No. 68	No. 69
Ethyl Cellulose	10 lb.	10 lb.	10 lb.
Manila Loba A	10 lb.	10 lb.	10 lb.
Triphenylphosphate	1 lb.	2 lb.	3 lb.
Butanol	48 lb.	48 lb.	48 lb.
Xylol	32 lb.	32 lb.	32 lb.
Flexibility (Mandrel)	Br.	Fl.	Fl.
Adhesion (Mandrel)	P	P	P
Gloss	F	P	P
Sanding	G	F	P
Rubbing	G	G	G
Discoloration	sl.	Mod.	B

Abbreviations Used in Tabulations of Natural Resin-Ethyl Cellulose Lacquers

G—Good
F—Fair
P—Poor
B—Bad

sl —slight
v —very
Br.—Brittle
Fl.—Flexible
Ex.—Excellent

Accroides—Cellulose Acetate Mixtures

Formula No. 1

Accroides	8 lb.
Cellulose Acetate	16 lb.
Dioxan	76 lb.

Mix all ingredients together until a uniform mixture is obtained. The solution is clear and the dried film is clear.

No. 2

Accroides	14 lb.
Cellulose Acetate	14 lb.
Dioxan	77 lb.

Mix all ingredients together until a uniform mixture is obtained. The solution is clear and the dried film is clear.

No. 3

Accroides	20 lb.
Cellulose Acetate	10 lb.
Dioxan	70 lb.

Mix all ingredients together until a uniform mixture is obtained. The solution is clear and the dried film is clear.

Aqueous Alkali Solution of Accroides

Powdered Accroides	100 lb.
Water	300 lb.
Caustic Soda	10 lb.

Dissolve the caustic soda in water. Add the accroides and agitate. The solution has a Gardner-Holdt viscosity of "A" and a Gardner color of 18+.

Lacquers

Formula No. 1

Boea, Hard Amber	7–13 lb.
Nitrocellulose	13– 7 lb.
Cellosolve	20 lb.
Methanol	20 lb.
Butanol	60 lb.

Mix all ingredients together until a homogeneous solution is obtained.

No. 2

Dewaxed Dammar	8–17 lb.
Nitrocellulose	17– 8 lb.
Butyl Acetate	80 lb.
Hi-Flash Naphtha	20 lb.

Mix all ingredients together until a homogeneous solution is obtained.

No. 3

Elemi	8–17 lb.
Nitrocellulose	17– 8 lb.
Butyl Acetate	80 lb.
Hi-Flash Naphtha	20 lb.

Mix all ingredients together until a homogeneous solution is obtained.

No. 4

Pale Kauri	7–13 lb.
Nitrocellulose	13– 7 lb.
Butanol	20 lb.
Butyl Acetate	20 lb.
Methanol	60 lb.

Mix all ingredients together until a homogeneous solution is obtained. Kauri should be dried thoroughly before use.

No. 5

Brown Kauri	7–13 lb.
Nitrocellulose	13– 7 lb.
Butanol	20 lb.
Butyl Acetate	20 lb.
Methanol	60 lb.

Mix all ingredients together until a homogeneous solution is obtained. Kauri should be dried thoroughly before use.

No. 6

Manila Resin	7–13 lb.
Nitrocellulose	13– 7 lb.
Cellosolve	20 lb.
Butanol	60 lb.
Methanol	20 lb.

Mix all ingredients together until a homogeneous solution is obtained.

No. 7

Mastic	8–17 lb.
Nitrocellulose	17– 8 lb.
Butyl Acetate	80 lb.
Hi-Flash Naphtha	20 lb.

Mix all ingredients together until a homogeneous solution is obtained.

No. 8

Pontianak	7–13 lb.
Nitrocellulose	13– 7 lb.
Butanol	60 lb.
Cellosolve	20 lb.
Methanol	20 lb.

Mix all ingredients together until a homogeneous solution is obtained.

No. 9

Thermally Processed Congo	8–17 lb.
Nitrocellulose	17– 8 lb.
Butanol	60 lb.
Butyl Acetate	25 lb.
Xylol	15 lb.

Mix all ingredients together until a homogeneous solution is obtained.

No. 10

Batavia Dammar	8–17 lb.
Ethyl Cellulose	17– 8 lb.
Butanol	20 lb.
Butyl Acetate	40 lb.
Hi-Flash Naphtha	40 lb.

Mix all ingredients together until complete solution is obtained.

No. 11

Boea Resin	8–17 lb.
Ethyl Cellulose	17– 8 lb.
Butanol	50 lb.
Ethyl Alcohol	10 lb.
Toluol	40 lb.

Mix all ingredients together until complete solution is obtained.

No. 12

Dewaxed Dammar	8–17 lb.
Ethyl Cellulose	17– 8 lb.
Ethyl Alcohol	20 lb.
Toluol	80 lb.

Mix all ingredients together until complete solution is obtained.

No. 13

Elemi	8–17 lb.
Ethyl Cellulose	17– 8 lb.
Ethyl Alcohol	20 lb.
Toluol	80 lb.

Mix all ingredients together until a homogeneous solution is obtained.

No. 14

Pale Kauri	8–17 lb.
Ethyl Cellulose	17– 8 lb.
Benzol	55 lb.
Butanol	20 lb.
Methanol	25 lb.

Mix all ingredients together until a homogeneous solution is obtained.

No. 15

Brown Kauri	8–17 lb.
Ethyl Cellulose	17– 8 lb.
Benzol	55 lb.
Butanol	20 lb.
Methanol	25 lb.

Mix all ingredients together until a homogeneous solution is obtained.

No. 16

Manila Resin	8–17 lb.
Ethyl Cellulose	17– 8 lb.
Butanol	50 lb.
Ethyl Alcohol	10 lb.
Toluol	40 lb.

Mix all ingredients together until a homogeneous solution is obtained.

No. 17

Pontianak	8–17 lb.
Ethyl Cellulose	17– 8 lb.
Butanol	50 lb.

Ethyl Alcohol	10 lb.
Toluol	40 lb.

Mix all ingredients together until a homogeneous solution is obtained.

No. 18

Sandarac	8–17 lb.
Ethyl Cellulose	17 –8 lb.
Butanol	20 lb.
Ethyl Alcohol	15 lb.
Methanol	65 lb.

Mix all ingredients together until a homogeneous solution is obtained.

No. 19

Thermally Processed Congo	8–17 lb.
Ethyl Cellulose	17– 8 lb.
Ethyl Alcohol	20 lb.
Toluol	80 lb.

Mix all ingredients together until a homogeneous solution is obtained.

No. 20

Accroides	12.5 lb.
Nitrocellulose	12.5 lb.
Ethyl Acetate	40 lb.
Butyl Acetate	40 lb.
Ethyl Alcohol	20 lb.

Mix all ingredients until a homogeneous mixture is obtained.

No. 21

Thermally Processed Batavia Dammar	12.5 lb.
Ethyl Cellulose	12.5 lb.
Toluol	80 lb.
Ethyl Alcohol	20 lb.

Mix all ingredients together until a homogeneous solution is obtained.

No. 22

Thermally Processed Brown Kauri	12.5 lb.
Ethyl Cellulose	12.5 lb.
Toluol	80 lb.
Ethyl Alcohol	20 lb.

Mix all ingredients together until a homogeneous solution is obtained.

No. 23

Thermally Processed Manila Bold Pale Chips	12.5 lb.
Ethyl Cellulose	12.5 lb.
Toluol	80 lb.
Ethyl Alcohol	20 lb.

Mix all ingredients together until a homogeneous solution is obtained.

No. 24

Ethyl Cellulose	30 lb.
Elemi	10 lb.
Hi-Flash Naphtha	12 lb.
Solox	48 lb.
Butanol	100 lb.

Mix and agitate all ingredients until a homogeneous mixture is obtained.

This lacquer dries to a clear, transparent film.

No. 25

Ethyl Cellulose	10 lb.
Elemi	10 lb.
Butyl Acetate	20 lb.
Butanol	20 lb.
Toluol	40 lb.

Mix and agitate all ingredients until a homogeneous solution is obtained.

This lacquer dries rapidly to a glossy, flexible film.

No. 26

Ethyl Cellulose	10 lb.
Elemi	10 lb.
Butanol	80 lb.

Mix and agitate all ingredients until a homogeneous solution is obtained.

This lacquer dries rather slowly to a glossy, flexible film.

Dull (Flat) Lacquer

Formula No. 1

Batavia Dammar	10 lb.
Nitrocellulose	10 lb.
Butyl Acetate	40 lb.
Hi-Flash Naphtha	40 lb.

Mix and agitate all the ingredients until a homogeneous mixture is obtained.

A light colored, cloudy lacquer is obtained which dries to a flat film.

No. 2

Pale East India Bold	10 lb.
Nitrocellulose	10 lb.
Ethyl Acetate	20 lb.
Butanol	20 lb.
Hi-Flash Naphtha	40 lb.

Mix and agitate all the ingredients until a homogeneous mixture is obtained.

A yellowish-orange colored, cloudy lacquer is obtained which dries to a flat film.

Congo-Ethyl Cellulose Lacquer

Congo Dust (Congo No. 28)	10 lb.
Ethyl Cellulose	10 lb.
Ansol M (Anhydrous Alcohol)	40 lb.
Isopropyl Alcohol	20 lb.
Methyl Propyl Ketone	20 lb.

Mix all ingredients together until a homogeneous mixture is obtained.

This product dries to a hard, glossy, transparent film.

Dammar-Nitrocellulose Lacquers

Formula No. 1

Commercially Dewaxed Dammar (30% Solution)	33 lb.
Nitrocellulose	10 lb.
Ethanol	7 lb.
Butanol	10 lb.

Toluol	7 lb.
Butyl Acetate	30 lb.

Dewaxing Gum Dammar

This is done by dissolving the dammar in an equal weight of toluol and then adding the same weight of ethanol as of toluol. The clear, dewaxed solution is about 30% concentration of dammar by weight. The other ingredients are then added and dissolved.

The above formula using dewaxed dammar is

Dewaxed Dammar	10 lb.
Nitrocellulose	10 lb.
Ethanol	20 lb.
Butanol	10 lb.
Toluol	20 lb.
Butyl Acetate	30 lb.

	No. 2	No. 3	No. 4	No. 5
Ratio Nitrocellulose to Resin	1:2	1:3	1:1	2:1
Dewaxed Dammar	22 lb.	24 lb.	16.5 lb.	11 lb.
Nitrocellulose	11 lb.	8 lb.	16.5 lb.	22 lb.
Ethyl Acetate	15 lb.	15 lb.	15 lb.	15 lb.
Butyl Acetate	10 lb.	10 lb.	10 lb.	10 lb.
Ethyl Lactate	5 lb.	5 lb.	5 lb.	5 lb.
Butanol	5 lb.	5 lb.	5 lb.	5 lb.
Toluol	40 lb.	40 lb.	40 lb.	40 lb.
Xylol	25 lb.	25 lb.	25 lb.	25 lb.

Mix all ingredients until a homogeneous lacquer is obtained.

Formula	No. 6	No. 7	No. 8	No. 9	No. 10	No. 11	No. 12	No. 13	No. 14	No. 15
Nitrocellulose.	10 lb.	10 lb.	10 lb.	10 lb.	10 lb.	10 lb.	10 lb.	10 lb.	10 lb.	10 lb.
Pale East India Chips (Macassar)	2 lb.	5 lb.	2 lb.	5 lb.	5 lb.	5 lb.	5 lb.	5 lb.	5 lb.	5 lb.
Castor Oil ...	2½ lb.	2½ lb.	2½ lb.	2½ lb.	2½ lb.	2½ lb.	2½ lb.	2½ lb.	2½ lb.	2½ lb.
Dibutylphthalate	2½ lb.	2½ lb.	2½ lb.	2½ lb.	2½ lb.	2½ lb.	2½ lb.	2½ lb.	2½ lb.	2½ lb.
Butyl Acetate.	25 lb.	12 lb.	12 lb.	25 lb.	35 lb.	25 lb.	19 lb.	35 lb.	25 lb.	19 lb.
Cellosolve Acetate ...	..	16 lb.	16 lb.	..	5 lb.	..	18 lb.	5 lb.	..	18 lb.
Butanol	19 lb.	..	..	19 lb.	15 lb.	20 lb.	5 lb.	15 lb.	20 lb.	5 lb.
Solox	..	26 lb.	26 lb.	..	..	10 lb.	10 lb.	..	10 lb.	10 lb.
Ethyl Acetate	..	..	..	..	5 lb.	10 lb.	..	5 lb.	10 lb.	..
Toluol	35 lb.	26 lb.	26 lb.	36 lb.	20 lb.	15 lb.	28 lb.	20 lb.	15 lb.	28 lb.

All lacquers are made by agitating all the ingredients together until homogeneity is achieved.

CONGO LACQUERS

Formula	No. 1	No. 2	No. 3	No. 4	No. 5	No. 6	No. 7	No. 8	No. 9
Nitrocellulose	10 lb.	10 lb.	10 lb.	10 lb.	10 lb.	10 lb.	10 lb.	10 lb.	10 lb.
Thermally Processed Congo	20 lb.	20 lb.	40 lb.	40 lb.	60 lb.	60 lb.	80 lb.	80 lb.	100 lb.
Ethyl Acetate	17 lb.	17 lb.	17 lb.	17 lb.	17 lb.	17 lb.	17 lb.	17 lb.	17 lb.
Butyl Acetate	11 lb.	11 lb.	11 lb.	11 lb.	11 lb.	11 lb.	11 lb.	11 lb.	11 lb.
Butyl Lactate	6 lb.	6 lb.	6 lb.	6 lb.	6 lb.	6 lb.	6 lb.	6 lb.	6 lb.
Butanol	86 lb.	26 lb.	166 lb.	46 lb.	246 lb.	66 lb.	326 lb.	86 lb.	406 lb.
Xylol	43 lb.	54 lb.	53 lb.	66 lb.	74 lb.	58 lb.	62 lb.	40 lb.	33 lb.
Ratio Resin: N. C.	2:1	2:1	4:1	4:1	6:1	6:1	8:1	8:1	10:1
Percent Solids	16	21	17	26	17	31	16	36	19

CONGO LACQUERS

Formula	No. 10	No. 11	No. 12	No. 13	No. 14	No. 15	No. 16	No. 17	No. 18
Nitrocellulose	10 lb.	10 lb.	10 lb.	10 lb.	10 lb.	10 lb.	10 lb.	10 lb.	10 lb.
Thermally Processed Congo	100 lb.	40 lb.	40 lb.	60 lb.	60 lb.	80 lb.	80 lb.	100 lb.	100 lb.
Ethyl Acetate	17 lb.	8 lb.	14 lb.	11 lb.	26 lb.	12 lb.	32 lb.	13 lb.	35 lb.
Butyl Acetate	11 lb.	5 lb.	9 lb.	7 lb.	17 lb.	8 lb.	21 lb.	8 lb.	23 lb.
Butyl Lactate	6 lb.	3 lb.	5 lb.	4 lb.	9 lb.	4 lb.	11 lb.	4 lb.	12 lb.
Butanol	106 lb.	76 lb.	36 lb.	163 lb.	97 lb.	231 lb.	160 lb.	299 lb.	214 lb.
Xylol	32 lb.	25 lb.	52 lb.	49 lb.	86 lb.	44 lb.	75 lb.	24 lb.	65 lb.
Ratio Resin: N. C.	10:1	4:1	4:1	6:1	6:1	8:1	8:1	10:1	10:1
Percent Solids	39	30	30	23	23	23	23	24	25

Fluorescent Lamp Coating

U. S. Patent 2,172,046

Nitrocellulose (50–100 Sec.)	1.5 g.
Camphor	0.5 g.
Amyl Acetate	100 cc.
Calcium Tungstate or other Fluorescent Powder	50 g.

Fluorescent X-Ray Screen

Fluorescent X-Ray Screen Coating

Fluorescent Calcium Tungstate	2500 g.
Ethyl Cellulose Lacquer	562 g.

The lacquer is made as follows:

Ethyl Cellulose Lacquer

Ethyl Cellulose (21 Cps.)	1500 g.
Solvent	8200 g.
Dibutyl Phthalate	300 g.

The solvent is made as follows:

Ethyl Cellulose Solvent

Alcohol, Anhydrous Denatured	1500 g.
Butanol	1000 g.
Xylol	7500 g.

The fluorescent x-ray screen coating is deposited on a paper backing by a knife coater and then dried. If a protective coating is desired use any good cellulose acetate lacquer.

Jet Black Lacquer

Formula No. 1

Put into a paddle type mixer or churn:

Toluol	32 lb.
Butyl Alcohol	6 lb.
Ethyl Acetate	4 lb.

Start the agitation and slowly add:

Coblac (Carbon Black Lacquer Chip)	20 lb.

Continue slow agitation until the chips are thoroughly softened, about 2 hours. Then with continuous agitation add:

Ethyl Acetate	5 lb.
Butyl Acetate	17 lb.

Agitate until solution is complete and add:

Resin Solution (50%)	12 lb.
Dibutylphthalate	4 lb.

When uniform, clarify.

The use of certain types of synthetic resins permits larger percentages of resin. For example:

No. 2

Put into a mixer or churn:

Toluol	30.0 lb.
Butyl Alcohol	6.0 lb.
Ethyl Acetate	4.0 lb.

While slowly agitating add:

Coblac	16.0 lb.

Agitate 2 hours and add:

Ethyl Acetate	4.0 lb.
Butyl Acetate	15.5 lb.

Agitate until solution is complete, then add:

Synthetic Resin (50% Solution)	21.0 lb.
Tricresyl Phosphate	3.5 lb.

When uniform, clarify.

As a matter of economy it is sometimes necessary to sacrifice some jetness and durability by lowering the content of coblac. This is accomplished by adding more nitrocellulose, resins and plasticizers.

Medium Jet Black Lacquer

Put into a paddle type of mixer:

Thinner	55 lb.
Nitro Cotton Solution (30%) (½ Sec.)	20 lb.
Resin Solution (50%)	10 lb.
ADM—100 Oil	5 lb.

Start the agitation and slowly add:

Coblac	10 lb.

Agitate until solution is complete. Clarify.

5–6 Second Black Lacquer

Put into a paddle mixer or churn:

Toluol	40.0 lb.
Butyl Alcohol	8.0 lb.
Ethyl Acetate	5.0 lb.

With slow agitation add:

Special 5–6 Coblac	11.0 lb.

Continue agitation for 2 hours and then add:

Ethyl Acetate	7.5 lb.
Butyl Acetate	20.0 lb.

Agitate until solution is complete and add:

Gum Solution (50%)	7.0 lb.
Dibutylphthalate	1.5 lb.

When uniform, clarify.

This lacquer contains only 16% solids as opposed to the 25–30% possible with low viscosity nitrocellulose.

High Synthetic Resin Black Lacquer

Put into a paddle mixer or churn:

Toluol	30.0 lb.
Butyl Alcohol	6.0 lb.
Ethyl Acetate	4.0 lb.

With agitation add:

Special 5–6 Coblac	11.0 lb.

Agitate 2 hours and add:

Ethyl Acetate	5.0 lb.
Butyl Acetate	15.0 lb.

Continue agitation until solution is complete, and add:

Synthetic Resin Solution (50%)	28.0 lb.
Tricresyl Phosphate	1.0 lb.

When uniform, clarify.

Lacquer for Sheet Metal Objects

Celluloid or Nitrocellulose	15 g.
Toluol	80 g.
Butyl Acetate	50 g.
Alcohol, Denatured	30 g.

Wood Lacquer Easy Rubbing

Wet Nitrocellulose (5–7 Sec.)	5.5 lb.
Union Solvent No. 8	39.5 lb.
Ethyl Acetate	10.0 lb.
Butyl Acetate	15.0 lb.
Ethyl Alcohol	8.0 lb.
Butyl Alcohol	6.0 lb.
Amberlac D-96	16.0 lb.

Lacquer for Zinc

Nitrocellulose (5–7 Sec.)	10 lb.
Toluol	20 lb.
Methyl Ethyl Ketone	10 lb.
Butyl Acetate	15 lb.
Butyl Alcohol	5 lb.
Rezyl No. 869-1	40 lb.

Wood Lacquer-Check Resisting

Formula No. 1

XX Low Vis. Ethylcellulose	6 lb.
Ethyl Alcohol	11 lb.
Toluol	50 lb.
Xylol	10 lb.
Butyl Alcohol	5 lb.
Manila Gum	18 lb.

No. 2

X Low Vis. Ethylcellulose	8.0 lb.
Ethyl Alcohol	14.0 lb.
Toluol	70.0 lb.
Lewisol No. 28	6.0 lb.
Castor Oil	1.5 lb.

Durable, Polished Metal Lacquer

Cellulose Aceto-Propionate	10 lb.
Toluol	50 lb.
Ethyl Alcohol	8 lb.
Butyl Acetate	15 lb.
Butyl Alcohol	10 lb.
Rezyl No. 14	5 lb.
Tricresyl Phosphate	2 lb.

Coating Lacquer-Slow Burning

Medium Vis. Ethylcellulose	8 lb.
Ethyl Alcohol	14 lb.
Toluol	70 lb.
Tricresyl Phosphate	8 lb.

Hot Melt Paper Lacquer

Low. Vis. Ethylcellulose	9 lb.
Dammar Gum	10 lb.
Tricresyl Phosphate	1 lb.

Lacquer, Esterified Copal

Cotton (½ Sec.) (Wet With Butyl Alcohol)	100 g.
Ester Gum	100 g.
Esterified Copal	50 g.
Tricresyl Phosphate	25 g.
Ethyl Acetate	400 g.
Butyl Acetate	180 g.
Ethyl Lactate	30 g.
Methylated Spirit	50 g.
Toluol	200 g.
Xylol	200 g.

Sanding Sealer Lacquer

Cotton (¼ Sec.) (Wet)	100 g.
Teglac 15	100 g.
Zinc Stearate	15 g.
Ethyl Acetate	130 g.
Butyl Acetate	150 g.
Benzene	180 g.
Toluol	270 g.

Nitrocellulose Lacquer Emulsion

Nitrocellulose	15 g.
Alizarin Oil	5 g.
Ortho Dibutyl Benzoate	5 g.
Butyl Acetate	25 g.
Butyl Alcohol	30 g.
Water	20 cc.

Lacquers for Hot Application

These lacquers are heated to 80–90° C. before application, to reduce their viscosity so as to carry relatively high concentration of solids.

Hot Lacquer Formula Base

Nitrocellulose (¼ Sec.) (Dry Basis)	1 lb.
Ester Gum	4 lb.
Tricresyl Phosphate	½ lb.

Hot Lacquer Thinners

Formula No. 1

Isopropyl Acetate	36 lb.
Amyl Acetate	40 lb.
Xylene	10 lb.
Union Solvent No. 8	14 lb.

No. 2

Ethyl Acetate	38 lb.
Amyl Acetate	20 lb.
sec-Butyl Acetate	25 lb.
Butyl Alcohol	5 lb.
Union Solvent No. 8	12 lb.

No. 3

Ethyl Acetate	38 lb.
Amyl Acetate	18 lb.
Isobutyl Acetate	22 lb.
Isobutyl Alcohol	5 lb.
Union Solvent No. 8	17 lb.

No. 4

Isopropyl Acetate	36 lb.
Amyl Acetate	35 lb.
Butyl Alcohol	5 lb.
Toluene	24 lb.

No. 5

Amyl Acetate	30 lb.
Ethyl Acetate	45 lb.
Amyl Alcohol	5 lb.
Toluene	20 lb.

No. 6

Amyl Acetate	20 lb.
Isopropyl Acetate	75 lb.
Butyl Alcohol	5 lb.

No. 7

Amyl Acetate	25 lb.
Amyl Alcohol	5 lb.
Ethyl Acetate	70 lb.

Clear Lacquer, Outside

¼-Sec. Cotton (Wet)	140 g.
Paralac 585	250 g.
Dibutyl Phthalate	25 g.
Butyl Acetate	200 g.
Cellosolve	100 g.
Butyl Cellosolve	30 g.
Toluol	300 g.
Petroleum Spirit	100 g.
Xylol	200 g.

Automobile Enamel Lacquer

¼-Sec. Cotton (Wet)	140 g.
Alkydal NT	150 g.
Tricresyl Phosphate	80 g.
Ethyl Acetate	100 g.
Butyl Acetate	275 g.
Toluol	180 g.
Xylol	280 g.
Pigment	300 g.

Perspiration Resistant Lacquer

U. S. Patent 2,170,187

Nitrocellulose	52 g.
Alkyd Resin	18 g.
Dibutyl Phthalate	15 g.
Silica Gel, Powdered	15 g.

Transparent Waterproof Coating

U. S. Patent 2,094,771

Paraffin Wax (60–62° C.)	7½ lb.
Pyroxylin	2½ lb.
Hydrogenated Rosin	1 lb.
Amyl Acetate	123½ lb.
Alcohol	20 lb.
Toluol	47½ lb.

After coating, drying should take place at about 65° C.

Lacquer for Glass Fabric

U. S. Patent 2,215,061

Cellulose Nitrate	14.0 lb.
Castor Oil	18.6 lb.
Pigment	23.4 lb.
Ethyl Acetate	17.6 lb.
Alcohol	26.4 lb.

Anti-Shattering Lacquer for Glass Windows

An easy-brushing anti-shattering lacquer for glass made in thick form, and requiring dilution when used, is as follows:

High Viscosity Chlorinated Rubber	4 lb.
Resin	2 lb.
Plasticizer	2 pt.
Butyl Acetate	2 pt.
Turpentine	2 pt.
Light Coal-Tar Naphtha (and/or Xylol)	12 pt.
Total	2½ gal.

The thinners consist of the spirit portion only.

For spraying, low-viscosity chlorinated rubber would be used preferably with toluol in place of light coal-tar naphtha and light petroleum in place of turpentine.

This lacquer gives a good thick film which dries to the required hardness and is absolutely resistant to hard blows and shattering, and holds all shattered pieces of glass together when hit by a heavy hammer.

Moisture-Vapor-Proof Lacquers for Paper

Chlorinated Rubber	50 lb.
Diamyl Phthalate	20 lb.
Pale East India Chips	30 lb.
Paraffin Wax	10 lb.
Toluol	165 lb.

Mix the ingredients by cold cutting.

The mixture is cloudy. Its coating on paper imparts excellent moisture proofness and is odorless, tasteless and non-toxic.

Book Cover Coating

Cellulose Nitrate Low Viscosity	10 lb.
Dibutyl Phthalate	5 lb.
Ester Gum	10 lb.
Butyl Alcohol	10 lb.
Butyl Acetate	25 lb.
Benzol	30 lb.
Methanol	10 lb.

This composition may be applied by either brush or with spray gun, the books being arranged so that the spray does not extend to the pages. Books so coated have a high gloss, and are waterproof, and do not stick to each other in warm weather such as is the case with shellac coatings, and usual varnishes.

Straw Hat Coating

Ethyl Cellulose (Low Viscosity)	20 lb.
Japan Wax	5 lb.
Toluol	60 lb.
Ethyl Alcohol	15 lb.

This solution may be applied by means of a pressure spray gun or with a brush. It renders the straw hat completely water resistant and rainproof, and will not yellow on standing.

Ski Coating
U. S. Patent 2,184,182

Celluloid	0.500 oz.
Acetone	0.333 pt.
Shellac (4 oz. Cut)	0.670 pt.
Graphite, Powdered	0.085 oz.

Flexible, Flame-Proof Electrical Insulation
U. S. Patent 2,178,365

Cellulose Acetate	100
Triphenyl Phosphate	35
Tritolyl Phosphate	40
Dimethyl Phthalate	40

Oilproof Material
U. S. Patent 2,199,224

50% "vinsol" resin and 17% castor oil and 33% denatured ethyl alcohol are incorporated together, the portions being by weight. Sheet cellulosic material, as for instance sheet stock or a paper container, such as of plural layer chip board, is treated with this material, the solution being flowed on or applied in any convenient manner, and the volatile solvent is driven off by moderate heating for a short time.

Depending upon the amount of the volatile solvent or thinner, impregnation or surface layer coating may be had as desired. The surface so obtained on cellulosic material for instance, is remarkably stable and oilproof. The composition base being oxidized does not deteriorate on exposure to air, and it remains flexible either hot or cold. In conditions of storage with oil directly in contact with surfaces so treated, capillary escape through the material does not occur, and the oil does not take up or attack the treated surface.

Window Shade Filling
U. S. Patent 2,127,320

Shade cloth having a fabric base containing zinc oxide and a cellulose nitrate composition coating, obtainable by impregnating an unfilled fabric base with a 5% slurry of colloidal zinc oxide, drying the fabric, and applying thereto a composition having the following formula:

Cellulose Nitrate	15.0 oz.
Pigment	22.6 oz.
Plasticizer	11.3 oz.
Ethyl Acetate	20.4 oz.
Ethyl Alcohol	30.7 oz.

Non-Offset Printing Spray

Cellulose Acetate	1 lb.
Ethylene Dichloride	5 lb.
Specially Denatured Alcohol Formula No. 1	2.5 lb.
Ethyl Lactate	1.1 lb.

Lacquer Thinner Blends

Group I

Formula	No. 1	No. 2	No. 3
Pent-Acetate	20 lb.	.....	.....
Pentasol	10 lb.	.....	.....
Butyl Acetate	.....	30 lb.	.....
Butyl Alcohol	.....	14 lb.	.....
Fusel Oil Acetate	.....	.....	18 lb.
Refined Fusel Oil	.....	.....	10 lb.
Isopropyl Acetate	13 lb.	.....	13 lb.
Anhyd Denatured Ethyl Alcohol	3 lb.	.....	3 lb.
Toluol	34 lb.	36 lb.	36 lb.
Troluoil	20 lb.	20 lb	20 lb.
Dilution Ratio			
Toluol	.50	.52	.60
Troluoil	.28	.30	.35
Blush Resistance			
Relative Humidity Clear	89	85	85
Relative Humidity White	92	89	89

Evaporation Rate			
Time vs. % Loss			
¼ hour	25%	15%	25%
½ hour	50	40	45
¾ hour	70	55	70
1 hour	75	65	75
1¼ hours	80	75	80
1½ hours	85	85	85
1¾ hours	90	90	90
2 hours	95	95	95
2¼ hours	98	dry	99
2½ hours	99		dry
3 hours	dry		

Group II

Formula	No. 4	No. 5	No. 6
Pent-Acetate	15 lb.	.....	.....
Pentasol	7 lb.	.....	.....
Butyl Acetate	.....	23 lb.	.....
Butyl Alcohol	.....	10 lb.	.....
Fusel Oil Acetate	.....	.....	14 lb.
Refined Fusel Oil	.....	.....	7 lb.
Isopropyl Acetate	17 lb.	7 lb.	17 lb.
Anhyd Denatured Ethyl Alcohol	7 lb.	4 lb.	7 lb.
Toluol	34 lb.	36 lb.	35 lb.
Troluoil	20 lb.	20 lb.	20 lb.
Dilution Ratio			
Toluol	.54	.60	.70
Troluoil	.32	.36	40
Blush Resistance			
Relative Humidity Clear	83	81	81
Relative Humidity White	87	85	85
Evaporation Rate			
Time vs. % Loss			
¼ hour	35%	25%	30%
½ hour	55	45	55
¾ hour	70	65	70
1 hour	85	75	85
1¼ hours	90	90	90
1½ hours	95	95	95
1¾ hours	98	98	98
2 hours	99	dry	dry
2¼ hours	dry		

Group III

Formula	No. 7	No. 8	No. 9
Pent-Acetate	10 lb.	.....	.....
Pentasol	5 lb.	.....	.....
Butyl Acetate	.....	14 lb.	.....
Butyl Alcohol	.....	7 lb.	.....
Fusel Oil Acetate	.....	.....	9 lb.
Refined Fusel Oil	.....	.....	5 lb.
Isopropyl Acetate	21 lb.	15 lb.	21 lb.
Anhyd Denatured Ethyl Alcohol	10 lb.	8 lb.	10 lb.
Toluol	34 lb.	36 lb.	35 lb.
Troluoil	20 lb.	20 lb.	20 lb.
Dilution Ratio			
Toluol	.72	.72	.80
Troluoil	.36	.36	.40
Blush Resistance			
Relative Humidity Clear	81	78	78
Relative Humidity White	85	81	81

Evaporation Rate

Time vs. % Loss			
¼ hour	40%	30%	40%
½ hour	60	55	60
¾ hour	85	75	85
1 hour	90	90	90
1¼ hours	95	95	95
1½ hours	98	dry	99
1¾ hours	99	.....	dry
2 hours	dry		

Lacquer Thinners

Butyl Acetate	1.8 fl. oz.
Butanol	13.0 fl. oz.
Butyl Lactate	4.1 fl. oz.
Toluol	0.06 fl. oz.
Xylol	0.08 fl. oz.
Naphtha	0.16 fl. oz.
Mixture No. 1	4.5 fl. oz.
Mixture No. 2	0.80 fl. oz.
Mixture No. 3	0.40 fl. oz.

	1	2	3	
Ethyl Acetate	10	25	..	fl. oz.
Ethyl Alcohol	10	..	..	fl. oz.
Butyl Acetate	20	25	..	fl. oz.
Butanol	10	..	10	fl. oz.
Toluol	50	50	50	fl. oz.
Naphtha	..	..	40	fl. oz.

Brushing Lacquer Thinner

Formula No. 1

Toluene	60 cc.
Ethyl Acetate	10 cc.
Cellosolve	10 cc.
Cellosolve Acetate	10 cc.
Butyl Cellosolve	10 cc.

No. 2

Toluene	60 cc.
Ethyl Acetate	10 cc.
Cellosolve	10 cc.
Amyl Acetate	10 cc.
Ethyl Lactate	10 cc.

Kauri-Butanol Solution

(For Making Solvency Tests on Thinners)

The solution is prepared as follows: Dissolve 100 g. of carefully selected pulverized kauri gum in 500 g. of butyl alcohol distilling from 114.4° C. to 116.6° C. (238° F.–242° F.), using a water-cooled reflux condenser to facilitate solution. Allow this mixture to cool, and after 96 hours decant into a clean, dry bottle and keep well stoppered.

PROPERTIES OF COMMON LACQUER SOLVENTS*

No.		Formula	Mol. Wt.	Boiling Range[1] Initial b. p.	Boiling Range[1] End point	Melting point[2]	Flash point[3]	Vapor pressure at 30° C.
				° C.	° C.	° C.	° C.	Mm. Hg
	Ketones:							
1	Acetone	CH_3COCH_3	58.05	55	57	−94.3	0	277
2	Methylacetone	48% acetone–28% Me acetate–24% MeOH	....	54	70	....	23	4
3	Methyl ethyl ketone	$CH_3COC_2H_5$	72.06	77	82	−86.4	34	119
4	Diethyl ketone	$C_2H_5COC_2H_5$	86 08	100	104	−42	59	46
5	Methyl propyl ketone	$CH_3COC_3H_7$	86.08	101	107	−77.8	60	48
6	Hexone (methyl isobutyl ketone)	$(CH_3)_2CHCH_2COCH_3$	100.09	112	118	−84.7	74	25
7	Methyl *n*-butyl ketone	$CH_3COC_4H_9$	100.09	114	137	−56.9	95	17
8	Mesityl oxide	$(CH_3)_2C:CHCOCH_3$	98.08	117	139	−59	90	<10
9	Diacetone alcohol	$(CH_3)_2C(OH)CH_2COCH_3$	116.09	153	160	....	135	2
10	Dipropyl ketone	$C_3H_7COC_3H_7$	114.11	138	144	−32.6	120	9
11	Methyl *n*-amyl ketone	$CH_3COC_5H_{11}$	114.11	147	153	....	115	7
12	Diisobutyl ketone	$(CH_3)_2CHCH_2COCH_2CH(CH_3)_2$	142 14	164	169	....	145	4
13	Methyl *n*-hexyl ketone	$CH_3COC_6H_{13}$	128.12	169	173	−21.6	160	3
14	Cyclohexanone	$(CH_2)_5CO$	98 08	130	173	....	145	7
15	Methylcyclohexanone	$(CH_2)_4CH(CH_3):CO$	112.09	114	173	....	145	4
16	Acetonylacetone	$CH_3COCH_2CH_2COCH_3$	114 08	188	193	− 9	190	<2
17	Phorone	$(CH_3)_2:C:CHCOCH:C:(CH_3)_2$	138.11	114	198	28	180	<1
	Polyethers:							
18	Diethylcellosolve	$C_2H_5OCH_2CH_2OC_2H_5$	118.11	119	125	....	90	22
19	Diethylcarbitol	$C_2H_5OCH_2CH_2OCH_2CH_2OC_2H_5$	162.14	181	189	....	170	1
	Esters:[6]							
20	Methyl acetate	CH_3COOCH_3	74.05	53	55	−98.1	5	263
21	Ethyl acetate	$CH_3COOC_2H_5$	88.06	70	80	−83.6	35	121
22	Isopropyl acetate	$CH_3COOCH(CH_3)_2$	102.08	84	94	−73.4	35	74
23	Isopropyl acetate	$CH_3COOCH(CH_3)_2$	102.08	82	90	....	45	..
24	Ethyl propionate	$CH_3CH_2COOC_2H_5$	102.08	90	118	−72.6	70	43
25	*sec*-Butyl acetate	$CH_3COOCH(CH_3)(C_2H_5)$	116.09	105	127	....	88	29
26	Isobutyl acetate	$CH_3COOCH_2CH(CH_3)_2$	116.09	114	118	−98.9	88	27

* From *Industrial and Engineering Chemistry.*

27	*n*-Butyl acetate	$CH_3COOC_4H_9$	116.09	119	127	−76.8	88	16
28	Ethyl butyrate	$CH_3CH_2CH_2COOC_2H_5$	116.09	107	131	−93.3	85	
29	*sec*-Amyl acetate	$CH_3COOCH(CH_3)(C_3H_7)$	130.11	121	144	....	111	10
30	Amyl acetate (mixed isomers)	$CH_3COOC_5H_{11}$	130.11	127	155	....	111	9
31	Butyl butyrate	$CH_3CH_2CH_2COOC_4H_9$	144.12	152	170	....	128	4
32	*n*-Butyl propionate	$CH_3CH_2COOC_4H_9$	130.11	124	171	....	105	7
33	Methyl amyl acetate	$CH_3COOCH(CH_3)CH_2CH(CH_3)_2$	144.12	140	147	....	113	2
34	Hexyl (2-ethyl butyl) acetate	$CH_3COOCH_2CH(C_2H_5)CH_2CH_3$	144.12	157	164	....	135	5
35	*sec*-Hexyl acetate	$CH_3COOCH(CH_3)(C_4H_9)$	144.12	129	158	....	110	10
36	Ethyl lactate	$CH_3CH(OH)COOC_2H_5$	118.08	119	176	....	140	5
37	Octyl (2-ethyl hexyl) acetate	$CH_3COOCH_2CH(C_2H_5)C_4H_9$	172.16	195	203	....	180	<1
38	Cyclohexanyl acetate	$CH_3COOCH:(CH_2)_5$	142.11	165	193	....	165	7
39	Isopropyl lactate	$CH_3CH(OH)COOCH(CH_3)_2$	132.09	149	167	....	130	5
40	Butyl lactate	$CH_3CH(OH)COOC_4H_9$	146.11	145	230	....	176	5
41	Glycol diacetate	$CH_3COOCH_2CH_2OOCCH_3$	146.08	184	191	−31	205	<1
42	Diglycol diacetate	$CH_3COOCH_2CH_2OCH_2CH_2OOCCH_3$	190.11	238	251	−43	290	<1
43	Diethyl carbonate	$(C_2H_5)_2CO_3$	118.08	87	127	....	85	17
44	3-Methoxy butyl acetate	$CH_3OCH(CH_3)CH_2CH_2OOCCH_3$	146.11	135	173	....	170	3
45	Methylcellosolve acetate	$CH_3OCH_2CH_2OOCCH_3$	118.08	143	145	....	132	6
46	Cellosolve acetate	$C_2H_5OCH_2CH_2OOCCH_3$	132.09	145	166	....	122	3
47	Butylcellosolve acetate	$C_4H_9OCH_2CH_2OOCCH_3$	160.12	188	192	....	180	<1
48	Methylcarbitol acetate	$CH_3OCH_2CH_2OCH_2CH_2OOCCH_3$	162.11	203	212	....	180	<1
49	Carbitol acetate	$C_2H_5OCH_2CH_2OCH_2CH_2OOCCH_3$	176.12	211	220	....	225	<1
50	Butylcarbitol acetate	$C_4H_9OCH_2CH_2OCH_2CH_2OOCCH_3$	204.16	236	249	....	260	<1
	Ether alcohols:							
51	Methylcellosolve	$CH_3OCH_2CH_2OH$	76.06	121	126	....	105	<2
52	Cellosolve	$C_2H_5OCH_2CH_2OH$	90.08	133	137	....	111	7
53	Isopropylcellosolve	$(CH_3)_2CHOCH_2CH_2OH$	104.09	140	143	....	125	8
54	Butylcellosolve	$C_4H_9OCH_2CH_2OH$	118 11	163	172	....	165	2
55	Methylcarbitol	$CH_3OCH_2CH_2OCH_2CH_2OH$	120.09	190	194	....	200	<1
56	Carbitol	$C_2H_5OCH_2CH_2OCH_2CH_2OH$	134.11	189	203	....	205	<1
57	Butylcarbitol	$C_4H_9OCH_2CH_2OCH_2CH_2OH$	162.14	220	231	....	230	<1
58	Benzylcellosolve	$C_6H_5CH_2OCH_2CH_2OH$	152.09	254	258	....	265	<1
	Alcohols:							
59	Methanol (anhydrous)	CH_3OH	32.03	64	66	−97.8	52	160
60	Ethanol (anhydrous)	C_2H_5OH	46.05	77	79	−117.3	65	78
61	Isopropanol (anhydrous)	$(CH_3)_2CHOH$	60.06	82	83	−85.8	67	60

PROPERTIES OF COMMON LACQUER SOLVENTS *(Continued)*

No.		Formula	Mol. Wt.	Boiling Range[1] Initial b. p.	End point	Melting point[2]	Flash point[3]	Vapor pressure at 30° C.
				° C.	*° C.*	*° C.*	*° C.*	*Mm. Hg*
62	*sec*-Butanol	$CH_3CH_2CHOHCH_3$	74.08	96	103	....	88	26
63	Isobutanol	$(CH_3)_2CH_2CHOH$	74.08	107	111	−108	111	17
64	*n*-Butanol	C_4H_9OH	74.08	116	119	−89.8	111	11
65	*sec*-Amyl alcohol	$(CH_3CH_2)_2CHOH$	88.09	117	124	....	110	12
66	Amyl alcohol (mixed isomers)	$C_5H_{11}OH$	88 09	121	139	....	111	[4]
67	Methyl amyl alcohol	$(CH_3)_2CHCH_2CH(CH_3)OH$	102.11	131	132	....	114	6
68	Hexyl (2-ethyl butyl) alcohol	$CH_3CH_2CH(C_2H_5)CH_2OH$	102.11	144	156	....	145	4
69	Octyl (2-ethyl hexyl) alcohol	$C_4H_9CH(C_2H_5)CH_2OH$	130 14	182	201	....	178	<1
70	Cyclohexanol	$C_6H_{11}OH$	100 09	150	182	23.9	170	2
71	Benzyl alcohol	$C_6H_5CH_2OH$	108.06	199	204	−15.3	212	<1
	Hydrocarbons:							
72	Benzene	C_6H_6	78.05	78	81	5.5	<5.5[7]	118
73	Toluene	$C_6H_5CH_3$	92.06	109	111	−95.1	44	26
74	Xylene	$C_6H_4(CH_3)_2$	106.08	127	159	−53.4	80	11
75	Hi-Flash naphtha	....	....	149	193	....	115	[4]
76	Petroleum naphtha	....	....	96	129	....	31	[4]
77	V. M. & P. naphtha	....	....	168	210	....	120	[4]
78	Mineral spirits	....	....	152	207	....	140	[4]
79	Cyclohexane	C_6H_{12}	84.09	80	83	6.5	<6 5[7]	121
80	Tetrahydronaphthalene	$C_{10}H_{12}$	132.09	196	217	−12.5	180	<1
81	Decahydronaphthalene	$C_{10}H_{18}$	138.14	186	194	....	145	2
82	Solvesso No. 1	....	....	94	139	....	45	[4]
83	Solvesso No. 2	....	....	134	185	....	110	[4]
84	Solvesso No. 3	....	....	179	214	....	155	[4]
85	Safe-T-Esso	....	....	157	217	....	145	[4]
	Chlorinated compounds:							
86	Ethylene dichloride	$ClCH_2CH_2Cl$	98 95	82	84	−35.3	70	94
87	Monochlorobenzene	C_6H_5Cl	112 50	130	134	−45.2	95	15
88	Orthodichlorobenzene	$C_6H_4Cl_2$	146 95	177	180	−17.6	175	3
89	Dichloroethyl ether	$ClCH_2CH_2OCH_2CH_2Cl$	142.98	172	178	....	185	2

	Naval stores solvents:							
90	Gum spirits of turpentine	....	....	154	201	....	110	[4]
91	Steam-distilled turpentine	....	....	155	173	....	115	[4]
92	Dipentene	$C.CH_3(C_4H_7)C:(CH_2)_2$	136.13	172	200	....	145	2
93	Hercosol	....	....	176	262	....	150	[4]
94	Pine oil	....	....	99	226	....	185	[4]
95	Heavy pine oil	....	....	211	219	....	200	[4]
96	Fenchone	$(CH_3)_2C_6H_7C:O$	....	190	210	6	160	2
	Furane derivatives:							
97	Furfural	$(C_4H_3O).CHO$	96.03	110	169	−38.7	145	5
98	Furfuryl acetate	$CH_3COOCH_2(C_4H_3O)$	140.06	180	186	....	185	1
99	Furfuryl alcohol	$C_4H_3OCH_2OH$	98.05	152	220	....	175	2
100	Tetrahydrofurfuryl alcohol	$C_4H_7OCH_2OH$	102 08	119	204	....	180	<1

[1] A. S. T. M. D268–31T. [2] Pure material. [3] A. S. T. M. D92–24. [4] Vapor pressures of mixtures cannot be determined by dynamic method. [5] Very slightly soluble. [6] Ester content appears under purity. [7] Flash point below melting point. [8] Sp. gr. determined with 14-inch hydrometers; accuracy, 0.0001. [9] Immiscible.

PROPERTIES OF COMMON LACQUER SOLVENTS *(Continued)*

No.	Sp. Gr. at 20° C.[2]	Wt./Gal. at 20° C.	Refractive Index at 20° C.[3]	Expansion Coefficient, 10–30° C.	Purity Commercial Product	Dilution Ratio				Solubility by Wt. at 20° C.	
						Toluene	Petroleum naphtha	Xylene	Mineral spirits	In water	Water in
		Lb.			%						
	Ketones:										
1	0.793	6.60	1.3591	0.00134	99	4.5	0.7	...	...	∞	∞
2	0.831	6.92	....	0.00138	Mixt.	4.7	0.7	...	...	∞	∞
3	0.809	6.73	1.3791	0.00128	99	4.3	0.9	...	...	25.6	11.8
4	0.815	6.78	1.3927	0.00113	99	3.0	0.7	...	...	4.3	2.1
5	0.810	6.74	1.3895	0.00111	99	4.0	1.0	...	...	0.54	3.34
6	0.802	6.67	1.3959	0.00112	99	3.6	1.0	...	...	1.91	2.81
7	0.818	6.80	1.4024	0.00099	87	3.9	1.1	...	...	0.22	2.14
8	0.855	7.12	1.4439	0.00108	86	3.8	0.9	...	...	2.89	2.85
9	0.936	7.79	1.4204	0.00094	99	...	...	2.3	0.3	∞	∞
10	0.816	6.79	1.4072	0.00107	99	3.1	0.9	2.7	0.8	0.43	0.87
11	0.818	6.81	1.4110	0.00103	98	3.9	1.2	3.6	1.1	0.4	1.4
12	0.808	6.72	....	0.00102	95	...	...	1.5	0.6	v.s.s.[5]	v.s.s.
13	0.820	6.82	1.4161	0.00092	96	3.6	0.9	...	...	0.09	0.6
14	0.946	7.87	1.4524 (16.8° C.)	0.00091	67	...	...	4.8	1.0	0.13	8.68
15	0.921	7.67	....	0.00085	74	...	...	4.5	1.0	0.15	3.04
16	0.973	8.10	1.449	0.00093	95	...	...	1.8	imm.[9]	∞	∞
17	Crystals	...	1.4998	.....	..	...	...	2.2	0.7	....	....
	Polyethers:										
18	0.849	7.07	....	0.00120	95	...	...	0.4	0.2	2.76	4.48
19	0.909	7.56	....	0.00106	99	...	...	1.4	0.5	∞	∞
	Esters:[6]										
20	0.908	7.55	1.3619	0.00134	82	2.9	0.9	...	...	∞	∞
21	0.886	7.37	1.3727	0.00134	85	3.3	1.1	...	...	6.92	11.01
22	0.870	7.23	1.3770	0.00132	95	2.7	1.1	...	...	2.58	2.86
23	0.857	7.13	....	0.00119	85	3.0	1.2	...	...	2.78	5.58
24	0.891	7.41	1.3844	0.00125	96	2.1	0.8	...	...	1.92	1.22
25	0.858	7.14	1.389	0.00118	82	2.2	1.2	...	...	0.62	1.65
26	0.870	7.24	1.3997	0.00119	96	2.7	1.1	...	...	0.67	1.64
27	0.876	7.29	1.3951	0.00117	90	2.9	1.3	2.7	1.3	0.43	1.86
28	0.880	7.32	1.3932	0.00116	99	1.9	0.7	...	...	0.49	0.75

29	0.862	7.18	....	0.00113	92	2.2	1.0	2.0	0.6	0.19	0.88
30	0.862	7.17	....	0.00104	84	2.1	1.2	...	...	0.17	1.15
31	0.874	7.27	1.4049	0.00107	99	1.6	0.7	...	...	0.05	0.43
32	0.874	7.27	....	0.00106	99	2.4	1.2	2.2	0.7	0.15	0.80
33	0.857	7.13	1.4008	0.00109	95	1.7	1.0	1.6	0.8	0.08	0.89
34	0.876	7.29	1.4103	0.00106	91	...	...	2.0	1.1	0.06	0.75
35	0.861	7.16	....	0.00104	98	...	...	1.8	0.8	v.s.s.[5]	0.68
36	1.034	8.60	1.4118	0.00098	98	6.3	0.7	...	...	∞	∞
37	0.873	7.27	1.4300	0.00099	99	...	...	1.4	1.0	v.s.s.[5]	0.39
38	0.963	8.01	....	0.00095	79	2.5	1.4	...	...	0.16	1.42
39	0.988	8.22	....	0.00101	99	5.0	1.2	...	...	∞	∞
40	0.980	8.16	....	0.00099	97	5.2	2.7	5.1	2.1	4.0	14.5
41	1.107	9.21	1.415	0.00102	99	...	...	1.4	imm.[9]	21.3	21.2
42	1.116	9.29	....	0.00095	99	...	...	1.3	imm.[9]	∞	∞
43	0.957	7.96	1.3852	0.00113	91	1.1	0.5	...	...	1.88	2.60
44	0.956	8.37	....	0.00100	99	...	...	2.1	0.9	6.46	3.72
45	1.005	8.37	1.4025	0.00110	99	2.3	0.6	1.9	0.4	∞	∞
46	0.974	8.10	1.4030 (25° C.)	0.00111	96	2.5	0.9	2.3	0.7	24.7	9.4
47	0.943	7.85	....	0.00104	99	...	...	1.9	1.0	0.9	1.9
48	1.040	8.65	....	0.00099	99	...	...	1.7	0.3	∞	∞
49	1.011	8.41	1.4230	0.00101	97	...	...	1.9	0.6	∞	∞
50	0.987	8.21	....	0.00094	99	...	...	1.8	0.6	1.6	3.4
Ether alcohols:											
51	0.966	8.04	1.4028	0.00094	99	4.0	imm.	2.9	imm.[9]	∞	∞
52	0.931	7.75	1.4080	0.00097	99	4.9	1.1	4.3	0.7	∞	∞
53	0.906	7.53	....	0.00093	97	4.3	1.6	3.8	1.3	∞	∞
54	0.902	7.50	1.4190 (25° C.)	0.00087	99	3.5	2 3	3.2	1.9	∞	∞
55	1.035	8.62	1.4244 (26° C.)	0.00087	..	...	...	1.0	imm.[9]	∞	∞
56	1.027	8.55	....	0.00082	..	...	...	1.2	imm.[9]	∞	∞
57	0.955	7.95	1.4290 (27° C.)	0.00087	96	...	...	4.2	1.2	∞	∞
58	1.070	8.90	....	0.00076	99	...	...	3.0	imm.[9]	0.4	18.1
Alcohols:											
59	0.793	6.60	1.329	0.00118	99	2.5	0.3	...	...	∞	∞
60	0.791	6.58	1.361	0.00108	99	...	...	...	...	∞	∞
61	0.786	6.54	1.3776	0.00107	99	...	...	...	...	∞	∞
62	0.808	6.72	1.397	0.00091	99	...	...	...	...	12.5	44.1 (25° C.)
63	0.803	6.68	1.396	0.00095	99	...	...	...	...	10 (25° C.)	16.9 (25° C.)

PROPERTIES OF COMMON LACQUER SOLVENTS *(Continued)*

No.	Sp. Gr. at 20° C.[3]	Wt./Gal. at 20° C.	Refractive Index at 20° C.[3]	Expansion Coefficient, 10–30° C.	Purity Commercial Product	Dilution Ratio				Solubility by Wt. at 20° C.	
						Toluene	Petroleum naphtha	Xylene	Mineral spirits	In water	Water in
		Lb.			%						
64	0.811	6.75	1.3974	0.00094	99	...	...	...	...	8.0	19.5
65	0.810	6.74	....	0.00088	95	...	...	...	...	0.13	9.87
66	0.814	6.77	....	0.00093	99	...	...	...	...	0.09	8.98
67	0.807	6.72	1.4087	0.00100	99	...	...	...	...	1.73	6.37
68	0.833	6.93	1.4229	0.00089	99	...	...	...	...	0.63	4.56
69	0.834	6.94	1.4300	0.00088	99	...	...	...	...	0.06	2.48
70	0.951	7.92	1.4656 (22.6° C.)	0.00077	94	...	...	...	...	0.13	11.78
71	1.047	8.71	1.5399	0.00073	99	...	...	...	...	0.08	8.37
Hydrocarbons:											
72	0.878	7.31	1.5014	0.00124	..	...	...	...	...	0.19	insol.
73	0.866	7.21	1.4962	0.00107	..	...	...	...	...	0.05 (16° C.)	insol.
74	0.862	7.17	....	0.00099	..	...	...	...	...	v.s.s.[5]	insol.
75	0.860	7.16	....	0.00094	..	...	...	...	...	v.s.s.[5]	insol.
76	0.735	6.11	....	0.00115	..	...	...	...	...	v.s.s.[5]	insol.
77	0.763	6.36	....	0.00098	..	...	...	...	...	v.s.s.[5]	insol.
78	0.769	6.40	....	0.00098	..	...	...	...	...	v.s.s.[5]	insol.
79	0.779	6.48	1.4273	0.00108	..	...	...	...	...	v.s.s.[5]	insol.
80	0.972	8.09	1.5461	0.00083	..	...	...	...	...	v.s.s.[5]	insol.
81	0.885	7.37	....	0.00088	..	...	...	...	...	v.s.s.[5]	insol.
82	0.796	6.62	....	0.00108	..	...	...	...	...	v.s.s.[5]	insol.
83	0.847	7.09	....	0.00091	..	...	...	...	...	v.s.s.[5]	insol.
84	0.877	7.29	....	0.00089	..	...	...	...	...	v.s.s.[5]	insol.
85	0.874	7.27	....	0.00089	..	...	...	...	...	v.s.s.[5]	insol.
Chlorinated compounds:											
86	1.256	10.45	1.444	0.00116	99	...	...	...	...	0.87	0.16
87	1.108	9.22	1.525	0.00092	99	...	...	...	...	v.s.s.[5]	insol.
88	1.308	10.88	1.549	0.00083	99	...	...	...	...	v.s.s.[5]	insol.
89	1.222	10.17	1.4570	0.00097	99	...	...	...	...	1.02	0.1

	Naval sto es solvents:										
90	0.868	7.22	....	0.00090	..	...	...	...	...	v.s.s.[5]	insol.
91	0.857	7.13	....	0.00089	..	...	...	...	...	v.s.s.[5]	insol.
92	0.853	7.10	1.473	0.00086	..	...	...	...	...	v.s.s.[5]	insol.
93	0.912	7.59	....	0.00083	..	0.4	0.1	...	...	v.s.s.[5]	insol.
94	0.925–0.935	7.7	....	0.00066	..	...	...	...	...	v.s.s.[5]	1.7
95	0.937–0.942	7.8	....	0.00085	..	...	...	...	...	v.s.s.[5]	2.4
96	0.948	7.89	1.4647 (14.5° C.)	0.00088	..	...	...	2.9	0.8	0.2	0.5
	Furane derivatives:										
97	1.159	9.64	1.5261	0.00087	98	...	...	1.6	imm.[9]	8.3	4.8
98	1.119	8.42	1.4627	0.00094	99	...	...	1.3	imm.[9]	v.s.s.	insol.
99	1.137	9.46	1.4852 (22.7° C.)	0.00077	98	...	...	1.5	imm.[9]	∞	∞
100	1.051	8.74	....	0.00074	99	...	...	2.6	imm.[9]	∞	∞

[1] A. S. T. M. D268–31T. [2] Pure material. [3] A. S. T. M. D92–24. [4] Vapor pressures of mixtures cannot be determined by dynamic method. [5] Very slightly soluble. [6] Ester content appears under purity. [7] Flash point below melting point. [8] Sp. gr. determined with 14-inch hydrometers; accuracy, 0.0001. [9] Immiscible.

SOLUBILITY OF ETHYL CELLULOSE AND OTHER CELLULOSE DERIVATIVES

Solvent	*Cellulose Acetate*	*Nitro-cellulose with 35% Alcohol*	*Ethyl Cellulose*	*Benzyl Cellulose*
Methyl Formate	S	S	S	S
Methylene Chloride	SW-A	—	S	S
Ethyl Formate	S	S	S	S
Dichlorethylene	I-A	I	S	S
Acetone	S	S	PS	PS
Ethyl Acetate	SW	S	S	S
Chloroform	I	W	S	S
Ether	I	W	S	I
Ether-Alcohol	I	S	S	SW
Petroleum Ether	I	I	I	I
Carbon Tetrachloride	I	I	S	SW
Methyl Ethyl Ketone	I	S	PS	S
Benzol	I	I	S	S
Ethylene Dichloride	I-A	I	S	S
Isopropyl Acetate	I	S	PS	PS
Trichlorethylene	I	I	S	S
Propyl Alcohol	I	I	S	I
Propyl Acetate	I	S	S	S
Dioxan	S	S	S	S
Toulene	I	I	S	PS
Butanol	I	I	S	I
Methyl Cellosolve	S	S	S	PS
Butyl Acetate	I	S	S	S
Ethylene Chlorhydrin	S	S	S	S
Ethyl Alcohol	I	I	S	I
Amyl Alcohol	I	I	S	I
Cellosolve	I	S	S	S
Amyl Acetate	I	S	S	S
Xylene	I	I	S	SW
Methyl Cellosolve Acetate	S	S	S	S
Cellosolve Acetate	I	S	S	S
Cyclohexanone	PS	S	S	S
Ethyl Lactate	S	S	S	PS
Pentachlorethane	I	I	S	S
Cyclohexanol	I	I	S	I
Diacetone Alcohol	S	S	SW	PS
Methyl Chclohexanone	I	S	S	S
Cyclohexanol Acetate	I	S	S	S
Butyl Glycol	I	S	S	PS
Butyl Lactate	I	S	S	PS
Benzyl Alcohol	I	I	S	S
Benzyl Acetate	I	S	S	S
Triacetin	S	S	I	I
Turpentine	—	I	S	I
Camphor-Alcohol	S	I	S	I
Dipentene	I	I	S	SSW
Pine Oil	I	I	S	PS
Glycol Diacetate	S	S	PS	PS

S—Soluble. SW—Swollen. I—Insoluble.
SW-A—Swollen but with addition of alcohol becomes soluble.
PS—Partially soluble. SSW—Slightly swollen.

BEHAVIOR OF ETHYL CELLULOSE WITH RESINS

Resin	*Miscibility in Solution*		*Compatibility in Film*	
	A	*B*	*A*	*B*
Mastic	M	SI	C	I
Shellac	I	I	—	—
Dammar	M	M	SI	SI
Sandarac	M	M	I	I
Wood Rosin	M	M	C	C
Kauri	M	M	I	I
Elemi	M	M	I	I
Manila	M	M	SI	I
Pontianac	M	M	I	I
Amberol F7	M	M	C	C
Beckosol 1323	M	M	I	I
Beckosol 20	I	I	I	I
Duraplex B37X	I	I	I	I
Lewisol 2	M	M	C	C
Lewisol L500	SI	I	I	I
Rezyl 11	I	I	I	I
Teglac 15	M	M	C	C
Resin AW2	M	M	C	C
Bakelite XR3180	M	M	I	I
Ester Gum	M	M	C	C
Esterol A	I	I	I	I
Beckosol 18	M	M	C	C
Beckosol 1324	M	M	C	C
Lewisol 115	M	M	C	C
Bakelite XR2342	M	M	C	C
Bakelite BR254	M	M	C	C
Bakelite BR820	M	M	C	C
Paraplex RG2	M	M	C	C
Phenac 615N	M	M	C	C
Staybellite A	M	M	C	C
Staybellite A Ester	M	M	C	C
Nevindene Resin	M	M	C	C
Cumar P 10	M	M	C	C
Petrex 5	I	I	I	I
Aroclor 5460	M	M	C	C
Santolite MHP	M	M	C	C
Vinsol	M	M	C	C
Petrex 8	M	M	C	C
Petrex 4	M	M	C	C
Petrex 1	M	M	C	C
Petrex 2	—	—	I	I
Petrex 3	—	—	I	I
Petrex 6	—	—	I	I
Petrex 7	—	—	I	I

M—Miscible
I—{Immiscible, Incompatible}
S—Slight
C—Compatible

The compatibility is often improved by the use of a solvent plasticizer; the compatibility is likewise affected in some cases by the solvent used.

INORGANIC PIGMENTS AND FILLERS AND THEIR COMPOSITION

Material	*Composition*	
Aluminum Flake	Al_2O_3	38 – 42%
	SiO_2	45 – 47%
	$(Ca, Fe, Mg)O$	Trace
Aluminum Hydrate	$Al_2O_3 \cdot 3H_2O$	
Aluminum Stearate	$Al\ (C_{17}H_{35}CO_2)_3$	
American Vermilion	$PbCrO_4 \cdot PbO$	
Antimony Oxide	Sb_2O_3	
Antimony Vermilion	Sb_2S_3	
Asbestine	$MgSiO_3$	92%
	$CaSiO_3$	4%
	H_2O (cryst.)	4%
Barium Carbonate	$BaCO_3$	
Barium Chrome	$BaCrO_4$	
Barytes	$BaSO_4$	
Blanc Fixe	$BaSO_4$	
Bone Black	$Ca_3\ (PO_4)_2$	85%
	C	15%
Burnt Sienna	Fe_2O_3	30 – 70%
	SiO_2	11 – 50%
	Al_2O_3	2 – 13%
Burnt Umber	Fe_2O_3	40 – 54%
	SiO_2	13 – 27%
	Al_2O_3	6 – 14%
	MnO	8 – 17%
Cadmium Yellow, Deep	CdS	
Cadmium Yellow, Light	CdS	30%
	$BaSO_4$	48%
	ZnO	22%
Carbon Black	C	
Calcium Stearate	$Ca\ (C_{17}H_{35}CO_2)_2$	
Chalk	$CaCO_3 \cdot xH_2O$	
China Clay	$2SiO_2 \cdot Al_2O_3 \cdot 2H_2O$	
Chrome Green	$PbCrO_4 \cdot FE_4\ [Fe(CN)_6]_3$	
Chrome Orange	$PbCrO_4 \cdot PbO$	
Chrome Oxide Green	Cr_2O_3	
Chrome Yellow	$PbCrO_4$	
Chrome Yellow, Primrose	$PbCrO_4 \cdot PbSO_4$	
Cobalt Green	$CoZnO_2$	
Copper Green	$CuCO_3 \cdot Cu\ (OH)_2$	
Cuprous Oxide	Cu_2O	
Drop Black	$Ca_3\ (PO_4)_2$	90%
	C	10%
Enamel White	$BaSO_4$	
French Ochre	SiO_2	53%
	Fe_2O_3	19%
	Al_2O_3	19%
	H_2O	9%
Gloss White	$BaSO_4$	75%
	$Al\ (OH)_3$	25%
Guignet Green	$Cr_2O_3 \cdot 3H_2O$	
High Strength Lithopone	ZnS	50%
	$BaSO_4$	50%
Hydrated Chrome Oxide	$Cr_2O_3 \cdot 3H_2O$	
Indian Red, American	Fe_2O_3	88%
	SiO_2	12%
Indian Red, British	Fe_2O_3	90%
	SiO_2	10%
Indian Red, Persian	Fe_2O_3	75%
	SiO_2	25%
Iron Blue	$Fe_4\ [Fe(CN)_6]_3$	
Iron Oxide Black	Fe_3O_4	

Iron Oxide Red	Fe_2O_3	
Iron Oxide Yellow	$Fe_2O_3 \cdot xH_2O$	
Keystone Filler	SiO_2	54%
	C	16%
	Al_2O_3	14%
	Fe_2S_3	8%
	Fe_2O_3	3%
Lampblack	C	
Litharge	PbO	
Lithopone	ZnS	30
	$BaSO_4$	70
Magnesia	MgO	
Magnesium Stearate	$Mg\ (C_{17}H_{35}CO_2)2$	
Metronite	$(Ca, Mg)CO_3$	65
	$(Ca, Mg)SiO_3$	35
Mica	$H_2KAl_3(SiO_4)_3$	
Milori Blue	$Fe_4\ [Fe(CN)_6]_3$	
Milori Green	$PbCrO_4 \cdot Fe_4\ [Fe(CN)_6]_3$	
Molybdate Orange	$PbMoO_4 \cdot PbCrO_4 \cdot PbSO_4$	
Monastral Blue	$(C_6H_4)_4 \cdot Cu(CN)_8$	
Naples Yellow	$Pb_3\ (SbO_4)_2$	
Ochre	$Fe_2O_3 \cdot xH_2O$	
Orange Mineral	Pb_3O_4	
Paris Green	$(CuOAs_2O_3)_3 \cdot Cu(C_2H_3O_2)_2$	
Persian Gulf Iron Oxide	Fe_2O_3	75%
	SiO_2	25%
Prussian Blue	$Fe_4\ [Fe(CN)_6]_3$	
Pyrophyllite Talc	$Al_2O_3 \cdot 4SiO_2 \cdot H_2O$	
Raw Sienna	Fe_2O_3	30 – 60%
	SiO_2	12 – 37%
	Al_2O_3	3 – 16%
Raw Umber	Fe_2O_3	42 – 50%
	SiO_2	13 – 26%
	Al_2O_3	3 – 8%
	MnO	6 – 17%
Red Lead	Pb_3O_4	
Red Oxide	Fe_2O_3	
Reflex Blue	$Fe_4\ [Fe(CN)_6]_3$	
Silica (Silex)	SiO_2	
Spanish White	$CaCO_3$	
Talc	$Mg_3Si_4O_{11} \cdot H_2O$	
Titanated Lithopone	TiO_2	15%
	ZnS	25%
	$BaSO_4$	60%
Titanium Dioxide	TiO_2	
Titanox A	TiO_2	
Titanox B	TiO_2	25%
	$BaSO_4$	75%
Titanox C	TiO_2	30%
	$CaSO_4$	70%
Ultramarine Blue	$Na_4(Na\ S_3\ Al)\ (Al_2SiO_4)_3$	
Venetian Red	Fe_2O_3	40%
	$CaSO_4$	60%
Vermilion	HgS	
White Lead	$2\ PbCO_3 \cdot Pb(OH)_2$	
Whiting	$CaCO_3$	
Zinc Chromate	$ZnCrO_4$	
Zinc Green	$ZnCrO_4 \cdot Fe_4\ [Fe(CN)_6]_3$	
Zinc Oxide	ZnO	
Zinc Oxide, Leaded	ZnO	3 – 53%
	$PbSO_4$	47 – 97%
Zinc Sulphide	ZnS	
Zinc White	ZnO	
Zirconium Oxide	ZrO_2	

Non-Chalking Pigments

U. S. Patent 2,092,838

Titanium dioxide and zinc sulphide pigments are rendered non-chalking as follows:

Add

Titanium Dioxide	100 lb.
to a water slurry of	
Portland Cement	300 lb.

Mix well; allow to set and grind.

Mineral Violet Pigment

Potassium Permanganate	1 lb.
Ammonium Dihydrogen Phosphate	4 lb.

Grind finely and mix together. Put in round enamel pots (⅔ full) and heat in muffle furnace at 100–150° C. Then raise temperature to 310–20° C. Leach with water; filter and dry precipitate at 60° C.

Molybdenum Orange Pigment

Formula No. 1

Solution 1

34.7 grams of lead nitrate dissolved in a liter of water. The excess lead nitrate is used to be sure that no excess of chromate will be left in solution.

Solution 2

Sodium Dichromate	11.5 g.
Sodium Sulphate	1.7 g.
Sodium Molybdate	2.8 g.
Sodium Hydroxide	3.2 g.
Water, to make	1 l.

The excess sodium hydroxide is added so that the pH of the solution after precipitation will be about 4.5. The amount used is approximately that required to convert the sodium dichromate to monochromate.

The pH of solution 1 will be about 4.8 to 5.0 if crystallized lead nitrate is used. If the solution is prepared from metallic lead and nitric acid or from litharge and acid, the pH of the solution may be adjusted to this value by the addition of caustic or account of this by addition of excess caustic to solution 2. The adjustment of the lead nitrate solution is recommended since by this method the pH at no time during precipitation will be lower than a minimum precipitation value of about 3.0.

Solution 2 is run into 1; addition in this manner maintains the necessary excess of lead salt. Rapid mixing is advocated on the basis of von Weimarns principle, since supersaturation is increased in this way so that the strength should be greater. Solutions should be at room temperature or lower.

When precipitation is complete, the pH of the mixture is lowered by the addition of nitric acid to 2.5 to 3.0, which permits the transformation to take place comparatively rapidly (from 15–30 minutes). Lower pH gives a greater degree of transformation and a redder color, but the shade is not so readily controlled as when the pH is about 3.0. As a matter of fact, at pH 3.0, the stirring time may be varied from 30 minutes to 3 or 4 hours without a great deal of change; the outcome is greater ease in plant manipulation and more reproducible results. When the desired color is reached, as in the previous formula, a solution of 2.3 grams of aluminum sulphate in 20 cc. of water is added, followed by a solution of sodium hydroxide to raise the pH of the mixture and effect the formation of a film of aluminum hydroxide on the particles. Just enough sodium hydroxide is added to raise the pH to the neutral point (about 0.56 gram is usually required). Care must be taken not to exceed a pH of about 8.5, since an alkaline solution will cause transformation to the monoclinic with resultant loss in color. A final pH of 6.0 to 8.0 is recommended, since it is found that the precipitate is flocculent and settles very slowly in the presence of aluminum hydroxide below pH 5.5. The precipitate may be washed as desired, filtered, and dried at a temperature as high as 100° C. without appreciable loss in color, although lower drying temperatures are recommended.

No. 2

Dissolve 33.1 grams of lead nitrate in a liter of water. Add with constant stirring a solution containing 11.5 grams of sodium dichromate, 1.7 grams of sodium sulphate, 2.8 grams of sodium molybdate, and about 2.8 grams of sodium hydroxide made up to 1 liter. The pH after mixing will be in the range from 1.5 to 2.5. Stir for about 30 minutes to allow for development of the color and then add a solution of 2.3 grams of aluminum sulphate in 20 cc. of water, followed by a solution of sodium hydroxide to raise the pH to the neutral point (requires about 0.56 gram of sodium hydroxide). Stir for a few minutes, wash twice by decantation, filter, and dry at 100° C.

Luminous Pigments

Formula No. 1

Strontium Hydroxide	20.0 g.
Sulphur	8.0 g.
Magnesium Oxide	1.0 g.
Sodium Carbonate	3.0 g.
Lithium Sulphate	1.0 g.
Bismuth, Colloidal (0.3:100)	6 cc.

No. 2

Strontium Carbonate	20.0 g.
Strontium Hydroxide	20.0 g.
Sulphur	8.0 g.
Lithium Carbonate	1.0 g.
Thorium Nitrate (0.5:100 in water)	2 cc.

No. 3

Calcium Oxide	20.0 g.
Strontium Oxide	20.0 g.
Sulphur	8.0 g.
Potassium Sulphate	1.0 g.
Sodium Sulphate	1.0 g.
Lithium Carbonate	2.0 g.
Starch	2.0 g.
Bismuth Nitrate (0.5:100 in Alcohol)	2 cc.
Rubidium Nitrate (1:100 in water)	2 cc.

Procedure for Formulae 1–3: Heat 45–60 minutes in a Roessler oven, or 30–40 minutes in a red hot oven.

No. 4

Strontium Hydroxide	20 g.
Sulphur	8 g.
Magnesia	1 g.
Sodium Carbonate	3 g.
Lithium Sulphate	1 g.
Colloidal Bismuth (0.3% solution)	6 cc.

This mixture (consisting of strictly pure ingredients) is heated in a crucible of porcelain or earthenware for 30–40 minutes in a red hot oven, or for ¾–1 hour in a Roessler oven.

When the mixture is cold it is powdered, and stored, well sealed.

The pigment is used suspended in a colorless alcoholic dammar solution.

No. 5

U. S. Patent 2,170,134

Calcium Molybdate	20 lb.
Lead Molybdate	5 lb.
Lithium Oxide	¼ lb.
Tricalcium Orthophosphate	75 lb.

No. 6

British Patent 495,774

Zinc Hydroxide	10 oz.
Cadmium Hydroxide	4 oz.
Sulphur	7 oz.
Silver Nitrate	0.0006 oz.

Heat for 3 minutes at 400° C. in rotary tube furnace in atmosphere of hydrogen.

No. 7

(Yellow)

British Patent 485,232

Zinc Oxide	1 lb.
Silica	1½–5 lb.
Manganese Silicate	1.3% of above total

Heat together at 1300–1600° C. for 30 minutes.

No. 8

(Red)

British Patent 492,296

Silica	42 oz.
Manganese Dioxide	15 oz.
Zinc Oxide	10 oz.
Beryllium Oxide	33 oz.

Heat at a glowing temperature.

No. 9

(For Lighting Tubes)

British Patent 491,224

Zinc Oxide	445 g.
Silica	413 g.
Beryllium Oxide	132 g.

Make into a paste with aqueous manganese nitrate (containing 5% manganese). Fire and grind. Aluminum may be added up to 25% of weight of the beryllium.

Luminous Pigments

Alkaline Earth Sulphide Type

Formula No. 1

(Violet)

Calcium Oxide	20 g.
Sulphur	6 g.
Lithium Sulphate	1.5 g.
Bismuth Nitrate Solution*	1 cc.

No. 2

(Dark Blue)

Calcium Oxide	20 g.
Barium Hydroxide	20 g.
Sulphur	8 g.
Sodium Sulphate	1 g.
Potassium Sulphate	1 g.
Lithium Sulphate	2 g.
Bismuth Nitrate Solution*	2 cc.

No. 3

(Greenish Blue)

Calcium Oxide	20 g.
Strontium Hydroxide	20 g.
Sulphur	8 g.
Potassium Sulphate	1 g.
Sodium Sulphate	1 g.
Lithium Sulphate	2 g.
Bismuth Nitrate Solution*	2 cc.

No. 4

(Sea-Green)

Calcium Oxide	10 g.
Strontium Oxide	20 g.

Calcium Wolframate (Tungstate)	10 g.
Sulphur	8 g.
Potassium Sulphate	1 g.
Sodium Sulphate	1 g.
Lithium Sulphate	1 g.
Bismuth Nitrate Solution*	2 cc.

No. 5

(Yellow)

Strontium Hydroxide	15 g.
Barium Carbonate	25 g.
Sulphur	10 g.
Magnesium Oxide	1 g.
Lithium Sulphate	1 g.
Copper Sulphate Solution†	3 cc.
Thorium Sulphate Solution‡	3 cc.

No. 6

(Red)

Barium Oxide	40 g.
Sulphur	9 g.
Lithium Phosphate	0.7 g.
Copper Nitrate Solution	3 cc.

No. 7

(Violet)

Calcium Oxide	20 g.
Magnesium Oxide	1 g.
Sulphur	8 g.
Lithium Sulphate	1 g.
Sodium Carbonate	3 g.
Colloidal Bismuth Solution*	6 cc.

No. 8

(Violet Blue)

Calcium Oxide	15 g.
Strontium Hydroxide	5 g.
Magnesium Oxide	1 g.
Sulphur	8 g.
Lithium Sulphate	1 g.
Sodium Carbonate	3 g.
Colloidal Bismuth Solution*	6 cc.

No. 9

(Violet Blue)

Calcium Oxide	17 g.
Strontium Hydroxide	5 g.
Magnesium Oxide	1 g.
Sulphur	8 g.
Lithium Fluoride	1 g.
Colloidal Bismuth Solution*	6 cc.
Rubidium Nitrate Solution†	1 cc.

