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## *A Chronicle of Textile Machinery*

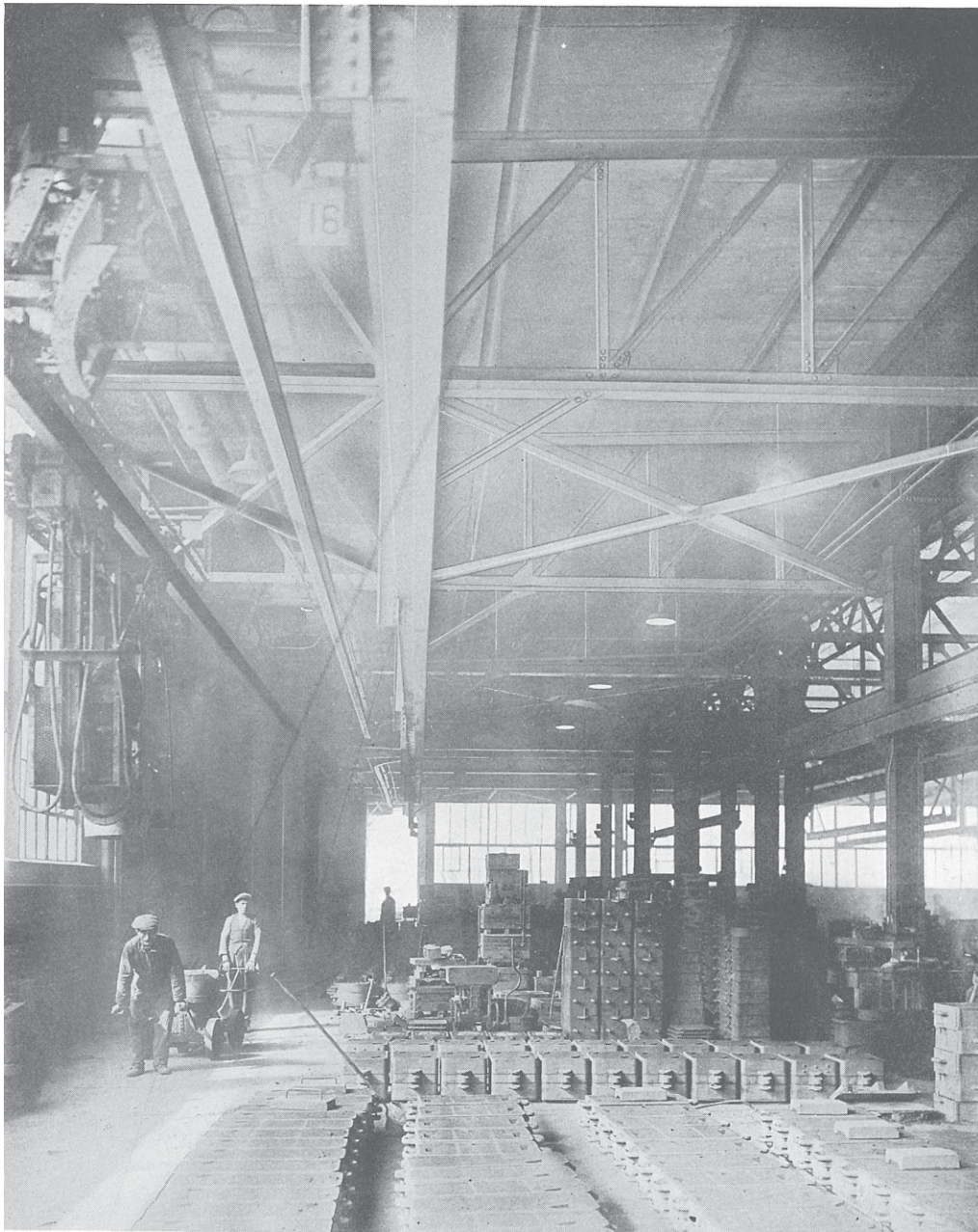
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In 1885, the Nashua and Jackson Mills of Nashua tried a new type of English Revolving Flat Cards which proved so satisfactory that the Amoskeag Manufacturing Company, of Manchester, ordered a number of these machines for their new Jefferson Mill. The Directors of the Pettee Works were shrewd enough to realize that this type of Card was the coming thing, and decided to be ready to meet the new demand. Accordingly, they sent representatives abroad who after an investigation of the different patterns, reported in favor of the flexible bend type, which the Company thereupon decided to adopt. This change was introduced by the new management in face of the misgivings of more conservative opinion, and indeed it demanded courage as well as foresight, for old tools had to be scrapped, and expensive new machinery installed; but time has justified the decision, and the policy which dictated it is still characteristic of the Saco-Lowell Shops. The first cards of the new type had cylinders 50 inches in diameter and 41 inches wide, with 84 revolving flats. They were delivered to the Jackson Company of Nashua at about the close of the year 1887, and it is interesting to note that the very first one of these cards, after having been run about thirty-three years by the Jackson Company, can now be seen in fairly good condition in the Experimental Room at Newton.

Previous to 1890, the Shop had put out a variety of machinery, including Cards, Drawing Frames, Railway Heads, Speeders, Roving Frames, and Looms. But the growth of the success of the revolving flat card business now led to concentration on the building of cards, drawing frames, and railway heads, in the development of which the ingenuity of Mr. L. W. Penney has played no small part during his active career of fifty years with the Company.

