to the shovel. Now, is 3½ pounds the proper shovel load or is 38 pounds the proper shovel load? They cannot both be right. Under scientific management the answer to this question is not a matter of anyone's opinion; it is a question for accurate, careful, scientific investigation.

Under the old system you would call in a first-rate shoveler and say, "See here, Pat, how much ought you to take on at one shovel load?" And if a couple of fellows agreed, you would say that's about the right load and let it go at that. But under scientific management absolutely every element in the work of every man in your establishment, sooner or later, becomes the subject of exact, precise, scientific investigation and knowledge to replace the old, "I believe so," and "I guess so." Every motion, every small fact becomes the subject of careful, scientific investigation.

What we did was to call in a number of men to pick from, and from these we selected two first-class shovelers. Gentlemen, the words I used were "first-class shovelers." I want to emphasize that. Not poor shovelers. Not men unsuited to their work, but first-class shovelers. These men were then talked to in about this way, "See here, Pat and Mike, you fellows understand your job all right; both of you fellows are first-class men; you know what we think of you; you are all right now; but we want to pay you fellows double wages. We are going to ask you to do a lot of damn fool things, and when you are doing them there is going to be some one out alongside of you all the time, a young chap with a piece of paper and a stop watch and pencil, and all day long he will tell you to do these fool things, and he will be writing down what you are doing and snapping the watch on you and all that sort of business. Now, we just want to know whether you fellows want to go into that bargain or not? If you want double wages while that is going on all right, we will pay you double; if you don't all right, you needn't take the job unless you want to; we just called you in to see whether you want to work this way or not.

"Let me tell you fellows just one thing: If you go into this bargain, if you go at it, just remember that on your side we want no monkey business of any kind; you fellows will have to play square; you fellows will have to do just what you are supposed to be doing; not a damn bit of soldiering on your part; you must do a fair day's work; we don't want any rushing, only a fair day's work and you know what that is as well as we do. Now, don't take this job unless you agree to these conditions, because if you start to try to fool this same young chap with the pencil and paper he will be onto you in 15 minutes from the time you try to fool him, and just as surely as he reports you fellows as soldiering you will go out of this works and you will never get in again. Now, don't take this job unless you want to accept these conditions; you need not do it unless you want to; but if you do, play fair."

Well, these fellows agreed to it, and, as I have found almost universally to be the case, they kept their word absolutely and faithfully. My experience with workmen has been that their word is just as good as the word of any other set of men that I know of, and all you have to do is to have a clear, straight, square understanding with them and you will get just as straight and fair a deal from them as from any other set of men. In this way the shoveling experiment was started. My remembrance is that we first started them on work that was very heavy, work requiring a very heavy shovel load. What we did was to give them a certain kind of heavy material ore, I think, to handle with a certain size of shovel. We sent these two men into different parts of the yard, with two different men to time and study them, both sets of men being engaged on the same class of work. We made all the conditions the same for both pairs of men, so as to be sure that there was no error in judgment on the part of either of the observers and that they were normal, first-class men.

The number of shovel loads which each man handled in the course of the day was counted and written down. At the end of the day the total tonnage of the material handled by each man was weighed and this weight was divided by the number of shovel loads handled, and in that way, my remembrance is, our first experiment showed that the average shovel load handled was 38 pounds, and that with this load on the shovel the man handled, say, about 25 tons per day. We then cut the shovel off, making it somewhat shorter, so that instead of shoveling a load of 38 pounds it held a load of approximately 34 pounds. The average, then, with the 34 pound load, of each man went up, and instead of handling 25 he had handled 30 tons per day. These figures are merely relative, used to illustrate the general principles, and I do not mean that they were the exact figures. The shovel was again cut off, and the load made approximately 30 pounds, and again the tonnage ran up, and again the shovel load was reduced, and the tonnage handled per day increased, until at about 21 or 22 pounds per shovel we found that these men were doing their largest day's work. If you cut the shovel load off still more, say until it averages 18 pounds instead of 21½, the tonnage handled per day will begin to fall off, and at 16 pounds it will be still lower, and so on right down. Very well; we now have developed the scientific fact that a workman well suited to his job, what we call a first-class shoveler, will do his largest day's work when he has a shovel load of 21½ pounds.

Now, what does that fact amount to? At first it may not look to be a fact of much importance, but let us see what it amounted to right there in the yard of the Bethlehem Steel Co. Under the old system, as I said before, the workmen owned their shovels, and the shovel was the same size whatever the kind of work. Now, as a matter of common sense, we saw at once that it was necessary to furnish each workman each day with a shovel which would hold just 21½ pounds of the particular material which he was called upon to shovel. A small shovel for the heavy material, such as ore, and a large scoop for light material, such as ashes. That meant, also, the building of a large shovel room, where all kinds of laborers' implements were stored. It meant having an ample supply of each type of shovel, so that all the men who might be called upon to use a certain type in any one day could be supplied with a shovel of the size desired that would hold just 21½ pounds. It meant, further, that each day each laborer should be given a particular kind of work to which he was suited, and that he must be provided with a particular shovel suited to that kind of work, whereas in the past all the laborers in the yard of the Bethlehem Steel Co. had been handled in masses, or in great groups of men, by the old-fashioned foreman, who had from 25 to 100 men under him and walked them from one part of the yard to another. You must realize that the yard of the Bethlehem Steel Co. at that time was a very large yard. I should say that it was at least 1½ or 2 miles long and, we will say, a quarter to a half mile wide, so it was a good large yard; and in that yard at all times an immense variety of shoveling was going on.

There was comparatively little standard shoveling which went on uniformly from day to day. Each man was likely to be moved from place to place about the yard several times in the course of the day. All of this involved keeping in the shovel room 10 or 15 kinds of shovels, ranging from a very small flat shovel for handling ore up to immense scoops for handling rice coal, and forks with which to handle coke, which, as you know, is very light. It meant the study and development of the implement best suited to each type of material to be shoveled, and assigning, with the minimum of trouble, the proper shovel to each one of the four to six hundred laborers at work in that yard. Now, that meant mechanism, human mechanism. It meant organizing and planning work at least a day in advance. And, gentlemen, here is an important fact, that the greatest difficulty which we met with in this planning did not come from the workmen. It came from the management's side. Our greatest difficulty was to get the heads of the various departments each day to inform the men in the labor office what kind of work and how much of it was to be done on the following day.

This planning the work one day ahead involved the building of a labor office where before there was no such thing. It also involved the equipping of that office with large maps showing the layout of the yards so that the movements of the men from one part of the yard to another could be laid out in advance, so that we could assign to this little spot in the yard a certain number of men and