No. 10

(Light Blue)

Calcium Oxide	5 g.
Strontium Hydroxide	15 g.
Magnesium Oxide	1 g.
Sulphur	8 g.
Lithium Sulphate	1 g.
Sodium Carbonate	3 g.
Colloidal Bismuth Solution*	6 cc.

No. 11

(Green)

Strontium Hydroxide	20 g.
Magnesium Oxide	1 g.
Sulphur	8 g.
Lithium Sulphate	1 g.
Sodium Carbonate	3 g.
Colloidal Bismuth Solution*	6 cc.

The formulae 1-11 given above are all understood to be made up with purest materials.

The mixtures are either put into a *hot* oven (electrical or of the Hempel or Roessler type) for 30–40 minutes, or, when starting in the *cold* oven for 1 hour.

Crucibles used should be without glaze.

Iron tools should not be used. The crucible should stand on a porcelain or earthenware plate.

No. 12

(Orange)

Calcium Oxide	3.2 g.
Sulphur	1.85 g.
Lithium Fluoride	0.08 g.
Starch	0.3 g.
Samarium (as Nitrate, in Alcoholic Solution)	0.0003 g.

Heat 20 minutes in yellow-hot crucible.

No. 13

(Orange Yellow)

Strontium Oxide	3.6 g.
Sulphur	1.6 g.
Lithium Fluoride	0.08 g.
Starch	0.3 g.
Samarium (as in No. 12)	0.0002 g.

20 minutes in red-hot crucible.

No. 14

(Golden Yellow)

Barium Oxide	5.4 g.
Sulphur	1.16 g.
Sodium Fluoride	0.1 g.
Potassium Fluoride	0.05 g.
Samarium (as in No. 12)	0.0005 g.

Heat 10 minutes in red-hot crucible.

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* **Bismuth Nitrate Solution for Luminous Paints:**

Bismuth Nitrate	0.5 g.
Alcohol	100 cc.

If not completely clear, add a few drops of nitric acid.

† **Copper Sulphate Solution:**

Copper Sulphate	0.4 g.
Water, Distilled	100 cc.

‡ **Thorium Sulphate Solution:**

Thorium Sulphate	0.5 g.
Water, Distilled	100 g.

* **Colloidal Bismuth Solution:**

Colloidal Bismuth	0.3 g.
Water, Distilled	100 cc.

† **Rubidium Nitrate Solution:**

Rubidium Nitrate	1 g.
Water, Distilled	100 cc.

Luminous Pigments
Technical Batches
(Violet)

Calcium Oxide (Purified or from Suitable Lime Ore, as Bohemian Lime, First Quality)	20	kg.
Starch	1.2	kg.
Lithium Carbonate	2.1	kg.
Sodium Sulphate	1.06	kg.
Potassium Sulphate	1.06	kg.
Sulphur	6.2	kg.
Bismuth Nitrate Solution (1%)	800	cc.
Rubidium Nitrate Solution (1%)	400	cc.

Procedure: The burned lime, from pure ore and free of matrix, is finely ground in a granite ball mill, or in a porcelain-lined ball mill. Save in sealed containers.

The flux-salts are mixed with the powdered sulphur (recrystallized from carbon disulphide) and wetted with the solutions of activating metal-salts on a steam dish. The whole is dried on the dish with frequent stirring, ground and kept in sealed containers.

The calcium oxide and the salt-sulphur mixture are mixed in a (cold) evaporating dish, wetted slightly with some distilled water. Starch is mixed in.

The reaction soon starts without applying heat, developing heat itself and causing discoloration.

Keep stirring to prevent the sulphur from burning.

If the reaction does not start by itself, apply gentle heat.

The reaction is continued in Hess-Crucibles of 3–5 liters, calcining for 1½–2 hours at 900–1100° C.

The crucibles should be filled completely and covered with a *thin* layer of sulphur, and should be covered with a suitable cover.

The best suitable ovens are puddling (reverberatory) furnaces with horizontal or down-going flames.

For small amounts, gas or oil-heated ovens are satisfactory.

The crucible should be allowed to cool quickly but with closed cover. When cold the cake is taken out, freed of pieces of slag, and cracked up into coarse pieces.

These pieces are spread in the light, and picked out after proving their luminosity in the dark.

The good pieces are spread on shallow cases in humidity chambers. There they weather and yield a powder that can be separated by sifting (2000–2500 mesh).

Strontium Sulphide cannot be powdered by this hydrolytical method, but has to be broken up mechanically and sifted (1000–1400 mesh per square centimeter).

(Blue)

Calcium Oxide	20	kg.
Strontium Hydroxide	8.85	kg.
Starch	2.3	kg.
Lithium Carbonate	2	kg.
Sodium Sulphate	1	kg.
Potassium Sulphate	1	kg.
Sulphur	6.3	kg.
Bismuth Nitrate (1% Solution)	1060	cc.
Thallium Nitrate (1% Solution)	1060	cc.

Procedure as described above.

(Bluish Green)

Magnesium Oxide	6.0	kg.
Strontium Hydroxide	14	kg.
Starch	1.2	kg.
Lithium Carbonate	2	kg.
Sodium Sulphate	0.6	kg.
Potassium Sulphate	0.6	kg.
Sulphur	4	kg.
Bismuth Nitrate (1% Solution)	600	cc.
Rubidium Nitrate (1% Solution)	300	cc.

Heat 1–1½ hours at 900–1000° C.

Luminous Pigments From Zinc Sulphide
Formula No. 1

Dissolve equal weights of
Pure Zinc Sulphate
Pure Sodium Acetate
in hot water, and introduce into the hot solution a flow of sulphuretted hydrogen gas to complete precipitation of the zinc.

Let settle, pour off the clear liquors, decant with hot water, filter through a suction filter, wash thoroughly, dry on a waterbath.

Use this

Zinc Sulphide	200	g.

with a solution of

Magnesium Chloride	20	g.
Calcium Chloride	10	g.
Strontium Chloride	10	g.
Barium Chloride	10	g.

in

Water	200	cc.

and

Ammonium Tungstate	0.040	g.

in

Water	10	cc

Evaporate the sulphide and the salts until dry, and heat the residue in a Hess crucible in a Roessler oven in such a way that the crucible is slowly heated to reach a red-hot temperature after 1 hour. Keep there for 30–40 minutes, then let cool.

Remove the soluble salts by extracting (decanting) with water.

Dry the remaining sulphide on the waterbath—Green Phosphoresence.

No. 2

Precipitate the Zinc Sulphide from mineral-acidic solution by hydrogen sulphide gas with slight pressure.

The suitable concentration is 7 parts of crystallized zinc sulphide in 100 parts. Work at 50° C.

To remove all traces of heavy metals, precipitate at the beginning with hydrogen sulphide or sodium sulphide from the hot solution, and filter the first fraction. The further introduction of hydrogen sulphide precipitates pure zinc sulphide.

Precipitation of Zinc Sulphide

To a solution containing about 40% zinc (= 100 g. Zinc Sulphate Anhydrous) is added water to dilute to 1500 cc., and a stream of hydrogen sulphide is introduced until the liquor is saturated with it.

Let stand sealed for 10 hours at 60–70° C. (sand-bath).

This operation is repeated.

The precipitated Zinc Sulphide yields 97.75% of the Zinc.

Zinc Sulphide Pigment

a. Zinc Sulphate	50 g.
Water, Double Distilled	500 g.
Sulphuric Acid, Dilute	3 drops
b. Ammonium Sulphide, Yellow Solution 1:10	2 cc.
c. Ammonia, 5%	about 10 cc.

Make solution *a*, add *b* until slight cloudiness appears. Add *c* until neutralization point is just passed, let stand, filter.

Add to the filtrate 25% ammonia, until the precipitate forming is redissolved. Heat, and add drop by drop

Ammonium Sulphide, Yellow, Solution 1:10	2 cc.

let stand, filter.

Add sulphuric acid until neutral, electrolyse for 1 hour with 2 volts tension.

Bring to ammoniacal reaction again, let stand 1 hour, boil, filter.

Precipitate the zinc sulphide with ammonium sulphide solution, filter off, wash with hydrogen sulphide solution. Dry gently.

The zinc sulphide thus obtained is calcined for 15 minutes at 1300° C. with the following additions:

For Zinc Sulphide	100 g.
Add	
Sodium Chloride	5 g.
Magnesium Fluoride	5 g.
Copper (as Sulphate)	0.01 g.

To avoid oxidation, put the mixture in a porcelain crucible which is put into a non-glazed crucible (Rose crucible). Between both crucibles, pieces of purest sulphur are inserted.

Cover crucibles with suitable earthenware plates, and put the whole into a tightly closed graphite crucible.

Use an electrical or Hempel oven. When finished, the crucible is taken out while still red-hot, the porcelain cover is removed, a piece of sulphur is put on the earthenware plate, and the cover is put back. Leave alone until cooled.

Technical Procedure for Zinc Sulphide Luminous Pigments

Dissolve in an earthenware vessel a suitable amount of pure zinc oxide in pure hydrochloric acid with agitation. Add a small amount of nitric acid, and oversaturate cautiously with ammonia.

To this	
Zinc Solution	30 l.
add	
Yellow Ammonium Sulphide	0.2 l.

thus precipitating all heavy metal salts and some of the zinc.

Let cool, settle and syphon off the clear solution, which should be passed through ceramic Berkefeld-Filters to remove colloidal sulphides.

Into the clear ammoniacal solution, hydrogen sulphide gas is passed (made in earthenware vessels and purified by gas-washers). The gas should bubble slowly and with low pressure.

The precipitated zinc sulphide is now settled out in sedimentation jars. Every 24 hours, the water standing over the sedimented sulphide is renewed cautiously 4–5 times. The jars have to be covered.

When thus washed sufficiently, the sulphide is filtered through fine cloth through porcelain suction funnels until dry. Further drying is accomplished in a dust-free air-oven.

All operations should be done in very clean containers, and in apparatus free of metal. The same precautions are necessary for grinding and sifting of the sulphide.

Mixture of Flux and Activating Metal Salt:

Potassium Chloride	5	kg.
Sodium Chloride	5	kg.
Ammonium Chloride	2	kg.
Sulphur	10.5	kg.
Copper, Chloride, Solution 1%, Saturated with Ammonia	1.05	l.

This mixture of pure materials is dried with intermittent stirring on an evaporating dish and water-bath, keeping free of dust.

Grind when dry.

The salts used are not sufficiently pure in the commercial "C.P." form. They should be dissolved and filtered, and recrystallized selectively.

Mix

Zinc Sulphide (Prepared as above)	20.5 kg.
Flux-Mixture	6.8 kg.

in a porcelain mixing-drum, and calcine in quartz crucibles (250 mm. high, upper diameter 160–180 mm., lower diameter 90–100 mm.) or (less favorable) Hess crucibles, at 1000° C. for 2½–3 hours.

Electrical ovens are recommended.

Take care to insure quick cooling. Crack up the sulphide mass, and expose to light. Choose the good pieces.

Pouring water over these, a fine powder forms which is filtered, washed until free of chlorides, dried, sifted.

CHAPTER FOURTEEN

PAPER

Waterproofing Paper
Formula No. 1
British Patent 492,608

Paper is coated or impregnated with the following:

Casein	30 oz.
Borax	6 oz.
Caustic Soda	7 oz.
Stearic Acid	59 oz.
Water (Boiling)	62 oz.

Then treat with

Formaldehyde	83 oz.
Acetic Acid	11 oz.
Water	250 oz.

No. 2
U. S. Patent 2,071,360

Paper is coated with a 1:1 mixture of stearine pitch (residue from the distillation of natural glycerides) and asphalt, the mixture having m.p. 99°. It is preferable to use the mixture in the blown condition in order to reduce its tackiness. The coating is applied at about 205°, under which conditions it may also be used as the (waterproof) cementing layer in forming laminated papers. Thus it may be employed for both the corrugated sheet and the liner in making corrugated container board.

No. 3
(Paper Board)
U. S. Patent 2,082,278

Hydrogenated Fish Oil	86 lb.
Rubber	14 lb.

Compound with heat and apply hot or as an emulsion.

No. 4

To meet the frequent need to waterproof and strengthen paper without the use of paraffin or wax, the following simple method is worth keeping in mind:

Using 1 part of glycerin by weight to 1 part by weight of gelatin and 4 parts by weight of water, cover both sides of the paper with the warmed solution. Then after a few minutes, before it is fully dry, place the paper in a solution of 7½ parts by weight of formaldehyde with 50 parts by weight of water.

No. 5

Paper is coated with following melted together and applied by a special brush coater.

Carnauba Wax	20 lb.
Ceresin Wax	5 lb.
Petrolatum	10 lb.
Rosin	5 lb.

No. 6

Paraffin Wax	20 lb.
Ceresin Wax	10 lb.
Congo Gum	20 lb.
Rosin	10 lb.
Rubber Latex	2 lb.
Titanium Dioxide	38 lb.

Melt the gums and waxes, add rubber and filter and blend while molten.

No. 7
(Millboard)

Cellulose Waste Fibers	100 lb.

are mixed with following emulsion

Paraffin Wax (Match)	1.50 lb.
Turpentine	0.75 lb.
Aluminum Oxide	12.00 lb.
Napthenic Acid	15.00 lb.
Water	70.00 lb.

Press between rollers heated to 50° C.

No. 8
("Cellophane")
U. S. Patent 2,073,301

Sheets are treated with

Tung Oil	¼ lb.
Gasoline	100 lb.

Dry at 124° F.; then dip in

Chloro-Rubber	9 lb.
Paraffin Wax	1 lb.
Gasoline	300 lb.

Dry at 88° F.

Insect Proof Building Paper
U. S. Patent 2,129,659

A felt base is saturated with

Lead Arsenate	25 lb.
Asphalt Paint	73 lb.
Nicotine Sulphate	1 lb.
Inert Filler	1 lb.

Oil Proof Coatings

Formula No. 1

(For Cardboard)

U. S. Patent 2,173,517

Sodium Silicate	80–95%
Glycerin	2.5–15%
Gum Arabic	1– 4%
Potassium Oleate	0.2%
Water	to suit

No. 2

(Paper Container)

U. S. Patent 2,199,224

Oxidized Abietic Acid	50
Alcohol	33
Castor Oil	17

Grease-Proofing Boxes

Paper or wooden boxes may be made grease-proof by applying the following mixture.

Fish Glue	16	oz.
Rosin	2	dr.
Litharge	½	oz.
Kaolin	½	oz.
Glycerin	½	oz.
Water	40	oz.

Boil the glycerin, glue, litharge and part of the water together until solution occurs, then mix with the other ingredients. The liquid is applied to the inside of the cardboard or wooden boxes with a brush and allowed to dry. If necessary the application may be repeated.

Telephone Cable Drier

To keep paper insulation dry inside a telephone cable, fine granular active anhydrous calcium sulfate (Drierite) is sprinkled on the splice where protection is desired before recovering from the weather.

Parchment Paper From Wood Pulp

Sulphite Pulp (Half Bleached)	900 kg.

Digest with 12–13 g./l. caustic soda at 1.5–2 atmospheres pressure for 4–5 hours and, after thorough washing, is bleached at 25–30° for 3–4 hours with a consumption of 0.6–0.8% of active Cl (based on the pulp). The refined stock is then converted into sheets and treated with 51–2° Bé. Sulphuric Acid as usual. The resulting parchmentized paper is equal to the product made from rag stock and is free from knots and metallic inclusions.

Zein (Prolamine) Paper Coatings

Formula No. 1

Zein	25	lb.
Lauric Acid	10	lb.
Ethyl Cellosolve	2½	lb.
Alcohol (95%)	100	lb.

If desired, 1¼–2½ lb. rosin, dammar or manila gum may be added to increase stability and gloss.

No. 2

Gives grease resisting coating.

Zein	25 lb.
Urea	8 lb.
Glycerin	5 lb.
Alcohol (85%)	100 lb.

No. 3

Zein	100 lb.
Formamide	35 lb.
Urea	15 lb.
Yumidol	11 lb.
Toluol	20 lb.
Alcohol (95%)	400 lb.

Emulsion for High Lustre Paper

Marseilles Soap	2	kg.
Montan Wax, Crude or Bleached	6.5	kg.
Water, Free of Calcium	40	kg.

High Gloss Paper Coating

Canadian Patent 382,050

Cellulose Acetate	12.2 lb.
Acetone	48.8 lb.
Xylene	36.6 lb.
Castor Oil	2.4 lb.

Non-Glare Writing Paper

U. S. Patent 2,174,095

Paper Stock (Soda Pulp)	3,400	lb.
Paper Stock (Bleached Sulphite)	10,200	lb.
Paper Stock (Unbleached Sulphite)	3,400	lb.
American Blue Index No. 1288	¾	oz.
Paper Yellow C. H. Index No. 365	6¾	oz.

Paper Transparentizer

Tricresyl Phosphate	50 oz.
Solvent Naphtha	49 oz.
Acetone	1 oz.

Applied to uncoated paper or the back of prints it renders it about the translucence of paraffin wrapping paper but not subject to crackle. It is to be applied with a perfectly clean, broad camel's hair brush. It dries in a few hours and remains clear for years.

Lampshade Paper Oil

Linseed Oil	30 cc.
Mineral Oil	20 cc.

Stencil Sheet Coating
U. S. Patent 2,194,291

Zein	10
Alcohol	35
Cellosolve	10
Dibutyl Tartrate	15
Castor Oil	3
Diglycol Stearate	10

Warm to 130° F.

Mix until dissolved and just before use add

Formalin	5

The above solution is applied to suitable stencil paper at 100–140° F. and then dried.

Carbon Paper Coatings
Formula No. 1
(Lead Pencil Carbon)

Carbon Black	10
Mineral Oil	40

Grind together until smooth.

Add

Nigrosine Base	1⅔

Dissolved in

Oleic Acid	3⅓

Mix well and add a hot solution of

Paraffin Wax	40
Mineral Oil	30

Grind again and spread on paper at temperature of 40–50° C.

No. 2
(Pencil)

Glyceryl Monostearate	6 oz.
Oleic Acid	20 oz.
Dye, Oil Soluble	10 oz.
Petrolatum	14 oz.
Kerosene	7 oz.
Paraffin Wax	85 oz.
Carnauba Wax	8 oz.
Montan Wax	30 oz.

No. 3
(Typewriter)

Oleic Acid	11 oz.
Diglycol Oleate	2 oz.
Dye, Oil Soluble	3 oz.
Pigment	17 oz.
Petrolatum	38 oz.
Carnauba Wax	30 oz.

Storage of Wrapping and Packing Materials

Storage of Transparent Sheetings

Cellophane sheeting materials are supplied by their manufacturers with a predetermined moisture content. They are capable of absorbing moisture. They are capable of drying out. Therefore, they should not be stored or handled under extreme conditions of heat, cold, moisture or dryness. The optimum temperature for storage is 70° F. A 50 per cent relative humidity is most desirable.

Purchasers of converted sheets, bags and other forms of cellophane have, on occasion, experienced difficulties with shipments received during or immediately after extreme cold spells. Such shipments, having been subjected to transit during sub-freezing weather, should be allowed at least 24 to 48 hours to reach room temperature before being used.

Unconverted sheet or roll stock is usually securely packed to be in prime condition for the maximum length of time. Original packages should not be opened until ready for use. When entire packages or rolls are not to be consumed immediately after opening, the unused portion of the packages should be rewrapped in their original wrappers for over night or longer storage.

Rolls should be stored in their original shipping containers until ready for use. Most manufacturers recommend hanging the holls horizontally. Sheets should be stacked, but such stacks should never be too high. One manufacturer recommends ten packages of 1000 sheets each as maximum stack height and advises smaller stacks in humid weather. Adherence to this particular specification will prevent sheets from adhering to each other.

The moisture-proof types of cellophane are not as readily affected by climatic changes as are non-moisture-proof varieties. Nevertheless, the precautions described above apply to moisture-proof varieties though, perhaps, to a lesser degree. One supplier recommends against the purchase and storage of more than a 60-day supply of material, as fresh stock can be obtained promptly.

Acetate Sheetings

Acetate sheetings, supplied in rolls, should be stored hung horizontally in suitable wraps at a room temperature of 70° F. and 50 per cent relative humidity, out of direct sunlight. The temperature should in no instance exceed 90° and 55 per cent relative humidity. Low temperature and humidity have no serious deleterious effect, but rolls may require conditioning before fabricating if stored at temperatures at the freezing point or below.

Sheets should be stored in their

original wraps and laid flat on smooth shelves under atmospheric conditions similar to those described for rolls above. They should not be stacked in piles more than 12 in. high.

Rubber Derivative Sheetings

These materials are virtually unaffected by dryness or dampness and hence special temperatures or humidity precautions are not generally considered necessary. Conditions in the average packaging plant are within the wide range which is not detrimental to such rubber derivative materials.

Materials are, however, affected by strong sunlight and should be shielded from the ultra-violet rays of the sun either by storing in the dark or wrapping the rolls or bundles in opaque paper. Rolls should be stored on end, with the ends reversed every two or three months so that there is no tendency to inflex one end. No particular precautions as to circulation of air are required.

Ethyl Cellulose Sheetings

Moisture absorption of these materials is low and volume change, under storage conditions, is therefore very small. The plasticizers of these materials are not moisture-soluble or volatile and do not bleed.

The foils usually employed for the manufacture of rigid fabricated or drawn shapes have a very high softening point and can therefore be subjected to temperatures—in storage—up to approximately 145–150° F. Precaution should be taken to avoid extreme changes in temperature during processing such as multi-color printing, although the coefficient of thermal expansion is not excessive.

Foil which has been subjected to extremely dry conditions will, if brought into contact with humid air, expand about ¼ of 1 per cent (0.0025″ per in.) but this expansion is not experienced under normal changes.

Adhesives

The term adhesives is a broad one covering a wide variety of materials of differing characteristics. None-theless, a number of general storage cautions can be applied almost without variation to most types of adhesive products.

Aqueous and non-aqueous adhesives should be kept at moderate temperatures at all times—at room temperature in winter and in a cool place in summer. All adhesives should be stored, if possible, during the winter at normal temperature of about 70° F. The viscosity of an adhesive is directly relative to its temperature. Thus, if the material is too cold, it will be very viscous and will possibly operate poorly on the machine on which it is used. Conversely, if the material is too warm, the viscosity is lowered to a point which again interferes with operation.

Prepared glues which have been subjected to excessive low temperatures may be restored to their normal consistency by placing the container in a warm location for a few days before using. If time does not permit this procedure, some manufacturers recommend filling a metal container with the glue and partially immersing the container in hot water. Consumers are warned against adding water to the glue until normal consistency has been restored; otherwise it is impossible to judge the correct amount of water to be added and the tendency is to add too much.

Aqueous adhesives where the containers have been opened in the customer's plant should be covered with a damp cloth at night, or the container sealed tightly so that evaporation of the water is minimized and the adhesive not allowed to crust over. This minimizes the necessity of throwing away adhesive that has hardened or crusted on the surface of the adhesive and the sides of the container. Some adhesives are shipped in special containers which must be closed tightly after portions of adhesive have been removed from the same so as not to allow the introduction of air, and likewise possible oxidation of the adhesive.

Manufacturers of the adhesives usually determine the type of container most suitable for the adhesive formula based on natural storage tests conducted experimentally in their plant. Non-aqueous or lacquer adhesives should be kept away from all flame, high temperatures, etc. These adhesives should be stocked the same as aqueous adhesives with normal conditions of temperature between 65–75° F. so that the viscosity of the adhesive is about correct when a portion of the material is removed from the container and placed on the machine.

All containers for non-aqueous adhesives should be closed tightly after adhesive is removed for use. The solvents in most of these types of adhesives are volatile and evaporation must be controlled as much as possible during storage so as not to have the material become viscous just because of solvent evaporation. Direct sunlight should not be allowed to play on the containers of non-aqueous adhesives because of the possible rise in temperature and expansion of the solvents which might burst the container if too much pressure is developed within the container itself. Explosion will cause a fire hazard or possible fire itself.

After adhesive barrels or drums have been opened, certain precautions are indicated. It is advisable to keep the sides of the container scraped down to the level of the glue. If this is not done, the accumulations on the side of the barrel may cake or crust entirely apart from the metal. These hard crusts may fall into the glue and cause endless trouble and even damage costly machinery.

In the case of heavy pastes, an effective method is to keep the paste in the form of a mound in the center of the barrel, so that no accumulation or crust will form on the sides.

The tendency of glue or paste to become heavier in consistency due to evaporation of moisture may be prevented by covering the container with several layers of well-moistened burlap. Another manufacturer recommends having heavy thicknesses of felt on the underside of the barrel head covers, the felt being kept impregnated with water to prevent drying out of the paste. This is reported to be particularly desirable in the winter time when relative humidity is low. With heavy bodied adhesives, another manufacturer suggests covering the glue with a ½ inch layer of water. A caution that applies to all adhesives is never to leave the container uncovered for any length of time as dirt or foreign substances may find their way into the adhesives and cause serious trouble at a later date.

Users of concentrated adhesives that require dilution of water are cautioned against adding water to the glue in the original container. It is far better to draw the required amount of adhesive for the day's run from the container and then to add water as required in a small receptacle. If the glue is used on a machine, users are cautioned against attempting dilution in the machine glue pot. Dilution should be carried on in a pail or other receptacle, mixing the water in thoroughly and then pouring the diluted glue mixture into the machine reservoir.

If diluted glue is left over at the end of the day, users are advised against returning it to the glue container. It is far preferable to be kept over night in a pail or other receptacle since it may contain dirt that was accidentally dropped into it or bacteria in the water to dilute it. Such conditions will have a tendency to deteriorate the entire keg or barrel of glue if the glue left over from the day's run is poured back into it.

Inks

Since ink is packed in cans or occasionally in tubes, both of which are airtight, the problem of storing is not particularly important. Obviously, they should not be kept below freezing temperatures or in a room that is excessively hot, but, generally speaking, the storage of ink in its original container is not much of a problem. Exposure to light, of course, is not a factor.

Ink should be kept enclosed in a can because if it is left exposed to air, it will liver, skin, etc. As a generalization, you might say ink should be kept airtight and exposed to air only when used and only great extremes of temperature would have much effect on it.

It is usually inadvisable to carry stocks of colored inks for greatly extended periods. Black inks, at least those of the ordinary linseed oil type, usually improve with age so that for periods of at least a year, they will be quite safe.

This is not true of many of the newer type inks containing synthetic vehicles. Many of these should not be stocked for more than a few months. Colors of this type should be ordered as they are required, since some of these special vehicles show tendencies of instabilities. The manufacturer can give data on such cases.

Wrapping and Box Covering Papers

Glazed and fancy decorated papers do not present extremely rigid storage requirements. In respect to temperature and humidity, the optimum is reported to be 75° F. and 50%. Maximum temperatures should not exceed 120° F. The minimum should not drop below 40° F. Humidity should not exceed 75% nor fall below 15%.

Packaging papers should be stored in dry rooms with shades drawn at the windows or other means adopted to keep out excessive light. Practically all coated and fancy papers have some tendency to fade under severe exposure to light even though the best nonfading dyes may have been utilized. Certain colors fade more easily than others and it is therefore a wise precaution to store papers in as dark a room as possible. One manufacturer recommends stacking on platforms at least 4 in. from the floor, both as a sanitary precaution and to avoid floor-obtained moisture. One manufacturer makes the following statement: "With the exception of paper containing deep embossings, all paper should be stored flat. Rolls of deep embossed papers should be kept in wrappers until ready for use. These rolls should be stacked on end."

Paper which is to be printed should be stored under similar conditions of humidity and temperature as the printing room, or, in the event that this is not possible, should stand in the printing room at least 48 hours before being used.

Glassines

Glassines should be kept in their original containers as long as possible before use, since these containers are designed to protect the material. Since glassines are affected by temperature and humidity in much the same way as are transparent cellulose materials, It is advised that they be stored at 70° F. or as near to that as possible, with the relative humidity of from 50% to 65%.

Rolls should be handled in such a way as not to damage the edges or the ends. Sheets should be stacked either in very low piles of not more than two or three bundles in height or, unless too large, they should be stacked on end. This applies particularly to waxed and lacquered glassines. Cautions against excessively deep stacking apply likewise to bags and other materials fabricated from glassines.

Waxed Papers

Waxed paper, as furnished in rolls, is usually most carefully wrapped by the supplier to afford adequate storage protection. One manufacturer, for instance, uses a corrugated paper sleeve with corrugated circles at top and bottom of the roll over which a tight paper wrap is applied and taped into place.

It is important to avoid bumping of the edges of the roll of waxed papers as such a bump may cause small tears to appear in the paper. When a roll which has been so bumped is put on to a machine, the natural jerk of the machine strains these slight tears and it sometimes becomes impossible to work the roll satisfactorily.

In cases where a bump does not result in tearing of the roll, it may still dent a few surfaces of the paper on the roll. This dent then interferes with the tension on the roll of the packaging machine and again provides a potential source of trouble.

Waxed paper should be stored in a cool place, certainly not one exceeding 70° F. Some waxed paper users find that, in extreme summer temperatures, they get better operation on the machine by placing the rolls in a refrigerator or cold room for a few hours in advance of use. This practice is particularly common among bakers who, of course, have the available necessary refrigeration facilities.

The storage conditions apply equally well to waxed paper in sheet form with the exception of problems affecting machine operation wherein requirements are naturally not quite as strict as in the case of rolls.

Aluminum Foils

Manufacturers advise the maintenance of humidity at as nearly uniform a point as possible and control of temperatures within a range that might be considered normal. It is wise to avoid transfer of stored aluminum foil from a hot temperature to a cold one for the reason that this sometimes causes condensation. This, of course, is true of a number of other materials as well.

Transparent Cellulose Vials

Normal temperature and humidity conditions are recommended for storage of transparent vials, tubes, bottles and specialties. It is particularly unwise to store any form of cellulosic material in a particularly cool room for any length of time. Exposure to light is not a problem in the usual storage of these vials since they are shipped by the manufacturers in cartons which protect them from light. Storage in direct sunlight is, of course, to be avoided.

PAPER VARNISHES

Formula No. 1

Batavia Damar	10 lb.
Chlorinated Rubber	10 lb.
Hi-Flash Naphtha	80 lb.
Tricresyl Phosphate	2 lb.

Mix all ingredients together with agitation until solution is complete.

No. 2

Thermally Processed Congo	10 lb.
Chlorinated Rubber	10 lb.
Hi-Flash Naphtha	80 lb.
Tricresyl Phosphate	2 lb.

Mix all ingredients together with agitation until solution is complete.

No. 3

Batavia Damar	65 lb.
Chlorinated Rubber	15 lb.
Gum Elemi	20 lb.
Toluol	100 lb.

Mix all ingredients together with agitation until solution is complete. This is a more flexible coating but a softer coating than previous formulas and it is recommended as a paper coating.

Batavia Damar	35 lb.
Chlorinated Rubber	25 lb.
Gum Elemi	40 lb.
Toluol	100 lb.

Mix all ingredients together with agitation until solution is complete.

This is a more flexible coating and a softer coating than No. 1 and No. 2 and is also recommended as a paper coating.

CHAPTER FIFTEEN

PHOTOGRAPHY

Photographers everywhere realize the importance which chemistry holds in photographic work, but often consider the subject too formidable and involved for application to their own work. This discussion has been prepared to help dispel that fear, and to show that theoretical knowledge is unimportant if the photographer knows in a practical way, what is in a developing or fixing solution, why it is there and how it accomplishes its own particular job.

The general structure of photographic film, its components of nitrocellulose (or acetyl cellulose) base, emulsion coating of gelatine which contains suspended particles of light-sensitive silver salt, and auxiliary layers for such purposes as prevention of halation, are common knowledge among photographers. The chemistry involved in this branch of the science is held under precise control by the manufacturer and causes the photographer little concern. Photographic chemistry begins to affect the photographer more directly in the developing and fixing operations carried out with film and paper. It is therefore well worth while to consider first the composition and function of the developing solution to see what it contains and what it does to effect development.

When a photographic emulsion is exposed to light, the silver salt (silver bromide, chloride or iodide) which the light reaches, undergoes a definite though invisible change to form what is known as the latent image. It is not yet definitely known just how this change takes place, but it is believed that the exposed parts of the emulsion gain a certain "activation" that makes them susceptible to the reducing action of a developer. When placed in a developing solution the exposed, "activated" particles of silver salt are reduced chemically to black metallic silver, leaving the unexposed particles of silver salt unchanged. Reduction in this sense does not have the meaning commonly thought of in the photographic field, namely, the lessening of density in a film negative. This *chemical* reduction is a conversion of the silver salt to free silver and for the reaction one or more *reducing agents* —which photographers call "developers" are necessary.

The Developer's Basic Component

There are many chemicals which are reducing agents, but most of them are too powerful to be used for developing because they reduce all the silver salt in the emulsion without regard to the latent image which exposure in the camera has produced. Therefore a reducing agent must be selected which is satisfactory as a developer and which confines its action to the exposed particles of silver salt, leaving the remainder unaffected. Of the reducing agents that are satisfactory for photographic use, metol, hydroquinone and pyro are most commonly used, and there are in addition other developing agents such as glycin, amidol and rodinal frequently employed. There are also several developing agents on the market under different names from metol, but which are basically the same chemical—monomethyl - para - aminophenol - sulphate.

As has been indicated, the chemical action of these developing agents is fundamentally the same. The photographic effect, however, depends to a large extent on the particular developing agent and the way in which it is used. Thus many developers contain a combination of developing agents, and one formula may have, for example, a high percentage of hydroquinone to produce brilliant photographic images while another formula may use a larger ratio of metol to produce softer results.

It is obvious therefore, that great care should be taken in the preparation of developing solutions, for a slight error in the type or amount of the developing agents (or the other constituents too, for that matter) may have a serious effect on the behavior of the developer. Most successful photographers have found that it is far wiser to use the formulas recommended by the manufacturer and to make sure solutions are carefully and accurately mixed, than to spend time on individual experimenting or research. The use of recommended formulas is undoubtedly one of the most important helps to getting good results in film development.

Other Ingredients of the Developing Solution

The function and importance of the developing agent in the developer have both been mentioned—but there are three other components which also play an important role in any developing solution. The first of these is the alkali—which is ordinarily essential for development. Most of the developing agents in use today are neutral or slightly acid in their normal state, and in this condition give little or no developing action. However, when an alkaline salt like sodium carbonate is introduced into the solution containing the developing agent, a very interesting change takes place. The developing agent forms what is called an alkaline salt which in a photographic sense is a more active material, and it is this alkaline salt of the developing agent that actually reduces the exposed grains of silver salt to metallic silver. The alkali has a secondary effect in the developing solution which is also important. It helps the gelatine emulsion to swell and thus facilitates the penetration of the developing solution throughout the network layer of the emulsion.

It is obvious that the alkali is a really important component of the developing solution and it is likewise evident that care must be exercised in using the right kind and correct amount of alkali. Sodium carbonate is normally recommended though potassium carbonate is sometimes used in its place. The caustic alkalis, sodium hydroxide and potassium hydroxide, should not be substituted unless definitely specified as they are much stronger and can easily cause fog. Normally they are used only in special-purpose developers giving high contrast. Borax and similar alkalis which are less energetic are often specified for fine-grain development in which grain size must be controlled by softer development. Another alkali used for photographic work is sodium metaborate which is helpful in reducing blister formation where it is difficult to control the temperature of processing solutions during hot weather.

The amount of alkali should of course be weighed accurately to the amount specified, as too much may cause fog in developed negatives; too little may result in slow, soft development. It is important to remember when using carbonate, that the potassium salt is generally available only in the anhydrous form, while the more generally used sodium salt can be obtained as (1) the anhydrous salt containing about 2% water, (2) the monohydrated salt containing about 15% water, or (3) in crystal form containing about 63% water. The anhydrous and crystalline forms are both unstable at ordinary conditions of temperature and humidity, and must be kept in tightly sealed containers and used with great care to prevent considerable absorption of water from the atmosphere by the anhydrous salt, or loss of water by the crystalline form. The monohydrated form of sodium carbonate is stable and therefore preferred by most photographers for accurate preparation of developing solutions.

The Importance of a Preservative

It is a characteristic of many photographic reducing agents in alkaline solutions to combine freely and easily with oxygen. Because of this "hunger" for oxygen, alkaline solutions of the developing agents spoil very quickly when exposed to air. To increase their useful life, to allow the developing agent to do its work on the exposed silver halide as desired, and to prevent the occurrence of stains, a preservative must be added to the developing solution.

Sodium sulphite is ordinarily used as the preservative, though in developers prepared for stock in two solutions, preservatives which are slightly acid in solution such as sodium bisulphite and potassium metabisulphite are preferred. Because developing agents keep better in acid solution than in one which is alkaline, it is common practice to use one of these acid sulphites as the preservative in the developer part of the stock solution. In single-solution developers, sodium bisulphite is never used alone as a preservative since it neutralizes some of the alkali in the solution and would result in softer development. One other interesting point about preservatives is that in some cases the preservative performs a secondary function in the developer. In some fine-grain developers, for instance, a large amount of sodium sulphite is used to aid in keeping grain size at a minimum.

The fourth and final important component of the typical developing solution is the restrainer, potassium bromide. This necessary constituent of the developing solution acts as a "brake" on the chemical reaction of development and keeps the operation under control. The action of the restrainer is such that an increase in the concentration of potassium bromide in the developer tends to slow down or "restrain" the development of the photographic image. The concentration of potassium bromide in the solution is obviously important, for too much may retard development excessively and indicate an apparent loss of speed while too little may permit development of fog.

Developer Exhaustion

The chemical reaction of development results in a depletion of certain constituents of the developing solution so that with continued use the developer becomes less efficient. This "exhaustion" of the developer is characterized by a loss in effective speed and gradation of the photographic emulsion (of importance in both film and paper development) and by a change in tone of the developed image (of special importance in making prints). In consequence of this condition, it is standard practice to use fresh developing solution whenever possible, as it is good insurance of obtaining uniformly optimum results with photographic films and papers.

There are, however, occasions when a rather large quantity of developer must be put in use, as in the tank development of films, and in such circumstances it becomes desirable, for reasons of economy, to prolong the usefulness of the developer by the addition of a "replenisher" solution which replaces solution carried away on developed films and helps restore the balance of active ingredients in the solution. For replenishers for Agfa formulas commonly used in tank development, see the appended formulas.

By the occasional addition of such replenishers to maintain a constant volume of solution in the developing tank, the useful life of the developer can be prolonged three to four times without seriously degrading the quality of developed negatives. If large amounts of replenisher are to be added at any one time, the activity of the solution may be so increased that developing time will have to be shortened excessively, unless the replenisher is diluted somewhat with water.

The rate of exhaustion is greatly influenced by the type of negatives or prints. When average density is high, exhaustion will be faster. When average density is low, exhaustion will occur more slowly.

The useful life of a developer is shortened by oxidation caused by contact with air. Exhaustion characteristics will, therefore, depend greatly on the age and manner in which the solution is used.

The degree of permissible exhaustion of paper developers is also dependent on the acceptable tolerance in variation of image tone of prints. Exhaustion figures cited below are based on what are normally considered acceptable prints, and may require modification if unusually critical standards of uniformity of image tone are established.

With appropriate regard given to the factors mentioned above, the following figures on developer exhaustion may be applied in practice. On the basis of a gallon of developing solution the increase in developing time amounts to approximately 10% for every four rolls of film processed—or more simply, 10% increase per roll per quart of developer. When used with their respective replenishers at the rate of ½ to ¾ ounce or more of replenisher per roll of film, these developers may be used for approximately 200 B2 rolls per gallon of original developer without necessitating an increase in the original time of development.

The Importance of a Short Stop

As negatives or prints are removed from the developing solution they carry with them considerable amounts of alkali and other chemicals which can contaminate the fixing bath and interfere with its action. Used-up developer carried along with negatives and prints can also cause troublesome stains if some method is not used to stop development instantly and completely. The best and most reliable way of doing this is the well-known short-stop bath of dilute acetic acid which neutralizes any alkali remaining on negatives or prints and prevents contamination of the fixing solution. Yet it is surprising how many photographers still try to get along without this intermediate bath between development and fixation. It is true that an acid fixing bath will give satisfactory results without the use of a preliminary short-stop bath, but its useful life is severely limited when a short-stop is not used.

Photographers frequently ask why acetic acid is used for the short-stop bath and fixing bath instead of other common acids like hydrochloric or sulphuric. The answer lies in the fact that a relatively large amount of acid must be available but the solution must not be too strongly acid. Consequently a compound is used which is weak in acidity but which has available a high reserve of acid to neutralize alkali. A corresponding larger amount of the weak acetic acid may therefore be used than could be used of a strong acid.

Composition and Function of the Fixing Bath

The procedure of fixation is relatively simple but it should be carried out with considerable care as it can be the source of much trouble when improperly handled. The photographic film negative upon removal from the developing solution is still sensitive to light, as it contains undeveloped silver salt in the shadow portions of the image. To make the negative image permanent by removing this undeveloped silver salt, as well as to make it clear and transparent for printing, the action of the familiar fixing bath must be employed. The principle constituent of the fixing solution is sodium thiosulphate, more commonly known as "hypo" (from its older name of sodium hyposulphite), for in solution this useful chemical has the property of dissolving light-sensitive silver salts. The method by which the silver salt is removed is generally considered as, first, a conversion to a soluble double salt by the hypo, and second, the washing out of this soluble salt with water.

The conventional fixing solution generally contains other chemicals in addition to the hypo. Acetic acid is often included to aid in regulating the acidity of the fixing solution and to prevent stains. However, a hypo solution containing much acid is apt to precipitate sulphur, so another chemical, sodium sulphite, is added to prevent this unwanted reaction.

An additional component of the usual fixing bath is the hardening agent which prevents frilling and softening of the gelatin emulsion. White potassium alum (potassium aluminum sulphate) is usually employed for this purpose though some photographers prefer potassium chrome alum used with a small amount of sulphuric acid. Care must be used with chrome alum as the hardener, however, as it rapidly loses its strength and is only truly effective when a fresh solution is used.

Fixing baths will seldom if ever give trouble when properly prepared from pure chemicals. If a bath turns milky after preparation it indicates that sulphur is precipitating because of too much or too strong an acid, too little sulphite, too high a temperature of the solution, or improper mixing. A milky appearance of the bath during use is due to the presence of excess alkali and indicates that the bath should be replaced. It is important not to overwork the fixing bath, because a nearly exhausted fixing solution will not completely remove the silver salts, and prints or negatives may turn yellow or stain on aging. A gallon of standard strength fixing bath should fix 100 8x10" double-weight prints or their equivalent. When the bath froths or foams it should be replaced. Many photographers have found a convenient, certain and economical method of insuring complete fixation lies in the use of two fixing solutions. Fixing is carried out first in the more used of the two baths and finally in the fresher solution. When the older bath becomes exhausted, the partly used solution takes its place and a fresh fixing bath is prepared for the second solution.

Suggestions for Trouble-Free Mixing

The first and perhaps most important point to follow in the preparation of solutions is that of using chemicals which are "photographically pure." Cheap commercial grades of every chemical used in photographic processes can be obtained, but many of them contain impurities which are detrimental to perfect results. Chemicals which are marked "C.P." (Chemically Pure) and those which are marketed for photographic purposes by reliable manufacturers are always safe to use, and can be depended upon. Chemicals marked U.S.P. may be suitable if the amount of impurity present is known to be insignificant. This can be determined by looking up the U.S.P. standards for the chemical in question by consulting the edition of the United States Pharmacopia, tenth edition (1925) or eleventh edition (1935) as indicated by the number X or XI which follows the U.S.P. on the chemical container label.

The second most important rule for trouble-free solutions is perhaps that of mixing all components of a solution in the order listed in the formula. This is extremely important and lack of attention to this point can easily result in the formation of precipitates which will not dissolve in the solution. A worth-while corollary to this rule is to wait until each chemical is thoroughly dissolved before adding the next component of the solution. In most single-solution developers the preservative sodium sulphite is usually added immediately after the developing agent but before the hydroquinone if this chemical is used. When two developing agents such as metol and hydroquinone are used, the addition is generally made in the order metol, sulphite, hydroquinone. However, with developing agents like glycin, the sulphite and carbonate are dissolved first, as the glycin dissolves with greater difficulty otherwise.

A third important rule for any photographer is to use the purest water obtainable. Innumerable troubles in developing and fixing have been traced to impurities present in the water. Many photographers find it a wise decision to use distilled water for all stock solutions, adding tap water for dilution.

The time required for the preparation of processing solutions can be reduced materially by the use of hot water (about 125° F.) as most chemicals dissolve more rapidly in hot than in cold water. A convenient method of preparing one quart of developer, for instance, is to start with about 24-28 ounces of hot water (125° F.) and after the addition of all chemicals, to add sufficient cold water to bring the total volume up to 32 ounces.

Another point well worth remembering is that of weighing and measuring all quantities as closely as possible. Particular care should be taken to avoid errors in small quantities, as a ten-grain error is obviously a very serious one on a fifty-grain quantity, while on a half-pound quantity it might not have harmful effects.

Finally and no less important for the order in which it is mentioned, is the matter of temperature. The need for uniform regulation of temperature in all processing solutions, and the maintenance of temperatures, as close as possible to 65° F. (18° C.) for film development and to 70° F. (21° C.) for photographic prints, cannot be over-emphasized.

Compensation of Non-Standard Temperatures

While best results are obtained when film development is carried out at 65° F., there are, of course, certain occasions when surrounding conditions are such that it is impossible to maintain solutions at this temperature. In instances when the temperature is not higher than 75° F. or lower than 60° F., development can be carried out with care if the developing time is modified to keep the contrast of the developed film negative within a desired range. The following table of Time-Temperature Coefficients indicates the percentage correction in developing time for a number of popular Agfa formulas. If, for example, it were necessary to use Agfa 17 at 70° F., with a film normally requiring 12 minutes development at 65° F., the developing time would be reduced 25% to 9 minutes in order to keep contrast within the desired range. Of course, care must be taken in handling wet photographic film at the higher temperatures, as the gelatin emulsion is then more susceptible to scratches and other physical damage.

Time-Temperature Coefficients

Developer	*Percentage Change From Developing Time Used at 65° F.*		
	60° F.	*70° F.*	*75° F.*
Agfa 17.	+50%	—25%	—50%
Agfa 17M	+50%	—20%	—50%
Agfa 20.	+50%	—30%	—50%
Agfa 30.	+50%	—35%	—50%
Agfa 45.	+30%	—25%	—40%
Agfa 47.	+16%	—16%	—40%
Agfa 48M	+33%	—16%	—33%
Agfa 64.	+60%	—18%	—30%

When development is necessary at temperatures above 75° F., and up to 90° F., the use of a chemical such as sodium sulphate, which acts as a "swelling suppressor," is advisable. For development at 80° F., 100 grams (3¼ ounces) of anhydrous sodium sulphate* should be added to each liter (quart) of *developer* and *short stop* so that protection against excessive swelling will be afforded until films have been hardened in the fixing bath. For development at 90° F., twice the quantity (200 g.) of anyhdrous sodium sulphate should be added to each liter of developer and short-stop. Developing time for temperatures between 80° F., and 90° F., with appropriate amount of sodium sulphate present will be approximately that indicated by the Time–Temperature tabulation above for development at 75° F., without addition of sodium sulphate. If temperature falls below that for which sodium sulphate addition is made, developing time may have to be lengthened 30 to 50% to compensate for loss in developing action.

Another method of minimizing the chance of physical damage caused by processing at high temperatures is the use of a hardening short-stop bath, such as Agfa 216, directly after development. In summation, these methods of high-temperature processing should not be considered as preferred developing technique but merely as the best expedient when processing solutions can not be maintained at 65° F.

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* If the crystalline form of sodium sulphate is employed (Glauber's salt) use 2¼ times the amount specified.

Agfa 17M

Fine-Grain Metaborate Tank Developer

This developer is recommended for those who desire a formula similar to Agfa 17, but permitting greater variation in developing time.

	Metric	*Avoirdupois*	
Hot Water (125° F. or 52° C.)	750 cc.	24 oz.	3 qt.
Metol	1.5 g.	22 gr.	88 gr.
Sodium Sulphite, Anhydrous	80 g.	2½ oz. 80 gr.	10¾ oz.
Hydroquinone	3 g.	45 gr.	¼ oz. 70 gr.
Sodium Metaborate	2 g.	30 gr.	¼ oz. 10 gr.
Potassium Bromide	.5 g.	7½ gr.	30 gr.
Water to make	1 l.	32 oz.	1 gal.

Do not dilute for use.

Development time at 65° F. (18° C.), 10 to 15 minutes for fine-grain films.

Larger amounts of Metaborate may be used with corresponding reduction of developing time (up to 10 g. of Metaborate per l. with a developing time of 5 minutes at 65°) although slightly coarser grain size will then be experienced.

Agfa 17M Replenisher

Add to 17M Developer whenever necessary to keep tank up to full volume.

	Metric	*Avoirdupois*	
Hot Water (125° F. or 52° C.)	750 cc.	24 oz.	3 qt.
Metol	2.2 g.	32 gr.	¼ oz. 20 gr.
Sodium Sulphite, Anhydrous	80 g.	2½ oz. 80 gr.	10¾ oz.
Hydroquinone	4.5 g.	65 gr.	½ oz. 50 gr.
Sodium Metaborate	8 g.	¼ oz. 10 gr.	1 oz. 40 gr.
Water to make	1 l.	1 qt.	1 gal.

Agfa 47(A) Replenisher

Add to Agfa 47 Tank Developer whenever necessary to keep tank up to full volume.

	Metric	*Avoirdupois*	
Hot Water (125° F. or 52° C.)	750 cc.	24 oz.	3 qt.
Metol	3 g.	45 gr.	¼ oz. 70 gr.
Sodium Sulphite, Anhydrous	45 g.	1½ oz.	6 oz.
Sodium Bisulphite	2 g.	30 gr.	¼ oz. 10 gr.
Hydroquinone	6 g.	88 gr.	¾ oz. 20 gr.
Sodium Carbonate, Monohydrated	12 g.	¼ oz. 65 gr.	1½ oz. 50 gr.
Water to make	1 l.	32 oz.	1 gal.

Agfa 48M Metaborate Developer

This formula is recommended for Photofinishing, Professional, and Amateur developing and is suitable for deep tank use over a long period of time.

	Metric	*Avoirdupois*	
Hot Water (125° F. or 52° C.)	750 cc.	3 qt.	2½ gal.
Metol	2 g.	¼ oz. 10 gr.	¾ oz. 90 gr.
Sodium Sulphite, Anhydrous	40 g.	5¼ oz.	1 lb. 2¼ oz.
Hydroquinone	1.5 g.	88 gr.	½ oz. 90 gr.
Sodium Metaborate	10 g.	1¼ oz. 30 gr.	4½ oz.
Potassium Bromide	.5 g.	30 gr.	¼ oz.
Water to make	1 l.	1 gal.	3½ gal.

Do not dilute for use.

TANK DEVELOPMENT: Normal developing time 5 to 7 minutes at 65° F. (18° C.).

TRAY DEVELOPMENT: Normal developing time 4 to 6 minutes at 65° F. (18° C.).

These developing times apply to Agfa portrait, press and commercial films and to all Agfa roll and pack films except Finopan which should be developed 20–30% less.

Agfa 48M Replenisher

Add 48M Developer whenever necessary to keep tank up to full volume.

	Metric	*Avoirdupois*	
Hot Water (125° F. or 52° C.)	750 cc.	24 oz.	3 qt.
Metol	6.3 g.	90 gr.	¾ oz. 30 gr.
Sodium Sulphite, Anhydrous	30 g.	1 oz.	4 oz.
Hydroquinone	10 g.	¼ oz. 35 gr.	1¼ oz.
Sodium Metaborate	40 g.	1¼ oz.	5 oz.
Water to make	1 l.	1 qt.	1 gal.

Agfa 79B (Two Solution)
Paraformaldehyde Developer

This developer has better keeping quality than when made in one solution.

Solution 1

	Metric	*Avoirdupois*	
Water (Not over 90° F. or 32° C.	750 cc.	24 oz.	3 qt.
Sodium Sulphite, Anhydrous	1 g.	15 gr.	60 gr.
Paraformaldehyde	30 g.	1 oz.	4 oz.
Potassium Metabisulphite	10.5 g.	¼ oz. 45 gr.	1¼ oz. 60 gr.
Water to make	1 l.	32 oz.	1 gal.

Solution 2

	Metric	*Avoirdupois*	
Hot Water (125° F. or 52° C.)	750 cc.	24 oz.	3 qt.
Sodium Sulphite, Anhydrous	120 g.	4 oz.	1 lb.
Boric Acid	30 g.	1 oz.	4 oz.
Hydroquinone	90 g.	3 oz.	12 oz.
Potassium Bromide	6 g.	88 gr.	¾ oz. 20 gr.
Water to make	3 l.	96 oz.	3 gal.

For use mix one part Solution 1 with three parts Solution 2.

Normal development time 2 to 3 minutes at 65 to 70° F. (18 to 21° C.). For Reprolith Orthochromatic, develop 1½ to 3 minutes at same temperature.

Agfa 125
Metol Hydroquinone Developer

This formula is recommended for development of Cykon, Cykora, Brovira and similar papers. It can also be used as recommended below for the rapid development of press films.

Stock Solution

	Metric	*Avoirdupois*	
Hot Water (125° F. or 52° C.)	750 cc.	24 oz.	3 qt.
Metol	3 g.	45 gr.	¼ oz. 70 gr.
Sodium Sulphite, Anhydrous	44 g.	1½ oz.	6 oz.
Hydroquinone	12 g.	¼ oz. 60 gr.	1½ oz. 20 gr.
Sodium Carbonate, Monohydrated	65 g.	2¼ oz.	9 oz.
Potassium Bromide	2 g.	30 gr.	¼ oz. 10 gr.
Water to make	1 l.	32 oz.	1 gal.

PAPER DEVELOPMENT: Dilute 1 part stock solution with 2 parts water. Develop 1 to 2 minutes at 70° F. (21° C.). For softer and slower development dilute 1 to 4, and develop 1½ to 3 minutes at 70° F. (21° C.). For greater brilliance, shorten the exposure slightly and lengthen the development time. For greater softness, lengthen the exposure slightly and shorten the development time.

FILM DEVELOPMENT: Dilute 1 part stock solution with 3 parts water. Normal developing time for Agfa press films is 3 to 4 minutes at 65° F. (18° C.).

Photographic Developer
Champlin Formula No. 17

"A new type developer combining fine grain, high emulsion speed, brilliance and gradation, prepared as a liquid concentrate":

Water	350 cc.	12 oz.
Metol	5 g.	74 gr.
Sodium Sulphite	45 g.	1½ oz.
Diethylene Glycol	12.5 cc.	190 min.
Triethanolamine	15 cc.	229 min.
Chlorohydroquinone	25 g.	367 gr.
Water to make	500 cc.	16 oz.

The working developer is prepared by adding 15 parts of a 10% solution of sodium sulphite to each one part of the concentrate.

Direct Developer for Brown Tones
(on developing paper)

Hydroquinone	15 g.
Sodium Sulphite	50 g.
Potassium Carbonate	55 g.
Potassium Bromide	5 g.
Ammonium Bromide	16 g.
Water	500 cc.

Dilute above stock solution with three volumes of water, and expose paper so as to require about 2½ minutes developing time at 60° F. The tone may be varied from brownish black to red brown by omitting the ammonium bromide from the stock solution and adding it as a 10% solution to the diluted developer in amounts varying from 20 to 77 cc. per l.

Developer for Direct-Duplicate Film

Metal	3.5 g.
Hydroquinone	9.0 g.
Sodium Sulphite	120.0 g.
Sodium Carbonate	108.0 g.
Potassium Bromide	3.5 g.
Water to make	1 l.

Two-Bath Developer

To give full shadow detail and avoid excessive high light density.

a. Metal	95 gr.
Sodium Sulphite	500 gr.
Hydroquinone	95 gr.
Potassium Bromide	40 gr.
Sodium Chloride	3 gr.
Water	32 oz.
b. Sodium Carbonate (Anhyd.)	1500 gr.
Water	32 oz.
c. Borax	800 gr.
Water	32 oz.

Developer for Offset or Contrast Film
U. S. Patent 2,162,765

Sodium Sulphite	2 oz.
Boric Acid	2 oz.
Hydroquinone	3 oz.
Sodium Carbonate	12 oz.
Oxalic Acid	200 gr.
Potassium Metabisulphite	300 gr.
Potassium Bromide	360 gr.
Citric Acid	50 gr.
Water	1 gal.

Sound Track Film Developer
U. S. Patent 2,181,861

Sodium Sulphite	50 g.
Hydroquinone	15 g.
Sodium Carbonate (Anhyd.)	80 g.
Potassium Bromide	9 g.
Sodium Hydroxide	30 g.
Potash Alum	40 g.
Water	1 l.

Diazotype Paper and Developer

Apply 2% p-Diazo Diphenylamine (Aqueous Solution) to paper and dry. Expose to light under positive original. Develop with aqueous solution of 0.2% 6 -Naphthol and 0.5% Sodium Hydroxide.

Low Temperature Photographic Developer

Solution A

Hydroquinone	2 oz.
Potassium Pyrosulphite	2 oz.
Potassium Bromide	2 oz.
Metol	¼ oz.
Water	80 oz.

Solution B

Potassium Hydroxide	4 oz.
Water	80 oz.

Use equal volumes of A and B for 3 minutes at 49° F.

Very Rapid Development and Fixation of Photographic Negatives

For development at normal temperature (20° C.) a development time of

25–40 seconds is obtained (for orthochromatic film) with:

Metol	15 g.
Hydroquinone	15 g.
Sodium Sulphite	50 g.
Sodium Hydroxide	20 g.
Potassium Bromide	1 g.
Water to make	1 l.

For high temperature processing at 50°, the sodium hydroxide content is reduced to 10 g. per l. and the potassium bromide increased to 8 g. per l., to restrain fog. The use of a 3% acetic acid bath between the developing and fixing solutions is suggested to arrest development.

The most rapid fixing solution is:

Hypo	250 g.
Sodium Pyrosulphite	12.5 g.
Ammonium Chloride	60 g.
Water to make	1 l.

"One-Shot" Developing-Fixing Solution

(For simultaneous developing and fixing with the same solution.) (5 minutes at 18° C.)

Hydroquinone	13.3 g.
Sodium Sulphite	49.5 g.
Sodium Carbonate	35.5 g.
Hypo	106.0 g.
Concentrated Ammonium Hydroxide diluted to 600 cc.	46.0 cc.

Compensatory Negative Developers

Soft-working developers, which are distinguished by their low alkali content and absence of hydroquinone, produce thin, flat negatives which, however, are characterized by richness of shadow and fineness of grain. The following is an example:

Metol	5 g.
Sodium Sulphite	87.5 g.
Sodium Carbonate	1.0 g.
Potassium Bromide	.5 g.
Water to one l.	

The time of development is 14 minutes at 18°.

Photographic Toning

The quality of a print often can be much improved by properly correlating the color of the image to the character of the scene. A snow scape, for example, can be printed most effectively by rendering the inherent grey tones of the print to a subtle blue.

Photographic papers, however, vary in tone only within a narrow range of colors, despite the many different types marketed. This inherent range of tones of photographic papers extends from cold blue-black tones over warmer brown-black to brownish tones. Colors like blue, sepia or red, however, cannot be obtained directly, that is without special treatment of prints.

Numerous methods have been described and used for toning prints in all possible shades of colors. All of these processes, however, may be classified in four distinct groups; these are :

1. Toning by direct developing.
2. Toning by means of converting the silver image into colored metallic salts.
3. Dye toning by mordanting.
4. Dye coupling.

However, before discussing the various toning processes themselves, something must be said about the inherent properties of photographic papers, since different kinds of paper react differently to the majority of toning processes.

Bromide papers, which are used for projection printing, generally, do not lend themselves very well to toning. They produce cold brown and purple tones only.

So-called chloro-bromide papers (used for both projection and contact printing), as well as chloride papers (contact printing papers) are much more applicable for toning. Therefore, it is preferable to use either of these two types if possible.

It should also be pointed out strongly at this time that the quality of the black and white print is of greatest influence upon its toning characteristics. Only correctly exposed and developed prints can be toned with good effect. Furthermore, any particular kind of paper produces definite colors in any one toning process; this color might not be reproducible on a different type paper.

Also, as will be discussed in more detail in later paragraphs, the type of developer employed determines largely the final color obtained.

With these points in mind, it will be easier to appreciate the following discussion on individual toning processes.

Toning by Direct Developing

The inherent color of a print may be altered to a somewhat warmer tone by shortening the developing time or diluting the developing solution. Somewhat more control over the image tone can be achieved by use of special developers. The range of tones obtained, however, generally varies only from cold black to warm black brown tones. Here again not all papers are equally well adaptable. Chloro-bromide papers allow generally the greatest tone variations. Also some chloride papers may be treated successfully by the use of special developers, although the majority produce blue-black tones. Bromide papers, as a rule, are the least well suited for toning by direct developing.

The color of a print—unless treated in a special toning process—depends upon the size of the silver particles that make up the image. Large silver grains result in blue-black tones (known as cold tones) whereas a decrease in particle size shifts the color toward brownish (or warm tones). Therefore in controlling the size of the silver grains, the color of a print can be altered.

Shortening the developing time and diluting the developer tend to decrease the magnitude of the silver grains and thereby affect a warmer brownish tone.

The toning of prints by use of special developers is based upon the inherent characteristics of reducing agents and the proportion in which different agents are utilized in a formula.

Hydroquinone, for example, being a low energy reducing agent, tends to produce warm tones, when used by itself. This, as has been pointed out, is due to formation of small silver grains.

Metol, on the other hand, yields usually black or blue-black tones. An addition of potassium bromide to the developer also changes the color of the image to brown tones. By adding various amounts, many different shades of brown may be obtained. It should be remembered, however, that toning by the direct developing method, aside of being restricted to a limited number of shades of brown, does not allow a very great change in color; it also requires great exactness and care; this is especially true if constant results are to be obtained at different times.

The following table shows the tone obtained on Agfa sensitized papers by use of certain standard as well as special developers.

TABLE I—TONES OBTAINED ON AGFA PAPERS BY DIRECT DEVELOPMENT*

TYPE AND NAME OF AGFA PAPERS	INHERENT TONE OF PAPER	No. 103—METOL HYDROQUINONE DEVELOPER	No. 125—METOL HYDROQUINONE DEVELOPER	No. 110 HYDROQUINONE DEVELOPER	No. 115—GLYCIN HYDROQUINONE DEVELOPER	No. 130—METOL HYDROQUINONE GLYCIN DEVELOPER	No. 135—METOL HYDROQUINONE DEVELOPER
Contact Printing							
CONVIRA chloride emulsion	cold, blue-black	standard developer cold, blue-black	blue-black tones	warm, brownish tones		cold, rich black tones	warm, brown-black tones
CYKON chloro bromide emulsion	warm, brownish-black	not recommended	normal, brown tones	warm, brown tones	warm, rich brown tones	medium, brown, black tones	warm, brown-black tones
SPEEDEX fast chloride emulsion	cold, blue-black	standard developer cold, blue-black		warm, brownish tones		cold, black tones	warm, brown-black tones
Enlarging							
BROVIRA bromide emulsion	cold, rich-black	cold, black tones	black tones	warm, brownish tones	warm, brown tones	cold, rich black tones	warm, brown-black tones
CYKORA chloro bromide emulsion	warm, brownish-black	not recommended	normal, brown tones	warm, brown tones	warm, brown tones	brown-black tones	warm, brown-black tones
INDIATONE chloro bromide emulsion	very warm, brownish-black	not recommended	warm, brown tones	very warm, brown tones	warm, brown tones	brown-black	warm, brown-black tones
PROJECTION PROOF chloro bromide emulsion	warm, black	cold, black tones	black tones	warm, brownish tones	warm, brownish tones	black tones	warm, brown-black tones

* It should be noted that this information is general and qualitative only. By describing the tone of a paper print acquired under given conditions "warm brown-black," for example, it is not implied that the tone of another paper so described will be of *exactly* the same tone.

Toning by Means of Converting the Silver Image into Colored Metallic Salts

Toning processes of this class are unquestionably the most widely used today. Their popularity is probably explained by the simplicity of the toning operation itself as well as the great variety of colors producable.

The principle on which the toning processes of this class are based is that certain metallic compounds possess different colors. Therefore, by simply converting the grey silver image into one that is made up of a silver compound (such as silver sulphide, for example) by transforming the silver into an altogether different metal compound, or by adding another metal or compound to the grey image, a great many colors can be achieved.

The toning operation itself requires generally two steps, although solutions are made that will tone in one step only. However, as a rule the black and white print is placed in a so-called bleaching bath first. In this bath, the metallic silver particles are converted into some intermediate compound such as silver ferrocyanide, for example. (The name bleaching bath in this instance is used since the dark silver image is changed in the solution to a very faint yellow.)

The print is then transferred into the so-called redeveloper, which solution incorporates the toning agent, such as sulphur, mercury, iron, etc. The color produced in any toner is again governed to an extent by the type of paper employed. Definite colors will be obtained with any particular toning method on one kind of paper. Also, the developer used to produce the original silver image is of great influence on the final toning characteristics. It has been found that variations in colors often can be traced back to the use of different developers.

It should be understood therefore, that in toning a print in any of the methods to be described, the results depend greatly upon the paper emulsion used and the way in which the print has been processed. It should also be attempted in all instances to expose and develop correctly for optimum quality.

From all toning methods, the sulphide toners which produce sepia tones are favorites among photographers. These can be classified into two groups, namely:

1. Direct sulphide processes in which the metallic silver image is changed directly to silver sulphide in one operation.
2. Indirect sulphide processes in which the silver is first changed to an insoluble silver salt or a mixture of silver and mercury salts which are then altered to sulphides of these metals.

Direct Sulphide Processes

In this group there are three methods to be discussed; these are, Agfa Direct Toner Sepia; Hypo-Alum; and Hypo-Alum Gold Chloride Toner.

The advantages of direct methods over the indirect processes are that firstly only one bath is required. Furthermore, it is not required for prints to be washed completely after fixation prior to toning, since most direct sulphide toners contain hypo as one ingredient.

Disadvantages are that the toning solution must be heated before use to about 105° F. and that temperature must be retained quite closely during the toning operation. Furthermore, one must be careful to carry out the toning procedure in a room where there are no sensitized goods, since the toner might give off detrimental sulphur fumes. Also, the odor of some direct sulphide toning solutions is annoying.

Agfa Direct Sepia Toner

(General instructions and tones obtained on Agfa papers)

General Information: Agfa Direct Sepia Toner is a single solution in concentrated form which greatly simplifies the procedure of sepia toning. It may be used with Convira, Indiatone, Cykora and Nokoline. The tone that it produces is a chocolate-brown sepia which is very beautiful in its warmth and richness. It is one of the few toners of this type that has practically no odor.

Directions

Make the print in the usual manner, fix thoroughly and wash for 5 to 10 minutes in cold running water. It is not necessary to wash prints thoroughly before toning, but only sufficiently to remove most of the hypo from the paper.

Toning: The concentrated toner should be diluted 1 part toner with

50 parts warm water about 105° F. (40° C.). This temperature should be maintained, either by placing the tray of toning solution in a larger tray of hot water or by the use of a heating element underneath the tray. Note—The toning solution may be used at room temperature, but results will be better and action of the solution more rapid when it is used at a higher temperature.

Place the print into the toning solution for a period of 3 to 10 minutes, giving it frequent agitation to assure uniform toning. The toner works to completion so that there is no harm allowing a print to remain in the solution for several minutes after it has reached its maximum tone. (See Table II for colors obtained with various papers.)

Washing: After toning, wash the print thoroughly, for 30 to 60 minutes in running water and dry in the usual manner.

Suggestions: The concentrated toner has excellent keeping qualities if stored in a stoppered bottle, but the diluted toning solution should be discarded after use. A 4-oz. bottle of concentrated toner is sufficient to tone about 150 8x10 double weight prints with excellent uniformity.

TABLE II
TONES OBTAINED BY USE OF AGFA DIRECT SEPIA TONER

Name of Paper	Inherent Tone	Tone Obtained
Contact Printing		
CONVIRA		
chloride emulsion	cold, blue-black	dark brown
CYKON		
chloro bromide emulsion	warm, brown	not recommended
SPEEDEX		
chloride emulsion	cold, blue-black	dark brown
Projection printing		
BROVIRA		
bromide emulsion	cold, black	dark slightly purplish brown
CYKORA		
chloro bromide emulsion	warm, brownish	brown
INDIATONE		
chloro bromide emulsion	warm, brown	rich dark brown

Hypo Alum Sepia Method

As implied by its name, this toner consists mainly of two compounds, namely hypo (sodium thio-sulphate) and potassium alum. When the acid alum is added to the hypo, sulphur is precipitated; this combines with the silver image to form brown silver sulphide. A silver "ripener" is also added to prevent the hypo from attacking the metallic silver. Chloride, bromide and iodide salts of silver are employed for this purpose. The bath may be used indefinitely. It is imperative to mix the solutions in the order listed since deviations from this order will result in failure.

	Metric		Avoirdupois
Solution A:			
Water	2350	cc.	80 oz.
Hypo (Sodium Thiosulphate)	450	g.	16 oz.
Solution B:			
Water	30	cc.	1 oz.
Silver Nitrate	1¼	g.	20 gr.
Solution C:			
Water	30	cc.	1 oz.
Potassium Iodide	2½	g.	40 gr.

Add solution "B" to solution "A." Then add solution "C" to the mixture. Finally add 105 g. (3½ oz.) of potassium alum to this solution, and heat the entire bath to the boiling point, or until sulphurization takes place (indicated by a milky appearance of the solution).

Prints should be toned at 110° F. to 125° F. (43° to 52° C.). Agitate prints occasionally until toning is completed (table III).

Hypo-Alum Gold Sepia Process

Hypo alum gold toner produces even more beautiful sepia tones than the regular hypo-alum bath. This toner is made by adding a soluble gold salt, such as gold chloride or gold sodium chloride, to a solution of hypo alum. A "ripener" is also added as in the case of hypo alum. It is necessary for obtaining good tones that the gold deposit be rapid. Since the solution must be kept alkaline, sodium phosphate is being added to the toning bath.

Solution A:

	Metric	Avoirdupois
Boiling Water (distilled)	4000 cc.	128 oz.
Hypo	450 g.	16 oz.
Potassium Alum	56 g.	2 oz.

Boil the above for 2 to 5 minutes, allow to cool and then add:

Sodium Phosphate	56 g.	2 oz.

Test this solution with red litmus paper; if the litmus paper does not turn blue within 1 minute, heat bath again, and add sodium phosphate in 2 oz. (56 g.) quantities until the solution has become alkaline, then dissolve:

1. Silver Nitrate	4 g.	60 gr.
Water	30 cc.	1 oz.
2. Potassium Bromide	8 g.	120 g.
Water	30 cc.	1 oz.

Separate solutions are made of the silver and bromide; each dissolved in 1 oz. (30 cc.) of water. The bromide solution is poured into the silver solution. The resulting mixture, precipitate and all, is then added to the hypo alum bath after the latter has thoroughly cooled.

Solution B:

Gold Chloride	1 g.	15 gr.
Water	15 cc.	1 oz.

To use, add 1 dr. (37 cc.) of gold solution (Solution B) to each 16 oz. (500 cc.) of hypo alum bath (Solution A). Tone at 90 to 110° F. but do not exceed 110° F. This toning bath will tone approximately 150 4x6 inch prints. Prints should be agitated during toning to insure even tones. After completion prints should be rinsed and fixed again in the regular fixing bath for about 5 minutes and washed and dried.

TABLE III

TONES OBTAINED BY USE OF HYPO-ALUM TONERS

Name of Paper	Inherent Tone	Tone Obtained
Contact Printing		
CONVIRA chloride emulsion	cold, blue-black	dark brown
CYKON chloro-bromide emulsion	warm, brown	medium yellow brown
SPEEDEX chloride emulsion	cold, blue-black	dark brown
Projection Printing		
BROVIRA bromide emulsion	cold, black	dark (purplish) brown
CYKORA chloro-bromide emulsion	warm, brown	brown
INDIATONE chloro-bromide emulsion	warm, brown	dark brown

Indirect Sulphide Processes

The indirect sulphide toning processes, as has been pointed out, are two solution methods. The *well washed* prints are immersed in a bleaching bath at first and then redeveloped.

Advantages of the indirect processes are that they can be used at room temperature and that they possess no odor. Also, some indirect toners allow a considerable range of sepia tones by slight variations in the formula.

Disadvantages are that prints must be completely washed free from hypo prior to toning and the somewhat greater complexity of the toning procedure.

Agfa Brovira Toner

Agfa Brovira toner is a concentrated solution which can be used to produce chalk red to brown tones on Brovira and Cykora papers. The procedure of use is very similar to that of the regular bleach and redevelopment toning processes.

Directions

The enlargement should be exposed, developed and fixed in the customary way, with particular care given to proper exposure and full development.

After fixation the enlargements should be thoroughly washed (from 30 to 60 minutes in running water) and bleached in the following solution.

Bleaching Solution

	Metric	Avoirdupois
Water to make	1 l.	32 oz.
Potassium Ferrocyanide	50 g.	1½ oz. 75 gr.
Potassium Bromide	10 g.	150 gr.
Sodium Carbonate (monohydrated	23 g.	¾ oz.

After bleaching, the prints should be washed for 3 minutes in running water and toned in the following solution.

Toning Solution

Agfa Brovira Toner	1 part
Water	25 parts

The tone is varied by the addition of Sodium Carbonate to the above solution in the following proportions per l. (quart) of diluted toner:

Tone	Metric	Avoirdupois
Chalk Red	0 g.	0 gr.
Red Brown	3 g.	45 gr.
Brown Red	10 g.	150 gr.
Brown	30 g.	1 oz.

Prints will be toned in about 2 minutes after which they should again be thoroughly washed and dried. Both solutions keep well and may be used until exhausted.

Caution: If steel enameled trays are used, be sure that the enamel has not been chipped off and that there is no metal exposed to the solutions. Imperfect steel enameled trays cause blue spots in the prints that cannot be removed.

Storage

Agfa Brovira Toner keeps very well at normal room temperatures, but a slight crystalline precipitation may occur at low temperatures. This does not affect its working quality in any way and may be disregarded.

TABLE IV
TONES OBTAINED BY USE OF AGFA BROVIRA TONER

Name of Paper	Inherent Tone	Tone Obtained
Contact Printing		
CONVIRA chloride emulsion	cold, blue-black	not recommended
CYKON chloro-bromide emulsion	warm, brown	not recommended
SPEEDEX chloride emulsion	cold, blue-black	not recommended
Projection Printing		
BROVIRA bromide emulsion	cold, black	reddish brown Addition of Na$_2$CO$_3$ gives chocolate brown tones.
CYKORA chloro-bromide emulsion	warm, brownish	sandy brown Addition of Sodium Carbonate gives darker brown.
INDIATONE chloro-bromide emulsion	warm, brown	yellowish brown Addition of Sodium Carbonate gives brown tones.

Care should be exercised to keep prints removed from iron rust while toning, since blue spots will result otherwise. Enameled trays, for example, with chipped corners should definitely be avoided.

Bleach and Redeveloping Formula

Bleach prints after thorough washing in solution 1 until the image is converted into a very light brown.

Solution 1 (Bleach for Sulphide Redeveloping Process)

	Metric	Avoirdupois
Hot Water (125° F. or 52° C.)	750 cc.	24 oz.

Potassium Ferrocyanide	50 g.	1½ oz. 70 gr.
Potassium Bromide	10 g.	¼ oz. 35 gr.
Sodium Carbonate Monohydrated	20 g.	½ oz. 70 gr.
Water to make	1 l.	32 oz.

Wash prints for about 5 minutes and redevelop in the following solution:

Sulphide Redeveloping Solution
Stock Solution

Sodium Sulphide	45 g.	1½ oz.
Water to make	500 cc.	16 oz.

For use, dilute 1 part stock solution with 8 parts water. After using this toner it is advisable to harden the prints. This can be done by mixing the following bath:

Hot Water (125° F. or 52° C.)	150 cc.	5 oz.
Sodium Sulphite (Anhydrous)	15 g.	½ oz.
Acetic Acid (28%)	45 cc.	1½ oz.
Potassium Alum	15 g.	½ oz.

After prints have been toned in the redeveloping bath, wash for 2–3 minutes and place then in hardener for about 5 minutes. After hardening wash thoroughly for 30 minutes (the hardening bath has no effect on the color of the print).

TABLE V
TONES OBTAINED BY BLEACH AND REDEVELOPING PROCEDURE

Name of Paper	Inherent Tone	Tone Obtained
Contact Printing		
CONVIRA chloride emulsion	cold, blue-black	not recommended
CYKON chloro-bromide emulsion	warm, brown	not recommended
SPEEDEX chloride emulsion	cold, blue-black	not recommended
Projection Printing		
BROVIRA bromide emulsion	cold, black	dark, yellowish brown
CYKORA chloro-bromide emulsion	warm, brownish	brown
INDIATONE chloro-bromide emulsion	warm, brown	dark, yellowish brown

Many colors, other than sepia, can be achieved with a class of toners known as Ferrocyanide toners. Ferrocyanide compounds, of a number of metals other than silver, possess various brilliant colors. These ferrocyanide compounds may be substituted for the silver image, accompanied, of course, by a change in hue. Iron compounds for instance, are blue; uranium; brownish red and brown; copper red, etc.

Some of the toners are two solution procedures, but more often they consist of a single solution method. As in the case of indirect sulphide processes, the silver image is first transformed into silver ferrocyanide in the so-called bleaching bath. Subsequently, replacement of silver ferrocyanide by the suitable metal, takes place in the redeveloper. In the direct toning processes the silver ferrocyanide and metal ferrocyanide compound are formed in one operation. All toners of this group are more susceptible to troubles caused by impurities than in the case of sulphide toners.