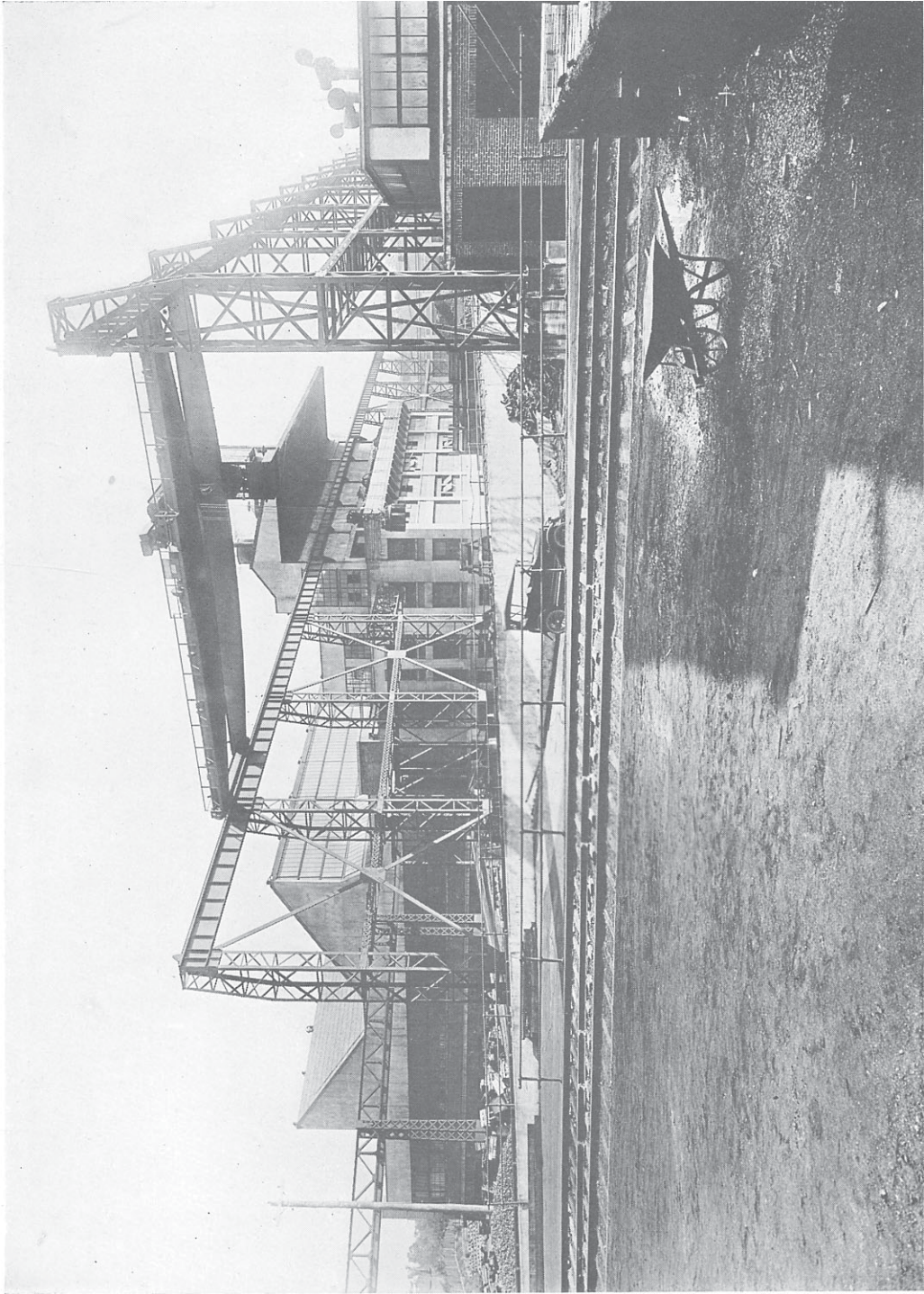
In 1893, Charles Mills began his twenty years of service as superintendent of the Shops, and under his administration marked physical changes were beginning to take place in the plant. The old wooden foundry was replaced by a new brick building with a capacity for melting about fifty tons of iron ore per day, and in 1895, the main building was supplanted by a new brick structure three stories high, covering an area of four hundred feet by seventy-five feet, and equipped with every modern appliance.

The Company continued to follow the progress of new inventions with alertness and intelligence, and to anticipate the rest of the manufacturing world in adopting those which showed promise. In accordance with this policy, about 1895 it investigated molding by machinery. This idea, which was then a novelty, consisted of applying foundry patterns to plates and drawing the plates from the sand by machinery in place of performing the operation by hand. After considerable experimentation, the new method was adopted, and gradually applied to nearly all the patterns. Thus another record was entered for the



INTERIOR OF FOUNDRY AT NEWTON, 1923  
Showing Monorail Car and Hand Truck Transporting Molten Metal



