composite tool in his turret, combined the operations of spotting and rough turning; the second, a forming tool on his cross-slide, combined the operations of finish turning, facing and chamfering. By accomplishing with two tools operations formerly done with five separate tools, the standard time per piece was reduced from 9.0 to 5.0 minutes.

Case 31—W. Groves. Metal working plant, February 1928. Lathe hand, counter boring aluminum pistons on a Hendey lathe, sought and received permission to transfer the operation to a fast drill press. The time necessary to finish a piece on the lathe was 6.0 minutes. The standard time per piece on the drill press is now 2.0 minutes.

Case 32—B. Whiteside. Metal working plant, February 1928. Operator, machining steel pipe flanges on Cleveland automatics, developed tools by means of which washers of a similar stock size could be produced simultaneously with the flanges. The feature of this idea consisted of two parallel cutting-off tools mounted on a common cross-slide tool post. While the first tool cut off a pipe flange, the second one was cutting off a washer. These washers formerly were made on a second automatic which was released for other work by virtue of this development.

Case 37—L. Parkins. Metal working plant. One of the hand screw machine operators had listened to many complaints relative to reamers coming from tool cribs dull and often with chipped edges. One day, while standing at the crib window, this worker noted some lengths of old rubber hose lying about on the floor. He asked the crib attendant what purpose this hose was serving. "No purpose at all," the attendant replied, "It is full of leaks and I intend to sell it for junk." "Don't do that," said the hand screw operator, "Cut it up into suitable lengths, and use the latter as a protection for the reamers while they lie on the crib-shelves. Put each reamer into a hose length and reserve whatever lengths are left over for future reamers." This idea, which was adopted, effected a very noticeable improvement in the condition of reamers throughout the shop.

Case 40—J. Hannah. Metal working plant, March 1926. Lathe hand, turning the outside diameter of aluminum pistons on a small Porter and Cable lathe, sought and received permission to perform this operation on a large Potter and Johnson semi-automatic turret lathe. On this heavier machine it was possible to use a greatly increased feed. The original time for turning a single piston on the Porter and Cable lathe was 20.0 minutes. *This time was reduced to* 4.0 *minutes on the Potter and Johnson.* For effecting this great economy, the worker received, I am glad to report, a substantial increase in his hourly wage rate.

Case 44—G. S. Robinson. Metal working plant, April 1928. Landis grinder hand performed a grinding operation on two separate surfaces of a steel shaft. He had been instructed to grind the first surface, then reset his wheel and grind the second surface from a new setting. By devoting thought to his work he finally developed a new shape of grinding wheel by means of which he was able to finish both surfaces from a single common setting. The new method quickly became accepted practice for this operation. Elimination of the second set-up reduced the standard time necessary to complete a piece from 10.0 minutes to 5.0 minutes.

Case 45—Tower and Handerson. Metal working plant, April 1928. An operator and a helper running a group of four Gridley automatics, on their own initiative suggested that they could take on another machine in addition to their regular quota. For several months now they have been successfully operating five of these machines without any increase in down time over the four machine basis.

Case 47—B. Whiteside. Metal working plant, April 1928. Automatic screw machine operator, running a group of Brown and Sharpes, developed a tool which greatly increased the output of push rod ball ends from these machines. Existing practice consisted of profiling and cutting off these parts on Brown and Sharpe automatics, and then sending them to hand screw machines where the more exacting operation of forming the ball was performed. Owing to the relative slowness of the hand screw machine operation, the output of ball ends produced in this manner was only 150 per day, a figure much below the output possibilities of a Brown Sharpe automatic, if an adequate all-forming tool could be developed for the latter machine. This worker applied his skill and wits to the problem, and presently came through with a tool for the automatics that formed a perfect ball radius. Since then this operation in its entirety has been performed on Brown and Sharpe automatics. The output on the new basis is 800 per day, an increase of 430 per cent over the old method.

Case 48—B. Whiteside. Metal working plant, April 1928. The steel ball ends described in the preceding case passed next to an Ott plain grinder where the ball radius was ground to a careful finish. Each piece, at this stage, was held in a special chuck, the grinder operator holding the chucked ball end against his grinding wheel, and slowly revolving the work to and fro through 180 degrees until he obtained a satisfactory finish. The maximum output obtainable from a single grinder in this way, was 50 pieces per day. The same worker, who already has effected the economy described in the preceding case, suggested that the operation be transferred to a Cincinnatti centerless grinder where a special radius form grinding wheel might be developed and used. Such a wheel was developed eventually, and it entirely eliminated the time formerly consumed on the Ott grinder in moving the work to and fro on the stone. *The output of these parts from the centerless grinder is now* 2,000 *per day, an increase of* 3,900 *per cent over the old method.*

Case 53—W. Yeager. Metal working plant, May 1928. A tool crib attendant noticed that specifications called for 3/64 inch drills which had to be made up specially at a cost of $11.95 per dozen. He submitted a suggestion that No. 56 drills, a stock size obtainable at $1.71 per dozen, be substituted. This worker, in his memorandum, called attention to the fact that as there was a difference of only .0004 inches in the sizes of the two, the stock drill probably would serve. This recommendation was adopted and its proposer received a reward.

Case 57—F. Dutnak. Metal working plant, May 1928. A hand screw machine operator developed a special chuck by the use of which the machining of water pump covers, formerly done on Fox lathes, could be transferred to a No. 4 Warner and Swasey universal. Through the greater accuracy of the universal, it was possible to obtain a satisfactory finish to these parts in considerably less time than on the Fox lathe. The standard time per piece for this operation was reduced from 33.5 minutes to 17.0 minutes by this development.