It is of great importance that all operations are carried out as prescribed. However, despite all precautions taken, colors produced in a ferrocyanide toner may not be stable at all times. Color changes are possible because certain chemical reactions can take place in the print which have this effect. Sulphur fumes, for example, which are present in air quite frequently undergo reactions with iron or uranium and cause discoloration or formation of spots. Also many of these metallic ferrocyanide compounds are soluble in even mild alkalines; therefore, washing in slightly alkaline water might be responsible for some fading of the color.

Iron Toner

Tone in following bath until desired color is obtained.

Iron Blue Toner

Producing brilliant blue tones, this formula is suitable for use with Cykora, Brovira and Indiatone papers.

Hot Water (125° F. or 52° C.)	500 cc.	16 fl. oz.
Ferric Ammonium Citrate	8 g.	¼ oz.
Potassium Ferrocyanide	8 g.	¼ oz.
Acetic Acid, 28%	265 cc.	9 oz.
Water to make	1000 cc.	32 oz.

Solutions should be prepared with distilled water if possible.

Prints for blue toning should be fixed in plain, non-hardening hypo bath (which should be kept at a temperature of 68° or under to avoid undue swelling).

When prints have been fully toned in the above solution, they will be greenish in appearance, but will be easily washed out to a clear blue color when placed in running water.

Water used for washing blue-toned prints should be non-alkaline, since the blue tone is quite soluble in alkaline solutions.

The depth of the blue toning will vary somewhat with the quality of the prints toned in it, light-toned prints generally toning to lighter blues. Some intensification of the print usually occurs in toning; consequently, prints should be slightly lighter than the density desired in the final toned print.

Copper Toner

Agfa Copper Intensifier may be used successfully for copper toning of bromide prints. Instructions for use of the ready prepared solution are given below:

For Toning Bromide Prints—Dissolve the contents of the bottle in 16 oz. of water (1 pint). Place the print into this solution and keep in motion. The print will become warm in color after 3 minutes and will continue to become a darker copper color as the time is lengthened. If a more concentrated solution is used, the tone will be more copper colored and the action will take place more readily. Wash 5–10 minutes in running water.

TABLE VI
TONES OBTAINED BY USE OF AGFA COPPER INTENSIFIER

Name of Paper	Inherent Tone	Tone Obtained
Contact Printing		
CONVIRA chloride emulsion	cold, blue-black tone	reddish brown
CYKON chloro-bromide emulsion	warm, brown	not recommended
SPEEDEX chloride emulsion	cold, blue-black	reddish brown
Projection Printing		
BROVIRA bromide emulsion	cold, black	reddish
CYKORA chloro-bromide emulsion	warm, brownish	reddish brown
INDIATONE chloro-bromide emulsion	warm, brown	purplish red

Gold Toner

This formula gives a range of red tones to sepia-toned prints, the brilliance of the tone depending on the paper used. Brilliant chalk-red tones are produced on Cykon, while with Indiatone and Cykora darker shades are formed. If desired, deep blue tones may be also obtained with this formula by using black and white prints instead of prints that have first been sepia toned.

	Metric	Avoirdupois
Hot Water (125° F. or 52° C.)	750 cc.	24 oz.
Ammonium Sulphocyanate	105 g.	3½ oz.
Gold Chloride (1% Solution)	60 cc.	2 fl. oz.
Water to make	1 l.	32 oz.

For Red Tones: Prints must first

be bleached and toned by sulphide redevelopment methods. After washing, place prints in above solution until toning is complete (requires 15–45 minutes).

For Deep Blue Tones: Omit sepia toning operation and place well-washed black and white prints directly in above toning solution.

Dye Toning by Mordanting[*]

The metallic silver image of a print can be replaced completely by a colored dye image by means of a so-called dye mordanting process. By dye mordanting we understand the fixation of a dye to a substance which normally has no affinity to the dye by a third substance which has an affinity for both. That means, a dye which has no affinity for the metallic silver may be fixed to a mordant such as silver ferrocyanide, for example. A mordanting bath recommended in the *British Journal and Almanac* for 1927 is given below:

Copper Sulphate	40 g.	350 gr.
Tribasic Potassium Citrate	60 g.	524 gr.
Glacial Acetic Acid	30 g.	262 gr.
Potassium or Ammonium Sulphocyanide	20 g.	175 gr.
Water	1 l.	20 oz.

Prints are mordanted from 1–15 minutes, washed for about 30 minutes, laid out on a sheet of glass and surface dried. A 10% solution of the dyes or mixture of dyes and a 1% solution of acetic acid is then applied with a tuft of cotton or flat brush.

A partial list of basic dyes suitable for dye toning follows:

Name of Dye	*Color Obtained*
Rhodamine G	Red
Auramine	Orange
Chrysoidine	Yellow
Malachite Green	Green
Methylene Blue	Blue
Methyl Violet	Violet

The fibers of the paper print in most instances have the tendency to hold back the dye. Also the baryta coating shows similar tendencies. A great portion of this dye can be removed usually by appropriate washing. If this does not remove all of the dye from whites and high lights, dried print should be bathed in the following solution for 1–2 minutes.

Potassium Permanganate	4 g.	3½ gr.
Sulphuric Acid	1½ cc.	20 min.
Water to	1 l.	20 oz.

It will be necessary to conduct some experimental work in order to determine the proper concentration of the dye in the solution. Furthermore, it cannot be stressed enough that exactness and cleanliness in work are of prime importance for successful results.

Dye Coupling

Dye toning by coupling consists of bleaching a normally developed, fixed and washed print in a special bleach, and then redeveloping in a developer whereby a dye image is formed along with a silver image.

There are certain requirements on the black and white print that must be met; these are:

1. The original print must be lighter than normal, since the subsequent toning operation increases its density.
2. No part of the print should be completely void of silver.
3. a. Bromide prints give more brilliant colors than other type papers.
   b. Chloro-bromide prints produce warmer colors.
   c. Chloride prints produce brilliant colors, but pleasant hues.

The Bleaching Operation

Prints must be completely washed, then bleached in

Potassium Ferricyanide	35 g.
Ammonia (Concentrated)	3 cc.
Water	1 l.

Prints are then washed *completely* and color developed or dried. If dried they must be moistened again before being developed.

Color Development

The wet prints are developed in the following bath until the desired hue is arrived at. The usual time extends from 30 seconds to 3 minutes.

The following developer is made up of two solutions.

Solution 1 (Keeps for 1 Week Only)

p-Amino Diethylaniline Monohydrochloride	3 g.
Sodium Sulphite (C. P.) Anhydrous	5 g.

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[*] **Note: We cannot ascribe to the practice of toning by dye-mordanting since our experience has shown no method to be fully reliable. The above data is published for those who are of an experimental bend.**

Sodium Carbonate, Anhydrous	30 g.
Distilled Water	1 l.

10 g. of Sodium Thiocyanate may be added to the above solution for some variations in color.

Solution 2 (Keeps for Several Months)

Color Former	10 g.
Methyl Alcohol	1 l.

For use take 10 parts of solution 1 and 1 part of solution 2 *immediately before development.*

Color formers are listed below:

BLUE:

Alpha naphthol—gives bright blues; is very energetic and stains paper slightly

2.4 dichloro-l-naphthol — gives color similar to above, but shows no staining tendencies

Ortho hydroxydiphenyl or 4—chloro phenyl phenol—blue-green

MAGENTA:

1 phenyl—3 methyl—5 pyrazolone—soft rose

Para-nitro phenylacetonitrile — true magenta

YELLOW:

2.5 dichloroacetoanilide or acetoacetanilide—olive yellow

GREY:

beta-naphthol—neutral

In conclusion, the most important factors in toning should be repeated once more.

1. Prints should be exposed correctly and developed as recommended by the paper manufacturer.

2. Each kind of paper according to its emulsion characteristics, produces definite tones in any one toner that may not be reproducable on another paper.

3. Cleanliness and exactness in work are imperative for good success.

4. The stability of tones varies with the type of toner used. In many instances the color is very stable (sepia toners), but some toners form compounds whose color is liable to change as the compound undergoes photochemical or purely chemical reactions.

Agfa 231
Gold Toner

This formula gives a range of red tones to sepia-toned prints, the brilliance of the tone depending on the paper used. Brilliant chalk-red tones are produced on Cykon, while with Indiatone and Cykora darker shades are formed. If desired deep blue tones may also be obtained with this formula by using black-and-white prints instead of prints that have first been sepia-toned. Unusual effects of mixed tones of blue-black shadows and soft reddish highlights can be produced by using prints which have been partially toned in a Hypo Alum sepia-toner.

	Metric	Avoirdupois
Hot Water (125° F. or 52° C.)	750 cc.	25 oz.
*Ammonium Sulphocyanate	105 g	3½ oz.
Gold Chloride (1% Solution)	60 cc.	2 fl. oz.
Water to make	1 l.	32 oz.

For Red Tones: Prints must first be bleached and toned by sulphide redevelopment method (see Agfa 221). After washing, place prints in above solution until toning is complete (requires 15–45 minutes). For redder tones one-half the specified amount of sulphocyanate may be used.

For Deep Blue Tones: Omit sepia toning operation and place well-washed black-and-white prints directly in above toning solution.

For Mixed Tones: Prints should be incompletely toned in a Hypo Alum Toner, such as Agfa 222, and washed before treatment in above solution.

Agfa 241
Iron Blue Toner

Producing brilliant blue tones, this formula is suitable for use with Cykora, Brovira and Indiatone Papers.

	Metric	Avoirdupois
Hot Water (125° F. or 52° C.)	500 cc.	16 oz.
Ferric Ammonium Citrate	8 g.	¼ oz.
Potassium Ferrocyanide	8 g.	¼ oz.
Acetic Acid (28%)	265 cc.	9 oz.
Water to make	1 l.	32 oz.

Solution should be prepared with distilled water if possible. If enamelled iron trays are used, no chips or cracks in the enamel should be present or spots and streaks may appear in the print.

Prints for blue toning should be fixed in plain, non-hardening hypo

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* May be substituted by:

Sodium Sulphocyanate	110 g.	3¾ oz.
or Potassium sulphocyanate	135 g.	4½ oz.

bath (which should be kept at a temperature of 68° or under to avoid undue swelling). When prints have been fully toned in the above solution, they will be greenish in appearance, but will be easily washed out to a clear blue color when placed in running water.

The depth of the blue toning will vary somewhat with the quality of prints toned in it, light-toned prints generally toning to lighter blues. Some intensification of the print usually occurs in toning; consequently, prints should be slightly lighter than the density desired in the final toned print.

Wash water should be acidified slightly with acetic acid since the blue tone is quite soluble in alkaline solutions and is considerably weakened when wash water is alkaline. Pleasing variations in the tone can be obtained by bathing the washed prints in a ½% solution (5 grams per liter) of Borax which produces softer, blue-gray tones, the extent depending on the length of treatment.

Red Chalk Toning

Prints toned brown by regular two bath sulphide process are immersed in:

a. Water	500 cc.
Thiourea	40 g.
Sodium Thiosulphate	40 g.
Potassium Pyrosulphate	10 g.
b. Water	500 cc.
Prepared Chalk	2 g.
Gold Chloride (Brown)	1 g.

Use equal volumes *a* and *b* and immerse well washed prints until proper color is reached.

Odorless Sulphide Toner

Thiourea (5% Solution)	140 cc.
Sodium Hydroxide (10% Solution)	360 cc.
Water	500 cc.

Tinting Home Movie Films

Home movie films may be tinted any one of several colors by using water soluble Easter egg dyes.

Formula No. 1

Soak the film to be tinted in tepid water (68° F.) for 15 minutes and immerse in the dye solution, made by adding 10–20 drops of liquid Easter egg dyes to 1 pint of water. Dyeing or tinting is complete in about 15 minutes, depending on the depth of color you wish for the film. The blues and the greens work very well, but the other colors can also be used.

No. 2

Home movie films may also be tinted by using water soluble dyes. The dyes that work best are Methylene Blue, Malachite Green, Tartrazine, Rhodamine B, Crocein Scarlet, and Methyl Violet.

Water solutions of the above dyes are made up by dissolving about 1 gram of the dry dye in 1 quart of warm water. Now soak film to be dyed in water for 10–15 minutes and immerse in the dye solution for the same length of time usually about 10–15 minutes, depending on the depth of tint you desire.

Mordanting Dye-Toning Transparencies

Water	1 l.
Copper Sulphate	40 g.
Potassium Thiocyanate	20 g.
Potassium Citrate	60 g.
Acetic Acid	30 cc.

After transparency is mordanted in above and washed, dye with

Rhodamine B
or
Thioflavine T
or

Methylene Blue	2 g.
Acetic Acid	2 cc.
Water	1 l.

Agfa 310
Farmer's Reducer

This is a cutting reducer for lessening the density of heavy negatives and at the same time increasing their contrast. It is especially valuable for reproduction films to clear the whites.

Solution 1

	Metric	Avoirdupois
Hypo	240 g.	8 oz.
Water to make	1 l.	32 oz.

Solution 2

Potassium Ferricyanide	19 g.	½ oz. 55 gr.
Water to make	250 cc.	8 oz.

For use mix one part Solution 2 and four parts Solution 1 in 32 parts water. Solutions 1 and 2 should be stored separately and mixed immediately before use.

Reducer for Reversal Home Movie Film

Many times underexposed Home Movie Film can be brought out very well by the use of a suitable reducer. Prepare the following solutions:

Solution A

Potassium Ferricyanide	1 g.
Water	32 cc.

Solution B

Hypo (Sodium Thiosulphate)	30 g.
Water	1000 cc.

After you have soaked the film in plain water for 15 minutes to soften the emulsion, mix in a glass vessel 1 part of Solution A and 1 part of Solution B. Place the film at once in the mixed reducer and inspect every 5 seconds, until the film becomes as light as you want it. Wash in plain water for 10 minutes and dry between cellulose sponges. This reducer works very fast, so care must be taken that the images are not reduced too far.

Reducing Contrast of Negatives

a. Potassium Ferrocyanide	10 g.
Potassium Dichromate (1%)	1.3 cc.
Water	100 cc.
b. Ferric Ammonium Sulphate	21.2 g.
Water	1 l.
c. Oxalic Acid	25 g.
Water	500 cc.

Mix equal volumes of each, for use. Treat negatives 5–10 minutes. Wash briefly, fix in 3% hypo and wash.

Devin Single-Bath Bleach

Solution A

Potassium Ferricyanide	50 g.
Potassium Bromide	50 g.
Ammonium Bichromate	15 g.
Water (not over 75° F.), to	1 l.

Solution B

Chromic Acid Flakes (U. S. P. XI)	10 g.
Water, to	1 l.

Solution C

Formaldehyde (40% U. S. P.)	50 cc.
Water, to	1 l.

For the working bath mix together 200 cc. of Solution A, 100–125 cc. of Solution B, and 20 cc. of Solution C. Add cold (50–60° F.) water to 1,000 cc. 100 cc. of Solution B per l. gives more contrasty results, while 135 cc. per l. gives rather soft results. 115 cc. per l. is about right for normal usage.

Acid Stop-Hardening Bath (Photographic)

Solution A

Chrome Alum	3 oz.
Water, to make	20 oz.

Solution B

Sodium Pyrosulphite	3 oz.
Water, to make	20 oz.

Use 2 oz. of each of the above to 13 oz. warm water.

Stabilized Photographic Fixing Powder

U. S. Patent 2,203,903

Sodium Hyposulphite	223 g.
Sodium Sulphite	16 g.
Sodium Acetate	18 g.
Citric Acid	11 g.
Alum	20–24 g.

The above is dissolved in water to make 1 l.

STAYFLAT PLATE

Hard Gelatin	4 lb.
Water	6000 cc.
Glycerin	2850 cc.

Soak gelatin in water-glycerin overnight, melt completely with stirring, pour on warmed glass plate and let set. To renew tackiness, moisten slightly.

Film Abrasion Bleach

Alcohol	50 cc.
Ammonium Hydroxide	10 cc.
Hydrogen Peroxide	10 cc.

Photographic Stripping

The rubber solution for stripping can be a 2% mixture of India rubber in benzol, or use may be made of the preparations commercially offered for the purpose. The rubber mixture is flowed over the negative in a thin even coating, allowing the solvent to evaporate and the film to dry until it attains a sticky feeling or "pull" when rubbed with the finger.

At this stage the rubber-coated plate is ready for application of the stripping collodion (also an article of trade), which is a relatively simple mixture, typified by the following formula:

Denatured Alcohol	32 oz.
Ether	32 oz.
Pyroxyln	1 oz.
Castor Oil	1 oz.

The collodion is flowed over the rubberized plate, taking care to avoid bubbles in the coating. When the collodion film has set, it may be allowed to dry spontaneously, or the film may be set afire to more quickly drive off the ether and alcohol. When dry, the collodion image possesses a tough skinlike coating, which permits stripping and handling quite readily.

Actual stripping consists of first

cutting through the edges of the collodion negative or image with a sharp knife, after which the plate is placed in a dilute acetic acid solution (1:10) to dissolve the albumen substratum applied to the plate for retention of the collodion film on the smooth glass surface. After 3 or 4 minutes the film begins to loosen, permitting the negative bearing its protective rubber-collodion layers to be pulled off the glass (if desired, by the aid of a sheet of wet paper, squeegeed into contact with the wet film), reversed as to position (if required), and then laid down on the final support, which usually is a sheet of heavy glass. Intimate contact with the glass is secured by blotting the film with squares of blotting paper, which forces the water out from between the film and glass.

A process of stripping in which the acid bath is dispensed with consists of coating the negative with a thick rubber solution, then with a 6% collodion mixture, containing 1% of castor oil. The plate is leveled and the collodion poured on, not drained off as in the first method. A rather thick film results, which can easily be stripped off the glass in a dry state. The process is suitable for stripping negatives directly on sensitized surfaces for photomechanics, the negative being squeegeed into intimate contact by means of petroleum. The procedure just outlined is sometimes useful in work of large size, or that exceeding the dimensions of the printing frame or photoprinting equipment.

Probably the best known method of stripping such plates is that recommended in 1916 by S. M. Furnald. The film is cut through with a knife and the following solution poured over the negative:

Sodium Fluoride (4% solution)	10 oz.
Formalin	5 oz.

The film becomes loosened from the glass in about 1 minute and can then be lifted by applying over it a sheet of dampened paper, lifting carefully at one corner and stripping the paper and film away.

If reversal of the film is required, it is easily transferred to a second sheet of paper and from that to the final glass support. This is first cleaned and then flowed with a 5% solution of gum arabic, to which is added a little glycerin. The glycerin tends to improve the condition of the stripped film, which otherwise may become rather horny and overdry from the formalin.

Silk Screen Photo Sensitizing Solution

Photo Engraving Glue	6 lb.
Dissolve in	
Water	3 pt.
in which there has been dissolved	
Ammonium Bichromate	¾ lb.
Ammonia	2 oz.
Add	
Water, to make	1 gal.

Make up in dark just before use.

Zinc Plate Sensitizing

The zinc plate should be scrupulously clean before attempting to sensitize it with the albumen mixture. Scrub the metal well with pumice paste, and if necessary, treat it with the alum-nitric acid mixture.

A good albumen formula for zinc etching is:

White of One Egg	
Water	16 oz.
Ammonium Bichromate	25 gr.
Ammonia Water, C. P.	8 drops

A zinc plate sensitized with this mixture is only moderately sensitive to light, and can be handled in an orange or yellow light. Exposure depends on the character of the negative and the strength of the illumination used.

A frequently neglected point is undue rubbing of the inked image during development, occasioned by over-exposure of the print. Unless a considerable quantity of ink is left on the lines of the image, there will not be sufficient adhesion of the etching powder to the greasy ink design, with the consequent liability of a porous "top," or one which will not completely resist the action of the acid.

Sufficient exposure of the metal through the negative is also necessary in order to thoroughly insolubilize the light-affected bichromated albumen image.

Lithographic Plate Sensitizing Solution

a.	Albumen	60 g.
	Water	550 cc.
	Ammonium Hydroxide	15 cc.
b.	Ammonium Dichromate	17 g.
	Water	400 cc.

Mix A and B.

Photo Lithographic Etching Solutions

Although zinc and copper are the most popular metals for the production of relief printing plates, other materials have been recommended and are sometimes used for the creation of etched images, either for printing or decorative purposes. The present paper is therefore devoted to etching solutions for the various materials; for ease of reference, the materials will be dealt with in alphabetical order.

First on the list is aluminum, on which relief images may be etched.

Aluminum Etching

Ferric Chloride	2 oz.
Hydrochloric Acid	2 oz.
Water	40 oz.

The iron salt is dissolved first, and the acid added. The strength of the solution should be 35° Bé.; weaker baths are likely to attack the photomechanical resist in the increased time required for etching.

Another mordant for aluminum is:

Alcohol	4 oz.
Acetic Acid	6 oz.
Antimony Chloride	4 oz.
Water	40 oz.

Brass Etching

Brass is sometimes used for line and halftone plates because of its greater hardness than copper, and is also employed for the production of embossing plates. The simplest mordant for etching brass is a solution of ferric chloride (40–45° Bé.), though other etching solutions for the purpose are:

Formula No. 1

Alcohol	4 oz.
Chromic Acid	4 oz.
Water	40 oz.

No. 2

Nitric Acid	20 oz.
Hydrochloric Acid	40 oz.
Potassium Chlorate	10 oz.
Water	200 oz.

Bronze Etching

The starting etch on this alloy usually is carried out with ferric chloride (40–45° Bé.), after which the plate is rolled up with ink, dusted with powdered asphalt or rosin (colophony), and then etched either with strong nitric acid, or *aqua regia.*

Nitric Acid	18 oz.
Hydrochloric Acid	82 oz.

For use, dilute with water according to speed of etching desired.

Celluloid Etching

Celluloid surfaces can be etched with any of the better known solvents of the material—amyl acetate, acetone, ether-alcohol mixtures, or glacial acetic acid.

Copper Etching

The most familiar photomechanical mordant for copper is a solution of ferric chloride, usually 40° Bé. in strength. Ferric chloride is supplied either in liquid or lump form: about 1½ lb. of the lump variety added to 1 pt. of water will provide a solution approximately 40° Bé. strong.

A more rapid etching solution for copper consists of:

Nitric Acid (40° Bé.)	4 oz.
Acetic Acid	1 oz.

diluted with water to test 30° Bé.

A solution popular among artist-etchers for biting designs on copper plates is *Dutch Mordant*, the following being a representative formula:

Water	40 oz.
Potassium Chlorate	1¾ oz.
Hydrochloric Acid	8 oz.

The water is heated and the chlorate added, allowing it to dissolve and the mixture to cool sufficiently before adding the acid. Greater rapidity of etching is promoted by heating the bath up to about 85° F. (NOTE: *Be careful with potassium chlorate—it is a dangerous explosive.*)

GLASS ETCHING

The most common solvent for glass is an aqueous solution of hydrofluoric acid, but the operation of etching is somewhat uncertain, since no two kinds of glass react in exactly the same way when subjected to the action of the acid.

Glass etching frequently is employed for the creation of indelible labels or writing on glass articles (bottles, scales), such etching capable of execution with the following mixture:

a.	Potassium Sulphate	105 gr.
	Sodium Fluoride	240 gr.
	Water	16 oz.
b.	Zinc Chloride	210 gr.
	Water	16 oz.

Dissolve, then add:

Hydrochloric Acid	2 oz.

Use equal parts of A and B in writing the inscription on the glass with a pen or brush.

Lead Etching

Etching of lead surfaces is seldom attempted in photomechanics, but the solution here quoted is an efficient mordant for the purpose:

Alcohol	4	oz.
Tin Chloride	2½	oz.
Water	40	oz.

Lithographic Plate Etching Solutions

The most popular etching agent for this purpose is nitric acid, generally used in conjunction with a gum arabic solution. Among other functions, the gum arabic increases the density of the etching solution, permitting more convenient distribution of the mixture on the stone's surface, and tending to promote a more uniform action of the acidified solution.

For purposes of litho etching, nitric acid should be pure and colorless; the yellow varieties often contain impurities.

To prepare an etching solution for stone, gum arabic solution of the consistency of thin varnish is mixed with an equal part of water, the mixture possessing a density ranging between 7 to 9° Bé. To this, sufficient nitric acid is added to bring the solution to a density of 8 to 10°, the final strength depending somewhat on the strength and character of the ink design or image.

Counter-Etching

Known also as *affinitizing*, this refers to the chemical preparation of zinc and aluminum plates prior to their reception of the lithographic image. The purpose of counter-etching is to remove surface oxidation and to render the chemically clean metal receptive to greasy ink. Counter-etching usually is performed with aqueous solutions of acids (gallic, nitric, acetic, hydrochloric), either with or without the addition of acid substances, such as alum.

Counter Etch

Formula No. 1

Alum	4	oz.
Nitric Acid	1	oz.
Water to make	1	gal.

No. 2

Hydrochloric Acid	2	oz.
Water to make	1	gal.

No. 3

Glacial Acetic Acid	6½	oz.
Water to make	1	gal.

Aluminum plates may be counter-etched with the above acetic acid formula, or the following mixture may be employed:

Nitric Acid	½	oz.
Hydrofluoric Acid	2	oz.
Water to make	1	gal.

Counter-etching, especially for albumen images on zinc plates, is frowned upon by some platemakers; they contend that the plate need not be unduly sensitive to grease for the reception of the albumen image, and therefore prefer to treat the grained metal with a gum-etch.

Gum Etch

Chromic Acid	1½	oz.
Phosphoric Acid (85%)	1	oz.
Potassium Alum	1½	oz.
Gum Arabic Solution (12° Bé.)	1	gal.

For use, 10 oz. of water are added to each 32 ounces of the gum-etch solution.

Plate Etches

Etching of lithographic images on either zinc or aluminum plates is performed with acidified gum arabic solutions, which sharpen the image or design on the metal, and create a chemical film on the surface of the grained zinc or aluminum.

White Etch

A

Ammonium Nitrate	5	oz.
Ammonium Phosphate	10	oz.
Water	100	oz.

B

Ammonium Fluoride	¾	oz.
Tartaric Acid	½	oz.
Water	60	oz.

Mix *A* and *B*, and use 1 part stock solution to 1 part gum arabic solution of 12° Bé. strength.

A formula of the same consistency, but providing a larger quantity of solution is:

A

Ammonium Nitrate	1½	lb.
Ammonium Phosphate	2½	lb.
Water to make	4	gal.

B

Ammonium Fluoride	7	oz.
Tartaric Acid	2	oz.
Water to make	1	gal.

Employ in the manner of the previously quoted formula.

Solutions containing chromic acid or bichromates are in wide use for lithographic etching, though objected to by some platemakers because of the danger of bichromate poisoning.

Chrome Etch

Chromic Acid (50% Solution)	1	oz.
Phosphoric Acid (85%)	¾	oz.
Gum Arabic Solution (1:2)	12	oz.
Water	32	oz.

Ammonium bichromate may form the chromium content of the etch, as in the following formula, which also contains tannic acid:

A

Phosphoric Acid (85%)	2	oz.
Water	20	oz.

B

Tannic Acid	1	oz.
Water	20	oz.

C

Ammonium Bichromate	2	oz.
Water	20	oz.

For use, take 4 oz. each of *A*, *B* and *C*, and add 20 oz. of gum arabic solution (12° Bé.).

Plate etches for aluminum are distinguished by their simplicity, usually consisting only of phosphoric acid and gum arabic solution:

Phosphoric Acid (85%)	1	oz.
Gum Arabic Solution (14° Bé.)	25	oz.

Tannic acid is sometimes used in litho etches for aluminum plates, generally with a corresponding reduction in the content of phosphoric acid:

Tannic Acid	¼	oz.
Phosphoric Acid	2	oz.
Water	32	oz.

Dissolve, and make up to 1 gal. with 12° Bé. gum solution.

Fountain Solutions

Damping (fountain) solutions on offset presses might really be considered as a form of mild plate etch, continuously applied to the zinc or aluminum plate during the course of the pressrun.

Fountain Solution for Zinc Plates

Water	5	gal.
Ammonium Bichromate	2	oz.
Phosphoric Acid (85%)	¼	oz.
Gum Arabic Solution (14° Bé.)	5	oz.

The following has been recommended as a fountain solution for use with aluminum plates:

Water	5	gal.
Citric Acid	½	oz.
Sodium Citrate	1½	oz.
Gum Arabic Solution (14° Bé.)	5	oz.

Fountain Solution for Zinc Lithographic Plates

Water	10,000	cc.
Ammonium Dichromate	3	g.
Ammonium Phosphate	20	g.
Ammonium Nitrate	10	g.
Gum Arabic	25	g.

Tusche for Offset Press Plate

1. Flush a clean, suitably grained, zinc plate with water, and after scrubbing vigorously with a scrub brush, drain, and again scrub, using the following cyanide solution:

Cyanide Cleaning Solution

Water	1	gal.
Potassium Cyanide	2	oz.

2. After thus removing whatever grease may be on the plate's surface (about one minute) the plate is washed well, again scrubbed under the running water, and then counteretched or cleaned in order to eliminate any possibility of oxidization or foreign matter acting as insulation between plate surface and ink image. The action of the counter etch is also assisted by vigorous scrubbing.

There are many satisfactory formulas for counter-etching, and either of these will be found to be satisfactory for the purpose:

Counter Etches

Formula No. 1

Water	1	gal.
Acetic Acid (28%)	¼	oz.
Nitric Acid, C.P.	10	drops
Potassium Alum	4	oz.
Sal Ammoniac	¼	oz.

No. 2

Water	1	gal.
Potassium Alum	3	oz.
Nitric Acid, C.P.	⅛	oz.

A solution of 8 oz. of glacial acetic acid to 1 gal. of water is sometimes recommended for counter-etching because of its mild action. This is especially desirable when producing extra-large plates as the action is easily controlled.

3. The plate is flushed with running water and scrubbed again, resulting in a perfectly clean piece of metal. (Note emphasis on washing and scrubbing up to this point.)

4. The surface of the plate is now as ink-receptive as it is possible to

attain. Blueprints, chalk transfers, or albumen prints cannot be made on the prepared metal, after which the "tusche" or "Ben-Day" operations are performed without further delay.

It might be well to add that the drying of the plate after counteretching should be accomplished as rapidly as possible in order to prevent oxide or plate rust from forming on the plate's surface. After the plate is "tusched" or completed, it is dried, dusted well with French chalk, and etched with any reliable etch. Tannic etch is satisfactory, but most platemakers prefer to use the one known as "White Etch":

White Etch

A

Water	16 oz.
Ammonium Nitrate	3 oz.

B

Water	16 oz.
Ammonium Phosphate	3½ oz.

C

Water	16 oz.
Calcium Chloride	½ oz.

Dissolve *A*, *B* and *C* separately, and, after mixing together in order, add ¾ oz. sodium fluoride and 32 oz. of strong gum.

Etching Ben-Day or crayon plates should be made up very carefully or streaks will result. The recommended method is to pour a large pool of etch in the center of the plate, and, without allowing it to cease spreading, distribute it rapidly over the plate's surface with a circular* motion of brush or sponge. While either a sponge or brush can be used safely, we believe a paste brush, such as is used by the paper hangers, to be the best. In either case, the sponge or brush should be carefully washed in pure water before it is used.

Etching operations completed, the plate is washed out and then gummed up. Some operators gum up delicate crayon and Ben-Day plates twice, first using a heavy gum, followed by a weaker solution, to give the image added protection.

When the gum has been fanned dry, the image is washed out with turpentine and after applying a smooth coat of asphaltum, the plate is rolled up with a stiff ink in the usual way. After again washing out *and applying Dubar, No Wok, Laquer,* or similar *greasy preparations,* the plate is ready for the press.

Deep Etch (Glule Method)

1. Counter etch the plate with:

Water	1 gal.
Hydrochloric Acid	2 oz.

2. Scrub under running water and flow with the following sensitizer (filter well):

A

LePage's Photo Engravers' Glue	6 oz.
Distilled Water	10 oz.

B

Distilled Water	16 oz.
Ammonium Bichromate	1 oz.

C

Aqua Ammonia	¼ oz.

3. Coat the plate outside the whirler and whirl quite swiftly to insure even distribution of the relatively heavy solution (75–80 revolutions a minute.)

4. When plate is dry, expose beneath the usual photographic positive plate. (It might be well to mention that halftone positives to be used in conjunction with the glue method should be a trifle full in the highlights, and slightly on the open side in the shadows. This is necessary to compensate for a certain increase in contrast bound to occur, due to the thickness of the glue coating—printing under. The exposure is usually from 1½–3 minutes.)

5. After exposure, apply heavy developing ink, distribute smoothly with a soft cloth, and, when apparently dry, dust well with powdered dragon's blood (obtained from any photoengravers' supply house).

6. Next soak the plate in water (85° F.) for about 3 minutes and "develop out" with a swab of wet cotton or wool.

Zinc Etching

For drawing directly on zinc, the metal must first be polished with a paste of pumice stone to free it of all grease; it is then treated with a graining or matting solution, which provides a "tooth" or chemical sensitivity for the ink used. This solution is a simple one:

Water	32 oz.
Powdered Alum	1½ oz.
Nitric Acid	1 dr.

After subjecting the metal to this bath, the surface is sponged off, after which the plate is quickly dried to prevent oxidation.

The actual drawing on the metal is executed with lithographic tusche, a commercial article of trade, though it may be individually prepared according to the following formula:

Tusche

White Wax	8 oz.
White Soap	2½ oz.

Melt with the aid of slow heat, and when well mixed, add:

Lampblack	1 oz.

Mix well with the wax-soap mixture, bring the mass to a rather high heat and add:

Orange Shellac	2 oz.

After thorough mixing and stirring, permit the mass to cool, and then cut it into small cakes. For use, it is only necessary to dissolve it by rubbing down with a small quantity of water.

The greasy nature of the ink causes the etching powder to adhere to its surface, thus providing the required acid resisting property for successful etching. If an image of greater resistance is desired, it may be necessary to coat the plate with a thin solution of gum arabic; when dry, the image is rolled up with etching ink until the design appears quite black in color. The gum solution is then sponged off the plate, the metal dried, after which the plate is ready for powdering.

Modern zinc etching is usually performed with special machines for the purpose, but for those who may desire to experiment, or whose volume of work does not justify this expenditure, a tub can be used. This can be constructed of cypress covered with a coating of pitch to resist the corrosive action of nitric acid used in zinc etching. Other designs of tubs are in existence, but the one shown will meet the requirements of the amateur, who can place it on a table and operate it by hand power.

Chalk Engraving

Steel is usually the metal chosen as a support for the chalk coating. While Kaolin (China clay) has been recommended for this purpose, it is seldom used. An old formula for a chalk composition contains:

Egg Albumen	120 gr.
Water	6 oz.
Ammonia (.88)	¼ oz.
Glycerin	7 drops

The following is added to the albumen mixture, employing a mortar to mix the whole to a thick paste:

Precipitated Chalk	3 oz.
French Chalk	1 oz.

Apply the mixture to the steel plate and then subject it to heat to accelerate drying. The hard crust forming on the top during the process of drying is removed with a flat knife before engraving the chalk surface.

It is hardly necessary to say that success in the process depends on the artistic skill of the "engraver," also on careful stereotyping of the engraved design.

Litho Gum Etch

A

Ammonium Nitrate	2¼ oz.
Ammonium Phosphate	2¼ oz.
Water	20 oz.

B

Ammonium Fluoride	180 gr.
Calcium Chloride	180 gr.
Water	10 oz.

Mix *A* and *B* and add (10° (Bé.) gum arabic solution to make 1 gal. of etching mixture.

Etching Solution for Zinc Lithographic Plates

Water	1000 cc.
Phosphoric Acid (Syrupy)	40 cc.
Ammonium Dichromate	8 g.
Gum Arabic	300 g.

Counteretch for Zinc Lithographic Plates

Water	1000 cc.
Nitric Acid (42° Bé.)	10 cc.
Potassium Aluminum Sulphate	30 g.

Lithographic Plate Cleaning Solution (For cleaning up plates showing scum after development)

Water	1000 cc.
Potassium Bicarbonate	20 g.

Collotype Plates

The glass plate should be quite level and from ¼–½ in. thick. Beveled plate glass is best; it must be provided with a smooth matt surface (ground-glass) to provide the required grip or "tooth" for the subsequent gelatin image.

To insure perfect adhesion of the gelatin film to the ground glass, a substratum is required. While this may be applied directly to the glass plate, Wilkinson recommended a preliminary cleaning by first scrubbing the plate free of all particles of dust, and then flooding the wet plate with a mixture of:

Ammonia Water	1 oz.
Alcohol	1 oz.
Water	5 oz.

This will aid in removing the last vestiges of grease and foreign matter. The cleaning solution is well scrubbed into the ground surface with a clean rag, after the plate is thoroughly rinsed in clean water and allowed to dry.

A simple substratum solution consists of:

Fresh Egg Albumen	5 oz.
Water	10 oz.
Sodium Silicate (Watery Solution)	2 oz.

The albumen is beaten to a froth and allowed to settle, after which the other ingredients are added and the whole mixture thoroughly shaken before filtering.

Place the plate on a leveling stand and spread the solution over the glass surface, then allow the coated plate to dry in a dust-free closet. The substratumed plates will keep for some time; they may be stored face to face, but should be kept in a dry place and free from dust.

The bichromated gelatin solution forms the sensitizer for production of the collotype image. The gelatin used in collotype plays an important role. The type recommended is known as *middling hard;* gelatins made expressly for photographic emulsions usually prove satisfactory.

Collotype sensitizers are not distinguished by scarcity—there seem to be as many formulas as the proverbial dog has fleas, each operator seeming to have his own pet formula. As in other forms of photography, success does not depend so much on the "efficiency" of the formula as it does on the care and intelligent manipulation of the operator.

Sensitizer

Gelatin	360 gr.
Potassium Bichromate	40 gr.
Water	8 oz.

The gelatin is soaked in distilled or boiled water (to minimize the formation of bubbles), then melted by heat in a porcelain vessel, and the previously dissolved bichromate added to the gelatin mixture. The solution is stirred well and brought to a temperature not exceeding 120–130° F., then filtered through fine muslin, or through chamois leather which has been thoroughly washed in strong soda, and afterward in clean water.

In coating the glass plate, the support is first heated to a temperature of 120° F. (best effected in a heat-controlled drying cabinet), after which a pool of the warm gelatin solution is poured on the substratumed surface. The plate is rocked slightly to cause the liquid to spread itself in a perfectly even film, running the excess off. The exact quantity of sensitizer to be used is best gaged by experience, a 13x16 inch plate requiring about two oz. of the gelatin mixture. Thick coatings produce wave marks, while thin ones are difficult to print.

The success of the process depends very much on the temperature at which the gelatin coating is dried. A practical necessity is a suitable drying cabinet, in which a temperature of 120° F. can be maintained—this is said to produce the most satisfactory grain. The time for drying is from 2–3 hours. Excessive heat will cause the gelatin to contract and peel off the glass.

Negatives intended for printing down on the sensitized glass must be laterally reversed, if position of image is of importance in the final impression. The negatives should be of perfect gradation, and a density suitable for direct printing on gelatino-bromid paper. The dimensions of the print should be masked off on the negative with thinnest tinfoil.

Absolute contact of the negative with the sensitized surface is essential during exposure — special pressure frames are recommended for this purpose. Exposure can be done by daylight, though sunlight or arc light is obviously quicker in action; these may, however, render negative imperfections more noticeable in the final print. A slight supplementary exposure is given through the back of the sensitized glass, taking care not to disturb the position of plate and negative when unpacking the face down printing frame. This extra exposure increases the adhesion of the film to the glass and reduces the relief of the gelatin image.

"Development" of the exposed plate consists of washing it in cold water (60° F.) until all trace of yellowness disappears in the image, when the plate is then permitted to dry spontaneously in the open air. The operations of sensitizing, exposure and development, and printing are best done on consecutive days, a continuous hardening action going on in the image.

Preparation of the image for printing is accomplished by *etching*, which is nothing more than treating the plate to render the gelatin film hygroscopic, and is effected with a solution of equal parts of glycerin and water, with the addition of 2% of common salt. The plate is evenly covered with this *etching* fluid, the period of time required for its action depending on the character of the image, weather conditions, and the printing equipment to be used.

During printing, the plates should be redamped with glycerin and water if the highlights show a muddy appearance, the ink being wiped off with turpentine prior to application of the glycerin solution.

Special inks are usually used for collotype printing, generally a stiff ink for inking the shadows (applied with a nap roller), a thinner grade being used for the half-tones and clearing the image (applied with a composition roller). In some cases, offset printing inks of sufficient covering power may be applied with one rolling of the plate with a composition roller.

Fotoldruck Process

The Fotoldruck process is based on the employment of an exposed but undeveloped blue print (cyanotype), placed in contact with a gelatinous film containing ferrous salt. Positive prints can be obtained from negative blue prints, on the principle that if an undeveloped blue print is placed on a set gelatin film containing ferrous salt, double decomposition between this salt and the unaffected potassium ferricyanid in the blue print renders those areas containing the insoluble salt thus formed capable of taking on greasy inks.

Cyanotypes for this process must have pure whites; only vigorous prints will give good results. Blue print papers prepared with red ammonio-citrate of iron appears to be more suitable than that made with the green citrate, the former being basic, the latter, acid.

A number of solutions have been advocated for the gelatin film, Albert suggested:

Gelatin	3½	oz.
Glycerin	154	min.
Oxgall	230	min.
Ferrous Sulphate	19	gr.
Water	16	oz.

The gelatin is dissolved in the water with the aid of gentle heat, and the ferrous salt, previously dissolved in a little water is then added to the mixture. The object of the glycerin is to keep the gelatin film moist and flexible. Thin zinc plates roughened with emery (grained offset zinc will do nicely) are coated with the warm mixture to a depth of about 2 mm. (1/12-inch).

With the zinc plate coated with the above composition, an exposed (undeveloped) blue print is gently rubbed into contact with the set gelatin film. Only a few seconds contact between the print and film are required. When the print is peeled off, the lines or other image places of the original appear matt and sunken in as regards the surrounding and unaffected gelatin.

The gelatin film is then rolled up with a good letterpress ink which has been reduced to suitable consistency with varnish and oil. Prints on paper are pulled in the manner of collotypic printing, except that mere pressure with the hand or a light roller is sufficient to transfer the ink to the paper. With care, it is possible to obtain quite a number of impressions from the gelatin film.

Dry Enamel (Photo Sensitive) Coating
(For Copper Plates)

a.	Water	8	oz.
	White (Sugar) Rock Candy	1	oz.
b.	Water	4	oz.
	Ammonio-Citrate of Iron	50	gr.
	Dissolve this, and add:		
	Chromic Acid	35	gr.
	Ammonia	¼	oz.
c.	Water	4	oz.
	Ammonium Bichromate	½	oz.
	Albumen	4	oz.

The formula is mixed in the order given, dissolving the candy in the water, after which solution B is prepared. Next the albumen is beaten up for C, the bichromate dissolved in the water and added to the albumen, after which solution A is added to solution C, and solution B then aded to the mixture very slowly and with constant stirring. After filtering, the mixture is ready for use.

Exposure under the negative completed, the copper plate is taken into a dampened room and developed by dusting over with anhydrous sodium carbonate (or sodium stannate, or magnesium carbonate). Dusting is continued with a soft brush until the image is clear, showing the print brown on a white background.

Various effects are possible by breathing on the plate: thus by breathing on a dark spot and applying the powder carefully, details can be brought up, giving the printer an opportunity to secure modified effects in the developed halftone image.

On completion of powdering, the plate is burned-in in the usual manner, and when almost cool, plunged into a bath of cold water. In this way, the unexposed parts (those to which the powder adheres) are washed away; any remaining enamel is then removed by rubbing a little damp table salt over the surface, or a dilute caustic soda solution may be poured over the wet surface of the plate immediately after withdrawal from the water bath.

After drying, the plate is ready for the regular etching process with ferric chloride.

Cold (Photographic) Enamel

Enameled cooking ware should be employed, of a capacity double that of the final quantity of enamel, so as to allow for the swelling tendency of the shellac during the process of solution.

Formula No. 1

Hot Water (185° F.)	160	oz.
Ammonium Carbonate	3½	oz.
Orange Shellac	1	lb.

A few oz. of the shellac are added to the hot water, then the previously dissolved ammonium carbonate is added, followed immediately by the balance of the shellac, which is added slowly while constantly stirring the mass. Cook the mixture for 15–20 minutes, stirring occasionally, and then set aside to cool. Next add 4 oz. of concentrated ammonia, stirring constantly during the addition, after which the following sensitizer is added to the mixture:

Ammonium Bichromate	360	gr.
Cool Water	8	oz.

Stir constantly while adding the bichromate solution, and then set aside for 24 hours before filtration and eventual use. Filtering can be done with cheese cloth, or preferably, canton flannel.

No. 2

Water	48	oz.
Ammonium Hydroxide	16	oz.
Orange Shellac	10½	oz.
Wood Alcohol	12	oz.
Ammonium Bichromate	275	gr.

The ammonium hydroxide is added to 40 oz. of water, followed by the shellac (accompanied by constant stirring), with the final addition of the alcohol. The mass is then permitted to stand for 36 hours, stirring occasionally during this time. It is then boiled for 20 minutes, and then allowed to cool completely.

At this stage dissolve the bichromate in 8 oz. of water, also adding 8 oz. of ammonium hydroxide, which is added to the *cool* shellac solution while stirring vigorously. Filter and allow to stand at least 24 hours before use.

Development of the exposed cold enamel images takes place in the following alcoholic bath:

Denatured Alcohol, No. 1	4½	gal.
Water	½	gal.
Methyl Violet	1	oz.

The methyl violet is added to promote visibility of the developed image, dissolve the dye in a small quantity of alcohol, then add it to the remaining alcohol, followed by addition of the water. Development takes place by simply immersing the plate in the alcohol bath, and usually is complete in 3 minutes. The developed image is dried and is then ready for etching.

Negatives Without a Camera

Briefly, an ink impression is printed on the face (emulsion side) of the film in daylight; the film is developed to obtain proper background opacity; the protective ink impression is washed off with benzol or tetrachloride; and the film is immersed in hypo until the last vestige of the creamy silver image has been dissolved. To produce a direct positive, the film is placed in the hypo bath after making the impression. The ink is then removed and the image developed to suitable opacity. In the production of either negative or positive, the film is washed well before drying. Either of the following developers can be used:

Formula No. 1

Sodium Sulphide (Sat. sol.)	8 oz.
Water	8 oz.

No. 2

Water	128 oz.
Hydroquinone	3 oz.
Sodium Sulphite	8 oz.
Sodium Carbonate	8 oz.
Potassium Bromide	240 gr.
Sulphuric Acid	40 min.

It is obvious that the original impression must be sharp and clear without rendering the image ragged through over-inking the form. This is a common cause of failure, due to over-zealousness on the proofer's part.

It is far better to use a normal flow of good stiff letterpress black or litho-transfer ink to which some *red lead* has been added. The negative or positive can be no better than the original impression, so the operation must be done most carefully.

Photographs on Watch Dials

If transfer printing paper is not obtainable, take any glossy print which is, of course, in a perfectly dry condition, and coat the emulsion side lightly with an even covering of Canada balsam. As soon as this begins to be tacky but not too set, rub the print face down on the watch dial or other porcelain article to which it is to be transferred, being careful that no air-bells exist. If the balsam oozes out at the edges, it can be removed later with a little turpentine. In a day or two the picture is virtually an integral part of the porcelain surface and the paper backing is wetted to saturation, when it may be gently peeled off by rubbing with the finger tip. It may be necessary to wet the paper several times before the operation is completed. Care is necessary not to run through the actual emulsion. When dry a thin coat of crystal varnish may be applied, but as watch dials are under glass this is not essential.

Transferring Designs

British Patent 485,260

A picture on paper is transferred to glass or other transparent support by coating with a solution of a transparent material adapted to adhere thereto, e.g., glycerol 4, gelatin 5 and water 100 parts, drying, hardening the layer by, e.g., formalin, applying a layer of glue, drying, hardening with formalin, coating the glass, etc., with glue and pressing the glue layer of the picture firmly thereon, drying and removing the paper by impregnating it with oil and rubbing it away, e.g., with water and powdered pumice stone. After being dried, the plate may be lacquered. The glue may consist of joiners' glue 12.5, glycerol 4 and water 100 parts.

Transferring Photos to Glass

Where it is desired to transfer photos to glass for display purposes the following process may be easily utilized and with a little practice should give excellent results. The simple glycerin using preparation required can be made up without difficulty.

Glycerin	¼ oz.
Gelatin	4 oz.
Water	8 oz.
Alcohol	3 oz.

Dissolve the gelatin in the water with gentle heat, add the glycerin and pour the mixture slowly, with thorough mixing into the alcohol.

Thoroughly cleaned glass and unmounted photos, without printing or writing on the backs, must be used. Flow the solution on the glass and place the photo, face down, on the glass and pour on more of the solution. Excess should be removed to prevent bubble formation. Allow to dry. The photograph, when it is dry, will be transparent and may be colored, if desired with oil paints.

Photographs on Glass, China, Etc.

The compounding of the emulsion and all the steps to the final fixing of the image must be conducted under a deep orange safe-light, the sensitivity of the coating being about that of gaslight paper. The black image may be toned to any color and with the same toning solutions as are specified for developing out papers.

All the vessels in which the emulsions are mixed and stored must be chemically clean. Chemically clean means more than physically clean. It is achieved by washing with sodium carbonate, scouring, abrasive powders or the sulphuric acid-bichromate solution, one or more or all.

Sensitizing Emulsion

a.	Water (Distilled)	5 oz.
	Ammonium Chloride	54 gr.
	Gelatin (Photographic)	2 oz.

Cut the gelatin into smaller pieces

and allow it to soak in the water for a few hours then place the container in a pot of hot water until it dissolves. Stirring constantly and add the chloride.

In a separate container dissolve the following:

b. Water (Distilled, Boiling)	4½	oz.
Silver Nitrate	126	gr.
Citric Acid	10	gr.

When completely dissolved add this to the *a* solution with constant stirring with a glass rod. Nothing metallic must be permitted to touch these compounds at any time.

To this mixture add with the same patient stirring 1 oz. of absolutely pure grain alcohol.

The resultant emulsion will set into a jelly of firm consistency in about 12 hours when it is to be placed in the center of a square of fairly strong cheesecloth which is then to be twisted as housewives press fruit masses for jelly. The emulsion will come through in wormlike strings or shreds and should be allowed to fall into an earthenware crock filled with cold water. Ice water is recommended. This water is to be changed at least eight times when it may be considered washed free of decomposed and deleterious salts. Three to five minutes in each change of water should be ample and the last of these should be of distilled water. The washed compound is then gathered in the center of a well-washed piece of cheesecloth gathered by the corners and ends to make a bag and is hung in a cool and dark place to drain for the better part of 1 hour. The shreds, which have retained their consistency throughout, are then preserved by placing them in a clean jar and 1 oz. of pure grain alcohol is poured over them.

When ready to use, the gelatin shreds are placed in an earthenware dish or bowl which is set in a pot of hot water until of a syrupy consistency when another ounce of pure grain alcohol is added and the mixture stirred to complete admixture.

In the now hot and fluid state the requisite quantity is poured over the porcelain or glass plate to be coated and by quickly tilting the same from side to side and every which way an even flow soon produces an even coating. Should too much have been poured the surplus may be drained into the original container from one corner of the plate.

The coated plate is now laid on a cold slab of marble or a thick sheet of glass, preferably one that has been chilled with ice or in the refrigerator and dried. When thoroughly dry such plates may be stored face to face just like negative plates.

To coat a small area, as on a watch-dial, a soft long-haired camel's hair brush may be used providing it be bound in rubber or quill.

Paper may be coated by floating, which is the dropping of the sheet upon the surface of a tray in which the emulsion is kept fluid by constant warming. The paper is held by two opposite corners, say the upper left and the lower right. It is slightly bent and the upper corner is allowed to snap down upon the emulsion by releasing it quickly. The lower corner is then dealt with similarly and, with rubber tongs holding an edge, the paper is slid backward and forward while resting on or floating upon the emulsion. This should suffice to break air-bells and streaks.

Remember that the emulsion is highly sensitive to actinic light and even more sensitive when dry.

Any reliable developer for gaslight papers will serve and the following is given merely as a formula that has been worked out for the particular constituency of the foregoing emulsion.

Metol	40 gr.
Hydroquinone	20 gr.
Water (Distilled and Hot)	30 oz.

When dissolved add 140 gr. of sodium sulphide (anhydrous) and when this is dissolved add sodium carbonate (anhydrous) 120 gr. When ready to use add 5–10 drops of a 10% solution of potassium bromide, the quantity being governed by the contrast desired. A flat negative will demand more, a plucky negative less.

The usual stop-bath or acid wash is advised and a short rinse in plain water, after which the fixing is done in the standard acid-hardener hypo bath.

A creamy-white sulphur precipitate may form in the fixer but this need not be feared. A very thorough washing in running water completes the job.

The printing speed should be that of normal, or medium speed gaslight paper and the distance from the printing light as well as its intensity will govern the contrast factor and render development easier.

Enlargements on Canvas

All operations must be performed in a perfectly safe light. The ordinary bromide safe-light will not do. It is necessary to use a ten-watt lamp behind a deep red glass and removed from the work in hand by at least 15 ft.

The fabric must be soaked overnight in Ivory soap suds, then be well washed in running water, finally be dried in the dark and when dry be sprinkled as for laundering and finally ironed by artificial light without too great a heat. It is not generally known that materials absorb light which later fogs sensitive emulsions coated upon them.

The so prepared cloth is now salted in the following solution.

Salting Solution

Distilled Water	25 oz.
Potassium Iodide	42 gr.
Potassium Bromide	126 gr.
Cadmium Bromide	42 gr.

Dissolve in the order given, being sure that each chemical is in perfect solution before adding the next. In this you are to soak the cloth for 20 minutes. Several layers may be salted at the same time if care be taken that each piece is saturated before laying the next on top of it and that all stay submerged for the entire period. They are then dried in a warm place free from dust and in the dark.

The actual sensitizing is accomplished with the following solution which must be placed in chemically clean trays which preferably should be glass, porcelain or rubber. Enameled trays when new and unchipped are safe but use makes such vessels subject to minute cracks and the slightest contact of the sensitizer with anything metallic will spoil all.

Sensitizing Solution

Distilled Water	14 oz.
Silver Nitrate	168 gr.
Citric Acid (Crystal)	42 gr.

Again dissolve in the order named and with the same precautions as to complete dissolving.

The tray is tilted so that the liquid is collected at the lower end, which for convenience of operation should be the farther from you. The cloth is laid on the bottom of the tray and with a gentle motion so as to flow the solution over the texture. If bubbles form, break them with a glass rod. In this operation allow about 4 minutes and then pick the cloth up by one corner and allow it to drain. Dry in the dark, being particularly careful as to light leaks and dust, as the emulsion is now as sensitive as bromide emulsions should be.

Warnings cannot be too often reiterated or emphasized as to the chemical cleanliness of every implement used.

The use of material prepared in the manner directed is exactly as for the enlarging papers of commerce. The developer to be recommended is that old friend but now quite neglected one, Pyro, and the formula is remarkably simple.

Developer

Distilled Water	50 oz.
Pyro	16 gr.
Citric Acid (Crystal)	88 gr.

Mix only as much and when ready to use. Development is very slow on account of the high acid content and the tone will be an intense red which may be pleasing to some. If so, fixing is to be done in the usual plain hypo bath, a 20% solution. If a purplish-brown tone is desired, the addition of 1 oz. of gold solution to the hypo will produce the result wanted. This gold solution is made by dissolving 15 gr. of gold chloride in 10 oz. of distilled water and 1 d. of the solution should tone 12 - 11x14 canvas pieces.

Amidol and other bromide developers may give blacks and amidol particularly, being without alakli, should serve well. It may be advisable to add 30 gr. of citric acid to each 50 oz. of any tried amidol solution. Finally, wash well and dry by hanging, not between blotters, as spots have been known to result. Mount on very heavy cardboard or on artist's stretchers.

Transferring Photographic Emulsions

1. Harden the gelatin layer in a bath of:

Chrome Alum	30 g.
Water	1150 cc.

for 10 minutes. If the negative has been fixed previously in an acid bath of chrome alum, wash thoroughly. Another hardening bath consists of:

Chrome Alum	0.05 g.
Water	100 cc.
Alcohol	400 cc.
Formaldehyde	500 cc.

2. Prepare separately two solutions:

(I)	Sodium Fluoride	30 g.
	Water	500 cc.

and

(II)	Citric Acid*	40 g.
	Water	500 cc.

Both solutions are mixed shortly before use in a vessel of hard rubber or synthetic resin, and the plate with the hardened photographic layer is put into the solution. When the layer begins to come off at the edges, pull it off carefully and transfer it into running, clean water.

3. The glass or cardboard to which the photographic layer is to be transferred is meanwhile cleaned and treated with a little gum arabic solution, or with a solution of:

White Gelatin	7 g.
Moldex (Preservative)	1.5 g.
Water	1000 cc.

and is quickly rinsed off afterwards. This leaves just enough adhesive matter to make the layer stick.

The photographic layer is now put on under water and spread carefully with a brush. Dampened paper is now put on top of it, and the layer is squeezed down with a strip of carton from the center towards the edges. Thereafter, the paper is carefully pulled off from the edges. After drying, the transferred layer may be lacquered over.

Photo Print Varnishes

Formula No. 1

Borax	30 gr.
Pale Shellac	60 gr.
Sodium Carbonate	10 gr.
Glycerin	30 min.
Water	1 oz.

Boil and allow to cool then add alcohol (absolute) 1 oz. Add about a mustard spoonful of whitening to precipitate the gum wax, shake well at intervals and allow several days for settling. Decant and filter the clear liquid and bottle.

No. 2

Gum Sandarac	1 oz.
Benzol	4 oz.
Acetone	4 oz.
Alcohol (Absolute)	2 oz.

Allow to stand with frequent agitation until dissolved then allow to settle for several days and decant the clear liquid.

No. 3

Gum Dammar	½ oz.
Ether	4 oz.
Benzol	4 oz.

Allow to stand with occasional agitation. After several days decant and filter.

All the above may be applied with a soft and fairly wide brush or may be gently wiped over the surface with a soft cotton swab. Once applied the coating must be allowed to dry without further contact of brush or swab, and in a room temperature away from dust.

No. 4

a.	Clear Celluloid	1 oz.
	Amyl Acetate	16 oz.

The celluloid must be free of gelatin or other coating and be cut into as small pieces as will tend to ready solution.

b.	Castor Oil	½ oz.
	Methyl Alcohol	4 oz.

Mix by frequent agitation until the admixture is complete and clear then add it to the *a* solution and again shake well. Bottle and keep well stoppered as the mixture is both volatile and inflammable.

To use pour into a glass or vitreous enameled (never a celluloid or composite rubberoid) tray, dip the print in bodily, count three, lift and drain it by one corner and when through with the number of prints to be treated pour the solution back into its container immediately as it evaporates in a short time.

No. 5

Poppy Oil	1 oz.
Copal Varnish	1 oz.
Turpentine	3 oz.

Apply with fine linen and allow to dry. Additional coats may be given in same way to obtain higher luster.

Photograph Film or Plate Varnish

Formula No. 1

Shellac	75 g.
Sandarac	75 g.
Castor Oil	2 cc.
Alcohol, Absolute	1 l.

No. 2

For color film.

Dammar	3 g.
Benzol or Carbon Tetrachloride	100 cc.

Photo Print Pastes or Waxes

The paste form of print enhancement and protection has merits and drawbacks and each worker must

---

* or 30 cc. of Sulfuric Acid.

choose which suits him and his methods. The following are formulated by eminent authorities and have served long and well in practice.

Formula No. 1

Beeswax, White	¼ oz.
Turpentine	¾ oz.

Place this in a jar which is to be, in turn, placed in a vessel of quite warm but not hot water. The heat should be sufficient to melt the wax. Excessive heat evaporates the turpentine. When completely dissolved and cooled add

Oil Lavender Flowers	¼ oz.

Stir well until a homogeneous emulsion is formed and keep in well-covered jar. Apply with a soft rag, being careful to make an even coating free from streaks. When dry and hard, polish with a clean cloth.

No. 2

Beeswax, White	1 oz.
Dammar Varnish (See Below)	200 min.
Oil Turpentine	1 oz.

Dammar Varnish

Gum Dammar	1 oz.
Oil Turpentine	2½ oz.

Dissolve with gentle heat in double boiler and bottle for use.

Lettering on Prints

For white letters on a dark ground simply write on the negative with a good grade of India Ink. For black letters on a white ground make an ink as follows and with a quill or gold pen write on the dense portion of the negative and through the bleached markings your letters will print black. The formula is: water 1 oz., potassium iodide 140 gr., iodine 15 gr., gum arabic 15 gr. After writing on the emulsion side of the negative wash the whole under the tap so that the chemicals may not act as a reducer. If the iodine stain persists immerse for a few seconds in a solution of 1 oz. of stronger ammonia to 100 oz. of water. Again wash well and allow the drying to proceed as for ordinary negative routine. Incidentally, if you do not wish to mar your negatives you may produce the same effects on each print by writing on the white portions of the picture with India Ink or on the black portion with the above etching fluid.

To Avoid Cockling of Photographic Papers

Thin papers are almost certain to cockle or flute at the edges and these wrinkles sometimes extend beyond an inch or more from the edges well into the image. Such papers should be dried by hanging on a line fastened by one corner. Evaporation from all over the area and from back as well as front, generally obviates the annoying fault of thin stock.

Black Print Paper

Oxalic Acid	5 gr.
Ferric Chloride	10 gr.
Water	3 oz.

Coat and dry in dark room—develop in water.

Blue Print Paper
White Lines

Stock A	
Iron and Ammonium Citrate	1 oz.
Water	4 oz.
Stock B	
Potassium Ferricyanide	1 oz.
Water	4 oz.

Coat with equal parts of A and B, dry in dark and develop in water—intensify with potassium ferricyanide.

Blue Print Paper
Blue Lines

Gum Arabic	385 gr.
Sodium Chloride	46 gr.
Tartaric Acid	62 gr.
Perchloride of Iron	123 gr.
Water	3½ oz.

Coat and dry in dark room. Develop in saturated solution of potassium ferricyanide. Fix in 5% solution of hydrochloric acid.

Silver Prints

Water, Warm	1 oz.
Gelatin	12 gr.
Ammonium Chloride	8 gr.

Coat and dry.

Apply following with absorbent cotton:

Silver Nitrate	60 gr.
Water	1 oz.

Dry in dark—expose—wash and develop in 1% acetic acid. Bleach with saturated mercuric chloride in alcohol.

Practical Motion Picture Screen Coating

A good projection screen suitable not only for showing moving pictures but also stills and color transparencies is of recognized value for display purposes, but the cost is sometimes prohibitive. A practical screen for such purposes, however, can be prepared with comparatively little expense by the use of either of the following glycerin-containing coating compositions applied on suitable fabrics:

Formula No. 1

Glycerin	1 lb.
White Glue	1 lb.
Zinc Oxide (Good Quality)	2 lb.
Hot Water	1 gal.

Apply while hot. The fabric should be stretched on a smooth surface during the coating and until dry. One gal. will cover a screen 10 ft. square.

No. 2

Stick Glue	½ lb.
Glycerin	½ lb.
Zinc Oxide	1 lb.
Hot Water	1 gal.

Melt the glue in the hot water, add the glycerin and thoroughly stir in the zinc oxide. Apply hot with a large brush to the stretched screen and let dry before removing from the stretcher. The screen may be rolled without breaking or cracking and gives very good detail.

Carbons for Intense Electric Arcs

British Patent 475,252

A carbon anode emitting light, approximating sunlight, has two or more carbon cores. The inner core consists of:

Carbon	38 oz.
Calcium Fluoride	32 oz.
Strontium Fluoride	20 oz.
Barium Fluoride	5 oz.
Chromium Fluoride	3 oz.
Copper	2 oz.

The outer core consists of:

Carbon	45 oz.
Rare-Earth Fluoride	30 oz.
Rare-Earth Oxides	10 oz.
Iron	15 oz.

Relative Speeds of Lens Apertures

The following table will be useful in computing exposures.

f. 1.5 requires 15% more expos. than f. 1.4
f. 1.8 requires 44% more expos. than f. 1.5
f. 2. requires 23% more expos. than f. 1.8
f. 2.3 requires 32% more expos. than f. 2.
f. 2.5 requires 18% more expos. than f. 2.3
f. 2.7 requires 16% more expos. than f. 2.5
f. 3.5 requires 70% more expos. than f. 2.7
f. 4.5 requires 70% more expos. than f. 3.5
f. 5.6 requires 55% more expos. than f. 4.5
f. 6.3 requires 27% more expos. than f. 5.6
f. 8. requires 61% more expos. than f. 6.3
f.11. requires 89% more expos. than f. 8.
f.16. requires 111% more expos. than f.11.
f.22. requires 80% more expos. than f.16.
f.32. requires 111% more expos. than f.22.

Chapter Sixteen

POLISHES

Metal Polish

Formula No. 1

An inexpensive liquid metal polish is made as follows: 2 parts of fatty acids from tallow or from hardened fat, 8 parts of talloil, 5 of petroleum and 5 of denatured alcohol are treated with 5 parts of ammonia, sp. gr. 0.91, for saponification of the fatty acids. To this are added 45 parts of water and then a mixture of 5 parts of bentonite and 25 parts of amorphous silica. This product is rather viscous and settles out only slowly.

No. 2

Hungarian Patent 120,708

To about 120 g. of finely powdered chalk are added 10 g. of crude oleic acid, 18 of ammonium oxalate, 5 of commercial ammonium carbonate, and 6 g. of soda ash.

No. 3

The following suggested formula gives a stable polish of low cost, free from the characteristic "sour" or "fishy" odor given by many polishes of this type.

Water	480.0 g.
Suspendite	15.0 g.
Ammonium Laurate S	40.0 g.
Silica	180.0 g.
Solvent Naphtha	13.6 g.
Ammonia 26°	22.4 g.

The suspendite is added to warm water with stirring until smooth. The ammonium laurate S is added with stirring and then the silica. Under rapid agitation this should take about 10–15 minutes. Then add the naphtha with continued stirring and finally the ammonia.

The consistency of the polish can be varied by varying the amounts of the different ingredients.

Liquid Metal Polishes

Formula No. 1

Red Oil	2.5 oz.
Ammonia (26° Bé.)	2.5 oz.
Ammonium Carbonate	1.0 oz.
Silica Dust	14.0 oz.
Tin Oxide	2.0 oz.
Colloidal Clay	6.5 oz.
Perfume and Color	0.5 oz.
Water	71.0 oz.

Here the colloidal clay is of more direct service as a suspending agent and detergent than a polishing material. The percentage of perfume and color is given empirically as 0.5, though it will naturally show variation in accordance with individual requirements.

No. 2

Kieselguhr	5.0 oz.
Silica Dust	4.0 oz.
Ferric Oxide	4.0 oz.
Naphtha	19.0 oz.
Kerosene	10.0 oz.
Red Oil	2.0 oz.
Triethanolamine	0.5 oz.
Ammonia (26° Bé.)	1.5 oz.
Water	54.0 oz.

In such a formula as this the oleic acid is first mixed with the kerosene and naphtha, the abrasives then being stirred in. Stirring is continued while the ammonia and triethanolamine solution is added. If desired, the proportion of water may be increased by about another 10%.

Paste Metal Polish

Dissolve 10 parts of hard soap in 50 of hot water, then incorporate 30 parts of fine silica and 8 of kieselguhr. Finally, stir in about 2 parts of pine oil and fill hot, just before the mass sets firm.

Wax Polish for Varnished Metals

Two types of waxing composition have been evolved, one suitable for application immediately after varnishing and containing 16% ceresin wax, 10% calcium stearate, 30% petroleum and 44% mineral cleaning oil, the other a wax cleaning composition and containing a mild abrasive, consisting of 33% abrasive powder, 3% calcium stearate, 7% ceresin wax, 2% iron oxide, 0.5% carbolic acid, 53% petroleum and 1.5% concentrated ammonia.

Silver Polish

Formula No. 1

Red Oil	4.5 oz.
Ammonia (26° Bé.)	2.7 oz.
Glycerin	5.0 oz.
Safrol	0.5 oz.
Kieselguhr, Fine	12.5 oz.
Colloidal Kaolin	1.0 oz.
Red Dye	*q.s.*
Potassium Carbonate	0.3 oz.
Water	63.5 oz.

The colloidal clay and kieselguhr should be intimately mixed together prior to being incorporated in the ammonium oleate, glycerin, etc., solution. Silver polishes are usually tinted pink —other permissible colors being green and yellow.

No. 2

Disperse by the aid of heat 8 parts of propylene stearate in 72 parts of water. To the dispersion is added 50 parts of infusorial earth 80 or 100 mesh and 1 lb. each of modified soda ash and trisodium phosphate.

Chromium Polish

Formula No. 1

Silica Dust	35 g.
Diglycol Oleate	17 g.
Water	48 cc.

No. 2

Silica Dust	17 g.
Water	48 cc.
Potassium Palmolate	35 g.

No. 3

Silica Dust	35 g.
Water	47 cc.
Red Oil Soap	18 g.

No. 4

Montan Wax, Doubly Bleached	5 kg.
Montan Wax, Crude	25 kg.
Chromium Oxide	70 kg.
Spindle Oil	to regulate consistency

Tin Plate Polish

U. S. Patent 2,073,427

Wheat Middlings	74 lb.
Rye Middlings	24 lb.
Diatomaceous Earth	1 lb.

Fine Instrument Scale Polish

To brighten up refractometer and polarimeter scales without injury to the metal was a problem until the following method was tried. After trying various polishes including kieselguhr, it was decided that the polish should be black so as to fill the division lines and thereby make them more visible. the desired effect was found to be given by rubbing with bone black or clarifying charcoal. A dry cloth with a little of the bone black on it is rubbed on the scale until a bright polish is produced. The divisions then stand out clearly and are easily read. The great advantage is that the fine lines are not worn away and no corrosive material is left to cause discolorations.

Polishing by Barrel Tumbling

In a dry barrel operation, wood pegs of an appropriate size or mixture of sizes are used in the general proportion of 3 parts of pegs to 1 part of the plastic parts to be cut down. Prior to placing the parts in the barrel it is customary to add about 1 quart of light paraffin oil, and when the surface of the pegs is all covered by a film of oil, dust in from 1–2 quarts of FFF pumice or diatomaceous earth of similar mesh size. No operating time cycle is suggested for this is always dependent on the character of the finish desired, but in this operation, cycles of from 5–10 hours are not unusual.

When the desired surface condition is obtained, and this should be a soft matte semi polish, the abrasive material is cleaned from the surface with an oil impregnated sawdust using about 1 quart of oil to each 6 quarts of fairly coarse sawdust. While kerosene oil is widely used in this operation, we do not subscribe to its use because the parts should be washed in a very mild alkaline solution, and kerosene is not readily saponifiable and far more difficult to remove than would be a very light vegetable oil, and absolute cleanliness is important to parts coming up for the final polishing operation.

As an alternative to the operation immediately above described, an operation quite widely applied to metal parts is also used wherein sawdust is utilized as the medium for carrying a greasy binding material to hold the abrasive. As in the preceding operation, 3 parts of wood pegs to 1 part of plastic parts is the customary proportion. To each 3 parts of pegs, 1 quart of grease impregnated sawdust should be used to which is added about 1 pound of precipitated chalk (whiting) or a material known as

Celite, a form of diatomaceous earth of 325 mesh size. If this is exhausted before the desired surface finish is obtained, it would be advisable to add an additional charge of the chalk or Celite. Operating time may vary from 2–12 hours, but must be continued until a finish is obtained that will be satisfactory for receiving the final or wax polishing operation.

One prominent plastics manufacturer recommends the following formula for preparing grease impregnated sawdust:

Coarse Hardwood Sawdust	100 lb.
Precipitated Chalk (325)	25 lb.
Twice Ground Tripoli	5 lb.
Rendered Beef Tallow	20 lb.
Flushing Oil	2 qt.

This composition may be prepared by placing the sawdust in the barrel in which the operation is to be performed and melting the tallow and adding the flushing oil. This solution should then be poured over the sawdust and operated in the barrel until the sawdust is fully covered. The tripoli and chalk may then be dusted in and the barrel again operated until a thorough mixture is obtained, after which the treated sawdust may be added for the cutting down or smoothing operation as above described. This material should be kept stored in covered metal containers.

For the final waxing or polishing operations there are many formulas of wax compositions, but in the main, commercial bees wax and Carnauba wax are widely used. Some typical formulas are as follows:

Beeswax	½ lb.
Carnauba Wax	1½ lb.
Turpentine	1 gal.

Shave the wax into chips, place in a suitable container and add the turpentine and dissolve, or

Stearic Acid	4 oz.
Carnauba Wax	8 oz.
Turpentine	1 gal.

Dissolve same as above, or

Stearic Acid	4 oz.
Spermaceti	4 oz.
Paraffin Wax	4 oz.
Carnauba Wax	4 oz.
Flushing Oil	4 oz.
Beeswax	2 oz.
Turpentine	1 gal.

In using any wax preparation, new pegs should be used. For 1 bushel of average pegs (approximately 24 pounds in weight) melt 4 to 6 ounces of wax solution over a water bath until it is thin enough to pour. The pegs should be placed in the barrel after which the melted wax can be poured over the surface and the barrel operated until the pegs are thoroughly covered. The pegs, when properly coated, will have a "tacky" feel and the plastic parts are then added to the mass and operated until the final polish is obtained. When the wax coating is exhausted either by being absorbed by the wood pegs or by a deposit on the surface of the plastic parts, the pegs will have a glossy appearance and a smooth feel to the touch. When in this state the pegs are no longer effective. When the pegs reach this condition, the plastic parts should be removed from the mass. Two to 4 ounces of additional melted wax should then be poured on the pegs for renewal of their wax surface after which the parts may again be placed in the barrel and operated as before.

As a rule, barrels for plastics polishing are made eight sided, with four panels that may be removed and replaced with screen panels.

Barrel Tumbling Material

U. S. Patent 2,185,262

The material consists of hard bony pellets, such as vegetable ivory, absorptive fibrous fragments and an abrasive material and lubricating and adhesive vehicles.

Proportions used are:

Metal Articles	25%
Dry Mixtures of Vegetable Ivory Chips, Abrasive and Lubricant and Adhesive	75%

Example:

Metal Articles to be Tumbled	25%
Abrasive Compound	10%
Hard, Bony Pellets Such As Vegetable Ivory Chips, Bone Chips, Synthetic Resin Chips or Hard Tree Root Chips	65%

The abrasive compound consists of 42% absorptive fibrous fragments such as hard wood, granulated sawdust, wood chips or leather fragments, 10% kerosene or equivalent light thin mineral oil, 20% abrasive such as 320–400 mesh pumice, emery or carborundum and 28% abrasive material and lubricating and adhesive vehicles.

The last item consists of 19% hard fine abrasive such as pumice, emery or carborundum, 47% kerosene or equivalent light mineral oil, 23% adhesive such as tallow, degras, red oil, stearic acid, etc., 11% petrolatum or other heavy mineral oil.

Stove Polishes

Since stove pipes, oven doors and other parts not exposed to direct heat are sold today with a glossy coating of baked enamel, the products described comprise only those applied to metal parts which are exposed to the flame and which, when not in use, corrode rapidly.

Sodium Silicate Solutions

Unlike other items, which fall under the general classification of polishes, these are designed or formulated to deposit eventually an opaque, heat-resistant solid in the form of a film. Graphite has properties which adapt it to this purpose, and the high polishing forms could be applied with a fibrous applicator to degreased stove parts. This has not been attempted, probably because the fluffy nature of graphite would cause it to distribute through the surrounding air and onto many parts where it is not desired. For some industrial uses, where it is mixed and used at once, graphite is stirred into viscous sodium silicate solutions and applied with due precautions for the strong alkaline nature of the product. Recently sodium silicate solutions, with graphite dispersed therein, have become available for this purpose. These can be shipped in tin lined cans.

However, graphite is usually dispersed in liquid, paste and semi-solid vehicles of an organic nature, which after application are burned off leaving behind the graphite interspersed with amorphous carbon from the vehicle.

Graphite possesses the peculiar property, not possessed by other finely divided solids, of adhering tenaciously to smooth surfaces upon which it is rubbed. This may be attributed to the shape and nature of the particles, which are plates of an oily nature and rubbing under pressure distributes and flattens them into a film. It is eventually burned off and lost by abrasion.

Artificial Graphite

Although some artificial graphite is available as a by-product from electric furnace operations, the majority of it is essentially a mineral, which is mined and refined to obtain the maximum carbon content, maximum percentage of flakes and smallest particle size.

The uninitiated is usually amazed at the enormous number of grades of graphite for sale by producers, ranging from five to seventy cents per pound. The specifications are carbon content and particle size with no data upon the ratio of flakes to amorphous carbon. However, those listed under high polish by reliable producers are usually the more expensive and should be chosen for satisfactory stove polishes.

The formula listed below contain rather high contents of binder which is burned off, but they are of a consistency which promotes ease of application and are what the public wants.

Liquid Form

Formula No. 1

Asphalt (By-Product)	**11.** oz.
Asphalt (Gilsonite)	**6.** oz.
Paraffin Wax	**10.** oz.
Naphtha (Varnoline)	**25.** oz.
Graphite	**20.** oz.
Carbon Tetrachloride	**25.** oz.
Nigrosine (Oil Soluble)	**3.** oz.

