ELECTRIC POWER IN AMERICAN COTTON MILLS

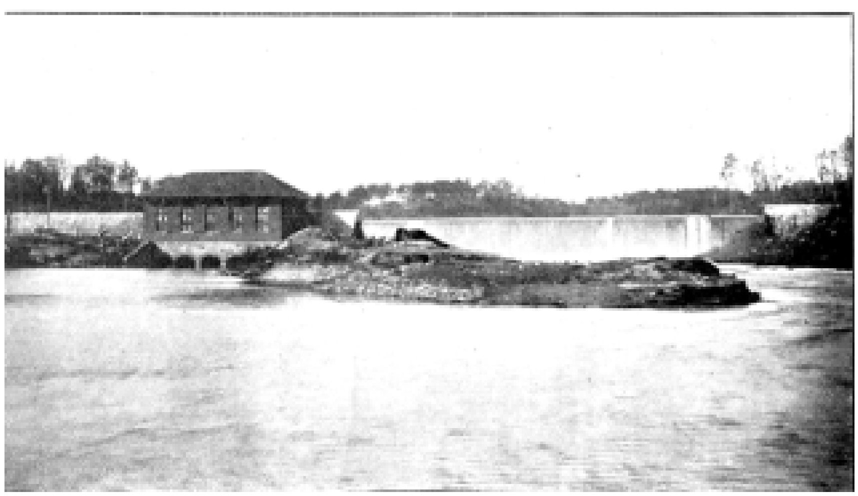
By W. B. Smith Whaley

COTTON spinning in the South of the United States had its origin in either North or South Carolina. In the early thirties cotton spinning machinery was installed either at Lincolnton, N. C., or at Batesville, S. C., both places having meritorious claims as the pioneer location of the industry. These early mills were located on small streams with less than fifty horse-power, with the overshot or undershot wheel customary in those days, made by the aid of local millwrights and blacksmiths, and were of a crude pattern and low efficiency.

Examples of the intermediate mills are not easily obtained. The machinery was, in many instances, imported from England, and could be had only at large expense. The Graniteville Manufacturing Company was organised in 1856, and erected a factory which represents the oldest existing type of mill in the South, equalling any mill of its day in New England. The mills which followed the one at Graniteville were located on water powers, then considered the only available means of operating factories, and afford little of interest or instruction.

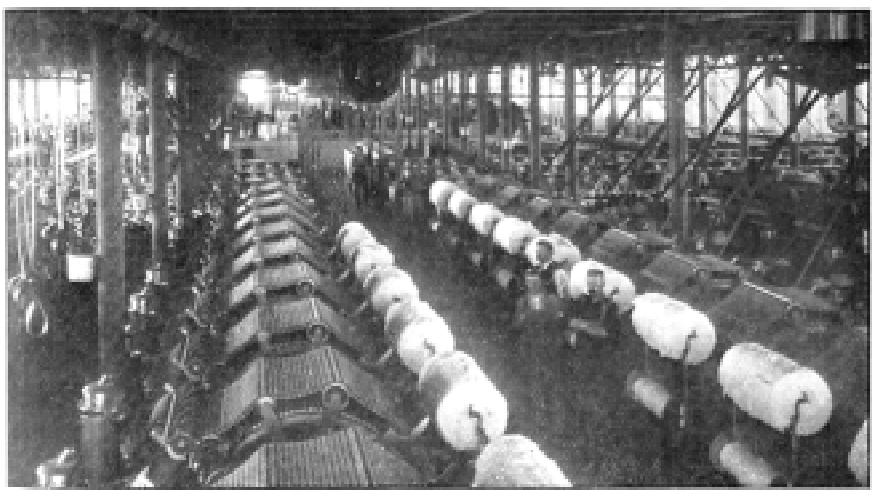
Steam for operating cotton factories was utilised as early as the sixties. The building now used as the almshouse in the city of Charleston, S. C., was constructed and equipped as a cotton mill, but was not a success, its failure being attributed to its steam power. The factory was dismantled and the machinery sold to a company in Georgia, to which State it was moved and where it operated satisfactorily in a water-driven mill.

The present substantial growth and expansion of the American cotton mill industry in the South began about 1880. Large manufacturing centres were established in the Piedmont district of South Carolina, followed by the development at Augusta and Columbus, in Georgia, and other prominent water power points. The larger portion of the mills were de-



THE HYDRAULIC PLANT OF THE PELZER MILL

A WATER-POWER ELECTRIC COTTON MILL AT PELZER, SOUTH CAROLINA



A VIEW OF THE CARDING ROOM

signed by expert engineers of New England, and equipped with imported machinery of British make. The success of these institutions led to the establishment of many others, which placed water power in great demand, as that was still considered the best power for cotton factories. The majority of the stock in these mills was owned in the South.