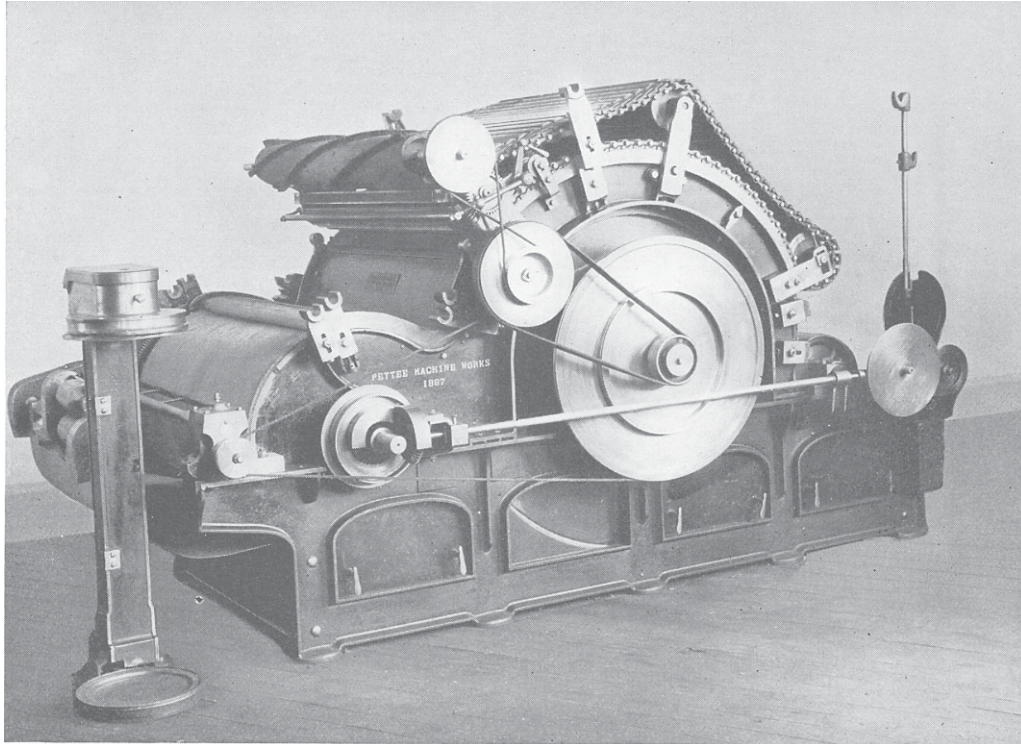


THE ELECTRIC CRANE AT THE FOUNDRY, NEWTON SHOP

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## *The Newton Shop*

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FIRST REVOLVING TOP FLAT CARD BUILT IN AMERICA, 1887

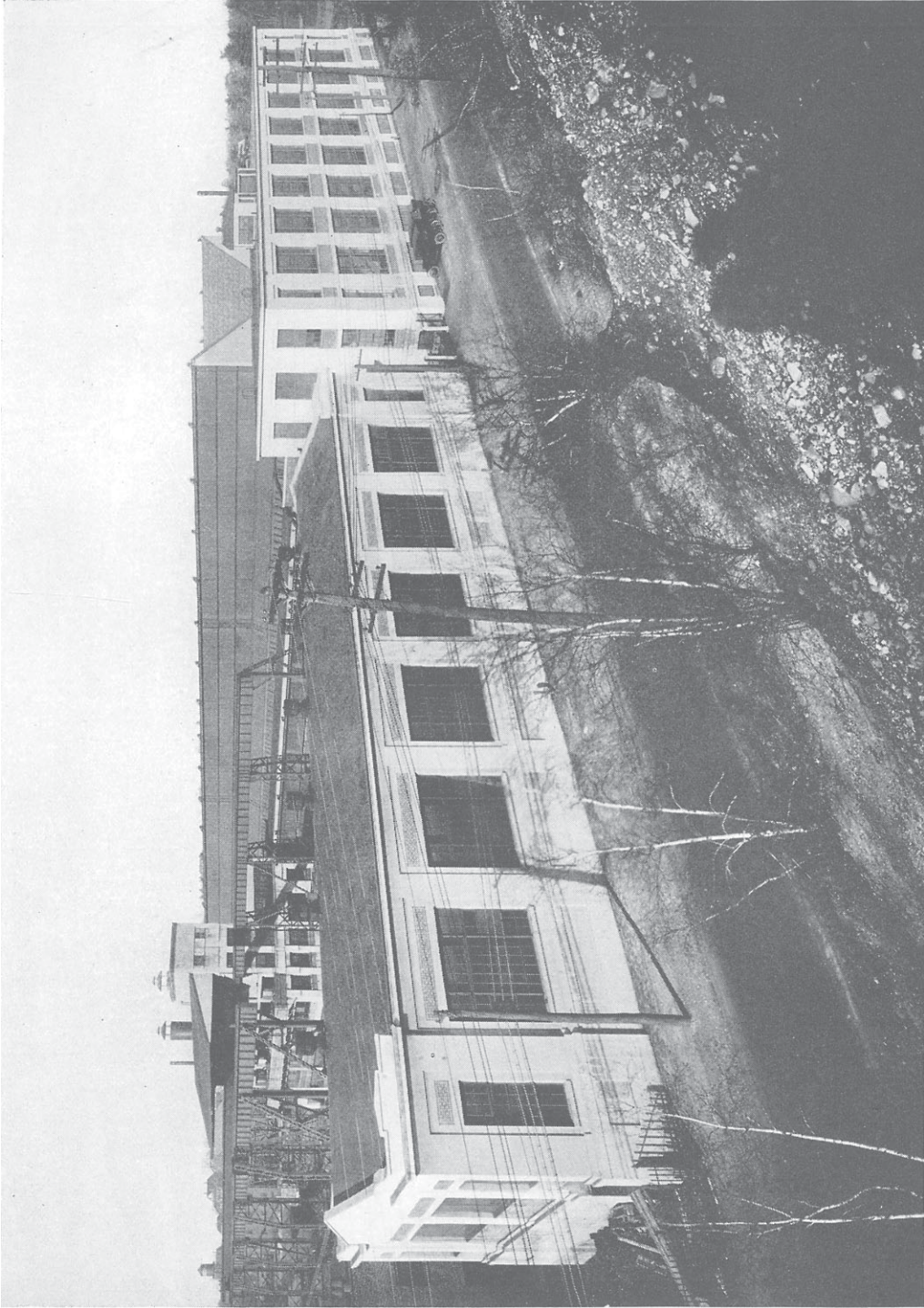
Works, since their factory was the first in the country to introduce this system, the merits of which have now been generally recognized.

In 1897, the Pettee Machine Works was incorporated with the Saco Water Power Machine Shop at Biddeford, Maine, under the name of Saco-Pettee Machine Shops. This consolidation meant that between the two shops a cotton mill could be equipped with all necessary machinery up to the looms. James MacMullan, Agent of the Biddeford Shops, was elected President, while R. P. Snelling and F. J. Hale remained as treasurer and agent respectively.

Yet even these improvements were insufficient to meet the growing demands of the business, and in 1899, the plant was again enlarged. This new building covered eight hundred by seventy-five square feet, and stood three stories high, with a foundry covering four hundred by two hundred square feet. It was all lighted by electricity, and operating day and night.

In 1912, the Corporation was consolidated with the Lowell Machine Shop and Kitson Shop and the name changed to the Saco-Lowell Shops. The management of the shops remained about the same, with Messrs. Snelling and Hale





EXTERIOR OF FOUNDRY, NEWTON SHOP

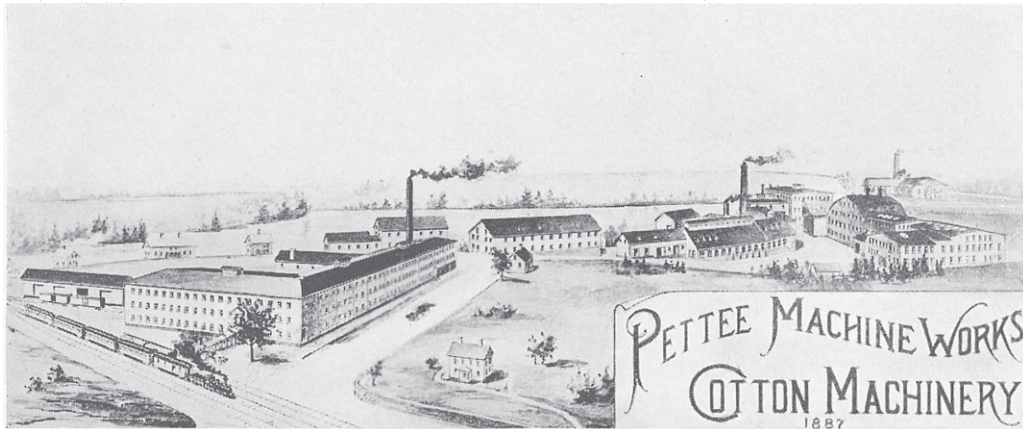
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## *The Newton Shop*