The natural asphalt is first crushed and heated until it can be stirred; then the by-product asphalt is poured in and heating continued until a homogeneous liquid results. The paraffin is then added, and after it has melted, the container is removed from the flame and the naphtha stirred in. When it is homogeneous the black liquid is passed through a screen to remove coarse minerals always present in gilsonite. In the meantime, the graphite and nigrosine are soaking in the carbon tetrachloride, and when both containers are at room temperature, the contents are mixed and are ready for packaging. In view of the fact that graphite forms aggregates or lumps in mixtures, where water is absent, it might settle to the bottom upon long standing and not be redispersed with vigorous shaking. However, the paraffins present in this mixture have a thickening effect and offset settling.

No. 2

Rosin	7. oz.
Montan Wax (Crude)	2. oz.
Naphtha (Varnoline)	2. oz.
Caustic Soda	1. oz.
Water	70. oz.
Nigrosine	3. oz.
Graphite	12. oz.
Lamp Black	3. oz.

It is obvious that this is an emulsion of montan wax and naphtha in water with a rosin soap as an emulsifier. The nigrosine, lamp black, graphite and a salt sodium will be deposited after heat is applied. It cannot be classed as fire-proof because naphtha and water are evaporating during and after application. It is one of the less expensive types which must be sold in glass containers, because its alkaline reaction would soon corrode tin lined iron cans.

The caustic soda is dissolved in ten parts of the water specified, and the rosin is passed through a sieve into this solution which should be kept at or near 100° F. The wax is melted over boiling water or by steam: the naphtha is added and heating continued until a liquid results. This can then be poured slowly into the warm soap solution with constant stirring.

The water soluble nigrosine, graphite and lamp black are stirred into the balance of the water, which is at 100° F., and when all lumps are broken up, the wax emulsion is added with vigorous agitation.

Paste Form

Formula No. 1

Bone Black	24. oz.
Graphite	24. oz.
Ferrous Sulphate	6. oz.
Water	46. oz.

This is one of the oldest types of iron polish and is based upon the principle, that the acid present from the hydrolysis of the ferrous sulphate will etch a smooth iron surface sufficiently to produce a rough surface, upon which the black pigments will adhere very firmly. Being in paste form, more water may be added from time to time to make it more workable, and after heat is applied to the polished part, water and decomposition products of sulphuric acid are evolved. This cannot be packaged in tin lined cans and is recommended only for industrial use, because oxides of sulphur in the home are injurious, but in industry good ventilation is usually provided.

No. 2

Paraffin Wax	10.
Candelilla Wax	10.
Graphite	20.
Naphtha (Varnoline)	59.
Lavender Oil	1.

The waxes are melted by hot water or steam and poured into the naphtha, which has been heated to the same temperature as the wax and in a similar manner.

The graphite and perfume oil are stirred into this and kept hot until a smooth slurry results, when heating can be stopped. When cooling has proceeded to the point where stirring is difficult, the mixture, still plastic, can be poured into tin cans to cool and set.

Stick Form

Formula No. 1

Ozokerite	30.
Beeswax	13.
Rosin	10.
Castor Oil	5.
Graphite	33.
Carbon Black	9.

The rosin and castor oil mixture is stirred over direct heat until a clear liquid results, which is poured into the waxes which have been melted by hot water or steam heat. The pigments are stirred in, heating is continued, and when a smooth cream results the heating is stopped and cooling allowed to proceed until viscous. Then it can be poured into cold molds of the hinge type. These sticks need only wrapping with a label, and the first cost to the producer is lessened.

No. 2

Resin (Gutta Percha)	14.
Rosin (Colophony)	14.
Graphite	22.
Lamp Black	14.
Castor Oil	7.
Naphtha (Varnoline)	29.

This is produced in a manner exactly similar to the one in stick form described in the previous paragraph.

In conclusion it may be well to add that this class of compounds has received no attention in the journals in the past thirty years, and it is clear that such a condition will not last long, because all that is needed are binders or vehicles which will volatilize and be effective in lower concen-

trations than the waxes and asphalts mentioned above. Naturally such vehicles, if chosen from the synthetic store-house, in which there is an abundance, must not have toxic effects in them or their decomposition products.

Stove Polishes

Formula No. 1

Paraffin Wax (40°–42° C.)	3.5 oz.
Ozokerite, Crude	2.0 oz.
Turpentine	40.0 oz.
Rosin (D to K Grades)	0.7 oz.
Lamp Black	4.0 oz.
Graphite	24.0 oz.
Ammonium Linoleate	4.0 oz.
Water	20.0 oz.
Nigrosine, Oil-Soluble	0.8 oz.
Potassium Carbonate	1.0 oz.

No. 2

A typical mixing for the waterless type of liquid grate polish is as follows: ceresin 8 parts, japan wax 6 parts, lamp black 6 parts, levigated graphite 8 parts, and turpentine, turpentine substitute, or mixed solvents 72 parts.

No. 3

On the other hand, a preparation based on a crude but satisfactory emulsion-suspension of graphite, etc., in water, free from any solvent whatsoever, may be devised on lines similar to the following:

Carnauba Wax	1.5 oz.
Self-Emulsifying Wax (Japsol)	2.0 oz.
Diglycol Stearate	2.0 oz.
China Clay (Colloidal)	4.0 oz.
Rosin	1.5 oz.
Potassium Carbonate	1.5 oz.
Graphite	18.0 oz.
Lamp Black	5.0 oz.
Nigrosine, Water-Soluble	1.0 oz.
Water	63.5 oz.

Several self-emulsifying waxes, suitable for inclusion in such a formula, are now commercially available. The diglycol stearate also helps to improve the suspension and homogeneity of the preparation, while the colloidal clay tends to prevent caking of the graphite and lamp black.

Two other formula for liquid stove blacks of this type are as follows:

No. 4

Mix 8 parts of ferrous sulphate with 5 of graphite and 3 of lamp black, adding sufficient water to give a creamy liquid.

No. 5

Make a paste of 2 parts of farina in 6 of water, add a sufficiency of preservative, then mix it with a solution of 8 parts ammonium linoleate in 58 parts of water. Then work 25 parts of a suitable mixture of graphite and bone black gradually into the dispersion.

No. 6

Cumarone Resin	2 kg.
Paraffin Wax, Soft	2 kg.
Montan Wax, Crude	5–6 kg.
Potash Carbonate	4 kg.
Water	200 kg.
Nigrosin Base BB	10 kg.
Lamp Black	24 kg.
Graphite	56 kg.

Dance Floor Polishes

The procedure for the following are one and the same; namely, melt the wax and add the resin at about 90°–100° C. Hold at that temperature until the mixture is homogeneous. These are all solid polishes.

Formula No. 1

Batavia Dammar	1 lb.
Carnauba Wax	1 lb.

No. 2

Batavia Dammar	1 lb.
Paraffin Wax	1 lb.

No. 3

Pale East India Resin	1 lb.
Carnauba Wax	1 lb.

No. 4

Pale East India Resin	1 lb.
Paraffin Wax	1 lb.

No. 5

Batu Bold Scraped	1 lb.
Carnauba Wax	1 lb.

No. 6

Batu Bold Scraped	1 lb.
Paraffin Wax	1 lb.

Bright Drying Floor Polishes

Formula No. 1

1. Prepare a Carnauba Wax Emulsion as follows:

Carnauba Wax No. 1 Yellow	30 lb.
Water	210 lb.
Trigamine	5 lb.
Oleic Acid	3.5 lb.
Caustic Soda	0.25 lb.

Melt the wax and oleic acid together in a boiling water bath until a homogeneous, clear liquid is obtained. Stir in the trigamine.

Dissolve the caustic soda in 25 parts of water. Heat it to boiling. Add this solution slowly and with stirring to

the above mixture still in the boiling water bath. A gel forms, at which time add the remainder of the water also pre-heated to boiling and also slowly and with stirring.

2. Prepare a Manila Gum solution as follows:

Manila DBB Gum	30 lb.
Water	158 lb.
Ammonium Hydroxide (28–29% NH_3)	12 lb.

Powder the resin and mix it with the water and ammonia. Agitate the mixture until the resin has dissolved. Strain the solution.

3. Prepare the finished polish as follows:

Manila Resin Solution (2)	39 lb.
Carnauba Wax Emulsion (1)	34 lb.

Mix the two well, using high speed stirring. The polish dries to a hard glossy, waterproof film.

No-Rub Floor Polishes

No. 2

1. Make a carnauba wax emulsion as follows:

Carnauba Wax No. 1 Yellow	30 lb.
Water	210 lb.
Triethanolamine	3 lb.
Oleic Acid	5 lb.

Melt the wax and the oleic acid in boiling water bath. When the mixture is homogeneous, add the triethanolamine and stir until it is all uniformly incorporated.

Heat the water to boiling and add it slowly, portion by portion, permitting each addition to be well agitated before the next addition. As the first additions of water are made, the mixture thickens considerably and becomes gel-like in consistency. As more water is added, the mixture becomes like a cream. When still more water is added, it breaks into an emulsion and then becomes a watery product. During the gel and cream stage, it is very important that the addition of water be made carefully and efficient agitation be used in order to obtain a thoroughly homogeneous mass. It is just as detrimental to add the water too slowly as too fast. Equally as important as efficient agitation and careful addition of water is the maintenance of high temperatures during the process.

2. Make a Manila resin solution as follows:

Manila DBB	30 lb.
Water	158 lb.
Ammonium Hydroxide (28–29% NH_3)	12 lb.

Powder the resin and agitate it with water and the ammonia until all the resin is dissolved. Strain the solution.

3. Prepare the finished polish as follows:

Carnauba Wax Emulsion	34 lb.
Manila DBB Solution	39 lb.

Mix the two well, using stirring. A glossy, waterproof polish is obtained.

No. 3

Carnauba Wax No. 1 Yellow	30 lb.
Thermally Processed Congo	30 lb.
Sodium Hydroxide	0.5 lb.
Water	420 lb.
Triethanolamine	4 lb.
Oleic Acid	9 lb.

Melt the wax and add the Congo at about 125°–150° C. Hold until the mixture is homogeneous. Put the mixture in a boiling water bath. Add the oleic acid slowly and with vigorous stirring. Do the same with the triethanolamine. Dissolve the sodium hydroxide in 25 parts of water. Heat the solution to its boiling point and add it slowly to the mixture still in the boiling water bath, using vigorous stirring. When the mixture is thoroughly homogeneous, add the remainder of the water (also at its boiling point, and also with vigorous stirring).

This polish dries quickly to a hard, glossy, waterproof film. It is especially valuable for polishing floors.

Natural Resin—Wax Polishes

Formula No. 1

Pale East India Gum	18 lb.
Paraffin Wax	8 lb.
Carnauba Wax	6 lb.
Turpentine	68 lb.

Melt the paraffin and carnauba, and sift in the Pale East India. Keep at 150° C. until the mixture is homogeneous. Add the turpentine. Allow to cool with occasional stirring.

This has a buttery consistency. Apply a small amount on a clean rag and rub until dry. A quick-drying hard, glossy film results.

No. 2

Pale East India Gum	18 lb.
Carnauba Wax	15 lb.
Paraffin Wax	17 lb.
V. M. & P. Naphtha	70 lb.

Melt the paraffin and carnauba and sift in the Pale East India. Keep at 150° C. until the mixture is homogeneous. Add the V. M. & P. naphtha and allow to cool, stirring occasionally.

This compound has a greater consistency than the preceding polish. By applying with a clean rag and rubbing until dry, a quick drying, hard, glossy film results.

No. 3

Pale East India Gum	23 lb.
Beeswax	6 lb.
Carnauba Wax	20 lb.
Montan Wax	8 lb.
V. M. & P. Naphtha	89 lb.
Turpentine	10 lb.
Pine Oil	3 lb.

Melt the waxes and sift in the resin. Keep at 150° C. until the mixture is homogeneous. Add the solvents and allow to cool, stirring occasionally.

This is a liquid at room temperature with pasty particles precipitated from it, but when applied with a clean rag it gives a quick drying, hard, glossy film.

No. 4

Pale East India Gum	18 lb.
Carnauba Wax	15 lb.
Paraffin Wax	17 lb.
Turpentine	35 lb.
V. M. & P. Naphtha	35 lb.

Melt the wax and sift in the resin. Keep the temperature at 150° C. until the mixture is homogeneous. Add the solvents and allow to cool, stirring occasionally.

This has about the same consistency as Formula No. 2. When applied with a clean rag, rubbing until dry, a quick-drying, hard, glossy film results.

Emulsified Floor Waxes

A stable emulsified floor wax can be obtained with 40% of a mixture of 1 part of beeswax, 1 part of paraffin, 1% of soap, 0.33% of soda ash, and 2.6–2.7% of methyl cellulose. The soap and soda ash are dissolved in boiling water, and an aqueous 5% solution of methyl cellulose added. This is warmed and the melted wax added. The product is then stirred while cooling to give a good emulsion.

A wax which spreads well and is very resistant to wear is prepared according to the following formula: 63 parts of a 5% aqueous solution of methyl cellulose are mixed into 1 part of potassium carbonate and 3 parts of soap dissolved in 37 parts of boiling water. The mixture is cooled to 70° C. and 100 parts of a melted mixture containing 1 part of beeswax, 1 part of paraffin and 8 parts of ceresine added. Heating is continued for a half hour, the mixture is stirred well, the amount of water which has evaporated is replaced, and 96 parts of white spirit or turpentine substitute are gradually added. The whole is stirred until cool.

Liquid Floor Wax

Heavy Panoline Oil	165.0 g.
Mineral Seal Oil	75.0 g.
Paraffin Wax	13.5 g.
Carnauba Wax	1.5 g.
Varnolene	24.0 g.

Paste Floor Wax

Carnauba Wax	30 g.
Beeswax	15 g.
Ceresin Wax	15 g.
Paraffin Wax	120 g.
Varnolene	340 g.

Solvent Floor Polish

Ozokerite	2.5 oz.
Paraffin Wax	25.0 oz.
Rezo Wax B	8.5 oz.
Turpentine	35.0 oz.
Mineral Spirits	35.0 oz.

Melt waxes on water bath and then add solvents slowly while stirring. Fill into containers and allow to stand undisturbed until gelled.

Wax Polishes for Wood

Formula No. 1

Montan Wax, Bleached	70 kg.
Soft Ozokerite	10 kg.
Paraffin Wax (50–52° C.)	20 kg.

No. 2

Paraffin Wax (50–52° C.)	80 kg.
Ozokerite	20 kg.

No. 3

Montan Wax, Crude	50 kg.
Ozokerite, Soft	20 kg.
Paraffin Wax (50–52° C.)	30 kg.

Wax-Water Polishes for Wood

Formula No. 1

a. Montan Wax, Double Bleached	4 kg.
Beeswax	5 kg.
b. Soft (Potash) Soap	1 kg.
Potassium Carbonate	3 kg.
Water	82 kg.
c. Ammonia (0.910)	5 kg.

Melt *a*, boil up with *b*, and stir until a smooth emulsion has formed. Cool. Add *c*.

No. 2

Crude Montan Wax	5 kg.
Beeswax	4 kg.
Soft Soap	1 kg.
Potassium Carbonate	3 kg.
Water	87 kg.

Boil all ingredients together until a smooth emulsion has formed. Stir cold.

Furniture Emulsion Polish

Formula No. 1

Spindle Oil	40 g.
Perilla Oil	20 g.
Trigamine Stearate	30 g.
Denatured Alcohol	10 cc.
Varnolene	120 cc.
Water	120 cc.
Borax	2 g.
Lemenone	5 cc.

No. 2

Blendene	20
Spindle Oil	40
Perilla Oil	20
Varnolene	40
Water	120
Borax	2

Auto Polish

Formula No. 1

A good liquid car polish can be made from:

Naphtha	2½ pt.
Mineral Oil	2½ pt.
Diglycol Laurate	4 pt.
Ammonia	1 oz.
Water	1 pt.
Glycerin	1 pt.
Formaldehyde	8 oz.
Fuller's Earth	9 oz.
Bentonite	6 oz.

Mix the oils together, add the abrasive powders and then the water, glycerin and formaldehyde. Mix rapidly until a smooth product results.

No. 2

Ceresin	6 kg.
Paraffin Wax, Hard	10 kg.
Montan Wax, Doubly Bleached, A.	12 kg.
Turpentine or Substitute	72 kg.

Water Resistant Wax Polish

Rosin	454.0 oz.
Oiticica Oil	760.0 oz.
Soybean Oil	18.0 oz.
Oiricuri Wax	4.5 oz.
Kerosene (62°)	152.0 oz.
Naphtha (54°)	182.4 oz.
Liquid Drier	1.5 oz.

Heat rosin and oiticica oil to 300° C. and remove from heat. Add soybean oil with good mixing. When temperature has fallen to 290° C. add the wax and stir well. Add the kerosene in portions while stirring until temperature has fallen to 165° C. Then add naphtha slowly with stirring and then the drier.

Wax for Polishes

French Patent 837,418

A wax composition comprises candelilla wax 20–95%, gum lac wax 5–50, lignite wax 0.5–10, stearic acid, 1–50, zinc stearate 0.05–20%, together with other ingredients if desired. The composition is emulsifiable and may serve as the basis of metal polishes, stove polishes, pastes and liquids, varnishes, abrasive soaps, creams, polishing waxes, or liquid waxes. For making metal polishes the composition is emulsified in white spirit (turpentine substitute) containing ammonia or an amine, and abrasives are then added.

Plastic Polish

Formula No. 1

Stearic Acid	16.5 kg.
Lauryl Sulphonate	1.5 kg.
French Chalk	11.0 kg.
Tripoli	11.0 kg.

No. 2

Stearic Acid	8 kg.
Montan Wax	2 kg.
Lauryl Sulphonate	2 kg.
Iron Oxide	38 kg.

Polishing for Synthetic Resin Plastics

U. S. Patent 2,143,888

Sodium Hypochlorite	4 oz.
Caustic Soda	0.3–1 oz.
Water to make	100 oz.

Polish for Cord

Paraffin Wax (50–52° C.)	10 lb.
Japan Wax	5 lb.
Caustic Potash	2 lb.
Water	to desired consistency

Boil together until saponified.

Paste Polish

Formula No. 1

Paraffin Wax	15 g.
Candelilla Wax	3 g.
Ester Gum	2 g.
Acrawax B	10 g.
Varnolene	70 cc.

Melt the solids together on a water bath until dissolved and then work in the varnolene.

No. 2

Glyceryl Abietate	10 g.
Paraffin Wax	20 g.
Candelilla Wax	3 g.
Acrawax B	10 g.
Varnolene	80 cc.

Carnauba Wax Resin Emulsion Polishes

	Formula No. 1	No. 2	No. 3	No. 4	No. 5	No. 6	No. 7	No. 8	No. 9	No. 10
Carnauba Wax No. 1	45	45	30	30	30	33.5	47	47	30	30
Gum Dammar A	15	15	30	30	30	26.5	13	13	..	..
Manila Gum DBB	5	5	..	..	..	..	..	..	..	..
Caustic Soda	1	1.5	0.9	2	2	1.5	0.6	0.6	1	0.5
Water	420	420	422	422	422	420	420	420	420	420
Triethanolamine	4	4	..	..	..	2	4	4	4	4
Trigamine	..	..	9.9	9.5	19	..	..	..	..	..
Oleic Acid	9	9	7	7	14	4	..	9	9	9
Stearic Acid	..	..	..	..	..	..	9	..	..	..
"Run" Boea (Hard Bold Amber)	..	..	..	..	..	..	..	..	30	..
"Run" Congo	..	..	..	..	..	..	..	..	..	..
	Film-Dull Slight Rubbing Gives Good Gloss	Film Same as No. 1	Film Same as No. 1	Film Same as No. 1	Film Same as No. 1	Film Glossy	Film Glossy	Film Glossy	Film Glossy	Film Glossy

The procedure used is to melt the wax and to incorporate in it the natural resin (at temperatures of 100°–150° C.). This mixture is permitted to solidify and then used as needed in making the polish. For this purpose, the resin-wax mixture is melted in a boiling water bath. The emulsifier is added, the oleic acid being first incorporated, followed by the triethanolamine or trigamine. The sodium hydroxide is dissolved in 25 parts of the water, the solution heated, and added at its boiling point. This sometimes causes a gel to form, which is the signal to add the remainder of the water at its boiling point. If a gel does not form, addition of the water is withheld for a few minutes to permit thorough mixing of all constituents. Nos. 1 and 2 are made slightly differently in that the Manila resin is dissolved in the sodium hydroxide solution mentioned above and not in the wax.

Results obtained from water resistance tests indicate that these polishes all have good water resistant properties. Water spot tests were run on them by placing on each panel two drops of water. At the end of 15 minutes and 30 minutes, these spots were taken off with blotting paper. It was found that none of the films had been attacked. Each panel was also wiped off with a wet rag and dried with a different one. In every case no loss of gloss was observed, also no softening of the film was noted, all remaining of the same order of hardness.

White Shoe Cleaners

Formula No. 1

Ti-Bar HH (Titanium Dioxide Pigment)	240 lb.
Batavia Dammar A/E	20 lb.
Solvesso No. 2	110 lb.
Triethanolamine Stearate	10 lb.
Water	100 lb.

Dissolve the dammar in the solvesso No. 2. Filter out insoluble matter.

Dissolve the triethanolamine in hot water, using high speed agitation. Add the Ti-Bar slowly and in portions to this solution, continuing high speed agitation. When a smooth paste is obtained, add the dammar solution slowly with high speed agitation. At the beginning of the addition of the dammar solution, the pigment drops out and shows a reluctance to mix, but on further addition of dammar solution, a smooth, thin paste will result.

No. 2

Titanium Doxide	5 lb.
Lithopone	15 lb.
Dammar	4 lb.
Carbon Tetrachloride	10 lb.
Petroleum Naphtha	13 lb.
Triethanolamine Stearate	2 lb.
Water	51 lb.

Dammar resin is dissolved in the petroleum naphtha and the solution is strained to remove undissolved matter. The triethanolamine stearate is dissolved in warm water. After cooling, the resin solution is stirred into the water solution, using vigorous agitation because an emulsion is being made and additions must be slow. When the emulsion is smooth, the carbon tetrachloride is stirred in followed by the pigments.

White Shoe Polishes

Formula No. 1

Titanium Dioxide	1 lb.
Lithopone	8 lb.
Water	3 gal.
Glue	½ lb.
Ivory Soap Chips	1¼ oz.
Dowicide A.	½ oz.

Perfume with Benzaldehyde

Dissolve soap chips in water, add glue and dissolve. Add perfume and preservative (Dowicide). Add pigments and mix thoroughly. Agitate while bottling.

No. 2

A cream of high covering power which is easy to spread and which can be packed in tubes is obtained by mixing 470 g. of heavy calcium carbonate with 270 g. of water, then adding 260 g. of a solution containing 20 g. of high viscosity methyl cellulose in 240 g. of water.

No. 3

Another cream is prepared by mixing 50 parts of a 5% solution of methyl cellulose with 9 parts of water, 1 part of Turkey red oil, 24 parts of precipitated chalk, 8 parts of zinc white, and 8 parts of titanium white. The materials are ground together to give a homogeneous paste and may be sieved if desired.

No. 4

A wax which spreads well and is very resistant to wear is prepared according to the following formula: 63 parts of a 5% aqueous solution of methyl cellulose are mixed into 1 part of potassium carbonate and 3 parts of soap dissolved in 37 parts of boiling water. The mixture is cooled to 70° C. and 100 parts of a melted mixture containing 1 part of beeswax, 1 part of paraffin, and 8 parts of ceresine added. Heating is continued for half an hour, the mixture is stirred well, the amount of water which has evaporated is replaced, and 96 parts of white spirit or turpentine substitute are gradually added. The whole is stirred until cool.

Shoe Creams

Formula No. 1

Montan Wax, Crude	15 lb.
Paraffin Wax, Soft	20 lb.
Rosin	4–6 lb.
Potassium Carbonate	3 lb.
Water	95 lb.
Oil Soluble Color { Mandarin Yellow Metanil Yellow }	1 lb. each

No. 2

Montan Wax, Doubly Bleached	15 lb.
Paraffin Wax, Soft	20 lb.
Rosin	4- 6 lb.
Potassium Carbonate	3 lb.
Water	95 lb.
Oil Soluble Color { Mandarin Yellow Metanil Yellow }	0.1 lb. each

No. 3

Montan Wax, Crude	10 lb.
Montan Wax, Doubly Bleached	4 lb.
Rosin	3 lb.
Potassium Carbonate	2.5 lb.
Hard Soap	0.5 lb.
Borax	0.5 lb.
Water	100 lb.
Nigrosin, Water Soluble	2 lb.

White Shoe Cleaning Paste

Lithopone	44 oz.
Dextrin	6 oz.
Borax	1 oz.
Water	47 oz.
Candelilla Wax	2 oz.

Borax is added to warm water and the wax is added and stirred until it is melted and dispersed, whereupon the dextrin can be added. It is allowed to cool and any water lost by evaporation must be replaced before adding the pigments. After grinding and adding a blue dye and preservatives it is pressed into tubes.

Black Shoe Polish with a Lasting Shine

Carnauba Wax	2 g.
Paraffin Wax	4 g.
Ceresin Wax	2 g.
Beeswax	2 g.
Glycoride	4 g.
Silica Black	3 g.
Water	17 g.
Turpentine	6 g.
Glucarine B	5 g.

Melt the first five ingredients together. Then stir in the silica black and add the water while heating and stirring until homogeneous. Remove from the flame, let cool a little and stir in the turpentine and Glucarine B, and continue stirring till mass thickens to the proper consistency.

Paste Shoe Polish

Acrawax B	10
Ester Gum	5
Paraffin Wax	20
Candelilla Wax	3
Varnolene	80

CHAPTER SEVENTEEN

PYROTECHNICS AND EXPLOSIVES

Pyrotechnic Compositions

Outdoor Red Fire

Linden Charcoal	300 g.
Black Antimony Sulphide, Crude	650 g.
Potassium Chlorate, Powdered	1000 g.
Sulphur, Powdered	1600 g.
Strontium Nitrate, Powdered	6450 g.

Outdoor Green Fire

Black Antimony Sulphide, Crude	250 g.
Sulphur, Powdered	1650 g.
Potassium Chlorate, Powdered	1500 g.
Barium Nitrate, Powdered	6600 g.

Outdoor Blue Fire

Copper Carbonate	1.5 kg.
Sulphur, Powdered	2 kg.
Potassium Chlorate, Powdered	4 kg.
Potassium Nitrate	2.5 kg.

All raw materials must be finely powdered and perfectly dry.

Mix with a wooden spatula or a cardboard without exerting any pressure or friction!

Pink Smoke Composition

U. S. Patent 2,091,977

Formula No. 1

Calcium Silicide	4 kg.
Potassium Iodate	6 kg.
Potassium Chromate	1 kg.

No. 2

Magnesium	5 kg.
Calcium Iodate	13 kg.
Potassium Chlorate	2 kg.

Pyrotechnic Flare

U. S. Patent 2,149,314

Barium Nitrate	36–40 kg.
Strontium Nitrate	6– 8 kg.
Magnesium, Powdered (Coated with Linseed Oil)	50–54 kg.
Linseed Oil	½– 2 kg.
Castor Oil	½– 2 kg.

Signal Torch (Flare)

U. S. Patent 2,073,530

Strontium Nitrate	45 lb.
Lacquer	4 lb.
Potassium Chlorate	7 lb.
Sulphur	6 lb.
Potassium Nitrate	2 lb.
Sawdust	2 lb.
Petrolatum	2 lb.
Strontium Carbonate	2 lb.
Paraffin Wax	7 lb.

Bomb and Military Shell Explosive

U. S. Patent 2,202,851

Picric Acid	85–90 lb.
Mono-Nitro Naphthalene	10–15 lb.

Mine Explosive

U. S. Patent 2,167,849

Sugar	24 lb.
Potassium Nitrate	33 lb.

Dissolve in minimum amount of hot water and mix with

Coal, Powdered	10 lb.
Potassium Chlorate	33 lb.

When mass begins to harden pass through a graining screen and dry carefully.

Blasting Explosive

U. S. Patent 2,069,612

Ammonium Nitrate (40–60 mesh)	88 g.
Ground Coal	7 g.
Nitroglycerin	5 g.

Use in cartridges.

Explosive Primer

U. S. Patent 2,124,568

Lead Dinitroresorcinate	75 g.
Black Powder	25 g.

U. S. Patent 2,124,569

Lead Dinitroresorcinate	75 g.
Tetracene	25 g.

Cartridge Primer

French Patent 839,039

Mercury Fulminate	35–40 g.
Potassium Nitrate	25–35 g.
Antimony Sulphide	15–25 g.
Calcium Silicide	1– 4 g.
Barium Peroxide	5–15 g.

Ammunition Primer

U. S. Patent 2,099,293

Tellurium Styphnate	20 g.
Mercury Fulminate	20 g.
Antimony Trisulphide	9 g.
Calcium Silicide	7 g.
Lead Peroxide	7 g.
Barium Nitrate	37 g.

Percussion Cap Charge

British Patent 483,994

Formula No. 1

Mercuric Fulminate	6 g.
Antimony Sulphide	4 g.
Potassium Chlorate	6 g.

No. 2

Lead Styphnate	26 g.
Barium Nitrate	45 g.
Antimony Sulphide	7 g.
Calcium Silicide	14 g.
Tetrazene	4 g.

No. 3

Mercuric Fulminate	19 g.
Antimony Sulphide	43 g.
Potassium Chlorate	2 g.
Black Powder, Mealed	2.4 g.
Sulphur	2.4 g.

Restoring Stability of Deteriorated Smokeless Powder

U. S. Patent 2,151,494

The process of restoring the chemical stability of nitrocellulose smokeless powder grains of the Pyro type which have undergone deterioration during storage comprises subdividing the powder grains under water to a fineness such that they will pass through an 8 mesh screen and be retained on a 200 mesh screen, removing excess water therefrom and then treating grains under pressure with ethyl alcohol.

Fire Lighter

British Patent 504,911

Naphthalene	17–25 oz.
Fuel Oil	5–13 oz.
Coal (Powdered) to make	100 oz.

Match Igniting Composition

British Patent 479,573

Potassium Chlorate	6 lb.
Sodium Dichromate	2 lb.
Sand	1 lb.
Dextrin	1 lb.

Friction Lighting Cigarette Tip

U. S. Patent 2,130,115

Formula No. 1

Potassium Chlorate	11½ oz.
Gum Acacia	2 oz.
Starch	2 oz.
Manganese Dioxide	1½ oz.
Silica	1½ oz.
Carbon	7 oz.

No. 2

Gum Arabic	5.7 kg.
Hide Glue	5 kg.
Potassium Dichromate	3.5 kg.
Sulphur	1.3 kg.
Zinc Oxide	3.5 kg.
Diatomaceous Earth	10 kg.
Potassium Chlorate	33.6 kg.
Water	40 kg.

Grind the gum and the glue into a powder, mix them well with the water and let stand for a few hours. Stir the potassium dichromate into this and then slowly grind the sulphur, zinc oxide and kieselguhr into the same. When the mixture is evenly dispersed, add the potassium chlorate which must also be ground in.

Tip each cigarette with the above paste. To light, strike on the side of any safety match box.

CHAPTER EIGHTEEN

RUBBER, RESINS, PLASTICS, WAXES

Rubber

Cellular Hard Rubber

If sufficient sulphur is contained in a latex foam mix, cellular hard rubber can be obtained on vulcanization. Approximately 50% of sulphur on the rubber is used in the mix, which is cured after frothing, gelling and drying. Light-weight slabs having great strength are made in this way.

A suitable formula for cellular hard rubber is shown below.

Rubber (From 60% Centrifuged Latex)	100 g.
Sulphur	50 g.
Accelerator 833	2 g.

Cure: 2½ hours at 287° F.

The amount of sulphur and time of cure will be determined by the hardness desired in the finished product.

Microporous Rubber

Microporous rubber can be made from latex by forming gels and vulcanizing them without drying under conditions that prevent the escape of the water present. For this work the gelling agents commonly used are salts of magnesium or the alkaline earths. If the rate of gelation is too rapid, it may be delayed by adding casein.

In making microporous hard rubber, the latex gel is formed to shape in a mold and then vulcanized in an autoclave in saturated steam at a pressure of 80 lb. per sq. in. or in water under an atmosphere of steam at this pressure. Using a compound similar to that shown for cellular hard rubber, the time of cure under the conditions mentioned is approximately 30 minutes, depending on the hardness desired. The resulting vulcanizate has uniform sized pores averaging 0.4 microns in diameter. It has been calculated that a cubic centimeter of such hard rubber may contain as many as 500 million pores.

Lining Tanks with Rubber Latex

Compounded latex finds some use in lining tanks. It may be sprayed on and this is much easier than to do a good job of fitting sheet rubber tightly over difficult configurations. The compound should contain vulcanizing agents and may contain fillers that are not acted upon by the materials that are to be used in the tanks. A cement containing powdered aluminum and some resinous materials in the first sprayed layers improves the adhesion of the latex coating to the metal. The latex film may be bonded by the use of cement containing a rubber isomer.

Rubber (From Latex)	100.0 g.
Sulphur	1.5 g.
Zinc Oxide	2.0 g.
Latac	0.5 g.
Neozone D	1.0 g.

Dry films from this compound will be well cured in a week at room temperature or in 30 minutes at 212° F.

Preserving Surface of Rubber Goods

British Patent 489,103

Glycerin	85–95 lb.
Lemon Juice	5–15 lb.

Rub on surface of rubber.

Dental Rubber Cement

Para Rubber	1 kg.
Benzine (Gasoline)	40 kg.
Chloroform	50 kg.
Mastic Gum	12 kg.
Dammar Gum	4 kg.

Dissolve the rubber in the solvents. Add the gums and stir until they are completely dissolved.

Alkalinity of Reclaimed Rubber

Reclaimed rubber is prepared by several different processes, some using sodium hydroxide and some being carried out in a neutral medium. This results in a variation in the alkalinity of reclaimed rubber. In general, whole tire reclaims are made by the alkali process. Although the alkali is largely removed by washing, a definite alkaline reaction is usually found in this type of reclaimed rubber. Reclaims made from scraps which do not contain fabric are generally neutral in reaction. Tube reclaims are generally alkaline and considerable variation in the degree of alkalinity exists in this type of reclaim. The so-called acid process reclaims are usually neutral.

The residual alkali in a reclaim is not to be considered detrimental. On the contrary, advantage may be taken of the residual alkali to activate accelerators, speed up cure, and increase physical properties of compounds in which the reclaimed rubber is used. Although it is true that residual alkali in a reclaim increases the rate of cure of the compounds in which it is used, neutral reclaims also speed up the cure. Residual alkali in a reclaim is not harmful provided the amount present is uniformly controlled so that variation does not occur from lot to lot. An excellent method of checking this is the use of a test formula containing an accelerator which is activated by small amounts of sodium hydroxide. Any variation in the alkalinity of the reclaim should be reflected in the properties of the test compound.

Reclaimed Rubber Sponge Compound

Rubber (Smoked Sheets)	33.70	lb.
Reclaimed Rubber	20.00	lb.
Thionex	.07	lb.
Zinc Oxide	1.90	lb.
Whiting	25.03	lb.
Agerite Powder	.40	lb.
Soda Bicarbonate	4.10	lb.
Stearic Acid	2.10	lb.
Oleic Acid	2.10	lb.
Petrolatum	9.00	lb.
Sulphur	1.60	lb.

Cure: 30 minutes at 287° F.

Swell: 1–3½.

Mixing Procedure: The crude rubber in the above formula should be masticated 30 minutes on a mill, aged 24 hours, and masticated 30 minutes more before using.

Mixing Specification: Break down crude 15 minutes and reclaim and breakdown 15 minutes, add sulphur and mix 2 minutes, add soda, stearic and oleic acids and mix 2 minutes. Add pigments and petrolatum and mix 10 minutes. Sheet off 2 minutes. Total time of mixing 46 minutes.

The batch should be well soapstoned and stored in trays until ready for curing.

Perbunan Laboratory Tubing Compound

Perbunan	100.0	lb.
Diphenyl Phthalate	20.0	lb.
Zinc Oxide	5.0	lb.
Stearic Acid	2.0	lb.
Paraffin Wax	1.5	lb.
Sulphur	1.8	lb.
Soft Brown Factice	50.0	lb.
Semi-Reenforcing Gas Black (Gastex)	25.0	lb.
Semi-Reenforcing Carbon Black (for example P-33)	25.0	lb.
Benzo Thiazyl Disulphide (Altax)	1.5	lb.
Butyl Amine	.25	lb.

Cure: 45 minutes at 287° F.

Perbunan Printers Roll Compound Formula

Perbunan	100.0	lb.
Soft Brown Factice	20.0	lb.
Rosin Oil	10.0	lb.
Diphenyl Phthalate	10.0	lb.
Semi-Reenforcing Gas Black	25.0	lb.
Zinc Oxide	10.0	lb.
Sulphur	1.8	lb.
Benzo Thiazyl Disulphide (Altax)	1.5	lb.

Cure: 120 minutes at 275° F.

The usual mixing procedures for rubber compounds must be modified to a considerable extent in processing Perbunan synthetic rubber. This material does not "break down" in the same way that crude rubber does. It should be milled on a cold, tight mill using a small bank. One-half of the softeners should be added as soon as the rubber has knit to the roll. This is followed by adding sulphur, zinc oxide, anti-oxidant, and part of the carbon black. Next, add the rest of the softeners and follow with the rest of the carbon black. The batch should then be aged 24 hours and then placed on the mill and the accelerator added. The compound is improved if it is refined through tightly set rolls.

Rubber Flooring Composition

Crepe Rubber	100	lb.
China Clay	30	lb.
Lithopone	30	lb.
Paraffin Wax	2.5	lb.
Sulphur	2.5	lb.
Nonox N.S.	1	lb.
Woodflour*	160	lb.
Whiting	50	lb.
Zinc Oxide	10	lb.
Stearic Acid	2	lb.
Vulcatex Blue (B.S.)	4	lb.
Vulcafor F	1	lb.

Cure: 20–30 minutes at 141° C.

Experiments indicate that the white

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* White Softwood Fir, 200 mesh.

softwood fir of 200 mesh, which is fibrous and very white, is suitable for use in rubber flooring, and it is sufficiently fine to obviate the need for dyeing before use. Furthermore, it is not necessary to use fugitive colors. The woodflour does not cause darkening during vulcanization at 141° C., and higher temperatures might be used with safety.

Tire Tube Puncture Filler

British Patent 480,862

Water	72 oz.
Gum Tragacanth	2 oz.
Mica, Finely Divided	18 oz.
Cork, Finely Divided	5 oz.
Rubber, Powder	1 oz.
Formaldehyde	2 oz.

Latex Flooring Compositions

All mixtures contain { Aluminous Cement 100 lb.; 60% Latex 50 lb. }

	Compounding Ingredients			Condition of Mixture	Period Workable	Time to Set Hard	Final Product
1.	Saponin	1	lb.	Thick cream	4 hours	3–6 days	Soft and rubbery
	Gum Arabic	3	lb.				
	Water	25	lb.				
2.	Calcium Chloride	4	lb.	Stiff paste	1 hour	20 hours	Hard
	Casein	1	lb.				
	Sodium Silicate $(5H_2O)$	1	lb.				
	Water	40.5	lb.				
3.	Potassium Hydroxide	2	lb.	Cream, pourable	1½ hours	1–2 days	Very hard
	Gum Arabic	1	lb.				
	Sodium Silicate $(5H_2O)$	1.2	lb.				
	Water	25	lb.				
4.	Potassium Hydroxide	2	lb.	Very thin cream	1½ hours	24 hours	Very hard
	Saponin	0.25	lb.				
	Sodium Silicate $(5H_2O)$	1.2	lb.				
	Water	25	lb.				
5.	Calcium Hydroxide	2	lb.	Smooth thick cream, not pourable	¾ hour	3–5 days	Medium hardness
	Casein	3	lb.				
	Water	31	lb.				
6.	Calcium Hydroxide	10	lb.	Cream, pourable	1 hour	24 hours	Hard
	Sodium Silicate $(5H_2O)$	4	lb.				
	Casein	1	lb.				
	Water	29	lb.				
7.	Calcium Cyanamide	20	lb.	Thick cream	40 minutes	2–3 days	Hard
	Casein	2	lb.				
	Water	30	lb.				
8.	Calcium Cyanamide	10	lb.	Cream, pourable	20 minutes	1–3 days	Soft and rubbery
	Sodium Silicate $(5H_2O)$	1	lb.				
	Water	35	lb.				

These mixtures of cement and latex are to be considered as binders and are generally used with aggregate, such as cork, asbestos, shredded waste rubber, wood-chips, lino-cuttings, granite chippings, marble, and sand. It is found desirable to match the properties of the aggregate with those of the binder; thus a binder which sets hard should be used with marble or granite; whereas a flexible binder is to be preferred with cork or shredded rubber.

The color of the mixtures, which is naturally dull gray, may be adjusted by adding suitable pigments, but care must be taken that the colors used will withstand the action of alkalies, such as lime, or sodium silicate; "fast lime" colors have been found satisfactory.

The cement-latex mixtures so far described have been prepared with aluminous cement. Portland cement, which is cheaper and lighter in color and so permits of brighter tints, has also been used, but the products are not considered so good as those given by aluminous cement as they tend to be rather hard and cementitious or too soft and flexible.

For mixing cement-latex compositions a Werner-Pfleiderer machine has been found satisfactory. It is the common practice to add stabilizers, sulphur, zinc oxide, and liquid constituents to the latex, and to mix the cement, cement-set accelerators, vulcanization accelerators, and other dry materials together as a powder; the compounded latex and the cement powders are taken to the site where the mixture is to be used, the required portions of each weighed out and mixed in the machine, the cement powders being added gradually to the latex. Aggregate is generally added after the cement and latex are well mixed. The total time of mixing takes not more than a few minutes; about 30–40 lb. of material are mixed at a time. The composition is made with a rather low viscosity and if thickened by adding wood flour, etc., it is usually stable for ½–1 hour. In laying floors or covering vertical surfaces the material is best applied by a trowel, taking a small quantity at a time and gently putting it into place. A to-and-fro spreading motion as used for concrete is not recommended and should only be used for smoothing the surface; a wet trowel should not be used for finishing as this leads to surface crazing. For molding purposes a thinner mixture is used which can be poured into the forms.

Surface Finish

After setting, the surface may be left as troweled, in which case it is necessary to lay a mixture capable of a smooth finish by troweling—this is achieved by suitably grading the aggregate as in concrete practice. An alternative finish is to buff the surface with a sanding machine, which exposes the aggregate in cross-section and gives pleasing decorative effects. By using a fine abrasive tool a very smooth, almost polished, surface may be obtained. Further surface treatment such as waxing and polishing or varnishing is sometimes used and with certain aggregate is very effective. Thus a cork filled mixture yields an attractive surface when waxed and polished.

Latex Sponge

Rubber (from 60% Centrifuged Latex)	100 lb.
Sulphur	2.5 lb.
Zinc Oxide	3 lb.
Zenite	1 lb.
Latac	0.25 lb.
Neozone D	1 lb.

Cure: 45 minutes at 212° F.

A small amount of mineral oil (5.0% based on the rubber content of the latex) added in emulsion form will make a softer vulcanizate. This type of cellular rubber has intercommunicating pores.

Latex for Dipping, Pouring and Impregnating

British Patent 496,780

Sodium Hexametaphosphate	2 lb.
Glue	½ lb.
Colloidal Sulphur	10 lb.
Zinc Oxide	16 lb.
Diphenylguanidine	4 lb.
Ammonia	1 lb.
Water	50 lb.

Add the above after dissolving, and thorough mixing to

Latex (50%)	200 lb.

Latex for Impregnating Textiles, Paper, Etc.

British Patent 498,754

Rubber Latex (Dry Basis)	17.0 lb.
Silica Gel	0.8 lb.
Tannic Acid	0.7 lb.

Rubber Paraffin Embedding Composition

To 200 g. of paraffin add 2 g. of rubber and 0.5 g. of beeswax. Heat at 105° for 16 hours with occasional stirring. The most suitable rubber is "Heveatex" which is 37% rubber latex in aqueous solution with a small amount of ammonium hydroxide as a preservative. It is air-dried in thin layers and cut into small pieces. The method is superior to paraffin for any tissue which varies in density. For trichrome staining it is excellent, since it permits cutting the entire specimen without fraying. Specimens can be reembedded in celloidin.

Rubber Printing Blanket Wash

Hydroquinone	7 oz.
Acetone	64 fl. oz.

Use 3 oz. of above to 1 gal. benzol.

Artificial Latex

U. S. Patent 1,950,451

Reclaimed Rubber	48.5 lb.
Cumar, Mineral Rubber or Gum Rosin	2.5 lb.
Rosin Soap	9.0 lb.
Whiting	40.0 lb.

Water as desired.

The reclaimed rubber and softener are mixed together in a Banbury mixer for approximately 20 minutes. The whiting and rosin soap are made into a stiff putty-like paste with water. This paste is then placed in a Werner-Pfleiderer mixer and the rubber-softener blend added gradually to the paste in the mixer. This process will require 30 to 80 minutes, during which time the mixer should be heated with steam passing through the jacket to a temperature of approximately 180° F. The mixing is continued until the rubber is completely dispersed in the form of fine particles 2–20 mu. in diameter. The dispersion thus made can be diluted as desired with water to reduce the viscosity. Bodying agents such as gum tragacanth and curing ingredients may be added with the water. This dispersion may be used to produce a rug backing material by spreading it on the back of the rug and evaporating the water.

Toy Balloons

Toy balloons are made by both straight and coagulating dipping from latex. The latex composition should be adjusted so that the cured film will have low modulous and be free of odor and taste.

Rubber (From 60% Latex)	100.00 lb.
Zinc Oxide	0.50 lb.
Sulphur	1.00 lb.
Tepidone	0.83 lb.
Dispersed Antox	1.00 lb.
Organic Color Pigment	2.00–3.00 lb.

Cure: 30–45 minutes at 212° F.

The average thickness of a toy balloon film is approximately .007 in. when made and .001 in. or less when inflated. This reduction in film thickness on distention is an important factor in determining the amount of color to use. It is even more important to have a brilliant color in the inflated than in the uninflated balloon and hence a greater concentration of color is required for masstone shades than in the case of latex products that are not distended greatly.

Latex Gloves

Household Use

Rubber (From 60% Latex)	100.00 lb.
Sulphur	1.00 lb.
Zinc Oxide	1.00 lb.
Zenite	1.50 lb.
Tetrone A	0.25 lb.
Dispersed Antox	1.00 lb.
Color	0.20–0.50 lb.

Cure: 45 minutes at 212° F.

Rubber Latex Thread

The method for making elastic thread from latex involves forcing a latex composition continuously through a tubular orifice into a coagulating bath. The latex is gelled at once and the thread thus formed is passed immediately into a dehydrating bath. Acetic acid solution may be used for coagulation and glycerine for the dehydration. In some cases a combination coagulating and dehydrating bath is used, made up to contain 200 grams of sodium chloride, 300 grams of ammonium acetate and 60 grams of acetic acid per liter of aqueous solution. A suitable latex composition for thread is as follows:

Rubber from 60% Latex	100. lb.
Zinc Oxide	3. lb.
Dispersed Antox	2. lb.
Tetrone A	3. lb.
Dispersed Heliozone	2. lb.

Cure: 90 minutes at 212° F. or 20 minutes at 250° F.

Thickening Latex

It is frequently necessary to increase the viscosity of latex mixes by artificial methods. This is necessary in normal latex compounds to decrease the penetration, and in concentrated latex compounds to produce a paste or dough. Karaya Gum, alkali alginates, and Bentonite are in general use while casein, gelatine, locust bean gum, Gum Tragacanth, glue, etc. are also effective.

With the exception of Bentonite these materials increase the hygroscopic properties and mildewing tendencies of the dry film. Bentonite, on the other hand, reduces the stability and adhesion of the latex. The mildewing is overcome by the use of antiseptics such as "SANTOPHEN 20S" phenol, boric acid, in about 2% based on the gum.

Solutions of these materials are prepared as follows:

Karaya Gum	3 lb.	Beat smooth and add
Water—150–180° F.	70 lb.	
Water—Cold		15 lb.

Then Add Soda Ash	12 oz.	Beat smooth and add
Trisodium Phosphate	1 lb. 8 oz.	
Dissolved in Water	9 lb.	
"Santophen 20S" (10% Solution) (Preservative)		12 oz.

Use 10–15 parts of this Karaya gum solution on 100 parts of normal latex (wet weight).

Locust Bean Gum	16	Beat smooth while water is hot
Water 180–200° F.	100	

Locust bean gum is coagulated by all acidic preservatives, and since it has little tendency to mildew no preservative is used. Add this gum to the latex carefully while hot, and use a sufficient quantity to produce a high viscosity, since otherwise the latex will cream. This gum is very useful for the preparation of spreader doughs from concentrated latex. Casein will not produce a high viscosity latex unless used in excessive quantities, thus producing a very stiff film. It does, however, improve the bond in adhesives and is used more for this property. Casein solutions vary considerably in formulation depending upon their use.

15% Casein Solution

Water (180–200° F.)	80
Casein (Lactic)	15
Ammonia	4
"Santophen 20S" (10% Solution)	1

Add casein to water while stirring, then add ammonia.

The ammonia may be replaced with an equal quantity of borax or 1 lb. of caustic soda and 3 lb. of water. This 15% casein solution is useful in the preparation of pebble mill dispersions, etc.

For thickening latex it is more desirable to use a 25% casein solution (given below), made up and used while still warm and in the liquid state.

Casein	25
Water (180–200° F.)	68
Ammonia	5
Preservative	2

Latex Thickeners

Formula No. 1

Karaya Gum	2 lb.
Sodium Carbonate	1 lb.
Preservative (Moldex)	0.2 lb.
Water	96.8 lb.

The gum is stirred well into the water and the mixture allowed to stand for about an hour. The sodium carbonate is then added and the stirring continued until a clear solution is obtained. The preservative is then added.

No. 2

When bentonite is used for thickening latex it should be thoroughly wetted with water first since any dry lumps present cause local coagulation of the latex due to its high water absorption. In most cases 0.5–2.0% bentonite figured on the rubber content of the latex is sufficient for thickening.

Dispersion of Latex Compounding Ingredients

Many of the usual compounding ingredients are dry powders, and as such are totally unfit for dispersion in latex. These must be dispersed in water to at least a paste, and it is usually advantageous to introduce them in the form of a dispersion which has a comparatively low viscosity.

Colloidal Sulphur

It is difficult to prepare this material so that it will remain stable over a protracted storage period. It is frequently prepared in a series of two or three mills, each being sufficient for one day's requirements. The mills are kept in rotation.

It may be prepared by the following method:

Sulphur (Rubber Grade)	100	Grind in Pebble mill 48–72 hours
*Dispersing Agent	3	
Water	97	

If it is desirable to grind and store the sulphur (always store in glass or stoneware container), a good grade of colloidal sulphur may be prepared as follows:

Colloidal Sulphur

Sulphur	100	Grind 72–96 hours and then treat as given below
*Dispersing Agent	6	
Water	44	

After about 96 hours grinding remove from the mill and weigh. Each 100 lb. of wet dispersion contains 66 lb. of sulphur, and requires 22 lb. of water to reduce this dispersion to 50% sulphur content.

In 18 lb. of water and 1 lb. of ammonia disperse 3 lb. of bentonite. Add this to the sulphur dispersion and mix thoroughly. This will produce a relatively stable colloidal sulphur and the small quantity of Bentonite will not cloud even the most transparent film.

Instead of bentonite it is possible to use locust bean gum, or gum tragacanth to stabilize the colloidal sulphur. In this case:

Hot Water	20	lb.
Locust Bean Gum (or Gum Tragacanth)	1¼	lb.
Formaldehyde	12	oz.

replacing the Bentonite mixture described above, is added to the sulphur dispersion and thoroughly mixed.

Colloidal Zinc Oxide for Latex

Tests show that it is better to use a zinc oxide with medium particle size than one more finely divided, as less dispersing agent is required, and after grinding all types show equally good activation. A zinc oxide with low water adsorption should be chosen, as it is wetted more easily and a better dispersion is obtained. A dispersion which may be stored from 6 to 8 weeks with only a slight settling is prepared as follows:

Zinc Oxide	100	Grind in Pebble mill 16–24 hours
Gum Arabic	1	
Water	99	

Any slight settling which may have occurred is easily redispersed.

Colloidal Zinc Sulphide

A colloidal dispersion of zinc sulphide may be prepared using the same formula and procedure as described in the preparation of colloidal zinc oxide.

Carbon Black

Carbon black is a good reinforcing agent in dry rubber, but in latex it acts only as a diluent, increasing quantities giving poorer physical properties. The regular grades of carbon black (channel process) are acidic, and unless given special preparation and treatment will thicken and coagulate latex. The soft blacks (Gastex, Thermax, P-33, etc.) are practically inert in their thickening or coagulation effects. *Carbon black is used for its color value only, and since it acts as a diluent it is desirable to use a black of high color value and one that disperses easily.* A carbon black having a low water adsorption gives the best pebble mill dispersions, and also a dispersion containing the highest carbon black content.

A low water adsorption carbon black may be dispersed as follows:

Carbon Black	100	Grind in Pebble mill 24–48 hours
Darvan, Blancol or Vultamol	6	
Water	192	
Ammonia	2	

Ordinary rubber grades of carbon black are dispersed:

Carbon Black	100
Darvan, Blancol or Vultamol	5
Water	392-492
Ammonia	3

Soft blacks disperse readily:

Soft Black	50
Darvan, Blancol or Vultamol	2
Water	48-98

Latex Stabilizers

Formula	No. 1	No. 2
Casein	100.1 g.	100 g.
Caustic Potash (45%)	11.1 g.	.....
Phenol	2.0 g.	.....
Water	887 cc.	875 g.
Borax	....	25 g.
Moldex (Preservative)	....	1 g.

Warm to 70–80° C. and mix till uniform.

No. 3

Stabilize latex before the addition of vulcanizing agents and fillers, by

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*Dispersing Agent: { Casein 2.5, Ammonia 0.5 } or Glue 3.0

* Darvan, Vultamol, or Blancol.

adding .5–1% casein solution. The casein should be added in the form of a 10% water solution. This solution should be made as follows:

Casein	100 g.

900 cc. distilled water (warm), 15 g. by weight of 25% ammonia solution are then added and the resulting solution allowed to stand until cold.

No. 4

1. Casein	100 g.
2. Caustic Potash (45% Solution	11 g.
Water	884 cc
3. Phenol	2 g.

Add 1 and 3 to 2 with stirring. Allow to soak ½ hour. Heat to 60° C. with stirring. Cool.

Natural Rubber Latex Preservation

Addition of following to raw latex gives satisfactory long period preservation:

Ammonia	1 %
Sodium Pentachlorphenate	0.3%

Casein and Latex Preservative

U. S. Patent 2,188,468

Tetrahydronaphthalene	3
Hexahydrophenol	1
Sulphonated Castor Oil	2

Surface Coatings and Inks for Vinylite Resin Products

Articles molded from Vinylite resins as well as Vinylite resin sheets can be covered with lacquers, marked with wipe-on paints, or printed.

Overlacquers

When Vinylite resin articles are to be covered with a lacquer, it is preferable that a lacquer containing Vinylite series V resins be used. In some cases, where the lacquer must be applied over oil-base inks, it is necessary to use a vehicle such as Vinylite resin CYCI and cellulose nitrate as the lacquer base, in order to obtain adequate adhesion to the inks. In all cases, it must be borne in mind that the surfaces of molded articles and sheets may be under strain. A careful balance of the thinner mixture must therefore be made to avoid surface crazing or embrittlement.

For Molded Articles

In preparing a thinner for a Vinylite resin CYCI and cellulose nitrate vehicle, it is best to omit the aromatic portions of the usual thinners for Vinylite resins, and replace a portion of it with aliphatic hydrocarbons or hydrogenated naphthas, such as Solvesso No. 1. Methyl isobutyl ketone is satisfactory as the solvent for such lacquers, and a small proportion of methyl ethyl ketone can be tolerated without causing surface crazing. Higher boiling ketones should be added only in the proportions necessary to obtain proper flow-out, because they tend to be retained by the Vinylite resin stock.

Several typical solvent formulas, suitable for use either with Vinylite resin VYHF or with resin CYCI and cellulose nitrate are as follows:

Methyl Ethyl Ketone	15 g.
Methyl Isobutyl Ketone	45 g.
Methyl Amyl Ketone	10 g.
"Solvesso No. 1"	30 g.

Methyl Isobutyl Ketone	70 g.
"Solvesso No. 1"	30 g.

Methyl Ethyl Ketone	15 g.
Methyl Isobutyl Ketone	75 g.
Methyl Amyl Ketone	10 g.

When using a Vinylite lacquer base of either resin VYHF or resin VYHH, it is desirable that the plasticizer does not exceed 10 to 15% of the resin weight. A typical formulation is:

Vinylite Resin VYHF	15 g.
Dibutyl Cellosolve Phthalate	2 g.
Thinner	83 g.

For greater film toughness, Vinylite resin VYNS is recommended, but the proportion of solids carried in solution will be much lower. Resin VYNS requires less plasticizer than resins VYHF or VYHH.

Lacquers formulated with Vinylite resin CYCI and cellulose nitrate should be plasticized to the extent of 25 to 35% of the vehicle weight. A ratio of 3 to 2 of resin CYCI to ½-sec. cellulose nitrate exhibits good film strength and flexibility and adheres well both to the Vinylite resin articles and to the oil-base inks. A typical formulation is:

Vinylite Resin CYCI	6.3 g
½-sec. R.S. Cellulose Nitrate (Wet)	6.0 g
Dibutyl Phthalate	3.2 g.
Thinner	84.5 g.

Replacing ½-sec. cellulose nitrate with the 5-sec. grade will give greater film toughness. In preparing this lacquer, it is desirable that separate solutions of resin CYCI and of the cellulose nitrate be prepared. These solutions should be mixed just before application. This precaution is desirable because of the tendency of a portion of these resins to co-precipitate on long storage.

The above discussion applies to spray application, as this appears to be the only completely satisfactory method. Dip application requires long contact with larger volumes of solvents, and the resulting surface effects are generally quite pronounced.

For Resin Sheet

Overlacquers for Vinylite resin sheet follow much the same principles as those discussed above for molded articles, with the exception of the choice of solvents. Surface changes of sheets due to contact with solvents are somewhat more critical because of the greater surface area per unit volume of resin. On the other hand, sheet surfaces are much less intensely strained than are the surfaces of injection molded articles. For example, sheets which have been exposed to any of the usual organic lacquer solvents do not exhibit, after aging, any marked visible surface changes such as crazing or checking.

A thinner mixture having a series V resin vehicle and that has shown good results for use on Vinylite resin sheet is:

Methyl Ethyl Ketone	17 g.
Toluol	83 g.

The following Vinylite resin CLCI-cellulose nitrate overlacquer is recommended:

XL-5064-1

Vinylite Resin CYCI	6.3 g.
½-sec. R.S. Cellulose Nitrate (wet)	6.0 g.
Dibutyl Cellosolve Phthalate	3.2 g.
Isopropyl Acetate (98%)	64.0 g.
Butyl Acetate	20.5 g.

Two mixed thinners, also used in solvent-sealing, are described in the section on "Cementing Vinylite." The first mixture, XT-5015, causes less embrittlement of sheet than do most other mixtures but it evaporates very fast. The second, a modification of mixture XT-5015, has a slower evaporation rate and may be useful in retarding moisture blushing.

In cases where all Vinylite resin solvents must be avoided, it has been found possible to obtain fair adhesion of the overlacquer to the resin stock by the use of a chlorinated rubber resin. If this is plasticized with 25 to 30% of chlorinated paraffin, the adhesion of the overlacquer to the Vinylite resin stock is apparently increased. A small addition of methacrylate resin may also be advantageous. Chlorinated rubber is completely soluble in Solvesso No. 2 or in a mixture of toluol and Solvesso No. 1.

Wipe-On Paints

Several methods of decorating depressed areas of molded plastics are available. The simplest of these is the application of a thinned lacquer from a well-type lettering pen. It is necessary, however, to be able to remove excess lacquer without marring or staining the plastic surface. Marking of Vinylite resin surfaces is best done by the use of chlorinated rubber resins in solvents which do not affect the Vinylite resins. Excess lacquer can then be removed before drying with a cloth moistened in an aliphatic hydro-carbon such as Troluoil solvent, which has proved quite satisfactory.

In some cases, it is desirable to apply the lacquer as a thick paste to the depressed portions, smoothing it and wiping the excess away with a squeegee. If the depressions are shallow, a cloth with a rigid backing, wet with Solvesso No. 1, can often be used to remove the excess paste in a single stroke. For deeper depressions, Troluoil solvent will often prove more satisfactory.

A typical chlorinated rubber-base paste can be prepared according to the following formula:

XE-5066, Blue

Ultramarine Blue	230 g.
Chlorinated Paraffin E60	115 g.
Dammar Gum	55 g.
Chlorinated Rubber (20 centipoise)	345 g.
Chlorinated Rubber (5 centipoise)	115 g.
"Solvesso No. 2"	640 g.

The pigment should be dispersed by pebble-milling in a 30 to 35% solution of the 20-centipoise chlorinated rubber before adding the other ingredients. Other pigments can be substituted for ultramarine, modifying the amounts as may be required by differences in bulking and absorption values of the pigments. Pigments should be chosen in preference to organic dyes, in all cases, because of the difficulty in removing the latter from Vinylite resin surfaces.

Mixtures of Toluol and Solvesso No. 1 can be substituted for part of the Solvesso No. 2 if it is desirable to increase the speed of drying, especially when mixture XE-5066 is thinned for use in lettering pens. The presence of the toluol decreases the length of time the lacquer can remain on the Vinylite resin surface without softening and marring the surface. Therefore the mixture should be wiped off as rapidly as possible.

Another method of decorating Vinylite plastics is based on the use of a masking wax, such as polyethylene glycol 4000. This wax, spread from a thick, pasty, alcoholic solution, can be used to mask portions of the plastic that are not to be colored. Over this is sprayed a light coat of Vinylite resin lacquer. After the lacquer is dry, a buffing wheel or a wet cloth can be used to remove the lacquer from those portions of the plastic covered by the polyethylene glycol paste. To facilitate cleaning, a lacquer resin of low film strength, such as Vinylite resin VYLF, is preferred.

Cementing Vinylite

Vinylite resin surfaces, whether on unfilled or filled compounds, can be cemented or welded together to form liquid and air-tight joints by means of either a solvent-type adhesive or by a simple, rapid, heat-sealing operation. For solvent mixtures, acetone, propylene oxide, ethylene dichloride, mesityl oxide, or the higher ketones are satisfactory. In general, however, solvent-non-solvent mixtures are preferable to single-component systems. Additions of Troluoil solvent; alcohols; and esters are sometimes advantageous. A 2% glacial acetic acid addition will improve surface wetting and speed the capillary penetration of the mixture between the two adjacent surfaces. The choice of the proper solvent-non-solvent components should be based, among other things, on the drying rate best suited to the particular job at hand. In all cases, the amount of liquid used for sealing should be kept to a minimum. If not, the excess liquid absorbed may unduly soften the resin.

The inclusion of Vinylite resin in the solvent mixture increases the body of the mixture, retards drying, and reduces the rate of travel under capillary forces. Such a cement should contain about 1 to 2% propylene oxide to help stabilize the solution against light and thermal discoloration when stored. Approximately 5% of tricresyl phosphate will increase the adhesion.

As soon as the contacting surfaces are wet with the mixture, it is advisable to hold these areas together under pressure until welding is accomplished. This is usually effected in a few seconds. Tests have shown that the following mixture is useful for solvent-sealing Vinylite resin sheets to one another because it causes less embrittlement of the sheets than many other mixtures tested:

Formula No. 1

Methyl Acetate	58 g.
Ethyl Acetate	10 g.
Butyl Acetate	10 g.
Troluoil	15 g.
Acetic Acid (Glacial)	2 g.
Dibutyl Cellosolve Phthalate	5 g.

Formula No. 1 evaporates too quickly for some uses. A slight modification of this composition, having a slower evaporation rate, can also be used as an adhesive:

No. 2

Ethyl Acetate	25 g.
Isopropyl Acetate	38 g.
Butyl Acetate	15 g.
Troluoil	15 g.
Acetic Acid (Glacial)	2 g.
Dibutyl Cellosolve Phthalate	5 g.

Many solvents, either single or in combination with other liquids, tend to embrittle Vinylite resins. In some cases, this embrittling action is not apparent from visual inspection of the solvent-treated areas; whereas, in others, the surface will show crazing after aging. Consequently precautions should be taken to prevent smearing the solvent or cement beyond the area to be sealed.

Vinlyte resins can be heat-sealed, and when feasible, heat-sealed joints are preferable because they are stronger. Some pressure is desirable, but, due to the extremely low heat conductivity of the resins, local areas can be raised to the softening temperature without distortion of the general shape of the article.

A simple heat-sealing or patching operation can be performed with a soldering iron, preferably electric. It is important that the metal contact surfaces for heat-sealing be smooth and clean. The soldering iron should be fitted with a smooth, chromium-plated tip, and the temperature of the iron should not exceed 160° C. or the resin in contact with it may become gummy and stick to it. The temperature used, of course, is dependent on the pressure applied, but approximately 140° C. is recommended and the pressure used should be maintained long enough to produce a bond. The joint should be cooled before distortion occurs.

Natural Resin-Wax Compounds

Petrolatum Wax	45 lb.
Pale East India or Batu or Black East India Gum	45 lb.
Paraffin Wax	10 lb.

Melt the waxes together and add the resin, stirring until mixture is uniform. Allow to cool.

Such mixtures are of higher melting point and are more water-resistant than the similar material made with ester gum instead of the natural resins.

Ion Exchange and Acid Removing Synthetic Resin
British Patent 472,404

Ortho Phenylenediamine Dihydrochloride	18 g.
Glucose	15 g.
Water	240 cc.

Boil for 1½ hours and add

Formaldehyde	10 g.

Boil for 40 minutes.

Bottle Cap Liner
U. S. Patent 2,181,481

Polymerized Vinyl Ester Resin	14–17 oz.
Tricresyl Phosphate	4–16 oz.
Petrolatum	⅛–⅜ oz.

Molded Cartridge Cases
U. S. Patent 2,137,350

Cellulose Acetate	100 oz.
Diethyl Phthalate	45–75 oz.
Wheat Flour	Up to 75 oz.

Injection Molding Plastic

Shellac	6.0 lb.
Wood Flour	4.0 lb.
Urea	0.2 lb.
Calcium Stearate	0.1 lb.
Pigment	to suit

Mold at 110° C.

Corn Gluten Plastic
U. S. Patent 2,134,764

Treat 100 parts of corn gluten with 25 parts of a 40% formaldehyde solution and with 20 parts of a half normal water solution of hydrochloric acid, and thereafter heat the material to a temperature between 200° and 300° F.

Water Resistant Zein
U. S. Patent 2,134,769

Zein	100 g.
Paraffin Wax	4 g.
Methyl Alcohol (94%)	270 cc.
Benzol	130 cc.

Colored Molding Composition
British Patent 498,131

Casein	1 lb.
Water	1–10 lb.
Sawdust	0.2–2.5 lb.
Pigment	Sufficient to color

Soybean Casein Plastic

Soybean Casein	82.2 lb.
Calcium Oxide	23.0 lb.
Ocher	34.0 lb.
Stearic Acid	1.5 lb.
Zinc Stearate	1.5 lb.
Sawdust	225.0 lb.

Mix the above well and press with 17.8 lbs. of the following mixture:

Novolac Resin	24.40 lb.
Pyridin	2.30 lb.
Stearic Acid	0.35 lb.
Zinc Stearate	0.35 lb.

Simple Bakelite Type Resin and Plastic

Phenol	376 g.
Formaldehyde	450 cc.
Ammonia (0.88)	10 cc.

The mixture is put into a beaker immersed in a boiling-water bath for about 1½ hours. As the molecular weight of the resin increases, the clear solution becomes turbid, and finally it separates out as a liquid which solidifies on cooling. The upper aqueous layer is decanted, and the solid resin carefully melted in a porcelain basin and the water distilled off. This dehydration needs care or the molten resin will froth up. The dehydrated resin should be quite clear and set hard on cooling.

Having prepared the resin, it is interesting to try molding it. After being ground to a fine powder, the resin should be mixed with about 20% of wood flour and half as much hexamethylenetetramine (made by evaporating to dryness a mixture of formalin and 0.88 ammonia solution in excess). The mixture can then be put into a home-made mold and heated under pressure to a temperature of about 140–50° C. The time required for heating depends upon the length of time the resin was in the water-bath during the first stage, and also upon the amount of hexamethylenetetramine used, but it should not be more than three to five minutes.

Phonograph Record Composition

Formula No. 1

Polymerized Vinyl Chloride (M.P. 120–130° C.)	21	lb.
Novolac (M.P. 92–96° C.)	21	lb.
Slate, Powdered	49	lb.
Gas Black	4½	lb.
Pitch	5½	lb.
Calcium Stearate	2	lb.
Montan Wax	2	lb.

No. 2

U. S. Patent 2,203,983

The following is coated on suitable base material:

Tricresyl Phosphate	16.0 lb.
Soybean Oil	3.0 lb.
Chlorinated Diphenyl	1.5 lb.
Butyl Stearate	1.5 lb.
Ethyl Cellulose	78.0 lb.
Color	To Suit

Plastic Molding Powder

Dutch Patent 44,502

Potato Starch	200	g.
Formaldehyde (40%)	80	cc.
Urea	8	g.
Water	16	cc.
Lactic Acid	1	cc.

Mix well until uniform; then heat for 1–2 hrs. at 90° C. in a closed vessel. Remove cake and grind to fine powder. Dry to 8% water content. To this add following solution:

Urea	8	g.
Formaldehyde (40%)	18	cc.
Ammonia (25%)	4	cc.

Mix well and mold under pressure.

Thermoplastic Printing Block

British Patent 522,555

Cumar	160
Tricresyl Phosphate	75
Benzyl Cellulose	80

Melt together and then stir in

Iron Oxide	200

Cement for Bolts in Plastics

Shellac	1 lb.
Accroid Resin	1 lb.
Methanol	1 lb.
Alcohol	1 lb.
Barytes (finely powdered)	2–3 lb.

Methyl Methacrylate Emulsion

French Patent 844,091

Methyl Methacrylate	30.0 oz.
Water	100.0 oz.
Ammonium Persulphate	0.3 oz.

Heat to 80° C. and mix vigorously.

Methacrylate Polymerization Inhibitor

U. S. Patent 2,143,941

Add 0.1–1% of anhydrous antimony, arsenic, aluminum or bismuth chlorides to prevent polymerization on heating.

Synthetic Casein Fiber

U. S. Patent 2,204,535

Formula No. 1

Spinning Solution

Casein	24.00 g.
Water	100.00 g.
A highly Sulphonated Vegetable Oil (or its Sodium Salt)	3.60 g.
A mixture of Sodium Hexametaphosphate and Pyrophosphate	1.50 g.
Barium Hydroxide	4.42 g.
Water	106.48 g.

The 24 parts of casein are soaked in the 100 pts. of water for 15–30 minutes. The sulphated oil and the phosphates are then added and the mixture warmed until the casein is largely dissolved. The barium hydroxide is then dissolved in the remaining quantity of water, and the solution stirred mechanically into the casein composition. Thus a smooth dispersion is obtained, free from lumps of insoluble caseinate.

The temperature of both the spinning solution and the precipitating bath is 50° C. However, other temperatures varying from room to 80° C. may be used.

The sulphated oil serves also as a plasticizer. If even softer fibers are desired, the amount of the oil may be increased, or the fibers may be subjected to an after treatment with oil, glycerol, or similar softening material.

The bath composition is:

Sulphuric Acid	8 g.
Formaldehyde	5 g.
Dextrose	20 g.
Water	67 g.

This bath composition may, however, be varied.

The above procedure for incorporating large amounts of metallic compounds into the spinning solution results in fibers of greater strength and water resistance.

The following example illustrates the use of a sulphonated aromatic product, and of a high percentage of a calcium salt.

No. 2

Casein	24.0 g.
Water	160.5 g.
Sodium Hydroxide Solution (2N)	8.0 g.
Calcium Cymene Sulphonate	7.5 g.

Additional plasticizers may be added if a softer product is desired or the fibers may be after treated with oils.

No. 3

French Patent 841,503

Casein	24 g.
Water	198 g.
Ethyl Glycolate	5 g.
Triethanolamine	6 g.
Calcium Chloride (10%)	7 g.

Dissolve above and compress. Spin into the following bath:

Sulphuric Acid	2 g.
Formaldehyde	5 g.
Glucose	10 g.
Water	83 g.

Sheet Celluloid Finish

Sheet celluloid can be softened by means of a chemical solution. In this state it can be easily stretced, formed or molded to cover many different articles regardless of their size or shape.

In using sheet celluloid as a decorative coating, there are two stages to consider in the process. First there is the covering; then the sanding, buffing and polishing to bring out the desired finish.

Celluloid can be purchased in sheets about 20x50-in., and from these sheets blanks are cut with a sharp pointed knife, according to the size and shape of the surface to be covered. These blanks then can be softened by the following means: First, place the sheets in a solution of acetone and water. This solution should be kept in a copper tank covered as nearly air tight as possible. This is termed the wet method.

Another method is to place the blanks in a box containing several copper-screen trays. The acetone is put into a copper pan in the bottom of the tank. Fumes from the acetone are blown up through a series of steam pipes and come in contact with the celluloid blanks, thereby softening them.

By either method the time required will depend upon the thickness of the celluloid; for thin sheets, about 20–30 minutes; for thick sheets, up to about two hours. Up to certain limits, the slower the celluloid is softened the better it is for application.

When the blanks are softened by the "wet method" they are taken out of the tank and one side is placed on a blotting cardboard to dry. The other side is to the outline of the article. Immediately after the article has been covered it is best to put it under pressure by means of a suitable press, or with rubber bags slightly inflated to fit loosely around the article; or vacuum bags can be used. The harder the celluloid is pressed, the better the adhesion.

With the celluloid in the properly softened condition, it is not so much the length of time it is under pressure as the maximum pressure that can be applied. In case the celluloid should have a tendency to stick to the press, a bit of talc can be dusted over the celluloid before it is put in the press.

As soon as the article comes out of the press, all excess celluloid should be trimmed off evenly with the back edges—or lapped together by means of a hand operation. At this stage of the process, the article is allowed to stand from three to five days. During this time the celluloid will return to its original degree of hardness. The solvents absorbed during the softening process and from the celluloid cement will pass off. A force drying operation will, in most cases, cut the drying time in half.

Dental Base Plate Composition

Formula No. 1

Asbestine (300–400 mesh)	60 g.
Ethyl Cellulose	25 g.
Ester Gum	15 g.
Butyl Acetyl Ricinoleate	10 g.
Red Dyestuff, Oil Soluble	Enough to Tint

The ester gum is heated with the butyl acetyl ricinoleate until a clear solution is formed, when the ethyl cellulose is then added to this mass. The asbestine is then worked into this plastic between rolls or by means of a jacketed kneading machine maintained at a satisfactory working temperature which will approximate 80–90° C. The product is then rolled out into sheets 1/16th in. and cut into the contour required by the trade.

No. 2

Shellac	27 g.
Gutta Percha	36 g.
Magnesium Aluminum Silica Hydrate	12 g.
Silica (300 mesh)	25 g.

Para Red, Lake Toner Pigment—enough to tint to color of gums.

This composition is the exact formula of the most popular dental base plate material on the American market. It is compounded much as that described above, except that it requires a small percentage of alcohol with the shellac in order to thoroughly incorporate the pigment and fillers with the vehicle component. It is also worked at an elevated temperature as described above, rolled into thin plates which are cut out to the desired contour, the trim being rerolled into sheeting and cut as above, thus eliminating all waste.

Plastic Tooth Filler

Mastic Resin	40 kg.
Ethyl Ether	40 kg.
Amber, Powdered	20 kg.

Before use, enough ether is allowed to volatilize to give a plastic mass.

Resilient Dental Impression Mass

British Patent

Dammar	28–31 g.
Rosin	4–6 g.
Pine Tar Pitch	13–17 g.
Stearin	5–7 g.
Eugenol	3–6 g.

Melt above slowly and mix until uniform.

Allow to solidify and then knead together in boiling water with

Balata (heated to 100° C.)	38–42 g.

Increasing Melting Point of Petroleum Asphalt

U. S. Patent 2,175,189

Mix the asphalt with 0.5–10% caustic soda and heat at 315–370° F. for 15 minutes to 8 hours.

Cheap Plastic Made from Wood

U. S. Patent 2,080,078

This process utilizes pine wood chips or sawdust. The material is heated in steam for periods of 15 seconds to 5 minutes at temperatures of 231–285° C., corresponding to 400–1,000 lbs. steam pressure. Following this treatment, the hydrolyzed wood is washed in water to reduce the concentration of water-soluble substances contained in it. It is then dried. In drying, it is well to leave several per cent of water remaining in the material since this serves as a plasticizer during molding. The material made as described above can be molded at a pressure of 2,000–3,000 lbs. per sq. in. at a temperature of 120–220° C. or higher, depending upon the time of heating and the moisture content of the resinous product. The molded product is vitreous-like and if the water-solubles content has been sufficiently reduced, it is very water resistant.

Plastic Wood Mass

a.	Wood Flour	20 kg.
	Whiting	6 kg.
	Butanol	4 kg.
	Glycerin	2 kg.
b.	Rosin	5 kg.
	Acetone	3 kg.
c.	Film Waste (Nitrocellulose)	7.2 kg.
	Acetone	30 kg.
	Butanol	22.8 kg.

Solutions *b* and *c* are made separately and added to the paste *a*.

Molding Composition

Zinc Oleate		147 g.
Made from Oleic Acid Distilled	133	
Zinc Oxide	17	
Japan Wax		33 g.
Mineral Oil		40 g.
Sulphur		107 g.
Kaolin, White		68 g.
Pigment		6–7 g.

