titative method of measuring quality is brought out in this subject for the purpose of making definite comparisons between different articles and different operators. The theory of the quality-rating plan as now set up in our plant is explained in detail in these classes.

In addition to the subjects mentioned, we also give the students descriptive matter on other subjects pertaining to supervision for outside reading.

After the classroom work on each subject is completed, a short examination is given. The questions asked are in the nature of practical job problems which require the application of the principles brought out in the classroom work. These cannot be answered directly from the text material furnished but require some initiative and practical application of these principles to solve the problem. In order to obtain as many data as possible on the qualifications of these candidates for supervisory positions, we also give them a mental alertness test. This, together with the results of the examinations on the training work and the instructor's estimate of the individual's supervisory qualifications as observed in the classroom, comprises a final overall rating.

As a result of our experience in carrying on this training work over a period of three years, we have found only 60 per cent of the candidates eligible for minor supervisory positions. It is interesting to note right here that had each department head been requested to select two men for immediate appointment as supervisors, without training, he would, of course, have made the same selection as he did for the pre-supervisory training course. Proceeding on his recommendation and appointing these men would then have resulted in 40 per cent of our new supervisors proving incompetent. This would have ended in a sad experience both for ourselves and the men.

Those men who satisfactorily complete the training course form a reservoir from which the first line of inspection supervisory positions are filled as they become available, either through expansion of the organization or promotion of the men filling these positions. Not only have these men gone a long way in proving themselves capable of filling these positions but now have a good working knowledge of what is to be expected from them and the way in which they should go about accomplishing the results.

The time expended on the men who fail to meet the qualifications for promotion to supervisory positions is not entirely lost in that we often find through this training that a man is exceptionally outstanding in some one of these subjects and can be used as a specialist on that phase of the work. This may often prove to be a promotion in a lesser degree because this special work will undoubtedly be considered of a higher order than the routine work he has been employed on and would therefore make him eligible for a higher rate of pay. Other training courses are provided for the men in the supervisory ranks to fit them better to administer their positions.

Of course, the satisfactory completion of the training course by no means completely forecasts the future of these men as supervisors. It does, however, tell us that they have the ability to learn, mental alertness, adaptability, judgment, and originality to cope with the problems of a minor supervisory position.

There is another valuable by-product of this training work. Potential supervisors and supervisors who receive this training are far more able to carry procedures and policies of the management down the line to the individual worker. The result of this is a better understanding of, and less resistance to, the company policies because there is a better appreciation of the reasons for them. A feeling is created within the lower level of supervision that they are a part of the management of the industry.

Now for a few examples showing how that part of the training in co-operation may be put to use. Let us suppose that the inspection supervisor finds a certain defective item occurring to an abnormal degree in the product which has, at first glance, all the appearances of poor workmanship. His first step is to instruct his inspectors to make special checks for this item and cull out the defective parts from the product. The inspector might simply reject these defects and let the operating foreman handle the situation as best he could. This is, in my opinion, absolutely the wrong procedure. A better plan would be for him first to take a few samples of the defective work and analyze them, in an endeavor to determine in his own mind just what is at the bottom of the trouble. After completing this analysis, he should visit the foreman of the department making the product and explain

the situation to him as he sees it. If it is a matter of poor workmanship, he must convince the foreman of this and offer in a tactful manner his assistance in correcting it. He can do this in several ways: by making a daily report to the foreman on the particular item in question or by offering to place at a strategic point in the Operating Department an inspector who, by making special checks, tells the foreman the progress being made by his operators in overcoming the difficulty. On the other hand, the discussion between the foreman and the inspector may reveal that the inspector erred in his analysis and that the trouble was not due to poor workmanship but caused by a tool that had developed a new kind of trouble or by raw material of the wrong quality. The inspector helps to eliminate this difficulty by getting in touch with the tool or raw-material inspectors who are, as a matter of fact, members of his organization. He should also see that they take immediate steps to help the operating foreman straighten out his troubles. In those cases where the design of the tools, machinery or equipment appears to be at the base of the difficulty, the inspectors should take the initiative in presenting the shop's troubles to the engineers and following through their correction.

Again, through a complaint from the sales organization on a certain item of quality in the product, the inspector may feel it necessary to raise the standard of workmanship on one of the operations. The inspector, however, may be demanding a quality of workmanship which is beyond the possibility of attainment. By a discussion between the inspector and foreman of the operations involved a mutual agreement is reached as to just what degree of workmanship can be expected from these operations. When this has been arrived at through mutual agreement the foreman will be more conscious of his responsibility to maintain this standard. The inspector, at the same time, will be satisfied that he is receiving the best quality possible under the circumstances.

Knowing what can be expected from the operating people, the inspector may still not be satisfied that the quality level will be sufficiently high. But he is then in the best position to present the case to the technical organization for any changes in design of tools or machinery that may be necessary to raise the quality level to the desired standard.

How can the inspection supervisor present to the operating foreman a picture of the degree to which his operators are building quality into the product, and the overall results of the operating organization? In the past, the practice has been to give this picture to the operating foreman in terms of the percentage of defective product. This does not distinguish between the seriousness of the defects found and a minor item of appearance. The latter may carry as much weight as a major trouble of operation. For example, an operator may have produced 10 per cent of work defective in a minor respect. This might actually be less serious than the production by a second operator of 1 per cent of work defective in a major respect. To overcome the inequality of this method, we have developed a weighted quality-rating scheme.

The quality rating for each product is established by the following means: each kind of defect that might be present in an article is assigned one of four demerit values depending upon the seriousness of the defect. Class A defects, which would surely cause operating failures and which cannot be readily corrected, are assigned one hundred demerits. Class B defects, which will probably cause an operating failure in service but of a less serious nature than a Class A failure, are given a sixty demerit value. Class C major defects of finish and adjustment which are readily corrected are assigned twenty-five demerits. Class D minor defects of appearance or finish are assigned five demerits.

The number of each of these defects in a unit multiplied by the demerit value for that defect (namely, one hundred, sixty, twenty-five or five, as the case may be), when added represents the total number of demerits charged against the unit. The number of these units is used as a means of evaluating the quality effort required of the operator. The ratio then between the number of demerits and the number of units inspected or, in other words, the "demerits per unit" measures the performance of the operators.

The quality level which must be present in a product ready to ship is called the base period. This is the average number of demerits per unit which, in our experience, represents satisfactory quality. Comparison of the demerits per unit with this base period for any product then gives us a relative picture of the operator's performance.

Since we now have all the different kinds of