WOOD FINISHING

Plain and Decorative

Methods, Materials, and Tools for Natural, Stained, Varnished, Waxed, Oiled, Enameled, and Painted Finishes. Antiqued, Stippled, Streaked and Rough Glazed Finishes. Stain Making Formulas.

BY

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PREFACE

Wood finishing today is a commercial art. With the greater appreciation of interior decoration by the great middle classes has come the realization that interior wood trim constitutes the frame of the picture, so to speak. Consequently the selection of color and texture of the finish for wood trim is being done with the same care that is exercised by the artist who chooses a frame for his painting.

The tendency to consider the wood finishing in homes and public buildings simply as one element of a decorative scheme, along with the several others, such as walls, floor, furniture, drapes, rugs and accessories, is a wholesome development which is making interiors truly beautiful.

The wood finisher, whether he be house painter and decorator, furniture worker or arts and crafts artisan, is confronted with an array of finishes calculated to confuse even the most experienced unless his working methods are based upon a sound knowledge of the most modern stains, fillers, varnishes and other materials. Then there has been a steady change in the kinds and grades of woods used for buildings, cabinets and furniture, calling for complete knowledge of the characteristics of present day woods.

And to make the wood finisher's task even more difficult the specifications by architects and customers change constantly to keep pace with styles in furniture and decorations of standard, period and novel designs. The wish is always for something new and different.

So the wood finisher must keep up with the procession in pursuit of style and vogue.

The matter of cost of producing finishes is usually the controlling factor, especially when surfaces to be finished are very large or are many times repeated, as when made up of hundreds of rooms in large office, hotel or similar structures. Then the cost of an extra coat or an extra sanding of the surface, for instance, may mean the difference between profit or loss on the job.

In this book the author has aimed to discard the old and obsolete materials and methods which are too costly in labor to be practical in this day of high wage scales. Only such materials and methods have been cited as are equal to present day demands for both practical and artistic finishes.

F. N. VANDERWALKER

PREFACE TO REVISED EDITION

Study of this first edition to check the subject matter against the facts of today, reveals a need for revision, chiefly of some details to conform with material changes. These have been made, and the work has been broadened considerably by the addition of many more illustrations of the standard methods previously presented in words only. The scope of the text has been increased by including both written descriptions and photographic illustrations of more and recent decorative finishing methods.

In some instances, wood finishes popular today appear to be new, but actually they are revivals of the working methods presented in the first edition; for example, the blond maple and birch finishes gained by selection of woods free from sap stains and bleaching them before application of pale varnish coatings. The bleaching methods were previously included.

It is my belief that this book has been brought up to date in practical wood finishing materials and methods.

F. N. VANDERWALKER

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WOOD FINISHING
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CHAPTER I

WOOD FINISHING IN GENERAL

THE wood finisher's ideal must necessarily be simply that of making the most of what he has to work with, producing the maximum of beauty and serviceability under the circumstances. For no two jobs are alike in all respects and he is seldom consulted in the selection of the wood before erection.

In undertaking a job of interior wood finishing there are four factors which must be considered: the kind of wood, the color decorative plan for the room, the durability of the finish expected, and the cost or investment of money to be made.

The kind of wood to be finished determines broadly the character of the finish to be employed. We may say that in common practice woods are finished as indicated by these groups:

Stain	*Natural*	*Paint or Enamel*
Mahogany	Gumwood	Pine, white
Hickory	Redwood	Pine, yellow
Chestnut	Cedar	Pine, Oregon Fir
Oak	Mahogany	Spruce
Ash	Walnut, American	Holly
Walnut, American	Walnut, Circassian	Bass

Butternut	Oak, white, red	Cottonwood
Rosewood	Cherry	Cypress
Cherry	Rosewood	Gumwood
Birch, select	Chestnut	Birch
Gumwood	Ebony	Redwood
Cypress	Satinwood	
Fir, select		
Cedar		
Redwood		

In addition to the kind of wood, the grade has much to do with the selection of the finish. The cheaper grades, and even the better grades which have not been selected for grain, figure and color by the mill, often leave one with no choice of finish except as between paint and enamel.

Trim lumber which is not selected is apt to show great differences in color, contrast and size of the grain and figure. To finish such surfaces in natural or stained color to have anything like a uniform color tone is quite impractical, because of the cost of bleaching, touching-up and blending off-colored boards. So it pays to have the trim lumber carefully selected and matched at the mill. The increased cost there is less than to have the wood finisher do the matching.

The color scheme or decorative plan for a room must be considered by the wood finisher if he is to make the most of his opportunity. It is his function to enhance by his finishing methods the natural color shadings and grain figure of the wood,—to subdue too much contrast and harshness of coarse grain and figure of some woods,—to carry out the color scheme by coloring the trim wood to become part of the background of the room,—to make it match or harmonize with the furniture,—to so finish it that the surface will be enduring,—and finally, the finish must protect both the color and the wood from moisture and gases which discolor, crack and warp the wood.

Wood trim ought never to be finished with color or grain figure so strong as to call attention to itself. It is really part of the background, with the walls, ceiling and floor,—the background for the furnishings of the room and not the focal point of interest in the picture. The display of strong, fantastic grain figure in either cheap or expensive woods, except for special novelty finishes, is evidence of poor taste as a rule. The beauty of the natural grain and of the color of wood or stain ought not to be obscured by finishes which lack transparency, but woods finished to subdue strong contrasts of grain color and to reveal only simple, graceful contours of figure are pleasing to behold,—and as one lives with them day after day they sustain interest and grow in appreciation of all who love the beauty of harmony and simplicity.

Durability of Finish.—The use to which the wood is put absolutely determines what constitutes a serviceable, durable finish. Wood trim which is never touched by human hands, never rubbed with elbows, never sat upon, scuffed with feet or ground by heels is often durably finished by no more treatment than stain, filler and wax or oil coats. Under other conditions of service stain, shellac and wax are quite enough. But when it comes to floors nothing short of stain, filler, shellac and three coats of varnish, waxed to finish, can be considered really durably and economically finished,—and this in spite of common practice to the contrary which puts on only two coats of varnish. The durability of finish must include not only the preservation of color but also the preservation of the wood from damage by moisture.

In the matter of cost the wood finisher is in position to and does give customers just what they pay for. By cutting down the number of finishing operations and coats he cuts down the cost. In the excitement of price competition, however, he ought not to lose sight of the technical limitations, of the fact that a certain number of operations are necessary to produce clear colors, brilliancy and durability. Then the protective coatings of varnish, wax, paint or enamel on top of the color and surfacing coats cannot protect the color from fading or abrasion and the wood from moisture unless adequate in number and quality of material.

To express this thought in another way, we may say that a schedule of working operations which reads, "stain, fill and wax," cannot possibly be as durable on some surfaces as one which reads, "stain, fill, shellac, varnish and wax." But the first schedule is much cheaper and may be adequate for a surface which is well protected and which is not subject to wear by abrasion, washing, etc. It all comes down to a question of what is the minimum number of coats and operations for the purpose of decoration and of durability for the particular kind of wood trim at hand.

Ideals in Wood Finishing.—Fortunately it no longer is the aim of people to imitate expensive woods by staining cheaper woods. It is still true that when we want to stain birch or gum a deep rich red, or a warm dark brown, we use what is called a mahogany or a walnut stain, but that is merely color designation for lack of better names. Few people having a cheaper wood finished now carry the idea that anyone will think they have the more expensive wood. Today we want the color needed to complete the decorative plan for the room and we don't care to make birch look like mahogany, gum like walnut, pine or chestnut like oak. That was the idea of other generations and was a reflection of the period and spirit of imitation which ruled during the period of graining.

The art of graining was highly developed and it is useful today for repair work where it becomes advisable to match up doors and odd pieces of trim with the general finish of the room, but as a general finish in itself graining has had its day. We are getting away from pretensions and shall now have more time and thought to devote to coloring our trim and cabinet woods to enhance their natural beauty, to finish them for their own beauty which in many instances fully equals far more expensive woods.

Nature has woven into the fibre of each kind of wood a richness and variety of coloring which are ever pleasing to the eye. And in the exquisite grain and figure of woods she has traced patterns far beyond the ability and the dreams of the artist. Each wood has its own peculiar grain texture and figure. The best finishing is that which preserves to view these natural beauties and enhances them with color. There are but few woods which lack beauty of structure when the finisher knows how to make the most of them.

A stain or natural finish which hides any of the natural beauty evident in the wood before finishing is not the best kind of finish, but we must sometimes sacrifice something to gain durability by using varnish coatings which are not completely transparent. And, of course, on cheaper grades of work the price will not permit the use of the high class finishing methods which make the most of the grain and color. In very cheap work we even must go to the point of mixing stain to partly obscure the imperfections of poor wood, knots, resinous streaks, etc.

It will be interesting for a little while to trace briefly the changing styles in wood finishing, just to impress upon wood finishers the necessity for progress and continual study of the art.

Going back only about forty years we were in a period when cheap woods were used for interior trim and grained in golden oak. This was true largely because the art of graining was flourishing, or perhaps the graining flourished because cheap woods were used.

Next the popular fancy took to dark oak colors and dark walnut on real oak and walnut. The finishing was done largely by rubbing in hot oil coats. But with age these finishes became almost black.

The swing of fashion took us back to golden oak, stained on real oak but with a high gloss and polished finish.

A few years of golden oak and we came upon mission finishes, fumed oak, weathered oak, bog oak, etc., done on real oak, finished without filler to retain the open pores and given a dull finish, usually with wax. Then oak became expensive and another change was due.

Furniture manufacturers now shifted to mahogany veneer, and wood trim followed to mahogany colors on other woods. Red mahogany with high gloss and polished finish was the rage. It was in this period that so much of the bleeding red aniline stains was used and which we are still fighting today whenever we try to enamel or paint over them. Today red mahogany is quite out of favor for wood trim and for furniture it has been darkened very much.

White enamel finish on interior trim next climbed upon the stage and was very popular until it proved difficult to keep clean on much used parts such as door casings, stair treads, etc.

White enamel gave way to combinations of white enamel and red or brown mahogany stained and varnished parts which took the wear,—such as baseboards, quarter-rounds, stair rails and treads, etc. Then light tinted enamels took the place of pure white and these combinations are still much in favor. But gloss finishes have given way to dull or satin enamel.

Italian walnut came in after the world war and also the renaissance styles for furniture. Brown mahogany and walnut on gumwood, birch, maple and cypress for trim followed the furniture style.

About this time, too, or a little earlier, the two-toned gray finishes, on oak and chestnut principally, arrived, —silver gray, Austrian oak, and many others gained by use of gray stain and white filler on open-grain woods.

Right now furniture is still walnut but in the lighter color tones, some of it bleached and called French walnut. The colors run from pale yellow to rich, light brown.

Considering the close relation between furniture finishes and wood trim finishes in buildings it is well to note that just as automobile painting represents the highest art in painting, so also does furniture finishing represent the highest art in wood finishing. Consequently any methods, tools and materials about which the house finisher can learn from the furniture finisher are often well worth study when within the limitations of cost. The furniture finisher can do many things which the house finisher cannot because his surfaces are smaller, his woods finer and his cost not so limited, but there is much in common between these two craftsmen. As a matter of fact the demand for natural and stained house trim came as a result of furniture finishes and a desire to harmonize the two elements of decoration in a room.

Furniture manufacturers have spared no time or expense in creating and reproducing fine finishes on wood. They have sent their expert finishers all over the world to study first hand the authentic period furniture and interior room designs of the so-called golden periods of decoration which are rich in the artistic works of master craftsmen. These experts have reproduced color, texture and finish of furniture and interior wood trim in ancient baronial halls, castles, cathedrals and other structures built during the rich historic periods of design and decoration.

So, good furniture of modern manufacture offers a remarkably fine field for study for the finisher whose work is that of finishing wood trim of buildings.

CHAPTER II

PREPARATION OF NEW AND OLD SURFACES

Getting a surface ready for finishing is work which should be done with the utmost care when the finish is to be the finest possible and even for ordinary jobs. Unfortunately the price received for many jobs of finishing is so low that it is quite impossible to do more than the most rapid cleaning and sandpapering,—so that is where the responsibility must be placed for many muddy, cloudy natural and stained finishes.

New Surfaces.—Wood to be finished in natural or stained color is especially deserving of most thorough work in preparing it for the finishing process. It should first be dusted off with a duster brush or a broom in the case of floors. Then all spots of plaster, dirt or grease ought to be removed. Usually such spots will come off with a washing over with benzine, using a putty knife to scrape off as much as possible. If the wood is oak, walnut or other open-grain variety, be particular to remove dirt, lime and grease from the pores of the wood. When such spots are not properly cleaned, stain does not take hold and penetrate and the finish is thus spotty in appearance.

New surfaces which are to be finished with paint and enamel ought to be cleaned well, but there is no need to be so particular about light stains. All loose particles on the surface should, however, be removed.

New surfaces which show dark stains from rust or other substances should be bleached out in such spots before being finished in natural or stained colors. The bleaching methods will be found later on in this chapter.

New surfaces after cleaning should next be sandpapered if the finish is to be natural or stain colors. This is not necessary for paint or enamel finishes. If water stain is to be used many finishers prefer to brush or sponge on a water coating before sandpapering. The water stain will raise the grain of the wood, making little wood fibres stick up all over. If the surface is wet in this way before staining, the water stain does not raise the grain so much and the second sandpapering is very light. If the water wetting is not done before staining with water stain the sandpapering operation on some woods must be done so heavily that some of the stain color will be cut off the wood. This sandpapering operation on new wood before or after wetting should be done with No. ½ and No. 00 paper, depending upon the roughness of the wood. Sometimes it is well to go over the wood first with a No. 1 paper and finish up with a finer grade.

The cleaning necessary after sandpapering should be well done with a duster brush on ordinary jobs. On fine furniture and cabinets more effort should be spent to remove every particle of dust. In furniture factories the dust from sanding is blown out of the pores with compressed air.

Woods to be finished in natural color as light as possible, maple, birch, etc., are often bleached before any finishing coats of filler, varnish or shellac are put on. The bleaching raises the grain of the wood and a thorough job of sandpapering must be done after that process. The bleaching methods will be found later in this chapter.

New surfaces to be finished in natural or stain colors and which show cracks and holes should be filled to remedy these defects. Plaster of Paris soaked in water is preferred by many finishers for this filling because it will absorb stain and also will take on the coloring given by filler. Other putty does not absorb color. On stained finishes as a rule the putty is put into the cracks and holes after the stain is dry. Putty mixing formulas will be found later in this chapter.

After putty is dry it should be sandpapered down smooth and clean. Then the surface should be cleaned up around the repairs.

Old Surfaces.—Preparing an old painted surface for repainting or for an enamel finish simply calls for sandpapering to remove dirt, grease and roughness, assuming that the old paint is firmly attached to the surface. If it shows any tendency to crack and scale or alligator it should be removed entirely from the surface with sandpaper or liquid paint remover.

Old enamel surfaces which are to be refinished call for sandpapering just enough to cut the old gloss and clean up the surface. Defects such as holes, bruises and cracks should, of course, be filled with good lead and whiting putty.

Old varnish to be refinished with varnish, paint or enamel should be rubbed down clean and smooth with No. 1 sandpaper just enough to remove the gloss, dirt and grease, assuming that the old varnish has not crazed or alligatored. If it shows indications of an infirm hold on the wood, better take off all of the varnish with liquid or paste varnish remover. After sandpapering to remove high gloss some finishers prefer to wash down a varnished surface with benzole or with warm water and sal soda to make it absolutely safe to paint or enamel. The soda bites into the varnish a little.

Old varnished surfaces which are to be refinished with stain call for stripping off all of the varnish, using liquid or paste varnish remover. A thorough job must be done. If any of the varnish is allowed to remain on the surface, even in a very thin coat, it will prevent new stain from penetrating into the wood. A penetrating stain is then needed to do an even coloring of the wood. After stripping off the varnish a most thorough washing should be done to remove any wax left on the surface by the remover. Wash up with benzole, preferably. Benzine, naphtha or turpentine will also do this clean-up work.

On low-priced work restaining is sometimes done without removing the old varnish. The old varnish is rubbed down with No. 1 sandpaper to remove the gloss and clean up any dirt or grease on it. Then it is washed down with benzole brushed on to cut the old varnish a little,—or is washed down with hot water in which sal soda has been dissolved to do the cutting of the old varnish. The stain used for such work is spirit aniline stain which must be brushed on very deftly with as few strokes of the brush as possible to avoid raising or lifting the old varnish. Brush this stain only in one direction. For very cheap work a good brush hand can coat the surface with shellac to which a little pigment or aniline color has been added to make a stain. These processes simply color the wood and supply a gloss. They do not pretend to enhance the beauty of the wood. In this sort of work it is sometimes necessary to touch-up bare, worn-through spots with a coat of thin spirit stain before staining the whole surface,—this to make the worn places match the whole surface in color.

Old stained or natural varnished surfaces from which the old finish has been stripped off with varnish remover are often too dark in color to produce a nice finish with the new stain. Then it is necessary to bleach out the old color before restaining. The bleaching methods are presented later in this chapter.

Putty Mixing and Use.—Most of the putty used by the wood finisher on trim in homes and public buildings is that made by mixing white lead in oil paste with enough dry whiting to make a stiff paste. Dry color is added to tint the putty to match the natural or stained wood. Some finishers like to add a few drops of japan drier and some prefer a very little hard-drying varnish, floor, coach or interior spar. Tinting colors in oil do not serve the purpose like dry colors. The putty is put in place as a rule after the stain is dry. It should be mixed a little lighter, rather than darker, than the wood. The colors usually used in dry form are raw and burnt umber, raw and burnt sienna, yellow ochre and Vandyke brown. With mixtures of these colors and black practically any wood surface can be matched.

Putty made as above will not shrink or swell and so only one filling is necessary. Care should be taken, however, completely to fill the holes and cracks, pressing the putty well into place. Let the holes be a little over filled if anything, because the putty can be cut down level when dry with sandpaper.

After filling holes and cracks be sure to wipe off any knife marks and excess of putty around the fillings. If allowed to remain this putty will cloud the finish, especially on natural and stained colors.

Plaster of Paris Putty is used by some finishers on new wood to be finished in the natural color or stained. This putty will absorb stain and the color given by fillers. Lead putty will not. The plaster of Paris putty is made by simply submerging a handful of dry plaster of Paris in water. As long as it remains below the surface of the water it will not set. A small amount should be lifted with the putty knife and kneaded with the fingers. Press it into place and clean off the surface around it. Be sure to fill the cracks and holes full and level with the surrounding surface.

General Utility and Floor Putty.—A factory formula for making a general utility putty for filling wood work, for glazing windows and for filling floor cracks is as follows:

80 lbs. dry whiting, bolted
20 lbs. white lead, dry
10 lbs. raw linseed oil
5 lbs. grinding japan drier

To make a softer putty add a little more oil.

Cabinet Makers' Putty is made of fine wood sawdust from the kind of wood to be filled. The dry sawdust is mixed with a glue size made from 1 ounce of good quality cabinet glue and 16 ounces of water. A little aniline water color or dry pigment tinting color is added if needed to make the putty match the surface. Some add a little whiting. When this putty is well made and used it is practically impossible to detect the fillings, even in fine woods like mahogany and walnut

Knifing and Glazing Putty.—When a surface is so rough that a great many coats of material would be needed to make a smooth surface it is well to follow the old carriage and automobile painter's methods by filling the whole surface with a thin putty mixed to dry hard. It is useful for repairing bruised and damaged places when the finish is to be paint or enamel. Such putty is mixed by the use of white lead in oil paste to which dry whiting (fine bolted) is added. Mix this stiff putty well by pounding or kneading with the hands. Then add equal parts of japan gold size, linseed oil and turpentine. The putty is mixed thin enough to be spread on to the surface with a broad stopping or scraping knife, Plate 1. The surface is thickly coated and when the putty has been thoroughly pressed into the wood pores it is scraped with the same knife to remove any excess of putty without leaving any knife marks. The aim should be to fill all depressions in the wood but not to coat the whole surface over solidly like a thick paint would do. In other words, don't hide the wood except in the rough places which you want to fill. Allow the putty to become hard and bone dry, then sandpaper down smooth to make a level surface.

When a very hard-drying, knifing putty is wanted and one which can be rubbed with pumice stone and

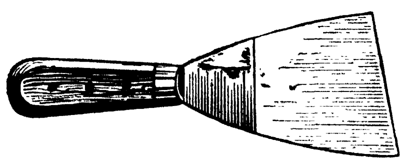

Plate 1.—The Broad Stopping Knife, Also Called a Broad Scraper. Used for the Application of Glaze-Putty, for Scraping off Scaling Paint and for Many Other Purposes.

water, it may be mixed by adding fine dry whiting and fine pumice stone (F F) to white lead in oil paste to make a stiff putty. Thin with rubbing or floor varnish or japan gold size.

Quick-Setting Putty.—On jobs which are to be puttied and then followed up within an hour or two with paint the putty may be best made by mixing a stiff paste with dry white lead and japan gold size. Add a few drops of turpentine if a quicker drying putty and one with a more porous texture is wanted. Another formula for a quick-setting putty calls for the use of white lead in oil paste, dry white lead, japan gold size and a little floor or rubbing varnish.

BLEACHING WOODS

The wood finisher has occasion to use bleaching solutions for the purpose of removing stains from woods to be finished or refinished,—such as rust stains, water and weather stains. He also needs a bleaching solution occasionally to bleach large surfaces of maple, birch, oak, walnut and other woods which are to be finished in as light a color as possible, for instance, oak, which is to be finished with one of the popular light gray, two-tone finishes with white filler, and walnut or gum, which are to be finished with the very light brown French walnut color. Then again when old stained and varnished surfaces are stripped off, removing all the old finish possible the wood is sometimes found to be too dark to take the new stain of light color and make a nice job. Then bleaching is resorted to.

The bleaching processes use water solutions and they raise the grain of the wood. So after the bleaching and neutralizing washes the surface is permitted to dry and is then sandpapered to cut off the raised wood fibres. Sometimes a very thin coat of white shellac is brushed on to make the wood fibres stiff so they can be clipped off easily with the sandpaper. This coat of shellac should be about a 2-lb. cut, that is, 2 lbs. of white bleached gum shellac to 1 gallon of denatured alcohol.

After bleaching the surface may contain a bit of the chemicals and it is well therefore to wash up immediately with clean water, using a sponge. Then a coat of ordinary table vinegar without dilution will neutralize any alkaline traces left on the surface and make it safe for finishing coats. The surface should be allowed to dry at least twelve hours before the finishing coats are put on.

There are many chemical solutions used for bleach-

Plate 1a.—How rough end-wood, bruises, scratches and other rough places in wood trim and furniture may be leveled off to make a perfectly smooth finish by use of glazing putty.

Plate 1b.—Proper sanding of woods to be finished natural color or stained calls for the use of fine sandpaper wrapped around a block of wood. Move the sandpaper only with the grain, never across grain. Cross sanding makes scratches that are magnified greatly by the stain and varnish or wax coats.

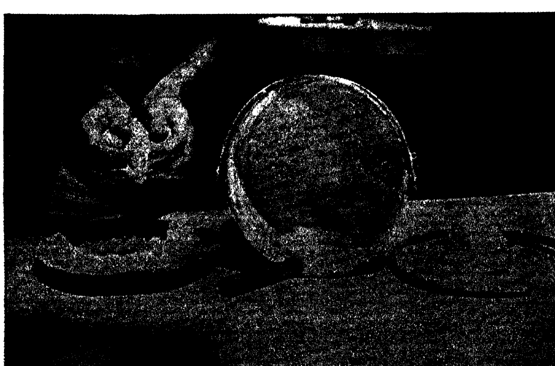

Plate 1c.—Oil putty for holes is mixed from white lead paste and dry whiting. Mix and knead by hand, then beat well with a wood club or

Plate 1d.—Preparing an old floor for refinishing in natural light color, a thorough scrubbing with brush and No. 3 steel wool may be required before bleaching.

ing. Some are most effective on one wood while others succeed best for other woods. The oxalic acid solutions are probably used most by wood finishers in the house building industry.

Before using any bleaching solution it is best to thoroughly clean and scrub a surface, using hot water to which soap and a little sal soda have been added. Use a wad of No. 2 or No. 3 steel wool for the scrubbing, then wash up well with clean water, using a sponge for the purpose.

Oxalic Acid Bleach.—Oxalic acid can be secured from any drug store and from paint store stocks in dry crystal form. Usually a saturated solution is made by dissolving as much of the acid crystals in a gallon of water as the water will take up. Hot water is best and the solution is more effective when put on to the surface to be bleached while it is very hot. Use an old flat wall brush or calcimine brush to apply the solution and let it dry on the surface. For bleaching weather stains and also dark sap streaks in wood 8 ounces of oxalic acid in two quarts of water is about right. If the first application of bleach does not remove the discolorations or make the whole surface as light as you want it, apply the same solution hot a second time or repeat several times.

When sap streaks or whole surfaces to be bleached are greasy, wipe them off by rubbing with denatured alcohol and let dry before the bleaching solution is put on.

Chlorinated Soda Bleach.—When dissolved in water chlorinated soda makes an effective bleach, especially if followed by a solution of peroxide of hydrogen. To make chlorinated soda proceed as follows:

SOLUTION "A"

10½ ounces sal soda, dissolved in 20 ounces of water.

SOLUTION "B"

5 ounces ordinary chloride of lime (household).
12 ounces of water.

Mix well by stirring and allow the solution to settle.

Pour off the clear liquid into another vessel and there will be a sediment in the bottom of the first container.

Add to the first container 12 ounces more of water; stir well; let settle and pour off the clear liquid again into the second vessel.

Now add a little more water, an ounce or two, to the sediment remaining in the first vessel and strain the solution after mixing through filter paper or silk into the second vessel.

SOLUTION "C"

Mix solutions A and B together and you should have a clear liquid bleach of a greenish color having a faint odor of chlorine and a strong alkaline taste.

Use this bleaching solution hot and brush on with an old flat wall brush; let dry; wash up with clear water.

Peroxide of Hydrogen Bleach.—This chemical is a positive acting bleach when freshly made. It is a little expensive when large quantities are needed for large areas of surface. For small stains on patches and spots it is entirely practical. Brush on and allow to dry. Wash up with clear water.

Hydro-Sulphite of Soda Bleach.—When used in a 10 per cent solution,—10 ounces of this chemical to 90 ounces of water, it makes an excellent bleach. Brush on one or several coats to the wood to be bleached. Let each coat dry, however, before another is put on. Wash up with clear water.

Chlorinated Lime Bleach.—For bleaching walnut especially, as well as other woods, the ordinary household chloride of lime dissolved in water and brushed on to wood is excellent.

Permanganate of Potash Bleach.—This chemical dissolved in water and used of varying strengths makes a good bleach. The wood will have a purple hue when dry. Apply with a brush. When the above solution is dry put on a second wash made by dissolving hyposulphite of soda in water, a saturated solution. This is the solution used by photographers for a fixing bath. A 5 per cent solution of oxalic acid in water is also effective as a second wash over permanganate of potash.

PAINT AND VARNISH REMOVERS

There are certain liquids which a finisher can use to remove paint and varnish, such liquids as benzole, wood alcohol, caustic soda and water solutions, ammonia, etc., but as a general proposition it will be found that it is most economical to use the factory prepared patented liquid and paste removers. The cost may seem high, but it also costs money to fuss around with mixing solutions with which you are not entirely familiar and which seldom work as effectively as the patented removers. In these days of high-wage scales time must be reckoned as money.

There are two or more grades of patented removers on the market. They are made in thin liquid form for flat surfaces and in thin paste form for vertical surfaces. The cheaper grades of removers depend upon wood alcohol and benzole largely as the solvents for action, while the more expensive and better removers use acetone as the principal solvent. Most of the removers sold now are made under the same license patents which cover the use of wax in the removers to prevent the very volatile solvents from evaporating too rapidly and before they have dissolved the old varnish or paint.

It pays to buy the best quality of patented removers as a rule. When they work too fast on large surfaces to permit scraping off the old varnish before it gets hard again, add more wax to the remover. Place the can of remover in a pail of boiling hot water and when the liquid is hot shave into it a few ounces of paraffine wax. Then it will remain wet longer and permit you to do a cleaner job. Also it is well to coat not so large a surface at a time when the remover permits the varnish to get hard again.

There are many formulas in use among furniture finishers and others when a large number of similar surfaces are to be treated, such as stripping off the finish on many school seats. These removers must be handled with rubber gloves and with care generally because most of them burn the skin. Also they will turn the wood to a darker color if allowed to remain on the surface too long. Following are some of the common formulas used:

REMOVER FORMULA NO. 1

20 ounces caustic soda (98% strength)
100 ounces of water
Dissolve the caustic soda in the water a little at a time
20 ounces mineral oil (light machine oil)
20 ounces fine sawdust
Mix the oil into the water and soda by stirring well until an emulsion is formed, then stir in the sawdust well. Run the whole mass through a paint mill or mixer and use the paste while fairly wet. Allow time enough for the remover to work, then scrape off the softened paint and

clean up the surface thoroughly with water in which a little vinegar has been mixed to neutralize any soda left on the surface.

REMOVER FORMULA NO. 2

8 pounds caustic soda (98%)
1 gallon water—dissolve the soda in the water
8 pounds bolted whiting
4 pounds corn starch
Mix thoroughly and use as a wet paste. Add more water if needed. Apply with old brushes, let stand long enough to soften the paint and scrape off. Use rubber gloves. Wash up with water and a little vinegar should be mixed into the water to neutralize the soda that may be left on the wood in the pores. Such soda would destroy new coats of paint or varnish if not washed off or neutralized.

REMOVER FORMULA NO. 3

4 ounces benzole of 90 degree strength
3 ounces fusel oil
1 ounce wood alcohol

REMOVER FORMULA NO. 4

5 quarts benzole, 90 degree strength
2½ pints acetone
½ pint carbon bisulphide
2 ounces paraffine wax
Mix the benzole and acetone, then add the last two items in the order given.

REMOVER FORMULA NO. 5

1 gallon benzole, 90 degree strength
1 pint fusel oil

1 pint acetone
$1\frac{1}{2}$ ounces paraffine wax

Mix the benzole and fusel oil, add the acetone and finally the wax.

REMOVER FORMULA NO. 6

$\frac{1}{2}$ lb. laundry starch dissolved in a little cold water
4 tablespoonfulls strong lye (household) dissolved in 3 pints water

Mix both solutions together and apply with an old fibre or bristle brush. Let the remover soak a while and scrape off the old finish with a putty knife, scraper or steel blade.

This is not likely to burn the skin unless soaked in it too long, but it will discolor wood. After using this wash make the surface clean with water. Then brush on a coat of ordinary table vinegar to neutralize any trace of lye left on the wood. If the wood is too much stained to be finished light it may be bleached.

Removing Shellac.—To remove shellac from floors and other wood brush on denatured or wood alcohol and scrape up the soft gum as rapidly as possible. Then wash over the whole surface with the alcohol as a final clean up. The denatured alcohol is cheaper than wood alcohol as a rule. Benzine will not do for the final wash-up. Turpentine does not dissolve shellac. Repeated applications of the alcohol may be necessary to remove all of the shellac. When the patented varnish removers are used to remove shellac be sure to wash up well with benzine or benzole later to remove any wax left on the surface from the remover.

Removing Wax from Varnish.—Before a waxed surface can be successfully revarnished or painted the wax must be removed. The new coats do not dry when spread on over wax. The wax must all be removed including what has lodged in the seams, cracks and pores of the wood.

The waxes usually used on floors and trim are soluble in benzine, benzole, turpentine and denatured alcohol. If you want to remove wax without injury to the varnish or shellac under it do not use alcohol; the benzine used freely will probably take off all of the wax if you scrub hard enough with it and sandpaper the surface well.

Removing the Remover.—None of the varnish and paint removers actually takes off the old finish of varnish; for instance, what the liquid or paste removers do, is to dissolve or soften up the old hard finish which must then be taken off the surface by scraping and wiping. In some instances, the soft sludge of varnish and remover must be scraped off with a broad scraping or putty knife. When the surface is of veneer glued on, this is about the only method safe to use, but on solid wood surface such as floors, and standing wood trim such as doors and casings, there is a much faster and easier way to remove the old soft varnish sludge. Take a pail about three-quarters full of hot water and add about one-half box of Gold Dust. Take a large wad of No. 3 coarse steel wool, dip it into the water solution, and rub off the soft varnish sludge upon which the liquid varnish remover has been working a few minutes. Rinse off the steel wool wad in the water as often as it becomes clogged, and when all of the sludge has been loosened and removed with the steel wool and scraper, wash well with clean hot water. This is not only a cleaner and faster removing method, but it removes the old finish more completely and at the same time bleaches the wood to some extent. Obviously, if this water washing were used on veneered furniture, there would be considerable risk of dissolving the glue that cements the veneer to its solid wood core.

CHAPTER III

STAINS IN GENERAL

THERE are a few considerations about stains in general which are worth brief mention before considering each kind of stain in particular and its characteristics. One aim of this chapter is to simplify what appears to be a rather complex subject. Changes in basic stain materials have occurred often in recent years and that accounts for some of the uncertainties in the minds of many. Some ideas about the old-fashioned, home-cooked stains using vegetable and mineral substances still persist. There is confusion about acid stains, so-called, because the aniline and coal tar dye water stains are still called acid stains by many. This designation is not correct, although the water soluble anilines were at one time made available as water stains by using an acid process. Then there are some who know only the advantages of the oil pigment stains and not their limitations. And about the modern coal tar dye and aniline stains few are really well informed.

The day has passed when a finisher can profitably spend his time making stains in the old way from the cooking of dyewoods, minerals and other substances. When he counts his time cost at prevailing wages no further argument is needed. Convenience and time saving are much in favor of using the best of manufactured ready-prepared stains.

Stains are usually named after the liquid in which the coloring matter is soluble. The logical classification of stains as they are made and used today, the classification which will be followed in the chapters to follow is:

Water Stains,—
- aniline and coal tar dye
- color pigment
- chemical,—acid and alkaline

Spirit Stains,—
- aniline and coal tar dye

Oil Stains,—
- aniline and coal tar dye
- color pigment

Varnish Stains,—
- color pigment, aniline and coal tar dye
- shellac.

There is no use confusing the subject by a consideration of the old time vegetable dye wood, mineral and gum stains. A few of them are still used by industries and craftsmen for special purposes and an occasional formula uses some of them in connection with other color substances, but as a class they have served their purpose and passed out of use. The aniline and other coal tar stains will produce any color that was ever produced with those old stain substances and hundreds of others too in a more permanent form.

Each of the various classes of stains is possessed of certain advantages and some disadvantages. What these are will be discussed in detail in the chapters to follow dealing with each type of stain. Various kinds of wood take a single stain with different color effect. The difference may be only a lighter or darker shade of the same color or it may be a similar color with a different hue. The brown stain, for instance, which will give you an excellent walnut color on gum will produce only a light brownish yellow on birch and maple.

The wood finisher must know intimately the characteristics of each class of stain, their advantages and disadvantages, penetration, brushing peculiarities, tendency to hold their color or fade soon, etc. Without such knowledge he cannot follow specifications and match samples of colors in a permanent way. Then there are other considerations such as variations in kinds of lumber used on one job and on different jobs, variations in grades of lumber, select and not select as to color and grain figure and variations in ideas of colors described by standard names. A color sample given to a finisher to match may show the color wanted, but the sample may be birch while the wood to be finished is gum, cypress or pine. Birch and cherry have a natural pinkish hue while some gum when stained has a greenish tone. The finisher must not only know these characteristics but how to treat the woods to make them match the other woods in color.

CHAPTER IV

FACTORY PREPARED STAINS

MOST of the stain used today in the building trade is of the factory-prepared type. Oil stains and spirit stains probably are used to a greater extent than water stains, although the latter are greatly preferred for very high class work. The oil stains are not pigment stains but rather are made with many coloring substances in addition to the oil-soluble aniline and other coal tar dyes. The spirit stains are practically all colored with the coal tar dyes, although there are some exceptions.

A busy wood finisher finds considerable advantage in using the factory-prepared stain. He usually uses several brands until he finds a line which suits his needs well and then confines himself to those stains. He secures finished wood panel samples from the manufacturers and soon becomes familiar with the working qualities of these stains and learns how to vary them to get different effects on all the commonly used woods. When he is given a color to match and a specification which is very different from the ordinary standard finishes he finds the manufacturer's service department willing to make up special stain for the purpose, or to direct his mixing of standard colors to produce the match needed.

With a set of wood sample panels showing all of the common or standard colors on the various kinds of woods the finisher is in position to expedite his customers' selection greatly. Then if he has pasted a label on the back of each sample showing the name or number of the stain used, the kind of wood, the finishing method as to filler, gloss, polish, rubbed, flat varnish or wax, he loses no time dealing with customers or giving out his shop orders when a large amount of work is being done.

When a finisher selects a brand of stains made by one of the larger and long-established manufacturers he finds much advantage in the fact that the colors are standardized in shade and working qualities. The fact that these characteristics remain unchanged year after year saves time for the finisher when matching colors, mixing and tempering his stains and in the brushing and wiping qualities. In other words, when his stain for walnut, for instance, is always the same color exactly and always the same strength, he has eliminated two variables and he has less trouble in matching samples. He soon learns exactly what that stain will do on each kind of wood. Then to change the color he adds other colors or more liquid to it, or he may in some cases spread one stain over another to gain the final color wanted.

The variety of stains offered by manufacturers is ample for all practical needs. For instance, here is the list of standard colors offered for the ordinary run of wood finishing in homes and public buildings:

OIL STAINS

Fumed Oak	Early English
Dark Oak	Brown Mahogany
Golden Oak	Red Mahogany
Mission Oak	Cherry
Light Oak	Rosewood
Weathered Oak	Malachite

Gray
Brown Flemish
Walnut
Jacobean
Antique Mahogany

SPIRIT STAINS

Brown Oak
Bog Oak
Light Mahogany
Dark Mahogany
Flemish Oak
Moss Green

DRY ANILINE AND COAL TAR STAINS

Mahogany Fast Red, water soluble
Mahogany Fast Brown, water soluble
Walnut, water soluble
Walnut R, alcohol soluble
Golden Oak, alcohol soluble
Bismarck Brown, water or alcohol soluble
Black Nigrosine J., water soluble
Black Nigrosine WN., alcohol soluble
Yellow Acid HM., water soluble
Orange Y., water soluble
Scarlet 2 R. B., water soluble
Green M X, water or alcohol soluble
Methylene Blue 2B, water and alcohol soluble
Fuchine Magenta RT, water and alcohol soluble
Violet 3 BPN, water and alcohol soluble

There are hundreds of other colors of this class available, but the use of these and by mixing two or more colors together they will serve most purposes. Sold by the ounce and pound.

PERIOD STAIN FINISHES

Brown Hepplewhite,	Acid (water) Stain
Chippendale,	" " "

Sheraton,	Acid	(water)	Stain
Baronial Oak,	"	"	"
Cathedral Oak,	"	"	"
Hungarian Oak,	"	"	"
Butler Oak,	"	"	"
Old English,	"	"	"
Kaiser Gray,	"	"	"
Fumed Oak,	"	"	"
Flemish Oak	"	"	"
Colonial Mahogany,	"	"	"
Antique Mahogany,	"	"	"
Austrian Oak,	"	"	"
Adam Brown Mahogany,	"	"	"
Early English,	Oil	Stain	
Weathered Oak,	"	"	
Flanders Oak,	"	"	
Antwerp Oak,	"	"	
American Walnut,	"	"	
Jacobean,	"	"	
William and Mary,	"	"	
Louis XVI			
Mission Stains			
Queen Anne			

The prepared stains are sold in pints, quarts, half-gallons, gallons and barrels.

CHAPTER V

WATER STAINS

ANILINE AND OTHER COAL TAR DYE STAINS

WATER stains are those which are composed of coloring matter soluble in water and which have a water vehicle as the principal part of the liquid. If you will think of them as four kinds in this one group it will be easy to learn their characteristics and the best use which you can make of them. They are: water soluble aniline and other coal tar dye colors; chemical (acid and alkaline) water stains; color pigment water stains; and dyewood water stains.

The first group, aniline and other coal tar dye stains, is the most modern and most important stains for the wood finisher in the building field for fine work, but the oil and spirit aniline and coal tar dye stains are used more extensively in this field, for ordinary work.

The second group, chemical acid and alkaline stains, is little used in the building field, but in the furniture trade there is growing use of them and the honors are about equally divided between the chemical and aniline coal tar dye water stains.

The third group, color pigment stains, are those made by the finisher with ordinary high grade tinting colors in dry form or what are called distemper graining colors. Pigment water stain is seldom used. Oil pigment colors are used for small jobs on soft woods and for repair work, making oil stains.

The fourth group, dyewood water stains, is practically obsolete. Since the introduction of aniline and coal tar dye stains, finishers cannot afford to spend the time needed to cook and fuss around with mixing stains from dyewoods, roots, bark, gums, berries, etc.

MODERN WATER STAINS

Considering the aniline, coal tar dye stains and the chemical stains as the modern group, not the pigment and dyewood stains, the following advantages and disadvantages are the important ones to keep in mind concerning water stains.

For the finest kind of finishing on interior wood trim of buildings, cabinets and furniture, water stains are easily the best type, particularly the aniline and coal tar dye group which comes in convenient dry and liquid form. When a finisher is anxious to build up a reputation he will be wise to use water stain as a rule and get a price which will cover the little extra labor of sandpapering the raised wood grain caused by the use of water on it.

The particular virtue of water stains of the modern type is that they are far clearer, more transparent, more brilliant in color hue and more permanent against the fading effects of strong light. These stains show up and enhance the natural color shadings and grain figure of beautiful woods to greater advantage than other stains. Fine finishing calls for coloring the wood fibre, not covering or obscuring the natural beauty of the wood, and water stain has no equal in this respect.

The permanency of water aniline, coal tar dye and chemical stains is far greater than spirit anilines and oil anilines and may be considered absolutely permanent for all practical purposes.

In the matter of available colors the water anilines and coal tar dye stains are far greater in number than all others; they are numbered by the hundreds.

In the matter of penetration of the wood water colors are also superior. Wood in its natural state, in trees, is composed of numerous little cells in the live tree which are filled with water. When the tree is cut down and the wood dried these cells are filled with air. Dry wood absorbs water more evenly than oil or spirit liquids, and the water, being a natural element to the tree, penetrates more deeply into the wood. The water evaporates more slowly than alcohol and other spirits, leaving a more even distribution of the stain on the surface. It is interesting to note, too, that wood at a temperature of about 90 degrees absorbs water better than at lower temperatures, hence water stain penetrates deeper at that temperature.

Water stains are cheaper, especially in the dry form of anilines and coal tar dyes, than oil and spirit stains. And even taking into consideration the extra labor and cost of sanding the raised grain of the wood many finishers consider water stain cheaper. Water stain spreads over and colors more surface per gallon than other stains.

There are certain surfaces like show windows, window sills, frames and casings, sun parlor wood trim, etc., which are subjected to very strong light, often the direct rays of the sun, which can only be finished permanently as to color when water stain is used. This is especially true of the mahogany reds and browns and the green stains. Oil and spirit stains fade too quickly on such surfaces to be practical.

Water stains are just as permanent and effective generally for light colors as for dark colors. They are necessary for such light stain finishes as the grays, light greens, cherry, Circassian walnut and French walnut. The oil anilines are good only for dark colors, used in light colors they and the spirit anilines fade too rapidly.

Now as to the disadvantages of water stains. The superior finishes which are produced with water stains are not gained without some extra effort and cost. These stains raise the grain of the wood and the rough surface so produced must be sandpapered down smooth to cut off the wood fibres so raised by the water. This raising of the grain of the wood is most evident on gumwood, fir, cypress, bass, poplar and white pine.

The machine finishing of lumber and machine sanding cuts off wood fibres to make the wood smooth, it is true, but these operations also press wood fibres into the open cells, closing them against the entrance of the filler. Sponging the wood with water or the use of water stain of the aniline or chemical groups surely does open the wood grain and make it possible to fill the surface properly. Due credit should be given this fact when the disadvantage of sandpapering the raised grain to smooth the surface again is cited as an objection to water stains.

Some finishers on fine work prefer to sponge the wood with water before staining. When dry the raised grain is sandpapered. When the water stain is then put on it does not raise the grain again so much. When the water coat is not used first it is sometimes necessary to do so much sanding on certain woods on top of the stain that the beauty of the finish is impaired a little by cutting through the stain.

When two coats of water stain are to be used there is no need to sponge the wood with water first. Sandpaper after the first coat of stain.

Water stain is a little more difficult than oil stain to brush on to avoid having laps and joints show, but not more difficult than spirit stain. Some manufacturers add a little shellac to spirit stain to enable the unskilled finisher to brush it out more easily and to avoid laps. A careful workman has no difficulty, however, in producing a good job, using a large brush for the application of the stain. When a surface is particularly difficult to coat with stain without showing laps and joints a coat of water may be brushed on just ahead of the stain. The stain should follow immediately before the water dries.

When water stain appears too dark after brushing it on the wood it can be made lighter in color by wiping it while dry or wet rather deftly with a sponge wet with water. You must be careful, however, not to wipe it lighter in some places unless you are trying to produce an antique or high-lighted effect as when wiping out the center of panels to make them lighter, leaving the corners, mouldings, etc., dark.

In the application of water stain use the brush rather dry, that is, don't load it too much with stain. Use a wide brush, a four or four-and-one-half-inch wall brush or a calcimine brush.

On very thin veneer and delicate wood structures water stain is not practical. It swells the wood and raises the grain too much. On such surfaces spirit and oil stains are best.

The application of water stain is best done with two or more thin, light coats rather than one strong, dark coat. Light coats are easier to brush on without showing laps and joints or streaks. Allow each coat to dry before putting on the next. Then you can judge the color already gained better than when wet. The surface should not be flooded with the stain. That might have a tendency to loosen up veneer on doors and of course the more water you put on the more the grain will be raised.

Hot water stain penetrates hard woods better than cold water stain and it is best to use any water stain hot, or at least warm, never ice cold. Soft rain water makes the best stain.

Some finishers use a sponge to apply water stain, but a large brush is better. The sponge carries more stain and the rubbing with it is likely to raise the grain fuzz more than a brush will do.

A gallon of water stain will cover from 400 to 500 square feet on soft woods. It will cover about 700 square feet on hard woods, one coat.

ANILINE AND COAL TAR DYE WATER STAINS

The extensive use and increasing importance of dye stains and tinting colors which are derived from coal tar make it desirable to present here a brief description of them.

The word aniline is being used rather broadly in the paint trade to designate all coal tar colors, whereas many of the colors are not anilines. Many, however, are very closely related to anilines, being coal tar dye derivatives. A great many of the colors commonly used are anilines.

The aniline and other coal tar dye stains are made from the light, middle and heavy oils which are cooked out of coal. By various fractional distillations over two thousand colors have been made available for textile dyes, tinting colors, stain colors and many other coloring uses. About ninety-five per cent or more of the colors now used for water stains are secured from the coal tar dye sources. One phase of the marvelous accomplishments of chemistry is indicated by the very numerous products which this science has been able to produce from coal. Note these on Plate 2.

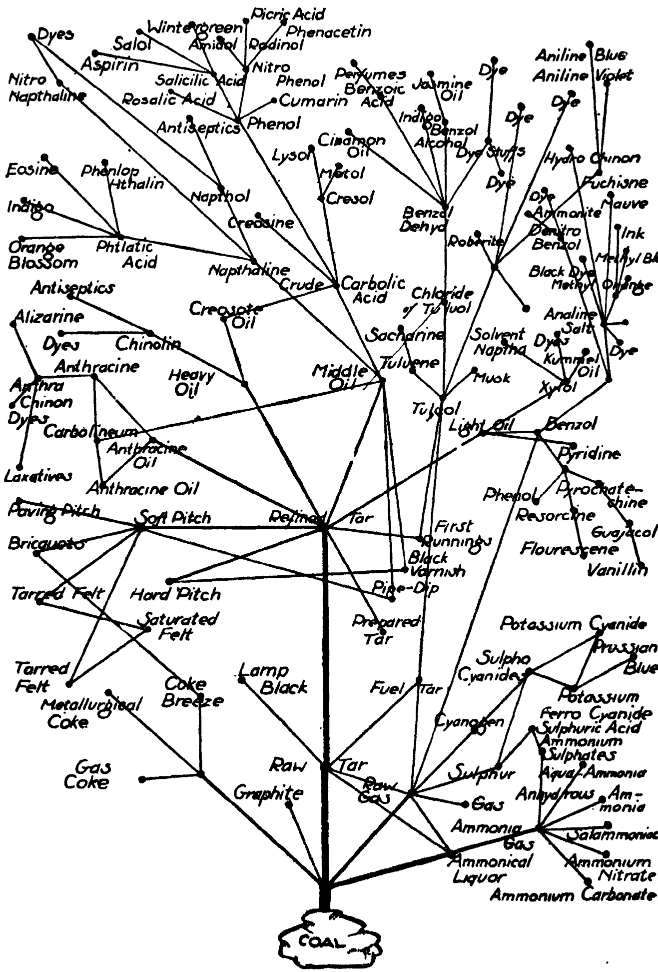

Plate 2.—Indicating Some of the Numerous and Varied Products Which the Modern Chemist Takes out of the Common Black Tar Boiled out of Soft Coal. The Colored Dye Stuffs Alone are Numbered by Thousands.

The first artificial coal tar dyes, called mauve and magenta, were made by Perkins from coal in 1865. From that beginning a tremendous development has taken place. Now all dyestuffs are of artificial coal tar origin with but few exceptions. Even natural indigo and madder lakes have been displaced by coal tar indigo and madder lake. The many lake color pigments used by the old time carriage and auto painter are nearly all made today under the same names but from coal tar dyes.

In the paint industry we hear most about aniline colors, alizarine reds, nigrosine black, para reds, chinolin, toluidine red and eosine, but there are a great many others. The coal tar dyes come to the painter in many forms as stains and tinting colors as well as in ready prepared paints. The stains are marketed in dry powder form soluble in water or alcohol, benzine, benzole, oil, etc. They are designated as water-soluble, spirit-soluble and oil-soluble colors. The factory-made stains are largely, but not entirely, made with coal tar dyes. Many of the tinting colors which are of earth pigment origin are toned and brightened up with coal tar dyes. The coal tar dyes resulting from the chemical processes direct are very finely divided pigments as to texture and have very little hiding power or opacity. They do have exceptionally great tinting strength, however, and are precipitated in the chemical process upon inert base pigments like barytes.

The coal tar colors are broadly classified as acid colors, basic colors, spirit colors, oil colors and direct colors. The acid colors are water soluble and can be mixed with acids or reacting chemicals. They interest the furniture industry mostly and all who use water stains. The direct colors can be mixed with the acid colors. The basic, spirit and oil colors are never mixed with acid or direct colors.

The colors of the coal tar group represent all degrees of permanency in strong light and direct sunlight. The eosine red coal tar group includes colors which are quite fugitive, fading too soon to have a wide range of utility. Magenta (mauve) is quite fugitive but enjoys rather extensive use among artists and decorators for its own peculiar color quality. The alizarine reds are permanent in strong light but not in direct sunlight, nor to the degree that earth colors are permanent. Toluidine red is strictly permanent in strong light and to a remarkable degree. It does not bleed. Its cost is rather high, however. Rose lake and rose pink are of the amaranth coal tar group and are only fairly permanent but quite extensively used. Vermilionette, an eosine coal tar color, fades too readily in sunlight to have great utility. Harrison red, also a coal tar color, is bright in hue and fairly permanent. Geranium lake is another eosine color which is rather fugitive and fades too much in strong light.

Some of the coal tar colors which fade too soon in strong light prove much more permanent when covered with varnish, shellac or wax. The coal tar colors which are absolutely soluble in both water and alcohol are not as a rule fast to strong light.

Most coal tar reds are stable chemically and cause no unfavorable reactions when mixed with other colors, pigments and liquids and when used in undercoats. One of the reds, however, has caused a great deal of trouble in years past, para red. It is soluble in oil and has been extensively used in the past for making bright red paints for farm machinery and for making red mahogany stains. A great deal of this stain was used on birch and maple doors and interior trim for houses. When these surfaces are refinished with paint or enamel the stain "bleeds" through many coats, giving a pink tint to white and light colors. Para reds are now made which do not bleed. The bleeding reds should never have been sold as stains. Sometimes a coat or two of shellac will stop the bleeding. This is especially true if the old finish is stripped off and washed up thoroughly with alcohol to remove as much of the stain as possible. In extreme cases, however, nothing short of a coat of black paint, flat, or a coat of aluminum bronze, or both, will seal up these bleeding reds.

Stain is simply a mixture of coloring matter in a liquid. There is a limit to the amount of coloring matter each liquid will dissolve per gallon. When that limit is reached the stain solution becomes cloudy, or may precipitate coloring matter which settles to the bottom of the pot, or it may do both. So when a clear, color-saturated stain does not produce a color on wood which is dark enough in one or two applications, allowing each to dry, don't overload the liquid with more coloring matter. It is better to find some other stain to do the job alone or as a first coat over which the other stain is used. Often two or more stains mixed together will give the color wanted. If it is convenient to use a stain quite hot it is satisfactory to make a supersaturated solution without having a cloudy stain or one from which the coloring matter crystalizes and precipitates to the bottom of the pot.

Heat increases the solubility of colors of the coal tar class, but if you use hot water, benzine, turpentine, alcohol, mineral spirits, etc. for the liquid in order to dissolve more coloring matter and secure a darker color and greater penetration of the stain into the wood, the stain should be kept hot while being brushed on to the wood. If the stain becomes chilled the aniline coloring matter will precipitate gradually as the stain gets colder. The first hot stain applied will be darker than the later applications of colder mixture.

In cold weather if aniline or other coal tar water stain gets chilled the coloring matter will slowly crystalize and settle to the bottom of the pot and the stain will then be lighter in color. It should be heated to redissolve the color. Alcohol spirit stains are affected by cold to a much less degree than water stains. Oil stains are not so affected. Nigrosine black is more completely soluble than some others like the orange and other light colors.

When water soluble aniline and other coal tar colors are dissolved in hot water and, upon cooling to 70 degrees, precipitate color which settles to the bottom of the pot a super-saturated solution has been made. More coloring matter has been dissolved by the heat than the water can carry at a lower temperature. The remedy is to add more hot water.

In manufacturing processes where large quantities of small articles like toys are stained by dipping them into a super-saturated solution of stain the stain is kept hot to the boiling point by a steam jet or coil in the tanks.

Coal tar colors are usually sold in dry powder form, although factory-prepared stains include these dissolved in water, spirit and oil and sold by the gallon. The dry stain colors are concentrated as to coloring matter and their great strength makes it necessary to use only a very little with each gallon of water to make a strong stain. An ounce or two to the gallon is often enough, depending upon what particular color you are mixing and how dark a stain is wanted. The dry stain is sold by the ounce and pound.

Where hot water is not available on the job it is better to buy the stain in liquid form of standard colors. The dry form costs less per gallon, however, and permits the mixing and blending of colors to suit the needs in matching.

The dry stain powders are often composed of fine and coarse particles. The finer particles settle to the bottom when the packages are subject to vibration or jarring. Care should be taken to see that the dry powder in a package is well mixed before using. The stain will not work right otherwise. It is also important to keep dry stain powders in a dry place and sealed up tightly in the cans. They will absorb moisture from a damp atmosphere. Deterioration will result.

A Stain Color Palette.—The water soluble aniline and coal tar stain colors from which practically any stain color on the market can be duplicated as to color are the following, used alone or intermixed with each other: black, brown, orange, red and yellow.

Blacks,—nigrosine J and naphthalene
Brown,—Bismarck, loutre, seal
Brown Mahogany,—Orange and naphthalene black
Reds,—Scarlet or carmosine
Orange,—Orange Y and orange G
Yellow,—Naphthalene yellow and auramine yellow

It is a good plan to make up concentrated stock solutions of these aniline colors by dissolving several ounces of dry color in its proper liquid and placing in tightly corked bottles or jugs. The gallon distilled water bottles are fine. Then when you want to mix a quart or gallon of stain of any color you can do it quickly by mixing two or more of these colors and thinning.

Stock Colors in Water-Solubles.—The water soluble aniline and coal tar dye colors are counted by the hundreds but the following list, which is typical of the stocks carried by paint supply houses, is adequate for all practical needs, since they can be intermixed to produce hundreds of lighter and darker colors. Other colors can be supplied for special purposes. These are sold by the ounce and pound in dry form. The names are now practically standardized, although some manufacturers and jobbers add their own private brand names and numbers to them:

Mahogany Fast Red	Orange Y
Mahogany Fast Brown	Scarlet 2R B
Walnut	Green M X crystals
Bismarck Brown (red in color)	Methylene Blue 2 B
Black Nigrosine J	Fuchine Magenta R. T.
Yellow Acid H M	Violet 3 B P N

The mixing of these dry stains is best accomplished with boiling hot water. Very little stain powder is needed, from an ounce to several ounces to the gallon of water, depending upon how strong a stain is wanted, the kind of wood and the color being used. A typical formula:

1 to 2 ounces dry stain
1 gallon hot water
½ pint table vinegar to help the stain penetrate a greasy wood.

WATER STAIN MIXING FORMULAS

ANILINE AND COAL TAR DYE

In the furniture industry considerable effort has been exerted to standardize colors of finishes to be used under certain names. Much progress has been made in this direction. For instance, standard formulas are now in use generally for Standard American Walnut, Standard American Mahogany, Standard Brown Mahogany, Standard Jacobean and Standard Fumed Oak. Definite formulas and colors are in use under these names. Many other names in use, however, designate finish colors quite similar but with some variation as made by different manufacturers.

The wood trim in houses and public buildings has always been finished to a considerable extent, at least, to accord with the furniture finishes. To gain complete harmony in interior decoration it is well that this tendency should increase until both the furniture and building industries are working on standard colors and names for colors. Individual preferences for color effects will always demand something a bit different than the standard, but if there is a standard to work by it will always be easier to produce the special color effects wanted.

The success of any formula depends absolutely upon the use of color ingredients which are of the same coloring strength as those used in producing the formulas used. When using the aniline and other coal tar dye stains little difficulty will be experienced in getting color matches true to name and formula, because such colors have been pretty well standardized as to character and strength, although some differences do exist between brands of the same colors put out by different manufacturers. The cheaper grades do not, of course, possess the same color value or tinting strength as the higher quality stains. Formulas are usually based on high quality stains. It is not difficult to check colors, however, since one usually has a pretty fair idea of the color he ought to get before staining is done. He usually knows, for instance, that it is a brown with a certain hue and other characteristics which should be produced under a certain name. If not, the finisher had better get a finished wood panel sample showing the color from stain manufacturers. Or, he may study the finish by the name wanted as produced upon correct period furniture made of the kind of wood for which the finish was originally designed.

To illustrate this point further, if you are not certain just what kind of a brown is correct for fumed oak color, study that color as produced by the real fuming process, not by stain, and on oak. Fumed oak color finish is done on many kinds of wood. All such colors resemble the original finish by the fuming process on real oak, but there are some differences. Better start right by making a study of the real thing on fine furniture.

Some finishers customarily add caustic soda or lye to all aniline colors to set the color and make them "take" on the wood. It is far better except where a standard formula calls for lye to use bichromate of potash, 1 ounce to a gallon of water. The bichromate of potash forms a natural mordant, especially on mahogany wood, and it has color-giving ability which is beneficial.

WEATHERED OAK WATER STAIN

On Oak or Chestnut

Formula:— 4 ounces walnut aniline crystals, dry, water soluble
1 gallon hot water
Brush on above freely for the first coat and let dry. Sandpaper and clean up.
6½ drams nigrosine J, dry, water soluble
1½ drams scarlet 2 R L aniline, dry, water soluble
1 gallon hot water

Filler:— None required. Open pores of wood grain are correct.

Finish:— Shellac, orange. Wax or flat varnish.

GOLDEN OAK WATER STAIN

On Oak and Other Woods

Formula:— 3 ounces loutre aniline, dry, water soluble
1 ounce naphthol yellow, aniline, dry, water soluble
½ to 2 gallons of hot water, depending upon the kind of wood and how dark a color is wanted.
Brush on one or more coats of the above stain. Sandpaper and clean up.

Filler:— For oak and other open grain woods use a silex (silica) filler. Color with Vandyke brown ground in oil and a little asphaltum varnish.

Finish:— Shellac, orange. Varnish and polish to high gloss.

FUMED OAK WATER STAIN

On Oak

Color, rich medium dark brown

Formula:— ½ ounce bichromate of potash, dry
½ ounce carbonate of potash, or carbonate of soda, dry
1 gallon of warm water
Brush on the above freely for the first coat, let dry and sandpaper.
2 drams acid brown aniline, dry, water soluble
2 ounces walnut aniline powder, dry, water soluble
1 ounce nigrosine black, dry, water soluble
1 dram naphthol yellow aniline, dry, water soluble
1 ounce and 6 drams sulphur brown M, aniline, dry, water soluble
Mix the above dry powders together. Mix 3½ ounces of this powder into 1 gallon of hot water. Brush on, let dry, sandpaper and clean up.

Filler:— No filler should be used for a correct finish.

