pump, engine, belt, etc. in detail, and note exactly what is to be inspected on each and how often it is to be inspected. He then gets out detailed instructions for the inspector of each of these items. These are given to the planning department who issues inspection tickets and corresponding instruction cards for each job to be inspected. This inspection card is then filled in by the inspector according to his findings. Upon its return, master mechanic goes over these cards and for all necessary repairs he issues repair orders to have the work attended to. These maintenance inspections must be made generally when the machines are down at night or over Sunday although in some cases we require the inspector to interview the operator on machine to get his viewpoint about how machine is running. In other words, you have to recognize the fact that the man or men using a machine day in and day out can tell pretty well as soon as the slightest noise or stiffening of a machine occurs.

The question about having tools with machines is another large item, and in the studying of routing for inspection that can be brought out. At one printing establishment we found only one kit of tools for about 12 machines, and the men spent about three-quarters of their time in getting their machines ready. It took them eight hours to make ready one press, and out of the eight hours, three hours were spent in hunting up tools. By an expenditure of possibly $100.00 all the machines could be equipped with all the necessary tools, which would mean a saving of at least this amount weekly.

MR. JAMES F. MCENNERY:[1] I came here tonight as the guest of our Production Manager, Mr. Ballou, who is a member of your society, and with no other thought in mind than the one we see painted on every railroad crossing-bar, namely, to "Stop, Look and Listen," when to my surprise I am asked to stand before you and say something on a subject which deals with me very closely in my position at our factory.

We have an installation of scientific management, placed there by Mr. Barth, that is giving us a result we would never have been able to attain in production and delivery of finished product were it not for this same installation, and after listening to the very instructive paper read by Mr. Hathaway, and having had experiences similar to some he told us about, it has brought still more forcibly to my mind this matter of maintenance and repair of machinery and tools, and its direct relation to production and delivery of finished parts.

While it is not my experience, as it was that of Lieutenant Coburn, to have men waiting for me at the gate, I do have men waiting for me as I pass through the factory, to notify me that they have a task to perform which specifies the turning out of so many pieces per hour, and that the belt is continually slipping, or the feed is not working properly, or the fixture is not in good condition, and they ask how they are going to make premium if such troubles are allowed to continue, and threaten to leave if they are not rectified. Of course, we do not want this to happen, nor do we want this spirit of annoyance to hamper them while endeavoring to earn their premiums, for then the company suffers in output, and the disturbed condition of the man prevents him from doing his best. The production manager has his troubles immediately this thing happens, and the manager and the sales force make his life miserable for him, so the train of ills that follows in the wake of a poor maintenance department is enough to wreck all the rest of the good work scientific management may produce. So, while as yet we are in a crude way as far as maintenance is concerned, we are endeavoring to get going in the right direction with this all-important part of our management. I can see we must deal with it just as specifically as we have with our speeds, feeds, time studies and all the other details that go to make a thorough installation of scientific management.

The results we get from this maintenance department of ours are shown up very forcibly in the returns in production we are able to get from our machines. While this result is also helped by good operators, by well applied speeds and feeds, yet it would go all for naught, if the equipment and tools were not kept up to a high state of repair. I can see how much more we can get from our equipment if we but develop in this matter along the lines Mr. Hathaway so ably presented.

The matter of setting tasks in this department seems rather a difficult one to me at this moment, yet I must say if this is possible, we should be as well fitted to put it in force as anyone, because we try to keep our machinery of the same type; this is, we adopt a certain type of machine to do our work, then stick to that type when we purchase others, making it easier for an inspector to follow the weak points and keep them tuned up, and also be able at the same time to fix a time for such repairs. I have given this matter considerable thought, but I must confess that Mr. Hathaway's paper shows me how little I have accomplished after all, and how much I must do to get it up to the plane of the rest of our installation.

I was interested to hear the remarks of Lieutenant Coburn, in regard to his experience with belting, and

[1]Universal Winding Co., Providence, R. I.

along that line I would like to tell of an experience we have had lately that may be of value.

