

March 11, 1941.

R. C. HANFORD
JOB PLANNING DEVICE

2,234,248

Filed Aug. 10, 1939

2 Sheets-Sheet 1

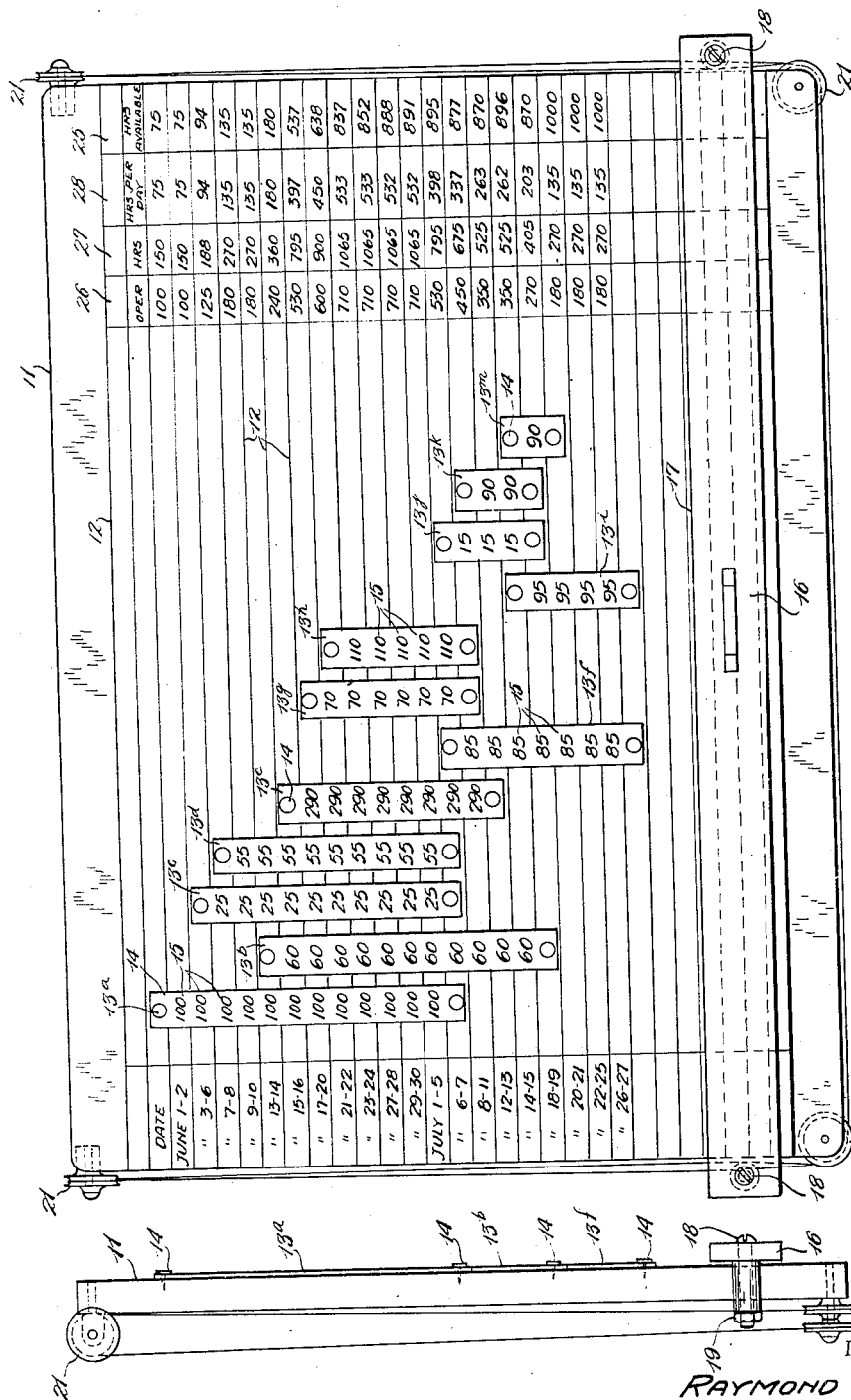
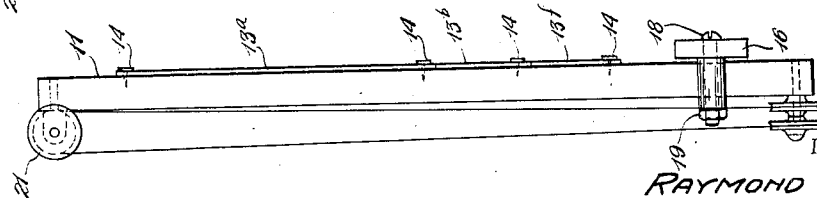