Finish:— Rub in one coat of oil, mixed—2 ounces boiled linseed oil, 1 ounce japan drier and 5 ounces benzine. Wipe off with rags and let dry. Rub in a second coat, wipe off and let dry thoroughly. Brush on one thin coat of orange shellac. Wax or flat varnish.

ENGLISH OAK WATER STAIN

On Oak

Color,—walnut brown

Formula:— 10 ounces walnut aniline, dry, water soluble
¼ ounce (2 drams) lye, household, dry
1 gallon hot water
Brush on the above, let dry and sandpaper. Clean up.

Filler:— Silex (silica) colored with Vandyke brown ground in oil to a dark shade.

Finish:— Shellac, orange. Varnish and polish to high gloss.

EARLY ENGLISH WATER STAIN

On Oak

Color,—very dark walnut brown with nearly black filler

Formula:— 2½ ounces mahogany brown aniline, dry, water soluble
13 ounces nigrosine black, dry, water soluble
½ ounce picric acid, dry
Mix the above dry and dissolve 3 ounces in 1 gallon of hot water.

Filler:— Silex (silica) colored with Vandyke brown and drop black ground in oil.

Finish:—Orange shellac. Gloss varnish rubbed dull, or flat varnish, or wax. Gloss varnish rubbed to dull finish is strictly correct.

ANTIQUE EARLY ENGLISH WATER STAIN

On Oak

Color,—very dark rich brown, nearly black

Formula:— ¼ ounce walnut aniline, dry, water soluble
½ ounce mahogany brown aniline, dry, water soluble
4 drams lye, household, dry
5 quarts of hot water
Apply above as first coat freely with a sponge or brush. Let dry, sandpaper and clean up. Apply a second coat as usual with a brush. Brush on one thin coat of shellac (¼ orange and ¾ white).

Filler:— Silex (silica) color nearly black with drop black and Vandyke brown ground in oil.

Finish:— Shellac (¼ orange and ¾ white) 1 coat. Wax and rub to dull lustre.

FLEMISH OR FLANDERS OAK WATER STAIN

On Oak

Color,—brownish black

Formula:— 2 ounces bichromate of potash
1 ounce stick caustic soda
1 gallon of hot water
Brush on the above as the first coat and let dry. Sandpaper and clean up.
2 ounces nigrosine black, dry, water soluble
1 dram sulphate of iron dry

2 ounces acid brown aniline, dry, water soluble
Brush on as a second coat, let dry and do not sandpaper.

Filler:— No filler used on the correct finish.

Finish:— Rub in several coats of oil, mixed,—2 ounces boiled linseed oil, 2 ounces japan drier, 4 ounces benzine. Let dry thoroughly and rub to dull lustre. Wipe each coat with rags and let dry before putting on another coat of oil.

TOBACCO BROWN WATER STAIN

On Oak, Chestnut and Other Woods

Formula:— 8 drams naphthol yellow, aniline, dry, water soluble
1 dram bichromate of potash
1 gallon of hot water
Brush on the above as a first coat. Let dry, sandpaper and clean up.
28 drams walnut aniline crystals, dry, water soluble
3½ drams mahogany brown aniline, dry, water soluble
1 quart and 10 ounces of hot water
Brush on for a second coat, let dry. Apply one thin coat of shellac, ½ orange and ½ white. Sandpaper lightly if the grain has been raised again. Clean up.

Filler:— Silex (silica) colored dark brown with Vandyke brown ground in oil.

Finish:— Shellac, ½ white and ½ orange. Varnish and rub dull, or flat varnish. When this finish is not to be filled finish with shellac and wax.

STRATFORD OAK WATER STAIN

On Oak and Chestnut

Formula:— ½ ounce bichromate of potash
½ ounce carbonate of potash or carbonate of soda, dry
1 gallon of water
Brush on the above for the first coat. Let dry, sandpaper the raised grain and clean up.
2 drams acid brown aniline, dry, water soluble
2 ounces walnut brown aniline, powdered, water soluble

1 ounce nigrosine J, dry, water soluble
1 dram naphthol yellow aniline, dry, water soluble
1 ounce and 6 drams sulphur brown M, aniline, dry, water soluble

Mix the above dry powders together. Add 3 ounces of this powder to 1 gallon of hot water. Brush on as second coat, let dry and spread on one thin coat of white shellac.

Filler:—Silex (silica) color light pink with rose pink ground in oil. Wipe with and across the grain. The aim is to color the pores of the wood pink and not to fill them very much.

Finish:—White shellac. Wax and rub to a dull lustre.

MALACHITE OAK WATER STAIN

On Oak or Chestnut

Color, dark bluish green

Formula:—¼ ounce methylene blue 2 B, aniline, dry, water soluble
1 ounce green M X, aniline, dry, water soluble
1 gallon hot water

Brush on one coat, let dry and sandpaper the raised grain. Clean up. Apply a second coat of the same stain and do not sand.

Filler:—Silex (silica) color very dark with a mixture of 6 ounces of drop black, 1 ounce of Vandyke brown and 1 ounce dark chrome green, all ground in oil.

Finish:—White shellac, 2 coats. Rub dull.

ANTIQUE WALNUT WATER STAIN

On American Walnut

Formula:—It is very important to sandpaper the wood to a smooth finish and to make it clean. After sanding with No. ½ or No. 0 paper finish up with No. 000 or No. 0000. Get the dust out of the wood pores.

2 ounces loutre R, aniline, dry, water soluble
1 ounce Indian yellow H, dry, aniline, water soluble
½ ounce bichromate of potash, dry
1 gallon of hot water, not boiling

After thorough mixing brush this stain on evenly and let dry over night. Apply a thin coat of white shellac (2 lbs. of gum shellac in 1 gallon of denatured alcohol). Sandpaper lightly with old used fine sandpaper. Clean up thoroughly.

Filler:— Mix from ¾ white lead in oil and ¼ zinc oxide in oil. Thin just enough to apply with a wad of cloth to rub it into the wood pores. Thin with a mixture of 4 ounces of japan drier, 2 ounces of turpentine and 2 ounces of benzine. Let the filler set long enough to wipe off clean, wiping across the wood grain only with excelsior. The extremely white pores after filling will be subdued by the final finish.

Finish:— Shellac, ½ orange and ½ white. Apply a moderately thick coat, about a 4 pound cut. Sandpaper lightly and clean up well. Wax with any good prepared wax or mix one from the directions in Chapter XV.

WALNUT BROWN WATER STAIN
On Maple, Birch and Other Hard Woods

Formula:— 12 ounces walnut aniline crystals, dry, water soluble
½ ounce carbonate of soda, dry
1 gallon hot water

Mix the above to dissolve well, then strain through cloth. Brush on a coat and let it dry. Sandpaper, clean up.

Filler:— Shellac only, orange.

Finish:— Varnish, dull rubbed or polished with a high gloss, or flat varnish.

WALNUT BROWN WATER STAIN
On Pine, Fir, Poplar and Other Soft Woods

Formula:— 10 ounces of walnut aniline crystals, dry, water soluble
4 drams bichromate of potash, dry
1 gallon of hot water

Brush on one coat, let dry and sandpaper. If when sandpapering the raised grain you cut through the color, because the stain did not penetrate deeply, brush on a second coat of stain. Let dry. Rub with a wad of burlap or old fine sandpaper to smooth down the grain if raised by the second stain coat.

Filler:— None required.

Finish:— Orange shellac. Color the shellac a little with walnut R aniline alcohol soluble. Varnish and polish to high gloss. Wax or flat varnish.

STANDARD AMERICAN WALNUT WATER STAIN

(Standard formula introduced by the Furniture Manufacturer and Artisan in 1917 and adopted by many furniture manufacturers.)

Formula:— ¼ ounce loutre C 3381, aniline, dry, water soluble

⅛ ounce brown mahogany 3982, aniline, dry, water soluble

¼ ounce yellow H 8903, aniline, dry, water soluble

3 ounces sulphur brown (Swiss)

⅛ ounce lye (Lewis' or Babbitt's)

1½ gallons and 1 pint of hot water

Sponge the wood with water, let dry and sandpaper the raised grain. Brush on the above stain and let it dry. Brush on one thin coat of shellac, ½ orange and ½ white. Sandpaper lightly and clean up.

Filler:— Silex (silica) color to match the wood as nearly as possible with Vandyke brown ground in oil. For a darker effect apply a second coat of stain after the filler is dry.

Finish:— Shellac (½ orange and ½ white). Varnish and rub dull.

SHERATON MAHOGANY WATER STAIN

On Mahogany, Birch, Maple, Cypress

Formula:— 1¼ ounces bichromate of potash, dry

2 drams and 2 scruples black P. B. aniline, dry water soluble

1 scruple mahogany red, aniline, dry, water soluble

1 gallon hot water for stain on real mahogany. For other woods use 3 quarts of water.

Brush on one or more coats, letting each dry before another is put on. Sandpaper and clean up. Apply a very thin coat of shellac, orange.

Filler:— Silica (silex) colored very dark with a mixture of 5 ounces of Vandyke brown, 4 ounces of burnt umber and 3 ounces of rose pink, all ground in oil pigments.

Finish:— Orange shellac. Varnish and rub dull or polish to a high gloss.

ADAM BROWN MAHOGANY WATER STAIN

On Mahogany, Birch, Gum, Maple, Cypress

Formula:— 2 ounces mahogany brown aniline, dry, water soluble

½ ounce nigrosine J, dry, water soluble

¼ ounce bichromate of potash, dry

1 gallon of hot water for real mahogany wood, and for gum. For other woods use 3 quarts of water

Brush on, let dry and sandpaper. Clean up and apply a very thin coat of orange shellac.

Filler:—Silica (silex) colored very dark with Vandyke brown and a very little rose pink, both ground in oil pigments.

Finish:— Orange shellac. Varnish and rub dull, or flat varnish.

MAHOGANY WATER STAIN

On Birch, Maple, Gum, Cypress

Formula:— 4 drams lye, household

1 gallon water

Sponge the wood freely with this solution for the first coat and let it dry. Sandpaper the raised grain of the wood and clean up.

6 ounces mahogany red aniline, dry, water soluble

4 ounces mahogany brown aniline, dry, water soluble

5 quarts hot water

Brush on, let dry and apply a very thin coat of orange shellac.

Filler:— None required.

Finish:— Shellac, orange, one coat. Varnish and rub dull, or flat varnish.

LIGHT BROWN MAHOGANY WATER STAIN

On Mahogany, Birch, Maple, Gum, Cypress

Formula:— 2 drams bichromate of potash, dry
2 ounces mahogany brown aniline, dry, water soluble
½ ounce mahogany red aniline, dry, water soluble
1 dram walnut aniline, dry, water soluble
5 quarts of hot water

Brush on one coat freely and let dry. Sandpaper and clean up. Apply one coat of very thin white shellac.

Filler:— Silex (silica) colored light brown with Vandyke brown ground in oil.

Finish:— Shellac, two coats, (½ white shellac and ½ orange shellac). Varnish and rub dull, or flat varnish.

MAHOGANY RED WATER STAIN

On Mahogany, Gum, Birch, Maple, Cypress

Formula:— 8 ounces mahogany red aniline, dry, water soluble
8 ounces bichromate of potash, dry
2 drams naphthol yellow aniline, dry, water soluble

Mix the above dry powders and add 6 ounces of the mixture to 1 gallon of water. Brush on, let dry and sandpaper the wood. Clean up and apply a very thin coat of orange shellac.

Filler:— Silex (silica) colored with Vandyke brown in oil, drop black in oil and a very little rose pink in oil.

Finish:— Shellac. Gloss varnish and polish to a high gloss, or rub to a dull finish. Flat varnish.

STANDARD AMERICAN MAHOGANY WATER STAIN

(Standard formula introduced by the Furniture Manufacturer and Artisan in 1917 and adopted by many manufacturers.)

Formula:— 2 ounces bichromate of potash, dry
⅛ ounce lye (Lewis' or Babbitt's) dry
3¾ ounces brown mahogany No. 909 aniline, dry, water soluble

¾ ounce scarlet 2 R B aniline, dry, water soluble
⅓ ounce nigrosine black T, dry, water soluble
1⅛ gallons of hot water

Sponge the wood with water, let dry and sandpaper the raised wood grain. Clean up and brush on one coat of the above stain. Apply one thin coat of shellac (½ white and ½ orange). Sandpaper lightly.

Filler:— Silex (silica) colored dark with Vandyke brown and rose pink ground in oil.

Finish:— Shellac, ½ white and ½ orange. Varnish and rub dull.

STANDARD BROWN MAHOGANY WATER STAIN

(Standard formula introduced by the Furniture Manufacturer and Artisan, 1917, and adopted by many manufacturers.)

Formula:— 3 ounces bichromate of potash
⅛ ounce lye (Lewis' or Babbitt's)
3 ounces loutre C 3381 aniline, dry, water soluble
¼ ounce mahogany H 9844, aniline, dry, water soluble (or, 3 drams red mahogany and 5 drams brown mahogany aniline)
½ ounce nigrosine black T, dry, water soluble
2½ gallons of hot water

Sponge the wood with water, let dry and sandpaper the raised grain. Brush on a full coat of the above stain and let it dry. One thin coat of shellac, ½ white and ½ orange, should be brushed on to seal the stain. Sandpaper lightly with old used No. 00 paper.

Filler:— Silica (silex) colored dark with Vandyke brown ground in oil.

Finish:— Shellac. Varnish and rub dull, or flat varnish.

SILVER OAK WATER STAIN

On Oak, Chestnut

Color, dark brown fibre with white pores, not like light gray oak

Formula:— 12 drams bichromate of potash, dry
12 drams lye, household, dry
1 gallon water

Brush on this solution for the first coat and let dry. Sandpaper and clean up.

½ ounce bichromate of potash
2 ounces sap brown aniline, dry powder, water soluble
2 ounces nigrosine J, dry, water soluble
½ ounce naphthol black aniline, dry, water soluble
1 dram methylene blue 2 B, dry, water soluble

Brush on, let dry, sandpaper and clean up. No shellac coat is needed to seal this stain.

Filler:—Zinc Oxide in oil and a little dry whiting. Thin to paste form with a mixture of 1 ounce of boiled linseed oil, 1 ounce japan drier and 6 ounces of benzine. Use like a silex filler, rubbing the filler in, letting it set and wiping off across the grain.

Finish:—Paraffine wax; heat, thin with ½ turpentine and ½ benzine. Rub to a dull lustre when thoroughly dry.

LIGHT GRAY WATER STAIN
On Maple

Formula:—14 grains nigrosine black, dry water soluble
2½ grains orange Y aniline, dry, water soluble
½ ounce sulphate of iron, dry
2 ounces sulphate of soda, dry
1 gallon hot water

Brush on one coat and let dry twelve hours. Sandpaper and clean up.

Filler:—None required.

Finish:—White paraffine wax. Heat and thin with ½ turpentine and ½ benzine. Rub to a dull lustre when dry.

DARK GRAY WATER STAIN
On Maple

Formula:—1 ounce tannic acid
1 gallon warm water

Brush on the above solution for the first coat, let dry and sandpaper.

14 grains nigrosine black, dry, water soluble
2½ grains orange Y aniline, dry, water soluble
½ ounce sulphate of iron, dried
2 ounces sulphate of soda
1 gallon hot water

Filler:— None required.
Finish:— Wax and polish to dull lustre.

KAISER GRAY WATER STAIN

On Oak, Birch, Maple, Chestnut

Formula:— ½ ounce sulphate of iron
½ ounce black P B aniline, dry, water soluble
2 drams oxalic acid, dry powder
1 gallon water

Brush on an even and full coat of the above stain after the wood has been sponged with water and allowed to dry. Put on a very thin coat of white shellac.

Filler:— White or light gray. Mix from zinc oxide in oil, and dry whiting. Thin with a mixture of 4 ounces japan drier, 2 ounces turpentine and 2 ounces benzine.

Finish:— Thin white shellac, 1 coat. Wax with paraffine wax heated and thinned with half benzine and half turpentine.

FOREST GREEN WATER STAIN

On any wood

Color, light vivid green

Formula:— 2 ounces and 4 drams acid green E aniline, dry, water soluble
1 gallon hot water

Brush on and let the above dry for the first coat.

½ ounce picric acid, dry
1 gallon hot water

Brush on as a second coat and mordant to fix and make permanent the brilliant green. Apply one very thin coat of white shellac.

Filler:— On oak and all open grain woods only. Silex (silica) filler colored very dark green with chrome green and drop black ground in oil.

Finish:— Shellac, white. Varnish and rub dull, flat varnish or wax.

EBONY WATER STAIN

On Any Wood

Color, jet black

Formula:— 4 ounces nigrosine J, dry, water soluble

4 ounces acetic acid
1 gallon hot water

Brush on, let dry and sandpaper the raised grain of the wood if any. Apply a second coat of the same stain after the first coat is dry.

Filler:— For oak and chestnut, silex (silica) colored black with drop black ground in oil. Maple, birch and other close grained woods require no filler.

Finish:— Rub in several coats of hot oil. Mix the oil with 2 ounces boiled linseed oil, 1 ounce japan drier and 5 ounces benzine. Wipe each coat with a cloth and let dry before another is put on. Or wax and rub to dull lustre. Or shellac, orange, and rub dull. Or flat varnish.

ROSEWOOD WATER STAIN

On Rosewood, Birch, Maple, Cypress

Formula:— 2 ounces bichromate of potash, dry
11 ounces and 4 drams mahogany brown aniline, dry, water soluble
4 ounces and 2 drams nigrosine J black, dry, water soluble
4 drams methyl violet aniline, dry, water soluble
2 to 4 gallons hot water, depending upon the kind of wood and how dark a stain is needed

Brush on one or more coats as needed. Sandpaper and clean up. Apply one thin coat of orange shellac.

Filler:— Silex (silica) colored very dark with a mixture of 3 ounces of Vandyke brown and 1 ounce of rose pink ground in oil.

Finish:— Orange shellac. Varnish and rub dull. Or flat varnish. Or gloss varnish polished with a high gloss.

GUN METAL BLACK WATER ANILINE STAIN

Formula:— First coat: Sulphate of iron (green copperas or vitriol) dissolved in water. Brush on and let dry.

Second Coat: Acid green aniline, water soluble. Dissolve in water and brush on. Let dry and sandpaper.

Third Coat: Picric acid diluted with water. Brush on and let dry.

Fourth Coat: Sulphate of copper. Dissolve in water and brush on.

Filler:— Black graphite, very fine grade. Thin with japan drier.

Finish:— Shellac and wax, or flat varnish.

VANDYKE BROWN WATER STAIN

On Gum, Cypress and Other Woods

Formula:— 5 ounces walnut aniline crystals, dry, water soluble

4 drams black P B aniline, dry, water soluble

4 drams lye, household, dry

1 gallon hot water for gum. For other woods use only 3 quarts of water

Brush on above stain and let dry. Do not sandpaper as it cuts up the surface of gum too much. Rub the raised grain down with a wad of burlap.

Filler:— White shellac, 2 coats. Color the shellac a trifle with a few drops of Bismarck brown, spirit soluble, aniline. Sandpaper each shellac coat.

Finish:— Varnish with very light colored varnish. Rub dull with pumice stone and oil for a high class job. Flat varnish or wax for others.

CHAPTER VI

CHEMICAL WATER STAINS, ACID AND ALKALINE

We hear and read about acid stains but just what constitutes this group of materials is not clear to a great many. One reason for the confusion of thought is the incorrect use of the word "acid" to describe factory-prepared aniline water stains. The aniline dye used in coloring these water stains is designated among manufacturers as "acid anilines" because an acid chemical process was used in their preparation in the concentrated form.

Chemical stains are water stains, as a rule, and they are of two kinds—acid solutions and alkaline solutions. In other words, there are a number of acids which when dissolved in water will color wood, and there are a number of alkalies which when dissolved in water will color wood. These acids and alkalies will be listed and described later on in this chapter.

Like other stains, the chemical stains have their advantages and disadvantages. For some work they are unequalled by any other stain, but they are not convenient nor practical for other classes of work.

The trend of the times in furniture factories is, perhaps, toward the greater use of chemical stains, although the aniline and coal tar stains are used today in far greater volume than any other class of stains. We have seen that the finishing of wood trim in buildings follows more or less closely the colors produced on furniture and to some extent the methods employed by furniture finishers. Therefore a knowledge of the chemical stains is of value to all, even though the house painter and finisher of woods may find the chemical stains not convenient for the average job. On jobs which include a very large amount of trim, especially when that trim can be finished before erection, as on modern office and other public buildings, the chemical stains may well be considered for the saving in cost which they will make.

There are certain colors of finished furniture which can only be matched by the use of chemical stains, and when very great penetration of the wood is necessary in order to make the finished color withstand great wear, the chemical stains cannot be equalled. The anilines and coal tar dye stains, however, are in most cases equal to the task of duplicating practically any color wanted when the finisher is skilled in their blending.

The use of chemical stains really involves a process, though a simple one as a rule, and also adequate equipment for handling the stains and the articles of merchandise or pieces of trim lumber upon which they are being used. An understanding of the characteristics of each of the chemicals is necessary to using them safely and effectively, although it is not by any means necessary that one be a chemist to use them to good advantage. Some of these chemicals are dangerous to the skin and it is well to make a habit of working with rubber gloves or to coat hands, face and all exposed skin with vaseline, petrolatum or heavy motor oil. Care must be taken not to get any of this grease or oil on the wood to be stained, however. The mixing of acids and strong alkalies should also be done with caution until one knows what the consequences are. For instance, it is entirely safe to mix sulphuric acid with water if only a few drops at a time of the acid are put into a large quantity of water. But reverse the method, pouring water into a quantity of sulphuric acid and the result is a small explosion which sends a shower of acid into the air and perhaps into your face and onto your hands. Sulphuric acid burns the skin and destroys cloth. And again, the fumes of hydrochloric (muriatic) acid are dangerous to breathe. Many of the chemical solutions appear harmless when only occasionally they come into contact with the skin, but frequent contact soon proves that they make sore hands and that there is danger of blood poisoning from the entrance of some acids into cuts, sores or scraped places on the skin. The use of rubber gloves eliminates these risks. Before using any strong chemical it is well to learn from your druggist or any chemist what the actions of those substances are when mixed or used as you propose using them.

The chemicals used for staining purposes are not always easy to secure conveniently. Some of them are carried by paint supply stores, some by the local druggists. Some of them the druggist will have to order from a wholesale stock.

Today the chemical stains are not used to any practical extent by the wood finisher doing the finishing of wood trim in buildings. In the building trades the wage scales are high enough to make contractors devote their major efforts to saving time rather than to cutting minor costs of materials. Even the furniture factories use other stains, mostly the aniline and coal tar dye stains. The house painter's money is made by doing many jobs at small profits on each. The cost of stain represents only a small part of the total cost of his jobs. Wages constitute the large item of cost. What little he might save by using a few gallons of home-made stain might be lost several times in wage cost.

There are a number of general points to keep in mind when using chemical stains and of course nothing but experience will teach the wood finisher to become expert in their use. The following are of interest in that connection, however.

Some of the chemicals used for stains, those which come in dry crystals or hard granular form, like permanganate of potash, should be dissolved first in a small quantity of water and later diluted to the desired strength for the color wanted. Other chemicals which come in the liquid form, or readily dissolved soft crystals, can be dissolved and diluted at the same time. Nitric acid is one of the chemicals in this class.

The chemical stains as a class penetrate deeper than any other class of stains. When used hot they penetrate deeper than when used cold. And when the wood being stained contains naturally some of the same chemicals as constitute the stain the stain goes into the wood even deeper yet. It is well to keep in mind that man does not create acids and alkalies. The chemist doesn't create anything, he simply separates and concentrates acids and alkalies from other substances. For instance, one of the stain chemicals much used is tannic acid. It is a chemical concentrated and separated by chemists from oak bark and gallnuts, from a vegetable substance called tannin. Most of the lumber contains tannic acid, some a larger amount than others. It is all quite simple and very interesting, yet most of us not being chemists fear what we do not understand. We might profitably understand much more of chemistry, which is so interwoven with life that we meet it at every turn, if we would but pursue the subject a little more.

The aniline stains produce their final color on wood rather quickly, but the acid and alkaline stains, depending as they do upon chemical reactions in the wood, develop slowly and continue to change color for hours.

Twenty-four hours or more are required by chemical stains to reach their final color.

The use of chemical stains by a novice is a little uncertain at first because it is not easy to determine how strong to make the chemical solution to produce the color wanted. The furniture finisher finds this no disadvantage in the factory because he usually has a great many pieces of furniture to finish alike and he makes up a few samples on the kind of wood used in the furniture and after a little experimenting he is able to measure his chemical solution, as to its ingredients, by weight, so that he knows exactly what the stain solution is going to do before he puts it on the surfaces to be stained. The wood finisher of houses can do the same thing often, but not always, and if the surface to be stained amounts to but a few pieces, he will waste his time with chemical stains, unless cost is no consideration in producing certain color effects which can only be done with chemical stains.

The chemical stains as a rule dry a much darker color than the wet color indicates.

In the use of both chemical acid and alkaline solutions as stains on one job do not mix them together as a rule because one will neutralize the other, in part at least. The common use of these solutions is to put on one and let it dry before the other is put on. The color which results is due to a chemical action of the two solutions and the chemicals in the wood.

The water used for mixing water stains of any kind is best when it has been boiled, distilled, or rain water carefully filtered.

The colors produced by chemical stains are the most permanent known, usually, because they are natural chemical changes in the wood and they penetrate deeply.

Chemical stains may be applied with an old bristle brush or a fibre brush of the tampico type. The weaker solutions are sometimes put on with a sponge. The sponge should be soaked in the solution and squeezed out before the surface is rubbed over with it.

Chemical stains should be mixed and stored in glass or earthenware jugs and kept corked tightly when not in use. Some chemicals destroy tin or other metal containers.

When chemicals are stored for use later they should be kept in dry places, that is the chemicals which come in dry powder, lump or granular form. Some absorb moisture and some give off moisture. They change in physical form, from dry to liquid, in some instances when moisture is present in the air. The temperature of the store room should be about 40 or 50 degrees and dry. Carbonate of potash, for instance, in the dry crystal form will change to liquid in the presence of moisture in the air. Then you don't know how strong one ounce of it is as compared with an ounce of the original dry powder; and what the first ounce did in the way of coloring wood is no indication, then, of what the second ounce will do. And again, sulphate of iron (green vitriol or copperas) comes in green, granular shaped particles. If not kept sealed up in the presence of moist air the little green lumps become coated with a gray powder and the grayish lumps do not weigh as much as they did at first. So to protect the coloring strength of chemicals store them properly.

A finisher using chemical and aniline stains needs certain tools for weighing and measuring small amounts of concentrated substances. A spring scale should never be used. A balance scale of the postal type is useful when nothing less than ounces is to be weighed. Smaller amounts require the use of a scale similar to those in use by druggists and photographers. They have weights graduated down to ounces, half ounces, quarter ounces, grains and drams. Such a scale is pictured in Plate 3.

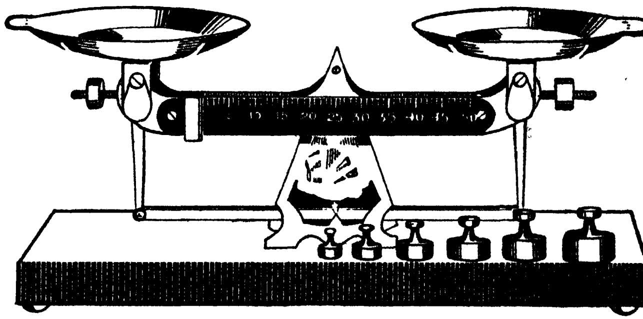

Plate 3.—The Type of Balance Scale Commonly Used by Photographers and Others is Essential to the Correct Mixing of Stain Formulas Calling for the Use of Coal Tar Aniline Colors in Dry Crystal Form and for Chemicals Which are Concentrated in Strength.

A mortar and pestle, such as are shown in Plate 4,

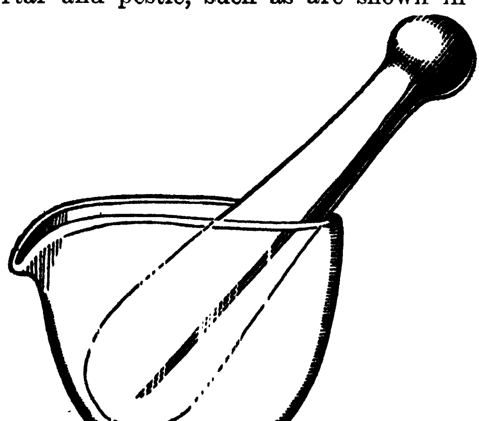

Plate 4.—Mortar and Pestle. Time-saving Tools for Breaking up Dry Stain Crystals and Chemicals Before Dissolving in Liquids.

is very handy and a time saver when it is necessary to pulverize granular or lump chemicals before dissolving them in water.

A one quart liquid graduate marked off into ounces, like Plate 5, is really needed, and a smaller one is also handy when it is marked off into smaller gradations.

A glass funnel and a hard rubber stirring rod are

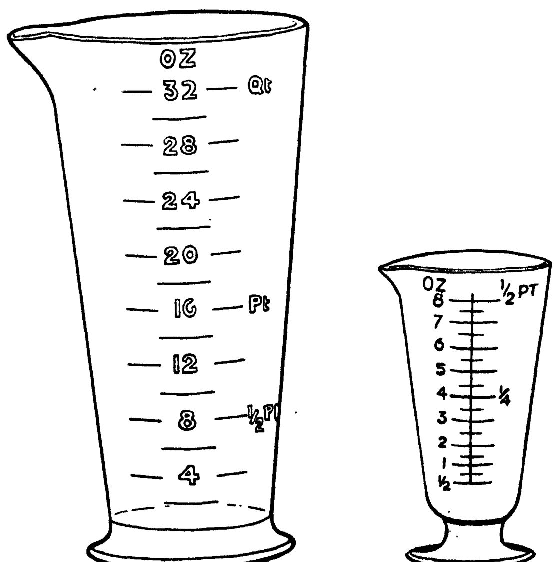

Plate 5.—Glass Graduates or Measuring Glasses, Used for Measuring Ounces and Less of Liquids.

also well worth the little they cost. All of these tools can be secured wherever photographers' supplies are carried, also through druggists. A gallon of chemical stain will cover about 500 square feet on soft woods and from 700 to 800 square feet on hard woods, one coat.

It should be noted that most of the aniline and coal tar dye stains used by the furniture finisher and others for the finest kind of work are both chemical and aniline in composition, that is, each formula contains both aniline and chemical coloring matter.

Stains on hard, close-grain woods like maple take a color slowly. A stain which gives a very light color on such woods produces darker and quicker results, as well as somewhat different color tones, when used on open-grain woods like oak and chestnut, and upon poplar, soft pine, etc. Then stains which are used on woods which are naturally colored, like gum, redwood and circassian walnut do not produce the same coloring effect as upon white or nearly white woods. Therefore, to stain hard and close-grain woods to match soft and open-grain woods, mix your stain much stronger, and the reverse is true too, naturally.

The number of colors which can be produced by the use of chemical stains is limited, of course, but when you can secure the color wanted by the use of chemical solutions the finish is superior to any other. The chemical stains make the most of the natural beauty of soft woods, enhancing the grain figure and retaining the natural color shadings of the wood. Chemical stains are considered superior even to aniline and other coal tar dye stains in transparency and permanency of color in strong light. On hard woods they are also superior.

When chemical stains are used on hard woods like maple, oak and birch, it is important to apply the stains uniformly over the surface in order to avoid blotched areas of color. A coat of water washed on first with a sponge just ahead of the stain coat will help greatly to spread the stain evenly, if it is done before the water is dry.

The chemicals used for staining purposes are many and they are used in various combinations. The acids and alkalines most commonly used are these:

Tannic acid
Pyrogallic acid
Chromic acid
Picric acid
Acetic acid
Nitric acid
Sulphuric acid
Muriatic (hydrochloric) acid
Ammonia
Caustic Soda
Lime
Carbonate of Soda
Pearlash
Bichromate of Potash
Potassium of Permanganate
Copper Sulphate
Sulphate of Iron (copperas, or green vitriol)
Chloride of Iron
Chrome Alum
Manganese Sulphate

The acids in the above group are usually used in connection with the aniline water stains as a preliminary wash.

Tannic Acid.—A brownish white extract from gallnuts and oak bark (tanbark). Tannic acid and pyrogallic acid, which is also an extract from gallnuts, are the basis for brown stains. These acids are diluted with water, brushed on and allowed to dry. Then usually a strong alkaline solution is brushed on. The colors produced with these acids are natural chemical changes in the wood and are absolutely permanent in strong light. The strength of the solutions used, of course, governs the shade of color gained. Most woods contain tannic acid, or tannin, as it is sometimes called. When a wood is deficient in the amount of tannic acid it contains a wash of tannic acid in water enables the finisher to produce a much deeper color or a different one.

Tannic acid is not present in the same amount in all trees, nor in all boards. Consequently a finisher cannot make a uniform finished color or mixed lumber, that is, boards from many trees by using either acid or alkaline solutions. Furniture factories select wood to match up as nearly as possible when chemical stains are used. To offset the deficiency of tannic acid in some surfaces some finishers, who are working on surfaces like furniture where a uniform color is essential, wash over the wood first with a 5% solution of tannic acid, or a 3% solution of pyrogallic acid (5 ounces tannic acid and 95 ounces of water, or 3 ounces of pyrogallic acid and 97 ounces of water). Then for the brown stains the wood is coated, after the tannic acid wash is dry, with a solution of potash, soda or ammonia and a uniform color results. The light-colored boards are coated more than once with the tannic acid solution, however, to bring them up to the color of the dark boards. One formula for the alkaline wash of potash sometimes used reads: 2 ounces caustic potash, 4 ounces bichromate of potash and 1 gallon of water.

Nitric Acid.—This acid diluted with from four to six parts of water produces yellow stains. When less water is used the stain color resulting from its use is a reddish or brownish yellow, depending upon the kind of wood. The color is permanent to strong light. Nitric acid is a colorless highly corrosive liquid.

Sulphuric Acid.—A colorless, corrosive acid compound of sulphur. When diluted with water it produces yellow stains. Used full strength it produces light and dark browns on oak but light and dark greens on soft pine. On some pines it will produce beautiful grays when diluted. If you pass the heat from a blow torch over it while wet the resulting color is black.

Picric Acid.—A yellow crystalline compound. It is used considerably in dyeing textiles, etc. Diluted with water it produces yellow stains on woods. A wash of picric acid on oak followed by nigrosine J makes an early English or olive black color tone stain. The acid acts as a mordant, fixing the color and making the stain penetrate more deeply.

Muriatic (hydrochloric) Acid.—A dark, greenish-yellow liquid which, when used very strong, produces black stains. On oak dark browns can be produced with it if wiped off before the full action has taken place. On pine of the soft variety the action of muriatic acid is that of producing a light, greenish gray. It may be diluted with water for lighter colors.

Permanganate of Potash.—One of the most widely used chemicals for staining. It comes in violet crystal form to be dissolved in cold water. The colors resulting from its use are beautiful, transparent nut browns. Used considerably for darkening the color of oak and other hard woods. On ash it makes a color which is a very close match for oak. About three ounces of this chemical in two quarts of water makes a medium shade of brown stain on many woods. The first color noted upon application of the potash is violet, but it changes to brown when dry. The stronger the solution, of course, the darker the brown color. Two coats are needed for very dark stains. When a color finishes up too dark it can be made lighter by a wash of a weak solution of hyposulphite of soda and water. A strong solution of the soda will bleach the brown to a white. This fact makes these chemical solutions handy for matching woods in the furniture factory and elsewhere, as all degrees of color can readily be secured. This peculiarity, the ability to make the stain color the wood dark or medium brown and then bleach it out white is taken advantage of when staining furniture or other wood surfaces parts of which are to be dark brown and parts white. After staining the whole area dark brown, masks made of strips of paper are pasted down on the wood parts which are to remain dark brown. Such parts as are to finish white are allowed to remain exposed. Then a wash of hyposulphite of soda is put on over the whole surface. When dry the paper is removed by soaking with water on cloths or blotting paper.

Strong potash and soda solutions should be put on with vegetable fibre brushes or a sponge, using rubber gloves. These chemicals burn the bristles of brushes, that is, hog bristles.

Potash.—A white solid caustic alkaline compound. Lye. Potassium. Made from wood ashes and rocks. Pearlash—a crude potassium carbonate. Carbonate of potash is a weaker form of caustic potash.

Soda (Sodium, Caustic Soda, Sal Soda, etc.)—A white alkaline compound, sodium carbonate, used in water solutions to stain woods brown. Carbonate of soda is a weaker form of caustic soda.

Soda and potash produce yellowish brown stain colors and dark browns on oak and other woods, depending upon the amount of tannic acid in the wood. And of course when washes of soda or potash are preceded by a wash of tannic acid the color resulting will be a darker yellow or brown.

The fixed alkalies, soda and potash, but not ammonia which is a volatile, when used in strong water solutions as dark stain colors are apt to leave a residue of alkali on the wood, which, if not washed off clean and neutralized with a coat of table vinegar, will saponify any oil mixtures put on top of it.

Bichromate of Potash.—The action of this chemical as a stain is much like that of permanganate of potash, except that the bichromate produces colors of a slightly yellower hue than permanganate. On ash, elm and beech the bichromate of potash produces a grayish hue to the yellows. Bichromate of potash is used for dark mahogany colors on real mahogany. A second coat of carbonate of potash put on over bichromate of potash coat produces light tans and browns.

Ammonia.—A colorless, pungent, suffocating gas. We commonly think of ammonia as a liquid, but then we are thinking of aqua-ammonia which is water charged with ammonia gas. On exposure to the air the gas evaporates from the water. Ammonia is a volatile alkali and when used as a stain should be fresh for each job. The volatile nature of ammonia is an advantage in one way,—nothing remains on the surface treated with it (except the color) to injure subsequent coats of finishing material. Ammonia is used in the strong solution (26 degree), not the household article, for producing brown colors, chiefly on oak and mahogany. It is used alone and as a second coat wash over acid-treated surfaces. It is brushed on for fumed oak effects, but makes a far more uniform color when used in an air-tight room filled with the wood to be colored,—the regular fuming process used largely by the furniture factories. Very strong ammonia has the disadvantage of being rather disagreeable to handle because its pungent fumes affect the eyes and nose.

Copper Sulphate.—When dissolved in water makes a stain which colors some woods jet black and some gray. The color penetrates deeply and is permanent to strong light.

Potassium Chlorate.—Dissolved in water makes a stain which colors some woods jet black and some gray, or weathered effect. The color is permanent to strong light and it penetrates deeply into wood.

Sulphate of Iron and Chloride of Iron.—Sulphate of iron is, perhaps, better known among finishers as green copperas or green vitriol. In the dry crystal form this chemical is unstable unless used when fresh. When fresh the crystals are glossy and when they are covered with a dry, white powder they are not good. It is better to use a dried sulphate of iron which is stable. The U. S. P. solution of sulphate of iron and also the U. S. P. solution of chloride of iron are easy to secure and are entirely satisfactory for stains which are to be mixed and used immediately. Both of these chemicals are dissolved in water to produce silver gray colors and black. Weak solutions make a bluish-black color. The color produced is permanent and penetrates deeply into the wood. The coloring effect is really a chemical change in the wood, since the iron salts act on the tannic acid in the wood.

CHEMICAL WATER STAINS

FUMED OAK

On Oak, Poplar, Pine, Maple, Ash, Chestnut

***Formula:*— 2 to 4 ounces tannic acid**
1 gallon warm water
Mix above, brush on and let dry. Sandpaper the raised wood grain. If a reddish brown is wanted add 1 ounce or more of pyrogallic acid to the above solution.
For the second coat,—
4 ounces bichromate of potash
1 ounce carbonate of potash
1 gallon of hot water (125 degrees)
Mix and brush on while hot.

FUMED OAK ON BIRCH

***Formula:*— ½ ounce pyrogallic acid**
½ ounce tannic acid
1 gallon warm water
Mix, brush on and let dry. Do not sandpaper.

2 ounces carbonate of soda
1 ounce bichromate of potash
1 gallon hot water

Dissolve the above chemicals in the water and then add to the mixture a solution mixed as follows: 1 ounce of copper sulphate dissolved in 8 ounces of water. Add enough ammonia, 26 degree, to the copper solution to cause a precipitation,—a settling of a crystallized substance to the bottom. Continue to add ammonia then until the precipitated substance is redissolved and disappears.

Brush on the above as a second coat after the first is dry. Sandpaper and clean up. Any shade of brown can be secured by using stronger or weaker solutions, that is more or less water.

Filler:—None needed on birch.

Finish:—Shellac, white for light browns and orange for dark brown; varnish and rub dull; or flat varnish or wax.

ANTIQUE OAK

On Oak, Ash, Chestnut

Formula:—4 to 6 ounces permanganate of potash
1 gallon soft water

Mix and brush on. Let dry and if not dark enough apply one or more additional coats.

For a second coat apply a wash of iron acetate dissolved in water, a saturated or a weaker solution, depending upon the color wanted and the wood being stained.

Filler:—No filler required. Open pores desirable.

Finish:—Rub in several coats of oil, preferably while hot. Mix the oil,—2 ounces raw linseed oil, 1 ounce japan drier and 5 ounces benzine. Wipe off after application and let dry before another coat is rubbed in. Or shellac, varnish and rub dull, or wax, or flat varnish.

MISSION BROWN

On Oak, Ash, Chestnut

Formula:—1 gallon warm water to which is added all the chrome alum that will be dissolved in it,—a saturated solution.

Brush on the above solution and let dry. Sandpaper and clean up. (A saturated solution of manganese sulphate in water can be used instead of the chrome alum.)

Filler:— None required.

Finish:— Shellac, orange, and wax; or flat varnish.

WALNUT

On Walnut or Gum

Formula:— 4 to 6 ounces permanganate of potash
1 gallon hot soft water

Dissolve the potash in the water and brush on to the wood. Let dry and sandpaper. Clean up.

Dissolve iron acetate in water and brush on as a second coat.

Filler:— Silex (silica) colored very dark with Vandyke brown and drop black.

Finish:— Shellac, varnish and polish to high lustre, or rub dull, or flat varnish.

EBONY BLACK

On Birch, Maple, Beech

Formula:— 1 ounce logwood extract
2 quarts hot water

Dissolve the logwood in the water and brush on freely while hot. Let dry and apply a second coat. Sandpaper and clean up. Let dry a day or two.

1 ounce sulphate of iron (green copperas or vitriol)
1 quart hot water

Mix well and brush on. Let dry in warm, light room. If furniture do not put near artificial heat.

Filler:— None required.

Finish:— Rub in hot oil mixed,—2 ounces raw linseed oil, 1 ounce japan drier, and 5 ounces benzine. Wipe off excess of oil and let dry before a second coat is applied in the same manner. Let dry thoroughly. Apply two coats orange shellac and rub dull with pumice stone and oil. Add a little drop black, dry, or spirit soluble nigrosine black to the shellac, just enough to offset the brown color of the shellac.

WEATHERED OAK

On Oak, Chestnut, Ash

Formula:— 4 ounces carbonate of soda
½ gallon water

Mix the above until the soda is completely dissolved. Add ½ gallon of aqua ammonia. Sponge the wood with this solution freely and let dry. Sandpaper and clean up.

1 ounce sulphate of iron (green copperas)
1 gallon water

Mix and apply with a sponge or brush. A stronger solution—more sulphate of iron—will make a darker color.

Filler:— None required.
Finish:— Shellac and wax, or flat varnish.

SILVER GRAY

Oak, Ash, Chestnut, Maple

Formula:— 1 ounce nitrate of silver
3 pints of water

Mix and brush on. Let dry and sandpaper. Clean up. Brush on a weak solution of muriatic (hydrochloric) acid and water. Let dry and brush on a wash of aqua ammonia, 26 degree. Shellac, white, one thin coat.

Filler:— Zinc oxide ground in oil. Thin with a mixture of 1 ounce boiled linseed oil, 1 ounce japan drier and 6 ounces benzine.

Finish:— Paraffine wax. Heat the wax in a pot placed in a pail of hot water. Thin with ½ turpentine and ½ benzine.

LIGHT AND DARK GRAY

Formula:— Sulphate of iron or chloride of iron dissolved in water. A weak solution produces grays of a light hue while strong solutions produce dark grays and blue-black.

CHAPTER VII

COLOR PIGMENT WATER STAINS

DYEWOOD WATER STAINS

THE group of stains which come within these classifications are relatively unimportant but are given largely to clarify the finisher's understanding of the various kinds of stains.

The color pigment stains are of no value for high-class work, especially upon hard, close-grain woods, because after all pigment stains of any type do not really color or dye the wood fibre, they simply spread a semi-transparent color coating on top of the wood. If the pigments are very fine and transparent, as those of good quality are, the stain does very well for porous, soft woods like soft pine, poplar, fir, etc. The pigment stains are satisfactory also for cheap work and temporary structures where it is desirable, principally, to color the wood and to put on little or no finish beyond color.

COLOR PIGMENT WATER STAINS

These are stains mixed by the finisher using preferably graining distemper colors, colors ground in water. Common dry colors of good quality are, however, often used on plaster walls. It is very important that high quality colors be used, since the low quality colors are not ground fine enough and are not transparent and bright; they cloud the wood grain, hide the natural figures and shading of the wood; also they fill the wood pores too much, giving a muddy color effect.

The mixing of the stains is simple, indeed. The dry colors are thoroughly mixed with hot water. No binder is required except a little glue. While in use the pot of stain should be stirred often to prevent the color from settling to the bottom. Sometimes a bit of aniline color, water soluble, is added to brighten up the color hue of the stain.

The dry colors commonly carried in stock by paint supply houses and which are suitable for mixing color pigment water stains are these:

BLACK

English Powdered Drop Black
American Powdered Drop Black
Swedish Black
1-lb and 25-lb packages and barrels

BLUES

Celestial Blue
Cobalt Blue
S. P. Prussian Blue
Soluble Blue
Ultramarine Blue
1-lb. and 25-lb. packages

BROWNS

Vandyke Brown
Raw and Burnt Turkey Umber
Raw and Burnt American Umber
Raw and Burnt Italian Sienna
Raw and Burnt American Sienna
Bismarck Brown (red)
1-lb. and 25-lb packages

WHITES

Zinc, oxide
Extra Gilders' Whiting, bolted

GREENS

Union Chrome, medium or dark
No. 3 Chrome, medium or dark
Paris Green
Bottle Green
Bronze Green
Olive Green
1-lb., 25-lb. and 100-lb. packages

VENETIAN REDS

York Venetian Red
Craydon English Venetian Red
Regent English Venetian Red
1-lb. and 100-lb. packages

REDS

Indian Red, Super
Oxide of Red
Permanent Red
English Rose Pink
English Rose Lake
Turkey Red, Light, No. 2
Turkey Red, Deep, No. 3
English Vermilion, in 30-lb. bags, Light and Dark
Agricultural Vermilion
American Vermilion
Tuscan Red
1-lb. and 25-lb. packages

LAKES, ETC.

Carmine, No. 40
Geranium, AA
Vienna
No. 16 Lake
1-ounce and pound packages

YELLOWS

C. P. Chrome Yellow, Light, Medium or Dark
Genuine Chrome, Light, Medium or Dark
Dutch Pink
1-lb., 25-lb. and 100-lb. packages

FORMULAS FOR COLOR PIGMENT WATER STAINS

DRY OR DISTEMPER GRAINING COLORS

RED MAHOGANY

1 lb. Italian burnt sienna
¼ to ½ lb. Vandyke brown
Water, hot

BROWN MAHOGANY

1 lb. Vandyke brown
2 to 4 ounces Turkey burnt umber
Water, hot

CHERRY

1 lb. Italian burnt sienna
1 to 2 ounces Vandyke brown
½ to 1 ounce rose pink
Water, hot

LIGHT OAK

1 lb. Italian raw sienna
2 to 6 ounces Italian raw umber
Water, hot

DARK OAK

1 pound Italian raw umber
2 to 4 ounces drop black
Water, hot

or

1 pound Turkey burnt umber
or ½ pound Italian raw sienna
4 ounces aqua ammonia, 26 degree
Water, hot

MISSION OAK

1 pound Turkey raw umber
½ pound Turkey burnt umber
Water, hot

WEATHERED OAK

1 pound drop black
½ pound Turkey burnt umber
Water, hot

FUMED OAK

1 pound Turkey burnt umber
2 to 6 ounces Vandyke brown
Water, hot

WALNUT

½ pound Vandyke brown
½ pound Turkey burnt umber
Water, hot
1 quart ammonia, 26 degree
Mix and strain. Let stand a few days before using

or

1 pound Vandyke brown
½ pound potash or lye
3 quarts water
Mix and boil until about half the quantity remains. Strain and brush on hot.

DYEWOOD WATER STAINS

Years ago before the coal tar dye stains, anilines, etc., appeared on the market for use as wood stains, finishers made water stains from a great many materials by cooking, steeping and brewing roots, berries, barks, leaves and minerals and gums in water and acid or alkaline solutions. In that manner the natural dye coloring matter was extracted.

After securing the dye extracts various solutions of acids or alkalies were mixed with the stain or used on the wood in advance in order to fix the colors, to act as mordants.

Time is worth too much in these days of high wages to make it practical to use these old formulas on the average job, but there is some advantage in knowing how those stains were made. The prepared aniline and other coal tar dye stains are much more simple to handle, they save time and produce better results. There is no danger connected with their mixing and use, whereas some of the acid and strong alkaline, caustic solutions in the following formulas burn the skin and clothing if carelessly handled. Rubber gloves are needed.

The dye woods and other materials commonly sold for use in these stains are:

Extract of logwood—(black).
Red Sanders—(red).
Alkanet Root—(dark red).
Dragon's Blood—(red).
Madder—(purple red).
Cochineal—(bright red).
Nutgalls—(brownish black).

There were many other dye substances used which are not listed by some of the paint supply houses, such as japonica, chestnut, fustic, bloodroot, etc.

All of these coloring substances vary greatly in coloring strength and so it is necessary constantly to doctor formulas. Some of them are quite permanent in strong light, others like madder are very fugitive. All colors produced by the dyewood group of stains can be reproduced in character and better quality by the use of the aniline and other coal tar dye stains, most of which are permanent in light.

FORMULAS FOR DYEWOOD WATER STAINS

OAK BROWNS

1 pound annato
1 ounce strong lye
6 quarts warm water

Mix and boil about thirty minutes or longer for a darker color. Add 6 ounces of picric acid. Brush on one or several coats as needed, letting each coat dry before another is put on.

MAHOGANY

Nitric acid. Dilute with water and brush on to wood. Let dry.

1 ounce dragons blood. Dissolve first in a little denatured alcohol.

1 ounce sal sode. Dissolve in ½ pint water.

Mix these two solutions together and strain. Apply one or as many coats as are needed to make the color dark enough. Let each coat dry before putting on another.

CHERRY

1 pound annato
1 ounce strong lye dissolved in 1 quart water
5 quarts of water

Mix together and boil for half an hour or longer for a darker stain. Brush on while hot. Use one or more coats, letting each dry.

EBONY BLACK

3 pounds extract of logwood
1 pound strong lye
1 gallon water

Mix and boil, then strain the solution. Brush on to wood, hot or cold. When dry brush on a coat of table vinegar. Heat the vinegar first and dissolve in it 3 or 4 ounces of copperas (sulphate of iron).

SILVER GRAY

3 pounds extract of logwood
8 ounces vinegar
1 gallon water, hot

Brush on, let dry and finish with white paraffine wax only. Heat the wax and cut with ½ turpentine and ½ benzine. Varnish or shellac will turn the gray to brown.

On oak fill the pores of the wood with a white filler mixed: —zinc oxide or white lead ground in oil. Thin with a mixture of 1 ounce boiled linseed oil, 1 ounce japan drier and 5 ounces benzine.

OTHER GRAYS

Gallnuts. Soak in denatured alcohol two or three days.

Green Copperas (sulphate of iron). Dissolve in denatured alcohol or boiling water.

Indigo. Dissolve in four times its weight of oil of vitriol (66 degree sulphuric acid) allow it to settle and dilute with water.

Mix each of these solutions separately in a stone jar or in glass. To stain hard woods apply 1. The gallnut solution; 2. The copperas solution; 3. A weak solution of indigo. Allow each solution to dry before putting on the next. Use a white filler for oak, ash, chestnut.

CHAPTER VIII

SPIRIT STAINS,—ANILINE AND COAL TAR DYE STAINS

A RATHER large part of the stains made by manufacturers and sold ready to brush on to the surface are of the spirit stain group. They are, however, made far better than a finisher can mix them. They possess all of the advantages of the best spirit stains and many of the disadvantages have been overcome by the expert chemists in the employ of manufacturers.

Spirit stains as a class have the advantage of drying quickly. With them a surface can be stained and filled or shellaced and varnished the same day. These characteristics make it a useful class of stain for repair and touch-up work on floors, wood trim and furniture and for all sorts of quick jobs. The spirit stains are mixed with shellac for this touch-up work and the colors nicely blended to match the old surface. The colors of the spirit stains are brilliant, transparent and beautiful. They, of course, enhance the natural wood grain and color shadings.

This class of stains will penetrate through old varnish on a surface and that is one of the characteristic advantages of it for touch-up and repair work on finished furniture and wood trim. You can mix spirit stains with shellac and spread the coating over a varnished surface, if done deftly and without excessive brushing which lifts the varnish. Thus old finishes can be changed, as from red to brown mahogany, without stripping off the old varnish and finish.

The spirit stains do not raise the grain of the wood, as a rule, or not to the same extent as water stains. That saves the labor of sandpapering.

As to the debit or unsatisfactory side of spirit stains. Each kind of stain has its advantages and disadvantages. Each is good for some purposes and not so good as others for other jobs. And within each class of stains some individual colors are more permanent or more fugitive than others.

Spirit stains as a class are not permanent in sunlight or very strong light. Some of the colors are very fugitive and some not so much so. All of them are more permanent when covered immediately with shellac or varnish to exclude the light and air action. Spirit stains are quite useless for light colors since in that case they fade too rapidly to be practical. They are used principally for the medium and dark colors. The reds and greens are especially fugitive in strong light and the black nigrosine is quite permanent. The latter is used considerably for grays and for ebony.

Spirit stains are used by furniture finishers largely for the coloring of interiors of drawers and cabinets where strong light does not penetrate and the air circulation is at a minimum.

The penetration of spirit stains is not great because they dry almost instantly.

The application of spirit stains must be done very skillfully to avoid the showing of laps and joints because they dry so quickly. Some manufacturers add a bit of shellac to the stains to slow up the drying a little and make them easier to brush on evenly. The brushing of these stains must be done in one direction and with a minimum of strokes. Do not rebrush or the color will be darker in some places than in others. Furniture finishers overcome the difficulties of brushing by applying spirit stains with the spray gun.

The thin shellac coat usually brushed on over spirit stains should be brushed as little as possible, as the alcohol in the shellac may dissolve and lift the stain, making it bleed into the shellac and cause a cloudy color finish. Apply the shellac with as few strokes as possible and do not rebrush it.

The materials used for making spirit stains are the aniline and other coal tar colors which are soluble in alcohol, called basic colors. They are soluble in hot denatured alcohol and cold wood alcohol. The latter is the more expensive as a rule. Some of the colors are soluble both in alcohol and water, but they too are usually the most fugitive.

When the alcohol is heated to dissolve spirit colors it takes up a larger amount of coloring matter and if the stain is applied while hot no difficulty results. But some finishers find that by making a super-saturated solution (using hot alcohol) the overloaded liquid when used cold is apt to cause "bronzing",—that is, the color remains on the surface of the wood while the alcohol penetrates into the wood more than when used cold. Wood alcohol is therefore the most common solvent used and it is used cold.

Spirit stains which have been mixed should be kept in the dark. Also wood finished with them should be kept in the dark until finished with shellac and varnish to protect the color from the air and light. Keep the stain corked up tightly or you will lose some of its strength. A cool place is best for storage.

A gallon of spirit stain will cover about 400 square feet, one coat, on soft wood and about 700 square feet, one coat, on hard woods.

The spirit or alcohol soluble coal tar dye stains and anilines listed by painters' supply dealers commonly in dry form are listed below. Spirit stains are also sold in pint, quart, half-gallon, gallon and barrel lots in liquid form ready to use:

SPIRIT SOLUBLE ANILINE AND COAL TAR STAINS

Walnut R
Golden Oak
Bismarck Brown (red)
Black Nigrosine W. N.
Green M X Crystals
Methylene Blue 2 B
Fuchine Magenta R. T.
Violet 3 B P N

There are hundreds more colors, but with these and the water stains the finisher can get along easily and produce practically any color wanted on any wood.

A definite formula for the average spirit stain is as follows

1 to 4 ounces spirit-soluble aniline or other coal tar dye stain, dry.

1 gallon wood alcohol, or hot denatured alcohol (heat it by placing the can in a pail of hot water, away from the fire).

SPIRIT ANILINE STAIN FORMULAS

MAHOGANY

Formula:— **4 ounces Bismarck brown, dry, spirit-soluble**
1 gallon wood or hot denatured alcohol

The coloring strength of Bismarck brown is subject to considerable variation, also its solubility in alcohol. Do not add to the alcohol more stain powder than will be dissolved. The stain should be clear and transparent. If cloudy and if the color settles to the bottom of the pot in crystallized form, the stain may give

you a blotchy, clouded wood color. When an excess of Bismarck brown is used in a stain the shellac coat which follows may lift the stain coat, making the color pile up and spread through the shellac. A cloudy, muddy finish results. So after mixing this color, let it stand several hours, then pour off the clear solution. Do not use what color has settled in the bottom, if any. Use no more dry stain powder than will dissolve in a few hours time. If the stain made with Bismarck brown is not dark enough add a very little spirit soluble nigrosine black.

EARLY ENGLISH

Formula:— 4 ounces nigrosine, spirit, soluble, dry
8 drams auramine, spirit-soluble aniline, dry
2 drams malachite green aniline, spirit-soluble dry
1 gallon alcohol, wood or denatured

Brush on, let dry and sandpaper. Apply a very thin coat of orange shellac. Brush the shellac very little and do not rebrush or you will lift the stain coat.

Filler:— Silex (silica) color black with ½ Vandyke brown and ½ drop black ground in oil. It is difficult to produce a good Early English finish with spirit stain because this stain does not open up the pores of the wood as much as water stain does.

Finish:— Shellac, varnish and rub dull; or wax; or flat varnish.

WEATHERED OAK

Formula:— 4 ounces nigrosine black, dry, spirit-soluble
1 ounce scarlet aniline, dry, spirit-soluble
1 dram auramine aniline, dry, spirit-soluble
1 gallon alcohol, wood or hot denatured

Brush on and let dry. Apply one thin coat of orange shellac brushing as little as possible to avoid lifting the stain. Add enough of the nigrosine black to the shellac to color it.

Filler:— Do not fill. Open pores of the wood are desirable.
Finish:— Shellac and wax.

From the following spirit soluble aniline and other coal tar colors any color stain wanted can be produced by blending and mixing:

Black—nigrosine or naphthalene.

Brown—seal, loutre.

Brown Mahogany—orange and naphthalene black.

Reds—scarlet, carmosine and Bismarck brown.

Orange—orange Y and orange G.

Yellow—naphthalene yellow, auramine yellow.

The above are the principal colors needed and are standard. Each manufacturer, however, markets these colors and modifications of them under private brand names and numbers. If you will order as above the manufacturer or supply house will know what is wanted.

CHAPTER IX

OIL STAINS:—ANILINE AND COAL TAR DYE STAINS,—OIL PIGMENT STAINS

Oil stains are very extensively used largely because they are convenient and very easy to apply. They dry slowly enough to permit brushing and rebrushing and so no laps and joints show. If the color is too dark after the staining is done some of the stain can be wiped off to make a lighter finish.

Oil stains as a class do not penetrate as deeply into the wood as water stains, but they penetrate deep enough for most practical purposes.

There are two kinds of oil stains, those made from the fat aniline and other coal tar dye colors called oil-soluble colors and those made from good quality tinting color pigments such as are used for coloring paints.

The oil-soluble anilines are not much used, as such, by painters for mixing stains. But on the other hand the most popular factory-made stains are, perhaps, the oil stains, most of which are anilines, although many are not. Paint supply dealers do not always carry the oil-soluble anilines, but they do carry the water and spirit-solubles. The oil-solubles are sold in the dry form like the water and spirit-solubles.

The factory-made oil aniline stains are called penetrating stains to differentiate them from the oil pigment stains made by painters. There is, of course, considerable difference in these two classes. The former really do penetrate into and color the wood fibre, they are really transparent. Whereas the oil pigment stains simply spread a very thin, fine coating of pigment on top of the wood, allowing some of the wood fibre to show through. The oil aniline stains as a class are far brighter, clearer and more transparent; they penetrate more deeply than pigment stains.

Furniture finishers prefer water aniline coal tar dye stains, and they are generally preferred for all high-class finishing, because they are far more permanent in strong light and there are thousands of colors. The oil-soluble anilines, however, are used on cheaper grades of furniture and wherever it is desirable to protect the wood from moisture with a heavy coat of stain. They are also used considerably for the interior of drawers and cupboards of case goods furniture. These places are not exposed to light much and when so finished require little sanding. Variations of color are not important in such places.

