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**PRODUCTION
PLANNING**

PRODUCTION PLANNING

BY

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PREFACE

An attempt is made, in this book, to deal with the subject of Production Planning, in a particular manner. In the first place, the subject is treated on fairly broad lines; many of the matters discussed are but remotely connected with physical productive activity; this book is not devoted to the special work of the so-called Planning Department. Secondly, the book is intended to be of service to people who have difficulty in finding what they require in other books dealing only with very large factories. It has been felt that the people who are in need of ideas about Production Planning are often those who have no experience or conception of gigantic undertakings, but who are engaged in the management of smaller factories; theirs is a desire to effect improvements in the planning of methods to secure the minimum of confusion with the maximum of profit; included amongst them are people who have come to realize that rule-of-thumb methods will no longer suffice. The bulk of manufacture is conducted in factories employing fewer than a thousand hands.

It is hoped that the book will prove useful, too, to students and others with managerial aspirations.

Everything in this book is based upon practical experience and, therefore, no more than an outline of the subject is possible. Necessary planning functions are arranged with regard to their natural sequence; difficulties encountered in practice have been stated, and the methods used to overcome them have been briefly explained.

This book has a further objective. The world of industry has accepted the scientific investigations of Dr. F. W. Taylor with much benefit to itself. It has been shown that work-people may produce considerably more than was previously

supposed, with advantage to themselves, to their employers and to the community. This book endeavours to point out that the methods of "Taylorization," as they have come to be called, may usefully be extended in another direction, namely, that of the scientific control of overhead charges.

The writer's twenty years of managerial experience includes that of works manager and of managing director, the latter giving a valuable angle of vision upon the former, but it also includes the conducting of a number of thorough investigations into the affairs of manufacturing businesses. He has always found that total overhead expenditure greatly exceeds the total expense of direct and indirect productive labour. It would, therefore, seem that the scientific control of overhead charges may be even more important than the scientific control of labour charges. Whether improvements can be effected in controlling overheads which are proportionately as great as those effected in labour output is another matter; whether "scientific" methods can be applied at all is for the reader to decide. The answer is only to be found in the study of Production Planning.

INTRODUCTION

PRODUCTION planning is that part of commercial organization which is concerned with the arrangements made within a factory whereby work may proceed without confusion. It is implied naturally that certain benefits shall accrue from the introduction of such orderly arrangements; otherwise, the effort expended in planning would not be worth while. Before making any plan, even a plan of a treatise on planning, it is necessary to have a clear idea of the objects which the plan is desired to achieve. The objects, or benefits, of production planning, using the term in a fairly wide sense, may therefore well be stated before any attempt is made to discuss the ways and means of achieving them.

The objects of planning may be divided into three groups; the order of their importance may vary with circumstances and with different industries, but always they must exist. One object of planning is the enhancement of the goodwill of the business: giving the customer *what* he requires *when* he requires it; seeing that he gets not only value for money but better value for his money than he can get elsewhere; ensuring that he will be favourably impressed not only with the goods, but also with the manner of his transaction, or, in other words, with the efficiency, service, and courtesy he receives and enjoys, over and above his expectations, as a kind of overweight given gratis. At first sight this may appear to be an exaggerated extension of the limits of the subject of production planning, but a moment's reflection will justify the claim here made that no value can attach to any transaction from a goodwill point of view unless it is backed by sound performance in the factory.

Another object of production planning is economy. Economy, which is here coupled with the elimination of waste,

must be understood to be only that kind of economy which can be called safe, that is to say, economy which must not detract from quality standards and which must imply no sacrifice of humanitarian standards. True economy considered in this way is almost synonymous with efficiency. By "false economy" is meant the employment of cheap and low-grade material, plant, and people. Production planning must, therefore, produce the best possible article in the greatest possible quantity at a fixed cost: not a low-quality article at a low cost.

The last of the three main objects is co-ordination. Every business is a complicated organism. No organism will function correctly unless its many members perform their quota of duty to the whole, smoothly and harmoniously.

Co-ordination of decentralized units towards the centre of control must be possible. Planning must occur before each and every department can know what it has to do, and how and when it has to do it, in order that the whole organism may live and grow. Each department must, therefore, receive its information from a central source. The central source must collect knowledge of what is required not only from outside the organism, but it must also obtain knowledge from within the organism to guide it in its demands upon its members. It must be sure its demands are reasonable. Methods must be devised which will provide a steady stream of vital information to those who need it.

So much then for a statement of the objects of production planning in general terms. It is now necessary to dissect this statement in order that its practical application to the two very distinctly different classes of factory production may be clearly understood by those engaged in either of these divisions of industry. One division may be called continuous process production: the other, intermittent process production. Some factories produce vast quantities of similar

articles; others produce built-up assemblies comprising hundreds of component parts, many of which are only required a few at a time. On the one hand, planning upon what might be called a grand and simple scale can be advocated, whilst on the other, planning of much niggling detail is required. Nevertheless, so long as this distinction is never forgotten, much that applies to one division can be useful to the other, for there are few continuous process factories which have not some intermittent departments, be they only concerned with works maintenance, and there are few intermittent factories entirely devoid of automatic processes.

It should be noticed that the first object stated above, that of the planning of production for the benefit of sales, applies much more strongly to the intermittent processes than to the continuous.

There is one further aspect of the three objects of production planning already outlined, which deserves consideration. Planning generally can apply to the physical or to the clerical work of production. Now, in the first object, that of planning for sale, both clerical and physical sides of the question are important. In the case of the second object, economy, physical work is affected, while the third object, co-ordination, is attained by the planning of clerical work entirely.

Briefly stated, object one, planning for sale, entails consideration of methods of stating customers' orders to factory, warehouse, progress, packing and dispatch departments; external transport outwards, invoicing, book-keeping, correspondence; planning the methodical and automatic sequence of all these (but only in relation to customers' orders or to orders for stocks to be held at some other place than at the works itself).

Object two, planning for economy, entails consideration of methods of purchasing, receiving, internal transport, time and motion studies, machine operations and speeds, power

production and consumption, machine maintenance, jigs and tools; safeguarding against waste in process work and of capital locked up in excessive stocks; research and experiment.

Object three, planning for co-ordination, entails consideration of methods of costing, stock recording, stock maintenance, issuing of internal orders for components, progress, chasing of internal orders, inter-departmental orders, rate fixing, wage and bonus systems, time recording, specifications and drawing office routine; planning sequence of operations through productive process department in relation to internal orders; planning to cover manufacturing programme laid down by central control, which includes regulation of labour strength to anticipated requirements.

The field covered by the subject of production planning is thus fairly extensive, and, although the list is by no means exhaustive, it should suffice as an analysis which provides convenient items for separate consideration.

Before proceeding, however, to the detailed consideration of these matters there is a circumstance which it may be as well to ventilate here at the outset. It is the question of expense. The attitude of some people towards the application of rational planning to their works is, "We can't afford it." In the majority of cases, though not always, this attitude is not warranted. The exceptions are those concerns whose proprietors are capable and content personally to supervise a small volume of production; but wherever a manufacturing business is of such size that the proprietors themselves cannot cope with the detail involved, it is far more costly to continue with methods of control evolved by chance in a single business than to draw upon the accumulated experience of world-wide industry.

The misconception as to cost arises entirely from lack of knowledge of what is really implied by "Production Planning." The man who is making money by working sixteen

hours a day at his own business imagines that the alternative which will give him a more natural life is the introduction of masses of paper docketts which he will never himself understand, and which can only be manipulated by a number of extra and highly paid assistants. This view is quite erroneous. No planning is justified unless it actually pays for itself—and pays handsomely. It is a certainty that the hypothetical gentleman considered spends much of his sixteen hours on jobs which can and should be done by juniors. For the rest he is doing work which uses his energy and intelligence extravagantly. If he has been capable of building a business, building and taking care of the safety of the edifice is his real job. If he attempts to do more than this he is wasting his time, his money, and his opportunity. The aspects of planning dealt with hereafter do not accept a multiplicity of paper work as a *sine qua non*; on the contrary it is recognized that a proper desire for system must not become a mania. It is a maxim of sound planning that written work in the works itself should be of insignificant volume. That written information should flow along defined channels is essential, but the provision of the actual written word which flows will be shown to require a very small effort, and that effort need never be exerted by manual workers.

The phrase, "Production Planning," has sometimes a special significance which does not altogether apply to its use in this book. In this special sense the institution of a definite department in the factory, the Planning Office, is implied. This book is not concerned with the setting up and the work of any such special department. It uses the phrase "Production Planning" in a broad and perhaps more elementary sense. It is written more particularly to provide guidance towards planning in its earlier stages. The Planning Office comes later, when the magnitude of an industrial enterprise is such that vast sums expended in overhead charges may

be effectively controlled by the Planning Department proper. Discussion of the work of such a special department provides scope for the detailed examination of many varying methods of performing definite planning functions; and such discussion provides ample scope for books of much greater size and more advanced character. For the present it is deemed sufficient, first, to establish that certain planning functions are necessary; second, to provide guidance as to the best methods, founded on experience, of performing these functions.

(A portion of this Introduction is reproduced by courtesy of the Editor of "Industrial Welfare and Personnel Management.")

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PRODUCTION PLANNING

PART I PLANNING FOR SALE

CHAPTER I

THE ORDER

STATING the customer's order—Action by warehouse—Action by factory—
Progress system—Tracing queries.

THERE are several possible ways in which a customer can place an order—

1. By word of mouth to a salesman or traveller, or to a clerk over the telephone, or to any person connected with the seller in any way. In these cases the order first appears usually on paper as a very rough note.

2. By writing it in a letter, post card, telegram, or on an official order form.

STATING THE CUSTOMER'S ORDER

In either case it is necessary, at the factory, to rewrite the order in some way which will put beyond all possible doubt the exact quantity and description of the goods required by the customer. It is usually desirable in the first place that the customer should be given the earliest opportunity of knowing that neither he nor the seller has made a mistake. His post card may read—

“Please repeat last order.”

Or his telegram may run—

“Your offer accepted.”

Possibly a traveller may telephone to the sales department—

“Johnson, of Tooting, wants a packet of No. 116 to-day certain.”

In every case someone has to investigate what it is that the customer really wants. The plan by which he gets it may be the provision of a man in the warehouse who has been taught where to find the required packet and to hand it over with a note of some sort. In less simple cases the plan is more elaborate. The point it is desired to make is that some kind of planned arrangement, which will ensure that the goods required are known and delivered, must be constructed in every business. This plan commences with the statement of the order in words and figures which will be instantly understood by every one who recognizes the piece of paper on which they are written.

As has been said, the first object of this writing of the order is usually to let the customer see it. The second object is to let people employed by the selling firm see it too. Here, then, are two documents required. Since they contain identical information they can obviously be duplicated on a typewriter, through carbon paper. *Since, also, a point about recognizing one of these documents has been mentioned, it is advantageous to use paper of DISTINCTIVE COLOUR for this purpose.*

Modern methods of dealing with customers' orders are an extension of the principles established above. While in actual practice it may not even be deemed necessary to send the first of these copies to the customer by way of acknowledgment of his order, it is found that the second copy is imperatively required by the firm that has sold the goods. Indeed, many duplicates of this second copy may often be made with advantage by further sheets of carbon paper. Where more than about eight to ten copies are required, special machines are constructed to supply them. This accounts for the hectographed documents sometimes received from large firms.

The plan for dealing with customers' orders provides a typist who understands that "a packet of 116" means, say,

12 gross Lincoln pens (our list No. 116), at 3s. 9d. per gross less 22½ per cent and 5 per cent discount. It is necessary next to consider how many times this line of writing or its equivalent may have to be repeated before the transaction is completed. An extensive list of every item of written work occasioned by this simple transaction is worthy of consideration and discussion—

1. Acknowledgment of order to customer.
2. Acknowledgment of order to traveller or territorial agent.
3. Permanent record for Sales Office, filed numerically.
4. Permanent record for customer's file.
5. Notification to warehouse. (Upon this the goods are taken from stock and sent to the packing and dispatch departments.)
6. Notification to packing and dispatch departments. (A separate copy may be unnecessary if No. 5 is passed on.)
7. Duplicate warehouse copy. (If No. 5 is retained by the warehouse department as a form of receipt for the goods, this copy is used to hand on, either to the packing and dispatch departments, or to the office, to show whether all or part of the goods required are in or out of stock.)
8. Notification to works. (If all or part of goods required are out of stock, the works are thus notified that production is required. This copy is passed to the works after the office has received No. 7 from the warehouse.)
9. Duplicate works copy. (If No. 8 is retained by the works as a permanent record, this copy is passed along with goods to the warehouse and thence to the packing and dispatch departments.)
10. Cost office copy. (If all orders are costed separately, this copy, suitably ruled, ultimately records the cost.)
11. Drawing or specification office copy (if special drawings or material lists have to be worked out).

12. Stock record copy. (This must be provided unless 5 or 6 is used by the stores record department.)

13. Director's duplicate. (This is frequently required by a director who keeps in touch with orders received.)

14. Advice note.

15. Consignment note.

The above full range of copies, or a reduced number, may be made in one operation, as simply as a single document may be typed. Pads of forms ruled with blanks falling beneath each other in "register" may be interleaved in bulk with carbon paper by the lowest paid member of the staff. Each form is on paper of a distinctive tint and each batch of forms bears one reference number throughout. This number serves to identify individual forms, provides a safeguard against forms being mislaid, and provides a ready reference number to the transaction for all purposes and for all time. The cost of such forms may be from £7 to £20 per thousand sets.

The list, however, is not yet quite complete; the book-keeping department must be notified of what has to be invoiced, and must carry out its share of the transaction. Some of the following may be incorporated in the original typing, or the complete list may be separated into two typings, out of consideration for the limits of the effectiveness of carbon paper, or for other reasons—

16. Invoice.

17. Day book copy. (The copies, placed on a suitable binder in numerical order, obviate the necessity for keeping any other form of day book.)

18. Copy of invoice for traveller or agent. (This is useful to the "man-on-the-road," who is thus informed of the execution of orders in his territory, and of any items not delivered, and it provides also a means of checking his commission account.)

19. Commission clerk's copy. (The copies are divided

into files for each person entitled to commission, and listed monthly or at any other time when commission is paid.)

20. File copy. (For customer's correspondence file.)

Discussion of these last five copies will be found later, in Chapter IV. They are mentioned here because it is often found expedient to include all or some of them in the original writing of the order. The only other occasions when written work is required by a normal order are—

21. Ledger posting.

22. Sending monthly statements of account due for payment by the customers.

There is no method whereby these last two duties can be included in the original writing of the order. They can, however, be performed mechanically. (See Chapter IV, Mechanical Ledgers.)

ACTION BY WAREHOUSE

Whenever a warehouse or store exists where goods are held in stock in readiness to be sold, the chief man in charge of the warehouse receives one or more copies of the customer's order. They are sent to him usually in batches as they are typed. Simple straightforward orders which can be executed at once from stock are usually dealt with first. The goods required are collected from bins or shelves and are sent forward to be packed. The order form is attached to the collection of goods in some convenient way for identification purposes.

Any such warehouseman handling a fair number of orders daily is bound to encounter either items included in orders which are entirely out of stock, or else some which cause him to doubt his ability to provide what is required. For example, he may notice that an item of stock is in poor condition, or that the design called for has been modified slightly in recent production. He desires to know, in the case of the former, whether the goods will "do" for the

customer ordering them; in the latter case, it may be that the goods are required to match, or to form a spare part of a machine. Such queries as these, or, in fact, all queries, are to be dealt with in bulk rather than piecemeal. At stated times the chief warehouseman should interview, as part of his regular routine, a capable member of the sales or office staff. If this is not done, much time will be wasted, not only by a multiplicity of journeys from one place to another, but also by fruitless journeys, because the person required by the warehouseman is not always at liberty to attend to him.

When items are definitely "out of stock," a pencil line is usually drawn through them on the warehouse copies. If it is desired to send at once the items which can be supplied from stock, the unfilled balances are thus plainly shown and are indicated to the packer, the office, and the customer.

ACTION BY THE FACTORY

Orders received directly from the office, or indirectly after attention by the warehouse, demand action by the works which varies widely in different industries. Where all goods manufactured are standard, it will first of all be necessary for the works manager, or a member of his staff, to ascertain whether the goods called for by an order are in process of manufacture in sufficient quantity to fill the order. If they are, he usually inserts, against every item so covered, the date when completion is anticipated. Copies of orders so marked are returned to the order-issuing office, whilst corresponding copies are retained by the works manager's office to form a record of delivery promises given, and to provide material upon which "Progress" or order-chasing may operate.

In factories where few, if any, goods are sold as a standard product, the procedure will vary with circumstances. Many factories produce assembled units made by fitting together

standard components (which are themselves manufactured for stock) in a series of combinations. In such cases, it is necessary for the works office to issue an order for fitting-up. To this order will be attached carbon-made duplicate forms, which, when handed to the component stores man, constitute documentary evidence of issue. The uses of this evidence are discussed hereafter.

In other factories where customers' orders have to be made specially from start to finish the procedure comprises the issue and recording of all relevant instructions. This is dealt with in Chapter XVII under the heading "Internal Production Orders."

PROGRESS SYSTEM

One of the commonest signs of a badly planned factory system is failure to obtain, rapidly, information about the progress which has been made in manufacturing any order, when such knowledge is suddenly and instantly desired. Indeed, an investigator into the efficiency of an organization can find no simpler test than to put the question—

"What is the position with order number so-and-so?"

He will note the number of minutes which elapse until the question is answered. In factories run by rule-of-thumb methods the time taken to answer the question may easily run into hours. Some factories still exist where the question cannot be answered at all.

It is highly important for several reasons that knowledge of this kind should be readily obtainable. In the first place, it irritates and shakes the confidence of a customer if he cannot be told, within a reasonable time, why his order is delayed or how much longer it will take to finish. It should be possible for a person answering a telephone call from the customer to say—

"Hold on a minute please, whilst I find out for you."

By internal telephone or other means is sent the inquiry—

“Customer on phone about order number so-and-so.”

The answer should come back at once in some such form as—

“In paint shop, drying, ready to-morrow.”

The system required to make quick reference possible will naturally be elaborate in proportion to the quantity of orders dealt with daily. In principle all systems are much the same. Copies of orders are filed in numerical order. Dates when various processes are completed are entered in tabulated blank spaces printed on the copy used in the works office, by a person responsible for recording progress. Variations of this may be introduced almost without limit to fulfil individual ideas and conditions. In some cases additional copies of orders are specially provided for dissection into groups, or for filing in date order. In other cases, cards giving order numbers, customers' names, and brief particulars, are made out. These are sometimes inserted in a visible-edge card index cabinet, and coloured signals are used on the edges, at different distances from one side of the cards. The colour may indicate the type or size of the product, and the position along the edge may show the progress of manufacture to date.

Yet another simple method is that illustrated. It consists of a white board into which some 5,000 small nails are partly driven. A small label may be hung on any nail. This board is ruled to accommodate some sixty different standard products. These are indicated on the oblong labels in the left-hand vertical column. Across the top, the row of nails is divided into three groups, each representing a calendar month. Each group is divided into four, to represent weeks. Each week has four nails. The small circular labels bear the customers' names and order numbers. The vertical cord is moved four times a week to represent the current date.

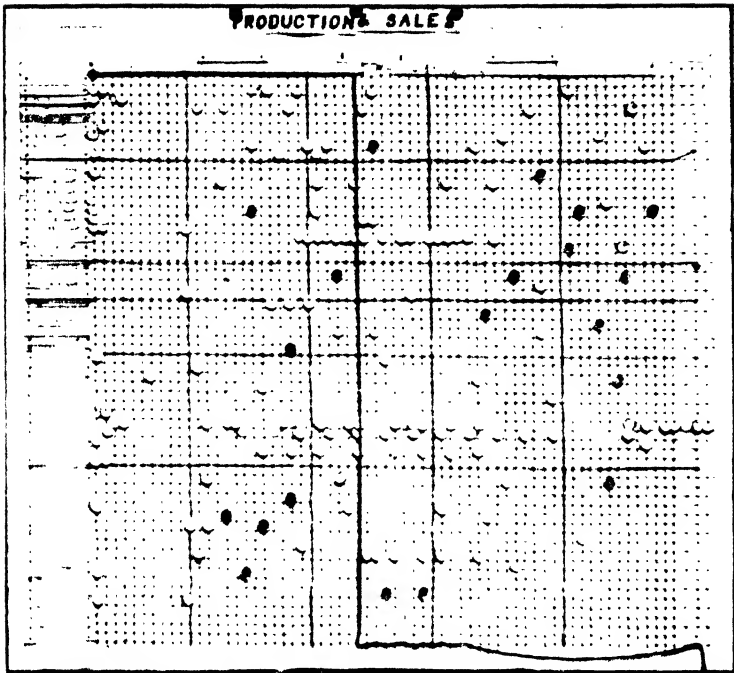


FIG. 1. ORDER AND PRODUCTION PROGRESS BOARD

(2152)

This board is used by the managing director and sales manager to show at a glance how the position varies from day to day with orders and deliveries for the various lines of products manufactured. The small labels are suspended from nails representing the date when delivery is due. New orders are added, and executed orders are removed, daily. Thus, all small labels remaining suspended on the board to the left of the vertical cord are for orders delivery of which is overdue; those to the right of the vertical line indicate forward sales commitments. A few columns of nails at the left are for very old orders; those on the extreme right are for orders held in abeyance. By the use of coloured labels and some imagination this system is capable of considerable elaboration.

From the foregoing it will be obvious that apart from fulfilling the important duty of giving satisfaction to a customer who suddenly inquires about an order, a progress system provides valuable information to those who are concerned with the internal affairs of a manufacturing enterprise. The duties of the person responsible for this work are discussed further in Chapter XVI.

TRACING QUERIES

The much used and abused general term "query" covers a multitude of unforeseen and unforeseeable difficulties. The tracing and solution of these minor problems become a matter of routine which is closely allied with the working of the progress system, because the tracing of orders, with the identification of goods the orders represent, is one of the special functions of progress work. It is not only required of the progress department that it shall make records of progress, but that it shall confirm the accuracy of its records by a physical examination of goods; it will often have to carry special instructions to foremen, charge hands, and labourers concerned with internal transport, and to

stand by, in its own interests, to see that the instructions are carried out on the spot.

It follows, therefore, that when some question arises which necessitates that goods be found, examined, and a decision reached about them, the progress department, as far as goods in the works are concerned, will provide valuable assistance.

Queries may emanate from the customer, or the management, and be directed at the works; they may also be set afoot by the works themselves and be directed at the customer or the management. In the first case, a customer may desire to modify his order—"If it is not too late."

In the second case, the management may, for example, desire to reduce cost by adopting a non-standard finish; or the works may find that some accessory, purchased from an outside source, does not fit, or will not perform its duty; or some item of defective workmanship may be detected, and the works desire to know whether there is time, and if it will be economical, to replace the defect by making a fresh start, or whether to patch it up and to make the best of a bad job.

All these things occur even in well-planned factories. Their quantity, of course, varies with the extent and nature of the undertaking. As has been said of warehouse queries, these works queries are best dealt with in bulk rather than piecemeal. To deal with them efficiently in a works large enough to require planning, it is necessary to include a well-thought-out progress system in the planning of production.

CHAPTER II

THE WAREHOUSE IN RELATION TO PACKING AND DISPATCH DEPARTMENTS

WAREHOUSE inwards traffic—Warehouse outwards traffic—Packing department—Contents notes—Dispatch department—Clerical work—Advice or delivery note—Advantage of sending invoice on day of dispatch

THERE is probably no department upon which general orderliness hinges more than upon the warehouse. Every factory needs storage accommodation of some kind. Much depends, in successful production planning, upon the care which is given to the position, size, and fitting up of the warehouses. If they are poorly placed, too small, or lacking in bin, shelf, and handling equipment, confusion is bound to arise. This confusion sets up endless difficulty throughout the entire factory and, from a sales point of view, may be very damaging to the goodwill of the business. The present chapter is concerned with this last aspect of the matter.

In a factory large enough to require planning, it will not, as a rule, be satisfactory to set aside odds and ends of floor space which are least useful for production purposes, and to make them serve for storage. It is true that many factories of quite moderate size utilize spaces under stairs, leaky sheds, and disused stables for storage purposes. But, while in some cases it may be justifiable to keep certain goods close at hand in an odd corner, the practice cannot apply to firms whose success depends upon attention to detail.

Generally it is necessary to consider storage in three or four main categories: raw materials, components (manufactured and brought out), finished goods and service stores.

Consideration of warehouse methods applicable to raw materials, components, and service stores is deferred to later chapters.

The first consideration in fixing the position of a warehouse for finished goods is that it shall lie as conveniently as possible between the place where production is normally completed and the place where communication with road or rail transport is available.

The next consideration, that of size, is highly important. There is a tendency to regard production as the only function performed within the walls of a factory, and to forget that production cannot remain for long free to proceed smoothly unless it is possible to clear away from the floor of productive departments all goods upon which production, or immediate further production, is not required. It is imperative to production itself to keep gangways clear. A simple test to determine the proper size for a warehouse is that it should be capable of storing all the goods which may be seen on the factory floors at times of full running capacity. It is impossible to achieve the best results in a factory whose floor space has to serve as part of the normal storage accommodation.

By the close of every day no completed order should remain in any place but its appropriate warehouse.

It is similarly important that the warehouse itself should have all gangways clear. This can only be achieved by adequate internal fittings.

The last consideration, therefore, is that of the equipment of the warehouse. This, of course, will differ widely in various industries. Heavy goods will stand direct on the floor and may require travelling cranes and other mechanical transport. Perishable goods may require cold storage. General merchandise, divisible into units which may be man-handled, is usually stored on shelves or in bins. Any goods seen on the floor of a general merchandise warehouse should only be those that are sold and awaiting transport to the packing department. Goods brought into the warehouse remain in their truck or box if they cannot be placed at once in their properly assigned warehouse space. If it be made an

established rule that no goods whatever may be left on the warehouse floor overnight, congestion and confusion will be abolished.

Some factories produce goods which are readily divisible into distinct classes. These separate classes often, quite properly, have their own separate warehouses. But whether this is the case or whether one warehouse alone is sufficient, it is usually sub-divided in accordance with a definite plan. Such a plan may exist in documentary form and consist of a list of numbered spaces with appropriate goods assigned to each, or it may consist of a diagram. Sometimes it exists only in the minds of the person or people who know, from use, where any given item is stored. For obvious reasons this last practice should not be allowed to persist except in factories where the output is small enough to require no more than visual control of finished goods.

The best, and probably the most usual, method of arranging a warehouse within which a large variety of small goods is stored is, first of all, to divide the floor space into aisles or passages, each of which is known by a letter of the alphabet or by a number. These passages are wide enough to permit the free movement of a hand-truck after bins or shelves of suitable size and depth have been constructed on either side, back to back and tier upon tier to the greatest practicable height. Each bin or section of shelf is numbered separately, and when referred to, with the letter or number of the aisle, may be easily located or designated in writing. The main gangway or central aisle permits a double line of traffic. A small office, or at least a desk or table, is provided, usually near the exit to the packing department.

Slow-selling stock is stored in the least accessible parts of the warehouse, whilst lines constantly in demand are placed where they are handy and quickly cleared. Heavy or bulky goods are kept near the floor; lighter articles are more highly placed.

Access to the warehouse should be closed by doors, half-doors, or barriers.

If circumstances permit, it is a good plan to divide the warehouse hands into two groups, those concerned with goods coming into the warehouse, and those whose work is to deal with goods which are sent out.

WAREHOUSE INWARDS TRAFFIC

The task of the former (the receiving group) should commence at the barrier between the warehouse and the works. All incoming goods should be listed in a duplicate book specially ruled to suit the product of the factory, with each pair of pages numbered in rotation. Where inspectors are provided to verify the quality and quantity of finished manufactures, their signatures should appear on each page. Alternate pages in these books are perforated, and when one is taken out of the book by the warehouse hand receiving the goods, it forms what may be called a "Warehouse Received Note." The copy of it remaining fast in the book is retained by the works as a "Warehouse Receipt." Each page is signed through carbon paper by the person who receives the goods into the warehouse.

The Warehouse Received Note may provide a space against each item to signify the immediate destination of the goods. If they are placed in a bin, the number and the aisle of it should be noted in this space. If they are sent forward immediately to the packing department, the order number is stated. These documents enable the stores records department to trace any query relative to the destination of any given item.

An additional tracing device, useful also in connection with short-term stock-taking, is the bin card. Each bin has a card or cards hanging on a nail or hook. A separate card is required for each description of goods placed in any one bin. If, for example, one bin is used to store gross packets

of screws of various sizes, a separate card is required for each size. The card, of course, bears the number of its bin. The card is ruled in two sections, "In" and "Out." The "In" section records the quantity and "Warehouse Received Note" number. The "Out" section records the quantity and order number.

WAREHOUSE OUTWARDS TRAFFIC

The work of the other warehouse group is that of getting out orders. On the whole, it is more difficult than receiving work, because goods described only in writing have to be found, whereas the receiving hand can see the actual goods he is handling. People with experience of the trade and products of the factory are usually required for this work.

If the method advocated in Chapter I is in use, the person whose duty it is to collect the goods required to fill an order will receive a carbon copy of the order. He will see at a glance the approximate bulk of the total, and with a moment's consideration will decide where to commence. If the warehouse is equipped, as it should be, with trays, baskets, and other suitable receptacles of varying sizes, together with wheeled trucks or trolleys, he will get what he deems to be suitable and will make a tour of the warehouse, collecting the goods required *en route*. His experience will save his legs, and the firm's time, in chasing backwards and forwards from one end of the warehouse to the other. When the collection is complete, he will take it, together with the duplicate of the order, to the barrier between the warehouse and the packing department and, if possible, get the packer to check and sign for the goods. Otherwise, he will leave the collection in its receptacle with the copy of the order attached and get the signed acknowledgment later.

There are two difficulties which sometimes cause friction between the warehouse and packing departments. They

both arise generally from a complaint made by the customer, who in one case states he has received the wrong goods or that they are too few (rarely too many), and, in the other case, that the goods have arrived damaged because of faulty packing.

A neat and orderly warehouse is the best safeguard against the mixing of orders. Documentary evidence and care in checking by packers fix responsibility for shortages. But the temptation to pass off goods which have been damaged by carelessness in the warehouse is difficult to check at times when the packing is rushed and some of it is done by people of little trade experience.

Genuine cases of poor packing are exceedingly rare. A curious pride attends the people who do this work. Nevertheless, it is sometimes a wise precaution to employ some device which will indicate the name of the packer of every order.

PACKING DEPARTMENT

Too strong emphasis cannot be laid upon the provision of adequate space in the packing department. If it is at all possible to subdivide the work there, it is advisable to do so. Small postal, carrier, and passenger train traffic forms one possible division; bulky home trade packing provides another; packing for delivery by owned transport is another; whilst export packing in cases provides a distinct, specialized division. Adequate space and division will obviate any tendency to jumble orders together while they are standing waiting to be packed.

CONTENTS NOTES

A question often arises as to whether or not it is advisable to include in every package a note stating the contents of the package. On the face of it, it would appear to be to the buyer's advantage to be presented with a document which

will assist him to identify the goods he receives. Against this, it is argued that since many factories do not supply goods direct to consumers, but sell to retailers or merchants, these intermediaries may unwittingly forward to consumers packages intact, containing information which it is desirable to withhold. On the whole, it is probably better to enclose the note. Prices should not, of course, be stated on it, and the manufacturer's name need appear only as initials, as a trade-mark, or not at all. In any case, the note of contents should not be written by the packing department, but should be furnished by the office as part of the batch of documents dealt with in Chapter I.

DISPATCH DEPARTMENT

The work of the dispatch department is frequently carried out in smaller firms by the warehouse or packer or both combined. When trade is of sufficient volume the detail of dispatch work requires careful handling. The good impression which a customer may get, about what has been called the manner of a transaction, will depend largely upon the pains taken by, and the speed of, the dispatch department. Promptness and reliability are attributes of goodwill which no firm can ignore.

Primarily, these two things are accomplished by getting the goods off the premises at the earliest possible moment, by the cheapest and quickest means of transport available. In the second place, they are achieved by following the goods with postal information which will arrive before, but not too long before, the goods are delivered.

A knowledge of geography must be possessed by this department. To this must be added knowledge of the transport facilities which exist between the works and every town and port in the home country, the times of day when these facilities are available, their relative costs and the clerical formalities each demands.

CLERICAL WORK

Since it is important that none of the three departments dealt with in this chapter should put pencil to paper more often than can be avoided by the ingenuity of planning, it is necessary that there shall be provided by the office, in addition to the copies of the order already discussed in this chapter, the following documents—

1. *Note of contents.* (This is a copy of the original order with “out-of-stock” items deleted. If more than one package is used, the document can be put into one of them and the total number of packages can be noted in pencil by the packer.)

2. *Advice note.* (Also a copy of the original order with “out-of-stock” items deleted. The packer marks the number of packages on it and hands it to the dispatch department with the goods. It is returned to the office with date and route noted by the dispatch department.)

3. *Consignment note.* (If it is desired to incorporate this in the set described in Chapter I, and so to avoid this item of clerical work by the dispatch department, it will be necessary to submit the form to the railway authority for sanction and registration.)

4. *Label.* (If more than one is required, the writing of duplicates is not a serious task for the dispatch department.)

ADVICE OR DELIVERY NOTE

The advice note *must* be dispatched on the same day as the goods leave, if they are sent by other than road transport. If the goods are delivered by the manufacturer's own conveyance, this note becomes what is called a delivery note. The buyer can thus tell what the goods are, before unpacking. Advice notes to be sent out should pass rapidly through the general office of the manufacturing firm to the postal clerk. They are first handed to the invoice department, which immediately releases the invoice of the goods to

which the advice note refers. If the values can be extended at once, the invoice can be pinned to the advice note and both can occupy the same envelope. Otherwise, the advice must go alone. In cases where goods are delivered by the firm's own conveyance or even collected by the customer, and the advice note is used as a delivery note, a perforated corner may be detached from the note and passed to the invoice clerk in lieu of the whole note. This counterfoil, usually of the vivid colour of the note itself, merely shows the reference number of the order. This is all that is required to release the invoice.

ADVANTAGE OF SENDING INVOICE ON DAY OF DISPATCH

There is an all-too-common failing in business procedure which causes much unnecessary confusion, trouble, and annoyance. It is the delay in sending out invoices. Employees are apt to think that so long as the goods and advice note have been sent there is time to breathe and any time will do for the invoice. This is a great mistake. Invoices received by customers long after the goods have been received cause much unnecessary work in tracing, in connecting with the goods, and in checking. If there is any item incorrect, the customer does not often know it until he receives the invoice. He may get the erroneous idea that the delay is intentional and is meant to cover up an overcharge. It may so happen that the customer himself requires to complete a list of charges for a contract, or for an order for which he desires payment. He cannot do this until some items of the delayed invoice are charged to him.

In any case, delayed invoices give an impression of poor management, whereas invoices sent at once, by causing the reverse impression, enhance the reputation of the firm. It is always well worth while to send out invoices at the earliest possible moment.

CHAPTER III

DELIVERING THE GOODS

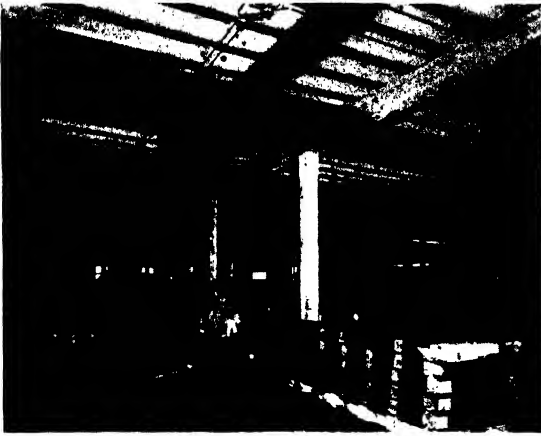
PACKING — Cases — Packing material — Canvas — Export packing — Rail transport—Road transport—Canal transport—Coastwise transport—Clerical work—Routing deliveries—Urgent orders.

THE size and arrangement of the packing shop have already been briefly discussed. Whilst it is impossible to discuss in detail the many methods of packing which are recognized as most suitable in individual industries, there are some general principles common to the packing of every type of product which requires to be protected against damage in transport. The opportunity offered by every transaction to add to the goodwill of the business does not terminate at the moment when the goods leave the factory premises. The difference in money cost between well-packed and badly-packed goods is negligible. The difference is mainly one of thought or, synonymously, planning.

PACKING

The first consideration is that of the nature of the preliminary wrapping which is standardized. Many classes of goods are not held in stock in the warehouse in the naked state of finished production. They are wrapped and boxed either singly or in sets, dozens or grosses, in accordance with trade custom. The work of protecting goods in this way may be under the supervision of the warehouse department, or it may constitute a small and useful department interposed between the works and the warehouse. Such an intermediate department fulfils the useful function of final inspection.

Articles treated in the above manner are frequently first wrapped in tissue paper, then in stouter paper, boxed; and finally the boxes are sealed by a plain, printed, or fancy



Morris



FIG. 3. DISPATCH DEPARTMENT. A JUNCTION OF CONVEYER TYPES

(By courtesy of Messrs. Herbert Morris, Ltd.)

wrapper. On the outer cover of all, the description of the contents is usually stated.

In the same way that people are sometimes judged by their clothes, so goods may be judged by their dress of wrapping. Hence the great advance which has been made by many famous manufacturers in recent years in providing their wares with well-designed cartons. On the whole, it may be safely said that it is better to be over-lavish rather than "cheese-paring" in the matter of standard wrappings. The provision of preliminary cartons or boxes simplifies the work of final packing for dispatch, for square or oblong boxes are easily made into a parcel of convenient size and shape, or they may be provided with standardized, outer, "fibre-board" cases.