FIG. 1



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2 Sheets-Sheet 2

		NO. OF PARTS		NO. OF OPERATIONS	
PARTS REQUIRING	12 OPERATIONS	100	1200		
"	"	60	660		
"	"	25	250		
"	"	55	495		
"	"	290	2320		
"	"	85	595		
"	"	70	420		
"	"	110	550		
"	"	95	380		
"	"	15	45		
"	"	90	180		
"	"	90	90		
TOTAL		1085	7185		

FIG. 3

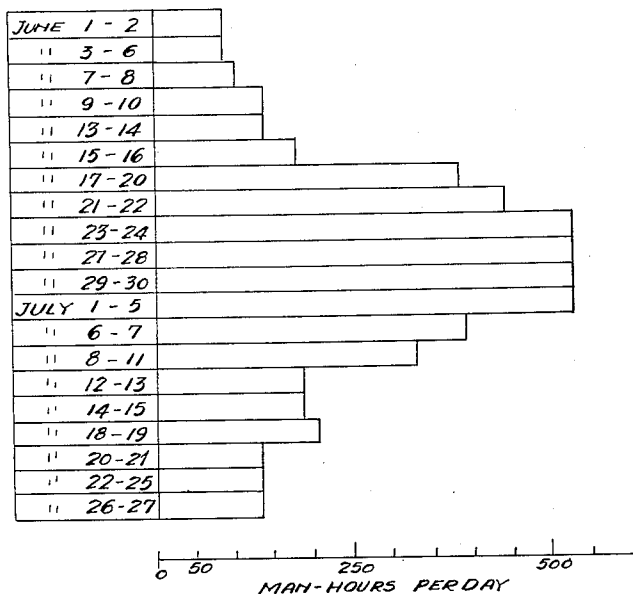


FIG. 4

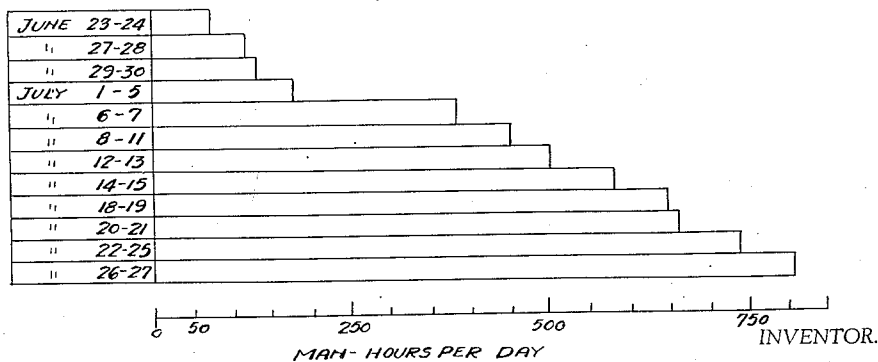


FIG. 5

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2,234,248

JOB PLANNING DEVICE

Raymond C. Hanford, Aurora, Ohio

Application August 10, 1939, Serial No. 289,458

4 Claims. (Cl. 35—24)

This invention relates to improvements in job planning devices and particularly to means for facilitating the planning of work in accordance with available man-hours and other requirements.