The oil-soluble aniline and coal tar dye colors are limited in number, as compared to the water anilines, but there are quite a number at that. From the following list of oil-solubles any stain color wanted can be produced by mixing and blending:

Black—nigrosine or naphthalene.

Brown—seal, loutre.

Brown Mahogany—orange and naphthalene black.

Reds—scarlet, carmosine and Bismarck brown.

Orange—orange Y and orange G.

Yellow—naphthalene yellow and auramine yellow.

These are the basic coal tar colors. Each manufacturer, however, markets such colors and modifications of them under private brand names and numbers. If you will order as above you will get what you want.

Among the advantages gained by using oil stains are the easy brushing qualities and freedom from laps and joints. That makes for lower labor cost because it saves time. They do not raise the grain of the wood and so save the labor cost of sandpapering such as is necessary when water stains are used. This class of stains is brilliant in hue, as has been said; they are transparent and they penetrate into the wood deeply enough to be practical. They really enhance the beauty of the wood grain and color shadings. In the hands of unskilled workmen the results obtained generally will be better than when other classes of stains are used. Largely for this reason the factory-made oil stains are probably the largest-selling class of all.

Considering the disadvantages attached to the use of aniline oil stains, we may say that as a class these stains are not permanent to strong light, at least not nearly to the same extent as the water aniline stains. The reds and greens in particular are very fugitive, so much so that when oil stains are used on interiors, the window sills, frames, casings and all trim exposed to sunlight, should be and usually are colored with water stains. Show windows, sun parlors and all light places ought never to be finished with oil aniline stains. Some of these oil stain colors are fairly permanent while others are extremely fugitive. It must be said, however, that the factory-prepared oil aniline stains are so prepared that they are far more permanent than the oil stains made by the painter from dry anilines and other coal tar dyes of this group. That is accounted for by the fact that skilled chemists are able to so combine the oil anilines with other chemicals as to get out of them the maximum durability or permanency in strong light. So that those stains used on the average interior and not exposed directly to the sun are entirely practical and satisfactory. It should be noted also that the factory-made oil stains are not all anilines; other coloring substances are used—whenever a more permanent color can be so produced. Asphaltum varnish is much used in these stains because of its great staining strength and permanency of color. In these factory-prepared stains correct proportions of many ingredients are used,—the aniline oil-soluble reds, yellow, black, scarlet, orange and browns, as well as naphtha, xylol, acids, acetone, benzole, asphaltum, etc. Each serves some purpose well when skillfully handled by experts, such purposes as penetration, permanency of color, easy brushing and spreading without laps and joints, keeping the ingredients in solution, etc.

In times past one of the most troublesome disadvantages of the oil-soluble anilines has been non-drying. A finisher should never spread varnish directly on top of an aniline oil stain. That causes the stain to bleed into the varnish, making a cloudy, muddy color effect. The solvents in the varnish lift the stain. Also this practice results in non-drying or tacky varnish. A thin coat of shellac should be put on top of the oil stain first and as soon as the stain is dry. That will seal it up. This shellac coat should go on before the filler, too, or the oil in the filler may lift the stain, resulting also in a muddy and cloudy color on the surface.

The oil anilines usually require wiping over with a cloth to even up the color before drying.

These stains are apt to make very dark or black streaks on soft woods unless the soft, porous places are treated before staining with oil or shellac. Also the pitch-filled streaks take the stain much lighter than the balance of the surface unless such areas are first treated with a coat of alcohol; this to cut the sap or resin and give the stain a chance to penetrate.

The oil aniline stains are useful in the medium dark and dark colors only. The light stains made of this class of coloring matter fade too soon to be practical. Better to use water anilines for very light colors as well as for the reds and greens.

The oil stains are usually put on with a flat wall brush four or four and one-half inches wide, and as has been said, it usually is well to let the stain soak in a little and then wipe off all excess in order to make an even coloring.

It is very important to clean the surface until it is free from all grease, glue, lime and dirt. The stain will not penetrate through such accumulations, so a light spot will occur where there is any foreign matter on the surface.

When soft woods are to be stained it is a good practice to coat the wood first with a mixture of one-fourth boiled linseed oil and three-fourths turpentine. Let it dry. That has the effect of equalizing the suction so that the stain will produce a more even tone.

Oil stains do not spread so well or penetrate so deeply when the stain is cold and when the surface is cold. The stain and surface should be about 70 degrees for best results.

Oil stains containing cheap rosin varnishes, japans or other resinous matter are injured more by the cold than others. When any oil stain is too cold the brush marks, laps and joints are apt to show. Creosote oil is one of the solvents used for stains, especially for shingle stains. It should be free from naphthalene, a solid, which remains in solution during the warm weather but crystalizes when cold. It causes many stain troubles on interior work and especially causes exterior shingle stains to fade and spot in a short time.

To secure greater penetration in any oil stain it is well to use from a pint to a quart of benzole to the gallon of stain,—90 degree benzole or 160 degree solvent naphtha.

The oil-soluble anilines are soluble in benzole, hot turpentine, xylol, mineral spirits and hot linseed oil. To heat the volatiles place the pot in a pail of hot water, away from the fire. They are, of course, very inflammable. After dissolving the stain colors in hot turpentine, benzole 90 degree, solvent naphtha 160 degree or mineral spirits, the stain may then be thinned with ordinary naphtha or benzine.

The following classification of the volatile spirits used to dissolve oil-soluble anilines, to secure penetration is useful:

Fast Evaporation	90 degree benzole. Water white. Flash point low. Dangerous near fire especially. Used largely for paint and varnish removers. Fine for washing up after using paint and varnish removers to take off any wax left on the surface, before re-varnishing. Straw color benzole. Flash point low. Dangerous near fire. Same uses as 90 degree benzole.
Moderately Fast Evaporation	Commercial toluol. Water white. Low flash point. Dangerous near fire. Straw color commercial toluol. Low flash point. Dangerous near fire.
Slow Evaporation	Solvent naphtha, 160 degree. Water white. Evaporates about as slowly as turpentine and has about the same brushing qualities. Flash point higher. Safer to use. Heavy naphtha. Dark color. High flash point. Safer still.

All of the above volatiles are of the benzole group and all have about the same solvent power and the same odor.

ANILINE OIL STAIN FORMULAS

GOLDEN OAK

Formula:— 8 ounces nigrosine black, dry, oil-soluble
4 ounces yellow, auramine or naphthalene, aniline, dry, oil-soluble
1 ounce walnut aniline, dry, oil-soluble
1 quart turpentine, hot
1 gallon black asphaltum varnish

Place the pot of turpentine in a pail of hot water. When very hot dissolve the nigrosine, yellow and walnut in it. Let cool and mix into the varnish.

Brush on this stain, let set about quarter of an hour and then brush on the filler across the grain. Rub in the filler with a wad of excelsior or burlap to force it into the pores of the wood. The natural colored filler will lift the excessive amount of stain on the surface and color itself. When it begins to set flat wipe off all of the filler on the surface, wiping across the grain and being careful not to drag the filler out of the pores.

Filler:— Silex (silica) natural color.

Finish:— Shellac (orange), varnish and polish to full gloss, or rub dull.

JACOBEAN OAK

Oak, Ash, Chestnut

Formula:— 2 ounces walnut aniline, dry, oil-soluble
1 ounce orange Y, or orange G, aniline, dry, oil-soluble
1 ounce nigrosine black, dry, oil-soluble
8 ounces drop black tinting color ground in oil
1 pint turpentine, hot
½ pint (8 ounces) boiled linseed oil
2 to 3 quarts naphtha or benzine

Place the pot of turpentine in a pail of hot water. When very hot add the walnut, then the orange, then the nigrosine and finally the drop black. Next add the oil while hot and when cold add part of the naphtha. Add the balance of the naphtha later if needed to make the color lighter and thinner. Keep well stirred. Brush on the stain and when set, but not dry, wipe out the highlights with a cloth in the corners and on the mouldings of panels, on carvings, etc.

Filler:— Not required.

Finish:— Shellac, orange. Wax or flat varnish.

WEATHERED OAK

Formula:— 4 drams scarlet or Bismarck brown aniline, dry, oil-soluble

8 ounces nigrosine black, dry, oil-soluble

½ ounce (8 drams) walnut brown aniline, dry, oil-soluble

1 pint and 8 ounces turpentine, hot

1 pint and 8 ounces benzole, 90 degree, or 160 degree solvent naphtha

1 gallon naphtha or benzine

Place the pot of turpentine in a pail of hot water. When very hot dissolve in it the colors. Let cool and add the benzole and naphtha.

Brush on, let dry thoroughly and then apply one thin coat of orange shellac, brushing carefully in one direction only to avoid lifting the stain.

Filler:— None required for the correct finish.

Finish:— Shellac and wax; or flat varnish.

EARLY ENGLISH

Oak, Ash, Chestnut

Formula:— 1 pound and 4 ounces nigrosine black, dry, oil-soluble

2 ounces and 8 drams yellow, naphthalene or auramine, aniline, dry, oil-soluble

8 drams walnut brown aniline, dry, oil-soluble

12 ounces linseed oil, boiled

4 ounces acetone to secure greater penetration (optional)

1 quart turpentine, hot

1 gallon naphtha or benzine

Place the pot of turpentine in a pail of hot water. When very hot dissolve the above colors in it and then add the oil. When cool thin with the naphtha or benzine.

Apply one thin coat of orange shellac. When the stain is thoroughly dry sandpaper lightly and clean up.

Filler:— Silex (silica) color black with drop black ground in oil

Finish:— Shellac, varnish and rub dull; or flat varnish; or wax.

FUMED OAK

Formula:— 8 ounces nigrosine black, dry, oil-soluble
9 ounces walnut aniline, dry, oil-soluble
1 ounce mahogany brown aniline, dry, oil-soluble
½ gallon benzole, 90 degree, or 160 degree solvent naphtha

Dissolve the above colors in the benzole in a bottle to prevent evaporation of the benzole. Brush on the stain and let dry. Apply a thin coat of orange shellac, brushing it in one direction only and as little as possible to avoid lifting the stain.

Filler:— None required. Open pores of wood are correct.

Finish:— Oil rub with a mixture of 2 ounces of boiled linseed oil, 1 ounce japan drier and 5 ounces benzine. Rub in, wipe off and let dry. Apply the second coat of oil in the same way. Let dry 24 hours or more. Shellac, 1 coat, orange. Flat varnish or wax.

ANTWERP OAK

Oak, Chestnut, Ash

Formula:— 4 ounces nigrosine black, oil-soluble, dry
6 drams yellow, naphthalene or auramine, dry, oil soluble
80 grains scarlet aniline, dry, oil-soluble
1 pint linseed oil, boiled
1 pint turpentine
1 gallon benzine or naphtha

Place the pot of turpentine in a pail of hot water. When the turpentine is very hot dissolve the above colors in it one at a time. Then add the oil and finally when the solution is cool add the benzine or naphtha.

Brush on the stain and let dry. Apply one coat of white shellac, let dry and sandpaper lightly.

Filler:— Silex (silica). Color black with drop black ground in oil.

Finish:— Shellac, white. Varnish and rub dull; or flat varnish.

OIL PIGMENT STAINS

In this group we have stains which are made by thinning a good grade of tinting colors ground in oil with linseed oil, turpentine, benzine or benzole. There are many jobs about houses and other buildings upon which these stains are used, especially for soft woods. The furniture finisher, however, does not recognize pigment stains as stains at all. His contention is that they do not really color the wood but simply fill and cover it with a thin layer of color pigment, allowing some of the natural characteristics of the wood to show through. From his viewpoint what the house painter calls pigment oil stains are really thin paints. His ideal is to really color the wood fibre to be as nearly as possible like woods colored by nature (redwood and gumwood) and not to hide the grain figure or natural color shadings of the wood in the least. To gain his ideal, therefore, the furniture finisher must use absolutely transparent stains. That is why the aniline water stains are his preference.

On hard woods like maple and birch the oil pigment stains do not produce such dark effects as upon soft woods like soft pine, poplar, fir, etc. They are, however, convenient to mix in the shop or on the job; they are permanent as to color in strong light and very useful for repair jobs and cheap work.

The oil pigment stains have very definite limitations. No bright colors are commonly mixed in this group. The dull reds, browns and yellows made from earth pigments like the siennas, umbers, venetian red, etc., are mostly used. And even when high quality pigments are used, which are very finely ground, this kind of stain hides the natural beauty of fine woods in cabinets and furniture too much to be useful for such work. But these objections have little weight when it comes to staining soft woods for ordinary work.

As to penetration the oil pigment stains do pretty well, as well as any oil stains, but do not, of course, penetrate as deeply as water stains. The penetration can be greatly increased, especially on hard, close-grain woods by the addition of benzole, 90 degree, in place of one-half of the turpentine.

The better grade of tinting colors, called decorators' colors, are much better than the ordinary tinting colors used for paints. The cheaper colors are apt to be less transparent and coarser ground. They are likely to make a muddy or cloudy stain. Only the semi-transparent colors are suitable for stains,—raw and burnt sienna, raw and burnt umber, chrome green, Prussian blue, ultramarine blue, Vandyke brown, Dutch pink, rose pink, verdigris green, drop black, etc. Chrome yellow, yellow ochre, lamp black, etc., are not suitable because they are opaque and hide the surface completely. Raw umber and ultramarine blue mixed make a good transparent black.

Pigment stains should be mixed the same as paint, being careful to thoroughly mix and strain all pigments.

The soft woods which may have very porous streaks sometimes take the stain very dark in places and quite light in others. To overcome this some finishers spread on a very thin coat of shellac,—about 2 pounds of shellac gum to a gallon of denatured alcohol. Others prefer to spread on a thin coat of oil mixed,—¼ boiled linseed oil and ¾ turpentine. This oil coat should be brushed on and allowed to dry before staining the wood. It will then eliminate the mottled, uneven coloring of the wood.

As a rule it is well to brush on an oil stain, let it soak in half an hour or less, and then wipe off all excess of stain on the surface. For a lighter color effect, wipe off sooner. And if the room is warm and well ventilated it is necessary to wipe off sooner. An oil stain should be allowed to dry thoroughly before shellac, varnish or filler coats are put on over it. This stain does not raise the grain of the wood, is very easy to apply and it will cover about 600 square feet per gallon, one coat.

OIL PIGMENT STAIN FORMULAS

FOR ANY COLOR

1 pound color pigment ground in oil
10 ounces japan drier
6 pints boiled linseed oil
12 ounces turpentine or mineral spirits
12 ounces benzole, 90 degree
Produces about 1 gallon of stain.

The amount of color needed varies with kind and quality and with the kind of wood, but from 1 to 3 pounds covers the range with the quantities of liquids indicated.

LIGHT OAK

1½ pounds raw sienna
½ pound raw umber
8 ounces japan drier
1 quart turpentine
1 quart benzole, 90 degree
3 pints boiled linseed oil
Produces about 1 gallon of stain.

DARK OAK

1 pound raw sienna
½ pound burnt sienna
½ pound burnt umber
½ pint japan drier
1 quart turpentine
1 quart benzole, 90 degree
3 pints boiled linseed oil
Produces about 1 gallon of stain.

WALNUT

1 pound Vandyke brown
1 pound burnt umber
1 ounce rose pink
1 quart turpentine
1 quart benzole, 90 degree
3 pints boiled linseed oil
Produces about 1 gallon of stain.

MAHOGANY, RED

1¾ pounds burnt sienna
¼ pound maroon lake or rose pink
1 quart turpentine
1 quart benzole, 90 degree
3 pints boiled linseed oil
Produces about 1⅛ gallons.

MAHOGANY, BROWN

12 ounces burnt sienna, Italian
4 ounces rose pink or maroon lake
4 ounces Vandyke brown
4 ounces burnt umber
½ pint japan drier
1 quart turpentine
1 quart benzole, 90 degree
3 pints boiled linseed oil
Produces about 1⅛ gallons of stain

GRAY STAIN

1¾ pounds raw umber
¼ pound drop black
1 ounce Prussian blue
½ pint japan drier
1 quart turpentine
1 quart benzole, 90 degree
Produces 1⅛ gallons of stain

GREEN OAK STAIN

½ pound raw umber
½ pound raw sienna
1 pound Prussian blue
½ pint japan drier
1 quart turpentine
1 quart benzole, 90 degree
3 pints boiled linseed oil.
Produces about 1 gallon of stain.

BLACK OAK

1 pound Vandyke brown
1 pound drop black
½ pint japan drier
1 quart turpentine
1 quart benzole, 90 degree
3 pints boiled linseed oil
Produces about 1 gallon of stain.

CHERRY STAIN

1⅞ pounds burnt sienna
⅛ pound crimson lake
½ pint japan drier
1 quart turpentine
1 quart benzole
3 pints boiled linseed oil
Produces about 1 gallon of stain.

ROSEWOOD

1¼ pounds burnt sienna
¼ pound rose pink
¼ pound drop black
½ pint japan drier
1 quart turpentine
1 quart benzole, 90 degree
3 pints boiled linseed oil
Produces about 1 gallon of stain.

While the stain is wet and flowing draw some black streaks in it, using a small soft blender brush or a feather from which some of the fibre web has been cut so the feather will trace several black streaks at a stroke.

STAIN COLORS FROM ASPHALTUM VARNISH (BLACK JAPAN)

Many light, medium and dark brown stains are commonly made simply by thinning asphaltum varnish with benzine. The colors are permanent in strong light and are more transparent than pigment stains. The mission and weathered oak stains are produced with this kind of stain to which a little drop black is added. The drop black should be that which is ground in oil. A great many other colors are produced by mixing one or more pigment colors with asphaltum varnish. Oil-soluble anilines are also used to color asphaltum stains.

CHAPTER X

VARNISH STAINS

COLOR PIGMENT VARNISH STAINS; ANILINE AND COLD TAR DYE VARNISH STAINS; SHELLAC ANILINE AND PIGMENT STAINS

Varnish stains are not often used by painters and yet there are occasional quick, cheap or temporary jobs where time or money limits make it handy to use a varnish or shellac stain. The large volume of factory-made varnish stains sold each year is used largely by women and others on furniture and on floors about old houses.

The varnish stains are simply varnish to which coloring matter has been added in sufficient quantity to produce a decided color but not enough to make the varnish completely obscure the surface. Transparent colors are used.

These stains fill, color and add a gloss to the surface all in one coat. They serve some purposes well enough but really high class finishing is not done with this class of stains by skilled craftsmen. Such stains do not penetrate the surface to any extent, they dry rather quickly, over night or in an hour or so in the case of the shellac stains. They are fast to strong light exposure or not depending upon whether the permanent earth pigments are used or the permanent anilines or the fugitive anilines.

In furniture factories where furniture is made from the cheaper grades of lumber varnish stains are used because the woods streaked with very soft and porous parts are given an even, uniform coloring with varnish stain, whereas that is quite impossible with other stains without much expensive preliminary work. Varnish stain prevents the very soft parts from absorbing the color excessively and so becoming very dark and making a spotty, mottled effect of color.

If varnish stains are made too dark in color they completely hide the wood grain figure and give the appearance of an enameled surface.

VARNISH PIGMENT STAINS

The materials which may be used for mixing varnish pigment stains are,—first class cabinet, coach, spar or floor varnishes to which good quality colors ground in japan and thinned a little with turpentine are added. Tinting colors ground in oil and commonly used for tinting house paints may be used, out the japan ground colors are much better. Only high grade colors ought to be used, because the cheaper colors are not transparent enough; they are apt to give the stain a muddy, cloudy appearance. Only the colors which are naturally fairly transparent should be used, such colors as the umbers, siennas, Venetian red, chrome green, Prussian blue, ultramarine blue, cobalt blue, Dutch pink, verdigris green, rose pink, maroon lake, orange chrome, drop black, etc. Yellow ochre, chrome yellow and lamp black are not suitable because they are opaque.

To mix varnish stains break the color pigment up first with a little turpentine and thoroughly mix it. Strain the color through double cheese cloth before adding it to the varnish. Next thoroughly stir it into the varnish which should be not colder than 70 degrees, a little warmer is better.

VARNISH PIGMENT STAIN FORMULAS

MAHOGANY, RED

7 pints varnish
¼ to 1 pound Italian burnt sienna
1 to 3 ounces rose pink
½ pint turpentine
Produces 1 gallon of stain.

MAHOGANY, BROWN

7½ pints varnish
½ to 1 pound Vandyke brown
4 ounces burnt umber
¼ pint turpentine
Produces about 1 gallon of stain.

WALNUT

7½ pints varnish
½ to 1 pound Vandyke brown
½ pint turpentine
Produces about 1 gallon of stain.

LIGHT OAK

7½ pints varnish
½ to 1 pound raw sienna
½ pint turpentine
Produces about 1 gallon of stain.

DARK OAK

7½ pints varnish
½ to 1 pound raw umber
4 ounces burnt umber
¼ ounce drop black
½ pint turpentine
Produces about 1 gallon of stain.

CHERRY

7½ pints varnish
½ to 1 pound burnt sienna
1 ounce rose pink or maroon lake
½ pint turpentine
Produces about 1 gallon of stain.

VARNISH ANILINE STAINS

This group of stains is mixed by adding oil-soluble coal tar colors to the proper kind of varnish for the surface to be finished,—cabinet, coach, spar or floor varnish. They are quite like other varnish stains except that the colors are far more transparent, brilliant and beautiful. Some of the colors are quite permanent to strong light while others are fugitive and fade too soon to be practical, especially the reds and greens. See Chapter IX for further detailed information on this subject.

The aniline or other coal tar dye color ought first to be dissolved in hot turpentine. Place a pot containing a little turpentine in a pail of hot water and when very hot add the color, stirring until completely dissolved. Then add the color to the varnish, running it through a double thickness of cheese cloth to strain out any sediment or undissolved matter. Mix the color thoroughly into the varnish. One or several colors may be mixed into the varnish to produce the exact color hue wanted.

SHELLAC ANILINE STAIN

A skilled brush hand can do a pretty good job of staining over old or new surfaces by using a stain mixed from shellac and spirit soluble anilines. Dissolve the aniline colors in hot denatured alcohol by placing the pot of alcohol in a pail of hot water away from the fire. The color when dissolved should be mixed with white shellac, making it thin or thicker as the case may require,—about a 3½ pound-cut is needed usually (3½ pounds of white shellac gum to 1 gallon of denatured alcohol). For more information about spirit soluble anilines see Chapter VIII.

FLAT WALL PAINT STAINS

This type of stain is not generally recognized under such a title, although it is frequently used by painters to gain an interesting finish. Such a finish is popular for furniture, particularly novel breakfast and dining room tables and chairs, which have the effect of natural wood color for the most part, in oak, but the grain of the wood shows white or some light tint. Any oil paint color, flat paint, or enamel, thinned a little with turpentine, brushed on to an open grain wood, or a wood with a very strong, contrasting grain like fir, and wiped off before it is dry, will stain the wood, leaving the paint in the open wood cells, but permitting the non-porous parts of the wood in the natural color.

The application of this pigment stain idea to walls of wood often provides just the right character of color and degree of contrast needed. The illustration, Fig. 5A, of a living room is a case in point. Here the fir lumber presented a very contrasty wood grain. To have finished with a transparent stain and varnish, shellac or wax would have made a room background for the furnishings entirely too contrasty. The color wanted was a very light pastel flat pea green; an impossible effect to gain with transparent stain. So, a flat wall paint was thinned a very little, brushed on and wiped off at once. Enough of the fir grain came through to be interesting; it was the color wanted and had no gloss. It is a delightful background for the Early American Maple furniture having red and yellow tones.

CHAPTER XI

STAIN MIXING, BRUSHING AND PROCEDURE, WEIGHTS AND MEASURES

THERE are but few additional points to keep in mind about the mixing, brushing and procedure in the application of stains. In the chapters treating each kind of stain the important considerations were discussed, but there are following some more points of general application.

It has been suggested in preceding chapters that the finisher ought to work by measure and not by guess. That takes more time but it pays to do it the first time or two, if not as an everyday practice. Put a label or tag on every stain mixture made, or keep a memorandum book to show the quantities of each ingredient used in mixing your stains. Then if you run short of stain you can easily and quickly duplicate the first batch exactly.

When mixing by measure you will need the glass graduates, mortar and pestal, funnel and the balance scales illustrated in Chapter VI. Then you will also have need of the following tables:

U. S. STANDARD WEIGHTS AND MEASURES

AVOIRDUPOIS WEIGHT

Commonly used in weighing all goods except drugs, gold, silver, precious stones and chemicals.

27$\frac{11}{32}$ grains	=	1 dram (dr.)
16 drams	=	1 ounce (oz.)
16 ounces	=	1 pound (lb.)
1 pound	=	7,000 grains (gr.)
25 pounds	=	1 quarter (qr.)
4 quarters	=	1 hundredweight (cwt.)
100 lbs.	=	1 hundredweight (cwt.)
20 hundredweights	=	1 ton (T.)
2000 pounds	=	1 ton (T.)

APOTHECARIES' WEIGHT

Used in measuring medicines, drugs and chemicals.

20 grains	=	1 scruple
3 scruples	=	1 dram
8 drams	=	1 ounce
12 ounces	=	1 pound

APOTHECARIES' FLUID MEASURE

Used in measuring drugs, medicines and chemicals.

1 minim	=	1 drop
60 minims	=	1 fluid dram
8 fluid drams	=	1 fluid ounce
16 fluid ounces	=	1 pint
32 fluid ounces	=	1 quart
8 pints	=	1 gallon
4 quarts	=	1 gallon

LIQUID MEASURE

Used in measuring fluids.

4 gills	=	1 pint
2 pints	=	1 quart
4 quarts	=	1 gallon
1 gallon	=	231 cubic inches
1 barrel	=	31 gallons (wine), 196 pounds (flour), 2¾ bushels (apples), 50 gallons (oil) or any of various quantities of liquids.
1 hogshead	=	63 gallons or any of various quantities of liquids or solids.

DRY MEASURE

Used in measuring various dry substances.

2 pints	=	1 quart
8 quarts	=	1 peck
4 pecks	=	1 bushel
1 bushel	=	2150.42 cubic inches (U. S.)
1 bushel	=	2218.2 cubic inches (British)

The many formulas given in this book may never be found to be exactly right because you may be using materials of greater or lesser strength than those used in testing out the formulas. They are, however, very close to the standard colors, or what are considered standard by many, and you should experience no difficulty because you will soon learn to temper any stain or to blend the various colors in your mixtures to produce the exact color tones wanted.

Many things influence the color of a stained wood surface. Various boards of the same kind of wood, and even from the same tree, may finish up a slightly different color hue when using the same stain. And again you may have a stain which gives exactly the color wanted on birch, but put it on pine, gum or maple and quite another color hue may result on each kind of wood. So, to mix stain to match a sample you must spread it on the same kind of wood of which the sample consists. All of which simply goes to demonstrate the necessity for a finisher learning the exact characteristics of various stains on the many common woods. A good finisher can usually mix or temper a stain to make it match closely enough on two or more kinds of wood. By mixing his stain thinner or thicker, lighter or darker, by adding other colors or mixing two or more liquid stains of the same group or class and by wiping skillfully a finisher has complete control of results and can usually, but not always, produce the color wanted on any kind of wood. In a room trimmed with two or more kinds of wood it often is necessary to have two or more pots of stain tempered to fit each wood. Then, too, the preliminary treatment of the wood with acids or alkalies to change their chemical content before staining, or with oil or sizes to make the suction of the wood more uniform increases control of results. Veneered doors and panels with light and dark streaks can be made uniform by brushing on a coat mixed from 1 to 1½ ounces of bisulphite of soda dissolved in 1 pint of water. It will bleach out discolorations and make the whole surface lighter.

The rougher the surface, naturally or from rough sandpapering with coarse paper, the darker the color produced by a stain. Rough surfaces soak up more stain. And smooth surfaces,—naturally hard, close-grain, and those made smooth with fine sandpapering take the stain with a lighter color.

To preserve and enhance the naturally beautiful characteristics of wood the stain substance or coloring matter dissolved in liquids should be completely soluble in the liquid used, that is, no coloring matter should remain in suspension, nor should any precipitate on to the bottom of the pot. Success in mixing to this extent means perfection and is the aim only for finishing fine furniture and cabinets. In the finishing of interior wood trim and cabinets of ordinary work the pigment oil or water stains sometimes used fail to meet this ideal because very little of the pigment coloring matter is really soluble in the liquids, they constitute merely a mechanical mixture of fine pigment with the liquid, the pigments remain in suspension. So when a pigment stain is being used the pot should be stirred often to maintain a uniform mixture. Otherwise the coloring pigment will settle to the bottom and the color imparted to the wood will gradually become lighter.

When water, spirit or oil aniline coal tar dye colors are used a good stain will remain clear at ordinary temperatures down to about 40 degrees. If at freezing temperature these stains show a settlement of coloring matter they should be heated, allowed to cool to 70 degrees and then they ought to be strained before using. If used while cold, strain them also or the color imparted to the wood will not be uniform. If you begin to spread such stains while warm do not allow them to drop to low temperatures or the color will get lighter as the stain gets colder. When you start a job one day with stain at a temperature of about 70 degrees, allow the stain to get very cold over night and begin using it next morning without warming, the color of the wood stained the second day will be lighter.

The theory of crystallization is interesting as it concerns the solubility of anilines and other coal tar dye colors. To illustrate its working,—a gallon of water at 70 degrees temperature may completely dissolve only say 2 ounces of a dry color of this type. It will remain clear with no precipitation and no cloudiness. You may let the temperature drop to 50, or even 40, degrees and still the stain will remain clear and hold the color in solution, showing no deposit of color on the bottom. Now if you raise the temperature to the boiling point, 212 degrees, you will find that at that temperature an ounce or so more of the color will be dissolved in the water, that the stain will remain clear and no deposit of color will be noticed on the bottom of the container. The coloring matter is completely in solution,—a super-saturated solution, as it is called. Now allow the temperature to drop to 70 degrees again and the excessive load of color begins to precipitate to the bottom. And here is where the interest of the experiment begins,—the crystallization goes on to the extent of throwing out of solution not only the extra one ounce of color added at 212 degrees but also some of the 2 ounces held in solution at 70 degrees before.

The conclusion, then, to be drawn from these facts is that one ought not to mix a super-saturated stain solution unless you are going to apply the stain while hot.

Any insoluble material thrown down in stain mixed at any temperature should be strained out before brushing it on to the wood. When this is not done the color may be streaked, cloudy or spotted. This insoluble material must be avoided especially in finishing with walnut browns of the water stain type. Of course, if you add more water to the stain the excess of coloring matter will be put into solution and that is more economical because you then have more stain.

PREPARING WOOD TO TAKE STAIN WITH EVEN COLOR EFFECT

The wood trim and cabinet work of the average building is stained without much thought about preparing the wood to take the color evenly, but there is no doubt about the better results to be gained by more attention to this detail. Some finishers, it is true, coat very soft, porous woods with a very thin shellac before staining and that has the effect of stopping the suction in the very porous streaks, when oil, water or spirit stains are used. Some prefer to brush on a coat of oil, about one-fourth boiled linseed oil and three-fourths turpentine, before the staining is done. The oil should dry before the application of the stain. Sometimes the whole surface is treated with the shellac or oil size and sometimes only the excessively porous boards.

Before the application of water stains the wood is sponged over with water and allowed to dry. This to raise the grain of the wood as the water stain would do anyway. The wood is then sandpapered and cleaned up before the water stain is applied. The object of this procedure is to avoid the sandpapering on top of the stain color because that necessarily removes some of the color. On some woods, the grain of which is raised excessively by water, it is also necessary to sandpaper after staining, even though a sponge coat of water was put on, but this sanding on top of the color is very lightly done and so does not remove color.

A water sponge coat is also used to make a water stain color the surface more evenly when there are great variations in the absorbing characteristics of the wood surface. In that case the water is sponged on and before it dries the stain is brushed on.

Old time finishers use what is called white sparkle, a size coat to be brushed on to soft open streaks in pine and other woods so the stain color will produce an even effect. White sparkle is mixed with a little good cabinet glue, warm water, dry whiting, white lead in oil, varnish and plaster of Paris. It is mixed very thin and brushed on to the porous streaks. When dry after two days it is sandpapered. Considerable skill is required in the use of this to avoid filling the wood up so much that it will not take the stain color and will not give a muddy appearance on the streaks treated.

The end grain on table tops, cabinets, etc., also the porous knots where they show end grain, are touched up by the furniture finisher before staining. He uses a very thin glue size made with the best cabinet glue and warm water. This must be done carefully. If too much glue is used a water stain will not take, will not penetrate through it. This glue size treatment serves for water, oil and spirit stains alike.

Resinous knots and streaks of sap wood do not take stain sometime, or they take the color very much lighter than the balance of the wood. To overcome this condition brush over these areas two or three times with a solution of water and potash,—a 1% solution—(1 ounce of caustic potash to 99 ounces of water). After this treatment wash up in a few minutes with clear water. When this treatment is not successful one or more coats of denatured alcohol may be brushed on to the surface to cut through the resin or pitch. Benzole, 160 solvent naphtha, is also good.

Before using spirit stains some finishers dilute a little of the stain very much with denatured alcohol and use that as a coating for the knots and sap streaks which are likely to come out a lighter color if not so treated.

Sap streaks, knots, etc., in wood to be finished with oil stains are treated before staining by some finishers with a mixture of turpentine, benzine and japan drier. Turpentine and benzole (99 degree or 160 degree solvent naphtha) are preferred by others, to be used in equal parts.

Woods which are generally resinous, like pitch pine, can be made to take a stain more uniformly, as to color, and to take a darker color if washed over with a soda and water solution. The sal soda alone, however, will stain the wood a bit, so a little yellow laundry soap is used with it to overcome that tendency.

Mix this soda wash as follows:

4 ounces sal soda
1 gallon warm water
1 ounce yellow laundry soap.

Sponge the surface with this wash, let dry and then clean up with clear warm water.

THE BRUSHING OF STAINS

As a rule it is best to use a large flat wall brush, 4 or 4½ inches wide and sometimes a 5-inch calcimine brush, for the application of stains on large surfaces. Smaller brushes are, of course, suitable for smaller surfaces, but better have the brush too large than too small. Note Plate 6.

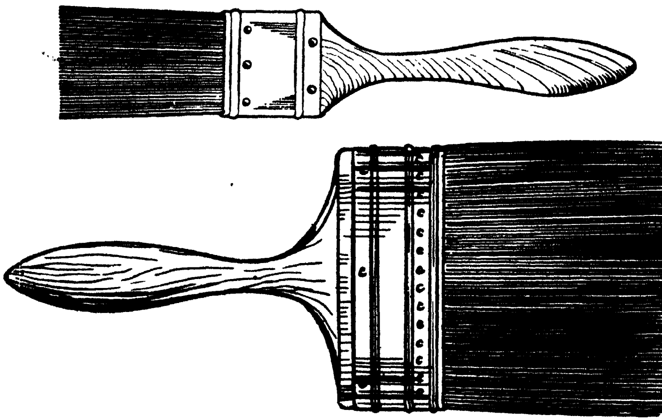

Plate 6.—The Flat Wall Paint Brush in Common Use for Coating All Large Surfaces With Paint or Stain. 4 and 4½ inches wide are the usual sizes.

Take a full load of stain with each brushful, but don't overload. Distribute the stain with long, strong, quick strokes. Do not use a comparatively dry brush except on end wood and when using spirit stain.

Speed is necessary in spreading any stain to distribute it evenly, especially on oak, chestnut and ash which have large open cells which soak up much stain making too dark a color in places. There is not so much danger on veneered wood in this respect,—the stain can penetrate only as far as the glue. But on solid wood more stain may go deep into the wood, if you flood the surface by working too slowly, than can dry in the time allowed. Then when you seal up this wet stain with filler, shellac and varnish trouble may follow. Sometimes the wet stain generates gas and forces itself to the surface pushing filler and varnish ahead of it and a disfigured surface results.

In your brushing to avoid laps, which are the result of piling up a double coat of stain at the joints, take advantage of the natural breaks of the surface. On cabinets, wall panels, furniture, doors, etc., do one whole panel or board at a time, letting the brush sweep the full length of the panel or board without a stop if possible. At any rate, make your stopping places at

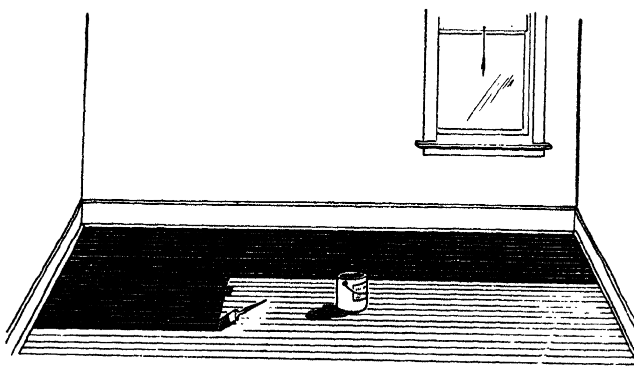

Plate 7.—When Brushing Stain it is Important to Brush From the Dry Wood Toward the Part of the Surface Which Has Been Coated With Stain. Cover Narrow Stretches to Keep All Edges Wet.

the natural limits of the surface whenever possible,—at the corners, ends, mouldings, seams, etc. Then if there is a little lapping of a wet stain coating over a partly dry stain coating it will not show up.

It is correct to brush from the dry wood toward the stain coated finished wood. Note Plate 7. When working on floors coat in about ten boards at a time and carry the stretch the full length across the room. Then the break between the partly dry stain and the new wet stain of the next stretch will come at the crack or seam and will not show darker.

In brushing stain on to panels and large boards the finisher sometimes has difficulty on refinishing old surfaces which had been varnished and filled because after putting the stain on it wipes off again with the finishing touches of the brush strokes, especially if a slow-drying stain is used. To avoid this it is necessary to wipe

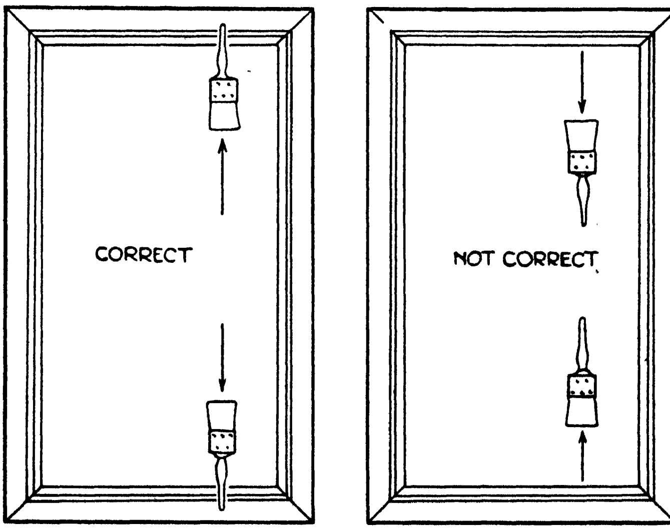

Plate 8.—Correct Brushing of Stain to Avoid Pulling Off the Color From Ends of Panels.

the brush fairly free from stain on the final touches and then brush up toward the top and down toward the bottom very lightly and deftly so the point of beginning with your brush will not show in the middle of the panel. This difficulty of having the brush drag the stain off of the surface is more likely to happen when flowing a full coat. See Plate 8.

Plate 8a.—Stained and varnished wood ceilings are greatly enhanced by the addition of suitable colors on beam soffits and in panels. Stencils offer an easy method.

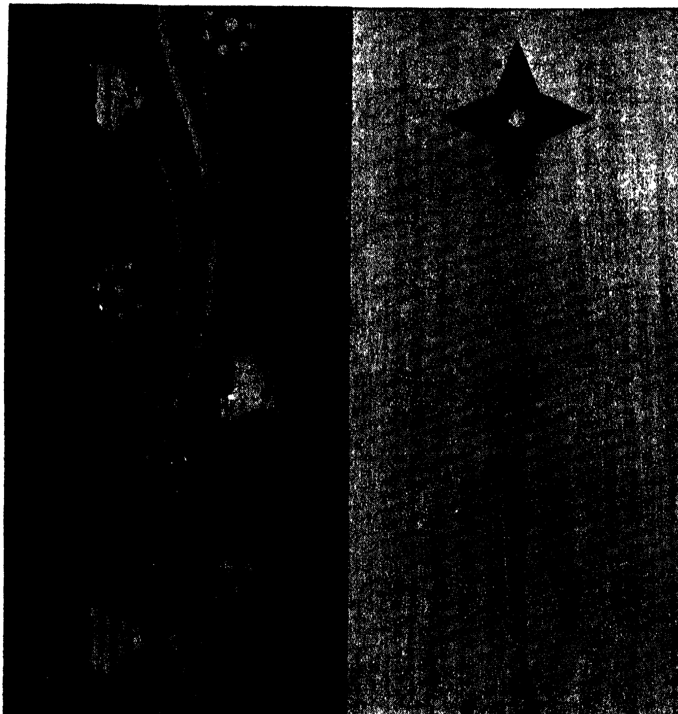

Plate 8b.—Floors, doors, casings and wood panels finished in natural or stained colors are easily decorated in marquetry effect. Before the staining operation the designs are applied with stencils using clear varnish on the stencil brush. Then when the surface is stained, the stain does not penetrate the varnished design, but is wiped off, revealing the natural color of the wood.

Soft porous woods are more difficult to coat with stain to avoid lapping or piling up of the stain color at the beginning and end of the strokes. Use a large brush, as has been said before, load it with stain so it will be full but not so any will drip out. If overloaded the brush will blot like a pen too full of ink. Then an excess of stain and a darker spot will appear on the surface. On soft woods especially the brush strokes must be strong and decisive, beginning at one end and running the full length of a panel or board at one sweep. If you break the stroke in the middle or let it stop short, the stain will pile up and be darker at the joint where you begin again.

On open-grain woods with large pores the stain sometimes bridges over the open cells filled with air. A stiff brush is needed to apply the stain and rub it into these cells. With slow drying stains it is a good plan to have a short bristled large brush, like a shoe brush, handy to rub in the stain after spreading it with the regular flat wall brush.

To get an even coloring on end wood, the boards cut across the grain you must use a fairly dry brush. This end grain soaks up stain rapidly and will dry a darker color than the balance of the wood if a full brush load of stain is used on them; the same is true of porous sap streaks and rough knots. When these parts are treated as described earlier in this chapter the stain can usually be flowed on full the same as on the balance of the surface.

As a rule two medium thin coats of stain are better than one heavy coat on close-grain wood for darker effects. Penetration is slow on these woods and it is well to apply the stain warm when the water stains or chemical stains are used. On these woods one standing is usually enough to smooth down the grain raised by two coats.

On any raw new wood the stain must be applied more freely than on a treated or sized wood.

When you start to use a full brush load of stain on a surface try to take up the same amount of stain every time you dip the brush.

The brushing and wiping of water and spirit stains require more skill than the application of oil stains. This is especially true when working on soft, porous woods like white pine, bass, poplar, fir and gum. These are more absorbent than woods like maple, birch and cypress.

Water stains penetrate more deeply and spirit stains more quickly, leaving dark spots where each brush load of stain is first put in contact with the wood. So after dipping the brush be sure it is not overloaded to the point where it may drip and blot the soft porous surface. Then apply the stain with light, long and rapid sweeps and lay the color off, distribute it evenly, with as few strokes as possible in order to gain a uniform color. It is safer to mix the stain very thin and apply two coats on these woods to gain a darker effect. If a water stain appears too dark after application some of the color can be removed if wiped over evenly with a wet cloth (water). A spirit stain should be wiped to lighten it, with a cloth dampened with benzine. Care must be taken in any case, however, to avoid wiping harder in some places than in others, or a light streaked surface or mottled effect will result.

Oil stains are easy to apply because the finisher has plenty of time to brush them on evenly and they do not show laps and joints. Such stains do not penetrate as deeply as water stains, although when they contain benzole they penetrate deeply enough for all practical purposes. The oil stains may be spread and allowed to stand a quarter or half hour and can then be wiped off to remove any excess stain not absorbed by the wood.

If the color is too light a second coat may be put on after the first is dry. If too dark some of the color can be removed by wiping with a dry cloth and more of it will come off if the cloth is dampened with benzine or turpentine. Care must be taken, however, to avoid wiping off in spots or streaks. The oil stains are especially good for soft porous woods in the brown colors, but do not give such dark colors on maple, birch and other close grained, hard woods.

Hog bristle brushes cannot be used for the application of strong acid and caustic alkaline stains. The strong acids and caustic alkaline solutions quickly destroy hog bristles. Brushes made of tampico or other vegetable fibres are used for brushing on these stains.

Weak stain solutions of acids and alkalines can be put on with old hog bristles brushes. It is well to test out the effect of a chemical stain on the bristles if the brush you propose using is of much value. Pull out a bristle or two and dip them in the stain. If the bristles curl up even slightly the brush will be injured;—it will become soft and flabby after use in such stains. In that condition they will not spread the stain evenly nor work it into the pores of the wood.

Hog bristle brushes used in chemical stains of little strength should be washed out clean when the job is finished, using clean warm water. Let the brushes dry and then fill the bristles with vaseline liquid or paraffine oil or neutral oil. After standing with this oil for a day or so wipe out all the oil you can and dry the bristles with clean cloths until they will not longer show grease marks on white paper. The brush must be dry before using it again in chemical stains. Brushes cared for in this way will stand considerable use in chemical stains and still retain their stiff, springy working qualities. After such treatment the brush doesn't carry so large a load of stain as it did at first but it soon returns to its former condition.

The cleaning of brushes used in other stains ought to be done as soon as the job is finished, laying the brushes flat to dry with the bristles straight. A brush should be cleaned with the same thinner liquid as was used in the stain or in a solvent of that liquid. Brushes used in spirit stains should be cleaned with denatured alcohol or wood alcohol. Brushes used in oil stains should be cleaned with benzine, naphtha or benzole. Brushes used in water stains should be cleaned with water.

PROCEDURE IN STAINING

Success in staining a surface beautifully and with the even color usually desired depends largely upon your procedure, upon which part of the surface is colored first and how you follow through to the conclusion. This subject has been touched upon earlier in this chapter and here are a few more points which will help the new man to develop his working methods.

When painting a wall panel or the panels of cabinets or furniture many finishers coat in the mouldings around the panels first and then follow up by coating-in the center of the panels all around. That method is not correct when staining with rapid setting stains. Don't brush the stain around the moulding edges of a panel, four sides, and then come back to coat-in the center. Working that way you will have to keep four edges wet and it can't be done on fairly large panels. It is better to start the first brushful of stain on one side, covering the moulding and part of the panel center. Then the second brushful should be laid right alongside of the first, repeating until the panel has been completely stained. In that way only one edge must be kept wet and there is much less likelihood that there will be dark streaks where a new brushful of stain is run alongside of a brushful that has become partly dry. Note the correct and incorrect brushing methods in Plate 9.

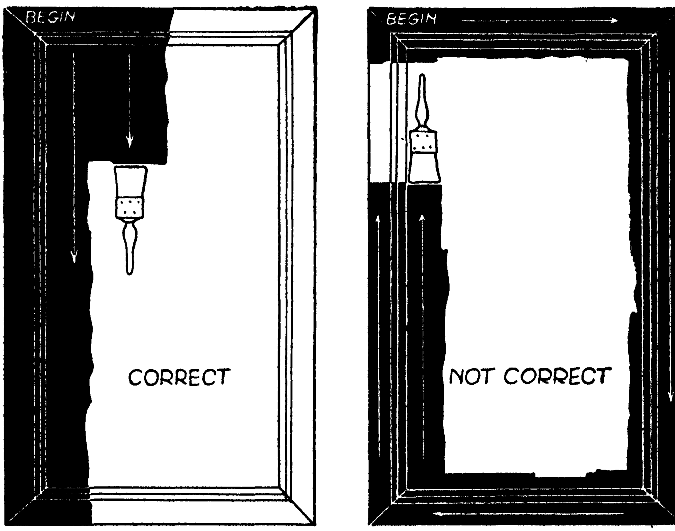

Plate 9.—Success in Staining Wood an Even Color Depends Upon Your Keeping All Edges Wet. To Do That Correct Procedure is Necessary. Above are Pictured the Correct and Incorrect Brushing Methods.

The finishing of a paneled door with stain must be carefully done to gain a uniform color, taking advantage of the natural breaks in the surface. A good procedure is indicated by Plate 10.

When it comes to staining the casings, jamb, stops, etc., of an inside doorway between two rooms there is a question in the minds of new men as to where to stop,—that is when one room has a stained finish and the other is painted, enameled or stained a different color.

Plate 11 shows the correct division of the surface between two finishes.

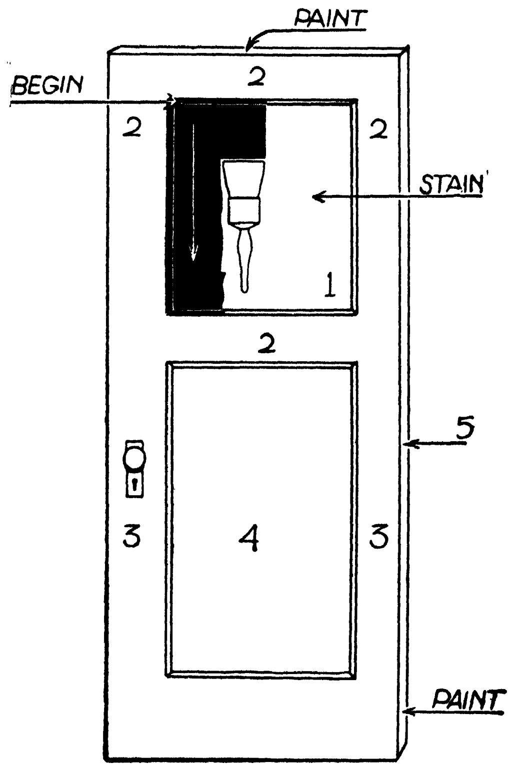

Plate 10.—A Good Procedure for Use in Staining a Paneled Door in Order to Keep All Edges of the Stain Wet Until the Brushing Has Been Completed.

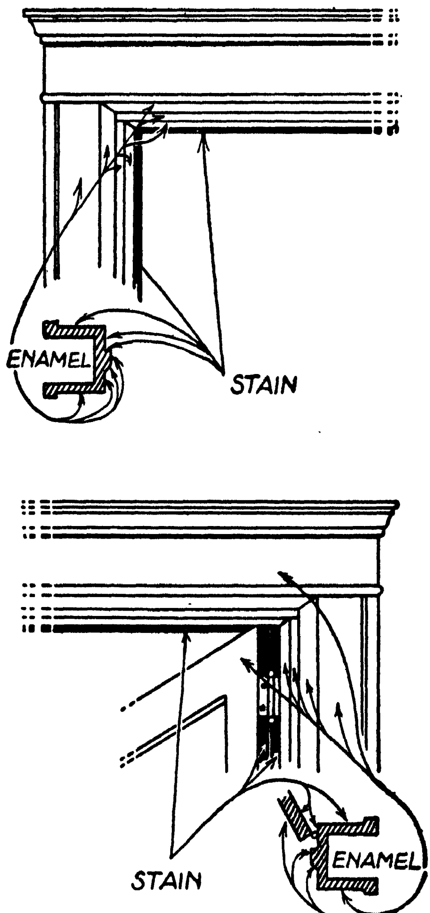

Plate 11.—Staining Door Trim and Doors Which are Between Two Rooms Finished Differently Puzzles the Inexperienced as to Where to Stop. Above Shows the Correct Handling When One Room is Stained and the Other Enameled.

CHAPTER XII

THE MIXING AND USE OF WOOD FILLERS

WOOD fillers are needed for the purpose of filling the open cells or tiny crevices in open-grain woods such as oak, ash, chestnut, butternut, elm, mahogany, walnut, etc. All woods are composed of fibres and cells. While growing these cells are filled with water, sap or resin. When the wood is seasoned and dried the cells are filled with air. The surface cells are littles holes or pores. In the open-grain woods listed above they are fairly large. In close-grain woods like maple, birch, bass, beech, cherry, cypress, fir, pine, gum, poplar, redwood, spruce, sycamore and holly, the cells are very small, the fibre being closely woven together.

Fillers are of two kinds, paste and liquid. Paste fillers usually are semi-transparent but sometimes are opaque. Liquid fillers are transparent. The paste fillers are used on open-grain wood, while the liquid fillers are used usually on close-grain wood.

The purpose served by fillers is that of leveling, by filling, the cells of the wood. They are used to build up the tiny depressions in the wood, in other words, and thus prevent the varnish finish from sinking in and from giving a pitted or rippled effect. This effect is apt to remain even though several coats of varnish are put on, unless the under coats of varnish are rubbed down a great deal, when they act as a filler. It is cheaper and quicker to fill the surface before varnishing. The filler, however, should be as transparent as possible in order to preserve the natural color beauty of the wood. Although in some cases, like the two-tone finishes, the filler is purposely made opaque to gain a special effect.

The close-grain woods are often finished without the use of any filler. And also the open-grain woods are finished without any filler to gain the correct effect for such finishes as weathered oak, fumed oak, Flemish oak, Flanders oak, antique oak, ebony, Jacobean.

In the best classes of work the filler is put on after the stain, but in certain special cases and for cheaper work where it is desirable to save the labor of putting on a separate stain coat, the filler and stain are put on in one coat. The stain does not penetrate so deeply when combined with the filler coat but satisfactory results can be secured, especially if about 20% of the thinner liquid for the filler is composed of benzole, 90 degree, or solvent naphtha, 160 degree. When oil stains are to be used some finishers prefer to put the filler on first because filler containing oil put on over an oil stain is apt to lift the stain, mix it with the filler and produce a muddy, cloudy finish. The best practice, however, is to put on even the oil stain first, let dry and then seal it up with a very thin coat of shellac—about a 2-pound cut—before the filler is spread on the wood. A thick coat of shellac which is not cut down by considerable rubbing makes a poor foundation for a finish. When it is rubbed enough to cut off all shellac except that which is lodged in the pores of the wood it makes an excellent filler.

One pound of paste filler will fill about forty square feet of surface. One gallon of liquid filler will fill from 200 to 400 square feet, depending upon its composition.

The importance of proper filling of wood is indicated by the fact that the expert furniture finishers inspect a filled surface after it is dry with a magnifying glass.

If he finds numerous pinholes in the filled surface, indicating that the filler bridged-over the open pores rather than entered and filled them, he brushes on a second coat of filler of thinner consistency, lets it dry hard, sandpapers down to the bare wood, then, removing all except what is lodged in the pores.

FACTORY-MADE WOOD FILLERS

Much of the filler used today is ground and mixed in the paint factories. It comes in paste form which is quite thick and is ready for use after being thinned with turpentine, mineral spirits or benzine.

The colors commonly listed by paint supply houses are: Transparent or Natural; Walnut; Mahogany, light; Mahogany, dark; Golden Oak; Ebony; Special White.

These paste fillers are sold in cans of the following sizes: 1, 5, 10 and 25 pounds each.

The chief advantages gained by using these fillers are that the quality is good, the fillers adhere firmly to the wood and the colors are standard. You can mix batch after batch of the same color, securing a match. The working qualities are also standardized. Success in filling depends largely upon tempering the filler just right with the thinner liquids. So when the factory-made fillers are always made the same way and you become accustomed to working with a particular brand, time is saved by knowing exactly how the filler will work every time.

Of the factory-made liquid fillers it must be said that some are good and some are not. Those which are made with good varnishes are very good, while those made with the cheap varnishes are not to be depended upon. In this class of goods it is unwise to buy any but the best brands of reputable manufacturers and pay the price of good material.

PAINTER-MIXED PASTE FILLERS

For a great many years finishers have mixed fillers by various formulas to serve a variety of surfaces. Such fillers are colored to match the stain used, usually but not always, with tinting colors ground in oil or dry colors. Mahogany filler is often colored black or very dark brown. Fillers for silver gray and other grays are white or light gray. For novelty finishes fillers of strongly contrasting colors are used on natural colored woods or upon stain colored woods. The color of the filler is very important when producing any of the period finishes or others of known standard effects. The color of the filler then must be correct or you cannot match the samples with the stain color alone. For this coloring of fillers it is far better to use tinting colors ground in oil than dry colors, because the ground colors are thoroughly mixed and very fine which makes them compact. Compactness is essential, indeed, in good fillers.

The basic materials used for mixing fillers must be ground very fine and ought to be as transparent as possible. The chief material used for high class fillers is silica (silex). It is doubtful if any other material is as good as very fine, water-floated silica. It is white when dry but, being quite transparent, it takes on the color of whatever substance it is mixed with. Silica is a white sand made by crushing quartz rock. It is much like powdered glass and, in fact, glass is also made from silica. Silica is inert chemically, showing no unfavorable reactions when mixed with other pigments and liquids.

Good filler must not shrink or expand, must not attract moisture and should be heavy enough to avoid carrying air cells into the pores of the wood. Silica filler when properly mixed sinks into the pores of the wood and does not expand, shrink, bulge or bleach out in the wood grain. These stable qualities make it an ideal pigment for this purpose.

Some of the other pigments used for mixing fillers are whiting, china clay, cornstarch, barytes, reno raw umber filler and keystone filler. Each is good for special purposes, but it is doubtful if any equals silica for general use.

A commonly used formula for mixing paste filler is:

½ pint boiled linseed oil
4 ounces first class japan drier
1 pint turpentine

Mix the above liquids and then add fine silica until you have a very thick paste which is well mixed. Put the paste through a paint mill or mix it thoroughly with a paddle and strain through a wire screen. Thin with benzine or naphtha to thick brushing consistency;—it should be just thin enough to pour out of a pot. Next add the tinting colors ground in oil to gain the color wanted. The colors should be broken up with turpentine or benzine and strained before adding them to the filler. While in use the filler should be stirred every few minutes, because the heavy pigment settles rapidly to the bottom of the pot and you will not have a well-filled job unless the filler is kept to the same consistency all the time it is being used.

When filler is to be made up in advance to keep for some time the above paste filler will separate, the pigment will settle to the bottom. In order to overcome this add cornstarch to the extent of from 10% to 20% of the weight of the silica used. Or add up to 25% of asbestine (silicate of magnesia). Such addition will keep the filler pigment suspended in the oil.

Paste filler mixed after the preceding formula is correct for natural colored finishes if the tinting colors are omitted. The silex or silica is white while dry but the filler when mixed without coloring matter takes on the color of the oil and is correct for natural finishes.

The correct colors for fillers used on period and other standard finishes are indicated in the following:

Golden Oak—Silex paste filler in natural color or tinted light with Vandyke brown and a very little asphaltum varnish.

Weathered Oak—No filler required for the correct finish.

Fumed Oak—No filler required for the correct finish.

English Oak—Silex paste filler tinted with Vandyke brown ground in oil to a dark shade.

Early English Oak—Silex paste filler tinted very dark with half Vandyke brown and half drop black, both ground in oil.

Antique Early English Oak—Silex paste filler tinted very dark with Vandyke brown and drop black ground in oil.

Flemish or Flanders Oak—No filler required for the correct finish. If filler is used silex paste colored black with drop black ground in oil is correct.

Tobacco Brown Oak—Silex paste filler tinted dark with Vandyke brown ground in oil.

Stratford Oak—Silex paste filler tinted pink with rose pink ground in oil. The aim is to color the pores of the wood pink but not to fill them level. Wipe the filler off across and with the grain of the wood.

Malachite Oak—Silex paste filler colored very dark with a mixture of 6 ounces drop black, 1 ounce Vandyke brown and 1 ounce dark chrome green.

Mission Brown Oak—No filler required for the correct finish.

Jacobean Oak—No filler required for the correct finish.

Antwerp Oak—Silex paste filler colored black with drop black ground in oil.

Baronial Oak—Silex paste filler colored to match stain with Vandyke brown ground in oil or with burnt umber and toned with drop black.

Cathedral Oak—Silex paste filler colored to match stain with Vandyke brown ground in oil or with burnt umber and toned with drop black ground in oil.

Dutch Brown Oak—Silex paste filler colored to match stain with Vandyke brown ground in oil or with burnt umber and toned with drop black ground in oil.

XVI. Century Oak—Silex paste filler colored with Vandyke brown ground in oil or with burnt umber and toned with drop black ground in oil to match stain.

Bog Oak—Silex paste filler colored black with drop black ground in oil.

Belgian Oak—Silex paste filler colored black with drop black ground in oil.

Silver Oak—White filler mixed from zinc oxide ground in oil and a little dry bolted whiting. Thin with a mixture of 1 ounce boiled linseed oil, 1 ounce japan drier and 6 ounces of benzine or naphtha.

Kaiser Gray Oak—Use same filler as for Silver Oak.

Olive Oak—Paste silex filler colored black with drop black ground in oil. The stain is green.

Antique Walnut—Filler to be light gray. Mix from ¾ white lead in oil and ¼ zinc oxide in oil. Thin enough to apply and rub in with a cloth. Use for a thinner a mixture of 4 ounces japan drier, 2 ounces turpentine and 2 ounces of benzine. The filler will dry white but the finish of shellac and wax will subdue the white to light gray.

