

statement of the implements which they had to use, and the part of the yard in which they had to work. That required organization planning in advance.

One of the first principles we adopted was that no man in that labor gang could work on the new way unless he earned sixty per cent higher wages than under the old plan. It is only just to the workman that he shall know right off whether he is doing his work right or not. He must not be told a week or month after, that he fell down. He must know it the next morning. So the next slip that came out of the pigeon hole was either a white or yellow slip. We used the two colors because some of the men could not read. The yellow slip meant that he had not earned his sixty per cent higher wages. He knew that he could not stay in that gang and keep on getting yellow slips.

TEACHING THE MEN

I want to show you again the totally different outlook there is under scientific management by illustrating what happened when that man got his yellow slips. Under the old scheme, the foreman could say to him, "You are no good, get out of this; no time for you, you cannot earn sixty per cent higher wages; get out of this! Go!" It was not done politely, but the foreman had no time to palaver. Under the new scheme what happened? A teacher of shoveling went down to see that man. A teacher of shoveling is a man who is handy with a shovel, who has made his mark in life with a shovel, and yet who is a kindly fellow and knows how to show the other fellow what he ought to do. When that teacher went there he said, "See here, Jim, you have a lot of those yellow slips, what is the matter with you? What is up? Have you been drunk? Are you tired? Are you sick? Anything wrong with you? Because if you are tired or sick we will give you a show somewhere else." "Well, no, I am all right." "Then if you are not sick, or there is nothing wrong with you, you have forgotten how to shovel. I showed you how to shovel. You have forgotten something, now go ahead and shovel and I will show you what is the matter with you." Shoveling is a pretty big science, it is not a little thing.

If you are going to use the shovel right you should always shovel off of an iron bottom; if not an iron bottom, a wooden bottom; and if not a wooden bottom a hard dirt bottom. Time and again the conditions are such that you have to go right into the pile. When that is the case, with nine out of ten materials it takes more trouble and more time and more effort to get the shovel into the pile than to do all the rest of the shoveling. That is where the effort comes. Those of you again who have taught the art of shoveling will have taught your workmen

to do this. There is only one way to do it right. Put your forearm down onto the upper part of your leg, and when you push into the pile, throw your weight against it. That relieves your arm of work. You then have an automatic push, we will say, about eighty pounds, the weight of your body thrown on to it. Time and again we would find men whom we had taught to shovel right were going at it in the old way, and of course they could not do a day's work. The teacher would simply stand over that fellow and say, "There is what is the matter with you, Jim, you have forgotten to shovel into the pile."

You are not interested in shoveling, you are not interested in whether one way or the other is right, but I do hope to interest you in the difference of the mental attitude of the men who are teaching under the new system. Under the new system, if a man falls down, the presumption is that it is our fault at first, that we probably have not taught the man right; have not given him a fair show, have not spent time enough in showing him how to do his work.

Let me tell you another thing that is characteristic of scientific management. In my day, we were smart enough to know when the boss was coming, and when he came up we were apparently really working. Under scientific management, there is none of that pretense. I cannot say that in the old days we were delighted to see the boss coming around. We always expected some kind of a roast if he came too close. Under the new, the teacher is welcomed; he is not an enemy, but a friend. He comes there to try to help the man get bigger wages, to show him how to do something. It is the great mental change, the change in the outlook that comes, rather than the details of it.

DOES SCIENTIFIC MANAGEMENT PAY?

It took the time of a number of men for about three years to study the art of shoveling in that yard at the Bethlehem Steel Works alone. They were carefully trained college men, and they were busy all the time. That costs money, the tool room costs money, the clerks we had to keep there all night figuring up how much the men did the day before cost money, the office in which the men laid out and planned the work cost money. The very fair and proper question, the only question to ask is "Does it pay?" because if scientific management does not pay, there is nothing in it; if it does not pay in dollars and cents, it is the rankest kind of nonsense. There is nothing philanthropic about it. It has got to pay, because business which cannot be done on a profitable basis ought not to be done on a philanthropic basis, for it will not last. At the end of three and one-half years we had a very good chance to know whether or not it paid.