The number of mills steadily increased, the returns were most satisfactory, and the readily accumulated surplus was converted into more spindles and looms. The type of mill was of the standard 8-foot bay and low-story construction of the period, found North and South, built of brick and roofed with tin. In many instances second-hand machinery was brought from Northern mills and used to good advantage, owing to the cheap labour, cheap living, and long hours prevailing. The class

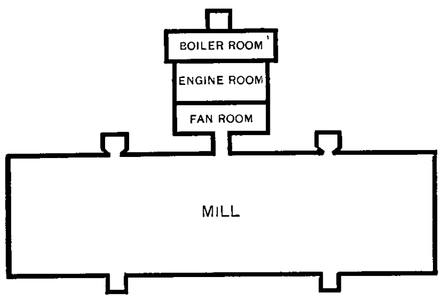


FIG. I.—OLYMPIA MILLS

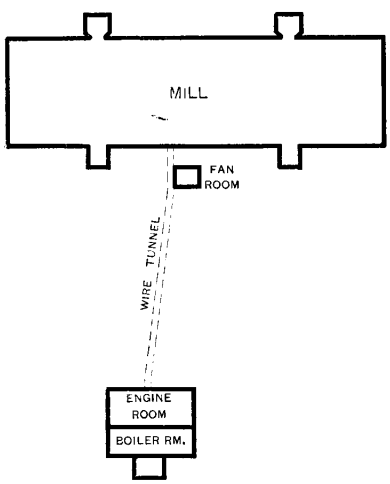


FIG 2.—THE BUFFALO MILLS

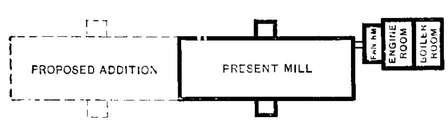


FIG. 3.—THE DE KALB MILLS

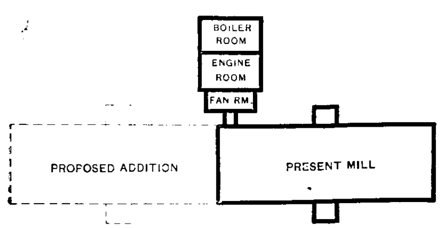


FIG. 4.—THE INMAN MILLS

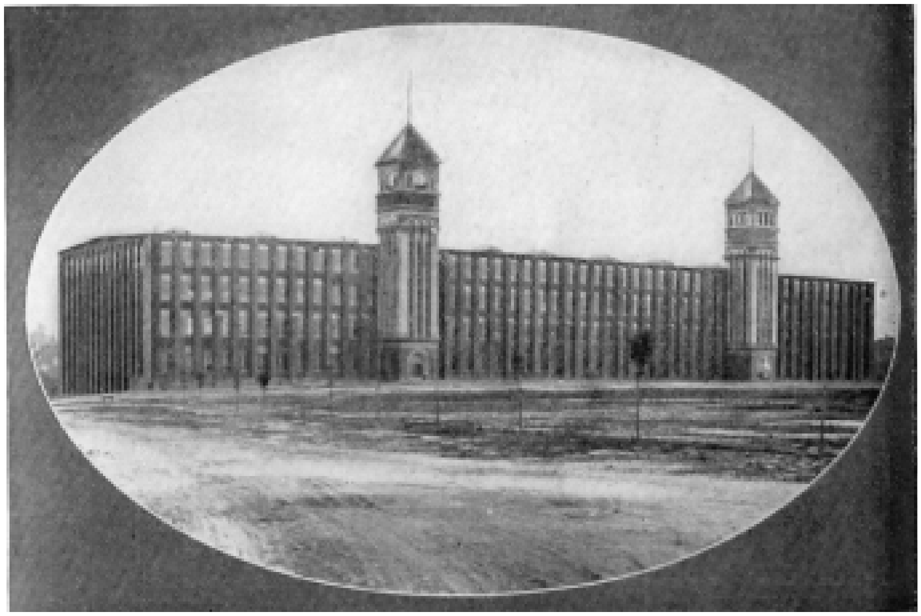
of goods manufactured was coarse sheeting for the export trade, as well as for the local country trade.

