

the proper time for doing each of the elements of the science of shoveling. There are many other elements which go to make up this science, but I will not take up your time describing them.

Now, all of this costs money. To pay the salaries of men who are studying the science of shoveling is an expensive thing. As I remember it there were two college men who studied this science of shoveling and also the science of doing many other kinds of laboring work during a period of about three years; then there were a lot of men in the labor office whose wages had to be paid, men who were planning the work which each laborer was to do at least a day in advance; clerks who worked all night so that each workman might know the next morning when he went to work just what he had accomplished and what he had earned the day before; men who wrote out the proper instructions for the day's work for each workman. All of this costs money; it costs money to measure or weigh up the materials handled by each man each day. Under the old method the work of 50 or 60 men was weighed up together; the work done by a whole gang was measured together. But under scientific management we are dealing with individual men and not with gangs of men. And in order to study and develop each man you must measure accurately each man's work. At first we were told that this would be impossible. The former managers of this work told me "You cannot possibly measure up the work of each individual laborer in this yard; you might be able to do it in a small yard, but our work is of such an intricate nature that it is impossible to do it here."

I want to say that we had almost no trouble in finding some cheap way of measuring up each man's work, not only in that yard but throughout the entire plant.

But all of that costs money, and it is a very proper question to ask whether it pays or whether it doesn't pay, because, let me tell you, gentlemen, at once, and I want to be emphatic about it, scientific management has nothing in it that is philanthropic; I am not objecting to philanthropy, but any scheme of management which has philanthropy as one of its elements

ought to fail; philanthropy has no part in any scheme of management. No self-respecting workman wants to be given things, every man wants to earn things, and scientific management is no scheme for giving people something they do not earn. So, if the principles of scientific management do not pay, then this is a miserable system. The final test of any system is, does it pay?

At the end of some three and a half years we had the opportunity of proving whether or not scientific management did pay in its application to yard labor. When we went to the Bethlehem Steel Co. we found from 400 to 600 men at work in that yard, and when we got through 140 men were doing the work of the 400 to 600, and these men handled several million tons of material a year.

We were very fortunate to be able to get accurate statistics as to the cost of handling a ton of materials in that yard under the old system and under the new. Under the old system the cost of handling a ton of materials had been running between 7 and 8 cents, and all you gentlemen familiar with railroad work know that this is a low figure for handling materials. Now, after paying for all the clerical work which was necessary under the new system for the time study and the teachers, for building and running the labor office and the implement room, for constructing a telephone system for moving men about the yard, for a great variety of duties not performed under the old system, after paying for all these things incident to the development of the science of shoveling and managing the men the new way, and including the wages of the workmen, the cost of handling a ton of material was brought down from between 7 and 8 cents to between 3 and 4 cents, and the actual saving, during the last six months of the three and one-half years I was there, was at the rate of \$78,000 a year. That is what the company got out of it; while the men who were on the labor gang received an average of sixty per cent more wages than their brothers got or could get anywhere around that part of the country. And none of them were overworked, for it is no part of scientific management ever to overwork any man; certainly overworking these men could

not have been done with the knowledge of anyone connected with scientific management, because one of the first requirements of scientific management is that no man shall ever be given a job which he cannot do and thrive under through a long term of years. It is no part of scientific management to drive anyone. At the end of three years we had men talk to and investigate all of these yard laborers and we found that they were almost universally satisfied with their jobs.

Of course certain men are permanent grouches and when we run across that kind we all know what to expect. But, in the main, they were the most satisfied and contented set of laborers I have ever seen anywhere; they lived better than they did before, and most of them were saving a little money; their families lived better, and as to having any grouch against their employers, those fellows, every one, looked upon them as the best friends they ever had, because they taught them how to earn 60 per cent more wages than they had ever earned before. This is the round-up of both sides of this question: If the use of the system does not make both sides happier, then it is no good.

To give you one illustration of the application of scientific management to a rather high class of work, gentlemen, bricklaying, so far as I know, is one of the oldest of the trades, and it is a truly extraordinary fact that bricks are now laid just about as they were 2,000 years before Christ. In England they are laid almost exactly as they were then; in England the scaffold is still built with timbers lashed together—in many cases with the bark still on it—just as we see that the scaffolds were made in old stone-cut pictures of bricklaying before the Christian era. In this country we have gone beyond the lashed scaffold, and yet in most respects it is almost literally true that bricks are still laid as they were 4,000 years ago. Virtually the same trowel, virtually the same brick, virtually the same mortar, and, from the way in which they were laid, according to one of my friends, who is a brick work contractor and a student of the subject, who took the trouble to take down some bricks laid 4,000 years ago to study the way in which the mortar was

spread, etc., it appears that they even spread the mortar in the same way then as we do now. If, then, there is any trade in which one would say that the principles of scientific management would produce but small results, that the development of the science would do little good, it would be in a trade which thousands and thousands of men through successive generations had worked and had apparently reached, as far as methods and principles were concerned, the highest limit of efficiency 4,000 years ago. In bricklaying this would seem to be true since practically no progress has been made in this art since that time. Therefore, viewed broadly, one would say that there was a smaller probability that the principles of scientific management could accomplish notable results in this trade than in almost any other.

Mr. Frank Gilbreth is a man who in his youth worked as a bricklayer; he was an educated man and is now a very successful contractor. He said to me, some years ago, "Now, Taylor, I am a contractor, putting up all sorts of buildings, and if there is one thing I know it is bricklaying; I can go out right now, and I am not afraid to back myself, to beat any man I know of laying bricks for ten minutes, both as to speed and accuracy; you may think I am blowing, but that is one way I got up in the world. I cannot stand it now for more than ten minutes; I'm soft; my hands are tender, I haven't been handling bricks for years, but for ten minutes I will back myself against anyone. I want to ask you about this scientific management; do you think it can be applied to bricklaying? Do you believe that these things you have been shouting about (at that time it was called the 'task system'), do you believe these principles can be applied to bricklaying?" "Certainly," I said, "some day some fellow will make the same kind of study about bricklaying that we have made of other things, and he will get the same results." "Well," he said, "if you really think so, I will just tell you who is going to do it, his name is Frank Gilbreth."

I think it was about three years later that he came to me and said: "Now, I'm going to show you something about bricklaying. I have spent three years making a motion and time study of bricklaying, and not I alone did it; my