

and the machines get just a little bit out of order—the spindles a little bit out of alignment—the shears on the lathe a little bit worn—not enough to prevent a man from earning his bonus or to prevent him from doing good work. But if you take the man off that machine—the man who has been running it right along in that condition, who is a man of long experience and who therefore has learned just how to humor the machine in order to allow for those slight inaccuracies of alignment and wear—and put a new man on there, who may be a perfectly good mechanic, it will be a week, two weeks or three weeks before that fellow can earn his bonus. Now, if the machine had been kept in condition through systematic inspection and systematic adjustment, the new man would go in there and earn his bonus right off the bat.

As an illustration of the old way, some few years ago, I took a place as superintendent of a concern that was manufacturing steam engines. In that shop there was a "bull lathe" for turning fly wheels—an old-fashioned affair. There are very few of that type of lathes in the country today. In the turning the diameter of the fly wheels did not have to be accurate, but of course it had to be fairly round. But when it came to the bore, that bore had to be a press fit on the crank shaft. There was only one man in that shop of about 150 men who could bore a hole in a fly wheel with the bull lathe and get that hole straight and round. Now, this man was somewhere around 75 years of age. He had been brought up with that lathe—he had lived with it—and he knew every tooth in its gears and every groove and scratch in its bearings, and he knew, as the tool advanced along the bore just when he must hit it a tap here or let it out a little for a tight place there, and he could accurately bore fly wheels with that machine. Now, that is going to a ridiculous extreme. If that man had left or had died, they would have had to have stopped building engines, because no man in the place could have bored fly wheels.

Now, then, in that shop nobody ever thought of doing anything to a machine until it broke down. Nobody ever thought of repairing a belt until the belt would not turn the machine over. In fact, each man was expected to look after his own belts and make his own repairs. That was really a remarkable shop. It was the only shop that I ever came in contact with where we had no "non-productive" labor. The men on the machines made their own repairs and moved their own machines from place to place, and repaired their own belts. If Bill over there on his machine needed help, John would leave the machine that he was on and go over and help him—thorough cooperation! This is an old story, and you may have heard it before. But when I went there the manager, who was a young man, as I was, said that the way

to make money was to keep down the non-productive expenses, and he hammered that into me, and I said, "Yes, that is right, let's keep down the non-productive expense;" and we had got it down to the point where there was no non-productive expense, and in less than two years time the concern failed. I am not giving you this non-productive instance just for fun, but because it carries a real lesson. It amuses me now although it did not amuse me then, because I took it very seriously. The persistence of the idea of keeping down "non-productive" expense is one of the chief reasons why we have had difficulty in carrying through the plan I have talked about tonight.

"Why should we go to this expense?" say our clients. "All the workmen are making their bonus nicely—what is the use of having a machine inspected when it is working all right?" That is the way our clients look at the matter and we cannot get it done.

You must bear in mind that before making time studies and putting the work on task and bonus all of the machines were gone over and put in first class condition.

Yes, we have maintenance departments. But as to having a man to go over a machine when it does not have anything apparently wrong with it, to find out what may be wrong with it, when nobody says there is anything the matter,—that they cannot do, because that is non-productive expense.

But let them go on, three, four or five years after the system has been started. Presently we find that this fellow on a lathe, where they have always made their bonus, is having difficulty to make it, and he is falling down; or you may have to put a new man on there, because the old man has been advanced to another machine, and the new man cannot make his bonus, in spite of all that is done to help him. And if you look into it you will find that that machine has little by little gotten out of adjustment and out of condition, and that that is the reason why the new workman has not been able to make his bonus and is not getting his work out on time.

Now, what I am proposing tonight is nothing new. It is something that is being done in a way, but it is not being done right. It is something that Mr. Taylor started 30 or more years ago at the Midvale Steel Works. I happened to see what was left of it when I was there.

