word I was a great deal older than I am now with worry, meanness, and contemptibleness of the whole damn thing. It is a horrid life for any man to live, not to be able to look any workman in the face all day long without seeing hostility there and feeling that every man around is his virtual enemy. These men were a nice lot of fellows and many of them were my friends outside of the works. This life was a miserable one, and I made up my mind either to get out of the business entirely, and go into some other line of work, or to find some remedy for this unbearable condition.

When I came to think over the whole matter, I realized that the thing which we on the management's side lacked more than anything else was exact knowledge as to how long it ought to take the workman to do his work. I knew how to do the work about as well as the rest of the workmen (many of them were better mechanics than I was, but on the whole I knew well enough how the work ought to be done in the shop). I could take any workman and show him how to run his lathe, but when it came to telling a man how long it ought to take him to do his work there was no foreman who at that time could do this with any degree of accuracy even if he knew ten times as much about the time problem as I did. You will remember, of course, that the chief object of the men in soldiering was to keep their foreman ignorant of how fast the work could be done. Realizing this deficiency on my part, I asked permission from Mr. William Sellers, the president of the Midvale Steel Company to make a series of careful scientific experiments to find out how quickly the various kinds of work that went into the shop ought to be done.

Now, these experiments were started along a variety of lines. One of the types of investigation which was started at that time was that which has come to be generally known as "motion study" or "time study". A young man was given a stop watch and ruled and printed blanks like those shown after page 160 of the red bound book written by me, entitled "Shop Management", which is in the hands of your committee. This man for two years and one half, I think, spent his entire time in analyzing the motions of the workmen in the machine shop in relation to all the machine work going on in the shop—all the operations, for example, which were performed while putting work into and taking work out from the machines were analyzed and timed. I refer to the details of all such motions as are repeated over and over again in machine shops. I dare say you gentlemen realize that while the actual work done in the machine shops of this country is infinite in its variety, and that while there are millions and millions of different operations that take place, yet these millions of complicated or composite operations can be analyzed intelligently and readily resolved into a comparatively small number of simple elementary operations, each of which is repeated over and over again in every machine shop. As a sample of these elementary operations which occur in all machine shops, I would cite picking up a bolt and clamp and putting the bolt head into the slot of a machine, then placing a distance piece under the back end of the clamp and tightening down the bolt. Now, this is one of the series of simple operations that take place in every machine shop hundreds of times a day. It is clear that a series of motions such as this can be analyzed, and the best method of making each of these movements can be found out, and then a time study can be made to determine the exact time which a man should take for each job when he does his work right, without any hurry and yet who does not waste time. This was the general line of one of the investigations which we started at that time.

At the same time, another series of investigations was started which I shall describe later, and which resulted in developing the art or science of cutting metals.

Before starting to describe these experiments, however, I want to make it clear to you that these scientific experiments, namely, accurate motion and time study of men and a study of the art of cutting metals, which were undertaken to give the foreman of the machine shop of the Midvale Steel Works knowledge which was greatly needed by him, in order to prevent soldiering and the strife that goes with it, marked the first steps which were taken in the evolution of what is called scientific management. These steps were taken in an earnest endeavor to correct what I look upon as one of the crying evils of the older systems of management. And I think that I may say that every subsequent step which was taken and which has resulted in the development of scientific management was in the same way taken, not as the result of some preconceived theory by any one man or any number of men, but in an equally earnest endeavor to correct some of the perfectly evident and serious errors of the older type of management. Thus scientific management has been an evolution in which many men have had their part, and I feel that this fact should be emphasized. Personally I am profoundly suspicious of any new theory, my own as well as any other man's theory, and until a theory has been proved to be correct from practical experience, it is safe to say that in nine cases out of ten it is wrong.

Scientific management, then, is no new or untried theory. Far from being a mere theory, on the contrary, the theory of scientific management has only come to be a matter of interest and of investigation during the past few years, whereas this type of management itself has been in process of evolution during a period of about 30 years, through actual use in shops, through being tried out, experimented with, and improved in the most practical way by hundreds, almost thousands of men. Scientific management, then, is not a theory, but is the practical result of a long evolution.

The illustrations of shoveling and bricklaying which I have given you have thus far been purposely confined to the more elementary types of work, so that a very strong doubt must still remain as to whether this kind of cooperation is desirable in the case of more intelligent mechanics, that is, in the case of men who are more capable of generalization, and who would therefore be more likely, of their own volition, to choose the more scientific and better methods. The following illustration will be given for the purpose of demonstrating the fact that in the higher classes of work the scientific laws which are developed are so intricate that the high-priced mechanic needs—even more than the cheap laborer—the cooperation of men better educated than himself in finding the laws, and then in selecting, developing, and training him to work in accordance with these laws. This illustration should make perfectly clear my original proposition that in practically all of the mechanic arts the science which underlies each workman's act is so great and amounts to so much that the workman who is best suited to actually doing the work is incapable, either through lack of education or through insufficient mental capacity of understanding this science.

A doubt, for instance, will remain in your minds—in the case of an establishment which manufactures the same machine year in and year out in large quantities and in which, therefore, each mechanic repeats the same limited series of operations over and over again—whether the ingenuity of each workman and the help which he from time to time receives from his foreman will not develop such superior methods and such a personal dexterity that no scientific study which could be made would result in a material increase in efficiency.

A number of years ago a company employing in one of their departments about 300 men, which had been manufacturing the same machine for 10 to 15 years, sent for my friend Mr. Barth to report as to whether any gain could be made in their work through the introduction of scientific management. Their shops had been run for many years under a good superintendent and with excellent foremen and workmen on piece work. The whole establishment was, without doubt, in better physical condition than the average machine shop in this country. The superintendent was distinctly displeased when Mr. Barth told him that through the adoption of scientific management the output, with the same number of men and machines, could be more than doubled. He said that he believed that any such statement was mere boasting, absolutely false, and instead of inspiring him with confidence he was disgusted that anyone would make such an impudent claim. He, however, readily assented to Mr. Barth's proposition that he should select any one of the machines whose output he considered as representing the average of the shop, and that Mr. Barth should then demonstrate on this machine