Circassian Walnut—On real walnut or gum this finish is in need especially of a transparent filler. Many coats of drying oil mixtures, like 2 parts boiled linseed oil, 1 part turpentine and 1 part japan drier, were much used at one time. The oil was applied hot and rubbed in and after allowing time to dry, more coats were applied in the same manner. Each coat of oil was allowed to soak in a little while and then was wiped off. The important thing is to see that each coat is thoroughly dry before putting on another. This is an expensive method. A less costly one is to put on two thin coats of thin shellac or first class liquid varnish filler. Each coat should be rubbed down to the bare wood. Then a thin coat of silex filler paste colored with Vandyke brown to match the wood is put on.

American Walnut—Silex paste filler colored to match the wood color with Vandyke brown ground in oil.

Sheraton Mahogany—Silex paste filler colored very dark with a mixture of 5 ounces Vandyke brown, 4 ounces burnt umber and 3 ounces of rose pink all ground in oil.

Adam Brown Mahogany—Silex paste filler colored very dark with Vandyke brown and a very little rose pink ground in oil.

Light Brown Mahogany—Silex paste filler tinted light brown to match the wood with a little Vandyke brown ground in oil.

Mahogany, Red—Silex paste filler colored dark with Vandyke brown, drop black and a little rose pink, all ground in oil.

When a thin coat of shellac has been used on the bare wood, as is done sometimes, less oil should be used in the paste filler which follows. This because the fine wood pores have been filled and sealed up by the shellac against absorbing so much oil as is needed when the filler goes on without the shellac coat.

Ebony Black—Silex paste filler colored black with drop black ground in oil.

Rosewood—Real rosewood has always been difficult to fill. The natural oil in the wood works up through the filler and disfigures the finish. The old time method of finishing included coat after coat of thin shellac, each one rubbed back to the bare wood. But that is expensive in labor cost. The best way to handle this wood now is to apply one fairly thick coat of white shellac mixing it with 1½ pounds of white bleached gum shellac to 1 gallon of denatured alcohol. Let dry thoroughly and do not sandpaper. Then fill as usual with silex paste filler mixed with the least possible quantity of oil and tinted with a mixture of 3 ounces of Vandyke brown ground in japan and 1 ounce of rose pink ground in japan or in oil.

Gun Metal Black—Fill with black graphite, dry and very fine. Thin the graphite with japan drier and very little benzine.

Vandyke Brown—On close grain woods. Use as a filler two coats of white shellac. The shellac should be thin,—about 3 pounds of gum shellac to 1 gallon of alcohol. Color the shellac with a few drops of Bismarck brown spirit soluble aniline.

Driftwood Gray—The pores are not to be filled level but should be colored white by adding to paraffine wax a little zinc oxide in the dry form or ground in japan.

Forest Green—Silex paste filler colored very dark with chrome green and drop black ground in oil. Equal parts of the green and black are about right. Sometimes a little Vandyke brown or burnt umber are also used to get the right color.

Birch Fillers—Some finishers prefer to use no paste filler on birch finishes. Some prefer liquid fillers of the prepared type and some only shellac. Paste filler used thin, however, brings out the wood grain figure better than liquid fillers, even though birch is classed as a close grained wood.

Novelty Gray and Colored Finishes—When used on oak, chestnut, ash, elm, etc., the filler should be light. The pores of the wood are extended by sponging the wood with water. When dry sand the raised grain and open up the pores more with a stiff picking brush. The fillers are silex paste tinted in any one of several colors,—white, grays, greens or browns. The gray oak stains are especially suitable for these colored fillers. For any color use a strong water stain to gain a deep color to contrast strongly with the light colored filler. In some cases no stain is used, but rather the white zinc filler (as for silver oak) is put on first and when dry a very thin coat of white shellac is put on. Next paraffine wax is colored with dry white zinc oxide and it is rubbed well into the wood.

Some of the gray finishes are done with a bleaching as the first step to lighten the wood. See Chapter II for this operation. Then a light gray stain is used. Next a thin coat of white shellac is put on. When dry the surface is filled with paraffine wax which has been made white by the addition of a little dry zinc oxide. The wax should be well rubbed into the pores of the wood. Allow it to dry at least 24 hours and coat with paraffine wax without the zinc or with any white wax. Polish to a hard surface.

Other novelty finishes can be produced in the same manner by using colored stains other than gray and filling with the white zinc filler or with the white paraffine wax filler.

MIXING, BRUSHING AND WIPING PASTE FILLERS

Mix and color the filler, if it is to be colored rather than used in the natural color, as indicated in the preceding pages of this chapter.

Thin the heavy paste with benzine until it brushes freely and yet is fairly thick. Tempering the mixture to have it just right is very important. Try out the mixture on some out-of-the-way place or on a sample of the wood you are going to finish. The filler should be used thinner for walnut, gum and similar woods than for oak, chestnut, ash, elm, etc.,—the latter woods have larger pores or cells to be filled.

Coat the surface freely with the filler using a stiff brush to rub the filler well into the wood. Brush the filler on with the grain, lengthwise of the boards, but

Plate 11a.—The wiping of paste filler used on open grained woods, oak, walnut and mahogany, is properly done across the grain of the wood. Use excelsior or burlap.

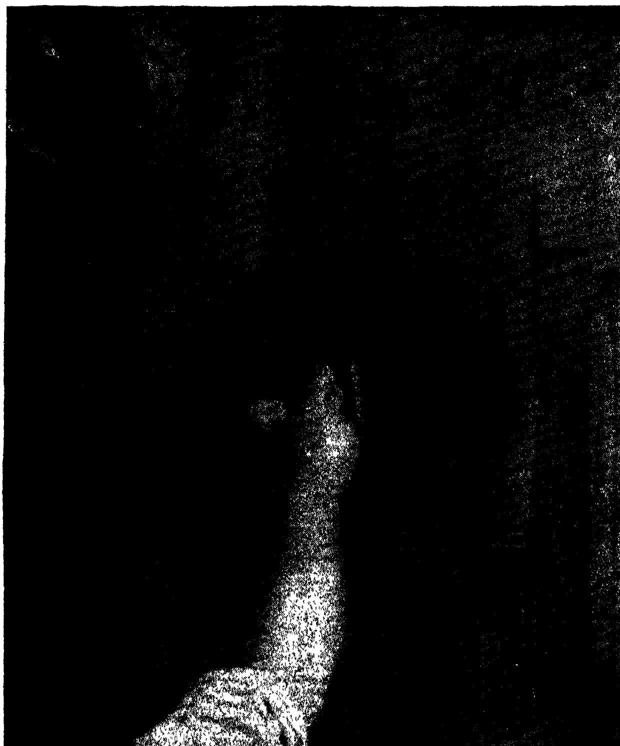

Plate 11B.—Brush the paste filler on across the grain of the wood and rub it well into the open wood cells.

lay it off to finish brushing across the wood grain. Wood pores are filled with air which forms a cushion. The filler will not sink in to the bottom of the cells unless thoroughly brushed. When the filler mixture is just right it will fill the wood pores and set up with a dead flat surface in from two to five minutes, depending upon the amount of ventilation and the temperature of the room.

If the filler settles quickly into the pores of the wood, leaving the liquid on top, too much benzine has been used.

Filler used by the house painter is usually tempered to save time. It contains very little oil and it sets flat ready for wiping in from two to five minutes, as has been said. It sets so hard in half an hour, usually, that it cannot be wiped off. The furniture finisher takes more time. He likes to temper the filler so it sets ready for wiping to begin in about 15 to 20 minutes, and yet so it can be wiped any time up to an hour or two after brushing. It will dry hard in twenty-four hours and will thoroughly mature and harden in forty-eight hours.

When the filler has been brushed on to a small area of surface and has set flat it is ready to wipe. A handful of excelsior or burlap may be used. The furniture finisher prefers to use a large wad of curled hair, the horse hair stuffing used in the cushions of upholstery. Sea moss (grass) is preferred by some, as doing a quicker, cleaner job of it. It is pretty hard to beat good excelsior, however. The wiping must be done *across* the grain of the wood and in such a way as will not lift the filler out of the cells but will cut it off sharp and level with the top of the wood fibres. The object of wiping is to remove all filler which is not lodged in the wood cells. If any is allowed to remain on the surface of the wood it will cloud the finish and give a muddy appearance. After wiping over a small area with the excelsior or other coarse material to remove most of the filler wipe over it again with clean cotton rags, but use no rags which leave lint. The cleaner the job of wiping the less sandpapering you will have to do when the filler is dry. Do not wait to begin wiping until the whole area coated in has turned flat; begin wiping the first filler brushed on as soon as flat spots appear, being careful to rub the filler into the wood cells as you wipe. In other words note carefully how the filler is coming off before you wipe too much.

If your filler has been mixed and tempered correctly it will roll up under the excelsior wad and come off easily. If it seems tough and hard to remove you have waited too long before wiping. You may have to wash the surface with benzine, let it dry and start over again to brush on the filler and try a second time to wipe it at just the right time.

If the filler lifts out of the pores when wiping after it has set flat, too little binder has been used. Add ½ pint of japan drier to 1 gallon of filler.

When a filler has too much oil in it it will not roll up as it should, like putty, when wiping. It will be sticky and will pull out of the wood grain and cracks.

When the filler after being mixed correctly sets too rapidly and becomes dry before wiping, stop part of the ventilation and coat in smaller areas of surface so you can get back soon enough to wipe before the set is too dry. It may also be necessary to add a few drops of linseed oil to the filler to slow up the setting. Be very careful, however, not to use too much oil. A surprisingly small amount of oil is needed and too little is better than too much. Oil makes the filler tough and prevents it from wiping off clean and level.

Filler which is mixed too stiff, not enough benzine, will take an excess of labor to brush it on and it will roll out of the cells of the wood while wiping.

When for any reason filler sets so hard that you cannot wipe it, brush on some benzine, let it set again and wipe when just right, or wash off the filler first coat and take a fresh start.

Don't coat a large area of any surface with filler until you try a small area to test out the brushing, wiping and filling qualities of the mixture. By following that suggestion you will save yourself much time and labor. As a matter of fact many finishers work much harder on filling jobs than they need to if they would only use their heads more and their muscles less. Learn how to temper the filler just right by experimenting and then it will wipe off easily, fill the cells well and do a clean job. If filler is permitted to dry hard before being wiped a great deal of labor is needed to remove it with scrapers and sandpaper.

An examination of the filler after it has been wiped and is dry will show whether the mixture was tempered correctly and properly brushed and wiped. Pinholes in the filler result from using too thin a mixture or from too little brushing. When the pores are not well filled, the filler was mixed too stiff, not enough benzine in it, or it was wiped off too soon. When the grain figure is clouded and muddy in appearance, the wiping was not done well enough to clean up thoroughly or the wiping was delayed too long.

While brushing on paste filler it should be stirred every three or four minutes. If not, the filler used off the top of the pot will contain too much oil and what is used from the bottom later will contain too little oil. The pigment settles rapidly unless cornstarch or asbestine have been added to it.

If a filler containing too much oil is used on woods having an excess of oil naturally, like rosewood and cypress, the excess of oil will ruin the varnish finish. The same is true when the surface has been shellaced before filling. And when filler containing too little oil or japan is used on mahogany, walnut, gum, etc., the filler will turn gray in the pores and so a clouded finish will result, giving somewhat the same appearance as the use of white shellac on dark stained finishes, instead of orange shellac.

Narrow mouldings, edges of cabinets, table tops and similar surfaces are more difficult to cover with a uniform thickness of filler than flat surfaces. It is necessary sometimes to put two coats on these. Let the first coat set flat before brushing on the second and then wipe both coats when the second is flat. Delicate carvings are never filled with paste filler. One or several coats of shellac are best, because the filler fills up the depressions and rounds off the sharp edges too much.

When filling and staining in one coat it is best to add about 20% benzole to the filler in place of some of the benzine. It will then penetrate and color the surface more deeply.

Where oil stains are used it is desirable to precede the filling with a very thin wash coat of shellac, as there is some danger that the filler with its linseed oil content might soften and wipe up the stain. Thus a muddy, cloudy color effect will result.

Where it is necessary to use paste filler on large surfaces, as on floors, wall panels, etc., reduce only enough of the thick paste with benzine for a day's work. When the filler which has been finally thinned is allowed to stand over night the pigment not only settles to the bottom but some of the solvents evaporate and a thick mixture which will not work as it did the first day results. If you add more benzine by guess to take the place of that which has departed you cut the oil too much and the filler may dry out powdery. It is really better to add a little more linseed oil, but too much oil will make the filler tough and it will then require more labor to wipe it off clean.

Paste filler should not be mixed too far in advance of your needs. It is better two days after mixing and up to about two weeks after mixing than it was the first day, if kept covered up so the volatile liquids cannot get away.

After being wiped clean paste filler should dry not less than 12 hours and a longer time is much better. Some finishers put on a second and thinner coat of filler, wipe and let it dry. This is to avoid all risk of having the varnish coats sink into unfilled cells and dry with a pitted effect.

When the filler is bone dry, sandpaper the surface with No. ½ paper and wipe the surface up clean with a cloth dampened with benzine. That clears up the wood grain considerably, making a finer finish. Of course, if the wiping of the filler has not been well done it will be necessary to sandpaper more. Use, then, No. 1 for the first time over and finish with No. ½ or finer paper.

LIQUID FILLERS OR SURFACERS

Close-grain woods like maple and birch, and those which are halfway between these—and the large open-grain woods like oak, chestnut, ash and elm, call for a filler of a liquid rather than thick paste consistency.

For example mahogany, walnut and rosewood are considered open-grain woods and yet they have not the large open cells of a size found in oak.

Some finishers use paste filler thinned considerably as a liquid filler. Some use one or two coats of shellac as a liquid filler, rubbing each down to the bare wood fibre so as to remove all shellac gum except what is lodged in the pores of the wood. Others use one of the many factory-made liquid fillers which are transparent. They are sold in quart, half-gallon and gallon cans. These materials when made of first-class varnish by one of the well known manufacturers are excellent.

Liquid fillers composed of gloss oil, hard oil or other cheap varnishes are not dependable materials. Some of the cheap fillers bleach out white in time and make a mottled cloudy appearance under the varnish. Some are too brittle and so crack.

Shellac makes a good filler. The white bleached shellac should be used for natural and light colored finishes while the orange shellac must be used for dark colors. White and orange are mixed for finishes which are medium dark. When white shellac is used on dark mahogany or other dark finishes it sometimes gives the finish a white cloudy effect in time. Shellac should always be used thin as a filler. One or two thin coats (a 2- or 3-pound cut) are best, letting each dry and sandpapering well to remove all shellac except what is in the wood cells. Shellac does not adhere to the surface or to subsequent coats of varnish any too well and for that reason a complete film of shellac makes a poor foundation. When used to fill the pores or cells only, however, it is excellent. Shellac also acts as a sealer over oil stains, preventing the oil from affiliating with the varnish. Varnish in direct contact with oil sometimes remains soft and tacky for a long time. The shellac coats over aniline stains, especially over reds in the oil or water form often prevents these stains from bleeding.

A formula for liquid filler used by some finishers is as follows:

1 gallon of pale cabinet varnish, or better yet, use the same kind of varnish as you will use for the varnish

undercoats. Then it unites better and there is less danger of cracking
1 quart turpentine
1 pint japan drier of light color
2½ pounds dry bolted china clay or water-floated silica

Mix the clay or silica well with a little of the varnish. Then the other liquids are added and thoroughly mixed. Grind the whole batch through a paint mill if one is at hand. It can be mixed with a paddle, however. After thoroughly mixing let the mixture stand two or three days and strain through muslin. Thin to easy brushing consistency with benzine or turpentine. Stir the filler occasionally while using to keep the silica in suspension; it may settle to the bottom. A little more or less silica or clay may be needed, depending upon the kind of wood. It should dry flat, but not dead flat. Use less pigment to avoid the dead flat. When correctly mixed this filler will sandpaper as easily and as clean and smooth as shellac, making a level, well-filled surface.

Brush this filler on in a thin coat as a rule. A heavy coat may safely be used if the filler is well distributed but you cannot wipe off a thick liquid filler coat and it will, therefore, reduce the transparency of the finish. That is all right on cheap work. Apply the filler with as little brushing as possible after distributing it evenly. Let the coating dry hard, preferably over night or longer, and sandpaper it smooth with No. ½ paper, removing all filler except that which remains in the pores of the wood. Trying to save time by cutting short the drying of any kind of filler is poor economy. Wet or immature filler slows up the drying of varnish coats and may cause worse trouble than that.

After brushing on a thin liquid filler allow it to set a few minutes and then wipe off all filler not lodged in the wood cells and cracks. If not wiped off clean it will bleach out white in time and show white clouds or a muddy appearance under the varnish. This is especially true if too much pigment has been mixed in with the filler liquids.

Liquid filler is used to stop the suction of the wood, principally, and is not good for woods having large open pores. Some liquid fillers are made to be brushed on and not to be wiped clean, but when any pigment is used in a liquid filler it is safer to wipe off all except what is lodged in the wood grain, otherwise the final finish may not be as clear and transparent as it should be. Liquid fillers are used by some on oak and other open-grain wood after a paste filler to make a more perfect surface.

Floor Fillers.—For open-grained floors like oak a filler is mixed using dry silica, sometimes called silex, with about four-fifths benzine and one-fifth boiled linseed oil. A little Japan drier, about two tablespoonfuls to a gallon of filler, is sometimes needed. To color the filler, dry color such as burnt umber for brown finished floors is used. Color ground in oil may also be used.

It is not possible to give exact mixing directions for a floor filler because the temperature of the room and ventilation are governing factors. The filler must be tempered by adding a little boiled linseed oil to slow the drying, or more benzine to hasten the drying.

The filler should be so tempered that when you brush it on to about one square yard of floor it will begin to set immediately and turn flat; that is, the benzine evaporates immediately.

The filler is brushed on to the floor freely like paint *with* the grain of the wood and across the grain, being careful to rub it into the pores of the wood. As soon as the dull surface appears the filler should be wiped off of the surface with a wad of excelsior. Rubbing with excelsior also forces the filler into the pores.

The wiping with excelsior should be done *across* the grain only. If the filler has been mixed correctly it will roll up into a thick paste and all excess filler not needed to stop the cracks and pores will come off readily onto the excelsior. If too much oil has been used the filler will not dry rapidly enough and it will not lodge in the cracks and pores of the wood as it should.

As each square yard is coated in with the filler and takes on a dull finish it must be wiped immediately, or it will get so hard and stiff that a great amount of labor will be needed to remove the excess filler from the surface. Plenty of excelsior should be used, and if the filler sets so rapidly that you do not succeed in wiping it off before it becomes dry, wash up the surface freely with benzine and start all over again.

In floor fillers for natural finished oak no color is needed. For dark oak burnt umber will color the filler and at the same time stain the wood. Where dark finishes are wanted it is well to put on an oil stain or a spirit stain before the filler.

There are very dark brown, almost black, fillers for mahogany and walnut and these are best secured from the manufacturer ready for thinning. If shop mixed the procedure is to add Vandyke brown to silica, linseed oil and turpentine or benzine as noted for other fillers. More simply, add the Vandyke brown to a factory prepared natural paste filler to make it very dark.

For novel finishes colored fillers are used; for example, a white filler is used over a gray stained open grain floor or wood trim of oak. The gray stain goes on first and then the white filler. White fillers can be purchased or they can be made by adding zinc oxide to natural oak paste filler. Dry zinc is best but not easy to purchase. So, the next best procedure is to get zinc oxide in paste form. Mix this paste with quite a little benzine and let stand over night. The linseed oil with which the zinc is ground will come to the top with the benzine as the zinc settles to the bottom and so can be poured off.

It should be clear that a paste filler of any color can be mixed for novel wood finishes done in natural or any colored stain. Adding dry color or oil color and zinc to natural paste filler produces many colors.

Filler Not Always Needed.—The idea that a paste filler must always be used on open grain wood, like oak, chestnut, walnut and mahogany should be qualified. From the decorative viewpoint oak is a very rugged surface that fits well in natural rustic interiors. Such of the Early English interiors as were done in the rugged effect had no fillers in the wood and the finish was usually an oil treatment. So today floors of oak put down with wood pegs are not given a paste filler; and they may or may not be varnished, sometimes being oiled and waxed.

Walnut and mahogany are usually associated with the more elegant interiors where floors are highly polished, walls are panelled in natural or stained high gloss and the furniture is also finished in that manner. Such surfaces, obviously, must be given the paste wood filler. But with these woods ever changing styles often make use of them in wood trim and furniture employing the open grain effect by omitting the paste filler and, in fact, by emphasizing the open grain through the use of a picking brush and water washes to raise the grain a little. The picking brush is merely a stiff wire brush that lifts the wood fibre ends out of the cells after the planer and sander have laid them flat. A thin coat of shellac stiffens the wood fibre ends, after they have been picked up, and then a sanding with the grain with fine paper cuts them off and leaves the cells open.

CHAPTER XIII

VARNISH AND SHELLAC

THE purposes served by the use of varnish are quite obvious. First, it is needed to protect surfaces from moisture which will warp, swell and raise the grain of the wood and from gases ever present in the air which discolor wood not protected. Varnish also protects stained colors from light and air which fade them, especially the oil and spirit anilines which must be covered immediately if they are to hold their color a reasonable length of time. Varnish protects wood from wear by surface abrasion to some extent.

Decoration produced by varnishes is just as important a purpose served as the protection of the wood,—decoration in the form of beautiful polished gloss or the alluring charm of the dull lustre finishes. Varnish increases and enhances the brilliancy of colors as well as to preserve them from fading.

What varnish is may well be considered for a paragraph or so. The word has taken on a broad meaning with its years of use. It does not mean any one definite composition, but rather includes many compositions within its meaning. A general definition may state that varnish is any liquid, containing no pigment, which is used for protection and decoration of surfaces, one that can be spread in a thin, homogeneous film and which will dry to a hard, transparent or semi-transparent coating. A chemist would describe varnish something like this,—a liquid which usually is transparent, but sometimes translucent, one which when spread in a thin film on a surface dries by oxidation and by evaporation of its volatile fluid content. It may dry with a high gloss or with a dull lustre.

Kinds of varnish are very numerous. The larger varnish factories offer in their sales lists between one and two hundred kinds. Many industries require a large number of varnishes of regular and special kinds and they are used for many purposes in addition to protection of surfaces from decay and corrosion and for decorative purposes. For instance, the harness on the looms of cotton mills and even bobbins of the mill machinery are varnished to reduce friction. But the varnishes in which the wood finisher is interested are limited to the architectural class described in the following pages. There are but three major classifications —(1) Oil Varnishes; (2) Spirit Varnishes; (3) Japans.

Oil or Oleo-resinous Varnishes.—These are solutions of gum resins such as amber, Zanzibar, kauri, pontianak, Sierra Leone and gums in fixed oils, usually vegetable oils like linseed and china wood (tung) oil, produced with the aid of heat. They contain small amounts of metallic salts like manganese, red lead, litharge, etc., to facilitate drying, and also volatile liquids like turpentine, mineral spirits, etc., to make the solution sufficiently fluid for brushing. Other vegetable oils like soya bean oil, nut oils, sunflower seed oil, poppy seed oil, etc., and fish or menhaden oil are also used to get certain qualities in special purpose varnishes.

Amber gum is considered the best varnish gum because it is very hard and resists moisture well, but amber gum varnish is dark in color. Zanzibar and kauri gums are the next best because the varnishes made from them are very hard and durable,—kauri is the most used. Of course the quality of varnish depends upon many things in addition to the gum used; the formula and skillful use of it are equally important. It is well to note also that the varnishes made with a small proportion of oil are harder and more lustrous, but they are less elastic and less durable. Varnishes containing large proportions of oil, called long-oil varnishes, are more elastic and more durable than others, even though they do not take so high a gloss or polish. Spar varnish is a good example of the long-oil class. Dark colored varnishes are fully equal to the light colored varnishes, except as to color, and they are cheaper because clear, transparent light colored varnish gums are rare and consequently more expensive than dark gums.

As with other materials varnishes of many grades are made. The high quality and more expensive grades are more transparent and more serviceable. There are medium grades and cheap grades made for cheap jobs. It is easy enough to test the quality of these oil varnishes. Simply coat a board with the varnish, about two coats are needed for a fair test. Let the varnish dry thoroughly. Then soak a sponge in water, squeeze out some of the water and place the sponge on top of the varnished board over night. If the varnish is of high quality it will be clear, bright and glossy in the morning; such varnish is durable and a good representative of its class. But if the varnish turns white it means that it has absorbed the water from the sponge and if it remains white the water has dissolved part of the varnish. Varnish of this kind is not good enough for use on interior wood trim of buildings or on furniture.

The oil or oleo-resinous varnishes are the most important group and include spar varnish, interior varnishes, floor varnish, gear varnish, rubbing varnish and color varnish. This group of varnishes is also reclassified, according to the proportion of oils to gums, as long-oil, medium-oil and short-oil varnishes. The short-oil varnishes are made with a proportion of about 4 to 6 gallons of oil to 100 pounds of gum. In this class are the furniture, rubbing, piano and polishing varnishes. They are very hard when dry, have a high gloss and dry quickly. They are not as durable as the medium-oil and long-oil varnishes, if used for the same purposes, but may be extremely durable when used for the purposes for which they are designed.

The medium-oil varnishes are made with from 12 to 30 gallons of oil to 100 pounds of gums. They are the interior and architectural varnishes such as cabinet and floor varnishes. These are hard, have good gloss and are durable to a considerable degree.

The long-oil varnishes were originally designed for exterior surfaces, and of course durability is the principal requirement for this class. In this group are included the spar varnishes, carriage, wagon, automobile, coach and agricultural implement varnishes. Spar varnish is particularly made to resist the action of water and salt, moist air. From 25 to 50 gallons of oil are used with each 100 pounds of gums in the production of the long-oil varnishes. A good exterior spar varnish contains about 36 gallons of oil to 100 pounds of kauri gum. Good floor varnish contains about 30 gallons of oil to 100 pounds of gum. A good interior varnish contains about 8 to 15 gallons of oil to 100 pounds of gum.

In addition to these three groups of varnishes which are more or less clearly defined as to composition and qualities, there are many which are in between these made by mixing and blending the principal varnishes. In this manner many degrees of hardness, elasticity, gloss and durability are secured to fit many purposes, chiefly in the many industries manufacturing merchandise. Then there are many special purpose varnishes made for such purposes as grinding colors, enamels, flat paints, enamel undercoats, etc., called grinding varnishes. We have, too, the baking varnishes which contain little or no metallic salts driers, depending upon high temperatures to dry the coatings,—the patent-leather varnishes, lithographic varnishes, etc.

Spirit Varnishes.—These are solutions of gum resins, like dammar and lac, in volatile liquids such as turpentine, mineral spirits, alcohol, benzole, etc., produced commonly with and without the application of heat. Shellac is the best known of the spirit varnishes. Dammar resin is the exudation of certain trees while lac from which shellac is produced is the result of the action of certain insects on trees. The subject is presented at length in the pages to follow.

Japan Varnishes.—These are of two principal kinds: (a) Painters' japan driers which are solutions of metallic salts like manganese, red lead, litharge, etc., gums, resins, drying oil and volatile liquids like turpentine, mineral spirits, etc. Especially strong driers of this type are also made for manufacturers' use in the grinding of paints, enamels, etc. (b) Black and other colored japan varnishes which usually contain asphaltum. They are made for air drying, semi-baking and for baking at high temperatures. Automobile fender japans and enamels are of this class and a great variety of machines and machine parts are finished with these japan varnishes because they are very durable.

Asphaltum Varnishes.—This is not considered a resin varnish. Asphaltum is a natural product, also called bitumen, found in many places the world over,—Syria, Cuba, Trinidad, Utah, Albania, and Barbadoes. Pure asphaltum from Utah is called Gilsonite while the bituminous limestone found in Texas is known as lithocarbon. Asphaltum is a constituent of both limestone and petroleum. It is insoluble in water and alcohol but may be dissolved readily with turpentine and naphtha.

All-Purpose Varnish.—The question of all-purpose varnishes is one which the finisher encounters. Is it possible for one varnish to serve all purposes equally well as each kind of varnish made for a special purpose? Will the so-called all-purpose varnish rub to as high a polish as a fine polishing varnish? Will it rub as clean, as easily and produce as fine a surface as good rubbing varnish? Will it prove equally durable used on exterior as on interior surfaces? No! is probably the best answer to those questions. There probably is not a long-oil varnish that is suitable for exterior exposure which is capable of being rubbed to a smooth and fine high-polished surface. A good interior, or under-coat varnish, has got to be rubbed and to hold up succeeding coats. It cannot be hard enough to rub and to hold up the finishing coats if it contains enough oil to be elastic and durable on exterior surfaces. It takes more time to rub long-oil varnishes than to rub short-oil varnishes.

Under-coat varnishes must be harder and contain less oil than finishing coat varnishes, if the finisher is interested in avoiding the evil effects which are bound to come from putting a very elastic coat under a less elastic one—cracking, crazing, alligatoring. Woodwork around sinks, washtubs, lavatories, etc., should be finished with hard, waterproof varnish. Standing trim, wainscoting, panels, etc., doesn't necessarily require such expensive varnish, but window sills, frames, seats and similar surfaces which will be exposed to the direct rays of the sun should be finished with spar or other varnish which will withstand the direct rays of the sun without softening or blistering.

One gallon of spar varnish will cover about 550 square feet, one coat. One gallon of floor varnish will cover about 500 square feet, one coat. One gallon of flat varnish will cover about 450 square feet, one coat.

Many conditions govern success in varnishing, but none is more important to observe than that of selecting the right varnish for each purpose. Each surface and the conditions of service expected should be fully known. Then when you also know the essential characteristics of each of the more common varnishes you are in position to select the right varnish for each job. The following brief descriptions of each kind of varnish will be helpful. And the wise finisher will also establish a friendly business contact with a reliable varnish manufacturer who will gladly act as technical adviser on unusual problems and also help any sincere and ambitious mechanic to learn more about varnishes.

Spar Varnish.—All surfaces exposed to the sun should be covered with spar varnish if they are to be varnished rather than painted. And no filler should be used. The filler decomposes and crumbles under the action of the sun and temperature extremes. Build up the surface with several coats of varnish, sand each lightly, clean up and flow on the last coat freely.

As the name indicates this varnish was first made to protect the spars of ships by keeping out the moisture, and of course it had to be a varnish which would resist both moisture and the salt air at sea. Today spar varnish includes all long-oil varnishes of a similar type and for similar purposes. The name spar is also used to designate a group of very tough and elastic interior varnishes.

As has been said spar is a long-oil varnish, which means that it contains a much larger proportion of oil to its gum resin content than other varnishes. Spar is dark in color, does not dry rapidly, is very elastic and retains this quality for a very long time, has only a moderate gloss and is very durable. Spar is still used largely on ships, but also on many exterior surfaces wherever a tough, elastic weather and water resistant varnish is needed, especially for wood surfaces, but also on metals.

Considering the characteristics of this varnish further, it is interesting to note the specification for it published in Circular 103 of the Bureau of Standards, U. S. Government. The circular reads, in part: "The varnish shall be suitable for use on both outside and inside surfaces of vessels, buildings, etc., and must be resistant to air, light and water. The manufacturer is given wide latitude in the selection of raw materials and processes of manufacture, so that he may produce a varnish of the highest quality. It must meet the following requirements:

Appearance—Clear and transparent.

Color—Not darker than a solution of 3 g. of potassium dichromate in 100 cc of pure sulphuric acid, specific gravity 1.84.

Flash Point—(Closed cup) not below 30 degrees C (85 degrees F).

Non-volatile Matter—Not less than 40 per cent by weight.

Set to Touch—In not more than 5 hours.

Dry, Hard and Tough—In not more than 24 hours.

Working Properties—Varnish must have good brushing, flowing, covering and leveling properties.

Safety of Working—Varnish must pass the draft test.

Water Resistance—Dried film must withstand cold water for 18 hours and boiling water for 15 minutes without whitening or dulling.

Toughness—Varnish must pass a 50 per cent Kauri reduction test at 24 degrees C. (75 degrees F).

Floor Varnish.—A medium-oil varnish which has many of the qualities of spar varnish. It must be elastic and tough to withstand the very severe abrasion of feet, grinding heels, furniture scraping, etc. It must dry more rapidly than spar varnish, however, as the revarnishing of floors in use constitutes a very large part of the consumption of this product. It must dry moderately hard over night and ready for use in about

48 hours. These varnishes must resist a moderate use of cleaning water and they must be able to carry the weight load of heavy pieces of furniture as no brittle varnish will do. Floor varnish is, of course, used principally for floors, but it is also suitable for interior trim generally when the color is not too dark for the finish wanted. It makes the very best kind of wall size when thinned down with turpentine and when a little of the paint is mixed in with it.

Architectural Varnishes.—This is a class name which refers to all varnishes which are used for interior building purposes, such as floor varnish, cabinet, coach, interior spar, etc.

Flat Varnish.—An interior varnish which dries with a dull lustre, rather than high gloss as usual, resembling the appearance of a hand-rubbed gloss varnish. The effect is not exactly the same, but it is beautiful and for a great many jobs the flat varnish serves the purpose fully and at less cost, because the flat is gained without the labor cost of rubbing.

Flatting varnishes are made on many formulas, most of which include the use of wax of one kind or another. China wood oil (tung oil) is also used. In the raw state this oil dries naturally flat, so its use in flatting varnish simply requires that it be not cooked to the point where it loses this flat-drying characteristic. There is also a flat-drying spirit varnish made usually with shellac, glycerine, etc. It is not much used.

The best of flat varnishes are made without wax, because wax put on to a surface in varnish or otherwise makes a very poor foundation for future coats of varnish, paint or enamel when it comes time to refinish. To be safe every trace of wax on a surface to be refinished must be removed with turpentine, benzole, sanding, etc. Wax never really dries, though it sets fairly hard when rubbed with weighted brushes. No varnish or paint will adhere to it for long. The flat varnish finishes are very effective over open-grain, unfilled oak and walnut.

There are a number of formulas by which finishers mix flat varnish, but the wisdom of the practice is open to question, if labor is worth anything and if it is worthwhile to have products of known dependability, standard working properties and quality generally. In an emergency when a small amount of flat varnish is needed for a surface which is not likely to be refinished in the future the finisher can mix a flat-drying varnish in this manner:

4 ounces pure beeswax, dissolved in
1 quart of turpentine
1 gallon of varnish

The more wax used the flatter the varnish will be. Place the pot of turpentine in a pail of hot water and shave the wax into it. When the wax is all dissolved take a gallon of hard drying varnish like floor, interior spar, coach, etc., and after heating it by placing the can in a pail of boiling hot water pour the wax solution into the varnish and stir it well into the varnish. Let the mixture stand a day or two if possible and then strain it through a double thickness of cheesecloth to remove any undissolved wax or grit which might disfigure the finished job.

Another formula for flatting varnish which may be used in an emergency is mixed:

1 gallon of flatting oil (sold for making flat wall paint from white lead).
1 pint of good interior varnish,—floor, spar, coach, etc.

Coach Varnish.—As the name suggests, this varnish was at first made for use on carriages and wagons, but later it included varnishes really made for the architectural surfaces, the interiors of buildings. Coach varnish is still made for railway coaches, carriages, wagons, etc., but the name has taken on so general a meaning that it really refers to no definite composition or varnish with very clearly-defined characteristics.

Color Varnishes.—The carriage painter, and following him the automobile painter, used rubbing varnishes which contained some color. One or several coats of clear rubbing varnish were put on and then one or more coats of the same varnish containing a few ounces of japan color were put on before the finishing varnish coats. These color varnishes were mixed by the painter and also were supplied by manufacturers ready to use with just the right amount of color pigment in them. Of course when color varnishes are made with opaque pigments instead of transparent they really ought to be classed as enamels.

Brush-keeper Varnish.—This material is made for use in tanks in which varnish brushes are stored when not in use. It is a long-oil varnish made without driers so that it will not skin over or dry in skins on the ferrules and bristles of the brushes. Varnish brushes should not be kept in oil baths.

Rubbing Varnish.—Short-oil varnishes, which necessarily dry quite hard and which have the special characteristic of being capable of withstanding considerable rubbing with pumice stone and water or oil to smooth up and polish the surface, also to cut down any inequalities, roughness and grit accumulations. Rubbing varnish must also be capable of withstanding considerable use of water or oil in the rubbing process without injury to itself. It must cut off sharp and not gum up the sandpaper like a long-oil, very elastic varnish will do. It must also take on a polish by friction of rubbing with rotten stone and must not be injured by the friction heat generated by rubbing with pumice stone. Some varnishes, when rubbed, soften up from the heat generated, some absorb the moisture or oil and take on a white clouded effect or they gum up by the rubbing instead of cutting down smoothly. Rubbing varnish is always used for undercoats, never for finishing coats. If used on top of more elastic coats cracking, crazing or alligatoring is bound to result. You can rub nearly any varnish enough to remove the gloss when it is really dry.

Finishing Varnish.—Usually refers to furniture or automobile or carriage varnish. Any varnish used for the final coat or coats, and which is tough and more elastic than the undercoats of varnish. Usually finishing varnish is able to withstand light rubbing with pumice stone and oil and polishing with rotten stone for a high gloss effect. Piano polishing varnishes are of this class, as also are the automobile and carriage body and chassis or gear finishing varnish. They are of the medium-oil content class, having more oil in proportion to the amount of gums contained than the short-oil class, but less oil than the long-oil spar and exterior varnishes.

Polishing Varnish.—Finishing varnishes, as described above, capable of taking on a much greater gloss after rubbing with pumice and oil and polishing with rotten stone on the bare hand palm. Usually refers to fine piano and furniture varnishes.

Flowing Varnish.—Finishing varnishes made to dry with a very high gloss without being subjected to the rubbing and hand polishing processes. Flowing varnishes are usually flowed on more freely than other finishing varnishes; they must have the characteristic of flowing together and leveling up to obliterate brush marks. It must also dry, when spread to a uniformly thick film, without runs and sags.

Piano Varnish.—Fine quality varnish which will dry with a high gloss. It has an unusually hard surface and will take on a brilliant lustre when rubbed with pumice stone and polished with rotten stone.

Hard-Oil Varnish.—The first methods employed for finishing wood were those by which hot or cold linseed oil was applied and rubbed into the wood, coat after coat being applied. It was a beautiful finish after years of exposure but the new jobs collected dust too much to be satisfactory. It was a soft-oil finish. So to overcome this defect oils or thin varnishes were made which dried with a hard finish while at the same time giving the effect of the soft-oil rubbing. From that point on the term hard-oil took on a general meaning which includes most any kind of cheap thin varnish for interior use.

Sealing and Suction Varnishes.—These are cheap varnishes made for use as sizes for plaster walls or other surfaces to save coats of paint. As the names imply, they are designed to stop suction and seal up the pores of the surface so that the paint coats will not soak into the surface. They are much inferior to first class varnishes thinned with turpentine and used for that purpose. A high grade floor varnish thinned with turpentine is the best and cheapest size of this kind in the long run and the first cost is little because not much varnish is needed.

Gloss Oil Varnish.—This is a cheap varnish made for temporary work such as coating barrels and similar surfaces. As a rule it is made of rosin and benzine or naphtha. It is very brittle, hard and crumbles easily. It is the poorest kind of a foundation for subsequent coats of paint or varnish.

Church Pew and Chair Varnishes.—Considerable difficulty has always been experienced because the varnish used on these surfaces often remain tacky or sticky. When used under proper conditions this trouble will not occur with ordinary good interior varnishes, but because the conditions of service are often not what they should be, special varnishes are made which will dry hard in spite of improper use. The ventilation in churches is not good;—they are too often closed up without circulation of air from one week end to another. Then there is often more or less dampness, and the stale air resulting from crowds of people is likewise detrimental to varnish. Finishers who paint or grain church pews sometimes use too much oil in the under coats and so when the varnish goes on top of an oily foundation hard drying is quite impossible. The under coats of such jobs should contain the least possible amount of oil and each and every coat should be allowed to become bone dry before the next coat goes on. When the under coats contain little oil, when they are allowed to dry properly and when the ventilation in the rooms is fair, any good interior varnish will serve for the finishing coats without remaining tacky and sticky. Tacky surfaces may often be overcome, once they occur, by spreading on a thin coat of shellac over the varnish.

The special church-pew and chair varnishes have good flowing properties, dry rather rapidly, are quite elastic, have fair gloss and dry real hard. They do not soften by the temperature from contact with the human body.

Heatproof Varnishes.—These are such varnishes as are made for machinery and similar surfaces which become quite hot. As a rule they contain fish oil, or what is called menhaden oil, because this oil has far greater heat-resisting ability than others.

Waterproof Varnishes.—China wood (tung) oil has very great water resisting ability. In fact the raw oil is used in China for coating boat bottoms and for many similar purposes where the surface is subjected to water. Therefore the varnishes which are made to resist contact with moisture are often made with a considerable China wood oil content.

Mixing Varnishes.—These varnishes are made for the purpose of imparting a high gloss to paints and enamels when mixed with them by the painter or the manufacturer. They also make a much harder surface on the coatings in which they are used. Good mixing varnish will mix with paints and enamels without any unfavorable reactions with any of the other contents of the coating, and will not separate after mixing.

Grinding Varnish.—Many compositions are included within this group. Such varnishes and japans as are used for grinding with colors for making what the painters call japan colors and for making flat wall paints and enamel under coats are included in this group.

Flat-Mixing Varnish.—Since the advent of prepared flat wall paints for interior use, this flat-mixing varnish has been marketed. It is a varnish which may be mixed with lithopone and other pigments and has the property of drying without gloss while at the same time it binds the pigments together and to the wall.

Spraying Varnish.—Varnishes of many classes which are simply mixed a little thinner than brushing varnishes in order that they may be applied with spray guns. Any good varnish, however, when thinned a little with turpentine or benzine, whichever is best for the particular varnish being used, is suitable for spraying.

Dipping Varnish.—In many factories merchandise, furniture, toys, etc., are finished by dipping in tanks of varnish. That saves much time required for brushing and produces a coating without brush marks and a cleaner surface. The dipping varnish used for this purpose is more fluid, it is thinner than brushing varnishes and has the property of draining off clean. The bottom or drip edge is usually wiped off clean with a soft brush after draining so as to avoid a fat edge.

Gear and Chassis Varnish.—Varnishes made for use on the wheels and running gear of carriages, wagons and automobiles come within this class. They are the finishing varnishes for these surfaces and so are applied over color coats. They are elastic, have good gloss and are very durable, being able to resist the action of mud, water, oil, grease and dust.

Baking Varnish.—Factory production of furniture, automobiles, sewing machines and hundreds of kinds of merchandise is greatly speeded by the uses of varnishes and enamels which can be dipped or sprayed on and baked at high temperatures. Special rooms, called ovens, are provided where the temperature can be controlled at from 90 to 200 degrees and where the air is washed and the humidity is regulated. Baking varnishes usually contain more oil than others and make a more elastic and durable finish because the drying is more uniform and is accomplished under perfect conditions.

Baking Japan.—Quite similar to regular baking varnishes as to application and drying. They are different in composition, usually being made from heavy black asphaltum. Automobile fenders are the best known finishes of this class.

Baking japans are made of resinous gums or oils, turpentine or benzine, asphaltum and linseed or China wood oil. The coatings are used on metals, largely, and are baked at high temperatures up to 400 degrees F. On wood the temperature cannot run above 150 degrees F. without some injury to the wood.

Dammar Varnish.—A spirit varnish made from the several varieties of gum resins, called dammar, dissolved in turpentine. Dammar is a soft varnish and its principal quality is its very light color. Aside from whiteness dammar can make no claim for patronage as it is neither hard nor durable. Dammar is very transparent and about the palest of varnishes. It is used where a light bleached or stained or enamel surface is to be varnished. Used also on novelty and art gifts which are French polished.

SHELLAC VARNISH AND ITS USE

Shellac is not an exudation of tree gum as are many of the other resins used for varnish making, although it is collected from trees. It is a resinous incrustation found on certain species of trees in the jungles of India, Siam, Ceylon and other far Eastern countries. It is deposited on the bark, branches and twigs of these trees by swarms of tiny insects known as the Lac insect (*coccus Lacca*). These twigs are broken off and in that form are called stick lac. They are collected in June and September of each year by the natives and are crushed and ground in primitive stone mills to separate the gum from the wood. Then it is sifted to free it from bark, twigs, etc. Next it is placed in large tubs of warm water to free it from lac dye coloring matter which the insects have deposited. In this form it is known as seedlac.

When the seedlac is dry it is placed in cotton bags and held over charcoal fire by two men, one at each end, who twist the bag when the seedlac melts, thus forcing the melted gum through the weave of the cloth from where it is scraped and spread in a thin sheet over the outside of a hollow cylinder filled with hot water, or on flat surfaces. When the gum has congealed on this cylinder surface it is scraped off and broken into flakes with a knife and forms the dry shellac which comes to the finisher and painter.

The natural color of shellac is bright orange. White shellac is prepared by bleaching orange shellac by a chemical process. The best grades of shellac are those which are most nearly free from impurities. Since most impurities are dark in color it follows that the lighter colored shellacs are apt to be the best.

The dry gum shellac is soluble in alcohol (wood, denatured or grain) and in alkali water solutions, but not in turpentine, oil or benzine. Denatured alcohol is most commonly used for making shellac varnish by dissolving shellac gum in it. Wood alcohol is more expensive, usually, and is very poisonous. The fumes from it are injurious to the finisher's health and it is more difficult to brush shellac mixed with wood alcohol than that mixed with denatured alcohol.

Pure grain alcohol is considered better than denatured or wood for cutting shellac gum, but that is not to be had in the United States, except under license. The best denatured alcohol for cutting shellac is the U. S. Government Formula No. 1. It calls for the use of 190 proof grain alcohol denatured by adding 5 gallons of wood alcohol (poison) to 100 gallons of grain alcohol. It is practically as good as pure grain alcohol for this purpose. Manufacturers using it are kept under bond to prevent the sale of this denatured alcohol unless mixed with at least 2 pounds of shellac gum per gallon. The denatured alcohol sold on the open market to painters contains more wood alcohol or other poison. For this reason a little better shellac can be purchased in the liquid form from manufacturers than the painter can mix by cutting shellac gum with the denatured alcohol which he can get, but on the other hand what he can mix is good enough for many purposes if he thinks it is wise to spend the time required to do the mixing.

SHELLAC VARNISH FORMULA

4½ pounds pure gum shellac
1 gallon denatured alcohol
Makes 1⅛ gallons of varnish

Dissolve the gum by placing in a glass or earthen jar or jug which can be corked tightly with the alcohol. Shake up the contents occasionally until all the gum is dissolved. By placing the container in a pail of boiling hot water the gum will be dissolved quicker. If the shellac flakes are put into a bag and pounded to powder the gum will dissolve more quickly. Small quantities may be dissolved in glass fruit jars, using the rubber; screw down the cover tightly. Store the shellac, especially white or bleached, in dark places. Light darkens the color. Storage in tin for any length of time will also make the shellac darker. This proportion of gum and alcohol makes a varnish which is too thick for most surfaces. A little more alcohol should be added when about to spread the shellac. There are very few places where thick shellac is advisable. It does not make a secure foundation for subsequent coats of varnish, paint or enamel.

The liquid shellac commonly sold is what is called a 4-pound cut, meaning that 4 pounds of shellac dry gum have been dissolved in 1 gallon of alcohol. This is a fairly heavy brushing consistency and is thinned more for most purposes with alcohol. It is also possible to purchase 4½ and 5-pound cuts. A 3½-pound cut is correct for general use.

For mixing large batches of shellac what is called a U. S. Government Formula may be used. It reads:

Orange Shellac, dry scales,	31 pounds
Alcohol, (10¼ gallons)	69 pounds

Makes 100 pounds of shellac varnish, or about 13⅓ gallons of 7½ pounds per gallon.

Pure shellac gum commands a fairly high price and so there has always been some call for cheaper material. Those who cater to this class of trade necessarily must extend the pure shellac gum to meet the price and so liberal quantities of cheap rosin, manila gum or other substances are mixed with it. This cheapens the quality as well as the price and those who use such materials are apt to run into considerable trouble. The mixtures of pure shellac are the safest to use, far safer than some of the liquid fillers of cheap character which do not bring out the true beauty of the wood grain and are apt to cloud the finish, if indeed, they do not cause the varnish coats to crack and craze. Doped shellac will also gum up the sandpaper and prevent cutting down a coating to a level, smooth surface. Pure shellac will dry hard enough to sandpaper smoothly and cut off clean in thirty minutes, but adulterated shellac mixtures may remain tacky for hours and never dry real hard.

Shellac is greatly used as a liquid filler for furniture and interior trim. It is an excellent filler if used in thin coats and if sandpapered enough to remove all shellac except what has lodged in and filled the wood cells. It penetrates the pores of the wood, dries quickly enough to save much time because it permits varnishing the same day as the shellac is put on and it seals up any stain coats or filler coats which might be lifted by subsequent coats of varnish or which might bleed through the finish.

While shellac is very valuable for many purposes, it is entirely unsuited for others. It will not withstand moisture without turning white. It does not make a really tough and hard surface. The orange shellac is translucent, while bleached or white shellac is transparent. Shellac gum absorbs moisture readily from the air in damp rooms and is then difficult to cut with alcohol. Gum should be stored in dry places sealed up tightly.

When shellac is kept in open pots and allowed to dry hard by the evaporation of the alcohol you cannot redissolve the hard gum to make a good varnish, not even with alcohol. The hard gum is then worthless. Of course when it has merely thickened by such exposure it can be thinned again with the addition of more alcohol.

One or two coats of shellac on trim or furniture do not produce a really durable finish, but several coats, as in the French polishing process, with oil coats too, make one of the most durable finishes known. Pure shellac doesn't scratch nor mar; it is an elastic finish. Finishes built up with water stain, several coats of thin shellac and wax are durable and do not take on a white cloudy effect when moderately exposed to moisture, as is sometimes noted on finishes where varnish is put on over shellac.

Flat and dull lustre finishes are very popular now for walls, trim and furniture. Shellac is one of the best materials to use for finishing furniture to avoid the new, shiny look and to make it fit into the color scheme better. Shellac makes a very fine finish but not a low cost job. Eight coats are needed where shellac alone is used for the finish, and a handsome as well as a durable one results. Apply two coats of pure shellac the first day six hours apart. Allow two days for drying. Then apply six more coats, allowing two days for each to dry in a well ventilated and dry room. Rub the fourth and eighth coats only.

It is not wise to apply shellac over stain, not even over water stain, the same day that the stain is put on. And do not apply more than two coats of shellac in one day, except in the French polishing process where shellac is used as thin as water.

Rub shellac with pumice stone and oil or with very fine sandpaper,—never with pumice stone and water, or a white clouded surface will result.

Orange shellac from which the natural orange color has been extracted to make white or bleached shellac sometimes proves difficult to keep in good condition. Not all of the bleaching chemicals have been extracted and the action continues. Strain white shellac often and if you find undissolved pieces of gum don't use the shellac, especially do not use it on mahogany finish as it is likely to make a cloudy white effect under the varnish.

Bleached white shellac takes on moisture and should not be used in a humid room. A hot, muggy atmosphere may give a cloudy appearance to the finish as is sometimes noted on furniture and store fixtures put into new cement buildings before the steam heat is turned on for a month or two. Humid hot climates experience considerable difficulty in this respect unless furniture and fixtures are finished especially to meet this condition. The white cloudy effect often disappears when the building becomes bone dry.

The use of white bleached shellac on dark finishes, especially on mahogany is not wise. In time the shellac will cause a cloudy white film to appear under the varnish. Orange shellac is needed for such surfaces.

Shellac is not suitable for any outside surfaces, not even when covered with varnish. It must not be used on damp surfaces or upon surfaces which are likely to become damp later.

When using shellac to touch up bare spots on old varnish floors, mix orange and white bleached in varying proportions to get the color wanted.

Some finishers add a little glycerine thinned with a little alcohol to shellac to slow up its rapid setting and make it easier to brush on without showing laps and joints. Some use 10% by weight of Venice turpentine, or 1 oz. of camphor gum to one gallon of liquid shellac, for the same purpose, but the practice, while successful in accomplishing these purposes, is of doubtful merit unless used with skill and extreme caution and in wood alcohol cut shellac which sets very rapidly.

Do not use shellac on surfaces which are hot.

Brushes used for the application of shellac should be the largest possible for the size of the surface, this in order to make it unnecessary to use many strokes to cover the surface. For large areas a four-inch flat brush is about as large as can be handled while for smaller surface the three and two-inch varnish brushes are about right. The furniture finisher uses soft badger, ox, bear and similar brushes.

Shellac must be brushed on rapidly and in one direction. Very little rebrushing can be done because shellac sets so rapidly. This material brushes "short" and cannot be stretched out like paint or varnish. Be careful not to skip places,—they can only be avoided by getting the right light on the work. It is especially difficult to brush shellac dissolved in wood alcohol which causes it to set quickly, yet dry hard more slowly than grain and denatured alcohol.

One gallon of shellac, cut to about 3½ pounds of gum to 1 gallon of alcohol, will cover about 500 square feet, one coat.

Technical progress, discovery and invention in the field of industrial chemistry have combined of late to institute radical changes in compositions of varnishes. A few years back the raw materials were chiefly from natural sources; now they are chiefly synthetic gums and resins produced by comparatively new chemical processes, plus such natural products as China wood, tung oil, and linseed oil.

From the viewpoint of the wood finisher, the change in varnish compositions from largely natural raw materials to chiefly synthetic, is real progress and all to the good. The new varnishes that dry much faster, are often much lighter in color, brush out just as freely, and make far tougher, more durable finishes. Some of them are not quite so heavy or thick in body and an extra coat may be desirable in some instances.

CHAPTER XIV

VARNISHING, RUBBING, POLISHING

GENERALLY speaking the varnishes of today are far superior to any supplied to finishers of other times. They are as nearly fool proof as science and remarkable manufacturing facilities can make them. They will produce remarkably beautiful finishes and durable finishes if used skillfully and under reasonable conditions of service. The wonder is that they behave so well and prove so satisfactory when used as they are under adverse circumstances in the building field. The furniture finisher and automobile painter have learned the reasonableness of, and necessity for, providing correct surfaces and surroundings fit for varnishing. It is easier for them to do so than for the finisher in the building field, because they have the work brought to their shops, whereas the house finisher must take his shop to the work. That is probably the fundamental reason why the finishing done on furniture and vehicles has always been far superior to any other. And still the house finisher is to be congratulated upon producing as fine finishes as he does, considering the adverse conditions under which he must work. The best he can do is to keep in mind what the perfect conditions for varnishing are and then do the best he can to approach them.

Conditions Suitable for Varnishing.—Temperature is, perhaps, the most important consideration. The surface to be varnished should be, preferably, between

70 and 80 degrees and surely not below 60 degrees. Heat is needed to make the varnish brush and flow properly. The varnish itself should be warm too, as nearly the same temperature as the wood as possible. If the varnish has been chilled in transportation or storage, never use it until the temperature has been raised by placing the can in a pail of hot water, about 110 degrees F. is best, or by letting the can stand near, not on, a hot radiator a day or two if possible. If the varnish has been subjected to zero temperatures for days, or even hours, there is some likelihood that some of the gums or driers have solidified. Then the varnish should be warmed up and put through a double thickness of cheese cloth before using. Otherwise you may have a case of seedy, sandy or specky varnish when it is brushed on to the surface.

Moisture in the air in excess of normal may cause trouble with varnish. Hot, humid days and cold, misty, muggy days are very hard on varnished surfaces. Keep the windows closed in a room which has been freshly varnished if the weather changes to excessive humidity. Most varnishes are made to perform perfectly under normal humidity. There are varnishes made which will do equally well in very moist atmospheres and they should be secured for use under those conditions.

Ventilation is very important to have because varnish dries by evaporation of the volatile thinners used in it and by taking on oxygen from the air. The air in a room soon becomes loaded with the fumes given off by the varnish and the oxygen in the room is soon exhausted. Therefore the more frequently you can change the air by ventilation of the proper kind the more rapidly the varnish will dry hard. Ventilation should be secured without having drafts blow directly upon the fresh varnish, however, if trouble is to be avoided by having the varnish dry flat or do many other undesirable tricks.

It is a good plan to apply your varnish, in buildings where many mechanics are at work, the last hour or two during the day when there is less likelihood of vibration caused by others walking through the room or building, raising dust or causing it to drop from ceiling or walls.

Storage and Handling of Varnish.—Since varnish works best at a temperature of about 70 degrees it is well to keep your supply in storage at about that temperature. The top shelf in the shop is often just the right place for it.

All cans in which varnish is kept for any length of time should be full of varnish. Partly filled cans, obviously, have considerable air at the top and that is sufficient to cause a skin to form over the varnish, especially, if the cork is removed often so as to renew the supply of air. It is evident, also, that all cans containing varnish must be kept corked tightly *all the time.* Varnish which has been allowed to skin over should be strained through silk or fine muslin and placed in new clean cans. A double thickness of cheese cloth, silk or other finer cloth make good strainers.

Getting Clean Work.—High quality varnish is absolutely clean when it leaves the factory, and it leaves in clean cans. It is not really difficult to produce varnished surfaces which are completely free from grit, dust, skins and other imperfections, if the finisher will train himself to do many little tasks well. He must be a "crank" about perfection in cleanliness. He may have the job and tools ninety-nine per cent clean and that one per cent dirty will ruin the whole job. For instance, the finisher accustomed to working in buildings doesn't often give a thought to cracks, corners and crevices as places which conceal loose dirt which will be dragged out upon a clean surface by a clean varnish brush when applying the varnish, yet the automobile painter searches out every possible hiding place for grit before he flows on a coat of varnish. Every crack, hole and crevice around hardware and elsewhere is sealed up tight with a small brush and a coating of shellac. If there is any dust in such places, any grit from sandpaper or pumice stone rubbing he makes sure that it stays there by sealing it up with shellac because he cannot completely remove it, can't even see it as a rule.

Before beginning the application of varnish the first step is to see that the surface is clean, not nearly clean but perfectly free from all loose particles, and the final cleaning should be done but a few minutes before the brushing of the varnish begins. A surprising amount of grit can settle on a surface in a quarter of an hour, especially if there are people moving around in the room or if the windows and doors are open. How to clean the surface varies with jobs. After sanding a good brushing with a clean duster brush makes a good start. And for ordinary work a final wiping over with a cloth or chamois skin dampened with benzine, turpentine or benzole will remove the grit. The automobile finisher uses what he calls a "tack rag", a cloth dipped into a mixture of varnish and turpentine and allowed to dry until it is a bit sticky and until none of the varnish would come off on the surface. The varnish is squeezed out of the rag after dipping, of course, and before it is allowed to set. Wiping over the surface with the tack rag picks up all loose grit.

With a surface that is known to be perfectly clean the next place to look to for grit which may ruin the job is the brush to be used. It is hopeless to try to produce clean varnishing with a brush which has been used for paint, shellac or any other material than varnish. It is difficult to do clean work with a new varnish brush, so a new brush should be shaken and worked with the fingers until all dust and loose bristles have been worked out. That will take a few minutes time. Then such a brush had best be used a few times for application of varnish under coats, not for finishing coats. Then if it is made perfectly clean after using by washing in at least two pots of turpentine, or a pot of benzine first and a pot of clean turpentine next, it will be in good shape to do a clean job of finishing varnish. Brushes which have been kept in a bath of brush-keeper varnish should be carefully worked free of such varnish by wiping it on the edge of the keeper tank. Then brush out as much more of the varnish as you can on a dry, clean board. Then work it well into the varnish you are going to use, but be dead sure that there is no dried varnish skin clinging to the upper ends of the bristles nor on the metal ferrule sides.

The varnish should now be considered. If good quality varnish which has been sealed up in the original can is used and if it has never been subjected to freezing or zero temperatures it is safe to assume that it is perfectly clean and free from solid, gritty bits of gum or drier. Otherwise, if in doubt strain the varnish into a clean pot or can. And remember that a pot may be clean and shining and still have grit in the side or bottom seams.

Surfaces Fit to Varnish.—Before one can reasonably expect success in varnishing the surface, old or new, paint, varnish, filler or any other should be free from moisture, both in the surface and on top of it. The varnish defects resulting from varnishing over moisture or sap in green wood are many, blistering being the most common result. Surfaces to be varnished must be free from oil and from grease of every nature, including the greasy film left by human hands and fingers. The surface, if varnish, paint, filler, etc., should be equally as elastic as the varnish to be applied or a little less elastic, never more elastic than the last coat, if trouble would be avoided. Surfaces composed of varnish, paint, filler, stain, etc., must be bone dry and hard, each and every coat of it and one at a time, before a new coat of varnish is spread on. It is foolish to take a chance on violation of this principle. It is not a good gamble to cut the time of drying short because you never have a chance from the beginning; the result is a certainty, a failure in durability or appearance. Crazing, cracking, flaking, etc., are among the fruits of applying varnish over surfaces which are not hard dry.

Surfaces having considerable gloss should be sandpapered or rubbed with pumice stone and water enough to remove the gloss before applying varnish, enamel or paint.

The secret of success in obtaining smooth, first class work is contained to a great extent in the preparation of the wood, and unless a little care is exercised on the initial stages of the job, the final coat will not show up well. Where a perfectly smooth and level surface is desired the woodwork must be sandpapered down well with No. 00 sandpaper and all traces of dust removed with a hair duster.

