

(The work covered by items "a" and "b" will usually be initiated by the Planning Department or the Superintendent, and will be done in accordance with their instructions).

(c) As may result, in decreasing liability or breakdown and necessity for frequent adjustment or repair.

(This will usually originate in the Maintenance Department as their inspections and records of repairs may indicate chronic weaknesses or defects in design or construction).

6. The operation of the Tool Rooms for all manufacturing departments and the maintenance in good condition of an adequate supply of small tools.

To appreciate fully the greater importance which work of this sort assumes under Scientific Management, it is necessary to have some understanding of the application of Scientific Management to productive work in the manufacturing departments, and to this end a brief explanation may be helpful. Each operation in the process of manufacture is analyzed and studied in the most minute detail, all unnecessary motions being eliminated, defects in materials corrected and such improvements made in conditions of machines and implements as may be necessary, to permit of the work being done most efficiently. These conditions are established as standards and by means of elementary time studies the time that each operation or job should take under standardized conditions is determined. This is known as the "bonus time"—which is fixed in the Planning Department, in advance, for each operation on each order started in the shop. If an operator completes an operation in the time allowed, he receives not only his regular hourly pay for the time worked on the job, but a bonus in addition thereto as extra compensation for following the method prescribed by the Planning Department and as his share of the gain resulting from the co-operation which the system brings about.

As the time allowed for each job is based upon machines and tools being in first class condition, it will be evident that unless these conditions are maintained it will be difficult or impossible for the operators to earn their bonus, resulting in a loss to both the company and the operators. As a simple illustration of this point, take the case of a belt driven machine which is intended to make a given number of revolutions per minute, performing a given operation on an article at each revolution. If the belt is not maintained at the proper tension it will slip and the revolutions per minute will be reduced, with the result that it will not turn out work in the time allowed. Likewise, in setting a machine, if the bolts, nuts, screws and other parts to be adjusted in changing from one job to another are

not in good working condition, and if the proper wrenches and other small tools are not provided and in good condition, this part of the work cannot be done in the time allowed.

The several functions listed on page 7 will now be taken up and discussed in the order given.

1. Emergency Repairs

Unfortunately, in spite of all that can be done to avoid breakdowns they will at times occur and no rules can be laid down to take care of this class of work. When breakdowns do occur, they will have to be dealt with according to the best judgment of the head of the Maintenance Department, who will give due consideration to the urgency and nature of repairs to be made, as well as to the possibilities of taking steps to prevent a recurrence of the breakdown.

Breakdowns will be recorded on the "machine record" sheets.

It may be said that in a great measure the efficiency of this department will be indicated by the degree of freedom that is enjoyed from breakdowns necessitating emergency repairs.

2. Systematic Inspection of Machines and Other Equipment

Periodic inspection of all machines, tools and equipment of all kinds will be made by the Maintenance Department's inspectors. These inspectors will be directly under the control of the Maintenance Department. Their work will be laid out for them each day; detailed and specific instructions being supplied as to the machines to be inspected, the nature of the inspection to be made and the adjustments or minor repairs to be made, where necessary, at the time of inspection.

The scheme proposed contemplates to a great extent having the inspections made by men whose primary function is that of inspection and who will report to the Maintenance Department office any repairs that their inspection shows to be necessary, while the actual repair work will be done by others. The Maintenance Department will issue orders to their repair men or for parts to be purchased or work to be done outside covering the work that is to be done in accordance with the inspector's report. There will, however, be certain well defined exceptions to this rule, such, for example, as making certain adjustments of the machine, or replacement of worn set screws or similar small parts. These exceptions should include not only things which do not require making of any parts nor the dismantling of a machine, and which may be done quickly by the inspector alone in the course of his inspection. The

instructions for the inspection should cover this point.

In order to carry out systematically the scheme of inspection proposed we must have certain printed forms, which with their use will be described further on.

Except in the case of the simplest machines or appliances, it will be found that certain features or parts of the machine require inspection and adjustment at frequent intervals, whereas other parts may require attention only at long intervals. In other words, there may be considerable variation in the periods of time that may be allowed between inspections of different parts of any given machine. For each machine (or group of machines of the same kind and size or class of other equipment such as small tools) there will be a record kept on suitably designed forms properly filled for convenient reference, there being one or more sheets as may be required for each machine or group. This will be known as the "Record of Inspection and Repairs."

These sheets will show: (a) the different sections of the machine to be inspected at one time; (b) the symbol of the instruction card for each of these sectional inspections; (c) the date of last inspection and name or initials of the inspector; (d) item letters or numbers designating on the instruction card the detailed subdivisions of the inspection that called for inspections and repairs. For each of these sections or parts of a machine to be inspected at one time, there will be a detailed instruction card stating explicitly what the inspection is to cover, how it is to be made, the tools to be used in making the inspection, and what adjustment, repairs or replacements, are to be made at that time.

The intervals at which each of these inspections should be made must be fixed at first in accordance with the best judgment of the man having charge of this branch of the system and later modified as experience may indicate the necessity or desirability. The intervals should be short enough to insure the detection and correction of any wear or getting out of adjustment before it has become bad enough to interfere with either the quality or quantity of work turned out.

The instruction card will be placed in the Tickler to come out on the date when inspection is to be made, when it, together with a maintenance inspection order, which is also to serve when properly filled out as the inspector's report, will be issued to one of the maintenance inspectors, who will make the inspection and adjustments as ordered, turn in his report and receive an order and instructions for his next job.

When an inspection report is turned in by an in-

pector it will first be checked to see that all the work called for by the instruction card has been done. Any repairs which the inspection shows to be necessary (in addition to the adjustment of minor repairs made in connection with the inspection) will be reported by the inspector on a form provided for the purpose, which will state fully the nature of the work to be done. These reports will be passed on by the head of the Maintenance Department, and if approved orders will be issued for making the repairs. Inspectors' reports calling for work to be done must indicate very explicitly the nature of the work to be done, giving information so fully that it will not be necessary for someone else to again examine the machine in order to issue intelligent orders for the repair work.

After the orders for any work called for by the inspectors' reports have been issued, the following procedure will take place:

- a—Make entries on "Record of Inspection and Repair Sheet."
- b—Fix date for next inspection and make out inspection order.
- c—Place new inspection order and instruction card in Tickler under date set for next inspection.
- d—File Inspector's report under machine and instruction card symbol for future reference.

Each day the maintenance inspection orders and the instruction cards for same will be taken from the tickler for that day and assigned and issued one at a time to the inspectors.

In this connection a small bulletin board such as is in use in the Planning Department should be used for the purpose of showing at all times the job on which inspectors are working and jobs ahead to be done by each.

3. Making Adjustments, Repairs and Replacements Which the Inspection Indicates to Be Necessary.

With the exception of certain points this has been covered in the preceding section.

So far as possible, parts that wear rapidly and require frequent replacement should be carried in stock ready to be put in place when wanted. This would apply to bearings, rolls which from time to time require truing up, etc. (Knives, dies, wrenches, etc. come under the head of tools and will be referred to under Section 6).