Modeling Clay

A simple inexpensive, yet permanently plastic modeling clay for such usage is readily made by mixing glycerine with clay and adding petrolatum to give the desired consistency. This clay may also be used for the usual artistic purposes and for making impressions of objects.

Imitation Chocolate for Display

Barium Sulphate	60 g.
Montan Wax, Crude	40 g.
Sienna	0.5–0.7 g.
Vanillin	0.1–0.2 g.

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* To obtain a better smelling wax base, it is recommended to use the following:

100 g. of melted Montan wax, crude are poured over 5 g. of finely powdered Sumatra gum benzoin. The mass is stirred for 2–3 hours on a boiling water bath, strained hot through a cloth, and the filtrate is to be used in the above formula.

Electrical Potting Composition (Condenser Wax)

U. S. Patent 2,083,077

Chlorinated Naphthalene	25–40 g.
Gilsonite	20–30 g.
Montan Wax	30–50 g.

This is used for coating electrical condensers.

Pencil Eraser

U. S. Patent 2,164,035

Lithopone	728 g.
Whiting	353 g.
Plaster of Paris	533 g.
Gelatin	728 g.
Pumice Stone	87 g.

Water to make an initially crumbly consistency.

Spinning Machine Rollers

Gelatin	50 g.
Water	250 g.
Glycerin	300 g.
3% Tannin or Potassium Bichromate Solution	150 g.
Spirits of Camphor	30 g.

Gelatin dissolved in water, to which is added glycerin and 3% tannin or potassium bichromate solution, and spirits of camphor. This is gradually heated on a water bath to 75°.

Synthetic Mass for Stamping Rollers

Glue	100 g.
Glycerin	500 g.
Water	375 g.
Bartyes or Kaolin	25 g.

Glue, glycerine and water, dissolved on a water bath and bartyes or kaolin added.

Coating Machine Rollers

Glue or Gelatin	105 g.
Water	33 g.
Ammonium Salt of Turkey Red Oil	162 g.

Glue or gelatin is soaked in water, slightly heated to which ammonium salt of Turkey red oil is added.

Hectograph Mass

Glue	100 g.
Water	375 g.
Glycerin	500 g.
Barium Sulphate (finely powdered)	25 g.

Glue melted in water, to which is added glycerin and barium sulphate (finely powdered).

The ink used is a concentrated solution of methyl violet.

Gelatin Foil

Gelatin	10–15 lb.
Glycerin	2–5 lb.
Alcohol	0–10 lb.
Water	98–70 lb.

This solution is poured out on glass plates by a special machine. After drying, the foils can be hardened by about 25% of formaldehyde.

The hardened foils can be pulled off their glass bases.

Modeling Wax

Beeswax	10 lb.
Mastic	10 lb.
Ceresin	8 lb.
Paraffin Wax (56–58° C.)	15 lb.
Tallow	65 lb.
Sulphur, Flower	90 lb.
Calcium Sulphide	42 lb.
Clay	120 lb.

Dental Modeling Wax

Formula No. 1

Paraffin Wax	2 g.
Carnauba Wax No. 1	2 g.
Glyceryl Tristearate	5 g.
Beeswax	1 g.

No. 2

Beeswax, Yellow	16 g.
Wheat Starch	8 g.
Turpentine, Thick	4 g.
Olive Oil	1 g.
Venetian Red	1 g.

Dental Impression Wax

Formula No. 1

Stearic Acid	19 g.
Ethyl Cellulose	1 g.
Paraffin Wax	40 g.
Beeswax	40 g.

No. 2

Manila Copal, White	30 g.
Rosin, Pale	30 g.
Carnauba Wax, Refined	10 g.
Stearic Acid	5 g.
Talc	75 g.
Peru Balsam	3 g.

Shoemaker's Sewing Wax

Candelilla Wax	2 oz.
Rosin	55 oz.
Burgundy Pitch	20 oz.
Rosin Oil	4 oz.
Lard	3 oz.
Mineral Oil (Heavy)	1 oz.

Black Brush Grafting Wax

Rosin	5 lb.
Beeswax, Crude	1 lb.
Linseed Oil	¼ pt.
Charcoal, Powdered	½ lb.

Melt together and mix until uniform.

Pliable Grafting Wax

Abietic Acid	5 lb.
Beeswax, Crude	1 lb.
Linseed Oil	¼ pt.
Charcoal, Powdered	½ lb.

Opaque Paraffin Wax Coating

U. S. Patent 2,159,218

0.5–5% of hydrogenated cottonseed oil is added to paraffin wax to render its film opaque.

Bleaching Montan Wax

British Patent 488,381

Montan Wax, Crude	1,000 kg.
40% Sulphuric Acid	4,500 kg.
30% Peroxide	500 l.
Chromic Anhydride	1,000 kg.

Crude montan wax is fused, sulphuric acid mixed in, peroxide added little by little and the whole stirred for 3 hours at 105° C. Chromic anhydride is slowly added and the whole stirred until the anhydride is used up; the wax is washed with sulphuric acid and then with water.

Stabilizing Chlorated Paraffin Wax

British Patent 495,410

Add 0.5–1% pinene, limonene, turpentine or phellandrene.

Barrel Impregnation

Formula No. 1

Rosin	66 lb.
Paraffin Wax	30 lb.
Beeswax	3 lb.
Carnauba Wax	1 lb.

No. 2

Rosin	55 lb.
Paraffin Wax	43 lb.
Beeswax	2 lb.

No. 3

Rosin	80 lb.
Paraffin Wax	20 lb.

No. 4

Shellac	4 lb.
Dammar Resin	5 lb.
Alcohol	90 lb.
Castor Oil	1 lb.

Cannot be used for wine barrels because the denatured alcohol would spoil the taste and odor of the wine.

No. 5

Rosin (F-G)	46 kg.
Paraffin Wax (50–52° C.)	48 kg.
Beeswax	4 kg.
Castor Oil	2 kg.

Melt at not more than 100° C. adding the castor oil last, at about 70° C. Pour into forms floating on a cold water bath, to avoid the sticking of the material to the forms. When a solid surface has formed the whole is dipped below the water to get quick cooling.

Barrel Preserving Paste

Paraffin Wax (50–52° C.)	25 lb.
Linseed Oil	74 lb.
Oil-Soluble Black	0.8 lb.
Sodium Chlorbenzoate	0.2 lb.

Melt the paraffin, add the black and stir at about 85–90° C. until a clear solution has formed. Add the linseed oil in a thin jet and finally add the preservative.

Pour into cans near titer, covering the first by a second, quickly cooling layer.

MELTING POINTS OF COMPOSITIONS OF STEARIC ACID AND PARAFFINS

Paraffin %	M. P.	Stearic Acid, M. P. 54° C.	Melting Point of Mixtures
90.0%	36.5° C.	10.0%	36.50° C.
66.6		33.3	39.00
33.3		66.6	45.75
10.0		90.0	51.75
90.0%	41.0° C.	10.0%	39.75° C.
66.6		33.3	40.50
33.3		66.6	47.50
10.0		90.0	52.00
90.0%	50° C.	10.0%	49.00° C.
66.6		33.3	47.00
33.3		66.6	47.50
10.0		90.0	52.50
90.0%	56.5° C.	10.0%	55.50° C.
66.6		33.3	52.00
83.3		66.6	47.00
10.0		90.0	52.50

MELTING POINTS OF COMPOSITIONS CONTAINING CARNAUBA WAX

Carnauba Wax %	and Stearic Acid, M. P. 58.5° C. ° C.	and Ceresin M. P. 72.7° C. ° C.	and Paraffin M. P. 60.5° C. ° C.
5	69.75	79.10	73.90
10	73.75	80.56	79.20
15	74.55	81.60	81.10
20	75.20	82.53	81.50
25	75.80	82.95	81.70

PROPERTIES OF WAXES

	M. P. (° C.)	Sp. Gr. at 15° C.	Saponification Value	Acid Value	Unsaponifiable Matter
Carnauba Wax.	80–86	0.990–0.999	79–88	0.3–10	55%
Montan Wax ..	80–90 refined approx. 73	1	60–100	....	43–52%
Wool Fat	31–42	0.941–0.970	82–130	....	52–55%
Beeswax	63–70	0.958–0.975	91–98	20	66–74%
Candelilla Wax.	67–71	0.936–0.990	55–64	13–18	....
Chinese Insect Wax	80–83	0.926–0.970	63–93	0.2–1.5	....
Japan Wax ...	50–54	....	......	....	0.7–1.6%
Shellac Wax ..	72–76	0.979–0.980	79–85 (according to Lüdecke 120–126)	12–24	....
Spermaceti	42–49	0.9845–0.960	123–135	0.1–6	50–54%
"Rilan" Wax ..	84–85	0.9893	155	25	....
"Lanette" Wax.	50	in liquid state at 50° C. 0.81	......	....	practically unsaponifiable
Fiber Wax	61–66	0.966–0.988	62–68	16.8–20	67–70%
Stearine	52–54	0.85 (at 62°)	206–208	205–207	0.3–0.5%

WAX TYPE ACIDS AND HIGHER WAX TYPE ALCOHOLS

Name	Formula	Melting Point ° C.	Specific Gravity at 15° C.	Soluble in	Occurrence
Cerotic Acid	$CH_3(CH_2)_{24}CO.OH$	77.8	.836 at 79° C.	Warm alcohol	Free in Beeswax, Montan Wax, Carnauba; also as cerotate in insect wax and Carnauba.
Montanic Acid	$CH_3(CH_2)_{26}CO.OH$	83		Methyl alcohol	Free in Montan Wax.
Melissic Acid	$CH_3(CH_2)_{28}CO.OH$	91			Free in beeswax and Montan Wax.
Palmitic Acid	$C_{16}H_{32}O_2$	62.2	.846	Alcohol; ether	As tri-palmitin in Japan Wax; as cetyl palmitate in Spermaceti; as myricyl palmitate in Beeswax.
Lauric Acid	$C_{12}H_{24}O_2$	43.5			As laurin in Japan Wax.
Cetyl Alcohol	$C_{16}H_{33}OH$	50	.810	Alcohol; ether; benzol	As cetyl palmitate in Spermaceti.
Octodecyl Alcohol	$C_{18}H_{37}OH$	59		Alcohol; ether	Spermaceti.
Ceryl Alcohol	$C_{26}H_{53}OH$ $C_{27}H_{55}OH$	79			As ceryl cerate in Chinese Insect Wax.
Myricyl Alcohol	$C_{30}H_{62}(OH)_2$	88		Alcohol; ether	As myricyl palmitate in Beeswax, Carnauba.
Anonymous Alcohol (Carnaubyl)	$C_{24}H_{48}(OH)_2$	103			Carnauba Wax.

ORIGIN AND USE OF WAXES

Wax	Type	Source	Locality of Origin	Original Color	Hardness	Commercial Grades
Beeswax	Insect	Apis Mellifica	World-Wide	Light Yellow to Dark Greenish Brown	Fairly Brittle, But Plastic When Warm	Crude; Yellow Refined; Bleached White
Candelilla	Vegetable	Euphorbia Antisyphilitica	Mexico, and Southern Texas	Dark Brown, or Brownish to Greenish	Harder Than Beeswax, Not So Hard As Carnauba	Technical
Carnauba	Vegetable	Corypha Cerifera	Brazil and South American Countries	Sulphur-Yellow or Yellowish Green	Very Hard and Brittle	No. 1 Yellow; No. 2 Yellow; No. 2 North Country; No. 3 North Country; No. 3 North Country Refined; No. 3 Chalky

Ceresin	Mineral	Purified Ozokerite from Lignite		Yellow or White		White ; Yellow ; Orange, Sold According to Melting Point Range, 130–133°, 135–138°, 140–145°, 150–160°, 160–170° F.
Insect Wax, or Chinese Wax	Insect	Coccus Ceriferus	Western China	White, Opaque, Fibrous		
Japan	Vegetable	Rhus Succedanea, Rhus Vernicifera	China, Western Provinces of Japan	Greenish, Pale Yellow or Light Brown	Hard and Brittle	Kitagumi, and Chickusan
Montan	Vegetable	Lignite	Saxony, Thuringia	Dark Brown, Brownish Black	Hard and Brittle ; Conchoidal Fracture	Crude, and Bleached
Ozokerite	Mineral	Lignite	Chiefly Galicia Tcheleken Islands ; Also in Utah, Austria, Egypt, Serbia, Orange Free State	Pure Yellow to Dark Brown, Greenish Brown, or Dark Amber	Varies From Quite Soft to As Hard As Gypsum	Crude ; Natural Yellow ; White
Spermaceti	Animal	Physeter Macrocephalus		White, Crystalline and Glistening	Very Brittle, Readily Powdered	Blocks, Cakes, Technical, U.S.P.

ORIGIN AND USE OF WAXES (*Continued*)

Wax	Containers and Weights, Lbs.	Special Features	Uses	Other Names
Beeswax	Barrels 300, Kegs 100, Cases and Bags	Distinctive Odor	Manufacture of Wax Polishes, Furniture Polishes, Wood Polishes and Finishes; Candles; Transparent Papers; Pomades, Toilet Preparations, Cosmetics; Food Products, Chewing Gums, Sweetmeats; Adhesive Compositions; Dressing and Polishing Leather; Modeling Fruits and Flowers; Base for Plasters, etc., Engraving, Lithography; Sizing and Finishing Textiles; in Medicine.	White Wax
Candelilla	Bags 150–200	Distinctive Odor	Manufacture of Leather Dressing, Furniture Polish, Shoe Polish; Candles; Cements; Varnishes; Sealing Wax; Electrical Insulating Compositions; Phonographic Records; Paper Size; Celluloid, Rubber; Waterproofing and Insect Proofing Containers; in Paint Removers; Soft Wax Stiffener; Substitute for Canauba and Beeswax.	
Carnauba	Bags and Cases of Varying Weights	Characteristic Odor of New Mown Hay on Warming. Takes a Fine Hard Gloss on Rubbing With a Cloth	Manufacture of Shoe and Furniture Polishes; Lacquers, Varnishes; Photographic Records; Carbon Paper Coatings; Hardening Candles; Leather Finishes; in Electrical Insulating Compositions; Waterproofing Textiles, Wood, etc.; Inks and Ink Compositions; as a Mold Lubricant; Substitute for Beeswax.	Brazil Wax
Ceresin	Bags	Plasticity	Manufacture of Candles; Shoe, Floor and Leather Polishes; Antifouling Paints; Wood Polishers and Fillers; Incandescent Gas Mantles; Paper Size; Waxed Paper; Lubricating Compositions; Waxes; Figures and Forms; Toys, Dolls; Bottles for Hydrofluoric Acid; in Electrical Insulations; General Size; Impregnating and Preserving Agent; Substitute for Beeswax in Crayons, Perfume Pastes, Pomades, Cosmetics, Salves, and other Pharmaceutical Products; Matrix Compositions in Printing; Printing Forms; Rubber Mixtures; Waterproofing Textiles and Cloth, Textile Dressing.	Cerin, Cerosin, Earth Wax, Mineral Wax, Purified Ozokerite
Insect Wax, or Chinese Wax	Bags and Barrels	Fibrous Crystaline Structure	Manufacture of Candles; Leather and Furniture Polishes; in treating Silk and Cotton Fabrics; Sizing and Glazing Papers.	Insect Wax, Tree Wax, Vegetable Spermaceti, Wrongly Called Japanese Wax

Japan	Cases 224, and Other Sizes	Effloresces; Tallowy Odor	Manufacture of Furniture, Shoe, and Floor Polishes; Candles, Wax Matches; Leather Polishing and Finishing Compositions; Substitute for Beeswax.	Japan Tallow, Vegetable Wax of Japan; Sumac Wax
Montan	Bags of Various Sizes	Lustrous Appearance, Bituminous Odor on Friction or Warming	Manufacture Polishing Preparations, Paints, Varnishes, Tarry Roofing Compositions, Waterproofing Paints; Shoe Creams and Polishes; Phonograph Records; Insulating Compositions; Candles; Soaps, Adhesive Pastes; Finishing Leather Goods; Increasing Hardness of Fat Compositions; Paper Sizing; to raise the melting point of softer waxes; Substitute for Carnauba and Beeswax.	Lignite Wax
Ozokerite	Bags of Various Sizes; Stands 80–100	Plasticity; a Mixture of Hydrocarbons	Manufacture of Paints, Varnishes, Wood Fillers, Wood Polishes; Candles; Lithographic and Printing Inks; Dolls, Toys; Carbon Paper, Shoe Polishes, Incandescent Gas Mantles; Pomades, Cosmetics, Pharmaceutical Ointments; Matrices in Galvanoplastic Work; Crayons, Waxed Paper and Cloth, Linen and Cotton Sizing Preparations; Electrical Insulating; Leather Finishing; Lubricant, and Lubricating and Sealing Wax Compositions; in Process Engraving and Lithography; Electrotyper's Wax; as Rubber Filler; Substitute for Beeswax, Carnauba, Ceresin.	Mineral Wax, Fossil Wax, Native Paraffin Ozacerite
Spermaceti	Cases 50–60	Odor and Taste Free When Pure	Manufacture of Chemical Emulsions, Cerates; Candles, Soaps, Sweetmeats, Candies, Confectionery; Cosmetics Ointments, Pomades, Toilet Preparations; Finishing Linens; in Medicine.	Cetaceum

SOLUBILITY OF WAXES

Wax	Acetone	Alcohol	Alkalies	Benzol	Carbon Bisulphide	Carbon Tetra-chloride	Chloroform	Dioxan	Ether
Beeswax	Insoluble Cold: Soluble Hot	Soluble Hot (76° C.)	Saponifiable			Soluble	Insoluble in Cold: Soluble in Hot	Soluble Hot	Soluble
Candelilla		Soluble Hot (63° C.)	Saponifiable			Soluble	Soluble Hot		
Carnauba	Insoluble in Cold: Not Very Soluble in Hot	Soluble Hot (82° C.)	Saponifiable			Soluble	Insoluble in Cold: Soluble in Hot	Soluble Hot	Insoluble in Cold: Soluble in Hot
Ceresin		Insoluble		Soluble			Not Completely Soluble		
Chinese or Insect Wax		Slightly Soluble	Saponifiable	Soluble					Slightly Soluble
Japan	Insoluble	Soluble Hot (76° C.)	Saponifiable	Soluble		Soluble	Soluble		Soluble
Montan		Soluble Hot (70° C.)	Saponifiable	Soluble		Soluble	Soluble	Soluble Hot	
Ozokerite		Insoluble		Soluble	Soluble				Soluble
Spermaceti	Insoluble in Cold: Soluble in Hot	Soluble Hot (44° C.)	Saponifiable		Soluble	Soluble	Soluble		Soluble

Wax	Hydrogenated Naphtha	Isopropyl Ether	Kerosene	Naphtha	Toluol	Trichlorethylene	Turpentine	Xylol	Fusel Oil
Beeswax		Soluble		Insoluble		Soluble	Soluble		Soluble
Candelilla		Soluble				Soluble	Soluble		
Carnauba		Soluble		Insoluble in Cold: Soluble in Hot		Soluble			Soluble
Ceresin	Soluble	Soluble		Soluble	Soluble	Soluble		Soluble	
Chinese or Insect Wax..		Soluble			Soluble	Soluble		Soluble	
Japan	Soluble	Soluble		Soluble	Soluble	Soluble	Soluble	Soluble	Soluble
Montan		Soluble		Soluble	Soluble	Soluble		Soluble	
Ozokerite		Soluble	Soluble		Soluble	Soluble	Soluble	Soluble	
Spermaceti		Soluble		Soluble		Soluble	Soluble		Soluble

PROPERTIES OF WAXES

Wax	Refractive Index	Specific Gravity	Melting Point		Direct Acid Number	Per Cent Fatty Acids	Saponification Number	Unsaponifiables, Percent	Ratio Number Sapon. #—Acid # Acid #	Iodine Number
			Deg. C.	Deg. F.						
Beeswax	1.4398–1.4451 at 75° C., 167° F.	0.959–0.975	62–70	145–158	16.8–20.6	46.77	88–96	52–56	3.6–3.8	8.3–11
Candelilla	1.4555 at 71.5° C., 160.7° F.	0.969–0.993	65–69	149–156	16	29.0	46–65	74.0	4.7	14.0–36.8
Carnauba	1.463 at 60° C., 140° F.	0.990–0.999	83–91	184–196	4–8	47.95	78–88	54–55	31	13.5
Ceresin	1.4415–1.4464	0.88–0.92	54–77	130–170	0	0	<2	100	0	7–9
Insect Wax, or Chinese Wax		0.926–0.970	65–80	149–176	13	51.5	80–93	49.5	29.3	1.4–2
Japan	1.450 at 60° C., 140° F.	0.975–0.984	50–56	122–133	6. Usually Not over 20	4–12	217–237	1.1–1.6	11–35	4–15
Montan		Crude 1.0	Crude 76–92 Dist'd 72–77 Ref'd 77–84	169–198 162–171 171–183	Crude 25 Dist'd 73–85 Ref'd 15–20	Dist'd 56–64 Ref'd 11–15	Crude 58 Dist'd 75–89 Ref'd 70–80	Crude 3.58 Dist'd 30–45	Crude 3–3.5 Dist'd 0–03 Ref'd 3–3.5	Crude 16 Dist'd 10–15
Ozokerite	1.4415–1.4464	0.85–0.95	58–100	136–212	0	0	0	100	0	7.8
Spermaceti	1.440 at 60° C., 140° F.	0.905–0.960	41–49	106–120	0.5–2.8, Not usually over 0.5	52–53	121–135	51–54	124	2.6–3.8

Wax	Acetyl Number	Dielectric Constant Initial (a)	Dielectric Constant After Immersion (b)	Dielectric Constant Final (c)	Effective A.-C. Conductivity (Unit = 10^{-12} MHOS CM.) Initial (a)	Effective A.-C. Conductivity After Immersion (b)	Effective A.-C. Conductivity Final (c)	Volume Resistivity (Unit = 10^{13} OHMS CM.) Initial (a)	Volume Resistivity After Immersion (b)	Volume Resistivity Final (c)
Beeswax	15.2	2.87–2.88	3.11–3.26	2.84–2.90	45–48	70–85	56–58	5–12	0.8–1.4	7–8
Candelilla		2.38–2.49	2.50–2.62	2.45–2.56	6.0–6.4	18	9.3–9.4	>290	>110	>630
Carnauba	55	2.66–2.83	3.84–4.19	2.82–2.83	4.9–5.3	240–300	74–75	60–120	0.3–4	270
Ceresin		2.16–2.24	2.29–2.32	2.28–2.29	<0.37	10–12	1.1	>290	400–>600	>900
Insect Wax, or Chinese Wax		2.94–2.98	3.62–3.89	2.95–2.97	125–137	189–210	120–123	1–2	0.03–0.16	1–2
Japan	27–31.2	2.96–2.99	3.15–3.20	2.91	9–12	33–34	13	6–7	0.40–0.75	21
Montan		2.62–2.67	2.88–3.05	2–68	29–31	45–55	25	>290	>270	>610
Ozokerite		2.37–2.43	2.50–2.55	2.40–2.47	10–12	19–24	15	30–40	7–9	30–40
Spermaceti	2.6	3.60–3.75	6–17	3.74–3.89	6.0–6.6	500–100,000	10–12	3–4	0.0006– 0.0003	9–15

(a) After drying over calcium chloride; (b) After 6-mos immersion in 3.5% sodium chloride solution: (c) After re-drying.

CHAPTER NINETEEN

SOAPS, CLEANERS

Liquid Soaps

Tar Shampoo

The following formula for a liquid shampoo gives a product that is very mild in its action, but one with very good cleansing power.

Coconut Oil Fatty Acids	15.0 kg.
Castor Oil Fatty Acids	8.0 kg.
Peanut Oil Fatty Acids	2.0 kg.
Caustic Potash (50° Bé.)	12.5 kg.
Potassium Chloride	2.0 kg.
Sugar	10.0 kg.
Purified Lignin Sulphonate 25% solution	20.0 kg.
Distilled Water	55.5 kg.
Anthrasol	2.0 kg.

The anthrasol is dissolved in twice its volume of alcohol.

Shampoo

Coconut Oil	45 lb.
Castor Oil	25 lb.
Palm Oil	30 lb.
Caustic Soda (38° Bé.)	10 lb.
Caustic Potash (40° Bé.)	40 lb.
Sodium Carbonate	1.5 lb.
Sodium Chloride	0.5 lb.
Alcohol	5 lb.
Water, Distilled	250 lb.
Perfume	1.5 lb.

Marseilles (Castile) Soap

Coconut Oil	35 lb.
Olive Oil	65 lb.
Caustic Potash (40° Bé.)	50 lb.
Sodium Carbonate	3 lb.
Glycerin	5 lb.
Alcohol	7 lb.
Water, Distilled	150 lb.
Boric Acid	0.5 lb.
Perfume	1.5 lb.

Hand Soap

Coconut Oil	30 lb.
Castor Oil	5 lb.
Cottonseed Oil	65 lb.
Caustic Soda (38° Bé.)	15 lb.
Caustic Potash (40° Bé.)	35 lb.
Sodium Carbonate	1 lb.
Sodium Chloride	2 lb.
Alcohol	7 lb.
Sugar	5 lb.
Water, Distilled	300 lb.
Perfume	1.5 lb.

Carbolated Soap

Coconut Oil	70 lb.
Castor Oil	10 lb.
Olive Oil	15 lb.
Palm Oil	5 lb.
Caustic Soda (38° Bé.)	5 lb.
Caustic Potash (40° Bé.)	45 lb.
Soda Ash	2 lb.
Glycerin	3 lb.
Alcohol	5 lb.
Sugar	1 lb.
Water, Distilled	200 lb.
Carbolic Acid	5 lb.
Perfume	1.5 lb.

Borax Soap

Coconut Oil	70 lb.
Castor Oil	10 lb.
Palm Oil	10 lb.
Cottonseed Oil	10 lb.
Caustic Potash (40° Bé.)	50 lb.
Soda Ash	2 lb.
Glycerin	3 lb.
Alcohol	7 lb.
Water, Distilled	200 lb.
Boric Acid	5 lb.
Perfume	1.5 lb.

Tar Soap

Coconut Oil Fatty Acid	12 lb.
Oleic Acid (Titer 8–11° C.)	4 lb.
Caustic Potash (50° Bé.)	8 lb.
Wood Tar	3 lb.
Water	73 lb.

Formaldehyde Soap

a.	Coconut Oil	30 lb.
	Caustic Potash (50° Bé.)	16 lb.
	Water	10 lb.
b.	Alcohol	12 lb.
c.	Formaldehyde to make	100 lb.

Saponify *a* by boiling in the usual manner; cool somewhat, add *b*. When a homogeneous mixture has been formed, work in *c*.

Transparent Solid Soap

Tallow Fatty Acid	50 lb.
Palm Oil Fatty Acid	20 lb.
Coconut Fatty Acid	30 lb.
Caustic Potash (42° Bé.)	55 lb.

Palm oil fatty acid may be replaced by bone fat fatty acid or by a hydrogenated oil fatty acid.

Glycerite of Starch

a. Glycerin	65.3 g.
b. Corn Starch	14.1 g.
Water, Distilled	8.2 g.
Glycerin	12.4 g.

Heat *a* to 60° G. Add the suspension *b* with good stirring.

Heat to 60–70° C. for 1 hour (water bath!).

Lecithin Soap

German Patent 666,208

Soybean Lecithin	85–90 g.
Cyclohexanol	15–10 g.
Soap	900–1900 g.

Medicinal Soaps

Potash Soap

Soybean Oil, Light, Pure	30 kg.
Caustic Potash (30° Bé.)	22.5 kg.
Alcohol	3 kg.
Water, Distilled	18 kg.

Formalin Soap

a. Potash Soap (as above)	25 kg.
Alcohol	18 kg.
Formalin	3 kg.
b. Tannoform	1 kg.
Coumarin	0.05 kg.
Tincture of Rhatany	3.5 kg.

The ingredients of *a* are mixed well and the ingredients of *b* are added in the order given.

Cresol Soap

Olive Oil Fatty Acid	30 g.
Soybean Oil Fatty Acid	30 g.
Potassium Hydroxide, Pure about	12 g.
Water	30 g.
Alcohol	6 g.
Cresol (B.P. 199–204° C.)	100 g.

Use this soap in 1% solution.

Spirit Soap

Olive Oil	6 kg.
Caustic Potash (Sp. G. 1.128)	7 kg.
Alcohol (90%)	30 kg.
Water	17 kg.

Saponify at 50° C. Let stand for several days to clarify. Filter.

Isopropanol may replace alcohol with advantage, since it has a better disinfecting power.

Medicinal Disinfectant Soap

Coconut Oil	525 kg.
Isopropanol	325 kg.
Water	70 kg.
Caustic Soda (33%)	262 kg.

Medicated Soap (Sapo Medicatus)

a. Hog Fat	50 kg.
Olive Oil	50 kg.
b. Caustic Soda (38° Bé.)	55 kg.
c. Alcohol	12 kg.
d. Water	270 kg.
e. Salt	25 kg.
Soda Ash	3 kg.
Water	80 kg.

Saponify *a* with small amounts of *b*, add *c* and part of *d* to get a homogeneous mixture. Add the balance of *d* and, to the finished soap, add the solution of *e* mixing well. Separate the curd. Filter if necessary before adding *e*.

Antiseptic Cleaning Composition

French Patent 802,782

Trisodium Phosphate	60 g.
Chloramine	5 g.
Soda Ash	10 g.
Sodium Perborate	3 g.
Borax	2 g.
Soap, Powdered	20 g.

Hand Cleaning Paste (Mechanic's Soap)

Formula No. 1

Soda Ash	200 kg.
Borax, Powdered	100 kg.
Soap Powder	400 kg.
Pumice Powder	1300 kg.
Turpentine or substitute Carbon Tetrachloride	50/50 to give paste

No. 2

Soda Ash	200 kg.
Borax, Powdered	100 kg.
Soap Powder	300 kg.
Emery Powder	800 kg.
Saw Dust, Finest	400 kg.
Liquid Soap	200 kg.
Solvent	to give paste

No. 3

Trisodium Phosphate	200 g.
Soda Ash	100 g.
Sodium Silicate, Powdered	50 g.
Hard Soap, Powdered	150 g.
Quartz, Powdered	500 g.
Solvent	to give paste

Use a dough mixer to mix uniformly.

No. 4

a.	Soft Soap	30 lb.
	Water	20 lb.
	Alcohol, Denatured	10 lb.
b.	Triethanolamine Oleate	5 lb.
	Naphtha	5 lb.
	Tetrahydronaphthalene	5 lb.
c.	Pumice Powder	4 lb.
	Saw Dust	1 lb.
	White Bole	1 lb.
	Perfume (Spike, Rosemary, Citronella, Sassafras Oil)	to suit

Make solutions *a* and *b* separately. Mix and add *c* with good stirring.

No. 5

Soft Soap, Unfilled	5 kg.
Alcohol	2 kg.
Water	10 kg.
Wood Flour	2 kg.
White Bole	1 kg.
Sea Sand	5 kg.
Pumice, Powdered	4 kg.
Naphtha or Kerosene	1 kg.

No. 6
(Abrasive)

Mechanics, painters, laborers and other workers will find practical usefulness in a simply compounded abrasive hand soap containing glycerin. This soap removes dirt, grease, grime and paint rapidly and effectively while the presence of the glycerin prevents undue irritation to the skin. It can readily be made from:

Soap (Chips)	100 g.
Water	200 g.
Pumice or Fine Sand	150 g.
Sodium Silicate	10 g.
Glycerin	10 g.
Perfume	5 g.

This basic formula may be varied to suit individual requirements.

No. 7

Paste hand soap can be made with a fatty acid content not exceeding 5%. A suitable composition is as follows: 15 parts of paste soap containing about 35% of fatty acids are dissolved in 30 parts of water, 5 parts of denatured alcohol and 3 parts of acetone. Into the solution is worked a mixture of 3 parts of soft sawdust, 3 parts of colloidal clay, 9 parts of ground quartz or fine pumice until a homogeneous paste is obtained. The product is perfumed with 0.1 part of thymol which also has disinfectant action.

No. 8

A hand soap of good quality is prepared as follows: I. 5 parts of kaolin or bentonite are mixed with 3 parts of fine sand or pumice powder and 2 parts of wood flour. II. 5 parts of calcined soda ash, 4 parts of 40° Bé. caustic soda solution, and 4 parts of methyl cellulose are dissolved in 90 parts of hot water and emulsified with 1–2 parts of neutral wool fat. Mixture I and solution II are worked up into a paste; 2–3% of foaming agent such as Saponin can also be worked in or can be admixed with the powdered ingredients.

Solid Potash Soap

Hard Fat Fatty Acid	50 lb.
Oil Fatty Acid	15 lb.
Caustic Potash (46° Bé.)	35 lb.

or

Hard Fat Fatty Acid	45 lb.
Coconut Oil Fatty Acid	20 lb.
Caustic Potash (50° Bé.)	35 lb.

Hard Soap Base

Tallow	30 lb.
Palm Kernel Oil	10–15 lb.
Bone Fat	55–60 lb.

Salt Water Soap

a.	Coconut Oil (or Fatty Acid)	25 lb.
	Castor Oil Fatty Acid	3 lb.
	Caustic Soda (38° Bé.)	15 lb.
	Water	10 lb.
b.	Sodium Silicate (36° Bé.)	25 lb.
c.	Potassium Carbonate Solution (30° Bé.)	8 lb.

Boil *a* together. Incorporate *b* with stirring. Adjust with *c*.

Soft Soap

Vegetable Oil	50 lb.
Cottonseed Oil Fatty Acid	20 lb.
Tallow Fatty Acid	25 lb.
Coconut Oil Fatty Acid	5 lb.
Caustic Potash (50° Bé.)	40 lb.
Caustic Soda (38° Bé.)	2 lb.
Potassium Carbonate	5 lb.
Ammonium Carbonate	5 lb.
Water	70 lb.
Filler (Potato Starch)	50 lb.

Fulling Soaps

	Good	Medium	Cheap
	%	%	%
Tallow or Grease .	47	31	25
Palm Oil	11	10	8
Soda Ash Solution, (36° Bé.)	6	9	11
Caustic Soda Lye, (36° Bé.)	31	26	25
Sodium Silicate ...	..	9	17

Starch	..	..	1
Water	5	15	13

Starch is used to close up the cheap grade, which would otherwise be too open a soap, due to the low proportion of fatty acids.

Neutralizing and Bleaching Soap

French Patent 823,776

To 1000 kg. soap add

Mannitol	0.1 kg.
Boric Acid	1.5 kg.

Soap Superfatting and Neutralizing Compound

Beeswax	700 g.
Lanolin	3000 g.
Stearic Acid	400 g.
Borax	62 g.
Distilled Water	3000 g.

The beeswax and half of the lanolin are heated together to about 80° C. The borax is dissolved in the water, which is boiling hot, and the solution stirred into the melted fats and allowed to boil for some time. The mixture is then allowed to cool to about 60° C. with stirring. The stearic acid is melted in another suitable vessel and the balance of the lanolin added to it. This is added to the first mixture at a temperature of 50° C. and stirred. About 2% of the compound may be used as a superfatting agent with soap chips.

Fireproofing Soap

A soap designed to make cotton uninflammable after washing can be made by mixing together:

Dry Powdered Soap	180 g.
Sodium Silicate	24 g.

This is made into a paste with:

Potassium Carbonate	8 g.
Glycerin	7 g.
Sodium Tungstate	4 g.

Powdered Milk Soap

Powdered Milk	12 lb.
Borax	8 lb.
Sodium Bicarbonate	20 lb.

Mix and pass through fine sieve.

Large Bubble Blowing Soap

Coconut Oil Potash Soap	5 oz.
Glycerin	2 oz.
Methyl Cellulose	1 oz.
Water	92 oz.

This preparation is used for the blowing and forming of large bubbles, which can be developed to several feet in diameter for theatrical and advertising purposes. The usual pipe is used for the blowing of the bubbles, while a source of compressed air will be necessary to fill the bubbles which can be extended to several feet in diameter. The glycerin content prevents the evaporation of the water, thus giving the bubble substantial longevity. Methyl cellulose forms a fairly tough film, giving strength to the bubble sidewall.

Soap Filler

Soaps which appear to be too soft can be given more body by the addition of a little tragacanth, which also produces a milder better lather. For 100 kg. of soap 0.28–0.5 kg. of tragacanth is sufficient, mixed with 1 kg. of glycerin. The flakes are allowed to soak in water for several hours before use and then passed through a nonrusting sieve to remove any solid material.

Saddle Soap

Formula No. 1

a.	Palm Oil, Lagos	14 lb.
	Rosin, Light	1 lb.
	Caustic Soda (38° Bé.)	7 lb.
b.	Water	35–40 lb.
	Glycerin, Water White (sp. g. 1.23)	5 lb.
c.	Talc	0.2–0.5 lb.
d.	Beeswax, Yellow	1–2 lb.

Saponify *a* hot. Thin with *b*. When cooled somewhat, work in *c* and add melted *d*. Pour into forms.

No. 2

Palm Oil Soap Chips	8 oz.
Water	24 oz.
Beeswax	1½ oz.
Neatsfoot Oil	1¼ oz.
DuPont Orange No. 110 (2% solution)	10 cc.

Dissolve soap chips in hot water, add color. Melt wax with the neatsfoot oil, and add to soap solution. Stir until the mix begins to thicken, and pour into cans.

Detergent Powders

(To remove grease from hands)

Formula No. 1

Sawdust, Fine	40.0
Soda Ash, Dry	12.5
Trisodium Phosphate	17.5
Powdered Soap	30.0

No. 2

Powdered Pumice	270
Trisodium Phosphate	10
Powdered Soap	20
Sassafras Oil	to suit

DRY CLEANING SOAPS

Dry Cleaning Soaps

Formula No. 1

Oleic Acid	35 oz.
Stearic Acid	5 oz.
Potash Solution (50° Bé.)	12 oz.
Ammonia (26° Bé.)	1 oz.
Diglycol Oleate	3 oz.
Water	5 oz.
Methylated Spirit	2 oz.
Cyclohexanol	5 oz.
Benzine	32 oz.

The diglycol oleate present in this formula dissolves readily in the solvents, increases the detergent properties of the soap, and is said to prevent deposition of a gelatinous film on the filters.

No. 2

Oleic Acid	30 oz.
Potash Solution (50° Bé.)	6 oz.
Ammonia (26° Bé.)	3 oz.
Water	9 oz.
Alcohol	15 oz.
Cyclohexanol	15 oz.
Benzine	22 oz.

The proportions of solvents may be modified as desired, but it is desirable to retain the cyclohexanol in order to make the soap readily dispersible.

No. 3

Oleic Acid	52 oz.
Butyl Cellosolve	10 oz.
Triethanolamine	10 oz.
Potash Solution (50° Bé.)	7 oz.
Water	5 oz.
Naphtha	16 oz.

In this formula the butyl cellosolve gives an effective coupling action, permitting the addition of water and to some extent assisting in the removal of stains.

For chlorinated hydrocarbon processes a soap may be built up on the lines of a good soft soap (about 20–25%), together with a small amount of oleic acid, dissolved in alcohol and water, to which is subsequently added from 15–25% of a chlorinated solvent such as trichlorethylene.

No. 4

U. S. Patent 2,070,908

Sodium Oleate	108 g.
Trichlorethylene	147 g.
Diethylene Glycol	56 g.

No. 5

Alcohol	5 oz.
Dichlorethylene	85 oz.
Diglycol Laurate	10 oz.

No. 6

A simply prepared soap soluble in naphtha is made by the partial saponification of fatty acids; 100 parts of tallow fatty acids are warmed to 80–90° C. and 25–30 parts of 38° Bé. caustic soda allowed to flow in slowly with stirring. The lye solution is also heated to 80–90°. A liquid soap can be prepared similarly by using caustic potash.

Textile Cleaning Soap

Hard Soap	50 lb.
Soft Soap	200 lb.
Methylene Glycol	40 lb.
Carbon Tetrachloride	200 lb.

Benzine Soap

Coconut Oil	100 lb.
Caustic Soda (38° Bé.)	50 lb.
Benzine	7½ lb.

Petroleum Soap

Coconut Oil	100 lb.
Caustic Soda (38° Bé.)	50 lb.
Turpentine	10 lb.
Petroleum	5 lb.

Oil and caustic lye are stirred together until a viscous emulsion has formed. To this, the solvents are added in thin jet with good agitation. Resulting soap should be a "solid" gel.

Methyl Hexalin Soap

Formula No. 1

Linseed Oil Fatty Acid	500 lb.
Caustic Potash (50° Bé.)	about 205 lb.
Methyl Cyclohexanol	740 lb.
Water	300 lb.

No. 2

Oleic Acid	500 lb.
Caustic Potash (50° Bé.)	about 200 lb.
Methyl Cyclohexanol	830 lb.
Water	2460 lb.

No. 3

Coconut Oil Fatty Acid	500 lb.
Cyclohexanol	125 lb.
Methyl Cyclohexanol	125 lb.
Caustic Potash (50° Bé.)	about 270 lb.
Water	1600 lb.

No. 4

Rape Oil Fatty Acid	500 lb.
Caustic Potash (50° Bé.)	about 194 lb.
Cyclohexanol	600 lb.
Methyl Cyclohexanol	300 lb.
Water	360 lb.

No. 6

Linseed Oil	1000 kg.
Caustic Potash (50° Bé.)	200 kg.
Caustic Soda (36° Bé.)	280 kg.

Methyl Cyclohexanol	600 kg.
Water	450 kg.

No. 7

Linseed Oil	500 kg.
Methyl Cyclohexanol	70 kg.
Caustic Potash (50° Bé.)	100 kg.
Caustic Soda (36° Bé.)	140 kg.
Water	about 230 kg.

No. 8

Linseed Oil Fatty Acid	500 kg.
Cyclohexanol	150 kg.
Caustic Potash (50° Bé.)	52 kg.
Caustic Soda (36° Bé.)	260 kg.
Water	about 300 kg.

Heat all ingredients in a kettle with an open steam coil, until the product is clearly water soluble.

No. 9

Marseilles Soap	10 lb.
Water	200 lb.
Cyclohexanol or Methyl Cyclohexanol	10.5 lb.

Tetralin Soap

Formula No. 1

Tetra (Hydro Naphthalin)	800 kg.
Methyl Cyclohexanol	100 kg.
Castor Oil Fatty Acid	50 kg.
Turkey Red Oil	40 kg.
Caustic Potash (50° Bé.)	about 20 kg.

No. 2

Tetra (Hydro Naphthalin)	790 kg.
Methyl Cyclohexanol	150 kg.
Castor Oil Fatty Acid	80 kg.
Caustic Potash (50° Bé.)	about 30 kg.

Hexalin Soap

A liquid soap can be made more economical in use and given improved detergent powers by the incorporation of Hexalin. As a suitable composition, add to a solution of 10 g. of Marseilles soap in 200 cc. water, 10.5 g. of Hexalin or Methyl Hexalin.

Solvent Soaps

Formula No. 1

Soap	35 g.
Cyclohexanol	10 g.
Water	55 g.

No. 2

Soap	30 g.
Trichlorethylene	25 g.
Water	45 g.

No. 3

Soap	28 g.
Trichlorethylene	10 g.
Water	60 g.
Potash, Caustic	2 g.

No. 4

Soap	5 g.
Ammonia (0.880)	25 g.
Cyclohexanol	10 g.
Water	60 g.

No. 5

Soap	10 g.
Ammonia (0.880)	5 g.
Tetralin	10 g.
Water	75 g.

No. 6

Coconut Oil	100 lb.
Caustic Soda (38° Bé.)	50 lb.
Methyl Cyclohexanol	8 lb.

Can be perfumed with 2–3% of bitter almond oil.

No. 7

Coconut Oil	100 lb.
Caustic Soda (38° Bé.)	50 lb.
Methyl Cyclohexanol	6 lb.
Pumice Powder	10 lb.

Mix oil and solvent in a kettle, and add the caustic lye. Mix thoroughly. When the soap emulsion is heavy enough, add the pumice through a strainer. Mix again, and let stand for some time, thereafter form the soap-pieces, which should be allowed to stand again well covered.

No. 8

Oleic Acid	225 kg.
Methyl Cyclohexanol	225 kg.
Caustic Potash (50° Bé.)	about 90 kg.
Carbon Tetrachloride	360 kg.
Water	100 kg.

Spotting Paste for Cleaning Garments

Triethanolamine Oleate	5 lb.
Water	3 lb.
Alcohol	3 lb.
Pine Oil	1 lb.
White Bole	to form paste

Spotting Soaps for Collapsible Tubes

Formula No. 1

Oleic Acid	31.86 kg.
Methyl Hexalin	19.17 kg.
Caustic Potash (50° Bé.)	3.33 kg.
Caustic Soda (36° Bé.)	16.47 kg.
Water	19.17 kg.
Carbon Tetrachloride or Trichlorethylene	10.00 kg.

No. 2

Oleic Acid	30.00 kg.
Triethanolamine	14.40 kg.
Benzine	20.00 kg.
Tetralin	15.60 kg.
Water	20.00 kg.

To No. 1: Mix oleic acid and Methyl Hexalin, heat to 60–70° C.;

stir into this the caustic followed by the water, and by the solvent. Let stand over night under cover. Fill into tubes.

To No. 2: Heat the oleic acid to 60° C. and add the triethanolamine (at the same temperature) with stirring. Let cool somewhat, and add the solvents with thorough stirring. Add the water (60° C.) while mixing vigorously. Cover, allow to stand over night. Fill into tubes.

Solid Spotting Soap

a. Tallow	25 kg.
Coconut Oil	25 kg.
b. Methyl Hexalin	13 kg.
c. Caustic Soda (37° Bé.)	25 kg.
d. Sodium Silicate (38° Bé.)	12 kg.

Melt *a*, dilute by adding *b*, heat to 40–50° C. and add *c* with thorough agitation.

Mix in *d* in the crutcher. The warm, still liquid soap is now left in covered frames to finish the saponification, and cut when cooled.

Dye with bile-green (very little).

Spotting Pencils

Formula No. 1

Powder good hard soap, and knead with a solid spotting soap to a tough dough. Press into rods in a soap press. Pack at once into tin-foil.

No. 2

Extract

Soap Root or Quillaya Bark	20 kg.
Water, Lukewarm	100 kg.

Allow it to stand over night; pour off next day, concentrate the extract by evaporating to about one-third on the water bath.

Now mix this

Saponine Concentrate	30 kg.

with

Hard Soap, Powdered	70 kg.

to a heavy dough.

Press, cut and pack in tin-foil.

No. 3

Hard Soap, Powdered	80 kg.
Ox Gall, Concentrated	20 kg.

Knead to a dough, press, cut, pack into tin-foil or cellophane immediately.

No. 4

Hard Soap, Finely Powdered	98.5 kg.
Sodium Cholate	1.5 kg.
Water	to make stiff paste

Treat as above.

No. 5

a. Soft Soap	25 kg.
Methyl Hexalin	5 kg.
Benzine	5 kg.
b. Hard Soap, Finely Powdered	65 kg.

Mix *a*, mix with *b* to form stiff paste, press, cut, pack as told above.

Emulsion Cleansers

Formula No. 1

Oleic Acid	28.7 lb.
Methyl Hexalin	43.0 lb.
Caustic Potash (50° Bé.)	11.5 lb.
Water	16.8 lb.
Carbon Tetrachloride	900.0 lb.

No. 2

Oleic Acid	35.4 lb.
Methyl Hexalin	21.3 lb.
Caustic Potash (50° Bé.)	3.7 lb.
Caustic Soda (36° Bé.)	18.3 lb.
Water	21.3 lb.
Benzine	900.0 lb.

No. 3

Oleic Acid	14.8 lb.
Methyl Hexalin	17.6 lb.
Caustic Potash (50° Bé.)	5.9 lb.
Water	11.7 lb.
Alcohol	500.0 lb.
Trichlorethylene	450.0 lb.

No. 4

Oleic Acid	14.3 lb.
Methyl Hexalin	21.5 lb.
Caustic Potash (50° Bé.)	5.7 lb.
Water	8.5 lb.
Tetralin	500.0 lb.
Isopropyl Alcohol	200.0 lb.
Ethyl Ether	250.0 lb.

Procedure for Formulae 1–4:

Mix oleic acid and methyl hexalin, heat to 60° C.

Saponify, adding the lye with agitation, and add the water thereafter.

Stir this soap until homogeneous, cool to about 30° C. Stir into this, the solvents, with good agitation.

When ethyl ether is being used, work at still lower temperature.

No. 5

Oleic Acid	67 lb.
Triethanolamine	33 lb.
Carbon Tetrachloride or Trichlorethylene	800 lb.
Alcohol	100 lb.

No. 6

Oleic Acid	3.35 lb.
Triethanolamine	1.65 lb.
Benzine or Benzene	60.00 lb.
Alcohol	10.00 lb.
Xylene	25.00 lb.

Procedure in No. 5, 6:

Heat oleic acid to about 60° C. and add the triethanolamine which has been heated to the same temperature. Stir well, cool to 30° C., add the solvents with good agitation.

No. 7

Benzine	40 lb.
Acetone	20 lb.
Alcoholic Soap*	20 lb.
Ammonia	20 lb.

No. 8

Ethyl Ether	30
Ethyl Acetate	30
Alcoholic Soap*	20
Ammonia	20

React oleic acid and triethanolamine (which both have been heated to 60° C.) with good agitation.

Cool, at 30–35° C. add alcohol. Stir.

Rug Dry Cleaner

Stoddard Solvent	5 gal.
Diglycol Laurate	1 lb.

Leather Cleaner

Castile Soap	6 g.
Water	100 g.

Heat until dissolved, cool and add:

Ammonia (26°)	6 g.
Glycerin	14 g.
Ethylene Dichloride	7 g.

Mix together vigorously.

Belt Cleanser

Triethanolamine	5 g.
Tetrahydrogen Naphthalene	25 g.
Carbon Tetrachloride	70 g.

Detergent for Leather, Cloth

Italian Patent 278,703

Ether	20 kg.
Alcohol	15 kg.
Ammonia	35 kg.
Soap Solution	30 kg.

Upholstery Cleaner

A practical formula for an upholstery cleaner which will lend itself to a variety of uses, especially in keeping up the reception room appearance, is given below:

Pure Olive Oil Soap	2 oz.
Pure Cocoanut Oil Soap	2 oz.
Hot Water	3 gal.
Glycerin	4 oz.
Borax	1 oz.
Ethylene Chloride	2 oz.

Dissolve the soaps in the hot water, then add the glycerin and borax. When the solution becomes lukewarm add the ethylene chloride.

Before using this preparation, a trial should be made on a small, inconspicuous area and care should be taken throughout that the fabric does not become any wetter than necessary. It is advocated that the solution be applied sparingly to a square foot or so at a time, by means of a soft brush, cloth or sponge, using a quick, light stroke to create fluffy suds over the area. To prevent too deep penetration, the suds should be quickly wiped off, or pressed off with a dull knife. The rest of the soap is removed by applying clean cloths wrung out of warm water. The use of a vacuum cleaner with a rubber hose attachment is also suggested.

Methyl Cellulose Soaps

To prepare a methyl cellulose solution for use in soap, add to 40 kg. of boiling water, 4 kg. of caustic potash or caustic soda, 40° Bé., stir and add 4 kg. of methyl cellulose powder. Mix well and let stand for a half hour, then add with stirring 52 kg. of cold water. Mix again the next day, when a smooth mucilaginous product is obtained. This gives a very unctuous soap when caustic potash is used in its preparation.

A suitable addition to paste soap is to add per 100 kg. of soap, a mixture of 20 kg. of sodium silicate, 36–38° Bé., 3 kg. of caustic soda, 40° Bé., and 3 kg. of water, all brought to a temperature of 70–80° C., after which 6 kg. of a cold solution of methyl cellulose are added little by little. By this means a hard soap with a fatty acid content of 48% can be obtained.

A transparent soft soap is prepared as follows: 1000 kg. of oil or fatty acid are saponified with caustic potash and the necessary potash added, giving 2200 kg. of soap base. To this add 150 kg. of potassium hypochlorite, 10° Bé., 150 kg. of a solution of potassium chloride, 10–20° Bé., 100 kg. of sodium silicate, 36° Bé., 350 kg. of methyl cellulose solution, and 50 kg. of caustic potash, 40° Bé. This soap becomes transparent after 2–3 days.

Sulphite Cellulose Soaps

The curd soap used is salted out twice so as to obtain a glycerin free

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* **Alcoholic Soap for Emulsion Cleansers used in No. 7 and 8.**

Oleic Acid, 60° C.	**13.4 lb.**
Triethanolamine, 60° C.	**6.6 lb.**
Alcohol (add at 30–35° C.)	**80.0 lb.**

and therefore non-hygroscopic soap. The curd is cooled in the usual way and then chipped. The chips are thoroughly dried and ground to a fine powder. The lignin sulphonate residue should be of the same mesh as the soap powder, otherwise it will be found impossible to obtain a perfectly uniform product.

Formula No. 1

Ground Curd Soap	20 oz.
Lignin Sulphonate	40 oz.
Calcined Soda	40 oz.

No. 2

Ground Curd Soap	15 oz.
Lignin Sulphonate	40 oz.
Calcined Soda	44 oz.
Ammonium Chloride	1 oz.

No. 3

Ground Curd Soap	20 oz.
Lignin Sulphonate	40 oz.
Calcined Soda	30 oz.
Sodium Perborate	10 oz.

The soap powder should be hard and preferably made from a stock of half coconut or palm kernel fatty acids and half tallow or bleached palm oil fatty acids. The use of low-grade garbage greases gives a soft natured soap and one which, in powder form, is apt to become lumpy and to discolor easily in the presence of lignin residue.

Sodium Metasilicate Cleaners

Cleaning Floors and Walls: Sodium Metasilicate lifts dirt from all types of floors, marble, tile, concrete, terrazzo, wooden (sodium metasilicate like other alkalies will remove varnish from varnished floors). When sodium metasilicate is used on stone, brick, concrete or tile floors, the surface becomes easier to clean because after the first washing the dirt does not adhere so well. Public buildings, factories, hotels, schools, etc., find that it takes less sodium metasilicate to do a better cleaning job.

General directions for thorough cleaning require the use of ½–1 oz. per gallon of hot water. Then rinse completely. If floor scrubbing machines are employed, slightly larger amounts of sodium metasilicate are recommended, *i.e.* 1–2 oz. per gallon of water.

Walls: Painted walls, marble, tile walls look like new with a solution of ⅛ oz. of sodium metasilicate in a gallon of lukewarm water.

Garage Floors: The removal of oil from the concrete floors, garages and service stations is quickly accomplished. A tested cleaner consists of 90–95% of sodium metasilicate and 5–10% of olein or similar soap which is readily soluble. The softer kinds are better than tallow soap. In some instances the soap is omitted to avoid slipperiness. Flush concrete with hot water, then distribute evenly, 1–2 lb. of the sodium metasilicate or sodium metasilicate soap mixture per 100 square feet. Allow this to remain on the floor for 5–10 minutes prior to scrubbing. Rinse thoroughly.

Sanitary Ware: Bathtubs, lavatories, toilets, sinks are kept clean and sanitary with sodium metasilicate.

Directions—An efficient method is to wash with a solution containing ½ oz. of sodium metasilicate per gallon of water. Unsightly rings disappear leaving the entire surface bright and shiny.

Dishwashing: Bright china and glistening glassware come out of the washer that has sodium metasilicate in the tanks. Not a trace of cloudiness with sodium metasilicate. It rinses freely. Aluminum and silverware are unharmed and unetched with the strength of solution and time needed to clean them. Hotels, restaurants, institutions, clubs, hospitals, schools now use sodium metasilicate to obtain sparkingly clean dishes and silver quickly and economically.

Directions—For dish washing machines use ½–⅛ oz. per gallon of hot water.

For dish washing by hand add ⅛ oz. per gallon to hot soapy water.

Any cooking utensils, urns or kettles are cleaned more quickly with sodium metasilicate. Grease is routed by the addition of ⅛ oz. of sodium metasilicate for each gallon of wash water.

Paint Removal: Sodium metasilicate makes a satisfactory paint remover.

Directions—Use a hot solution of about 4 oz. per gallon or even more. Brush or rub this solution over the painted surface. Be sure the hands are protected from such a strong solution.

Sodium metasilicate makes a good paint remover because it has little tendency to open the grain of the wood.

Printing Shops: Sodium metasilicate satisfactorily removes inks from color rolls (except water-sensitive composition rolls such as gelatine and glycerine) and from type and plates. Various cleaning-up in the printshop calls for a thorough and quick cleaner, which is non-inflammable, and sodium metasilicate satisfies these requirements.

Directions—Usually 2 oz. per gallon of water furnish the proper cleaning.

Ink Pots, Knives, Wiping Rags are thoroughly cleaned with sodium metasilicate.

Directions — For such stubborn cleaning use 1 lb. per gallon of water.

Blatchford or Warnock Bases.

Directions — Four oz. of sodium metasilicate per gallon of water have been found very effective. The bases are allowed to remain in the solution over night at room temperature. The residue is removed by flushing or spraying with water.

Laundries: The whiter appearance of white fabrics and the brightness of colors of clothes washed with sodium metasilicate are the best evidence of its value.

Directions — For laborers' grimy garments or heavily soiled uniforms, use a mixture consisting of 2 parts by weight of sodium metasilicate to 1 of soap, or 4 parts of sodium metasilicate to 3 of soap, and add sufficient to the wheel to give desired amount of suds. For flat work and some colored goods, 3 parts by weight of soap and 2 parts of sodium metasilicate.

Cleaning Rags: Dust cloths, wiping rags, rags used for various cleaning operations can be washed to a new standard of cleanness with sodium metasilicate. The fibers are stronger than when washed with other cleaners.

Directions—Use a mixture consisting of 2 parts by weight of sodium metasilicate to 1 of soap, or 4 parts of sodium metasilicate to 3 of soap, and add sufficient to the wheel to give desired amount of suds.

Packing Houses: Sodium metasilicate makes an excellent all around cleaner for packing houses. Greasy floors, for instance, are thoroughly cleaned with a mixture of 95% sodium metasilicate and 5% soap. See directions for garage floors.

Aluminum ham boilers, cookers and other apparatus constructed of this metal are cleaned quickly and safely in boiling baths containing 1–2 oz. of sodium metasilicate per gallon.

Vegetable cutter, holding tanks, cookers, all are effectively cleaned with 1–3 oz. per gallon sodium metasilicate solutions.

Hot scalding baths: Sodium metasilicate has been successfully used for scalding hogs. The advantage is that it easily and thoroughly removes the bristles, leaving the hide very white and clean. Concentration: 8 lb. of sodium metasilicate per 1500 gallons of water.

Transportation Companies: Railroads and steamships have their cleaning problems. Refrigerator cars can be cleaned with a 1% sodium metasilicate solution (8.6 lb. per 100 gallons of water). About 20 gallons of solution are used per car.

Directions—First wet the freight car floors with clean water. Then sprinkle the sodium metasilicate over the wet surface and follow by scrubbing with a brush and water. Rinsing will flush away all the dirt.

In the car shops, much metal cleaning must be done. The general recommendation is 3 oz. per gallon of water for metal parts.

Scouring Paste for Machines

Hard Soap	7 lb.
Water	60 lb.
Pine Oil	5 lb.
Soda Ash	10 lb.
Sand, Finest	to give a paste

Magnesium Cleaners

British Patent 499,046

Formula No. 1

Nitrobenzol	90 pt.
Acetic Acid	10 pt.

No. 2

Nitrobenzol	45 pt.
Carbon Tetrachloride	45 pt.
Nitric Acid (d 1.5)	10 pt.

These remove oxide films with very little attack of magnesium.

No. 3

British Patent 500,009

Sulphuric Acid	5 pt.
Glycerin	25 pt.
Water	70 pt.

Removing Silver Tarnish

1. Secure a few pieces of sheet zinc about ⅛ in. thick. Add 4 oz. of sodium chloride and 2 oz. of bicarbonate of soda to each gallon of hot water used. Place a couple pieces of the sheet zinc in the bottom of a pan, then place the silverware on top of the zinc plates. See that the solution entirely covers the silverware; then lay a couple of pieces of the zinc on top of the silver-

ware. Almost immediately the tarnish will be dissolved, or

2. Add 4 oz. of tri sodium phosphate to each gallon of hot water used. Place the solution in an aluminum pan or use a few pieces of sheet aluminum in the same way as the zinc plates are used in method No. 1, and this will be found equally effective.

Chromium Plate Cleaners

Formula No. 1

Amorphous Silica	5.0 oz.
Bentonite	1.0 oz.
Orthodichlorobenzene	10.0 oz.
Triethanolamine Oleate	3.0 oz.
Oleic Acid	0.5 oz.
Water	80.0 oz.

No. 2

Bentonite	5 oz.
Stearic Acid	5 oz.
Orthodichlorobenzene	40 oz.
Water	50 oz.

No. 3

Mineral Oil	13.0 oz.
Pine Oil	3.0 oz.
Ammonium Oleate	2.0 oz.
Ammonium Oxalate	3.0 oz.
Tripoli	25.0 oz.
Ammonia	0.5 oz.
Water	54.0 oz.

Metal Cleaner

Fatty Acid	8 lb.
Alcohol	15 lb.
Ammonia (sp. g. = 0.91)	4 lb.
Fatty Alcohol Sulfate	2 lb.
White Spirit	58 lb.
Neuburg Chalk	50 lb.

Cleaner for Electrical Connections

Phosphoric Acid	100 cc.
Alcohol	100 cc.
Water	150 cc.
Isopropyl Ether	1–5 cc.

Rust Cleaner and Penetrant

U. S. Patent 2,135,066

Dichlorethylether	70 fl. oz.
Kerosene	30 fl. oz.
Trisodium Phosphate	1 lb.

Automobile Body Cleaner (Used Prior to Refinishing or Waxing)

Kaolin	10 lb.
Soap	25 lb.
Tetrasodium Pyrophosphate	15 lb.
Petroleum Solvent	10 lb.
Water	40 lb.

If strictly neutral soap be used, the above mixture will not injure lacquer finish. Excess of alkali must be avoided. The pyrophosphate may not be replaced with trisodium phosphate unless the user intends to repaint and does not object to partial removal of the old finish.

Auto Radiator Cleaner

U. S. Patent 2,196,264

Kerosene	25 lb.
Orthodichlorbenzene	25 lb.
Borax	5 lb.
Diglycol Oleate	5 lb.
Water	40 lb.

The borax is dissolved in the water and the other ingredients are dissolved in the kerosene, and the two solutions are then emulsified together, making a stable emulsion.

When the cleaning composition is to be used, it is added to the water in the cooling system of an engine, and the engine is set in operation so that the water, by its circulation, carries the emulsion to all parts of the system. While the water is still cool the oily ingredients, together with the diglycol oleate dissolved in them, penetrate the solid deposits in the system, and dissolve or soften any grease contained in the deposits. When the water is sufficiently heated, by the continued operation of the engine, the borax reacts with the diglycol oleate to produce a water-soluble soap, with the result of disintegrating the deposits and producing an oil-in-water emulsion. The cooling water and the emulsified materials are then drained from the system, and any remaining solids, having been loosened and disintegrated, may be flushed from the system with additional water.

Ink Cleaner

Formula No. 1

a.	Naphtha	10 lb.
	Trichlorethylene	20 lb.
	Methyl Hexalin	5 lb.
	Soft Soap	25 lb.
b.	Ammonium Sulphate	25 lb.
	Water	100 lb.
c.	Pumice Powder 000 Chalk Powder	equal parts

Mix solution *a* with a paste prepared from *b* and *c*.

No. 2

a.	Pumice Powder	50 lb.
	Soap Powder	30 lb.
	Trisodium Phosphate	15 lb.
	Ammonium Sulphate	5 lb.

b. Turpentine	equal parts
Methyl Hexaline	
Carbon Tetrachloride	

Typewriter Cleaner

Petrolatum, Yellow	2– 5 lb.
Lanolin, Anhydrous	12–15 lb.
Montan Wax, Bleached	10 lb.
Paraffin Wax, Soft (40° C.)	20 lb.
Clay, Finely Ground	50 lb.
Earth Color	3–13 lb.

Paste Paint Cleaner

White Chip Soap	15 oz.
Diglycol Stearate	5 oz.
Wetanol	2 oz.
Water	125 oz.
Infusorial Earth	4 oz.

Motion Picture Film Cleaner

Solvent Naphtha	30
Ethylene Dichloride	30
Carbon Tetrachloride	40

This is an active cleansing agent which in no way softens or injures the surfaces of the films.

Wash Powder

Tallow Fatty Acid	16–20 kg.
Coconut or Palm Kernel Oil Fatty Acid	16–12 kg.
Sodium Silicate (38° Bé.)	6 kg.
Sodium Hydroxide (38° Bé.)	16 kg.
Water	20 kg.
Soda Ash	28 kg.

This soap, after properly boiling and drying is powdered, and 90 kg. of it is mixed with 10 kg. of sodium perborate, stabilized.

Detergent

a. Caustic Soda (20° Bé.)	50 kg.
Sodium Silicate (38° Bé.)	150 kg.
Water	400 kg.
b. Soda Ash	400 kg.

Boil *a*. Mix with *b* to get a paste-like semi-solid mass.

Cool on trays. Grind.

Cleaning Paste

Strong, hot soap solution, sufficiently concentrated so that it sets to a jelly upon cooling, is mixed with 10–15% of a powder consisting of equal parts of trisodium phosphate and tetrasodium pyrophosphate. Finely ground pumice (100 mesh or finer) may be added, to yield an effective scouring abrasive paste.

Cleaning Powder

Soda Ash	94.5 lb.
Ammonium Sulphate	5.0 lb.
Tricalcium Phosphate	0.5 lb.

Tricalcium phosphate may be replaced by an equal amount or more, of dried starch to prevent caking.

Plastic Non-Scratching Detergent

British Patent 483,928

Soft Soap	5 lb.
Water	12 lb.
Sal Soda	1 lb.

Mix until dissolved and work in

Whiting	24 lb.

Pine Oil Jelly

Pine Oil	95 g.
Aluminum Stearate	5 g.

Heat together at 90–100° C. with stirring. Forms gel on cooling.

Rosin Oil Jelly

Rosin Oil	95 g.
Aluminum Stearate	5 g.

Method as for pine oil jelly.

Terpineol Jelly

Terpineol	95 g.
Aluminum Stearate	5 g.

Method as for pine oil jelly.

Parquet Floor Cleaner

Formula No. 1

Mineral Oil	68 lb.
Oleic Acid	18 lb.
Ammonia	4 lb.
Turpentine Oil	10 lb.

Dilute 4–8 times with water for use.

No. 2

a. Montan Wax, Refined	15 lb.
Ceresin	15 lb.
Paraffin Wax, Soft	15 lb.
Stearic Acid	15 lb.
b. Turpentine	864 lb.
Tetralin	52 lb.
Benzol	24 lb.

Melt *a*, thin with *b*. Stir till cold. Perfume with Pine Needle Oil.

No. 3

Triethanolamine Oleate	16 lb.
Mineral Oil	40 lb.
Sodium Perborate Solution (2–2.5%)	44 lb.

Floor Cleaning Paste

1. Ammonium Oleate	12
2. Oleic Acid	3
3. Water	45
4. Silica Dust	35
5. Pine Oil	5

Dissolve 1, 2 and 3 at 85° C.; stir while adding 4 and then 5 and continue stirring until smooth and uniform.

Carpet Cleaning Mixture

U. S. Patent 2,165,586

Buckwheat Flour	100 lb.
Light Mineral Oil	24 lb.
Aluminum Stearate	2 lb.
Salicyclic Acid	2 lb.
Water	60 lb.

Cleaning Laboratory Glassware

Formula No. 1

For bottles, use a test bottle washer or place the bottles in a suitable rack with perforated or slotted cover and immerse. A cleaning solution made of 1 oz. of a good grade of washing powder to a gallon of water and heated to 130°–150° F. will be found satisfactory. Scrub the *inside only* with a brush having soft bristles. Rinse in hot water to remove all traces of the cleanser and invert the bottles to drain. Do not soak the bottles too long.

When very dirty, greasy bottles must be cleaned, a very good cleaning solution can be made by dissolving 3⅓ oz. of potassium dichromatic in 1 qt. of water, and slowly adding to this 1 qt. of sulphuric acid. This solution will remove all traces of grease after sufficient soaking, but care must be taken to keep it from prolonged contact with the outside of the necks, because of its effect on the enamel in the lines and numbers.

No. 2

Take a 10 oz. cake of a good grade of cleaning and polishing grit cake soap, such as "Bon Ami" and pulverize it to a powder with a mortar and pestle. Cut a 12 oz. cake of a good grade of rosin laundry soap, such as "Octagon," into thin slices and add just enough water to cover the mass. Slowly heat on a hot plate until the soap has dissolved in the water and a clear solution results. Add this liquid soap mixture to the powdered grit cake in a beaker or earthen jar, stirring the mixture well. Allow to stand overnight or until the resulting mixture has solidified into a soft mass. The mixture can then be easily applied to the wet glassware in the usual manner with a brush or the hands, scrubbed thoroughly and finally rinsed in running water. It is only necessary from time to time to add small quantities of water to keep the mixture at the proper consistency. To make a larger supply increase the quantities accordingly.

Removal of Tars and Carbon Residues from Glass Equipment

Distillation flasks and other equipment which have contained tars, or flasks which have been used for distillations in which tars and carbon residues are formed, can usually be cleaned when all other methods fail by treatment with a hot concentrated solution of sodium hydroxide to which small amounts of potassium permanganate have been added. The strong oxidizing powers of permanganate solutions are especially effective on tarry materials. At times it may be necessary to repeat the treatment, and to boil the solutions for a time. This method has been found to be much superior to those using boiling acids and solvents, and much better than alkaline solutions by themselves. The economy of materials employed makes it available to all.

Window Cleaners

Formula No. 1

Whiting	300 lb.
Alcohol, Denatured	150 lb.
Ammonia	50 lb.
Water	250–500 lb.

No. 2

Lactic Acid	3 lb.
Water	18 lb.

To use, dampen a cloth with the above and wipe window.

No. 3

Canadian Patent 383,826

Dioxan	10–20 lb.
Water	90–80 lb.

No. 4

A paste product for cleaning and polishing windows, mirrors, windshields, etc., is prepared by dissolving 10 parts of curd soap in 40 parts of warm water and 20 parts of denatured alcohol. Ammonia is added until complete solution is obtained. This solution is worked up with a mixture of 50 parts of precipitated chalk, 30 parts of kieselguhr and 20 parts of kaolin to give a paste. The latter is allowed to stand for 1–2 days and is then kneaded up and transferred to containers. From 10–15 parts of glyerine may be used in place of a corresponding amount of water to keep the product moist.

No. 5

Alcohol	6 oz.
Water	94 oz.

Color to suit.

No. 6

Alcohol	20 oz.
Water	80 oz.

No. 7

Alcohol	70 oz.
Water	30 oz.

No. 8

Ethylene Glycol	3 oz.
Water	97 oz.

No. 9

Diethylene Glycol	1 oz.
Isopropyl Alcohol	45 oz.
Water	54 oz.

No. 10

Alcohol	35 oz.
Ethylene Glycol	1 oz.
Water	64 oz.

No. 11
(Powder)

Borax	89 oz.
Sodium Hexametaphosphate	11 oz.

No. 12

Ethylene Glycol	1 oz.
Wetanol (Wetting Agent)	1 oz.
Isopropyl Alcohol	20 oz.
Water	78 oz.

No. 13

Isopropyl Alcohol	70 oz.
Diglycol Laurate	1 oz.
Water	29 oz.

No. 14

A paste for cleaning and polishing windows, mirrors, and similar glass products can be made, according to a report from abroad, from the following ingredients:

Curd Soap	10 g.
Warm Water	25 g.
Glycerin	15 g.
Alcohol	20 g.
Ammonia	5 g.
Precipitated Chalk	50 g.
Kieselguhr	30 g.
Kaolin	20 g.

Dissolve the soap in the mixed liquids, add enough ammonia until solution is complete. The solution is then worked up with the previously mixed dry ingredients to form a paste. This is allowed to stand for a day or two, then is kneaded before being placed in suitable containers.

Lens and Glass Cleaner

Lending itself to a variety of uses is a simple glycerine-containing preparation which is particularly recommended for cleaning spectacle lenses, but is of course, just as valuable for glass of all sorts—windows, mirrors, etc. It also helps to prevent clouding and steaming on the glass. It is made of:

Potassium Oleate	2 oz.
Glycerin	1 oz.
Turpentine	1 dr.

Melt the glycerin and the potassium oleate together on a water bath, then add the turpentine. The thickness of the paste can be adjusted by the addition of glycerin.

Eye Glass Cleaner

Isopropyl Alcohol	77 cc.
Acetone	25 cc.

This preparation is highly volatile and quickly drying. It is best used by spraying with an atomizer and wiping dry with a clean cloth.

Cleaner for Celluloid Windows
(Of Cars, Tents, Etc.)

a.	Diglycol Oleate	5 g.
	Alcohol	3 g.
	Glycerin	22 g.
	Water	60 cc.
b.	Tripoli, Soft, Finely Powdered	10 g.

To the solution *a*, *b* is added and thoroughly stirred in.

To be shaken before use.

Dishwashing Compound
Formula No. 1

Tetrasodium Pyrophosphate, Anhydrous	1 lb.
Trisodium Phosphate	3 lb.

If crystalline (hydrated) pyrophosphate is used, take 2 lb. instead of the 1 lb. specified. Dissolve 1 to 2 teaspoonfuls of the mixture in dish pan of hot water—amount varying with the hardness of the water. The solution of this preparation not only softens water and acts as detergent, but remains clear after getting rid of the harmful free calcium and magnesium, which are not precipitated. This gives a clear drain and rinse, particularly desirable with glassware. Excellent for restaurant machine washing.

No. 2

Moisture	21.82 oz.
Sodium Silicate	6.02 oz.
Soda Ash	70.33 oz.
Salt	0.47 oz.
Impurities, Neutral Salts, Etc.	1.33 oz.

No. 3

Moisture	19.20 oz.
Sodium Silicate	3.52 oz.
Soda Ash	65.00 oz.
Caustic Soda	2.00 oz.
Trisodium Phosphate	9.57 oz.
Salt	0.60 oz.

Interior Stone Cleansers

Formula No. 1

Water	34 lb.
Flour	30 lb.
Salt	8 lb.
Borax Soap	8 lb.
Soda Ash	4 lb.
Borax	8 lb.
Ammonia (28%)	8 lb.

No. 2

Oxalic Acid	2 lb.
Water	5 lb.
French Chalk	37 lb.
Hydrochloric Acid	5 lb.
Sulphuric Acid	19 lb.

No. 3

Borax Soap	4 lb.
Soap Stock	8 lb.
Soda Ash	8 lb.
Water	10 lb.
Borax	4 lb.
Ammonia (28%)	2 lb.
Volcanic Ash	64 lb.

No. 4

Linseed Oil (Raw)	25 lb.
Vinegar	25 lb.
Turpentine	25 lb.
Alcohol	25 lb.

No. 5

Feldspar	80 lb.
Soda Ash	20 lb.

No. 6

Pearl Ash	5 lb.
Black Ash	5 lb.
Water (Boiled)	90 lb.

No. 7

Oxalic Acid	12 lb.
Carbolic Acid	1 lb.
Water	87 lb.

No. 8

Ammonium Fluoride	75 lb.
Oxalic Acid	10 lb.
Soda Ash	15 lb.

(Use 1.5 lb. per gallon of water.)

No. 9

Hydrochloric Acid (Concentrated)	87 lb.
Water	9 lb.
Salt	4 lb.

No. 10

Volcanic Ash	53 lb.
Talc (Soapstone)	27 lb.
Soda Ash	4 lb.
Tri-Sodium Phosphate	16 lb.

No. 11

Sodium Bisulfate	25 lb.
Sodium Sulfate	75 lb.

No. 12

Sulphuric Acid	9 lb.
Diatomaceous Earth	3 lb.
Sodium Sulfate	88 lb.

No. 13

Abrasive (Volcanic Ash or Celite)	70 lb.
Soap Powder	10 lb.
Oxalic Acid	2 lb.
Nelgin	10 lb.
Mineral Oil (Heavy White)	10 lb.

This should be mixed thoroughly by mechanical means whereby a rubbing or scraping action is exerted to break lumps which are sure to form when the oil is absorbed by the abrasive, and to avoid local points where high concentrations of oil might still remain and soak through the package. Otherwise this is one cleaner which will not harm polished stone surfaces, and instead of attempting to clean and polish it will only do the former.

Care of Soapstone Desk Tops

Experience has shown that an application of a mixture of equal parts of boiled linseed oil and oil of turpentine to which has been added some paraffin wax, serves admirably as a soapstone dressing. Paraffin wax to the size of a walnut to a quart of the above oils and applied hot penetrates and dries rapidly and results in a comparatively hard and impervious surface.

Dustless Sweeping Mixture

Sand	50 lb.
Sawdust	25 lb.
Mineral Oil	20 lb.
Beeswax	5 lb.

Melt the wax in the oil and then stir in the sand and sawdust. A green oil soluble dye is usually added to give the mixture a pleasing appearance.

Cleaning Chamois

There are several methods of cleaning chamois skins; one is as follows:—Moisten the chamois in water just off-cold (water must not be hot), squeeze it between the hands, then lay it on a flat surface and rub soap over both sides. Keep squeezing and opening it in the hands to get the soap well through it. Then rinse it in cold water several times until all the dirt it out.

If examination shows that it is still dirty in spots, repeat the foregoing process. Then hang the chamois skin up to half dry; when this point is reached, rub it in the hands to soften and stretch it, continuing until it is dry. Finally, roll it in a mangle.