CASES

A general principle, which should, whenever possible, be adopted for final packing for dispatch, is that demanding a range of uniform sizes of outer casings. Recent years have seen the rapid growth of an industry which produces an excellent substitute for the wooden boxes of earlier times. This is the "fibre-board" box. The material from which it is manufactured is remarkably strong, for its weight, and bulky packages, of a hundredweight or over, may safely be sent in it on inland journeys. The manufacturers of these cases obtain certificates from railway and transport companies signifying acceptance of responsibility for damage in transit when cases of relevant design are used for specified purposes. The main advantages of these cases are—

1. They cost less than wooden boxes and, being sealed with gummed tape, require no nails.
2. They are stored flat and occupy far less space than wooden boxes.
3. Their outer surfaces provide valuable space for printed advertisements.

4. They are cheap enough to be non-returnable, thus avoiding the vexation and wasteful expense of organizing the accounting of empties.

No firm which can afford to, and does, value the external appearance of the packages its customers receive, ever makes use of second-hand or shabby cases and packing material. Where wooden boxes, cases, or crates are imperative, proper provision should be made for their construction. If the work is of magnitude the rough carpentering required should be properly planned and mechanical appliances introduced. Circular and cross-cut saws will effect a great saving in wages spent in hand-sawing. A box-nailing machine is faster and cheaper than the lowest grade of youthful labour which may be employed to nail standard boxes together. The boxes produced are sounder, more reliable, and better in every way.

PACKING MATERIAL

A surprising number of different materials are still used to absorb the shocks which packages receive when roughly handled in transit. Hay, straw, and old paper are, however, rapidly being discarded in favour of specially prepared wood. This may take the form of dust, chips, or shavings. The last-named is technically known as wood-wool. It is marketed in various grades of fineness, the finest being almost indistinguishable from paper strips, a material which for packing purposes has also many valuable uses. There is a point about wood-wool which is worthy of note. It may be purchased by weight or by the bale. Unscrupulous purveyors of wood-wool will cut prices and add water to van-loads taken over a weigh-bridge; alternatively, they sample heavy and bulky bales, but, being under no restriction as to the weight of bales delivered, send in a lower average. There is no standardized bale of wood-wool other than the press-packed goods imported from abroad.

Apart from the obviously hygienic superiority of fresh

wood over insect-infested hay and straw, it must be borne in mind that certain overseas countries, amongst which are U.S.A., Canada, and the Irish Free State, prohibit the importation of most packing materials other than wood-wool.

It is not always realized that it is possible to make a parcel which will safely convey the most fragile article without the use of a box. Tests have been made to find the reason for losses in packages containing thin glass-ware. It has been found that corrugated paper used inside stiff "Kraft" paper will adequately protect a thin glass tumbler, providing the same is first tightly nested in wood-wool. Corrugated paper of various weights may be purchased in 50-yd. rolls at surprisingly low cost. It is invaluable material in the packing department.

Brown paper is a commodity of which it is advisable to use good quality. Whether self-cutting roller fittings are installed or not, it will be found that sheets in bales can rarely be dispensed with.

There are several substitutes for string which may well be used wherever conditions permit. For light work, gummed paper strips fed through rapid damping devices are far speedier, cheaper, and more efficient in use than string. For heavy work, metallic tape or wire, fixed and tied by special appliances, undoubtedly provide many advantages, in packing work, over heavy string or sisal cord.

CANVAS

Bagging, baling, and canvas-covered packing provide scope for careful planning in the packing department. Good quality canvas runs into money, and it is wise to keep records of the quantity used on each order. It is wise, too, to adopt some standard marking of canvas. The canvas technically known as "hessian" may carry effectively a stencilled trademark. Any simple device may be rapidly printed by means of a stencil plate at appropriate intervals throughout each

roll of material. Alternatively, hessian with distinctive coloured bands running along the edges or "selvedge" may be purchased at negligible extra cost. Apart from the check which easily identified canvas provides against pilfering and misuse for many unjustifiable purposes about the factory, there is the important advantage of recognizing empty returned wrappings. Good canvas not only makes a respectable-looking package, but it will outlast many journeys. Firms who take some pride in the appearance of the packages leaving their works make a fair charge to their customers for the canvas. The price is usually sufficiently high to secure the return of canvas for which credit notes are given. If plain canvas is used which cannot be easily identified by the customer, there is ample excuse for the return of the worn-out, torn, and dirty rubbish which, if protested against, often leads to disagreeable correspondence, and possibly nullifies all the efforts which have gone into the making of goodwill. The customer may close his account, and the supplying firm rarely resorts to legal proceedings to recover the cost of the canvas in dispute. If it did, it would not be easy to convince a county court magistrate about the identity of unmarked wrappings. Apart from this, losses in canvas costs often turn the small profit of a moderate-sized enterprise into a serious loss. A certain firm before the War sold cotton waste for £5 a ton. It was packed in 1 cwt. bales, the canvas of which cost, and was charged at, 8d. each bale. The net profit on one ton was less than the 13s. 4d. represented by the canvas.

EXPORT PACKING

This is specialized work which should never be delegated to inexperienced packers.

In the first place, shipping companies will not accept second-hand and unsound cases, or cases which are not properly bound with hoop-iron and adequately marked. In

the second place, an overseas customer will speedily object to packages and cases which are not carefully planned to reduce the cubic measurement to the absolute minimum. Forty cubic feet constitute a shipping ton. Any excessive measurement means a dead loss in freight charges. In the third place, packages will not be accepted at the docks unless they are correctly marked in orthodox fashion, in accordance with instructions the customer has caused to be sent to the shipping company (see Chapter VI, Shipping Routine). Failure in any of these three things is bound to cause trouble and pecuniary loss.

Whenever a factory does not possess its own experienced export packing staff, it is far safer to employ the services of an outside export packing firm. If the correct dimensions of the cases required cannot be calculated with assured accuracy by a manufacturing firm, the goods to be exported should be sent loose to be packed. In most towns the construction of export cases is a trade by itself and prices are usually keenly competitive. Packing-case makers are familiar with the correct timber required, the design of cases for every purpose, and with the provision of sheet-metal linings or other requirements of tropical and various markets.

In connection with export packing it is as well to note that many classes of goods are carried at lower rates of freight when packed in crates. Crates, of course, cost less than cases.

RAIL TRANSPORT

The first thing to know about railways is the geographical extent of the system over which each company operates. This information is often not too clearly supplied by the railway companies themselves. They issue maps whereon the rail routes are printed with varying degrees of prominence; but one may easily experience doubts as to which of two or more companies really serves a certain town. Most

railway goods depots will accept traffic for destinations which are on the lines of other companies, but it is important to give traffic whenever possible to the company actually running through to the required destination, otherwise delayed delivery is encouraged. The best method of discovering the most direct route is to consult a general passenger railway guide. The shortest time, of course, represents the shortest route.

The next thing to know is the time at which collections are made by the vans of competitive railway companies, and also on occasion the times when goods trains are made up and dispatched. The times of passenger services are often urgently required, and, for this reason, the dispatch department should contain a person to whom railway time-tables are not anathema, as they are to many people.

Familiarity with railway rates and methods of consignment is essential. In Great Britain the rates themselves are based upon what is called "General Railway Classification of Goods by Merchandise Trains." A copy of this is issued in book form and is readily obtained from every railway company. Between any two points all railway companies are compelled by law to make exactly the same charge for similar goods consigned in a similar fashion. However circuitous the route of one company compared with another, there is no difference in the rates charged. Unlike shipping companies, railways calculate their charges always upon weight, never upon measurement or volume.

The classification covers every description of merchandise. There are, at the moment of writing, 21 numbered classes of goods and 23 groups of goods which are carried at exceptional rates under special conditions, applicable to each group. These groups are signified by letters of the alphabet from A to W. As far as the numbered classification goes, the lower the number the lower the rate per ton. Some of the lower-numbered classes are for consignments of over

2, 4, and 6 tons. The actual money rate per ton for any class between any two stations is not published. This may be ascertained from time to time by inquiry. Every railway goods department knows the rates it has to charge on the various classes for the mileage of the shortest rail route to any destination. Once a money rate has been obtained, it should be recorded for future reference and for the checking of accounts sent in by the railway companies. Any person who is expert at the work may save many times his or her salary in the checking of railway accounts.

Expertness consists of understanding when lower alternative classifications exist, when exceptional rates apply, and when facilities exist which permit of goods being consigned in a particular way. An example of each may well be stated :

1. Alternative classification :

Iron oxide ground is Class 9.

Iron oxide for gas purification is Class 6.

Iron oxide waste is Class 2.

2. Exceptional rates: Castings, iron and steel, Class 17, but certain specified castings are included in exceptional rate list M.

3. The facilities are too many for complete enumeration here, but some are given—

(a) The bringing of a consignment within a classification which covers a heavy minimum weight.

(b) The reduction for the use of privately owned railway wagons.

(c) The acceptance by the owner of risk of damage. (Railway companies cannot evade the risk of loss.)

(d) The use of a "station to station" rate in preference to a "carted and delivered" rate. The "S to S" rate, as it is called, generally applies to a specified quantity per railway truck.

(e) Returned empties are carried at specially low rates. Whether or not cartage is included in the rate quoted

by a railway company should be ascertained. If goods charged at full C and D rates are either delivered or collected by the sender or receiver respectively, a refund will be made at a fixed rate, *if claimed*.

Warehouse accommodation possessed by the railways may often be used, by arrangement, with much advantage. Merchants and others frequently purchase goods which they do not require to handle on their own premises. These may be consigned "to order." Upon arrival, such goods are not delivered to the consignee; a "railway advice note" is sent instead. It states that the goods are being held at the railway goods depot awaiting instructions. If these instructions are not forthcoming within 48 hours, storage rent (or, alternatively, a charge called "demurrage" for railway wagons kept out of use) will be charged. The rate charged may be considerably reduced by application for constant use of the storage facilities available.

The subject of railway transport sketched above is obviously capable of great extension.

ROAD TRANSPORT

The main categories of road transport are—

1. *Parcel Collection and Delivery Service Undertakings* (e.g. Carter Paterson, Pickford, Sutton, etc.). The efficiency of these is well recognized and appreciated. They each offer special individual facilities to meet customers' requirements, which would require too much space to elaborate. Contracts may often be made with economy and other advantages.

2. *Hiring by Time, Distance, or Job*. Cartage firms exist whose business it is to place vans at the disposal of manufacturers and others at short notice. Much may be said for the convenience where it is available, and where the needs of the user are spasmodic. The rates charged, whilst moderate in themselves, are not sufficiently economical as a rule for general and constant use.

3. *Full-time Contract.* Horse-drawn and mechanical vehicles may be obtained by contract. Where the term of contract is of sufficient duration, and the status of the contracting manufacturer warrants it, the vehicles are painted with the manufacturer's advertisement and decorated in any way he desires. The object of this type of business is to provide all that is required, at a fixed price per week or month, to traders who desire to avoid the burden of setting up accommodation, vehicles, and personnel on their own account. Apart from the question of capital, this method provides at least one great advantage where but few vehicles can be kept constantly at work. Difficulties due to breakdown are reduced to the minimum, and no expense and handicap are experienced when extensive repairs and overhauls to vehicles are in progress. The cost of a contract per vehicle rarely exceeds what true all-over annual cost would be of maintaining and running a vehicle owned outright. The driver usually attends the works at opening time, takes instructions from the works authorities, and is subject to the usual works discipline.

4. *Owned Transport.* When the volume of trade so warrants, the establishment of a transport department may become imperative. Until it does it is safe to say that one or other of the foregoing is preferable to the ownership and maintenance of a single vehicle. Where single vehicles are possessed, there is usually some special reason for the practice.

In considering the acquisition of road vehicles it is as well not to decide blindly upon the ubiquitous petrol motor, despite the superiority for general purposes which is evident from its present overwhelming numerical preponderance. Under circumstances where empty and full vans have to remain at rest for many hours, it is often far more economical to rely upon horses. They may be changed from vehicle to vehicle as haulage is required. For intermittent haulage

over short distances mechanical tractors are sometimes used with advantage.

The steam wagon has many advocates where loads are very heavy or of unusual dimensions. Whilst this type of vehicle does not appear to commend itself for short, quick journeys, the advantages of steam over internal combustion engines should be known by all who accept the responsibility of organizing a transport department. Similarly, the electrically-propelled vehicle possesses many features which satisfy particular needs. It is outside the scope of this book to enter into detailed comparisons; all that it can do is to suggest that knowledge of the merits of the various types of mechanically-propelled vehicles is essential before choice of any one type is made.

CANAL TRANSPORT

Wherever inland water transport facilities are within reach, it is as well to become thoroughly acquainted with the possibilities they offer. Often they are neglected, where they could be of great service, merely because no person has taken the trouble to make inquiries. Freight rates are always much below rail rates; for full barge-loads of bulk goods the cost of transport by canal is generally but a mere fraction of the rail cost. The duration of time in transit is, of course, longer by canal than by rail, although, for journeys of below a hundred miles or so, the difference in time is surprisingly small. Apart from this, canals can be used freely for traffic where a few days, or even weeks, occupied in transit are of no consequence. For certain types of merchandise, the jolt-free running is an important consideration.

COASTWISE TRANSPORT

It is often not sufficiently well appreciated that coastal steamer services exist between ports, and that their use may

provide a considerable saving in transport charges. Many firms trading in bulk cotton products in London, for instance, obtain, by use of cargo steamers, an advantage over less enterprising competitors who send goods from Manchester by other more expensive transport.

CLERICAL WORK

The preparation of the documents necessary to the delivery of goods has been dealt with briefly in Chapter II. The consignment note itself deserves a few further remarks. If, instead of maintaining a stock of the blank forms supplied by the local agents of transport companies, a standardized form of consignment note is used for all, there will be several advantages. In the first place, it is necessary to print on this form two things—

1. That it replaces the usual consignment note issued by the carrier and acknowledges acceptance of all the conditions printed on the usual forms.
2. That a copy of it has been submitted to and accepted by the carrier.

The standardized form may then be ruled to provide information better suited to the products of the factory, and thus be more individualized than are the forms issued by transport companies to all traders alike. The form may, indeed, be a carbon copy of the invoice (unpriced), or of the order itself. The special blanks necessary to make it into a consignment note are provided for the following—

1. Weight, measurement, and number of packages.
2. Freight rate.
3. Total amount of carriage charge.

In addition to these it may be backed by a duplicate copy to be retained by the sender. This duplicate receives the signature of the employee of the transport company who accepts the goods. It is provided with blanks for particulars, which serve as a good check upon transport charges and

which assist very simply in the recovery of charges, either from the customer or from the transport company. The information carried in blanks on this duplicate is—

1. Date of transport account.
2. Date and initials of checker.
3. Date paid and amount of payment.

Since it is not the custom of transport companies to furnish separate accounts for each transaction, but to send a list of charges periodically, it is important that each transaction appearing on such a periodical charge sheet shall be readily identified. Should it so happen that because of delay in payment or for any other reason, more than one account is sent in by a transport company which includes identical items, there will be some danger of paying again items already paid. By the proper use of the system suggested, this risk is considerably reduced. Each item on the periodical account is marked with the reference number of the duplicate of the consignment note. This may be the original order number, or one of a separate series of numbers.

ROUTING DELIVERIES

The routing of deliveries applies particularly to road transport, and is necessary where trade runs to a considerable number of daily parcels. It is necessary to plan in miniature an arrangement similar to that used in a postal sorting office. This may be done on paper in the preparation of carriers' sheets, but, unless the rotation of the deliveries listed on these sheets is followed by the physical arrangement of parcels, much confusion will result. Whenever the volume of trade is of fair magnitude it is essential that routed deliveries shall be made up well in advance of the appearance of the empty van, otherwise vans and their attendants will waste time. The latter are apt to show their impatience by being excessively obliging in the matter of searching for parcels which lie on their own rounds. They are careless of parcels

whose destination is of no interest to them, and these are tumbled vaguely in all directions, with resultant confusion.

The principle to be aimed at is to mark dispatch department floor space into divisions, each of which will accommodate a full load for each van. The routine work becomes one of getting into the respective divisions all the parcels received from the packers prior to the arrival of the empty van. Delivery sheets can be made up from a physical survey of the parcels and delivery notes sorted out for attachment to each sheet or for the carman's wallet. An experienced man will not write delivery sheets as straightforward lists, one entry on each line. He will make provision for urgent orders and for orders received subsequent to the making-up of the list. He may write on alternate lines, or where deliveries are known by him to be miles apart he may leave several blank lines. He may even seek knowledge of any orders on hand which are destined for addresses along the route which for the moment is blank. He will endeavour to urge goods from the warehouse to fill the gaps. If, as frequently happens, certain routes are not covered daily, an intelligent routing man may often enhance goodwill by getting goods forward in this way to customers who might otherwise have to wait as long as a week for the next delivery in their district.

URGENT ORDERS

When a customer says an order is urgent, it is good policy to believe him. It is not sufficient, however, merely to type-write the word "urgent" on the set of order papers and leave it at that. The best method of giving effect to urgent instructions is to provide special printed slips (these slips merely state the order number and are usually printed in brilliant red), which are handed separately to the people most capable of dealing with them. The most important of these people is in the dispatch department. He should

be given authority to make inquiries throughout the premises and to require immediate answers to these inquiries. If the order is for an article not in stock the second urgent slip goes to the progress or order-chasing department (see Chapter I); otherwise the warehouse man has it, attaches it to his order copy, and sends the goods with it post-haste to the packing department.

CHAPTER IV

THE INVOICE

METHOD—Cost of invoicing—Book-keeping—Mechanical ledgers—Promptness and accuracy.

To those readers who may not be familiar with the system of duplication of orders, invoices, and other documents referred to in Chapter I, a little clarity will perhaps be welcome.

All the different purposes served by the statement in writing of the details of orders were presented in the form of a list. Of the twenty-two items included in this list note was made that five required further discussion in this present chapter. They are—

No. 16. Invoice.

No. 17. Day book copy.

No. 18. Traveller's copy invoice.

No. 19. Commission clerk's copy invoice.

No. 20. File copy.

It is not possible to lay down any hard and fast rule governing the manner, time, and place of preparing these five copies, which will satisfy the needs of every manufacturing business. Broadly speaking, the full list of twenty-two items falls into three groups—

1. Notifications which precede and aim at getting the goods produced, collected together, and deposited in the packing department.

2. Instructions and documents relative to packing, dispatch, and reception by the customer.

3. Documents concerned with the financial aspect of a transaction.

In some firms papers relative to these three groups are typed separately; in some they are divided into two separate

typings, in others they are all hectographed at once. Under some circumstances they may be produced automatically as part of a mechanical book-keeping system, or they may even be handwritten. It is permissible to group the writing of all the forms required into any number of separate operations, and to combine in any one operation whichever forms are found to be most suitable to the conditions of the individual firm. This chapter is concerned with the first five forms, Nos. 16 to 20, which make up the financial group 3. Whether they are typed together as a small set of five documents, or whether their typing is combined with that of some of the other documents, is of no particular consequence here.

Before proceeding to make a plan of the method recommended for the invoicing of goods sold and delivered, it is as well to have a clear understanding of what it is the method is desired to achieve. The objects may be stated thus—

1. To inform the customer in detail of the value of goods for which he has to make payment.
2. To provide evidence of the transaction which satisfies legal requirements.
3. To provide duplicate records of the transaction.
4. To provide all the above as quickly and as inexpensively as possible.

The first of these objects is fulfilled by the invoice itself; the second, by the day book; the third is covered by the copies required for travellers, commission clerk, filing and statistical purposes. The fourth object is fulfilled by the method itself.

METHOD

The main advantages of the method outlined below are speed and economy. Speed is achieved by so arranging routine work that the invoice is written well in advance of the time when the goods are dispatched. Economy is

based on comparison with other methods in which the main factor of cost is the time occupied in clerical work.

The set of forms of which the invoice is the master are typed together through carbon paper. The column devoted to prices is filled in on the invoice, but these prices do not appear upon any copies contained in the set in which cash values are either of no consequence or are definitely undesirable. The removal of sheets from the typewriter when the prices are typed on the invoice can be avoided, either by the use of narrower carbon paper for these sheets, or by having them cut narrower than the invoice.

When the list of goods which are included in the transaction is complete, the set is removed from the typewriter without any extension of the prices with values calculated to give the cash amount of each item. For example: 6 gross pens at 4s. gross is not worked out at £1 4s. The working out, or extension, as it is called, is omitted in the first instance. The sets are now partly broken down by the removal of any sheets which are not concerned with the financial, book-keeping, or accountancy side of the transaction. The sheets remaining unremoved are laid aside, still interleaved with carbon paper. This is all that can be done before the exact quantities of goods dispatched are definitely known.

If, as is usually the case, the invoice so far discussed is an exact copy of the order, it is necessary that the quantity of each article required should be typed in a column headed "Quantity Ordered." Another column should be provided with the heading, "Quantity Delivered." It is usual, also, to print boldly at the foot of the invoice—

"ITEMS NOT EXTENDED AND BALANCES TO FOLLOW."

The warehouse department sends a copy of the order to the invoice clerk. This copy states the exact quantity of each item sent to the packing department. This is the

information required to release the invoice. It remains only to fill in the "Quantity Delivered" column, to extend the values, to fold and insert the invoice in a "window" envelope and to post it.

Sometimes an indication can be given on the invoice of the length of time which is likely to elapse before out-of-stock items can be delivered. This is achieved by the provision of a marginal space on the left-hand side of the invoice, against each item. The dates are filled in by reference to the works copy of the order as previously described.

After the invoice is completed, the remainder of the set is broken down, and the separate forms are sorted and distributed to the destinations indicated by their nature.

COST OF INVOICING

There is nothing to be gained from the consideration of the bare cost of a single form, a single envelope and a single halfpenny stamp. Manufacturers to whom invoicing cost means no more than this have no need as yet to delve very deeply into problems of planning. The cost which, however, is worthy of consideration comprises a list of every item of ascertainable expense which is incurred in connection with the clerical work occasioned by a transaction. The problem is of particular interest to manufacturers who are forced by competition or by other circumstances to accept orders of low average value from retailers. There are many trades where the average value per invoice is so low as to be almost incredible to those who are engaged in industries where each sale runs into serious figures. In a certain trade the average value of an invoice may often not exceed forty shillings. If the net profit made by a manufacturer engaged in this trade is 10 per cent of his entire turnover he may not be regarded as unsuccessful, particularly in times of depressed trade, when manufacturers are often thankful to be able to make any profit at all. Such a manufacturer then may

regard each invoice he sends out as being worth the four shillings net profit it will bring in. Wherever a manufacturing concern permits all the written work to be done separately, the real cost of it may well run into shillings per transaction. It is no uncommon thing for as many as twenty writings to be performed separately. If trade is so depressed that net profit works out well below 10 per cent, as unfortunately it often does, then the cost of badly organized clerical work may not only cut seriously into profit but may occasion actual loss, which proper attention to this problem could avoid. It is for this reason that the question is stressed in these pages.

The best way of calculating invoicing costs is by taking bulk figures over a fixed period and finding the average cost of a single invoice by dividing the total expense by the total number of invoices issued in the period. The following is a fair example based on experience—

COST OF 1,000 INVOICES		£	s.	d.
Two sets each of 9 forms at £7 per 1,000		14	—	—
Wages: (2 typists at 50s. per week can cope with 50 orders per day each = 600 for 100s.)		8	6	8
Wages: Stores and production records, say		4		
Envelopes			3	6
Stamps			1	8
Carbons, ribbons, typewriter maintenance and depreciation, say				
Office overheads: (rent, light, heat, etc.)				
Total		<u>£30</u>	<u>11</u>	<u>10</u>
Average cost per transaction: 7½d.				

Although a person who thinks only of the bare cost first mentioned may be astonished at this figure, it may be accepted as a low one, to be achieved only by careful planning.

It is apparent from the foregoing that any separate writing of the entire order may cost anything above, say, £8 per thousand for each writing. This works out at almost 2d.

for each transaction in bare cost of clerical wages. Add to this the greater cost of forms specially printed, which cannot be less than one-ninth of £7 per 1,000, and consider that the reduced speed of hand-work and transfer from one desk to another must be paid for in clerks' wages, and then it will be seen that the method outlined cannot fail on the ground of economy.

On the question of speed it is obvious that, since the separate writing must consist entirely of copying, the document being transcribed must be at rest during the process. It will be seen, therefore, that considerable time must elapse before all written work is completed. These delays form quite a different consideration from that of the laxity which often exists in the mailing of invoices, for they are delays which hinder the earliest possible receipt of goods by the dispatch department. Liability to error also is increased in repeated hand-copying.

BOOK-KEEPING

It is now necessary to consider the connection with the accounts department entailed by the method advocated.

The account department will receive batches of day-book copies of the invoice. These will have been extended and totalled and, in fact, will be exact copies of the invoices as received by the customers. All these forms are numbered in rotation as they are first used by the typists, but the numerical order of the day-book copies as they are received by the accounts department will be very irregular, for the reason that the rotation in which orders are executed depends on stocks, production, and other circumstances which have no relation to the sequence in which the forms are issued.

The accounts department is that most suitable for safeguarding the firm against failure to enter all debits against customers' ledger accounts. For this reason, it must adopt

measures to satisfy itself that every numbered form is accounted for and disposed of properly.

Where sets of forms are spoiled or cancelled, the day-book sheets must, nevertheless, be passed to the accounts department, who will file them in their numerical order.

The first duty of the accounts department is to enter the total of each invoice in the ledger to the debit of the customer's account. The ledger entry should show the number of the invoice. The invoice should be marked with the number of the page in the ledger in which it is entered. Day-book copies should then be bound in suitable book form. Before, however, the copies are placed in a permanent binder, it is a good plan to keep them for a time in a file of the "pillar" type, where they may be more rapidly interleaved with copies bearing numbers missing from the series, and indicating that delay has occurred in the execution of the orders. This file may be periodically transferred to the permanent binder, note being made of numbers still missing.

MECHANICAL LEDGERS

So far it has been assumed that ledger entering, or "posting," to give it its technical name, is carried out by hand, and that the ordinary type of bound or loose-leaf ledger will be used. That this work should be accurate is very important from the standpoint of the manufacturer and that of the customer. Figures entered in a ledger represent money, although they may not look quite as tangible and impressive as a corresponding array of coins or bank-notes. These ledger figures must be, indeed, transferred into tangible cash in a month or two, to enable the manufacturer to carry on his trade. Ledger work should be as impervious as possible to human error and to the possibility of falsification. In other words, the liability of human frailty may with advantage be curtailed by the use of machines. This is the main basis upon which rests the claim for the replacement of hand

by mechanical ledgers. That they save time and possess other advantages may be gathered from the brief description which follows. Time-saving as well as accuracy is of value to the customer, and hence to the building of goodwill, the objective of this section of the book.

There are many variations which may be introduced into a mechanical ledger system. The principles alone fall within the scope of this volume and are fairly consistent.

The machine itself consists of a combination of a typewriter and an adding machine. Unlike an ordinary typewriter, this machine prints upon a flat surface underneath instead of against a roller ("platen") mounted in the machine itself. The ledger-writing machine is mounted in a framework which serves two purposes: first, it holds the ledger page upon guides, enabling it to be moved in the direction which makes a line from the top to the foot of the page; second, it holds the writing and adding machine in such manner that it may travel across the pages at right angles to the first movement noted above. It is thus possible to print anywhere on the page. Carbon-paper copies of the written work may be obtained for two or more purposes; firstly, for analysis, secondly, for writing monthly statements, and, further, for the satisfaction of special requirements.

In some systems ledger pages remain fixed in binders; in other systems they have to be fed loose into the machine.

Machines are fitted with a number of independent adding units called "registers." By the manipulation of a lever, a master register may be caused either to add or subtract. Each register is used for one column of money figures in the ledger.

The usual method of making an entry commences with setting in one of the registers the amount of balance outstanding without printing it on the ledger page. The entry is typed in its appropriate column. The new balance is then shown by the machine, which automatically adds or

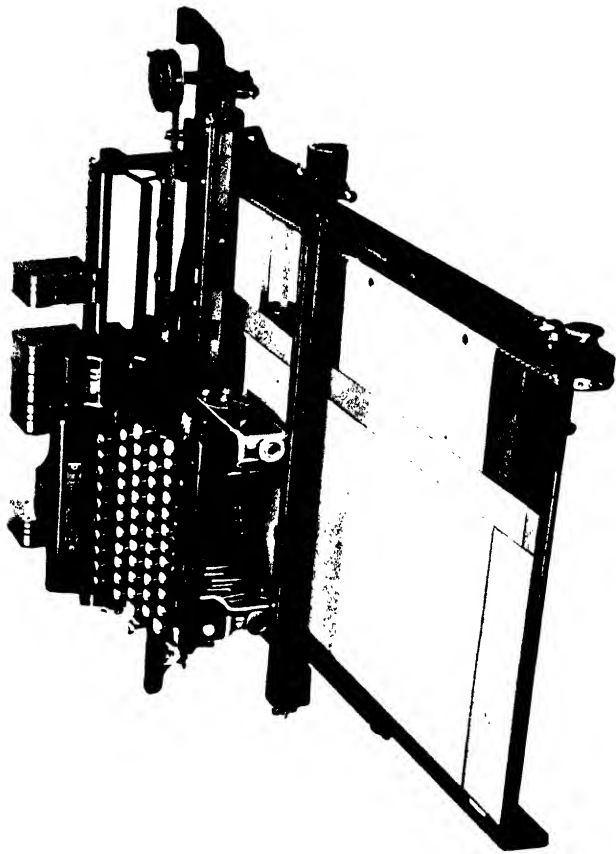


FIG. 4. THE ELLIOTT-FISHER UNIVERSAL ACCOUNTING MACHINE
(By courtesy of Messrs. Underwood Elliott Fisher, Ltd.)

subtracts. This balance is printed in another column. The net alteration to the total of all the entries made is recorded on still another "register." It therefore follows that all accounts are perpetually balanced, and the work of taking out a "trial balance" merely consists of listing and adding all the balances; this is done separately in the machine. The accuracy of entering any batch of documents may be readily checked by noting the commencing and ending total shown and then by running the figures of the series through the machine rapidly.

If, as is usual, ledger pages are interleaved with "statement forms," the document which is sent to the customer at the end of each month to inform him of the date and amount of each transaction is produced at the time of entry. The statements are withdrawn from amongst the ledger pages at the end of the month, and there is no tedious special work, involving delay.

The system outlined may be elaborated to cover many of the intricacies of accountancy which are outside the boundary of the subject of production planning for sales and goodwill.

PROMPTNESS AND ACCURACY

Although these have already been stressed, it is felt that no emphasis can be too great. Excellent production is far too often damaged by slipshod office methods. The quality of goods may be unimpeachable, their packing may be good, deliveries may be made at the proper time; but all these a customer may be able to get from several competitive sources. If that customer suffers constant irritation from any one of those sources, by delayed invoices, inaccurate calculations, and statements which do not show the latest and correct position of his account, he will cease to buy from that source. All the pains taken in the planning of production will be wasted as far as that one customer is concerned.

But if one customer is dissatisfied in this way, it is probable that the inferior work causing the trouble enters into all the transactions of the manufacturer. The total handicap suffered by this manufacturer cannot be estimated. If he doubts the truth of these remarks let him confer with a departmental buyer of any great retail store.

CHAPTER V

CORRESPONDENCE

INWARDS—Outwards—Filing—Alphabetical and numerical systems—
Status reports—Telephones—Telegrams—Cables.

IT is often insisted upon that the opening of the incoming mail shall only take place in the presence of the executive head of the business. That such a person should make this rule is a sign of defective planning. It means either that he has little confidence in the people he has selected to serve him in his business, or else that he has no understanding of the delay and inconvenience attendant upon this arrangement. Unless he is one of those employers who are as meticulous in the matter of early time-keeping as they were, or ought to have been, in the days of their youthful entry into the world of industry, the losses of time will be the minutes he is late multiplied by the number of clerks (and some others) employed.

INWARDS CORRESPONDENCE

The best plan is to delegate the power of opening letters to a trusty and punctilious senior employee and to make it an honour for one or two juniors to attend at a sufficiently early hour to assist him for all the mail to be opened and sorted before the regular time for commencing office work. Letters and all other documents should be opened by a junior and stamped with an official date stamp. They should be passed to the senior who scans them to discover the department concerned. They should then be sorted into baskets, either bearing the names of individuals or classified more or less as follows—

1. Orders.
2. Sales correspondence.

3. Accounts.
4. Cheques and other forms of payment.
5. Purchasing correspondence.
6. Other letters which may be further subdivided.

The head of the business, when he arrives, sometimes requires all departmental chiefs to attend in his office to discuss the outstanding features of their respective correspondence. Sometimes this conference becomes protracted; members of it, who are not concerned with points absorbing much time, are impatient to get away and to commence their daily work; typists, book-keeping clerks, and others are idle.

It is a far better plan for the principal to dispose of that of his own correspondence requiring no more than casual consideration, as the first item of his daily work. He will then be able to visit his subordinates, most of whom he will find engaged in dictating replies upon commonplace matters. His own mail will probably contain matters which will require discussion. These letters he can take with him. They take the edge off the feeling of being supervised which always makes a good departmental chief mildly uncomfortable. This, however, is a very minor point; the main object is served when the departmental man produces the documents he has set aside for discussion with the chief. Typists to whom dictation is being given take the appearance of the principal as a sign for them to disappear. They go to their machines and start the letters already dictated. Thus, no time is lost. If departmental chiefs do not possess private rooms, or are so situated that there is noise, or discussion is overheard, it is probably better for them to be called into the principal's private room, one at a time.

Correspondence to which straightforward replies can be given without prolonged consideration should be disposed of first, by departmental chiefs. Other letters should be placed in one of two groups: (1) The matters awaiting discussion with the principal, and (2) the matters which entail

investigation. When the straightforward work is finished, investigation can be set going. Files may be required, references to other departments may be entailed, or members of works, warehouse, and other physical departments may have to be interrogated. Inquiries of this kind should be dealt with together. If, for example, there are several letters asking about dates of future deliveries, they should all be dealt with at one interview with the appropriate works official. This person should be discouraged from furnishing replies to the queries one at a time.

OUTWARDS CORRESPONDENCE

It has been truly said that the correspondence of a firm is its cheapest advertisement. Yet, how often are letters received which, although they may not always be, as alas! they sometimes are, quite a disgrace to the sending firm, nevertheless fall far short of the possibilities of building and maintaining goodwill, offered by well turned-out letters.

The days when elaborately printed letter paper could be relied upon to provoke admiration have departed. Simplicity of design and high quality of printing and paper make a stronger appeal.

It should be almost unnecessary to state that any letter carrying an impression of the standing of the sending firm, where there is any prospect of its being of value, should be free from unsightly corrections of typescript. Some firms make it a rule to destroy all imperfect letters; others permit one and even two neat alterations.

The lay-out of a typewritten letter must be made attractive. It often does not occur to a correspondent that a brief lesson given by him to a typist will be time well spent, both in the interests of the firm and as an act of kindness to a young woman who is doubtless anxious to please. If quarto, the usual size, letter paper is used, it is a good plan to extend the printed heading to within about $1\frac{1}{4}$ in. of

each edge of the sheet. The typewriting, by following the same margin, will make a neat block of wording. If the space between the top of the sheet and the printed heading is about $\frac{3}{4}$ in., there should be about double this space left plain at the foot of each sheet. This arrangement presupposes that single spacing between lines and double spacing between paragraphs will be used. Whenever double spacing is used throughout, the margins may be considerably less. Double spacing, except for letters of very few lines, does not lend itself to effective arrangement on quarto, trade letter paper unless the printed heading is comparatively small.

Letters should be signed in ink in clear handwriting. If it is the custom to sign only by initials all fancy flourishes should be avoided. There is no excuse for the affectation of illegible signatures. The name is there for a purpose and every one can write his name with at least reasonable clearness if he makes up his mind to do so. The habit of having the name typewritten beneath the signature is deplorable; it amounts to a confession of either: "I am incapable of writing clearly," or "I am too grand to be bothered." Rubber stamp facsimile signatures should never be used. Circulars and other letters which the proper person is unable, or does not desire, to sign should be signed with his name over the initials of the actual writer.

Regular times for signing letters, to correspond with outgoing mails should be instituted and regarded as important engagements. Similarly, it must be laid down as important that typists should deliver their finished work to meet these engagements.

The question of envelopes is debatable. There are three main choices—

1. Plain envelope addressed by typist.
2. Plain envelope addressed by hand.
3. Window envelope.

The first presents most objections. An envelope is an

awkward thing to keep in place in a pile of letters which pass through several hands. There is a danger of placing letters in wrong envelopes. Several letters may be sent by the same post to one destination with consequent waste of postage stamps. The window envelope is safe and economical, but necessitates a special folding of the letter which often spoils its appearance and, at best, the window envelope is itself not very sightly.

The plain envelope addressed by hand is perhaps the best, though rather costly in clerical time. Its use necessitates the provision of persons with quick and clear handwriting who can leave their regular work at post times. They write the envelopes and put aside larger ones for those regular correspondents who usually receive several communications. When they meet a letter for which an envelope has already been written, they notice it and include the two letters in one cover.

The fastening of gummed envelopes is aided by the use of appliances the elaborate nature of which will vary in proportion to the volume of work. The same remarks apply to automatic stamping devices. It is essential that postage stamps should be accounted for by the entry of every item in a postage book. This serves the additional purpose of providing evidence that a letter was or was not posted to any intended recipient who denies receipt of it.

FILING

It is imperative to the efficient conduct of modern business that documents should be found very quickly when reference to them has to be made. Much thought and inventive genius have been lavished upon the provision of facilities for this purpose, but many firms still adhere to old-fashioned and cumbersome systems of filing.

An efficient system is that outlined below.