From 1890 to the present time the increase of the industry throughout the South has been phenomenal. The buildings are modern, and the very best British and American machinery has been installed in mills holding as large an equipment as thirty and forty thousand spindles, whereas formerly a ten-thousand spindle mill was considered a very large enterprise. The adoption of improved methods of manufacturing was rapid, until at present there is no section of the world with better operatives or finer equipped plants.

Steam almost entirely succeeded water as a source of power; ropes and belts supplanted cogs and gearings, and have, in turn, been superseded by electricity. This brings us to the present stage of the industry in the South, which is now converting cotton into a variety of goods on as large a scale as any other portion of the United States, not excepting New England, which has long led in cotton manufacturing.

To the engineer, the chief interest in these Southern cotton mills is afforded by the fact that pre-eminently the South is the section in which the electric drive is being used to a larger extent than any other. This is due chiefly to the fact that the proportion of new mills is larger there than elsewhere, and each builder wishes to erect a highly modern plant, while an established mill is slow to change its source of power. The electric drive is certain to effect important changes in mill construction, and has already done so very largely. It will, therefore, be profitable to consider the Southern cotton mills which illustrate the advantages claimed for electricity in cotton mills.

In the early development the employment of electricity was spasmodic and mainly confined to the conveying of power to points difficult of access, for which it was found better adapted than any other method of transmitting power, despite the increased cost of installing the machinery. From this small beginning electric power has assumed, as we



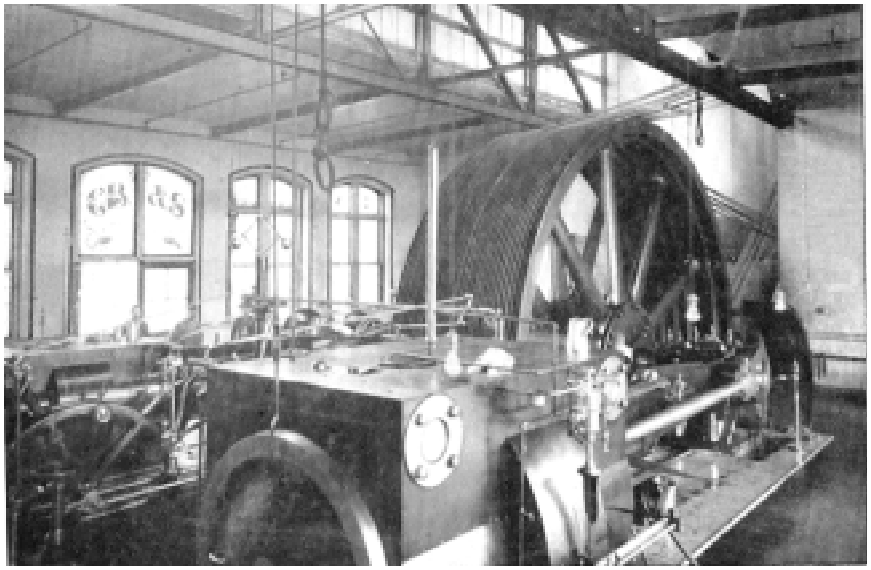
THE OLYMPIA MILLS, COLUMBIA, S. C. THE LARGEST AND LATEST TYPE OF ELECTRICALLY DRIVEN COTTON MILL IN THE UNITED STATES

will see, large proportions, and it is safe to say that it has established itself so permanently in cotton manufacturing that in the future its utilisation will be the rule and not the exception.

The Ponema Mills, at Taftville, Conn., were among the first to employ electricity for the convenient transmission of power, being enabled by it to carry power from one of their mills, which had a surplus, to another which required a larger amount of power than the plant installed in it could develop. Both plants used water power. Following on the heels of this progressive experiment came the notable installation, at the Columbia Duck Mills, at Columbia, S. C., in 1894, of the electric drive. The motive there was not that it was more economical than the usual methods of transmission then in use, but the peculiar conditions existing, for the mill had to be located on the inner bank of the canal furnishing the power, instead of between the canal and the river, where the power plant was located. It was in this case found more convenient to install the electric drive than to convey the power by ropes across the canal in such a fashion as to permit the passage of boats. Consequently, the electric method of driving the mill was accepted, and this led to the application of the electric drive in its true sense as a method of operating the factory, rather than as an adjunct or side issue to supplement other means of operating.