After washing the chamois thoroughly to get the dirt out, if it becomes stiff, the flexibility can be restored by applying a solution of ½ teaspoonful of olive or neatsfoot oil in one-half pint of gasoline, which acts as a vehicle for distributing a small amount of the oil and then evaporates.

Cleaning and Bleaching Straw Hats

Formula No, 1

Dissolve 8 oz. of binoxalate of potassium in 1 gallon of hot water (it will dissolve quicker if pulverized), and add ½ lb. of flowers of sulphur to the solution, which can be used hot or cold. Then scrub the hat thoroughly with this solution, taking care not to injure the straw or Panama. Have handy a box of dry flowers of sulphur into which occasionally dip the brush, since the grit of the sulphur will help to cut the dirt. After you have the hat thoroughly cleaned, rinse well in running water and then hang it out in the sun to dry and bleach.

No. 2

Another process which is not quite so quick, but much more thorough, and which gives a lasting cleanliness, is as follows: All trimmings are taken off and cleaned separately. Then prepare a lukewarm bath of a good neutral soap with an addition of a little tetralin. Soak the hat for a few minutes in the soap, then brush well through on the wash-board. Rinse again into the soap bath first, then into lukewarm soda bath, and then through two baths of lukewarm water to get all the soap out.

Prepare a good strong solution of oxalic acid, also warm. In this leave the hat for ten minutes. From the oxalic acid bath the hat is taken out, dripped, but not rinsed, and entered into a new bath containing 1 oz. of perborate per gallon of water. In this also lukewarm bath the hat is left for about a quarter of an hour, after which time 1 oz. of acetic acid is added to the perborate bath, and the hat left another quarter of an hour. This process gives a splendid bleaching. After the perborate bath the hat does not need rinsing, but is ready for the drying.

No. 3

The third method is the peroxide process. Peroxide is much preferable, since with it the bleach is a lasting one. There is no change in the method of cleaning except that after the oxalic acid bath, the hat is entered into the peroxide bath, which is prepared with 2 parts of water and 1 part peroxide of hydrogen. A small amount of silicate of soda or ammonia has to be added to the peroxide bath in order to liberate the oxygen.

Removing Picric Acid Stains

If collodion is applied to the stain and allowed to dry, a thin film is formed which, when lifted off, brings with it the picric acid.

Removing Iodine Stains

On old iodine stains, first wet with fresh iodine then, while stain is still wet, pour some strong "hypo" solution on the stain and cover it with an inverted bowl to keep out the light. Next place a small amount of "hypo" in a small cheescloth bag, dip the bag in water and place the wetted bag on the stain, replacing bowl over the stain. Several applications may be needed to entirely remove iodine.

Removing Perspiration Stains

Sweat stains may be removed from clothing with a solution of hydrogen peroxide containing a teaspoonful of sodium perborate per ½ pint of peroxide. Allow to soak for 5 minutes and repeat. Clean garment after such treatment.

The Removal of Rust Spots from Fabrics

It is generally recognized that rust spots cling very tenaciously to textile materials and for example that treatment with oxalic or citric acid is in most instances almost without effect.

The rust (ferric oxide) can only be dissolved by very prolonged action of dilute mineral acids, and even this treatment is only completely effective at increased temperatures. Such a treatment can only be carried out, particularly on vegetable fibres, under extremely careful control or else the fabric will be tendered.

Rust specks can be easily removed from yarn and fabrics by spotting with an almost cold solution of sodium hydrosulphite which reduces the ferric oxide to the greenish gray ferrous oxide. The latter can then be completely removed by a treatment with 2 g. conc. hydrochloric acid (20° Bé.) per liter at 35° C. followed by thorough rinsing in water.

Stains, Removing Linen

Linens, badly stained with lipstick, rouge, nail polish, shoe polish, blood, iodine, mercurochrome, gentian violet, balsam of Peru, cooking grease and other stains, are given a 6-hour kier boil in 12–15 lb. sodium metasilicate and 4–6 lb. 42-titer soap per 100 gallons of water. Afterward they are given a regular laundry rinse. Argyrol and rust are not removed by this method.

Laundry Sours

Formula No. 1

Ammonium Bifluoride

No. 2

Ammonium Silico Fluoride

No. 3

Ammonium Bifluoride	10%
Ammonium Silico Fluoride	90%

No. 4

Ammonium Bifluoride	25%
Ammonium Silico Fluoride	75%

No. 5

Ammonium Bifluoride	50%
Ammonium Silico Fluoride	50%

No. 6

Sodium Bifluoride

No. 7

Sodium Silico Fluoride

No. 8

Sodium Bifluoride	15%
Sodium Silico Fluoride	85%

No. 9

Sodium Bifluoride	25%
Sodium Silico Fluoride	75%

No. 10

Sodium Bifluoride	50%
Sodium Silico Fluoride	50%

No. 11

Oxalic Acid	10%
Sodium Silico Fluoride	90%

No. 12

Oxalic Acid	25%
Sodium Silico Fluoride	75%

No. 13

Oxalic Acid	50%
Sodium Silico Fluoride	50%

No. 14

Oxalic Acid	10%
Ammonium Silico Fluoride	90%

Laundry Blue

Ultramarine Blue	88 kg.
Dextrin	12 kg.
Water	9 kg.
Sodium Bicarbonate	1 kg.
Preservative	0.25 kg.

The mass is mixed well and formed into cakes in a plodder.

Laundry Bluing, Solid

Ultramarine Blue	30 oz.
Sodium Bicarbonate	20 oz.
Glucose	6 oz.

Mix the dye and the sodium bicarbonate, and then knead in the glucose. This mass is to be pressed into balls and tied up in small squares of linen.

Laundry Water Softener

U. S. Patent 2,099,743

Sodium Silicate	67 lb.
Soda Ash	33 lb.

Faster and Easier Ironing Spray

A mixture of equal parts of Solox and water is sprayed, with an automatic spray gun, on goods such as pajamas preparatory to pressing them for market. With the Solox mixture it is easy to get a sharp crease and the operation takes less than half the time when water alone is used.

The other pressing operation involves the use of a mixture of 25% Solox and 75% water (in some cases 50% Solox and 50% water) for ironing collars lined with "dry" linings instead of the acetate type of interlayer.

It is claimed that the use of Solox with "dry" linings not only produces a good crease but raises the adhesion of the fabric layers from about 2 lb. to between 4½ and 5 lb.—a figure which is more than enough to eliminate all blisterings. The immersion time in Solox solution may vary from 4–15 seconds.

CHAPTER TWENTY

TEXTILES, FIBRES

Textile Sizings

Formula No. 1

Twill suiting (2.75 yd./lb.).

Corn Starch	20 lb.
Tapioca Starch	10 lb.
Avitex C	11 lb.
Water	100 gal.

This finish is full and pliable.

No. 2

Filling sateen (4.40 yd./lb.).

Corn Starch	20 lb.
White Dextrin	12 lb.
Avitex C	10 lb.
Avitex Assistant	1 lb.
Water	100 gal.

Schreiner calender finish.
This finish is soft and silky.

Printed twill suiting (2.75 yd./lb.).

Tapioca Starch	50 lb.
Corn Dextrin Gum	80 lb.
Avitex C	18 lb.
Water	100 gal.

Plain calender finish.
This finish is full and pliable.

No. 4

Printed twill suiting (2.25 yd./lb.).

Tapioca Starch	25 lb.
Dextrin	30 lb.
Avitex C	11 lb.
Water	100 gal.

Pre-shrunk finish.
This finish is full and pliable.

No. 5

French Patent 810,688

Maltose	50 kg.
Dextrose	35 kg.
Dextrin	15 kg.
Water	to suit

No. 6

French Patent 841,162

(Non-Oxidizing Benzene Soluble)

Colza Oil	200
Rosin	800
Paraffin Wax	100
Borax	10

Heat together, mixing well.

No. 7

U. S. Patent 2,188,167

Gelatin	12½ lb.
Sulphonated Olive Oil	1½ lb.
Sodium Salt of Sulphated Lauryl Alcohol	½ lb.
Glycol Bori-Borate	1 lb.

No. 8

Gelatin	13 lb.
Triethanolamine Salt of Sulphated Oleyl Alcohol	1 lb.
Mineral Oil	¼ lb.
Glyceryl Bori-Borate	1 lb.

Starch Latex Mix for Textiles

Five pounds of bone blue are dispersed at 140° F. in 1 gallon of water, and diluted to 5 gallons, with water made alkaline with 50 cc. of 5% sodium hydroxide solution. The alkaline glue solution is then added to 9 gallons of normal latex.

Thirteen lb. of tapioca flour are cooked in 25 gallons of water and cooled to 150° F. with 14 gallons of water made alkaline with 1000 cc. of 5% caustic soda solution. The alkaline glue solution containing the latex is then added slowly while stirring to the size bath.

Sizing or Stiffening for Clothing

Gum arabic, best in granulated form, is dissolved overnight in warm or cold water, in the proportion of about ¼ lb. to 1 gallon of water to form a stock solution which is strained through several thicknesses of cheese cloth to remove undissolved impurities before storing for use. From ¼–½ oz. of borax is added to preserve. From ½–1 pt. of the stock solution is added for each gallon of water to make an ordinary sizing bath.

A stock solution of gelatin or a good quality of flake glue is prepared by dissolving about 1 lb. in two gallons of cold water by adding and letting stand overnight, finally heating in a double-boiler or in a water bath to completely dissolve. Borax is added as above to preserve. From ½–1 pint added to 5 gallons of cold water makes a sizing bath suitable for ordinary purposes on thin materials. Two oz. of monopol oil may be added to either a gum arabic or gelatin sizing bath to impart flexibility and to some degree a sheen to the fabric. When monopol oil is used, the sizing bath may be made heavier to give more body or "feel" to the material and still have flexibility.

Table Linen Size

Locust Bean Gum (Fine Powder)	2 oz.
Starch	2 oz.
Water	⅝ lb.

Glazing and Sizing for Cotton Thread

Gray thread—16 gal. water at 170° F., 9 lb. starch, 1 lb. yellow beeswax.

Black thread—15 gal. water, 7 oz. white soap, 16 oz. hard paraffin wax. Boil until well dissolved, and then add 9 lb. Indian cornstarch, which has previously been made into a thin pulp. Boil together until well mixed, then cool and use.

White thread—17 gal. water at 175° F., ¾ lb. oil soap, cut into small slices and stirred until properly dissolved—add 7 lb. starch mixed with cold water. Pour into the boiler the liquid starch, then add 12 oz. paraffin wax, 8 oz. white beeswax, 5 oz. castor oil. The mixture should not be used until quite cold.

The following formula has been found to give good results:

White sewing cotton—16 gal. water 175° F., 7 oz. pale white soap, sliced and properly dissolved, 6 lb. starch, mixed with cold water. Pour into the boiler the liquid starch, and add 6 oz. white beeswax, 5 lb. yellow beeswax, 2 oz. spermaceti.

The mixture should not be used until thoroughly dissolved and allowed to cool.

The above are suitable for two or three-ply single throw sewings or for 6-fold cabled.

How to Resize a Rug

After cleaning or hard wear, a machine-made pile rug often loses its shape, or wrinkles and curls up because the sizing on the back has worn off. A rug may be resized by stretching it tight and true, and tacking it at frequent intervals face down on a floor or some flat surface where it can remain undisturbed. Then sprinkle generously with a solution made by dissolving ¼ lb. of flake glue in ½ gallon of water in a double boiler or container surrounded by hot water. Allow the rug to dry for at least 24 hours. *Caution*—If the rug is light weight, care should be taken not to put on so much glue that it soaks through to the face side.

Yarn Size

British Patent 508,068

Gelatin	20 lb.
Water	250 lb.
Dissolve at 60° C. and add	
Sorbitol Syrup	4.6 lb.
Sulphonated Castor Oil	4.0 lb.
Water	5000 lb.

Weighting of Textile Materials

British Patent 488,836

Cellulose acetate fabric is passed for 1 minute through aqueous stannic chloride (density 1.30) at 45–55°, and then through a similar bath at 10–20° for ⅓ minute. After squeezing and spraying with water to effect hydrolysis, the washed fabric is immersed for 20 minutes in aqueous sodium monohydrogen phosphate (density 1.05) at 50°, washed, and treated in aqueous sodium silicate (density 1.02) at 55° for 30 minutes. The material is finally washed and dried, an increase in weight of 25% being obtained.

Rayon Warp Size

Formula No. 1

Gelatin	150 lb.
Sulphonated Olive Oil	27 lb.
Aquaresin G. M. (Glycol Bori-Borate)	6 lb.

The gelatin and Aquaresin G.M. are dissolved in the water before adding the sulfonated oil. The solution is then made up to 50 gallons with water. This solution is further diluted in the proportion of 5 parts of water to 1 part of solution. The size is easily removed in the boil-off.

No. 2

Water	1600 lb.
Gelatin	64 lb.
Sulphonated Coconut and Olive Oil	15 lb.
Stearic Acid	1 lb.

The gelatin is steeped in cold water for 4 hours, then warmed gradually to 140° F. and stirred gently until it is completely dissolved. The stearic acid is melted, mixed with the oil then added to the gelatin solution.

Sizings for Cellulose Acetate Yarns

U. S. Patent 2,188,167

Formula No. 1

Gelatin	12.5 lb.
Sulphonated Olive Oil	1.5 lb.
Sodium Salt of Sulphated Lauryl Alcohol	0.5 lb.
Glycol Bori-Borate	1.0 lb.

Water to make 5–14% solution.

No. 2

Gelatin	13.00
Triethanolamine Salt of Sulphated Oleyl Alcohol	1.00
Mineral Oil	0.25
Glyceryl Bori-Borate	1.00

Either of the above is dissolved in water by warming and stirring. The amount of water used depends on amount of sizing desired.

Viscose Sizing

Canadian Patent 376,889

Modified Starch	10 lb.
Urea	½–3 lb.
Water	120–333 lb.

Primer for Rubber Cloth

Hard Soap	1.7 lb.
Carnauba Wax, Light	8.7 lb.
Shellac	1.3 lb.
Borax	1.4 lb.
Water	86.9 lb.

Degumming Silk

A crepe de chine composed of high twist yarn is completely degummed when treated for two hours at 65% C. with a liquor consisting of 20% papain, 40% sodium thiosulphate and 40% hydrosulphite in a 3 gr. per l. concentration.

The following recipe is recommended if it is desirable to avoid the use of hydrosulphite. Formula No. 1. The liquor consists of 40% papain, 40% sodium thiosulphate and 20% sodium phosphate, to which is added about 8 cc. acetic acid per l. of liquor. The goods are treated in a bath of this composition for about 1 hour at 65° C., after which they are transferred to a bath where they are lightly soaped for half an hour at 65° C., the bath being made up of 5 g. Marseilles soap per l. of liquor. After rinsing and drying the goods will be found to have been completely degummed.

By following the papain method, the avoidance of alkaline conditions fully preserves the appearance and handle of the goods. Even where acetate is present the final soaping at 65° C. (which is necessary completely to remove or disperse the products brought about by the decomposition of the sericin) should be harmless. Where doubt exists, the temperature may be reduced to 60°. It has proved inadvisable to attempt to degum by the use of the enzyme in a bath containing one of the modern washing and dispersing agents, as some of these are precipitated at once, some hinder the action of the enzyme, and none gives as satisfactory results as ordinary Marseilles soap.

No. 2

Water	500 gal.
Marseilles Soap	30 lb.
Silicate of Soda, Soda Ash or Sodium-Hexametaphosphate	1 lb.

The silk fabric is treated in this bath for one hour at 195° F. for the first treatment, and successive treatments may be given in the manner indicated, if necessary. A prolonged treatment is sometimes necessary for the removal of the yellow coloring matter in the silk fabric which is due to the retention in some measure or other of the silk gum. This yellow color arises from the presence in the silk gum of a modified form of chlorophyll or the green coloring of vegetable matter. The origin in this case of course, being the mulberry leaves upon which the silkworms are fed. The extra treatment in soap which will be necessary in many cases for the complete removal of this coloring matter will be found to be cheaper in the long run than the use of a bleaching operation for this purpose.

In degumming any quantity of silk the removal of the oils used in spinning is also a matter to be contended with. The oils used for this purpose are removed along with the gum and tend to form a scum upon the top of the degumming bath. Unless precautions are taken to have this oily scum emulsified there is a danger of some of this matter being transferred to the surface of the silk as it is removed from the degumming baths. The surface accumulation of scum in local patches on the material may give rise to trouble in printing and dyeing and any precautions which will lessen the risk of its occurrence will be well worth while. The addition of an emulsifying agent is indicated. The use of this is, of course, always understood to be in conjunction with soap.

Another method of degumming is here appended for the guidance of those who require an alternative method to that already given.

No. 3

Water	600 gal.
Marseilles Soap	30 lb.
Soda Ash (if water is hard)	3 lb.

Soap may be used up to 30–50 percent on the weight of material and soft water is always desirable and in any event not more than one degree of hardness should be tolerated in any boil-off process for silk. The use of sodium-hexa-metaphosphate will give give excellent results in conjunction with soap where difficulties with hard water are encountered. The goods are treated in the foregoing bath for 1–1½ hours at 195° F. (never above 200° F.) as silk is likely to turn yellow above the latter temperature. The pH of the bath should be kept below 9 in order to avoid the solvent action of the alkali upon the fiber to say nothing of the resultant loss of luster.

The method outlined may be repeated if necessary for the production of whiter or cleaner goods. This method is used for the production of *Cuite* or boiled-off silk.

No. 4

Souple silk is cleaned and softened by treatment for ¾–1 hour at 40° C. in

Water	500 gal.
Soap	30 lb.

and afterwards soupled by treating in a rinsing bath containing

Cream of Tartar	4 lb.
Sulphuric Acid (168° Tw)	1 pint
Sulphurous Acid (Aqueous)	3 pint
Water at 80–90° C.	400 gal.

Afterwards rinse well in hot and cold water alternately.

Ecru or hard silk is simply cleaned in warm water and soap solutions, dried and dyed but seldom used for printing as has already been indicated.

Tussah or wild silk is well washed in soda ash solutions 2 oz. per gal., then rinsed in an acidified bath of one pint hydrochloric acid per 40 gal. water, rinsed well and bleached by any of the ordinary methods. Well cleaned Tussah silk is capable of giving very choice printed effects.

DEGUMMING RAMIE OR CHINA-GRASS

Formula No. 1

The purification treatment consists of digesting 300 parts by weight of air dried ramie ribbons (five to ten percent moisture) with forty-five to seventy-five parts of sodium hydroxide in 2600 parts of water for three hours in a rotary digester operated at 100 pounds per square inch steam pressure. The process works equally as well on the green, freshly stripped ribbons or China-grass. It is imperative that the digested fiber be kept out of contact with air while it is saturated with hot alkaline digester liquor since in this condition the fiber is readily attacked by atmospheric oxygen with the formation of oxycellulose. If the fiber is to be removed from the digester immediately after digesting, it is necessary to displace the hot spent cooking liquor with cold water. It is desirable but not absolutely necessary that the exact quantity of sodium hydroxide be used that will remove the bark and gums and at the same time yield a solution of low alkalinity at the end of the digestion. The tensile strength of the fiber varies with the weight ratio of sodium hydroxide to raw fiber charged in the digester, keeping the other factors constant. A neutral spent cooking liquor is obtained using about 1 part of caustic to six parts of bone dry ribbons by weight. The optimum ratio will vary with different samples and in large scale work should be determined previously to the digestion.

Upon removing from the digester, the fiber is thoroughly washed, after which it is of a grayish color and must be bleached to bring out its whiteness and luster. Bleaching is effected by treating the digested and thoroughly washed fiber for one hour at approximately 25° C. in a solution containing 2 parts of available chlorine as sodium hypochlorite in 2000 parts of water. The fiber is agitated from time to time to insure uniform results. The bleach consumption of fibers of different ages has been studied and the data recorded which reveals that the bleach consumption decreases as the age of the fibers increase.

Upon the completion of the bleaching operation the fiber is removed and the spent bleach, which contains some available chlorine, may be used to give a preliminary bleach to a fresh batch of fiber. Upon removing from the bleaching bath, the fiber is soured at room temperature with four parts of sulfuric acid in 2000 parts of water for fifteen minutes, during which time the fiber is agitated intermittently. It is then removed from the acid bath and treated with an anti-chlor containing three parts of sodium bisulfite in 2000 parts of water. At the end of thirty minutes it is removed and washed thoroughly.

After bleaching and drying, the fiber is harsh and quite wiry. It is very difficult to separate the fiber bundles into individual fibers although they become quite "free" upon immersion in water. To overcome the adhesion of the fibers during the drying operation, the thoroughly washed and damp fiber, after it has been bleached may be treated with an emulsion composed of hydrocarbon—89 parts, oleic acid —8 parts, triethanolamine—3 parts, and water—100 parts, for a period of several hours or until the fibers become thoroughly impregnated with the emulsion. After treatment, the fibers are squeezed free of the emulsion and allowed to dry. The emulsion can be used repeatedly. The fibers thus produced are soft, pliable, of very good luster and the strength is not impaired to any appreciable extent.

No. 2

The ramie is treated in an open kier with 1% soap solution while the temperature is raised to, and held for 20 min at 75–85° C.; the emulsion of gum and soap is then shaken off by vibration, the temperature meanwhile being raised to 100°. Calcium hypochlorite may be present if desired. Rinsing is effected with hot or cold water while vibrating.

Textile Degumming

French Patent 819,322

Sodium Hydroxide	10	kg.
Potassium Persulphate	1	kg.
Hydrogen Peroxide	½	kg.
Water	1500	l.

Temperature of bath is increased from 50–60° C.—100° C. in an hour.

Boil-Off Liquor

A simple formula for a boil-off liquor is 2 lb. Marseilles soap; 2½ oz. gelatin; 2 oz. common salt. The solution is made up to 10 gal.

FLAMEPROOFING OF TEXTILES

Textile flameproofing is concerned chiefly with cotton and other fibers of vegetable origin. Such fibers are composed of cellulose, which is readily combustible. Wool and other fibers of animal origin are less flammable, largely because the protein constituents decompose on heating to liberate non-flammable nitrogenous gases.

Complete fireproofing of textiles—making them fully resistant to charring and decomposition even at high temperatures — has not yet been achieved, and is probably not possible. The most that can be expected of a flameproofed fabric is that it will resist ignition by a match or similar small sources of heat, or that, if once ignited, it will not continue flaming upon removal of the source of ignition, since after a fire is well started, even a well-treated material will add fuel to the flame. Such flameproofing may be accomplished by impregnating the cloth with solutions of various chemicals, either singly or mixed.

Salts suitable for textile flameproofing may be grouped as follows, according to the way in which they are supposed to protect the fabric: Group 1.—Salts, such as certain ammonium compounds, which on heating give off non-flammable gases to dilute the flammable gases from the decomposing textile. Group 2.—Salts which produce a glaze over the fiber surface, cutting off the oxygen supply, examples being ammonium phosphate, and borax-boric acid mixtures. Group 3.—Salts having a mechanical action in that they load the fabric, rendering it less susceptible to ignition and less able to perpetuate its own kindling temperature, an example of which is stannic oxide. Some salts may fall within more than one group.

Chemicals of the second group are the most effective flameproofing agents.

In the choice of a flameproofing agent, several factors, the importance of which is dependent upon the intended use of the fabric, must be considered. Some chemicals discolor the cloth or injure it when it is ironed; others weaken it, or make it unduly harsh or heavy. Chemicals which absorb moisture from the air may promote the growth of mildew and accumulation of dirt. Chemicals which give off moisture to the air, thus causing dusting or discoloration, also are undesirable. Crystalline compounds deposited from concentrated solutions may mar the appearance of the fabric. Most chemicals deposited in a fabric will be worn away or dusted out with handling. Some chemicals cost too much, or are poisonous. If the material must stand wetting or laundering, the flameproofing agent must not wash out.

In their efforts to find a flameproofing agent having the optimum of desirable properties, many experimenters have prepared mixtures of fire-retardant chemicals. One such mixture contains ammonium sulfate, ammonium carbonate, borax, and boric acid. The ammonium salts on heating liberate non-flammable gases, while the borax and boric acid fuse to glaze the surface of the fibers. Often an expensive chemical is mixed with other chemicals which may be somewhat less effective as flameproofers but are less costly.

The relatively insoluble compounds are fixed in the cloth by successive dippings in solutions which interact chemically and precipitate the flameproofing agent on and within the fibers. Soluble flameproofing agents are generally applied from water solution by steeping, brushing, or spraying, followed by drying. In the case of certain fabrics, the method of application may have considerable effect upon the success of the treatment. For example, the application of a cold solution with a brush may be unsatisfactory for treating theater scenery, since the sizing may prevent rapid absorption of the solution. Hot treatments are generally to be preferred for most materials. Dipping the fabric insures more complete penetration than brushing or spraying. A number of successive applications are often made before effeffctive protection is achieved.

II. RESEARCHES

The subject of fireproofing has been one of great interest since ancient times. It is said that the Romans attempted to fireproof their houses and war vessels by dipping the wood in a bath of vinegar and clay. An early mention of textile flameproofing occurs in a paper published in 1638 by Nikolas Sabbattini, who urged reforms in the construction and furnishing of Italian theaters from the standpoint of fire prevention, and recommended that the color used in painting theaters and scenery should be mixed with clay or gypsum.

In 1735 Jonathan Wild, of England, was granted a patent dealing with a flameproofing mixture composed of alum, ferrous sulfate, and borax. Wild's work was followed by other investigations; and the subsequent history of textile flameproofing contains the names of many experimenters, of whom only a few can receive mention here.

Gay-Lussac in 1821 published the results of an investigation suggested by Louis XVIII, in which he determined the flameproofness imparted by numerous salts when deposited on linen and hemp cloth in the amounts of 10 and 20 per cent. He found that ammonium phosphate, equal parts of ammonium chloride and ammonium phosphate, and equal parts of ammonium chloride and borax, were effective.

A worthy contribution was made by Versmann and Oppenheim who in 1859 reported to the British Association for the Advancement of Science the results of a study of 40 chemicals in their protective action on muslin. Their work was conducted on a commercial scale as well as in the laboratory. They found that only five of the salts and mixtures tried had practical value: Ammonium phosphate, sodium-ammonium phosphate, ammonium phosphate and ammonium chloride mixture, ammonium sulfate, and sodium tungstate.

At the instigation of Freeman, Whipple and Fay did considerable work on flameproofing theater scenery. Ammonium phosphate was found to be the most effective of many salts tried; it was, however, conducive to the growth of mold and mildew. Reporting the results, Freeman states emphatically that although many substances were found that would make gauze and canvas proof against ignition by small flames, "nothing was found that would prevent the instant burning with a rush of flame when the test was made with a strong blaze on closely hung sheets of canvas." In later work on scenery, Kling and Florentin of the Paris Municipal Laboratory found a solution of borax and boric acid in a 6:5 ratio to be the most suitable of many agents tried.

Ramsbottom and Snoad, working at

the Royal Aircraft Establishment with cotton fabric, corroborated the effectiveness of a borax-boric-acid mixture, but preferred a 7:3 ratio to the proportions of Kling and Florentin.

Perkin, seeking a permanent process for cotton flannelettes and other highly flammable cotton goods, found the best treatment to be stannic oxide precipitated on the fibers by a method given in Section III. Flannelettes treated by this method retained their flameproof qualities after being laundered 20 times.

III. FORMULAS AND PROCESSES

Numerous formulas for the flameproofing of textiles are to be found in the literature and patents. Although they include a variety of substances, most of these formulas depend for their fire-retarding effect upon ammonium salts, phosphates, borates, stannic oxide, or sodium tungstate, or mixtures thereof.

A few representative formulas are given below. Only the first of these, the Perkin process, may be said to be truly water-resistant. Some of the other formulas specify the use of insoluble salts, but these are more or less subject to removal by the mechanical action of water as in washing.

Type numbers given with the formulas have the following significance:

Type 1—Insoluble salts, resistant to the mechanical action of water.

Type 2—Insoluble salts, not fully resistant to the mechanical action of water.

Type 3—Soluble salts.

Measurements are by weight unless otherwise indicated. One gallon of water weighs about 8.3 lb. at 20° C. (68° F.).

1. *Perkin Process* (Type 1):

Solution A	
Sodium Stannate	41.8 lb.
Water	100 lb.

Solution B	
Ammonium Sulphate	15.0 lb.
Water	100 lb.

The cloth is thoroughly washed to remove oils, waxes, or other substances which might reduce its absorptive power; it is then acidified with acetic or other weak organic acid, washed, dried, and immersed and agitated in Solution A, then squeezed and dried again. It is next run through Solution B, squeezed, dried, and washed in cold water to remove the sodium sulfate formed by the interaction of the salts in the two solutions. If desired by the finisher, the sodium sulfate may be left in the cloth.

The goods must be heavily squeezed after passing through the solutions, since the pressure seems to increase the affinity of the cloth for the stannic oxide formed, with the consequent deposition of more of the latter.

The process has been used for flannelettes and other light cotton goods. Perkin states that the stannic oxide is not removed by any amount of washing with soap and hot water; the treatment does not injure delicate colors, and is not harmful to the skin; the stannic oxide gives the cloth a softer and fuller feel than that of the original flannelette; and the material is considerably strengthened by the process.

2. (Type 2):

Solution A	
Sodium Aluminate	14.1 lb.
Water	100 lb.

Solution B	
Ammonium Sulphate	12.0 lb.
Ammonium Phosphate, Dibasic	12.0 lb.
Water	100 lb.

The goods are saturated in the cold Solution A, let stand wet in roll form for several hours, and dried without rinsing. The treatment is fixed in Solution B. For some goods and uses, a little clay suspended in the bath is recommended. The finish is harsh, but the treatment stands weather, is fairly effective, and is cheap. It is used for heavy cotton goods.

3. *Matthews* (Type 3):

Ammonium Phosphate, Dibasic	7.5 lb.
Ammonium Chloride	5.0 lb.
Ammonium Sulphate	5.0 lb.
Water	100 lb.

Either the cloth may be impregnated directly with this solution, or the starch sizing may be made up with it. It has been used for curtains; Matthews recommends it for cotton fabrics in general.

4. *Ramsbottom and Snoad* (Type 3):

Borax	7.0 lb.
Boric Acid	3.0 lb.
Water	100 lb.

The amount of water may be varied, and should depend upon the absorptive capacity of the fabric to be treated. This mixture, when present on light cotton fabrics to the amount of 6% of the weight of the untreated fabric, is said to be effective in retarding flame. Fabrics so treated retain their flexibility and softness. They do not become dusty, feel damp, or lose their strength under ordinary conditions of use. The materials are non-poisonous and do not promote the growth of destructive micro-organisms. Brosnan recommends the solution in 7% strength for rayon and sheer fabric.

5. *Kling and Florentin* (Type 3):

Borax	6.0 lb.
Boric Acid	5.0 lb.
Water	100 lb.

The fabric is steeped in a warm solution until thoroughly impregnated, then dried. Heavy applications by spray or brush are usually reasonably effective. Such applications may have to be repeated 2–3 times with drying between applications to get the desired degree of flameproofing. The treatment has been used for many kinds of fabrics, including theater scenery; Grove-Palmer recommends it for rayon. As in the case of most of the other formulas listed, care must be taken in ironing to avoid discoloration by heat.

6. *Chesneau* (Type 3):

Sodium Tungstate	20.6 lb.
Sodium Phosphate, Dibasic	0.6 lb.
Water	100 lb.

Sodium tungstate has been used for flameproofing theater scenery in Paris, London, and elsewhere. The addition of the sodium phosphate is recommended by Chesneau to prevent crystallization, resulting from the formation of an acid sodium tungstate.

7. *National Bureau of Standards* (Type 3):

Sodium Tungstate	24.0 lb.
Ammonium Phosphate, Dibasic	6.0 lb.
Water	100 lb.

This formula was developed for use on airplane fabrics. Results of further work on airplane fabric treatments were published by the Bureau of Standards in 1935.

8. *Matthews* (Type 2):

Solution A

Lead Acetate	3.2 lb.
Zinc Sulphate	2.4 lb.
Water	100 lb.

Solution B

Alum	6.0 lb.
Water	100 lb.

The goods are immersed and agitated in the boiling Solution A and allowed to remain therein overnight. Next morning they are treated again with the hot solution and dried. They are then run through Solution B and dried without rinsing. This recipe has been used for awnings.

9. *Matthews* (Type 3):

Starch (or Flour, Sago, Dextrin, Etc.)	22.0 lb.
Sodium Tungstate	11.0 lb.
Borax	7.0 lb.
Water	as desired

This mixture is used for sizing.

10. *Martin* (Type 3):

Ammonium Sulphate	8.0 lb.
Ammonium Carbonate	2.5 lb.
Borax	8.0 lb.
Boric Acid	3.0 lb.
Starch	2.0 lb.
Dextrin	0.4 lb.
Water	100 lb.

The amount of water may be varied as desired. The mixture is applied at 86°–100° F. It is useful for many purposes, particularly for laces, curtains, and aprons.

IV. TESTS AND TESTING METHODS

For the most part, the various experimenters seem to have devised their own methods of testing the relative effectiveness of the flameproofing treatments investigated. None of the methods developed has received general recognition as a standard procedure.

Whipple and Fay used ignition tubes with small pieces of the treated cloths to determine whether combustible gases were evolved at different temperatures. They later devised a portable lamp for testing treated fabrics in the form of strips 8 in. long by 1 in. wide. J. R. Freeman suspended six strips of treated fabric, about 3 in. wide by 24 in. long, in an asbestos-lined joint of stove pipe 5 in. in diameter by 24 in. long with ¾ in. spacing between strips. He found that the strips burned regardless of the kind of treatment used.

Ramsbottom and Snoad have thoroughly investigated the subject of tests and testing procedure. They used cotton fabric weighing 4 oz. per sq. yd., having 110 warp yarns and 100 filling yarns per inch. The flame tests were made on strips 1 in. wide by 18 in. long held vertically in a box perforated at top and bottom. A flame 1 in. long from an orifice 0.02 in. in diameter was played across the lower end of the strip until it was burning evenly, whereupon the flame was withdrawn. The rate of flaming was determined by observation of the time required for the fire to travel over a 12-inch length between marks 3 in. and 15 in. from the lower end.

Three methods, which have been used at the National Bureau of Standards to determine the relative flammability of various treated and untreated fabrics, are the Match-Flame Ignition Test, the Horizontal Rate-of-Burning Test, and the Vertical Rate-of-Burning Test.

Match-Flame Ignition Test.—This test is employed qualitatively to determine whether an untreated fabric should be classed as hazardous or slow-burning, or whether a supposedly treated fabric contains an effective amount of the flameproofing agent. It is described as follows:

A specimen 2 in. wide is suspended vertically with the long edge in a horizontal direction. Lighted safety matches are applied to the lower edge, and the susceptibility to ignition is determined.

A similar match-flame test is used by inspectors of the District of Columbia Fire Marshal's Office to determine whether theater scenery and curtains have been effectively flameproofed. To be acceptable, a fabric must not burst into flame when the burning match is held along a vertical edge.

Horizontal Rate-of-Burning Test.—A specimen about 2¾ in. wide and 15–30 in. long is cut from the sample and placed with its surface horizontal between two parallel clamps 2 in. apart, supported on a steel frame. The specimen is ignited at one end with a small flame from a Bunsen burner and allowed to burn freely over the entire length in the still air of the laboratory. The time for the flame front to travel over a definite length is measured, from which the rate of burning in inches per minute is calculated.

The Horizontal Rate-of-Burning Test is employed chiefly to compare the rates of burning of untreated fabrics. Test results can be reproduced within a variation of about 10%. It is not a severe test, and therefore will generally not give useful results in the case of fabrics treated with a flameproofing agent.

Vertical Rate-of-Burning Test.—This test is similar to that devised by Ramsbottom and Snoad. It is more severe than the Horizontal Rate-of-Burning Test, and affords a simple and speedy means of determining the flameproofness of a fabric. The results have a somewhat wider range of variation than in the horizontal test.

A specimen 2 in. wide by 12½ in. long is clamped in a vertical position with the lower end free, and with ½ in. of the upper end in the clamp, so that a 12 in. length is exposed. To protect the specimen from drafts, the apparatus is inclosed in a sheet metal shield 14 in. wide, 12 in. deep, and 30 in. high, open at the top, and provided with a vertical sliding glass front. Sufficient room is left at the bottom of the front to allow manipulation of the gas burner used in igniting the specimen.

The specimen is suspended ¾ in. above the top of the gas burner—which has a tube of ⅜ in. inside diameter—and is ignited by a luminous flame 1½ in. long. The flame is applied for 6 seconds (in the case of an untreated fabric) or 12 seconds (in the case of a treated fabric).

A record is made of the time from the application of the burner flame until flaming, if any, ceases, and the rate of burning in inches per minute is calculated on the basis of the length of specimen which has been charred. A successfully treated fabric should not flame at all after the test burner has been removed.

Flameproofing Artificial Fibers

The most active flameproofing substances are the salts of ammonium, borax, and chloride of magnesium.

To overcome the solubility of the impregnating salts, which makes them liable to be washed out by rain, for instance, they are made insoluble by double combination; for instance, a tissue is treated with stannate of soda, then passed through a bath of sulphate of ammonia, thus producing oxide of tin. This at the same time makes the tissue less permeable to water. The goods are rendered completely impermeable by treatment with colored asbestos preparations or cellulosic varnishes.

A cheap recipe for light rayon tissues is based on sulphate and borate of ammonia:

Sulphate of Ammonia	80 g.
Carbonate of Ammonia	25 g.
Boric Acid	30 g.
Borax	20 g.
Starch	20 g.
Water	1000 g.

The goods are passed at full width through the bath, which is kept at about the boil; they are then centrifuged and dried at a low temperature. The colors must be fast to washing to stand this treatment, which in itself gives no resistance to washing.

Light fabrics can also be treated with 5% solution of sulphate of magnesia or of borax. By using boric acid a cold bath can be employed.

Sulphate of Ammonia	125 g.
Borax	15 g.
Boric Acid	5 g.
Water	1000 g.

This recipe is simple, but it does not give rise to insoluble mineral substances.

Sulphate of lead and acetate of alumina can also be used. In a French patent (565,577) impregnation is made in 2 baths. The first bath contains insoluble sulphate of lead formed by double decomposition: 7.5 kilos acetate of lead, 4 kilos alum, 1000 liters water. The sulphate of lead fills the pores of the tissue, the acetate of alumina impermeabilizes the tissue. This first bath is given at 50° C. The goods are squeezed and passed into the second bath which contains:

Sulphate of Ammonia	18 g.
Borax	5 g.
Boric Acid	3 g.
Alum	2 g.
Water	100 l.

The goods are squeezed and dried.

Another process is based on the formation of hydroxide of zinc. Pass the tissue through a concentrated solution of sulphate of zinc (35 kilos in 70 liters of water). Impregnation should leave about 70% of the sulphate in the tissue. After squeezing pass into a second bath containing 15 liters of ammonia, 16° Bé., in 30 liters of water. This produces precipitation of sulphate of ammonia and hydroxide of zinc on the fiber. The oxide of zinc formed on drying gives a 100% charge on the fiber. This treatment gives little resistance to washing. The charge is fixed by passage through a bath of gelatine followed by passage through a bath of tannin.

A good flameproofing finish is given with tungstate of soda which melts on heating and covers the fiber with a pellicle. To prevent crystallization in the impregnating bath 3% of phosphate of soda on the weight of the goods is added.

To render the tissue at the same time impermeable to air and flameproof a treatment is given with a 5% solution of silicate of soda mixed with a 2% solution of sulphate of alumina. The goods are squeezed and dried and insoluble silicate of alumina is formed.

In another process the goods are treated first in a solution of phosphate of ammonium, then in an ammoniacal solution of chloride of magnesium. The compound on the fiber is insoluble in water. The goods are rinsed to eliminate the chloride of magnesium in excess.

Another process consists in giving a first bath of stannate of soda 14° Bé., then drying and passing into a second bath containing:

Tungstate of Soda 35° Bé.	4 oz.
Acetic Acid 9° Bé.	1 oz.
Chloride of Ammonium 4° Bé.	3 oz.
Acetate of Zinc 17° Bé.	2 oz.

After centrifuging and drying, the acetic acid is evaporated by hot calendering. In all these treatments it is necessary to take into account the effect on the handle of the goods.

Rayon and other artificial fibers can also be flameproofed in the process of spinning. The best plan is to use insoluble metallic salts which, under the action of heat, release gases capable of extinguishing flame. These salts must have the property of melting at a temperature below the combustion point.

Fireproofing Coating for Canvas

British Patent 498,181

White Lead	57 –73 lb.
Boiled Linseed Oil	3½–11 lb.
Chlorinated Rubber	6 –10 lb.
Benzol	15 lb.
Whiting	12 –30 lb.

Fireproofing Textiles

British Patent 487,969

Ammonium Sulphate	5–10 lb.
Ammonium Chloride	1– 4 lb.
Formaldehyde	1– 2 lb.
Magnesium Carbonate	1– 2 lb.
Zinc Sulphate	1– 2 lb.
Sodium Phosphate	1– 2 lb.

Dissolve in water and use at a boil.

Flameproofing Liquid

(Patent Pending)

Formula No. 1

Borax	7 oz.
Ammonium Dihydrogen Phosphate	3 oz.
Urea	5 oz.
Water	85 oz.

No. 2

Borax	7 oz.
Ammonium Dihydrogen Phosphate	3 oz.
Ammonium Chloride	5 oz.
Water	85 oz.

No. 3

Borax	7 oz.
Ammonium Dihydrogen Phosphate	3 oz.
Hexamethylenetetramine	5 oz.
Water	85 oz.

Flameproofing Printing Press Tapes

The tape used on certain types of printing presses, because of the fact that it travels at a moderate rate of speed continuously and over a gas flame, often catches fire. Treating the tape in a 15% solution of Abopon Special (sodium borophosphate) for 36 hours at room temperature, or a shorter time at a more elevated temperature, then wringing or squeezing the excess solution and allowing the tape to air dry, gives a flameproofed tape which is impossible to burn under all the tests used in actual operation. In all tests made, there was ample time to shut off the gas and remove the paper clogs before damage to the tape, an almost impossible task with untreated tape.

In plants using a sprinkler system for fire protection, this is a big item as a paper clog is liable to cause the release of the sprinkler, causing immense damage to the machines and plant.

Stiffening and Waterproofing for Cotton Goods

Formula No. 1

Batavia Dammar A/D	10 lb.
Stearic Acid	10 lb.
Morpholine	1 lb.
Water	100 lb.

Melt the dammar and stearic acid. Keeping the temperature at 90°-95° C., stir in the morpholine and the water which has been preheated to 90°–95° C.

Strips of cotton cloth may be impregnated with this material and dried at about 210° F. The cloth is stiffened.

No. 2

Batavia Dammar A/D	5 lb.
Paraffin Wax	5 lb.
Morpholine	1 lb.
Oleic Acid	2 lb.
Water	100 lb.

Melt the paraffin. Sift in the dammar and mix the two thoroughly. Keep temperature at about 125° C. during this combination. Allow to cool to 90°–95° C. Add oleic acid and stir in. Then add and stir in the morpholine, keeping temperature at 90°–95° C. Heat the water also to 90°–95° C. and add it to the mixture slowly with thorough agitation.

Strips of cotton cloth may be impregnated with this material and dried at 210° F. The cloth is stiffened.

Waterproofing Synthetic Textile Fibers

British Patent 485,593

Impregnate with 1% solution of stearamide in carbon-tetrachloride. Treat for 20 minutes in solution of

Formaldehyde	50 g.
Lactic Acid	5 g.
Water	1 kg.

Dry at 50° C. and heat at 135–140° C. for 10 minutes.

Textile and Leather Waterproofing

U. S. Patent 2,073,630

Rubber	2½ lb.
Xylene	90 lb.

Allow to stand until swollen and then mix slowly until dissolved and then add

Hydrogenated Fish Oil	7½ lb.

This may be brushed or sprayed.

Waterproofing Bath for Canvas, Tent Cloth, Etc.

Ammonia (sp.g. 0.880)	1 kg.
Linseed Oil	5 kg.
Paraffin Wax, Hard	8 kg.
Stearic Acid	8 kg.
Montan Wax, Bleached	8 kg.
Glue	10 kg.
Soft Soap	15 kg.
Water	200 kg.

Waterproofing for Heavy Canvas

Brown

Amorphous Wax (145–165°)	40 lb.
Paraffin Wax (133°)	50 lb.
Gilsonite Selects	20 lb.
Petrolatum (140°)	15 lb.
Red Oxide of Iron	5 lb.
Extender, Repeller Clay or Asbestine	55 lb.

Tan

Amorphous Wax	45 lb.
Paraffin Wax	45 lb.
Yellow Ochre	30 lb.
Extender	30 lb.
Petrolatum	18 lb.

Olive

Amorphus Wax	25 lb.
Paraffin Wax	25 lb.
Petrolatum	16 lb.
Asphalt (190°)	2 lb.
Yellow Ochre	10 lb.
Chrome Green	2 lb.
Extender	20 lb.

Waterproofing for Tarpaulin

Neutral Petroleum Asphalt	25 lb.
Paraffin Wax (124–126°)	20 lb.
Petrolatum (135–140°) (Amorphous Wax)	25 lb.
Venetian Red	35 lb.

The above compound is thinned from 50–100% for the impregnation of canvas. The wide variation in the percentage of solvent named is due to the wide variation in the qualities of finishes required as well as the many varieties of canvas that are treated. Some instances may require as low as 15% solvent naphtha where a heavy fill is desired. All percentages are based on the weight of the compound as a basis.

Naturally when finishing very heavy ducks without the benefit of squeeze rollers the solvent proportion runs higher. When the impregnating machine is equipped with a set of squeeze rollers smaller quantities of solvent are used. Just how low depends on the expression of the nip and the final degree of fill desired and must be determined definitely for individual equipment.

If color is of no great importance the following is a good example of a pure finish that is to be recommended for such heavy fabrics:

Fused Lead Oleate	15 lb.
Petrolatum (110°)	30 lb.
Petroleum Asphalt (190°)	50 lb.
Paraffin Wax (133°)	5 lb.

Another formula of excellent characteristics employs Gilsonite rather than the asphalt and produces a dryer finish that is very durable, protecting the strength of the fabric quite well.

Fused Lead Oleate	15 lb.
Petrolatum (140°)	75 lb.
Gilsonite	10 lb.

Both of these 2 latter formulas will give a pleasing brown color. The formula containing the asphalt will naturally be considerably darker than the latter which produced a pleasing light nut brown.

These two formulas are designed to produce maximum repellency, a good resistance to mildew and flexibility at all natural temepratures without becoming smudgy by heat or too stiff from cold. Small amounts of color may be added to tone these finishes up if desired; however if flexibility is of great importance this must be done in strict moderation since any great addition of inerts will cause a decided stiffening of the finish in cold weather.

The preparation of the above compound should be carried out over a gas fired or an electric kettle. Ordinary steam heat makes it a very slow matter to incorporate the gilsonite and lead oleate in the melt. It is recommended that the petrolatum be heated to about 400° F. The gilsonite is then stirred in until completely dissolved and the lead oleate is entered last with constant stirring. The melt is then run through a strainer to remove any impurities the gilsonite or oleate may have contained. The compound may then be stored for use later when it is cut with the proper amount of naphtha and applied to the goods.

Sun Proof Wax Waterproofing

Hard Amorphous Wax (148°)	22 lb.
Petrolatum (130°)	70 lb.
Magnesium Stearate (or Aluminum)	8 lb.

When using the above formula

ample solvent must be used and a final weighting of the goods should not represent more than a 20% increase over the original weight of the untreated fabric. This is ample to produce the high repellency desired and since there is no inert content to this finish it will have excellent durability even with this small filling.

The above formula may be used to showerproof goods also by running a fill of only from 7–10% on the goods. This will give a high repellency and lasts exceedingly well.

Further this formula may be rebalanced and used to produce a colored finish of the heavier loading variety.

White Waterproofing

Asbestine	20 lb.
Lithopone	10 lb.
Paraffin Wax (135°)	20 lb.
Petrolatum (140°)	72 lb.
Aluminum Stearate	8 lb.

With this formula which is designed to fill the more open constructions from 35–45% fill should be used based on the original weight of the fabric. The closeness of the fabric will have to be the determining factor for the degree of fill in the final analysis.

Wetting and Mildewproofing Agent
U. S. Patent 2,110,074

Sodium Isopropylnaphthalenesulphonate	10.0 g.
Orthophenylphenol	2.2 g.
Water	71.5 g.
Ethylene Chlorhydrin	6.0 g.
Alcohol	10.0 g.

Creaseproofing and Waterproofing Fabrics

Cotton fabric is treated with a 5% alcoholic solution of stearamide. Dry and impregnate with 10% formaldehyde solution containing 0.1% ammonium sulphocyanide or aluminum chloride. Dry and heat at 120° C. for 10 minutes.

Mildewproofing Textile Fibers
Growth Inhibited by Concentration of Antiseptic

Inorganic Compounds	
Ammonium Fluoride	0.04%
Borax	0.9
Copper (Metal Present in Salt)	0.11
Mercuric Chloride	0.02
Sodium Fluoride	0.8
Sodium Silicofluoride	0.15
Thallium Carbonate	0.02
Uranium Nitrate	0.1 –0.05
Zinc Chloride	0.8
Zinc Hydroxide	1.0
Organic Compounds	
Acetanilide	0.3%
Acetylsalicylic Acid	0.1
Acetyltribromophenal	0.02–0.01
Benzoic Acid (Also Sodium Salt)	0.05
Benzylated Orthochlorphenol	0.01
Benzylated Cresylic Acid	0.1 –0.05
Ortho- and Para- Benzyl Phenols	0.1 –0.05
Ortho- Bromophenol	0.07
4 Chloro - M - Cresol	0.05
Ortho- Chlorophenol	0.08
Cresol	0.1
2:4 Dibromophenol	0.01
2:4 Dinitrophenol	0.02
Formaldehyde	0.05
Naphthalene	0.25
Para- Nitrophenol	0.017
Pentachlorphenol	0.014
Phenol	0.13
Phenol (Sodium Salt)	0.20
Salicylanilide	0.025
Sulfo-Naphthenate (Sodium Salt)	0.05
Thymol	0.04
Tribromophenol	0.01
2:4:6 Trichlorphenol	0.01

Non-Slippery Belt and Rope Preservative
British Patent 488,643

Tallow	6 lb.
Beeswax	1 lb.
Soap	3 lb.

Melt together and add slowly with vigorous stirring

Water (Boiling)	30 lb.

When emulsion is complete, dilute with water to a density of 0.950.

Rot Proofing
British Patent 491,501

Textiles or wood are impregnated with

1	Zinc Naphthenate	60.0 oz.
2	Mineral Spirits	17.5 oz.
3	Emulsifying Agent	2.5 oz.
4	Water	20.0 oz.

1 is dissolved in 2 and added slowly with vigorous mixing to 3 and 4 (mixed) and mixed until emulsified. The emulsion is diluted, as desired, with water before use.

Rot Proof Filter Cloth

U. S. Patent 2,035,527

A process of rendering filter cloth resistant to rotting comprises impregnating the cloth with solution containing about 12.5–100 grams of chromium sulphate and 4 cc. of glacial acetic acid per liter and thereafter filtering a hot alkaline solution through the cloth whereby the chromium sulphate is hydrolyzed and an insoluble chromium hydroxide is formed in the cloth.

Protection Against Gnats

German Patent 557,760

To protect persons wearing summer clothes from the stings of gnats, the garments are treated for 15–20 minutes in a bath prepared as follows: In distilled water at 30–40° is dissolved 6% (based on the weight of goods) of curd soap, olive oil soap or other good textile soap. In the warm soap solution there is emulsified 2% oil of cloves or 1% of oil of cloves and 1% of bay oil and 0.1% of pyrethrum extract.

Mothproofing Solution

Sodium Silicofluoride	0.60
Potash Alum	0.30
Oxalic Acid	0.03
Water	99.07

Mothproofing

British Patent 407,356

Formula No. 1

A mothproofing solution comprises benzine containing a mixture of 2 parts of 2-nitrobenzenesulpho-methylamide and 3 parts of diethylbutylglycophosphate.

No. 2

British Patent 407,356

A mothproofing solution consists of benzine containing a mixture of 1 part of 3, 4-dichlorobenzene sulphodibutylamide and 1.5 parts of dibutylamylphosphate.

No. 3

British Patent 407,356

Goods to be protected against textile pests are treated with a carbon tetrachloride solution of 1 part of 3, 4-dichlorobenzenesulphonoamide and 2 parts of triethylphosphate.

No. 4

(For Horse Hair)

British Patent 403,957

Raw horse hair is immersed in a warm alkaline solution of 2% by weight of a sulphoricinoleate for 12 hours. Then, without rinsing, it is immersed in a solution containing ammonium stearate to the amount of 3% by weight of the material treated. The hair is lightly squeezed and is then immersed in a suitable solution of magnesium chloride. It is finally subjected to prolonged rinsing and to washing and drying by the usual methods. After this treatment it is waterproof and insect proof.

No. 5

French Patent 42,266

Articles to be mothproofed are treated with a benzine solution containing 5% of a mixture of 2 parts of 3, 4-dichlorobenzene-sulphomethylamide and 3 parts of diethylbutylglycophosphate.

No. 6

German Patent 526,611

Material to be mothproofed is treated at room temperature for 10 minutes with a 1.5% carbon tetrachloride solution of 3 parts brucine and 1 part salol.

No. 7

U. S. Patent 1,921,926

Fabrics are rendered moth-, mildew-, mold-, and waterproof by treatment in a bath prepared by mixing a solution of 6 lb. of egg albumen in 125 gallons of water and a solution of 66 lb. of metal acetate (cerium, thorium, lanthanum, aluminum, tin, zinc, copper, etc.) in 250 gallons of water.

No. 8

U. S. Patent 1,903,864

One hundred g. of wool are treated in the manner of a dyeing process while boiling with 6% of naphthylamine black (color index 1924, number 246), 10% of Glauber's salt, and 4% of selenic acid. The material thus treated is permanently protected against attack by moths, *Anthrenus*, *Attagenus* and other textile pests.

No. 9

(For Wool)

German Patent 581,990

Wool to be mothproofed is washed with a solution of 10–20 kg. of soap containing 90 kg. of an acid soap and 10 kg. of sodium fluosilicate in 1000 kg. of water at 40–50° C.

No. 10

British Patent 396,064

Wool, fur, hair, hide, and the like which have been immersed in a 1% solution of quinoline fluosilicate and dried are mothproofed.

No. 11

U. S. Patent 1,630,836

Insects and eggs in garments, rugs, furs, etc., are destroyed by fumigating with carbon disulphide, carbon tetrachloride or p-dichlorobenzene mixed with cedar leaf oil to mask the odor. A preferred mixture consists of cedar leaf oil mixed with from 5–10 times as much carbon disulphide.

No. 12

(For Furs)

British Patent 368,179

Arsenic, green soap, and common salt are mixed (9:12:4) and dissolved in about ⅔ liter of water. This solution is mixed with about ⅓ liter of methylated spirit and the mixture applied to the leather side of fur by means of a brush or the like. Moths and their eggs in the hair are destroyed and mildew is prevented.

No. 13

German Patent 576,411

Wool is rendered mothproof by treating it with a 1% solution of collodion, drying, and denitrating the collodion with a 5% solution of sodium hydrosulphide.

No. 14

German Patent 576,411

Wool and viscose are rendered mothproof by impregnating with an approximately 1% solution of cellulose in ammoniacal copper hydroxide and subsequent precipitating the cellulose on the fibers by treating with acid.

No. 15

German Patent 588,851

Wool gabardine is boiled for 1 hour in a bath (1:40) containing 10% of Glauber's salt, 4% of sulphuric acid and 4% of the ester salt prepared by heating sulphophthalic acid anhydride with amyl alcohol, neutralizing, and drying. (Percentage based on the weight of wool.) The material is rendered mothproof by this treatment.

No. 16

(For Wool)

U. S. Patent 1,903,864

Wool to be mothproofed is treated for sometime with a cold aqueous solution containing 1–1.5 grams per liter of ammonium selenate. The material is then centrifugal and dried.

No. 17

100 kg. of wool are treated in the manner of dyeing process with 0.5% of ammonium selenate and 4% of sulphuric acid. The wool is then protected against textile pests.

Curled Artificial Silk Fibers

British Patent 492,570

Fibers of regenerated cellulose or cellulose esters are curled by treating at 90° C. with

Sodium Pyrophosphate	1.5 g.
Water	1 l.

and then rinsed and dried.

Crease Proofing Cellulose Acetate Fabrics

British Patent 500,804

Immerse fabric in

Acetic Acid	25–30%
Urea	5–10%
Pyridin	5–10%
Water to make	100%

for 10–20 minutes at 20–30° C.; squeeze and dry at 20–40°; heat at 140–190° F. for 1 hour; wash and dry.

Crease Resisting Viscose Crepe

British Patent 492,449

Viscose crepe is padded with a hot solution (pH 9) of

Borax	15 lb.
Lactic Acid	3 lb.
Sulphonated Cetyl Alcohol	1 lb.
Ammonia	1 lb.
Water	80 lb.

and stretched and dried.

Non-Buckling Mats

Wipe over the backs of mats, 2–3 hours before casting, with a cloth soaked with glycerin, it will help to prevent bothersome buckling.

Unshrinkable Wool

Formula No. 1

British Patent 483,707

Scoured knitted wool fabric (7% moisture) is exposed for 15 minutes to a 1:1 mixture of chlorine and sulphur dioxide. Absorbed gas is removed by circulating warm air prior to washing.

No. 2

British Patent 513,919

Scoured Loose Wool	100

is treated for 10 minutes at 65° C. in the following:

Papain	1¼
Water	5000
Sodium Bisulphite	50
Soda Ash	30

Anti-Static Textile Dressing

Formula No. 1

British Patent 484,858

Magnesium Chloride (10% Solution)	7 lb.

Water	50 lb.

Filter and add to the following emulsion previously prepared:

Mineral Oil	80 lb.
Sulphonated Lauryl Alcohol	25 lb.
Lauryl Alcohol	5 lb.
Oleic Acid	7 lb.
Water	50 lb.

The above is used on cellulose acetate staple fiber to the extent of 1–4%.

No. 2

British Patent 477,639

Triethanolamine Oleate	6½ lb.
Diethylene Glycol	100 lb.
Water	30 lb.

2–3% of this mixture is applied to cellulose acetate yarn.

No. 3

British Patent 488,945

Oleic Acid	10 lb.
Triethanolamine	5 lb.
Pine Oil	3–5 lb.

Mix and add to

Water	180–200 lb.

Yarn Finish

Potash Carbonate	2 kg.
Rosin	7 kg.
Paraffin Wax, Soft	10 kg.
Montan Wax, Bleached, A	10 kg.
Water	65 kg.

Textile Glazing

British Patent 486,316

Titanium Dioxide	5 lb.
China Clay	50 lb.
Water	100 lb.

Make a slurry and mix with

Corn Starch	35 lb.
Dextrin, White	5 lb.
Sulphonated Oil	15 lb.
Water	350 lb.

Boil for 15 minutes.

Luster Emulsion for Starching

Stearic Acid	1 kg.
White Beeswax	200 g.
Borax	60–75 g.
Water	4 kg.
Citronella Oil for Perfume	5 g.

Of this emulsion, 10 spoonfuls are used for 1 kg. of starch.

Finish to Make Silk Rustle

Neutral Oil Soap (Castile Soap)	3000 g.
Pearl Glue (or Silk Glue)	500 g.
Turkey Red Oil	100 g.
Salt	250 g.
Water	100 l.

The silk is treated hot in this solution, then treated with diluted acid, such as lactic or formic acid (0.8% solutions).

Reducing Felting of Wool

British Patent 501,292

Wool	100 lb.

Treat for ½ hour in following boiling solution:

Ammonium Sulphate	1½ lb.
Sodium Bisulphite (Crystals)	3 lb.
Water	3000 lb.

adjust to pH 8 with ammonia.

Treating Cotton for Better Adhesion of Rubber

British Patent 507,493

Degrease cotton with boiling aqueous caustic soda or steaming with ammonia and then treat with

Resorcin	12 lb.
Formaldehyde	24 lb.
Caustic Soda (10%)	12 lb.
Latex (60%)	120 lb.
Water	1600 lb.

Bleaching Textiles

For colored silk, e.g., yellow Italian silk and Tussah silk, bleaching with aqua regia is sometimes resorted to. This is prepared by mixing:

Hydrochloric acid 32° Tw., 5 parts, nitric acid 63° Tw. 1 part.

Allow to stand 4 or 5 days, and dilute to 3–4° Tw.

Treat the silk in it for about ½ hour, until a sufficient bleach is obtained, and rinse off well. Care must be taken that the treatment is not too prolonged, or yellowing of the silk fiber may occur.

Occasionally, nitrous acid is used on animal fibers, particularly silk. The bleaching bath is prepared cold with:

Sodium Nitrite	4 oz.	per 100 gal.
D. O. V.	4 pt.	

Work in this bath until a sufficient bleach is obtained.

Another process which is occasionally used for bleaching wool is that in which permanganate of potash is used. The well scoured goods are treated for about ½ hour in a bath containing 2–3 lb. permanganate per 100 gal., then taken out and allowed to lie for 5–6 hours. They are then worked for 2–3 hours in a cold bath, freshly prepared, containing 10–15 lb. bisulphite and 2–3 pt. sulphuric acid per 100 gal., and well washed off.

In peroxide bleaching, either hydrogen peroxide or sodium peroxide may be used. In each case the bleaching action is obtained from oxygen liberated from the alkaline peroxide solutions. The alkalies most generally used are sodium silicate, sodium phosphate and sodium carbonate. For vegetable fibers sodium carbonate may also be used, in conjunction with sodium silicate or phosphate.

A typical recipe for bleaching wool or silk with hydrogen peroxide consists of:

2–3 gal. hydrogen peroxide (30%) per 100 gal. water.

Sufficient sodium silicate or phosphate to render the bath slightly alkaline.

For silk an addition of 3 lb. Marseilles soap and for wool an addition of ½ lb. of sulphonated fatty alcohol, is often advantageous.

Enter the goods and raise the temperature to 120° F. for wool, or 185° F. for silk. The goods are then immersed and left overnight, being weighted by a wooden grating to prevent floating.

Wash off well, sour with sulphuric acid and rinse again.

A similar procedure is used in the case of rayon or mixed goods, the time being limited to 1–1½ hours, and an addition of sodium carbonate being made to the bleach liquor, e.g.:

2–3 gal. Hydrogen Peroxide (30%)	per 100 gal.
½–1 lb. Sodium Silicate	
½–1 lb. Soda Crystals	

Bleaching Rayon

Grey spun rayon goods are given a 45 minute scour at 180°–190° F. for 250 lb. of goods:

Textone (80% Sodium Chlorite)	1½ lb.
Synthetic Detergent (Wetanol)	1 lb.
Acetic Acid (28%)	4 qt.

Hot and cold wash is all that is necessary. It gives a fine white and excellent dyeing properties. This product is certainly worth investigating.

Waxed Strings for Foundries

are impregnated with:

Woolfat, Crude, Anhydrous	5 kg.
Beeswax or Substitute	10 kg.
Montan Wax, Bleached	10 kg.
Paraffin Wax, Soft (40° C.)	15–20 kg.
Black, Oil Soluble	0.5 kg.

Casein Textile Fiber

U. S. Patent 2,140,274

Casein	24.0 g.
Water	197.5 g.
Linseed Oil Fatty Acids	5.0 g.
Sodium Hydroxide Solution (2N)	13.0 g.
Sodium Aluminate	0.5 g.

Temperature of the solution is 70° C. but other temperatures ranging from 50° C. up may be employed. The dispersion is extruded into a precipitating bath heated at the same temperature. The bath composition is: sulfuric acid, 2; formaldehyde, 5; glucose, 10; water, 83. This procedure gives fibers which are flexible, fairly strong, and water repellent. Oleic acid substituted for the linseed oil acids gives somewhat more flexible fibers.

Care of Hosiery

As for the daily care of stockings:

1. When laundering, squeeze stockings gently in tepid water and neutral soap-suds. Rinse carefully in tepid water. Hang over *smooth* surface away from heat or cold to dry.
2. If the inside of the shoe at the heel is rough, rub a little ordinary paraffin wax over the rough place. This will postpone holes at the heel.
3. Keep callouses and rough places on the foot softened with cold cream to prevent snags from occurring when the stockings are drawn on.
4. Draw stockings on carefully. Do not grip them below the reinforced top with the fingernails.

Run Proof Stockings

Canadian Patent 389,679

Hosiery is dipped in following, squeezed and then dried on forms:

Crepe Rubber	2 oz.
Paraffin Wax	2 oz.
Naphtha	1 gal.

Flock or Short Fiber Coating

British Patent 495,168

Articles are given a thick coating of following:

Stand Oil	4
Amber Varnish	2
Japan Drier	1
Linseed Oil	1

and then short fibers or flock are sprayed on.

Textile Olive Oil Substitute

Mineral Oil, Light	74–80
Diglycol Laurate, Neutral	15–20

Detection of Oxycellulose on Cotton Material

Remove any dyestuff that may be present. Then re-dye the piece with a basic dyestuff. If oxycellulose is present the basic dyestuff will develop fully twice as strong at that point.

Detection of Silk, Celanese, Viscose and Cotton

Immerse the piece in a bath of acetone. If celanese is present it will dissolve out leaving the other fibers untouched. Burn threads of the remaining fabric. Silk will smoulder and give an animal odor. Cotton and rayon will burn quickly. Celanese itself burns and leaves a fused bead at the end of the thread. The quickest way to distinguish rayon from mercerized cotton is physical examination. Rayon is usually highly lustered and if it is delustered it is best to test for zinc or titanium oxides.

Textile Mordant

Canadian Patent 383,688

Aluminum Chloride	14 lb.
Sodium Hydroxide	13 lb.

Add above slow to suspension of

Starch	10 lb.
Water	100 lb.

Mixing well. Filter off solids, wash and filter.

Mordant for Candle Wicks

Water	1000 g.
Ammonium Sulphate	50 g.
Boric Acid	6 g.
Oxalic Acid	1.5 g.

or

Water	1000 g.
Ammonium Sulphate	50 g.
Ammonium Phosphate	17 g.
Borax	25 g.

Fugitive Tinting Dye

1. Diglycol Laurate	98
2. Fugitive Dye	2
3. Mineral Oil	1000

Dissolve 2 in 1 and then add 3. Goods marked with the above are washed out easily.

Textile Tinting Crayon, Washable

Water or Oil Soluble Dye	5 g.
Diglycol Stearate	95 g.

Warm together until uniformly dispersed. Cast into crayon forms.

Fluorescent Oil Soluble Dye

U. S. Patent 2,074,288

Anthraquinone	100 oz.

Melt at 250° C.

Add

Iron, Powdered	80 oz.

Heat to 300–360° for 20 hours. Grind finished product and extract with hot benzol.

Color Wash

French Patent 829,367

Calcium Carbonate	40–65 g.
Sodium Ricinoleate	1–15 g.
Sulphonated Oil	1–15 g.
Zinc Stearate	2–10 g.
Lithopone	5–17 g.
Zinc Oxide	5–17 g.
Sodium Caseinate	3–11 g.
Gelatin	1– 8 g.
Dyes	1–10 g.

Dye Lakes

Violet No. 1

Dissolve

National Methyl Violet 2B Conc. Crystals	5.0 g.
Acetic Acid (70%) in 500 cc. Water	0.3 g.

At 140° F. add in succession

Lead Acetate, 10% Solution	2.50 g.
Tannic Acid, 10% Solution	8.75 g.
Tartar Emetic, 5% Solution	3.75 g.

Stir ½ hour, filter, wash and work pulp into lithol varnish.

Violet No. 2

Dissolve

National Methyl Violet 2B Conc. Crystals in 500 cc. Water	5.0 g.

At 150° F. add

Hydrate of Alumina in 10 cc. Water	0.2 g.
Tannic Acid, 10% Solution	5.0 g.
Tartar Emetic, 5% Solution	2.5 g.
Turkey Red Oil (50%), 10% Solution	0.2 g.

Stir ½ hour, filter, wash, dry at 135° F. to 140° F.

Violet No. 3

Dissolve

Aluminum Sulphate Crystals in 90 cc. Water	9.0 g.

Add at the boil a 5% suspension of

Whiting	5.0 g.

Stir a few minutes before shutting off heat.

Then pour in at 100° F.

National Methyl Violet 2B

Conc. Crystals, 1% Solution	5.0 g.

Finally precipitate at 110° F. with

Tannic Acid, 10% Solution	7.5 g.

Filter and dry at moderate heat.

Table III gives the amounts of tannic acid which will precipitate the indicated dyes. An amount of tartar emetic not exceeding one-half the weight of tannic acid is to be used in addition to the tannic acid.

Table III
Tannic Acid Required for 1 lb. of Dye

Dye	Tannic Acid
National Auramine O Conc.	3.00 lb.
National Thioflavine TG Extra Conc.	1.80 lb.
National Victoria Blue B	1.00 lb.
National Methylene Blue 2B	1.50 lb.
National Brilliant Blue 6G	1.25 lb.
National Rhodamine B Extra	1.50 lb.
National Safranine A Conc.	1.50 lb.
National Fuchsine Special Powder	1.50 lb.
National Crystal Violet 6B	1.25 lb.
National Methyl Violet 2B Conc. Crystals	1.00 lb.
National Victoria Green WB Crystals	2.00 lb.
National Brilliant Green B Crystals	2.00 lb.
National Chrysoidine Y Extra Conc. New	2.50 lb.
National Bismarck Brown 53 Conc.	1.50 lb.

Note: Tannin lakes of fuchsine yield their most brilliant effects when struck on an unwashed gloss white base, but a very soluble type of fuchsine must be used or else the dye will be salted out to a great extent before the formation of the tannin lake can be completed.

Silica Lakes of Basic Dyes

There is little to be said of silica lakes except that they are moderately bright but not very fast to bleeding.

A silica lake of methyl violet may be prepared as follows:

Add at 110° F.

Soda Ash, 10% Solution	12.0 g.

to

Aluminum Sulphate Crystals, 10% Solution	24.0 g.

Wash by decanting with three 2-l. portions of water.

Pour into the washed base

National Methyl Violet 2B Conc. Crystals, 1-2/3% Solution	2.8 g.

Then at 130° F. introduce

Sodium Metasilicate Crystals, 10% Solution	3.6 g.

or

40° Bé. Silicate of Soda, 10% Solution	6.0 g.

If too much bleeding occurs clear up with added tannic acid. Filter, wash and dry at low temperature.

Bases for Color Lakes

Base 1: Alumina Hydrate I

At 90° F. pour

Soda Ash, 10% Solution	50.0 g.

very slowly while stirring into

Aluminum Sulphate Crystals, 10% Solution	100.0 g.

Wash free of sulphates by decanting or filtering.

The decanted hydrate yields more transparent lakes than the press-washed product. Press-washed hydrate is whiter and cleaner than the decanted material. The volume of water and long exposure of hydrate to it during decanting causes small amounts of iron and organic material to lake onto the hydrate. The greater transparency also contributes to the darker appearance of the decanted hydrate. This hydrate is suitable for lakes of triphenylmethane colors.

Base 2: Alumina Hydrate II

At 180° F. pour

Soda Ash, 7½% Solution	50.0 g.

very slowly while stirring into

Aluminum Sulphate Crystals, 7½% Solution	98.8 g.

Wash free of sulphates by decanting or filtering. This base is more suitable for eosines, lithol rubine lakes, etc.

To obtain specific results numerous variations in hydrate formation are resorted to, such as using an excess of alum to insure complete precipitation of peacock blues or boiling for prolonged periods to obtain certain properties in alizarine lakes, etc.

Base 3: Gloss White Base

At 175° F. add in succession, while stirring, to

Aluminum Sulphate Crystals, 10% Solution	100.0 g.
Soda Ash, 10% Solution	50.0 g.

Barium Chloride Crystals, 10% Solution 110.0 g.

Allow to settle, decant and wash almost free of chloride by decantation or filtering.

Gloss white lakes frequently are formed during the lake making. That is, the soda ash is added to the alum, then the dye solution is run in and finally sufficient barium chloride to precipitate the sulphates and dye is added. This base is used mostly for lake scarlet, bordeaux, etc.

Base 4: Acid Gloss White Base

Add while stirring at 160° F.

Soda Ash, 10% Solution 43.5 g.

to

Aluminum Sulphate Crystals, 10% Solution 100.0 g.

Adjust to proper temperature, run in dye solution and add

Barium Chloride Crystals, 10% Solution 110.0 g.

plus enough additional barium chloride to precipitate the dyestuff.

This method is used for azo bordeaux and in other cases where it is desired to influence the shade of the lake by slight acidity, such as throwing lake scarlet to a yellower shade.

Base 5: Blanc Fixe Base

Blanc fixe base is simply a precipitate of barium sulphate prepared as follows:

Add while stirring

Barium Chloride Crystals, 10% Solution 100.0 g.

to

Sodium Sulphate Anhydrous, 10% Solution 56.0 g.

The temperature usually is from 150° F. to the boil, depending on the coarseness desired. The higher temperatures give coarser precipitates. Below 150° F. the blanc fixe has a slippery feel and fails to settle readily enough for most purposes.

Base 6: Satin White Base

This base seldom is used in lakes. It is prepared as follows:

Carefully slake

Lime 33.6 g.

and wash through a 100 mesh screen. Adjust volume to about 400 cc. and run in slowly at the boil

Aluminum Sulphate Crystals 66.6 g.

in 700 cc. water.

Shut off heat, filter and use as required.

Satin white is a mixture of calcium sulphate and calcium aluminate. The reaction involved in the above processes are as follows:

$$6\,CaO + 6H_2O = 6\,Ca(OH)_2$$

$$6\,Ca(OH)_2 + Al_2(SO_4)_3 = Ca_3Al_2O_6 + 3\,CaSO_4 \cdot 2H_2O.$$

This base is quite alkaline and although often recommended for basic color lakes has a deleterious effect on alkali-sensitive colors such as fuchsine.

Base 7: Hydrate—Calcium Sulphate Base

Unless carefully made, this base is likely to have hard lumps in it. When properly made, however, it has the property of extreme softness. The formation of this base depends upon the reaction below.

$$2H_2O + 3\,Ca\,(OH)_2 + Al_2\,(SO_4)_3 = 2Al\,(OH)_3 + 3\,CaSO_4 \cdot 2H_2O.$$

To prepare this base:

Slowly pour

Slaked and Screened Lime 16.8 g.

suspended in 200 cc. water, into

Boiling 10% Solution of Aluminum Sulphate Crystals 66.6 g.

Shut off heat, allow to settle and use as required.

Calcium carbonate (whiting) frequently is substituted for the milk of lime in this base.

Base 8: Base Containing Basic Aluminum Sulphate or Acid Hydrate Base

An acid hydrate base frequently used for tartrazine and alphazurine precipitation is prepared as follows:

At 90° F. add slowly while stirring

Soda Ash, 10% Solution 43.5 g.

to

Aluminum Sulphate Crystals, 10% Solution 100.0 g.

Wash at least five times by decantation with 4-l. portions of water or press-wash thoroughly.

Alphazurine Lake

Dissolve

National Alphazurine FG Conc. 6.0 g.

in 600 cc. water and pour into Alumina Hydrate II base, suspended in 2000 cc. water.

Add at 90° F.

Aluminum Chloride Crystals, 10% Solution 2.0 g.

Barium Chloride Crystals, 10% Solution 10.0 g.

Stir 4 hours, filter and wash. Dry at 140°-150° F.

Wool Yellow Extra Lake

Dissolve
National Wool Yellow Extra Conc. 24.0 g.
in 2000 cc. water and pour into Alumina Hydrate II base, suspended in 3000 cc. water.
Add at 100° F.
Aluminum Chloride Crystals, 10% Solution 24.0 g.
Barium Chloride, 10% Solution 15.0 g.

Stir until bleeding stops, filter, wash and dry at 140°–150° F.

This type of procedure also is suitable for quinoline yellow conc., fast wool yellow 3GL, fast light yellow 2G, canary lake yellow PL, etc.

Croceine Scarlet MOO Lake

Dissolve
National Croceine Scarlet MOO 15.0 g.
in 1500 cc. water and pour into Alumina Hydrate II base, suspended in 2500 cc. water.
Add at 110° F.
Barium Chloride Crystals, 10% Solution 60.0 g.

Heat to 150° F., stir 20 minutes, shut off heat and stir until cool.

Filter, wash and dry at 140°–150° F.

This lake yields a bright scarlet shade with a clean undertone.

Lake Scarlet R Lake

Dissolve in 1500 cc. water
Aluminum Sulphate Crystals 100.0 g.
Calcined Glauber's Salt 33.0 g.
Boil, shut off heat and pour into this a boiling solution of
Soda Ash 43.0 g.
in 400 cc. water.

Stir 15 minutes or more, shut off heat and add 1500 cc. cold water.
At 120°–130° F. add a solution of
National Lake Scarlet R 30.0 g.
in 1500 cc. water.
Finally at 130° F. add
Barium Chloride 200.0 g.
in 2000 cc. water.

Stir ½ hour, filter, wash and dry at 140°–150° F.

Lake Scarlet R Lake for Coatings

Dissolve
Aluminum Sulphate Crystals 30.0 g.
in 500 cc. water.
Add
China Clay 10.0 g.
Blanc Fixe 10.0 g.
Boil.
Add a boiling solution of
Soda Ash 14.0 g.
in 140 cc. water.
Run in a boiling solution of
National Lake Scarlet R 27.0 g.
in 100 cc. water.
Finally add
Barium Chloride Crystals 60.0 g.
in 600 cc. boiling water.