In a manufacturing plant, for example, where various products are being manufactured, there are commonly a considerable number of units of production, which may be called "lots," in process at the same time. Such lots may differ widely in the total amount of work they require, the interval of time over which they are required or desired to be spread, and the amount of work which can profitably be spent on them at various stages of their progress through the plant. It is also a matter of common experience that the proportion of the total operating facilities which is available for application to a particular lot varies depending upon the presence of other work in the plant. Insufficient regard for or knowledge of these variable factors frequently results in wasteful "stock chasing," unnecessarily large in-process inventory, uncertainty as to shipping dates, delay of the completion of work, and general inefficiency.

The principal object of this invention is to provide means for planning work in an orderly manner whereby the above variable factors may be taken into account and efficient and economical production may be accomplished.

According to the invention, the work of a lot is broken down into classes and subclasses of work according to a definite procedure, and these classes and subclasses are empirically arranged with respect to each other and with respect to time so that the work may be done in desired order and with due regard to the variable factors above referred to.

In the accompanying drawings

Figs. 1 and 2 are plan and elevational views respectively of one form of device which may be used in carrying out the invention, the movable elements being arranged in a particular manner;

Fig. 3 is a table representing a break-down of the work of a hypothetical lot; and

Figs. 4 and 5 are diagrams illustrating two different arrangements of the work of the table in Fig. 3.

Referring to the drawings, 11 is a support of any suitable material, for example, wood, heavy cardboard, or the like. The surface of this support is divided into areas of uniform width by lines 12. A plurality of strips 13a, 13b, etc., formed of cardboard or other suitable material adapted to bear a column of figures, are remov-

ably secured to the surface of the support 11 by thumbtacks 14 or by any other suitable means such as Scotch tape, temporary adhesive, or the like. Upon each of these cards is arranged a column of characters 15, both their number and their numerical significance constituting factors tending to identify the work to be performed and being, in addition, an indication of the quantity of work involved. These characters are arranged with spacing corresponding to the spacing of the lines 12 so that when a card is placed in such a position on the support that one character falls within the area between adjacent lines each of the other characters will likewise fall within a different one of these areas.

To facilitate the identification of characters lying within the same area but on different cards, I provide a member 16 movable over the surface of the support and having a straight edge 17. This member is secured by screws 18 and shouldered studs 19 to a cable 20 which passes over pulleys 21 secured to the corner portion of the support, all in the usual manner of constructing a straight edge member movable parallel to itself, as in a drafting machine or the like.

The mode of operation of the invention will now be further described by way of example as applied to the planning of the production of a lot consisting of the parts required for a group of identical machines. In this example, the following assumptions are made, all of which are in accord with conditions frequently encountered in practice:

(a) The lot consists of 1085 parts of which 100 require 12 operations, 60 require 11 operations, etc., as indicated in Fig. 3.

(b) The operations on each part are to be performed consecutively and a period of two working days is to be allowed in which to perform each of the successive operations on the parts of a given group.

(c) The work required to perform each operation is on the average 1.5 man-hours.

(d) The plant cannot spend more than 550 man-hours per day on any one lot.

(e) The man-hours available for this lot over and above those reserved for other work in process are as shown in column 25 marked "Hrs. available" (Fig. 1).

(f) The work of the lot is to start gradually, reach a maximum, and decrease gradually with lapse of time.

(g) Work on the lot may not be started before June 1st and must be finished by July 27th.

In applying the invention to this example, the

work is divided into classes consisting of parts requiring the same number of operations, and each class is associated with one of the cards 13. These classes are divided into subclasses consisting of similarly numbered operations, and each subclass is associated with a character on the corresponding card. These characters are arranged in a column and are spaced similarly to the spacing of the lines 12 of the support 11.

