

come under scientific management—better treatment, more kindly treatment, more consideration for their wishes, and an opportunity for them to express their wants freely. That is one side of the "make." An equally important side is, whenever a man will not do what he ought, to either make him do it or stop it. If he will not do it, let him get out. I am not talking of any mollicoddle. Let me disabuse your minds of any opinion that scientific management is a mollicoddle scheme.

I have a great many union friends. I find they look with especial bitterness on this word "make." They have been used to doing the "making" in the past. That is the attitude of the trade unions, and it softens matters greatly when you can tell them the facts, namely, that in our making the science and the men come together, nine-tenths of our trouble comes with the men on the management side in making them do their new duties. I am speaking of those who have been trying to change from the old system to the new. Nine-tenths of our troubles come in trying to make the men on the management side do what they ought to do, to make them do the new duties, and take on these new burdens, and give up their old duties. That softens this word "make."

#### THE PRINCIPLE OF THE DIVISION OF WORK

The fourth principle is the plainest of all. It involves a complete re-division of the work of the establishment. Under the old scheme of management, almost all of the work was done by the workmen. Under the new, the work of the establishment is divided into two large parts. All of that work which formerly was done by the workmen alone is divided into two large sections, and one of those sections is handed over to the management. They do a whole division of the work formerly done by the workmen. It is this real co-operation, this genuine division of the work between the two sides, more than any other element which accounts for the fact that there never will be strikes under scientific management. When the workman realizes that there is hardly a thing he does, that does not have to be preceded by some act of preparation on the part of the management, and when that workman realizes when the management falls down and does not do its part, that he is not only entitled to a kick, but that he can register that kick in the most forcible possible way, he cannot quarrel with the men over him. It is team work. There are more complaints made every day on the part of the workmen that the men on the management side fail to do their duties, than are made by the management that the men fail. Every one of the complaints of the men have to be heeded, just as much as the complaints from the management that the workmen do not do their share. That is char-

acteristic of scientific management. It represents a democracy, co-operation, a genuine division of work which never existed before in this world.

#### THE PROOF OF THE THEORY

I am through now with the theory. I will try to convince you of the value of these four principles by giving you some practical illustrations. I hope that you will look for these four elements in the illustrations. I shall begin by trying to show the power of these four elements when applied to the greatest kind of work I know of that is done by man. The reason I have heretofore chosen pig-iron for an illustration is that it is the lowest form of work that is known.

A pig of iron weighs about ninety-two pounds on an average. A man stoops down, and with no other implement than his hands, picks up a pig of iron, walks a few yards with it, and drops it on a pile. A large part of the community has the impression that scientific management is chiefly handling pig-iron. The reason I first chose pig-iron for an illustration is that, if you can prove to any one the strength, the effect, of those four principles when applied to such rudimentary work as handling pig-iron, the presumption is that it can be applied to something better. The only way to prove it is to start at the bottom and show those four principles all along the line. I am sorry I cannot, because of lack of time, give you the illustration of handling pig-iron. Many of you doubt whether there is much of any science in it. I am going to try to prove later with a high class mechanic, that the workman who is fit to work at any type of work is almost universally incapable of understanding the principles without the help of some one else. I will use shoveling because it is a shorter illustration, and I will try to show what I mean by the science of shoveling, and the power which comes to the man who knows the science of shoveling. It is a high art compared with pig-iron handling.

#### THE SCIENCE OF SHOVELING

When I went to the Bethlehem Steel Works, the first thing I saw was a gang of men unloading rice coal. They were a splendid set of fellows, and they shoveled fast. There was no loafing at all. They shoveled as hard as you could ask any man to work. I looked with the greatest of interest for a long time, and finally they moved off rapidly down into the yard to another part of the yard and went right at handling iron ore. One of the main facts connected with that shoveling was that the work those men were doing was that, in handling the rice coal, they had on their shovels a load of 3 3-4 pounds, and when the same men went to handling ore with the same shovel, they had over 38 pounds on their shovels. Is it asking too much of any one to inquire whether 3 3-4

pounds is the right load for a shovel, or whether 38 pounds is the right load for a shovel? Surely if one is right the other must be wrong. I think that is a self-evident fact, and yet I am willing to bet that that is what workmen are doing right now in Cleveland.

