make time studies. If I need a man for the machine shop, I get one trained in that work; if I want one for the trim shop, I get one who has had a thorough training in that line, and so on. I try to maintain my force by taking men from our establishment rather than from the outside. Preferably I pick a man between twenty-five and thirty years of age, who has had a fair schooling and has demonstrated his skill in his particular line of work. He must be observing, have an analytical turn of mind, a keen sense of fairness, confidence in himself, and be willing to work. I mean work in the sense of effort, as continued effort is the price we must pay for all progress.

When a man has these natural attributes it does not take long to train him to make good, intelligent studies. The longest part of his training is spent in learning the use of standard nomenclature. Without this you are lost when you wish to use your studies for establishing standards.

It is a difficult task to write a good job specification. If it is too short, it is of little help. If it is too long and detailed, it is confusing. It must describe every essential activity in a single clear-cut statement, contain every word needed to make the meaning unmistakable, and yet have no superfluous terms.

I should like to outline briefly the practice in our own shops in order to illustrate how time study is applied to shop operations.

We get a request from a certain department, say Department 20, to make a time study on Job No. 26241, Operation 4. This information is given to the time study engineer in that division. He first goes to the operation sheet, taking his time study sheet with him. He then records the following information: the part number, the operation number, the department number, the part and operation names, and also the time of day and the date. When he has this information he goes to the job and checks it. He next records the inspection requirements. Then his attention is directed to the machine by the order of arrangement on the time study sheet. He takes the machine name and number and notes its condition, the fixture number and its condition, gauges and their condition, belts and their condition. He notes the kind, hardness and tensile strength of the material. He gets this information from engineering drawings. He also notes the lubricant used, the revolutions per minute of the work or tool, and finds the surface feet on the controlling diameter. He checks the length and depth of cut and the feed; makes a sketch of the tools and of the part, showing the operation performed in red pencil, and then calculates the cutting time. After checking the above mentioned items, he should be acquainted with the job. Using our standard nomenclature, adopted for this type of machine wherever possible, he writes up the elements of the job. At this stage of the study constructive criticism is offered and the necessary changes are made. The decimal timer is then used. It is started at zero and runs continuously through the entire study, recording not only the elemental time, but all delays, necessary or otherwise. The number of cycles timed depends entirely on the job, but a sufficient number is made in all cases to get a true picture of the job.

The study is then handed to a clerk who makes the subtractions and computes the standard time by adding a percentage allowance taken from our fatigue charts. Labor as a whole is divided into several classes, each with its own particular base rate. At this point our standard time is converted into terms of money. The studies are then checked by a competent inspector. After receiving his approval they are sent to the typist, who types the piece work tickets, making five copies of each. The original ticket remains in the time study office, the second goes to the foreman, the third to the timekeeping office, the fourth to the factory accounting department, and last, but by no means least, the fifth goes to the count division.

I want to say at this point that we probably differ with ninety-nine per cent of the industries in that we no longer use standard time. We have converted standard time into money, and money is our unit of measurement.

The studies then go through the general office routine of keeping up an accurate car cost, by model, for each department. They are turned over to the standards department where new elemental readings are recorded and old ones checked. When this information is completed formulas and graphs are drawn off to be used in making future studies. Studies are then filed by part number and operation number.

In making up the payroll each individual is charged to an order number in accordance with the job he is doing. Therefore, when the entire payroll is assembled, and this is done at the close of every day, we have a payroll in terms of order numbers and money spent for each. Our order numbers cover direct labor in the foundry, in the machining division, in the paint division, in the assembly division, etc.; indirect labor, such as supervisory, clerical, machine setting, material handling and sweeping operations, lost time, overtime, piece work excesses, repairs to product, inspection, etc. The list might be extended indefinitely to cover every operation performed in the shop.

With direct labor segregated, and rates for it established by the best time study procedure we know, it becomes our unit of measure for all indirect labor activities that cannot be allocated accurately to their particular functions.

Using our direct labor departmental cost, we establish a cost for any given car schedule. This is converted into terms of men for direct labor. Again using our direct labor departmental cost, and an established ratio for indirect labor, we get our standard indirect labor cost. This is converted into terms of men for indirect labor. These figures must be calculated for each change in schedule and then sent to the production manager, who governs his shop accordingly. This does away with the irregular employment that is the result of haphazard planning, and is a real advantage to both management and workers.

Our daily attendance rolls are checked at irregular intervals to compare the actual men working with the men necessary for the car schedule. If the actual number is above the scheduled number, it is necessary to take steps to bring the force within our schedule requirements because, with more men than necessary in the department, the men receive less pay and, as you know, the employe's pay envelope is the very heart of all industrial relations. On it to a large extent depend the success and prosperity of American industry. If more men are in the department than necessary to produce the schedule and their earnings still remain the same, they are building up expensive inventories. In these days of rapid changes, that is not what most of us call good business. We therefore make a real effort to avoid such a situation.

Using our direct labor payroll as our unit of measure, we also plot a chart showing the ratio of scrap values and expense items to the direct labor payroll.

With all this information plotted on departmental graph charts, using direct labor as the base, the management is provided with a true measure of production, an intimate knowledge of conditions within the departments, and a simple guide to secure maximum results.

The Application of Time Study to Office Workers Both Clerical and Machine[10]

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THE application of time study to office workers is the same as the application of time study to factory workers. There are differences, however, between office work and factory work. For example, in the factory you are working, as a rule, on something that you can see and feel. You can visualize the turning of a lathe, or a part of an automobile, or a garment, or some other piece of work. Although you may find an opportunity to improve the operation on it, still you know that there are certain operations that must be performed. That is not true of office work. You cannot tell by looking at the piece of paper upon which the clerk is working whether the work she is doing has any real value or not. It may be utterly unreasonable; it may be entirely worthless, and very often it is. Therefore, time study in the office requires that you be able to make not only time studies but also the requisite analysis to determine if the thing you are doing is worth doing.

Measurement of one sort or another is the beginning of all science, and as science progresses the measurements become more and more precise. To this universal rule scientific management in business is no exception. Time study in scientific management is a form of measurement which may be regarded as precise, although such terms as precision and accuracy are purely relative. In the days before mass production, the foot, inch and standard fractions of the inch were sufficiently precise linear measures for most purposes, but today, with modern methods of production and manufacture, the micrometer is an indispensable measuring device. The inch is now divided into thousandths, and in some cases even into finer divisions. So in former days the division of time into hours and minutes was fully satisfactory, and to a large ex-

[10]See footnote 18, p. 155.