Thus card 13a represents a class consisting of 100 12-operation parts, and the numerals in the column represent the subclasses consisting of 100 first operations, 100 second operations, etc. to be performed on these parts, the top numeral 100 representing the first operation to be performed on these parts, the second numeral 100 representing the second operation to be performed on the same parts, etc., and the fact that there are twelve such numerals indicating that each part of the class is to have twelve operations performed upon it. The 100 pieces making up this class may be all duplicates, they may be all different, or they may be partly duplicates and partly otherwise. Also the twelve operations to be performed on any given piece may be the same or similar to those performed on another piece, or they may be different partly or wholly. However, the class of each piece as a 12-operation piece is identified by the fact that the card carries twelve numerals and the subclass of the piece at a given point in the processing thereof is identified by the fact that it is then undergoing a particular operation, the fifth operation, for example, indicated by the fifth numeral on the card.

Similarly, card 13b represents the class consisting of the 60 11-operation parts, which class is made up of subclasses consisting of 60 first operations, 60 second operations, etc.

Cards 13c to 13m inclusive likewise represent other classes of work in which there are a gradually decreasing number of subclasses, the total represented by all cards comprising the complete lot. The order of the cards in their arrangement upon the board need not necessarily follow that illustrated in Fig. 1 however.

The required dates or time intervals, in this case June 1st to July 27th inclusive, are indicated in column 24 marked "Date," two working days being allotted to each space between the lines, in accordance with assumption (b). The man-hours of plant capacity which are available on those dates are entered in column 25 marked "Hrs. available."

The cards are then temporarily fastened on the support in any desired vertical relationship between the areas representing the starting and finishing dates, so that the figures fall within the horizontal areas between the lines 12. The figures lying in each area are then totalled in column 26, multiplied by 1.5, and entered in column 27 and divided by 2 in order to convert to man-hours per day entered in column 28. The totals in column 28 are then compared with the available plant capacity for those dates, shown in column 25 and with the maximum number of man-hours which can be spent on any one lot. If the resulting arrangement of the work does not utilize the available capacity efficiently, or if it exceeds the permissible maximum, or if for any reason the arrangement is unsatisfactory, the cards are moved into new positions and new horizontal totals are taken. This process of trial is continued until a satisfactory arrangement is attained.

Such a satisfactory arrangement is shown in Fig. 1. It will be seen that the work to be done on each of the working days within the specified interval is identifiable as to the kinds of parts to be worked on and the operations which are to be performed on those parts. For example, on June 15th and 16th the work consists of all sixth operations on 12-operation parts, all first operations on 11-operation parts, all fourth operations on 10-operation parts, and all third operations on 9-operation parts. The distribution of work corresponding to the arrangement of cards in Fig. 1 is shown graphically in Fig. 4. It will be seen that this distribution satisfies the requirements of assumptions (d), (e), (f), and (g).

By way of contrast, I have shown in Fig. 5 the distribution which would result if work on each part were delayed until only enough days remained in which to finish that part, that is, if all the parts of Fig. 1 were placed with their last operations falling on July 26th and 27th. It is obvious that this arrangement does not satisfy the requirements of assumptions (d) and (f), and that it does not make efficient use of the available plant capacity. Other rules may be followed to arrive at other arrangements, but no such other rule has been found to fit all conditions properly.

My invention provides means for treating each case individually and yet in a systematic manner so that the most efficient arrangement of work may be obtained, all conditions considered. Furthermore, reference to the chart by the factory superintendent or by a foreman charged with a given portion of the work may be had at any time during the period scheduled to ascertain the condition of the work as compared with schedule, in order that measures may be taken if necessary to bring up to date certain identified operations which may then be in arrears.

In carrying out the invention it may be desirable at times to sever one or more of the cards into two or more parts and to move the severed parts of the card relatively to a greater or lesser extent while retaining their identity and association with each other.

If desired, suitable numbers or other symbols may be employed in place of the dates shown in column 24 of Fig. 1, these numbers or symbols being arranged in some regular order and being associated with suitable time intervals.