The problems were carefully worked out, and the power plant has been completely successful. The questions there presented were carefully investigated by

FIG 5.—THE SENECA MILLS



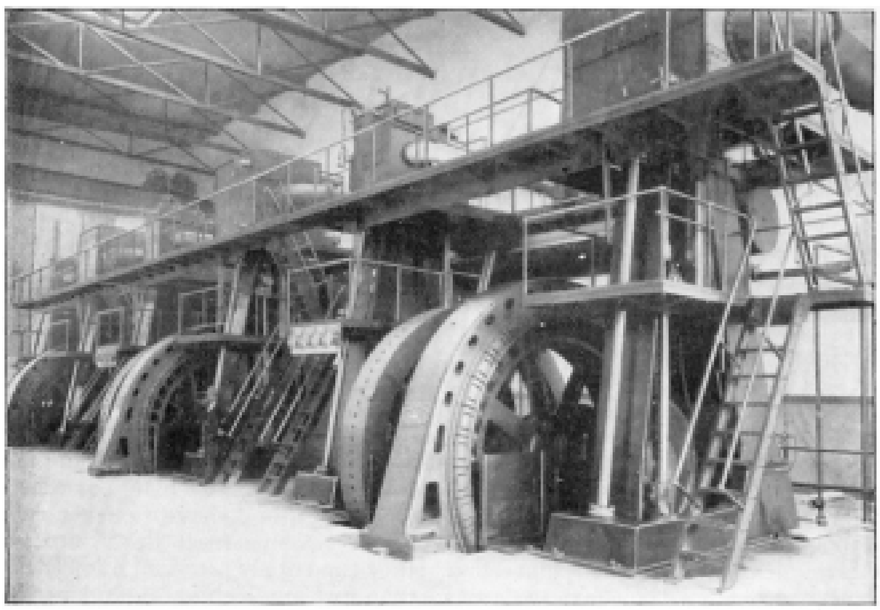
A COTTON MILL ENGINE ROOM OF THE OLD TYPE, WITH ROPE DRIVE

all those interested in textile factories, with the result that, from the valuable data obtained, a series of evolutions followed that have culminated to-day in the economical application of electrical power for textile purposes. And there are installed and are being installed no less than twenty plants of over 40,000 horse-power, all driven by electricity.

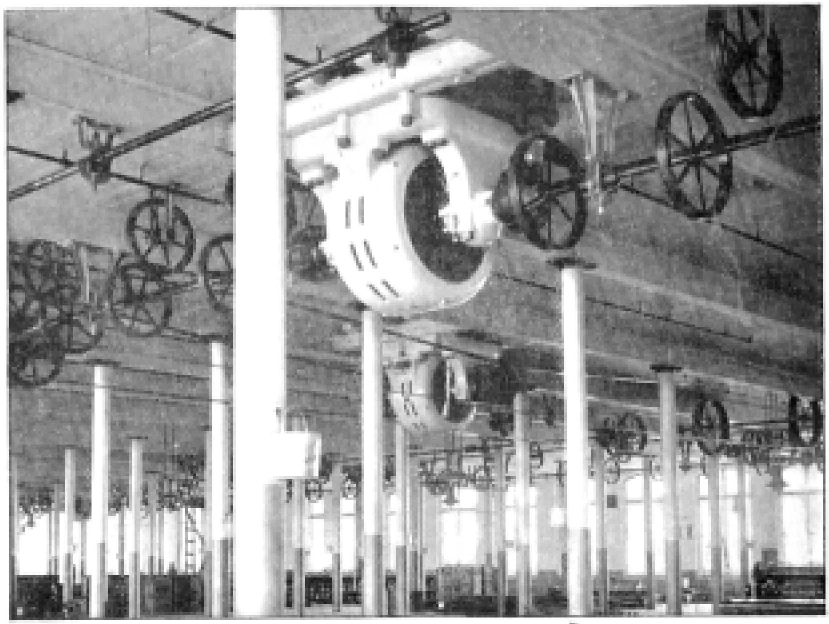
The first mills adopting this method of transmitting the power from the prime mover to the manipulation of the mill considered it feasible only where water mills were established, and on account of the fact that the location of the mill itself could be more conveniently arranged where it was not incumbent upon the engineers to place it at the water power. These views have been gradually changed through the improvements that have sprung up from the vast amount of information obtained from the pioneer plants, so that it became practical and advisable, from the standpoint of first cost, as well as manipulation, to apply the generator to the steam-engine also, and operate the mill electrically instead of by means of ropes or belts. With this latter phase of the development the writer has had the privilege of being peculiarly and largely identified.