Wherever it is possible, and that is in most places, it is a good rule to sprinkle the floor with water or wet sawdust in order to keep down the dust. Beautiful workmanship is often finally marred by floating dust settling on the surface of the work.

To avoid trouble, old surfaces to be varnished should be well washed with water in which has been dissolved a little sal soda or any good washing power. Care must be taken to see that the solution of soap is not strong enough to injure the surface of the varnish. Do not attempt to wash too large a surface at one time as this gives the solution a chance to dry up and thus injure the surface. In washing doors and other upright surfaces lay the soapy water on with a soft brush, starting from the bottom of the surface and working up to the top in order to avoid little streams of water which will trickle down and mark the unwashed surface below. Work the surface well over with the brush, then rinse off all traces of the solution with a liberal supply of warm water which is clean, starting at the top and washing down. After drying the water with a chamois skin, the surface is ready for sandpapering, dusting and revarnishing.

Where wax has been used on old surfaces it is necessary, before varnishing, to wipe off all traces of wax with a rag soaked in benzole, benzine or turpentine. Unless every trace of wax is removed the new varnish coat will crawl and will not dry. In most cases after cleaning with benzine or other wax solvent liquid it is well to apply a very thin coat of shellac before the varnish coat is applied. The alcohol in the shellac will penetrate any traces of wax film on the surface and gain anchorage better than varnish. Wax left on a surface by the use of liquid varnish removers must also be removed by washing in the same way.

Mixing and Thinning Varnishes.—The varnish manufacturer advises that you do not thin varnish in any way, that as it comes in the can it is ready for the brush. That is good advice and could be literally followed to the advantage of all concerned, if a new can of varnish were opened for every job, was completely used on that job and if the thickness of varnish was suitable for every coat on every job. There are very few occasions, however, which justify the thinning of varnish. Varnish in its original condition should never be thinned for second, third and fourth coats. For the first coat, however, on hard woods like oak, maple and birch, a better job will surely result from thinning the varnish about 25% with pure turpentine. This makes a much better first coat than shellac if it is mixed from the same kind of varnish that is to follow it in subsequent coats. This thin varnish sinks into and fills the wood cells or pores and attaches itself more firmly to the wood than if the first coat were thick enough to bridge over the cells.

In this matter of thinning varnish the furniture finisher has the right idea. He takes a pint of the heavy varnish to be thinned, adds to it a quart of pure turpentine, making sure the temperature of both is 70 or 80 degrees F. He mixes this varnish with the turpentine in a most thorough manner and lets it stand over night or longer. Then he uses this thin varnish to reduce the thick varnish of the same, not a different kind. Oil should never be used for thinning varnish. Varnishes which have become thick from improper exposure with the cork out or loose must be thinned and strained in the same way.

It is not wise to mix two or more kinds of varnish together, even if made by the same manufacturer, nor different brands of the same kind of varnish, unless you know each varnish thoroughly well and have acquired skill in this sort of thing. If mixed the varnishes should be warm and should be allowed to stand a day or two after mixing to make sure that you have not formed chemical combinations which have bad reactions, such as livering or separation of some of the gums or liquids. It is much wiser to use varnishes for the purposes for which they are made. If you need varnish for a special purpose, consult the manufacturers and get technical advice which is correct. It will cost nothing and may save you considerable money.

Brush-Keeping and Cleaning.—Starting with a new varnish brush of good quality, the first thing to do is to carefully work out any dust and loose bristles with the fingers. Jar the brush by pounding it in the palm of the hand, but never on a board which will ruin the setting. When you have worked out as much of the loose material as possible, wash the brush thoroughly with benzine, working the fingers through the bristles while they are submerged in a pot of the liquid. Never put a brush in water for any reason. The bristles are little hollow tubes and if you fill them with water they will become soft and flabby, and you will lose the very much-prized spring of the brush, its elasticity. When the brush is as clean as you can make it dip it into clean varnish and work the varnish into the bristles by repeatedly dipping and wiping it out on the side of the pot. It is best to break a new brush in by using it for application of varnish under coats, before using it for finishing varnish coats. Never use it in paint, or in shellac, if you would avoid having it become "lousy" and worthless for varnishing. Little particles of shellac or paint work their way up into the root ends of the bristle, become dry skins, and you will have a time of it trying to get them out.

When you have finished using a varnish brush and when you stop for lunch or any other reason do not lay a varnish brush down flat. It is sticky and will pick up grit. Hang it so the bristles will be submerged in the pot of varnish and let the varnish completely cover the bristles up to the metal ferrule. To keep varnish brushes when not in use never use an oil bath, which is good for paint brushes. The brushes should be suspended in a bath of varnish so the bristles do not touch the bottom and so the bristles are completely covered. The kind of varnish should preferably be what is called brush-keeper varnish. It is a long-oil varnish made without driers so it will keep its liquid form for a long time without skinning over on top or drying on the varnish ferrules. Next to brush-keeper varnish good quality long-oil spar exterior varnish is

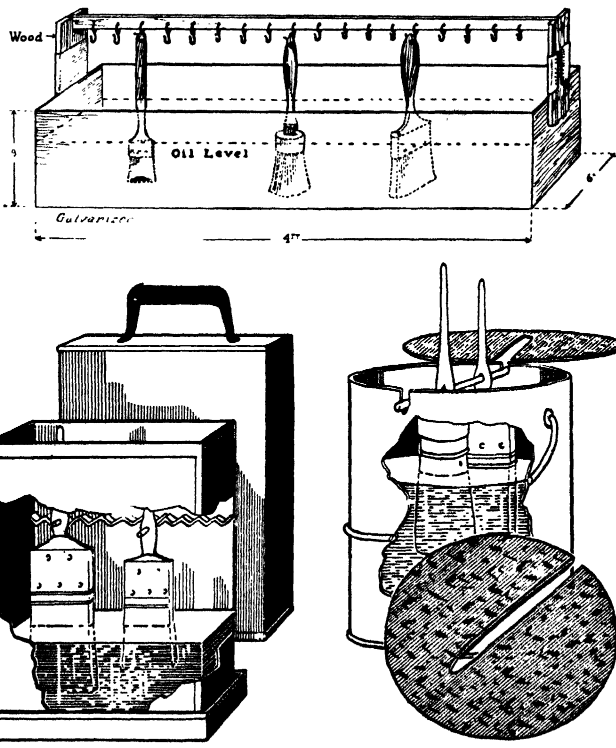

Plate 12.—Brush-keepers of Various Types. Filled With Raw Linseed Oil for Paint Brushes or with Brush-keeper Varnish for Varnish Brushes.

best. The brush-keeper tank should be covered up as tightly as possible to keep dust out and to prevent undue drying of the varnish supply. Plate 12 pictures a varnish brush-keeper of the large shop type and also a handy pot brush-keeper which can be used on the job.

When no brush-keeper is at hand to take care of varnish brushes the only course left is to wipe out as much of the varnish as possible on the side of the varnish pot, then wipe as much as you can out on a board and finally wash the brush in a pot of benzine, working your fingers through the bristles submerged in the benzine, and finally, wash in a pot of turpentine. Shake out the liquid and lay the brush flat to dry. If the varnish is permitted to dry until it is sticky use alcohol to clean it.

Varnish brushes which have been neglected until the varnish is hard dry in the bristles are ruined for further application of varnish. They can be cleaned out. however, for use on rough paint work by use of the following, which is called Downie's formula:

Submerge entire brush in a metal tank filled with a solution made by thoroughly mixing:—

1 gal. denatured alcohol
1 gal. water white benzole, 188 proof
1 gill muriatic acid

If a small quantity is to be mixed keep to the same proportions.

Soak the brushes in this solution for 24 hours. Then remove each brush and scrape out the paint using a putty knife or steel comb. Wash free from grit and small particles of paint by submerging the brush in a pot of benzine, gasoline or turpentine and working the liquid through the bristles with your fingers.

By this method all old and neglected brushes may be redeemed and they will be found useful for some purpose or other.

After cleaning the brushes in this manner they may be soaked with kerosene and laid flat on a shelf where they will remain soft. If the cleaning has been thoroughly accomplished the brushes may be stored and allowed to dry;—the bristles will remain soft.

Paint and varnish removers are successfully used for reclaiming hard brushes but as a rule they work more slowly than the above solution. And, of course, there are several patented preparations on the market made for this purpose. Usually they are successful and satisfactory.

The Brushing of Varnish.—To one who has not tried it the brushing of varnish, particularly finishing coats which are flowed on rather full, is accomplished merely by dipping the brush into the varnish and spreading

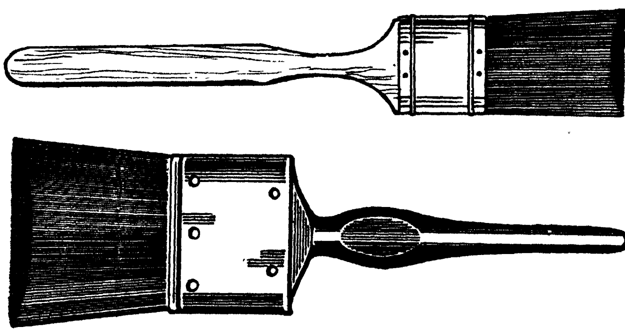

Plate 13.—Flat Varnish Brushes. Above, the Smaller Brushes are 1, 1½, 2 and 2½ Inches Wide. The Lower Brush is 3 Inches Wide and is the Size Commonly Used for Large Floor and Panel Surfaces.

it around on the surface, much as we spread oil paint. But one attempt to varnish a fairly large surface and get a clean, perfect gloss will suffice to teach anyone that there is considerable skill, understanding and experience yet to be acquired.

The first consideration in the application of varnish is the brush. Needless to say that a perfectly clean, well broken-in varnish brush is essential, quite as essential as good varnish and the proper method of application. No matter whether you prefer a flat varnish brush or an oval, it must be good, clean and well used to do perfect finishing. The flat varnish brush pictured in Plate 13 is a very common type used for small panels, mouldings, etc., in the smaller sizes, 1 inch to 2½ inches wide. The flat brushes which are 3, 3½ and 4 inches wide are used on floors and other large surfaces. The bristles are double thick and very elastic in order that a pretty good load of varnish can be carried and that thick varnish can be spread and distributed properly. Plate 14 shows the oval varnish brush of common type among furniture and house finishers and to some extent used by automobile finishers. They come in many sizes from No. 1-0 to No. 10-0. No. 2-0 is about 1⅞ inches in diameter, No. 5-0 is about 2¼

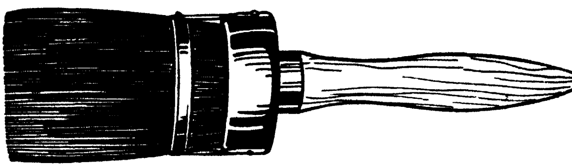

Plate 14.—The Oval Varnish Brush. Preferred by Many Finishers. It Comes in Several Sizes.

inches in diameter and No. 10-0 is 2¾ inches in diameter. The ovals are very thick and carry a large load of varnish. There is little choice between ovals and flats, except personal preferences.

The successful brushing of varnish merely requires that you work methodically, that you work out a system of brushing which will properly distribute the varnish over the entire surface to an even thickness. That means first, look over the surface to note the best place to begin and to finish so as to take advantage of the natural breaks in the surface, mouldings, edges, joints, carvings, etc.

It is not wise to pour out the last inch or so of varnish in a can because it may contain settlements of grit or crystalized gum or drier. The can should not be shaken unnecessarily and when pouring varnish from it let the stream hit against the side of the pot which has been tilted over a little, this so you will not fill the varnish in the pot with air bubbles which are likely to make your brushing more difficult.

Dip your brush into the varnish deep enough to take a full load, but not so large a load as will drip off the brush. Do not scrape out the varnish on the side of the pot any more than you have to, because that fills the varnish with air bubbles which may make your brushing more difficult when laying-off the coating to finish. A clean wire stretched across the center of the varnish pot is better than wiping on the sides of the pot, if any wiping at all is necessary. It really is better to dip the brush just enough to load it and so require no wiping.

Carry the loaded brush to the surface, the center of a small panel or not too near one end or edge, and with quick strokes moving the length of the wood grain distribute the varnish roughly as far as it will go without too much stretching. Then with the empty brush begin cross-brushing this load, across the grain of the wood. Now the varnish is pretty well distributed, so lay it off to finish by rubbing again with the grain of the wood, using the tip ends of the brush bristles.

Take up your second brush load of varnish and distribute it in the same way, repeating the operation until a fairly large area has been coated in and laid off to finish. Now after the varnish has had a little time to set, the time from the first brushful until the last, you can tell pretty well whether too much has been put on and whether there are going to be any runs, sags or wrinkles. It is well to take your varnish brush when empty, wipe it out more on the pot and with it go over the entire surface to pick up any excess of varnish which may be in evidence in the form of folds, runs or sags near mouldings, corners, etc., brushing with the grain of the wood. Long, light strokes are best for this final brushing, and be very careful not to do this work too late, after the varnish has set so much as to become sticky. Let your brush strokes run up to and over the edges of boards, panels, cabinet tops, etc. Inspect the surface against the light reflections to find any skipped places, "holidays" as the finishers call them.

The first coat of varnish should always be brushed out thinner than later coats. Put on less varnish and brush it out until a thinner film is distributed than is wanted for the finishing coat. But on any varnish coat it is better to brush it out too thin than to leave it too thick. If too thin it will dry perfectly, as long as you have not skipped any places, and if greater depth of varnish is wanted another coat or two can be put on. But if too thick a coat is spread it is likely to develop such defects as runs, sags and wrinkles which will mar the beauty of the finish. Heavy-bodied varnish should be thinned about 25% with pure turpentine for the first coat only. Then it will sink into the wood cells better, dry harder and more quickly and make a fine foundation, firmly attached, for the future coats.

Allow plenty of time for the first coats of varnish to dry hard. Time cut short on the drying of the undercoats must be added to the drying of succeeding coats and a poorer finish results, too. Each coat of varnish spread stops the drying of the varnish or other coatings under it. On jobs which have as many as four coats of varnish it is well to let the first two coats dry bone hard. The third coat should dry hard enough to rub safely, but not so dry as the first two. Then the last coat will fuse into the varnish body below it and fill up any abrasions where the rubbing might have cut through a little. If the third coat is bone dry and very hard any rubbed through places may show up in the finish. Of course, it is far better to do the rubbing so carefully that there will be no rubbed through places.

When brushing panels it is well to deposit your first brushful in the center near one end. Then coat-in the corners and across the ends, following up by filling in the centers. That method prevents laying on an excess of varnish on the edges and in the corners,—"fatty runners" as they are called. When it comes to laying-off with the final strokes with the grain of the wood, brush the whole panel first with the length of the grain, then across the grain and finally with the grain again. These final, light, long strokes should start in the center of the panel and work both ways toward the ends. They should not start at the ends and finish in the middle as is sometimes done. That method often drags the varnish from the ends and piles it up in the center where it will run, sag and wrinkle.

Finishing coats of varnish are as a rule flowed on a little thicker than the undercoats, but as has been said, if there is any doubt about how thick to flow the varnish, put it on too thin rather than too thick. And when flowing any coat of varnish do not take small brush loads and spread them on small areas. In that way the varnish will set before you can get enough on the surface to cover it and distribute it evenly. Take full loads in your brush, spread it out vigorously and decisively, aiming to get enough varnish on the surface quickly and then you will have more time to distribute it evenly and lay it off to a fine finish. Varnish must not be rubbed-in but applied with a firm stroke.

When varnishing table and cabinet tops or any projecting surfaces be very careful to run your brush up to the edge, but not over the edge. When you scrape the brush over the edge an excess of varnish is left on those places and that excess will run or form a fat edge.

It is well to keep close watch on any varnished surface for a few minutes after the brushing has been completed. Often you can catch up runs, sags and wrinkles with the brush before the final setting and so prevent a disfigured surface. This must, however, be done very deftly to avoid roughing-up the partly dry varnish about the runs.

Runs in varnish after the varnish is dry can sometimes be made less conspicuous in this way,—wet a cloth, rub it on a piece of hard soap and then rub the varnish run which is dry and hard. Then take up a

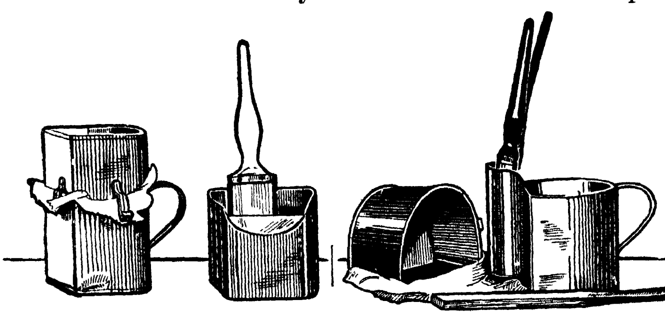

Plate 15.—The Automobile Painter's Varnish Cup. It Has Strainer and Brush Wiping Cup Attached. Very Useful for All Varnishing Work.

bit of pumice stone on the same cloth and gently rub the defective spot. The soap enables you to rub down the excess of varnish without having the pumice stone lodge in the varnish film.

In Plate 15 is pictured the varnish cup with strainer attachment which is commonly used by the automobile finisher. This is a most excellent tool which deserves wider use among other finishers. It permits one to pour out a small amount of varnish at a time, thus preventing the exposure of the large supply. It permits you to strain the varnish often and so remove the grit which the varnish brush is bound to pick up on the surface.

A bit of common cheese cloth, silk or muslin is used each time for straining, is quickly placed between the upper section and the cup and may be thrown away each time the varnish is strained.

RUBBING

The preference for highly polished surfaces of a few years ago has given place to a popular liking for dull lustre and flat finishes on walls, wood trim and furniture. The dull effects take away the new appearance of furniture and trim, making them take their place more modestly in the general decorative scheme.

Some woods, like mahogany and walnut, present a far richer effect as wall panels, when finished with a dull lustre and the hand-rubbed surface is much to be preferred on such woods. On these woods and upon oak dull finish is historically correct. A high gloss causes reflections which prevent one from seeing the full beauty of the wood. Next to the hand-rubbed finish the flat varnish finish is preferred. Some believe that wax finish is decidedly out of place on walnut and mahogany, but is very appropriate on oak.

The surfaces commonly rubbed dull are gloss varnish, gloss enamel and shellac for the cheaper work. The means of producing a dull finish are several,—hand rubbing with pumice stone and oil or water, coating a surface with varnish or enamel which dry with a dull lustre instead of a gloss, waxing a gloss surface, rubbing a gloss surface with sandpaper and oil, or waterproof sandpaper and water, rubbing a gloss surface with steel wool or with an electric rubbing machine which uses pumice stone and oil or water.

Nearly any kind of varnish, shellac or enamel can be rubbed to a dull finish if it is hard dry, but more work is called for on all except the varnishes which are made especially for rubbing. The rubbing varnishes are short-oil and medium-oil varnishes which dry hard and more rapidly than others. If you rub a long-oil varnish or enamel too soon it will gum up the paper badly and rupture the coating to the point of disfiguring it. Of course, if you rub any coating before it is dry the same thing will happen.

Pumice Stone and Water Rubbing.—The finest kind of rubbed and polished surface is produced by this method of rubbing the under coats and with the final rub on the finishing coat done with pumice stone and oil.

The pumice stone used for this rubbing is a fine grain, hard abrasive which comes in many grades. The grades are designated as F for a fine grade and FF for a very fine grade. Others grade pumice stone and list it as follows:

Extra Extra Fine, powdered
Extra Fine "
Fine "
No. 0 Usual, "
No. 1 Coarse, "
No. ½ Grain, "
Lump, Select
Lump, Carriage

The FF grade of pumice is commonly used for rubbing varnish. The tools used for rubbing with pumice stone are simply a piece of felt pad which is fairly soft for fine rubbing and hard for coarse rubbing. The felt is purchased in sheets from ¼ to 1 inch thick by the pound and can be cut to suit the job. Some use pieces cut from old felt hats, but it is too thin for good work. The felt is cut about 3 by 5 inches and tacked at two ends on a block 3 by 4 inches. The felt is turned up at the two ends and tacked on the ends so the heads of the tacks will not come in contact with the surface being rubbed. There are various kinds of patented rubbing pads on the market which are excellent for the work. Plate 16 shows one of these. Other things are used for rubbing,—such as burlap, curled hair, excelsior, haircloth, etc., but all have their faults and none are as good as felt for the purpose.

The procedure to follow in rubbing with pumice and water is as follows: Make sure that the varnish or enamel is bone dry and hard before any rubbing is done. Then place the dry pumice stone in a cigar box or any dish which is handy. Soak the felt pad in water and soak the surface to be rubbed in water.

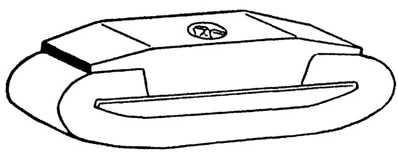

Plate 16.—Felt Rubbing Pad. For Use With Pumice Stone and Water or Oil When Rubbing Varnish, Shellac or Enamel.

Whenever possible place the surface to be rubbed flat on a bench or on saw horses at a height from the floor which will enable you to rub without leaning over too much. Take the wet felt and dip it into the pumice stone so as to put a thin coating of the dry powder on the pad and begin rubbing the surface with a light pressure first, gradually increasing it to the degree of pressure which you can maintain comfortably for a long time over the whole surface. Rub only with and never across the wood grain, that is, rub in the direction in which the wood fibres extend. If you rub across grain you will scratch the surface so that it will be difficult to remove the marks. Rub in fairly long, straight strokes, never in a circular manner.

Success in rubbing depends upon doing the work methodically, that is, you must cover every inch of the surface with the same pressure and with about the same number of strokes. No need to count the strokes, but a little practice will teach you to quit rubbing when the gloss has been cut off and the grit or dirt nibs disappear. There is no advantage in rubbing beyond that point. No need to cut off any more of the varnish body than you have to to get a dull, smooth surface.

When it comes to rubbing panels where it is not possible to rub the ends without rubbing across grain, rub them first and across grain but do not rub any more than you have to to take off the gloss. Then when rubbing the balance of the panel with the grain you will have to rub out the scratches put in the ends by cross rubbing.

Rubbing is strenuous labor at best, but many finishers work much harder at it than is necessary. If they would use their heads more and their muscles less a better job would result with less work.

The finisher must be especially alert to avoid cutting through the finish at the corners of mouldings, carvings and edges of all overhanging boards. It takes but a stroke or two to cut through at these places, so keep away from them with the pad while rubbing the surface generally and go back to them later with a smaller felt and rub them with unusual care. If you do cut through at such places, they should be touched up with shellac colored to match after the surface has been completely rubbed and before the next coat of varnish or enamel is put on.

Another point which must be carefully guarded against is that of rubbing too long in one place. That will heat the varnish enough by friction to burn and ruin it. Burning may also result from rubbing without sufficient water. The rubbing should be started in one place and should proceed progressively, always in a forward motion. In other words, rub back and forth a few strokes in one place and then move on to the position next to it and so on.

Add more water to the surface from time to time to keep it wet but it is a good plan not to add more pumice stone to a board or panel being rubbed. Take enough pumice onto the panel when you start rubbing to finish rubbing that panel. The point is that after you have rubbed a little with the pumice it becomes finer as the surface becomes smoother. If you add more pumice stone it will cut faster than the partly worn stone on your pad and it will scratch the fine surface already produced.

Two-coat work will not stand close rubbing, if rubbed at all it should be rubbed lightly. From six to eight strokes in each place will usually be enough to remove the gloss and dirt nibs. For really fine work from four to six coats of varnish are needed.

The rubbing is a very important part of the work of finishing. It makes or breaks the job since expert rubbing adds lustre or depth to the finish.

Keep a sharp lookout for a caking or gumming up of the felt pad. If the varnish or enamel cut off gums or cakes the pad the surface is likely to be scratched. To avoid that wash the pad off in clean water occasionally. If it becomes necessary to add more pumice to a panel or board to finish it use a finer grade than that with which you started so you will not scratch the surface already produced and so make the polishing difficult. Varnish which is not dry will cake up easily and some varnishes will cause caking no matter how dry.

When a varnish or enamel is so dirty or rough that conisderable coarse rubbing is necessary that cuts off what is equivalent to one or one and a half coats of varnish. So it is evident that very little rubbing can be done on anything less than a four-coat job and it also makes clear the desirability of doing clean varnishing work to save rubbing time and labor cost.

The first rubbing done on a job is called coarse rubbing and is done with pumice stone which is not so fine as that used for fine rubbing and it is done with a felt which is only medium hard and from 1/4 to 2 inches thick.

Carvings are rubbed with a brush rather than a felt pad which will not of course reach into the depressions.

Pumice Stone and Oil Rubbing.—This is called fine rubbing because the object of it, on fine furniture and cabinet work at least, is to remove the fine scratches produced by coarse rubbing. The fine rubbing is often done first with very finest of pumice stone and oil and then after a wash-up the surface is finished with rottenstone which is very fine, sifted and bolted, and oil.

Oil rubbing should never be done on under coats, only on the last coat of any finish. If done on under coats the next coat of varnish or enamel may crawl or behave even worse.

Fine rubbing is done with a fine-grained, thin hard felt, and it may be done with either water or oil. As a rule the flow coat, or finishing and polishing coat, of varnish is clean and smooth, the very nature of the varnish makes it so if the application is made under anything like favorable conditions. The rubbing should under no circumstances cut through this coat or the finish will be ruined. This rubbing should not take place until the varnish is hard dry beyond any doubt,—at least not until forty-eight hours after application and longer time for drying is much better.

The oil used for fine rubbing may be any one of several. Raw linseed oil was used in years that have passed. So also was sweet oil in favor. Of late years the non-drying mineral oils have been favored,—such as light motor oil thinned a little with benzine, or sewing machine oil. Then there are special rubbing oils put out by all of the large oil refineries which are very good for this purpose. Paraffine oil is liked by some for the work.

When rubbing with oil do not flood the surface, simply dip the pad into the oil and then pick up a thin coating of pumice stone on it. Repeat as often as is necessary to transfer to the panel or board enough pumice to finish rubbing that area. Some finishers prefer to mix the oil with the pumice stone. The rubbing method with oil is identical with that used for water rubbing. There is not, however, as much danger of cutting through or burning the surface and for that reason oil rubbing is a little safer for the new hand at it.

After rubbing with oil wipe the surface as clean as possible with cloths and then wash absolutely clean with benzine.

Allow a fine rubbed surface to dry at least twenty-four hours before polishing. Otherwise the polish may not be durable. A longer time for drying and to allow the surface to "sweat" is much better.

Brush Rubbing.—For quick and cheaper results in the way of rubbing gloss varnish or shellac a brush is used. For large flat or vertical plain surfaces a short bristled brush like a shoe brush is used, while for general trim and mouldings an old short stub flat wall brush or oval varnish brush is used. The pumice stone is mixed with the oil into a "soup", as the finishers call it. The brush is dipped into the soup and the surface rubbed rapidly. Such rubbing, of course, does no more than to remove the gloss from the surface, but it does very well for some jobs. Note these tools in Plate 17.

Sandpaper and Oil Rubbing.—On some of the cheaper work fine sandpaper of the ordinary grades is used after dipping it in one of the oils listed in the pages preceding for pumice stone and oil rubbing. This is a practice which should be extended until it entirely supersedes the practice of sandpapering paint, enamel, etc., dry, a dangerous habit. Breathing the dust from dry sandpapering is perhaps the only real health hazard of the trade today. The paper cuts just as well or better when used with oil. When it clogs up it can be washed with benzine and used again. It leaves no grit on the surface to be cleaned up. The greatest objection to it is that on new woods which are to be finished

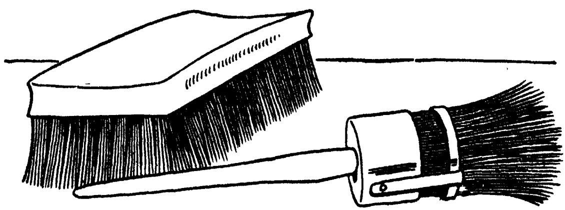

Plate 17.—The Brushes Used Also for Rubbing With Pumice Stone and Oil for a Quicker Job than is Done With the Felt Pad.

in as light a natural color as possible, or in gray stains, the oil is apt to darken the wood color. For dark stains, however, the oil has a beneficial effect, since what is absorbed by the wood will seal up the excessively porous places and make the stain take with a more uniform color.

Waterproof Sand and Grit Papers.—In recent years these specially made papers covered with sand, glass, emery and other grits of a very fine and uniform nature have made great progress in the favor of furniture, automobile and house finishers. They are used for a great many jobs where pumice stone and water or oil were used in the past. They do just as fine finishing and do it much faster. The cost is much greater for material, but considering the time and labor cost saved they are really cheaper in the end.

To use these papers soak a sheet in water, wet the surface and rub as usual. It is best to place the paper on a sandpaper block. Any wood block will do but the patented kinds are very handy. Note Plate 18. Wash the sandpaper out every few minutes with water to remove the accumulation and keep the surface wet. Wash the wood surface off with a sponge and water after finishing the rubbing. A felt rubbing pad on a block of wood makes a good tool over which to stretch the sandpaper. Some finishers stretch the piece of canvas over the felt before putting the sandpaper in place.

These papers are made so fine in grain and so uni-

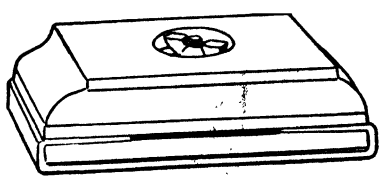

Plate 18.—One Type of Sandpaper Block.

form as to composition that they cannot scratch the surface and they do not leave any grit on the surface.

The fineness or coarseness of sandpaper is rated as FF, F, 3/0 (or 000), 2/0 (or 00), 0, ½, 1, 1½, 2, 2½, 3, 3½, 4, 4½. No. FF is the finest and No. 4½ the coarsest.

Most of the sandpaper used by the house painter comes in sheets 9x11 inches or thereabouts. The finer grades used on automobiles, furniture finishing and on interior wood trim of houses is cut into small sheets about the right size to fit the hand. For the sanding of floors it is well to remember that large sheets of sandpaper can be secured for use on a board. A piece of plank about 10x18 inches having a broom handle secured to the center to work like a waxing brush and with a brick or two on top for weight saves a great deal of labor. A large sheet of sandpaper is secured to the board, being lapped over at both ends and fastened with thumb tacks. With such a tool floors are quickly surfaced without working on hands and knees. Note Plate 19.

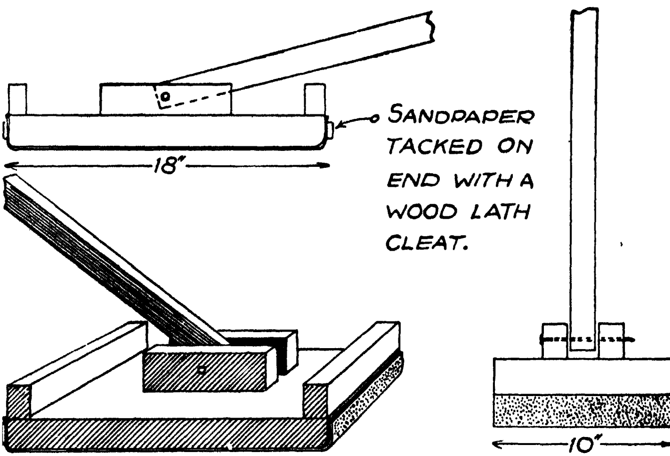

Plate 19.—A Home-made Sandpapering Tool. Useful for Floor Finishing.

A ream of sandpaper is 480 sheets single-faced paper of any size, or 240 sheets of double-faced paper.

A quire of sandpaper is 24 sheets,—any size.

Sandpaper can be secured also in rolls 50 yards long and from 4 to 28 inches wide. Rolls are used chiefly in factory and millwork as belt sanders.

Steel Wool and Oil.—This abrasive is used extensively by the house painter especially and serves the purpose well. It is used both dry and with one of the rubbing oils to keep down the dust and protect the health of the finisher. It is made in the following grades from fine to coarse:

No. 00,—equal to FF pumice stone
No. 0, —equal to F pumice stone
No. 1, —equal to No. 0 sandpaper
No. 2, —equal to No. 7 sandpaper
No. 3, —equal to Nos. 1½ and 2 sandpaper
Fine steel shavings
Medium steel shavings
Coarse steel shavings

Electric Machine Rubbing.—In the furniture and automobile factories and in the railway equipment shops much of the rubbing is now being done by machines such as is pictured in Plate 20. These machines do fine rubbing every hour of the day and do not get tired at four o'clock. It is only a question of time until hand rubbing, in the factories at least, is largely superseded by machines. They are already in extensive use. These machine rubbers run by electricity and each has a small motor on it. There are two oscillating pads four or five inches square covered with felt which is, of course, detachable. The pads can also be covered with sandpaper or other grit papers. There are pads for flat surfaces and for curved surfaces. The cost to run such machines is very small. They make no noise, run from ordinary electric light sockets, are light in weight and portable. The operator guides the machine with two hands and no pressure is needed other than the weight of the machine.

POLISHING

Wood finishers doing the ordinary run and even the better class of finishing in homes and public buildings are seldom called upon to do any polishing beyond a careful clean up and rubbing with soft cloths after varnished surfaces have been coarse and fine rubbed. The piano polish, however, is often inquired about and occasionally a fine piece of furniture or cabinet work calls for polishing to a high lustre after the rubbing.

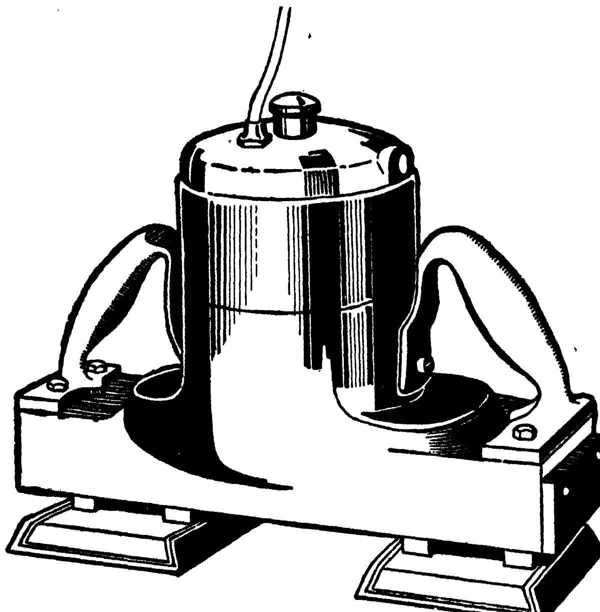

Plate 20.—One Type of Electric Rubbing Machine. Used by Furniture and Auto Finishers. It Does a Better and Faster Job Than Hand Methods.

The rather dull lustre of hand rubbed wood trim and cabinets is generally considered much more artistic than a high piano polish, surely it harmonizes with flat finished walls and dull finished furniture so much in use better than an extremely high gloss.

There is no possibility of producing a highly polished surface unless the wood has been well filled, is level and hard dry. A surface with a ripple effect caused by insufficient filler, or no filler, little or no rubbing cannot be polished. Then, too, polishing must be done on the right kind of varnish. The varnishes intended for polishing are short-oil, very hard drying kinds. You cannot produce a high polish on the long-oil, elastic varnishes which are made to be very elastic and to withstand exterior exposure. And, further, you cannot polish or rub any varnishes which have not been allowed to become bone dry. If you can dent a varnish coat with your finger nail it is too soft to rub and polish.

Having a properly filled, varnished and rubbed surface the polishing is done by one of three methods,—a quick polishing, a slow polishing or French polishing. The latter method is never used except on furniture and while it produces a very beautiful and durable finish its cost is too great in labor and time to be considered for any except furniture pieces.

Using the quick polishing method you begin after the varnish has been coarse-rubbed and fine-rubbed and cleaned up very thoroughly. The polishing is done with fine, dry rottenstone and rubbing oil. This oil may be a mixture of half sweet oil and half denatured alcohol. Fresh cottonseed oil was used in years past, too. Also you can purchase what is called rubbing oil now made especially for this purpose or you can use the piano finisher's rubbing oil which is mixed:

1 quart paraffine oil
1 quart turpentine, pure
5 ounces oil of cedar
3 ounces oil of citronella

Mix thoroughly and let stand a few days or more before using. Water will not mix with these oils but an ounce or two added makes a better mixture when well shaken into it.

Some finishers prefer a soft piece of felt about 3x5 inches, some a wad of cotton batting and some a clean, soft piece of cotton waste. Whichever is used, it should be dipped into the rubbing oil and squeezed out dry. Then the surface may be rubbed with it until coated with oil and then the very fine rottenstone may be sprinkled on to the oily surface. Some prefer to dip the rubbing pad in the dry rotten stone. The rubbing should be done in a circular manner and should proceed over the surface until a good polish has been gained by even pressure and an equal amount of rubbing on all areas. It takes time to produce this polish. When the polish has been completed wipe off the oil as clean as possible with a soft cloth or cotton waste. Then dampen the chamois skin with benzine and wipe off the surface. Then to remove every trace of oil, dry cornstarch or dry bran can be sprinkled on the surface and rubbed over it. After that polish the surface with a clean, soft cloth to a high lustre.

A slower method of polishing is done with an extra coat of flowing or polishing, finishing varnish put on after the surface has had the usual rub with pumice stone and water and has been thoroughly cleaned up. Let this extra coat of varnish dry hard and then rub it fine with the finest pumice stone you can secure, FF grade, and water, using a soft felt pad. When a smooth and evenly dull surface has been secured, clean up by a thorough washing. Then wet the surface with water, wet the palm of the hand and pick up on it some dry and fine rotten stone. Rub the surface well and evenly with your hand, keeping the surface wet and using a circular motion. Decrease the amount of rotten stone gradually until you are rubbing with the hand and water alone. When finished let the surface dry and then with your hand clean and dry wipe off the rotten stone white powder which remains, cleaning your hand after each stroke. Polish with a soft piece of silk or a dry, soft chamois skin. This slower method produces better results than the oil polish described. The oil rub, however, always cuts faster than a water rub.

FURNITURE POLISHES

For cleaning and polishing old wood trim, furniture and cabinets the following formulas will be found useful:

Formula 1:—1 pint vinegar, 1 pint denatured alcohol; 1 pint paraffine oil.

Rub on, let dry half an hour or so and rub off any excess.

Formula 2:—Mix equal parts of sweet oil and denatured alcohol.

Shake well and apply with a wad of cotton. Rub with a circular motion until the polish begins to set.

Formula 3:—1 pint raw linseed oil; 2 ounces spirits of camphor; 4 ounces vinegar; 1 ounce butter of antimony; ½ ounce ammonia, household.

Keep in a bottle corked tightly. Shake before using. Apply with a soft cloth and rub to a polish with a soft flannel or silk.

One of the very best polishes for furniture and all wood trim is:

Formula 4:—1 ounce paraffine oil; ½ ounce butter of antimony; 1 ounce denatured alcohol; 3 ounces water.

Shake this mixture well and then add carbonate of magnesia until the mixture stops bubbling, indicating that it has been completely neutralized. Then add to each pint of this above mixture two tablespoonfuls more of the carbonate of magnesia.

A good cleaner and polish for furniture and wood trim:

Formula 5:— ½ pint butter of antimony; 1 quart cider vinegar; 6 pints turpentine; 1 quart denatured alcohol; 3 quarts raw linseed oil.

Mix well and store in a glass or earthen jug. It will eat through metal containers. Shake well before using. Apply with a soft cotton cloth and rub briskly.

It should be noted perhaps that now much less use is made of furniture polishes for wood trim and furniture. Wax puts on these surfaces a protective coating that is more durable. The hard waxes made for automobile bodies is the type used and it should be polished to high lustre.

For the refinishing of furniture and wood trim today one should always assume that the surfaces have been waxed, or treated with furniture polishes containing wax. No new finish of paint, enamel, varnish or lacquer will dry over a wax film; and so trouble is prevented if the surfaces are well washed with benzine, white gasoline or one of the wax remover preparations made for that purpose. Of course, sanding helps and thorough water scrubbing with tri-sodium phosphate or one of the kitchen soap powders removes wax.

CHAPTER XV

VARNISH DEFECTS AND THEIR CAUSES

We see about us remarkably beautiful jobs of varnishing on furniture and automobiles. In our homes and business buildings we like to expect equally beautiful varnishing to be done on wood trim, floors and cabinet work. None but those who know the exacting requirements to which the furniture finisher and the automobile painter hold themselves can appreciate the inconsistency evident in the expectations of those who want the finest type of finishing done on wood trim in buildings under the working conditions found.

The furniture finisher and the automobile painter are tireless in their vigilance to keep out dust from their work rooms, to regulate the ventilation and to control the humidity of the air. In the factories of most modern design huge sums of money are spent in providing apparatus for the control of heat, air and moisture for the finisher.

Is it any wonder, then, that the finisher who must do his work in new buildings and old, where he must accept conditions as they are, encounters varnish troubles? Even though the quality of the products used be beyond question, surface and working conditions are sometimes such that a high class job is simply impossible of production.

But adverse working conditions for varnishing can be greatly improved if the finisher but has a knowledge of the causes of the more common varnish failures.

Some such failures are so complicated that it is sometimes impossible to diagnose the case because of lack of facts concerning what was done. The more common failures, however, repeat themselves so regularly when conditions are duplicated that there is little difficulty in pointing out the cause and remedy. The use of cheap varnishes, poor tools, improper under coats, application of varnishes on wet, dirty, cold and greasy surfaces account for a very large part of the troubles encountered.

Crawling Varnish.—This condition can readily be recognized by the fact that the varnish acts like oil on a wet surface. The varnish fails to attach itself to the surface in places and crawls or wrinkles or puckers up in tiny waves or folds.

The cause of crawling is the application of varnish over surfaces which are wet, or greasy, or cold, or which have too high a gloss. Crawling may also occur when new varnish is put on over previous coats which are sweaty, which are not hard and dry. Dirty and sweaty finger marks on the surface before varnishing will cause crawling, the perspiration really is a greasy film. A film of soap left from washing without thorough rinsing with clean water will cause crawling. The addition of drier to varnish may cause crawling by making it dry too rapidly and before it has attached itself firmly to the surface. The practice of adding drier to varnish is a vicious habit and ruins good material. The manufacturer puts in the right kind and amount of drier when he makes the varnish and it is unwise for the finisher to add drier in his ignorance of the chemical actions involved. When two or more kinds of varnish are mixed together the finisher is inviting the appearance of crawling varnish. And when a can of varnish is allowed to remain uncorked until it becomes thick it may cause crawling if it is thinned with benzine instead of pure turpentine. Too much benzine will ruin any except the cheap rosin varnishes.

Even the best of linseed oil ought not to be mixed with varnish,—it may cause crawling. The use of an oil-soaked brush may cause it. Quick changes of temperature from warm to cold and of weather from dry to cold, foggy air, cold drafts, etc., are sometimes sufficient to cause crawling of varnish. Oil in the wood surface may cause crawling. Cypress contains a little natural oil on the surface and some finishers oil-coat wood to even up the suction, a good practice, before staining. But if these oily surfaces are not bone dry before varnishing the coat may crawl. The cypress surface can be wiped free from surface oil with a turpentine or benzole soaked cloth. When the surface is cold and the varnish is cold, either below 70 degrees, crawling is apt to occur. Poor workmanship in the brushing of varnish will cause the coating to crawl because it is a thick and thin job, that is, the varnish is not distributed evenly over the surfaces. In the places where the varnish is put on too thick it will crawl, wrinkle or pucker up. A thin film of wax on a surface left by the use of liquid varnish removers will cause crawling, fitting and cracking. The wax should be washed off with benzole or alcohol.

A varnish having excessive body, too thick, may crawl, especially on a surface with a high gloss.

Running, Sagging and Wrinkling.—The causes for these troubles are substantially the same as for crawling. If the surface is vertical and considerable varnish is flowed on it is apt to run, sag and wrinkle as well as to crawl.

The word curtaining is used to indicate the sagging effect of varnish when it sags in long ridges like the draping of curtains. This is apt to occur also near mouldings, carvings, etc., about which more varnish is likely to have been brushed than upon the open places. Varnish which is too new, which is unfinished or not aged enough will cause this festooning, but the trouble is more often faulty application of the varnish in the form of cold, wet, greasy surface or brushing on the coating in a film of uneven thickness. Slow-drying, elastic and durable varnishes containing more oil than the quick, hard-drying varnishes require more brushing and laying-off and are more likely to run, sag, wrinkle, etc., if not properly brushed to distribute the varnish in an even film.

The wrinkling of varnish is caused by flowing on too much varnish. The outside surface absorbs oxygen and dries faster than the under side of the varnish coat, forming a skin. The under part of the varnish film gives up part of its volatile thinners by evaporation and thus loses part of its bulk. The outside skin taking on oxygen soon becomes too large for the mass of soft varnish under it and so it draws up into wrinkles or ridges.

Silking or Enameling of Varnish.—When varnish in drying takes on a texture of a grainy and fibrous appearance it is called by some "silky" because it has a textile fibre appearance. It is called "enameling" by others because it looks like the grain of enameled leather. The cause is usually the spreading of varnish in an unheated room,—cold surface and cold varnish. One cannot brush such varnish enough to keep it in place before it sets in the condition described. The temperature of a room in which varnish is being spread should be kept between 70 and 80 degrees and both the surface coated and the varnish should be of the same temperature.

When varnish is spread over under coats of varnish or paint which are not completely dry silking is likely to occur. Cold drafts may cause silking. Mixing turpentine with some varnishes will cause silking and if a varnish is brushed too long brush marks may remain which give the same appearance.

Seedy, Sandy or Specky Varnish.—This defect looks like a surface over which some fine sand or other gritty substance had been sprinkled while the varnish is wet. These particles will not be in evidence at first but after the coating has been drying from half to one and one-half hours the seedy effect appears.

As to the cause of this trouble. Look first at the varnish used. Varnish which has been recently made, has not aged enough and is not ripe may dry with a seedy surface.

Allowing varnish to become chilled in winter is one cause of the appearance of a sandy finish of varnish. After varnish has been brushed on, if the surface becomes chilled, it may become covered with a multitude of tiny specks and when the coating is dry the specks are even more in evidence. The cause is the chilling of the oil and the reaction of the driers. The remedy is, of course, the proper heating of the room and the varnish to 70 or 80 degrees. The seedy or sandy particles are congealed bits of gum resins or oils or driers. Crystalized particles of drier are usually the cause.

When varnishes are exposed to zero temperatures or nearly so during transportation from factory to finisher the sandy, seedy surface may appear when the varnish is spread. Such varnish should be warmed thoroughly before being used. Place the varnish can in a pail of hot water for half an hour or more. About 110 degrees is the correct temperature of the water for this purpose.

Age does not cause varnish to become sandy or seedy, but with age, when the can has stood around for years, varnish will deposit some settlings in the bottom of the can. For that reason a careful finisher will never use the varnish from the bottom of old cans without first straining it. As a rule the last quarter inch in the bottom of any can, old or new, will not be used for finishing by a careful man. Such varnish is set aside for rough work.

When varnish is allowed to stand around uncorked it will skin over the top and when this skin is broken it is sure to become mixed with the clear varnish and a seedy or specky surface will result, unless the varnish is strained before using.

Pumice stone or other grit, like that from sandpaper or steel wool, on the surface will give the specky, seedy appearance to the finished varnish coating. Dust from ceilings or other surfaces which cast it off into the air will give the seedy appearance to varnish. Likewise the use of brushes which are full of dust or the dried varnish or paint skins from previous work will cause the gritty, sandy, seedy finish on varnish.

Pitting, Pin-holing, Pocking and Blotching.—The causes of these defects are similar and each of these difficulties denote relative degrees of the same general trouble.

Pin-holing is the condition of varnished surfaces which show disfiguring by innumerable small holes resembling pin-holes.

Pitting is the same pin-hole effect but the holes are larger.

Pocking or Blotching describes the same condition but the indentations are still larger, taking on the effect of large scars.

The causes which are usually found in such cases as are called pitting, pinholing, etc., are these: The mixing of two or more varnishes of different kinds or different brands together; change in the air from dry to damp; spreading the varnish in rooms which are excessively hot or excessively cold; brushing varnish over varnish or color which has not become bone dry or which is sweaty; varnishing in a room with a floor which is very wet or cold; placing cold varnish on warm panels, or warm varnish on cold panels; lack of proper ventilation and a uniform temperature of from 70 to 80 degrees.

In the summer time a sudden drop of temperature may cause the pin-hole or pitting of varnish if the air in the room is quite damp. The excessive moisture in the hot air is condensed on the surface when the temperature drops suddenly. The drops of water on the surface prevent the varnish from taking hold and the pin-holes result. It is just like rain on the surface. If it occurs after the varnish is brushed on and before it sets, the same action takes place,—the water sinks in and attaches to the surface while the varnish recedes from the water just as water and grease separate.

When brushes are kept in oil and not made perfectly clean before loading them with varnish they may place enough oil on the surface to cause pin-holing. Varnish brushes, for that reason, ought not to be kept in oil but in varnish, preferably in the special brush-keeper varnishes made for the purpose.

The defect called blotching may be caused by thinning varnish with turpentine or benzine. It may result from the presence of turpentine or benzine in the varnish brush which has not been thoroughly cleaned. Varnish brushes kept in oil and not cleaned perfectly are a fruitful cause of blotching. Varnish is very particular about what it associates with. It takes only a little of some liquid of other kind to start trouble. And the strange part of it is that the varnish contains oil and turpentine usually, but incorporated under heat and in correct ways.

Improper or careless filling of wood is largely responsible for pin-hole defects. And on close-grain woods where no filler is used a first coat of varnish which is too thick will cause pin-holes to appear. The thick varnish fails to penetrate into the wood cells. The first coat of varnish should be thinned with about 25% of pure turpentine—for first coat only.

Sweating Varnish.—Gloss varnish which has been rubbed to a dull finish will sometimes change back to a greasy gloss and that is called sweating. The most common cause of this defect is the application of varnish over under coats which are not sufficiently dry and hard. Sweating may occur over varnish under coats or over color and paint coats which are not dry. In some cases varnish will sweat, even when applied to properly dry and hard under coats, if it is rubbed too soon and before it is hard and dry. The long-oil varnishes, those which contain a large proportion of oil, are much more likely to sweat than the short-oil, hard-drying varnishes. The long-oil varnishes are, of course, the most durable type but are not intended for much rubbing. When they are rubbed they should be bone dry and hard. The very best quality finishing varnish is likely to sweat if rubbed as soon as a week or two after application. A much longer time must be allowed before rubbing such varnish with safety.

When it becomes necessary to rub finishing varnish of the long-oil type the job should be cleaned up after rubbing and be allowed to stand five or six hours in Summer, or over night in Winter, before another coat of varnish is applied. Usually if sweating is going to occur it will show up in that time. And when sweating does occur allow the job to stand just as long as possible before brushing on the next coat. Also rub it again lightly with very fine pumice or an old pumice rag before application of the next coat of varnish. When a job is so handled that sweating may occur it is well to use another precaution, that of applying the rubbing coats as carefully as finishing coats are put on, as to brushing, and rub as lightly as possible, using plenty of water. In this way the under coats are not cut deeply by the rubbing and a deeper lustre will finish on the job. If this procedure is not followed or if the job is finished too soon the finished surface may be specky or full of brush marks.

Green varnish, that which has not aged enough, is often the cause of sweating, but when using high quality standard brands of varnish this is a very remote possibility and the cause of sweating is more likely to be one of those suggested above or rubbing too long and too hard in one place which heats up the varnish even though it was hard and dry enough to begin with.

Sinking-in.—When an open-pored wood like oak is not sufficiently or properly filled, when the paste filler is wiped too soon or incorrectly so as to drag or lift the filler from the wood cells, the varnish coats sink in. It is not possible to produce a really high polish on such a foundation which has a rippled effect. Sinking-in is also a term used to describe deadening, flatting or loss of gloss.

Deadening, Withering, Saddening Varnish.—This condition is really the loss of gloss, giving the varnish a withered, dead appearance. The cause usually may be traced to insufficient or defective under coats, improper filling or insufficient filling of the wood. The cause may be traced to under coats which have not been permitted to dry hard, causing the finishing coat to be absorbed in part by the under coats. This trouble is very common and occurs sometimes even in the best of shops.

Some of the other causes for this defect are the spreading of varnish on unseasoned lumber, on composition panel surfaces which are very absorbent or upon paint under coats which are not perfectly dry. This latter is a very fruitful cause of the loss of gloss on the varnish. If the paint is not dry the varnish most certainly will sink in and go dead; the gloss is not there. There are no exceptions to the principle in painting, varnishing, shellacing, staining, enameling, etc., that each and every coat must be bone dry before another coat is put on. When a finisher violates that law he is in for trouble and he has it coming to him. The customer can hurry the finisher, but the finisher cannot hurry the coatings, beyond certain limits, without paying the price either in the appearance of defects or in the loss of durability. Certain chemical reactions must take place in all these coatings before they become dry and hard.

Spreading varnish over porous, absorbent under coats of paint or enamel undercoaters results in the varnish sinking in and the loss of gloss. The spreading of polishes and waxes of certain compositions on top of gloss varnish will cause the loss of gloss, even when the under coats and the varnish are correctly applied and dried. When too many coats of material making up the surfacing and coloring of the job are put on in one day deadening or sinking-in is an inevitable result. The addition of an elastic binder like varnish to japan color is apt to cause both deadening and checking of varnish. Japan color comes to the finisher with sufficient binder in it and any more added is detrimental.

Tacky, Sticky, Slow-Drying Varnish.—Varnishes are made to work perfectly within certain limits. Perfect results come only when varnishes are applied under perfect conditions. The requirements are a temperature of from 70 to 80 degrees, good ventilation, without drafts, light and not too much humidity. Extremes in weather, very hot, very cold and very humid, damp days interfere with getting perfect results. Varnishes are made which will do good work under each of these imperfect conditions, but special varnishes should be used under special conditions.

Tacky, slow-drying or non-drying of varnish is most often encountered in churches, halls and other places as on pews and seats. The cause of the trouble is poor air, poor or no ventilation, air loaded with ammonia and other gases and moisture. If the old wood is greasy before varnishing, not thoroughly cleaned of perspiration, finger marks and the usual dirt accumulation on furniture, the varnish may fail to dry or remain tacky. Or it may dry and soften up again under the heat of the human body when on chairs or pews. Painted or grained surfaces containing too much oil will prevent the varnish from drying hard and tackiness may result. A minimum of oil ought to be used in all under coats for varnish. The remedy is to remove the varnish and refinish with hard-drying pew varnish. In some cases a coat of thin shellac will eliminate the trouble. Tackiness is often the result of using the wrong kind of varnish for the job. Any good interior spar, coach or cabinet varnish will serve satisfactorily if the surface and under coats are correct.

Crazing of Varnish.—This defect is the appearance of fine interlacing cracks which seem to be in the under side of the varnish film, not on the outer surface. It is much the same effect as is noted on old china dishes. Automobile bodies are especially subject to crazing, even on the finest of finishes. The cause of this defect is often sudden changes of temperature. An automobile, for instance, may be stored over night in a garage with a temperature of 50 or 60 degrees. It is suddenly driven out into freezing or even zero temperatures. The metal surface contracts rapidly; if the varnish and whole body of finish does not contract in the same degree, crazing, or worse, may result. Then when the engine warms up there is heat on the inside of the surface and extreme cold on the outside. No wonder crazing is common with such extreme conditions. Crazing may result also from the use of excessively hard gums in the varnish and from the use of varnish which is not elastic enough for the job at hand, in other words, an unwise selection of varnish for the purpose.

Cracking and Checking.—A common defect which is pretty well described by the terms "cracking" and "checking". The varnish breaks up much like a mirror. There are many causes of the defect. Severe changes in temperature when the varnish is not thoroughly dry and hard and the use of cheap, inelastic varnish in thick coats are common causes. Under coats which are not dry when the finishing coats are put on and the use of under coats which are too thick are fruitful causes.

If slow-drying varnish is applied over quick-drying varnish, the finish is likely to crack. The safe method on all surfaces is to use the same quality of varnish from the start to the finish of the job.

The use of two varnishes having entirely different degrees of drying on the same surface is unwise. The use of a cheap first coat varnish and an elastic good quality finishing coat of long-oil varnish invites trouble from cracking and checking or worse.

Some finishers will not use shellac for varnish under coats, even when absolutely pure, on the theory that it is very brittle and prevents the varnish from taking hold of the surface and anchoring firmly. This is open to argument, obviously, since shellac is very widely used, and, when spread on in thin coats and rubbed down considerably, none of it remains except what is lodged in the wood pores as a filler.

The best and only safe method for finishing is one which puts on an elastic priming coat next to the wood or metal. Then from the primer to flat color coats the elasticity should decrease. From the flat color to the finishing coats the elasticity should increase by degrees. Any other method is likely to result in cracking. This, of course, has special reference to automobile and similar finishing, but the principle is the same for enameling.

Varnish films which are exposed to unusual amounts of ammonia fumes, coal gas, alkalies, etc., are likely to crack.

Varnish which has cracked can seldom be refinished to eliminate the cracks, except temporarily, unless the varnish is stripped off far enough to cut out the cracks, and then refinish.

Chipping, Flaking, Scaling, Peeling Varnish.—These defects are such as show a separation of one varnish coat from another, or of varnish from coats of paint or other color ground. These terms are used to describe different degrees of the same defect,—thus, chipping means that the varnish film is coming off in small pieces; flaking means that the varnish film is coming off in larger pieces; peeling and scaling refer to still larger pieces of varnish coming off.

These failures often follow cracking and are due sometimes to the same causes. The most common cause is the spreading of a hard, inelastic varnish over an elastic one, lack of uniformity of elasticity in the various coats of the finish. It all comes back to the principle which has no exceptions in varnishing, that from the surfacer to the finishing coats the elasticity of each coat should be increased progressively. And it takes a good finisher to know how to do this. The truth of the principle, however, is easy to prove by simply reversing the method, by placing the long-oil elastic varnish on first and the short-oil, hard-drying varnish on top as a finishing coat. You can wager anything on the result as being chipping, flaking, scaling, cracking, etc. The only way to work strictly in accordance with the correct principle is to study the varnish you are using. Learn just what it is and what to expect from it. The manufacturer will be glad to advise you on these technical points. Various brands of varnish, even those sold under the same general names such as spar, cabinet, coach, etc., vary considerably in elasticity.

A common cause of flaking is the use of japan color or oil ground color which contains too much binder under varnish. When a greasy surface is varnished without thoroughly cleaning off every trace of grease you may expect one of these difficulties. And when old varnish has been stripped off with liquid remover containing wax, the surface must be thoroughly washed with benzole, alcohol or turpentine to remove the wax film, if you would avoid flaking of the new varnish. And when lye, potash or caustic soda removers are used they are likely to leave some alkali on the surface. If not removed by washing well with clean water the varnish is very likely to flake off. The flaking, scaling, etc., of varnish in some cases is the result of using cheap liquid fillers and not wiping them off clean from the surface. They prevent the varnish coats from gaining a good anchorage on the wood fibre.

Milky, Cloudy, Foggy, Blooming Varnish and Shellac.—As the descriptive terms imply, this defect amounts to a clouding of the varnish transparency. In spots the varnish takes on irregular, mottled opalescent effects. The cause is nearly always the presence of moisture from damp air, spilled water, hot dishes on table-tops and in shellac varnish, which is very easily discolored by moisture. The rubbing of the coat with pumice and water instead of pumice and oil will turn it white in places.

A common cause of this trouble is foggy, misty weather which produces moisture-laden atmosphere in rooms where varnishing is done. During such weather windows must be closed during and after the varnish is spread and until the varnish is hard dry, if these defects are to be avoided. They are much more likely to happen to short-oil, quick-drying varnishes than to others because they do not contain sufficient oil to repel the moisture which is absorbed by the varnish gum.

The lack of ventilation in rooms where varnishing is being done invites blooming, clouding, etc., especially in new buildings where there is an excess of moisture which collects on the surface.

By increasing the ventilation and rubbing the dry varnish with a soft cloth or chamois skin to clean and warm it up, the blooming will often be removed. Sometimes if the surface is rubbed with a soft cloth which has been wet with denatured alcohol and squeezed and shaken out dry it will help remove the discolorations.

When shellac finished surfaces turn white the milky clouds are due to moisture absorption. Brush on a coat of denatured alcohol with a light touch. Let it dry. That will redissolve the shellac and eliminate the white clouds as a rule. Next brush on a thin coat of boiled linseed oil and wipe off gently immediately. Let it dry and put on a coat or two of varnish of good quality.

Varnishes in which the oils and gums are not perfectly fused together are apt to show a bloom in humid atmospheres.

Varnish Turning Yellow, Green or Blue.—This difficulty is more often encountered by the automobile and carriage painter than other finishers. The cause is the exclusion of light or the presence of coal gas or other impurities in the air. These have a discoloring effect and a darkening effect on the varnish, usually increasing its yellow hue. The change in the varnish color, of course, has its effect on the color under it, so much so in fact that bluish grays will be changed to greenish grays.

The use of clear varnish over black japan ground is a common cause of varnish taking on a bluish or greenish cast. The remedy is to add a bit of the black to all varnish coats except the last. Newly varnished surfaces which are stored in the dark are apt to turn to a greenish cast.