Each letter sent out by the manufacturer is copied on cheap, thin paper in the typewriter. This copy is usually

fastened to any letter to which it is a reply. If it is a copy of an originating letter (that is to say, a letter which first opens correspondence with someone outside the firm) it is not usually filed until a reply is received.

Correspondence for filing is usually collected by a junior, whose first task is to sort it into alphabetical order. Correspondence between a manufacturer and people who are well known to him is kept in special files devoted one to each correspondent. Other correspondence is filed alphabetically. It is probable that no cheaper method of filing exists than that provided by vertical filing cabinets. The reason for this is that the actual receptacles may be plain sheets of stiff paper folded across the middle, with or without clips for fastening the letters contained; another reason is that the space occupied is far less than that of any method where files are kept on shelves. The cabinet consists of a set of drawers made to accommodate the folders when arranged upright with the middle fold at the bottom of the drawer and the open edges at the top. A device is fitted at the back of each drawer to keep the folders in an upright position.

There are many excellent methods of classifying folders, so that any one called for may be quickly extracted from the cabinet. All these methods are based on one, or a combination of more than one, of the following—

1. *Alphabetical Classification.* Each letter of the alphabet is provided with a stiff guide card. The initial letters of the names of correspondents determine the guide cards behind which their correspondence is filed. Where this system is used to cope with a large volume of correspondence, subsidiary guide cards subdivide each letter of the alphabet into groups showing the first vowel in the name, or even more elaborately to give some hundreds of subdivisions to the alphabet.

2. *Numerical Classification.* Each correspondent is provided with a folder bearing a numeral which is reserved

permanently for him alone. His name and file number are recorded on an index kept adjacent to the cabinet. (The visible strip index is much to be preferred to an ordinary book or card index for this purpose.)

3. *The Alphabet and Numerical System Combined.* Here there is no need for a separate index. Each alphabetical guide card is backed by a range of numbered guide cards. Written on the alphabetical card itself is a list of the names of the people to whom are devoted the numbered files placed behind each alphabetical guide card.

There are one or two rules which may be adopted with advantage in connection with filing.

(a) To use one system only throughout the works and offices.

(b) To use foolscap instead of quarto equipment. Otherwise, documents larger than quarto will need folding and space will be lost. The initial extra cost is insignificant.

(c) To make one person alone responsible for putting material *into* each section of files. Any one may take it out, but any letter replaced in the wrong folder may be regarded as destroyed, since a search for it is almost hopeless.

(d) To file in its place a note stating the temporary whereabouts of anything removed from the files.

STATUS REPORTS

Knowledge about the financial standing of customers must be obtained and recorded. It is customary to require trade references from unknown people and firms who order goods. Sometimes these are difficult to obtain, or the information supplied by referees is vague and meagre. Sometimes, firms who open business involving credit for small amounts suddenly place a large order and the manufacturer feels doubtful about the wisdom of trusting the buyer to the extent of a large amount of money.

Confidential information about the financial standing of

all traders is supplied by agencies that exist for this purpose and for the purpose of collecting debts for which the manufacturer fails to obtain payment. The reports issued by these status inquiry agencies often state a reference number instead of the name of the trader concerned. A suitable method of locating all documents of this kind is that of gumming them to the inside of the filing folder devoted to the relative name.

Credit limits based on these reports are generally marked on the ledger pages. If credit required exceeds the limit or the customer develops a tendency to become slow in making payment, fresh inquiries are made, and the later reports are superimposed upon the old.

TELEPHONES

The handling of telephone traffic forms no small item in planning for sales. A telephone service left to take care of itself may create in customers' minds an impression equally as unfortunate as weaknesses already discussed. It is a curious fact that some people possess a peculiar aptitude for telephone work, whilst others cannot use the apparatus without causing exasperation at the other end of the line. The provision of a person of the former type to receive incoming calls is important. There is a definite formula to make a pleasant opening which may become almost a greeting. An inflexion of voice may well take the edge off the anger of an impatient caller who has grown weary of waiting to hear the welcome name of the manufacturer. It is unnecessary to conceal this name; it is usually printed somewhere about the building in enormous lettering for all to read! Yet telephonists sometimes guard it as a secret until they have insisted upon knowing the name of the caller.

There is a tendency in large towns to make too frequent use of the telephone. For all except urgent matters it is

wise before using the telephone to consider whether a letter would not serve the purpose. The points are—

1. Will the message be too late to-morrow morning?
2. Is there an advantage in putting it in writing?
3. Is there sufficient justification for interrupting a busy man?
4. Should our line be blocked by this call?

There is not much difference in cost, as between a telephone call and a letter, but the telephone bell for some mysterious reason is allowed to interrupt everything; when it does so unnecessarily it gives annoyance.

It is wise also to tie a pencil to every telephone. A scrap of paper is easier to come by in a hurry than is a missing pencil.

TELEGRAMS

Telegram service is considerably expedited by the use of the facilities provided for sending and receiving over the telephone. Under these circumstances, care must be exercised on the following points:

1. That written copies are made, and treated with respect.
2. That charges are properly recorded.
3. That the operator takes great pains that no mistake in the wording occurs. The calling-over of all telegrams and the spelling of doubtful words and figures are imperative.

CABLES

The subject of coding is far too large for adequate treatment here. As a principle for adoption in most businesses, the study of any standard five-letter code book will be well repaid. If it is supplemented by the careful use of blank words included in the book, cabling costs can be greatly reduced. The five-word code is, of course, far more rigid than the ten-letter system, but these deficiencies may be overcome if all overseas senders who are in frequent communication are circulated with private code words. It is

surprising how few are required to cover the special needs of most businesses, yet all code books contain thousands of blanks.

It is as well, too, to become acquainted with the nearest office of a large cable company. Information may be obtained about many exceptional facilities, and the free registration of cable addresses should not be neglected.

Much money is frittered away because this subject is not sufficiently well considered. Overseas trade has many advantages which may easily be lost by inefficient use of the cable.

CHAPTER VI

SHIPPING ROUTINE

CLERICAL work—Shipping note—Customs entry—Invoicing—Obtaining payment.

IT is not suggested that the subject of production planning should be so extended as to include a detailed explanation of the routine work necessitated by shipping transactions. But in so far as the proper carrying out of this work affects the preservation of goodwill, it has been deemed advisable to sketch in general terms the manner in which the formalities connected with the export of goods may be incorporated in the plan which hitherto has been confined to home trade.

The routine work to be considered is distinctly that of a specialist. It is not particularly difficult or beyond the power of a clerk of intelligence and enterprise to learn. It is unwise, however, to permit an inexperienced person to handle transactions until proficiency is gained in practice under qualified supervision. The reason for this is that failure to attend to an insignificant detail is almost certain to cause serious loss. This loss may not only be financial but also may entail the sacrifice of an export market that is often far more profitable than the trade of hundreds of home buyers.

For the reason stated, it is unusual to incorporate the work with that of the dispatch department discussed in previous chapters. One of two methods is recommended—

1. To employ an outside firm of shipping agents.
2. To employ a qualified specialist as a member of the permanent staff.

Where the volume of export trade is insufficient to warrant the second alternative, the first is far preferable to the attempt which is often made to muddle through the routine

somehow, with the assistance of a clerk or two having only a "rough" idea of what is required.

It is far from the intention here to confirm the notion, so commonly held, that mysterious rites exist. The following brief explanation should serve to explode this misconception, but too much emphasis cannot be laid upon the qualification that the information given below is set out only for the purpose of showing what work has to be incorporated in the general plan. This information is quite inadequate as a guide to the work itself; it should not be used in place of prolonged study and training. There are many excellent books devoted entirely to this subject.

The work required may conveniently be divided into two sections: (a) Matters relating to shipment. These can be attended to by an outside shipping agent or by the "Forwarding Department" of the owner of the ship carrying the goods. (b) Matters relating to finance. These cannot be attended to entirely outside the firm manufacturing or supplying the goods shipped. An outside agent can, however, examine the documents and advise upon their formal correctness, but he cannot, of course, have any knowledge about the method of calculating prices and values.

Before proceeding to consider the complete routine which must be covered when it is all carried out by direct employees, it is as well to dispose of the simpler arrangement whereby the outside services of the shipping agent are engaged.

An order obtained from abroad will indicate, as a rule, certain detailed instructions which the buyer desires the supplier to follow. For example, certain symbols called "shipping marks" will be given. These are usually initial letters of the buyer's name arranged in or around some simple device of straight lines. They permit of speedy recognition of the goods, and save many writings of the buyer's full name and address. If no mark is given, the

supplier should invent one. The route to be used, the method of packing, the nature of insurance required, the quantity and method of drawing up bills of lading, the manner in which invoices and "certificates of origin" are to be provided, the way in which payment is to be obtained and other matters may be stated on the order. If the supplier does not know how to comply with such requirements, a shipping agent will readily assist. In many cases, buyers abroad are so well aware of the danger of entrusting this work to the hands of suppliers that they themselves appoint an agent in the exporting country to safeguard their interests.

If, as is quite common, the supplier upon receipt of an order gets into touch with a shipping agent, the first question asked is, "Are the goods in stock?" When the goods are ready for shipment the shipping agent will advise the supplier as to the method of packing, and will notify him of an address to which the goods are to be dispatched. Under such circumstances, the supplier has so far embarked upon no routine work other than that which has been described in earlier chapters.

CLERICAL WORK

Whenever it is desired to incorporate in the planning of production arrangements which will enable a manufacturer to keep within his own hands the entire routine work entailed by export sales, he or his employees must be facile with the technicalities now stated.

There are two principal methods of fixing the selling prices of goods in overseas markets: (a) Free on Board (F.O.B.) prices correspond with the "carriage forward" prices of the home trade; (b) Cost, Insurance and Freight (C.I.F.) prices correspond with the "carriage paid" prices of the home trade. The routine work of shipping will be affected by the use of either of these.

When an order is obtained from abroad, and it is known

that the goods are ready, or how soon manufacture will be completed, the first step is to ascertain the name, date of sailing, and place of loading of a convenient steamer. In shipping circles this steamer is referred to as an "opportunity." Paper-covered handbooks, like railway time-tables, are published weekly and monthly and provide the simplest means of discovering "opportunities."

SHIPPING NOTE

This is the first document required and is usually a printed form supplied in blank by the shipowner. It is sometimes necessary to obtain the initials of a representative of the shipowning firm upon the form when it is completed. This form is merely a notification to the people (called wharfingers) who receive the packages intended for shipment. In other words, it is a delivery note to provide a record to account for the ownership of the goods. This note is retained by the wharfinger who gives in exchange for it a *wharfinger's receipt*. This document is, in turn, exchanged by the shipowner for a more important-looking form bearing a 6d. impressed revenue stamp; this is the *bill of lading*. The only existing legal title to the goods represented on a bill of lading rests with the holder of it, and such goods will only be surrendered by the captain of the ship, upon the production of the bill of lading at the port of destination named. Apart from this, the bill of lading sets up a contract between the shipowner and the owner of the goods. It states the conditions upon which the goods are conveyed and, in doing so, usually makes it very clear that the shipowner's responsibility for the safety of the goods is considerably limited. It is thus usual to insure the risks which the shipowner repudiates in the bill of lading.

Each shipowner designs, and causes to be printed, a bill of lading peculiar to himself. If he carries goods regularly to a number of different ports, he will often adopt a change

in design and wording for each port. The blank bill of lading forms are sold by stationers in the neighbourhood of shipping offices. They may be purchased both with and without the impressed 6d. stamp.

Bills of lading are usually prepared in sets of two or three stamped copies, and one or two unstamped copies relative to each shipment. At least one unstamped copy is demanded by the shipowner for the use of the captain of the ship. If, as is most usual, three stamped copies are provided, one of them is retained by the supplier to be used should emergency arise; the other two are sent by fast mail steamers to the consignee. Every effort is made to secure the arrival at the port of destination of at least one copy before the slower cargo steamer reaches it. The other copy is sent by a later mail or by another route as a safeguard against the possible loss of the first copy. When one copy has been used to secure delivery of the goods, the other copies become void.

Having delivered the goods to the place at which the ship is loaded, and having obtained a wharfinger's receipt, the supplier must, therefore, purchase the required number of blank bill of lading forms. The names of the shipper and consignee are inserted, and in the wide blank margin provided must be written the shipping mark and a description of the contents and measurements of the numbered packages covered by the bill. The set of bills of lading is then presented to the shipowner for signature, together with the wharfinger's receipt. The shipowner will probably take a day or two to ascertain whether the goods have been shipped, and when he is satisfied he will sign the bills, return them to the supplier and retain the wharfinger's receipt. At the same time, he will probably present his account for *freight charges*. This is the name given to the charge made by the shipowner for carrying the goods. A shipping "ton" may be either 20 cwt. or 40 cub. ft., whichever is most advantageous to the shipowner.

A tariff of freight rates is generally agreed between the majority of shipowners serving any distant group of ports. These shipowners form what is known as a conference. It is a practice of members of a conference to add a percentage to their freight charges which is repaid to shippers after a period, usually six months, providing goods have not been sent by steamers owned outside the conference during the period. The cash repaid is called a rebate. It is advisable to keep records and to make claims on the appropriate dates, especially when shipping agents are engaged to handle this business.

The question of *marine insurance* has now to be considered. This is usually effected with an underwriter or group of underwriters who are members of an institution called Lloyd's, which exists primarily for the purpose. By convention, underwriters do not come into direct contact with parties desiring to effect insurance; their dealings are with brokers. A Lloyd's broker must, therefore, be entrusted with the business. There are two standard classes of insurance in common usage—

(a) With Particular Average (W.P.A.) is an insurance against all risks.

(b) Free of Particular Average (F.P.A.) is an insurance limited to damage which may arise only from an accident which affects the whole ship.

Much merchandise is immune from damage by salt water and rough handling; for this F.P.A. insurance only is required.

Of that part of the routine work frequently handled by a shipping agent, only that concerning the Harbour and Customs Authorities remains to be considered.

CUSTOMS ENTRY

This is the term used to denote the formality required by the Customs Authorities in regard to every shipment of goods. There are many articles requiring special formalities

which are beyond the scope of the present volume. Other articles may be exported freely and with them it is sufficient here to deal.

Particulars of all such goods must be lodged at the Customs House of the port of departure within six days after the sailing of the vessel. These particulars must be written on a special form which is to be purchased from commercial stationers. In a very similar manner most Harbour and Port Authorities require a declaration to be lodged with them. Upon this, small charges called "Dues," are levied; they must be paid immediately. It is convenient to prepare both these declarations in one operation.

INVOICING

It is quite possible to utilize for export purposes the ordinary invoice already discussed. But such conditions are rare, and when they do occur it is advisable to hand the set of forms, complete with carbon paper, to the person in charge of shipping matters. The forms should be thus passed over at the stage when all items have been extended and totalled. The invoice must not, however, be ruled off and closed, because certain additions will have to be made.

In the case of an F.O.B. transaction the extra charges may be—

1. Cost of cases.
2. Freight.
3. Bills of lading.
4. Insurance.
5. Consular services.
6. Bankers' charges.

In the case of a C.I.F. transaction, the last two charges may stand or not according to the terms of contract with the buyer; or, similarly, other special charges may be added.

The invoicing of goods sold abroad is usually, however, a little more complicated for two reasons—

(a) Some colonies and foreign countries require invoices to be made out on special forms and to be endorsed by a *certificate of origin* of the goods.

(b) Some foreign countries protected by import duties levied on all goods entering the country require *consular invoices* to be drawn up in a very special manner, perhaps in the language of the country, and sometimes these documents have to be submitted to the Consul resident in the exporting country. His examination is usually certified by a signature and a rubber stamp; this is called a *visé*; payment for this service is demanded by the Consul and is usually charged to the buyer.

OBTAINING PAYMENT

Few manufacturers are content to extend to buyers in distant countries the ordinary open credit accorded to home trade customers. Indeed, one of the main advantages of export trading, apart from the considerable size of orders worthy of shipment, is that payment can usually be obtained immediately upon shipment. This arrangement is called payment of *sight draft* upon presentation of documents to a specified bank.

In carrying through a transaction on these terms there are two points to be borne in mind in preparing the necessary documents—

(a) Insurance should usually cover an amount which is at least 10 per cent greater than the total of all charges shown on the invoice. This is to protect the buyer against contingencies, and against loss of profit should the goods miscarry.

(b) The word "order" should be written on the bill of lading in place of the name of the consignee. The supplier's signature must then appear as an endorsement on the bill, which thus becomes a negotiable instrument and of value to the bankers as security.

The set of documents which must be presented to the bank are—

1. All stamped copies of the bill of lading.
2. Insurance policy.
3. Invoices.
4. Draft. (A bill of exchange bearing appropriate stamp duty, drawn on the customer for payment at sight or at any agreed upon period after sight.)

The bank, usually a branch of, or acting as agent for, the customer's bank abroad, will have received instructions to make payment, if all is in order, in accordance with pre-arranged terms. Where doubt may exist as to the readiness of the bank to honour a draft, inquiry should be made prior to shipment.

Many variations of this arrangement exist by which credit may be prolonged, but for the present purpose the essential routine work has been sketched in sufficient detail.

It remains to show how this work may be planned to run smoothly with the work dealt with in previous chapters.

Probably the point at which the routine of shipping makes most serious contact with the planning of production is that of time. Once it has been decided to make shipment by a certain steamer, failure to do so is highly detrimental to the impression made upon a distant customer. He has probably asked to be advised of the name of the steamer by letter or cable; as a result he will, in all likelihood, have committed himself to deliver *ex* that steamer. If the goods are not shipped he may suffer considerable harm. Much time may elapse before the arrival of a subsequent vessel, and there is a strong possibility of his refusal to accept delivery or to honour the bill of exchange drawn upon him.

A simple and useful method of keeping the closing dates of steamers constantly before the eyes of officials of a manufacturing concern is to chalk the name of each steamer and the date on a blackboard. If this is done, the manager of

the department responsible should take care to satisfy himself daily that any obstacle which might cause failure to dispatch goods in time for shipment is removed.

Apart from the disastrous effects consequent upon failure to deliver in time for shipment is that which may easily result from failure to comply with some minor point in the regulations laid down by the government of the country to which the goods are exported. Many months' delay may result from correspondence backwards and forwards with an overseas buyer who sees his goods standing in a customs warehouse abroad, pending the clearing up of an inconsistency between the documentary description and the actual nature of the goods.

On this question of description, it is wise to use carbon paper freely to ensure that all documents are alike, and to abandon any descriptive wording customarily used in the home trade in favour of that appearing on the customer's order.

There is a good deal of the routine work entailed by shipping which necessitates the visiting of outside offices. Ship-owners, customs officials, consuls, and stationers must be called on personally. The customs authority in particular will accept no documents by post. It is apparent, therefore, that where the volume of trade warrants the employment of the specialist suggested, much of his time will be spent outside the manufacturer's office, and will thus be outside the control of internal work. This time spent outside should, however, be properly regulated. The clerk should be required to notify the manager of the purpose of his peregrinations. Any tendency to make two or more journeys where one would suffice will then be readily noticed.

The internal work of the shipping department is, however, capable of co-ordination with the routine earlier described. Order sets and invoice sets of the standard design should be used and free access to, or even custody of, them be given

to the shipping clerks. Every effort should be made to avoid departure from standard practice. Recommendations from shipping clerks will be forthcoming in plenty with the alleged object of providing short cuts. These recommendations should be examined carefully by a person who thoroughly understands the entire plan of production. He is far better able to judge the effect of any departure from standard practice than is a shipping clerk who sees only a small part of the whole picture.

PART II

PLANNING FOR ECONOMY

CHAPTER VII

PURCHASING

FACTORY requisitions—Issuing orders—Keeping track of deliveries—
Contract orders—Purchasing records—Interviewing travellers—
Subject indexing.

THERE is an important distinction between the exercise of technical knowledge or taste in the selection of goods required, and the routine work necessary to maintain proper control over the purchase of such goods. With the former function of selection, production planning is but slightly concerned; to the latter function of purchase it may be valuably applied.

In the growth of a manufacturing business there comes a time when it is realized that these two functions may well be separated. The principal of the business, or a manager of high technical skill, can afford to devote no time to detail work of a purely clerical and mechanical nature.

It must be sufficient, when such a person knows exactly what is required, to instruct another person to attend to the purchasing routine. When exact knowledge is not possessed, it must be sufficient to instruct the purchasing department to send out inquiries for samples, catalogues, quotations, and so forth.

Apart from the question of conserving the time of important technical people, there is another advantage in the appointment of a separate person or department to take care of these matters. The order is placed by a party who, since he has little or no influence in deciding to whom it is given, is impervious to temptations which are sometimes held out to buyers. The person who makes the deciding

selection or final choice must do so entirely on the merits of the goods and price, because he has no contact with the seller or his agent.

FACTORY REQUISITIONS

A simple and satisfactory plan, to give effect to the foregoing, necessitates the printing of "requisition" forms. These are usually made into pads and are placed in the possession of the works manager and others who are authorized to require purchases to be made. Each form bears an identification number, and is printed with some such words as these—

Please { inquire for
order
Suggested suppliers :
Date required :

Requisitions necessitating the sending out of inquiries are attached to the carbon copies of the letters dispatched, and are held in abeyance until the replies are received.

These replies are, in due course, submitted to the person who issued the requisition, a decision is made, and the documents are returned to the purchasing department with a note of the action required.

A requisition which contains straightforward instructions to order goods is scrutinized by the purchasing department, which should be capable, from knowledge in its possession, of amending the wording of it in any manner necessary to make it completely intelligible to the supplier. It is then priced and handed to a typist who issues an official order.

ISSUING ORDERS

Official order forms are preferably printed on paper of distinctive colour. The number of duplicates required will depend upon the size and complexity of the individual manufacturing firm issuing the order.

The following is a list of uses which may be made of copies of orders. It is a matter of convenience whether one copy is made to serve several purposes or whether a separate copy is retained by each department concerned—

1. Original to be sent to supplier.
2. Copy retained by purchasing department.
3. Copy for department which issued requisition.
4. Notification of accounts department.
5. Notification of goods receiving department.
6. Notification of keeper of raw material or appropriate stores.
7. Notification of stores records department.

The original order may usefully contain a perforated counterfoil which is printed with a request to the supplier for its speedy return by way of acknowledgment. This counterfoil should bear the printed identification number which appears on the order itself and all its duplicates.

There may be some value in printing on the original form sent to the supplier some notification to the effect that orders are only valid on an official order form. There is, of course, no legal significance in this precaution. Another precaution, however, which is legally valid and a safeguard against fraud, is the notification that orders above a stated value must be signed by a director or some other named person.

KEEPING TRACK OF DELIVERIES

Since correspondence of a routine nature with suppliers should be conducted by the purchasing department, it is advisable to construct a simple plan by which this department may keep a record of the delivery of outstanding orders. This is particularly necessary with regard to orders often placed for delivery in part, at stated intervals.

A method of doing this, entailing a minimum of effort, is to file copies of orders in folders bearing future dates. As these dates come round, the folder contents are examined

and suppliers are notified that the specified time for delivery has elapsed. This method, however, possesses the disadvantage that unless separate copies of orders are also filed in the alphabetical folder of each supplier, it will be difficult to find order copies when the daily marking off of deliveries is made. This latter operation in many businesses is unnecessary, and where it is dispensed with, order copies when removed from a dated folder may be checked against "goods received notes." (See next chapter.)

A more cumbersome method which is frequently adopted is to retain order copies in numerical rotation and to note forward delivery dates of selected important orders in a diary. The general run of goods bought from the supplier's stock, being delivered as a rule by return, require no routine attention. Under this system, deliveries may be checked against the supplier's invoices instead of against goods received notes. The operation of checking prices is thus carried out at the same time.

Items which are short-delivered should be entered in the diary or other "memory-tickling" device. If delivery of orders is checked against the supplier's invoice, it is usually done by the book-keeping or accounts department when passing invoices for entry in the purchases analysis or day book.

It follows, from what has been said in earlier chapters, that the necessary consultation between the accounts department and the purchasing department, concerning queries and discrepancies between orders and invoices, should occur in connection with batches of collected items rather than with single instances discussed piecemeal at odd times.

Correspondence with suppliers urging delivery may be curtailed with advantage by the use of stereotyped post cards. The wording of a "hurry-up" notification is a constant repetition and does not warrant separate dictation or typing. A note should be made on the order copy, of any such communication.

CONTRACT ORDERS

It is frequently found that no inconsiderable economy can be effected when small articles in constant use are purchased by contract. Such articles as screws, nails, nuts, and bolts, produced by automatic machinery, are not in constant production, by manufacturing suppliers, excepting for a very few of the most commonly used sizes. It is of great assistance to a manufacturer of such goods to possess knowledge well in advance of future demand for odd sizes. It will pay him better to make the whole of a year's requirements at one time and hold the goods in stock than to make the same quantity in several batches at intervals of a few weeks or months. For this knowledge such manufacturers are usually prepared to make some concession in price.

This concession may even take the form of a discount from "prices ruling at time of delivery."

The purchaser who suspects a fall in price over a twelve-month has, therefore, something to gain and nothing to lose by placing a contract of this kind. It is necessary, of course, to conduct a close investigation in order to fix the total quantity of goods required over a comparatively long period.

When this is done the contract order is placed for "delivery as required" within the stated period. The method possesses also the advantage of securing prompt delivery of odd sizes, which safeguard may only otherwise be obtained by the locking-up of capital in the laying-in of a large stock by the purchaser. The foregoing remarks must not be misunderstood in the sense that they refer to all contracts. Major contracts entered into by a manufacturer involving extensive financial commitments and perhaps affecting the policy of the entire undertaking do not, as a rule, enter into the routine work of the purchasing department until the final terms are arranged and settled. Thereafter, the routine is handled in the ordinary way.

It is a great mistake, of which many people concerned with the management of manufacturing undertakings are guilty, to permit the circumvention of the proper purchasing channels under any circumstances. The purchasing department should be aware of every commitment entered into by the firm, involving the expenditure of cash outside the payment of wages and petty cash disbursement. Confusion arises when goods are received, or accounts are rendered for services, for which no official order has been issued. Orders for advertisement, stationery, furniture, and equipment, and many other non-productive items, are sometimes placed by managers of departments or by directors. This is contrary to planning methods and is to be emphatically deprecated.

PURCHASING RECORDS

The proper recording of information is an important function of the purchasing department. It requires information not only for its own use, but also for the benefit of other branches of the internal organization. For example, the estimating department or drawing office may frequently require to know the price and design of fittings procurable from existing stocks; the works manager may desire to renew or replace old or instal new, equipment; a productive department may desire to discover alternative sources of supply for a commodity which has failed to give satisfaction; the cost department may wish to verify suspected inaccuracies in its own records. Such examples may be multiplied almost without limit.

The records required primarily for internal use within the purchasing department itself are the following—

1. *An index of inquiries sent out and quotations received.* This may be compiled simply on cards arranged behind classified guides. These guides may signify productive departments or they may denote groups of commodities, but

it is quite useless to attempt to build up an index of this kind based upon an alphabetical arrangement of firms' names. The object of the index is to supply names which are too numerous to be remembered, and to give together with these names the latest available information about the goods procurable from the firms.

2. *An index of prices.* The purchasing department should be in a position to price the majority of the orders it issues without the delay consequent upon reference to the supplier. Changes in prices are frequently circulated to all known buyers. Such notifications received by post or otherwise should find their way to the purchasing department records. The card index cabinet and system under the previous sub-heading may suitably be made to incorporate the information gathered in this way about prices, excepting in concerns where the volume of this work warrants or demands the setting-up of a separate system.

3. *A filing system which is distinct from the main correspondence system discussed in Chapter V.* The special filing system required by the purchasing department is necessitated by its inability to recall the names of the multitude of suppliers who offer their wares for sale. This matter is dealt with in greater detail at the close of this present chapter. It is necessary to divide this system into two groups, because much of the matter to which access is required is supplied in forms which are unsuitable for storage in an ordinary vertical filing cabinet. Shelves or cupboards must be provided to accommodate large bound catalogues and samples. It is this third system of records which will furnish, to a large extent, the information required by departments and officials external to the purchasing department.

INTERVIEWING TRAVELLERS

Around this question circles an endless controversy. Most manufacturing firms employ travelling representatives.

These men are loud in expressing their disgust at the off-hand treatment they receive from many potential customers whose businesses have the appearance of being well organized. The buyer of the very manufacturer whose travellers express these views, himself complains that he would have no time to carry out his duties if he allowed every traveller who called to interrupt him. An outdoor representative is necessarily and notoriously a gentleman who must not lightly accept "no" for an answer. Every conscientious buyer is aware of the danger of lightly saying "no."

It is outside the subject of production planning to recommend a line of conduct for salesmen which includes the virtue of brevity, but the subject here discussed is intimately concerned with the suggestion of plans which will assist the buying side of the controversy.

The devotion of stated hours and days to the interviewing of representatives is not sufficient. In remote localities, particularly, it is impossible to ensure that the itinerary of a traveller will bring him to the door at the appointed time. Yet, though he may call at an inconvenient moment, he may, without the buyer's being aware of it in advance, be able to show that buyer's employer an important advantage in some vital direction.

There are various ways of meeting this difficulty, amongst which the following suggestions are offered—

1. The buyer should make a point of seeing every unknown traveller.

2. The buyer should be in telephonic communication with the inquiry clerk at the door.

3. The inquiry clerk should be supplied with blank forms to be filled in by travellers, stating the nature of their business.

4. The buyer should have an assistant who is capable of determining whether or not it is desirable for the buyer to grant an interview.

This assistant should secure the submission of samples or other matter prior to the appearance of the buyer himself. He should be capable, upon short instructions from the buyer, of taking full particulars of any offer likely to prove interesting. This can be done after the buyer has withdrawn.

It is highly desirable that a record be made of any interview between a buyer and a traveller, for, although the subject of it may be of no immediate interest to the buyer, it may prove a valuable reference at some subsequent date. Further, the employer of the traveller may make some reference to the interview by correspondence, in which case the buyer may be called upon to give an account of it. There is, also, the humane aspect of the matter which arises from the fact that mention of the interview in subsequent correspondence from the buyer may secure to the traveller his hard-earned commission.

It is also desirable, whenever circumstances permit, to provide a reasonably well-furnished room where travellers can wait, and to arrange that interviews take place in a room free from documents which might be read to the firm's detriment.

A practice which should be sternly discouraged is that attempted by indifferent representatives to save themselves the trouble of paying calls, namely, the use of the telephone as a substitute for a personal visit entailing the possibility of irksome waiting.

SUBJECT INDEXING

The disposal of advertising material received by post is a matter frequently omitted from the consideration of those responsible for planning the work of the purchasing department. As a result, much material well worth keeping is consigned at once to the waste-paper basket, or else ultimately gets there, after becoming an untidy eyesore littering any odd corner.

A plan which has proved to be of no small value is the following—

An index is prepared, preferably of the visible strip kind. (See illustration, Fig. 5.)

Suitable main headings are devised and these are given numbers which are used in accordance with what is known as the Dewey system. Under this system, every sub-item of a main heading is given a number which commences with the numerals used to denote the main heading. Any sub-heading of a first sub-heading commences with the numeral thereof. The zero sign is used as a division to indicate the subordination of an item to a superior heading, in other words, that it belongs to a group. A simple example will best serve to explain this method, which possesses the advantage of unlimited expansion and subdivision—

(Main Heading)	PRODUCTIVE RAW MATERIAL . . .	3
(1st Sub-head)	— METALS (Ferrous) . . .	301
(2nd Sub-head)	— — H.S. Steel . . .	30101
(1st Sub-head)	— TIMBER . . .	302
(2nd Sub-head)	— — Birch . . .	30201
(3rd Sub-head)	— — — Birch Three-ply	3020101

The addition of each sub-sub-heading adds two numerals; this appears somewhat formidable, but in practice the lengthy number is found to present no difficulty. In manipulation the early numbers indicate locality of files in cabinets, and great speed in tracing is possible. It will be seen that a file bearing, for example, the number 30101 is not placed in a position relative to thirty thousand one hundred and one, which would, of course, be far behind 301 and 302, between which in the specimen list given it must properly rest. The next number above 9 is 11, above 19 comes 21, and so on.

When the index has been prepared, it is the duty of one person, to whom it is advisable to confine this task, to receive all material for subject-indexing. Each item is marked with the number which, in the opinion of the marker, most correctly denotes its classification. Where no suitable title

exists, he invents one and pins a note of the new number he allocates to it, to the paper which has to be so classified. The numbered batch of material is then passed to a junior for insertion in the files numbered as indicated. New index strips and folders are made where necessary. Samples and catalogues are numbered in the same way.

The reason it is advisable to confine this work to one person is because no two minds work in the same way. If, for example, a manufacturer in no way concerned with maritime work receives a circular about, say, ships' anchors, one man might decide to file it under "Castings;" another, more knowledgeable, might know that "Forgings" would be more correct. Alternatively, a heading for "Heavy Iron and Steel Goods" might exist, or it might be decided to adopt it. Whenever reference to the index does not immediately produce a document desired, application to the person who classifies should be made. If this latter task is left to one person, the item required will be produced with surprising rapidity.

It is usual when this system is adopted for the buyer to decide which circulars are worthy of retention.

CHAPTER VIII

GOODS RECEIVING DEPARTMENT

IDENTIFICATION—Goods received notes—Checking quantities—Testing—
Internal distribution—Internal transport—Returnable empties.

THE correct planning of arrangements for receiving goods into a factory is essential in the interests of orderliness and economy. This is the first point at which the physical work of production may become confused. It is not sufficient to instruct a doorkeeper to inquire of each person delivering goods the nature of them, and for this doorkeeper to direct the carrier to whatever place he thinks appropriate. In cases where the doorkeeper's opinion is at fault, considerable delay may occur before the goods are finally received in the place where they are urgently required. In extreme cases, such goods may even lie unclaimed indefinitely while further supplies are ordered and consequent loss is entailed.

Any sound plan for dealing with goods inwards necessitates the setting up of one definite place of clearance. This is called the receiving department.

This department should be located somewhere in a short level line between a point convenient of access to road and rail traffic, and the point where the largest quantity of raw material is stored. In most factories, a fair amount of floor space should be made available to enable this department to carry out the work of unpacking and of checking contents. Space also is required for the disposal of empty cases, crates, and other packing material. Untidiness and confusion will result from failure to supply adequate space.

In works extending over considerable area, where raw material may be received loose in bulk loads, it is, of course, essential that conveyances shall discharge their loads at

places more convenient than that at which the receiving department is definitely set up. Nevertheless it is essential that, however well the man delivering may know his way about the works, no goods shall be accepted until the receiving department has been notified and has had the opportunity of making arrangements for unloading.

It is not usually practicable for the receiving department to connect goods with the copies of orders it holds, before the departure of the delivering conveyance. It is usual, however, to look over packages as they are unloaded, and to mark the sender's name (taken from the carman's delivery sheet) on any package upon which it does not already appear. Many persons receiving goods write the word "unexamined" after their signature on the delivery sheet, but failure to do this does not invalidate a claim for damage in transit.

IDENTIFICATION

The process of identifying goods often presents considerable difficulty. It is desirable to put the receiving department in possession of such information as will assist it to arrive at a reasonable conclusion as to the contents of packages. It is thus provided with a copy of every order issued to suppliers. This department is not, however, to be equipped with technicians, and it is a mistake to impose upon it the labour of discovering the exact technical definitions applicable to several articles of identical appearance which may be included in one package. For example, a gross each of 6 in. springs in a variety of tensions may be ordered. It is not the function of the receiving department to classify such springs other than by a description which the supplier may attach to each lot.

These goods will be sent to the stores usually concerned with like articles; exact classification is the work of that department. Therefore, some provision must be made to enable the stores department to record exact descriptions.

GOODS RECEIVED NOTE

This is the document which signifies to all persons concerned with recording and checking work, occasioned by a purchase made by a productive enterprise, that the goods purchased have been received. Two or more copies of it are prepared by the goods receiving department and should give the result of the physical examination of each item received.

It is argued by some people concerned with production planning that there is a serious disadvantage in furnishing the receiving department with copies of orders. It is stated that the work of physically checking will be shirked. The position surely is this: if the correct use of order copies reduces confusion it is justifiable. It is the abuse rather than the use which is condemned. Therefore, the problem is one of discipline alone in the securing of conscientious workers.

The goods received note states—

1. Name of supplier.
2. Date of delivery.
3. Description of package.
4. Contents of package item by item.
5. Quantity or weight of each item.
6. Department to which goods have been sent.

The notes are usually bound together in book form, one copy remaining fast in the book; the original and duplicates each bear the same printed identification number.

Separate copies, or a sight of one copy, are required by—

1. The storekeeper receiving goods.
2. The stores records department. (Copy No. 1 is frequently initialed by the storekeeper and passed on for this purpose.)
3. Purchasing department. } (For use see previous
4. Ledger clerk. } chapter.)

CHECKING QUANTITIES

One of the most astonishing things in modern industry is the curious disinclination of purchasers to take pains to verify that the quantity of goods received corresponds with the quantity for which payment is demanded. This may be because the work entailed is often quite considerable. It is safe to say that in every trade there exists at least one individual supplier whose low prices may be explained by the fact that he trades on this knowledge that his deliveries will not be checked.

Goods receiving departments should not be stinted of mechanical aids to weighing and counting. Counting can be carried out often with sufficient exactness from calculations based on weights of units, tens, or dozens. Counting apparatus provides a means of balancing a unit against any quantity of identical articles by means of a sliding cursor or weight; this registers the correct number on a bar at the point of balance.

There are many substances sold under trade customs of which the buyer is often unaware. For example, cotton waste is sold packed in rough bags, technically called tares, of uneven weight. These tares are the wrappings originally used to protect bales of raw cotton. They have the appearance of close-mesh rope nets and are very heavy. They may represent 25 per cent of the total weight of a package of cotton waste. It is thus necessary to ascertain the correct tare weight under circumstances of this kind.