Mr. R. R. KEELY:¹ With a client of mine I have just gone into this problem. We are scheduling the work, and that brings up the matter of the repair and maintenance of machines, because if we assign a definite piece of work to a machine, and then the machine goes down, there is trouble because of that

¹Consulting Manager, Philadelphia, Pa.

repair work. I have formed in this particular plant what we are calling a standing committee on standards, made up of three heads of departments, one of them the chief tool designer, another the maintenance engineer, and the other the supervisor of time study. These three men recommend standard practice. The first thing coming up in studying an operation is whether the operation is necessary, and if it is necessary, whether the equipment is right or not. That involves the tool design, and then the maintenance of equipment. Our maintenance engineer has not only cut down the size of the repair gang, but has greatly improved the quality of their work. We have in use an "idle time card" on the face of which is designated various possible causes for delay. The proper item showing the cause of the delay is checked on this card and the card sent into the office. This gives definite information, and on this, the maintenance engineer acts in making the repair, if such is necessary. The maintenance engineer has an inspector devoting his time exclusively to inspecting machines with the object of preventing shut-downs. He is assigned definite departments daily, and makes his report on a printed form where all the points to be looked after are listed, by checking each item as inspected, and making notations where necessary. By this method, he does not overlook any points in his inspection trip. He also makes required minor repairs himself as he proceeds in his work. On this written report, as a basis, the maintenance engineer assigns the jobs to the proper men in the repair gang.

We are to have a belt machine, which Mr. Hathaway's company is building.

The maintenance engineer is in charge of the entire physical upkeep of the plant. This includes the repair foreman, master mechanic, the electrician, the powerhouse engineer and the millwright, and an inspector under his direction.

The small tool repair we have not found fit to put under the maintenance engineer, because so many of the tools require tool-room work. We have left the tool inspection and repair of all tools directly under the tool-room foreman, and he in turn is directly under the supervision of the chief tool designer. Therefore, the matter of the small tools is not under the maintenance engineer.

Repair parts were being handled in all kinds of ways under the old scheme. The parts that were not needed on a machine, together with new repair parts, were chucked away in a room. We are now standardizing the kinds and quantities of repair parts to be carried, and have put these in charge of the store keeper, to be delivered only for repairs on the proper order of the maintenance engineer. This

not only reduces the investment in new parts, but puts them where they can be found quickly when wanted.

We are using all leather belts, and whenever a belt is badly worn, it is sent away to the factory, remade, properly oiled, glued and sewed together. With the present high price of leather belting, we find that this practice materially reduces our bills for leather belting.

Mr. FRANK ADAMS BAKER:¹ The company with which I am connected has started a system of machine inspection that is giving good results. The inspection of various classes of machines is made weekly, special attention being paid to the safety devices. Reports to be filled in by the inspectors are made up by listing vital parts of the machine as clutch, spur gear, bearings, glands, steam connections, etc. These words are checked to indicate that the parts have been examined. As the machines are brought into better condition, it will of course be necessary to change the form of these reports, but for the present they are serving their purpose in a very satisfactory manner.

Mr. SANFORD E. THOMPSON:² In listening to the criticisms that are being made tonight by scientific managers themselves, one almost might say that shops operating under scientific management are handling their repairs in exceptionally poor fashion. One might almost think, also, that the bonus workers were being hard put to accomplish their jobs. Now, why do we hear such remarks from these men, men having as fine running shops as any in the country? For this reason. In a shop running on old-fashioned, haphazard principles, where a belt breaks and it is considered an act of providence and something that cannot be avoided, where if a machine gives trouble the operators simply have to sit down and lose their piece rate or their time—for that is the old-fashioned way of doing it—in that kind of a shop bad management in handling repairs does not show up. Break-downs are expected. No record is kept of them. But just as soon as you organize the shop so that it is operating under exact standards and is running smoothly, where the work is laid out for the individual men, and they are expected to do a job not only in the right time but in the best fashion; then it is that even small defects as well as large ones in the maintenance department show up quickly and clearly and the maintenance department is forced to raise itself to a plane which compares with the rest of the mill or factory.

¹Eastern Manufacturing Co., Boston, Mass.

²Consulting Engineer, of Thompson and Lichtner, Boston, Mass.