

GRADUATES' ASSOCIATION.

TWELVE MONTHS' REVISION OF A DRAWING OFFICE.*

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The exigencies of modern manufacturing competition in the Engineering Trade have caused many firms to remove from London into the country, to enable them to build new works, arranged for more economical production. It is the object of this Paper to set forth some of the alterations made necessary in the Drawing Office system of one of these firms, by the improved conditions of manufacture, in the hope that it contains a few hints which may be useful to others about to undergo similar changes.

Before proceeding to describe the New Drawing Office arrangements, it will be advisable to give a short description of the methods in vogue before the move took place.

(1.) In the first place Drawings were made in various sizes up to Antiquarian, Double Elephant being the most usual.

(2.) Forgings were detailed "full size," but castings were very seldom drawn out in detail.

(3.) Drawings were numbered in connection with the number of the drawer in which they were kept; this number was never made use of for reference, and did not appear on shop tracings.

(4.) Tracings were used in the works, no blue-printing apparatus being available.

(5.) No pattern numbers appeared on any drawings, and very few pieces had names.

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(6.) Tracings sent outside the works were entered in a tracing book and given a number, the information for whom and to whom they were sent being also noted. This number had no relation to the drawing, and did not appear on it.

(7.) Certain machine parts, such as cutters and tools, etc., more particularly those which had to be obtained from the country, were given a detail number, one or more detail numbers being on one drawing.

(8.) Hand sketches were sometimes made, but no copy was kept in the office.

(9.) Drawings were kept in drawers numbered 1 to 79 under the class of machine to which they belonged, and the drawers were arranged against one wall of the drawing office from floor to ceiling.

In the New Works the Drawing Office has about two and a half times the floor area of the old, is lighted with a north light, the artificial light being two inverted arc lights supplemented by six incandescent lights.

In proceeding to revise the system just described, three points were seen to be imperative, namely: (1st) Every drawing must have a number and be known by that number: (2nd) All drawings must be made to standard sizes, and of as few sizes as possible; (3rd) A copy of every drawing must remain in the office, and be known as the Office Copy.

To consider the first of these points, the number, it was seen that a simple number would not do, because there were already in existence some hundreds of cutters, tools, etc., bearing detail numbers, and to avoid confusion it was decided to number the drawings in the following manner:—Below the drawing number proper a line was ruled, and underneath this a number was put to represent the year, thus $\frac{25}{0}$ represents $\frac{\text{Drawing 25.}}{\text{Year 1900}}$. Each year the top number will commence at 1, and the lower advance with the years. The author believes that a similar system to this is in use by Messrs. J. Simpson and Co., of Pimlico. This method was made easier at

starting, owing to the change taking place at the commencement of the century; and no doubt before three figures are introduced for the years a better method will be devised.

The second point is the size, and 36 inches by 24 inches was decided upon as being most convenient for general use, this size allowing a fair margin on a Double Elephant sheet; any smaller drawings are made 24 inches by 18 inches, 18 inches by 12 inches, or 12 inches by 9 inches, these sizes referring to border lines.

The third point is the Office Copy. The Office Copy drawing in all cases is a tracing, generally made on cloth, but sometimes tracing paper is used for a special job. All drawings referred to hereafter are Office Copy drawings. These have an additional border line and margin, at the right-hand end, the latter bearing the words "Office Copy" as well as the initials of tracer and of the draughtsman who checked the figures. This margin allows these particulars to be cut off any prints made from a tracing without departing from the regular sizes. Drawings are all numbered in the left-hand bottom corner and titled in the right-hand bottom corner; the number of the drawer in which it is to be put away appearing outside the border line, in the right-hand top corner. In the right-hand bottom corner also appears the Working or Shop Order No., and the number of sets required for that Working Number and the date, the quantities in all cases on a drawing being for one set only.

Having settled these three important points, the "Number," "Size," and "Office Copy," the next thing to consider was the method of keeping them. In the old office the drawers near the ceiling were impossible to get at without the aid of a pair of tall steps, which was very inconvenient. Therefore it was decided to keep all drawings in the new offices below the level of the tables. The method adopted was this:—

The drawers, Double Elephant size, were made up in cases of ten, each case being a complete thing in itself. Each case contains as nearly as possible all the drawings for one class of machinery, so that in the future, when the business expands, any case can be moved to another office if necessary without disturbing any other class, and

if one draughtsman is working on that class only, he can have the case under his table, and all the drawings immediately to hand; this will be an immense advantage as specialisation progresses. Each drawer in the centre of the front bears a label stating its contents; the top drawer of each block bears in large letters the group or class of machinery in that block.

Having described the sizes and form of drawings, the author will proceed to describe the method of making them. All drawings are made in pencil on a cheap cartridge paper and then traced; the drawing paper is used on both sides and ultimately is either used for envelopes or destroyed. The use of these envelopes is described later. When tracings have been checked, they become Office Copy drawings, and they are then blue-printed. These prints when in the shop are kept on boards, of which there are three sizes, specially constructed to allow the prints to be readily mounted or removed from them. Each Department has a supply of these boards.

