

Of recent years I have come to view mechanical engineering and other scientific departments as part of the methods function of a plant. They cover a big part of the problem of time for work, and the methods and time study department covers the rest of the methods function. They supplement each other both in present and future problems. There can be little doubt, it would appear, that engineering eliminates the necessity for much time study work.

With this preliminary discussion, which seemed essential to treating the subject with proper qualifications, and in order to clarify just what is the problem of time study on machines, we can proceed to the two methods of studying the work of machines, the time of which is dependent upon time study.

By the study of fundamental operations of a machine is meant, for the purposes of this paper, the separate study of the movement, manipulation and control of the various features of the machine; whereas, by the study of individual operations is meant the study of jobs performed on materials by the machine. Job here refers to an operation performed by some machine on a given piece of material. The first is a study of what the various features of the machine can and should do, and the other a study of what is being done with a view to ascertaining what can be done. One is a close study of an element of work and the other is an overall study.

Naturally at the outset there seem to be advantages for both methods. A superficial observation may, however, be incorrect in sizing up the advantages and disadvantages for both methods.

In the purchase of equipment there are usually the questions, "Where are we going to use it; how long do we want it to last, and is it best to have an early replacement?" Then, too, there is always the question of initial cost and expediency.

These same questions may not in the same sense apply to the methods of time study, but we may well ask at the outset, "What do we expect to accomplish; how far do we want to go, and how soon do we expect to get there?" Once the purpose and aims are established, we should be able to choose the method of procedure. The study of fundamental operations provides a study of extensive reconstruction before establishing times; the other method provides for studying existing times

without the purpose of improvement. Either method can be used for a purpose involving limited improvement.

Let us consider the conditions, standards and product of the two methods, and then we may have the answer of advantage or disadvantage in a particular case, for after all the individual is interested in what his selection will provide. The conditions, standards, product and limitations of the two methods will be listed separately, for otherwise it may be difficult to follow through without confusion.

No industrial case, whether it has had time study previously or not, will be followed.

The two methods are treated in the order mentioned in the program of the meeting.

Fundamental Operations of a Machine

In the study of fundamental operations of a machine, a careful standardization of the features of machines, tools, and the devices used on them, is essential to obtain the real advantages of simplification and make possible the extended universal use of time studies. It is also necessary in order to provide standards of maintenance upon which performance is dependent. Some of the objects and problems of establishing elementary time study for fundamental operations of a machine are to establish time study data that will serve for all operations done on a machine for an indefinite period, or so long as the machine is not redesigned; to establish exactly the same time for a given element of work regardless of the machine or the product it is used on.

This form of time study should always be guided by engineering accomplishment in the study of existing machinery, and therefore be a force in the selection of additional new or replacement machinery, and in the standardization of existing machinery. It may well be stated that a first purpose of the study of fundamental operations of a machine is one of selection and establishment of standards. Once standards have been established, making similar parts of various machines and equipment alike, then final studies are made. This necessitates considerable preliminary work. The extent to which poor features of design are shown up is striking.

Under the plan of studying fundamental operations a very effective technique can readily be

developed. One small element is studied repeatedly by itself and it is not difficult for the operator being studied to perform this element skillfully. The time study man is able to concentrate, and through the combined efforts of the operator and the time study man, data are developed representative of a high degree of mental and physical dexterity. The skill so developed readily takes on a tempo, which gives a consistency for all study.

This means that time study is not a direct study of methods on products in operation. It is necessary to devise methods out of the data provided. Data so provided permit of constant change and improvement in method. Method is here referred to as any of a number of ways of proceeding with a given machine and tools; with a variation of tools; or with other machinery. It is a mental and physical procedure of doing a job. Fundamental operation time study permits a change in any of these directions. This is one of its big advantages. Industry should be so constructed as to permit constant improvement and time study should be organized to function accordingly.

The feature of equality provided by elementary time study of fundamental operations gives it great importance from the human standpoint. It furnishes an excellent means for training into new work. In the case of a plant that has had day work the jump from old production to new seems out of all reason and therefore involves a real training problem. However, with elements so small that they are readily learned the problem is almost solved.

Individual Operations of a Machine

One of the objects of establishing time study for individual operations of a machine is to establish overall time for jobs done on the machine. These studies are for the particular operation on a product. They may be taken in subdivided fashion and used for other work. If they are not taken with this in view, however, they are usually used to furnish time for a particular job.

Under this plan of time study any condition may be readily studied either with little or considerable improvement. Standardization of similar features of machinery throughout the plant is not necessary, for it is not a purpose to establish universal data. Because of this it may be claimed that this method is quicker and has more general application, espe-

cially where conditions are not to be improved. There is, however, a real danger of copying in part the existing method and time for it.

The study of an operation on a job makes possible a connected study of the machine, tool and material manipulation.

The question arises, "Will such a study develop a particularly effective technique for each element of a man's work?" Unusual features of work may be absorbed. At times overall studies absorb the performance of cutting or forming, for which distinct research should be made, in case engineering data do not already exist.

The overall method of study provides a ready means for studying minute operations where it would be difficult to make separate fundamental machine operation studies. By clearly defining the elements of such work elementary data can be developed as well as an overall time provided for the job. The whole study is short and the advantages of the close observation of an elementary study can be obtained.

Under the plan of job study (unless data are developed from it) a new study is necessary with each improvement of method, either general or specific improvement. Unless such studies are made adjustment is difficult and can only be taken care of in an arbitrary way. Some industrial engineers claim, because of improved devices and technique, that studies are only good for a period of about a year. The importance of restudy, unless careful study has been accomplished at the outset, is at least emphasized. This is a considerable subject in itself and can hardly be treated in the limits of this paper. One thing is certain, and that is that provision needs to be made for technique, general improvement, and specific improvement in devices. In order to cope with improvements under any conditions, the influence of time study should be constant.

It has already been suggested that overall studies at times readily permit the study of material handling in connection with machinery.

The study of individual operations is also more readily applicable in some cases of group operations.

The advantages of the two methods and the problems attending them, both previous to and after time studies, may be summed up as follows: The study of fundamental operations of a machine, or the