We have two sets of machines of the same type which came from a western firm. The first set which we received were equipped with leather belts, and when the second set arrived, we found those equipped with cloth belts. Now, with the first lot we are having trouble with the belts slipping and stretching, while on the other lot, with the woven belts, we get a much more regular speed, a better production, and our time studies work out better. I wonder whether this is a condition any other of you gentlemen have ever experienced. It would interest me greatly, if there are any here this evening who have this problem to contend with, to hear their views on the subject, as this matter of belting is going to give us considerable thought and expense before we are through with the problem of upkeep and maintenance.

MR. GUSTAV E. SCHULZ:[1] There is one point I should like to bring out, that possibly Mr. Hathaway did not fully bring out in his talk on maintenance, and one I think that the new members and those here who are not members should understand. Some of us have been maintaining conditions for a considerable time on small tools and part of a plant's equipment. Some visitors here may get the impression that we do not do that. I do not know whether Mr. Hathaway made that point clear, or whether my statement is worth while; but we do maintain the tools, and many features of the machine tools, including belting. In other words, under Scientific Management there is a condition determined under which the job is to be done, and under the Taylor System that condition is maintained at least up to the point of present control of points that affect the job directly.

But this does not include maintenance as a matter of prevention on some parts of the machines. Parts not covered by this maintenance can be properly analyzed and the maintenance as a preventive can be taken up. We might take an engine lathe and analyze and find the weak points. We can find the weak points on some of our machinery, and that will give us a lot of information. It is largely those things that we haven't control of, because they do not come under a regular inspection. The point that I want to make is that we do maintain the other standards. I have been requested to put a question to Mr. Hathaway. What is there in Mr. Hathaway's method for the maintenance of machinery different from the method, first, of ordinary management, and second, of systematized management, so called?

[1]Tabor Manufacturing Co., Philadelphia, Pa.

MR. H. K. HATHAWAY: I have not had any personal experience with the so-called systematized management, and I don't know anything about it. I have had experience with so-called ordinary management—and I have had experience with scientific management. Under ordinary management there is no such thing as the sort of maintenance I had in mind in presenting this paper tonight—that is, *maintenance for the purpose of preventing interruption to manufacture* and the prevention of breakdowns. Under the old style of management the custom is to *wait until something breaks down*, and then fix it. That is the old style. What I am proposing is not something new at all—it is something which does not exist. As Mr. Schulz states, we do under scientific management in the plants operating under the Taylor System maintain our equipment; and as Mr. McEnnery brought out we do maintain our equipment. Otherwise the earning of a task and the earning of a bonus would not be possible.

The point I am making is that we do not carry it out in a systematic manner. We do not do it as thoroughly and in a manner so as to avoid annoyances to anything like the extent that we should. What I am proposing is in anticipation of breakdowns—anticipation of troubles—and not waiting as we do under the old-style management, until something goes wrong, and then going and fixing it.

A comparison might be made with a fireman. We maintain fire departments in our cities. When a fire breaks out we rush the firemen there to put the fire out. There is such a thing, however, as fire prevention. And fire prevention is more important than fire extinction.

Now, Mr. Schulz pointed out in his discussion that we take care of the small tools. Mr. Schulz has just completed overhauling and rearranging what I regard as the best tool room in the United States. I thought it was the best before Mr. Schulz took hold of it, and I think it is by far the best at the present time. Now, what he said with respect to small tools applies and holds good in the case of machine shops, because there we are compelled to keep up our small tools and provide a system of keeping them up. In the machine shop we are required to provide a system for keeping our belts up to proper condition and tension, and we do it in a very scientific manner. But when it comes to the machines themselves, in the Tabor Manufacturing Company, of which I happen to be an officer, I know men are earning their bonus on the machines, but they are in some instances having difficulty to do it, where it ought to be perfectly easy, because we have not looked far enough ahead and taken care of those machines in a sufficiently systematic manner. That is, we have let them go on