

Allan H. Mogensen.<sup>4</sup> I think that complete functionalization was made necessary by the type of foremen we used to have. That state of affairs is changing and we are beginning to get a new type—the foreman-manager. In talking to foremen this last year I have noticed an increasing interest in the things formerly left to management. As we further develop and train foremen we can let them handle some of the things that caused difficulties under the completely functionalized system. As Dean Kimball stated about a year ago, in the future the foreman who cannot make use of such aids to management as economic lot-size determination will not be able to hold his job.

In the field of motion study we are finding unusual co-operation on the part of foremen. After attending classes in fundamentals of motion economy they are going back to their departments and teaching their men these principles. They appreciate as well as do the workers how much easier it is to teach an operation when the right way of doing it is known.

While they may not do as perfect a job as could the technician, the benefits of interest, co-operation and understanding far offset these disadvantages.

B. Eugenie Lies.<sup>5</sup> From Mr. Herrmann's paper I could not determine whether his organization makes its products for stock or whether they manufacture only to special order. I got the impression that they manufacture at least some items for stock. If this is the case, what is his method of prognosticating future style trends?

Mr. Flanders. In answering the question about inventory I would say that we first began to question our scheme of production planning when the Robert Morris Associates, to whom a group of machine-tool builders send their figures for combined ratio values in the industry, reported that our turnover was slower than that of the trade as a whole. Ours is a little worse than three times a year while for the industry as a whole it is about four times. This led to the questions I raised in my paper.

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As to set-up costs, there are really three types of pieces that go into our machines. There are the major castings, the general run of small parts and the automatic screw-machine work. The major castings are run through, in practically continuous manufacture, various planers, boring mills, etc. Changes on these machines are made frequently so as to bring the parts to the assembly line in the right order, but set-up time is decreased by the use of fixtures. It is entirely a matter of providing tools and setting gauges to get these parts to run through continuously with the required changes rather than in lots. There are usually more pieces to the lot on the automatic screw-machine jobs, and this largely takes care of the problem in this class of work. If necessary we run the machines on lots for two or more periods, as long runs are essential to economic production here. On the middle class, which makes up the great bulk of the work, the advantages of running on program are two, both of which I mentioned. First, the expense of routing and scheduling is greatly reduced, and second, all similar parts are scheduled together, greatly reducing set-up time.

As to the question on detailed planning, in general we run our shop on a compromise between line authority and completely functionalized control. We have our general plan, which is repeated every two months. The original routing under this plan is done by a functionalized man who spends all his time on it. It is done in consultation with the foremen, but this man is the responsible person.

The actual scheduling of the different operations to different machines is a little more informal. Originally a sort of dispatch book was worked up in which every operation was scheduled to a given machine. Our real purpose in working it up was simply to assure ourselves that the schedule was possible; we do not insist that everything take place exactly as stated. The foreman has this book as a standard and knows the dates on which given operations should start and finish. Within those limits, as men are out or machines repaired, he may shift his schedule. We have tried to make a routine of everything possible and do not repeat routing and scheduling operations which can be reduced to a routine.

We have not been particularly conversant with management trends, so that I cannot say what the general tendency is.

Mr. Herrmann. We have no records which are worth anything as a guide to changing styles from season to season. That is a matter of taste on which there can be no bookkeeping. As far as general classes are concerned old records are helpful. We know that we have sold so many of a large general class in the past; that if we are successful in working up new designs we shall probably sell about the same number in that class in the future. Our product is not stable and the raw materials change with the market. We turn our inventory over from four to five times a year. We have come to the conclusion that a small inventory may be an expensive fetish. We probably have a low turnover because we wish to have flexibility in raw materials and to be able to operate more quickly toward the finished article as the season progresses.

Answering Miss Lies' question, we finish our stuff for stock but are guided by orders received. We plan the first steps—purchase of raw material and preliminary designing—on the basis of past experience and then proceed to develop a series of patterns within each general class of goods. The results of the preliminary sales on these patterns are our guide for final manufacture. We do not go in for the extremes in style because our manufacturing time is too long to take on this uncertain factor. So far we have been fairly successful in following this procedure.

### The Motion-Picture Camera and Clock For Recording Time and Method

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THE procedure involved in the analysis of any operation may be divided into such major steps as: (1) the recording of facts; (2) the analysis of them; (3) the setting of a standard of performance.

The subject of our discussion today, that of time-measuring devices, keeps us well within the first step. I shall, therefore, confine my remarks to the recording of facts by means of a motion-picture camera and clock, and illustrate briefly how the data are later put into graphical form for analysis.

<sup>1</sup>Paper presented before a meeting of the Taylor Society, New York, December 4, 1930. Mr. Piacitelli also gave a practical demonstration of the method of reading the film.

Before taking a film for the purpose of making a necessary record of the time and method involved in an operation it is important for the observer to do certain preparatory work of planning in order that his time, as well as the time of the workers, may be most effectively utilized. This preliminary work is an essential part of the entire procedure in the recording of facts. Before discussing the time-measuring aspect of the work, therefore, I want to mention some of the most important factors which need to be taken into consideration before the recording is done.

It is well for the analyst to make a brief survey of the job to be studied, especially if more than one worker is to be observed, in order that he may establish the number of scenes to be taken and the best point of view for each. As a second step the observer should decide on the number of cycles that will be necessary to make an adequate analysis of each operation. These considerations will enable the observer to plan the entire filming job for thoroughness in the collection of data and economy in time and film.

It is sometimes necessary to sacrifice the most desirable point of view from the standpoint of method, to avoid glares and other undesirable lighting effects that would interfere with the making of proper exposures.

In the early days of motion study the camera used was of the large type, equipped with f3.5 lens and designed for standard-sized film. The lens of this camera was not as fast as that used in our modern camera and it was often necessary to use artificial lighting in order that reasonably good photographs of indoor activities of the worker could be made. With the smaller camera now on the market, designed for using sixteen millimeter film and equipped with f1.9 lens, three and one-half times as fast as that used in the older type of camera, it is now possible to take many indoor photographs without the aid of artificial lighting.

Before discussing the characteristics and use of the clock, I want to mention the fact that in a very few cases its use can be avoided altogether by exposing the film at a rate of two turns of the crank per second. The time for the various elements of motion can then be calculated on the basis of the number of frames, of one-sixteenth of a second each, in which the element under consideration appears. Generally, however, a clock is