TESTING

Apart from the technical skill required to determine quality as already discussed, provision should be made whereby the receiving department should be able to exercise reasonable discrimination. For example, there are many occasions when no more than common sense is required to

decide whether goods are in accordance with the sample upon which the order was placed. In such cases the receiving department may be placed in possession of samples or portions of samples.

Again, where simple tests are constantly repeated as a matter of routine these may, even though they are of a distinctly technical nature, be entrusted to an intelligent receiving man rather than be permitted in an inspector's department or in a laboratory, with consequent delay and absorption of highly-paid time.

Whenever an investigator is appointed by debenture holders or others to discover weaknesses in concerns where profits have fallen, it is in the above matters where loose working is particularly sought.

INTERNAL DISTRIBUTION

Once goods have been checked and entered on goods received notes, their movement to the departments concerned should be made without delay. One of the most useful purposes served by providing the receiving department with a copy of the order is that an indication may be given there of the correct department. It frequently happens that articles are ordered without the knowledge of storekeepers, who are, in any case, too busy to set up inquiries as to the purpose for which unusual articles are required. Such goods are delivered direct to "the job."

The simplest method of bringing this "short-circuiting" of stores into the regular routine is by obtaining the signature of the departmental foreman or other person accepting goods from the receiving department. The goods received note book may be carried with the goods. A storekeeper taking goods into stores in the usual way will sign the fixed copy and detach the perforated original, in order that he may store away the goods when convenient and pass the note to the stores records keeper or retain it. When the stores are

“short-circuited” by delivery direct to a departmental foreman, his initials should appear on the original received note and also upon the copy handed to the storekeeper or to the stores record clerk.

INTERNAL TRANSPORT

This is an important problem of production planning. A works which has grown by stages suffers as a rule from the abandonment of the original lay-out and the substitution of makeshift arrangements involving complicated communication between departments. When effective planning becomes imperative, the internal transport problems must be overhauled. These problems are divisible into two sections: (a) Arrangement of lay-out, or the relative geographical position of one department to another; (b) Methods of conveyance.

The guiding principle of satisfactory factory lay-out is, of course, the arrangement of parallel lines along which goods travel from the raw material stores through various productive operations to the packing and dispatch departments. If the floor space is all on one plane there will be no complication of vertical as well as horizontal directions to these parallel lines. It is not possible in many cases to secure this ideal, but it often *is* possible, at inconsiderable expense, to secure a straight level run on each story of a factory. The removal of a few stairs may permit goods to be moved in large quantities on wheels. Alternatively, where changes in level cannot be avoided, overhead conveyers can often with advantage be introduced.

Any simplification on the lines indicated produces considerable economy in the wages paid for portage within the factory.

The actual methods of conveyance employed will differ widely in various industries. It is not possible here to survey the whole field, or to do more than state the main principles which govern it.



FIG. 6. AN OVERHEAD GRAVITY
CONVEYER
(By courtesy of Messrs. Harland & Wolff, Ltd.)



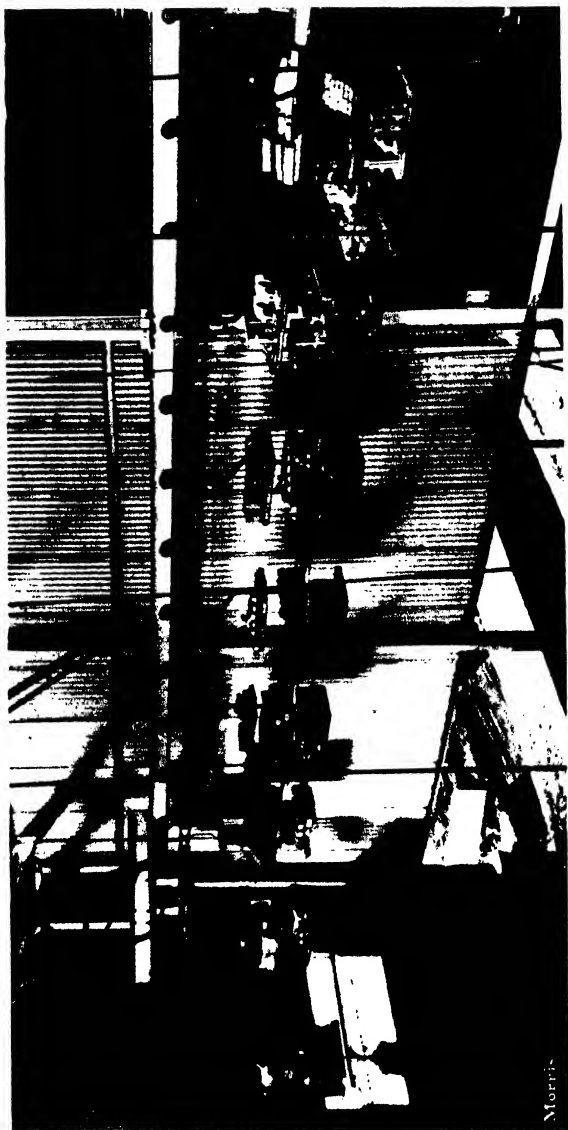


FIG. 8. CASTINGS LEAVING A FOUNDRY
(By courtesy of Messrs. Harper Morris, Ltd.)

In the first place, a mechanically- or gravity-propelled conveyance is always far cheaper than manual labour.

Automatic conveyers are concerned more with the transfer of goods between productive operations than with the removal of purchased goods to their appropriate stores.

The lifting truck provides probably the best all-round means of obtaining the maximum of internal haulage at the minimum of expense. Goods to be moved are placed in a large wooden box, the longer sides of which are extended beneath the bottom of the box. The extensions form stands which raise the box about six inches from the floor. The lifting truck platform is lowered and inserted underneath the box. It is then raised and the truck proceeds under its own power to the destination required, where the platform is again lowered and the box set at rest. These trucks are propelled electrically or by small petrol motors, or they may be drawn by hand or other power.

The overhead gravity conveyer has few rivals in internal transport, whenever conditions are favourable. It is particularly valuable for the transport of articles of a fragile nature, which, since the receptacle containing goods is suspended in the air, are subjected to no jolts due to floor unevenness. It may also be used where the levels of a floor change by a few inches. Its radius of effectiveness is restricted to within a few feet of the overhead rail, upon which the carriage runs with almost frictionless ease and smoothness.

The introduction of electric goods lifts may do much to reduce the cost of raising goods to upper floors; similarly, the use of gravity chutes and conveyers provides a valuable method of descent from upper floors.

RETURNABLE EMPTIES

The value of cases, crates, and other returnable receptacles is often sufficiently high in relation to the value of the goods contained for great care to be exercised to avoid loss

in this direction. The suppliers of such goods usually make a fairly heavy charge for these packages in order to secure their prompt return; full allowance is given as a matter of course unless otherwise stated and agreed. The whole system is a bugbear from which industry has not yet succeeded in entirely freeing itself. Where the value of goods is sufficiently great to make the cost of the case an insignificant addition, there is a tendency amongst suppliers to make no charge.

It is the duty of the goods receiving department to sort out the packages which are charged and to see that they are promptly returned.

All empty cases, etc., whether returnable or not, should be sent daily, or more often, to the dispatch department. Non-returnable items can often be utilized by the firm for sending out its own goods. A simple method of signifying which cases are returnable is by labelling in the receiving department. Where the suppliers use reversible labels, this entails little effort. Any unlabelled cases received in the dispatch department are either used again or broken up.

Another method, which involves a small departure from the routine requiring every item leaving the works to pass through the dispatch department, is to permit the receiving department to dispatch empties by the vans delivering goods. The method used will often be determined by the proximity of the receiving and dispatch departments to each other.

CHAPTER IX

DIRECT PRODUCTION

TIME and motion studies—Collating data—Routing work for machines—
Obtaining raw material—Identification of work—Programme system.

THE term "direct production" is used to denote all the work taking place within a factory with the object of altering the shape of, or combining, materials to produce that which will be sold as the manufacture of the factory. Direct production, therefore, concerns physical work on material ultimately intended for sale.

The manner in which human labour is applied to material will determine not only the nature of the finished product itself, but also to an important extent, but not entirely, the cost of it.

There are very few articles of merchandise which could not be produced entirely by hand; that is to say, by craftsmanship aided only by the simplest of cutting tools. In many departments of industry, hand-made goods are superior in quality to those manufactured by machinery. They are rarely, if ever, cheaper to produce because the object of machinery is, with very few exceptions, to substitute mechanical for human energy. If it cannot effect economies in the process it has no chances of becoming widely used.

A proper study of the planning of direct production must not assume, as it frequently does, that only machine production is to be considered. There are still many processes in which hand methods are used because machines have not been devised capable of producing work of the excellence of that of highly-skilled artisans.

The highly-skilled mechanic is not by any means an easy problem for treatment when he is introduced into a factory where planned production is essential. He is not as a rule

enthusiastically in favour of measures directed towards the effecting of economies as far as he is concerned. It may, therefore, be taken as a maxim of successful planning that the co-operation of the skilled worker depends upon there being shown to him any advantages to himself that may exist. A trained planning consultant may spend many hours observing the movements of skilled workers. He may be able to suggest methods which will save fatigue and speed up output; but these methods will not be received with anything but resentment by the operatives unless they are accompanied by proposals which will give some share of possible economies to the people working. There is a pitfall here into which the unwary manager or plan-maker may unwittingly fall. If a change in method involves the provision of expensive equipment, such as racks, conveyers, and so on, although no actual change to mechanical means is required as far as the operation itself is concerned, the planner must make no rash promises regarding piece-work rates or bonus payments. If, as sometimes happens, the success of the new plan greatly exceeds expectations, anomalies will be created which can only be removed after bitter conflict. This may, indeed, cause loss to the manufacturer of the services of skilful people who are not easily replaced. The assumption that conditions have been altered is an important stipulation here. Where wages are paid on piece-work rates, it is almost impossible quickly to make changes of method produce any effect on rates in force, as far as purely manual operations are concerned.

The consideration of the methods of applying labour to machinery is quite another matter. It is here that knowledge and planning can and do influence economical production.

The speed at which many automatic machines can be run depends upon the dexterity of the operative. In factories possessing a number of identical machines of this kind, it will be found that certain workers are able to get a much

larger output than others. On the other hand, where machines performing simple operations, not automatically, are installed, it will be found that considerable variation exists in times taken. In each case it is necessary to observe workers closely and to discover how far the faster time is the result of natural ability and how far it is due to variations of actual movements made by operatives.

TIME AND MOTION STUDIES

This is a highly specialized function of production planning. The industrial world is indebted to Dr. F. W. Taylor and others for much extensive enlightenment on the subject. Managers of factories where the economical production of large quantities of articles made by repetition processes occurs are recommended to make themselves acquainted with the detail of the methods referred to.

✓ In factories where work is entirely intermittent, or where certain processes do not run entirely on identical goods, it is still necessary to secure rapid production. Apart from possible economies in direct labour charges, it is essential that capital locked up in expensive machines and other productive apparatus shall yield the highest possible return in value of goods produced.

It will be found, as a rule, that workers are not unwilling to submit to reasonable tests in order to establish a fair basis for payment by results. ✓ The scientific analysis of time, motions, and methods advocated by Taylor are not always possible. ✕ A method sometimes used with success is to arrange a competitive demonstration of skill by any workers willing to take part; the object of so doing must in fairness be properly explained to the workers before the test begins. Some variation should enter into the task scheduled for each worker. That is to say, a small range of sizes, or of different material, should enter into the test. Careful observation with a stop-watch should be made of the times taken on

each variety by each worker, and of the time taken and the manner of changing from one job to another. The observer, if he is well acquainted with the work, as is essential, is not likely to find that workers are unreasonable in assisting him to arrive at practicable rates satisfactory to the manufacturing firm. The worker, as a rule, welcomes this method, which he regards as fair play; the method he finds difficult to accept is the fixing of an arbitrary basis by a non-practical person.

The question of fatigue plays an important part in the consideration of the movements made by operatives. Not only is the avoidance of strain necessary from a humanitarian point of view, but it will be found that the quickest method applicable to a single operation may not be the means of effecting maximum production in bulk. This is because muscular relaxation must occur periodically; otherwise, tiredness will soon rob a fast worker of any advantage.

COLLATING DATA

Where the production of a standard line of goods is not an everyday occurrence, but, on the contrary, demands come forward for articles which are produced at infrequent intervals, it is not possible for an operative or foreman to know, off-hand, with complete certainty the best and most speedy method by which to perform the work required. Such information must be recorded in a form readily accessible for reference.

In Chapter XVIII will be found a description of the routine work connected with the fixing of rates and the payment of wages. With this, the routine work of collating data is closely connected. If the finished product consists of the assembly of a number of component parts, each of the latter provides a heading under which information relative to the method of production is recorded. It is usual to tabulate this information on cards located in index drawers. The table is headed—

1. Operation number (the numbers are in rotation giving the sequence of operations).
2. Operation.
3. Machine used.
4. Setting up (jigs and tools used).
5. Setting-up time.
6. Working time for minimum economical quantity stated.
7. Method of fixing time.
8. Remarks relative to fatigue or to special observations.

As a general rule, an elaborate schedule of this kind will not be required where continuous process work appertains. Under these conditions, standard practice will be discussed and established, and will be insisted upon until such time as any improvement may evolve. The necessity for collating data will depend upon the circumstances of each industry. Where long runs of continuous work occasionally occur in a factory where runs are usually short, it is wise to collect ample data from actual experience of long runs, for use on future occasions. Conversely, where short runs infrequently interrupt continuous process work, comprehensive data will often prevent loss of time.

ROUTING WORK FOR MACHINES

Much confusion and delay may arise when no effort is made in advance to allocate work to machines. It is necessary that every machine shall be used to the best advantage of the factory and, as far as possible, for full working time. It is no uncommon thing to find many idle machines in a factory during a period when trade is good and when machines are overloaded. It is not proposed here to discuss the principles governing the selection of machinery, but to lay emphasis upon the need for a satisfactory method of distributing work amongst existing productive machine units.

There is scope for much ingenuity in devising suitable

plans to meet the point under consideration. Such plans may be physical or otherwise. The physical method is simple, and, in an intermittent works of no great magnitude, has much to recommend it.

Instructions are issued in writing by the works manager, or his staff, for the production of specific goods (see Chapters XVII and XIX). These are handed to the appropriate raw material storekeeper or his equivalent. After consultation with the foreman of the productive department concerned, the raw material is carried to the machine where the first operation is to be performed. As each operation is completed, the partly manufactured articles are moved to machines upon which subsequent operations take place. The amount of work before each machine can thus be roughly assessed by visual inspection.

In many factories so simple a method is neither possible nor desirable. Under these conditions, a record is kept clerically. New orders are entered against each machine in a book or on loose cards or in some such way, and as operations are completed the records are adjusted. An enormous amount of work can be entailed in such a process, and, when any such system is projected, caution should be exercised against the adoption of a method which is theoretically perfect, but which is a practical impossibility. Harassed works managers spend many feverish hours constructing, with the ingenuousness of novices, primitive methods which, after a short time, are abandoned; many a heart-broken assistant is the victim of his chief's ill temper. The object is desirable enough, but is by no means easy of achievement.

A few limitations of the ideal are usually required. They are—

1. Every change of operation is too much to expect; a daily record should suffice.
2. The system should be visual and a signal or a moving card-sign should be used to avoid constant rewriting.

3. Nothing which can be furnished by the progress department should be demanded of this system. (See Chapter XVI.)

Where there is a very large number of machines, a visible-edge card cabinet or its equivalent probably provides the best solution.

Each machine has a card devoted to it. The name or number of the machine is typed at the left-hand edge of the card. Order numbers and the hours of work represented by each order are entered on the card and crossed off as the work is completed. A running total is signified by the movement of a coloured signal along the edge. New work may thus be allocated to machines whose signals indicate the least amount of work ahead. Machines of a similar nature may be grouped together, and a rapid survey of commitment ahead for any group is possible.

Where the number of machines is comparatively few, a board similar to that illustrated is both simple and effective. The column on the left carries the names of machines. The horizontal interval between nails represent four-hour or other convenient periods. On eyeletted tags are written brief details of orders. The number of periods of work before each machine is shown by the number of spaces covered by the suspended labels; the adjustment of these labels is a routine task taking place at fixed times.

OBTAINING RAW MATERIAL

Raw material may be delivered direct to machines by the raw store-keeping department, as already described, or, as is frequently necessary, it is drawn from stores by application at times convenient to the department requiring to use it. The moment of issue of raw material is important as signifying the commencement of work.

Thereafter the work is said to be in progress. The exact moment is shown by the written acknowledgment which bears the signature or initials of the person accepting the

material. If, as is frequently the case, the person instructed to carry out the first operation is handed a copy of the works manager's instructions, by him or by his foreman, this worker himself fetches the necessary material from the stores. It is important that he shall not be kept waiting. The stores must be adequately staffed and must never be left entirely unattended. Separate internal transport should be at the disposal of all stores where heavy goods are commonly handled.

IDENTIFICATION OF WORK

Unless some proper method of identification is used, much confusion can arise from the difficulty in recognizing goods in a partly manufactured state. A good plan is to attach a label giving the order number and the sequence of operations; this follows the goods until they emerge completed. Alternatively, a copy of the works manager's order, or "Internal Production Order," as it will subsequently be called, with operations and machines stated, may be attached. Trays or boxes should be used for small articles.

PROGRAMME SYSTEM

Many factories manufacture standardized articles for stock, rather than produce goods for individual customers' orders as they are obtained.

When the range of standard goods is lengthy in comparison with the demand for any one of the individual items comprising the range, it is found that the items in least demand can only be manufactured economically at lengthy intervals. This is because it is impossible profitably to produce less than a known quantity at a time. This known quantity may be sufficient to cover sales for a year, or more, although it can be manufactured in a few weeks or less. It is, therefore, necessary, in "intermittent" factories of the kind in mind, to prepare periodically a manufacturing programme to

cover the future activities of the factory for such time ahead as experience has shown to be suitable.

Such a programme is usually prepared at a conference of the principal or managing director, the sales manager, and the works manager. When it is completed it constitutes

BROOK & WADE, LTD. FORM 7.

ORDER NO. _____ DATE _____

DEC. NO. _____ QTY. _____

DESCRIPTION _____

Scrap	
Balance	

K. Ind. L734407.

CHECK										
CARD										
W/C										
OPER.										

FIG. 10. WORK-IN-PROGRESS IDENTIFICATION LABEL
(Both Sides)

the instruction and authority of the works manager to produce what is required.

Each item on the programme requires careful analysis to determine the identity and quantity of each component part necessary to complete it. Those components which are not manufactured may have to be purchased; the remainder

may require the issue of "Internal Production Orders" (Chapter XVII). But in neither case may new components be requisitioned or manufactured until it is ascertained that available stocks are insufficient to cover requirements. It follows, too, that the stock figure to be considered will not be that of the actual stock in existence, but will be the figure arrived at after adding any internal production orders outstanding and deducting the requirements of any previous programmes still incomplete.

CHAPTER X

DIRECT PRODUCTION (*continued*)

WORK-in-progress—Dangers of interruption—Overlapping programmes—
Estimating capacity—Real and apparent bottle-necks—Promises of
delivery dates.

ALL productive material which has passed out of raw material stores is considered to be "work-in-progress" until it has been delivered into a finished goods warehouse in a fit condition for sale. Upon the effective control of work-in-progress depend not only the general orderliness and lack of confusion in productive departments, but also the ability to produce economically.

WORK-IN-PROGRESS

To a casual outside observer the appearance presented by any busy factory is generally one of great disorder. Masses of goods existing in stacks and odd lots seem to indicate little or no effort to maintain any methodical arrangement. The picture, even in well-regulated factories, is often one of confusion; and it is surprising to learn that the work is properly controlled, that the muddle is apparent rather than real, and that the tangle is easily and automatically unravelled.

The secret, of course, lies in the possession of knowledge of what is being done at any given moment, and of foresight in arranging that a task finished is followed by another without loss of time. As will be seen from the perusal of later chapters, this knowledge is obtained and used in two ways. For the immediate handling of work-in-progress, which is occurring concretely on the floor of a productive department, physical control is exercised. Foremen and charge hands are given authority to issue instructions to workers who are direct producers, and to labourers who are

indirect producers, in the sense that they are concerned, not with the fashioning or combination of material, but with its movement from one place to another.

The provision of knowledge which regulates the activities of the foreman, and others concerned with the physical work described, involves clerical routine which need not occur in immediate conjunction with the goods it affects. This is the second way in which knowledge is obtained and used; the method adopted to provide and use this knowledge may be regarded as the very essence of production planning.

It is unfortunate that in this essential connection it is impossible in a book to bridge the gap between theory and practice. Detail arrangements can only be made after a close study in each factory. This study involves consideration of the shape, size, and place of every file, book, shelf, basket, cabinet, desk, office, and even the placing of a nail or hook upon which may hang a "bull-dog" clip; it involves, too, consideration of the personalities of the workers available.

Nevertheless, it is possible here to offer advice in general terms which it is hoped may be of value in assisting managers to differentiate with some degree of clarity those items of essential routine which are not always sufficiently well analysed in the minds they pervade.

A sound maxim is to recognize that the amount of reliable information about the constantly changing position of orders carried in the memory of one foreman is strictly limited. It is useless, and bad planning, to supplement this limit by the infliction of clerical work on shop foremen. Satisfactory planning demands that the limit shall be correctly assessed, and that a sufficiency of foremen, charge hands, floor inspectors, or whatever they are called, be provided. The process is one of well planned decentralization. This does not mean that these people should not be supported by written data. The point is that they must not be required

to do the writing themselves. Indeed, proper use of written data will reduce the number of foremen and others required. Their minds must be freed from the burden of memorizing unnecessarily.

There are two documents which may be used to control work-in-progress—

1. The "Internal Production Order," issued by or with the authority of the works manager.
2. The "Routing Card," attached to raw material, which states the operations required.

The first of these two documents is retained by the head of each productive department, usually in a small office.

When work is commenced, these orders may be sorted into batches which indicate the stage of manufacture reached, or they may be manipulated in whatever way is found to be most useful. In many productive departments, it is found that the services of juniors is warranted in order to leave the chief the maximum liberty in the shop. These juniors are occupied in collecting data by examination of the route cards, by inquiry, or by scrutiny of men's job time cards (discussed in Chapter XVIII). From the juniors, too, the progress department, already discussed in Chapter I and referred to later in Chapter XVI, gathers the data from which its records are compiled.

In addition to the necessity for using knowledge of the position of work-in-progress to secure orderliness and economy, it is essential that the heads of productive departments should themselves be in a position to secure to subsequent departments a steady flow of goods in the proportions required to keep their various capacities employed. If, for example, a shop, pressing tiles from humidified clay dust, makes floor and wall tiles, it must see to it that these are made in proportions to fill the ovens, as it is known that various classes of ware can only be fired in certain temperatures; and that the contents of pottery kilns must be

balanced accordingly. This consideration is, of course, of general application; a chair factory must not employ more than the correct proportion of lathes turning legs to fit together into complete chairs, if this will mean a shortage of backs and other rails used in the making shop. Orders must not, therefore, always be put in hand without regard to this factor, but here again exact internal study is necessary to the making of a workable plan.

The necessity for the provision of adequate intermediate storage accommodation for work-in-progress may not be sufficiently well recognized, although its lack may occasion a state of perpetual and deplorable congestion. General tidiness, clear gangways, and absence of litter under and around benches are signs of a well-planned factory. Slavish indulgence of a mania for tidiness may be extended to a point of absurdity, but a reasonable mean is highly desirable.

DANGERS OF INTERRUPTION

These are sometimes not well realized by directors and others who often have little practical experience of production planning.

The commitments they enter into with customers, who may be personal friends, are frequently unnecessary and may entail more expense than is apparent. The kind of commitment in mind is an undertaking to deliver an order in a short time. If, as sometimes happens, such an undertaking is given in ignorance of, or without regard to, the planning of work-in-progress, it will probably be necessary to interrupt the production of many items and to upset a carefully balanced plan. This caution applies particularly to the intermittent factory engaged in the production of components to complete a programme. The caution applies also to the acceptance of orders for non-standard goods in a factory where all prices are based on standardized production. "Specials" are the bugbear of works managers.

The interruption of a single operation may entail not only the expense of breaking down the setting of a single machine, but also the expense of a breaking down of many other machine settings throughout the whole line of operations. In addition to this, there must arise a dislocation of balance. Uninterrupted machines will go on producing articles which may be required for use in conjunction with components, the production of which has been suspended. Individual examples may be rare where so much difficulty would arise, but if a tendency to interrupt operations remains unchecked it will not be unusual for a number of interruptions to occur at the same time. The damage cannot be assessed by arithmetical progression; it seems to obey the law of geometric progression. Effective production planning, under such conditions, becomes impossible, and interruptions which are not caused by the gravest emergency should be sedulously discouraged.

OVERLAPPING PROGRAMMES

This is a problem which applies only to what have been called intermittent process factories. The experience upon which this section is based is that of an engineering works where ranges of powerful pumps are manufactured and assembled. The standard range numbers some 30 models of various sizes.

The first step taken by the works manager's staff is to ascertain, by reference to stores records, the quantity of each component part which it will be necessary to produce to cover the programme. If, for example, the programme calls for 20 pumps of a twin-cylinder type, and it is known that each cylinder requires two valves, it is obvious that 80 of each of the parts which form a complete valve will be required to cover the programme. The quantity 80 may not, however, be the correct quantity to put into production, for the following reasons.

(a) There may be a constant demand for valves by the spare parts department for replacements to pumps which are being used throughout the world.

(b) This particular type of valve may be common to several types of complete pumps.

(c) Some, but perhaps not all, the parts of each valve may be interchangeable with other standard valves.

(d) Some of the parts may be castings, and separate internal production orders must be made upon the foundry to whom allowances for defective castings must be covered.

There are thus a number of considerations to be introduced into the routine job of issuing internal orders to the foundry and machine shop. To this routine is added the task of safeguarding the arrival of raw material at the time it is required for use.

Providing the clerical work outlined above is carried out efficiently it would seem that all that remains is to see that work is proceeded with in that sequence which will secure its emergence from the inspection department when it is required by the fitters for erection. Unfortunately, this is not true. The above presupposes that one programme is completed and out of the way before the next programme is commenced. Such cannot be the case. There are, in fact, oddments for slow-selling pumps, required for a programme a year old, still straggling through production. Two or three earlier programmes are actually filling the works when a new one is issued. In other words, the programmes overlap. The problem which arises from this concerns the duplication of internal orders for identical articles. It is obvious that if, say, 100 valve seats are required for each of three succeeding programmes, it is uneconomical to produce them in three separate batches. Yet this is what does actually happen in many factories.

In such factories attempts are made to connect the internal orders, but this is extremely difficult in practice,

because, as has been shown, chaos results from a constant interruption of the routine of production. This would occur if articles which had passed through many operations were held up to await the arrival of another batch which may be several operations behind.

A practical solution of this very real problem is a modification of the programme system by the classification of all components into at least four distinct groups. This is discussed in Chapter XVII.

ESTIMATING CAPACITY

The substitution of production planning for haphazard, rule-of-thumb methods necessitates the establishment of two items of knowledge.

1. The output desired.
2. The capacity of the equipment available. Since output is usually expressed in money values, it is necessary to use money as a common denominator in calculations of capacity.

Usually it is possible to fix upon one productive department which may be regarded as the key by which all other departments are in a sense regulated. It is the department which determines the nature of the goods and often gives them shape. In a general engineering works it is the machine shop; in a metal stampers' works it is the pressing department; in a bakery it is the number of ovens, and so on. The capacity of a single department may be calculated in money values in several ways. Probably the simplest is that based on previous full-time experience. Otherwise, the cost department should be able to furnish data providing material for accurate calculations. Should no quantitative method be possible, there is no very great harm in using the qualitative opinions of people who possess expert knowledge. This, however, should be well sifted before irrevocable decisions are made; excessive optimism is a well-known failing of enthusiasts. For this latter reason, it is dangerous to accept

without question the figures of capacity given by manufacturers of machines. Much chagrin and even ruin have been caused by reliance upon exaggerated figures. In this connection, conservatism is to be commended; under-estimates are far less dangerous than over-estimates.

Whenever it is possible, the key department of a works should not be surrounded too closely by departments whose fixtures represent considerable capital expenditure. Expansion under such conditions may present insuperable difficulty. Given a key department capable of rapid expansion, and subsidiary departments radiating from it in a manner best fitting to the requirements of the industry, the problem of the "bottle-neck" becomes much easier of solution than when less favourable conditions exist.

REAL AND APPARENT BOTTLE-NECKS

There can be but very few factories in existence which have remained for any length of time exactly as originally laid out. Even when the product is an unvarying commodity, as cement or cork, sugar or sand-paper, it is certain that the works producing it rarely even approximates in the disposal of its machinery, power supply, and storage accommodation to the picture of the same works a few years earlier. If this be true of the straightforward continuous-process factories, what of those works wherein the duplication of identical articles may never occur? Between these two extremes stand a multitude of productive concerns wherein the evolution of the needs and desires of mankind is fulfilled.

If it were possible to discover how and when these changes came about, it would probably be found that they are, more often than not, the result of haphazard decisions arrived at as expedients to overcome congestion. It may be that the element of chance is inevitable in these decisions; it is none the less undesirable, and if the problem of



FIG. 11. OBSOLETE INTERNAL TRANSPORT
(2152) (By courtesy of Messrs. Herbert Morris, Ltd) 102



FIG. 12. MODERN INTERNAL TRANSPORT

(By courtesy of Messrs Herbert Morris, Ltd.)

immediate need is recognized as part of a larger problem, the adventitious nature of these decisions may with advantage be reduced.

Whether congestion at some particular point be caused by change of fashion, by advanced mechanization, or by economic necessity, it is first felt in a slowing-up of dependent subsequent processes and ultimately by a check in the development of the business considered as a single productive unit. It would be almost safe to say that all the deviations from the original plan of a factory lay-out are a result of the discovery and removal of departmental congestion, familiarly known as "bottle-necks." It is quite safe to say that in every works where operations occur in series, the capacity to perform each operation is never perfectly matched. It is equally true that there exist also what may be termed intermittent bottle-necks.

Although, on the face of it, it might appear that the discovery of bottle-necks would present little difficulty, it is a fact, of which many readers will have corroborative experience, that in practice this discovery is by no means easy. There are indications pointing in a thousand directions towards false conclusions. Always the correct path lies in a fog of irrelevant detail; frequently, the constant and the intermittent bottle-necks are intermixed and confused; generally the verbal information of the men on the job is misleading.

Some little time ago a large contract was obtained by a firm whose key department was the largest of its kind in Great Britain. The goods required were all of one kind, and were capable of production in the key department, although this department also gave shape to a large range of goods, the subsequent treatment of which varied. The capacity for subsequent treatment of the goods required under the contract was inadequate. Some £10,000 was spent on new equipment. Contrary to anticipation, no serious

difficulty was experienced in circumventing bottle-necks in early process departments about which doubts had been expressed. Considerable difficulty arose, however, in the key department itself. Wastage from breakage increased far beyond normal percentages. Internal transport arrangements had not been designed to carry so great a proportion of exceptionally fragile goods as those required by the contract. The building was unsuitable for the introduction of jolt-free overhead conveyers, although these in the end had to be introduced at great expense and inconvenience to work-in-progress.

No golden rule exists which will meet this ever-present, though seemingly dormant, problem of the bottle-neck. As a problem it is important in proportion to the recognition it receives before it becomes overwhelming. Conversely, it disappears by early anticipation. The only real safeguard is in a complete understanding of the job by those responsible for the planning of production. It is the interlocking of conditions with circumstances which defeats the theorist or the director who attends the board once a month.

PROMISES OF DELIVERY DATES

When delivery is promised in a period which is shorter than that occupied by the normal processes of manufacture, one or both of two undesirable results ensue. Either goodwill suffers if the customer is disappointed by late delivery, or manufacturing costs are increased, and other losses consequent upon interruptions in process work are suffered.

The commonest offenders in the giving of too short promises are those whose energies are directed at effecting sales. It is true that the actual words must be uttered by them to the customer, but precautions should be taken that promises are authenticated in the proper quarter. The guilty salesmen invariably blame the works for slowness of production and say that they could not have obtained the order

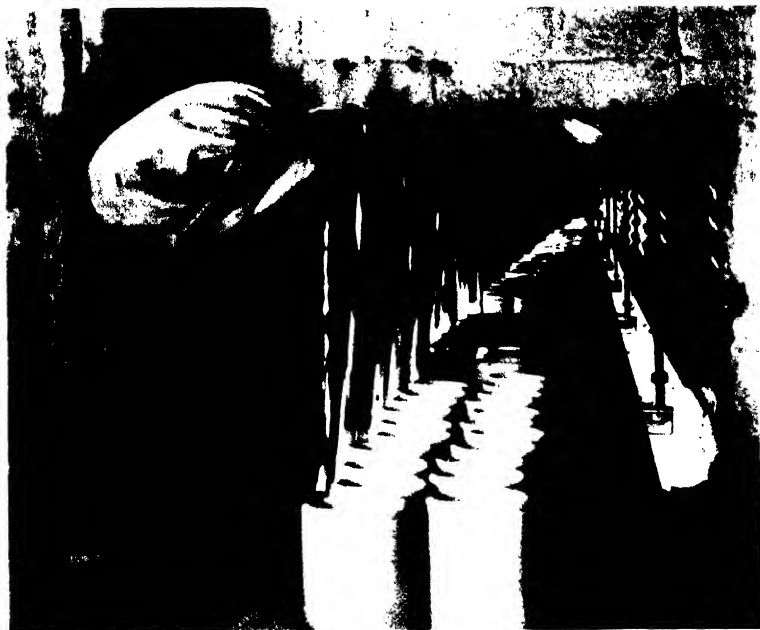


FIG. 13. MODERN INTERNAL TRANSPORT
(By courtesy of Messrs. Herbert Morris, Ltd.)

unless they promised delivery in the time stated. If it be found that this state of affairs is chronic, it is high time that the management takes pains to investigate and find a remedy. A reputation for late delivery is extremely difficult to remove once it is established. If it is found that the difficulty of the sales staff is real, measures must be adopted to speed up production and to carry adequate stocks.

If, on the other hand, it be found that early promises are given too freely, it must be insisted upon that the person who alone has any real authority to make promises of delivery must signify his acceptance of the times stated. This person is the works manager. Should difficulties persist after this rule is insisted upon, the source of weakness will be apparent. If any other person or more than one person is permitted to give promises of delivery dates, it is impossible to discover a remedy with certainty as to its being effective.

An efficient works manager bases his promises upon facts, not upon hopes.

CHAPTER XI

WASTE

INSPECTION and testing—When to scrap—Time wasting—Issuing specification and setting up—Preventing time and material waste—Disposal of material waste.

It would be difficult to name an industry in which waste could be entirely avoided. Indeed, the problem of waste in some great undertakings is such that separate factories are established whose business it is to convert the waste of the parent firm into money. In considering the question of waste, it is necessary, therefore, to differentiate between what may be regarded as normal, permissible, or unavoidable waste and the waste which is excessive and intolerable.

Waste material of the first group will include: turnings, borings, and short ends of metal; sawdust, shavings, and waste scraps of timber; short and dirty fibres of textile materials, and impurities extracted in countless industrial processes.

Methods of sale of such material are peculiar to every trade and do not enter into the present discussion. For the immediate purpose the only share of attention they require is that which concerns their quantity.

When waste is said to be excessive, a comparison is implied.

Records of waste produced are therefore imperative, and, when excesses occur, pains must be taken to discover whether they are due to defective material or to faulty workmanship. The remedy in either case is obvious; the point it is desired to make here is that waste records are worth the small amount of trouble involved in keeping them. Neglect to do so is common, and wherever it has been suspected that their institution would prove useful, the suspicion has

been amply justified by the facts their establishment has revealed.

That proportion of waste which has been classified as intolerable may again be considered separately from two angles, namely—

1. Scrap material as already described.
2. Scrapped work-in-progress (i.e. goods which during the process of manufacture have been discovered to be unsatisfactory).

In those industries where a high percentage of loss of weight of material occurs naturally in refining processes, it is advisable to keep records at as many different points as are under separate control, and as are subject to conditions peculiar to themselves. If this is done, any fluctuation above the normal will be noticed at the place to which attention may be most usefully directed. It may be decided at once, for example, whether the loss is caused by defective machinery, human error, or poor quality material.

In other industries, such as use common materials, metal, wood, leather, and so on, material waste is not, as a rule, measured by percentage loss in weight. Yet, if for no other reason than that of preventing the waste of usable material, some check is desirable. If scrap is weighed at fixed periods and classified, (*a*) as to material, (*b*) as to each productive department concerned, these weights may be shown in relation to total output of finished goods by each department during the same fixed period. Where circumstances do not warrant so elaborate a method, visual inspection before disposal will do much to check a tendency to scrap material of small size which, at low cost, could be collected and brought into use. Factories have been known where small sizes of material are the staple requirement of one department when another department has consistently scrapped such material, merely because no method has been planned to deal with the problem.

INSPECTION AND TESTING

Defective work-in-progress may often be detected without careful examination. Flaws in material, and mistakes in machining or hand work, are often obvious and easily noticed. Faulty work-in-progress is not always obvious, being at times detected only by minute examination. In many industries, where exactness of dimensions is imperative, each article must be subjected to a searching inspection where measurements to close limits are made.

In addition to such inspection, it is often necessary to apply tests which are usually fixed by standards set far higher than the limits of the normal use of articles tested.

With the work of the inspection and testing department may be combined the important function of closing orders. The work of this department may be regarded as the final productive operation. Thereafter there remains but the passing of goods into the finished goods warehouse. It is sometimes planned that goods are not passed into the warehouse piecemeal or until orders are complete.