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retaining their respective positions, but the main office was moved from Newton Upper Falls to Boston. So successful was this consolidation that in 1920 a very modern foundry was built, comprising the most advanced ideas in factory construction, and equipped with labor-saving devices such as electric monorail carriages, sand handling machinery, and other features found only in the latest and best equipped foundries. The Works have thus grown since 1887, the date when Mr. O. E. Nutter, its present agent, first came to the company, from a plant covering a total area of about 130 square feet, with a foundry melting seven and one half tons of iron per day, and employing 175 men, to a plant covering an area of 133,000 square feet, with a foundry melting 60 tons of iron per day, and employing 1100 men.

In looking back over these many years of progress, one marvels no less at the inventive genius of the founder of the Company, than at the subsequent developments which many minds have contributed to its continued success. The outstanding feature of the early years is the gigantic shadow of Otis Pettee, and of later years, the organization of many individual minds into one large corporation, the outgrowth of small but sound beginnings.





# THE BIDDEFORD SHOP




SACO FALLS IN 1829  
From an Old Lithograph, drawn by B. F. Nutting



## CHAPTER III

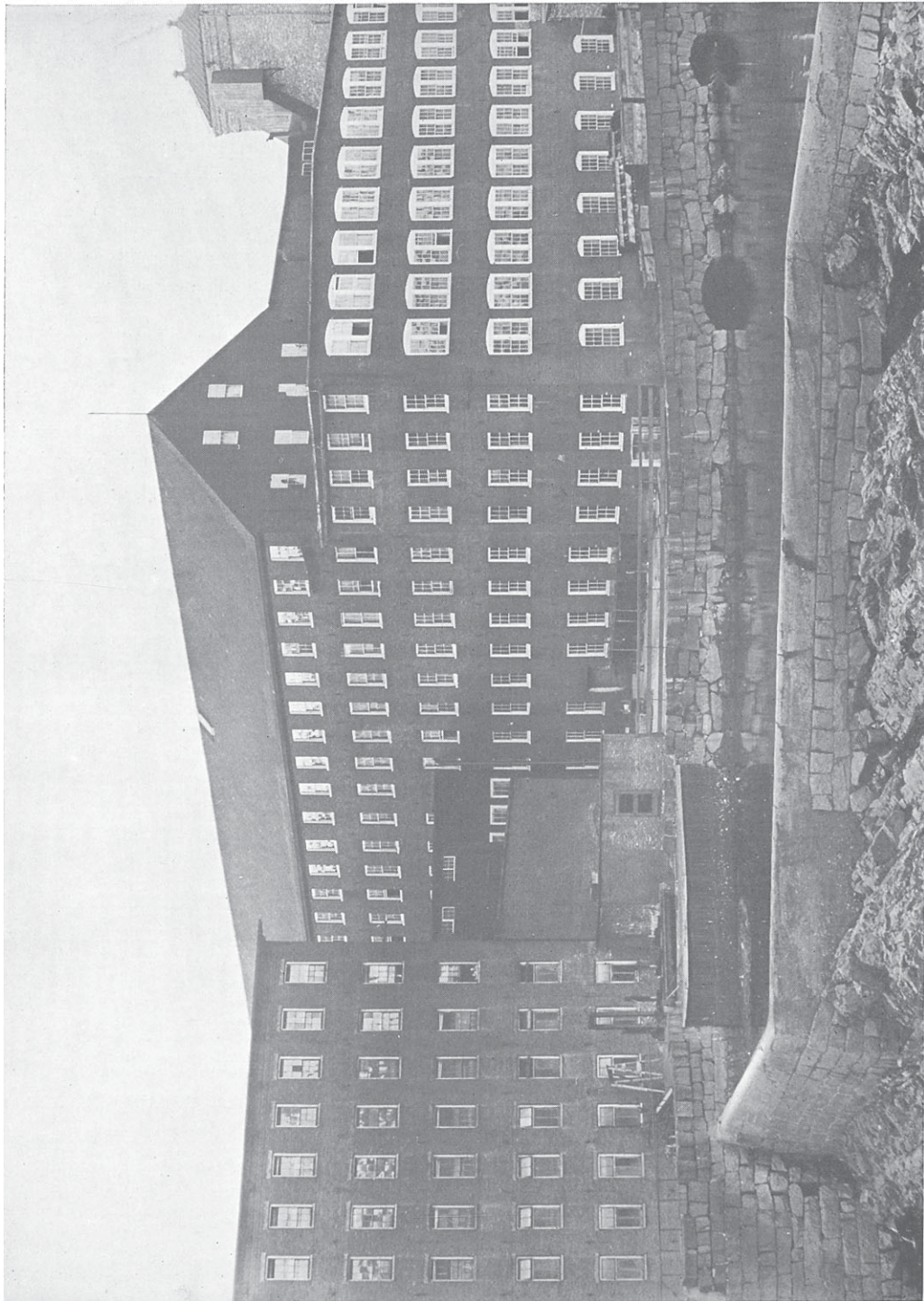
### BIDDEFORD SHOP

*Formerly the Saco-Pettee Machine Shops*

N a sense the early history of the machine shop at Biddeford runs parallel to that of the shops at Newton and Lowell. The same economic and social forces which were leading the citizens of Massachusetts to emancipate themselves from the Old World industrially, as they had already done politically, were equally potent in Maine — then still a province of the older Commonwealth. There was, however, this notable difference between conditions at Lowell and Biddeford, whereas the former was created by her mills, a true child of the industrial era — Biddeford had her beginnings in early colonial times and a history of the phases through which the town has passed may be said to reflect in miniature the economic history of all New England.