Fortunately in the Bethlehem Steel Works they

had records of how much it cost to handle the materials under the old system, where the single foreman led a group of men around the works. It costs them between seven and eight cents a ton to handle materials, on an average throughout the year. After paying for all this extra work I have told you about, it cost between three and four cents a ton to handle materials, and there was a profit of between seventy-five and eighty thousand dollars a year in that yard by handling those materials in the new way. What the men got out of it was this: Under the old system there were between four and six hundred men handling the material in that yard, and when we got through there were about one hundred and forty. Each one was earning a great deal more money. We made careful investigation and found they were almost all saving money, living better, happier, they are the most contented set of laborers to be seen anywhere. It is only by this kind of justification, justification of a profit for both sides, an advantage to both sides, that scientific management can exist.

I would like to give you one more illustration. I want to try to prove to you that even the highest class mechanic cannot possibly understand the philosophy of his work, cannot possibly understand the lays under which he has to operate. There is a man who has had a high school education, an ingenious fellow who courts variety in life, to whom it is pleasant to change from one kind of work to another. He is not a cheap man, he is rather a high grade man among the machinists of this country. The case of which I am going to tell you is one in which my friend Barth went to introduce scientific management in the works of an owner, who, at between 65 and 70 years of age, had built up his business from nothing to almost five thousand men. They had a squabble, and after they got through, Mr. Barth made the proposition, "I will take any machine that you use in your shop, and I will show you that I can double the output of that machine." A very fair machine was selected. It was a lathe on which the workman had been working about twelve years. The product of that shop is a patented machine with a good many parts; 350 men working making those parts year in and year out. Each man had ten or a dozen parts a year.

The first thing that was done was in the presence of the foreman, the superintendent and the owner, of the establishment. Mr. Barth laid down the way in which all of the parts were to be machined on that machine by the workman. Then Mr. Barth, with one of his small slide rules, proceeded to analyze the machine. With the aid of this analysis, which embodies the laws of cutting metals, Mr. Barth was able to take his turn at the machine; his gain was from two and one-half times to three times the amount of

work turned out by the other man. This is what can be done by science as against the old rule of thumb knowledge. That is not exaggeration, the gain is as great as that in many cases.

Let me tell you something. The machines of this country, almost universally in the machine shops of our country, are speeded two or three hundred per cent wrong. I made that assertion before the tool-builders in Atlantic City. I said, "Gentlemen, in your own shops; many of your machines are two and three hundred per cent wrong in speeds. Why? Because you have guessed at it." I am trying to show you what are the losses under the old opinions, the difference between knowledge on the one hand and guess-work on the other.

In 1882, at the end of a long fight with the machinists of the Midvale Steel Works, I went there as a laborer, and finally became a machinist after serving my apprenticeship outside. I finally got into the shop, and worked up to the place of a clerk who had something wrong with him. I then did a little bit more work than the others were doing, not too much. They came to me and said, "See here, Fred, you are not going to be a piecework hog." I said, "You fellows mean that you think I am not going to try to get any more work off these machines? I certainly am. Now I am on the other side, and I am going to be straight with you, and I will tell you so in advance." They said, "All right then, we will give you fair notice you will be outside the fence inside of six weeks." Let me tell you gentlemen, if any of you have been through a fight like that, trying to get workmen to do what they do not want to do, you will know the meanness of it, and you will never want to go into another one. I never would have gone into it if I had known what was ahead of me. After the meanest kind of a bitter fight, at the end of three years, we fairly won out and got a big increase in output. I had no illusion at the end of that time as to my great ability or anything else. I knew that those workmen knew about ten times as much as I did about doing the work. I set out deliberately to get on our side some of that knowledge that those workmen had.

Mr. William Sellers was the president, and he was a man away beyond his generation in progress. I went to him and said, "I want to spend quite a good deal of money trying to educate ourselves on the management side of our works. I do not know much of anything, and I am just about in the same condition as all the rest of the foremen around here." Very reluctantly, I may say, he allowed us to start to spend money. That started the study of the art of cutting metals. At the end of six months, from the standpoint of how to cut the metal off faster, the study did not amount to anything, but we unearthed a gold