

that, and 80 per cent for another kind are all arbitrary figures, arrived at from some one's judgment. These percentages were adopted as the result of a long series of experiments. They represent a most difficult type of experiments to make. Nevertheless they were experiments, carefully and scientifically made experiments.

To make one of these experiments I took, perhaps, eight or nine of my friends who were workmen—it was after we had started scientific management, after we had arrived at this condition of mutual confidence which exists between employer and employee under scientific management—I picked out six or eight of my working friends who were nice chaps and sensible, common-sense fellows, who had confidence in our integrity and believed in what we were doing. We were good friends. I said to this group of six workmen, "I am going to give you the same class of work that you have been doing in the past, but I want you to change from working on plain daywork in which you have done the work according to your own method, and to follow the method which we will lay down for you in an instruction card and also you will be expected to do the work within the specified time. Whenever you do the work right and within the specified time we will give you a premium amounting to 15 per cent increase in your pay. Now, just go at that fairly, you fellows, work in the new way for six or eight months, and then if at the end of that time you do not like it, after you have given it a fair trial, let me know, and you can go right back to the old conditions again if you prefer them."

Another set of men, we will say the same number, were given 20 per cent increase in pay; another set of men were given 25 per cent increase in pay, and another set an increase of 30 per cent in pay, and another 35 per cent, and so forth.

Now, out of the six who were given 15 per cent—I do not say that six was exactly the number, but that it is approximately right—practically almost all of them came at the end of the six months and said, "Now, see here, Fred, I have tried that scheme of yours, and I do not like feeling all the day long that I am tied down to any old pace, or to a new way of doing things. I should prefer going back to the old way." Very well; this experiment showed that an ad-

dition of 15 per cent to the workman's pay was not sufficient to compensate him for the bother of having to change his ways and methods of working and adopt some other man's way of doing things. For it is true, as you know, under scientific management, that the man is not allowed to do work in the old way. He has got to learn a new set of motions and do many new things, and the 15 per cent increase in wages was not enough to make those men feel happy and contented in making this change.

At the 20 per cent increase almost all of the men asked to return to their old conditions and their old pay. At the 25 per cent increase more than half of them stuck to the new conditions and preferred them to the old, the 25 per cent increase was attractive to them. At the 30 per cent increase all but one stuck to the new plan. At 35 per cent my remembrance is that all stuck.

It took some years before that experiment was fully carried out, and we made up our minds that when workmen are paid from 30 to 35 per cent increase in wages, 19 out of 20 good workmen, well suited to their jobs, are happier and more contented under the new system than they were under the old, because you will remember that they had had their free choice between two systems. It was in this way that we got at these percentages. I call that a scientific experiment; that is not some one's guess. And it is typical of scientific management that every element that comes under it sooner or later becomes the subject of careful scientific investigation.

Mr. Redfield. The statement has been made that it is un-American and an indignity for a workman to submit to time study with a stop watch; that it is annoying and makes a man nervous and irritable. To what extent have you any knowledge as to what extent that is true or not true?

Mr. Taylor. Mr. Redfield, I think that the average workman, if any man came to him with a stop watch without any previous explanation or understanding and began timing every motion and writing down what he was doing, would become nervous and would be irritated by it. I think it is perfectly natural that any workman should become irritated at an action

of that sort. I am very sure that I should be nervous to a greater or less extent if anyone were timing every one of my motions. I would feel that it was a darned mean job while the thing was going on. But, Mr. Redfield, I wish to call your attention to one fact, which is not at all appreciated: somehow there has come to be an impression in the minds of people who speak and think of scientific management in its relation to time study, that for every workman who is working in the shop there are probably four or five men standing over him year in and year out with stop watches. Let me tell you that in some of our shops there are many workmen, who in the whole course of their lives, never have had a stop watch held on them. And that probably the average man would not be timed for more than one day in his lifetime. So that probably one day of the workman's life would sum up the total of this terrible nerve-racking strain which several of the men who have testified before your committee have complained of. Therefore, if any man objects to time study, the real objection is not that it makes him nervous. His real objection is that he does not want his employer to know how long it takes him to do his job. Because when his employer has this knowledge soldiering becomes much more difficult.

The Chairman. Would it not be more likely that his real objection was that a time study taken under those circumstances and for a brief period of time with an unaccurate system of stop watch, was not the proper kind of study upon which his wages should be based?

Mr. Taylor. I am very glad you brought that out, Mr. Chairman. You must remember that in any one workman's work, which is now being studied with a stop watch, all that the time student is looking for are perhaps eight or ten motions that the workman makes. The rest of his motions have already been studied on other workmen. The great majority of the movements of machinists have become standardized and require no further analysis or timing. When you study new work nineteen-twentieths of the motions made by the machinist have already been studied. It is the one-twentieth, the one new type of motion that we have not yet had the opportunity to study, which the time student is after. You will understand that

modern time study as it is done in our shops is a study of each elementary motion made by the workman. It is not a roundup of how long it takes a man to do a whole job. That kind of time study is very rare. With each new machine that a man starts to run there may be five or six new motions that have never been studied before, and it is those five or six which we are after. And a day's work will give plenty of opportunity to get those few motions all right. These same motions may be repeated 50 times a day, and that will give you a chance to get a fair average of them. The workman does not know unless you tell him what it is you are studying. You come out to see him and say: "John, I want to find out four or five things about your work. When they come around in the course of your work I am going to note down those four or five motions." We rarely make a time study of a man without taking the man into our confidence, without going to him in advance and saying this is what we come after. We want to find out these facts. It is to your interest, just as it is to ours, to have this time study accurately made.

I can tell you that time and time again the request comes to us from a workman to please come and study his job, so that we can give him a chance to earn a premium. He will say the other fellows are getting paid a premium for their work and I would like to get in on it too.

Mr. Redfield. Mr. Taylor, is soldiering still practiced in the works that are systematized under scientific management?

Mr. Taylor. I think that I may say that to a small extent it is still practiced in every scientifically managed shop. I do not think it has ever been entirely done away with. I can tell you the reason why. In the early stages, when scientific management is being put into a shop, the men who are installing the system are very anxious to have the workmen participate as early as possible in the gain which accompanies the scheme. We are very anxious for them to earn larger wages. We are desirous of proving to them as soon as possible, through an object lesson, that the management is not going to be the only party to benefit by the change, but that the workmen will benefit through an increase in wages quite as much as we do. So there is a very great temptation to fix tasks which are