The region about Saco and Biddeford — originally the two were one town — was settled almost contemporaneously with the founding of the Pilgrim settlement at Plymouth. The first colonists led a struggling existence. The severe climate made conditions even harder than about Massachusetts Bay, and the privations of the first years were followed by the Indian War — a time of bloodshed and terror when the women kept their guns beside their spinning wheels, and at church each Sunday the congregation watched against surprise attacks while the minister prayed. In spite of constant anxiety and frequent massacres, Saco prospered. Able and energetic men realized the economic resources of the region, and began to develop them, until soon the cod fisheries, the trade in rum and molasses with the West Indies, and the building of ships from the abundant timber provided by the forests of Maine, had given the town a place of importance in the New World.

Out of the ranks of rough farmers and fishermen who had composed the original population, there emerged a new aristocracy of merchant princes who dressed in fine red coats and lace ruffles, educated their sons at Harvard, and sent to England for silks of “fine green paduroy and watered tabby” to furnish their daughters’ trousseaux. Such a merchant was Sir William Pepperell, famous as the captor of Louisburg, whose name is still remembered throughout the district; and such another was Colonel Thomas Cutts. Not content with his activities as a merchant and ship builder, this Colonel Cutts in 1811 entered



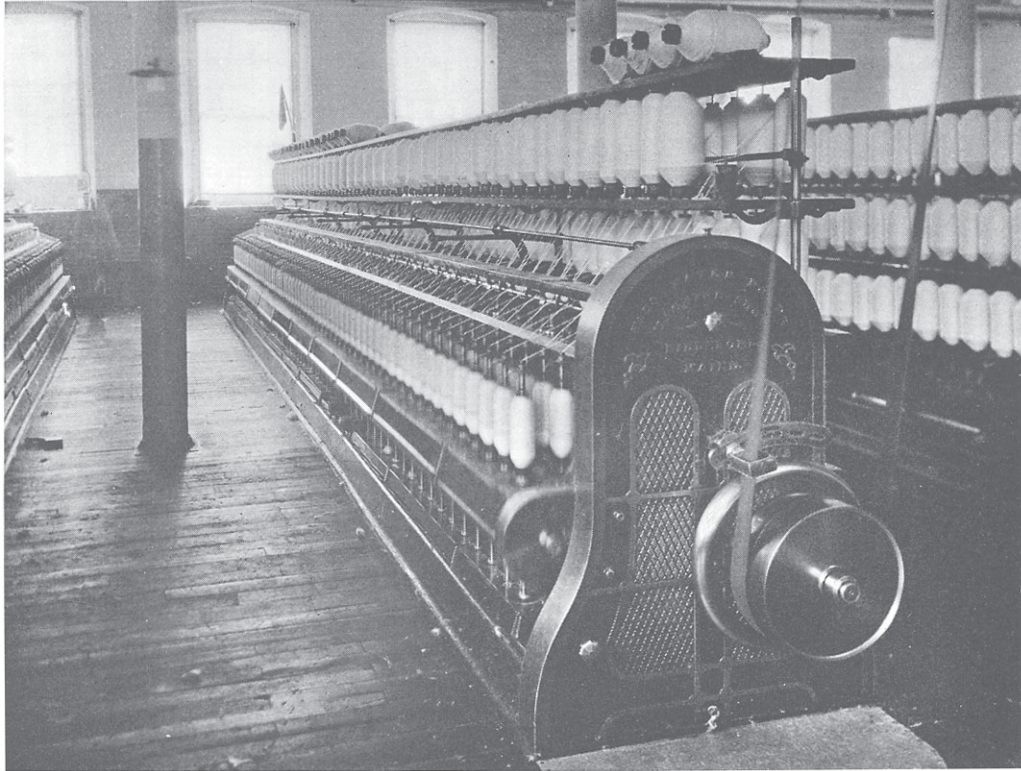
**YORK MANUFACTURING COMPANY**  
This pitched roof building replaced the wooden structure lost by fire in 1830



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## *The Biddeford Shop*

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ROVING FRAME BUILT IN 1883 STILL RUNNING AT PEPPERELL MILLS

into a partnership with Josiah Caleff of Boston for the manufacturing of nails, spikes, and iron hoops.

The embargo of 1812 struck the first blow at American shipping. For several years, all vessels were tied up idle, and though trade partially recovered, this date may be taken as the first warning of that slow, tragic decline which all but banished the American flag from the seas, and left many of the ports of New England with only their elm-lined streets of stately old houses to bear witness to their former commercial glories. It was to manufacturing that New England had to turn to retrieve her ebbing fortunes, and it is to the manufacturers that the wealth and influence of the old merchants has passed. In the light of this fact, it is perhaps not fantastic to see Colonel Cutts' new venture as symbolic of the coming of the new order, although he himself was probably unaware of any very deep significance of his step.

The Saco Iron Works, as the new firm was called, erected shops in the town of Saco, on Indian Island, later known as Factory Island, and continued to do business there until 1825, when their plant was taken over by the Saco Manu-

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HOUSE OCCUPIED BY COLONEL THOMAS CUTTS IN THE EARLY DAYS

facturing Company, newly formed for the manufacture of cotton textiles. This Company proceeded to construct a mill 210 feet in length, 47 feet in width, and with seven floors calculated to contain 12,000 spindles, and 300 looms — no small undertaking when we remember that in addition to building the mill and doing the general engineering work connected with it, the owners had to build themselves all the machinery necessary for equipping the plant. With reference to this the record states: “A large number of experienced and skillful workmen were employed in the construction of the necessary machinery, much of which was executed with a skill and ingenuity seldom equalled.”

By 1829, the Company had developed a business of much promise, and was employing about 500 people; but in 1830 a disastrous setback was experienced, as the mill shared the fate of the old Pettee Works, and was completely destroyed by fire. When we remember that the mills of this period were constructed of wood throughout, and that the local fire brigades had to leave their farms and counters to man the tub and form the bucket line, the destructiveness of these frequent fires seems easily explicable. But the future of manufacturing was now assured, and by 1831 a new Company, organized under the name of the York Manufacturing Company, found the capital to build a new brick mill.