Other variations in the details of the invention may be made without departing from the spirit thereof so long as such variations fall within the scope of the appended claims.

Having thus described my invention, I claim:

1. A device for facilitating the scheduling of work operations through trial and error procedure in order to distribute the operations entering into a job of work to good advantage over a period of time during which other jobs are being performed, comprising a support member bearing on its surface a series of elongated appropriately designated spaces of uniform width, indicia constituting a time scale registered with said spaces, a plurality of strips each adapted to relate to a given class of work and movably mounted on said support in selected positions at right angles to said spaces, each strip bearing a series of numbers spaced apart the width of said spaces, the combined numbers on a strip being adapted to represent a given quantity of work to be performed and the arrangement of the numbers on the strip being adapted to indicate the

order of performance of the different operations, the strips being adapted to be moved individually and selectively longitudinally a distance corresponding to the width of one or more of said horizontal spaces in order to adjust the total work represented by the rows of numbers on said strips to desired amounts approximating the available capacity for each division of the time scale.

2. A device for facilitating the scheduling of work operations through trial and error procedure in order to distribute the operations entering into a job of work to good advantage over a period of time during which other jobs are being performed, comprising a support member bearing on its surface a series of elongated appropriately designated spaces of uniform width, indicia constituting a time scale registered with said spaces, a plurality of strips each adapted to relate to a given class of work and each bearing a series of identical numbers spaced apart a distance corresponding to the width of said spaces, said strips being movably mounted on said support in selected positions at right angles to said spaces, the individual numbers on a strip being adapted to indicate the order of performance of different work operations and the combined numbers being adapted to represent a given quantity of work to be performed, the numeral bearing portions of the different strips being of different lengths, the strips being adapted to be moved individually and selectively longitudinally a distance corresponding to the width of one or more of said spaces in order to adjust the total work represented by the rows of numbers on said strips to desired amounts approximating the available work capacity for each division of the time scale.

3. A device for facilitating the scheduling of work operations through trial and error procedure in order to distribute the operations entering into a job of work to good advantage over a period of time during which other jobs are being performed, comprising a support member bearing on its surface a series of elongated appropriately designated spaces of uniform width, indicia constituting a time scale registered with said spaces, a plurality of strips movably mounted on said support in selected positions at right angles to said spaces, each strip being adapted to relate to a given class of work and bearing a

series of numbers spaced apart a distance corresponding to the width of said spaces, the combined numbers on a strip being adapted to represent a given quantity of work to be performed and the arrangement of the numbers on the strip being adapted to indicate the order of performance of the different operations, and a column on said support parallel to the date scale bearing numbers adapted to indicate the available work capacity for each division of the time scale, said strips being adapted to be moved individually and selectively longitudinally a distance corresponding to the width of one or more of said spaces in order to adjust the total work represented by the rows of numbers on said strips to the available work capacity for each division of the time scale.

4. A device for facilitating the scheduling of work operations through trial and error procedure in order to distribute the operations entering into a job of work to good advantage over a period of time during which other jobs are being performed, comprising a support member bearing on its surface a series of elongated appropriately designated spaces of uniform width, indicia constituting a time scale registered with said spaces, a plurality of vertical strips each adapted to relate to a given class of work and each bearing a series of identical numbers spaced apart a distance corresponding to the width of said spaces, said strips being movably mounted on said support in selected positions at right angles to said spaces, the individual numbers on a strip being adapted to indicate the order of performance of different work operations and the combined numbers being adapted to represent a given quantity of work to be performed, the numeral bearing portions of the different strips being of different lengths, and a column on said support parallel to the date scale bearing numbers adapted to indicate the available work capacity for each division of the time scale, said strips being adapted to be moved individually and selectively longitudinally a distance corresponding to the width of one or more of said spaces in order to adjust the total work represented by the rows of numbers on said strips to the available work capacity for each division of the time scale.

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