That is the old way. Suppose we notice that fact. Most of us do not notice it because it is left to the foreman. At the Midvale works, we had to find out these facts. What is the old way of finding them out? The old way was to sit down and write one's friends and ask them the question. They got answers from contractors about what they thought it ought to be, and then they averaged them up, or took the most reliable man, and said, "That is all right; now we have a shovel load of so much." The more common way is to say, "I want a good shovel foreman." They will send for the foreman of the shovelers and put the job up to him to find what is the proper load to put on a shovel. He will tell you right off the bat. I want to show you the difference under scientific management.

Under scientific management you ask no one. Every little trifle,—there is nothing too small,—becomes the subject of experiment. The experiments develop into a law; they save money; they increase the output of the individual and make the thing worth while. How is this done? What we did in shoveling experiments was to deliberately select two first class shovelers, the best we knew how to get. We brought them into the office and said, "Jim and Mike, you two fellows are both good shovelers. I have a proposition to make to you. I am going to pay you double wages if you fellows will go out and do what I want you to do. There will be a young chap go along with you with a pencil and a piece of paper, and he will tell you to do a lot of fool things, and you will do them, and he will write down a lot of fool things, and you will think it is a joke, but it is nothing of the kind. Let me tell you one thing; if you fellows think that you can fool that chap you are very much mistaken, you cannot fool him at all. Don't get it through your heads you can fool him. If you take this double wages, you will be straight and do what you are told." They both promised and did exactly what they were told. What we told them was this: "We want you to start in and do whatever shoveling you are told to do, and work at just the pace, all day long, that when it comes night you are going to be good and tired, but not tired out. I do not want you exhausted or anything like that, but properly tired. You know what a good day's work is. In other words, I do not want any loafing business or any overwork business. If you find yourself over-worked and getting too tired, slow down." Those men did that, and did it

in the most splendid kind of a way day in and day out. We proved their co-operation because they were in different parts of the yard, and they both got near enough the same results. Our results were duplicated.

I have found that there are a lot of schemes among my working friends, but no more among them than among us. They are good, straight fellows if you only treat them right, and put the matter up squarely to them. We started in at a pile of material, with a very large shovel. We kept innumerable, accurate records of all kinds, some of them useless. Thirty or forty different items were carefully observed about the work of those two men. We counted the number of shovelfuls thrown in a day. We found with a weight of between thirty-eight and thirty-nine pounds on the shovel, the man made a pile of material of a certain height. We then cut off the shovel, and he shoveled again and with a thirty-four pound load his pile went up and he shoveled more in a day. We again cut off the shovel to thirty pounds, and the pile went up again. With twenty-six pounds on the shovel, the pile again went up, and at twenty-one and one-half pounds the men could do their best. At twenty pounds the pile went down, at eighteen it went down, and at fourteen it went down, so that they were at the peak at twenty-one and one-half pounds. There is a scientific fact. A first class shoveler ought to take twenty-one and one-half pounds on his shovel in order to work to the best possible advantage. You are not giving that man a chance unless you give him a shovel which will hold twenty-one pounds.

The men in the yard were run by the old fashioned foreman. He simply walked about with them. We at once took their shovels away from them. We built a large labor tool room which held ten to fifteen different kinds of shoveling implements so that for each kind of material that was handled in that yard, all the way from rice coal, ashes, coke, all the way up to ore, we would have a shovel that would just hold twenty-one pounds, or average twenty-one. One time it would hold eighteen, the next twenty-four, but it will average twenty-one.

When you have six hundred men laboring in the yard, as we had there, it becomes a matter of quite considerable difficulty to get, each day, for each one of those six hundred men, engaged in a line one and one-half to two miles long and a half mile wide, just the right shovel for shoveling material. That requires organization to lay out and plan for those men in advance. We had to lay out the work each day. We had to have large maps on which the movements of the men were plotted out a day in advance. When each workman came in in the morning, he took out two pieces of paper. One of the blanks gave them a