found. Polka dots are most in demand in this line. Printed hose, that no one wanted or would look at some weeks ago, is now in demand. Embroidered goods have gone well all year, and are going now. Open work, lace-like in appearance, is much favored. Richelieus, Rembrandts and ribbed goods have gone well too. In some lines supply is not nearly up to demand Staples of all kinds went fairly well at fair prices. Of course, you cannot have forgotten the reductions recorded in prices in the last two or three years, they are astonishingly low The process of peeling off profits resembles very much that of being skinned alive. Manufacturers must writhe A meaner system than that so successfully employed by some parties for forcing down prices was never employed Commendable efforts are being made by the biggest and best manufacturers to find a way to wipe out this evil.

THE TRANSMISSION OF POWER FOR WOOLEN MILLS BY ELECTRICITY.*

BY C. J. H. WOODBURY, BOSTON, MASS.

A conservative manufacturer naturally looks to precedents, for experimentation in machinery is an expensive process, uncertain in results, which if successful are apt to make him a philanthropist in spite of himself, and this raises the general average only to leave conditions of competition relatively as before. In calling your attention to electric transmission of power for woolen mills there are but few precedents in this line of manufacture; yet this method of distribution has been so widely installed in other textile industries, and throughout such a miscellaneous range, that the mechanical portions of the problem are now well established, and a purchaser can as definitely contract, from any one of numerous manufacturers, as to price, time of delivery, and guarantees for an electric transmission, as for the steam engines, boilers or water wheels which operate them. It is but natural that the woolen industry as a whole should not have given as much attention to questions of mill organization, outside of the design of productive machinery, as some other textile industries, on account of the relative insignificance of these elements to the whole value of the product. The machinery tributary to the fabrication of the goods lies midway between an expensive and variable raw material and a finished product in which design forms an essential factor An appreciated pattern covers a multitude of sins of manufacture

The problem of power generation and distribution is an essential factor in determining the design and operation of manufacturing property. Passing by earlier mills operated by horse power, which were not extensive enough to be considered organizations, the first mills were driven by undershot wheels, and this required the placing of the mill at the side of the stream, with the water wheel at the end of the mill. Further development of the breast wheel, which was placed at the face of the dam, in turn required the building to span the water course, and with the overshot wheel of later date, there was an opportunity for the farther separation of the water wheel from juxtaposition with the dam, and mill designs became more free in consequence. But these early utilizations of water power were necessarily made on rapid streams, which generally flowed through close valleys, in which the mill building, on the narrow space between the canal and the river below the dam, was necessarily narrow, and the floor area obtained by a building of many stories, which was most firmly trussed at the top, thus originating what was known as the factory roof, with its unavailable spaces of no use in manufacturing, and which proved such a costly experience to underwriters, for when a fire reached those spaces the mill was generally "well sold." The turbine water wheel was necessary to permit the development of the modern mill, as the trunk supplying the water as a part of this system could increase the distance from the turbine wheel to the dam, and mill organization reached an important stage in its development. The introduction of the steam engine for driving textile mills rendered the design of the building still more free, as the mill could be increased beyond the natural capacity of the water power, and was not bound to a water power, but could be placed where freights, abundant labor, or other conditions were more advantageous. Yet the conditions of the transmission of power through the mill were exacting, although continued improvements were feasible, many of them being introduced as the result of experience with fires in power transmission, and it was this cause which developed the closed belt tower from which the power was communicated to the several stories along the shafting, rather than by means of belts.

The subject of this paper prevents further allusion to the other improvements in mill construction made possible by the progress in power transmission. Mills have been made broader, better lighted, more fully adapted to economical organization of machinery, with reduction in cost of supervision, but the whole has been an inorganic evolution of that complex organization which constitutes a textile establishment. The latest step in this development is the electrical transmission of power, which requires only space for the wires, and leaves the mill engineers perfectly free to design the mill for its manufacturing organization as a producer of goods, without reference to provision for the communication of power to the machine, knowing that he is equally free to have a single motor in each room or to divide the machines into groups, or even attaching motors to each of the individual machines; in the latter case not merely driving by belt, but motors may be attached in such a way as to form an integral part of the tool. The uniformity of speed, without the losses due to the creeping of belts, by change of length in their passage around pulleys, in their alteration from a tense to a relaxed condition. In its independence of position a new mill may be placed away from the source of power, but for existing establishments the present power may be increased by using distant water powers. There is a well-known water power in the United States which has been on sale for many years. The dam and canal were built, and time and again enterprising men attempted the exploitation of the privilege, but when the site was critically examined by engineers it was found that the banks of the river were of such nature that it would be expensive, and perhaps, from the imminency of land slides, impracticable to place mills below the canal. Within a few years this water power has been developed, the banks being ample to suport a light building for the water wheels, and generators which furnish electricity to operate mills in a neighboring city.

The purpose of this paper is to present to your consideration the proper place of electric apparatus in the transmission of power from the steam engine or water wheel to other parts of the establishment, in comparison with belts or ropes, in the same spirit as considering the usefulness between belt and rope driving, or one engine as a unit of power, or many similar engines, notwithstanding elements of mutual advantage, yet the problem of power distribution in each plant is, within certain limits, a study to be worked out by itself, yet I wish to call your attention to some of the principles involved in the electric transmission of power without going into technicalities, which are live issues only to those identified in the business Sometimes the questions are presented in a manner comparable to the remark of the Oxford Oriental scholar who declared that everybody knew a little Arabic. The motor in its first inception, or I might say accident, was a reversed dynamo, that is, a

*From a paper read at the thirty fourth annual meeting of the National Association of Wool Manufacturers, at Boston, January 11, 1899.