as the mill machinery is concerned, but some persons seem to think that the machinist having a hammer, a cold chisel, and a file, with possibly an old lathe, is provided with all the tools required to do the repairs in the mill. If the machine shop and the mill require so much care to keep the working machinery up to a high standard of efficiency, the same principle applies to the mill repair shop. Drills, resumers and measuring instruments can now be purchased at such reasonable figures, that no shop can afford to be without a supply sufficient to meet all requirements. For quick and accurate measurements the micrometer caliper furnishes one of the best means. By its use, parts may be duplicated with an exactness that can be obtained in no other way.

The subject of reamers is worthy of a little attention. The day of the old solid reamer is gone by, except as a machine or roughing reamer. For finishing holes and keeping to uniform sizes, the adjustable blade reamer takes its place, and as this style of reamer may be purchased at only a slight advance in cost over that of the solid ones, its use will be found to be a saving.

ART IN TEXTILE PRODUCTION.*

Director France spoke in part as follows:

"The importance of a careful training in the technical processes of the textile industry is beginning to be realized in this country, although the extent to which this is true is by no means commensurate with the immense interests at stake. As a nation we have spent many years in the development of ideas tending toward the improvement of our textile machinery. The aim has been more production, more yardage, more saving of labor; and this end has been attained. Up to the present time, thanks to the development of our mechanical appliances, we have been enabled to meet foreign competition in many lines of production, but it is needless to deny, or to attempt to persuade ourselves to the contrary—the day of reckoning has arrived. We are on the threshold of the closest kind of competition with men who have the advantage of us in many ways and in many lines of textiles; the foreigner has all our economic appliances, and he has also the skilled craftsmen trained in the artistic branches which we have systematically neglected. He has watched our wonderful mechanical progress, and he has set himself to surpass us on other and perhaps more profitable lines. After a little careful study it was apparent that quality rather than quantity was, after all, the chief factor in the problem, and to attain success in this direction it was recognized as indispensable that not only the working classes, but the manufacturers as well, must be educated to higher and finer standards of taste.

Europe recognized long ago the supreme importance of educating its people in the technical details of their vocations, and this has especially been true of textiles. Many schools have been established by different Governments for the diffusion of knowledge in relation to this important branch of manufacture, and the claim that Germany's supremacy in manufacturing is mainly due to her generous provision for systematic education of this kind, is heard on every hand, and is generally accepted. The lesson for American manufacturers is plain. If we expect to win our way to the highest kind of success in textile production we must build better in the years to come than we have built in the past. We should begin by insisting that provision should be made for industrial art and technical instruction in connection with the grammar school grades. It is idle to talk about what we have accomplished without this kind of education, and to compare ourselves with others who have it. The thing to think about is not what we are, or have been, or have done, without it, but what we would have been, and what we may accomplish, with this aid. Add to an adequate protective tariff, textile training schools, industrial, industrial art and technical schools, and we shall not only retain our own, the best market of the world, but we shall slowly perhaps, but surely, gain a stronger foothold for our goods in the world's markets. It is the nation which possesses the most skill which will win in the race. The country which expects or deserves to make fabrics which will find a ready sale in the markets of the world, must see that her citizens engaged in the manufacture of such goods, not only possess a knowledge of the minutest details of the various operations, but that they also have a training which will supply that refining influence of culture and taste which is essential to all high-class production.

The truth that needs to be brought home to those who are looking to technical education for the solution of the industrial problems which press the hardest upon us, is that culture, of the most thorough kind, is not to be dispensed with, but directed. It is, unfortunately, rather easy to believe that it can be dispensed with; that our boys need not go to college at all, because so many that have gone fail to make profitable use of the things they learned. If people draw such conclusions as this, they make a great mistake. The demand for culture of the most thorough kind was never so great as it is at this moment, and it was never demanded so persistently as it is by the industrial classes in whose interest this great movement for technical education is going on. It is not less cultivation, then, but more, that we are after, and the business of the technical school is not to withhold it, but to increase and multiply, under proper direction, the forces that make for culture and refinement. The need of this manifests itself in various ways. On the side of science, the lessons are obvious and do not need to be insisted upon here. However definite and specific the aim of the future manufacturer may be, it is a truism that his success will depend upon the amount of knowledge which he is enabled to carry from the school into his business.

The industries of the world are rapidly being transformed by the revolutions wrought by science and the development of scientific processes. The old methods of doing things are rapidly giving place to new ones, which the laboratory of the chemist and of the mechanician have developed, and the road to success in any branch of econo-

* Abstract of a paper read before the New England Cotton Manufacturers Association, by E. W. France, Director of the Philadelphia Textile Schools.