The bluish cast taken on by dry varnish on vehicles is a bloom due to moisture being absorbed by the varnish. The blue disappears when the moisture is dried out.

Blistering of Varnish.—This defect is familiar to all, the swelling out of the varnish film in places after it is dry into bubbles or blisters. The cause of blistering is the action of heat, usually the sun, drawing out of the wood moisture or sap which has been sealed in by the varnish. Moisture in the under coats of paint, enamel, etc., and grease on a surface varnished are also fruitful causes of this trouble. Non-drying oil in the wood varnished will cause blistering. The action of the sun or heat from other source is that of heating and expanding the liquid under the varnish. The expanding necessarily tears the varnish loose to make room for the increasing volume of the liquid. The better the quality of the varnish the more elastic it is, and the more elastic the varnish the more likely it is to blister when subjected to these unfavorable conditions. Newly varnished surfaces should be protected from the concentrated rays of the sun or other heat source until hard and dry. There are on record cases where varnished surfaces have been blistered by the action of a bubble imperfection in a window glass. The bubble concentrated the sun's rays upon the varnish in the same manner as a burning or magnifying glass works.

Shellac, especially, will not withstand heat. When used for under coats it may cause blistering when heated, even though no moisture is under it.

Blistering is more troublesome, perhaps, on doors of residences, stores and public buildings which have south exposure. Some cases persist in spite of repeated refinishing. Stubborn cases are usually cured by stripping off all of the old finish down to the bare wood, using liquid paint and varnish remover or a blow torch, and then refinishing this way: For a stained and varnish finish, use a water stain, allowing at least six hours to dry and follow with from two to four coats of first-class exterior spar varnish. If a high polish is wanted, necessitating a well-filled, level surface, do not use filler but rather allow the first coat of varnish to dry two or three weeks and rub it down level with pumice stone and water. Clean up thoroughly. This will make the first varnish coat serve as a filler and it may be necessary to rub the second coat a little too, but be sure it is dry. If you rub long-oil, exterior spar too soon it will sweat and it will gum up and destroy itself. Be sure to use the same brand and kind of varnish for all coats, from the same can if possible.

For refinishing such a job with paint or enamel, use the least possible oil from the start to the finish. The first coat may contain not more than ten to twenty-five per cent of oil and the balance turpentine. The under coats to follow should be thinned entirely with turpentine, making sure that each and every one is bone dry before applying the next. A first class enamel under coater may next be used or a coat of half lead and half zinc ground in oil and thinned with turpentine. The finishing coat should be first class white enamel of the kind that is made for exterior exposure, meaning a long-oil enamel must be used. Or, for the last coat mix with high class spar varnish a little of the lead and zinc under coater, just enough to kill the brown color of the varnish, and use that as the enamel coat. If it is to be colored be sure to use colors ground in japan, not oil colors.

Alligatoring of Varnish.—This trouble is noted most often on doors and window frames, sills, casings, etc., which have been grained or painted. The cause is the use of too much oil in the painted or grained under coats. The paint is more elastic than the varnish, so the varnish film breaks to let the paint expand more when heated by the sun or otherwise. Paste fillers mixed with too much oil and used on woods which do not absorb much oil, or when not allowed to dry hard before varnishing will sometimes cause alligatoring. The alligatoring of varnish is caused by the use of quick-drying, short-oil, hard varnishes over long-oil elastic varnishes. Alligatoring, of course, is that condition which causes the varnish to break up into cracks which look like an alligator's back.

Powdering, Crumbling, Perishing Varnish.—All of these terms and a few others are used to describe varnish which first loses its gloss and then gradually becomes lifeless, powdery and crumbles away to complete destruction.

The causes of this destruction are several and they destroy even good varnish prematurely. Exposure to coal gas, ammonia fumes and other gases are common causes of this trouble. Washing varnish with excessively hot water is destructive in this manner. Exposure to sudden and great changes in temperature while the varnish is drying will sometimes cause it to be destroyed in this way. The crumbling of varnish to dust may be due to the use of the improper kind of varnish for the purpose,—for instance, the use of short-oil, hard, inelastic varnish for exterior surfaces where a long-oil elastic varnish is needed. One of the greatest causes of premature perishing of varnish on furniture and vehicles is the use of so-called renovators, soaps and polishes. Such compounds as a rule do not remove dirt and grit from surfaces but grind it into the varnish and also they tend to keep the varnish in a soft condition which is injurious. Where soaps are necessary the neutral soaps containing little free alkali should be used. Linseed oil soap is good. Cleaning with clear cool water is best.

Brush-Marked Varnish.—Varnish sets soon after being spread on a surface. It can be brushed and rebrushed safely if done quickly and immediately after spreading, but when brushed too much, or too long, or too late the brush marks remain. For a few minutes after spreading varnish and enamel flow out and level up the brush marks, but when they have taken a set by the evaporation of some of the volatile liquids it is harmful to do more brushing, it roughs-up the coating and leaves brush marks. The use of rubbing varnish having excessive body, producing heavy coats, causes much brushing and the brush marks may show. The varnish sets before it can be brushed out evenly.

Chilling of Varnish.—Varnish should be stored and used in a temperature of from 70 to 80 degrees. When the temperature is allowed to drop to low levels some of the gum or driers or oils in the varnish solidify, they drop out of solution. These may or may not be redissolved when the varnish is again warmed up by placing the can in a pail of hot water. If the solid portions do not redissolve, little specks will appear on the finished surfaces causing what is called seedy, sandy, specky varnish. Such varnish should be very thoroughly strained after heating and before using.

Brittleness of Varnish.—One of the greatest problems of the varnish maker has always been to produce varnish which will dry hard, rub smoothly and clean and be sufficiently elastic, in other words, to secure these qualities without making the varnish brittle. Brittleness is a matter of degree. Some are more brittle than others. Interior short-oil varnishes and rubbing varnishes necessarily are more brittle as a class than exterior, long-oil varnishes which must be very elastic to withstand exterior exposure.

Excessive brittleness of varnish is an inherent defect which is due to an excess of drier, lack of oil, adulterated gums or improper cooking. When a varnish crumbles and powders white under friction from the finger nail, when it scratches white easily that varnish is of poor quality. Brittle varnish has no value except, perhaps, as a temporary coating on barrels, etc. It should not be used on surfaces as under coats on the theory that it will be protected by the good quality, elastic finishing coats. The brittle varnish will then rob the finishing coats of its tough, elastic character upon which it is dependent for durability.

Livering Varnish.—When varnish coagulates into a thick mass like liver you have the condition described by this term. It also occurs with paint when it is mixed with cheap varnishes which contain considerable rosin. Livering of varnish occurs when it is mixed with certain kinds of paints and certain other varnishes. The cause usually is separation of some of the varnish constituents and the formation of new chemical combinations. In other words it is not always safe to mix varnishes and paints indiscriminately in large batches until small trial mixes have been made first to determine what reactions may be expected. Not all varnishes are good mixing varnishes. The special mixing varnishes are made with a view to overcoming any bad reactions when it is mixed with the common materials in use. Occasionally varnish which has been subjected to extremely cold weather for some time and those which are not completely sealed in the can will liver, due to separation of the varnish constituents and chemical reactions when the varnish is again warmed up.

Skinning of Varnish.—This term is used to describe that condition which results when the cork of a varnish can is not put in tightly or not at all. The top varnish in the can oxidizes, forming a tough skin. This exposure also permits the evaporation of some of the volatile solvents of the varnish and is decidedly detrimental to the quality of the varnish. The storage of varnish should always aim to keep it corked tightly and to keep it in cans which are full. An air space at the top of the can permits skinning. Large cans which have been partly emptied should not be kept half full, or with any air space at the top. Pour the contents into smaller cans which will be filled by the varnish.

Varnish Spotting.—Flat and discolored spots on new varnish may appear due to cold blasts of air hitting the fresh varnish while drying, to the splashing of liquids like gasoline, benzine, etc., on to the wet varnish. Such accidents may cause the varnish constituents to separate and flat or discolored spots may result. Splashes of water or contact with a stream of humid air will cause the varnish to become cloudy in spots.

Fire Cracks in Varnish.—These are very fine, delicately woven cracks in the underside of the varnish or surface coats. The cause is the same as for cracking and crazing as described elsewhere in this chapter. One or two extra coats of rubbing varnish will often eliminate fire cracks.

Discoloration of Shellac.—Shellac which is kept in tin cans too long will turn black or greenish black, due to the action of the alcohol in the shellac on the metal. Shellac should be stored in glass or earthen vessels and in the dark and, of course, must be corked up tightly.

Shellac which has discolored this way is a loss. Nothing can be done to restore its color.

Varnish Fails to Flow.—When varnish is permitted to get very cold it will not flow properly and should not be applied until it has been placed in a pail of hot water and warmed through to the temperature of the surface to be coated. When a can of varnish has been allowed to remain uncorked for some time, or when a little varnish is kept in a large can with much air space at the top it becomes thick and will not flow freely or evenly. It should be warmed, thinned with pure turpentine and strained. Allow it to stand a few days then before using.

CHAPTER XVI

LACQUERS—PYROXYLIN NITRO-CELLULOSE, SHELLAC, CHINESE AND JAPANESE

THERE has been a much needed change in the use of the word lacquer of late to describe transparent coatings. It has been used in such a general way for years that one had little idea of the composition of any product called lacquer. The Chinese and Japanese lacquers are simply varnishes made of oils and gums peculiar to those countries. In the United States the word lacquer has been used to describe certain varnish coatings of a highly transparent nature which produce a dull lustre on metals and other surfaces. Some were used for decoration and some simply to exclude the air from brass, copper and other polished surfaces to preserve their brilliance. Some were air-drying and some baking varnishes.

Today the word lacquer is rapidly being accepted as a designation for the cellulose pyroxylin coatings and it will be well if it is used in the future exclusively to designate these materials. All others really are varnishes and should be so described and referred to.

The word lacquer is derived from lac, a gum resin produced by lac insects which feed upon the sap of certain trees in India. Shellac varnish is a solution of this gum in alcohol. When refined and purified it makes a nearly colorless coating and one which is quite transparent. In this form it has been long used, as stated before, for preserving the lustre on highly polished metals like brass, copper, etc. The shellac gum is also colored with aniline and other coal tar colors, the spirit-solubles, and is then called lacquer. It has been greatly used on furniture and art objects and when many coats are applied thin, remarkably durable finishes result. When these lacquers are baked at temperatures between 100 and 200 degrees the gum is fused, the lacquer is made to adhere more firmly to the surface and is a more durable finish.

The Chinese and Japanese lacquers are not like the shellac lacquers. They are made from the juice of trees which grow in those countries, trees which are related to the sumac and dogwood known to America. After collecting this juice which looks like that which one squeezes from milkweed, it is purified and worked through many operations to make varnish. It is used in its natural white, transparent state and also is colored with various pigments and metallic substances which make it resemble enamels. These lacquers are used on woods and metals and for the finest work about three dozen operations are required to bring the job along to the finish of a perfect character. Such lacquer is not baked but, strange as it may seem, dries best in cold, damp and dark closets. The most valuable pieces of this lacquerware, boxes, trays, vases, etc., required from five to twenty years to complete the work.

Pyroxylin Nitro-Cellulose Lacquers.—The lacquers in which we are so much interested today as they are used on automobiles and furniture are not products of very recent inventions as is commonly thought, but are the result of perfecting a lacquer which has been used over a dozen years. The first lacquers of this type made and used a few years ago were thin, so very thin that to secure a body of finish equal to oil and gum varnishes from fourteen to twenty coats of lacquer were required. The trouble was that at that time a very limited amount of the solid matter could be used in each gallon of liquid. When enough of the solid matter (nitrated cotton) was put into a gallon to make a thick film when dry, it was so thick and sticky that it could not be sprayed upon the surface. These early lacquers were transparent and white. A little later a small amount of color could be added, but not enough to make the beautiful lacquer enamels we now have. The early lacquers also had no gloss. The reason for the great progress in the use of lacquers in the last year or two is the fact that the chemists have learned how to overcome the disadvantages of the old-time cellulose lacquers by producing what is called low viscosity cotton which can be added in sufficient amount to each gallon of liquid to make a thick, transparent film on the surface coated when dry. They have also given us lacquers which will carry, not only sufficient color pigments to produce the brilliant colors noted on automobiles and all manner of merchandise, but also lacquers which will carry opaque pigments; thus we have lacquer enamels. They do not carry as much of the opaque pigments as the oil and gum varnish white enamels, but sufficient for the purpose.

It should be noted that pyroxylin, nitro-cellulose lacquers are not related in any way to the other kinds of lacquers which have been used for a great many years, for centuries in the case of the Chinese and Japanese lacquers. These latter lacquers are varnish and shellac compositions of gums, resins and oils, while the pyroxylin lacquers are of entirely different composition; and although they do contain a little of the gum resins used in oil varnishes, as an incidental means of increasing elasticity, they can be made entirely without these gums.

A brief outline of the manufacture of pyroxylin lacquers is interesting. The word cellulose is the chemist's name for all vegetable fibre. Ordinary cotton and wood are the chief forms of cellulose. Paper is simply a physical combination of cotton and wood vegetable fibres, and waste paper is, therefore, used as well as cotton in the making of lacquers.

The first step in the making of lacquer is the treatment of cotton with a mixture of sulphuric acid and nitric acid. The short-fibre cotton which remains after long-fibre cotton is stripped from the plants is the grade used; it is called linters cotton, and after washing, cleaning and bleaching, it is ready for the acid treatment when it is dry. The cotton takes up the nitric acid and is then called cellulose nitrate, nitro-cellulose or nitro-cotton. This nitro-cellulose is washed thoroughly with water and some soda to remove the acid, leaving the nitrogen in the cotton, and then the water is taken out. The water is displaced with alcohol and the nitro-cellulose is then called pyroxylin, or soluble cotton. It is shipped in the wet state, containing about 30% of alcohol by weight. The alcohol materially reduces the fire hazard. Pyroxylin is the raw material from which the lacquer manufacturer makes his product. It is also called collodion and is used in surgery for coating wounds.

Nitro-cellulose which contains a great amount of nitrogen, up to 13.5%, is the base of smokeless powder. That which contains more nitrogen is the base for making gun-cotton explosives. The nitro-cellulose used for lacquers, that which makes pyroxylin, is nitrated to an intermediate degree, from 11.8% to 12.5% of nitrogen, and as long as it is kept wet with alcohol there is little or no risk of fire or explosion.

Pyroxylin used as the base for lacquers looks very much like ordinary cotton. It is white, rather solid and the fibres are more brittle. To make lacquer this pyroxylin is dissolved in solvent liquids like ethyl, butyl and amyl acetates, acetone and methyl alcohol. These solvents are, of course, very volatile. Combinations of denatured alcohol and camphor and of alcohol and ether are also used as solvents of pyroxylin. Alone these substances are not solvents, but in the combinations they are.

Then other thinners are added which are volatile but are not solvents of the pyroxylin. They are used simply to make the lacquer more fluid so it can be sprayed on to a surface more easily, or so it will distribute itself better when articles of merchandise are dipped into it. The volatile, non-solvent liquids used in lacquers to make them more fluid, help control the rate of drying and to help decrease the cost are: denatured alcohol, butyl alcohol, fusel oil, benzol, toluol and xylol.

Pyroxylin dissolved in the solvents mentioned and diluted with the non-solvent volatile liquids makes an exceedingly tough and transparent coating, but one which is too brittle and which does not adhere as firmly as is desired to under coats. Therefore to that solution is added what are called plasticisers, or softeners, which remain in the lacquer when dry and increase the elasticity. Castor oil, rape oil, camphor and a group of liquids called esters are used as plasticisers. In order to increase adhesion and the gloss of the lacquer, gum resins, such as are used in making oleo-resinous varnishes of the old type, are added to the solution.

Lacquers made of the materials so far mentioned are very transparent and very light in color, as well as exceedingly tough and resistant to wear of all kinds. In order to make lacquer enamels, color pigments and also opaque pigments are added to the clear lacquer.

The drying of lacquers requires from ten minutes to an hour, depending upon the composition which is within the control of the manufacturers. It dries by the evaporation of the solvent and non-solvent volatile liquids until nothing is left on the surface except the cellulose in the hard, solid form, plus the plasticisers and the gums incorporated.

The application of lacquers is made by use of the spray gun and by dipping. Lacquers which can be applied with the brush have also appeared on the market for use on a great many kinds of surfaces, particularly household articles like furniture, etc. It is offered for use also on floors and general wood trim and will dry hard enough to walk on in half an hour.

The cellulos lacquers made years ago were little used except upon metals as a bronzing liquid with metal bronzes and as a very thin, transparent coating over polished metals, brass, copper, bronze, etc. They were used largely for the same purposes as the shellac and varnish lacquers.

In modern manufacture of merchandise and in the arts and crafts the clear lacquers and lacquer enamels in innumerable colors are used on merchandise and decorations very extensively. The thin, light colored and tough transparent lacquers find great usefulness in coating metals such as silverware, electric light fixtures, building hardware, all manner of metal spinning and stamping products like art and novelty pieces and jewelry. The clear lacquers are used both as bronzing liquids with which bronzes are mixed and as coatings for bronze-coated surfaces and enameled surfaces. The furniture industry employs both the clear and colored lacquers extensively and more and more each year. The colored lacquers, enamels, are also very widely used on automobiles, machinery of many kinds, electric light fixtures, furniture, fixtures, toys and novelties.

The use of lacquers, in short, is growing very rapidly to include not alone the automobile industry, but also railway equipment, furniture of every kind and the house building industry. In the development of any product which promises so much in durability and general service there are bound to be some set-backs, due to too much speed and inexperience in the making and the application of lacquer, but the great research work being done, combined with the experience which craftsmen are getting in the application of lacquer, is bound to overcome the difficulties which cause the low percentage of failures which is evident.

The lacquers so extensively used for finishing furniture, automobiles, doors and other wood trim, dry too rapidly to permit application by brush. Application by spray gun is a comparatively simple operation, although the spray gun like any other tool calls for a bit of experience and strict attention to manufacturer's directions for successful operation. The chief requirements are that the coating material be strained to make it perfectly free from skins and dirt that clog the gun ports; that the amount of air pressure put through the gun be correct; and that the gun be held correctly and moved at a steady pace. Air pressures vary with the viscosity or thickness of the material; ten pounds may be enough for thin varnish, while forty to fifty pounds is required for enamel. As the gun is moved along like a paint brush on the same plane with the surface, the trigger is pulled at the beginning and end of each stroke. If the gun is stopped before the stroke is completed, the trigger must be released; otherwise a run will be made. If the gun is moved too slowly, or if the material valve is opened too much, an excess of material will be put on the surface and it may run or sag. Manufacturers of spray guns give full instructions for operation.

CHAPTER XVII

WAX FINISHES AND OIL-RUBBED FINISHES

THE wax-finished surface has a beauty all its own, although it cannot really be said that it reproduces the effect of a hand-rubbed varnish finish. Like most finishes, it has its advantages and some disadvantages. To make the most of this finish, therefore, the finisher should acquaint himself with the characteristics of this material and its actions under common circumstances.

Wax is a fatty, solid substance of animal, vegetable or mineral origin. It sets rather quickly as commonly used, will take a hard finish or polish by friction, but never gets really dry like varnish and paint. A number of waxes are in common use in the paint and varnish industry and each has its own characteristics. Some dry with a harder, tougher surface than others and some are light in color, while others are quite dark. The most common waxes are beeswax, light and dark, paraffine wax, carnauba, ceresine and spermaceti. Beeswax is most used because it is abundant and is not very expensive. Paraffine or para wax is a petroleum product which is also abundant and moderate in cost, but it is a bit too soft. Its white color, however, makes it very valuable for light gray wax finishes upon which other waxes could not be used without discoloring the finish. Carnauba is a much better wax than either of those, but it is not generally carried in stock by paint supply houses. It is largely used by manufacturers. It has a higher melting point (185 degrees) and is more expensive than beeswax and paraffine. Carnauba wax is also called Brazil wax because it is a product of the Brazilian wax-palm tree. It is hard and white in color. Japanese wax is sometimes called ozocerite and is obtained from the fruit of a tree. It is used for making candles in Japan. Chinese wax is very similar and is secured from the twigs of the Chinese ash tree upon which it is secreted by an insect.

Concerning the merits of the wax finish as compared with other finishes it must be noted that, while it makes an artistic finish which harmonizes well with other surfaces in an interior decorative scheme, it is not really a durable finish. This very fact is considered an advantage, however, since it can readily be renewed without stripping off the old finish. When a waxed surface is properly built up it is a fairly durable one if anything like regular attention is given to its upkeep. Consider the waxed floor, for instance. It is very durable or not durable at all depending upon how it is done. If the floor is filled and stained in one operation and then waxed, it will not be a satisfactory finish unless rewaxed very often and unless it is in a family where the traffic is not heavy. If, however, the floor is first stained, using a penetrating water stain, is then filled and waxed with at least two good coats, each one allowed to dry two days and polished to a hard finish a durable surface is gained. And if two or three coats of varnish are put on before the wax and on top of the filler a very durable finish is secured.

When regular waxing is done every week or two or three, depending upon the amount of traffic, some prefer the job without varnish because the floor is not so slippery and if the finish is worn through near the doors it is easy to build it up to the original finish and match these spots perfectly. The penetrating stain holds the color in the wood.

If a varnished floor is neglected to the point where the traffic wears through the varnish to the bare wood it takes a skillful finisher, indeed, to coat with blended, colored shellacs to make a touch-up match. If there was no stain coat before the filler it is very difficult to match up bare spots which are worn and discolored.

Wax will not withstand water. Hence a damp floor or one which is washed with water is no place for a wax finish. A waxed floor can, however, be wiped up with a damp cloth which will not turn the wax white like an excess of water. Waxed floors should be cleaned with a dry dust mop or one slightly moistened with paraffine oil or liquid wax, never linseed oil.

A floor which is warm from being over a furnace or boiler is no place for wax because it remains fairly soft and picks up dirt. To give good service from the standpoint of cleaning and appearance as well, wax must be polished by friction to a high gloss and that can only be done when it is not warmer than the normal 70 degrees.

Wax makes an impossible foundation on a surface that is to be painted, enameled or varnished. No materials like these will remain long if even a trace of a wax film remains on the surface. Therefore surfaces to be finished with these materials, especially waxed floors which are to be revarnished, should be cleaned thoroughly first by scrubbing with warm water containing sal soda or any good washing powder. Then it ought to be sandpapered, cleaned up free from dust and washed with benzole, benzine or turpentine.

Some object to varnishing a floor which is to be finished with wax on the theory that the varnish makes the polished wax more slippery than if the finish consists of nothing but stain, filler and wax. There is some truth in this, but when the two finishes are highly polished one is about as slippery as the other.

On standing wood trim one coat of wax is commonly considered enough, but there is no doubt that two coats give a deeper lustre and more beautiful finish.

Wax should be applied with a soft cloth or with one of the soft mops made especially for that purpose. Then it may be rubbed over with a dry, soft cloth to

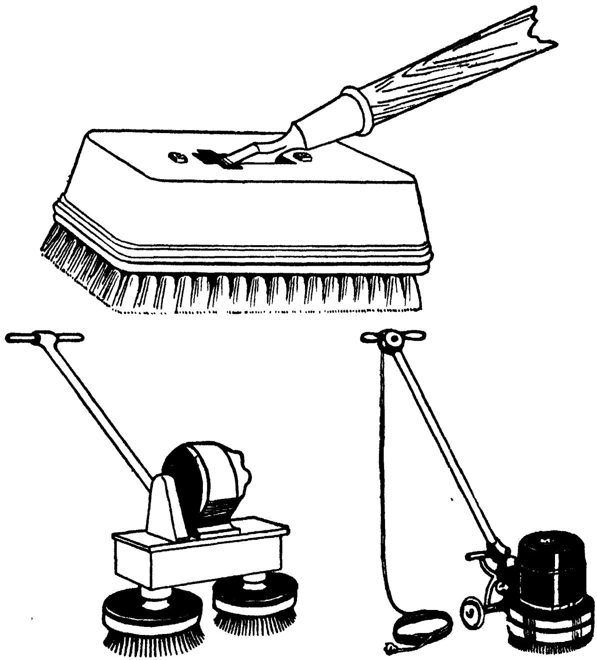

Plate 21.—Wax Polishing and Scrubbing Machines. Driven by Electric Motors. They Do Rapid and High Class Work.

polish, or a short-bristled, weighted brush will do the polishing much more easily. The electric polishing machines with revolving brushes are wonderful labor savers and they produce a harder finish, which means a more durable one, than can be done by hand polishing. Note Plate 21. One pound of paste wax of the ordinary consistency will cover about 125 square feet, one coat.

Wax may be colored to suit, especially paraffine wax, by adding to it colors ground in japan and thinned with turpentine. Color ground in oil, if used, should first be thinned with benzine and allowed to stand over night to let the oil come to the top. Pour off the oil and mix the color pigment with turpentine before adding to the wax.

Factory-Prepared Waxes.—Because the manufacturer has at his command a greater number of waxes, has the chemical knowledge and experience to handle them and the manufacturing skill and equipment at his command he is able to make better wax pastes, for floors especially, than the finisher can mix from available materials. The factory-prepared waxes are mixed and tempered to work properly and yet to give a much harder wearing surface and a higher polish than any that can be mixed by the finisher.

Painter-Mixed Wax Formulas.—From the materials which are commonly available to painters and wood finishers in general the following formulas have been used considerably in the past. But with the cost of labor ever on the increase it is well to ponder the wisdom of spending the necessary time to mix waxes. Sometimes it pays and sometimes the wax so mixed costs more than a superior wax made by manufacturers. There is no doubt that the factory-made wax is superior for floors.

Formula 1:—**1 pound of white or yellow beeswax; ½ pint turpentine; 1 tablespoonful ammonia, 26 degree or XXX.**

Place the shaved-up wax in a pot and put the pot in a pail of hot water. When melted add the ammonia and turpentine. The ammonia keeps the paste from getting hard. Paraffine wax can be used in the same way, but it makes

a softer, though whiter, wax paste, that is, one which when dry is softer.

Formula 2:—1 pound carnauba wax; 1 pound ceresine wax; 1 pint turpentine.

Cut the waxes into shavings, place in a pot and put the pot in boiling hot water. When melted add the turpentine. When cool if it is too thick more turpentine may be added.

Formula 3:—½ pound carnauba wax; 1 pound ceresine wax; 2 pounds paraffine wax.

Melt the waxes together after shaving them up in a pot and place the pot in a pail of hot water. When melted add 3½ pounds of turpentine or mineral spirits. Store this wax in an air-tight can. The wax may be poured into molds and allowed to cool in cakes before the turpentine is added. The turpentine may be added later as needed. This wax takes a good polish, makes a hard finish and is not expensive to prepare. It is much used on furniture made in factories.

Formula 4:—Dry wax for Dance Floors—4 ounces spermaceti wax; 4 ounces paraffine wax; 8 ounces talcum powder.

Shave the waxes and melt together in a water bath. Add the talcum powder and mix thoroughly. Then pass through a No. 10 sieve.

OIL-RUBBED FINISHES

The first use of oak for interior trim in the English feudal castles and baronial halls included no attempt to finish the wood. It was allowed to age and color from the greases and gases liberated by the cooking over open fires. In time beautiful and colorful finishes resulted naturally. Later to produce the mellowed and aged effects on these old surfaces without waiting for the passage of time, new oak was treated with oils; probably animal fats, linseed oil and others. Coat after coat was rubbed in and renewed from time to time.

There is no more serviceable finish today than that produced by coat after coat of hot linseed oil. The great durability and beauty of French polished woods is due largely to the oil coats rubbed in, each being allowed to dry.

On table tops or any surfaces which are subject to hot dishes there is no better finish than that produced by brushing on a coat of half boiled linseed oil and half turpentine; let it dry an hour or so and wipe off any excess remaining on the surface. In a day or two coat again with the oil, wipe off and let dry. When the oil is put on hot it penetrates more deeply and so makes a more serviceable finish. Three or four coats of oil makes a good finish, and if the process is continued by adding a coat of hot oil occasionally, the finish is very satisfactory and decidedly appropriate for oak, especially. It will not spot white from hot dishes and may be washed as often as necessary to keep it clean. Such a finish is, therefore, very practical for restaurant tables.

CHAPTER XVIII

PAINTED INTERIOR WOOD TRIM

IT IS the history of art that only the more simple forms of decoration survive through the ages. That accounts for the continued popularity of painted and enameled wood trim. The simplicity of this mode of decoration makes it grow in one's appreciation as a decorative mode to be lived with seven days in the week. And what accounts most for the enduring beauty of painted wood trim is the practice of painting it a color which is exactly that used on the walls, but a fe tones lighter or darker. By such treatment the wood trim is definitely corelated with the decorative scheme and serves properly as part of the background of the whole decorative plan.

Among the advantages gained by painting and enameling wood trim is the ease with which old trim which has been marred, bruised and scratched can be filled and leveled up to efface the damage. Then, too, when remodeling has taken place there is apt to be two or more kinds of wood trim in the building and they are harmonized by painting and enameling.

Painted and enameled wood trim is not only beautiful in its color tones and relation to the color plan, but it is serviceable as well when properly done. This sort of finish can be renewed from year to year, changing the color note to fit the wall treatment and the furnishing of the room. This latter point is very important with some folks who tire of one style of decoration in a year or two. With painted wood trim the style of furnishing the room may be completely changed from conservative, classic to novelty treatments and back again with considerable ease.

The matter of mixing paints and colors, includes innumerable details which cannot be included within the limited space of this volume, but the most essential facts are given in the working schedules which follow. All of the details were presented in the author's book,—"The Mixing of Colors and Paints."

PLAIN PAINTING

NEW INTERIOR WOOD TRIM

Operation 1: Brush down the wood with a duster brush and scrape off any accumulations of dirt, etc.

Operation 2: Shellac knots and sappy streaks, if any, using a thin shellac. If the color of the finish is to be white or any very light tint, brush on a thin coat of shellac over the entire surface. This is to stop suction of soft, porous places which would cause the paint to dry spotty as to gloss and flat. The shellac also seals up streaks of resin or pitch which may come through and discolor light colored paint. The shellac coat should consist of about 2 pounds of orange shellac gum to 1 gallon of denatured alcohol,—a two-pound cut, in other words.

Operation 3: Paint. Apply one coat of paint, the liquid portion of which is about ¼ boiled linseed oil and ¾ turpentine. Tint to the final color wanted with tinting colors ground in oil. Let this coat dry 24 hours.

Operation 4: Putty. Nail holes, cracks and bruises should be filled with good putty made from lead in oil paste, dry whiting and a little japan drier. Color the putty with dry colors. Let the putty dry and then sandpaper the whole coat lightly with No. ½ paper, using turpentine with the paper to keep down the dust. If there is not time to allow the putty to dry be sure to fill level and smooth off perfectly and wipe off all putty around the holes and cracks.

Operation 5: Paint. Two coats of paint should now be applied. Prepared flat wall paint may be used. Or white lead thinned with turpentine, or with flatting oil, may be used for these coats. If desired it is proper to use from 20% to 40% zinc oxide ground in oil with the white lead and a harder wearing surface will result.

For a gloss finish mix the paint with about ¾ linseed oil, boiled, and ¼ turpentine. White gloss paint should contain no linseed oil except that in the first coat. Linseed oil turns the white paint yellow when not subjected to sunlight. For gloss white interior paint thin the pigment with about 1/5 turpentine and 4/5 white mixing varnish or first class white enamel.

A varnish finishing coat may be used so that the paint will be more washable. The undercoats, then, should be mixed to dry flat;—the first coat as specified above, second and third coats should be mixed with turpentine only. A final coat of white enamel over three under coats of paint makes even a better finish.

OLD INTERIOR WOOD TRIM

Operation 1: Rub down the old paint, enamel or varnish with No. 1 sandpaper or steel wool to remove all gloss, dirt or grease. If the old surface has been waxed or finished with flat varnish containing wax no paint or varnish will adhere well until every trace of wax has been removed. Sandpaper well with No. 1 paper. Then wash down thoroughly with benzole (160 degree solvent naphtha) or benzine or turpentine. If the old paint, enamel or varnish is considerably cracked and scaled, which is not often the case on interior wood, it should be stripped off with liquid paint and varnish remover. Then sandpaper well and wash down with benzole to remove the wax film left by the remover.

Operation 2: Brush down with a duster and clean the surface generally.

Operation 3: Same as Operation 4, on new work.

Operation 4: Same as Operation 5, on new work.

NEW INSIDE WOODWORK

First Coat

100 lbs. pure white lead, soft paste
1 gal. pure linseed oil
3 gal. pure turpentine
1 pt. Japan drier
Makes about 7 gal. of paint

Second Coat

100 lbs. pure white lead, soft paste
1½ gal. pure raw linseed oil
1½ gal. pure turpentine
1 pt. Japan drier
Makes about 6 gal. of paint

Third Coat

Same as Second Coat for Old Inside Woodwork.

OLD INSIDE WOODWORK

First Coat

100 lbs. pure white lead, soft paste
1 gal. pure linseed oil
2 gal. pure turpentine
1 pt. Japan drier (if raw oil)
Makes about 6 gal. of paint

Second Coat—Oil Gloss

100 lbs. pure white lead, soft paste
3 to 3½ gal. pure linseed oil
1 pt. pure turpentine

1 pt. Japan drier (if raw oil)
Makes 6 to 6½ gal. of paint

Second Coat—Semi-Flat

100 lbs. pure white lead, soft paste
1½ to 2 gal. pure turpentine
¾ gal. linseed oil
½ pt. Japan drier
Makes about 5½ gal. of paint

Second Coat—Flat

100 lbs. pure white lead, soft paste
2½ gal. pure turpentine
½ pt. Japan drier
Makes about 5½ gal. of paint

Third Coat—Full Gloss

3 lbs. pure white lead broken up smooth with turpentine
1 gal. white mixing varnish

Third Coat—Flat Finish

100 lbs. pure white lead from which the oil has been drawn, as described previously
3 gal. pure turpentine
Makes 5¾ gal. of paint

Use of Zinc Oxide.—The use of half zinc oxide and half white lead for second and third coats makes a harder, finer-textured surface and one which is very white. Zinc bulks more than lead and so a little more oil, turpentine or varnish thinner will be needed, depending upon which coat is being mixed. More gallons of paint will result from the mix, also.

Use of Flatting Oil.—In place of linseed oil, turpentine and mixing varnish, a flatting oil may be used with white lead and zinc for flat and semi-gloss finishes. This paint is suitable for interior wood surfaces as well as for plaster and cement.

First Coat

Mix the same as previously specified for new or old wood, interior trim.

Second or Finishing Coat—Flat

100 lbs. of white lead, soft paste
2 to 3 gal. flatting oil
Makes 4¾ to 5¾ gal. of paint

Finishing Coats—Semi-Gloss

100 lbs. of white lead, soft paste
¾ gal. light mixing varnish
1½ to 2 gal. flatting oil
Makes from 5 to 5½ gal. of paint

Mixing White Paint for Dark Rooms.—When linseed oil mixed with white paint is placed away from strong daylight the paint will turn yellow. To avoid this with white paint and light tints, use flatting oil or use no linseed oil, aside from a very little in the first coat.

For second and third coats, to dry semi-flat, on new or old interior surfaces, mix your paint in these proportions:

100 lbs. of pure white lead

$1\frac{1}{2}$ to $2\frac{1}{2}$ gal. pure turpentine
$\frac{3}{4}$ gal. white mixing varnish or white enamel varnish
$\frac{1}{2}$ pt. Japan drier

Less turpentine and more varnish will give a gloss finish.

CHAPTER XIX

ENAMELED INTERIOR WOOD TRIM

WHAT was set down in Chapter XVIII about the beauty and appropriateness of painted wood trim applies with even greater force to the finishing of trim with white and colored enamels. The use of enamels makes a more durable and more washable finish. They also make a more beautiful finish because the surface is built up full and level and may then be rubbed and polished, using the same methods as were detailed for use on varnish in Chapter XIV. And when the expense of hand rubbing is not desirable, a satin finish, matt or flat drying enamel may be used and it will produce a beautiful dull lustre which, while not exactly equal to the hand-rubbed finish, is fine enough for most practical purposes.

High class enamels are now made in white, ivory, cream, light blues, greens, grays and many other beautiful tints and shades. And if you cannot get the exact tint or shade wanted you may mix two or more of the colors which you can secure, or you may change the tones enough to exactly fit any decorative scheme by adding a little tinting color ground in japan. The color should first be thinned a little with turpentine, then mixed with a little of the enamel and strained, then added to the larger quantity of enamel and thoroughly stirred to secure an even mixture throughout.

ENAMEL FINISH

NEW INTERIOR WOOD TRIM. A MODERATE PRICED JOB ON BIRCH, POPLAR, MAPLE, SOFT PINE, FIR, CEDAR, REDWOOD AND GUM.

Operation 1: Brush down with a duster brush, scrape off any dirt or grease accumulations, sandpaper any rough places and clean up generally.

Operation 2: Shellac knots and sap streaks with a thin orange shellac, about a two-pound-cut (2 pounds of shellac gum in 1 gallon of denatured alcohol).

Operation 3: Paint. Prime with a thin coat of white lead paint tinted the final color and well brushed. Thin the lead with about ½ boiled linseed oil and ½ turpentine. If pitch pine, cypress or any sap or oil-filled wood is used thin the paint with about ¼ linseed oil and ¾ turpentine.

Operation 4: Putty. Fill all nail holes, cracks and bruises with good putty made with white lead in oil, dry whiting and a very little japan drier. Let the putty dry over night if possible.

Operation 5: Sandpaper the surface lightly when it is bone dry, using No. ½ paper or steel wool. Dust off the surface.

Operation 6: Paint. Brush on three coats of paint, white or tinted the final color wanted. The pigment of this paint should consist of about 60% white lead ground in oil and 40% zinc oxide ground in oil. Thin these coats with turpentine only, or with flatting oil. Allow at least 12 hours for each coat to dry and more time if possible. Sandpaper each coat with No. $\frac{1}{2}$ paper or steel wool and dust or wipe clean with a damp chamois skin.

Operation 7: Paint. One coat of zinc oxide ground in oil, white or tinted the final color wanted. Thin with about 4/5 turpentine and 1/5 white mixing varnish or good white enamel. If preferred this coat may be one of the factory-prepared enamel under coaters. Allow at least 24 hours for drying. Sandpaper lightly with No. 0 or 00 paper and dust off. Then wipe clean with a chamois skin dampened with water or benzine. Be sure to remove every trace of grit and dust from the corners, carvings, mouldings, etc.

Operation 8: Enamel. One coat of first quality white or colored enamel. Brush it on freely, but keep your eyes open for runs, sags and wrinkles especially under mouldings, on edges and corners. After spreading the enamel and laying it off, wipe the brush out quite dry and with this empty brush go over the surface with long, light strokes, using the tip ends of the bristles only. That will pick up any excess of enamel laid on and avoid the runs, sags and wrinkles which result from too much material on the surface. See that the temperature of the surface and of the enamel is between 70 and 80 degrees. Otherwise, the enamel will not brush and flow as it should. If white enamel is to be tinted for this coat use colors ground in japan and thinned a very little with turpentine. Mix the color into the enamel thoroughly and strain it before adding it.

(Note: Linseed oil should be used only in the first coat on new wood and then very sparingly. This to avoid having the enamel turn yellow when not exposed to strong light.)

A HIGH QUALITY ENAMEL JOB

The preceding schedule will give an ordinarily good and serviceable job. A strictly high quality job, one with even better appearance as to surface texture and more durable can be produced this way:

To Operation 5 add one more coat of paint, making four instead of three coats.

To Operation 7 add one more coat of enamel, after rubbing the gloss off of the first coat with No. 00 sandpaper or with pumice stone and water on a soft felt pad.

If a hand-rubbed dull lustre is wanted rub the last coat when bone dry, after two or three days, with grade FF pumice stone and water or oil on a felt pad. Note the rubbing details in Chapter XIV. The same procedure is used for varnish and enamel rubbing.

ENAMEL ON OLD INTERIOR WOOD TRIM

Operation 1: Sandpaper the old paint, enamel or varnish to remove dirt, grease and gloss. Then clean off thoroughly with a duster and a damp chamois skin.

If the old surface was waxed or flat varnished every trace of the wax must be removed by sandpapering and washing with benzole, benzine or turpentine. No paint, varnish or enamel will adhere to a wax coating.

If the old paint is cracking and scaling badly, it should be stripped off with liquid paint and varnish remover. Then sandpaper well and wash up with benzole, turpentine or benzine to remove the film of wax left by the remover.

Operation 2: Follow Operations 5, 6 and 7 specified for new wood. If working on old paint or enamel in good condition and if the new color is not greatly different from the old you may be able to eliminate a coat or two of paint from Operation 5.

MIXING PROPORTIONS FOR ENAMEL JOBS BASED ON 100 POUNDS OF PIGMENT

First Coat—Operation 3:—

100 pounds white lead in oil....bulks 2¾ gallons
1½ gallons boiled linseed oil... " 1½ "
2½ gallons turpentine......... " 2½ "
Makes........... 6¾ gals. of paint

Second Coat—Operation 5:—

59 lbs. white lead in oil..bulks about {1.68 gals.}
41 lbs. zinc oxide in oil.. " " {1.69 " }
....3⅜ gals.
3 to 4 gals. turpentine..... " " .. 3 "
Makes..............6⅜ to 7⅜ gals. of paint

Third and Fourth Coats—Operation 6

Same as Second Coat

Fifth Coat—Operation 6:—

100 lbs. zinc oxide in oil..bulks 4⅛ gals.
3½ gals. turpentine.... " 3½ "

1 qt. white mixing varnish
or enamel .... " –¼ "
Makes ....7⅞ gals. of paint

Sixth Coat—Operation 7:—

First class factory-made enamel, white or tinted. Do not thin it but use as it comes from the can. If it gets thick from exposure in the pot or from a loose cork, thin with turpentine.

Taking the Pull Out of Enamel.—When enamel pulls and is hard to spread, the first thing to do is to see that the temperature of the surface and of the enamel is between 70 and 80 degrees. If raising the temperature does not remedy the defect, or if it is not possible to raise the temperature of the surface the "pull" may be taken out of the enamel by the addition of 1 tablespoonful of water white kerosene. The ordinary kerosene is not suitable. Some finishers use olive oil, castor oil or glycerine, but the water white kerosene is better.

Covering Capacity of Enamel and Undercoaters.—Some products, of course, cover more surface than others, just the same as is true of paints. And the character of the surface, the color of the coating and the ability of the brush hand govern the covering capacity of any coating. But you may figure that on an average 1 gallon of enamel will cover from 350 to 400 square feet, 1 coat.

1 gallon of factory-made undercoater will cover about 400 square feet, 1 coat.

When Stains Bleed Through Enamel.—Much of the wood trim which is eventually enameled has been stained, usually mahogany red. A few years back the para red aniline stains used were oil soluble and they bleed through or discolor any number of coats of paint and enamel, sometimes, giving a pink cast to the white and light colored enamels.

The remedy for this difficulty is sometimes simple and then again the bleeding persists in spite of many attempts to stop it. A coat of pure shellac, orange, will often seal up the stain. In other cases it has been found necessary to strip off the old varnish and wash the stain out of the wood as much as possible with benzole, benzine or alcohol, whichever proved to be the best solvent of the particular red stain causing the trouble. Then the refinishing included a coat of pure shellac and the paint coats. Some finishers go so far as to apply a coat or two of flat black, drop black and turpentine, over the shellac. On the most persistent bleeding stains nothing but a coat of aluminum bronze thinned with the usual bronzing liquids of lacquer composition have been successful.

Sagging, Creeping and Crawling Enamel.—Usually this difficulty results from the application of too much enamel, the brushing of enamel on to a dirty, greasy surface, failure to remove the gloss from the old paint, enamel or varnish over which the enamel is spread or from a surface covered with the greasy film left in the form of finger marks. Cold surface and cold enamel may also cause the trouble.

Difficulties with enamel finishes are really easy to avoid by giving some attention to preparing the old surface for refinishing. Sandpapering the surface cuts the gloss some, removes grit, lint and any application defects such as runs, sags and fat edges. The finish about to be put on will look far better because of the sanding and dusting. Some painters make a habit of washing such surfaces with a fairly strong hot water and sal soda solution, rinsing it off. This cleans off the dirt, grease, wax and cuts the gloss. Tri-sodium phosphate is preferred to sal soda by many for such cleaning. Three or four tablespoonfuls to one half a pail of hot water is about the right strength.

The character of your first coat put over old surfaces of enamel or varnish or paint with a high gloss is a most important consideration. Even though you cut down the old gloss by sanding and washing, it is well to avoid the application of a full coat of gloss enamel, or of enamel undercoat. A mixture of equal parts of enamel and enamel undercoater, or some other proportion of these materials, depending upon how many coats the job is to have, will build a more firmly attached coating. After such a mixed coating the full enamel coat may follow with better results.

Those not greatly experienced in handling enamels are apt to have application difficulties such as runs, sags, curtains and fat edges. These result from putting on too much enamel, or more often from failure to lay it off to a uniform coating of the same thickness all over.

Excellent enamel finishes result from putting on this material with a methodical working method in mind,—a checker board for example. Dip the brush about an inch into the pot, roughly spread it on to about one square foot of surface and let it alone for the moment. Repeat by coating in another two or three square feet. Next wipe the brush out on the side of the pot and with this empty brush lay off the coated surface in both directions to distribute the enamel evenly and remove any excess. That part of the surface is finished now and should be let alone, so the enamel can flow out and eliminate brush marks.

The runs and fat edges result from carelessness. They appear on the ends of window sills, corners of medicine cabinets, in panel corners and on all projections. The remedy is brushing to avoid scraping off too much enamel on edges and corners. Finish brushing such places with an empty brush.

CHAPTER XX

SCHEDULES OF WORKING OPERATIONS

NATURAL FINISH ON HARD AND SOFT WOODS; STAINED FINISH ON HARD AND SOFT WOODS; CABINET AND FURNITURE FINISHES; EXTRA FINE CABINET AND FURNITURE FINISHES

For quick and ready reference it is thought that the following working schedules will be of considerable help to those who want to learn quickly just what constitutes the common practice for each of the various kinds of jobs. After all there is no difference between a high class, costly finish and a less costly one except that in the former many coats and operations are included which are not a part of the quicker, less costly job. As a general proposition when a craftsman has spent the years necessary to become possessed of expert skill it is difficult, if not quite impossible for him to do more than one kind of work, so what he does on a low cost job is usually done just as well as those operations can be done on the better jobs, but of course, he simply omits some coats and operations for the cheaper jobs.

NATURAL FINISH: NEW INTERIOR HARD WOOD TRIM,—OAK, ASH, CHESTNUT, CHERRY, WALNUT, GUM, BIRCH AND MAPLE

Operation 1: Clean up the wood with your duster brush and putty knife. Sandpaper the rough places.

Operation 2: Bleach. Maple, Birch and any wood which is to be finished with the lightest possible color should be bleached as per the directions given in Chapter II. Then a coat of bleached white shellac, very thin, should be put on after the surface is dry and has been sandpapered to smooth the raised grain caused by the bleaching with water solutions. Or the sandpapering may be done after the shellac coat, as preferred by some. The shellac coat will seal up the wood against discoloration from the oil in filler coats or varnish coats to come.

Operation 3: Filler. Open-grain woods such as oak, ash, chestnut, walnut, etc., require filling usually, but not always, with a paste filler. Some finishes like Jacobean and Missions call for unfilled wood cells, —the open-grain effect is correct.

Birch, maple and cherry and gum, close-grain woods are usually filled sufficiently with a coat of shellac which is rubbed close. Paste filler is used on these woods by some finishers after mixing it very thin. Let the filler dry at least 12 hours, then clean up the wood grain by wiping over it with a cloth dampened with benzine. For mixing methods and use of fillers see Chapter XII. No color is used in the filler for natural finishes.

Operation 4: Putty. Fill all holes, bruises and cracks with lead putty mixed from white lead in oil, dry whiting and a little japan drier. Be sure to wipe off all putty marks from around the fillings or it will cloud the beauty of the finish. Let the putty dry over night if possible and sandpaper the filled places. Clean up the whole surface with a duster brush and wipe over with a damp chamois skin.

Operation 5: Shellac. A thin coat of shellac of the white or bleached kind is next applied. About a three-pound cut, that is, three pounds of shellac gum dissolved in 1 gallon of denatured alcohol. Let it dry hard, requiring about an hour or so if the shellac is pure. Then lightly sandpaper the surface with No. ½ paper or steel wool. Dust off the surface and wipe down with the damp chamois skin. Some finishers prefer to omit this shellac coat, but it is really a benefit on either open or close grain woods, since it acts as a liquid filler, when sandpapered close as it should be, and puts on the finishing touches in leveling up and sealing the surface porous places.

Operation 6: Varnish. Apply from one to four coats of first class interior varnish. When more than one coat is used each undercoat must be sandpapered enough with No. ½ or No. 00 sandpaper to remove the gloss. Then clean up the surface, cracks and corners with your duster and chamois skin before brushing on the next coat. Be sure the varnish coat is bone dry, however, before any sandpapering is attempted. Thin the first coat only of varnish 25% with pure turpentine.

Operation 7: Rub Dull. If a dull, flat finish is wanted rub the last coat also when dry after two or three days, with FF, pumice stone and oil or water on a felt pad as noted in Chapter XIV. Wash up with benzine after an oil rub and polish the surface dry.

Operation 8: Wax. A wax coating may be applied immediately after Operation 4, but a much more serviceable job results from waxing over a coat or two of varnish. After applying the wax, let it dry fairly hard and polish. Then let it dry two days before applying a second coat. Polish the second coat to a hard surface with the usual weighted brush or rotary electric machine polisher.

NATURAL FINISH: NEW INTERIOR SOFT WOOD TRIM,—WHITE PINE, YELLOW PINE, POPLAR AND CYPRESS

Operation 1: Clean up the surface with a duster brush and putty knife. Sandpaper any rough places, remove grease, dirt, etc.

Operation 2: Shellac. One thin coat of white shellac. Use about a three-pound cut, 3 pounds of shellac gum to 1 gallon of denatured alcohol.

Operation 3: Putty. Fill holes, bruises and cracks with putty mixed from white lead in oil, dry whiting and a little japan drier. Tint the putty to match the surface with dry colors. Let dry and sandpaper, then clean up thoroughly.

Operation 4: Varnish. Apply two coats of first class interior varnish. Rub down the first coat with No. 00 sandpaper, rubbing just enough to remove the gloss and dirt nibs. Flow the second coat of varnish on a bit more freely than the first, but brush it enough to distribute the coating evenly and to avoid runs, sags and wrinkles. Rebrush any defects with an empty brush before the varnish sets. Thin the first coat only of varnish with about 25 per cent of pure turpentine.

Operation 5: Rub Dull. If a dull finish is wanted, rub the last coat lightly with grade FF pumice stone and oil or water as noted in Chapter XIV. Two coats of varnish will stand very little rubbing, and each coat must be bone dry.

Operation 6: Color Tone. To change slightly the objectionable natural color of some woods, without staining, and to make a more uniform color over all, add to the first coat of varnish a touch of tinting color ground in japan. Such colors as raw and burnt sienna, raw and burnt umber are commonly used. Colors ground in oil and thinned with turpentine slightly can be used but the japan colors are better.

STAINED FINISH: NEW INTERIOR HARD WOODS,—OAK, ASH, CHESTNUT, CHERRY, WALNUT, GUM, BIRCH AND MAPLE

Operation 1: Clean up the wood with duster brush and putty knife, making sure all dirt and grease are removed. Sandpaper any rough places.

Operation 2: Stain. Use an oil, spirit or water stain. Let it dry and if the grain of the wood has been raised by the water or spirit stain sandpaper it down smooth, using No. ½ paper. Let the stain dry twelve hours or more before sandpapering. Then clean up after the sanding operation.

Operation 3: Putty. Fill all holes, bruises and cracks with lead putty made from white lead ground in oil, dry whiting and a little japan drier. Add dry colors to make the putty match the stained wood, making the putty a trifle darker because the wood will get darker with age and when the finishing coats are added.

Operation 4: Filler. Open-grain woods like oak, ash, chestnut, walnut, etc., require filling usually, but not always, with a paste filler. Some finishes call for unfilled grain. Birch, maple and cherry are close-grain woods and usually are filled enough with a coat of shellac which is rubbed close, removing all shellac except what remains in the pores of the wood. The shellac is used very thin, about a two-pound cut. Care should be taken not to use a white bleached shellac on dark stained woods. It will in time show up in a white cloud under the varnish. This has occurred often when white shellac has been used on mahogany. Use white only on light colored finishes, a mixture of white and orange on medium dark finishes and orange or brown on dark finishes.

Some finishers use paste filler on birch, maple, cherry, walnut and gum after making it quite thin. See Chapter XII for mixing and use of fillers. Usually, but not always, the filler is colored to match the stain. But the filler for gray stains is usually white or light gray, while the filler for mahogany is usually very dark brown, nearly black. Allow any filler, except shellac, to dry at least twelve hours. Sandpaper lightly and clean up with a cloth dampened with benzine to clear up the grain.

Operation 5: Shellac. Brush on one thin coat of shellac. Let it dry, sandpaper and dust off the surface clean. This will seal up the stain against rubbing up or bleeding when the varnish coats are put on.

Operation 6: Varnish. Apply one to four coats of first class interior varnish. Let each coat dry hard before another is put on. And if more than one coat of varnish is used each undercoat should be rubbed lightly, but enough to remove the gloss and dirt nibs with No. 00 sandpaper or steel wool. Then clean up the surface, cracks and corners before brushing on another coat. Use a duster brush and a damp chamois skin for the clean up work. Thin the first coat only of varnish about 25% with pure turpentine.

Operation 7: Rub dull. If a dull finish is wanted rub the last coat of varnish with grade FF pumice stone and oil or water on a felt pad. Then wash up with benzine and rub the surface to a dull lustre. Or use a flat-drying varnish on the last coat and no rubbing is necessary.

Operation 8: Wax. The wax may be applied immediately after Operation 4 or 5, or over one or more coats of varnish. Apply the wax, let it dry fairly hard and polish with a weighted brush or electric polishing machine. Let the first coat dry two days and wax and polish again to a hard surface. For details on waxing see Chapter XVII.

(Note: When a finish with open pores, like Jacobean oak or mission oak is wanted, omit the filler and add one more coat of shellac, which with one or two very thin coats of varnish is sufficient.)

STAINED FINISH: NEW INTERIOR SOFT WOODS,—YELLOW PINE, WHITE PINE, POPLAR AND CYPRESS.

Operation 1: Clean up the surface with duster brush and putty knife. Sandpaper to remove dirt and rough places. Remove grease, oil, etc., because stain cannot penetrate such substances and leaves a light spot in the finish if not removed.

Operation 2: Oil Coat. Brush on a coat composed of ¼ linseed oil and ¾ turpentine to even up the suction and fill the soft, open-grain spots in the wood. This enables you to gain a more uniform coloring of the wood with the stain coat. Let the oil coat dry over night. It should be brushed on and any excess of oil not absorbed should be wiped off with a cloth after half an hour. A coat of thin shellac is preferred by some finishers for this purpose of sealing up the wood porous places and sappy, pitchy streaks. The shellac coat also enables you to gain a more even coloring of the wood.

Operation 3: Stain. Any oil stain or spirit stain may now be brushed on, and wiped off if needed to remove excess of stain, or to make the color lighter. Water stain may be used on these woods over a shellac first coat as indicated.

Operation 4: Putty. Holes, bruises and cracks should be filled with putty as soon as the stain has set. No need to wait until the stain is dry. Mix the putty from white lead in oil, dry whiting and a few drops of japan drier. Add dry tinting colors to make it match the wood and be a little darker, if anything, because the wood will get darker with age. Allow the putty and stain at least 12 hours to dry. Then very lightly sand the surface with No. 00 paper and clean off any putty marks, dust, etc., using a duster and a damp chamois skin.

Operation 5: Varnish. Brush on two coats of first class interior varnish, thinning the first coat only with about 25% of pure turpentine. Allow the first coat to dry hard and then rub it very lightly with No. 00 sandpaper to remove the gloss and dirt nibs. Clean up well and apply the second coat of varnish freely, but brush out enough to avoid runs, sags and wrinkles. Go over the coat with an empty brush after laying it off and that will pick up any excess of varnish which you may have put on the surface.

Operation 6: Rub dull. If a flat, dull lustre is wanted the second coat can be rubbed a little and lightly with FF pumice stone and oil or water on a felt pad. Clean up well after the rubbing with benzine and polish with a dry cloth. Two coats of varnish will not stand hard or close rubbing without cutting through and spoiling the finish. Three coats at least are needed. A flat drying varnish may be used to save the rubbing, but select a flat varnish which contains no wax. Wax makes a poor foundation for future finishing.

REFINISHING OLD WOOD TRIM

Old natural finished wood trim of either hard or soft woods can be refinished in the natural or a stained color. If the old natural finish is in good shape it may need no more than sandpapering and revarnishing. If marred, bruised and scratched it will require stripping off the old finish, bleaching and revarnishing or staining.

Old stained wood which has been stained and varnished or waxed may be restained within certain limitations with new stain colors. The same color or a darker color of similar kind is easily used, after stripping off the old varnish, wax and as much of the stain as can be washed off with benzole, turpentine, benzine or alcohol. A brown stain over an old red stain will usually succeed, and the reverse is often true. It usually is not practical within the limitations of expense to change from browns and reds to greens and grays, unless the old surface is completely stripped off and bleached thoroughly. Of course, varnish stains can be used no matter what the old color. Whatever stain is used the new finish will usually be as dark as or darker than the old.

Operation 1: Strip-off the old varnish with liquid varnish remover. Wash up the surface with benzole, benzine or turpentine to remove the wax film left by the remover. Sandpaper the surface thoroughly with No. ½ or No. 1 paper or steel wool. Clean up with duster brush.

Operation 2: Bleach. If the surface is dark and uneven in color it should be bleached, using one of the bleaching methods described in Chapter II. Usually oxalic acid bleaches will serve the purpose. After bleaching let the surface dry well.

Operation 3: Sandpaper the surface well with No. ½ paper to remove the raised grain caused by the water bleaching solution. Clean up well with a duster brush, being certain to get the dust out of the pores, corners, mouldings, etc.

Operation 4: Refinish the same as new wood, using a penetrating oil stain, spirit stain or water stain.

CABINET AND FURNITURE FINISH:—STAIN ON NEW WOODS, OAK, ASH, CHESTNUT, MAHOGANY, CHERRY, WALNUT, MAPLE, HOLLY AND SATINWOOD

Operation 1: Clean up the wood with duster and putty knife. Sandpaper rough places and see that all dust, dirt and grease are completely removed.

Operation 2: Water Coat. For oak and all woods upon which water stain is to be used it is best to sponge the wood with warm water and let it dry. Water stains, and spirit stains to a lesser degree, raise the grain of the wood. It is better to raise the grain before staining and then to cut down the rough wood fibres with sandpaper than to stain and sandpaper after. So much rubbing is needed in some cases that the sandpaper cuts away part of the color beauty if done after the staining. After a water coat a water stain raises the grain but little and so little and light sandpapering only is needed.

Operation 3: Sandpaper. All woods require perfect preparation with fine sandpaper, No. ½ and No. 00 to finish. Then the dust must be removed from the wood cells. In the furniture factories compressed air is used to blow it out.

Operation 4: Stain. Use a high grade water stain. Brush it on uniformly and let dry at least 12 hours. If you anticipate any difficulty in brushing the stain uniformly sponge the wood with water immediately before staining and brush on the stain while the water is there. That will slow up the penetration of the stain a little and enable you to distribute it evenly and avoid an uneven coloring. After the stain is dry sandpaper it lightly with No. 00 sandpaper and clean up the dust thoroughly with duster brush and damp chamois skin.

Operation 5: Putty. Fill holes, bruises and cracks with white lead putty, colored to match or a little darker than the stained wood. Mix the putty from white lead in oil, dry whiting and a few dops of japan drier. Wipe off all putty marks around the fillings to avoid clouding the finish in such places.

Operation 6: Filler. Paste wood filler of fine texture and colored to match the stain, or darker than the stain, as the correct finish may call for should be brushed on and wiped off with great care as noted in Chapter XII.

Operation 7: Shellac. One coat of thin pure shellac should be brushed on. A two-pound cut, 2 pounds of shellac gum to 1 gallon of denatured alcohol. Let it dry half an hour or longer and sandpaper it to make a fine textured surface. That will remove most of the shellac except what is lodged in the pores of the wood and places not filled by the paste filler. Clean up thoroughly with duster brush and damp chamois skin.