The advantages presenting themselves were the following:—1, Less costly and more conveniently arranged buildings; 2, immunity from interruptions due to the necessity of shutting down the whole plant on account of any section being out of order; 3, more economical steam plants, both in first cost and in operation; 4, a very large saving in shafting and belting; and 5, the absolute unimportance of the relative position of the power plant and the mill. Starting with this last proposition are shown Figs. 1 to 5, illustrating several steam-electric-driven mills actually constructed and in operation, and embodying various plans for locating the power plant. In each case the locations were determined by the most economical position of power plant, to enable it to obtain water for steam and condensing purposes, and of the mill for the most convenient situation for the railways and to find inexpensive foundations. In Fig. 1, representing the Olympia Cotton Mills, at Columbia, S. C., there are installed 6000 horse-power in three units, giving the advantage of not only much lighter machinery in the power plant, but a far more flexible plant, on account of the rare probability of the three units being out of repair at the same time. Fig. 2 illustrates the Buffalo Cotton Mills, at Union, S. C., where the mill is situated practically at the top of the hill and the power plant 300 feet in front, at the foot of the hill, to gain access to water for steam purposes and convenient railroad facilities. Fig. 3 shows the De Kalb Cotton Mills, at Camden S. C., with the power plant at the end of the mill instead of in the rear, for the reasons last stated, and also to permit an enlargement, with no further addition to the power plant, except the installation of the necessary units of engines, generators, and boilers. Figs. 4 and 5 are, respectively, the Inman and Seneca mills, at Inman and Seneca, S. C., which illustrate the same advantages. These show the extreme adaptability of the electric drive more forcibly than any other method. The illustration opposite shows the method previously followed in driving a mill by means of ropes, or belts, in a rope-way, and which made it necessary for the engines to be located in the rear of the mills with heavy transverse walls for the rope-way. This plan permitted no flexibility, and necessitated the shutting down of the whole plant in case of any accident to a part.

The convenience of distributing power in any direction by means of electric wires must appeal to those interested in the transmission of power, to say nothing of the absence in the sub-divisions of the mill itself of friction clutches and other devices for disconnecting continuous lines of shafting. The absence of weight in transmission, due to belts, or ropes, heavy receiving pulleys, large shafting, expensive head gearing, etc., is an advantage, as well as the decreased first cost, and the subsequent decreased power consumption due to the lessening of friction. The absence of dirt, dust, lint, and other flyings that are continually brought to the bearings of the engines and which often cause heating; the assurance that incompetent employees cannot put undue strains on the transmitting shafts by injudicious



THE NEW TYPE, WITH ELECTRIC GENERATORS



THE ELECTRIC MOTORS ARE OVERHEAD, OCCUPYING NO FLOOR SPACE

tightening of belts or ropes; and the entire absence of hygrometry on ropes and belts, which produce similar results, are factors of considerable saving in power. The transmitting wires have no moving weight, and consequently entail none of these detriments. There is no change in them except electric losses, and no necessity for belt way, belt guards, or safety devices.

The motors, which are placed overhead, as shown above, do not occupy any floor space, are absolutely out of reach, afford no danger to human life, and are so proportioned as to give, according to the number installed, the greatest flexibility to the plant as a whole. No special machinery is installed for lighting the plant, as the current is taken from the generator producing the power. Temporary power for any purpose, in any portion of the plant, is easily supplied by a portable motor, which is readily tapped on any power circuit in convenient reach. These and many other advantages, from a mechanical standpoint, have been demonstrated by actual experience.

There is a saving in the friction alone of 20 per cent. The producing capacity of the machinery operated is, in actual practice, increased about 4 per cent., due to the steadiness of this method of driving over the usual method of ropes and belts, and the more uniform speed obtained throughout the plant. The enormous flexibility and economic problems solved by the installation of these electric-driven cotton mills are felt even outside of the mill itself. The plants are readily available for furnishing power to others within reach to the extent of its surplus, and may produce a considerable revenue from this source; and they can supply power at a lower figure than that at which isolated plants could generate their own power.

In the city of Columbia, S. C., the Olympia power plant not only drives the Olympia Cotton Mills, the Granby Cotton Mills, and the Capital City Mills, but also the street railway, and furnishes the light and power company current for cars, arc lights and incandescent lights from the same source, and more economically than the individual companies could maintain separate power plants, while the Olympia Mills sell the current at a substantial profit.

South Carolina will shortly have operating no less than fifteen of these electrically-driven cotton mills, which will gradually affect the economic conditions in the section surrounding each of them, by offering conveniences more cheaply than these communities could possibly hope to get them by independent plants.

It appears possible thus in the near future to operate a line of electric railroad, with mills and intermediate power stations, from the mountains to the sea, and at less cost than by the establishment of plants for the purposes of the roads alone.

The direct electric drive is no longer an experiment, and there is no more exacting work than textile factories, on account of the demand at all times for the maximum of power.