For this, or for other reasons, there may be a hiatus in records of work-in-progress if goods (not orders) are not shown as completed until the warehouse inwards sheet is recorded.

Where heavy or valuable articles are produced in small batches, it may be advisable to arrange that inspection cards be passed to the progress department immediately goods have passed inspection. Alternatively, copies of internal production orders may be held by the inspection department, or they may be received by it from the productive department together with the goods. In either of these cases, the signature or initials of the inspectors in a space provided on the order will signify completion. The orders will then be handed to the progress department for the routine treatment described in Chapter XVI.

The work of inspection itself is greatly facilitated by an

adequate supply of instruments and gauges. Not only can a higher standard of quality be maintained, but the work can be carried on more rapidly and with fewer inspectors than when ordinary measuring scales, callipers, and so on, alone are provided. It is true that the equipment in mind is often expensive, but it is certain that the leading firms in most industries face this expense and have gained and maintain their predominance largely as a result. A reputation for high quality, than which there is nothing more valuable in industry, is often gained entirely as a result of rigorous inspection. Scientific tests never even contemplated in factories producing to a lower standard are faithfully conducted on every item. Costs, of course, are correspondingly high. But there is always a market for the very best, and quality remains when price is forgotten.

The subject now reverts naturally to the second of the two angles from which intolerable waste is to be considered.

WHEN TO SCRAP

By the exercise of ingenuity, skill, and patience, it is often possible to remedy defects, but these things are costly. The point requiring to be determined is how and when the use of these costly qualities is justifiable.

The tendency noticed in many factories to recover everything possible is as surprising as is the complete absence of this tendency in other factories. To some extent, of course, the point will be decided by the nature and custom of each industry, but even within the same industry the tendency differs widely.

It has been said that many a good potter has been led by his pride to bankruptcy. The same notion may doubtless be applied to other industries where a desire for high quality may be excessive and may become unwise. This is not a contradiction of the notion that quality pays; it is merely a plea for a proper regard for a sense of proportion.

The difference in tendency within one industry can only be explained by the temperamental variations of personalities. Some men love puzzles: they provide a diversion in the humdrum daily routine; other men grudge the cost. Whatever the cause may be, it is advisable to adopt a plan which will prevent the indulgence of qualities, commendable enough in some walks of life, which have no place in a factory where profit, if not the only objective, is always important.

Small items of trifling value are not usually considered as worthy of recovery. The suggested method which follows is intended to apply only to articles of individual value approaching or considerably exceeding, say, £1.

1. No attempt at recovery should be permitted without the works manager's consent.

2. All time spent in recovery should be booked separately.

3. All recovered items should be costed separately.

4. Comparison with normal cost should be made to discover whether it would not have paid better to scrap the article at the stage when the defect was discovered and to commence remaking from the commencement.

If these rules were properly insisted upon, it is certain that the insidious evil referred to would be checked. A few test cases on the lines suggested will frequently astonish many who have hitherto supported existing methods.

Further than the above, it is suggested that defective items possible of recovery need not always be scrapped out of hand. They may be stored for emergency uses or for recovery at times of quiet trade or when odd jobs are useful for filling gaps.

TIME WASTING

As with material, this form of waste may be either normal or intolerable. Its occurrence is, unfortunately, not always easily detected.

Much of what may be called normal time wasting is due to defective planning. Assuming that the methods of rate fixing, time recording and costing advocated in subsequent chapters are in force, it will be difficult for workpeople to waste time which is chargeable to definite jobs. When, however, wages are paid at hourly rates calculated from the times of arrival at and departure from the factory, it is possible for much to be lost. The difference between time spent on jobs and the total time of attendance at the works may be revealed by the system outlined hereafter. Some of this difference may be normal and permissible under the planning in vogue; some of it may be intolerable. The two sections may be shown in tabular form—

NORMAL	ABNORMAL
<ol style="list-style-type: none"> 1. Fetching material and waiting. 2. Fetching tools and waiting. 3. Fetching drawings or specification and waiting. 4. Clocking on to new jobs. 5. Clerical work. 6. Shop labour. 	<ol style="list-style-type: none"> 1. Accident. 2. Ill-health. 3. Mislaidd implements. 4. Gossiping and loitering. 5. Eating, drinking, and smoking. 6. Excessive use of lavatory.

The lists are not exhaustive, but serve to indicate the idea in mind.

The NORMAL items present scope for obvious planning remedies; the first three items on the list may be removed if arrangements are made to deliver what is required at the place where work is carried out; the fourth item requires the recording of time to take place at or near the machine or bench; the fifth and sixth items are dealt with in this book in several connections.

The ABNORMAL items require adequate welfare supervision for the first two and proper discipline for the remainder of the list. Item 5 perhaps deserves a special word: provision of facilities and set times for eating, drinking, and

smoking during work hours will not only remove many evils, but may, indeed, prove beneficial to employees and also to the employer. A morning shift of four hours, commencing early and preceded by a long, cold journey will cause fatigue before midday comes round. Where labour is strenuous, a break becomes imperative.

Permission to smoke during working hours is becoming more and more prevalent in factories where no unusual fire risks exist. On the democratic principle of "do unto others," etc., it is difficult to see how an employer could justify denial of the privilege. A compromise which seems to work well is the fixing of a half-hour in the morning and in the afternoon shifts when smoking is permitted.

Lavatory accommodation, although supposedly settled by law, is often scandalously inadequate, badly cared for, and awkwardly placed. It is difficult for a foreman of a department where some women are employed to interfere on this subject as far as they are concerned. A capable woman should be given the necessary authority. Lavatories should be periodically inspected, and cases of disorderly behaviour severely reprimanded. Lavatory superintendents can prevent loitering, but they can only usually be employed at very large factories.

ISSUING SPECIFICATION AND SETTING UP

Any time which can be saved between the moment when an operative clocks-on to a new job, and the moment when his energy has its first effect upon material, will reduce the cost of every article produced. The interval between jobs has already been shown to be occupied in part by the obtaining of particulars about new work. In addition to this, time may be occupied—

1. In notifying the foreman that the old job is finished.
2. In setting up a machine or appliances necessary to the new job.

The first of these can be circumvented by imposing upon the foreman the duty of having new jobs ready and waiting.

The specification or drawing of the new job should be looked over by the foreman before the moment arrives when it is handed to, or picked up by, the operative. Explanations are frequently necessary and workpeople should not be kept standing idly at the foreman's side whilst he himself absorbs and digests the detail.

The time allowed for setting up is usually settled in advance by an expert rate fixer (see Chapter XVIII). It is rarely, if ever, on the generous side, and makes no allowance for the perversity of fate which hides spanners, causes nuts to bind, and many other exasperating hindrances. Nothing can be done to overcome difficulties of this kind which may be experienced by an able operative. By far the best plan is to provide an experienced setter-up, unless circumstances are such that the foreman himself can undertake to supervise and assist.

This does not mean that the worker is idle while the setting is accomplished. His time may be well occupied in handing tools, holding loose fitments, and in the useful capacity of a "plumber's mate."

PREVENTING TIME AND MATERIAL WASTE

Where all job time cards are handled by a rate fixer, it should become a matter of routine for him to seek an explanation of excesses, or else to pass a note of them to the departmental foreman. Under other conditions, excesses will become apparent to the costing department. It is no use providing apparatus for the acquisition of facts unless means are adopted to make use of the information obtained.

Works managers, foremen, and others in authority have plenty to occupy their time, apart from the investigation of paltry cases of wasted time. A compromise, with the necessary disciplinary effect, must be devised. One of the

commonest valid excuses for lost time is that of mechanical breakdown, and power and transmission difficulties, over which the worker has no control.

Notes of these occurrences can be made on job cards, and, if desired, the foreman can be required to initial them. They should be deducted from times recorded by the rate fixer, but included in costs where ordinary job costing is practised. (See Chapter XIII.)

Material waste of an abnormal kind should similarly be brought to the notice of those who have authority to remove its causes. In some industries, a definite check upon the destruction of goods, and upon a tendency to cover up technical disaster, is imperative and has been found in the rule that no scrap may be carried from the shops producing it, until it has been viewed by a director or other high officer of the manufacturing concern.

Such a rule necessitates a definite routine. Inspection occurs periodically. The persons present are the official referred to, the departmental foreman or works manager, and the person who removes the scrap. The last-named official has first listed the condemned goods in a duplicate book. The list, when signed by the director or his equivalent, constitutes the only authority upon which goods may be removed, sold as scrap, or destroyed. In running through the list, explanations may be asked for and received about items which require them. Repeated technical incompetence is thus revealed, and may be remedied before unknown serious losses are at last shown by financial accounts. The signed scrap sheets are essential in factories where all items of production have to be accounted and balanced.

DISPOSAL OF MATERIAL WASTE

A moment's reflection will show that the method last sketched is incomplete as a perfect check, unless some arrangement is devised to prevent the short-circuiting of

the periodical routine of scrap inspection. When scrap is valueless and may be easily destroyed, as in the pottery industry, it is advisable that the official conducting the inspection should personally witness the actual destruction. Under such a rule, it would be extremely dangerous to destroy scrap illicitly; such an action may easily be noticed and reported by any workpeople who understand the rule.

Scrap material which is accumulated for sale or other disposal should be removed as far as possible from its source of origin. It should be bagged, stacked, or stored in a manner of finality, and be under lock and key whenever possible. The stringency of the methods adopted will depend in various trades upon the relative value between scrap and work-in-progress, and upon the value of the scrap material itself.

CHAPTER XII

INDIRECT PRODUCTION

POWER production and expenditure—Electricity—Steam—Internal combustion engines—Refined oil engines—Compressed air—Jigs and tools—Maintenance of plant and buildings—Experiment and research.

IT is not always easy to draw a hard and fast line between direct and indirect production. The sharpening of a tool may be carried out solely with regard to one item of production in which it is employed, or it may be done entirely as a matter of routine for the purpose of maintaining the general tool equipment of a factory in a condition suitable for future productive purposes. It is not proposed here to contribute towards the controversy which seeks to limit the use of the term "indirect." For the present purpose, indirect production is taken to mean all those items incurring productive expense which cannot be analysed and charged to individual jobs.

The manner of charging such items is a subject for an accountant with whom production planning has no present connection, other than to see that his requirements are met. As a principle of good planning, however, it may be stated that methods should be used which provide information capable of maximum analysis.

In the interests of accurate costing alone it is necessary that indirect production expenses shall be allocated as nearly as possible to the goods demanding them. For example, it is unsatisfactory to regard the cost of power as a general overhead charge. Efforts should be made to determine as nearly as possible the exact uses of power, and to avoid laying an undue proportion of its cost upon goods or operations which require little or none of it.

POWER PRODUCTION AND EXPENDITURE

Power may be manufactured, or it may be purchased ready made, or it may, in rare cases, be obtained gratis. Even where wind- or water-power is available there are supervisory, maintenance, and other charges incurred. But, for the present purpose, power, either purchased or produced, is considered.

ELECTRICITY

In towns of any size, it will generally be found that it is better to buy electric energy from the local supply undertaking than to make it. There is, however, one difficulty in many small towns: during the period of peak load, a large factory cannot get sufficient current. This period occurs at dusk, during those seasons of the year when artificial light is used in factory hours. The solution is to produce current for these periods. It will still, in most cases, be more economical to buy current for daylight working.

Whether current be bought or made, electricity possesses many advantages over other forms of energy for a large number of purposes. These advantages fall chiefly into two divisions: (1) For driving light machinery, (2) For driving scattered machinery.

Where a considerable quantity of light machinery is installed, and forms of energy other than electricity are used, they are absorbed disproportionately in moving shafting and belts running over the loose pulleys of idle machines. Electricity possesses the advantages, first, that units consumed are self-adjusting to the load more readily than in the cases of other forms of energy; secondly, that separate electric motors may be used to drive small batches of, or single, machines. On the first point, it is to be understood that where, say, a motor of 10 h.p. is provided to drive ten machines each requiring 1 h.p., the loss when only one or two machines of the ten are running is negligible. A 10 h.p.

electric motor does not consume its full 10 h.p. of current except at full load.

On the second point, it is to be observed that losses which may occur under the first point can be entirely eliminated by the use of individual motors attached to each machine.

In addition to the direct economy of individual or small group drives by electricity, there is another important advantage to be gained from this method of distribution of energy. It is that power consumption records may be obtained by the installation of motors. These records are an invaluable aid to accurate costing. They may be collected simply by imposing upon the operatives the duty of recording meter readings on job time cards where meters are fitted to machines driven by individual motors. Where meters covering groups of machines are used, a rate fixer or cost clerk should collect readings daily and calculate power consumption for addition to his data (see Chapters XIII and XVIII). A point worth remembering in this connection is to construct a method of checking the total of all individual meter readings against the reading of the meter fitted at the main switchboard. This latter, being used by a power supply company, for the purpose of computing its charges, may reveal discrepancies. Any serious loss will probably be due to defective wiring and must be traced and rectified.

Alternatively, it frequently happens that meters are inaccurate and their calibration is a matter of urgency, to delay which may cause serious loss.

There is another aspect of electric power with which production planning is intimately concerned. Where a works is distributed over a wide area, the cost of the installation of the "transmission" of electricity is far less than that of other forms of energy. The difference is a comparison between the cost of line-shafting, bearings, and brackets, with or without the addition of trapped and lagged steam-tubing, and the cost of running and supporting electric cables. In

the former, maintenance cost of lubrication is a constant expense, and losses of energy through friction and the cooling of steam are considerable and also constant.

STEAM

This is still the cheapest form of power under many circumstances. Where rough machinery carrying great loads is used, the direct application of a steam engine cannot be surpassed either for economy, efficiency, or freedom from breakdown. In colliery districts cheap fuel adds much to the balance in favour of steam. In such districts it is common to find complete installations of machinery driven direct by steam. The cost of scrapping it and of substituting more modern equipment may well be beyond the resources of its owners. Much, however, can be done by careful planning to obtain good results from an old-fashioned steam installation.

The use of steam in a works may take the form of one central steam-generating unit, or it may be that boilers and furnaces are scattered throughout the works. In the former case, steam will be conducted through tubing to engines located at different points. In the latter case, fuel and water supplies must be duplicated, as also must the labour required to attend to furnaces.

Where central steam-generating units exist, the quantity of energy obtained from a given amount of fuel may be so much greater than that obtained by small scattered units as entirely to offset losses occurring from steam transmission over long runs. Furnace draught is obtained by a tall chimney stack; pre-heated water may be injected automatically; steam condensers may be installed; automatic stokers may be added.

Steam may be generated at one central point for distribution as described, or it may be used entirely on the spot to deliver its energy to a steam power unit engaged in rotating

electric dynamos. In the latter case, of course, electric energy is distributed as already described. In all cases, planning as it affects the production of energy by steam falls into two sections: that which concerns the generation of steam: that which concerns generation of power from steam.

The first section includes problems of fuel consumption, furnace maintenance, and boiler inspection.

Fuel consumption should be properly recorded daily and graphed. Changes of fuel should be noted on the graph. By this means economies in size and type of fuel can be obtained. Steam consumption must, of course, be taken into consideration. Pressure gauge readings should be recorded at least hourly and undue rises and falls explained.

The operation of the safety valve should call for the immediate presence of the works manager or his deputy. Many hundreds of pounds' value of fuel may be blown away to atmosphere in the course of a year if little notice is taken of this important warning.

A rough log book should be kept by the chief furnace man, and the above particulars entered in it. All variations from normal should be recorded at the times they occur. At least twice daily it should be the routine duty of a responsible person, with engineering knowledge, to visit the boiler room and initial the book. On the occasion of each visit he should note gauge readings, examine water gauges, and require furnace doors to be opened. He should watch the run of fuel, clinker, and ash. The use of forced steam draught should not be allowed until permission is first obtained. If the simple routine outlined were practised far more commonly than it is, power costs would fall and much less would be heard about poor quality fuel.

In comparatively recent times the use of automatic stoking appliances has grown. Although it is not the function of this book to discuss the merits of mechanical appliances, it is perhaps necessary in the present connection to point

out that an appliance of this kind possesses one particular advantage within the field of planning. Since these devices feed fuel automatically, they lend themselves by adjustment of speed to the precise manipulation which it is the function of sound planning to set up in place of haphazard methods. The type of fuel used is also such that economies may be effected. The same remark applies to the use of pulverized fuel burners.

Where coal is expensive, and the measurement of fuel consumption correspondingly important, the use of alternative fuels may provide great economies. The alternatives most widely used for steam raising are oil and gas.

Modern oil and gas burners possess several advantages from a planning point of view.

1. Their consumption may be regulated and accurately measured.
2. Furnace labour is considerably reduced.
3. There is no ash, clinker, and maintenance of fire bars.
4. Fuel storage need occupy no valuable space, and handling is simple.

A further source of economy often overlooked in the raising of steam lies in the utilization of waste heat on the one hand, and of waste steam on the other.

These are two points to which great attention seems to be directed in certain countries, but which are surprisingly neglected elsewhere.

Great heat is required in many factories for purposes other than for the raising of steam. These same factories frequently consume great quantities of fuel in furnaces under steam boilers. In some cases, this steam is actually used for heating drying rooms, workshops, and offices, often at great expense, particularly where long runs of tubing are necessary. It is well worth the while of any manufacturer working under these conditions to have a thorough investigation made.

While it is not always possible, owing to the method of

construction and the arrangement of factory buildings, to conserve heat expended merely in temperature-raising, for conversion into power, there are few circumstances where this heat could not be used for other heating purposes upon which money is spent separately and unnecessarily.

In the same way, waste material combustible under properly designed conditions is often destroyed at considerable expense, instead of being burnt in the production of steam. The woodworking and textile industries are particularly behindhand in this respect.

Passing to the conversion of steam into mechanical energy, the subject may again be divided under two main heads—

1. The single cylinder, pump type, reciprocating engine operating on low-pressure steam.
2. The compound, double or triple expansion, engine, and the steam turbine, operating on high-pressure steam.

The first section covers what is probably the simplest, most trouble-free and fool-proof method of applying artificial energy to industry. In witness of this there are thousands of veteran steam engines still running, still wasting more steam than they convert into power, and still sadly neglected.

Under many circumstances the use of primitive engines is quite profitable, but no excuse can exist for leaving these faithful relics for years to look after themselves. The cost of the routine attention suggested below is small in comparison with the constant fuel waste its lack involves.

1. A qualified engineer should visit and inspect each engine casually at least once a week.
2. Bearings and glands should be tightened and packed whenever knocking or escaping steam is noticed.
3. Indicator diagrams should be taken periodically and compared. Valve openings should be checked and adjusted where necessary.
4. Horizontal cylinders in particular should be opened once a year and carefully measured. They should be

re-bored and new pistons should be fitted when wear entails steam losses.

The second division, high-pressure engines, is usually treated with greater respect. Even so, it is no uncommon thing to find men with but a sketchy understanding of the power in their hands controlling units where maximum efficiency can only be obtained by men of high technical capacity and training. The difference in wage costs between the two types of engineers is small in comparison with the economy which should result from the employment of the latter type. A qualified person will usually be capable of carrying out the boiler-room routine already indicated, and also of co-operating with a specialist upon the conservation of waste heat. He will be able, too, to undertake control of the fuel problems. It is a sound plan to offer an incentive to such a person based on a bonus paid to him in return for fuel economies.

In addition to the care aimed at securing efficiency in steam consumption, it is necessary to measure as accurately as possible the use made of the power produced. Records should be prepared giving the power exerted under varying engine conditions. Abnormal demands for power should be investigated after the power consuming capacity of each machine or department has been calculated or otherwise assessed. The proper allocation to each machine of the quantity of power required under varying loads will provide invaluable information for costing and other purposes. Amongst the latter is included the ability to determine the most suitable machines for various purposes.

INTERNAL COMBUSTION ENGINES

These may be conveniently subdivided—

I. Gas engines:

- (a) Using local gas.
- (b) Using producer gas.

2. Oil engines :

- (a) Using crude mineral oil.
- (b) Using refined oil, gasoline, or petrol.

All these power units possess the advantage of having much in common, in principle, with the ubiquitous automobile engine. Perhaps the most important common principle is the law that power output depends upon speed. It is necessary, therefore, to safeguard the running of each engine at the speed for which it is designed. Half-daily inspection routine should be instituted, as already outlined under the remarks on the subject of steam. On most internal combustion engines are fixed plates giving the correct speed. The first duty of an inspector should be to ascertain the actual speed of each engine running. Overloading is definitely detrimental to these engines ; if they are running slow and labouring, and this cannot be accounted for at the engine, investigation of the load should be made immediately ; any excessive burden should be at once reduced. Internal combustion engines need to be dismantled at periods which can easily be ascertained in practice. It is as well to make this a matter of routine whether any immediate indication of its need can be detected or not.

Providing the above receive routine attention, any variations in speed will be due to fuel variation or failure to attend to lubrication, cleanliness, and adjustment of moving parts. These are matters an inspector's routine may check before serious damage occurs. Neglect inevitably leads to breakdown.

Variations in the quality of gas delivered through the mains of supply companies are apparent to no users more readily than to those who convert it into power. Nothing can, of course, be done direct to remedy the supply of poor gas. Complaints should be made immediately and the presence of an official from the gas works demanded.

Gas producers, usually under the direct control of the man who runs the engine, do not often fail unless from neglect to obey the conditions laid down by their makers. Inspection of engines should be accompanied by a visit to the gas producer. The inspector need be no expert; working instructions are always printed and provided with each plant (if they are lost, duplicates should be obtained from the makers); providing the fuel conforms to specification and there are no air leaks in the system, trouble can only occur from neglect.

Gas producer manufacturers will always analyse samples of fuel submitted.

Crude oil engines may be subdivided into two groups—

(a) Those in which the fuel entering the cylinder is artificially ignited.

(b) Those wherein heat generated on the compression stroke causes combustion.

For heavy work, there is little doubt that these engines are more economical in fuel consumption than any other type of internal combustion engine. Their running and particularly their starting certainly demand a little more knowledge and skill than are required by other types.

Starting difficulties are generally the natural result of the size and weight of the machine, but sometimes they are added to by excessive cold. It is, therefore, common to find attached to these engines some form of subsidiary power device, also a means of applying artificial heat.

Routine inspection of a running engine follows the lines already indicated, with the addition of attention to the starting appliances, which, during the time of inspection, are out of use. It is impracticable, of course, to stop an engine in order to test the starter. The best course is to examine it, inquire the time taken in starting each day, and to arrange that the inspector is present at starting time, at least once a week.

REFINED OIL ENGINES

Since it is unreasonable to assume that there can be any difficulty in finding a person who runs or understands the running of an automobile engine, there is little need to add to what has already been written. The diligence exhibited by a person in charge of a productive engine, over a machine owned by himself, may often be observed and used as a measure of his capacity in this direction on the manufacturer's behalf.

Engines of this kind are frequently attached to mobile machines and appliances and are cared for by those responsible for owned road transport. Where a garage exists, it is advisable to delegate to the chief of it the authority to examine, and the responsibility to keep in running order, all the engines of this type which are used in production.

COMPRESSED AIR

The recent rapid extension of the uses of compressed air in industry is an outstanding feature of modern engineering development. Stated broadly, the reason is that this method is often a solution of internal transport problems where, as in shipyards and mines, power can be taken by means of a rubber hose into places inaccessible to machinery of a heavy description. The alternatives are slower and more costly hand-work, or the expensive complications consequent upon the bringing of work into conjunction with fixed machinery.

Another basic factor to account for this development is the percussive as well as rotative function for which pneumatic tools are designed. In other words, the work of the hammer in its many forms can be performed more rapidly and economically with the aid of compressed air than by an electric motor or any other device which is transportable and capable of being introduced into a space too limited even for the swinging of an ordinary hammer.

The method of obtaining a supply of compressed air has now been fairly well standardized. An air compressor is driven by whatever power is available or by an internal combustion engine specially provided for the purpose. Compressed air is pumped into a steel receiver whence it is drawn off for use. A predetermined pressure is maintained by an automatic air governor affixed to the compressor.

The efficiency of an air compressor depends upon its continuance to deliver the quantity of compressed air per minute specified by its makers. This output is contingent upon the maintenance of several variable factors—

1. Speed and power consumed.
2. Pressure required.
3. Temperature of atmosphere.
4. Barometric pressure.

Control of the last two items is assumed to be impossible; therefore, where pressure required is predetermined at a fixed number of pounds per square inch, adjustment to meet the uncontrollable variables must centre on the first item. Points for attention are—

1. To note any rise in power consumption for a given speed of compressor revolution. Where electric motors supply the energy, the power consumption may be read direct from an ammeter. Where petrol-driven units are in operation, fuel consumption will give a rough guide. In other cases, calculations require technical knowledge.

2. To note pressure gauge readings on the air receiver, and the readiness of the governor to cut in and out.

3. To calculate volume of air passing. This involves a slide-rule calculation on a formula readily understood.

Efficiency generally depends upon the condition of valves and valve springs, proper lubrication, and effective cooling.

In order to prevent damage to rubber hose caused by the passing of oil with air, and failure of or damage to pneumatic tools by the freezing of water, it is necessary to

examine air filters fitted to the intakes of compressors and also any oil and water separators used in the delivery circuit. The air receiver must also be drained periodically, whether the separators are fitted or not.

In order to economize in the use of air, it is necessary that pneumatic tools be tested from time to time to ascertain their air consumption. This may be done by scientific calculation or by a rough-and-ready observation of the number which can be kept running at one time.

JIGS AND TOOLS

General purpose machinery, used by engineers, such as lathes, milling, planing, drilling, grinding, and boring machines fall under the comprehensive term "machine tools."

Corresponding machines are used in woodworking and other trades. Special purpose machines such as are used, for example, for grain grinding, textile spinning and weaving, sewing, printing, and so on, are peculiar to each trade, and information about them must be sought in the technological literature of each trade rather than in a general treatise on production planning.

Similarly, automatic machines designed to perform a sequence of operations are outside the scope of the subject about to be considered.

Great economy can be effected in the use of machine tools by the application to them of special fittings called jigs.

Probably the simplest form of jig to use, as an example, is a drilling jig. It is used when one or more holes are required in an exact position. The jig is made to fit the article requiring to be drilled, either by holding it firmly as in a box or by other means. A drill passing through a hole in the jig will perform the necessary operation. Were a jig not used, it would be necessary to measure and mark accurately the position and depth of each hole. This would take far longer than the actual work of drilling.

Jigs are costly, particularly if they are of complicated design, and the expense of their provision is justified only when it is known that considerable use can be made of them. Production planning, therefore, is concerned with the proper determination of jig requirements. Economy can be effected in two ways—

1. By saving hand marking and setting.
2. By saving the cost of unnecessary jigs.

The first rule required is that the sanction of the works manager or other high official should be necessary before new jigs can be purchased or made.

Such sanction can only be given by one conversant with the entire manufacturing policy of the principals. If this safeguard is not insisted upon, a clever and ingenious machine shop foreman, given a free hand, can contrive marvellous appliances at ruinous expense.

The second rule is that estimates of cost be obtained before the manufacturer is committed, and the third rule is that these estimates be checked against costs of doing the work without jigs in order to discover how long it will take a jig to save its own cost. The latter point involves investigation of records of stock and of previous labour costs.

Where jigs are made in the factory, accurate costing is essential, and the common practice of a tool-room foreman neglecting to book his own time should not be permitted.

All jigs and tools should be stamped with an identification sign and the date of their manufacture. The former will serve to secure that they are stored in an orderly manner and that they will be forthcoming when required, without delay. The date provides evidence of length of service, an important consideration in connection with these expensive items of equipment.

The term "tools" in its present connection is intended to include the following—

- (a) Hand tools provided by the manufacturer, such as

files and hack-saw blades, which are rapidly worn out, or "consumable."

These should be stored under lock and key and definitely accounted for.

(b) Cutting tools used in machines, such as drills, reamers, grinding wheels, saws, lathe and milling cutters.

These, also, should be stored under lock and key, and a simple method used to show where items issued and in use are located. All tools in this category should be reconditioned as they are returned after use.

(c) Special purpose tools, such as stamps, dies, and special thread-making appliances. These should be the subject of the same routine of storage and issue as is applied to jigs. A card index cabinet provides a simple method of recording location, periods of use, and amount of reconditioning. Foundry patterns may also be subject to similar treatment.

MAINTENANCE OF PLANT AND BUILDINGS

Work of this description should never be put in hand without proper sanction as far as items other than those of a routine nature are concerned.

It is usual to classify different items of maintenance work in such manner that expenditure over a period upon each item may be separated and analysed. Each section is signified by a code sign or number in the following manner—

Repairs to Building	A	.	.	.	.	.	S.O. 101
" "	B	.	.	.	.	.	S.O. 102
" "	C	.	.	.	.	.	S.O. 103
Machine Maintenance Shop	A	.	.	.	.	.	S.O. 201
" "	B	.	.	.	.	.	S.O. 202
" "	C	.	.	.	.	.	S.O. 203
Power House Maintenance	.	.	.	.	.	.	S.O. 301
" Transmission Maintenance	.	.	.	.	.	.	S.O. 302
Internal Transport	.	.	.	.	.	.	S.O. 401
External Transport	.	.	.	.	.	.	S.O. 402

The symbols, S.O., mean "Standing Order." This is issued and signed by the works manager and all material and labour

are booked to the code number. In order to avoid undue duplication of paper work, the forms used should be of large size to permit of as much information as is possible and required to be collected on the one form.

The order should be addressed to the person responsible for the work, and all instructions necessary as to the manner of carrying it out and the material required should be stated.

Where work is carried out by outside contractors the same form may be used and the cost information collected on it.

Maintenance work of a routine nature is charged to the same series of standing order numbers or signs, unless it is desired to keep non-recurring items separate.

A simple adjustment of symbols will give effect to this, and such items as cleaning, lubricating, etc., may be separated and distributed to appropriate departments if desired. Routine maintenance work is frequently carried on without the use of special records of individual tasks.

Under these circumstances it becomes a general overhead charge of indirect production.

EXPERIMENT AND RESEARCH

This work is imperative to the development, if not to the conduct, of many manufacturing concerns. In the interests of economy, it is necessary to confine the scope of such work within reasonable limits. This is not always easy, because a scientist does not know in advance the extent of the unexplored territory which lies before him. Nevertheless, a good deal of money can be, and frequently is, wasted when safeguards could have been taken to prevent these losses. The best way to do this is to insist that nothing of a non-routine nature shall be commenced without sanction.

When an experiment of magnitude, or a branch of research with far-reaching possibilities, is contemplated, probable costs should be estimated, and a limit, of the commitment

undertaken, made and enforced. Thereafter, reports should be called for periodically, together with a return of total expenditure to date.

On the routine side of this work it is useful to consider how far the installation of automatic recording instruments may be of assistance.

Processes dependent upon conditions of temperature, pressure, vacuum, or humidity may be watched in the offices of the principal or technical expert, on charts electrically marked. If, for example, steady rises and falls of temperature are required to take place at stated times of day and night firing, the instruments, expensive though they are, may easily pay for themselves by preventing one night fireman from neglecting his duty on one single occasion alone.

PART III PLANNING FOR CO-ORDINATION

CHAPTER XIII

COSTING

PRIMARY function to provide costs—Secondary function—Job costing—
Continuous process costing—Standard costing.

It would be extremely difficult so to plan the activities of any manufacturing enterprise that profit would be produced, unless some satisfactory method were devised to ascertain with reasonable accuracy the cost of every part of these activities. The subject of cost finding is far too large to be covered with anything approaching adequacy here. The present purpose is to give an outline of the requirements of various recognized cost systems, and to show how methods may be planned to co-ordinate with other routine work in order to supply these requirements.

Costs are used for several purposes which, for the sake of clear thinking, may well be stated—

1. To fix selling prices.
2. To ascertain if selling prices are profitable.
3. To discover which line of product pays best.
4. To secure economical production—
 - (a) By checking waste of time and material.
 - (b) By comparison between alternative methods of production.
 - (c) By disclosing excessive costs of recovering defective work-in-progress.
5. To provide information which will enable overhead charges to be confined within budgeted limits.

These items have been referred to throughout the foregoing

pages. It must now be shown how the cost department deals with the points raised.

Before proceeding to detail, there are several general points to be considered. The first is that of expense. A cost department may itself easily become far too costly in proportion to the size of a factory. It is no uncommon thing for a manufacturer not initiated into the intricacies of costing to become convinced of his weakness in this direction, and to straightway engage the services of a "qualified cost accountant." If he does this, he will very likely find that the person he has engaged is in a sense so well qualified as to become a liability rather than an asset. In theory, a thorough cost system demands a definitely recognized routine. There is no use in pretending otherwise; many manufacturers cannot afford to bear the cost of this routine. Since this book is written particularly for the benefit of such manufacturers, it is necessary for it to show how this well-defined routine work may be modified without the sacrifice of fundamental principles.

It must not, however, be assumed from the foregoing that thorough cost finding is not in every way desirable, where the size of an undertaking warrants it. The point here made is that the expense of cost finding does not vary exactly in proportion to turnover.

Each cog in the cost-finding machine has to be paid for, whether the machine is fully loaded or not.

A costing system is usually accepted as thorough and complete when it includes a method of reconciliation with the financial books of a manufacturing concern. Indeed, it may go farther still and actually become merged in the general system of accountancy. The object in view is sound and excellent in every way, with the proviso already noted: "Can the manufacturer afford it?" It is said with almost, but not quite, complete truth that if every single penny expended by a manufacturer is shown to have entered into

the cost of the goods he produces, then, and then only, will the costs arrived at be accurate. It is proposed to refer to such costs as "reconciled costs."

That this can rarely, if ever, be completely true is worthy of consideration, because it is proposed to describe methods of costing which do not include reconciliation; and whilst it is admitted that such costs are imperfect, it may be as well to show that the complicated measures necessary to reconciliation produce costs which may be equally imperfect.

Reconciled costs are accurate in total, but the costs of the individual items of manufacture which make up the sum cannot be exact for the reason about to be explained.

It is assumed that it is desired to discover what a certain product has cost to produce, rather than to calculate what it ought to cost or what it will most likely cost in the immediate future, or to investigate the effects of failure to produce goods at a predetermined fixed cost. All these are methods in common practice to be dealt with in turn, but the point under discussion concerns the most usual process which aims at finding a cost in the immediate past.

Now, all costs are composed of three ingredients—

1. Cost of raw material.
2. Cost of labour.
3. Cost of overheads.

The third item includes all expenses borne by the manufacturer other than those included in items 1 and 2. It is possible by sound planning to devise methods of distributing overheads so minutely that each product gets charged with a share definitely and reasonably assignable to it. But, however well this is done, there are still many items of expenditure, e.g. rent, directors' remuneration, interest on loans, etc., which cannot be charged to products except upon some arbitrary basis. It is the difficulty of attaining mathematical perfection by arbitrary means that adds an element of guesswork to this type of costing and

provides an answer to the "qualified cost accountant," who will countenance no system which is not what he calls thorough.

As has been said at the commencement of the previous chapter, the manner of charging items is a matter of accountancy rather than of production planning. It is not proposed, therefore, to dilate in this direction, other than to offer two general observations which may assist the work of the accountant and incidentally that of the cost department.

1. Departmental subdivision of overheads places a burden of routine work upon the cost and other departments. It may be avoided if it be found in practice that a simple, general, all-over allocation on a percentage basis will make no serious alteration in individual costs.

2. Where departmental subdivision is required, it is useful to prepare duplicated plans or blue prints of the whole factory and adjoining premises and to mark them clearly with machine numbers, warehouse divisions, and titles of all departments, stores, and outbuildings.

If a straight line were drawn across this page, one end of it might denote the minimum, and the other end the maximum of cost-finding systems. The thorough method discussed in general terms might be considered to occupy the maximum position; the minimum position might be occupied by what has been called "back-of-an-envelope" costing. The latter term fairly well pictures the easy-going manager who calculates material and labour costs in his head and slaps on, if he remembers, enough to make the total come to even money, by way of tribute to that unpleasant factor "overheads."

Somewhere along the line between these two extremes lies a method of costing which represents all that can be obtained by a manufacturer who cannot afford, and does not really need, the maximum.

PRIMARY FUNCTION TO PROVIDE COSTS

A list of the uses of costs has already been given. The point about the expense of cost-finding work has been laboured at length because it is, perhaps, the commonest characteristic of the owner or manager of a badly-planned factory to protest that he cannot afford to instal a cost department. The real truth of the matter, if he only knew it, is that neither he nor, very often, his creditors can afford to be without it. Nearly every public examination of a bankrupt, small and genuine manufacturer discloses defective costing as the prime cause of trouble.

It has been mentioned in passing that costs may be of several distinct kinds. These may be stated thus—

1. Actual costs, calculated as nearly as possible, of goods after manufacture is complete.

2. Approximate costs, calculated from the latest data collected after manufacture is complete. No method is used to identify every individual component. Average costs of components are used and, for this reason, reconciled costs are impossible, unless over- and under-charges are collected and carried forward to subsequent accounting periods. There is little virtue in this last operation as far as accuracy of individual cost is concerned.

3. Estimated costs. Systems providing so-called costs, which are, in reality, only estimates, exist. They disclose the amount which goods *ought* to cost if the optimism which envisages none of the frailties of men and the perversities of Nature were justified. No method exists which answers fully the question of cost in the future tense.

The primary function then of the cost department is to provide costs in one form or another. It has another function.

SECONDARY FUNCTION

The cost department should provide a focus point. It is here that the lines of factory routine work converge. It

acts as a clearing house for documents, and abstracts from them knowledge bearing on almost every angle of the plan by which production is carried on. Any failure to work to plan should be noticed in the cost department, as also should be noticed all weaknesses in the plan itself.

There are two broad reasons for this: (1) knowledge about time is co-ordinated with (2) knowledge about cash values. The cost department gathers dated documents and puts cash values to materials and services. It is presented with a documented history of every productive transaction. Not only may cost be deduced, but shortcomings are signalled with a pointer which gives the exact time and place of their occurrence and their value in money represented.