Stir until cool, filter and wash. Leave in pulp form.

Lake Scarlet R Lead Toner

Dissolve
National Lake Scarlet R 30.0 g.
in 1000 cc. boiling water.
Add, at the boil, basic lead acetate, formed by boiling for 15 minutes
Lead Acetate 27.2 g.
in 100 cc. water, while sprinkling in
Litharge 12.8 g.

Boil 15 minutes after adding basic lead acetate to dye. Wash, filter and either dry at very low temperature or, preferably, grind the pulp into lithol varnish.

Lead lakes of lake scarlet seldom are encountered of late but formerly were widely used in lacquers.

Eosine Lake

Dissolve
National Eosine OJ 50.0 g.
in 1500 cc. water and pour into Alumina Hydrate II base, suspended in 4000 cc. water.
At 150°–155° F. pour in
Lead Nitrate, 10% Solution 50.0 g.

Stir at 150°–155° F. for 20 minutes and flood with 4000 cc. cold water.

Filter at once, wash very lightly and dry at 140°–145° F.

The beauty of this lake depends upon the quality of the dye used and upon exact adherence to the formula. This, also, is suitable for phloxine precipitation.

Following are some of the more light resistant acid blues and reds:

Alizarine Sapphire BLN Lake for Coatings

Dissolve
National Alizarine Sapphire BLN 5.0 g.
in 500 cc. boiling water.
Add at 150° F.
Soda Ash, 10% Solution 4.0 g.
Barium Chloride Crystals, 10% Solution 20.0 g.
Aluminum Sulphate Crystals, 10% Solution 8.0 g.

Stir 1 hour, filter and wash. Use as pulp for paper coating.

Lakes and Toners of Dyes Manufactured Exclusively for Lake Purposes

Lake Rubine Lake

Boil up
National Lake Rubine R 11.0 g.
Turkey Red Oil (50%) 0.5 g.
in 2200 cc. water for 15 minutes.
Cool to 110° F. and add the full amount of Alumina Hydrate II base at 110° F.
Add while stirring at 110° F.
Calcium Chloride Anhydrous 8.0 g.
in 80 cc. water.

Stir at 110° F. for at least 1 hour; filter and dry at 160° F.

These lakes are hygroscopic. To overcome this objectionable feature, strontium chloride may be substituted for part of the calcium chloride.

Red for Lake C Lake

Add
Red for Lake C 10.0 g.
in 300 cc. water at 120° F. to
Barium Chloride 10.0 g.
in 100 cc. water at 120° F.

Bring to boil, boil 10 minutes, cool and add full amount of Alumina Hydrate II base.

Filter, wash and dry.

Note: For bronze toner do not add hydrate.

Lithol Red Sodium Salt

Diazo Solution: Dissolve
Caustic Soda 3.25 g.
in 300 cc. water.
Heat to 140° F. and add
Tobias Acid (100%) 14.9 g.
Into a second beaker put
Cold Water 300.0 cc.
Ice 100.0 g.
20° Bé. Hydrochloric Acid 22.0 g.
Pour the tobias acid solution into the hydrochloric acid-ice solution, then add
Sodium Nitrite 5.5 g.
in 15 cc. cold water.
Stir 45 minutes and add
Sodium Acetate 10.0 g.
just before coupling with the following beta-naphthol solution.
Beta-Naphthol Solution: Dissolve
Beta-Naphthol 9.75 g.
in 200 cc. hot water containing
Caustic Soda 8.10 g.
Cool to 60° F. with 1600 cc. cold water.
Run the diazo solution very slowly into the beta-naphthol solution.

Stir ½ hour, bring to the boil, filter and wash.

Lithol Red Barium and Calcium Salts

The barium and calcium salts may be made as follows:

After coupling the diazo solution and the beta-naphthol solution, stir for 1 hour and add
Calcium or Barium Chloride 18.0 g.

Bring to the boil and boil for ½ hour. Filter, wash and dry at 160° F.

CHAPTER TWENTY-ONE

MISCELLANEOUS

Stabilized Colored Gasoline
U. S. Patent 2,097,773

Stearic Acid	1
Spirit Blue	1
Aluminum Stearate	2

Dissolve the above in benzol and use 1 part of this to 100,000 parts gasoline.

Motor Fuel
Formula No. 1
U. S. Patent 2,179,151

Butyl Alcohol	38 lb.
Alcohol	10 lb.
Acetone	30 lb.
Turpentine	4 lb.
Benzol	18 lb.

No. 2
French Patent 821,132

Gasoline	60 l.
Alcohol or Benzol	20 l.
Acetone	20 l.

Gasoline Improver
U. S. Patent 2,088,000

0.04–1% of the following mixture is added to improve it:

Naphthalene	1
Alcohol	5
Acetone	10

Anti-Detonating (Anti-Knock) Agent for Gasoline
U. S. Patent 2,145,889

Kerosene	40%
Iron Carbonyl	40%
Diglycol Stearate	20%

4 cc. of above solution is used per gallon of gasoline.

Anti-Knock Fuel
U. S. Patent 2,125,448

Triethanolamine	18 oz.
Oleic Acid	58 oz.
Butyl Cellosolve	20 oz.
Sec.-Hexyl Alcohol	25 oz.
Water	75 oz.
Gasoline	750 oz.

Brake Lining
Formula No. 1

Short Fiber Asbestos	600.
Rubber from 30% Latex	100.
Sulphur	30.
Graphite	10.
Powdered Lead	7.
Accelerator 808	2.
Carbon Black	15.

The asbestos is made into a water slurry containing a small amount of sodium hydroxide. The sulphur, graphite, powdered lead and carbon black are made into a water paste and mixed with the asbestos slurry, the water present being removed by filtration to give a concentration of 10% solids. The latex (30% rubber content) to which emulsified Accelerator 808 has been added is then mixed with the slurry. This mixture is then molded to shape, dried and set, and vulcanized in open steam for approximately 2 hours at 287° F.

No. 2
French Patent 826,687

Asbestos Fibers	40 kg.
Cement	15 kg.
Synthetic Resin	45 kg.

Auto Anti-Freeze
Formula No. 1
(Non-Corrosive)
U. S. Patent 2,182,612

Denatured Alcohol	100 cc.
Mineral Oil	1–4.2 cc.
Sulphonated Castor Oil	0.03–0.3 cc.
Sodium Salicylate	0.1–0.4 g.

No. 2
French Patent 841,438

Ethylene Glycol	70
Propylene Glycol	15
Diethylene Glycol	15

Automobile Oil Filter
British Patent 498,634

1. Mineral Wool	43.4 g.
2. Water	52.6 g.
3. Ammonia	1.03 g.
4. Casein	1.72 g.
5. Formaldehyde	1.25 g.

Soak 2, 3, 4 for ½ hour and warm to 60° C. Stir until smooth. Add 5 and then impregnate 1 with it at once. Put into a container through which the oil will circulate.

Windshield Anti-Fog and Anti-Mist
Formula No. 1
U. S. Patent 2,107,361

Glycerin	1	gal.
Camphor	4	oz.
Turpentine	½	pt.
Potassium Oxalate	1	lb.
Oxalic Acid	4	oz.

Ingredients are dissolved by heating together on a water bath, and mixture applied by wiping the glass with a sponge dipped into the preparation.

In paste form is another somewhat similar formula for a windshield mist preventative for which users report good results. This composition calls for:

4 oz. Potassium Oxalate	112	gr.
2 oz. Glycerin	60	ml.
1 gr. Camphor	0.1	gr.
1 oz. Turpentine	30	ml.

Heat on water bath.

Application of this product is reported to be beneficial both on the inside and on the outside of the windshield. Use on the outside of the windshield causes the rain to flow more evenly so that it does not reflect and refract street lights and the lights from other cars. On the inside, its use prevents accumulation of mist or fog, resulting in clearer visibility, and easier and safer driving. Product is applied to a clean windshield and rubbed well with a clean cloth.

No. 2

Sodium Oleyl Sulphate	18
Titanium Dioxide	27
Alcohol	33
Water	22

Procedure is to grind the materials together to form a liquid of uniform consistency.

No. 3
U. S. Patent 2,107,361

Glycerol	1	gal.
Camphor	4	oz.
Turpentine	1	pt.
Potassium Oxalate	1	lb.
Oxalic Acid	4	oz.

Charcoal Briquettes
French Patent 827,216

Powdered charcoal is mixed in following proportion and pressed and dried:

Charcoal	1000	kg.
Glue, Joiners'	30	kg.
Sodium Nitrate	7	kg.
Gelatin, Bone	½	kg.
Water	105	l.

Coal Solution

Coal, Powdered	45 lb.
Tar Oil	405 lb.

Heat at 90–110° C. with stirring.

Coal Improver
U. S. Patent 2,089,599

Coal containing large amounts of iron sulphur compounds can be burned satisfactorily if treated with

Calcium Chloride	92
Potassium Dichromate	3
Manganese Dioxide	3
Tannic Acid	2
Water	10,000

The amount of the above solids to be used is 5% of the sulphur content of the coal.

Flocculating Coal Slurry
British Patent 507,553

Ulmus Fulva	24.5 lb.
Borax	4.9 lb.
Glycerin	8.8 lb.
Potato Starch	6.8 lb.
Water, Boiling	454.0 lb.

Mix until uniform and dilute with

Water	4600.0 lb.

The above is added to

Coal Slurry (12% Coal Dust)	41,000.0 lb.

Flotation Reagent for Coal Cleaning
U. S. Patent 2,094,646

Crude Paraffin Base Oil	4
Kerosene	4
Creosote	1

Thickening Organic Fluids
(Solidified Fuel)
British Patent 492,320

Solidified fuels, paint removers, etc., are made by dissolving a polymer containing saponified groups in a nonsolvent for the saponified polymer, e.g., higher alcohols (above butyl), benzine, mineral oil, ethyl acetate, benzol, etc. The gel formed does not melt on warming.

Benzol	99.0 g.
Ethyl Polyacrylate	0.5 g.
Sodium Hydroxide (Normal Solution in Ethyl Alcohol)	0.5 g.

Mix together; gel forms in a few hours.

Petroleum Gas Catalyst
U. S. Patent 2,158,154

A catalyst suitable for use in the

conversion of crude-oil refinery gases containing saturates and unsaturates into hydrocarbon liquid polymers, consists of a mixture of the following ingredients in substantially the following proportions by weight:

Natural Phosphate Rock	20–100 lb.
Carnotite Ore	20–100 lb.
Zinc Phosphate	5–20 lb.
Barium Chloride	3–12 lb.

Stabilizing Chlorinated Hydrocarbons

British Patent 493,875

Add 0.001–0.5% picoline or commercial methyl pyridines.

Keeping Lamp Wicks Clean

Boiling new lamp wicks in vinegar helps to keep them from smoking. Old wicks should be washed occasionally and then boiled in vinegar. The burners should be boiled occasionally in soda water, rinsed and dried.

Perfumed Cigarette Lighter Naphtha

Use 1 lb. of citronella oil or 2 lb. of lavender oil for 1000 lb. of deodorized naphtha.

Solidified Fuel for Lighters

British Patent 497,619

Methaldehyde	85 g.
Artificial Silk (Fine Fibers)	7 g.
Benzyl Peroxide	3 g.
Pyroxylin	5 g.

This burns without smoke or residue.

"Solid" Naphtha

Naphtha, Hot	85
Stearic Acid, Melted	15
Oil Soluble Dye	to suit

Pour into metal forms. Cut when cooled.

"Solid" Alcohol

Stearic Acid, Melted	4
Alcohol, Denatured, Hot	92
Caustic Soda (24° Bé.)	4

The soda is added last to the clear solution of stearic acid in alcohol. Stir well.

Deodorizing Petroleum

a.	Water	1750 g.
	Sulphuric Acid (66° Bé.)	450 g.
b.	Potassium Permanganate	30 g.
c.	Petroleum	5000 cc.
d.	Sodium Bicarbonate	15 g.
	Potassium Permanganate	7.5 g.
	Water	1000 cc.
e.	Soda Ash, Anhydrous	10–20 g.

Prepare *a*, cool well, add *b*. This solution is mixed with *c*, allowed to stand together with frequent shaking for 24–48 hours. The watery layer is drawn off, and solution *d* is added to the petroleum, shaken frequently, and drawn off after a few hours.

The petroleum is dried over *e*.

Deodorizing Solutions for Naphtha

Solution No. 1

Potassium Permanganate	1 lb.
Water	50 lb.
Sulphuric Acid	8 lb.

The acid is added last with good stirring.

No. 2

Potassium Permanganate	1 lb.
Water	100 lb.
Potassium Hydroxide, Pellets	2 lb.

Shake up 2000 lb. of naphtha (or gasoline) with Solution No. 1, shake up repeatedly, finally filter after 24 hours. Separate in separatory funnel.

Now treat the naphtha with Solution No. 2 in a similar way.

Separate the layers. The gasoline or naphtha should now be odorless.

Smothering Solvent Fires

"Where a dry, smothering fire extinguisher is suitable, pails, boxes or bins containing sand, sawdust, salt, bicarbonate of soda or talc, with shovels or scoops for spreading the extinguishing material on the fire, are effective and low in cost. These materials are particularly adaptable for fires in chemical laboratories where the use of water might be dangerous, and, in the case of sand, salt or talc, for fires in materials such as aluminum powder and magnesium chips, which water or other wetting fire extinguishers merely intensify.

"A mixture of sawdust and soda (10 lb. of sodium bicarbonate to 1 bushel of sawdust) is effective on small fires in heavy flammable liquids, waxes or greases, on the floor or in open containers where the fire can be closely approached and the mixture be rapidly applied and spread over the area. In making up the mixture, clean, dry sawdust, free from dirt or foreign matter, is thoroughly mixed with sodium bicarbonate, dry and free from lumps. The addition of a small amount (about 1 lb.) of talc or drying agents will help to prevent the sodium bicarbonate from caking and make the mixture smoother flowing and resistant to moisture. It is advisable to mix thoroughly the talc or other material with the sodium bicarbonate before adding the sawdust. Bins of sawdust and soda mixture are sometimes arranged in case of fire to automatically dump their contents upon the hazard they are protecting."

Fire Extinguishing Fluid
British Patent 490,122

Tetrachlorethane	15 lb.
Carbontetrachloride	29 lb.
Dibromdichlorethane	30 lb.
Tribromethane	11 lb.
Cellulose Acetate	15 lb.

Boiler Feed Water Compound
Formula No. 1

An excellent water treating compound can be made for boiler water use as follows:

Soda Ash (Anhydrous)	1 lb.
Tetra Sodium Pyrophosphate	2 oz.
or	
Trisodium Phosphate	3 oz.
Quebracho Tannin Extract	1 oz.
Sodium Hexametaphosphate	1/50 oz.

Mix well and use 1–2 lb. per 1000 gallon to make up feed water to the boiler. Run tests for soap hardness, alkalinity, and total solids. Keep hardness at 0.0–0.5 grains per gallon, alkalinity as $CaCO_3$ 20–25% of total dissolved solids. Increase or decrease treatment as case may be and as the water gets harder or softer.

No. 2
British Patent 513,386

Graphite	85
Talc	3
Aluminum Bronze	9
Zinc	3

All of the above must be finely powdered and mixed.

Water Softening Blocks
British Patent 502,833
Formula No. 1

Soda Ash	85 oz.
Borax	15 oz.

No. 2

Soda Ash	75 oz.
Borax	10 oz.
Sodium Aluminate	15 oz.

Either of the above is mixed with just enough water to form a paste and put into forms to produce blocks on cocling.

Base Exchange Material
British Patent 503,847

Kaolin (Calcined at 700° C.)	300 lb.
Sodium Silicate ($5H_2O$)	290 lb.
Quartz Flour	253 lb.

Grind together in ball mill and mix with

Water	18%

allow to set into brick forms. These bricks are steamed in an autoclave at 30 lb./sq. in. until reaction is no longer alkaline. The bricks are then crushed to 10–50 mesh for use in water treatment.

Boiler Anti-Foam

Addition of 10–15 parts per million of castor oil prevents priming in boiling water.

Defoaming Agent

Paraffin Wax	1 oz.
Liquid Petrolatum	1 oz.
Octyl Alcohol	2 fl. oz.

Warm together and stir until uniform.

Phosphate Rock Concentration
U. S. Patent 2,069,182

Florida Phosphate Debris	550 lb.
Sodium Sulphide	1 lb.
Turkey Red Oil	1 lb.
Fuel Oil Distillate	0.8 lb.
Water	Excess

Mix well and separate on Wilfley table.

Preventing Loss of Circulation in Oil Wells

Cheapest Building Cement	100 lb.
Mud (sp. g. 1.15–1.20)	40–100 lb.
Water Glass (40° Bé.)	10– 20 lb.
Caustic Soda (1:2 solution)	6– 12 lb.
Water	10– 18 lb.

Mix water glass, caustic soda and water then add mud and finally cement. Pump into well 5–10 minutes before mixture will set.

Drilling Mud
U. S. Patent 2,146,693

A drilling mud comprises bentonite in substantially undispersed state and 20% or more by volume of sodium silicate in which the molecular ratio of silica to sodium oxide is greater than 1.

Disinfecting Fermentation Tanks

Use 100 cc. formaldehyde or 200 g. chloride of lime per 100 hectoliters capacity; close hermetically and boil.

Contact Catalyst for Sulphuric Acid Manufacture

British Patent 466,721

Finely divided platinum is supported on the following carrier:

Magnesium Sulphate	75 oz.
Aluminum Sulphate	12 oz.
Ferrous Sulphate	13 oz.

Sodium Hexametaphosphate

Phosphoric Acid	214 lb.
Sodium Carbonate, Anhydrous	106 lb.

Mix well and evaporate to dryness. Heat at 620° C. for 15–30 minutes and chill quickly by pouring on water cooled rolls.

Schweitzer's Solution (Cellulose Solvent)

The preparation of Schweitzer's solution by the ordinary method is tedious, but a solution which readily dissolves cellulose can be easily obtained by adding an excess of "copper carbonate" to 0.880 ammonia, diluted with an equal volume of water. The undissolved substance adheres to the bottom and sides of the vessel and, after a few hours, the solution can be poured off as required.

Gelatin Duplicator Composition

Commercial grade sorbitol is used to partially replace glycerin. Due to the fact that commercial grade sorbitol has a higher viscosity than glycerin at the same concentration, complete substitution of sorbitol for glycerin cannot be made, as the resulting increase in viscosity is too great and the composition becomes dead. However, if the substitution is only carried to the point where the composition has optimum resilience and, at the same time, the highest possible viscosity without becoming dead, then the properties of the composition are greatly improved. The advantages obtained when commercial grade sorbitol is substituted in the previously described manner are: greater mechanical strength, especially as regards resistance to cutting: many more copies can be made with increased brilliance and brightness throughout the average; the rolls do not have a tendency to burn and have a greater heat resistance for a given amount of tanning.

A typical sorbitol formula now in commercial use is as follows:

Glue	8.5%
Commercial Grade Sorbitol	31.0%
Glycerin	48.4%
Water	12.1%
Formaldehyde	0.2–0.3%

(based on the weight of glue)

The foregoing formula can be prepared in just the same way as though nothing but glycerin was employed as a softener. It will respond to the commonly used tanning agents, although it is not necessary to tan quite as heavily or to as high a melting point when using sorbitol. This is because of the added strength imparted to the composition by the sorbitol.

Soluble Starch

British Patent 490,070

Starch is treated with 10% alkali hypochlorite solution at 130–160° F. A little formaldehyde is added as a preservative.

Stabilized Cuprous Oxide

British Patent 523,736

Cuprous oxide is made less subject to atmospheric oxidation by mixing in 0.05–2% of glue or gelatin.

Whitening Yellowed Materials

British Patent 522,672

Textiles, paper, etc., are immersed in following bath and then dried:

Borax	24
Methylumbelliferone	1
Water	10,000

Self-Heating Pad

U. S. Patent 2,126,734

Formula No. 1

A self-heating pad comprises a single ply of aluminum foil and a single ply of absorbent paper with their margins folded to form a container, and a composition in container substantially of the following formula:

Chlorate of Potassium	.90 oz.
Aluminum Powder	1.30 oz.
Anhydrous Sulphate of Copper	.15 oz.
Kaolin	2.00 oz.
Pumice	2.00 oz.

No. 2

U. S. Patent 2,118,586

Manganese Chloride	3.3 oz.
Sodium Acetate	94.0 oz.
Ethylene Glycol	2.7 oz.

No. 3

British Patent 502,059

Aluminum Powder	1.5 oz.
Potassium Chlorate	2.0 oz.
Copper Sulphate	1.0 oz.
Fuller's Earth	4.0 oz.

Acid Proofing Corks

First place the corks to be treated in a solution of glycerin 2 parts, gelatin 1 part, and water 40 parts and heat at from 112 to 120° F. for several hours to permit the fluid to penetrate the cork. After this treatment the corks should be wiped clean and will be found to retain their elasticity.

The next step is to cover the treated corks with a mixture of petrolatum 2 parts and paraffin 7 parts, heated to about 105° F. An alternative to the use of this mixture is use of a small quantity of ammonium dichromate dissolved in the glycerin-containing solution. After this latter treatment the corks should be exposed to light.

Keeping Mercury Manometers Clean

Just cover surface of mercury with a very thin layer of phosphoric acid (sp. gr. 1.16–1.75).

Activated Magnesium Oxide

British Patent 483,096

Magnesium hydroxide formed by treated sea water with lime is washed until it contains less than 0.28% salt. Spray dry and pass through a rotary kiln at 400° C. which converts 80–85% into magnesium oxide. The product is an efficient decolorizer for sugar and oils.

Activated Carbon (Decolorizing)

U. S. Patent 2,146,024

Sawdust or peat is calcined at 400–700° C. with zinc chloride so as to yield a dry ratio of 3:1 (cellulose material to zinc chloride) and phosphoric acid amounting to 2½–10% of the zinc chloride used.

Tear Gas Bomb Liquid

U. S. Patent 2,146,715

Chloracetophenone	20–40 oz.
Chloroform	50 fl. oz.
Chlorpicrin	50 fl. oz.

Artificial Fog

Formula No. 1

Zinc Dust	34.6 lb.
Carbon Tetrachloride	40.8 lb.
Sodium Chlorate	9.3 lb.
Ammonium Chloride	7.0 lb.
Magnesium Carbonate	8.3 lb.

No. 2

Zinc Dust	25 lb.
Carbon Tetrachloride	50 lb.
Zinc Oxide	20 lb.
Infusorial Earth	5 lb.

The powders are set afire, forming zinc chloride fogs with the moisture of the air.

Sulphuric Acid Dilution Formula

To dilute concentrated sulphuric acid (sp. gr. 1.84) to a weaker acid—

1.84 : a : : b : c

In which

a = desired sp. gr.
b = total volume after dilution
c = water added

For instance: to make up over a l. of sulphuric acid (sp. gr. 1.29) from acid sp. gr. 1.84—

1.84 : 1.29 : : b : 1000 (water)
b = 1426 cc. of diluted acid, of which 1000 cc. is water.

Therefore, 1426 — 1000 = 426 cc. concentrated sulphuric acid added to 1000 cc. water will produce 1426 cc. of solution of 1.29 sp. gr.

Halpin-Hicks Test Reagent

(A test used to evaluate rosin)

Solution A

1 part (by volume) of phenol dissolved in 2 parts of carbon tetrachloride.

Solution B

1 part (by volume) of bromine dissolved in 4 parts of carbon tetrachloride.

Formula for Phloroglucinol Solution

(Used in the acid test for turpentine)

Concentrated Hydrochloric Acid	1 oz.
5% Phloroglucinol in Ethyl Alcohol	1 oz.
Glycerin C. P.	1 oz.

Anti-Static for Belts

Static electricity on fan belts of automobiles, refrigeration equipment and the like, aside from its generally dangerous nature and interference with radio reception, is apt to give unpleasant shocks when metal parts are touched. The friction which is the cause of the static electricity, however, may be reduced by means of a mixture of glycerin and graphite, applied at the points of friction.

The glycerin-graphite mixture is also an excellent lubricant, valuable not only because it is insoluble in most organic solvents but also because it retains its activity at very low temperatures and extremes of weather. Being non-toxic, glycerin alone or in combination with graphite, may safely be employed as a lubricant for food-treating equipment.

Liquid Dielectric

British Patent 493,961

Chlorinated Diphenyl (60% chlorine)	2 lb.
Trichlorobenzol	2 lb.
Tetrachlorobenzol	1 lb.

Condenser Electrolyte

British Patent 492,950

Ethylene Glycol	500 g.
Water	500 g.
Boric Acid	70 g.
Ammonia (N Solution)	12 cc.

Rectifier Element

British Patent 490,550

Copper elements are oxidized by heating in air at 960–1040° C.; keep for ½– 2 hours at 300–600° C. Quench in water or paraffin at 25–100° C.

Positive Storage Battery Composition

British Patent 496,554

Red or Yellow Lead Oxide	96 lb.
Powdered Porous Coconut Charcoal	4 lb.

Knead with sulphuric acid (d 1.10) and apply to grid.

Magnetizable Fluid

U. S. Patent 2,149,782

A magnetically responsive fluid comprises approximately from 2–14% by volume of steel dust, 3% by volume of powdered graphite, and from 83–95% by volume of quick-silver.

Artificial Skating Surface

U. S. Patent 2,179,664

Carnauba Wax	10 kg.
Gum Dammar	2 kg.
Naphthalene	7 kg.

Melt together with mixing and apply hot. Smooth surface with hot irons and lubricate surface with low viscosity mineral oil.

Detecting Forged and Altered Documents

U. S. Patent 2,123,597

1. Testing solution: 200 g. magnesium chloride are dissolved in 100 cc. water. To this solution 40 g. potassium iodide, dissolved in 40 cc. water containing 0.15 g. iodine, are added.

2. Clearing solution: 60 g. sodiumthiosulphate are dissolved in 100 cc. of water.

The document or the like to be treated is first coated with the halogen solution and then treated with a dry brush, a piece of cotton wool or the like, for the removal therefrom of superfluous liquid. After the intactness or alteration of the document has been determined, the testing solution is, if required, removed by treatment with a sodiumthiosulphate solution whereupon the document is blotted and carefully dried. Previous to the blotting and drying the document may be washed in water. Instead of the thiosulphate, sodium sulphite or other substance which reacts on halogen, may be employed.

Tests for Glycerin, Glycols and Other Polyhydric Alcohols

A qualitative color test for glycerin is as follows: Place the following in a 6-in. test tube in the order given: (1) 3 cc. of the sample solution; (2) 3 cc. of a 10% aqueous solution of catechol, freshly prepared; and (3) 6 cc. of concentrated sulphuric acid. Heat gently for about 30 seconds. If glycerin is present, a blood-orange color will quickly appear at about 140–145° C. No color is formed with ethylene glycol, diethylene glycol, and ethyl alcohol. Acrolein interferes by giving a purple flocculent precipitate. Other polyhydric alcohols give colors as follows:

Alcohol	*Color*
Propylene Glycol	Faint pink
Triethylene Glycol	Faint pink
Trimethylene Glycol	Dark brown
Glycerin	Blood orange
Pentaerythritol	Dark purple-red
Erythritol	Faint pink
Mannitol	Red-orange
Sorbitol (neutral)	Blue
Sorbitol (H_2SO_4)	Faint pink

Aldehydes, in general, give color reactions with catechol and sulphuric acid, but with the exception of acrolein, are not apt to be present.

Heat Transfer Salt Mixture

Sodium Nitrite	40
Sodium Nitrate	7
Potassium Nitrate	53

This is thermally stable and has a high heat transfer coefficient. It can be used at temperatures of 300–1030° F.

Can be used with mild steel below 850° F. but at higher temperatures low alloys are necessary.

Lowering Heat Conductivity of Water

British Patent 505,978

The thermal conductivity of water used in quenching metals is lowered by adding:

Soft Soap	16	oz.
Borax	1	oz.
Ammonia	1	oz.
Water	½	gal.

Preserving Alberene Laboratory Tables and Tops

Once a month wash with soap and warm water. Then rinse with warm water. Wipe and allow to dry for an hour.

Apply white mineral oil generously and rub in. This is best done on a weekend so that oil can soak in. On following Monday rub with a dry cloth.

Colored Coatings for Indicating Temperature

The following coatings containing metal compounds undergo irreversible reactions accompanied by color changes at definite temperatures:

Ammonium Manganese Pyrophosphate $(NH_4)_2MnP_2O_7$, violet to white at 400°.

Copper Pyridine Thiocyanate $[Cu(C_5H_5N)_2]$ $(CNS)_2$, green to yellow at 135°, yellow to black at 220°.

Cobalt Potassium Phosphate $CoKPO_4$ H_2O, rose to blue at 140°.

HOW TO CARE FOR FURNITURE

To Remove Alcohol Spots from Polished Surfaces

Fold sandpaper around small block of wood. Pour a little lemon oil or crude oil on spot. Rub sandpaper across spot until surface is smooth and spot has disappeared. Paint Shellac over it and let dry. Sandpaper lightly again. Then paint coat of varnish over entire top surface.

To Remove Scratches from Furniture

If scratch is light, lemon oil or furniture polish will darken it. If scratch is deep, darken it with wood stain; rub with crude oil or lemon oil. If scratch is deep, rub lightly with steel wool and oil. Dampen soft cloth with alcohol, add 10 drops of shellac. Pour a few drops of lemon oil on scratched surface, then work soft cloth over scratch lightly, and it will disappear.

To Wax Wood

Use either hard or liquid wax, but use it sparingly—a little goes a long way. Too much makes wood sticky and gummy. Remove old wax by washing with a little ammonia and water.

To Refinish Old Furniture

Cover entire surface with liquid varnish-remover, applying it with a paint brush. As fast as varnish softens, scrape it off, using a paint-scraper or razor blade in holder. Soak up old varnish with a crushed newspaper. Wash surface with denatured alcohol. Before refinishing, new stain may be needed to darken wood. When color is right, allow to dry thoroughly. Then, finish with shellac, varnish and wax. Let each coat dry completely.

To Remove Water Spots from Polished Furniture

If the water spot hasn't soaked into the surface too deeply, rubbing with finger will remove it. If that won't remove spot, dampen small piece of cheesecloth with denatured alcohol and few drops of lemon oil. Rub spot lightly and briskly until it disappears.

To Wash Varnished Wood

To wash varnished surfaces of mahogany, walnut, maple, oak or pine, first remove all dust. (Use cheesecloth for washing and wiping.) 1: Prepare 1 qt. boiling water. 2: Add 3 tablespoons of lemon oil and 1 tablespoon of turpentine. 3: Soak cheesecloth in this solution and wring dry as possible. Wash small section of surface at a time and wipe immediately with dry cheesecloth.

To Polish Wood

Dip cheesecloth in equal parts of crude oil and benzine. First, rub against grain of wood — then in straight lines, with the grain. Give wood time to absorb oil, then rub evenly to a satiny gloss.

Repairs

If a rung or joint is loose, remove it. Scrape off all remaining pieces of hard glue. Secure some cabinet maker's glue. Place on stove, in double boiler, and bring to boiling point. When glue is as thin as light paste, it is ready to use. These are but a few hints on the proper care of furniture.

Denture Fixative

Formula No. 1

Tragacanth (Finely Powdered)	50	parts
Maize Starch	50	parts

No. 2

Tragacanth (Finely Powdered)	50	parts
Acacia Gum	44.5	parts
Boric Acid	5	parts
Vanillin	0.5	parts

Nicotine Filter Cartridge

Hungarian Patent 121,494

Silica gel is moistened with 5% boric acid solution to absorb nicotine and other toxic ingredients from tobacco smoke.

Coloring Agates

The coloring of agates depends on the introduction of a coloring matter into their pores. Some layers of agate are less porous and therefore these will not absorb pigments, but remain wholly uncolored or only partially colored. The cutter calls the less porous layers in the agate *hard*. The layers or bands readily colored are termed *soft*. The skilled artisan can often judge the ability of an agate to absorb pigments, prior to the treatment.

The art of coloring agates and similar stones has been known to us for only a relatively short time. Long ago the Romans had learned the secret of the black colors, but they kept this secret for centuries. Finally in 1819 this old Roman technic was discovered by accident.

The manner in which the coloring pigment is introduced into the agate varies according to the color desired. In all cases where a permanent color is attained, the coloring matter is not introduced in a dissolved form directly, but by the use of various chemical reactions; these take place within the agate.

In general there are two methods of coloring an agate. In one case the soluble metallic salt is permitted to soak into the pores of the agate. This soluble salt in turn is changed to a colored insoluble oxide by heating. In the other method two solutions or "baths" are used in succession, the second bath causing a colored precipitate of an insoluble metallic salt to be deposited within the agate.

The following will serve to illustrate how some of the colors can be obtained in an agate:

Red—Soaking stone in iron nitrate solution and then by "burning" an iron oxide is produced.

Bluish Green—Soaking in solution of chromic acid or ammonium bichromate, and heating to produce a chrome oxide.

Apple Green—Soak in nickel nitrate and "burn" to produce a nickel oxide.

Brown—Soak in a sugar solution and heat strongly to carbonize sugar to caramel.

Blue—Soak in bath of yellow prussiate of potassium and then in a solution of iron sulphate to precipitate "Berlin blue."

Blue—Soak in solution of red prussiate of potassium and then in solution of iron sulphate to precipitate "Turnbull blue" in agate.

Black—Soak in sugar solution and then in sulphuric acid, to change sugar to carbon.

For completeness it may be mentioned that aniline dyes have been used to some extent in the artificial coloring of agates. The aniline colors, however, are not as permanent as the metallic oxides and precipitates described above. Aniline tends to fade when exposed to strong light.

Before the agate is colored it must be cleaned of all oil and impurities which may be adhering to or soaked into the stone. In the cutting of agates, oil or kerosene is used to lubricate the saws, and this must be first "extracted." The petroleum substances can be removed by boiling in a strong solution of sodium bicarbonate, or solvents like gasoline or some non-inflammable commercial cleaning fluid can be used "cold."

The agate may carry a small amount of iron and it is desired to remove this prior to "burning" for green colors, otherwise a dull or muddy green may be obtained. To remove iron compounds the stone is placed in warm nitric acid for two or three days and then placed in warm water for several days. The purpose of the nitric acid is to render any iron present soluble, so the water soaking may remove same. The warm water bath should be changed a number of times.

The knowledge of obtaining carnelian and sard (reddish) colors in agate by "dry burning" was first discovered in 1813, but the "bath" method of obtaining the red shades came later, and at an uncertain date.

Red—To produce red colors the agate is soaked in a strong solution of iron nitrate. According to the directions of the old German agate cutters, this solution should be as thin as Munich beer. The aqueous solution of iron nitrate should be kept warm and the agate submerged for from 1 to 4 weeks according to the thickness of the stone.

Stones 3 mm. thick for about a week, 6 mm. about 3 weeks, and 10 mm. stones about 4 weeks. Stones thicker than 10 mm. will seldom color throughout. (A mm. is 1/25 of an inch.) This means that seldom will the color penetrate into an agate deeper than about 5 mm., or about 1/5 of an inch. Let it be understood at this point that all coloring is done *after* the stone or slab is completely cut and polished, otherwise grinding would expose the uncolored material below.

After the agate has been soaked in the above solution for the desired time, it should first be carefully dried in a warm oven for from 2–10 days. This is to remove as much free moisture as possible prior to the "burning" to avoid possible fracturing.

The agate is removed from the oven and while still warm is placed in a crucible. The agates can be best packed in some substance like fibrous asbestos or powdered magnesium oxide, and the crucible cover (an iron crucible will answer).

The heat in the oven is raised very slowly until the crucible has reached a red heat. It is then allowed to cool very slowly. This is best carried out by reducing the flame or heat gradually. The agate must not be removed from the crucible until the contents are completely cooled.

It is possible that some stones may not have the desired color. In this case the soaking in the iron nitrate solution and the oven "burning" can be repeated one or more times as desired.

Green colors can be produced in a number of ways. Two "baths" are in common use—saturated or strong solutions of chromic acid or potassium bichromate. The solution of chromic acid seems to be preferred, although the bichromate salt is cheaper.

The stone is placed in the chromic acid solution for from 8–14 days according to the thickness and the "hardness" of the agate. Stones or slabs over 10 mm. in thickness should remain in the bath for a longer time up to 8 weeks.

The stones are then removed from the bath and placed in a warm closed container with lumps of ammonium carbonate, for at least 2 weeks. The purpose here is to have the ammonia gas penetrate the agate and cause a bright green precipitate of a chromate salt. (Liquid ammonia solution would possibly leach out some of the soluble chromic acid or bichromate.) After the agate is removed from the ammonia gas chamber it is dried and then gradually strongly heated in a crucible and oven as described under red coloring.

Green colors often do not come up to expectations. A muddy green or bluish-green may be noted. Experiments will often solve the problem in various kinds of agate.

Black coloring was first known to the Idar cutters in 1819, and was discovered in an accidental manner.

The agate is first soaked in a solution of ordinary sugar, 375 g. to 1 l. of water, or about as thick as flowing honey. The earlier cutters employed diluted honey, hence this solution is often called the *honey bath.* While the agate is in the sugar solution the vessel should be kept warm, as this seems to promote penetration. The stone is kept submerged for from 1 week to 3 weeks, according to thickness, "hardness," and depth of color desired. As water evaporates from the warm solution additional water can be added.

The agate is removed from the sugar solution and without washing is placed in sulphuric acid. The acid is slowly warmed on a hot plate and then brought to boiling or near the boiling point for about 15 minutes. The vessel should be covered and care should be exercised to avoid the hot acid from spattering in the eyes, skin, or clothing. A large vessel is best and a hot plate where the heat can be controlled is excellent. The agate is permitted to cool with the acid for a few hours.

After the sulphuric acid treatment a stone may tend to "sweat," due to a small amount of acid remaining in the pores of the agate. This can be eliminated by soaking the agate in warm water for several hours or longer.

Blue coloring was first used at Idar in 1845. Two shades of blue can be had, by the use of yellow prussiate of potassium or by the use of the red prussiate of potassium (ferrocyanides of potassium).

Dissolve 250 g. of one of the above salts (poisonous) in 1 l. of water. The agate is soaked in this solution for from 1 week to 2 weeks. This bath should be kept warm, but not too hot and should not be boiled.

The agate is then soaked in a solution of iron vitriol (iron sulphate) for from 4–8 days according to the depth of color desired. No "burning" is needed in this method.

A darker blue color will be had if the iron sulphate solution is acidified with a few drops of sulphuric and nitric acid. While the agate is in the iron sulphate solution it can be examined from time to time, and removed when the desired color is noted. The solutions used in agate coloring can be used repeatedly, by adding water to replace evaporation and small amounts of the salts as the liquid becomes weakened.

Some of the chemicals employed in agate coloring are poisonous or corrosive and should be used with due caution. In the use of the prussiate of potassium solutions, small amounts of cyanide gas may be generated and care should be used in the inhalation of these fumes. This can be best used in a chemical laboratory under a hood, or outdoors where the fumes can not reach a possibly dangerous concentration.

Artificial Pond Water for Aquariums

Sodium Chloride	1.20 g.
Potassium Chloride	0.30 g.
Calcium Chloride	0.04 g.
Sodium Bicarbonate	0.02 g.

Phosphate buffer, with pH of 6.9–7.0: 50 cc.

Distilled water to 1000 cc.

This is a stock solution. For use, dilute this by adding 900 cc. of distilled water to 100 cc. of the solution.

Dry Preservation of Museum Specimens

Wax infiltration has been simplified by using diglycol stearate a light colored wax-like solid complete dispersible in hot water, soluble in hot alcohol, hydrocarbons and oils. It has a melting point of 53–54° C., and possesses a faint fatty odor. Specimens infiltrated with diglycol stearate have an appearance similar to those prepared by Fredericq's method. However, because of the peculiar properties of the wax one can attain infiltration of specimens without the necessity of complete dehydration and clearing, the technical steps which constitute such a great expense in the paraffinization process. Thus diglycol stearate as the infiltration mass in dry preservation presents an economical advantage which is further emphasized by the fact that the alcohol reagent required in the process may consist of reclaimed or used alcohol. The details of the method are given in the following:

1. The specimen is fixed in any of the usual fixing or embalming fluids; ordinary 4% formaldehyde being quite satisfactory. Care should be exercised in maintaining proper conformation or position during the fixing period. Fixation must be thorough.
2. After draining and blotting the specimen free of the excess fixative, the specimen is processed for a liberal length of time in 95% alcohol. If reclaimed alcohol is used it should not be of a lower concentration. If the specimen contains much fat a second change to fresh alcohol is indicated. Acetone may be employed in place of alcohol.
3. Transfer the specimen directly into molten diglycol stearate, in an oven at 56° C. where it is kept until complete infiltration takes place. The time of this processing depends, of course, on the size and consistency of the specimen. An average sized heart, for example, requires about 4 days' immersion in the melted wax.
4. Remove from hot wax, and drain as much as possible before cooling occurs. Then, after the specimen is completely hardened and cooled, the excess wax is removed from the surface by rinsing with hot water. A moderately stiff brush can be used in conjunction with this rinsing to remove any large particles of wax which might be present. Prolonged contact of the specimen with the hot water is to be avoided, since this might remove the wax from the outer layers of the specimen itself. Small amounts of wax still remaining after the hot water

rinse may be removed with a cloth moistened with xylol, and by brushing with a polishing brush. The latter treatment is done when the specimen is dry Certain types of specimens may be scrubbed with soap and water to remove the excess wax; this is particularly necessary when preparing hair-covered items.

5. The final step consists of appropriate mounting.

Specimens prepared by this method are expected to remain permanently preserved, since specimens have shown no appreciable change over long periods. It is not suggested that this method will replace wet preservation of gross specimens. It is probably more useful and applicable in the preparation of anatomical models than for the demonstration of pathological lesions. The finished product looks and feels much like a wax model. The method has certain advantages to recommend its use.

a. It is a simplified method of dry preservation employing a water miscible wax and therefore requiring no elaborate dehydration or clearing of the specimen.

b. It is inexpensive and relatively quick.

c. The dry specimen is convenient to pass around a class or group for demonstration.

d. It keeps indefinitely without submerging it in liquid of any kind.

e. Blocks of tissue may be cut from the dry preserved specimen, the wax removed, embedded, cut and stained as ususal.

Preservation of Small Amphibia

It is difficult to retain the natural colors and appearance of frogs and salamanders by preserving the specimen simply in formalin or alcohol. The use of tubes of gelatin, described below, overcomes this difficulty and also makes a handy mount for identification purposes. The gelatin mixture is a clear medium through which the external features of the specimen are clearly visible. Several successive stages in the life cycle of a given species may be replaced conveniently in 1 tube.

Procedure: The live specimen is killed and placed at once in 20% formalin. A slit in the abdomen of the larger specimens may be made to permit more ready penetration. After remaining in the formalin overnight, the specimen is removed and washed in tap water 8 hours. It is next placed in Kahle's fixative overnight, then washed in running tap water 10 hours. Kahle's fixative is:

Alcohol, 95%	15 g.
Formalin, 40%	6 g.
Glacial Acetic Acid	2 g.
Distilled Water	30 g.

Test-tubes of from 15–50 cc. capacity are used, depending on the size of the specimen. The mounting medium is made as follows, using Difco Standardized Bacto Gelatin:

Purified Gelatin	10 g.
Formalin (40%)	36 drops
Water	100 cc.

Heat the water to boiling, add the gelatin and allow to dissolve. Add the formalin just before pouring the mixture into the tubes. In some cases good results are obtained by adding the formalin after the gelatin has been poured into the tubes and mixing thoroughly. When the tube feels moderately warm to the hand, place the specimen in the medium in the desired position, with tweezers, etc. Further cooling will stiffen the gelatin sufficiently to hold the specimen in position. After the specimen is satisfactorily oriented, the tube may be placed in a refrigerator to hasten gelation.

The tubes are later sealed with a mixture of equal parts of paraffin wax and sealing wax, and should be placed in a vertical position in a rack for safe storage.

Embalming Fluid for Preserving Biological Specimens

Water	85 cc.
Furfural (Technical)	5 cc.
Formalin	10 cc.

The advantages of this solution over the embalming fluids ordinarily used are:

1. Better control of the growth of mold.
2. Less offensive odor.
3. Much less dessicating action.
4. No sickening effect on anatomists using the embalming fluid.
5. Cheaper.

Preservation of Anatomical Specimens

A simple method to preserve anatomical specimens for museum and teaching purposes may be utilized by applying the following solution; 1 oz. formalin, 3 oz. 95% alcohol and 2 oz.

of ordinary white shellac. The cadavers from which the specimen is obtained have been preserved for varying periods of time from several months to a year or longer, with equal parts of 95% alcohol, phenol and glycerin, to which a small quantity of formalin has been added, approximately 1 pint to 5 gallons of the above solution.

After dissection, if necessary, the material is allowed to dry from 8–24 hours and then with a sprayer 2 or 3 applications of the solution are used, allowing each to dry before another coating is given. Respraying the specimens every year or two helps to keep them in good condition.

Insect Embalming Fluid

Formula No. 1

The ingredients below are mixed in the order given and injected with a hypodermic syringe:

Toluol	60 cc.
Tertiary Butyl Alcohol	25 cc.
Ethyl Alcohol	15 cc.
Phenol	5 g.
Paradichlorbenzol	20 g.
Balsam in Xylene	10 drops

Do not inject too much fluid.

Specimens will dry in less than 48 hours without color change. Insects and mice will not attack specimens.

No. 2

Glacial Acetic Acid	4 g.
Distilled Water	30 g.
Formaldehyde	6 g.
95% Alcohol	15 g.

Staining Live Starfish

This method has been used very successfully for the past two years in studying of the migration of starfish population of Long Island Sound and in connection with other problems where the marking of the individual starfish was desired.

The method consists in immersing living starfish in a solution of Nile Blue Sulfate for a short period of time. The solution is prepared in the following way: One gram of Nile Blue Sulfate is dissolved in a small volume of distilled water and then diluted with sea water to make up 1 liter of solution. If a large number of animals is to be stained at the same time, it is more convenient to prepare about 10 liters of solution at once.

When the solution is ready the starfish are placed in it. To avoid the suffocation of animals the solution should be aerated. The normal starfish *(A. forbesi* and *A. vulgaris)* are usually of orange-red color. After being placed in a freshly made solution of the dye, the animals acquire a very deep blue color in from 3–5 minutes, but as the solution weakens, longer immersion is necessary. It is possible to stain several hundreds of medium-sized starfish, using 1 gram of the dye. The method can be used equally well for the marking of small or large starfish. Small, rapidly growing starfish, however, retain the color for considerably shorter periods than large ones. In the studies of the migration of starfish population of Long Island Sound, many large starfish were recovered 10 months after they had been stained and released in the Sound. At the end of the 10-month period the blue color was considerably faded but still quite deep.

In experimental work occasion often arises when each starfish has to be marked so as to be distinguishable from all other animals used in the same experiment. In such cases, the Nile Blue Sulfate method is indispensable because of the simplicity of its use. Any ray or any portion of the starfish's ray can be quickly stained by immersing it in the solution of Nile Blue Sulfate for several minutes. The stain is localized in the immersed part of the starfish and does not spread over the entire animal.

Microscopic Stain for Difficult Plant Material

Aqueous Gentian Violet (1%)	1 cc.
Aqueous Safranin (1%)	1 cc.
Distilled Water	1–4 cc.

Schedule: If a fixative with no chromic acid has been used, slides are soaked in 1% aqueous chromic acid from 1 hour to overnight, and rinsed through several changes of tap water. They are stained 1–24 hours—depending on strength of stain. A dilute stain over a period of 24 hours gives the best results. They are then washed in tap water. Thereafter they are placed for 30 seconds in 1% iodine-potassium-iodide in 70% alcohol and washed a few seconds in each of the following:

Alcohol 50% (two jars in series)
Alcohol 70%
Alcohol 95% plus Picric Acid (about 1 g. per 100 cc.)
Alcohol 95% plus Ammonia (8–10 drops per 100 cc.)

Alcohol 95%
Alcohol 100%
Clove Oil plus Orange G (0.2 g. per 100 cc.)
Clove Oil clear
Xylol (three jars in series)

The slides may be examined in xylol. Excess safranin may be removed by returning the slide to 100% alcohol, then back to xylol. Excess gentian violet may be removed by returning the slide to clove oil, then back to xylol.

This stain is extremely selective. Chromosomes in different stages of development take up varying shades of color, usually from light to dark purple. The spindles become a different shade of purple, the nucleoli red, and the cytoplasm orange-yellow. Anatomical structures are stained the same as with Flemming's triple stain.

Lure Odors for Baits

(For Foxes)

Formula No. 1

Asafoetida, Tincture	2 g.
Anise Oil	4 g.
Nitrobenzol	5 g.
Benzoin, Tincture	12 g.

Brush this mixture on a herring.

No. 2

Civet	3 g.
Anise Oil	4 g.
Camphor	10 g.
Asafoetida	20 g.
Valerian Root	60 g.

Rub this on the trap or the bait.

For Martens or Polecats

Formula No. 1

Beaver Odor	1 g.
Civet	5 g.
Foenugreek Seed	30 g.

No. 2

Valerian Powder	4 g.
Anise Oil	10 g.

For Moles

Formula No. 1

Styrax Resin	3 g.
Anise Oil	4 g.
Asafoetida	10 g.

No. 2

Anise Oil	20 g.
Valerian Powder	20 g.
Rose Oil	a few drops

For Butterflies

Coumarin	1 g.
Apple Ether	40 g.
Honey	100 g.
Fly Paper Adhesive	2500–3000 g.

For Pigeons

Anise Oil	30
Clay, Powdered	30
Water	50
Fennel Powder	100

Mix well, knead into little pellets

Wolf's Scent

Musk	4 g.
Onion Juice	5 g.
Foenugreek Seed	8 g.
Valerian Powder	10 g.

For Fish

Formula No. 1

Anise Oil	1 drop
Cod Liver Oil	10 g.

No. 2

Nitrobenzol	15 g.
Peru Balsam	15 g.
Alcohol, Dilute	40 g.

For Flies

Honey and Sugar or Styrax Resin, Honey and Sugar.

These are added to a sticky non-drying fly-paper adhesive.

Melting Ice on Roads and Walks

Rock salt is the most economical material.

Using ½ lb. rock salt per square yard of icy surface, the following concentrations of brine will be formed when all the ice has melted.

Ice— ¼ inch thick—4.5% brine
½ inch thick—2.3% brine
¾ inch thick—1.5% brine
1 inch thick—1.1% brine

Using 150 lb. rock salt per cubic yard of cinders or sand and applying the mixture at the rate of 2 lb. per square yard of icy surface, approximately the following concentrations of brine will be formed when all the ice has melted.

Ice— ¼ inch thick—1.58% brine
½ inch thick—0.80% brine
¾ inch thick—0.53% brine
1 inch thick—0.40% brine

POUNDS OF CHEMICAL REQUIRED TO MELT ICE OF DIFFERENT THICKNESSES FROM ONE SQUARE YARD OF SURFACE

Temperature Degrees Fahrenheit	Thickness of Ice ¼ Inch	½ Inch	¾ Inch	1 Inch
30°—Salt	.23 lbs.	.46 lbs.	.70 lbs.	.93 lbs.
Calcium Chloride	.35	.69	1.04	1.38
25°—Salt	.75	1.5	2.2	2.9
Calcium Chloride	1.03	2.1	3.1	4.1
20°—Salt	1.2	2.5	3.7	5.0
Calcium Chloride	1.6	3.2	4.7	6.3
15°—Salt	1.7	3.4	5.1	6.8
Calcium Chloride	2.0	3.9	5.9	7.8
10°—Salt	2.2	4.4	6.6	8.8
Calcium Chloride	2.2	4.5	6.7	8.9
5°—Salt	2.6	5.2	7.9	10.5
Calcium Chloride	2.4	4.9	7.3	9.8
0°—Salt	2.9	5.9	8.7	11.6
Calcium Chloride	2.7	5.4	8.1	10.8
—6.5°—Salt	3.4	6.7	10.1	13.4
Calcium Chloride	2.9	5.8	8.7	11.6

SODIUM CHLORIDE BRINE TABLE

Salometer Degrees 60° F.	Specific Gravity 60° F.	Baumé Degrees 60° F.	Per Cent. Sodium Chloride by Wt.	Wt. of 1 Gallon of Brine Lbs.	Pound per Gallon of Brine		Wt. of 1 Cu. Ft. of Brine Lbs.	Pounds Per Cu. Ft. of Brine		Freezing Point	
					NaCl	Water		NaCl	Water	° F.	° C.
0	1.000	.0	.000	8.33	.00	8.33	62.30	.00	62.30	+32.0	.0
2	1.004	.6	.528	8.36	.04	8.32	62.55	.33	62.22	31.5	—.3
4	1.007	1.0	1.056	8.39	.09	8.30	62.74	.66	62.08	31.1	.5
6	1.011	1.6	1.584	8.42	.13	8.29	62.99	1.00	61.99	30.5	.8
8	1.015	2.1	2.112	8.45	.18	8.27	63.23	1.34	61.89	30.0	1.1
10	1.019	2.7	2.640	8.49	.22	8.27	63.48	1.68	61.80	29.3	1.5
12	1.023	3.3	3.167	8.52	.27	8.25	63.73	2.02	61.71	28.8	1.8
14	1.026	3.7	3.695	8.55	.32	8.23	63.92	2.36	61.56	28.2	2.1
16	1.030	4.2	4.223	8.58	.36	8.22	64.17	2.71	61.46	27.6	2.4
18	1.034	4.8	4.751	8.61	.41	8.20	64.42	3.06	61.36	27.0	2.8
20	1.038	5.3	5.279	8.64	.46	8.18	64.67	3.41	61.26	26.4	3.1
22	1.042	5.8	5.807	8.68	.50	8.18	64.92	3.77	61.15	25.7	3.5
24	1.046	6.4	6.335	8.71	.55	8.16	65.17	4.13	61.04	25.1	3.8
26	1.050	6.9	6.863	8.74	.60	8.14	65.41	4.49	60.92	24.4	4.2
28	1.054	7.4	7.391	8.78	.65	8.13	65.66	4.85	60.81	23.7	4.6
30	1.058	7.9	7.919	8.81	.70	8.11	65.91	5.22	60.69	23.0	5.0
32	1.062	8.5	8.446	8.84	.75	8.09	66.16	5.59	60.57	22.3	5.4
34	1.066	9.0	8.974	8.88	.80	8.08	66.41	5.96	60.45	21.6	5.8
36	1.070	9.5	9.502	8.91	.85	8.06	66.66	6.33	60.33	20.9	6.2
38	1.074	10.0	10.030	8.94	.90	8.04	66.91	6.71	60.20	20.2	6.6
40	1.078	10.5	10.558	8.98	.95	8.03	67.16	7.09	60.07	19.4	7.0
42	1.082	11.0	11.086	9.01	1.00	8.01	67.41	7.47	59.94	18.7	7.4
44	1.086	11.5	11.614	9.04	1.05	7.99	67.66	7.86	59.80	17.9	7.8
46	1.090	12.0	12.142	9.08	1.10	7.98	67.91	8.25	59.66	17.1	8.3
48	1.094	12.5	12.670	9.11	1.15	7.96	68.16	8.64	59.52	16.2	8.8
50	1.098	12.9	13.198	9.14	1.21	7.93	68.40	9.03	59.37	15.4	9.2
52	1.102	13.4	13.725	9.18	1.26	7.92	68.65	9.42	59.23	14.5	9.7
54	1.106	13.9	14.253	9.21	1.31	7.90	68.90	9.82	59.08	13.7	10.2
56	1.110	14.4	14.781	9.24	1.37	7.87	69.15	10.22	58.93	12.8	10.7
58	1.114	14.8	15.309	9.28	1.42	7.86	69.40	10.63	58.77	11.8	11.2
60	1.118	15.3	15.837	9.31	1.48	7.83	69.65	11.03	58.62	10.9	11.7
62	1.122	15.8	16.365	9.34	1.53	7.81	69.90	11.44	58.46	9.9	12.3
64	1.126	16.2	16.893	9.38	1.58	7.80	70.15	11.85	58.30	8.9	12.8
66	1.130	16.7	17.421	9.41	1.64	7.77	70.40	12.26	58.14	7.9	13.4

68	1.135	17.2	17.949	9.45	1.70	7.75	70.71	12.69	58.02	6.8	14.0
70	1.139	17.7	18.477	9.49	1.75	7.74	70.96	13.11	57.85	5.7	14.6
72	1.143	18.1	19.004	9.52	1.81	7.71	71.21	13.53	57.68	4.6	15.2
74	1.147	18.6	19.532	9.55	1.87	7.68	71.46	13.96	57.50	3.4	15.9
76	1.152	19.1	20.060	9.59	1.93	7.66	71.77	14.40	57.37	2.2	16.5
78	1.156	19.6	20.588	9.63	1.98	7.65	72.02	14.83	57.19	+1.0	17.2
80	1.160	20.0	21.116	9.66	2.04	7.62	72.27	15.26	57.01	—.4	18.0
82	1.164	20.4	21.644	9.69	2.10	7.59	75.52	15.70	56.82	—1.6	18.7
84	1.169	21.0	22.172	9.74	2.16	7.58	72.83	16.15	56.68	—3.0	19.4
86	1.173	21.4	22.700	9.77	2.22	7.55	73.08	16.59	56.49	—4.4	20.2
88	1.178	21.9	23.228	9.81	2.28	7.53	73.39	17.05	56.34	—5.8	21.0*
90	1.182	22.3	23.756	9.84	2.34	7.50	73.64	17.49	56.15	—1.3	18.5
92	1.186	22.7	24.283	9.88	2.40	7.48	73.89	17.94	55.95	+4.8	15.1
94	1.191	23.3	24.811	9.92	2.46	7.46	74.20	18.41	55.79	+11.0	—11.7
96	1.195	23.7	25.339	9.95	2.52	7.43	74.45	18.87	55.58	.....	.....
98	1.200	24.2	25.867	9.99	2.59	7.40	74.76	19.34	55.42	.....	.....
100	1.204	24.6	26.395	10.03	2.65	7.38	75.01	19.80	55.21	.....	.....

* Approximate eutectic point.

The above figures are based upon properties of chemically pure sodium chloride. For computation of bin volumes, the weight of dry rock salt may be approximated at 72 lb. per cubic foot.

Pounds of Salt x .450 = Gallons of Saturated Salt Brine.

Temperature Corrections in °Salometer and in °Baumé for each 10° variation from 60° F. Add to observed reading for temperatures above 60° F.; subtract for temperatures below 60° F:

Temperature of Brine F.	Correction Salometer Degrees	Correction Baumé Degrees
	Subtract from Observed Reading	
0	60 x .02	60 x .01
10	50 x .03	50 x .01
20	40 x .04	40 x .01
30	30 x .05	30 x .02
40	20 x .06	20 x .02
50	10 x .07	10 x .02
	Add to Observed Reading	
70	10 x .08	10 x .02
80	20 x .09	20 x .02
90	30 x .10	30 x .03
100	40 x .11	40 x .03

Interconversion Tables and Chart

for Units of Volume and Weight, and Energy

MULTIPLY BY

TO CONVERT FROM	To Cu. In.	To Cu. Ft.	To Cu. Yd.	To Fl. Oz.	To Pint	To Quart	To Gallon	To Grain	To Oz. Troy	To Oz. Av.	To Lb. Troy	To Lb. Av.	To CC. or G.	To Ltr. or Kg.	To Cu. M.
Cu. in.	1.00000	$.0_{3}5787$	$.0_{4}2143$	.554112	.034632	.017316	.004329	252.891	.526857	.578037	.043905	.036127	16.3871	.016387	$.0_{4}1639$
Cu. Ft.	1728.00	1.00000	.037037	957.505	59.8442	29.9221	7.48052	436996	910.408	998.848	75.8674	62.4280	28316.9	28.3169	.028317
Cu. Yd.	46656.0	27.0000	1.00000	25852.6	1615.79	807.896	201.974	117990_{2}	24581.0	26968.9	2048.42	1685.56	764556	764.556	.764556
Fl. Oz.	1.80469	.001044	$.0_{4}3868$	1.00000	.062500	.031250	.007813	456.390	.950813	1.04318	.079234	.065199	29.5736	.029573	$.0_{4}2957$
Pint	28.8750	.016710	$.0_{3}6189$	16.0000	1.00000	.500000	.125000	7302.23	15.2130	16.6908	1.26775	1.04318	473.177	.473177	$.0_{3}4732$
Quart	57.7500	.033420	.001238	32.0000	2.00000	1.00000	.250000	1460.45	30.4260	33.3816	2.53550	2.08635	946.354	.946354	$.0_{3}9463$
Gallon	231.000	.133681	.004951	128.000	8.00000	4.00000	1.00000	58417.9	121.704	133.527	10.1420	8.34541	3785.42	3.78542	.003785
Grain	.003954	$.0_{5}2288$	$.0_{7}8475$	.002191	$.0_{3}1369$	$.0_{4}6850$	$.0_{4}1712$	1.00000	.002083	.002286	$.0_{3}1736$	$.0_{3}1428$	.064799	$.0_{4}6479$	$.0_{7}6479$
Oz. Troy.	1.89805	.001098	$.0_{4}4068$	1.05173	.065733	.032867	.008217	480.000	1.00000	1.09714	.083333	.068571	31.1035	.031104	$.0_{4}3110$
Oz. Av.	1.72999	.001001	$.0_{4}3708$	.958608	.059913	.029957	.007489	437.500	.911457	1.00000	.075955	.062500	28.3495	.028350	$.0_{4}2835$
Lb. Troy	22.7766	.013181	$.0_{3}4882$	12.6208	.788800	.394400	.098600	5760.00	12.0000	13.1657	1.00000	.822857	373.242	.373242	$.0_{3}3732$
Lb. Av.	27.6799	.016018	$.0_{3}5933$	15.3378	.958611	.479306	.119826	7000.00	14.5833	16.0000	1.21528	1.00000	453.593	.453593	$.0_{3}4536$
CC or Gram	.061024	$.0_{4}3531$	$.0_{5}1308$	.033814	.002113	.001057	$.0_{3}2642$	15.4323	.032151	.035274	.002679	.002205	1.00000	.001000	.000001
Liter or Keg.	61.0237	.035315	.001308	33.8140	2.11337	1.05669	.264172	15432.3	32.1507	35.2739	2.67923	2.20462	1000.00	1.00000	.001000
Cu. M.	61023.7	35.3146	1.30795	33814.0	2113.37	1056.69	264.172	154320_{2}	32150.7	35273.9	2679.23	2204.62	1000000	1000.00	1.00000

Note. The small subnumeral following a zero indicates that the zero is to be taken that number of times; thus, $.0_{3}1428$ is equivalent to .0001428.

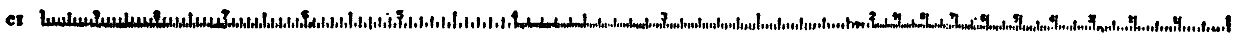
Values used in constructing table:
1 inch = 2.540001 cm.
1 cu. in. = 16,387083 cc. = 16.387083 g H_2O at 4°C. = 39°F.

1 lb. av. = 453.5926 g.
∴ 1 gal. = 8.34541 lb.
∴ 1 lb. av. = 27.679886 cu. in. H_2O at 4°C.

1 lb. av. = 7000 grains.
∴ 1 gallon = 58417.87 grains.
231 cu. in. = 1 gallon = 3785.4162 g.

TO CONVERT FROM	MULTIPLY BY										
	B. T. U.	P. C. U.	Cal.	Ft. Lbs.	Ft. Tons.	Kg. M.	HP Hrs.	KW Hrs.	Joules	Lbs. C	Lbs. H_2O
B. T. U.	1.00000	.555556	.251996	778.000	.389001	107.563	$.0_3 3929$	$.0_3 2931$	1055.20	$.0_4 6876$	.001031
P. C. U.	1.80000	1.00000	45.3593	1400.40	.700202	193.613	$.0_3 7072$	$.0_3 5276$	1899.36	$.0_3 1238$	.001855
Calories	3.96832	2.20462	1:00000	3091.36	1.54368	426.844	.001559	.001163	4187.37	$.0_3 2729$	.004089
Ft. Lbs.	.001285	$.0_3 7141$	$.0_3 3239$	1.00000	.000500	.138255	$.0_6 5050$	$.0_6 3767$	1.35625	$0_5 8840$	$.0_5 1325$
Ft. Tons	2.57069	1.42816	.647804	2000.00	1.00000	276.511	.001010	$.0_3 7535$	2712.59	$.0_3 1768$	.002649
Kg. M.	.009297	.005165	.002343	7.23301	.003617	1.00000	$.0_5 3653$	$.0_5 2725$	9.81009	$.0_6 6394$	$.0_5 9580$
HP Hrs	2544.99	.141388	641.327	1980000	990.004	273747	1.00000	.746000	2685473	.175044	2.62261
KW Hrs.	3411.57	1895.32	859.702	2654200	1327.10	366959	1.34041	1,00000	3599889	.234648	3.51562
Joules	$.0_3 9477$	$.0_3 5265$	$.0_3 2388$	.737311	$.0_3 3687$	.101937	$.0_6 3724$	$.0_6 2778$	1.00000	$.0_7 6518$	$.0_6 9766$
Lbs. C.	14544.0	8080.00	3665.03	113150_2	5657.63	1564396	5.71434	4.26285	153470_2	1.00000	14.9876
Lbs. H_2O	970.400	539.111	244.537	754971	377.487	104379	.381270	.284424	1023966	.066744	1.00000

"P. C. U." refers to the "pound-centigrade unit." The ton used is 2000 pounds. "Lbs. C" refers to pounds of carbon oxidized, 100% efficiency equivalent to the corresponding number of heat units. "Lbs H_2O" refers to pounds of water evaporated at 100°C. = 212°F. at 100% efficiency



By the use of the foregoing table[1] about 330 interconversions among twenty-six of the standard engineering units of measure can be directly estimated from the alignment chart to three significant figures or calculated by simple multiplication to six figures. The multiplier factor given in the table is located on the center scale "A" giving the point which when aligned with any number point on "C1" determines the product on "C." Imperfections in the scale due to lack of precision in printing should be checked at intervals along "A" scale by actual division of "C" by "C1," the lines being left out so that the reader can do this. A line scratched on a transparent celluloid triangle gives the best medium for making alignments.

When volume and weight interconversions are given, water is the medium the calculations are based upon. By the introduction of specific gravity factors the medium can be changed, giving the weight of any volume of any material, etc.

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[1] Courtesy of Chemical and Metallurgical Engineering.

A USEFUL SET OF IMMERSION LIQUIDS FOR USE IN INDEX OF REFRACTION WORK

C.	Substance	Refractive Index
10.0°	Hydrochloric Acid	1.254
16.5°	Ammonium Hydroxide	1.325
20.0°	Methyl Alcohol	1.329
20.0°	Water	1.333
22.0°	Diethyl Ether	1.351
16.0°	Triphenyl Amine	1.353
20.0°	Acetone	1.357
20.0°	Ethyl Formate	1.358
20.0°	Ethyl Alcohol	1.361
14.8°	Methyl Acetate	1.363
24.0°	Ethyl Isocyanide	1.366
20.0°	Formic Acid	1.371
16.4°	Ethyl Acetate	1.374
20.0°	Ethyl Butyrate	1.381
20.0°	Diethyl Carbonate	1.385
17.6°	Diethylamine	1.387
20.0°	Butyric Acid	1.392
19.6°	Isobutyl Alcohol	1.396
20.0°	n-Butyl Alcohol	1.399
20.0°	Amyl Acetate	1.402
20.0°	p-Amyl Alcohol	1.407
20.0°	Ethyl Oxalate	1.410
20.0°	Allyl Chloride	1.415
15.0°	Sulphuric Acid	1.420
20.0°	Ethylene Glycol	1.425
22.5°	Ethylene Glycol	1.430
8.0°	Ethyl Bromide	1.432
20.0°	Lactic Acid	1.441
20.0°	Chloroform	1.446
18.7°	Piperdine	1.453
20.0°	Chloral	1.456
20.0°	Carbon Tetrachloride	1.461
22.9°	Ethyl Thiocyanate	1.465
22.3°	Hydrazine	1.470
20.0°	Glycerine	1.474
26.8°	Allyl Trisulphide	1.487
20.0°	Toluene	1.495
20.0°	Benzene	1.501
20.0°	Ethyl Benzoate	1.506
21.0°	Pyridine	1.509
20.0°	Ethyl Iodide	1.512
20.0°	Furfurol	1.526
20.0°	Clove Oil	1.531
20.0°	Benzyl Alcohol	1.539
26.0°	Benzaldehyde	1.542
10.5°	Ethylene Bromide	1.545
30.0°	Phenol	1.550
20.0°	Nitrobenzene	1.553
20.0°	Bromobenzene	1.560
20.0°	Salicylic Acid (used in molten state, then cooled to 20.0° C.)	1.565
20.0°	Meta-Toluidine	1.571
20.0°	Ortho-Toluidine	1.573
20.0°	Aniline	1.586
20.0°	Tribomethylene	1.589
20.3°	Phenylhydrazine	1.608
20.4°	Meta-Bromaniline	1.626
18.0°	Carbon Bisulphide	1.629
20.0°	Brom-Naphthalene	1.658
25.0°	Di-Iodomethane	1.737

Liquids of a specific refractive index, or of a refractive index higher than 1.737 can be obtained by intermixing two liquids of known index in varying amounts. The refractive index of the mixture is found by substituting the equation:

$$n_1 v_1 + n_2 v_2 = n (v_1 + v_2)$$

where n is the refractive index of the mixture, v_1 and v_2 the volumes of the two liquids whose indices are n_1 and n_2.

SUBSTANCES SUITABLE FOR INTERMIXING

1. Petroleum and α-Monobromnaphthalene—1.475-1.650.
2. α-Monobromnaphthalene and Methylene Iodide—1.650-1.740.
3. Sulphur dissolved in Methylene Iodide—1.740-1.790.
4. Methylene Iodide and Arsenic Trisulphide—1.740-2.280.
5. Sulphur and Selenium — 1.998-2.716.
6. Selenium and Arsenic Selenide—2.720-3.170.

TABLES

Weights and Measures

Troy Weight

24 grains = 1 pwt.
20 pwts. = 1 ounce
12 ounces = 1 pound

Apothecaries' Weight

20 grains = 1 scruple
3 scruples = 1 dram
8 drams = 1 ounce
12 ounces = 1 pound

The ounce and pound are the same as in Troy Weight.

Avoirdupois Weight

27$\frac{11}{32}$ grains = 1 dram
16 drams = 1 ounce
16 ounces = 1 pound
2000 lbs. = 1 short ton
2240 lbs. = 1 long ton

Dry Measure

2 pints = 1 quart
8 quarts = 1 peck
4 pecks = 1 bushel
36 bushels = 1 chaldron

Liquid Measure

4 gills = 1 pint
2 pints = 1 quart
4 quarts = 1 gallon
31½ gals. = 1 barrel
2 barrels = 1 hogshead
1 teaspoonful = ⅛ oz.
1 tablespoonful = ½ oz.
16 fluid oz. = 1 pint

Circular Measure

60 seconds = 1 minute
60 minutes = 1 degree
360 degrees = 1 circle

Long Measure

12 inches = 1 foot
3 feet = 1 yard
5½ yards = 1 rod
5280 feet = 1 stat. mile
320 rods = 1 stat. mile

Square Measure

144 sq. in. = 1 sq. ft.
9 sq. ft. = 1 sq. yard
30¼ sq. yds. = 1 sq. rod
43,560 sq. ft. = 1 acre
40 sq. rods = 1 rood
4 roods = 1 acre
640 acres = 1 sq. mile

Metric Equivalents

Length

1 inch = 2.54 centimeters
1 foot = 0.305 meter
1 yard = 0.914 meter
1 mile = 1.609 kilometers
1 centimeter = 0.394 in.
1 meter = 3.281 ft.
1 meter = 1.094 yd.
1 kilometer = 0.621 mile

Capacity

1 U. S. fluid oz. = 29.573 milliliters
1 U. S. liquid qt. = 0.946 liter
1 U. S. dry qt. = 1.101 liters
1 U. S. gallon = 3.785 liters
1 U. S. bushel = 0.3524 hectoliter
1 cu. in. = 16.4 cu. centimeters
1 milliliter = 0.034 U. S. fluid ounce
1 liter = 1.057 U. S. liquid qt.
1 liter = 0.908 U. S. dry qt.
1 liter = 0.264 U. S. gallon
1 hectoliter = 2.838 U. S. bu.
1 cu. centimeter = .061 cu. in.
1 liter = 1000 milliliters or 100 cu. c.

Weight

1 grain = 0.065 gram
1 apoth. scruple = 1.296 grams
1 av. oz. = 28.350 grams
1 troy oz. = 31.103 grams
1 av. lb. = 0.454 kilogram
1 troy lb. = 0.373 kilogram
1 gram = 15.432 grains
1 gram = 0.772 apoth. scruple
1 gram = 0.035 av. oz.
1 gram = 0.032 troy oz.
1 kilogram = 2.205 av. lbs.
1 kilogram = 2.679 troy lbs.