The route of an Order through the Drawing Office into the Works will now be described. An Order, called a Production Order and bearing a Production Order Number, is received from the works manager, say for twelve complete machines of one sort and size. This production order is first divided into as many Shop or Working Order Numbers as is considered advisable, these numbers being noted on it. It is then passed on to the draughtsman taking the job in hand, who affixes his initials on it when the drawings are completed. When drawing casting details a 36-inch by 24-inch sheet is generally used, and each casting is allotted a certain space; these spaces are all of regular size, and whenever possible 9 inches by 6 inches. Of course large pieces require more than this size, and then a space twice or four times this is allowed, but all spaces are made so that if taken separately they will fold up to 9 inches by 6 inches.

The objects aimed at in allotting each piece a certain regular space are:—(1st) to make each a complete drawing in itself with a name and a number, the number being the pattern number; (2nd) the compilation of a "Subject-Matter Pattern Index," which is effected by cutting up the blue prints when returned from the shops,

and filing in a 9-inch by 6-inch Card Index, which index the author thinks it would be impossible to obtain economically in any other manner. In a few years' time, no matter what sort of piece is required, it will be possible to tell if there is a suitable pattern for it in existence, by referring to this Subject-Matter Index; should only the number of a pattern be known, it is possible to find the number of the drawing on which it appears by referring to the Numerical Pattern Index, which is also kept on the card system. For any material required to be ordered out, and in this particular business few machines are made in which this is not the case, a purchase requisition is written in triplicate, one copy going to the purchase department, two copies being retained in the drawing office, one in the book itself, and the other is torn out and filed away under its shop order number, so that a record of all material ordered out for any one number is automatically collected, thus obviating serious delays likely to occur through parts, which should have been ordered out, having been overlooked when an order is repeated.

As the drawings are completed, the various parts required for each shop order are type-written in quadruplicate on specially ruled foolscap sheets, Fig. 1 (page 1008). The first of these copies remains in the drawing office, the second goes to the Cost Clerk, and the remaining two go into the shops. These detail shop orders form the foreman's authority for putting the work in hand in their respective departments. As there may be several shop order numbers for one production order, they are collected together in what is called the Production Order Cover, Fig. 2 (page 1008). The weight of each casting or forging, as it is made, is entered on the detail shop order sheet, and eventually, in the case of castings, on the Pattern Number Card Index, thus giving the drawing office useful information which hitherto had not been obtainable without reference to the cost-keeping book.

The detail production orders are found to be immensely useful in the various shops for checking over the quantities, etc., and more especially is this noticed in the machine shop, where they enable the foreman to keep all the parts on the move much more readily than if he had only the drawings to work from. A copy of each detail

FIG. 1.—*Shop Order Sheet.*

A RANSOME & CO., LTD., NEWARK ON TRENT.									
Cognome <u>Smith</u> & <u>John</u> & <u>Co.</u>									
Production Order No. <u>286</u> Shop Order No. <u>1269</u> Supp. No. <u>1</u>									
QTY. REQD.	QTY. ISSUED	DESCRIPTION	COSTING NO.	RATINGS, STOPS, IN MARCH NO.	WEIGHT				
					DATA	QTY.	WGT.	IN	OUT
		<u>in No 2 Top Run Band Saw</u>							
<u>4</u>	<u>01</u>	<u>Main Standard</u>	<u>3661</u>	<u>980</u>					
<u>4</u>	<u>01</u>	<u>Roller</u>	<u>3641</u>	<u>2863</u>					
<u>x</u>	<u>01</u>	<u>to Lubricants</u>	<u>3641</u>	<u>2845</u>					

* Weight to be filled in column 7,
only completed and this form to be then returned to Drawing
Office

Date issued _____
Date returned _____

FIG. 2.—*Production Order Cover to hold the Shop Order Sheets.*

[illegible]

Scale about $\frac{1}{4}$ th originals.

FIG. 3.—*Shop Order Form.*

SHOP ORDER No. 4780	DATE 6.12.52.	IN. O. No. 1676
CUSTOMER. J. S. Hall Newark		
DATE COMPLETED	DESCRIPTION OF ORDER.	DATE COMPLETED
	1. C.I. Bracket to their pattern 6715	
NOTES FOR FOUNDRY.		D.G. Sign.
By my sample to test side with flange in correct position		Man. Sign.
DRAWINGS REQUIRED		Delivery required

FIG. 6.—*Drawing Index Card.*

[illegible]

FIG. 4.—*Shop Order Form.*

IN O. NO	1676	DATE	6.12.02	SHOP ORDER NO	4788
CUSTOMER	J. S. Hall Newarth				
<p>Fit up one C.1 Bracket with 4 5/8 Bolts to template Template to be returned with Bracket</p>					
DELIVERY BY	10.12.02		<input type="checkbox"/>	ORDER APPROVED	
FITTING SHOP					

FIG. 7.—Drawing Requisition Form.

DRAWING REQUISITION FORM.		
To	Date	S.O. No.
DESCRIPTION OF DRAWING.		No
PLEASE SEND ABOVE DRAWING TO _____ DPT.		Foreman

FIG. 5.—Tool or Cutter Sheet.