JOB COSTING

This is the name given to the method of costing which discloses the cost of individual orders, rather than the cost of a large number of orders lumped together over a period.

In intermittent process factories, it is most commonly used and, since it is elastic, it may be either elaborated or curtailed at the will of the power who pays for it. Its elasticity lies in the possibility of adjusting the quantity of jobs costed. It may be unnecessary, or too expensive to employ sufficient clerks, to calculate the cost of every job. The principal, a director, or a works manager may signify that one only, or a definite number of costs on each line of product, is required monthly. Otherwise, definite instructions may be given in respect of stated orders. This system also permits reconciled costs to be made where every job is costed.

Orders to be costed are both customers' orders and internal production orders. In each case, the cost department is furnished with a copy ruled in such a manner that hours worked may be entered on one side of it and material issued on the other.

The collection of time data may be made by scrutinizing and posting men's clock cards to appropriate orders, discovering their rates of pay, and extending and entering the value of their time. Similarly, material issued may be posted from "demand notes" after these have been priced and extended. These two items of routine may be exceedingly cumbersome, but are capable of considerable simplification if the work is carefully planned.

A method advocated for the recording of workers' time is discussed in Chapter XVIII. The recording of costs of material is considered in Chapter XIV.

Where these methods are adopted, it will be unnecessary for the cost department to dissect labour charges from job time cards. Time and its value will be collected at one operation from the summary card, issued one each weekly to all workers engaged in direct production, upon which wages are actually paid.

After these cards have been listed by the wages clerk, they are passed to the cost department, where cards are dealt with one at a time. The clock number of each worker, rate of pay, and time spent on each order during a week are entered on the appropriate order. When all the weekly summary cards have been entered the total time is collected in an adding machine, or otherwise, to obtain a check against accurate posting and also a check against actual wages paid.

Providing men "clock off" each completed operation at the same time as they "clock on" to a new one, the difference between total wages paid and total time charged for costing purposes will amount to no more than the total of fractions of a penny not calculated in analysis.

This work is somewhat monotonous, and it has been found that women are better suited to it than men.

On the material side there will be no turning up of records by the cost department if the system outlined in the next chapter is used. After notification is received from the

progress department of the date when the order is complete and all time worked to that date has been entered on the order, the document is ready for final costing. The cost may be summarized on the order itself, or in a book, or elsewhere.

An operation is saved if the order carries the cost summary, because all orders are numbered and may be easily traced when filed.

Final costing entails the calculation of material costs from the prices appearing against each item, the addition of the total of labour costs and the application of such formulæ as may be laid down to take care of overhead charges. A simple summary is given as an example, and it requires a cash value to be placed against each item—

	£	s.	d.
1. Total value of raw material	—	—	—
Percentage charge to cover cost of handling	—	—	—
2. Total value of any components manufactured in the works (This item is made up of costs to which overheads have already been added. Therefore no further overheads are charged)	—	—	—
3. Wages	—	—	—
4. Percentage on wages to cover factory overheads not otherwise distributed as formula ¹	—	—	—
5. Machine charges, calculated according to formula	—	—	—
6. Power charges as formula	—	—	—
7. Left blank to cover any special overhead charges,	—	—	—
8. e.g. heat treatment	—	—	—
9.	—	—	—
10. Bonus	—	—	—
TOTAL being Works Cost of Job	£	—	—
Average unit cost where more than one article is included in total job	£	—	—

¹All factory expenses, which cannot be allocated direct to the product, or indirectly to it by departmental or process charges for which blanks 7, 8, and 9 are provided in this table, are usually applied to costs by adding an arbitrary fixed charge. This charge is usually calculated as a ratio of labour cost. The argument against using a fixed percentage of the money value of labour is that in a mixed factory it adds too heavy a charge to hand-made goods and too little to machine-made goods. Similarly, the work of junior hands who are paid low wages whilst learning will produce misleading costs. The "Man Hour" system offers a solution of this difficulty. Total overheads are divided by total number of hours worked by

The above may be entered in a table printed in blank on the order copy provided for costing, or it may be shown on a separate printed slip attached to the order.

Frequently a rubber stamp is used for endorsing the table on a convenient space on the order.

Unit costs of all manufactured components are entered on the stores records cards in relation to delivery into the warehouse of each numbered order. This is usually done by the cost clerk, because any variation from normal is instantly noticed and may be investigated. He also notices delays and absence of costs against orders issued earlier. From constant scrutiny of stores records cards irregularities are brought to light.

Costs of customers' orders are supplied to whatever quarter is in accordance with plan. Usually comparisons are made with sales values of orders, but action arising therefrom is not usually a function of the cost department.

Costs of standard unit articles ready for sale may be filed under the code number of the article. Each new cost coming into the file will invite useful comparison with its predecessor.

In the manner outlined, data are collected for the benefit of other departments who require to use them.

CONTINUOUS PROCESS COSTING

There are many factories where job costing, as outlined, is impossible, for the simple reason that there are no individual orders used. Works producing bulk goods by the ton, mile, yard, square yard, and so on, require constantly to discover the price of each product per standard unit of weight or measurement. The method of costing is entirely different from that applicable to a factory engaged in what has been called "intermittent" process work.

all hands, either departmentally or throughout the works. The resulting quotient is a standard hourly rate to cover the charge to be distributed. There are many other methods.

Bulk goods are usually manufactured in stages. Raw materials of various kinds are treated in many different ways; they are sometimes combined and passed forward for subsequent treatment and mixing, until finally a process occurs from which emerges the finished product. Under such circumstances, it is necessary to discover the cost of materials at various stages. Each cost so discovered is used as a basis of raw material cost for every subsequent process. In this manner, it is possible to determine with complete accuracy the average cost per unit weight or measurement of goods produced during any given period where *only one* line of manufacture occurs. Where more than one line of product is manufactured, the distribution of overheads will still govern the correctness of cost of various lines in relation to each other.

It should be apparent from the foregoing that the reconciliation of the work of the cost department with that of the general accountancy department is far more simple than in the case of the job costing previously described. Indeed, it is essential that complete reconciliation should occur. Many manufacturers have paid for this lesson by heavy losses.

A very large number of factories are occupied in the manufacture of goods all composed of material needing preliminary preparation. The cost of this preparation is calculated by the continuous process cost routine described; the remaining operations may be costed by job costing methods.

Continuous process costing is extremely simple in theory; in practice, its accuracy depends to a very large extent upon the correctness of the records the cost department receives of the physical movement of material from department to department in the factory.

Raw material purchased from an outside supplier is debited against the first department consuming it. All carriage, handling, and preliminary charges of every kind are also

debited. If the cost per ton during each month is required, all the wages of the department, together with direct departmental overhead charges for the period, are similarly debited. General factory overheads having been divided between departments on an arbitrary basis, the first department is charged with its share. Adjustments having been made to the departmental account to cover opening and closing stocks, and credit being given for any value possessed by waste, the total expenditure during the month will be shown. This figure divided by the number of tons delivered will give the cost per ton at which material is charged to the subsequent department. In each succeeding department, the process outlined is repeated.

In practice, it is frequently found that quantities do not tally, despite the exercise of every theoretical precaution against leakage. A certain department commences the month with stocks which have been actually weighed. During the month a known weight of raw material has been delivered; at the end of the month stocks on hand are again weighed. It is thus simple to calculate the quantity which should have been produced and delivered to the subsequent department, particularly if no allowance for waste is a necessary complication. It may be found, however, that when all notes of delivery to the subsequent department are totalled, there is a considerable difference between this total and the calculation of what should have been produced. Sometimes the physical total is even greater than the clerical total.

Discrepancies may only be explained by inaccurate weighing and recording. Excesses point clearly to falsification of records. The steps necessary to eradicate these troubles are the following—

1. To see that all weighing machines are accurate, and to inspect them often enough to ensure that the pans are kept clear of adhering material.

2. To supervise weighing of stock at the close of each cost period.

3. To replace the people responsible for weighing and recording the acceptance of raw materials inwards and the deliveries outwards. Persons whose conscientiousness is beyond doubt must do this work for at least one month.

4. Change the locks on doors and take all other precautions against pilfering. Where waste is produced, tighten up all safeguards against its illicit disposal.

If all these things are done there are only two possible ways in which losses can continue: (1) by the evaporation of moisture (this is usually slight and the coefficient known); (2) by the presence of an ingenious thief (if the loss continues to be serious, experts at detection must be called in).

This point has been laboured because cost departments are often blamed for that which they cannot possibly control. In desperation, they have been driven to cover up discrepancies. The results of doing so are lamentable.

In planning a cost department to handle continuous process work, it is advisable to place the stock records office near to the cost department, and to give the latter complete authority over that office. Where monthly costs are dependent upon knowledge of stocks on hand, as they must be, a great deal of calculation and routine work must be carried out where many lines of goods are produced by many processes. A perpetual inventory is essential, and all balances must be shown at their money value monthly. This entails the calculation of a money value for every physical transfer of material. The recording of this information is dealt with in the next chapter. The calculation work may easily call for the use of a machine; the sorting of records may also be facilitated by the use of a sorting machine.

It will be found that great speed in the working of these machines can be demonstrated at the time when their purchase is considered, and that it is extremely difficult to

maintain anything approaching such speeds in use afterwards. High wages are demanded by, and are well spent upon, experienced operators; it is a common mistake to imagine that the machine does all the work.

Physical stocktaking monthly is usually out of the question. Stock records constituting what is called a "perpetual inventory" must be relied upon. The reliability of these records will be enhanced if a routine duty is made of verification by physical inspection. In many factories it pays to employ one or more persons who are engaged entirely in satisfying themselves that balances shown by stock record cards are actually represented by existing goods. In smaller factories it may be a part-time occupation. Always it is essential.

STANDARD COSTING

This is a method of costing, applicable particularly to factories which fall into neither of the two groups whose costing has been already discussed. It possesses many advantages over job costing in works manufacturing many different articles at the same time in great quantities. In short, standard costing is used extensively in "mass production" works where long runs lasting for weeks, months, and even years on each article are assured. It is practised widely in America and is far more economical than is the job costing of every item of any given turnover.

In principle its object is only to discover variations from standard costs previously established. By its advocates it is claimed that to reveal variation from standard is the sole function of all cost work. That such a claim may not be universally conceded may, perhaps, be discerned from the foregoing pages and subsequent chapters.

The application of this method of costing, wherever possible, is strongly recommended because it seems to be true that no other method exists which can so usefully and

economically perform the following three functions at the same time—

1. Provide forecasts of costs based on facts.
2. Compare actual costs with these forecasts so that standards may be set with a closer approach to accuracy.
3. Explain the causes of variation between standard and actual costs, whereby standards may not only be maintained but may definitely be reduced, to the benefit of the manufacturer.

It is impossible, in the space available in this book, to describe the procedure necessary to the installation of this method of costing. A detailed understanding of the somewhat elaborate steps required can only be gained by a comprehensive study of the subject. The rough outline given below may serve as an indication of the direction to be taken by those to whom the idea of standard costing appeals—

Two costs are obtained: (1) standard, (2) actual; these are compared in order to discover—

- (a) Where variation occurred.
- (b) Why variation occurred.

Standard costs are first constructed from existing data. They are estimates of reasonable expectation. The fixing of standard labour rates and times and of material costs for a given article presents no difficulty.

Overhead charges are allocated according to budget with minute discrimination.

By the algebraical use of symbols, formulæ are constructed. For instance, symbols may be used to denote—

1. Actual wages or material cost.
2. Actual wages or material cost at standard time or price.
3. Standard cost for any standard period.
4. Standard cost for the maximum possible working time in any period.
5. Standard cost at time actually worked (overhead costs per unit are actual instead of standard).

6. Actual cost per unit of goods produced.

Thus: Symbol for 2 minus symbol for 1 = difference due to wage rate or material cost alterations.

" " " 5 " " " 4 = difference due to short time.
 " " " 6 " " " 5 = " " " workmanship.
 " " " 6 " " " 1 = total difference, taking actual wage *and* material cost into consideration.

Formulae may be combined with simple equations to disclose differences due, for example, to the following causes—

1. Workmanship.
2. Time taken by and wages paid to productive workers.
3. Materials consumed at various prices.
4. The setting of machines.
5. Salaries, indirect expenses, and general overheads.

This list may, of course, be extended and subdivided indefinitely.

It is obvious that this system is of no value where similar articles are rarely, if ever, repeatedly manufactured. Standards can only be set for standard goods.

The above gives only a bare outline of the subject of standard costing. The subject is dealt with fully by Mr. G. Charter Harrison in *Standard Costs*.

CHAPTER XIV

STORES CONTROL

Stock records—Signalling—Physical control preferable—Uses of records—Production delay—Value of connection with cost records—Raw material stores and cost records—Summary of simultaneous operations.

THE co-ordination of planned production routine work depends very largely upon the effective control exercised over the movable possessions of a manufacturing enterprise. Control consists of keeping account of receipts and issues of goods of all kinds not only into and out of the factory, but also as between departments within the factory. In order to keep this control, stock records have to be set up. These can only be of value if the accuracy of the information they contain is maintained by rigorously enforced measures governing the storage of goods and their transference from place to place. It follows that these measures will not only furnish information about quantities of goods on hand, but they will supply information about the progress of manufacture. The issue of raw material denotes that work has commenced; the receipt of partly finished goods into an intermediate store gives a statement that work has progressed to a definite stage; the receipt of finished components into another store supplies verification that, as far as the article is concerned, assembly may proceed; the receipt of the finished goods is evidence that production required has been completed. Similarly, issues made by intermediate stores to productive departments signify well-marked stages in the journey travelled by raw material towards its destination in the customer's hands as manufactured goods.

There must exist, then, a close relationship between the routine of controlling stores and the routine of controlling the progress of production. The correct welding of this link is an important planning function.

The physical arrangement of warehouses and storage accommodation has already been discussed in Chapters II, VIII, and X. The essentials of controlled manipulation of these arrangements are the following—

1. That all goods received into store shall be identified by a written record.

2. That this written record shall pass to an office where it will be used—

(a) To clear any outstanding time cards.

(b) To adjust progress records.

(c) To adjust stock records.

(d) To notify the cost department that a cost may be calculated.

3. That goods received in store shall be identifiable by label or in any other unmistakable manner.

4. That the location of goods in store may be ascertained without delay.

5. That no goods shall be issued from stores until a written record of the issue has been made. This record must contain :

(a) Date of issue.

(b) Quantity of goods issued.

(c) Full description and identification number of the goods.

(d) Signature or initials of the person to whom goods are issued.

6. That this record of issue shall pass to an office where it will be used—

(a) To release time cards.

(b) To adjust progress records.

(c) To adjust stock records.

(d) To notify the cost department that a cost calculation is about to be opened.

7. That there shall always be present and in view at least one person in every open store, and that this person shall be familiar with the goods stored.

8. That no unauthorized person shall be permitted to pass the barrier of an open store.

STOCK RECORDS

Records of stocks may be kept in many ways, e.g. in bound books, in loose-leaf books, on cards in drawers, or on cards in visible-edge trays (see Fig. 14). For a set of records covering more than a few hundred descriptions of stock, visible-edge records are strongly recommended—

Reasons. 1. Since it is proposed to set up no duplicate sets of records this one set will be heavily worked. The trays, arranged in cabinets, permit several people to work on records at the same time more conveniently than does any other arrangement.

2. Since more time may be occupied in finding cards than in writing on them, this arrangement, permitting cards to be found more quickly than any other, is to be preferred.

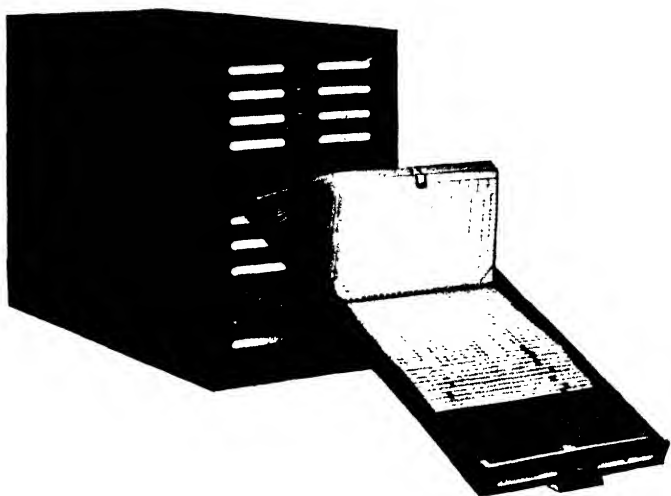
3. Since the replacement of loose cards leads to great difficulty, this method obviates the removal of cards from fixtures when writing is required, and so reduces the danger of losing cards.

4. Signals may be used with much ingenuity to provide swiftly knowledge of a kind indispensable to the progress department.

5. A perpetual inventory of stock values is obtained without displacement of regular routine work, with great rapidity and accuracy.

It is essential to arrange stock records departmentally. That is to say, the cabinets or trays are arranged in convenient groups to facilitate the use of, and reference to, each group, by the people concerned, in an orderly manner.

Each card is ruled to suit the requirements of the industry and to suit the special purpose within that industry which it is designed to serve. The card illustrated on page 151 is a standard card supplied as a regular line by a well-known



(By courtesy of Karlex, Ltd.)

FIG. 14. A VISIBLE-EDGE STORES RECORD

firm of stationers. It is designed for use in a visible-edge tray, and will serve as a basis for a description of the following purposes it serves. The list also shows the manner of carrying out the routine work entailed—

Entry 1. To record identification number and date of requisition and quantity of goods required.

Entry 2. To record identification number of order issued against requisition.

Purpose. To provide records that goods have been ordered and to supply references thereto.

Entry 3. To record receipt of goods on same line as order. To adjust balance if required, but no extension of value to be made.

NOTE. Running balances may be dispensed with and this task left to periodical balancing.

Purpose. The closure of orders being thus shown, outstanding orders will be apparent. Delayed orders will be noticed by blank lines.

Entry 4. To record issues. Adjust balance. State cost on issue form.

NOTE. Where issues are numerous and in small quantities, it may be convenient to attach a small subsidiary card for issues only. The totals from these cards may be transferred periodically to main cards.

Purpose. (a) To disclose necessity for replenishment of stock. The person making this entry may initiate re-ordering by writing a requisition at the same time. This saves routine work, but necessitates a reliable and conscientious worker.

(b) To supply priced issue forms to the cost department.

Entry 5. To record allocation to assemblies in advance of actual issue.

NOTE. This is required only in relation to items which are not produced or ordered on a maximum and minimum stock basis. See "Programme System" Chapter IX.

Purpose. To avoid depletion of programme requirements

by casual sales as spares. When a new programme is put forward, this figure must be taken into account in order that programme requirements are augmented by the quantity of articles sold in depletion of allocation.

Entry 6. To record cost in the price column of the "received" section.

NOTE. Theoretically, every entry of receipt could be made from a costed copy of the closed order and the cost recorded with Entry 3. In practice, this is not possible if it is necessary to avoid a few days' delay in recording receipts. The delay occurs in the holding up of costs until the weekly wages summary is prepared.

Purpose. To provide cost figures which are copied to issue sheets before they are passed to the cost department. There is a great advantage in this over a system which necessitates the maintenance of a duplicate set of cost records. Not only is time gained in the saving of an operation in referring twice to every card, but in order to settle queries which must arise from time to time, one experienced person only instead of two is required. (See previous chapter.)

Entry 7. To record result of physical count.

NOTE. This is not, strictly speaking, routine work. It provides a record of the checking system recommended in the previous chapter.

SIGNALLING

This is dealt with in Chapter XVI, since it is part of the routine work of the progress department.

PHYSICAL CONTROL PREFERABLE

The maintenance of stock records of small articles in constant use is unwarranted. Nails, screws, bolts, nuts, rivets, washers, and so forth, cannot be costed individually with accuracy except by the use of calculations carried to many places of decimals of a penny. Detailed cost and record

work on these items might easily entail more expense than all the other routine work added together.

From a cost point of view calculations of the value of these small parts covering one gross of complete assemblies should be made, since prices of most of them are stated in grosses. Division of the total by 144 will give the value of small parts per unit. If these small part valuations are repriced and recalculated yearly, it will be quite often enough to take care of price fluctuations in the majority of industries. The total value of the small parts is usually a very small percentage of the total cost, although the number of individual small parts in an assembly may often be many times greater than the number of larger manufactured components.

Stock control of these small parts, therefore, may similarly be maintained in bulk. Stock cards for these items merely show bulk deliveries and bulk issues. The goods are usually packeted; for the stock recording of receipts packeted quantities only are considered. Adjustment of issues is made when a period covering the issue of at least 144 assemblies has elapsed. If it is considered that even this method is unnecessary, purely physical control may suffice. No records whatever of issues are kept. A conscientious storekeeper can be relied upon to prevent theft of these small parts and he is required to obtain requisitions for replenishment of the stocks as he observes them to be depleted.

USES OF RECORDS

Apart from the functions already described, the prime use of stock records is to provide an account of consumption. In a works of any size it is highly undesirable to leave goods other than those discussed above with none but physical control; doubts will arise as to the causes of shortages, particularly since the people issuing the goods will then be required to originate requisitions for replenishment. A

responsibility is thrown upon a type of person who usually is not entitled to it, does not desire it, and is not paid the amount of wages fitting to it.

In addition to the above, knowledge that stocks are recorded is a definite deterrent to pilfering. Losses due to casual removal from stores, and displacement in various parts of the works, do not occur when a storekeeper knows that he will be reprimanded for any departure from his share of the routine of stores records work.

PRODUCTION DELAY

In actual practice it is probable that the most frequent and valuable use made of stock records, by people other than those directly concerned with the routine described, is by way of reference to facilitate the tracing of delays in production.

When items of stock are required for productive purposes, the action taken in the first place is physical. No reference to records is made. It is only when stock is short that it becomes necessary to discover the prospects of early delivery. Reference to stock records provides the simplest means of securing this information. The plan of activity of a productive department for the immediate future is often nullified, until from knowledge obtained from stock records, the progress department gets to work to rectify shortages. (See Chapter XVI.)

VALUE OF CONNECTION WITH COST RECORDS

The value of the link between cost and stores records is often too little understood and appreciated. There is no single item of production planning work recommended in this book which is considered of more consequence than this. References to this point have already been made, and will continue to be made, but here is the place to insist upon the use and value of the link and to emphasize the reasons for giving special attention to the matter.

In the first place, the cost department is responsible not only for the placing of money values on goods produced, but it has to produce priced stock lists periodically, the total value of which when inserted into financial accounts affects the results obtained by the whole organization during a period immediately past. Upon the accuracy of these figures may depend vital decisions affecting the future policy of the business. The very life of the community engaged in the manifold activities connected with the factory depends upon the soundness of this policy. Now, prices and quantities are interdependent. Unit cost can only be discovered when the total expense of production is divided by the total quantity produced. Total quantities of goods in stock can only be valued by the multiplication of unit prices. Fundamentally, therefore, there is a natural link. The logic of this is not to be lightly ignored.

In actual practice, it will be found that the recognition of this natural conjunction of the two functions not only simplifies routine, but reduces the cost of it accordingly.

The economical aspect of this matter should not be neglected. The alternative to the use of stores records for cost recording is the setting up of a separate system. It may be claimed that this separate system can be designed to carry details of costs instead of bare cost figures, and that, for this reason, it is of more value to the cost department. There is no denying the truth of this, but it misses the real point at issue. The number of times when comparisons of detail are required is small compared with the amount of work involved, when it is assumed that every cost entails comparison of detail. When costs and stores records are linked it will be necessary to refer to two sets of records in order to compare detail—

1. From the stock records prices and order numbers are obtained.

2. The costed orders must then be extracted from their numerical file.

Against this second occasional operation is balanced the whole expensive routine of compiling a second set of records. This, in practice, is no less an undertaking than the duplication of the whole staff and apparatus engaged in stock recording.

RAW MATERIAL STORES AND COST RECORDS

Where a separate cost recording system exists it is the duty of a cost clerk to examine and classify suppliers' invoices. Prices are picked up and recorded. At the same time, corresponding stores records of goods received will also be made elsewhere. It is quite a simple matter to have these two things done at the same time, and in one operation. A method found to work well in practice is to price goods received notes before they are entered in stock records. It is thus possible to enter both price and quantity together. In any case, it is necessary at some point or other to bring suppliers' invoices into contact, for checking purposes, with goods received notes. Often this is done in the accounts department quite independently of the records with which this chapter is concerned. There is no reason why this practice should not continue, the point for attention being to avoid repetition of precisely the same work by the cost department.

Finally, the principle involved in the foregoing is this: since most of the effort of recording work is expended in finding records, it is wise to make the fullest possible use of each finding operation. If something may be *taken out* at the same time as something is *put into* records there will be a distinct gain over any system requiring two operations. This gain will not only be in time and economy, but will be also a gain in accuracy. Descriptions are sometimes given without identification numbers or with incorrect numbers.

If it be left to the discretion of two independent people to decide the correct designation, there is a likelihood of difference between them. This difference may lead to much confusion and investigation.

Close proximity of locality between cost and stores records departments is most desirable when two or only one set of records is installed; otherwise much time may be wasted in the settlement of queries. Both departments should be under the disciplinary control of one chief. The latter is usually the head of the cost department.

SUMMARY OF SIMULTANEOUS OPERATIONS

1. (a) Raw material receipts entered.
(b) Raw material prices entered.
2. (a) Raw material issues entered.
(b) Raw material prices extracted.
3. (a) Finished components receipts entered.
(b) Finished components prices entered (if possible).
4. (a) Finished components issues entered.
(b) Finished components prices extracted.

In each operation where prices are extracted these are entered on the document from which quantities are recorded.

CHAPTER XV

STOCK-TAKING

SHORT-period figures—Classification—When physical and when clerical—Physical system during production—Work-in-progress inventory.

NOTE has already been made, in the preceding chapter, of the important part which may be played in the affairs of a business by the correct valuation of stock. The manner of arriving at this valuation is also important in two respects—

1. The work must be done speedily.
2. There must be as little interference as possible with production.

On the first count, it is to be remembered with regret that many commercial calamities could have been averted, or at any rate stayed, had knowledge of the effects of critical conditions been possessed sooner. At shareholders' and creditors' meetings, it is to be noticed on many occasions that accounts are not completed until long after the close of a financial year.

These delays, when genuine, are usually caused by difficulty in working out stock valuation rapidly. It would probably be true to say that, as often as not, the difficulty is immeasurably increased by lack of foresight in making plans to carry out the work entailed. Considerable attention may be devoted to the technique of production in a factory, where the routine of stock-taking is regarded as a nuisance and is left to take care of itself.

This leads naturally to the second point.

Stock-taking may well be regarded as a nuisance by those whose whole energies are strained in the effort to get the last ounce of productive efficiency from a works.

It is very undesirable that conflict should arise between

those responsible for the two duties, production on the one hand, stock evaluation on the other.

In the first place, it seems necessary that an adjustment of viewpoint should be made with the object of establishing quite definitely that stock-taking should be planned to interfere as little as possible with production, rather than that stock-taking should ride roughshod over all productive arrangements.

Production is of paramount importance, and the routine of stock-taking must be properly planned well in advance of the time when it becomes necessary to put the plan into operation in productive departments. The nuisance only arises from failure in this last respect.

SHORT-PERIOD FIGURES

There can be little advantage in maintaining close control over the activities of persons and things unless it is possible to observe the effects of such control. In industry, control which does not see, and takes no account of, the effects of various causes is blind control; it can have little value and may be harmful. At best its decisions are founded upon the hopes and speculations of qualitative mental processes. Opposed to this type of control is that which bases its decisions on cold, hard figures and facts; it is control by reasoned plan, rather than control by impulse and emotion. Planned control relies upon quantitative data for its guidance. It bases its judgments upon observation of the quantitative effects of the causes it sees in motion.

A complete statement of the condition of a manufacturing business at a given moment is read in its financial accounts. Comparisons made between two sets of the financial accounts of a business reveal the ultimate value of changes in the period intervening between their respective dates. The value of these changes is reduced to an expression in terms of money. Money values constitute the acid test of effective

control as far as the business as a whole is concerned. Quantitative information may be supplied in plenty to departments, but the value of the uses made of it can only be measured in financial accounts.

It follows from the above that prompt and frequent knowledge of results obtained is essential to the planning of production. In short, financial accounts must be prepared at frequent intervals.

One of the first steps taken by a qualified person entrusted by debenture holders, or other interested parties, with the reorganization of a manufacturing concern is to arrange for the production of financial accounts at intervals of one, two, or three months. But it is not only in firms where reorganization is required that such steps are taken; in many, if not in most, of the largest and most prosperous manufacturing undertakings in the world, short-term accounts are insisted upon.

From an accountancy point of view, there is nothing to delay the balancing of, and extraction of, figures from books, especially in these days when calculations and other functions are performed mechanically. But the insertion into accounts of the essential figure of correct stock valuation is another matter, and may, if the routine work is badly planned, become a wellnigh impossible task when constantly attempted.

CLASSIFICATION

The first step necessary is to classify stock in order that plans may be made for the routine work entailed by each class. In every factory there will be two main divisions—

1. Productive stock.
2. Non-productive stock.

The first of these is subdivisible under three main heads—

1. Raw material.
2. Work-in-progress.
3. Finished manufactures and purchased goods.

By way of illustration, a simple but complete classification of the stocks of a factory is given. This factory operates both on continuous and intermittent process lines—

(a) CONTINUOUS PROCESS (FOUNDRY)—

1. Foundry Raw Material (N.O.E.)	S 101
" Metal	S 1011
" Fuel	S 1012
" Pattern Shop Material	S 1013
" Work-in-Progress	S 1014

NOTE. All finished castings are delivered to the raw stores of the Intermittent Process Departments and therefore do not appear as Foundry Stock. (N.O.E. = Not otherwise enumerated.)

(b) INTERMITTENT PROCESS—

1. *Raw.*

Productive Metal and Material (N.O.E.)	S 102
Castings <i>ex</i> Foundry	S 103
Hardening Fuel and Material	S 104
Consumable Material (N.O.E.)	S 105
Scrap	S 106
In Transit	S 107

2. *Work-in-Progress.*

Machine Shop (i)	S 201
" (ii)	S 202
Blacksmith Shop	S 203
Press Shop	S 204
Sheet Metal Shop	S 205
Hardening Shop	S 206
Fitting Shop	S 207
Testing Dept.	S 208
Inspection Dept.	S 209

3. *Finished Manufactures.*

Components Manufactured	S 301
" Purchased	S 302
" for Resale: Engines	S 303
" " Electric Motors	S 304
" " Special List	S 305
Completed Assemblies Section A	S 306
" " " B	S 307
Agents' Stocks on Consignment	S 308
Sundries (including Junk Store)	S 309
In Transit	S 3011

(c) NON-PRODUCTIVE—

Packing	S 401
Maintenance	S 402
Tools	S 403
Power and Light	S 404
Testing	S 405
Transport	S 406
Stationery	S 407
Advertising Material	S 408
Postage	S 409
Office Fuel and Sundries	S 4011
Canteen	S 4012

The numbers appearing against each item are useful for dissection purposes, and also for showing up items which occasionally appear in sheets devoted to other stock record classes.

It is usual to prepare sheets ruled in a manner which will facilitate extension of the values of the stock to which they apply. Metal in bars, for instance, is valued at a price per cwt. or ton. Quantities are stated by measurement of "foot run." It is, therefore, necessary to provide ruled columns—

1. Location.
2. Metal.
3. Size of section.
4. Measurement in stock.
5. Weight per foot.
6. Total weight.
7. Price.
8. Value.

A great amount of routine work may be saved if sheets capable of carrying figures for several periods are bound in book form. Only three items of information relative to each line of standard stock will alter periodically; they are—

1. Quantity.
2. Price.
3. Value.

The description and other particulars remain the same, and need not be written out every time stock valuation occurs. Separate books should be used for each class. The more sections of stock listed separately the more people may be occupied on similar work at the same time, and the more rapidly can the entire task be completed.

A glance through the specimen stock classification list given will show that some items are capable of compilation by clerical means entirely and some require the goods to be physically seen and counted. The former group is the subject

for treatment in the permanent stock sheets referred to; the other group requires new sheets for every stock-taking.

WHEN PHYSICAL AND WHEN CLERICAL

All stores of which records are kept may be listed on permanent sheets for short-term stock-taking purposes, providing experience has shown that the records are accurate. This dispenses with the onerous work of emptying and counting the contents of warehouse bins.

Although confidence in the accuracy of stock records may suffice for daily production needs and for monthly valuations, some manufacturers prefer to take stock physically once a year. It is a sound thing to do, if it can be done at small cost and without prejudice to production. A yearly physical count is invaluable in providing an opportunity for giving all stock records a new start with a verified balance. It is useful, too, in bringing to light items of stock which have deteriorated and are no longer entitled to be regarded as in first-class condition.

Apart, however, from the classes of stock which it is possible to list at choice either from clerical records or from physical count, there are items which *must* be physically counted. These will vary in every industry and factory; in the main they comprise all those items of which no records are kept. Fuel, petrol, oil, cleaning material, and many goods stored in bulk require physical assessment every time. Work-in-progress is a subject by itself apart and will be considered later in this chapter.

PHYSICAL SYSTEM DURING PRODUCTION

The old method of commandeering the services of all available members of the clerical staff, equipping them with pencils and paper, and attaching each one to a man who knows the correct descriptions of stock, is far too cumbersome and unsatisfactory in every way, and clearly cannot

form part of a planned and frequently recurrent routine. The sheets they write are thickly interspersed with doubtful entries, and the lack of order of listing necessitates a painful search for any item it may be necessary to find. No space is available for explanations and, on the whole, the performance is a muddle which may take weeks or months to unravel.

A simple method obviating these difficulties and, at the same time, making no inroads in the normal routine of production, is based upon the provision of specially printed stock-taking labels. These are preferably of stout substance and of strong vivid colour. Every label bears an identification number and must be accounted for. Spoilt cards must not be destroyed. Supplies of these labels are distributed to the people whose special knowledge makes them most capable to deal with each class of stock. The labels are delivered to these people at such time previous to stock-taking as may be deemed sufficient to give a reasonable interval for preliminary work during odd moments. Alternatively, a little overtime for difficult departments may be permitted.

It is the duty of each person entrusted with these labels to see to it that, before he leaves the factory on the night when an accounting period closes, every item of stock has a label attached to it. On the following morning, it is the duty of the person who is held responsible for the entire stock-taking to attend before the works open and to make a rapid though searching tour of the establishment, in an endeavour to discover any items minus labels. If he finds more than three missing labels when five thousand have been used, the work may be considered unsatisfactory. It is impossible, and indeed unnecessary, for this person to examine the writing on all labels. It is his duty only to see that every item bears a label.

Two rules must now be observed—

1. No labels may be removed without the permission of a person authorized to give it.

2. No goods are to be moved unless it is observed that full particulars are written on the label.

Collection of labels will be made in due course only by a person having special authority. The collection may not be made for some days or even a week. Sufficient time must be given for the entry of particulars, and it is the collector's business to examine the cards as he gathers them. He must, therefore, have sufficient general knowledge of the industry to enable him to decide whether the information given is adequate to identify the goods with the office records of their values. After the labels are collected they are placed in numerical order and are checked against a list showing the numbers printed on labels issued for each class of stock. A search is immediately made for any labels found missing from the series. If instructions are given that labels are always to be placed in positions where they may be easily seen, no trouble in this direction is likely to occur. There is no better method to ensure that no articles are missed and that none are recorded twice over.

Having obtained all the labels, the cost department is now in possession of an elastic set of records. Strings may be removed from labels, and, since the latter are usually of suitable size, they may be arranged in any convenient order in card-index drawers.

Standard lines arranged in order of identification number may now be called over with existing records, and prices or values may be rapidly inserted. All queries are put aside for later attention. The back of the label is usually ruled to permit of calculation of the total value of the goods represented by the label.

When all cards are valued, they may be listed as previously described, or they may be listed and added mechanically.

The final figures should be obtained within a week of collecting the last card.

An advantage of this system which becomes apparent

when it is first substituted for the old method is its rapidity in the settling of queries in bulk. Items in poor condition or of doubtful value, for example, are collected and disposed of at one interview with the person empowered to decide arbitrary values.

WORK-IN-PROGRESS INVENTORY

The greatest difficulty encountered in connection with the demand for short-term financial accounts is usually that of estimating values of work-in-progress. This need not be so. This class of stock is amenable to the plans already described with very little modification of them.

The method used may, as before, be either clerical or physical.

To evaluate work-in-progress clerically, all that is required is to calculate the value of all uncompleted orders on hand. If the system to be discussed in Chapters XVII and XVIII is used, this calculation is simple. When the last day of a financial period does not coincide with the day of making up wages summary cards for payment, it will be necessary to enter wages on costing copies of outstanding orders, to the time of closing on the night the financial period ends. Wages for the remainder of the week are, for stock-taking purposes, ignored.

It is obvious that clerical valuation presents no difficulty when the following are provided—

1. Written copies of all orders for which material has been issued.
2. The value of material on each order.
3. The value of wages expended to date on each order.

The methods advocated in this book require costs to be made on copies of orders, and, therefore, material and labour values are kept together where they may be joined at any moment into a calculation of cost to date, whether the order has been completed or not.