Approximate pH Values

The following tables give approximate pH values for a number of substances such as acids, bases, foods, biological fluids, etc. All values are rounded off to the nearest tenth and are based on measurements made at 25° C.

pH Values of Acids

Hydrochloric, N	0.1
Hydrochloric, 0.1N	1.1
Hydrochloric, 0.01N	2.0
Sulphuric, N	0.3
Sulphuric, 0.1N	1.2
Sulphuric, 0.01N	2.1
Orthophosphoric, 0.1N	1.5
Sulphurous, 0.1N	1.5
Oxalic, 0.1N	1.6
Tartaric, 0.1N	2.2
Malic, 0.1N	2.2
Citric, 0.1N	2.2
Formic, 0.1N	2.3
Lactic, 0.1N	2.4
Acetic, N	2.4
Acetic, 0.1N	2.9
Acetic, 0.01N	3.4
Benzoic, 0.1N	3.1
Alum, 0.1N	3.2
Carbonic (saturated)	3.8
Hydrogen Sulphide, 0.1N	4.1
Arsenious (saturated)	5.0
Hydrocyanic, 0.1N	5.1
Boric, 0.1N	5.2

pH Values of Bases

Sodium Hydroxide, N	14.0
Sodium Hydroxide, 0.1N	13.0
Sodium Hydroxide, 0.01N	12.0
Potassium Hydroxide, N	14.0
Potassium Hydroxide, 0.1N	13.0
Potassium Hydroxide, 0.01N	12.0
Lime (saturated)	12.4
Sodium Metasilicate, 0.1N	12.6
Trisodium Phosphate, 0.1N	12.0
Sodium Carbonate, 0.1N	11.6
Ammonia, N	11.6
Ammonia, 0.1N	11.1
Ammonia, 0.01N	10.6
Potassium Cyanide, 0.1N	11.0
Magnesia (saturated)	10.5
Sodium Sesquicarbonate, 0.1N	10.1
Ferrous Hydroxide (saturated)	9.5
Calcium Carbonate (saturated)	9.4
Borax, 0.1N	9.2
Sodium Bicarbonate, 0.1N	8.4

pH Values of Foods

Apples	2.9–3.3
Apricots	3.6–4.0
Asparagus	5.4–5.8
Bananas	4.5–4.7
Beans	5.0–6.0
Beers	4.0–5.0
Beets	4.9–5.5
Blackberries	3.2–3.6
Bread, white	5.0–6.0
Butter	6.1–6.4
Cabbage	5.2–5.4
Carrots	4.9–5.3
Cheese	4.8–6.4
Cherries	3.2–4.0
Cider	2.9–3.3
Corn	6.0–6.5
Crackers	6.5–8.5
Dates	6.2–6.4
Eggs, fresh white	7.6–8.0
Flour, wheat	5.5–6.5
Gooseberries	2.8–3.0
Grapefruit	3.0–3.3
Grapes	3.5–4.5
Hominy (rye)	6.8–8.0
Jams, fruit	3.5–4.0
Jellies, fruit	2.8–3.4
Lemons	2.2–2.4
Limes	1.8–2.0
Maple Syrup	6.5–7.0
Milk, cows	6.3–6.6
Olives	3.6–3.8
Oranges	3.0–4.0
Oysters	6.1–6.6
Peaches	3.4–3.6
Pears	3.6–4.0
Peas	5.8–6.4
Pickles, dill	3.2–3.6
Pickles, sour	3.0–3.4
Pimento	4.6–5.2
Plums	2.8–3.0
Potatoes	5.6–6.0
Pumpkin	4.8–5.2
Raspberries	3.2–3.6
Rhubarb	3.1–3.2
Salmon	6.1–6.3
Sauerkraut	3.4–3.6
Shrimp	6.8–7.0
Soft Drinks	2.0–4.0
Spinach	5.1–5.7
Squash	5.0–5.4
Strawberries	3.0–3.5
Sweet Potatoes	5.3–5.6
Tomatoes	4.0–4.4
Tuna	5.9–6.1
Turnips	5.2–5.6
Vinegar	2.4–3.4
Water, drinking	6.5–8.0
Wines	2.8–3.8

pH Values of Biologic Materials

Blood, plasma, human	7.3–7.5
Spinal Fluid, human	7.3–7.5
Blood, whole, dog	6.9–7.2
Saliva, human	6.5–7.5
Gastric Contents, human	1.0–3.0
Duodenal Contents, human	4.8–8.2
Feces, human	4.6–8.4
Urine, human	4.8–8.4
Milk, human	6.6–7.6
Bile, human	6.8–7.0

CONVERSION OF THERMOMETER READINGS

F°	C°	F°	C°	F°	C°	F°	C°	F°	C°	F°	C°
—40	—40.00	30	—1.11	80	26.67	250	121.11	500	260.00	900	482.22
—38	—38.89	31	—0.56	81	27.22	255	123.89	505	262.78	910	487.78
—36	—37.78	32	0.00	82	27.78	260	126.67	510	265.56	920	493.33
—34	—36.67	33	0.56	83	28.33	265	129.44	515	268.33	930	498.89
—32	—35.56	34	1.11	84	28.89	270	132.22	520	271.11	940	504.44
—30	—34.44	35	1.67	85	29.44	275	135.00	525	273.89	950	510.00
—28	—33.33	36	2.22	86	30.00	280	137.78	530	276.67	960	515.56
—26	—32.22	37	2.78	87	30.56	285	140.55	535	279.44	970	521.11
—24	—31.11	38	3.33	88	31.11	290	143.33	540	282.22	980	526.67
—22	—30.00	39	3.89	89	31.67	295	146.11	545	285.00	990	532.22
—20	—28.89	40	4.44	90	32.22	300	148.89	550	287.78	1000	537.78
—18	—27.78	41	5.00	91	32.78	305	151.67	555	290.55	1050	565.56
—16	—26.67	42	5.56	92	33.33	310	154.44	560	293.33	1100	593.33
—14	—25.56	43	6.11	93	33.89	315	157.22	565	296.11	1150	621.11
—12	—24.44	44	6.67	94	39.44	320	160.00	570	298.89	1200	648.89
—10	—23.33	45	7.22	95	35.00	325	162.78	575	301.67	1250	676.67
— 8	—22.22	46	7.78	96	35.56	330	165.56	580	304.44	1300	704.44
— 6	—21.11	47	8.33	97	36.11	335	168.33	585	307.22	1350	732.22
— 4	—20.00	48	8.89	98	36.67	340	171.11	590	310.00	1400	760.00
— 2	—18.89	49	9.44	99	37.22	345	173.89	595	312.78	1450	787.78
0	—17.78	50	10.00	100	37.78	350	176.67	600	315.56	1500	815.56
1	—17.22	51	10.56	105	40.55	355	179.44	610	321.11	1550	843.33
2	—16.67	52	11.11	110	43.33	360	182.22	620	326.67	1600	871.11
3	—16.11	53	11.67	115	46.11	365	185.00	630	332.22	1650	898.89
4	—15.56	54	12.22	120	48.89	370	187.78	640	337.78	1700	926.67
5	—15.00	55	12.78	125	51.67	375	190.55	650	343.33	1750	954.44
6	—14.44	56	13.33	130	54.44	380	193.33	660	348.89	1800	982.22
7	—13.89	57	13.89	135	57.22	385	196.11	670	354.44	1850	1010.00
8	—13.33	58	14.44	140	60.00	390	198.89	680	360.00	1900	1037.78
9	—12.78	59	15.00	145	62.78	395	201.67	690	365.56	1950	1065.56
10	—12.22	60	15.56	150	65.56	400	204.44	700	371.11	2000	1093.33
11	—11.67	61	16.11	155	68.33	405	207.22	710	376.67	2050	1121.11
12	—11.11	62	16.67	160	71.11	410	210.00	720	382.22	2100	1148.89
13	—10.56	63	17.22	165	73.89	415	212.78	730	387.78	2150	1176.67
14	—10.00	64	17.78	170	76.67	420	215.56	740	393.33	2200	1204.44
15	— 9.44	65	18.33	175	79.44	425	218.33	750	398.89	2250	1232.22
16	— 8.89	66	18.89	180	82.22	430	221.11	760	404.44	2300	1260.00
17	— 8.33	67	19.44	185	85.00	435	223.89	770	410.00	2350	1287.78
18	— 7.78	68	20.00	190	87.78	440	226.67	780	415.56	2400	1315.56
19	— 7.22	69	20.56	195	90.55	445	229.44	790	421.11	2450	1343.33
20	— 6.67	70	21.11	200	93.33	450	232.22	800	426.67	2500	1371.11
21	— 6.11	71	21.67	205	96.11	455	235.00	810	432.22	2550	1398.89
22	— 5.56	72	22.22	210	98.89	460	237.78	820	437.78	2600	1426.67
23	— 5.00	73	22.78	215	101.67	465	240.55	830	443.33	2650	1454.44
24	— 4.44	74	23.33	220	104.44	470	243.33	840	448.89	2700	1482.22
25	— 3.89	75	23.89	225	107.22	475	246.11	850	454.44	2750	1510.00
26	— 3.33	76	24.44	230	110.00	480	248.89	860	460.00	2800	1537.78
27	— 2.78	77	25.00	235	112.78	485	251.67	870	465.56	2850	1565.56
28	— 2.22	78	25.56	240	115.56	490	254.44	880	471.11	2900	1593.33
29	— 1.67	79	26.11	245	118.33	495	257.22	890	476.67	2950	1621.11

ALCOHOL PROOF AND PERCENTAGE TABLE

U. S. Proof at 60° F.	Per cent Alcohol by Volume at 60° F.	Per cent Alcohol by Weight
0	0.0	0.00
1	0.5	——
2	1.0	0.80
3	1.5	——
4	2.0	1.59
5	2.5	——
6	3.0	2.39
7	3.5	——
8	4.0	3.19
9	4.5	——
10	5.0	4.00
11	5.5	——
12	6.0	4.80
13	6.5	——
14	7.0	5.61
15	7.5	——
16	8.0	6.42
17	8.5	——
18	9.0	7.23
19	9.5	——
20	10.0	8.05
21	10.5	——
22	11.0	8.86
23	11.5	——
24	12.0	9.68
25	12.5	——
26	13.0	10.50
27	13.5	——
28	14.0	11.32
29	14.5	——
30	15.0	12.14
31	15.5	——
32	16.0	12.96
33	16.5	——
34	17.0	13.79
35	17.5	——
36	18.0	14.61
37	18.5	——
38	19.0	15.44
39	19.5	——
40	20.0	16.27
41	20.5	——
42	21.0	17.10
43	21.5	——
44	22.0	17.93
45	22.5	——
46	23.0	18.77
47	23.5	——
48	24.0	19.60
49	24.5	——
50	25.0	20.44
51	25.5	——
52	26.0	21.28
53	26.5	——
54	27.0	22.13
55	27.5	——
56	28.0	22.97
57	28.5	——
58	29.0	23.82
59	29.5	——
60	30.0	24.67
61	30.5	——
62	31.0	25.52
63	31.5	——
64	32.0	26.38
65	32.5	——
66	33.0	27.24
67	33.5	——
68	34.0	28.10
69	34.5	——
70	35.0	28.97
71	35.5	——
72	36.0	29.84
73	36.5	——
74	37.0	30.72
75	37.5	——
76	38.0	31.60
77	38.5	——
78	39.0	32.48
79	39.5	——
80	40.0	33.36
81	40.5	——
82	41.0	34.25
83	41.5	——
84	42.0	35.15
85	42.5	——
86	43.0	36.05
87	43.5	——
88	44.0	36.96
89	44.5	——
90	45.0	37.86
91	45.5	——
92	46.0	38.78
93	46.5	——
94	47.0	39.70
95	47.5	——
96	48.0	40.62
97	48.5	——
98	49.0	41.55
99	49.5	——
100	50.0	42.49
101	50.5	——
102	51.0	43.43
103	51.5	——
104	52.0	44.37
105	52.5	——
106	53.0	45.33
107	53.5	——
108	54.0	46.28
109	54.5	——
110	55.0	47.24
111	55.5	——
112	56.0	48.21
113	56.5	——

U. S. Proof at 60° F.	Per cent Alcohol by Volume at 60° F.	Per cent Alcohol by Weight
114	57.0	49.19
115	57.5	——
116	58.0	50.17
117	58.5	——
118	59.0	51.15
119	59.5	——
120	60.0	52.15
121	60.5	——
122	61.0	53.15
123	61.5	——
124	62.0	54.15
125	62.5	——
126	63.0	55.16
127	63.5	——
128	64.0	56.18
129	64.5	——
130	65.0	57.21
131	65.5	——
132	66.0	58.24
133	66.5	——
134	67.0	59.28
135	67.5	——
136	68.0	60.32
137	68.5	——
138	69.0	61.38
139	69.5	——
140	70.0	62.44
141	70.5	——
142	71.0	63.51
143	71.5	——
144	72.0	64.59
145	72.5	——
146	73.0	65.67
147	73.5	——
148	74.0	66.77
149	74.5	——
150	75.0	67.87
151	75.5	——
152	76.0	68.92
153	76.5	——
154	77.0	70.10
155	77.5	——
156	78.0	71.23
157	78.5	——
158	79.0	72.38
159	79.5	——
160	80.0	73.53
161	80.5	——
162	81.0	74.69
163	81.5	——
164	82.0	75.86
165	82.5	——
166	83.0	77.04
167	83.5	——
168	84.0	78.23
169	84.5	——
170	85.0	79.44
171	85.5	——
172	86.0	80.62
173	86.5	——
174	87.0	81.90
175	87.5	——
176	88.0	83.14
177	88.5	——
178	89.0	84.41
179	89.5	——
180	90.0	85.69
181	90.5	——
182	91.0	86.99
183	91.5	——
184	92.0	88.31
185	92.5	——
186	93.0	89.65
187	93.5	——
188	94.0	91.02
189	94.5	——
190	95.0	92.42
191	95.5	——
192	96.0	93.85
193	96.5	——
194	97.0	95.32
195	97.5	——
196	98.0	96.82
197	98.5	——
198	99.0	98.38
199	99.5	——
200	100.0	100.00

Buffer Systems

The following table gives some common buffer systems and the approximate pH of maximum buffer capacity. The zone of effective buffer action will vary with concentration but the general average will be ± 1.0 pH from the value given, for concentrations approximately 0.1 molar.

Glycocoll - Sodium Chloride - Hydrochloric Acid	2.0
Potassium Acid Phthalate-Hydrochloric Acid	2.8
Primary Potassium Citrate	3.7
Acetic Acid-Sodium Acetate	4.6
Potassium Acid Phthalate-Sodium Hydroxide	5.0
Secondary Sodium Citrate	5.0
Carbonic Acid-Bicarbonate	6.5
Primary Phosphate-Secondary Phosphate	6.8
Primary Phosphate-Sodium Hydroxide	6.8
Boric Acid-Borax	8.5
Borax	9.2
Boric Acid-Sodium Hydroxide	9.2
Bicarbonate-Carbonate	10.2
Secondary Phosphate-Sodium Hydroxide	11.5

Courtesy of W. A. Taylor & Company

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Allg. Oes. v. Gettzeitung
Aluminum Co. of Amer.
Amer. Cyanamid & Chem. Corp.
Amer. Druggst
Amer. Dyestuff Reporter
Amer. Electrop. Society
Amer. Gum Importers' Ass'n
Amer. Paint Jol.
Amer. Perfumer
Amer. Photography
Amer. Wool & Cotton Reporter
Analyst
Anal. Fis. Quim.
Ault & Wiborg Varnish Wks. Handbook

Baker's Helper
Bakers Review
Baker's Weekly
Behr Manning Corp.
Better Enameling
Boonton Molding Co.
Bottler & Packer
Boyce Thompson Inst.
Brewers' Tech. Review
Brick & Clay Record
Br. Jol. Dent. Science
Brit. Jol. of Photography
Brit. Medical Jol.
Bull. Imp. Hyg. Lab.
Bulletin of Imperial Institute
Bull. Soc. Franc. Phot.

Camera
Camera (Luzern)
Canadian Jol. of Med. Technology
Canadian Textile Jol.
Canner
Cement & Cement Mfr.
Ceramic Age
Chemical Abstracts
Chemical Analyst
Chemical Industries
Chemical Products
Chemical Weekblad
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Chr. Hansen's Lab.
Cleaning & Dyeing World
Combustion
Confectioner's Jol.
Consumers' Guide
Cramer's Manual

Dairy World
Damsk. Tids. Farm
Dental Items
Dental Lab'y Review
Devt. Part. Zeitung
Drug & Cosmetic Industry
Druggists Circular
Drugs, Oils, & Paints
DuPont Rubber Bulletins

Eastman Kodak Co.
Electric Journal

Farbe u. Lacke
Farben Zeitung
Farming S. Africa
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Fettchem, Umschan
Fils & Tissus
Flavours
Focus
Food Manufacture
Fruit Products Jol.

Gelatin, Leim, Klebstoffe
General Abrasive Co.
Glass Industry
Graphic Arts Monthly

Hawaiian Planters' Record
Hercules Powder Co. Bulletins
Hide & Leather

Ice Cream Review
India Rubber World
Indian Lac Research Inst.
Indian Soap Jol.
Indiana Acad. of Sciences
Industrial Chemist
Industrial Finishing
Instruments
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Jol. Amer. Dental Assn.
Jol. Amer. Medical Assn.
Jol. Chem. Eng.
Jol. Chinese Chem. Soc.
Jol. Federation Curriers
Jol. Federation Light Leather Tanners
Jol. Ind. & Eng. Chemistry
J. Res. Nat. Bur. Standards
Jol. Rubber Industry
J. Russ. Rubber Ind.

Jol. Soc. Leather Trades
Jol. Soc. Rubber Ind. Japan
Jol. Tech. Physics
Jol. of Technical Methods (I.A.M.M.)

Keram Steklo
Khimstroi
Kozhevenna-Obuvnaya Prom.
Kunstdunger, Und Leim

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Meat
Meat Merchandising
Melliand
Metal Industry
Metall und Erz
Metallurg
Metallurgist
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Mich. Agric. Exp. Sta.
Milk Dealer
Mineralogist
Monatschr. Textil-Ind.
Monsanto Chem. Co.
Munic. Eng. San. Record

Nat'l Butter & Cheese Jol.
Nat'l Provisioner
Nickelsworth
Nitrocellulose

Ober Flachen Tech.
Oil & Color Trades Jol.
Oil & Soap

Pacific Rural Press
Paint Technology
Paper Trade Jol.
Parfum Mod.
Peinture, Pigments, Vernis
Phar. Acta Helva
Pharmaceutical Jol.
Phot. Abstracts
Photo Art Monthly
Phot. Ind.
Phot. Korr.
Photog. Kronik
Phot. Rev.
Photo Rundschau
Physics
Phytopathology
Pix
Plater's Guide Book
Portland Cement Assn.
Power
Practical Druggist
Practical Everyday Chemistry
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Prob. Edelmetalle
Process Engr. Mo.
Proc. World Petroleum Congress

Rayon & Mell. Tex. Monthly
Refiner & Nat. Gas Mfr.
Rev. Aluminum
Rev. Amer. Electro Society
Rock Products

Science
Sharpless Solvents Corp.
Silver Technologist
Shoe and Leather Journal
Soap
Soap Gazette & Perfumer
Solvent News
Sovet-Sakhar
Spirits
Steel
Synthetic & Applied Finishes

Textile Colorist
Textile Mfr.
Textile Recorder

Univ. Nebr. Agric. Coll. Bull.
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U. S. Bureau of Mines
U. S. Bureau of Standards

Veneers and Plywood

Z. Elektrochem.
Zeit. Unters. Lebensm.

TRADE-NAME CHEMICALS

During the past few years, the practice of marketing raw materials, under names which in themselves are not descriptive chemically of the products they represent, has become very prevalent. No modern book of formulae could justify its claims either to completeness or modernity without numerous formulae containing these so-called "Trade Names."

Without wishing to enter into any discussion regarding the justification of "Trade Names," the Editors recognize the tremendous service rendered to commercial chemistry by manufacturers of "Trade Name" products, both in the physical data supplied and the formulation suggested.

Deprived of the protection afforded their products by this system of nomenclature, these manufacturers would have been forced to stand helplessly by while the fruits of their labor were being filched from them by competitors who, unhampered by expenses of research, experimentation and promotion, would be able to produce something "just as good" at prices far below those of the original producers.

That these competitive products were "just as good" solely in the minds of the imitators would only be evidenced in costly experimental work on the part of the purchaser and, in the meantime, irreparable damage would have been done to the truly ethical product. It is obvious, of course, that under these circumstances, there would be no incentive for manufacturers to develop new materials.

Because of this, and also because the "Chemical Formulary" is primarily concerned with the physical results of compounding rather than with the chemistry involved, the Editors felt that the inclusion of formulae containing various trade name products would be of definite value to the producer of finished chemical materials. If they had been left out many ideas and processes would have been automatically eliminated.

As a further service the better known "trade name" products are included with the list of chemicals and supplies.

CHEMICALS AND SUPPLIES: WHERE TO BUY THEM

Numbers on right refer to list of suppliers on pages directly following this list. Thus to find out who supplies borax look in left hand column, alongside borax, on page 633. The number there is 34. Now turn to page 645 and find number 34. Alongside is the supplier, American Potash & Chemical Corp., New York, N. Y.

Product	*No.*
A	
A-Syrup	423
Aacagum	251
Abalyn	276
Abietic Acid	276
Abopon	251
Accelerator 808	195
Accelerator 833	195
Accelerators, Vulcanization	195
Acceloid	245
Accroides	463
Acelose	18
Acetaloid	2
Acetamide	20
Acetic Acid	140
Acetic Anhydride	16
Acetoin	335
Acetol	445
Acetone	150
Acetphenetidin	360
Acetyl Cellulose	see Cellulose Acetate
Acetyl Salicylic Acid	368
Acidolene	349
Acids, Fatty	540
Acimul	251
Acrawax	251
Acriflavine	1
Acrolite	157
Acrxyeol	442
Acrylic Resins	450
Acryloid	450
Acrysol	450
Acto	507
Adeps Lanae	see Lanolin
Adheso Wax	251
A.D.M. No. 100 Oil	44
Aerogel	368
Aerosol	23
Agar	14
Agene	399
Agerite Powder	559
Akcocene	23
Aktivin	8
Albacer	251
Alba-Floc	550
Albalith	387
Albasol	381
Albatex	137
Alberit	471
Albertol	471
Albinol	464a
Albolit	53
Albolith	387
Albone C	195
Albron	11
Albumen	515
Albusol	344
Alcohol, Denatured	449
Alcohol, Pure	551
Aldehol	312
Aldol	392
Aldydal	294
Alfalate	322
Alframine	365
Alginic Acid	313
Alizarin	595
Alkalies	148
Alkaloids	360
Alkanet	285
Alkanol	195
Alkyd Resins	409
Alloxan	88
Almond Oil	342
Aloes	413
Aloin	398
Aloxite	109
Alperox	335
Alpha Naphthol	286
Alphasol	23
Altax	559
Alugel	376
Alumina	11
Aluminum	11
Aluminum Acetate	392
Aluminum Bronze Powder	549
Aluminum Chloride	99
Aluminum Hydrate	121
Aluminum Oleate	479
Aluminum Silicate	580
Aluminum Stearate	229
Aluminum Sulphate	513
Alums	256

Product	*No.*
Alundum	397
Alvar	478
Amandol	195
Amberette	522
Amberlac	442
Amberol	442
Ambreno	195
Amco Acetate	316
Amerine	26
Ameripol	254
Amerith	117
Ameroid	33
Amidine	103
Aminostearin	251
Aminox	384
Ammonia	377
Ammoniac Resin	23
Ammonium Bichromate	431
Ammonium Bifluoride	269
Ammonium Carbonate	586
Ammonium Chloride	420
Ammonium Laurate	251
Ammonium Linoleate	251
Ammonium Nitrate	234
Ammonium Oleate	251
Ammonium Persulphate	92
Ammonium Phosphate	521
Ammonium Stearate	251
Ammonium Sulphate	60
Ammonium Sulphite	344
Ammonium Sulphoricinoleate	251
Amyl Acetate	96
Anchoracel 2p	38
Angstrol	190
Anhydrone	62
Aniline Chloride	see Aniline Hydrochloride
Aniline Dyes	240
Aniline Hydrochloride	99
Aniline Oil	188
Ansol	552
Anthraquinone	412
Antidolorin	227
Antimony	530
Antimony Chloride	475
Antimony Oxide	283
Antimony Sulphide	223
Antimony Trioxide	see Antimony Oxide
Anti-Oxidants	248
Anti-scorch	195
Antox	195
Apco	39
Apocthinner	39
Appramine	574
Aquadag	3
Aqualoid	309
Aqualube	251
Aquamel	251
Aquapel	408
Aquaplex	442
Aquaresin	251
Aquarex	195
Aquarome	216
Aquasol	23
Arachis Oil	see Peanut Oil
Arapali	450
Araskleen	368
Aratone	50
Archer-Daniels No. 635	44
Archer-Daniels-Midland Oil	44
Arctic Syntex	144
Areskap	368
Aresklene	368
Aridex	195
Arlex	52
Arochlor	521
Aroflex	519
Arolite	519
Arosol	239
Arsenic	35
Arsenious Oxide	see White Arsenic
Artisil	462
Asbestine	299
Asbestos	429
Ascarite	534
Asetoform	258
Aseptex	251
Asphalt	65
Asphaltum	9
Astrinite	246
Astrulan	23
Atrapol	406
Aurosal	58
Avirol	379
Avitex	195
Avonac	379
Azo	36

B

Product	*No.*
Badex	515
Bakelite	56
Bakers' Plasticizer	57
Balsams	288
Barak	195
Bardal	68
Bardex	68
Barite	see Barytes
Barium Carbonate	66
Barium Nitrate	102
Barium Peroxide	66
Barium Silico Fluoride	25
Barium Sulphate	66
Barium Sulphide	173
Baroid	382
Barretan	68
Bartyl	248
Barytes	382
Basic Colors	15
Batavia Dammar	23
Bay Rum	451
Bayberry Wax	84
Beckacite	440
Beckamine	440

Product	*No.*
Beckolin	440
Beckophen	440
Beckosol	440
Beeswax	192
Beetle Resin	23
Bellaphan	311
Bensapol	588
Bentonite	22
Benzaldehyde	279
Benzidine	236
Benzine	32
Benzocaine	1
Benzoic Acid	111
Benzol	68
Benzoyl Peroxide	335
Benzyl Cellulose	6
Bergamot Oil	407
Beryllium	72
Beryllium Salts	223
Beta Naphthol	99
Beutene	384
Bicarbonate of Soda	136
Bismuth	122
Bismuth Subnitrate	388
Bitumen	see Asphaltum
Black Leaf	539
Blanc Fixe	291
Blandol	494
Blankit	240
Bleaching Powder	208
Blendene	251
Blood Albumen	370
Bludtan	123
Boea	297
Bole	580
Bonderite	411
Bondogen	559
Bone Ash	176
Bone Black	484
Bone Glue	170
Bone Meal	60
Bone Oil	532
Borax	34
Bordeaux Mixture	358
Bordow	188
Boric Acid	83
Borol	193
Botanical Products	414
Bresin	276
Brisgo	276
Bromine	181
Bromo "Acid"	436
Bromo-Fluorescein	251
Bronze Powder	189
Brosco	466
Burgundy Pitch	331
Butacite	195
Butalyde	149
Butex	402
Butoben	360
Butyl Acetate	149
Butyl Acetyl Ricinoleate	150
Butyl Alcohol (Normal)	434
Butyl Aldehyde	150
Butyl Amine	150
Butyl Carbitol	106
Butyl Cellosolve	106
Butyl Lactate	150
Butyl Propionate	96
Butyl Stearate	316
Butyric Ether	396

C

Product	*No.*
Cadalyte	256
Cadmium	555
Cadmolith	128
Cajuput Oil	292
Calagum	251
Calcene	148
Calcium Arsenate	85
Calcium Carbonate	330
Calcium Carbonate (Precipitated)	360
Calcium Chloride	366
Calcium Chloride (Anhydrous)	213
Calcium Cyanamid	23
Calcium Fluoride	238
Calcium Hydroxide	see Lime, Hydrate
Calcium Oxide	see Lime
Calcium Phosphate	433
Calcium Polysulphide	98
Calcium Propionate	251
Calcium Stearate	524
Calcium Sulphate	see Plaster of Paris
Calcium Sulphide (Luminous)	29
Calcocid	99
Calcolac	99
Calcoloid	99
Calcozine	99
Calgon	94
Calgonite	100
Calomel	590
Calorite	505
Camphor	69
Camphor Oil	342
Candelilla Wax	298
Capillary Syrup	see Glucose Syrup
Captax	563
Caramel Color	231
Caraway Oil	336
Carbasol	107
Carbitol	106
Carbofrax	109
Carbolac	97
Carbolic Acid	see Phenol
Carbolic Oil	441
Carbolineum	108
Carbon, Activated	305
Carbon Bisulphide	62
Carbon Black	547
Carbon, Decolorizing	169
Carbon Tetrachloride	395
Carbonex	68

Product	*No.*
Cresophan	258
Cresylic Acid	68
Cromodine	19
Cryolite	568
Cryptone	387
Crysalba	368
Cumar	68
Cupric Chloride	see Copper Chloride
Curbay Binder	552
Curgon	471
Cuttle Fish Bone	228
Cyclamal	239
Cycline	368
Cyclohexylamine	195
Cyclohexanol	195
Cyclonol	195
Cymanol	296

D

Dammar Gum	331
Dapol	247
Darco	169
Darvan	559
Daxad	178
Deceresol	23
Degras	27
Deo-base	494
Deramin	251
Derris Extract	472
Derris Root	73
Devolite	471
Dextrins	370
Dextrose	162
Diacetin	316
Diafoam	442
Diakonn	295
Diamond K Linseed Oil	499
Diamyl Phthalate	552
Diastafor	504
Diastase	526
Diatol	552
Diatomaceous Earth	586
Dibutyl Cellosolve Phthalate	368
Dibutyl Tartrate	312
Dibutylphthalate	316
Dicalite	180
Dichlorbenzol	284
Dichlorethylene	195
Dichlorethylether	106
Diethanolamine Lactate	251
Diethylcarbonate	552
Diethylene Glycol	106
Diethyl Phthalate	560
Digestase	345
Diglycol Laurate	251
Diglycol Oleate	251
Diglycol Stearate	251
Dilecto	157
Dinitrophenol	379
Diolin	195
Dionin	360
Dioxan	106

Product	*No.*
Dipentene	276
Diphenyl	521
Diphenyl, Chlorinated	368
Diphenyl Oxide	248
Diphenyl Phthalate	368
Discolite	454
Disodium Phosphate	565
Disperso	586
Distoline	587
Dowicide	188
Dow-metal	188
Dow plasticizers	188
D. P. G.	368
Drierite	265
Driers (Paint and Oil)	401
Driers, Varnish	401
Drop Black	582
Dry Ice	351
Dulux	195
Duolith	320
Dupanol	195
Duphax	501
Duphonol	195
DuPont Rubber Red	195
Duprene	195
Duraplex	442
Durez	245
Durite	516
Durophene	471
Dutox	195
Dyestuffs	379
Dynax	195

E

East-India Gum	23
Eastman Products	202
Egg, Dried	430
Egg Yolk	515
Elaine	210
Elemi	552
Emulphor	240
Emulsifier L83A	251
Emulsone	251
Emulsone B	251
Eosin	440
Ephedrine	360
Epsom Salt	238
Erinoid	33
Erio Chrome Dyes	235
Escolite	163
Essential Oils	152
Esso	507
Ester Gum	329
Esterol	409
Estersol	552
Ethavan	368
Ether	106
Ethox	561
Ethyl Acetate	361
Ethyl Cellulose	276
Ethyl Lactate	23
Ethyl Parasept	279

Product	*No.*
Gutta Percha	191
Gypsum	553

H

Product	*No.*
Halex	89
Halowax	262
Harcol	251
Harveg	272
Harvite	484
Haskelite	271
Heliozone	195
Hemlock Bark	528
Henna Leaves	414
Herbs	139
Hercolyn	276
Hercusol	276
Herkolite	241
Heveatex	277
Hexamethylenetetramine	279
Hexone	106
Hexyl Alcohol	106
Hyamine	450
Hydralite C	240
Hydrated Lime	see Lime
Hydristear	583
Hydrochloric Acid	238
Hydrofluoric Acid	250
Hydrogen Peroxide	573
Hydrogenated Fish Oil	492
Hydromalin	251
Hydromel	251
Hydronol	195
Hydropel	151
Hydroquinone	202
Hydroresin	251
Hydrowax	251
Hygropon	251

I

Product	*No.*
Ichthyol	360
Idalol	274
IG Wax	240
IG Wax O	240
Igepon	240
Ignex	251
Indian Red	79
Indigisols	105
Indigo	437
Indium	72
Indolylacetic Acid	360
Indur	441
Indusoil	296
Infusorial Earth	see Diatomaceous Earth
Insect Wax, Chinese	451
Invadine	137
Invert Sugar	400
Iodine	388
Iridium	58
Irish Moss	414
Iron Ammonium Citrate	468
Iron Chloride	133
Iron Oxide	79
Iron Sulphate	238
Isocholesterol	see Cholesterin
Isohol	251
Isolene	383
Isoline	587
Isomerpin	195
Isophan	115
Isopropyl Acetate	264
Isopropyl Alcohol	503
Isopropyl Ether	106
Ivory Black	79

J

Product	*No.*
Japan Wax	491
Jasmogene	563
Jointex	251

K

Product	*No.*
Kainite	230
Kalite	559
Kaolin	465
Kapsol	561
Karo	162
Kellogg KVO	499
Kellogg Varnish Oil	499
Keltone	313
Kerol	91
Kerosene	147
Kerosene, Deodorized	482
Ketanol	195
Ketonone	23
Kilfoam	20
Kolineum	319
Kopol	71a
Koreon	374
Kronisol	561
Kronitex	561
Kryocide	420

L

Product	*No.*
Laboratory Equipment	118, 129, 132, 206, 221, 386, 470
Lacquer Blue	40
Lacquers	338
Lactac	195
Lactic Acid	43
Lactoid	89
Lactol Spirits	128
Lake Colors	315
Lamp Black	79
Lanette Wax	195
Lanolin	360
Lard Oil	212
Latac	195
Latex	277, 384
Laurex	384
Lauric-Ol	249
Lauryl Alcohol	195
Lauryl Sulphonate	195
Lavekol	240
Lavender Oil	558

Product	*No.*
Migasol	137
Milcol	251
Milk Gloss	251
Milk Sugar	344
Mineral Oil	see Paraffin Oil
Mineral Rubber	65
Mineral Seal Oil	507
Mineral Spirits	32
Minium	see Lead Oxide
Mirasol	107
Moldex	251
Moldslip	251
Molybdenum	141
Molybdenum Compounds	141
Molybdenum Oxide	141
Monex	384
Monoamylamine Oleate	251
Monoethanolamine Lactate	251
Monolite	241
Montan Color	251
Montan Wax	517
Morpholine	106
Mowilith	294
Mulsene	251
Muriatic Acid	see Hydrochloric Acid
Mycoban	195
N	
Naccolene	379
Naccon	379
Nacconol	379
Naphtha	172
Naphthalene	68
Naphthalene, Chlorinated	262
Napthenic Acid	251
Napoleum Spirits	172
Narobin	251
National Oil Red	379
Neatsfoot Oil	381
Nekal	240
Nelgin	251
Neolan	137
Neomerpin	195
Neoprene	295
Neozone D	195
Neutroleum	233
Neville Resin	385
Nevindene	269
Nevinol	385
Nickel Chloride	160
Nickel Sulphate	269
Nicotine	539
Nicotine Sulphate	323
Nicotinic Acid	99
Nigrosine	99
Nipabenzyl	461
Nipagen	253
Nipasol	461
Nitramon	195
Nitre Cake	541
Nitric Acid	368
Nitrobenzol	99
Nitrocellulose	196

Product	*No.*
Nitro-cotton	see Nitrocellulose
Nopco	381
Novolak	56
Nu-Char	296
Nulomoline	400
Nuodex	401
Nusoap	401
O	
Ochres	490
Octyl Acetate	106
Octyl Alcohol	106
Oil, Citronella	292
Oil, Mineral	505
Oil, Olive	325
Oil, Red	see Oleic Acid
Oil Root Beer C	474
Oilate	401
Oildag	3
Oilsolate	442
Oiricuri Wax	87
Oiticica Oil	303
Olate	432
Olein	119
Oleoresins	474
Oleyl Alcohol	195
Olive Oil	518
Olive Oil Substitute	251
Olive Oil, Sulphonated	454
Ondulum	251
Opal Wax	195
Orange Oil	454
Oroco	453
Ortho Dichlorbenzene	284
Ortho-phenylphenate	188
Orthosil	420
Osmo-Kaolin	225
Ouricuri Wax	186
Oxalic Acid	374
Oxgall	385
Oxygen	131
Oxynone	455
Oxyquinoline Sulphate	74
Ozokerite Wax	518
P	
Palm Kernel Oil	59
Palm Oil	586
Palmitic Acid	46
Panoline	507
Para Aminophenol	564
Parachlormetacresol	368
Parachol	251
Paracide	284
Para-dor	188
Paradura	409
Paraffin, Chlorinated	20
Paraffin Oils	469
Paraffin Wax	403
Para-flux	261
Paralac	295
Paraldehyde	279

Product	*No.*
Paramet	409
Paranol	409
Para-Phenylenediamine	37
Parapont	195
Parasept	279
Paris Black	79
Paris Green	177
Paris White	497
Parlon	276
Paroil	12
Peachol	251
Peanut Oil	207
Pearl Essence	357
Pectin	101
Peerless Clay	559
Pegopren	252
Pentacetate	477
Pentalyn	276
Pentasol	477
Pentrol	312
Peppermint Oil	342
Peptone	183
Perchloron	420
Perfume Bases	293
Perilla Oil	308
Permosalt	251
Permosalt A	251
Perone	195
Perrol	558
Perspex	295
Petrex	275
Petrobenzol	39
Petrohol	502
Petrolatum	419
Petrolene	39
Petroleum Ether	489
Petroleum Jelly	494
Petroleum Spirits	520
Pharmasol	105
Phenac	23
Phenol	16
Phenol-Formaldehyde Resins	197
Phenolic Resin	440
Phenothiazine	99
Phenyl Chloride	284
Phisol	406
Phobophene	579
Phosphoric Acid	565
Phosphorus	300
Phosphotex	368
Phthalic Anhydride	368
Piccolyte	418
Pigment Colors	40
Pine Oil	244
Pine Tar	496
Pitch	438
Plaskon	426
Plastacele	195
Plaster of Paris	580
Plastogen	559
Plastopal	294
Plaz	471

Product	*No.*
Plexigum	450
Plexite	450
Plextol	471
Plioform	255
Pliolite	255
Pliowax	225
Pollopas	428
Polyacrylic Esters	195
Polycol	251
Polyrin	251
Polystyrene	368
Polyvinyl Acetate	106
Polyzime	526
Ponolith	320
Pontalite	195
Pontianak Resin	363
Pontol	195
Potash, Caustic	393
Potassium Abietate	251
Potassium Carbonate	542
Potassium Chlorate	542
Potassium Chloride	34
Potassium Dichromate	431
Potassium Hydroxide	360
Potassium Iodine	388
Potassium Metabisulfite	344
Potassium Nitrate	see Saltpetre
Potassium Oleate	251
Potassium Palmolate	251
Potassium Perchlorate	542
Potassium Permanganate	111
Potassium Silicate	423
Potassium Tartrate	360
Prague Powder	259
Prestabit	240
Proflex	251
Proofit	251
Propylene Oxide	106
Protectoid	116
Protovac	112
Provatol	204
Proxate	332
Prussian Blue	315
Prystal	17
Puerine	349
Pumice	166
Psyllium Seeds	324
Pylam Red	436
Pyrax	559
Pyrefume	414
Pyrethol	353
Pyrethrum	414
Pyrethrum Extract	356
Pyridin	319
Pyro	see Pyrogallic Acid
Pyrogallic Acid	595
Pyrolusite	189
Pyroxylin Solutions	205

Q

Quakersol	415
Quebracho	24

Product	*No.*
Quince Seed	285
Quinine Bisulphate	258
Quinine Hydrochloride	360
Quinoline	68

R

Product	*No.*
Raisin Seed Oil	444
Rancidex	251
Rapeseed Oil	63
Rapidase	572
Rauzene	438
Rayox	559
Red Oil	119
Red Squill	285
Redmanol	56
Reogen	559
Resin DA 1	251
Resin R-H-35	195
Resinox	442a
Resins, Natural	23
Resins, Synthetic	440
Resipon	45
Resoglaz	6
Resorcin	416
Revertex	443
Rezidel	251
Rezinel	251
Rezyl	23
Rhodium	58
Rhonite	450
Rhoplex	450
Rhotex	450
Rochelle Salts	422
Rodo	559
Rose Water	336
Roseol	342
Rosin	244
Rosin Oil	383
Rosoap A	251
Rotenone	535
Rubber	201
Rubber Hydrochloride	347
Rubber Latex	334
Rubber Resin	251
Rubber, Synthetic	195, 254, 255
Rubidium Salts	340

S

Product	*No.*
"S" Syrup	423
Saccharine	279
Sal Soda	136
Salicylic Acid	188
Salt	371
Salt Cake	23
Saltpetre	164
Santicizers	368
Santobane	368
Santomask	368
Santox	368
Sapamine	137
Saponin	309
Savolin	251

Product	*No.*
Schultz Silica	124
Selenium	31
Sellatan A	235
Sepia	see Cuttle Fish Bone
Serinol	310
Serrasol	130
Shellac	595
Shellac Wax	291
Sherpetco	482
Sicapon	251
Siennas	217
Silex	580
Silica	67
Silica Black	304
Silicon	72
Silvatol	137
Silver	266
Silver Cyanide	160
Silver Nitrate	202
Slaked Lime	see Lime
Soap	511
Soda Ash	179
Soda, Caustic	351
Soda, Sal	154
Sodium Acetate	542
Sodium Alginate	313
Sodium Aluminate	376
Sodium Arsenite	268
Sodium Benzoate	284
Sodium Bicarbonate	136
Sodium Bichromate	431
Sodium Bisulphite	256
Sodium Borate	see Borax
Sodium Borophosphate	251
Sodium Carbonate	493
Sodium Chlorate	404
Sodium Chlorite	351
Sodium Choleate	183
Sodium Cyanide	195
Sodium Fluoride	23
Sodium Hydrosulphite	454
Sodium Hydroxide	360
Sodium Hypochlorite	174
Sodium Hypochlorite Liquid	447
Sodium Hyposulphite	256
Sodium Lauryl Sulphate	251
Sodium Metaphosphate	94
Sodium Metasilicate	423
Sodium Nitrate	70
Sodium Nitrite	493
Sodium Oleate	251
Sodium Oxalate	565
Sodium Perborate	195
Sodium Phosphate	521
Sodium Propionate	251
Sodium Pyrophosphate	565
Sodium Resinate	408
Sodium Silicate	423
Sodium Silico Fluoride	256
Sodium Stannate	269
Sodium Stannate	354
Sodium Sulphate	238

Product	*No.*
Tonsil	460
Tornesit	275
Triacetin	392
Triamylamine	477
Tributyl Citrate	150
Trichlorethylene	195
Triclene	195
Tricresyl Phosphate	258
Triethanolamine	106
Triethanolamine Lactate	251
Triethanolamine Naphtenate	251
Triethanolamine Oleate	251
Triethanolamine Phthalate	251
Triethanolamine Stearate	251
Trigamine	251
Trigamine Stearate	251
Trihydroxyethylamine	see Triethanolamine
Trikalin	251
Triphenylguanidine	195
Triphenylphosphate	368
Tripoli	527
Trisodium Phosphate	565
Triton	450
Troluoil	39
Tuads	559
Tung Oil	see China Wood Oil
Tungsten	215
Tunguran, A	6
Turkelene	251
Turkerol	251
Turkey Red Oil	381
Turmeric	414
Turpentine	42
Turpenine Substitute	39
Turpentine (Venice)	383
Turtle Oil	473
Twitchell Base	210
Typaphor Black	238

U

Uformite	442
Ultramarine Blue	510
Ultrasene	49
Ultravon	137
Umbers	217
Unilith	548
Union Solvent	545
Unyte	426
Uranium Nitrate	269
Urea	480
Ureka C	455
Ursulin	23
Uversol	269

V

Product	*No.*
Valex	95
Vandex	559
Vanilla Beans	536
Vanillal	487
Vanillin	474
Vanzyme	559
Varcrex	104
Varcum	562
Varnish	372
Varnish Gums & Resins	23
Varnolene	507
Varsol	507
Vaseline	126
Vaso	567
Vat Colors	15
Vatsol	23
Vegetable Colors	437
Vegetable F Wax	517
Vermiculite	280
Vermilion	217
Victron	554
Vinapas	6
Vinsol	275
Vinyl Acetate	392
Vinyl Chloride	106
Vinylite	106
Virifoam	251
Viscogum	251
Viscoloid	195
Vistanex	6
Vitriol	see Sulphuric Acid
V. M. P. Naphtha	507
Volclay	22
Vultex	570

W

Water Glass	see Sodium Silicate
Wax L33	251
Wax, Synthetic	251
Wetanol	251
Wetting Out Agents	251
White Arsenic	424
White Lead	380
Whiting	148
Witch Hazel Extract	181
Wood Flour	333
Wood Oil	see China Wood Oil
Wool Wax	82
Wyo-Jel	591

X

X-13	238
Xerol	232
Xylene	see Xylol
Xylerol	251
Xylol	68
Xynomine	406

Y

Yeast	504
Yelkin	453

Z

Zein	30
Zelan	195
Zenite	195
Zikol	391
Zimate	559

SELLERS OF CHEMICALS AND SUPPLIES

No.	*Name*	*Address*
1.	Abbott Laboratories	North Chicago, Ill.
2.	Acetate Products Corp.	London, England
3.	Acheson Colloids Corp.	Port Huron, Mich.
4.	Acheson Graphite Corp.	Niagara Falls, N. Y.
5.	Acme Oil Corp.	Chicago, Ill.
6.	Advance Solvents & Chem. Corp.	New York, N. Y.
7.	Ajax Metal Co.	Philadelphia, Pa.
8.	Aktivin Corp.	New York, N. Y.
9.	Allied Asphalt & Mineral Corp.	New York, N. Y.
10.	Alpha Lux Co., Inc.	New York, N. Y.
11.	Aluminum Co. of America	Pittsburgh, Pa.
12.	Amecco Chemicals, Inc.	Rochester, N. Y.
13.	American Active Carbon Co.	Columbus, O.
14.	American Agar Co., Inc.	San Diego, Calif.
15.	American Aniline Products, Inc.	New York, N. Y.
16.	American-Brit. Chem. Supplies, Inc.	New York, N. Y.
17.	American Catalin Corp.	New York, N. Y.
18.	American Cellulose Co.	Indianapolis, Ind.
19.	American Chemical Paint Co.	Ambler, Pa.
20.	American Chemical Products Co.	Rochester, N. Y.
21.	American Chlorophyll, Inc.	New York, N. Y.
22.	American Colloid Co.	Chicago, Ill.
23.	American Cyanamid & Chem. Co.	New York, N. Y.
24.	American Dyewood Co.	New York, N. Y.
25.	American Fluoride Corp.	New York, N. Y.
26.	American Insulator Corp.	New Freedom, Pa.
27.	American Lanolin Corp.	Lawrence, Mass.
28.	American Lecithin Corp.	New York, N. Y.
29.	American Luminous Products Co.	Huntington Park, Calif.
30.	American Maize Products Co.	New York, N. Y.
31.	American Metal Co.	New York, N. Y.
32.	American Mineral Spirit Co.	New York, N. Y.
33.	American Plastics Corp.	New York, N. Y.
34.	American Potash & Chem. Corp.	New York, N. Y.
35.	American Smelting & Refining Co.	New York, N. Y.
36.	American Zinc Co.	New York City
37.	Amido Products Co.	New York, N. Y.
38.	Anchor Chemical Co.	Manchester, England
39.	Anderson Prichard Oil Corp.	Oklahoma City, Okla.
40.	Ansbacher-Siegle Corp.	Rosebank, New York
41.	Ansul Chem. Co.	Marinette, Wis.
42.	Antwerp Naval Stores Co., Inc.	Boston, Mass.
43.	Apex Chem. Co.	New York, N. Y.
44.	Archer-Daniels-Midland Co.	Minneapolis, Minn.
45.	Arkansas Co.	New York, N. Y.
46.	Armour & Co.	Chicago, Ill.
47.	Asbury Graphite Mills	Asbury Park, N. J.
48.	Atlantic Gelatine Co.	Woburn, Mass.
49.	Atlantic Refining Co.	Philadelphia, Pa.
50.	Atlantic Research Associates	Newtonville, Mass.
51.	Atlas Import Co.	Chicago, Ill.
52.	Atlas Powder Co.	Wilmington, Del.
53.	Augsburger, Kunst Fabrik	Augsburg, Germany

No.	*Name*	*Address*
54.	Autoxygen, Inc.	New York, N. Y.
55.	Badcock, Robert & Co.	New York, N. Y.
56.	Bakelite Corp.	New York, N. Y.
57.	Baker Castor Oil Co.	Jersey City, N. J.
58.	Baker & Co., Inc.	Newark, N. J.
59.	Baker, Franklin Co.	Hoboken, N. J.
60.	Baker, H. J. & Bro.	New York, N. Y.
61.	Baker, J. E., Co.	York, Pa.
62.	Baker, J. T. Chem. Co.	Philipsburg, N. J.
63.	Balfour, Guthrie & Co., Ltd.	New York, N. Y.
64.	Barada & Page, Inc.	Kansas City, Mo.
65.	Barber Asphalt Co.	Philadelphia, Pa.
66.	Barium Reduction Corp.	Charleston, W. Va.
67.	Barnsdall Tripoli Corp.	Seneca, Mo.
68.	Barrett Co.	New York, N. Y.
69.	Barry, E. J., Inc.	New York, N. Y.
70.	Battelle & Renwick	New York, N. Y.
71.	Battleboro Oil Co.	Battleboro, N. C.
71a.	Beck, Koller & Co.	Detroit, Mich.
72.	Belmont Smelting & Refining Wks.	Brooklyn, N. Y.
73.	Benkert, W. & Co., Inc.	New York, N. Y.
74.	Benzol Products Co.	Newark, N. J.
75.	F. C. Bersworth Labs.	Framingham, Mass.
76.	Beryllium Corp. of America	New York, N. Y.
77.	Bick & Co., Inc.	Reading, Pa.
78.	Bilhuber-Knoll Corp.	New York, N. Y.
79.	Binney & Smith	New York, N. Y.
80.	Bisbee Linseed Co.	Philadelphia, Pa.
81.	Bohme, A. G., H. Th.	Chemnitz, Germany
82.	Bopf-Whittam Corp.	Linden, N. J.
83.	Borax Union, Inc.	San Francisco, Calif.
84.	The W. H. Bowdlear Co.	Syracuse, N. Y.
85.	Bowker Chem. Corp.	New York, N. Y.
86.	Bradley & Baker	New York, N. Y.
87.	Brazil Oiticica, Inc.	New York, N. Y.
88.	British Drug Houses, Ltd.	London, England
89.	British Xylonite Co.	London, England
90.	Brooke, Fred L., Co.	Chicago, Ill.
91.	Bud Aromatic Chemical Co., Inc.	New York, N. Y.
92.	Buffalo Electro Chem. Co., Inc.	Buffalo, N. Y.
93.	Burkard-Schier Chem. Co.	Chattanooga, Tenn.
94.	Buromin Corp.	Pittsburgh, Pa.
95.	Bush, W. J. & Co., Inc.	New York, N. Y.
96.	C. P. Chemical Solvents, Inc.	New York, N. Y.
97.	Cabot, Godfrey L., Inc.	Boston, Mass.
98.	Calcium Sulphide Corp.	Damascus, Va.
99.	Calco Chemical Co.	Bound Brook, N. J.
100.	Calgon, Inc.	Pittsburgh, Pa.
101.	Calif. Fruit Growers' Exchange	Ontario, Calif.
102.	Campbell, C. W. Co., Inc.	New York, N. Y.
103.	Campbell, John & Co.	New York, N. Y.
104.	Campbell Rex & Co.	London, England
105.	Carbic Color & Chemical Co.	New York, N. Y.
106.	Carbide & Carbon Chem. Corp.	New York, N. Y.
107.	Carbogen Chemical Co.	Garwood, N. J.
108.	Carbolincum Wood Preserving Co.	Milwaukee, Wis.
109.	Carborundum Co.	Niagara Falls, N. Y.
110.	Carey, Philip Co.	Lockland, Ohio
111.	Carus Chem. Co., Inc.	La Salle, Ill.
112.	Casein Mfg. Co.	New York, N. Y.
113.	The Casein Mfg. Co. of Amer. Inc.	New York, N. Y.
114.	Celanese Corp. of America	New York, N. Y.

No.	*Name*	*Address*
115.	Cellonwerke	Charlottenburg, Germany
116.	Celluloid Corp.	Newark, N. J.
117.	Celluloid Corp.	New York, N. Y.
118.	Central Scientific Co.	Chicago, Ill.
119.	Century Stearic Acid Wks.	New York, N. Y.
120.	Century Stearic Acid & Candle Wks.	New York, N. Y.
121.	Ceramic Color & Chem. Mfg. Co.	New Brighton, Pa.
122.	Cerro de Pasco Copper Corp.	New York, N. Y.
123.	Champion Paper & Fibre Co.	Canton, N. C.
124.	Chaplin-Bibbo	New York, N. Y.
125.	Chazy Marble Lime Co., Inc.	Chazy, N. Y.
126.	Chesebrough Mfg. Co.	New York, N. Y.
127.	Chemical & Pigment Co.	Baltimore, Md.
128.	Chemical & Pigment Co., Inc.	Scranton, Pa.
129.	Chemical Publ. Co., Inc.	Brooklyn, N. Y.
130.	Chemical Solvents, Inc.	New York, N. Y.
131.	Cheney Chem. Co.	Cleveland, Ohio
132.	Chicago Apparatus Co.	Chicago, Ill.
133.	Chicago Copper & Chem. Co.	Blue Island, Ill.
134.	Chipman Chem. Co., Inc.	Bound Brook, N. J.
135.	Chrystal, Charles B. Co., Inc.	New York, N. Y.
136.	Church & Dwight Co., Inc.	New York, N. Y.
137.	Ciba Co., Inc.	New York, N. Y.
138.	Cinelin Co.	Indianapolis, Ind.
139.	Clarke, John & Co.	New York, N. Y.
140.	The Cleveland-Cliffs Iron Co.	Cleveland, Ohio
141.	Climax Molybdenum Co.	New York, N. Y.
142.	Clinton Co.	Clinton, Ia.
143.	Coleman & Bell Co.	Norwood, Ohio
144.	Colgate-Palmolive-Peet Co.	Chicago, Ill.
145.	Colgate-Palmolive-Peet Co.	Jersey City, N. J.
146.	Colledge, E. W., Inc.	Cleveland, Ohio
147.	Colonial Beacon Oil Co.	Everett, Mass.
148.	Columbia Alkali Corp.	New York, N. Y.
149.	Commercial Solvents Corp.	New York, N. Y.
150.	Commercial Solvents Corp.	Terre Haute, Ind.
151.	Commonwealth Color & Chem. Co.	Brooklyn, N. Y.
152.	Compagnie Duval	New York, N. Y.
153.	Conewango Refining Co.	Warren, Pa.
154.	Consolidated Chem. Sales Corp.	Newark, N. J.
155.	Consolidated Feldspar Corp.	Trenton, N. J.
156.	Conti Products Corp.	New York, N. Y.
157.	Continental Diamond Fibre Co.	Bridgeport, Pa.
158.	Continental Oil Co.	Ponca City, Okla.
159.	Cook Swan Co., Inc.	New York, N. Y.
160.	Cooper, Charles & Co.	New York, N. Y.
161.	Coopers Creek Chem. Co.	W. Conshohocken, Pa.
162.	Corn Products Refining Co.	New York, N. Y.
163.	Cowles Detergent Co.	Cleveland, Ohio
164.	Croton Chem. Corp.	Brooklyn, N. Y.
165.	Crowley Tar Products Co.	New York, N. Y.
166.	Crystal, Charles B. Co., Inc.	New York, N. Y.
167.	Cudahy Packing Co.	Chicago, Ill.
168.	Danco, Gerard J.	New York, N. Y.
169.	Darco Sales Corp.	New York, N. Y.
170.	Darling & Co.	Chicago, Ill.
171.	Davison Chem. Corp.	Baltimore, Md.
172.	Deep Rock Oil Corp.	Chicago, Ill.
173.	C. P. De Lore Co.	St. Louis, Mo.
174.	Delta Chem. Mfg. Co.	Baltimore, Md.
175.	Delta Chem. & Iron Co.	Wells, Mich.
176.	Denver Fire Clay Co.	Denver, Colo.

No.	*Name*	*Address*
177.	Devoe & Raynolds Co.	New York, N. Y.
178.	Dewey & Almy Chem. Co.	Boston, Mass.
179.	Diamond Alkali Co.	Pittsburgh, Pa.
180.	Dicalite Co.	New York, N. Y.
181.	Dickinson, E. E. Co.	Essex, Conn.
182.	Dickinson, J. Q. & Co.	Malden, W. Va.
183.	Difco Laboratories, Inc.	Detroit, Mich.
184.	Digestive Ferments Co.	Detroit, Mich.
185.	Marshall Dill	San Francisco, Calif.
186.	Distributing & Trading Co.	New York, N. Y.
187.	Dodge & Olcott Co.	New York, N. Y.
188.	Dow Chemical Co.	Midland, Mich.
189.	Drakenfeld, B. F. & Co.	New York, N. Y.
190.	Dreyer, P. R. Co.	New York, N. Y.
191.	Dreyfus Co., L. A.	Rosebank, N. Y.
192.	Drury, A. C. & Co., Inc.	Chicago, Ill.
193.	Ducas, B. P. Co.	New York, N. Y.
194.	Duche, T. M. & Sons	New York, N. Y.
195.	DuPont, E. I., de Nemours & Co.	Wilmington, Del.
196.	E. I. DuPont de Nemours & Co., Inc.	Parlin, N. J.
197.	Durite Plastics	Philadelphia, Pa.
198.	Dynamit, A. G.	Troisdorf, Germany
199.	The Eagle-Picher Lead Co.	Cincinnati, Ohio
200.	Eakins, J. S. & W. R., Inc.	Brooklyn, N. Y.
201.	Earle Bros.	New York, N. Y.
202.	Eastman Kodak Co.	Rochester, N. Y.
203.	Economic Materials Co.	Chicago, Ill.
204.	Eff Laboratories, Inc.	Cleveland, Ohio
205.	Egyptian Lacquer Co.	Kearney, N. J.
206.	Eimer & Amend	New York, N. Y.
207.	Elbert & Co.	New York, N. Y.
208.	Electro Bleaching Gas Co.	New York, N. Y.
209.	Electro-Metallurgical Co.	New York, N. Y.
210.	Emery Industries, Inc.	Cincinnati, Ohio
211.	Empire Distilling Corp.	New York, N. Y.
212.	Enterprise Animal Oil Co.	Philadelphia, Pa.
213.	Fales Chem. Co., Inc.	Cornwall Landing, N. Y.
214.	Falk & Co.	Pittsburgh, Pa.
215.	Fansteel Metallurgical Corp.	No. Chicago, Ill.
216.	Felton Chemical Co.	Brooklyn, N. Y.
217.	Fezandie & Sperrle, Inc.	New York, N. Y.
218.	Fiberloid Corp.	Indian Orchard, Mass.
219.	Filtrol Co.	Los Angeles, Calif.
220.	Fishbeck, Chas. Co.	New York, N. Y.
221.	Fisher Scientific Co.	Pittsburgh, Pa.
222.	Florasynth Laboratories	New York, N. Y.
223.	Foote Mineral Co.	Philadelphia, Pa.
224.	Formica Insulation Co.	Cincinnati, Ohio
225.	Fougera, E. & Co.	New York, N. Y.
226.	France, Campbell & Darling	Kenilworth, N. J.
227.	Franco-American Chemical Wks.	Carlstadt, N. J.
228.	Frank-Vliet Co.	New York, N. Y.
229.	Franks Chem. Products Co., Inc.	Brooklyn, N. Y.
230.	French Potash Co.	New York, N. Y.
231.	Alex Fries & Bro.	Cincinnati, Ohio
232.	Fries Bros.	New York, N. Y.
233.	Fritzchie Bros.	New York, N. Y.
234.	Garrigues, Stewart & Davies, Inc.	New York, N. Y.
235.	Geigy Co., Inc.	New York, N. Y.
236.	General Aniline Works, Inc.	New York, N. Y.
237.	General Atlas Carbon Co.	New York, N. Y.
238.	General Chemical Co.	New York, N. Y.

No.	*Name*	*Address*
239.	General Drug Co.	New York, N. Y.
240.	General Dyestuffs Corp.	New York, N. Y.
241.	General Electric Co.	Pittsfield, Mass.
242.	General Electric Co.	Schenectady, N. Y.
243.	General Magnesite & Magnesia Co.	Philadelphia, Pa.
244.	General Naval Stores Co.	New York, N. Y.
245.	General Plastics Corp.	London, England
246.	General Plastics, Inc.	No. Tonawanda, N. Y.
247.	Girdler Corp.	Louisville, Ky.
248.	Givaudan-Delawanna, Inc.	New York, N. Y.
249.	Glidden Co.	Cleveland, Ohio
250.	Globe Chem. Co.	Cincinnati, Ohio
251.	Glyco Products Co., Inc.	Brooklyn, N. Y.
252.	Goldschmidt, A. G., Th.	Essen, Germany
253.	Goldschmidt Corp.	New York, N. Y.
254.	Goodrich, B. F., Co.	Akron, Ohio
255.	Goodyear Tire & Rubber Co.	Akron, Ohio
256.	Grasselli Chemical Co.	Cleveland, Ohio
257.	W. S. Gray Co.	New York, N. Y.
258.	Greeff, R. W. & Co.	New York, N. Y.
259.	Griffith Laboratories	Chicago, Ill.
260.	Gross, A. & Co.	New York, N. Y.
261.	Hall, C. P. & Co.	Akron, Ohio
262.	Halowax Corp.	New York, N. Y.
263.	Hammil & Gillespie, Inc.	New York, N. Y.
264.	Hamilton, A. K.	New York, N. Y.
265.	Hammond Drierite Co.	Yellow Springs, Ohio
266.	Handy & Harman	New York, N. Y.
267.	Hardy, Charles, Inc.	New York, N. Y.
268.	Harrison Mfg. Co.	Rahway, N. J.
269.	Harshaw Chemical Co.	Cleveland, Ohio
270.	Hart Products Corp.	New York, N. Y.
271.	Haskelite Mfg. Corp.	Chicago, Ill.
272.	Haveg Corp.	Newark, Del.
273.	Hegeler Zinc Co.	Danville, Ill.
274.	Heine & Co.	New York, N. Y.
275.	Hercules Powder Co.	New York, N. Y.
276.	Hercules Powder Co.	Wilmington, Del.
277.	Heveatex Corp.	Melrose, Mass.
278.	C. B. Hewitt & Bro.	New York, N. Y.
279.	Heyden Chemical Works	New York, N. Y.
280.	Hill Bros. Chem. Co.	Los Angeles, Calif.
281.	Hillside Fluor Spar Mines	Chicago, Ill.
282.	Holland Aniline Dye Co.	Holland, Mich.
283.	O. Hommel Co.	Pittsburgh, Pa.
284.	Hooker Electro-Chemical Co.	New York, N. Y.
285.	Hopkins, J. L. & Co.	New York, N. Y.
286.	Hord Color Products	Sandusky, Ohio
287.	Horn Jefferys & Co.	Burbank, Calif.
288.	Horner, James B., Inc.	New York, N. Y.
289.	Huisking, Chas L. & Co., Inc.	New York, N. Y.
290.	Hummel Chemical Co., Inc.	New York, N. Y.
291.	Hurst, Adolph & Co., Inc.	New York, N. Y.
292.	D. W. Hutchinson & Co., Inc.	New York, N. Y.
293.	Hymes, Lewis Associates	New York, N. Y.
294.	I. G. Farbenindustrie	Frankfurt, Germany
295.	Imperial Chem. Industries	London, England
296.	Industrial Chem. Sales Co.	New York, N. Y.
297.	Innes, O. G., Corp.	New York, N. Y.
298.	Innis Speiden Co.	New York, N. Y.
299.	International Pulp Corp.	New York, N. Y.
300.	International Selling Corp.	New York, N. Y.

No.	*Name*	*Address*
301.	Interstate Color Co., Inc.	New York, N. Y.
302.	Iowa Soda Products Co.	Council Bluffs, Ia.
303.	Jackson, L. N. & Co.	New York, N. Y.
304.	Jacobson, C. A.	W. Va. University, Morgantown, W. Va.
305.	The Jennison-Wright Co.	Toledo, Ohio
306.	Johns-Manville Corp.	New York, N. Y.
307.	Jones & Laughlin Steel Corp.	Pittsburgh, Pa.
308.	Jones, S. L. & Co.	San Francisco, Calif.
309.	Jungmann & Co.	New York, N. Y.
310.	Kali Mfg. Co.	Philadelphia, Pa.
311.	Kalle & Co.	Wiesbaden Bierich, Germany
312.	Kay Fries Chem., Inc.	New York, N. Y.
313.	Kelco Co.	San Diego, Calif.
314.	Kentucky Clay Mining Co.	Mayfield, Ky.
315.	Kentucky Color & Chem. Co.	Louisville, Ky.
316.	Kessler Chem. Corp.	Philadelphia, Pa.
317.	Kinetic Chem., Inc.	Wilmington, Del.
318.	H. Kohnstamm & Co.	New York, N. Y.
319.	Koppers Products Co.	Pittsburgh, Pa.
320.	Krebs Pigment & Color Corp.	Newark, N. J.
321.	Kuhlman, Etabls.	Paris, France
322.	Kurt, Albert, G. M. B. H.	Amoneburg, Germany
323.	Lattimer-Goodwin Chem. Co.	Grand Junction, Ohio
324.	Laxseed Co.	New York, N. Y.
325.	Leghorn Trading Co., Inc.	New York, N. Y.
326.	Lehn & Fink Corp.	New York, N. Y.
327.	Theo. Leonhard Wax Co., Inc.	Haledon, Paterson, N. J.
328.	Lewis, C. H. & Co.	New York, N. Y.
329..	Lewis, John D., Inc.	Providence, R. I.
330.	Limestone Products Corp. of Amer.	Newton, N. J.
331.	Lincks, Geo. H.	New York, N. Y.
332.	Liquid Carbonic Corp.	Chicago, Ill.
333.	Litter, D. H., Co.	New York, N. Y.
334.	Littlejohn & Co., Inc.	New York, N. Y.
335.	Lucidol Corp.	Buffalo, N. Y.
336.	Geo. Lueders & Co.	New York, N. Y.
337.	Lundt & Co.	New York, N. Y.
338.	Maas & Waldstein	Newark, N. J.
339.	MacAndrews & Forbes Co.	New York, N. Y.
340.	Mackay, A. D.	New York, N. Y.
341.	Magnetic Pigment Co.	New York, N. Y.
342.	Magnus, Mabee & Reynard, Inc.	New York, N. Y.
343.	Makalot Corp.	Boston, Mass.
344.	Mallinckrodt Chemical Works	St. Louis, Mo.
345.	Malt Diastase Co.	Brooklyn, N. Y.
346.	Manchester Oxide Co.	Manchester, England
347.	Marbon Corp.	Gary, Ind.
348.	Marine Magnesium Prod. Corp.	S. San Francisco, Calif.
349.	Martin, Dennis Co.	Newark, N. J.
350.	Martin, L. Co.	New York, N. Y.
351.	Mathieson Alkali Co.	New York, N. Y.
352.	Maywood Chem. Works	Maywood, N. J.
353.	McCormick & Co.	Baltimore, Md.
354.	The McGean Chem. Co.	Cleveland, Ohio
355.	McKesson & Robbins, Inc.	New York, N. Y.
356.	McLaughlin, Gormley, King & Co.	Minneapolis, Minn.
357.	Mearl Corp.	New York, N. Y.
358.	Mechling Bros. Chem. Co.	Camden, N. J.
359.	E. Meer & Co., Inc.	New York, N. Y.
360.	Merck & Co.	Rahway, N. J.
361.	Merrimac Chemical Co.	Boston, Mass.
362.	Metro-Nite Co.	Milwaukee, Wis.

No.	*Name*	*Address*
363.	Meyer & Sons, J.	Philadelphia, Pa.
364.	Mica Insulator Co.	New York, N. Y.
365.	Michel Export Co.	New York, N. Y.
366.	Michigan Alkali Co.	New York, N. Y.
367.	Miller, Carl F., Co.	Seattle, Wash.
368.	Monsanto Chem. Works	St. Louis, Mo.
369.	Moore-Munger	New York, N. Y.
370.	Morningstar, Nicol, Inc.	New York, N. Y.
371.	Morton Salt Co.	Chicago, Ill.
372.	Murphy Varnish Co.	Newark, N. J.
373.	Mutual Chem. Co. of Amer.	New York, N. Y.
374.	Mutual Chem. Co. of America	New York, N. Y.
375.	Mutual Citrus Products Co.	Anaheim, Calif.
376.	National Aulminate Corp.	Chicago, Ill.
377.	Nat'l Ammonia Co., Inc.	Philadelphia, Pa.
379.	Nat'l Aniline & Chem. Wks.	New York, N. Y.
380.	National Lead Co.	New York, N. Y.
381.	National Oil Products Co.	Harrison, N. J.
382.	Nat'l Pigments & Chem. Co.	St. Louis, Mo.
383.	National Rosin Oil & Size Co.	New York, N. Y.
384.	Naugatuck Chem. Co.	Naugatuck, Conn.
385.	Neville Co.	Pittsburgh, Pa.
386.	N. J. Laboratory Supply Co.	Newark, N. J.
387.	N. J. Zinc Co.	New York, N. Y.
388.	The N. Y. Quinine & Chem. Wks., Inc.	Brooklyn, N. Y.
390.	Newmann-Buslee & Wolfe, Inc.	Chicago, Ill.
391.	Newport Industries, Inc.	New York City
392.	Niacet Chem. Co.	Niagara Falls, N. Y.
393.	Niagara Alkali Co.	New York, N. Y.
394.	Niagara Chemicals Corp.	Niagara Falls, N. Y.
395.	Niagara Smelting Corp.	Niagara Falls, N. Y.
396.	The Northwestern Chem. Co.	Wauwatosa, Wis.
397.	Norton Co.	Worcester, Mass.
398.	Norwich Pharmacal Co.	Norwich, N. Y.
399.	Novadel-Agene Corp.	Newark, N. J.
400.	Nulomoline Co.	New York, N. Y.
401.	Nuodex Products, Inc.	Elizabeth, N. J.
402.	Ohio-Apex, Inc.	Nitro, W. Va.
403.	Oil States Petroleum Co.	New York, N. Y.
404.	Oldbury Electro-Chem. Co.	New York, N. Y.
405.	Olive Branch Minerals Co.	Cairo, Ill.
406.	Onyx Oil & Chem. Co.	Passaic, N. J.
407.	Orbis Products Corp.	New York, N. Y.
408.	Papermakers' Chem. Corp.	Wilmington, Del.
409.	Paramet Chem. Corp.	Long Island City, N. Y.
410.	Parke, Davis & Co.	Detroit, Mich.
411.	Parker Rust Proof Co.	Detroit, Mich.
412.	Patent Chemicals, Inc.	New York, N. Y.
413.	Peek & Velsor, Inc.	New York, N. Y.
414.	Penick, S. B. & Co.	New York, N. Y.
415.	Penn. Alcohol Corp.	Philadelphia, Pa.
416.	Penn. Coal Products Co.	Petrolia, Pa.
417.	Penn.-Dixie Cement Corp.	New York City
418.	Penn. Industrial Chem. Corp.	Clairton, Pa.
419.	Penn. Refining Co.	Butler, Pa.
420.	Penn. Salt Mfg. Co.	Philadelphia, Pa.
421.	Pfaltz-Bauer, Inc.	New York, N. Y.
422.	Pfizer, Chas. & Co., Inc.	New York, N. Y.
423.	Phila. Quartz Co.	Philadelphia, Pa.
424.	Philipp Bros.	New York, N. Y.
425.	Pittsburgh Plate Glass Co.	Pittsburgh, Pa.
426.	Plaskon Corp.	Toledo, Ohio

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427.	Plymouth Organic Labs.	New York. N. Y.
428.	Pollopas, Ltd.	London, England
429.	Powhatan Mining Corp.	Woodlawn, Baltimore, Md.
430.	Pray, W. P.	New York, N. Y.
431.	Prior Chem. Corp.	New York, N. Y.
432.	Procter & Gamble Co.	Cincinnati, Ohio
433.	Provident Chem. Wks.	St. Louis, Mo.
434.	Publicker, Inc.	Philadelphia, Pa.
435.	Pure Calcium Products Co.	Painesville, Ohio
436.	Pylam Products Co.	New York, N. Y.
437.	Ransom, L. E., Co.	New York, N. Y.
438.	Robert Rauh, Inc.	Newark, N. J.
439.	Read, Chas. L. & Co., Inc.	New York, N. Y.
440.	Reichhold Chemicals, Inc.	Detroit, Mich.
441.	Reilly Tar & Chem. Corp.	Indianapolis, Ind.
442.	Resinous Prod. & Chem. Co.	Philadelphia, Pa.
442a.	Resinox Corp.	New York City
443.	Revertex Corp.	Brooklyn, N. Y.
444.	Revson, R. F. Co.	New York, N. Y.
445.	Rhone-Poulene, Inc.	Paris, France
446.	Richards Chem. Works	Jersey City, N. J.
447.	Riverside Chem. Co.	No. Tonawanda, N. Y.
448.	Robeson Process Co.	New York, N. Y.
449.	Rogers & McClellan	Boston, Mass.
450.	Rohm & Haas	Philadelphia, Pa.
451.	Rosenthal, H. H., Co.	New York, N. Y.
452.	Ross, Frank B., Co., Inc.	New York, N. Y.
453.	Ross-Rowe, Inc.	New York, N. Y.
454.	Royce Chem. Co.	Carlton Hill, N. J.
455.	Rubber Service Labs. Co.	Akron, Ohio
456.	Russell, W. R. & Co.	New York, N. Y.
457.	Russia Cement Co.	Gloucester, Mass.
458.	Ryland, H. C., Inc.	New York, N. Y.
459.	Saginaw Salt Products Co.	Saginaw, Mich.
460.	Salomon, L. A. & Bro.	New York, N. Y.
461.	Samuelson & Co., P.	London, England
462.	Sandoz Chem. Works	New York, N. Y.
463.	Scheel, Wm. H.	New York, N. Y.
464.	Schimmel & Co.	New York, N. Y.
464a.	Schliemann Co., Inc.	New York City
465.	Schofield-Daniel Co.	New York City
466.	Scholler Bros., Inc.	Philadelphia, Pa.
467.	F. E. Schundler & Co.	Joliet, Ill.
468.	Schuylkill Chem. Co.	Philadelphia, Pa.
469.	Schwabacher, S. & Co., Inc.	New York, N. Y.
470.	Scientific Glass Apparatus Co.	Bloomfield, N. J.
471.	Scott, Bader & Co.	London, England
472.	Seacoast Laboratories	New York, N. Y.
473.	Edwin Seebach Co.	New York, N. Y.
474.	Seeley & Co., Inc.	New York, N. Y.
475.	Seldner & Enequist, Inc.	Brooklyn, N. Y.
476.	Serinsky, Moses Co.	Indianapolis, Ind.
477.	Sharples Solvents Corp.	Philadelphia, Pa.
478.	Shawinigan, Ltd.	New York, N. Y.
479.	Shepherd Chem. Co.	Norwood, Cincinnati, Ohio
480.	Sherka Chem. Co., Inc.	Bloomfield, N. J.
482.	Sherwood Petroleum Co.	Englewood, N. J.
483.	Thomas J. Shields Co.	New York, N. Y.
484.	Siemon Colors, Inc.	Newark, N. J.
485.	Siemon & Co.	Bridgeport, Conn.
486.	Silica Products Co.	Kansas City, Mo.
487.	Silver, Geo., Import Co.	New York, N. Y.

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488.	Sinclair Refining Co.	Olmstead, Ill.
489.	Skelly Oil Co.	Chicago, Ill.
490.	Smith Chem. & Color Co.	Brooklyn, N. Y.
491.	Smith & Nichols, Inc.	New York, N. Y.
492.	Smith, Werner G., Co.	Cleveland, Ohio
493.	Solvay Sales Corp.	New York, N. Y.
494.	Sonneborn, L., Sons	New York, N. Y.
495.	Southern Mica Co.	Franklin, N. C.
496.	Southern Pine Chem. Co.	Jacksonville, Fla.
497.	Southwark Mfg. Co.	Camden, N. J.
498.	Sparhawk Co.	Sparkhill, N. Y.
499.	Spencer Kellogg & Sons Sales Corp.	Buffalo, N. Y.
500.	A. E. Staley Mfg. Co.	Decatur, Ill.
501.	Stamford Rubber Supply Co.	Stamford, Conn.
502.	Stanco Distributors	New York, N. Y.
503.	Standard Alcohol Co.	New York, N. Y.
504.	Standard Brands, Inc.	New York, N. Y.
505.	Standard Oil Co. of Calif.	San Francisco, Calif.
506.	Standard Oil Co. of Indiana	Chicago, Ill.
507.	Standard Oil Co. of N. J.	New York, N. Y.
508.	Standard Oil Co. of N. Y.	New York, N. Y.
509.	Standard Silicate Co.	Pittsburgh, Pa.
510.	Standard Ultramarine Co.	Huntington, W. Va.
511.	Stanley Co., John T.	New York City
512.	Starch Products Co.	New York, N. Y.
513.	Stauffer Chem. Co.	New York, N. Y.
514.	Stauffer Chem. Co. of Texas	Freeport, Texas
515.	Stein, Hall & Co.	New York, N. Y.
516.	Stokes & Smith Co.	Philadelphia, Pa.
517.	Strahl & Pitsch	New York, N. Y.
518.	Strohmeyer & Arpe Co.	New York, N. Y.
519.	Stroock & Wittenberg Corp.	New York, N. Y.
520.	Sun Oil Co.	Philadelphia, Pa.
521.	Swann Chemical Co.	New York, N. Y.
522.	Synfleur Scientific Labs.	Monticello, N. Y.
523.	Synthane Corp.	Oaks, Pa.
524.	The Synthetic Products Co.	Cleveland, Ohio
525.	Taintor Trading Co.	New York, N. Y.
526.	Takamine Laboratory, Inc.	Clifton, N. J.
527.	Tamms Silica Co.	Chicago, Ill.
528.	Tanners Supply Co.	Grand Rapids, Mich.
529.	Tannin Corp.	New York, N. Y.
530.	C. Tennant & Sons Co. of N. Y.	New York, N. Y.
531.	Tenn. Eastman Corp.	Kingsport, Tenn.
532.	Texas Chem. Co.	Houston, Texas
533.	Texas Mining & Smelting Co.	Laredo, Texas
534.	Thomas, Arthur H., Co.	Philadelphia, Pa.
535.	Thorocide, Inc.	St. Louis, Mo.
536.	Thurston & Braidich	New York, N. Y.
537.	Titanium Alloy Mfg. Co.	Niagara Falls, N. Y.
538.	Titanium Pigments Co.	New York, N. Y.
539.	Tobacco By-Products & Chem. Corp.	Louisville, Ky.
540.	Trask, Arthur C., Co.	Chicago, Ill.
541.	Trojan Powder Co.	Allentown, Pa.
542.	Turner, Joseph & Co.	Ridgefield, N. J.
543.	Uhe, George Co.	New York, N. Y.
544.	Uhlich, Paul Co.	New York, N. Y.
545.	Union Oil Co.	Los Angeles, Calif.
546.	Union Smelting & Refining Co., Inc.	Newark, N. J.
547.	United Carbon Co.	Charleston, W. Va.
547a.	United Clay Mines Corp.	Trenton, N. J.
548.	United Color & Pigment Co.	Newark, N. J.

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556.	Utah Gilsonite Co.	St. Louis, Mo.
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559.	Vanderbilt, R. T., Co.	New York, N. Y.
560.	Van Dyk & Co., Inc.	Jersey City, N. J.
561.	Van Schaack Bros. Chem. Co.	Chicago, Ill.
562.	Varcum Chem. Corp.	Niagara Falls, N. Y.
563.	Verley, Albert & Co.	Chicago, Ill.
564.	Verona Chem. Co.	Newark, N. J.
565.	Victor Chem. Works	Chicago, Ill.
566.	Virginia-Carolina Chem. Corp.	Richmond, Va.
567.	Virginia Smelting Works	W. Norfolk, Va.
568.	Vitro Mfg. Co.	Pittsburgh, Pa.
570.	Vultex Chem. Co.	Cambridge, Mass.
571.	Waldo, E. M. & F., Inc.	Muirkirk, Md.
572.	Wallerstein Co., Inc.	New York, N. Y.
573.	The Warner Chem. Co.	New York, N. Y.
574.	Warwick Chem. Co.	West Warwick, R. I.
575.	Welch, Holme & Clark Co.	New York, N. Y.
576.	Welsbach & Co.	Gloucester, N. J.
577.	Werk, M., Co.	Cincinnati, Ohio
578.	Western Charcoal Co.	Chicago, Ill.
579.	Westinghouse Elec. & Mfg. Co.	E. Pittsburgh, Pa.
580.	Whittaker, Clark & Daniels	New York, N. Y.
581.	Wiffen & Co., Sons, Ltd.	London, England
582.	Wilckes-Martin-Wilckes Co.	New York, N. Y.
583.	Will & Baumer Candle Co.	New York, N. Y.
584.	C. K. Williams & Co.	Easton, Pa.
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590.	Wood Ridge Mfg. Co.	Wood Ridge, N. J.
591.	Wyodak Chem. Co.	Cleveland, Ohio
593.	Young, J. S. & Co.	Hanover, Pa.
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