

were all working the new instead of the old way, a very great and immediate increase in the output per man occurred. So that during the latter part of the construction of this building the bricklayers—and I wish it distinctly understood that all of these men were union bricklayers; Mr. Gilbreth himself has for years insisted on having what is known as the closed shop on his work—who were engaged in building a 12-inch wall with drawn joints on both sides—which you gentlemen who understand bricklaying will recognize as a difficult wall to build; a 12-inch wall with drawn joints on both sides—these bricklayers averaged 350 bricks per man per hour, whereas the most rapid union rate up to that time had been 120 bricks per man per hour. And you will recognize, gentlemen, that this is due principally to the very great simplification of the work brought about thru Mr. Gilbreth's three years' of analysis and study of the art of bricklaying, which enabled him to reduce the number of motions made by the workman in laying a brick from 18 per brick to 5 per brick.

The immense gain which has been made through this study will be realized when it is understood that in one city in England the union bricklayers on this type of work have limited their output to 275 bricks per day per man, when on municipal work, and 375 bricks per day per man when on private work.

I want to make it clear to you gentlemen that this great increase in output on the part of Mr. Gilbreth's bricklayers could only be brought about, and was brought about, through the application of the four principles of scientific management to which I referred yesterday in my testimony.

In the first place, it is perfectly clear that unless Mr. Gilbreth had developed the science of bricklaying himself this could not have been done.

In the second place, unless the management cooperated in the most hearty way in the scientific selection of the workmen, and then in his progressive development—that is, first choosing the workmen (picking out those men who were able and willing to adopt the new methods in bricklaying), and then teaching them the

new movements—this result could not have been realized.

You will appreciate this fact when you know (as those of you who are familiar with bricklaying know) that practically the whole of a wall must go up at the same rate of speed; that it is impossible for the man working on the middle of the wall, for instance, to put his work up faster than the men working on either side of him. If he did, you would have the most horrible looking wall imaginable, unsightly, and with broken joints. Therefore, the whole wall must go up uniformly, and yet under the old system of management no one bricklayer has the authority to compel other men to adopt new methods and cooperate with him doing work faster.

Now, I have not the slightest doubt that during the last 4,000 years all the methods that Mr. Gilbreth developed have many, many times suggested themselves to the minds of bricklayers. I do not believe Mr. Gilbreth was the first man to invent those methods, and yet if any man or men had invented Gilbreth's improvements and methods prior to the time that the principles of scientific management were understood and accepted, no useful results could have come from them, because the adoption of Gilbreth's methods demands a degree of cooperation, coupled with a kind of leadership on the management's side, which is entirely impossible with the independent individualism which characterizes the old type of management. Under the old system a resourceful man might persuade some, or even most of your bricklayers to adopt the new and scientific methods, but one stubborn man, by refusing to join with the rest, could prevent a realization of any great increase in output. It therefore requires in the development of these methods that the management shall assume the responsibility for seeing that each workman either learns an entirely new method of doing his work or else gets off the job. This is something which no management ever thought of doing in the past.

In short, it requires the hearty cooperation of the management at all points with the workmen, and the voluntary assumption on the part of the management of new duties which they

never did before. To make this point clear, it requires the management to appoint men to go around and keep the scaffolding at a proper height, all day long, and to keep the bricklayers supplied with the right kind of brick, systematically placed near them with their right edge up, etc. Every care must be taken by the management to see that the mortar is tempered exactly for the particular kind of work which is to be done. Mr. Gilbreth puts on special men to see that all conditions under which his men work shall be the best that are known and that these perfect conditions shall be maintained at all times.

I want to emphasize the fact that it is due to the application of what I have pointed out as the four principles of scientific management that Mr. Gilbreth has accomplished his large results, namely:

First. The development—by the management, not the workmen—of the science of bricklaying, with rigid rules for each motion of every man, and the perfection and standardization of all implements and working conditions.

Second. The careful selection and subsequent training of the bricklayers into first-class men, and the elimination of all men who refuse to, or are unable to adopt, the best methods.

Third. Bringing the first-class bricklayer and the science of bricklaying together, through the constant help and watchfulness of the management, and through paying each man a large daily bonus for working fast and doing what he is told to do.

Fourth. An almost equal division of the work and responsibility between the workman and the management. All day long the management work almost side by side with the men, helping, encouraging, and smoothing the way for them, while in the past they stood one side, gave the men but little help, and threw on to them almost the entire responsibility as to methods, implements, speed, and harmonious co-operation.

Now, before I start on the last illustration—that is, the illustration of the application of these principles to the work of a machine shop—it may perhaps be better for me to explain the first steps that were taken toward scientific

management, because that will help you to understand how the science of cutting metals came to be developed. I defer entirely to your judgment, gentlemen, on that matter. If, on the contrary, it be your desire that I shall go ahead at once with machine-shop illustration, I will do so, and afterwards proceed with a description of how scientific management first started.

The Chairman. Proceed in your own way. Mr. Taylor. Thank you. In 1878 I came to the Midvale Steel Works as a day laborer, after having served two apprenticeships as a pattern maker and a machinist. I came then as a laborer because I could not get work at my trade. Work at that time was very dull—it was toward the end of the long period of depression following the panic of 1873. I was assigned to work on the floor of the machine shop. Soon after I went there the clerk of the shop got mixed up in his accounts and they thought he was stealing—I never could quite believe that he was; I thought it was merely a mix-up—and they put me in to take his place, simply because I was able to do clerical work.

I did this clerical work all right, although it was distasteful to me, and after having trained another clerk to do the work of the shop I asked permission of the foreman to work as a machinist. They gave me a job on the lathe, because I had made good as a clerk when they needed one, and I worked for some time with the lathe gang.

Shortly after this they wanted a gang boss to take charge of the lathes and they appointed me to this position.

Now, the machine shop of the Midvale Steel Works was a piecework shop. All the work practically was done on piecework, and it ran night and day—five nights in the week and six days. Two sets of men came on, one to run the machines at night and the other to run them in the daytime.

We who were the workmen of that shop had the quantity output carefully agreed upon for everything that was turned out in the shop. We limited the output to about, I should think, one-third of what we could very well have done. We felt justified in doing this, owing to the piecework system—that is, owing to the