Theoretically, the above would appear to be simplicity itself. In practice, it is found that one serious difficulty is apt to arise which would seem to be unnecessary and whose existence is hard to explain. It is this: all orders which are outstanding in theory are not outstanding in practice. If, without warning, a perfect record of items actually in the productive departments is made from physical examinations, it is usually found that they are fewer in number than is represented by a list of outstanding orders. So great and so unavoidable is the discrepancy in many factories that clerical records of work-in-progress are not permitted for incorporation in financial accounts. The difference is the sum total of all irregularities which have occurred since the previous physical stock-taking. However well planned and well disciplined a factory may be, there are always human errors, and there are always people "above the law"; goods are mislaid, the routine is short-circuited in the cause of urgency, someone forgets to make a record, or a director wants a sample in a hurry, takes it from the shop floor and forgets, or is unable, to return it. These and a hundred other causes leave orders unclosed which should be closed. The copies of these orders wait patiently in the cost department and elsewhere until such time as a general clearance occurs. The last sentence gives a clue to the only method of making clerical valuation of work-in-progress a reasonable possibility. A general clearance of outstanding orders must occur before they are all listed and included as stock.

Clerically-obtained figures of the quantities of work-in-progress should never be accepted until several tests have been made to discover how nearly they approximate to actuality. In other words, the work should be done twice, until, by the discovery and eradication of planning defects, the causes of discrepancies are understood, and the results obtained are separated by no more than a negligible margin. The second method to be used as a test of the

correctness of the clerical stock-taking is, of course, the physical method.

The use of brightly-coloured labels as already described may be readily adapted to the physical stock-taking of work-in-progress. The main modification of the procedure already outlined is this: work must not proceed on the morning following the close of the financial period until particulars are written on the labels attached to the goods operated upon. This merely means that those who know which jobs will be worked on at once must see to it overnight that the labels on these items at any rate are completed. Other labels on goods which will remain at rest for a little time may be left blank until time can conveniently be spared to attend to them.

Another point worthy of consideration is the desirability of clearing labels from work-in-progress as early as possible. The productive departments undergoing this physical treatment should receive first attention on the morning following the closed period.

In concluding this chapter it is, perhaps, as well to make it quite clear that every suggestion made is aimed at one invaluable object: the taking of stock without the interruption of production.

CHAPTER XVI

PROGRESS DEPARTMENT

PROGRESS of customers' orders—Progress of stock orders—Progress of component orders—Order chasing—Paper work—Works clerical staff.

THIS department is known by a variety of names: alternatives sometimes used are "Production Department," and "Planning Department." The words used do not closely define the work of the department because it is rarely confined to one function only. In some firms, a group of people working together in an office in, or adjacent to, a works may have very clearly defined duties, for which it is difficult to find a comprehensive name. Similar duties may in other industries be carried out by people who do not work together in that one place commonly called "The Works Office." It will be obvious that many of the functions dealt with in this section of this book may be performed by people who are entitled to regard themselves as members of a staff named with any of the above descriptions.

In order to escape from the limitations surrounding, quite properly, in the minds of many people, the subject technically known as "planning," the use of this word applied to a department has been purposely avoided. As has been stated at the outset, this book attempts to outline general routine work necessary to production, rather than to concern itself in detail with the organization of one special department.

This chapter, for the reasons given, is somewhat difficult to arrange; it serves, however, to some extent as an introduction to the chapter succeeding it.

PROGRESS OF CUSTOMERS' ORDERS

At the commencement of this book, in Chapter I, it was stated that the time taken to obtain knowledge of the

position of an order is a fair test of effective production planning. Only in those factories where the processes of production are few and simple, is it possible quickly to find and examine goods destined for a particular customer's order. It is essential, therefore, that records shall be available for instant reference, to obviate any necessity to search for goods in production. Such records have uses other than to satisfy the curiosity of a customer about his order. One of their purposes is to furnish information which may be used at a desk in the making of plans; hence, perhaps, the name "planning department."

The only kinds of customers' orders requiring treatment by this department are either those for special, or non-standard work, or else they are orders for goods which are not regularly stocked. All customers' orders for regular products are considered later in this chapter. These non-standard orders may, with advantage, be progressed independently of the main system.

A good method is an elaboration of the visual system illustrated in Chapter I. Instead of using small tickets suspended from nails, cards are filed in slots in a fixture similar to that of the familiar clock-card rack. These cards carry abbreviated detail of the special features required. A small squared table may be printed on the reverse side of the card and a square is ticked against each item as it is completed, or as each stage of manufacture is passed. Another method is described hereafter under the subject of "Order-chasing."

PROGRESS OF STOCK ORDERS

It is assumed that stock orders are those issued according to a programme compiled and operated as previously described. (Chapters IX and X.)

In the next chapter an explanation will be given of a method of classifying items of manufacture in a manner

requiring certain goods to be produced when stocks reach a fixed minimum, and certain other goods to be produced in accordance with programme requirements. Observation of the progress of manufacture of this latter group is desirable and calls for the planning of a method of so doing. The items comprising this group are, on the whole, large and expensive.

A visible-edge card system is recommended for this purpose. From the list of component parts, the assembly of which forms a complete standard article in a range offered for sale, those items requiring individual attention from the progress department are selected. Headings are inserted in the index trays to indicate the names and sizes of completed standard assembled goods. Under each of these headings specially ruled cards are arranged so that on the visible edge of each appear the identification number and description of one component part. These are generally typed well to the left of the visible edge. The remainder of the edge towards the right is divided into small spaces to indicate manufacturing operations.

A completed assembly may consist of several hundred component parts, of which, perhaps, no more than half a dozen need be progressed separately by this system. The right-hand portion of each card is ruled in squares. At the left of the card is entered the date or code sign indicating the programme concerned, together with the internal production order number and the quantity. The columns of squares are numbered in rotation at the head, to indicate successive productive operations. As operations are completed, a mark or date is made in each square. If any units of a batch are spoilt in production, the quantity is reduced in the square indicating the failing operation. The right-hand portion of the card thus furnishes a history of manufacturing procedure affecting every large and expensive item of manufacture, in the same way that stock cards supply the information in

relation to small parts manufactured on a maximum and minimum stock basis.

It may be found in practice that the routine work described above is greater than its utility warrants, and that sufficient information may be obtained rapidly by the scrutiny of coloured signals arranged along the visible edge of each card. There is scope for much ingenuity in the devising of arrangements to meet the needs peculiar to individual factories. The following method is merely given by way of illustration.

Signals are of coloured transparent celluloid, oblong in shape and wide enough to fill the small spaces marked along the edges of cards. One colour, say green, is chosen for recording the progress of operations. The other colours may be allocated each to denote a calendar month, or a different colour may be assigned to each programme. About six or eight colours are available and care must be taken to avoid confusion when the series of colours is repeated by lapse of time.

As soon as a programme is issued, the various *complete assembly* headings receive an appropriate signal placed at the extreme right end of the visible edge. As orders for the large components are issued, a signal of the same colour is similarly placed at the end of the appropriate card. When raw material is issued, a green signal is placed in the space marked 1, denoting the first operation. This green signal is moved to the succeeding numbers as operations proceed. It is thus possible at any moment to discover the exact stage of manufacture, or "progress," of every item. When the manufacture of one item is complete, the coloured date or programme signal is moved from the extreme right to the extreme left of the visible edge. A glance at the group of cards covering each complete assembly will suffice to show which articles are ready and which are still required. The progress of the latter is seen at once.

It is quite usual for new programmes to be issued whilst older programmes are still in progress. In this case, the original coloured programme signal will be joined by others denoting later programmes. Where one or more coloured signals appear at the same time at the right-hand extremity of a visible edge, the moving operation signal refers only to the earliest of them.

PROGRESS OF COMPONENT ORDERS

The method applicable to the progress of components, other than those dealt with above, can be adapted to a visible-edge stock-recording system.

It is with this part of progress work that the internal planning of production is mostly concerned.

Since, say, 90 per cent of a factory is engaged in producing stock items, any attempt to record progress of them by operations is abandoned. Where knowledge of progress by operation is desired, the stock cards cannot easily be used, because their edges serve a better purpose in forming a rapid index of fluctuation of stock quantities. There is quite sufficient routine progress work in the following for most practical purposes.

As internal production orders are issued a coloured signal denoting the calendar month of issue is placed on the extreme right of the visible edge. One signal for each order is inserted and, therefore, two or more signals of the same colour may sometimes appear at the same time. A definite period fixed by experience is allowed to elapse before progress work commences on each colour. If, for example, red is used for January, blue for February, and yellow for March, on the 1st March instructions may be in force that all cards bearing red signals are to be examined. On 1st April, blue-signalled cards require attention, on 1st May yellow signals are scrutinized, and so on. The progress man will note the internal order numbers involved, and will ascertain from

examination of work labels, or by other means, the progress attained. Alternatively, he may commence at the opposite end. He may secure information in bulk about all order numbers issued in January. Whatever direction is taken, a small progress card is inserted in the tray carrying the stock record. This card gives (1) the date of information, (2) a note usually coded, stating progress.

ORDER-CHASING

This is a term to which exception may well be taken by those who hold, quite rightly, that order-chasing should never be necessary in a properly planned factory. There are, however, many industries where a person functions in a manner very similar to the old-fashioned order-chaser. In other words, progress may be recorded departmentally instead of in one central works office. A person employed to co-ordinate scattered records is called in this book an order-chaser. He is particularly useful when sales are almost entirely of goods requiring some degree of special treatment. Such operations as, for example, colouring and decoration of standard goods require internal production orders. It is necessary to devise a method by which the progress of these orders may be recorded in conjunction with the actual orders of customers.

The order-chaser is usually furnished with his own special copy of the order. On it, against each item, are shown the date and reference number of each production order. Various coloured pencils may be used to denote different productive departments or operations required. The foreman of each department working to written orders is required to arrange these in a manner desired by the order-chaser and to allow him free access to them. The order-chaser's routine work will consist of a daily or half-daily visit to each department. He will carry with him all orders that may possibly have moved since his last visit. If, for example,

a department engaged in decorating fancy metal ware is visited, the chaser will discover—

1. Orders sprayed.
2. Sprayed orders in drying stove.
3. Dried orders hand-painted.
4. Painted orders finally dried.

(The written order forms may thus be kept in four groups by the foreman or his assistant.)

In addition to the discovery of the progress of each item on a customer's order, the chaser performs a valuable service in signifying and obtaining the completion of all items through unrelated departments at approximately the same time.

PAPER WORK

An outside planning consultant who is called in to investigate the methods of routine work installed in a factory frequently discovers a redundancy of paper work. The cause of this redundancy is usually a lack of co-ordination in planning the routine as a whole, all at one time. In the course of years changes occur which require additions to, and modifications of, established routine work. These additions and modifications are often made with a view which sees only the immediate problem calling for a change. All that has gone before and all that will continue, apart from this one problem, are not considered.

It is obviously impossible to suggest any but broad and general principles to govern planning of written routine work. Detail arrangements depend upon a multitude of individual conditions far beyond the scope of this work. It is as well to recognize, however, that an attempt should be made to distinguish between what may be described as official and unofficial methods. Official routine methods may be considered as those designed, authorized, and insisted upon by the management; unofficial methods may be those which are evolved by individuals to meet the personal

convenience of individuals in departments. Both methods are, nevertheless, paid for by the firm, and the latter therefore should be kept within reasonable limits.

It would pay many manufacturers to have their methods overhauled periodically by an expert. Failing this, the most capable and experienced high official available in an establishment should be directly charged with the responsibility of giving sanction to all routine work practised. Thus, it would be an infringement of rules for promiscuous unofficial routine work to exist. That which possesses value may ultimately become official.

One person possessing a complete understanding of all routine work connected with production is essential. It is strange that in most factories no such person exists. Such a person, seeing the organism as a whole, can probably save many times his own remuneration in clerical overheads.

Each document used in the routine work under discussion should be considered from three angles—

1. Its origin.
2. Its circulation.
3. Its destination.

A plan might be made upon which fixed essential foci of information are marked, e.g.—

1. Customers' order records.
2. Financial accounts.
3. Purchase order records.
4. Stock records.
5. Specifications.

All these, and others, are definitely fixed and must exist no matter what methods are adopted of using routine documents to carry information from one fixed point to another.

As far as is possible, two main sources of origin of moving documents may be set up more or less geographically—

1. The main office.
2. The works office.

For production purposes, the documents originating in the former source will be of two kinds—

1. Instructions as to requirements.
2. Assistance in the purchase of and payment for raw material and labour.

From the second source will emanate—

1. Instructions to secure performance of productive work.
2. Requests for service No. 2 described above.
3. Notification of what has been done.

The manner in which these things will intermingle and circulate provides material for discussion elsewhere throughout this book, but the manner is more particularly a matter for consideration in its application to individual needs.

A simple test may be used to ascertain whether a document is really necessary. The ultimate destination should be considered. If it is found that no destination other than the waste-paper basket suggests itself, it is as well to make additional use, if possible, of some other document whose destination is a permanent file.

WORKS CLERICAL STAFF

The number of persons occupied by clerical duties in a works will, of course, depend upon circumstances which cannot be considered in a general textbook. In order to make discussion possible, it is assumed that one person is required for each of the following tasks. It will be easy to reduce or add to the numbers to suit individual circumstances. Here are shown the relative numbers of people which have been found by experience to make a satisfactory disposition of works clerical staff.

The disposal of people in the office of a works producing composite goods by intermittent component processes—

1. Listing clerk making up typed sheets in duplicate of components of complete assembled products.

Form *a*. Handed to storekeeper giving authority to issue.

Returned to stock records giving evidence of issue. Passed to cost department with latest prices inserted. Destination, cost file.

Form *b*. Handed to cost department for entry of wages on one side, until work is completed when Form *a* is brought into conjunction, and material cost is calculated. Destination, works manager's or managing director's cost file.

2. Progress clerk. Originates no documents.
3. Stores records clerk. Enters receipts.
4. Stores records clerk. Enters issues.
5. Rate fixer. To be discussed in Chapter XVIII.
6. Internal order clerk. To be discussed in Chapter XVII.
7. Cost clerk. Records wages.
8. Cost clerk. Completes component costs.
9. Cost clerk. Costs customers' orders and completes costs of standard assemblies for sale.
10. Time card clerk. Enters particulars of operations on job cards. (See Chapter XVIII.)
11. Time card boy. Finds and hands job cards to men on request.

Here are eleven people arranged in a proportion observed in actual experience. If there is more work than one rate fixer, for example, can manage, he must be assisted and all the rest must be increased *pro rata*.

A works office in a factory mainly operating on continuous processes, with a few special finishing departments, has been staffed thus—

1. Internal order clerk for special finishing departments only. Continuous process work fixed by works manager in person.
2. Order chaser.
- 3-4. Stores records clerks. Receipts.
- 5-7. Stores records clerks. Issues.
8. Calculating machine operator.

9-10. Cost accountants posting cost ledgers of continuous process work.

11. Stores records physical checker.

12. Time-keeper and hall porter.

Here are twelve people, nine of whom are engaged in stores records and cost work against five on similar work in the intermittent factory first described. The money turnover in each factory is about equal. It will be noticed that wages clerks have been omitted, since it will be remembered that they are considered not to belong to the works staff.

The lists are given with a proper appreciation of the difficulty of making estimates of this kind for universal application; it has been felt, however, that a rough statement of the kind is better than none at all.

CHAPTER XVII

INTERNAL PRODUCTION ORDERS

INTERMITTENT process method—Continuous process method—Provision for cost data—Programme *versus* maximum and minimum—Inter-departmental orders—Demand notes.

It is advisable in every factory to insist that written instructions shall be issued for all physical work which is not part of the ordinary routine. For such work of a directly productive nature, these written sanctions may be called internal production orders.

The whole work of production in every well planned factory is controlled by such documents, drawn up and used in various ways. It is now proposed to examine methods representative of actual practice in factories in the two main groups of industry, namely, continuous and intermittent processes. In the latter group methods are more rigid than in the former; they conform more to a common pattern; for this reason they will be considered first.

INTERMITTENT PROCESS METHOD

The order is in triplicate. Forms are convenient in use if they are made up printed in pads of 50 sets of 3. Each set is numbered in rotation for identification and reference. Orders for the production of component parts should contain the following information—

1. Date of issue of order.
2. Identification: pattern or drawing number of the article required.
3. Quantity required.

The top copy is handed to the progress clerk who retains it, filed in numerical order for reference purposes. He may use a series of files, each to represent a stage of manufacture,

and move copies of orders as progress proceeds. It may be sufficient if he uses three files only—

1. Orders issued but work not started.
2. Work-in-progress.
3. Orders closed.

The remaining two copies are handed to the rate-fixer, who secures the time cards as explained in Chapter XVIII, "Labour." The two copies are then sent to the raw stores keeper. When he issues the necessary material, he enters the description and quantity of it on one copy of the order, in a space provided, together with the date. The person receiving the raw material signs or initials this copy, hands it to the storekeeper, and retains the other copy. The last copy he takes to the boy in charge of the time cards, obtains the card for the first operation and clocks on to the job. The order copy in his possession is passed to his foreman.

The signed copy given to the storekeeper by way of receipt for the raw material described on it is now sent to the progress clerk who adjusts his files and records, to show that raw material has been issued, and that the order may now be regarded definitely as "in progress."

This task completed, the "stores issue copy," as it may be called, is handed to the stores records clerk dealing with issues. This clerk records the issue, prices the raw material and hands on the document to the cost department, where it is held for wage recording purposes on the specially ruled reverse side, as previously described.

Since this one stores issue copy of the order passes through so many hands, it is advisable to have it printed on very stout material, preferably a good surface Manila card.

CONTINUOUS PROCESS METHOD

Here orders are not required to cover data of material issues or to collect time records. Their purposes are:

1. To notify the departmental foreman that certain goods are wanted.
2. To collect records of the dates when work proceeds from department to department.

In this case, orders are printed, numbered and padded as in the case of the intermittent process orders, but a separate copy is required for each productive department. Paper of distinctive tint may be used for each department. It may be found in practice that every productive department is not always affected by an order. The forms relative to them in each set are destroyed forthwith. The remaining valid copies are distributed to departmental foremen, who classify them according to the articles or materials stated on them. The number of varieties of product in a continuous process factory is not usually great. The foreman usually collects orders until their total is sufficient to warrant production, or where operations of the kind required are actually in progress, he uses the orders to regulate the flow of material through his department. He will thus subdivide each group of orders into two: (1) orders not started; (2) orders in progress. As an order is completed and the goods are delivered to the next department in the process, the order is sent with the goods, signed or initialed by the next foreman and passed to, or collected daily by, the order chaser, as previously described. Thence, it proceeds to stores records and costing departments as before. Before parting with a receipted order, the foreman uses it to connect the goods with his copy of the order.

As has been said elsewhere in this book, continuous process work may require no attention at all from the standpoint of individual orders. The works manager's instructions given in writing or verbally may be all that are required. On the other hand, detailed instructions may be required in finishing departments.

Possible combinations of these circumstances are infinite.

It is hoped that general guidance capable of adaptation to any conditions is given.

PROVISION FOR COST DATA

It is a very sound idea to bring costs into definite relations with facts by so planning matters that the cost department will handle the actual documents used by the factory and stores. This is one of the aims of the system outlined. There are, in fact, three departments working in line and actually located side by side, with stores records in the centre, costs at one end, and progress at the other. The line may be extended thus—

Costs ←—— Stores Records \longleftrightarrow Progress ———→ Rate fixer
 ———→ Time Records.

Internal orders flow as indicated. They originate at the point where arrows point both ways, and come to rest finally in the cost department. In this way, costing is in intimate relationship with all the links in the chain. The practical utility of this is forcibly made apparent in practice.

PROGRAMME VERSUS MAXIMUM AND MINIMUM

In Chapters IX and X, reference has been made to the programme system of standard production for sale and stock.

Where the programme system is adhered to religiously, it is necessary to issue orders for every manufactured component part of a complete standard assembly. This means that many orders for similar goods are outstanding at the same time. There are two drawbacks to this method—

1. The problem, so called, of the overlapping programme, explained in Chapter X.
2. The unnecessary duplication of routine all along the works clerical line.

A way out of these difficulties is to fix maximum and minimum limits to stocks and to issue orders accordingly. But this method may become excessively expensive since items

very costly to manufacture, if held in stock, may easily absorb more capital than is convenient.

A compromise may be effected between the two methods which secures the advantages, and discards the disadvantages, of each method.

All standard components should be classified for different treatment under distinct heads—

1. Large and expensive items, rarely, if ever, required as spares, which the experienced managers of the business decide may be left safely to be produced exactly as called for by programme.

2. Smaller manufactured parts, many of which are interchangeable. An elaborate survey must be made of these in order to decide from previous sales experience the minimum quantity required to cover sales during a period which would elapse between the issue of an internal order and its completion. To this minimum figure must be added a figure which represents a quantity considered suitable from two points of view. It must be sufficient to cover estimated requirements for a reasonable time ahead; it must be a quantity which can be reasonably manufactured economically. The total arrived at forms the maximum stock limit. The difference between maximum and minimum, of course, informs the order clerks what quantity is required. If a visible-edge stores record system is used, coloured signals will facilitate progress chasing. (See previous Chapter, "Progress Department.")

3. Bought-out items of a costly nature should also be grouped in the above manner.

4. Standard small parts such as studs, bolts, and nuts which are purchased in bulk, may, excepting in very large concerns, be well left unrecorded. It is found that better results can be obtained by observation of physical stock than by encumbering stores records with notes showing the movements of these items. (See Chapter XIV.)

Providing the settlement of figures to form the maximum and minimum basis is conscientiously worked out, there may be considerable resultant saving to the firm over and above the main saving, by avoidance of producing too small batches. Clerical time in writing and issuing requisitions, orders, and job cards, and in recording and costing small batches is greatly reduced. Capital locked up in material and labour is reduced. Another aspect of the matter is the opportunity afforded to the machinists to make better times on longer runs, with consequent advantage to the employee and to the firm, where bonus or other similar systems of payment on results are in vogue.

INTER-DEPARTMENTAL ORDERS

Factory divisions may be financially independent, or it may be advisable to keep departmental accounts in water-tight compartments for purposes of control. Departments so segregated are required to produce each its return on capital invested.

Where such conditions exist, it frequently happens that departments are called upon to perform operations for each other. When this occurs, some little confusion and difficulty are apt to arise if no carefully considered plan exists to take care of the eventuality.

All that is required is to introduce an internal order set printed on distinctive coloured paper, and, of course, carrying its own series of order numbers.

Stock cards for goods requiring this treatment should be suitably marked. If, for example, the normal order set is on white paper the inter-departmental set may be green, or of any other colour. This colour will tell the cost department that labour charges on this order must be credited to the several departments carrying out the work. The ruling on the back of the cost copy should be modified to permit wages analysis.

DEMAND NOTES

A common practice is that which provides foremen and others with books of perforated forms which may be filled in, signed, and handed to storekeepers in exchange for goods. This system is probably the primitive beginning of the attempt to control stores. One of the objects of effective planning is to curtail this system and to replace it by more exact methods. In the first place, it is highly undesirable that any individual should possess power of access to the firm's property, at will. The arguments used against this are that only persons of proven integrity are allowed this privilege and that, in any case, the signature fixes responsibility. Neither of these arguments is complete, (a) because the supply of people of proven integrity may not be sufficient to cover the number properly requiring goods; (b) because the system produces so vast a number of demand notes in a factory of any size that by the time they are all sorted out, and doubts have arisen and inquiries have been made, it is impossible for the signer to remember the incident.

Good planning looks askance at the demand note, and, whilst it may permit its continued existence, it does so only upon condition that it is never used except in cases of emergency. Even then, some explanation should be attached to each note.

The following illustration taken from experience is doubtless typical of many existing issuing arrangements in practice.

The fitting shop foreman writes a comprehensive demand note for all the components for, say, six complete standard assemblies. Each assembly, say, comprises 400 items. Thus, his note covers 2,400 items; the value in all may be £1,500. There are 100 men in the fitting department split into small groups, all engaged in erecting assemblies of various sizes and kinds. All day long this foreman is writing demand notes for items additional to those supposedly covered by

the original comprehensive notes. Some of the articles may be genuine additions required to effect modifications of standard, to customers' orders; others may be replacements of goods damaged by fitters; or they may be for items missing from the original issue either because of storekeepers' carelessness, or because of temporary shortage. Many hundreds of such notes are issued daily. They must all be sorted, entered on stock records, and charged to appropriate cost accounts. The task is a heavy one, and can only be carried out at considerable expense. A large number of queries arise from this system as to the reason for apparently superfluous issues; no satisfactory answers are forthcoming, and little reliance can be placed upon the accuracy of stock recording and costing.

In a factory actually using the planned routine suggested, detailed assembly lists were printed in duplicate: all components were listed in print. One copy was used for issuing, recording, and pricing: the other copy for collecting—wages on one side, and component costs on the other as previously described in this chapter. There was thus a consistency in method both for components and assemblies.

The curtailment of the use of demand notes was strongly resisted. Foremen and others refused to state reasons on the backs of the notes. They were justified to some extent in a desire to avoid casting blame on others. In the end the use of demand notes was restricted to cases of emergency by the application of the following simple method, applying a code letter to every demand note thus—

- | | | |
|---|---------------------|---|
| A | signifies component | issued faulty; to be credited. |
| B | „ „ | damaged by fitter. |
| C | „ „ | short-issued. |
| D | „ „ | extra excluded in error from list;
list to be corrected. |
| E | „ „ | issued in emergency; see note of
explanation. |

It will be seen, of course, that all the foregoing on the subject of demand notes presupposes a state of affairs which is diametrically opposed to the entire spirit of this book. Good planning demands the minimum of clerical work by foremen and others.

This section has been included because it is felt that it may be of value to the many victims of a system still in widespread use. The looseness of the control it gives often causes more trouble than no control at all.

CHAPTER XVIII

LABOUR

WAGE and bonus systems—Time-recording—Double-clocking—Checking time cards—Rate-fixing—Operation and machine time records.

THE prosperity of a manufacturing business depended more, perhaps, in the past than it does to-day upon the ability of a manufacturer to obtain a sufficient supply of skilled work-people. One of the evolutionary tendencies of industry has been to diminish this dependence. The development of machinery has undoubtedly played a great part in bringing about the changes which have occurred, but much is due to the adoption of planning in various forms.

In the first place; the industrial world is indebted to Dr. F. W. Taylor, whose remarkable researches have led to a new conception of labour problems. To him, perhaps more than to any other person, is owed acknowledgment of the discovery of what may be called the personal efficiency factor. He has demonstrated methods by which the interest of the worker and the employer may become truly identical. The result has been that the last ounce of effort, which a worker may, with safety to his health, put into the goods he produces, has in many cases been determined. There is, however, another factor, and one with which this present book and chapter are concerned, namely, the division of labour.

The phrase "division of labour," has become a term commonly used by industrial investigators. It is used to denote a system adopted almost from the birth of modern industry. Before the days when boots, for example, were made in factories, one man made a boot from start to finish. In a factory a better boot can be made at far lower labour cost when a dozen or more people take a hand in its making.

Each of these people is a specialist in one operation; he is able, because of his knowledge and practice, to do it better and more quickly than a man who is capable of performing all the operations single-handed.

What is true of boots is true of almost everything else. Labour has to be divided. The planning of the division may be as important as, or even of greater value than, the exertion by each worker of a fair proportion of the energy of which he is personally capable.

Every industry, grown to maturity, possesses its own technique. Knowledge of accepted technical practice has come to replace the personal skill of the craftsman. The apparatus and mechanical appliances required to give effect to the technique of modern accepted practice are often so costly that only factories producing on a large scale can hope to compete successfully in an industry. It is impossible, therefore, here to intrude upon the field covered by that literature which exists for the purpose of supplying technical information to those engaged in the individual industries to which such books are devoted.

It seems, however, a proper function of the present work to point out that full use of technical data should be incorporated in the plan governing production, and that these data should be applied and controlled methodically.

Plans, methods, and technical data cannot be made to produce goods until they are placed in the hands of human beings. The supply and selection of these people still remains a vital subject, even though modern conditions are so different from those of the primitive beginnings of industry.

One of the outstanding changes is in the proportionate quality of labour. The proportion of unskilled and semi-skilled people who can be usefully given employment in factories becomes increasingly greater. People who are mentally and physically healthy are quickly initiated into the performance of a single operation, the division of labour

which becomes the task of an individual. In short, planned training of a simple kind may replace apprenticeship.

The labour required in many factories is thus of two kinds: (1) trained; (2) trainable. Methods of selection and training are often haphazard.

Since people who lay claim to trained skill apply for work in a stream which, throughout the year, runs fairly steady, a simple method is suggested for dealing with them. Each department should prepare a simple labour report monthly, stating—

1. Present strength compared with total capacity.
2. Number of new hands required, if any.
3. Operations capable of improvement.

These records in the hands of the person who deals with all applicants will indicate a prompt "yes" or "no," or "perhaps." "Possibles" should be handed on to be interviewed and tested by departmental experts at fixed times. Similarly, people who have to be trained should be handled methodically. A batch of recruits can be handled with as little effort as can one person. A reputation for fair play will be gained, and this first impression goes far to secure that feeling of loyalty which ultimately is essential.

WAGE AND BONUS SYSTEMS

Payment of wages to productive workers may be made on a basis of time, piece-work, or a combination of these two. No explanation of time or piece-work methods is necessary, but their combination may be achieved in various ways which necessitate the planning of routine work within the factory.

All methods of combining payment at an hourly rate with a reward for results obtained require similar routine treatment.

1. It is necessary to obtain records of the total time to which the hourly rate applies.

2. It is necessary to discover how the above time has been occupied.

3. It is necessary to have some set standards with which the first two items may be compared.

Probably the commonest combined method of calculating wage earnings used in modern industry is some form of bonus system based on individual performances. As a variation of this there is a similar system, where payment over and above hourly rates is calculated from results obtained by groups of workers. In principle, and in the planning of the routine required, both methods have common features.

The most usual, the simplest, and perhaps, therefore, the best method, is to make up wages as follows—

1. Number of hours at hourly rate, plus
2. Bonus earned, calculated from job cards and transferred to wages summary card.

TIME-RECORDING

Wages paid entirely on a time basis necessitate nothing more than a rapid method of signifying the arrival and departure of each worker. All that is really essential is a rule that every worker shall enter the factory by an entrance which permits of observation. The observer intercepts late-comers where no records are kept and departmental foremen notify the wages clerks of absentees. An improvement on this provides each worker with an identification number and a metal ticket. This ticket is removed from a hook on one board and placed upon a hook on another board each time the worker enters or leaves the factory. A list of late-comers and absentees is made out from observation of these boards. Instead of using metal tickets, a time-recording clock may be used to show on a chart the times of arrival and departure of each numbered employee.

Piece-workers are required to record their hours of attendance for disciplinary purposes. In all the above cases

observation is necessary to prevent collusion between workers who might not only record their own attendance, but also by arrangement, the attendance of absentees.

The combined or bonus system needs more elaborate arrangements for time-recording.

DOUBLE-CLOCKING

A method that is possible, and is, in fact, often practised, is for time spent on jobs to be recorded by hand by juniors employed in the shops. This method is expensive and has little to recommend it on the count of speed, when contrasted with the accuracy assured by the system called "double clocking." Clocks cannot be coerced, neither will they pay attention to argument!

Double-clocking, occasioned by the combined or bonus system, requires each worker to make two clocking operations, both upon arrival and departure. The total time of attendance is shown on the card hitherto called a wages summary card. This is a folded card which is placed into a slot in the recording clock, and, by depressing a lever, the time is printed in a space automatically fixed. The inside of this card contains the handwritten analysis referred to in Chapter XIII. On the arrival of the worker, the folded card is removed from a rack, time-stamped, and replaced in another rack. Contained in the fold of the card is the job card referring to the work left on hand on the previous departure. This second card is also stamped with a printed record of time by the clock. Various colours of card may be used to facilitate departmental and other dissection.

During working hours, when a worker changes his task, the old job card is recovered from the rack, time is recorded on it by the clock, a new job card is obtained, time is recorded, and the card is replaced.

In practice, time may be saved if a boy in charge of the job cards makes the final connection with the summary

card, since, at the same time, he may calculate the total time taken on a job and enter it in the interior of the card.

CHECKING TIME CARDS

All completed job cards are checked either by the rate-fixer himself or by the time-clock boy in order to discover whether more or less than the set standard time has been taken. Any saving in time is used as a basis of calculation to determine the amount of cash bonus payable to the worker in accordance with whatever system of bonus payment may be in force. Under some systems excessive times are written off, while under other systems these times are carried forward and their value set against bonus earnings.

The checking of job cards against set times is part of the definite daily routine. In some cases it is found advantageous to leave the analysis made on the interior of summary cards until job cards have been checked for bonus purposes. In any case, the calculation made in the works office is one of time saved only. All job cards showing a saving of time and a consequent liability for payment of bonus are sent to the wages clerk, in the general accounts office, where the hours saved are converted into money values to secure actual cash additions to the hourly-rate wages payable weekly. It is a wise precaution to institute a check on the calculation of bonus, since it is impracticable to recover amounts overpaid to workers due to errors or deliberate falsification.

It is impossible to pay wages, calculated as described, on Friday night unless the wage week terminates earlier. The most usual practice is to pay on Friday all earnings up to the previous Wednesday night. Thus, the manufacturer always has at least two days' wages of every worker in hand. The total may amount to no inconsiderable sum. The two days' difference in time are required: (1) to calculate the amount of cash payable to each worker after

deducting compulsory insurance and other items; (2) to obtain the total amount of cash required and to draw it from the bank; (3) to write pay envelopes and to place the correct amount of cash into each.

RATE-FIXING

This work arises from the foregoing, and is, of course, only applicable to factories where payment by results on a time basis can be arranged. A rate fixer is, as a rule, a highly skilled technical person of considerable practical experience. He must, also, be a person of undoubted integrity, since by collusion with work-people he could manipulate illicit bonus payments.

The method used to set standard times in the first place, for items of which no previous experience has been recorded, is usually by estimate rather than by a specimen physical demonstration by the rate-fixer. Two figures are required in respect of each operation estimated—

1. Setting time, i.e. the time which may reasonably be occupied in preparing for production.
2. Actual productive working time.

The rate-fixer is able to determine from an examination of a drawing—

1. Operations required.
2. Machines required.
3. Speeds and feeds of machines.
4. Setting times.
5. Productive time.

A good plan is to use loose-leaf books for recording standard operation times, and to devote one book to each complete assembled standard unit for sale. One leaf of the book, suitably ruled, is used for each component part. On each line on a page is stated an operation; operations are numbered line by line in sequence, the data being tabulated as shown on page 201.

Name of Part..... Identification or Drawing No.....

Operation No.	Operation	Machine Used	Speed	Feed	Setting Time	Average Time Allowed per Unit

OPERATION AND MACHINE TIME RECORDS

On the reverse of each page actual times are noted from job cards, until sufficient information has been gathered about each operation to establish the fairness of set times beyond reasonable contradiction. This is necessary because, however capable a rate-fixer may be, he is never infallible; indeed, the majority of rate-fixers are nothing loth to admit that no estimates can be equal in accuracy to practical demonstration.

Usually, a good rate-fixer endeavours to observe personally the first performances of unfamiliar work. In the matter of machine feeds this is particularly important, as cuts at various angles in different material cannot be determined with complete accuracy even with the aid of the series of specially designed slide rules used. The calculations may be exceedingly intricate, involving, as they do, many variable factors. The provision of adequate slide rules and facility to use them are of course, imperative, but the results of calculations should always be checked by physical observation.

Errors may cause damage to expensive material, to cutting tools, and even to costly machinery.

CHAPTER XIX

PLANNING OPERATIONS

SPECIFICATIONS and drawings—Using cost- and rate fixing data—Works manager and foremen.

CONSIDERATIONS of planning operations have so far been separate and abstract. Various factors have been discussed separately which it is now proposed to co-ordinate in the concrete physical activity of mechanical production.

There are five definite factors involved in the performance of even the most simple item of productive work when labour is applied to machinery.

1. An internal production order, i.e. a written statement of what is required and when it is needed.
2. Availability of suitable machinery and equipment.
3. Availability of suitable labour.
4. Availability of suitable material.
5. Knowledge of the process work necessary, i.e. a written record of data relative to the operations in sequence.

If only one order were dealt with in a factory at one time, the procedure would be simple enough. Upon receipt of an order, the remaining four factors would receive attention and the work would proceed. Should a second order be received before the first was completed, a little consideration might be necessary before any steps could be taken with regard to it. It might be found that work could not proceed at once without interference with the progress of the first order. Any of the factors 2, 3, 4, 5, might need adjustment or modification. A factory so limited in capacity that one order alone could be tackled is difficult to imagine; certainly it would hardly deserve the dignity of the title unless it were engaged in some such field of industry as the building of

ships. The principle involved, however, is of a radical nature; its recognition is necessary to the understanding which lies at the very root of planned as opposed to unplanned productive activity.

The ordinary factory in mind requires to produce not one or two or a few orders, but a very large number of orders at the same time. There is only one way open to the people whose purpose it is to secure that work shall proceed without confusion in an orderly and economical manner; it is the planning of operations ahead of time.

It is impracticable to make plans reaching beyond a reasonable distance into the future; it is equally undesirable to make them a few hours or minutes before they are to be put into operation. A well-qualified man at the head of a productive department possesses a well-balanced sense of the time element necessary. Once he can visualize forthcoming requirements, his mind becomes busy with the question of labour strength. If, for example, a seasonal programme of production is anticipated, he will give full consideration to details of mechanical capacity, and the provision of a labour force to fill it. He knows that labour strength cannot properly be regulated as is the flow of liquid from a tap, and that a works should not run alternately overtime and short time, at frequent intervals. However irregular the curve of sales may be when plotted as a graph, the line representing production on the same graph must be fairly flat and steady; overtime and undertime are each a costly evil. The question of material supplies may well be, as it usually is, outside the jurisdiction of the productive departmental head, but this is not always so. Materials may be of such a nature that purchase requirements can only be estimated in the department. Their requisition then forms part of the plan.

The real crux of the situation is reached when the sequence of operations is studied in detail in relation to the other

four factors. The expert must sit down with pencil, paper, and data before him and exercise solid thought and calculation.