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## *The Biddeford Shop*

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BIDDEFORD SHOP  
Aeroplane view looking toward Saco

The experience obtained in equipping and developing this enterprise, and the promising field which it was now clear that Saco, with her abundant water power and navigable river, offered for the expansion of the new textile industry, prompted the forming in 1839 of another and separate company, under the name of the Saco Water Power Company, with a capitalization of \$500,000, organized to build and equip factories. This Company purchased the Shops owned by the York Manufacturing Company, and obtained control of much of the water power of the Saco River at Biddeford and Saco. In 1841, a machine shop (140 feet in length, and 46 feet in width, with four floors and a basement, a foundry, 81 feet long and 50 feet wide), a forge shop, and an office — all substantial brick buildings — were erected on the Biddeford side of the river. The machine tools and other equipment were moved from the old shops on the Island into these new buildings, and Mr. Rufus Nichols, who had been in charge of the old shops, was made superintendent of the new plant. The first contract of this Company was to erect a mill and furnish machinery for the Laconia Company in Biddeford in 1844, and for several years their business was largely confined to building and equipping mills for the Laconia Company, and for the Pepperell Manufacturing Company, which was also situated in Biddeford.

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The machinery built by the Saco Water Power Company proved so excellent that it was found advisable to expand their business, and in 1847, the Machine Shop and foundry buildings were enlarged to about double the original size, and the capitalization was increased from \$500,000 to \$2,000,000. At this time control of additional water power at points above the Saco Falls was acquired, and purchase made of large tracts of land and ponds for reservoirs. In 1847, Mr. Rufus Nichols resigned as superintendent, and was succeeded by Mr. Otis Holmes, who in turn was followed by Mr. Sylvanus I. Wetherell in 1851. Mr. Wetherell served until 1854 when Mr. William H. Thompson took his place, and continued in office until after the Civil War.

It is interesting to compare the shop conditions of this period with those existing at the present time. Power was furnished by an over-shot water wheel, and was transmitted in the various rooms by square shafting machined round where the bearings came. Drums built of wood extended the full space between hangers and served as pulleys, additional belt speed being obtained by building up the drums at the desired points. The lighting system consisted of large sheet metal lamps, with open wicks, and burning whale oil. These were suspended from the ceiling and served for general illumination, while individual requirements were taken care of by a small portable hand lamp similar in construction to the large lamp. The working hours in the early 50's were from 6.30 A.M. to 12.00 M. and from 12.45 P.M. to 6.30 P.M. with the exception of Saturdays, when work stopped at 6.00 P.M. during the summer months, and at dark during the winter. These hours would not recommend themselves to a modern Trade Union member, but they seemed quite attractive when compared to conditions prior to 1850, when the hours in the mills and shops were from 5.30 A.M. to 6.30 A.M., thirty minutes off for breakfast, then work from 7.00 A.M. to 12.00 M., and work again from 12.45 P.M. to 7.00 P.M. During those times, and until considerably later there were only three recognized holidays in the year — Fast Day, Fourth of July, and Thanksgiving. The wages of an A-1 machinist were \$1.25 per day, excellent pay at a time when the experienced male operatives in the neighboring cotton mills received from \$.75 to \$.92 per day.

Curiously enough, in spite of long hours and small wages, the workers seemed contented, and self-respecting. High cost of living curves had still to be invented, board could be obtained for \$2.00 per week, and only Yankees were employed even in the cotton mills. Girls came in from the farms of Maine and New Hampshire to work in these mills during the winter, and returned home in the summer when the plants had to be partially closed down for lack of hands. They were lodged like one big family in the long, brick boarding house provided by the companies, and could be seen trooping contentedly back to their work





JAMES H. MACMULLAN  
President, Saco-Pettee Machine Shops, 1897

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after supper. It is superfluous to add that there were then no moving pictures. Among the list of regulations issued by the Laconia Company for their employees was the following :

“It is expected that all persons in the employment of the Company will be regular in their attendance upon public worship on the Sabbath.”

This was before the days of intensive specialization. The Company had been organized to build factories as well as to equip them with machinery, and besides constructing the factory buildings proper, it erected a number of the brick boarding houses which the mills were forced to provide for the accommodation of their employees ; and even undertook contracts for many of the larger brick buildings for the growing town of Biddeford, no inconsiderable service to the community which before 1839 had boasted of but two brick houses. During the stresses of the Civil War, they also turned their ingenuity to the making of worsted machinery, some of which is still in operation.

But at the close of the Civil War, came the call for more progressive and intensified methods, and in 1867 the manufacturing of textile machinery was dissociated from the other branches of activity with which the Company was connected, and a new company, the Saco Water Power Machine Shop, was formed with a capitalization of \$300,000, solely for the purpose of manufacturing cotton and other textile machinery. At this time, Mr. Thompson severed his connection with the Company, and Mr. James H. MacMullan, who had been acting as his assistant, was placed in charge of the Shop, with the title of Agent. Associated with Mr. MacMullan was Mr. Eustace P. Morgan, who had charge of the designing and drafting department. Under his direction, during the period from 1867 to 1870, considerable improvements in the design of the product were effected. The roving frame, in particular, was largely re-designed, with success, for which Mr. Morgan's calculations and mechanical acumen, no less than the high standard of workmanship which he established, must be given credit.

The product for a time consisted of cards, railway heads, drawing frames, roving frames, spinning frames, mules, spoolers, warpers, wide and narrow looms, mill elevators, and some worsted machinery, but after about 1880, there was an increasing tendency for the shops to specialize in roving and spinning frames, a policy which in 1897 resulted in a consolidation with the Pettee Machine Works, which (as has been brought out in the history of their Shop), was recognized as the leading builder of cards, railway heads, and drawing frames. This consolidation, incorporated under the laws of Massachusetts, as the Saco and Pettee Machine Shops, enabled the Biddeford Shop to confine their efforts entirely to the building of roving frames and spinning frames, spoolers and reels, and to concentrate on improvements in the design of these





HENRY S. SHAW  
President, Saco-Lowell Shops, 1912-1923  
President, Saco-Petee Machine Shops, 1898-1912

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machines, and in the methods of manufacturing them. Mr. MacMullen was appointed president of the new Company, but, as his health rendered it advisable that he withdraw from active business, he declined a re-appointment in 1898, and was succeeded by Mr. Henry S. Shaw. Messrs. R. P. Snelling and F. J. Hale, of the Pettee Machine Works, became Treasurer and General Agent respectively, while the resident management of the Biddeford Shop was under Mr. William V. Trefall, until 1904 when he was succeeded by Mr. E. E. Blake.