Operation 8: Varnish. When a polished varnish is wanted apply three or more coats of first class polishing varnish. The first coat should be thinned about 25% with pure turpentine so it will not bridge over any open pores and will sink into the surface and attach itself well. A pale, transparent quality of varnish is needed to enhance the beauty of the stained wood. Under coats to be pale rubbing varnish and the last coat pale finishing, polishing varnish. Let each coat dry not less than 48 hours. Then rub each under coat with FF pumice stone and water on a felt pad as indicated in Chapter XIV. Rub just enough to remove the gloss and dirt nibs and then wash up well with water and dry with a chamois skin. Be sure to remove all pumice stone and dirt from corners, mouldings, etc. The last coat should be first class cabinet finishing, polishing varnish. Flow it on full, but not so freely as to cause running, sagging and wrinkling. After laying it off brush over it lightly with the empty brush, using the tip ends of the bristles only. That will pick up any excess of varnish and avoid trouble. When this coat is bone dry, so you cannot dent it with your finger nail, after two or three days, rub it fine with FF pumice stone and water or oil on a felt pad as per Chapter XIV. Clean up with benzine. Then polish as directed in that chapter. When only two varnish coats are put on the rubbing must never be close. A light rub is permissible if carefully done. A high polish requires a solid, firm and level surface. That cannot be secured in less than four coats of varnish.

Operation 9: Wax. Two coats of good quality, hard-drying wax may be put on after Operation 7 or after one or two coats of varnish have been applied. Apply the wax as directed in Chapter XVII. Let each coat dry after polishing for at least two days and then polish to a hard surface with a weighted brush or a power driven rotary brush. Nothing but friction will put the hard glaze on wax which makes it durable. On small surfaces, of course, this polishing can be done with a sheeps wool pad or soft cloths or brushes.

Operation 10: Dead Flat. When a dead flat, lustreless finish is wanted omit the filler and shellac coats, placing the wax directly upon the stain. It is better, however, to put on the coat of shellac and accept the slight lustre which comes with it. Or apply a good flat varnish before or after Operation 7 and omit waxing. That is not a real durable finish, but it is used for open grain finishes like oak where the rough, open pores of the wood break up the varnish effect. In such finishing the window sills and sash should be coated with good gloss varnish which can be rubbed to a dull finish with pumice stone and oil. Flat varnish will not withstand exposure well on such surfaces.

Operation 11: Open-Grain Effects. When open pores are wanted, as in the case of Jacobean, mission and weathered oaks, omit the paste filler and add an extra coat of shellac mixed thin. It is very important that all shellac coats on this finish be very thin, about 2 pounds of shellac gum to 1 gallon of denatured alcohol, and that they be uniformly spread to an even thickness to avoid filling up the pores too much and having laps and joints show.

EXTRA FINE FURNITURE AND CABINET FINISH

WHITE MAPLE	SATINWOOD	ITALIAN WALNUT
BIRDSEYE MAPLE	MAHOGANY	FRENCH WALNUT
HOLLY	AM. WALNUT	CIRCAS. WALNUT

These fine cabinet and furniture woods are usually finished in their natural colors and to retain as light a color as possible in order to preserve and enhance the natural coloring and shading of the grain figures. No oil is used because it darkens the color. No filler and little or no stain are used. A good working schedule to follow for the finest class of finishing is:

Operation 1: Sandpaper the wood to make it smooth and to start with the finest possible surface. Sandpaper with No. ½ and finish No. 00.

Operation 2: Clean up thoroughly to remove dust from the pores of the wood and all grit, particularly from mouldings, cracks, etc. A good stiff duster brush will do the work and it should be followed with a clean up using a damp chamois skin.

Operation 3: Shellac. Two thin coats of pure white shellac, cut about 2 pounds of shellac gum to 1 gallon of alcohol. Brush on thin and evenly. Let dry half an hour or more and sandpaper with No. 00 paper to remove all shellac except what is lodged in the wood cells. Use orange shellac for dark woods and white for light woods.

Operation 4: Putty. Fill holes, cracks and bruises with white lead putty made with white lead in oil, dry colors, dry whiting and a few drops of japan drier. Color the putty to match the surface or a little darker as may be called for to make the most of the wood you are finishing. Wipe all putty marks off of the surface around the fillings so it will not cloud the finish. Let the putty dry hard.

Operation 5: Sandpaper the surface lightly with No. 00 paper. Clean up with duster brush and chamois skin damp.

Operation 6: Varnish. Four coats of extra pale cabinet or furniture varnish are needed. The first coat should be thinned about 25% with pure turpentine so it will sink and fill any pores in the surface and not bridge over as thick varnish may do. Each coat of varnish must be allowed to dry at least 24 hours and longer is much better. Each coat should be rubbed to remove the gloss and dirt nibs, using FF pumice stone and water on a felt pad. Note Chapter XIV on rubbing. The last coat of varnish should be fine rubbed and polished with rotten stone as noted in that chapter also.

Operation 7: Waxing. As a rule these fine woods are completely finished with the first six operations. If a wax finish is wanted the wax may be put on after Operation 5 or 8, omitting all following operations. Two coats of wax are needed. Let the first coat dry and polish. Let it stand two days and apply the second coat and polish it with a pad, or a bristle brush to a hard lustrous surface. Such a finish costs less, looks well but is not very durable unless put on over a varnish finish.

Operation 8: Stain. These woods are sometimes stained. A good quality water stain is best because it is most transparent and penetrates deepest. Apply the stain after Operation 2 and putty before Operation 3. When dark stains are used apply orange shellac, never white. The latter will bleach out in time and cause a white cloud under the varnish.

FINISHING CARVED DECORATIONS

One of the first things that a skilled finisher learns is that one should never use several coats of gloss varnish or filler on carved surfaces, and don't rub such surfaces in the usual way. Filler and thick varnish coats fill up the depressions and round off the sharp edges of carved decorations. Rubbing also cuts off the sharp projections. Clean cutting and sharp projections are marks of great skill possessed by the carvers, and so good carving should not be ruined by the finisher, rather enhanced and preserved. It is well to finish carvings by this schedule:

Operation 1: Clean up with duster and soft sharp wood sticks.

Operation 2: Stain to match other wood trim about it. There is some likelihood that the edge grain of the carvings may take the stain darker than the other surface, so be very careful until you find out. It may be necessary to thin the stain considerably. It may be necessary to give the carvings a very thin coat of shellac first to seal up the porous edge grain and prevent it from absorbing too much stain.

Operation 3: Shellac. After staining apply two thin coats of shellac, white or orange, as needed to match the stain.

Operation 4: Wax. Two thin coats. Apply and rub to a hard finish with a stiff bristle brush, —a sash tool is good.

Operation 5: Flat Varnish. In place of wax one fairly thin coat of flat varnish may be used.

A TROPICAL FINISH

To meet the unusual conditions which a furniture and cabinet finish must withstand in hot, humid climates, the following is a quick and satisfactory finish for oak and other woods. It is particularly appropriate for finishing open-pore woods like oak, ash and chestnut, also for gumwood, and is equally satisfactory for the general wood trim as for furniture and cabinets.

Operation 1: Clean up the wood with duster brush, putty knife and finally with a damp chamois skin or cloth. Be sure to remove all grease and dirt.

Operation 2: Stain, using a water or spirit stain, preferably, but oil stain will do. If water stain is used the wood should be sandpapered after the stain is dry to smooth down the raised grain of the wood.

Operation 3: Shellac. Apply one thin coat, mixed about 2 pounds of shellac gum with 1 gallon of denatured alcohol. In about an hour sandpaper the shellac with No. 00 paper and clean up the surface.

Operation 4: Brush on at least four coats of banana oil (amyl acetate). This spirit dries very rapidly. Put it on with the least possible brushing. It flows out and you need not fear brush marks, laps and joints. Just brush enough to quickly spread it over the surface. Too much brushing will cause this oil to lift the shellac and stain coats,—it is a powerful solvent. This oil will dry without any gloss. If you want the finish to have a little lustre add about one pound more of shellac gum to the shellac coat —Operation 3. If the banana oil gets too thick reduce it with alcohol.

Operation 5: Let this finish dry hard, allowing an hour or more between coats of the oil, and when all are dry rub with a soft cloth to a dull lustre.

CHAPTER XXI

INTERIOR TRIM WOODS,—DESCRIPTIONS OF CHARACTERISTICS

THERE is a great deal of knowledge about the characteristics of woods commonly used for interior trim, cabinets and furniture which helps the wood finisher to do his work more effectively, both as to beauty of the finishes he produces and their durability.

One of the very first considerations is whether the trim in a building or the wood used in a cabinet or piece of furniture is sufficiently uniform as to color, grain and figure to make it practical to finish it in the natural or a stained color, whether it might not be better to finish with paint or enamel. A skillful finisher can always bleach dark boards and stain light boards to tone in with the general appearance of the other wood, but it costs money and time to remedy defects. Then again it may be that the wood has too many defects in the way of knots, end grain, cross grain, etc., to make suitable natural or stained finish. First class natural and stained finishes are transparent, the whole plan in finishing is aimed to bring out the beauty of the wood, not to obscure defects. It sometimes helps to darken the stain and to touch up defects, but the facts remains that wood to be finished in the natural color or with stains should be selected by the mill to match as to grain, figure and color. That saves money in the end, even though selected lumber costs more than the general run.

Nature has not produced two woods which are exactly alike. Each kind differs as to hardness or softness, fine or coarse texture, open or close grain, light and dark colors. Then there are medium degrees of all of these characteristics. It is often difficult to say whether a certain wood belongs in one class or another. Some woods have characteristics which would put them in two or more classes. So it is much better to classify woods as open or close grain, rather than soft or hard. The kind of grain is a more important consideration when it comes to the finishing method to be employed. Then there are some woods which have a beautiful grain figure and color shadings while others are rather uninteresting. Some of the former group have very large, outstanding figures which make them suitable for large rooms, while some of the same group are beautiful because of fine, small and subdued grain and figure. Because of the natural color of some woods, like Circassian walnut, redwood and some others, they are far more beautiful when finished in their natural color than when stained. But staining, on the other hand, adds beauty to the natural grain of some woods.

In the matter of finishes it may be said that generally the woods like white pine, poplar, cottonwood and bass are better finished with paint or enamel.

A logical classification of woods as to open-grain and close-grain is as follows:

OPEN-GRAIN WOODS

Oak (hard)	Elm (hard)
Ash (very hard)	Mahogany (soft)
Chestnut (medium hard)	Walnut (medium hard)
Butternut (medium hard)	Rosewood (hard)

CLOSE-GRAIN WOODS

Bass (soft)
Beech (soft)
Birch (hard)
Cedar (soft)
Cherry (hard)
Cypress (soft)
Fir, Oregon Pine (soft)
Gum (medium hard)
Hemlock (soft)
Holly (soft)
Maple (very hard)
Georgia Pine (hard)
Southern Pine (hard)
Norway Pine (hard)
Yellow Pine (hard)
White Pine (soft)
Sugar Pine (soft)
Poplar, whitewood (soft)
Redwood (soft)
Spruce (soft)
Sycamore (soft)

The manner in which wood is sawed makes a difference, of course, in the grain figure, as plain sawed, quarter sawed, edge grain, slash grain, etc. When the trim of a room includes wood of the same kind but sawed by two different methods it will be difficult to finish them to match up exactly as to color. Then again we have wood from the same tree which is different in color,—the sapwood is light in color while the heartwood is dark. This is especially noticeable in gum wood and cypress. Note Plate 22 in this connection. Quarter-sawing of wood is done with many varieities and has been done for hundreds of years. It is considered somewhat wasteful of wood, but it gives greater uniformity of surface and greater strength. The beauty of the grain and figure and color shadings is greater, the wood resists wear by abrasion better when quarter-sawed and is less likely to warp, shrink or swell.

OAK

The characteristics and the sterling merit of oak are so well known to all that it would seem like a waste of time to describe it. Since the very earliest records of man oak has played an important part in life. Its fruit, acorns, has fed man and beast and its wood has served every conceivable purpose from that of forming humble huts to stately castles and mansions, from shrines and churches to battleships.

The qualities of oak are truly remarkable. It is hard, open grain, heavy, tough and strong. It is durable even in contact with moisture beyond all common belief, especially white oak.

There are about 295 kinds of oaks found in the world, of which about 50 are found in the United States. More than one-third of all hardwood produced in the United States is oak. Of all the kinds of oak found they may be generally divided into two groups, red and white oaks. The white oak is more durable, less porous, finer textured, has better color than red oak; it is considered better for furniture and cabinet work. But on the other hand, red oak is greatly used and is considered just as good as white for a great many purposes. The color of red oak will usually enable anyone to identify it,—it has a reddish tinge, especially near the knots. The most reliable way to distinguish between red and white oak, however, is by noting the grain of the woods. Red oak is invariably a coarser wood and white oak has a more prominent figure.

There are differences between oaks of the same kind according to where they were grown. Oaks which grow slowly and evenly on high, well drained land make lumber of the finest grain, easiest to work with tools and least likely to shrink or swell in humid atmospheres. Oaks grown in low, warm, humid lands which are flooded occasionally are coarse in structure, though very hard and tough.

Considerable oak is imported from Europe and is considered superior to American oak. English oak is harder on the surface, although more difficult to work, and is preferred by some for furniture. Slavonian or Austrian oak is imported, too. It is softer to work and has a very straight grain. It also has a small grain figure which is especially interesting and is very easily stained and finished like antique oak.

Pollard oak is a cultivated variety grown in sections of Europe for its peculiar figure of grain. The small limbs of this tree are cut into rounded heads close to the tree and as the tree grows larger the stunted heads

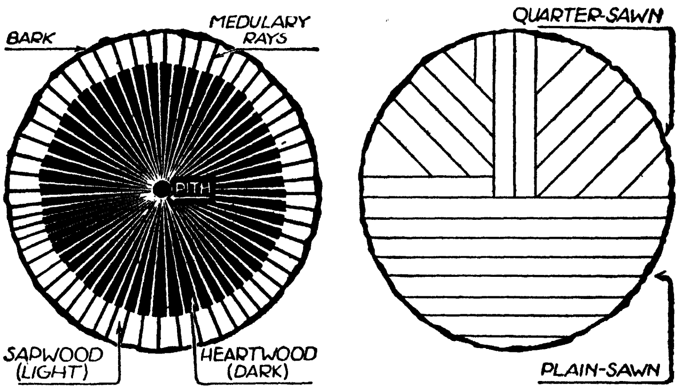

Plate 22.—Indicating Where the Heartwood and Sapwood of a Tree Grow, Also the Methods of Cutting Straight and Quarter or Rift-sawed Boards.

are included in the wood growth. Then when the tree is cut up for lumber these heads produce burls or knots which form very unusual grain figures.

Oak is prepared in two ways with the saw,—straight or plain sawed and quarter-sawed. It is peculiar in the fact that there are strips of special tissue radiating from the center of the logs, like spokes in a wheel, called medullary rays. When these are cut through by quarter-sawing the logs the boards show flakes of smooth wood with which all are familiar. Quarter-sawed is much preferred for many purposes, yet plain or straight-sawed oak is greatly used for carving and for the finest of furniture, cabinets and general trim lumber. It is especially not desirable to use quarter-sawed lumber with large flakes when the boards are narrow or small in both directions,—casings around windows, small panels and delicately designed furniture and cabinets are especially not the place for prominently flaked quarter-sawed oak. Both are pictured in Plates 23 and 24.

When to Use Fillers.—Some of the period and standard finishes on oak call for a paste filler and some should be produced without filler. The division of the common finishes is as follows:

NO FILLER REQUIRED—FINISH WITH SHELLAC AND WAX

Baronial,—deep brown
Jacobean,—yellowish brown
Smoked,—black
Weathered,—very dark, greenish black
Gothic,—medium, warm brown
Fumed,—warm, reddish or yellowish browns
Flemish,—black or dark brown
Mission,—rich brown or very dark brown
Flanders,—reddish brown
Italian,—grayish brown

PASTE FILLER REQUIRED—FINISH WITH SHELLAC AND VARNISH

Golden,—yellowish brown colored filler
Antique,—black filler
Old English,—very dark, rich brown filler
Forest Green,—black filler

Light Oak,—natural filler color
Early English,—black filler

NOVELTY CONTRASTING FILLERS REQUIRED—FINISH WITH WHITE SHELLAC AND WAX

Silver Gray,—white filler
Ash Gray,—light gray filler
Hungarian Oak,—white filler
Italian Oak,—gray wax filler
Frosted,—natural paraffine wax color
Greens,—gold bronze filler
Dark Gray,—aluminum bronze filler

Oak being open grained to a great extent offers a greater opportunity than any other wood for novelty finishes by using two-tone finishes which are produced by using a stain of one color and a filler of a different and contrasting color. By developing the flake of quarter-sawed oaks, by sanding and picking out the pores, after treating with a water sponge coat to raise the grain of the wood, and by the use of various filler colors a great number of interesting special finishes are produced. Such finishes are welcome relief and afford variety for tea rooms, clubs, shops, store fixtures, window trims, furniture, etc. When the grain is raised with water in one or more applications a stiff bristle or fine steel wire picking brush can be used to open up the pores more and to remove the dust resulting from sandpapering. Then the filler will show up better because there is more of it left in the wood cells. A penetrating stain should be used and white shellac and wax or white paraffine wax alone constitute the finishing materials.

To Offset the Color of Red Oak.—Some kinds of red oak are so red that it is not possible to produce very light gray finishes on it unless the red color is killed. Brush on a light green aniline stain first and let it dry; the wood will be toned to take a gray or a brown stain with a much more satisfactory effect. This toning is needed quite as much for light brown oak stains as for gray.

The whole tradition, sturdy quality and dignity of oak seem to forbid that it be stained red to imitate mahogany. Don't do it. Gum, cypress and birch, on the other hand, make very fine finishes to represent mahogany when selected for grain and suitable figure.

BIRCH

Because of its very desirable qualities, birch is one of the most versatile of woods, being used for innumerable purposes in addition to its many uses in the building and furniture fields.

Birch is a hard, close-grain, fine-textured wood. It is tough, strong and heavy. The heartwood is reddish yellow and the sapwood is yellow. The grain figure of birch shows great variety ranging from very plain, inconspicuous growth to the strong figures and the very ornate curly birch. When well seasoned, birch does not warp, twist, split or swell. Its very hard surface makes the wood withstand much abuse in the way of mars, bruises, scratches and knocks without showing ill effects. And, again, its very hard nature makes it possible to give birch an unusually high polish without a great number of surfacing coats. Birch is suitable for finishing in the natural color, for any stained color and for enamel finishes.

The grades of birch are,—unselected, red birch and curly birch. Unselected birch is a mixture of the reddish heartwood and yellow sapwood and a mixture of grain figures. It is suitable for stained finishes in dark

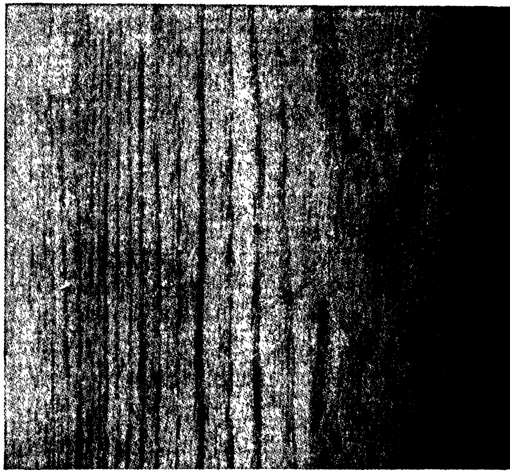

Plate 23.—The Grain and Figure Markings of Straight-sawed Oak

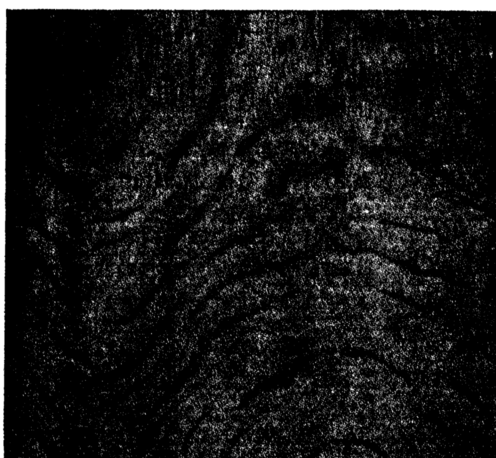

Plate 24.—Quarter-sawed Oak Showing the Peculiar Flakes Caused by Cutting to Show up the Medullary Rays of the Wood

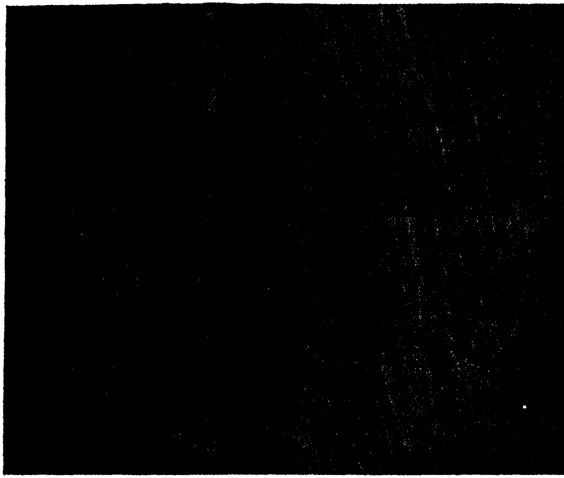

Plate 25.—Birch. Straight-sawed and of the Unselected Grade

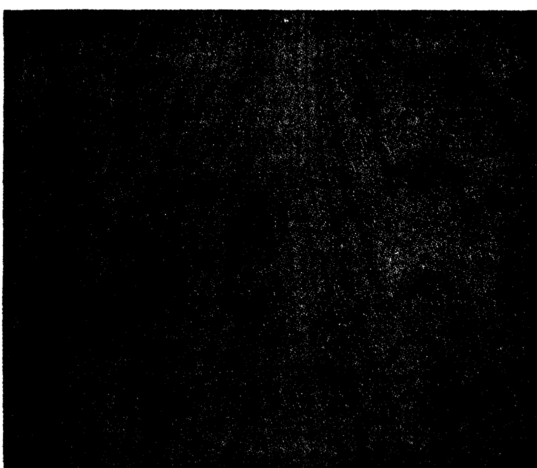

Plate 26.—Birch. Selected for the Wavy Figure and Called Curly Birch

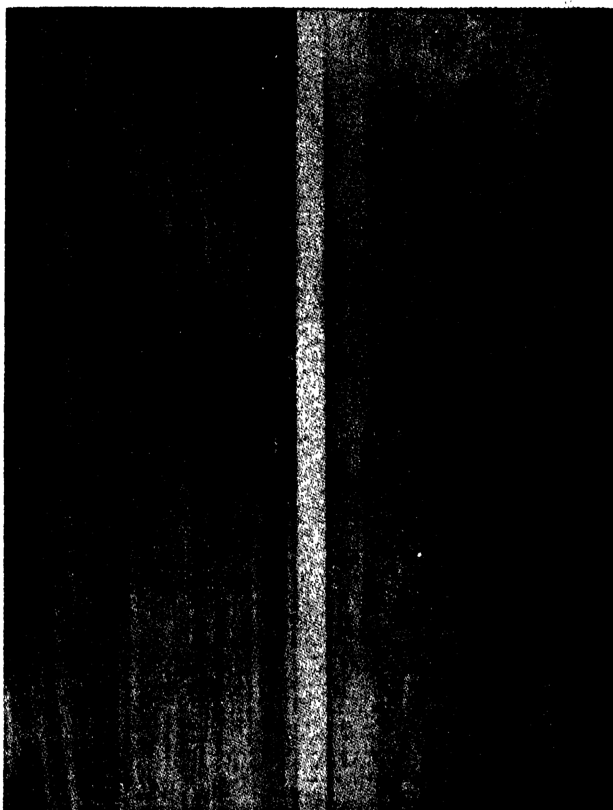

Plate 27.—Gumwood of the Plain-sawed Grade. There is Great Variation in the Grain and Figure Even Within the Straight-sawed Grade

Plate 28.—Gumwood. Quarter or Rift-sawed to Produce a Great Variety of Grain and Figure Markings

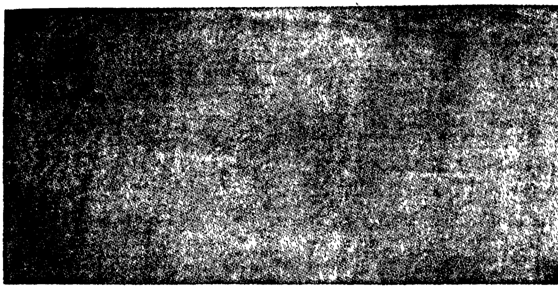

Plate 29.—Maple. Straight-sawed Grade

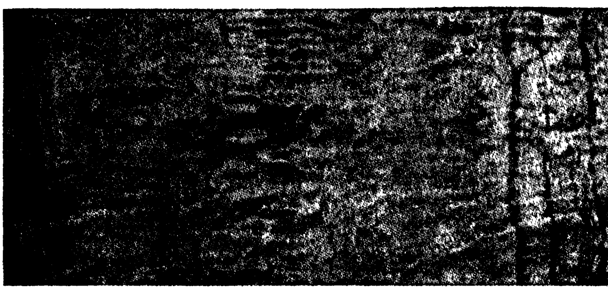

Plate 30.—Maple. Selected Curly Figure

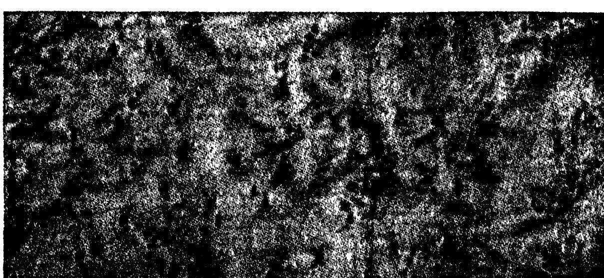

Plate 31.—Birdseye Maple. Used for Furniture Mostly

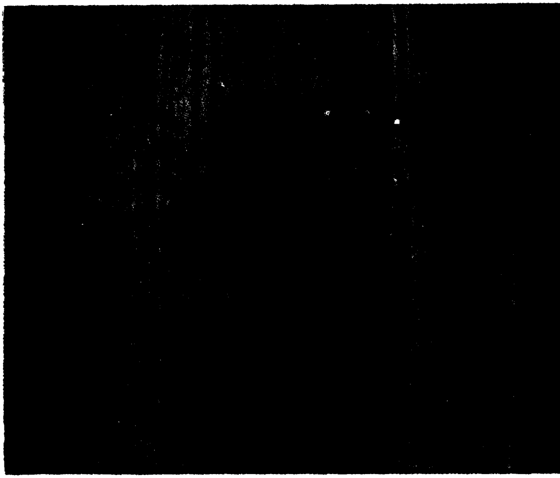

Plate 32.—Yellow Pine. Plain-sawed or Slash Grain

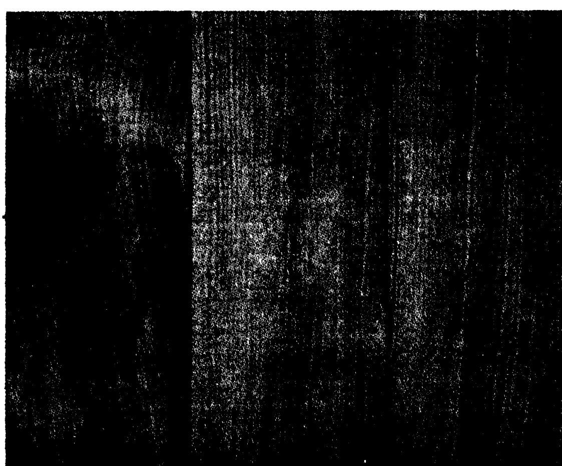

Plate 33.—Yellow Pine. Quarter or Rift-sawed Edge-grain

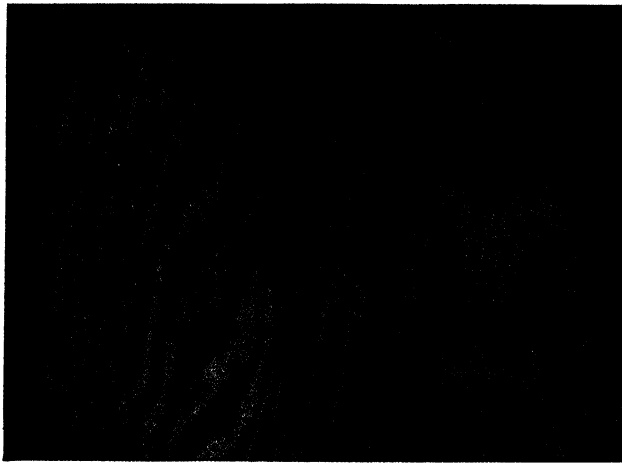

Plate 34.—Douglas Fir (Oregon Pine)

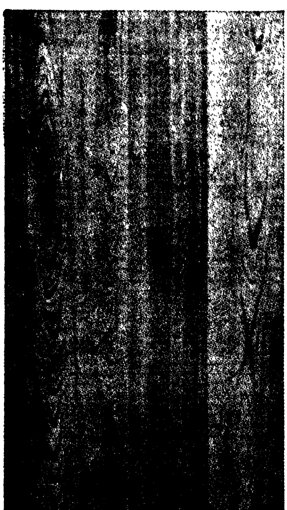

Plate 35.—Cypress. Straight-sawed

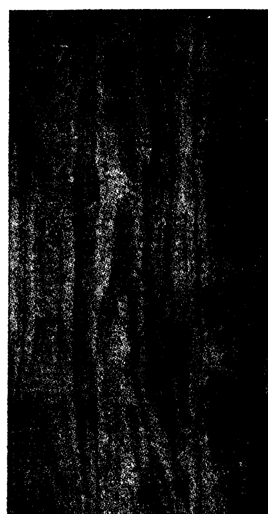

Plate 35A.—Selected Fancy Cypress Grain

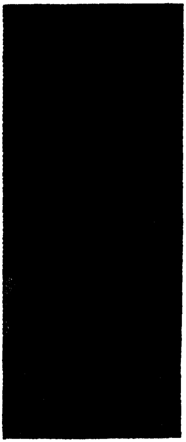

Plate 36.—American Black Walnut, Straight Grain

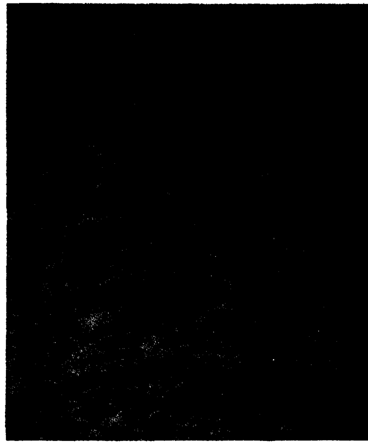

Plate 37.—American Black Walnut. Figured Stump Wood

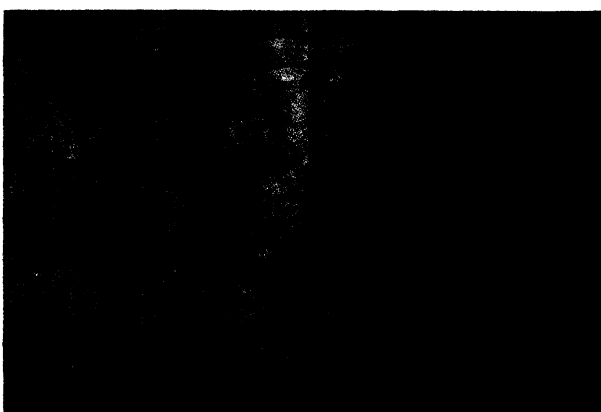

Plate 38.—American Black Walnut. Matched Veneer Wood

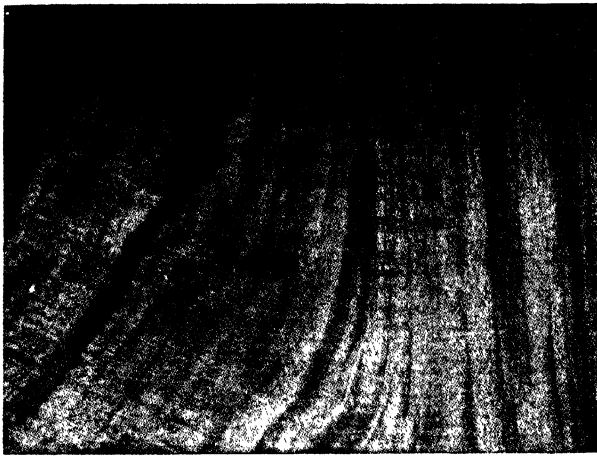

Plate 39.—French Walnut

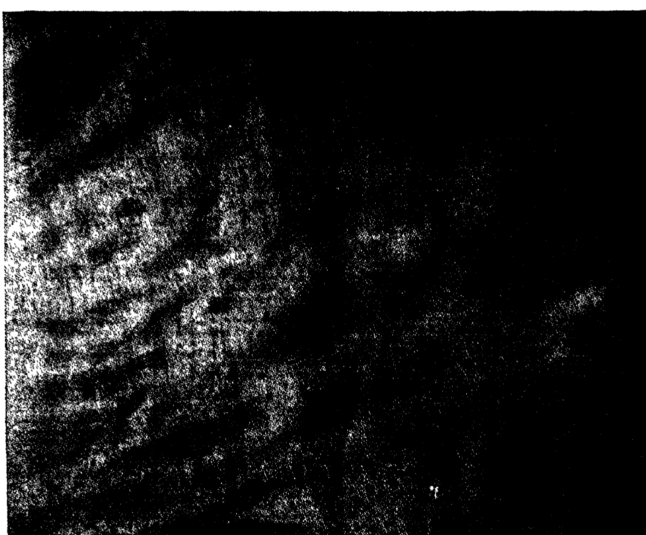

Plate 40.—Circassian Walnut

colors and for painted and enameled finishes. Red birch is all reddish heartwood and is much used for trim, cabinets and floors. It is suitable for dark stained finishes, for painted and enameled finishes. When used for gray or other very light finishes a toner of light green aniline water stain should be spread on the wood first and allowed to dry. That will neutralize the reddish tone of the wood, making better grays and light browns from stains. See Plate 25.

Curly birch has a beautiful wavy grain figure which looks like watered silk. It is rather scarce because only an occasional tree is found to produce this peculiar grain. It is much used for furniture, cabinets, doors and panels. It costs more than the other grades, of course. Curly birch gives an impression of delicacy and is used on furniture which is to have the feminine appeal.

See Plate 26.

White birch is the heartwood of the tree. It is generally light in color, but because it has a reddish tone also it is called red birch.

For producing silver gray and other similar gray finishes, birch and white oak divide honors, especially if these woods are bleached do they make perfect finishes of this kind. Some object, however, to the yellowish tone which comes through the gray from the birch and prefer maple for grays.

The stained finishes most commonly produced on birch are mahogany, red and brown, walnut, antique mahogany, fumed browns, produced with tannic acid washes and bichromate of potash solutions, and it also makes a close representation of cherry. In producing a cherry finish with birch take care not to allow a reddish tone to occur which real cherry doesn't have. The stain must be absolutely clear,—no sediment or undissolved coloring matter should be permitted. It is best to use a strong, water-soluble aniline stain very thin. Add about 1 ounce of acetic acid to a quart of stain to secure increased penetration.

Birch is a wood which sandpapers well and finishes up after sanding with a velvety lustre much admired. It has one peculiarity which is apt to give trouble to the inexperienced, however. The wood seems to grow in both directions at the same time,—it has many areas where the end grain crops up. End grain takes stain darker than the balance of the surface unless the stain is very thin or unless the end grain is coated with very thin shellac or glue size before staining. Sometimes when looking at the finished birch from one end it looks uniform in color, but from the other end it looks darker. Uniformity of color is, of course, very desirable and more so for furniture and fine cabinet work than for the average run of wood trim. In the furniture factory uniformity of finish begins with the proper selection of each board as to color and grain and the way the wood is laid out to be glued and joined together. If a board which is too light accidentally gets into a piece of furniture that board is stained first to make it match up with the balance of the wood before the whole surface is stained. If the board is too dark it is bleached out before the staining is done.

Birch is a close-grain wood, as has been said, and some finishers object to the use of a filler on it, claiming that it will muddy up or cloud the finish. That surely is true if a poor filler is used and especially if the stain is not wiped off clean, but if good fine silex (silica) filler is used, is properly tempered and made thinner than for oak and is wiped at the right time and wiped clean the beauty of the finish is enhanced by the filler. This is especially true when a dark or black filler is used to contrast with the stain color, as is true in producing mahogany. The wood cells or open parts of birch grain are very small, to be sure, but they offer some opportunity for the filler to lodge and so improve the finish. It is quite out of the question to produce the best kind of finish in silver gray without the use of pure white filler. Of course white paraffine wax can be used as a finish for silver gray and it will serve the purpose of the white filler to some extent.

Those who object to using a paste filler on birch use one or two thin coats of shellac and rub each coat close, which practically removes all of the shellac except that which is lodged in the pores of the wood. These same finishers object to the use of filler on wall panels which are constructed with mahogany veneer center panels and birch stiles and mouldings. Their method of finishing such surfaces is to stain the mahogany and the birch with the first coat of stain. Then to fill the mahogany only and brush on a second coat of stain to the birch only to make it dark enough to match the mahogany. If the stain fails to take, to penetrate the birch, as it sometimes will, add 1 ounce of acetic acid, or more of strong table vinegar, to a quart of water stain. That will increase penetration of the stain.

The weight of the argument, however, is in favor of using a dark paste filler, thinned more than for oak, in order to bring out the grain of the wood more effectively and make the open pores contrast with the stain color of the fibres.

GUMWOOD

Gumwood has been used a great many years for fine cabinet construction and furniture. For a long time it was not known in the finished wood by its rightful name —American Gumwood—but was called satin-walnut, hazelwood, etc., because in the hands of skillful finishers it was made to resemble other woods so closely that very few could distinguish it from those other woods. In Europe, especially, it has been used under other names and was recognized for its good qualities long before it became so popular in America. Today it is known as red gum, sap gum and sweet gum. It enjoys very extensive use for furniture, building trim, cabinet work and for many other purposes.

Gumwood is a very close-grain, close-knit wood of fine texture. It is commonly called a soft wood, but is designated as a hard wood by its manufacturers. It is harder than white pine but not so hard as maple, oak and birch, so it may well be called a medium hard wood.

This wood is plain or straight-sawed and also quarter-sawed, but to account for the wonderfully interesting grain figure is beyond the ability of most men today. That is one of Nature's riddles. The formation of figure in gumwood obeys no laws, apparently; it ramifies throughout the logs at random. Some trees have pronounced grain figure in the wood, some have much and some little. Soil conditions and location of individual trees affect in some mysterious way the structure of the wood. Each gumwood log produces boards of somewhat different grain figure; one will be rather subdued while another may be strong, while still another will be intricate and quite ornate. See Plates 27 and 28.

As to color, the sapwood of the gum tree makes a rather light colored wood with occasional dark brown streaks. The heartwood produces boards of a medium light brown with a reddish tinge. The lumber from the sapwood is called sap gum and the lumber from the heartwood is called red gum.

Red gumwood is graded or selected to supply plain or figured wood. For fine panels and furniture the wood is veneered and when matched as to pattern produces wood which is very similar to Circassian walnut. The plain sawed gumwood finished natural or with a very light brown stain is much appreciated for interior wood trim because it produces walls of soft, subdued quality that is very rich for a background of a decorative scheme. The quarter-sawed plain gumwood, not selected for decorative figures, is also much used for the same purpose.

The present day popularity of gumwood in America was somewhat delayed because no one took the trouble to learn how properly to season or dry it. When not properly dried the wood warped and generally was not stable. But now these structural difficulties have been overcome by correct seasoning.

Gumwood is beautiful in its own right and there is no need to place its value according to what woods it will represent well when properly finished. It is, nevertheless, prized because in the hands of skillful finishers the grain figure can be selected and patterns matched so well as to make finishes which are fully as beautiful as Circassian walnut. Then properly finished gum resembles black and other walnut woods closely, so much so that when used in the same panels or piece of furniture with other woods it takes an expert to tell the difference between the two woods. Gumwood finishes very much like mahogany, too, when the wood is selected for grain figure of similar nature. Finished in its natural light brown color gumwood is much liked by some, while others like it better after a very light, thin brown stain has been used on it to slightly darken the color. For enamel jobs gumwood makes an excellent base. Its uniformity of cell structure, its uniform density does not permit the wood to absorb paint, stain or enamel coats unevenly, and there are no pockets or streaks of resin to come through the finish.

For stained finishes water stains raise the grain of gum a bit more than it does on other woods, but it penetrates deeply and its very transparent nature produces a far more beautiful finish than other stains, and the sapwood really needs a water stain to make a uniform color and clear tone because of the very light streaks of wood. It is well to use a very thin stain coat on light wood streaks which appear along side of dark wood; coat these light streaks before staining the whole surface.

Gumwood is most beautiful when finished in dull lustre. The hand rubbed, varnished surface, the flat varnish surface and the shellaced and waxed surface are all preferred to the high gloss, polished surface for interior trim, especially.

When gumwood is used for the stiles and mouldings of wall panels with mahogany or walnut veneer for the panel centers the gumwood should be coated with a toner before staining. For a toner a weak solution of chloride of iron, or sulphate of iron (copperas), is suitable. Dissolve this chemical in water and brush it on to the gumwood and let it dry. That will subdue the sharp contrast between sap streaks and give a more uniform effect. Follow this toner with water stain or oil stain.

Gumwood being very close-grain does not require a filler, at least not a paste filler or varnish liquid filler. It is good practice to brush on a thin coat of raw linseed oil, or a mixture of 1/4 raw linseed oil and 3/4 turpentine first. Let it set a few minutes and then wipe off. Let it dry at least twelve hours before staining with water or oil stain. The oil fills the very fine wood pores and makes a more uniform suction which helps to stain the wood a uniform color. Paraffine oil has been recommended for that purpose, but that is a very doubtful proceeding, because that oil is bound to leave a thin film of wax on the wood and wax is a mighty poor foundation for varnish, shellac, paint or enamel. Gumwood is often finished with a stain, two or more coats of white shellac and wax, or the shellac is rubbed dull and no wax is used. Then again the furniture finisher likes to apply one very thin coat of white shellac and when dry rub it close which removes all shellac except what is lodged in the fine wood cells and which acts as a filler. The shellac goes on after the stain.

MAPLE

When we think of maple the first use to which the wood is put is the only one which occurs to us. The extremely hard, tough surface of maple which takes on a higher polish as it is subjected to wear has made it a remarkable material for floors. But maple is also very good for wood trim which is to be finished in the lightest possible natural wood color. The grade known as white maple, when finished with white shellac alone or with white wax, makes a truly beautiful finish which cannot be duplicated by any other wood. Sometimes it is bleached before finishing to make it even whiter. And maple, of course, is much used for furniture, especially the curly and the bird's-eye maples. For floors which are subject to much traffic, maple has no equal,—schools, dance floors, kitchens, bedrooms, halls, etc.

Maple is a close-grain, very hard, fine-textured, tough and strong wood. The sapwood is very light in color, while the heartwood is a light brown. The grain figure is subdued but beautiful and quite uniform and interesting as well. See Plate 29.

All maple is light in color, but the white, clear grade is especially light. It is the sapwood from the outside of the log, winter-sawed and end piled in sheds to prevent staining. It is ivory white and the finest grade of maple flooring and lumber produced. Birch floors and trim give an airy, cheerful color to a room which reminds one of the northern forests where the best maple trees grow.

Maple is what is called a single-growth wood, meaning that when the present supply is exhausted there will be no more to take its place. United States Government forestry experts estimate that within twenty-five years the present supply of maple will be gone. Then it will become as costly as walnut and similar rare woods because the rate of growth is very slow and reforestation is not equal to producing a growth equal to the natural and original stand of timber.

The growth of maple is common to England, Central Europe and America. Curly maple is the wood which results from trees which have made a twisted growth and which peculiarity has been preserved by special methods of cutting the lumber. It has a curly, mottled figure quite similar to satinwood. Bird's-eye maple is sugar maple. The peculiar bird's-eye knots are presumed to be the result of buds or shoots which formed in the wood but were unable to penetrate the hard, tough bark and thus come out to form branches. Sugar maple when newly cut is a creamy white in color, but it darkens to a golden yellow with age. In finishing this bird's-eye maple the best practice is to put on a toner in the form of a water solution of tannic acid. This brings out the little eyes or knots interestingly. The toner is followed with a weak water stain. See Plates 30 and 31.

The heartwood of maple is rather too dark a brown to be finished in light gray stains and it cannot be bleached enough to make it suitable. It, however, makes finishes which are quite as beautiful and similar to mahogany, brown, red or antique. The white maple, or sapwood of the tree, produces the finest kind of silver gray, also driftwood and Kaiser grays by correct staining methods. A select grade of maple which has a red tone is sometimes used to represent cherry and when finished by skillful men it makes a wonderfully fine appearance.

Maple makes a first class foundation for enamel finishes because of its even, close grain texture and uniform color and absorption.

Maple floors are, of course, often oiled when the traffic is very heavy, as in schools. That makes a finish which is easy to keep clean and a uniform color, but of course it darkens the color of the wood.

PINE AND FIR

White Pine.—In the memory of the older building craftsmen white pine has a glorious past. Its very extensive employment for all manner of building exteriors acquainted all of those men with its great strength and fine working qualities.

White pine is a soft wood with a close, even and uniform grain texture. It is light in weight but very strong. Its color is pale, light yellow with few markings, none of which are very strong. The surface of white pine is smooth and without raised grain. It is a durable wood which holds its shape exceptionally well, showing no warping, swelling, shrinking, checking or splitting.

Considering the finishes which are best for white pine first mention should be made of painted and enameled finishes. White pine has no superior when it comes to forming a permanent and satisfactory foundation for paint and enamel. Its soft, fine texture and its habit of staying where you put it, avoiding warping, swelling, opening of joints, etc., gives it first place for these finishes. Then its subdued grain and figure, the absence of strongly contrasting streaks, make it possible to cover and hide this light colored wood with fewer coats of paint than is possible with other pine woods.

For stained finishes white pine is not interesting unless selected and matched for figure. Then it makes an interesting finish in the browns. Selected grains of white pine finish well with mahogany stains. And selected grains with many small knots are popular for finishing in the natural color when used for library and dining room panels which are a reproduction of early English and American colonial architecture of pine and deal wood. The wood is yellowed with ammonia washes before finishing to give an antique or aged appearance. The finish then is thin white shellac and wax or white wax alone.

Before staining white pine it is best to brush on an oil coat first, mixing about one-half raw linseed oil and one-half turpentine. Brush this coat on, wipe off any excess after a few minutes and let it dry. Then finish with oil stain, preferably, but water and spirit stains can be used. Some prefer to use a thin coat of shellac instead of the oil first coat to seal up the suction places.

Sugar Pine.—This wood is a true white pine, botanically, and has practically all of the characteristics of white pine. It is used for all interior and exterior building construction as well as for tanks, silos, boat decking, pattern making, organ pipes, piano keys, etc.

Deal (Pine).—The wood finisher occasionally gets a specification which calls for finishing pine like English deal wood paneled interiors. The pine used for this work in America is usually white and has been selected for having many small knots of dark color. The wood is simply sandpapered and brush coated once or twice with strong ammonia to give it a yellow color similar to the aged or antique appearance of the real deal wood after long exposure. The finish is then simply waxing with white wax or it is shellaced with white bleached shellac used thin and waxed or rubbed dull. Deal is a pine tree of the northern group which grows in Europe and North Asia. It is known as yellow deal and red deal. Russia, Poland, Sweden and Norway export deal lumber. It has been used for hundreds of years for interior house trim and as the core stock or solid parts of furniture and cabinet work over which veneers of finer finishing woods were glued. White deal (spruce) wood is used for cheap furniture in England.

Southern Pine.—It is true that there is more confusion in the minds of finishers and building mechanics in general about names for the various pine lumbers than about any other class of woods. The uncertainty about names has made it a bit difficult to specify finishes and for two people to discuss finishes and be sure they are talking about the same kind of wood.

All of the Southern pine lumbers belong to the yellow pine group. The white pines come from the Northern states,—from Eastern states first, then from the states about the Great Lakes and today from California.

Seven trees of the coastal plains of the South furnish the commercial cut of southern or yellow pine. These trees are: longleaf, shortleaf, loblolly, Cuban, pond, spruce and sand pine. The lumber produced from all of these trees is similar as to qualities and so only three kinds of Southern yellow pine are generally recognized, namely, longleaf, shortleaf and loblolly pine.

The confusion of thought has been added to greatly by the use of many local names for these three kinds of pine lumber. We have all heard and read about hard, pitch, fat, Georgia, Florida, North Carolina, turpentine and Norway pine. All have been used indiscriminately to describe longleaf, shortleaf and loblolly pines.

To distinguish each of these three kinds of pine lumber is not at all difficult. In longleaf pine the growth rings are narrow, uniform in width and outline and number from eight to twelve rings per inch, looking at a log cut off across the length. The wood of this longleaf pine is heavy, hard and full of resin or pitch. The color of the wood is reddish yellow or reddish brown. The ring of sapwood on the outside next to the bark is thin or narrow, the tree is mostly heartwood. The leaves of the tree are very long, from 9 to 15 inches.

In shortleaf pine the growth rings are of medium width and number from six to eight per inch. The wood is fairly hard and fairly heavy but not to the same degree as longleaf. Shortleaf contains less resin than longleaf. The color of the wood is from whitish brown to reddish brown. The width of the sapwood ring on the outside of the log next to the bark is greater than that on the longleaf, it is, in fact, rather thick.

In loblolly pine the growth rings are usually very broad and there are but from four to six rings to the inch showing on the face of a cut-off log. The wood varies considerably in texture from hard, strong and compact to light, coarse and brashy. The color is subject to variation, too, from yellowish to reddish orange brown. The sapwood ring about the outside of the log is very thick.

The Southern pines are cut straight or plain sawed (flat or slash grain) for most interior trim and exterior purposes. Some of it is quarter or rift-sawed and that method produces what we know as edge-grain pine commonly used for flooring. The edge-grain sawing makes a much harder, tougher wood to resist wear by abrasion. See Plates 32 and 33.

The uses to which Southern pine is put are innumerable for all exterior and interior building purposes.

Interior trim and cabinets as well as some furniture of the kitchen type are made from it.

Pine is generally classed as a soft wood, but some of it is very hard. It is for the most part a close grained wood with alternate hard and soft streaks. It is tough and very strong for the most part.

Considering Southern pine from the standpoint of finishing, it makes an attractive appearance when finished in brown stains, dark red, green and weathered effects. It is rather a difficult wood to stain gray because of the very strong yellow grain figures. Silver gray stains for use on this wood should have a rather strong violet hue to neutralize the yellow as much as possible. To succeed with gray stains considerable white filler should be retained in the pores of the wood and pine is so close grained that it does not offer much open-grain to permit the white paste filler to lodge and remain on the surface. A wash of strong muriatic (hydrochloric) acid makes an interesting gray stain on Southern pine.

On Southern pine stains take or soak into the soft streaks considerably and do not penetrate the hard resin-filled streaks much. Light colored stains as a rule are not so good on soft woods; dark stains are better. An even coloring is desirable on all staining jobs so any wood like this which takes stains spotty should be treated before staining so as to gain an even tone. Some finishers wash over the wood with benzole first to remove any surface pitch or resin and give the stain a chance to penetrate the hard resin-filled places. Benzole is a powerful solvent of resin. Alcohol will also serve this purpose. Then to overcome the excessive suction of the soft wood streaks some finishers brush on a thin coat of raw linseed oil, that is, half oil and half turpentine, wipe it off and let it dry over night. Some prefer a thin coat of shellac to stop suction and even up the absorbing ability of the wood.

Water aniline, or the so-called acid stains, raise the grain of pine and do not penetrate the resinous streaks much. After the stain the wood must be sandpapered to smooth it again. Spirit stains may be used effectively and on this wood is one place where oil pigment stains show considerable advantage. They cover up part of the strong grain figure and fill up the excessively porous places, thus making an even color tone more easily than the more transparent water and spirit and chemical stains.

As to enamel finishes on Southern pine, much has been written against the use of enamel on this wood because some trouble has been experienced. When the character of the wood is considered by the finisher and when he fits his finishing methods to the surface as he should, no trouble will be experienced and this pine will give good service as a foundation for paint and enamel. The only real objection to the wood is that its strong grain figure contrasts so much with the soft, light-colored parts of the wood that it takes an extra coat of paint to hide the figure and make a uniform color in white and light tints. The first step before painting Southern pine should be to wash down the wood with benzole or alcohol so as to open up the pores of the wood in the resin, sap-filled streaks. That will give the paint a chance to penetrate a bit as it must in order to gain a firm hold on the wood. The benzole or alcohol wash will also remove any excess of resin on the surface which may bleed through the paint and discolor the finish later, especially in the presence of heat.

Benzole (160 degree solvent naphtha) is a powerful and volatile solvent of resin. Some finishers add a little of it to their paint for use on Southern pine which is unusually resinous. About one-half or one-fourth of the turpentine used in the first coat *only* may be benzole and it will assist the first coat to anchor itself. It evaporates completely with the turpentine and has no binding effect. It should be put into the paint immediately before using.

The next step of importance is that of using the least possible amount of oil on the surface. This wood will absorb little oil and so only enough oil should go into the first coat of paint to bind that coat together and to the wood. Any more oil than is needed to do that only makes a softer foundation and tends to make a white enamel turn yellow. The second and succeeding coats should contain no oil. The first coat should be white lead thinned with about one-fourth linseed oil, boiled, and three-fourths turpentine. The second coat may be white lead, or white lead and zinc oxide thinned with turpentine only, or first class enamel undercoater of the factory-prepared type. All three materials may be used in the order named for the better class jobs calling for a number of preparatory coats.

Douglas Fir (Oregon Pine).—This wood is cut from giant trees which furnish lumber for many purposes such as common boards, sheathing, framing timbers, finishing lumber, flooring, etc. The grain figure of fir is interesting and some of it in the veneer form is selected and matched to make very fine appearances. The color of the wood is a pinkish yellow or brownish red and it may be distinguished from Southern pine which has a decided yellow color. The grain figure of the straight or plain-sawed fir is very similar to Southern yellow pine but a bit more angular and sharp. See Plate 34.

Fir is a light weight, strong, soft and close-grain wood. Its absorption of oil and stain is rather uniform and it makes an excellent foundation for paint and enamel finishes. It seasons well, resists weather excellently and shrinks moderately.

Fir should be finished as soon after erection as possible because ordinary moisture in the air will raise the grain of the wood into ridges which cannot be cut down level again by sanding. For this reason water and chemical stains should not be used on fir except for the novel effects which are sometimes wanted when the wood is sponged with water to raise the ridge as much as possible before the application of acid solutions as toners or special fillers, etc. Oil and spirit stains, especially the former, are best for coloring fir.

White Fir.—This is a very light colored, grayish white wood of light weight. It has a close grain and a moderately soft, uniform texture. The grain figure is much subdued like white pine. It is strong lumber as is indicated by the fact that it is classed by forestry experts with Sitka spruce which is the official airplane construction lumber of many governments. White fir is used for cutting into common boards, sheathing, framing timbers, heavy timbers, finishing lumber and many other purposes. It takes paint and enamel finishes wonderfully well because of its uniform structure as to density and absorbing quality. Its grain figure is rather too much subdued to hold a great deal of interest, but it can be stained effectively like soft and white pine.

CYPRESS

A most enduring wood and one which is being used rather extensively for clapboard siding on building exteriors, for sash, doors, floors and many other purposes where the ability to stand up against moisture and the weather generally is especially desired. It is only the brown heartwood which shows remarkable durability when subjected to conditions favoring decay. Cypress is a close, straight grained, soft wood, although its winter growth wood is quite hard. The texture of grain is rather fine. Not a strong wood. It does not swell or shrink, once well seasoned. The heartwood of the tree is rather a dark brown, while the sapwood is a yellowish white. See Plate 35.

This tree grows in swamps and when the wood is green and before seasoning it is very heavy, being filled with water and an oily sap. When correctly seasoned cypress is very light in weight. A very durable wood even in service where it is damp and where conditions are right to promote decay in other woods. It has no resin ducts and is not resinous or pitchy like hard yellow pine. It does contain considerable oily sap which is a compound having antiseptic properties and which imparts a waxy feel to the finished lumber. It is this sap which no doubt resists decay in the wood when subjected to moisture. This oil should be wiped off before painting or staining or varnishing cypress. A cloth soaked with benzine or benzole will remove the surface oil. Wipe it immediately before painting or staining. The oil will rise to the surface again.

Cypress weatherboards, clapboard siding and similar cuts show great contrasts of color. When used for interior trim or for any purpose requiring a fairly uniform color in natural finish, cypress must be selected to gain some uniformity of color, the variations of color between the nearly white sapwood and dark brown heartwood are great. Penetrating stains will even up the color differences, as a rule, however. Oil stains should contain about two parts linseed oil, one part turpentine and one part benzole.

In dry kilns cypress acts badly and so most of it is seasoned by air drying. When well seasoned it doesn't shrink abnormally, nor does it swell and warp in the presence of moisture.

The painting of cypress while not difficult requires a bit of special knowledge and understanding of the nature of the wood. Because of the oily sap which permeates the wood, oil paint doesn't penetrate and gain sufficient anchorage unless mixed properly. The priming coat only of paint for cypress should be mixed to contain about 40 per cent of benzole (160 degrees solvent naphtha), 10 per cent turpentine and 50 per cent linseed oil. That would make your formula read about like this:

100 lbs. white lead
$2\frac{1}{2}$ gal. linseed oil
2 gal. benzole
$1\frac{1}{2}$ gal. turpentine
Makes $7\frac{3}{4}$ gallons of paint.

Benzole is one of the greatest penetrating solvents of resin, gums, grease, etc. It cuts into the oily sap of cypress and the gum resin of hard yellow pine, aids the paint pigment and oil to penetrate and gain anchorage and then the benzole evaporates completely. Benzole works about like turpentine in the paint, evaporates about as quickly and is very inflammable. Great care must be taken to keep fire away from it. The paint must be well brushed in and out.

Benzole must never be used in any except the priming coats of paint. If used in a second or third coat it will soften up the under coats of paint.

Benzole is a coal tar naphtha, a by-product of gas works by distillation from gas tar. It is waterwhite and will freeze solid in low temperatures. It is sometimes used to rough-up old varnish coats which are to be painted over. A coat of benzole brushed on saves rubbing with sandpaper before painting. Benzole looks like benzine but has a decidedly different odor.

Cypress makes a good foundation for enamel and interior paint finishes after wiping off the oil on the surface and after mixing your first coat of paint with little oil and much turpentine and benzole. The wood being dark in color, having strong grain figures in places and strong contrasts between sap and heartwood requires an extra coat of white and colored paints to hide the dark surface. Also the grain growth is of a circling nature in places; it seems to curl up and sometimes requires more coats of paint to give a smooth level finish. Much of this roughness can be removed by sandpapering.

In the stained finishes penetrating oil stain is much used. Spirit stain is satisfactory and water stain may be used with excellent results, especially when used hot and with some alcohol in it to help secure penetration.

Selected and matched grain woods of cypress make very fine finishes to represent mahogany in red and brown; likewise it makes good walnut and takes all brown stains beautifully. It is practically impossible to produce a gray stain on cypress with oil stains and, in fact, any stain is quite ineffective in producing gray on this wood because of its naturally dark color. The so-called penetrating acid stains serve best on this wood for gray finishes.

When selected for grain figure cypress finishes up beautifully in its natural reddish brown color. It requires no filler. Simply wipe off the oil, make the surface smooth and clean and then shellac, varnish and rub or wax, or use flat varnish.

The lacy grain of cypress finishes up with a remarkable effect in what is called the Sugied Cypress. The wood is burned over some with the flame of a blow torch which burns the soft parts but not the hard. A soft wire brush is then used to remove the charcoal resulting between the hard streaks of wood. When clean the wood is given a filler or toner coat which lodges in the depressions burned out and gives a contrast to the darker ridges of grain figure. White shellac and wax or flat varnish are then used to finish the surface. This interesting finish cannot be duplicated with any other wood.

WALNUT

American Black Walnut.—The remarkable strength, hardness, variety of grain, figure and coloring of this wood have made it so popular for furniture construction, for gun stocks and for airplane propellers that most people have carried the idea that the supply of American walnut is exhausted. Yet in 1918, when the American government took control of the supply and when every forest was searched for possible additions to the supply, the saw-mills cut about 100,000,000 board feet. This walnut is first choice of woods for airplane propellers and no other has ever been found so satisfactory for gun stocks. For more than thirty years Europe has taken a very large proportion of the American cut for furniture manufacturing. The great popularity of American walnut for interior trim and furniture a number of years ago was eclipsed by the popular craze for golden oak, because of a too somber use of walnut in dark, straight grain effects. Today this walnut has returned to popularity, is being used in the select and decorative patterns and in somewhat lighter colors for the finishing. It is even being used for floors in the finer homes as well as for trim and furniture. The desire for lighter, brighter colors in furniture is being satisfied with painted pieces and wicker furniture.

American black walnut is a hard wood with open-grain and fine texture. In color it is a dark, tawny brown for the heartwood, while the sapwood is very light, grayish white. The wood has exceptional strength and is so hard that it does not bruise, mar or scratch easily. When it is damaged the defect doesn't show up much because of the dark color of the wood and its dense texture. In strength it is superior to English, Italian and French walnuts. See Plate 36.

American black walnut is native in North and Central America. It is closely related to butternut, which it resembles in color and grain formations. It is also related to English, French, Italian and Circassian or Turkish walnuts.