Case 58. Metal working plant, May 1928. The production department has sent operation sheets into the shop stipulating that two machining operations on aluminum gear housings be performed on a straight lathe. The first operation consisted of rough and finish facing a hub—the second one consisted of rough and finish turning the hub and then back-facing the flanged end of the housing. Each of these operations required a special set up. A hand screw machine operator suggested that both operations be combined in a single hand screw machine operation, in this way eliminating the second set-up, as well as a considerable amount of unnecessary handling time spent at the lathe. To support his idea, the worker suggested a new way of holding the work on an adapter so that all machined surfaces would be made accessible to the necessary cutting tools. This development was successful and the new method was permanently adopted. Standard time for machining a single housing by the old method was 11.0. This time was reduced to 5.0 minutes by the new method.

Case 65—B. Whiteside. Metal working plant, June 1928. Operator running a group of Cleveland automatics, devised and suggested equipment by which the machining of steel clamp nuts, formerly done on Jones and Lamson engine lathes could be transferred to the automatics. When this change was permanently adopted, it increased the output of these parts from 50 pieces to 200 pieces per day, an increase of 300 per cent.

Case 66—B. Whiteside. Metal working plant, June 1928. Operator running Gridley automatics suggested and developed necessary cutting tools for the machining of steel packing nuts on the automatics. Former practice had consisted of making these nuts on an engine lathe, and 40 pieces per day was regarded as a fair average output. On the automatics production was increased to 500 per day, a great increase in productivity over the old method.

Case 67—H. Edge. Metal working plant, June 1928. A drill press operator running a Burke sensitive drill had been instructed to drill a hole in the hubs of aluminum nuts, locating the center of each hole with a scale and spotting it with a center punch before drilling. It took 2.0 minutes to finish a piece by this method. This worker thought out and prepared the sketch of a drilling jig which located the center as soon as the nut was clamped into position in the fixture. This device was adopted and it reduced the standard time per piece from 2.0 minute to .5 minutes.

Case 70—H. Wankling. Metal working plant, June 1928. According to the operation layout prepared by the production engineering department, two machining operations on steel knuckle pins were performed on different machines. The first operation, consisting of facing, turning, drilling and undercutting, was accomplished on a hand screw machine; the second, consisting of undercutting a groove and chamfering, was done on an engine lathe. A set-up man working on a hand screw machine conceived the idea of combining these two operations into a single hand screw machine operation. He then developed the necessary turret and cross-slide tools to make the change effective. This new manner of working was entirely successful, and reduced the standard time per piece from 6.5 minutes for both operations done separately, to 4.2 minutes for the single operation.

Case 71—J. Piaja. Metal working plant, 1926. According to the standard operation sheet, aluminum cylinder pads were faced off with a face milling cutter, mounted on the spindle of a Hudson universal boring mill, and then were bored out in another operation on the same machine. The operator of this machine suggested that a combination spot facing and boring tool be substituted for the milling cutter, the proposed tool thus being brought in contact with the entire surface at once, instead of having to travel across it; and in addition, performing the boring operation as an unbroken continuation of the facing operation. This idea was tried out successfully and adopted, and it increased the productivity of the operation by about 800 per cent.

Discussion

Gustave Geiges.[2] I am very glad of the opportunity of presenting labor's views to the Taylor Society and its friends. The American Federation of Full Fashioned Hosiery Workers, the organization which I represent, clearly recognizes the need for co-operation with management in every problem which the full fashioned hosiery industry must face. We, therefore, welcome the engineer and the scientifically trained expert in industry, because we feel that the greater knowledge which these men can bring to this task will, in the long run, aid both capital and labor to find a more reasonable and certain method of reaching a rational and practical system of mutual assistance in the conduct of industry.

The hosiery workers' union welcomes the technical expert in industry. We have just recently sought the professional services of certain distinguished members of the Taylor Society in an effort to solve the problems of our industry without resorting to a strike and the sort of conflict which has usually been an almost inevitable feature of disputed industrial situations, involving differences of opinion on matters of wages and working conditions. Progressive elements in the modern trade union movement believe that strikes, like wars, must be eliminated if social progress is to be maintained in a complicated industrial society such as we are living in today. We must develop not only a clear understanding in industry of the rights of both employer and employe, but we must create the opportunities which will translate understanding into useful action.

Most of the employers with whom I have come into contact during the past ten years agree that it would be advantageous for their industry if all parties in the industry were organized — workers and manufacturers alike. The difficulty, however, is to convince the individual employer by reasonable argument to accept organization of his employes, when the workers in the entire industry are still not unionized 100 per cent.

The American Federation of Full Fashioned Hosiery Workers has demonstrated its willingness to meet the needs of a competitive business system and has been alert at all times to adapt itself to the present industrial problems resulting from constantly increasing production.

Let me digress for a moment and make clear the difference between full fashioned hosiery and other types of hosiery manufactured. First of all, there is the difference in the method of manufacture. The seamless, or circular, knit is knitted in tubular form, while the full fashioned hose is knitted as a piece of flat fabric shaped to the limb of the wearer. This is the difference in techniques, but there is a greater difference in the actual composition of the full fashioned hosiery industry as compared with the seamless industry. The use of full fashioned hosiery is increasing, while the use of seamless hosiery is tending to decrease. The full fashioned hosiery knitting machine is much more expensive than the seamless and is much more productive.

The average full fashioned manufacturing plant is probably more efficiently operated than most factories, due to the fact that the various operations are performed by specialists. The knitters, who are

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