This work should be regarded as a fixed and definite task, taking place at stated times, and subject to the same supervision as any other task. The departmental chief should be required to produce his plan on paper for the knowledge and approval of the works manager, managing director, or the superior competent official.

The method of making a plan will naturally differ widely in various industries; a rough indication in general terms of the course to be pursued can alone be given.

A plan to cover a period involves consideration of a mass of detailed orders. This mass is first roughly dissected into groups or classes. Each rough class may be redissected and dissected again as far as the limits of experience and mental knowledge will permit. At this stage it is necessary to calculate the machine hours needed for operations from recorded data and to collect the totals of each. Having arrived at basic figures, planning commences in a process of working backwards, by allocating and distributing work to machines until all orders are absorbed in every class. It will be found, of course, as the process of allocation proceeds from class to class that modifications of the plans will be required.

In the end it should be possible to write the name of every productive machine unit, one each at the head of a blank sheet of paper, and to state on each sheet the rotation of order numbers which will pass through each individual machine, and the hours to be occupied by each order. The collection of sheets is a real plan. If the plan is well made, it will work smoothly. The departmental chief should have freedom to see that it does so work, and should be able to devote his time to the supervision of production towards two ends: (1) quality; (2) economy.

SPECIFICATIONS AND DRAWINGS

Before physical productive work can proceed it is necessary that the producer should be in no doubt as to every exact detail of the work required. This information is conveyed in some industries by a written specification, in other industries by drawings, and in yet other industries by both specifications and drawings.

Upon the accuracy and ready flow of this information, the prompt and economical dispatch of orders frequently depends.

Specification clerks and drawing office staffs are notoriously blamed for difficulties which, in justice, are beyond their control. Usually, their troubles arise from lack of foresight on the part of those responsible for the planning of routine work in these departments.

It is very difficult to form an accurate estimate of time occupied in this work, and it is practically impossible to lay down any hard and fast rules. Two sets of difficulties are commonly experienced—

1. Spasmodic rushes of work.
2. Inability to settle queries by reference to routine data.

Elasticity in the supply of staff is a remedy for the circumstances which at one time demand more, and at other times less, strength than is available. There are two good methods of securing some degree of elasticity. The first is to give juniors some training in these departments before passing them on to other work. The other is to provide juniors in the departments for all routine functions of a kind requiring no special knowledge or skill. If the first of these methods is adopted, there will be available at close range those who are capable of lending a hand in times of pressure. The second idea secures that in rush periods all skilled men are free from work requiring no skill.

Delays caused by an inordinate amount of investigation

and inquiry, prior to the commencement of work on specifications and drawings, are only to be avoided by the provision of data in a form conducive to rapid reference. There is little doubt that identical research work in some factories is repeated many times unnecessarily, and that reference to a record of the first experiment, if available, would save much time. An account of all trials and experiments should be written, filed, and indexed. Similarly, where drawings are built up from sketched material, the latter should be preserved. There should never be, though there often is, any difficulty in obtaining detail relative to standard work. A simple rule which will assist in this direction is that prohibiting the removal of original documents of this kind from their permanent location. Copies or blue prints alone should be used for all other purposes than those which can be satisfied by a rapid scrutiny on the spot.

Drawings for use by productive workers should be mounted on stiff millboard and varnished, or they may be mounted on fabric attached at one edge to wooden rollers. The latter bear numbered metallic discs on the projecting ends of the rollers, to facilitate identification without unrolling.

When both specifications and drawings are required, the former appertain usually to the work of erection and the latter to that of producing components. The specification contains a list of standard drawing numbers and states the quantity of each item necessary to complete a finished standard unit for sale. It is obvious that no progress can be made with erection until this list is forthcoming. Usually, knowledge of orders demanding specifications is obtainable in the works some time prior to the appearance of the list. A good plan to secure prompt action by the specification or drawing office is to keep a daily check on orders waiting for these data. The works manager should be notified of, and he in turn should communicate the need for speedy attention to, outstanding cases. The date of receipt of

specifications and drawings will, if appended to orders, be useful on occasion to trace causes of delays.

Such documentary information as is required in the physical work of production should be readily available, close at hand, in the departments. A definite routine, also, should be set up to secure that drawings and documents be returned and filed after completion of production. It is a common and deplorable sight to see these documents lying about on benches and littering odd corners. They require orderly central storage in the works. When they are handed out for use the fact should be recorded, and the record should state the name of the person held responsible.

USING COST- AND RATE-FIXING DATA

Where "standard" costing is installed, this process is automatic. Some of the advantages of the standard costing method may be obtained when "job" costing is operated, by giving instructions for excessive times or costs to be reported to the rate-fixer. In a similar way the rate-fixer should be encouraged to confer with the cost department with regard to the figures of cash value represented by changes and innovations. It may be said that provision has been made to enable the rate-fixer to become acquainted with excessive times. But this alone does not ensure maximum service from the arrangement planned. Without this link between rate-fixer and the costing department, the former looks only to the works manager, an individual who is rarely in a position to examine in detail those masses of daily records which alone can make him familiar with matters needing his attention.

WORKS MANAGER AND FOREMEN

The title "works manager" is applied to men who cover a great field of direct and indirect productive activity. The size of a factory frequently determines the limitations of the

duties of this individual. Often, from lack of definition or for other reasons, the works manager's responsibility in respect of certain matters is found to be purely nominal. Such a state of affairs is contrary to the object of satisfactory planning. It is no uncommon thing to find works managers usurping authority in matters where they are ill-qualified to interfere. Again, circumstances are sometimes encountered where directors and others have a disposition to give instructions to persons in the works other than the manager.

All these things militate seriously against the real usefulness of the works manager and call for a very definite remedy. It is highly desirable that the limit of authority of a works manager, foremen, and all other persons possessing it in, or about, a factory should be clearly stated. A plan, on the familiar pattern of a genealogical tree, has its uses, but it cannot fittingly be exhibited to all and sundry. Such a plan, however, in some form, be it only a mental picture, must exist.

In most factories the limits referred to will depend upon a correct assessment by the principal of the ability and capacity of the individual works manager. In many cases the work is divided, each person being directly responsible to one central control. The following is a list of subdivisions of works management—

1. Production manager. This person supervises by constant personal inspection technical process work in which he has received a long and complete training.

2. Progress manager. Takes care of all paper routine, planning of departmental activity, and gives promises of delivery.

3. Labour manager. Superintends engagement, employment, and discharge of hands.

4. Engineer manager. Is responsible for machinery and buildings.

Any of these four functions may be subdivided ; together they comprise all that is often centred in one man.

The distinction between the performance of these functions and the work of a departmental foreman is one of geographical location. All the above duties may require the presence of the individual entrusted with them in any part of the works. The foreman may not wander about ; he must remain in one place, his department.

Perhaps the most useful method of maintaining proper co-operation between the individuals concerned with the management of a factory, and of putting the limit of responsibility of each beyond all doubt, is that of periodical conferences, with the principal as chairman.

It may be objected, with truth, that the conference habit may easily be overdone, that there is no time for useless gossip. With equal truth it is here emphatically stated that a proper use of the method is invaluable, if in no other direction than that of promoting goodwill between departmental heads, and loyal co-operation to the concern as a living organism. Statements made by a principal to a group of all the team captains upon whom he depends can rarely be misinterpreted ; they possess, too, the merit which attaches to frankness and open, fair dealing. Difficulties explained by departmental men in the presence of all are received with sympathy and often with the understanding which leads to their solution. Certainly, there is no more fitting place and manner in which to make clear to all concerned the exact relationship which each member bears to the whole concern, and to fellow-workers.

CHAPTER XX

CENTRAL CONTROL

EQUIPMENT—Subject-indexing—Budgetary control—Time the essence of effective control—Disputes and breakdowns—The board of directors.

THE managing director, chief executive partner, or whatever else the principal person may be called who has the final deciding voice in controlling the affairs of a manufacturing business, has need to keep in touch with every division of the firm's activity. Although production may be the most important of all these divisions, at any rate in the minds of the people concerned entirely with it, it is still only one out of several distinct forces needing to be co-ordinated in one ultimate place—the principal's office. It is necessary that information received there from the productive and all other sections shall be concise and free from all but essential detail.

The task of production control by the executive head of a manufacturing business is facilitated by a plan which provides a steady stream of vital information to his office. This information must be in summary form and must be delivered automatically in his room at the earliest possible moment. The managing director can afford to expend no energy in extracting what he requires from masses of detail, neither can he constantly be kept waiting while facts are ascertained by members of his staff. Information which is not the latest available is useless.

The plan outlined below is operated by the personal secretary of the supreme executive. Data required concerning production may be enumerated thus—

1. Production in relation to sales. The method used will conform to the requirements of the industry and also to

the ideas of the principal himself. Generally, it is desirable to know from day to day all or some of the following—

- (a) Total production, possibly classified departmentally.
 - (b) Orders executed, either by name or by total quantity or value.
 - (c) Orders received.
 - (d) Value of balance of outstanding orders.
2. Stocks expressed by either quantity or value—
 - (a) Finished goods classified departmentally.
 - (b) Raw material classified departmentally.
 3. Quality data. These are of great importance where recognized standard qualities are sorted from the bulk product of hazardous processes, e.g. pottery.
 4. Costs. (a) Summarized costs of complete standard articles or materials. (b) Entry of cost data in a register of sales orders where such is applicable.
 5. Labour strength. This is a weekly statement accompanying the wages cheque presented for signature. It summarizes: (a) number of hands in each department; (b) value of departmental wages; (c) an explanation of the amount of the cheque. This statement is retained by the chief.
 6. Inspection reports. These are concisely tabulated and summarized reports upon matters which the chief either desires to be specially watched or else knows should be constantly watched. Special items may include such matters as building operations, results of innovations, and so on. Regular reports may cover: power and fuel consumption, waste production and disposal, percentages of stated impurities in raw material; or there may be, in addition, a general report covering scattered items of productive equipment where surveillance is valuable in securing its proper and full use.
 7. Staff personnel records. Names, addresses, telephone numbers, ages, occupations, and salaries of all staff employees.

8. Overhead expense data. These are dealt with later in this chapter and also in the appendix in the examples of budget charts.

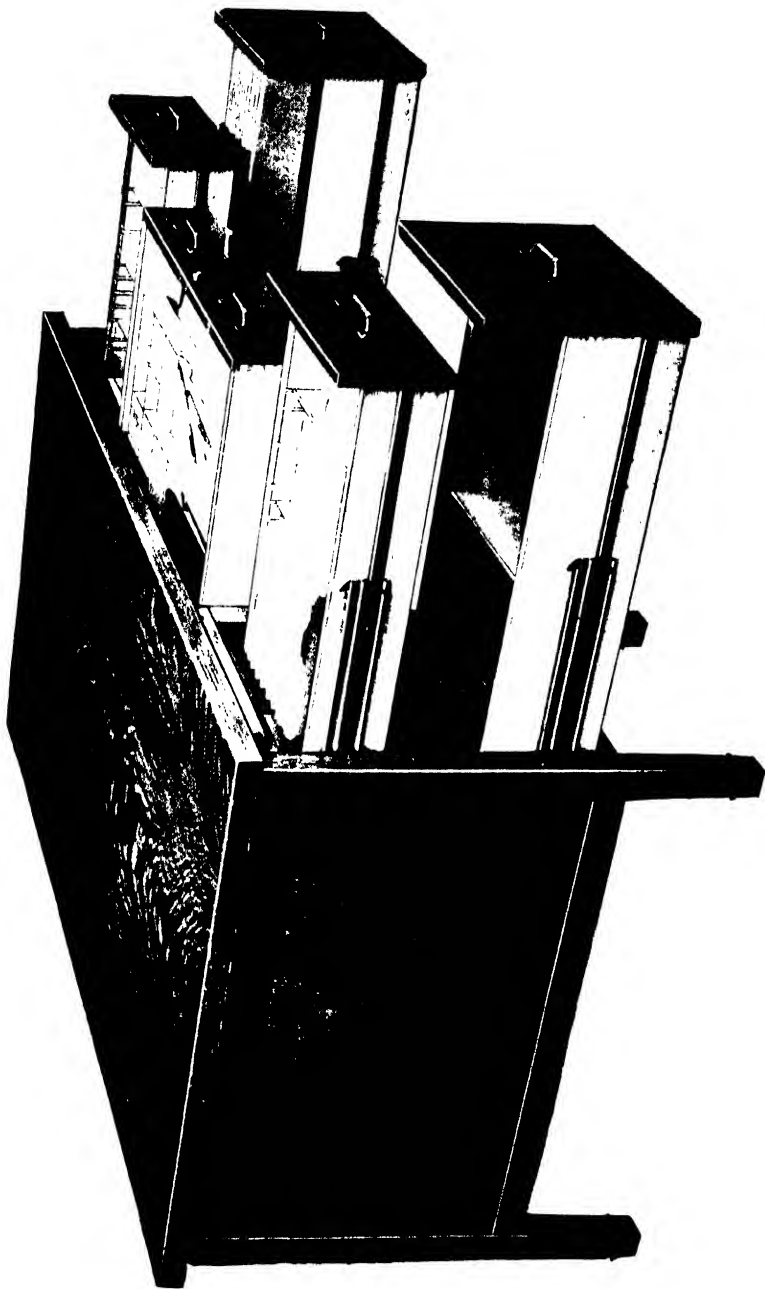
The above may seem a fairly formidable list involving a busy man in multitudinous detail, especially when it is remembered that there are many other items, not connected with production, requiring his attention. Sales and finance alone are separate headings which will add many further items to the list. It is true that a great mass of detail is collected, but no effort whatever on the part of the chief to digest it is suggested. Generally, the form of each item is designed by the chief himself; he thus recognizes without effort the purport of each record he has occasion to examine. The examination of records may not occur at stated times. Days may elapse between a scrutiny of any or all the items. All that is required is that at any moment the chief may secure an accurate idea of the position and progress at any point, as rapidly as possible.

Rapidity has been secured by the arrangement of the managing director's desk and office equipment. A description of this may be an aid to an understanding of the foregoing, by introducing a mental picture.

EQUIPMENT

The desk has a flat top and is devoid of papers, pens, ink, letter baskets, telephones, or any of the paraphernalia associated with offices. At the left of the swivel chair are two telephones, one, for external communication, perhaps fixed on an extending arm to swing clear above the desk; the other, for internal communication, consists of a box instrument fixed rigidly on a shelf or side table, within easy reach, but clear of opening desk drawers.

The remaining essential furniture is a vertical filing cabinet, a cupboard, glass-fronted bookshelves, chairs, a calendar, and a clock. Maps of the home country, Europe,



(By courtesy of Messrs. Shannon, Ltd.)

FIG. 1. A Mechanical Component, Detail

and the world may usefully occupy the walls. A rack in a well-lit position may contain a series of hinged charts.

The flat central drawer above the knee-hole of the desk contains writing material, paper fasteners, and so on. The top drawer on either side is fitted to carry card indexes. The cards run across the drawers and face the centre. Below these, the drawers on each side are deep and are fitted as vertical files. There being but these two drawers on either side, the desk is supported by eight legs to raise it clear from the floor. The drawers are mounted on ball-bearing metal runners and will not fall down when fully extended.

All the items of data required are furnished to the secretary written on cards designed to fit the system. They are of various sizes from 5 in. by 3 in. upwards. The side of each index is adjustable, and in the two drawers there is room for many separate sets of records and for many thousands of cards. The secretary merely inserts cards in their appropriate places in the index drawers as they are received.

When the chief is present in his room, the only papers visible on his desk top will be those engaging his attention. When he leaves, his desk top is cleared.

One of the vertical file drawers is used as an abeyance file, and all loose papers relating to matters under consideration are kept in it. There are two sets of folders in this file. One set bears departmental or personal names of staff members; the other is a diary file. Whenever a person or departmental head named on a file is interviewed by the chief, the file is examined. The diary file is usually composed of 31 numbered files and 12 files bearing the names of the calendar months. The secretary examines these files daily before the arrival of the chief; the file of yesterday is cleared by the transference of any papers remaining in it to the file of the current day. The empty folder is placed behind the guide card of the succeeding month.

The second vertical file drawer in the desk is used for constantly needed data which are too large or otherwise unsuitable for inclusion in the card index system located above. The files containing these data are arranged in accordance with a subject index which also governs a portion of the contents of the vertical filing cabinet included in the list of the furniture required.

SUBJECT-INDEXING

An outline of subject-indexing has already been given in Chapter VII. There it was applied to the classification of printed matter received by the purchasing department from suppliers whose names were not familiar. In a modified form this method may be exceedingly useful in classifying the many documents required for reference by the executive head of a manufacturing business. It is clear that information of the kind in mind cannot be associated with the names of persons or firms. Much of it could be attributed to departments and filed accordingly, but it is preferable to incorporate the departmental classification with a method more completely comprehensive.

For the purpose the strip index is again used.

A method of main head numbering, together with a few appropriate subheads, actually in constant use in several chief executive offices, is given here and on the next page.

MAIN HEAD NUMBERING

The Company	I
Board of Directors	101
Secretary	10101
Shareholders	10102
Finance	102
Debentures	10201
Bank	10202
Stocks	2
Raw	201
Finished	202
Costs	203

MAIN HEAD NUMBERING—(contd.)

Production						3
Capacity Records						301
Labour						302
Women						30201
Welfare						30202
Wages (Day)						30203
Piece Work						3020301
Bonus						3020302
Machinery						303
Transmission						30301
Power						304
Electricity						30401
Sales						4
Home Sales Records. A Territory	A	Territory .				401
" " " B "	B	"				40101
Export Sales Europe						402
" " Dominions						40201
" " Foreign						40202
Travellers						403
" Potential						40301
Advertising (Press)						404
" (Postal)						40401
" (Exhibitions)						40402
Accounts						5
Cash Forecasts						501
P. & L. Accounts						502
Creditors						503
Bills Payable						50301
Debtors						504
Bills Receivable						50401
Staff 6 and subdivisions.						
Land and Buildings 7, and subdivisions, and so on.						

BUDGETARY CONTROL

The success of manufacturing is measured in terms of profit. Profit, in the long run, is more important than production, sales, or anything else. All the ability and energy of the executive head are directed to the earning of profit. It is claimed by the advocates of budgetary methods that profit on any given sales turnover may be fixed in advance with a fair degree of certainty.

Whether this be true or not, there is no doubt that the use of budget charts may be of great assistance in the control of expenditure, productive and otherwise. Since this book is concerned with none but the productive side of industry, it is preferred to confine consideration of budgeting to

productive expenses only. The subject concerns finance, and is thus apart from the meaning given to the word "planning" as applied in this book. For this reason, it is relegated to Appendix I. An important object, and perhaps the main object, of planning and also of central control is the regulation of overhead charges. The total cost of labour and material usually bears a fairly steady ratio to the quantity of goods produced. If these were the only items of expenditure, it would merely be necessary to sell the goods at prices higher than the total of these two items, to be sure of making a profit. The introduction of a third cost ingredient, overhead charges, often greater than the other two ingredients combined, destroys the simplicity of profit-making. It is only by exercising the greatest possible degree of control over these charges that the risk of loss may be reduced. This control must clearly originate from the centre.

TIME THE ESSENCE OF EFFECTIVE CONTROL

There are two ways in which this dictum may be applied to the subject of the central control of production planning or to the planning of the central control of production: (1) it is essential that the chief should not expend his own time on work which less important people can do equally well; (2) it is essential that control be swift in its effect; that instructions issued by the chief be instantly obeyed.

To the conservation of the chief's time much of what has already been written is devoted. There are still one or two small devices which it may be worth while to mention.

The external telephone should not be permitted to interrupt until the personal secretary has received the incoming call and is certain that an interruption is warranted. Even then the actual person desiring to speak should be ready on the line.

The internal telephone used by the executive head should be capable of interrupting any other internal conversation,

but should not be capable of being interrupted. A refinement of internal telephones is that which incorporates a microphone and loud-speaking device, and thus necessitates no holding of receiver or transmitter. Conversations may be interrupted and several instruments, located in different departments, may be brought into discussion with the master installation. When the latter is calling, or interrupting, a small electric lamp signifies the fact at the instrument called.

To prevent personal interruption in the chief's office, an "Engaged" sign is turned on the door when its desirability is signified to the personal secretary.

DISPUTES AND BREAKDOWNS

As the ultimate authority, the chief is, from time to time, called upon to adjudicate between members of the staff upon responsibility for failure and in matters causing trouble. A rule worthy of more use than it gets is a stern refusal to listen to only one side of a story at a time. When the chief is consulted about a serious difficulty he is wise, if parties other than his informant are involved, to require the presence of all these parties. Not only is this desirable in the interests of justice, but also in the interests of speed. Incidentally it pays. A sense of fair play is instilled and it becomes known that it is no use going to the chief with a one-sided story. Reprimands administered by the chief should never occur in the presence of others.

THE BOARD OF DIRECTORS

The executive head is not always himself the real head of a business. The owner or owners of a firm have the power of his appointment. He is required to justify it by making profit, or else to give some very sound and thorough explanation of his difficulty. In the case of many manufacturing concerns the executive head may shift some of his

responsibility on to a group of individuals who meet periodically for the purpose of discussing progress and of recommending action. Where board meetings of company directors occur at regular times, it is necessary for the executive head to produce figures to illustrate results obtained.

The use of graphs in place of sheets of paper containing lists of figures is to be highly recommended. Figures are only of value for purposes of comparison. Graphs, by visual means, give extensive comparisons at a glance. Specimen graphs are illustrated in Appendix II.

By the use of graphs it becomes unnecessary for directors at a meeting to search amongst sheaves of papers in their dispatch cases in order to bring earlier records to light. A binder containing a complete set of graphs is provided for each director; it is sent to him with the notice and agenda of each meeting; he leaves his graphs behind after each meeting.

Statistical information gains its true significance by the use of this method, which is useful alike in application to the problems of central control and to many of those of production planning.

APPENDIX I

BUDGET CHARTS

BUDGET charts applicable to various aspects of commerce may be used; here the manufacturing viewpoint only is considered.

PURPOSES—

1. To supply a visual measure of expense items in relation to turnover and to each other.
2. To provide a guide which, if followed, makes it possible to determine in advance that profit will be made.
3. To fix the amounts of direct and indirect productive expenditure which are permissible to secure that a known profit on a given turnover will be made with certainty.
4. To facilitate the control of spending departments by the issue of sanction of expenditure in elastic and visual form.

Chart 1. This is the master chart covering a manufacturing budget.

DATA REQUIRED FOR CONSTRUCTION. The following figures are required to be taken from accounts, preferably for a number of short periods immediately preceding the construction of the chart—

1. Net Sales.
2. Fixed Overheads.
3. General Management Expenses.
4. Factory Overheads (including indirect labour).
5. Direct Material.
6. Direct Labour.
7. Balance (which may or may not include sales cost as well as profit).

A series of figures for any one of the above is unlikely to

bear a consistent percentage ratio to turnover. The causes of peaks and depressions must be understood, as they usually are, and the curve flattened to represent reasonable probability in each case.

CONSTRUCTION. The same scale is used both vertically and horizontally. The line rising at 45° from zero to a figure slightly exceeding possible sales for the period used will therefore pass through all points representing amounts of turnover which can be achieved.

FIXED EXPENDITURE. This is represented by an area bounded by a horizontal line, because these charges do not vary in proportion to sales.

GENERAL EXPENSE. The line bounding this area slants but slightly because these charges show no great fluctuation with sales.

FACTORY EXPENSES. The line bounding this space slants steeply in accordance with sales, until a point is reached when it changes its direction and becomes parallel to the base. The reason for this is that, so long as the factory is kept running, certain of the charges included must continue, whether the business is profitable or not.

DIRECT MATERIAL AND LABOUR. Each entering in a definite proportion into every unit of production sold will vary exactly as sales fluctuate.

PROFIT. The area between the uppermost of the expense lines and the line rising from zero sales on the left to maximum sales on the right will indicate the profit earned on any turnover, providing the expense items remain in the proportion graphically shown. Loss occurs where the last of the expense lines crosses the sales line. It will be noticed in the chart illustrated that this occurs, as it always must at some point, when sales are too low to cover overheads.

Chart 2. The specimen budget chart illustrated is built up in the same way as Chart 1, with the exception that the vertical and horizontal scales represent different units.

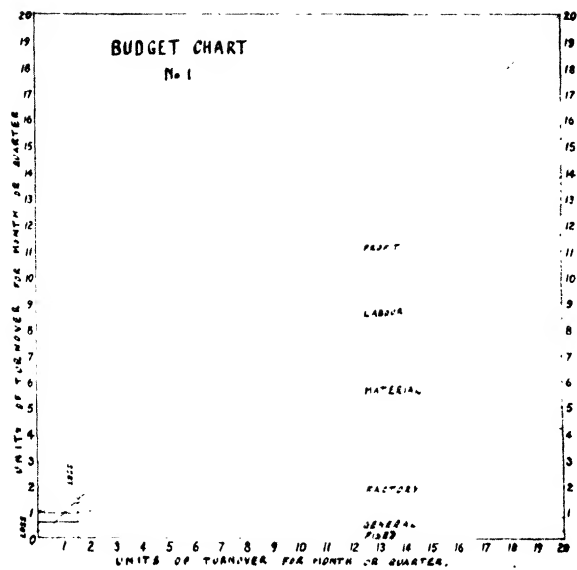


FIG. 21. MASTER BUDGET CHART
(Budget Chart No. 2 is shown overleaf.)

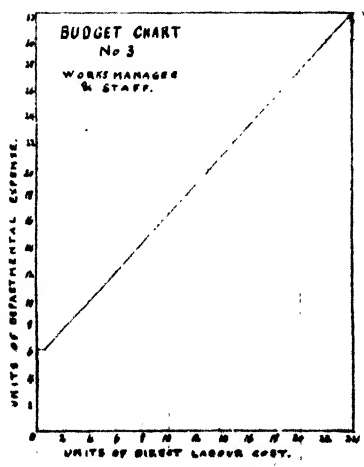


FIG. 22. DEPARTMENTAL BUDGET

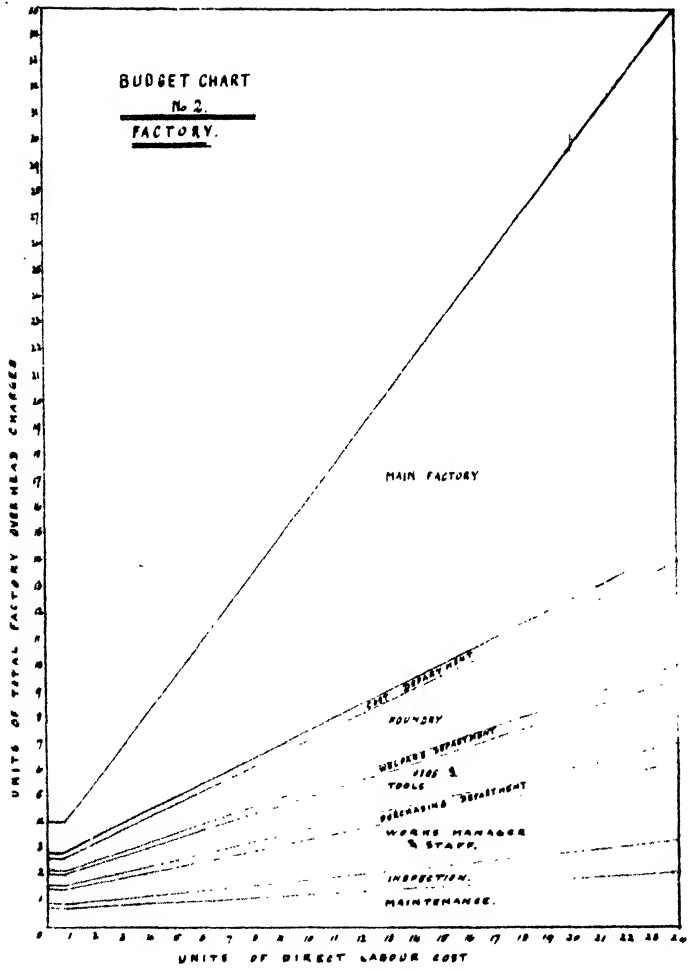


FIG. 23. BUDGET OF FACTORY EXPENSE

Expense items are shown in relation to total labour cost, and an analysis of the area of factory expense shown in the first chart is available for control purposes. The diagram is thus self-explanatory.

Chart 3. This chart provides a sub-analysis of one item taken from Chart 2. It provides no guidance beyond that shown in the former chart. Its purpose is to provide a single department with information confined to itself without disclosing conditions applicable to other departments.

APPENDIX II

GRAPHS

THE graphs illustrated represent some of those found to be useful to directors attending board meetings. The specimens illustrated cover a full calendar year, but in practice the lines will, of course, be extended month by month, and

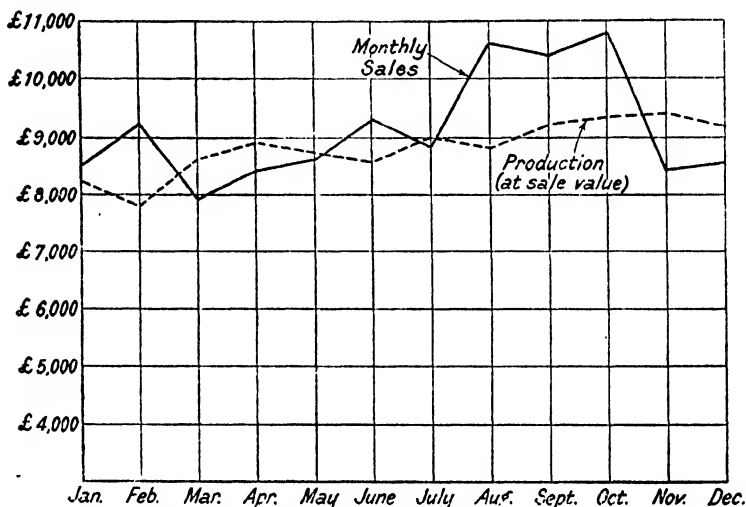


FIG. 24. MONTHLY SALES AND PRODUCTION

often the record of the previous year is shown faintly on the same sheet.

MONTHLY SALES AND PRODUCTION. This chart gives a comparison between the gross invoice value of total monthly sales and the total volume of goods produced valued at full selling prices. It is, of course, easy, and, indeed, customary, to amplify the information by including an analysis of sales either by classification into Home and Export or territorially.

Such items may conveniently be shown in various coloured lines on the lower part of the chart.

MONTHLY DELIVERIES. The object of this chart is quite different from that of the first specimen, where the value of goods produced was illustrated without regard to whether

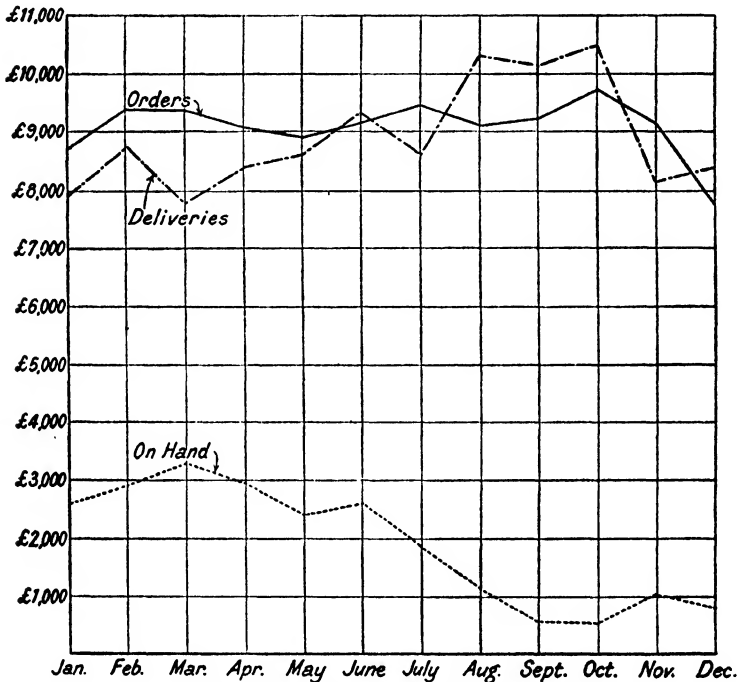


FIG. 25. MONTHLY DELIVERIES

they were sold or not. Here, in this second chart, a comparison is made of the values of three classes of orders—

1. The total value of all firm orders obtained from customers during the month.
2. The total value of all firm orders actually delivered or dispatched during the month.
3. The total value of all firm orders remaining unexecuted at the end of each month.

It will be noticed that when delivery overtakes sales the value of unexecuted orders, of course, falls.

These first two charts provide an exceedingly valuable and facile method of following the exact progress of a business without recourse to confusing statistics expressed figuratively.

MONTHLY COST ANALYSIS. This chart is designed to

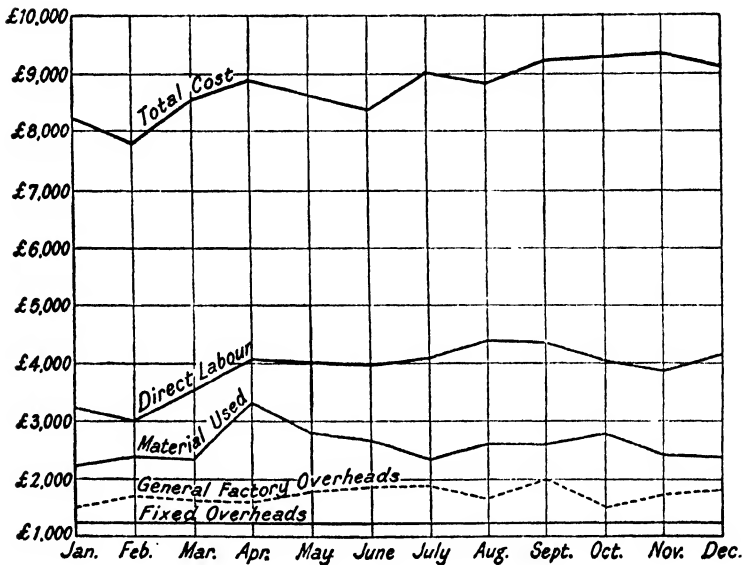


FIG. 26. MONTHLY COST ANALYSIS

correspond with the Master Budget Chart. Its purpose is to show where divergencies from budgetary requirements have occurred. The figures are not superimposed upon each other as they are in the Master Budget Chart, but are shown as actual readings against the vertical money scale. A simple method of indicating divergence is to connect budgeted points for each item of expense in another colour alongside the line of actual expense.

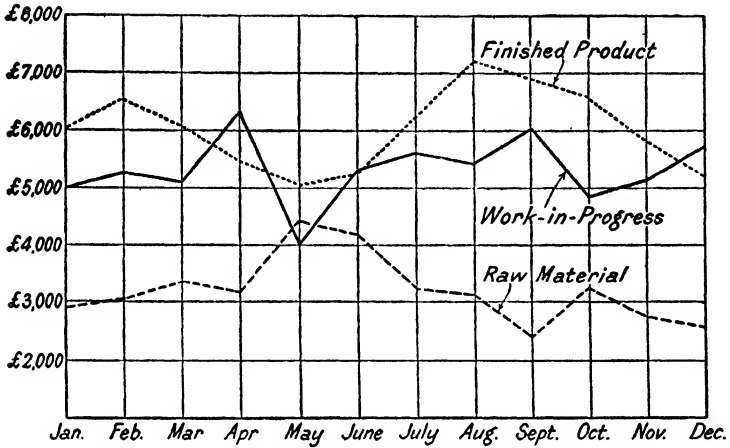


FIG. 27. MONTHLY STOCK VALUATION

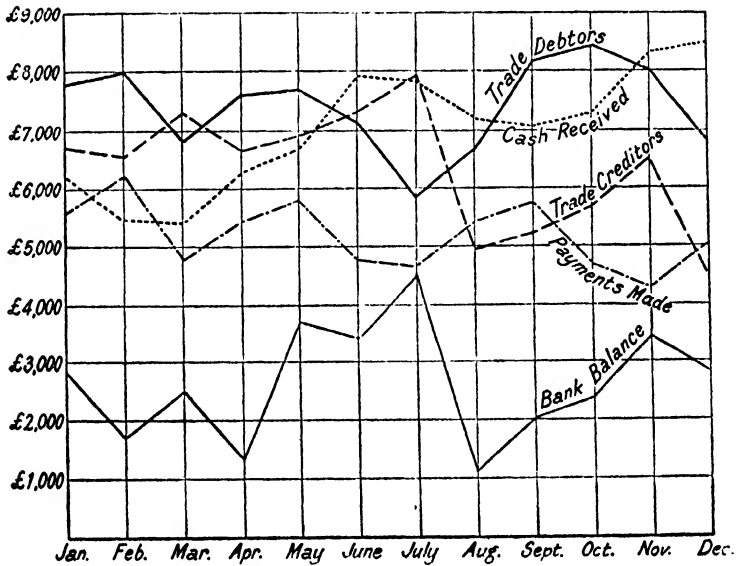


FIG. 28 MONTHLY FINANCIAL STATEMENT

MONTHLY STOCK VALUATION. The example illustrates monthly variations in value of the three simple stock categories. It may, of course, be useful to increase the number of categories to meet the need for knowledge of further interesting subdivisions of stock.

MONTHLY FINANCIAL STATEMENT. In the manner of this example, the liquid finance of a manufacturing company can be rapidly envisaged and traced historically. It will be found in practice that all the information disclosed in the graphical manner already suggested will be reflected in this financial statement.

GENERAL. Although the number of charts which may usefully be constructed to meet the conditions of individual enterprises is generally greater than the number shown, it is felt that these not only serve to explain the method, but they in themselves provide a definite basis of "key" information. All this information is essential and it is all interconnected: there is no plotted item unrelated to other items on other charts; they may all be explained by each other. It is this feature of interesting cohesion which adds greatly to the value of the system outlined.

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