Already in 1868 and 1869, new buildings had been added to the shops and foundry, almost doubling their previous capacity, and the over-shot water wheel has been replaced by a turbine wheel, while a single Corliss Engine was installed to insure a supply of power during seasons of drought. Further extensive additions also had been made during the early eighties, and now the union with the Newton Shop marked the beginning of a new era of expansion. In 1900, the single Corliss Engine was replaced by a cross compound condensing engine, an electric system was installed, and the productive capacity of the Shops was materially increased. So rapid was the growth of the business that even these changes soon proved inadequate, and in 1903, an additional machine shop was constructed (509 feet long and 65 feet wide with five floors). As a large increase in power was required for this expansion, a new power house was built and equipped with Turbo Generators, and the Shops were electrified throughout. Even this does not end the story of continuous expansion. During the years from 1905 to 1915, numerous minor additions were made to the Shops, but since these were still inadequate to meet the needs of a constantly expanding trade, in 1919 the Machine Shops were enlarged (by an extension of 234 feet by 65 feet with five floors), and a small single story building was replaced by a modern structure three stories high. A foundry extension also furnished additional floor space for the department. These additions furnished temporary relief only, and in 1920 the Shops were further increased by a modern, reënforced concrete extension (of six floors with an extreme length and width of 313 feet by 87 feet). The erection of the latter building gives the Biddeford Shop a total floor area of 16 acres.

Meanwhile, improvements in the quality of the product had kept pace with the increase in its quantity. The opening years of the twentieth century witnessed a marked forward movement in the methods of machine construction, which revolutionized previous practice in many respects, and made commercially possible the production of accurately machined duplicate parts on a scale previously unattempted. The advantages of the application of these methods to the construction of the Biddeford frames were recognized, and steps were taken to effect them. This necessitated an extensive re-designing of the existing



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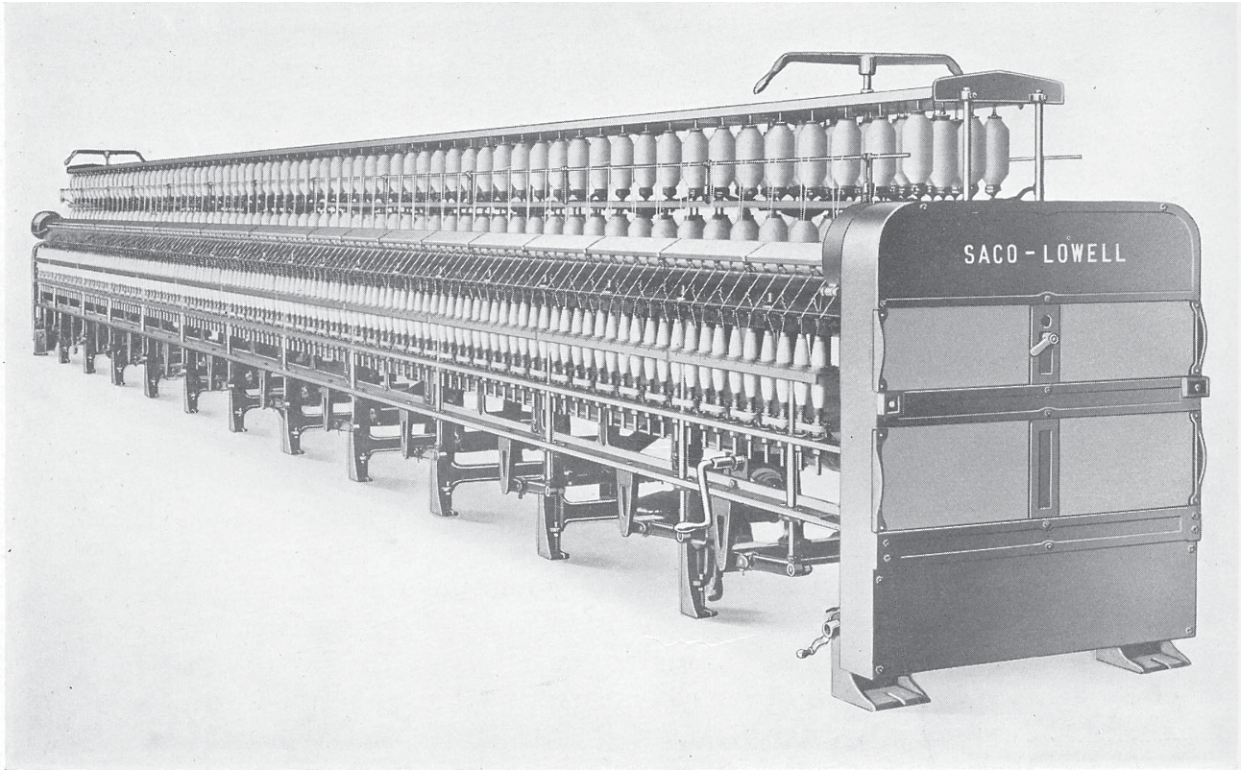
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types of frames, as well as the installation of many special machine tools and precision fixtures. The first machine brought out under the improved system of manufacturing was the Roving Frame in 1908, and the immediate approval with which this frame was met demonstrated the wisdom of the change. In this new design, no alteration was made affecting the principles governing the operation of the frame, these being of proved correctness. The opportunity was embraced, however, not only to produce a machine by the most approved shop methods, with an integrity of alignments not previously thought possible, but also to furnish a frame more convenient to operate, and better safe-guarded against injury to the operator. In re-designing the spooler, the changes were more radical, and in 1910 an entirely new type of Spooler, greatly improved in its method of operation, and of superior mechanical construction, was put on the market. The design of the existing type of spinning frame was such as to lend itself more readily to the new methods of manufacturing; there were numerous minor changes made in this machine, however, and the design was improved throughout.

Nineteen hundred and twelve marked another change in the affairs of the Biddeford Shop, for in that year, as we have seen, a consolidation of the Saco and Pettee Company, the Lowell Machine Shop, and the Kitson Shop of Lowell was effected. This combination made the new corporation, the Saco-Lowell Shops, the largest builders of textile machinery in America, and brought to each of the Shops the advantages of a larger business and sales organization, with a more economical general administration. The expansion of business, which resulted partly from this change and partly from the improved methods of construction, has already been commented upon in connection with the remarkable enlargements of the plant.