Burl walnut is veneer cut from the root growths of American black walnut. The stumps from which it is cut are very large, weighing from one to two tons. The veneer is, of course, very carefully matched into patterns of very fantastic and decorative forms when artistically handled. Burl veneer is also cut from knotty formations, called burls, which form on the roots and larger limbs of the trees. The veneer walnut is not, of course, suitable for interior trim except for panels on walls, doors, etc. See Plate 37.

Curly walnut, the wood which has a wavy, curly grain formation, is very popular. It is cut from certain trees which have grown in a twisted shape because of soil conditions or the stress and strains to which they have been subjected. See Plate 38.

Because of its interesting variety of grain and figures when cut by different methods, and because of its variety in color shadings, walnut is usually finished in its natural rich, brown color. Sometimes it is bleached to make lighter effects. It is never painted or enameled today, although in some of the older houses it was painted. In many of those houses the paint, enamel and even graining is being stripped off today to reclaim the natural beauty of the walnut.

The filler used for walnut is of the paste kind and it is usually colored very dark brown, nearly black, for the classic, conventional finishes. Light colored, gray fillers are used for some of the novelty walnut finishes.

The finish on walnut should be polished gloss varnish or hand-rubbed gloss varnish.

For a while the American furniture market offered very light, yellowish brown walnut finishes which were produced by much selecting and bleaching of the expensive veneer walnut required. It was not a staining but a bleaching process which proved very expensive and rather uncertain. Popular preference then returned part way toward the darker finishes, medium dark, not the very dull dark walnuts.

To retain and enhance the beauty of walnut when a stain is used it should be a water aniline or chemical water stain, because these are the most transparent of stains. What is called Italian walnut finish is produced by the use of a gray water stain, white shellac, gray paste filler and a final coating of white shellac, white wax or clear lacquer.

English, French and Italian Walnuts.—The English walnut is not much used for wood trim or furniture, being difficult to obtain. It is most valuable for its fruit, the English walnut of commerce. It is related to American black walnut but is inferior in strength and beauty of grain figure.

French walnut is closely related to the others mentioned and is used only in a limited way for trim and furniture. It is not equal to American black walnut in either figure, coloring or strength and hardness. See Plate 39.

Italian walnut is like American black walnut. It is very fine in texture with a close, dense grain figure of much beauty. Delicate carvings and antiques made of it have nearly the quality of bronze statuary. The grain figure of Italian walnut is not so pronounced as English and French walnuts and is more beautiful. It grows in the southern European regions and is much used for fine furniture.

Circassian and Turkish Walnut.—These walnuts are of the same species as the others, but because they grow in rather barren soils and because of other influences of environment, the trees are much twisted, knotted, gnarled and the growth is stunted. The trees, therefore, when cut up produce wood which is quite similar to the burl and curly grain figures of American black walnut. It is employed only for cutting veneers and is much prized because of the extremely fantastic grain figures which may or may not be used artistically by the craftsmen to construct furniture and panels for interior building trim. The trees grow on the slopes of the Caucasus mountains in Russia. See Plate 40.

MAHOGANY

The history of mahogany is long and fascinating, too much so to be more than touched upon in the limited space of this chapter. In 1597 Sir Walter Raleigh returned to England after one of his wandering voyages at sea. In the decks of his ships were reddish brown planks which had been used to make repairs to the ships after long weeks of battle with the sea. The repairs were made in the West Indies where Raleigh had made a stop for rest and repairs. The natives had suggested the use of this wood which was strange to the civilized world. On visiting these ships when they returned to England, Queen Elizabeth commented upon the strange brown wood in the decks of the ships, whereupon Raleigh had the planks removed, and sent to skilled furniture craftsmen who made a table from them. The table was presented to the Queen. Its great beauty and royal patronage soon placed mahogany in a preferential position as a fine cabinet wood, where it has remained ever since. It has always been associated with quality of furniture and, of course, has always been imitated in every conceivable way. A great many of the finest pieces of furniture made by such master designers and cabinet craftsmen as Chippendale, Heppelwhite, Sheraton and others were made of mahogany and these masters worked almost entirely with mahogany because of its sound qualities in construction and its great beauty.

A small number of mahogany trees grow in the United States, in the Florida everglades, but they are not accessible. Genuine mahogany grows in tropical sections. The wood is imported from Mexico, Honduras, Guatemala, Nicaragua and other Central American States. It comes, too, from South America, the Nigerian, Gold and Ivory coasts of West Africa. The West Indies, principally Cuba and Santo Domingo supply some of the best mahogany. There are woods which are sold as mahogany, called Hawaiian, Philippine and East Indian mahogany, which are not related to genuine mahogany in any way. They, however, have qualities and beauties of their own.

Prima Vera is another wood called mahogany, or white mahogany. It comes from Mexico and Central America. It is very similar in grain and figure to genuine mahogany. Its color is a light, golden yellow. It, too, is open-grain and makes a beautiful finish in stains.

Spanish cedar from Mexico, Cuba and the West Indies is called mahogany. It resembles mahogany in grain and figure but is more porous of texture. This wood is much used for cigar boxes because of its porous structure which assists the seasoning process supposed to improve cigars. It is sold for and used as mahogany in furniture and wood trim.

Butternut, called white walnut, is another wood which resembles genuine mahogany in many respects when stained. It is not difficult for one who is familiar with real mahogany to detect the difference, however.

Because mahogany has always been associated with quality and richness of surroundings it is generally considered a very expensive wood, yet the actual figures of cost when using it for interior wood trim of the better buildings shows that it costs but a few dollars more than oak, birch and some other woods. About 50,000,000 board feet of mahogany are imported into the United States each year for furniture and interior building trim and panels.

In characteristics mahogany ranges from soft to very hard. The Cuban mahogany is the heaviest and hardest, but produces the richest grain and figure beauties. Mahogany is an open-grain wood of great strength. It does not shrink and warp and for that reason was so quickly favored by cabinet workers. In color it is varied from light pinkish browns to dark browns. Its surface takes a polish with a depth of lustre which is unequalled and with age it takes on a marvelous color depth and quality which is illusive to describe in words, being like the deep red of old wine with yellow light showing through it. The red commonly associated with mahogany is not the natural color of the wood, but a stained color which has been superceded lately by brown stain. Natural finished mahogany, called toona mahogany, is light pinkish brown in color.

The grain character and figure of mahogany is not due to various ways of sawing the wood, as is true with oak and others. It comes in two grades called plain and figured. An explanation of the figure is well presented by the Mahogany Association, Inc., New York, N. Y., as follows:

"Considerable confusion exists as to what is meant by the word Figure. Figure has nothing to do with grain. The grain of wood is produced, partially, by the size and character of its pores and fibres, but more by the lines of demarcation between periods of growth, known in temperate zone woods as annular growth rings. While mahogany is a tropical tree and grows practically continuously, it has these latter grain markings to some extent. Furthermore, they show on both plain and figured surfaces.

"Figure, on the other hand, is produced in mahogany by the interlocking and interlacing of the wood fibres. In other words, the fibres of the tree twist and curl so that, when manufactured into lumber or veneers, some are seen from one angle and some from another, producing that play of light and shade known as figure. It can readily be seen that these growth convolutions which, by the way, usually extend through several periods of growth, could never be twice alike and, therefore, that every piece of figured mahogany is individual.

"Notwithstanding this diversity there are certain characteristics of figure that enable those in the trade to establish types, or names under which figured mahogany is sold. These number over twenty, of which a few typical examples will be described.

"Plain"—has no surface markings except those produced by the tree's growth and known as grain—as above explained.

"Stripy Figure"—means that the surface is broken into ribbon-like stripes of fairly uniform width, lengthwise with the grain.

"Broken Stripe"—means that the irregular stripes twist and tumble, come to the surface and disappear, in a play of light and shade that produces a satisfying individuality.

"Mottle"—in its various forms, means that the surface of the wood looks as though the tree had met with some cataclysm of nature that boldly forced the fibres into great confusion, pushing them sidewise and pro-

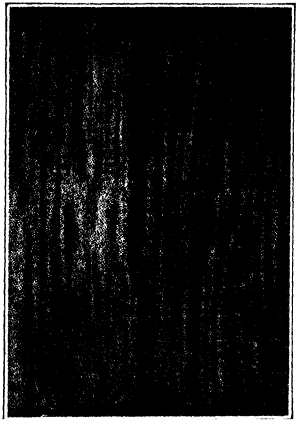

Plate 41.—Mahogany. Broken Stripe Figure

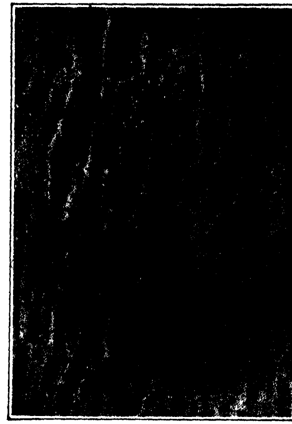

Plate 42.—Mahogany. Mottle Figure

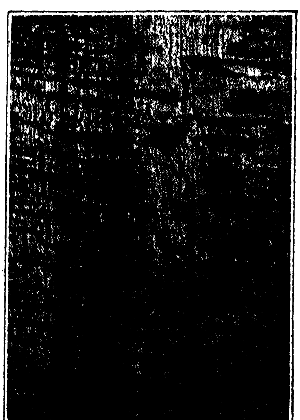

Plate 43.—Mahogany. Fiddle-back

Plate 44.—Mahogany. Crotch Wood Figure

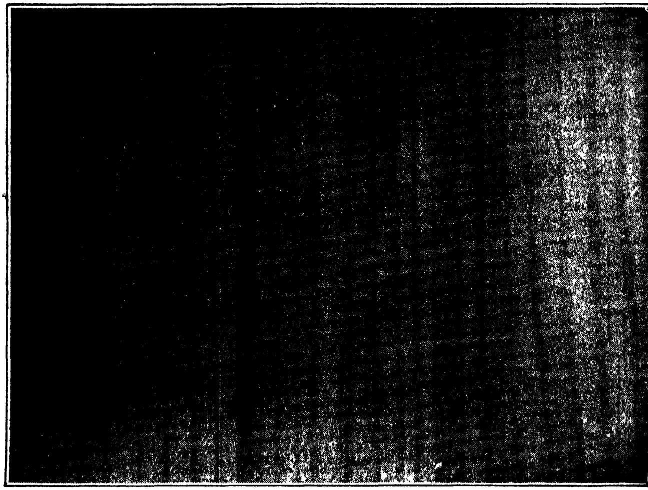

Plate 45.—Redwood. Straight-sawed Plain Figure

Plate 46.—Redwood. Selected for Figure

ducing countless splashes of light and shade that mingle in a kaleidoscopic riot of figure effect.

"Rain-drop"—in some ways is similar to a combination of Mottle and Broken Stripe. The interruptions in the Broken Stripe figure are sudden and positive, giving the effect of rain splashes driven by a high wind.

"Fiddle-back"—is named from the fine, curly, rippling figure seen on the backs of rare, old violins. It is like the effect of a gentle summer breeze on a placid pond where one tiny wavelet follows another in a procession of ripples. Fiddleback is a typical, well-named and distinctive variety of figured mahogany.

"Crotch"—High up in the air, in the trunk of a mahogany tree, a silent but intense struggle takes place among the fibres in the attempt of each to follow its own inclination in determining to which of the great branches overhead it shall pledge its allegiance and support. Consequently the fibres cross, twist and tumble in a swirl that, when manufactured into veneer, produces the most highly figured mahogany of all—the "Crotch" figure so well known and so long used."

It was not until about one hundred and fifty years after Sir Walter Raleigh introduced mahogany into England that it became a product of commerce. It was used much at first for building ships and still is used for the smaller pleasure craft because of its enduring and strong qualities. From the beginning it has been used both in solid and veneered forms for the construction of furniture and cabinets. Today its greatest use is for furniture, cabinets and panels for interior walls and doors.

In the matter of finish mahogany has had an eventful career. The early masters of furniture design and construction knew that the least possible finish and the most transparent finish was best for this wood. Many of the pieces were finished simply by rubbing into the wood coat after coat of oil, wiping it and letting it dry before the next coat. The most beautiful and durable French polish finishes amounted to about the same thing, using oil and very thin shellac, much time and much labor. When first finished these fine old pieces which are worth fabulous sums of money today were quite light in color, but as the play of sunlight and the natural aging of the wood progressed the finishes developed marvelous depths of color variety and richness. Noting these beauties people who devote their lives to pretending they are or have something of great value were not satisfied with the genuine mahogany finish when new. They ordered the furniture craftsmen to doctor the finishes to make them look like the artistic beauties of the mellowed-with-age pieces of mahogany furniture. So no matter how it went against the artistic natures of craftsmen who worked for bread they were compelled to stain the new mahogany to look like the old. They succeeded well, but their imitators soon produced stains and finishes which had none of the transparent nature of the masters' finishes. The red color which the average person calls mahogany soon developed, devoid of any depth of finish and beauty such as is possessed by the aged mahogany. From this point it was only a step or two down to the practice of staining other woods with the same red color and calling it mahogany, purposely making the stain with a lack of transparency so that the real character of the wood would be obscured.

Real mahogany finish is neither a flaring red nor a nearly black brown, but a color in between which is too illusive to describe. It is well that today there is a well-defined movement on foot to stop obscuring the natural beauty of mahogany, walnut and in fact all woods with finishing coats which are too thick and which lack the transparency of quality finishes. Each of the cabinet woods has beauties all its own. Nature has not made two woods alike and those which are fit for finishing in their natural color and with really transparent stains which simply preserve and enhance the wood grain should be finished for their own value, not as imitations of something they are not. Pretensions are of no value among woods any more than they are among people. Many of the troubles with fine finished woods, such as murky, cloudy, mottled defects which develope in use are afflictions which have been thrust upon the wood by the use of finishes which are not artistic and not practical for the service to which the furniture and trim woods are put.

The open grain of mahogany is best filled for period and conventional finishes with silex (silica) filler of very fine and fairly thin character. It is usually colored very dark with drop black and Vandyke brown ground in oil tinting colors. The wiping of the stain must be done with exceptional care to avoid clouding the very fine grain.

For the finest of finishes no filler is used. The wood is carefully matched as to grain and figure and is filled with a coat or two of very thin orange shellac which is rubbed close, resulting in the removal of all shellac except what lodges in the pores of the wood. White shellac ought never to be used on mahogany because in time it clouds the finish with a white mottled effect. Sometimes white and orange shellac are mixed for this filling. The slow hand-rubbed oil and French polish finishes require no filler of the paste type. As a matter of fact about all these finishing methods do is to fill the grain of the wood with oil, shellac or both by thin coats; they saturate the wood to considerable depth and that is why they are both beautiful and very durable, while at the same time allowing the natural markings of the wood to remain unobscured.

The best stains for making mahogany darker are the water aniline and the chemical water stains which are the most transparent. They simply dye the wood fibre and do not fill or obscure any of the natural color shadings and figure markings.

The final finish on most mahogany wood used for furniture and building panels and trim is pale gloss varnish which may be hand polished to a high lustre in the case of furniture and cabinets and dull rubbed by hand for wall panels and other large surfaces which do not look well with a high gloss.

REDWOOD

California redwood is a tree of such mammoth size that it is awesome. Specimens three hundred feet high and as much as twenty-five feet in diameter have been found. This wood grows only in California and the supply is estimated as sufficient for one hundred and forty years to come at the present rate of cutting. Some of the trees are two thousand years old.

In many characteristics and uses to which it is put redwood resembles cypress. It resists fire and moisture. It does not rot. It is a soft wood of close grain and straight figure of great uniformity. It is a wood which shows very few knots and some panels six feet and more wide are common because the trees are so large in diameter. Properly seasoned redwood does not shrink, swell or warp. It is a strong wood and a medium light one. In color redwood ranges from the lightest cherry to darkest mahogany. The grain figures are varied, too, from straight and plain to the curly figure of the stumpwood and roots. See Plates 45 and 46.

Redwood contains a natural preservative substance which prevents decay and which gives it natural seasoning qualities.

We shall probably come more and more in contact with this truly remarkable wood as time passes. With durable qualities which apparently are equal to cypress for all special and common purposes it is probable that redwood will be with us for centuries after cypress has been depleted in supply twenty-five to fifty years hence. Redwood is used for all common building purposes and many special purposes for exteriors and for most interior purposes, except perhaps for floors to any great extent.

Redwood takes all finishes well. In painting it permits the coatings to penetrate well and good paint proves remarkably durable on it. It is commonly said that there is no need to paint redwood for protection, since it is not injured by moisture and does not rot from fungi. Care must be taken not to paint this wood while it is wet, however. It absorbs moisture rather easily. The grain is free from pitch or resin.

When painting and enameling redwood on interior trim it should be handled in the ordinary way except that any shellacing of knots should be done after the priming coat of paint is on and dry, not before painting. The same is true of knots on exterior surfaces.

Redwood may be stained and takes a beautiful finish with the browns, greens, red and gray. Penetrating oil stains and spirit stains are used on this wood as well as acid or chemical water stains. Some very unusual color effects can be secured on redwood which are peculiar to it and are artistic, indeed. A large number of special formulas for chemical water stains for use on redwood have been developed by the California Redwood Association, San Francisco, California, and they will be given to anyone interested in these special finishes.

No filler is required for this close-grained wood. A coat of shellac will usually fill the fine grain sufficiently for succeeding coats of varnish or wax.

CHERRY

This is the wood of the fruit tree and while it was used rather more extensively in former years it never has been extensively used except for novelty effects, parquetry, etc., on fine furniture. The wood is close-grain and of very fine texture. It is a hard wood of a pinkish white color.

CHESTNUT

This wood is so near to oak in the appearance of the grain figure that few can tell the difference. It is a light weight, coarse grained wood. It is open grained, of course, and is very durable. Chestnut is little used for exterior building construction and not to any great extent anywhere. Its open grain doesn't absorb paint as readily as might appear. The paint doesn't seem to penetrate. Mix paint thin with a liberal amount of turpentine and brush out each coat, allowing plenty of time to dry. Chestnut interior trim may be stained attractively and a filler is required when varnishing.

BASSWOOD

This wood is also called linn and linden. It is a straight, close-grain wood, soft and compact in structure. Light in color and in weight and only moderately strong. It is used to a limited extent for building construction. Rather too soft. The painting of basswood is easily accomplished. It absorbs paint well, affording good anchorage and penetration. Mix the paint thin with both linseed oil and turpentine to secure penetration into the compact structure of the wood. Owing to the very light color and absence of prominent grain figure in this wood, it is easy to cover and hide with white paint.

POPLAR

The other names for poplar are whitewood and yellow poplar. Poplar has had extensive use for clapboards or weatherboard siding on the sides of residences, but cypress is taking its place in some sections. It is a soft, clear, close and straight-grain wood which is not very elastic. It shrinks little on being seasoned, and while it is light in weight, it is strong enough for the purpose. One of the easiest of woods to paint, it has the ability to absorb paint, offering excellent penetration and anchorage for the paint. Not extensively used for interior trim but it makes an excellent foundation for white enamel finishes. It takes stain well but its grain figure is not very attractive.

CEDAR WOODS

Several kinds of cedar are used for various purposes in different localities. White cedar is used for exterior building construction rather extensively in some sections. A wood of light weight, soft, brittle, close-grain and compact character. And of course all cedars are durable woods. The sapwood of white cedar is light in color while the heartwood is brown. An easy wood to paint because it absorbs paint well and offers good penetration and anchorage. Considerable oil is needed to satisfy suction. Use thin coats. White cedar takes stains well.

California and Oregon cedars are similar and are used for exterior construction. These woods are light in weight, soft, strong and durable. They are close grain and absorb paint well, offering good penetration and anchorage. At least three thin coats are needed and four coats of paint are much better in order to supply enough oil.

Red cedar is used in a limited way for exterior lumber and extensively for making shingles,—the very best lumber for this purpose. Lead pencils are made from this wood. A light-weight, soft, close, even-grained wood which is not very strong. The sapwood is white and the heartwood is red. Oil of cedar is made from this tree and that oil is a paint solvent. So unless the wood is well seasoned this oil will likely destroy the paint coatings. Red cedar doesn't absorb paint readily nor does it offer good penetration and anchorage. Paint dries slowly on it. Mix paint for it thin, with plenty of turpentine and allow plenty of time for each coat to dry. The dark color of the wood and the necessity for thin coats makes it imperative to use at least three coats on new wood.

Washington cedar is considered a soft wood, but the trees produce wood which is both soft and fairly hard. This wood is very close grained but is light in weight. It absorbs paint rather unevenly. Thin coats well brushed out and with a little more turpentine than usual are needed. Allow plenty of time for each coat to dry.

COTTONWOOD

Most of this wood is used for making paper pulp, but some is used for building construction. It is substituted for whitewood (poplar) but is not as good. Cottonwood is a close-grain, compact, light-weight wood and is very soft indeed. The sapwood is nearly white while the heartwood is dark brown. This wood has little strength and warps to a considerable extent.

It is not difficult to paint this wood because it absorbs paint readily and offers good anchorage for it. It is so soft and porous, however, that extreme care must be taken to be sure it is dry, because it absorbs much moisture. When allowed to stand in the weather unpainted it molds, turns very dark and decays on the surface. In that condition it is a treacherous wood to paint, the wood fibres having little strength, the paint scales off as the wood on the surface crumbles away. Cottonwood is also subject to dry-rot. Sometimes when painted while wet, dry rot occurs under the paint causing the paint to scale off. So paint cottonwood only when absolutely dry, use plenty of oil and allow plenty of time for each coat to dry,—a week between coats is little enough.

HEMLOCK

A wood which is quite extensively used for exterior construction. It is a coarse, rough, soft wood with open grain. When well seasoned it is light in weight and in color. It warps badly and splits. A pile of it in the hot sun will literally crawl all over the lot. The western hemlock is better as a rule than the eastern and middle-west product.

This wood is not as easy to paint well as some others. It absorbs the paint unevenly in spots and the paint upon it dries slowly. The paint must be well brushed into the wood to gain good anchorage. Hemlock is not used for interior trim lumber.

CHAPTER XXII

BRUSH GRAINING

REAL graining has passed into the discard, like all else in life and art which pretends to be something which it is not. At its highest point of development, graining was done with great skill, forty or fifty years ago, but of course much poor graining was done by finishers with but little skill and so that only hastened the day when people ceased to want pine and poplar to look like oak, walnut or mahogany. Today there are but few occasions where the skill of the grainer is needed and then it is usually a door or two or a few office fixtures on remodeling jobs which are to be refinished to look like some new furniture, fixtures or trim.

On some jobs of remodeling the matter of cost must be kept down to the minimum and for that reason the old painted, grained or cheaply finished trim, fixtures and often the furniture must be given a brighter color note and fresh look without spending much money on the refinishing. A job of real graining done by capable craftsmen costs quite as much as any first class finish. So brush graining is often resorted to to meet the requirements in all respects. Brush graining is really a process of staining on top of prepared, opaque grounds. The finished effect is clean, bright and attractive, without any attempt to imitate the grain and figure of any wood in detail, although the general color tone of other finishes are closely followed.

Brush graining is easy and very simple. A working schedule for the average job is as follows:

Operation 1: Prepare the old painted, grained or varnished surface as you would for repainting. That is, sandpaper it to make it smooth, clean and to remove the gloss.

Operation 2: Mix and brush on a ground coat to dry flat and tinted a color to suit the final color wanted. The paint may be white lead thinned with about ¼ linseed oil and ¾ turpentine or with flatting oil. Or use a flat wall paint. The color may be any color wanted for novelty finishes but for conventional colors ivory white, cream or tan is best. Use a pink for a mahogany ground. If the old surface is light in color one coat may serve, but usually two coats are needed and the second ground coat, then, should be mixed without any linseed oil, using turpentine or flatting oil. All holes, cracks and bruises should be filled with putty after the first coat has been spread and is dry.

Operation 3: Stain coat. If the final finish is to be varnish, shellac or wax the stain coat should be mixed with what are called distemper water, or graining, colors, using cider or vinegar for the liquid. A very little glycerine may be necessary if the color sets too fast to permit drawing in the grain with the brush. If there is to be no finish beyond the stain coat you may use tinting colors ground in oil and thinned with about ¼ boiled linseed oil and ¾ turpentine or with flatting oil. Any of the semitransparent colors may be used. Those most often used are raw and burnt umber, raw and burnt sienna, chrome green and to make black for a gray finish, mix raw umber and ultramarine blue for use over a light gray ground color. Apply this coat with the usual four inch flat wall brush and while it is wet proceed with the next operation.

Operation 4: Stipple the wet stain color using an ordinary calcimine brush. Hold the brush like a hammer and pound the surface with the flat side of the bristles as indicated in Plate 47. Start at the top of the door or other surface and draw the brush down while stippling with it all the time as noted in Plate 48. Don't coat in too large a surface at a time, since the stain color, when water colors are used, sets in a few minutes so it can not be worked any longer. If you fail the first time wash off the stain color put on and start over again. It is not likely that you will be able to produce a nice even stipple the first time you try, but keep on washing it off and repeating until you have a fairly even grain effect.

Operation 5: Grain streaks may now be put in while the stain color is still wet by taking an ordinary whisk broom or a coarse dry duster brush and drawing it down through the color from top to bottom. This will uncover the light colored ground coat and give a contrast with the stain color which the whisk broom piles up in streaks which resemble in a

Plate 47.—The Correct Way to Hold the Brush for Stippling

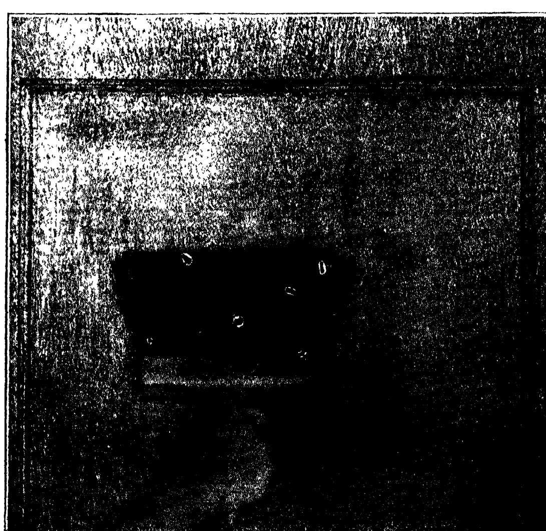

Plate 49.—Drawing in the Wavy Grain with a Whisk Broom

Plate 50.—Streak-Glazing Painted Wood Trim

general way the grain of woods finished in stains. When drawing the whisk broom down don't try to keep it moving in a line that is straight, wiggle the brush a little so as to produce a wavy grain in places. Note Plate 49.

Operation 6: Varnish, shellac or wax. When water color has been used for the stain coat it will be dry in half an hour or an hour so that you can coat it over with shellac, varnish or wax to make a serviceable finish. If oil color has been used for the stain coat it can be finished in the same way but it should dry at least 12 hours before any coating is put on top of it.

CHAPTER XXIII

DECORATIVE WOOD FINISHES

PAINTED and enameled wood trim is finished with very interesting, artistic effects by glazing it much in the same manner as walls are finished with the glazing, mottling and blending methods. The object of this treatment is sometimes to give a novelty finish in vivid color effects, but more often it is done to subdue the color of the wood trim and to make it harmonize in low tones with walls, furniture and the general furnishings of the room. The work is simple to do, yet it requires the use of good taste both in the selection of the glazing or stippling color and the strength of the pattern put on to the wood.

Streaked Glazing.—This finish is done on both wood trim and plaster walls of the smooth type, as well as upon furniture. The working operation is very simple but some good taste must be exercised in selecting the colors. As a rule, but not always, the walls and wood trim are painted the same color, a light tint, mixing the paint to dry flat or semi-flat. When the ground coats of paint are dry and when the color is even all over, showing that enough coats of paint have been spread to hide the surface completely, you are ready to apply the glaze streaks. The effect to be produced is that of a very fine grained wood in which no figure or pattern is seen, only the grain. Plate 50 indicates the effect to be produced.

Tinting colors ground in oil or japan, thinned with turpentine and tempered to easy working consistency with boiled linseed oil are used for this glazing. Choose a color of the same kind as is used for the ground coat, but a little darker. For instance, for an ivory white or cream color ground coat, mix your glazing color with raw sienna and burnt or raw umber. Mix this color quite thin. Brush the thin glazing color on to a stretch of the surface and while it is still wet take a clean, dry, soft cotton rag, crumple it up into a wad and you are ready to begin the streak glazing of the surface. Start at the top and draw the rag down over the surface, bearing down just heavy enough to leave an even streaked color on the wood. The rag should not get wet with color at any time or it will not do good work to match the first stretch done. Change rags often enough to be using a comparatively dry one all the time.

When the surface has been uniformly streaked allow it to dry, preferably over night before it is finished with flat varnish, shellac or wax. One of these finishes is essential on wood trim to protect the color from being rubbed off. On walls the finish is protected with starch.

Brush Stipple Glazing.—Rather novel and interesting shading is done by stippling a light colored surface with the stippling brush, using a color which usually is the same as the color of the ground coats but a little darker. For novelty effects contrasting colors can be used, one or more, for the stipple coat.

The wood is painted or enameled as usual and when dry the stipple may be put on. The color used may be regular tinting colors ground in oil or in japan and thinned with turpentine, a very little linseed oil and a bit of drier. If the work is to be finished with flat varnish, wax or white shellac after the stipple glaze the color used must contain the least possible amount of oil.

Mix the color quite thin and brush out a little of it on a board, piece of sheet iron or newspaper. Then with a clean, dry stippling brush pick up some of the color from the board and proceed to stipple the surface as indicated by Plate 51. In the case of doors and other paneled surfaces the stipple color is usually run along the borders of the panels, leaving the centers untouched. Casings and other plain surfaces may be stippled all over or only on both edges, leaving the center untouched by the stipple color. No wiping is done in this work, the color is put only where you want it. When the color is dry it may be left in that condition as finished, but it is better to at least coat it with flat varnish, thin white shellac or wax in order to make it more serviceable. When the stipple glaze is done over enamel the enamel should be rubbed dull first with pumice stone and water.

Antique and Old Ivory Glazing.—In any decorative scheme the appearance of brand new shiny surfaces are a jarring note. Surfaces of furniture, wood trim, etc., are more artistic and more comfortable to live with when they have been mellowed by age and toned down a little from the glaring new effect. To gain this mellowed-with-age effect glazing is resorted to on new painted and enameled surfaces. The surfaces may be smooth, hard and polished, fairly rough or very rough as may be preferred.

The color combinations used may be any which are in harmony with the surface and its surroundings, but raw umber and mixtures of raw and burnt umber and raw sienna are often used for antique effects. Only the colors which are semi-transparent are used. Colors ground in oil or ground in japan are used and are thinned with about one-third boiled linseed oil and two-thirds turpentine. The mixture is made quite thin. Less oil is sometimes used.

Plate 50A.—How the Streaked Glaze Finish is applied. The wood trim or furniture is painted two or three coats in a light color. All coats are stippled; that is, pounded with a dry wall stippling brush or a dry duster brush to give a pattern, as noted on page 346. Plate 50 illustrates how a streaked glaze is done with a square cut sponge. Above is shown how to do it with a wad of cheese cloth.

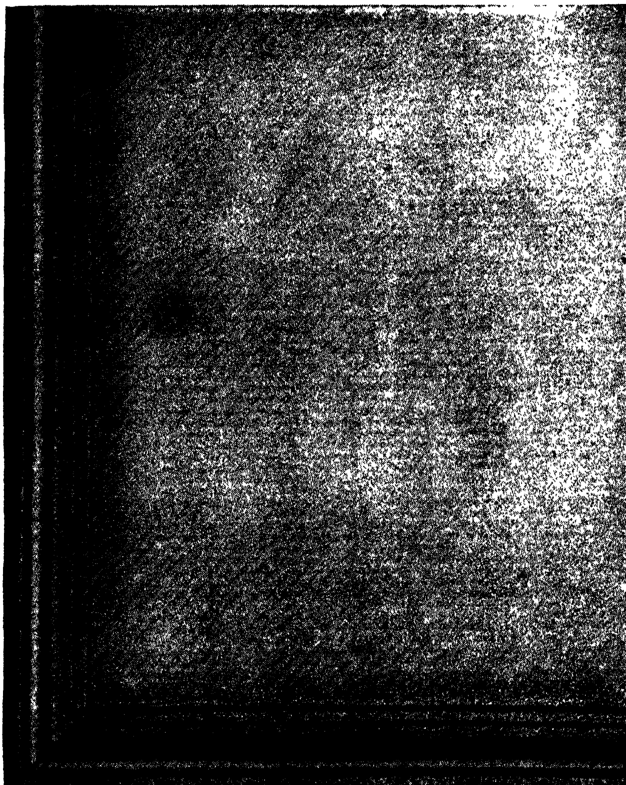

Plate 50B.—Old Ivory Glaze Finish in close-up view showing how the wiping is done to produce gradual shading toward the center of panels and highlighting of the high points of the panel mouldings.

Plate 51.—Brush-stippling and Glazing Painted Wood Trim

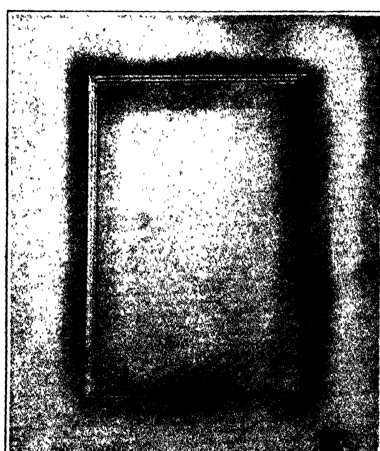

Plate 51A.—The Finished Brush-stippled Surface. The Color Contrast as Shown is Much too Strong but was Made so to Illustrate the Placing of the Color on the Panel, Stile and Rails

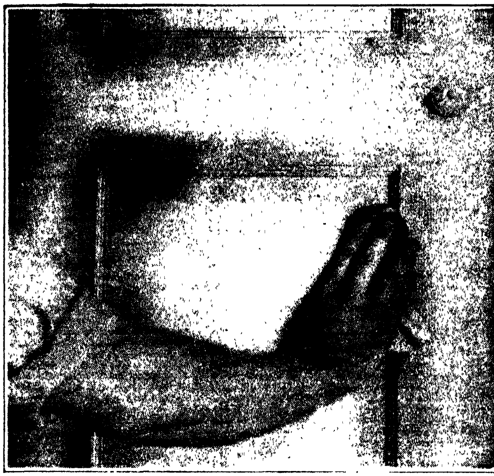

Plate 52.—Wiping-out High-lights on Old Ivory or Antique Finish on Painted or Enameled Wood

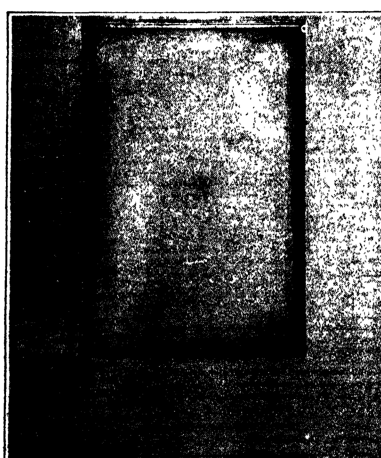

Plate 52A.—The Wiped-out or High-lighted Old Ivory Job Finished

The surface to be glazed is built up in the regular manner with paint and enamel and when dry and clean the glaze color is brushed on with a flat wall brush; the surface ground should be flat, not glossy. Usually the glaze color is brushed on over the mouldings, at the edges of the panels, in the corners, on the carvings, etc. It is very thin. As a rule no glaze color is put on to the center of panels and other places which are to appear very light as the highlights of reflections.

Sometimes the color of an entire paneled wall surface, for instance, is about right as near as the mixing of colors can make it, but still there is a raw, sharp appearance to the work which mars its beauty. In such a case the glaze coat is spread over the entire surface and is immediately wiped off with clean cloths. Just enough of the glaze color remains in the pores of the surface to take away that raw, sharp, new look which is objectionable. Sometimes the same method is employed to change the color hue of a surface a trifle by using a different glaze color,—for instance, a brown surface which is a bit too cold may be warmed up with a burnt sienna or other red glaze, a green which is too yellow can be benefited by a clear blue glaze.

As a rule the glaze color is brushed on only to the surfaces which are to remain shaded and as soon as it has set a trifle it is wiped off rather deftly with clean cloths, wiping more near the center of panels and boards and on high projections of mouldings, carvings, etc., than elsewhere, leaving the glaze color in the depressions untouched or stippled lightly with the wad of cloth or a stippling brush.

To produce old ivory the ground coats of paint or enamel are tinted with raw sienna and a bit of burnt umber to a light ivory color. When dry the surface is glazed about the mouldings, carvings, etc., with a glazing color mixed from raw sienna and a little burnt umber ground in oil and thinned with 1/3 boiled linseed oil and 2/3 turpentine. Some finishers add a little melted beeswax to the glazing color. The ground coats in this case are usually rubbed dull with pumice stone and water, or they are composed of semi-flat drying enamel or full gloss enamel. In the case of full gloss it may be necessary to wipe over the parts to be glazed with a cloth wet with benzine before applying the color, so the color will take hold. When the color is on and has set a little wipe it over with clean cloths to remove the color from the high projections like moulding tops, carving projections, etc., leaving the color dark in the depressions. Note Plate 52.

When glazing some new painted or enameled surfaces it will be found necessary to make the glazing color so thin that there seems to be no staining ability left. Sometimes a glaze of varnish, turpentine and a little linseed oil and no color is sufficient to color the surface the little needed.

Rough Stipple Glazes.—In the case of painted, not enameled, surfaces the rough stippled surfaces make far more beautiful effects. The ground coats of paint in this case are stippled in the regular manner with a stippling brush before the paint becomes dry. That eliminates the brush marks, distributes the paint better and leaves a surface pitted with tiny pores. The coat should be mixed thicker than is used for finishing with a brush in the ordinary manner and it should be mixed to dry flat. If a much rougher surface is wanted mix the paint in that manner and then just before brushing it on throw a handful or two of dry plaster of Paris in the pot of paint. Stir it in to mix it only fairly well. You don't want it completely soaked up and mixed with the paint. When such paint is brushed on it may be stippled to a far rougher and more beautiful finish than plain stippling of ordinary paint alone. Then if a very rough surface is wanted mix into the paint a few handfuls of fine screened sand and stir it well to mix the sand in the paint.

When one of these rough surfaces is coated in part or all over with a glaze color and wiped off the effect is very interesting. The glaze color may be one which is closely related in hue to the ground color or it may be one which harmonizes by contrast. One or several glaze colors may be used. A common method is to pick out, that is, color, the mouldings a different color than the ground and different than the general color used to gain the antique shading, or aged effect in the corners and depressions of carvings, corners, etc.

Combed, Wire-Brushed or Sugi Finish.—The rather rough antique appearing finish noted on oak furniture of Early English and Italian design, seen also on wood trim of some public buildings such as clubs and hotels, as well as some homes of the Pacific Coast regions, is novel and interesting. It has the appearance of drift wood cast up on the beach after long weathering and wearing by water, sun and wind. It is to be seen on oak in furniture, particularly tables, and in wall panels. Redwood, cypress and even fir and pine can be so finished.

Two principal methods are used,—sandblasting, and charring followed by wire brushing. Sandblasting accomplishes the finish very rapidly, and often door and cupboard panels, as well as beam soffits and pilasters are partly covered with a stencil design cut from sheet rubber to form interesting patterns. Then the sand bounces off the rubber and cuts away the soft pulp wood only in places where the design is cut through the rubber stencil sheet. Where sandblasting equipment is not at hand, the wood is burned over with a gasoline or acetylene paint burner torch until it is evenly charred. Then the surface is brushed vigorously with a stiff wire brush. Under the char an interesting finish will be noted in beautiful brown. Then by simply dusting off the wood and waxing you have a finish. Or, a thin coat of pale varnish or shellac may be used. The varnish should be thinned about 25% so it will not fill up the surface too much.

Hand Adzed Finish.—Illustrated nearby is a novel finish on oak employed in buildings of rustic character. In such finishing the oak or other wood is actually chopped or hacked with an adz or a broad wood chisel and mallet. Then a filler of modeling clay thinned with water is brushed on and wiped off, leaving it only in the cuts and open wood cells. The paste filler of natural oak type used for floors may also be used here and if a light gray is wanted for filler simply add a little zinc oxide in oil to the oak natural paste filler.

Pecky Cypress Finishing.—The very unusual wood called pecky cypress used for novel effects in some rooms, calls for very little or no finishing. It is a very open, brashy wood surface, full of holes. If it is to be smoothed somewhat, liquid wax may be employed and if its color is to be made even more contrasty and ancient looking, a smut coat of rotten stone may be brushed on and wiped off. The rottenstone dry powder may be mixed with a glue size, brushed on and wiped. This wood can be stained too.

DECORATIVE DESIGNS WITH STENCILS

Natural, stained, painted and enameled surfaces are greatly enhanced by the addition of decorative designs. Application of such designs by freehand painting, is restricted to few but really good designs are to be had in stencils and they are easy indeed to put on to the surface, following correct methods. Following are a few indications of the possibility.

Oil Colors on Stained Wood.—Illustrated by Figure 55 is the ceiling of a dormitory. Here the roof was constructed of four-inch pine flooring with the finished side down. That was stained in walnut brown. The rafters were spaced in pairs instead of on the standard sixteen inch centers. Then the designs were applied in oil colors used for tinting flat wall paint to ivory, dull red and green.

Door Designs for Cupboards.—Doors of cupboards in kitchens, bath rooms and bed rooms, are given far greater interest by repeating on them one or more of the colors of the room, or contrasting hues by stencil methods. In the case of painted or enamel finished surfaces the stencils are transferred with enamel tinted with oil color, as noted by Figure 56. If the doors happen to be of glass, apply the designs to the inside of the glass. When the stencil design on the glass is dry, the whole back side of the glass is painted with flat wall paint and enamel as a background for the design, and to conceal the shelves of cooking utensils or grocery supplies.

But, suppose the wood trim and cupboard doors are to be finished in stain? There are two methods for applying the stencil designs. One is to apply the designs in enamel or flat wall paint tinted with oil color on top of the stained finish. The other method is to apply the design to the unfinished natural wood before staining, but — here you apply the stencil design with white or bleached shellac and let it dry. Then apply the stain to the whole panel right on top of the shellac formed design and when you wipe off the stain, the decorative design will appear in the natural wood color, looking very much like inlaid wood.

Natural and Stained Color Floor Designs.—Floors of oak, maple, birch, pine and other woods are given far greater charm in a decorative scheme by adding suitable borders, corners or center patterns with stencils. In Figure 57 are shown two types of border treatment easily applied with shellac to the natural color floor before the stain is applied and wiped, thus giving an inlaid wood effect under the final finish of wax or varnish. On floors to finish in natural color, these and many other designs may be applied with flat wall paint, tinted with oil colors. Then the varnish or wax finish protects the designs. Figure 58 illustrates an oak floor in natural oak finish with design applied through a stencil with flat black and ivory. Figure 59 pictures the design applied in ivory white on a dark brown stained floor, after the staining but before the varnish or wax.

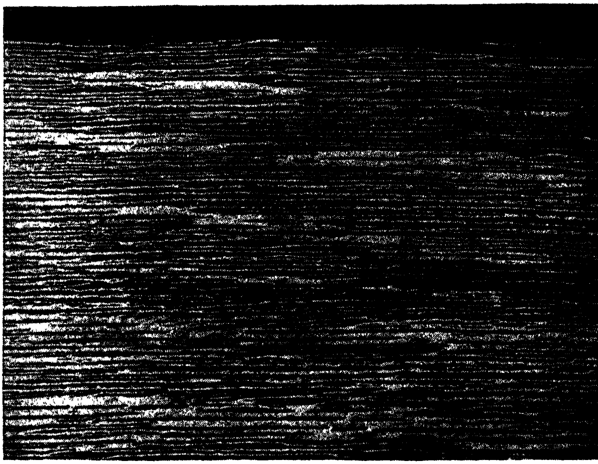

Plate 52B.—Combed, Wire-brushed or Sugi Finish.

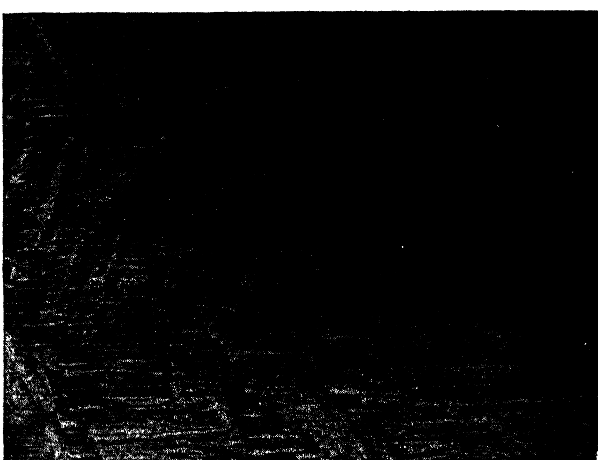

Plate 53.—Hand-Adzed Finish.

Plate 54.—Pecky Cypress Finish.

Plate 55.—Decorated Stained Wood Ceiling.

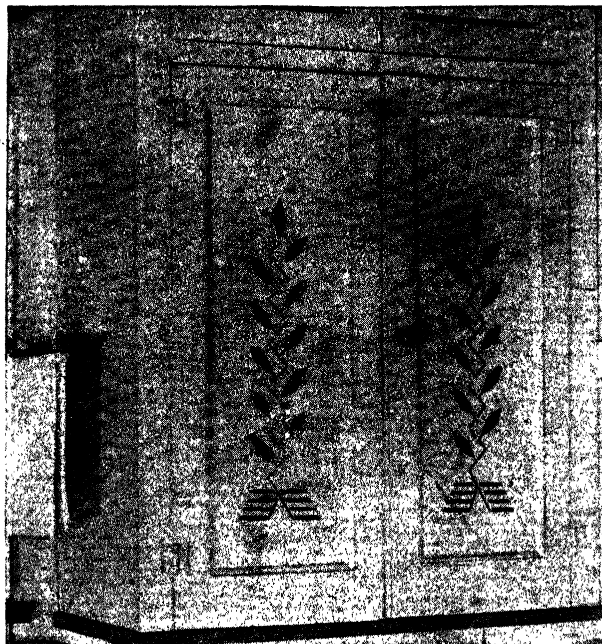

Plate 56.—Kitchen Cupboard Doors of Ivory Enamel Stencilled in Black Enamel.

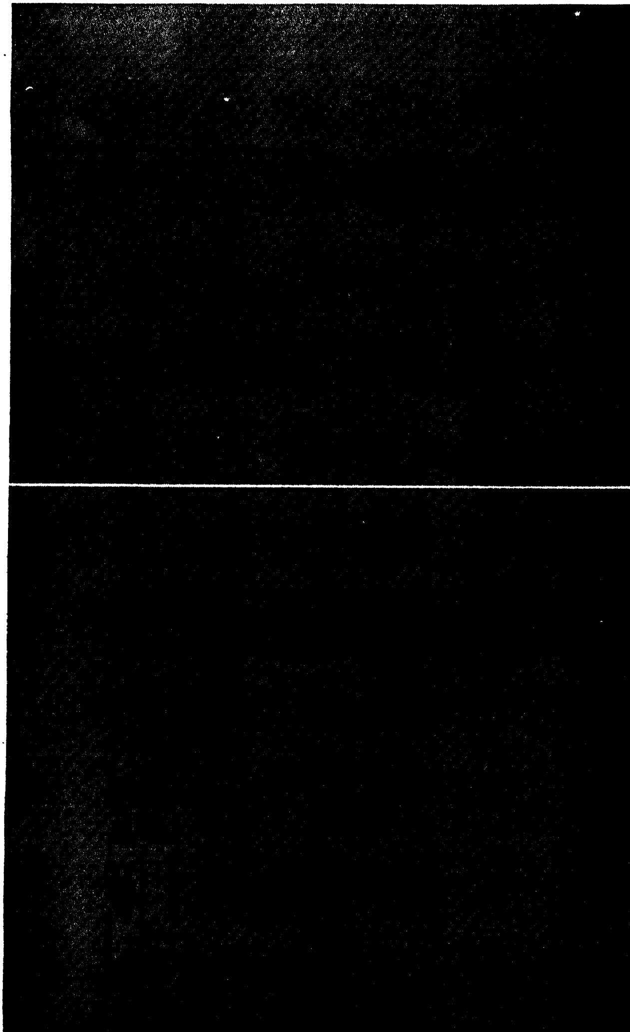

Plate 57.—Suitable Floor Designs for Natural or Stained Woods.

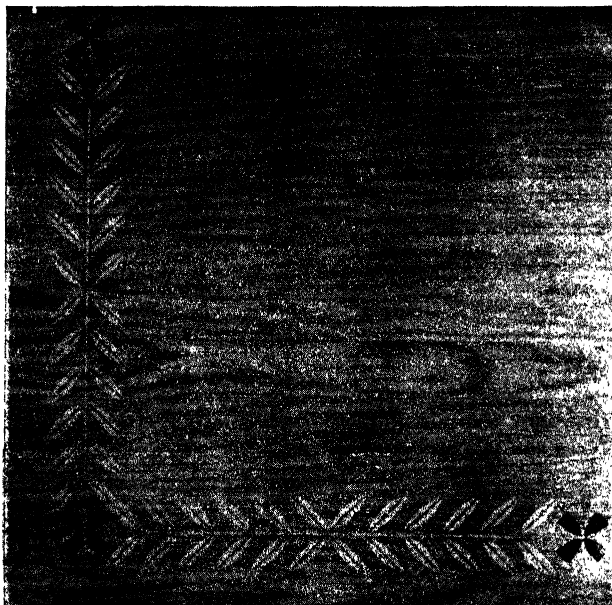

Plate 58.—Natural Oak Floor with Decoration in Black and Ivory.

Plate 59.—Stained Oak Floor with Decorative Border in Ivory.

CHAPTER XXIV

REPAIRING DAMAGED FINISHES

After producing a well nigh perfect job of finishing on wood trim, cabinets or furniture the finisher sometimes meets with the great disappointment of having some other mechanics about the job damage the surface before the architect or customer has accepted the work, or after. What to do in such cases is exceedingly valuable knowledge and marks a finisher as a high grade man when he can meet the emergency with skill. Sometimes in refinishing old surfaces the damaged places consisting of bruises, deep scratches, splinters, cracks, etc., are too deep or extensive to be eliminated by the ordinary stripping off of the old finish and sandpapering the surface. Filling and patching must be done. The following will be of great help in these situations, but of course the principal requirement is experience and practice in the work. What follows will give you the tools, methods and some suggestions to make a start with.

Furniture Repair Kits.—There are on the market boxes or kits of tools and materials needed to do this sort of repair work on furniture. They are made for furniture stores, factory finishers, etc. One of these should be in the hands of every finisher. An excellent kit of this kind can be assembled by any finisher and should consist of the following items all fitted into a box of substantial character with cover and lock (see Plate 60):

8 clean glass bottles of the 4 ounce size with cork stoppers.

1 small camel hair artist's brush.

1 larger camel hair brush.

8 aniline colors, spirit-soluble; one ounce of each of the following,—black, orange, yellow, Bismarck brown (red), walnut, golden oak, green and methylene blue.

1 quart denatured alcohol.

6 or more shellac cement sticks of the best quality in such colors as,—light, dark and medium oak, walnut, mahogany, ebony, natural transparent, etc.

1 electric soldering iron such as is used for radio work, or a small alcohol lamp.

1 pocket knife.

1 old table knife.

6 sheets of fine sandpaper, No. 00.

1 ounce fine pumice stone, FF grade.

½ bar yellow laundry soap.

½ pint pure white bleached shellac.

½ pint polishing wax.

½ pound cake of paraffine wax.

½ pint turpentine.

Clean wiping rags.

Dents and Bruises on Unfinished Wood.—These can be so perfectly repaired before finishing that they will never be found. The first thing to do is to wet the dented or bruised spots with water. Let the water soak in a bit. Then take the point of a sharp knife and heat it over the alcohol lamp until it is red. Stick the hot knife into the wet spot about an eighth of an inch repeatedly but between different fibres of the wood each time. Be careful not to hold the hot blade in the wood so long as to burn the fibres. Don't get the blade too hot. The steam thus produced will swell the wood fibres until they level up with the surrounding surface. Let these repaired spots dry thoroughly, sandpaper and clean up and the surface is ready for finishing in the usual manner.

Dents and Bruises on Finished Wood.—When the finish has not been broken but the wood has been depressed it can often be raised again to a level by treating the spot with heat and cold repeatedly. If the finish is shellac the heat should not be raised above 100 degrees, but varnish will stand 120 degrees. A felt pad should be placed over the injured spot and a hot flat iron should be placed on it for ten or fifteen minutes. Then wrap some crushed ice in a cloth and place it on the spot for about the same time. A water bottle of rubber is best for the ice treatment. Repeat this heat and cold several times and it usually will cause the compressed fibres to raise back to their original level. If this fails there is nothing to do except to scrape off the finish and raise the wood with steam by placing a damp cloth on it with a hot flat iron on top. Then refinish as suggested elsewhere in this chapter for other repairs. Keep a close watch on the hot flat iron however it is used so it will not damage the surface around it.

Blisters of Veneer Wood.—When the glue under veneer lets go and the thin plywood blisters up it can often be secured back in place by heating the old case knife blade and rubbing it over the blister repeatedly. If the blister is near the edge of a flat board lift it up and insert a thin coating of first class wood glue with a flat stick, knife or toothpick. Then clamp the veneer down or place a board on it with a heavy weight on top for at least 12 hours. The glue alone without the clamp or weight will not hold it.

Chipped Wood, Knot Holes, Deep Splits, etc.—Sometimes these defects and others caused by nails and deep scratches must be repaired in old or new surfaces. The first step is to take a sharp knife and clean out the

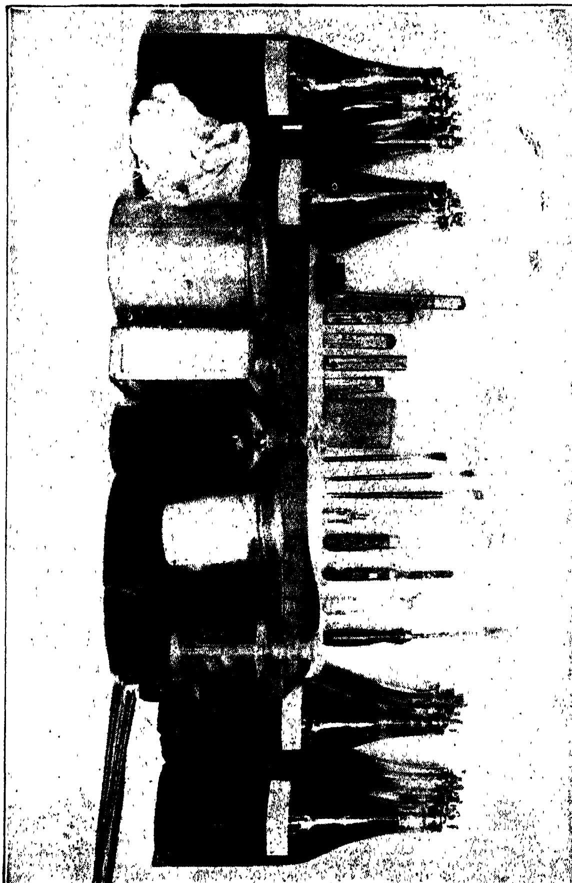

Plate 60.—Furniture Finisher's Repair Kit

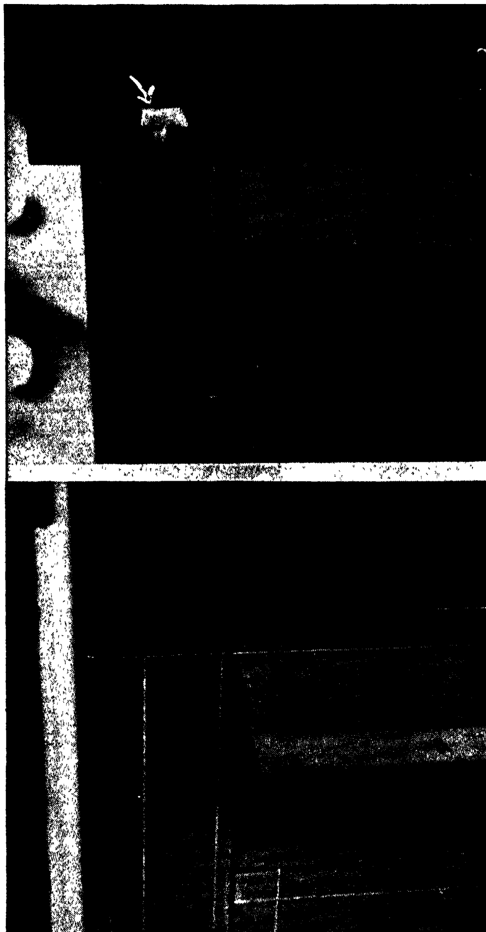

Plate 61.—Damaged dresser top. Showing bruised wood cut out (above) and (below) after hole was filled with stick shellac cement, stained and varnished.

damaged space so as to remove all splinters and loose wood fibres. Such loose wood fibre will take a stain darker than solid wood and will prevent getting a perfect job if not removed. Have the hole clean and smooth coat it with a stain mixed to match the old or new finish to be put on in color but make the stain lighter than the new or old color. You can never strike it just right in color because the subsequent coats of shellac, wax or varnish will darken the color. So make it too light and then you can darken the coats to follow and repeat them until a perfect color match has been made. The stain is made by dissolving the dry aniline stain powders in denatured alcohol. The more color you put in the darker the finish will be.

The repair kit mentioned in the first part of this chapter should be completed by filling each of the bottles with the denatured alcohol. Then put into each bottle 1 heaping teaspoonful of dry aniline color. Only one color to the bottle, of course. You will then have a fairly strong stain of each of the eight colors and you will also have some dry stain powder left for making stronger solutions and for replacing the original contents of the bottles. By mixing these stain solutions in various proportions you can match any finish color wanted. The Bismarck brown, for instance, is a deep, rich red. By adding to it some of the black you can match any shade of red mahogany and by addition of walnut brown you can match any of the brown mahogany shades. By mixing black and orange you make rich brown shades also and a bit of Bismarck brown will give it a reddish hue. A little experimenting will teach you how to produce any color effect needed. Test your mixtures by dipping narrow strips of white blotting paper into it. When the color is right, add an equal amount of white shellac to it and apply this stain to the spot of wood to be repaired, using the camel hair brush. Put on a thin coating first and let it dry. If too light, apply another coat and repeat as often as is necessary, keeping the color lighter always than the finished surface. If the damaged place is shallow like scratches it can be built up by repeated coats, letting each one dry, until the surface is level.

When dry a repair made as above should be rubbed by coating it with a mixture of FF pumice stone and paraffine oil, sweet oil or light sewing machine oil. Use a soft piece of felt to rub with. Rub this repair in the same direction as the original rubbing was done on old finishes. Don't rub much. Wipe up the surface clean often to inspect it. For a final rub on a real dull finished surface use the oil alone on the palm of the hand. If a highly polished surface clean up after the rubbing with the oil and polish to a good gloss with a soft flannel cloth. In the case of large panels, cabinet and table tops it is well to rub the entire panel to make a better match.

In this sort of repair work on the weathered and mission finishes which are finished without filler and with open pores care must be taken to mark the filling coats with the knife so that it matches the surrounding surface. Only about half as much shellac can be used in the stain coat on these surfaces. The marking of the pores or grain may be done with a dull table knife or a small screw driver. At any rate don't make a solid, smooth filling in a surface which is broken up generally with pores. You have practically got to draw the pores and grain marks on the filling you put into scratches, especially those across the grain. After making a repair on such a surface coat it with wax and rub to a hard luster to match the surrounding surface. Often it is well to rewax the whole panel or board.

Deep holes, chipped-out places and large cracks must be filled on new or old wood with wood cement or shellac sticks. This cement is made of shellac and rosin colored to match the standard finishes. It is much like the sealing wax used for letters and packages but of much more transparent quality. Shellac sticks are made in more than fifty colors and you can get color cards from the manufacturers showing just what is available. The cheaper grades do not work right. Good sticks will not gum up or soften when sandpapered, the cement can be rubbed and polished and it will not only remain tenaciously in the hole or crack but will not chip or crack.

To make this kind of a repair clean out the hole, removing all loose splinters as before. Then with the electric soldering iron or the alcohol lamp melt the proper colored shellac stick into the hole to completely fill it, but don't put in any more than is necessary to level it with the surrounding surface. A second filling can be made and any excess put on can be cut off with a sharp chisel or knife. Also the filling can be finally smoothed and leveled with sandpaper. It is best to stain the hole and the wood around it before filling, using a stain of the same color as will be used for finishing the whole surface, but a little lighter. Let the stain dry before filling with cement. The cement filling will dry immediately but can be smoothed out with the hot blade of the table knife or a small spatula. The cutting down with a sharp chisel and with sandpaper must be done after the cement has set, of course.

After the repair filling has been put into place and finished as level and smooth as possible mix a stain for the whole surface and finish as usual if a new surface. If it is an old surface mix your stain with the spirit colors and shellac as suggested previously, blending and matching colors and applying coat after coat until the exact match has been made with the old surface. Apply the stain deftly and a perfect job can be done.

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