defects in a similar product reduced to a common unit on some kinds of work, it is possible to evaluate an individual operator's quality performance in the form of a weekly or monthly rate. These rates are furnished to the operating foreman, who posts them in the order of their relative performance, using the base period as a bench mark. Each operator, as well as the foreman, knows how he compares with the others and with the standard expected. The foreman is then able to discuss each man's quality problems with him and to aid him to better his performance in the light of the information received.

We believe we have thus accomplished the two major objectives we have set up for the inspection organization. The first of these has been accomplished by furnishing the operating foreman with a gage by which he can measure the quality performance of his operators and apply corrective measures where the need is greatest. The detailed inspection from which the data are obtained for rating the operators erects a barrier that prevents any poor workmanship being passed on to the customer while the corrective measures are being applied.

What are the economic phases of handling inspection in this manner? We are introducing considerable additional work for the inspector, such as keeping a number of records that are not necessary if his only purpose is to screen out defective work.

At first these additional inspection duties will increase the cost until, through the efforts of the operating foreman, quality conditions begin to improve. At that time, the inspection effort required to prevent poor quality from passing through inspection is reduced. This in turn reduces the cost of inspection. This process may continue to a point where only sampling inspection is necessary to satisfy the inspector that quality is present. An outstanding example of this is the inspection of details and partial assemblies of goods that are in process.

In our inspection of these parts, we have been able to apply a statistical sampling plan where the gage indicates that in general, a satisfactory product is being made through the operating foreman's training work. This plan can also be applied where machine operations are of such a nature as to assure a fixed quality level under normal conditions. In brief, this plan operates in the following way.

We establish a "breaking point," or that point where the per cent of defects is such that the cost of making repairs or weeding out the defects in a succeeding operating department using these parts is less than the cost of a detailed inspection. This allowable percentage of defects is known as the "out-going quality limit," or the maximum average per cent of defects that can be economically passed on to another operating department in the organization.

A process average, or the average per cent of defects received by the inspection department under normal conditions, is determined. This is obtained from the history of a detailed inspection of the product. From our process average and our out-going quality limit, we then are able to select our sampling plan.

Reference tables which show the sample size and acceptable number of defects for various lot sizes are prepared for the use of the inspectors. By using these tables as a guide, the inspector either accepts or rejects the lot that has been sampled by him.

These tables are based on laws of probability and chance and have been so prepared that under the worst conditions we will pass a product with a percentage of defects greater than the acceptable out-going quality level only fifteen out of one hundred times. This risk has been arrived at with the consent of our operating departments, who use these parts, as satisfactory from a manufacturing standpoint. This acceptance risk, you understand, could have been set at any point desired by the manufacturer.

By this and other similar means we are able to take advantage of the improvement in quality made by the operating foreman as he applies the measuring stick received from the inspectors in the form of an individual quality rating. This results in a decreased inspection cost.

In our inspection work we have come to the conclusion that, with the proper training for co-operation between the inspector and the men producing the product, accompanied by an economical screening of the product, we are best applying the principle of "less inspection and more control." This, in our opinion, is a most desirable aim for inspection work.

An Outline of Organization for Quality Control

By A. G. Ashcroft
Industrial Engineer, Mohawk Carpet Mills, Inc., Amsterdam, N. Y.

WHILE there has been during the past few years a growing interest in management with relation to control of quality of product, the idea of quality control is not new in industry. It goes back to the pride of craftsmanship of the original artisan. When the trades first graduated from the home to the shop, inspection of product in some form was always present. The importance of inspection, however, gradually grew, until in Taylor's time it assumed enough importance as a manufacturing function to separate it from the manufacturing organization and make it a separate department. The importance of the control of quality has more recently grown to such a point that it has assumed importance as a major part of manufacturing, with inspection as one of its functions, so that the three elements—quantity, quality and cost—are assuming equal importance in industrial management.

That there has been a definite trend in this direction there can be little doubt. This has been pointed out by Mr. Henry S. Dennison, former president of the Society, in a paper on developments in management, in which he states that: "The progress of engineering toward objectified control of quality is one of the significant trends of our technical progress."

It is difficult, of course, for us to see in the bricks we are using, the finished building. Quality is an inclusive work. In industry it is used to mean the manufacture or fabrication of the product up to prescribed and recorded manufacturing standards of uniformity as to appearance or performance. For instance, in rugs there is a definite quality or standard for the manufacture of a $20.00 axminster rug, and a definite standard of quality for the manufacture of a $30.00 axminster rug, although the materials or fabrication of these two rugs are entirely different, consistent with the difference in price. The quality comparison is not, therefore, between the fineness of these two rugs in comparison with each other, but between the prescribed uniform standards that have been set up for each of these two rugs and the actual product in the case of each.

What are the elements in managing for quality and how can these be controlled? The elements are the same principles of manufacture with which we are all familiar: (1) the setting of standards of uniformity and quality of materials, parts and product; (2) accomplishment of these standards; (3) continuous development of new and improved standards in anticipation and recognition of increased technical skill and machinery, consumer demand and competition, and the economies of manufacture.

I. General Administrative Duties.

1. Development of continuous co-operation of the whole body of employes toward the accomplishment of the standards and the production of a first-class product.

2. Reduction of losses caused by errors in manufacture through investigation and correction of underlying causes.

3. Development of favorable group thought through financial incentives, quality meetings, and publications such as *Quality News*.

II. Inspection Division Duties.

1. Constant inspection of goods in process at all points where failure to maintain standards would affect production or the final quality of product.

2. Constant inspection of final product on completion to insure shipment of only first-class goods.

3. Interpretation for the production groups of the standards and specifications of raw materials and parts.

4. Interpretation for the production groups of the standards of final product as evidenced from customer demand through claims, comparisons with competitors' products, and previous standards of performance.

5. Aid in the operation of new standards and in the extra control necessary when changes in specifications are made and new products placed in production.