[illegible]

Scale about $\frac{1}{3}$ rd originals.

order sheet is also sent to the stores, thus enabling the storekeepers to look out all the material required for it; this also gives them time to order anything they are short of. All these production orders are returned to the drawing office through the Cost Clerks' department, whose business it is to check the weights with the delivery notes they have already received from the stores. In this system a record of all material used for an order has to pass through the storekeeper's hands at one time or another.

The foremen of the various departments are instructed to make notes, on sheets provided in each Production Order for the purpose, of any improvements they can suggest for the cheapening of the work in their department, and also of any variations or delays which occur in the execution of the work. In this manner a history of the machine is gradually compiled, by means of which the repetition of mistakes is avoided in future orders, and besides which the information obtained is most useful in other ways.

With regard to repair parts and sundry orders which are always urgent, the order, just as received from a customer, is sent into the drawing office, and a Shop Order Form, Figs. 3 and 4 (page 1009), is issued to all departments concerned. This method gets the work put in hand very quickly, and as each department returns its order as soon as it has completed it, from any which are not returned it is immediately known where the job is stopped. A bright red label printed URGENT is fixed on breakdown and other very urgent repair orders.

Concerning the tools and cutters, etc., previously mentioned as bearing a detail number, a very great difficulty was at first experienced in the new works, owing to more than one detail number appearing on one drawing; and as one item might be used for a great number of customers, and to write the name of each customer on the drawing caused endless confusion, the following method has since been devised, which seems to meet all requirements. A Form, Fig. 5 (page 1009), was drawn out, and a quantity obtained on thin parchment paper, the printing on it being black. Each tool or cutter is now drawn on one of these forms to scale, and a record is kept in the table at the right-hand end of it, of the customer's

name, shop order number or inwards order number, quantity required, and the trade-mark; the record of the trade-mark is a very important item, because where a large quantity of tools is used, they cannot always be obtained from the same source, and in the case of complaints being received from a customer the name of manufacturer of goods can instantly be ascertained. As will be seen from Fig. 5, each article made from a detail number drawing bears its number, so that all a customer has to do when requiring a further supply is to quote the number and date on the tool itself. The detail number drawings bearing the tabular record of customers' names are filed away under their subject headings, and being all one size they form a card index.

A blue-print of each is also kept; these are filed away in numerical order, also in a card index. These two indexes thus enable any detail number drawing to be found immediately, no matter whether only the number or the name be known. With very little expense these records could be duplicated by blue-printing, and thus a stores reference index could be formed, which would also be a safeguard against fire. A 5-inch by 3-inch card index of customers' names is also kept in the office; for all machines and repairs, etc., ordered by them a white card is used; for tools, etc., ordered, a salmon-coloured card is used.

All drawings sent out are indexed under the name of customer they are sent out for; for this a blue card, Fig. 6 (page 1009), is used. There is also a machine index kept, all machines made being indexed under the class and size; for this a white card is used. All drawings received in the office are numbered and filed away in pigeon-holes. All samples of work done on the machines manufactured are numbered, recorded, and kept in a sample room which is in charge of one of the junior draughtsmen. All catalogues received are kept in the drawing office, being filed away according to their size, the stiff-covered ones by themselves, and the limp-covered ones in cloth-covered pamphlet boxes. Two indexes are kept of these, one of makers' names, and one subject-matter index.

Sketches are made in numbered sketch books, each page also being numbered in duplicate; the sketch is duplicated by carbon

paper, and being already numbered no other reference is needed. Specifications of shafting, belting, piping, etc., are written in copying pencil on forms printed in copying ink, and press-copied in a book in the ordinary way. Complete specifications are compiled for each new machine made, by the draughtsman in charge of the job; in this manner any alterations in design are recorded, thus helping to avoid mistakes occurring when tenders are being sent in, and which, when they do occur, are apt to prove very costly.

Each department in the works is supplied with a pad of Drawing Requisition Forms, Fig. 7 (page 1009), one of which forms is filled up and forwarded to the drawing office when a drawing is required. This obviates the necessity of a foreman having to hunt round for a piece of paper on which to write his requests, or perhaps sending a verbal message which is translated into something quite different before reaching the office. One notable deficiency still is the impossibility of obtaining a rubber stamp to make a sufficiently opaque impression on a tracing for blue-printing purposes. If some ink or pad could be found which would make this possible it would be a great boon. The detail shop orders are all type-written, as it is quite possible to obtain four good copies at once on a suitable machine, and it is found that type-written orders are fully appreciated in the works. Photo prints are made by means of an electric copier, which is constructed of a 24-inch diameter glass cylinder around which the tracings are pressed, and a strong arc lamp which is automatically lowered through the cylinder.

In conclusion, the author would like to thank the following gentlemen for their kindness in explaining to him the systems in use in their respective offices, the information obtained having been most useful: Mr. Jones, of the Brush Electrical Engineering Co., Mr. Jennings, of the Sturtevant Engineering Co., and Mr. Burdon, of Messrs. J. Simpson and Co.

The Paper is illustrated by 7 Figs. in the letterpress.
