formerly relied upon to determine the right number of each kind of warp beams. The weaving department also estimated the number to be required, but it was largely a matter of guesswork, and almost always there were a large number of beams on hand but at the same time several looms waiting for warp beams. A careful analysis of what the looms really required resulted in a prepared schedule of work for the dressing department to follow. This reduced the number of beams on hand from six hundred to three hundred and eliminated all waiting for beams. It was found that one slasher[3] could be stopped. Friction between the weaving and dressing departments was eliminated, and the loom production was increased because the looms were kept in operation. The stock in process was reduced considerably, which was a distinct advantage.

In the card rooms the overseer formerly determined the number of roving frames to be run to supply the spinning frames. But usually there would be too much roving on hand or the spinning room would be short. The same was true of the filling yarn for the looms. Accordingly the work of the departments was coordinated for the purpose of having the proper supply of material on hand at all times. Now the work is planned, and each overseer has definite instructions to follow as to the constant operation of the right number of machines, and there his responsibility to the following department ends. This has resulted in the elimination of idle machine time (because when too many machines in a department were run, it was the custom to stop early on Saturday mornings).

Time study and analysis of the various jobs in the mill, the nature of which has been determined by experience and custom, result in the development of new and better facilities for increased efficiency and significant savings. In the spinning room a study was made of the work of doffing the warp frames. There were three crews of doffers, each crew having a section of the frames to doff. At times all three crews would be doffing and this would result in an overflow of yarn to the spoolers. The outcome of the study was the rearrangement of the work and the elimination of one crew of eight doffers. Special trucks are prepared in advance for the operatives, the boxes being enlarged to hold one-third more bobbins. Now the crews alternate the work of doffing so as to get a uniform flow of yarn to the spoolers. While one crew is doffing the other does other work such as changing travelers, picking rolls and sweeping. When one crew finishes doffing, the other crew starts in. The stoppage of the spinning frames is reduced to a minimum, six frames of 252 spindles each being doffed in ten minutes.

A study of the work of the men who handled the yarn and empty boxes in the spool room resulted in changing the spooler frames in order to eliminate dumping the yarn into the trays on the frames. The boxes of yarn are placed on a small stand, and by a change in the method of passing the yarn and picking up the spools and empty boxes, two men were eliminated.

A study of the work of cleaning and sorting filling bobbins, returned from the weave room, resulted in building a special table which facilitated the work tremendously. The operatives were shown the best way to sort the bobbins and to prepare the boxes for the filling spinners, and although their earnings were increased, there was a saving of the cost of three men.

There were four or five men in the weave room picking up empty bobbins from the loom-cans. Each man did the work in his own way, and emptied the cans twice a day. After a study of this work, a special truck was provided and definite instructions were issued as to the method to pursue. The result was a saving of three men, the cans being emptied only once a day and the work being made easier by the new truck.

Standardization, as far as possible, of product, of methods, and of equipment such as trucks and boxes, is a distinct advantage in the efficient and systematic operation of a cotton mill. Constant changes in roving, yarns, or styles of cloth reduce the efficiency of the machines and of the operatives. Where one standard number of yarn and one standard number of roving and one style of cloth are made with no changing on the roving, spinning frames, and looms, a great deal of productive time is saved. Where loom changes are frequent, careful planning is necessary in order to obtain the maximum efficiency and economy. Confusion and delay result where no standards are followed as to the size and number of boxes and trucks. At the Jackson Mills boxes for the carding and spinning rooms are made and repaired according to standard specifications, and the trucks in the carding, spinning, and weaving rooms are of special design, carefully worked out to obtain the greatest benefit from the conveyor.

[3]See page 175, column 1, for a description of the slashing process.

An excellent example of standardization of work is that of the slashers. The slashing process consists in passing the yarns through a bath of starch which has been boiled up in water to the consistency of thin glue. After this treatment the yarns are dried by passing them over hot cylinders. This process is essential to give the yarns the necessary resistance to the abrading effect of the loom. Unless a proper amount of size has been added to the yarns, they will be unable to resist the weaving action of the loom and will break. Sometimes poor warp sizing will completely tie up the production of the weave room. According to previous practice, cotton mills operate their slashers almost hit-or-miss, allowing the tender to operate as he sees fit under the general direction of the overseer. There is no way of exact regulation of the final size and moisture content of the warps. At the Jackson Mills this problem was attacked systematically. A survey was made at the start to find out just how much the yarns were already being sized and how far the work deviated in quality from the proper average. Analyses were made to show these values and to indicate whether the warps were being sent from the slashers to the weave room with the necessary amount of moisture to insure good resistance to the tensional strains of the looms. After this information was obtained, the action of the slashers was carefully studied, and fifteen variable factors connected with their control were worked out as the causes of poor or good work according as they might be poorly or well controlled. As a final result of this work, the operation of the slashers has been practically removed from guesswork—almost to an exact art. The overseer is able to impose on the machines the exact schedule for each grade of warps, which he knows to be proper for uniform results. The guess work element has been removed because the size itself is boiled under strict control and a recording device gives a permanent record of every batch of size and shows whether it was properly boiled at the proper time and for how long. A size re-circulation insures a constant supply of uniform size to every slasher. At each slasher the size box, through which the yarns pass, is automatically regulated to a fixed temperature predetermined as best for the purpose. Each slasher runs at a fixed speed for a given grade of warps, the speed depending on the heaviness of the goods and certain other factors. For the control of the machines the operative has a speedometer which is graduated in terms of the styles of goods being run. If he is slashing a D warp, the machine is run with the indicator of the speedometer on the letter D, and so on. The beneficial results of this work are shown in the reduction of the fluctuations in the sizing of the warps to one-half their former magnitude. The maximum possible speed of the machines is also being obtained safely, due to the strict regulation. This results in faster production, accompanied by much improved uniformity in the product, and consequently the lowest possible production cost. To one familiar with the usual uncertainties of slashing, this work will be of especial interest and significance.

A study of the method of preparing the filling spinning frames for doffing showed that the average length of yarn left on the end of the bobbin to be pulled off by the battery girls in the weave room was sixty inches, the lengths varying from one to three yards. This great variation in lengths made it difficult to standardize the work of the battery girls as to the amount of yarn that they should pull off. A stop motion for the spinning frame was developed, resulting in a uniform length of about eighteen inches to be pulled off by the battery girls. This saved a great deal of the battery girls' time and also cut down the amount of waste yarn.

A rearrangement of many of the jobs along the lines of specialization is extremely advantageous to the management and to the operatives, resulting in increased earnings to the latter and lower machine costs to the former. A revolutionary change in the weave room is an excellent illustration showing that much can be done along these lines in the textile industry. The weavers were in the habit of doing work other than actual weaving. The average weaver's duties, in addition to running the looms, were to be on the watch for cut-marks, to remove the cloth roll at the cut-mark, to make pickouts and to aid the room-girl in mending smashes, to help the battery girls, and, in some cases, to make minor repairs to the looms. The loom-fixers' duties were to repair and adjust looms, and to put in new warps, removing the empty beam and lease, with the necessary trucking to and from the "spare floor." In the performance of these duties the loom-fixer went to the supply room for supplies, helped other fixers with big jobs, and made rounds of the looms of his section every day to estimate the number of new warps needed on the following day. There was a loom cleaner for every fixer because the looms were cleaned thoroughly before a new warp was put in. A careful analysis of