During the past years the Biddeford Shop has given employment to 2000 workmen. Most of these are citizens of Biddeford, Saco, or the neighboring districts, and a large proportion of them own their homes. The Company's policy has always been to maintain the most friendly and helpful relations with its employees. Building plans, weekly savings systems, excellent restaurant and lunch arrangements, first aid and medical attention, have all helped to establish that relationship of mutual respect and confidence which is essential to continued efficient service. Besides this direct contribution to the welfare of the region, the Biddeford Shop, in common with the other branches of the Saco-Lowell Shops, has been a very essential factor in the development of American made textile machinery.



SPINNING FRAME BUILT AT BIDDEFORD SHOP, 1923  
Contrast with Primitive Spinning Wheels, page 5



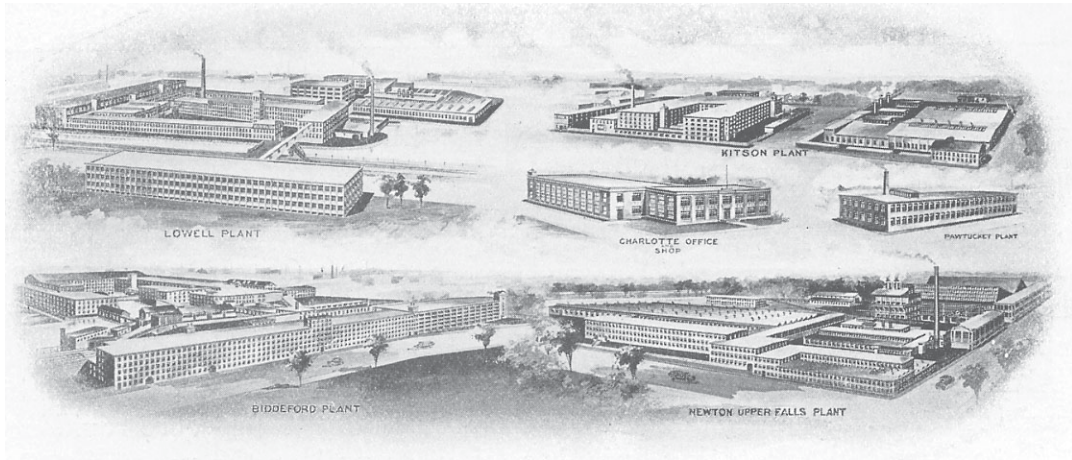
# A CENTURY OF PROGRESS



**ROBERT F. HERRICK**

President, Lowell Machine Shop, 1905-1911  
Treasurer, Lowell Machine Shop, 1911-1912  
Chairman, Board of Directors, Saco-Lowell Shops, 1912-1923  
President, Saco-Lowell Shops





## CHAPTER IV

### A CENTURY OF PROGRESS

**T**EXTILE machinery, as we have seen, had its origin in England, but the great contributions America has made to the later mechanical development should not be forgotten. When the Spinning Jenny of James Hargreaves, the Mechanical Carder of Lewis Paul, and the Spinning Frame of Richard Arkwright were invented in England, the American colonies had not yet developed into industrial communities.

As late as the time of the Revolution the production of clothing was still the almost exclusive province of the women, as is shown by a quaint anecdote told of Lafayette. The French patriot attended a gay ball in Baltimore, at which all the fairest ladies were present to do him honor. Instead of joining in the festivities, however, as might have been expected, he surprised everyone by addressing the ladies: "You are very handsome, you dance very prettily, your ball is very fine, but — my soldiers have no shirts." The appeal was irresistible, the ball broke up in confusion, the ladies rushed to their spinning wheels and looms, and within a few days a large number of shirts were prepared by the fairest hands in Baltimore for the Continental Army.

This state of affairs did not last, however. Political independence paved the way for industrial independence, and soon the United States was beginning to make its own textile machinery.

In 1790 the United States Patent Office was inaugurated and in 1794 a patent was granted to Eli Whitney for his Cotton Gin. As the United States was then an agricultural country, it is not surprising that its first great contribution to

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the Textile Industry should pertain to the raising of cotton in the South, nor strange that to a New Englander, of proverbial Yankee genius, should have fallen the honor for the invention.

Not until the War of 1812, when the United States began to feel the need of complete economic independence, did cotton mills begin to multiply rapidly, but from that time on American improvements in the manufacture of textiles made themselves felt, and they have continued to increase in number and importance up to the present day.

Although spinning with a Flyer was done by Arkwright on his Spinning Frame of 1775, it remained for an American named John Thorpe, of Providence, R. I., to invent the Rotating Spinning Ring, as well as the process of Cap Spinning, for which he obtained patents in the year 1828; and for two other Americans, Addison and Stephens, of New York City, to invent the Traveler in 1829. Both of these American inventions were of the first importance, for although Roving remains to this day in the realm of the Flyer, by far the greater part of spinning and twisting Cotton is done with the Ring and Traveler; and by far the greater part of spinning and twisting Worsted is done with a Cap.

There are many other fundamental improvements in textile machinery for which America is responsible. Perhaps none of these has been more far reaching than the Spindle which Rabbeth, a native of Ilion, New York, and Atwood, of Willimantic, Connecticut, patented on April 2, 1867. This invention, which consists in making the spindle a self-contained unit supported by one rail instead of two, made it possible to increase the speed of the spinning spindle from 4000 or 5000 to 9000 or 10,000 revolutions per minute, and was largely responsible for the superseding of the Mule by the Ring Spinning Frame.

Another invention, of interest not only because of its own importance but also because it was the fore-runner of all later loom developments, and more particularly of the Automatic Loom, was the self-acting Loom Temple patented by Ira Draper on Jan. 7, 1816. The Rotary Temple allowed a weaver to run two looms instead of one.

The inventions of those early days followed each other rapidly. On July 30, 1832, John C. Whitin, of the Whitin Machine Works, patented a "Machine for Spreading and Picking Cotton." On May 4, 1838, William Mason, of Taunton, Mass., founder of the Mason Machine Works, patented a "Spinning Machine," which bears a very striking resemblance to the Spinning Frames of the present day. Mr. Mason made other important improvements in the textile industry. On March 28, 1834, Otis Pettee, whose inventive genius has already been mentioned, patented the Double Arm Flyer. This early improvement in the Flyer, is of interest both because it is still in use on certain machines, and





R. PAUL SNELLING  
Vice-President, Saco-Lowell Shops  
Treasurer, Saco-Lowell Shops, 1912-1923  
Treasurer, Saco-Pettee Machine Shops, 1897-1912  
Treasurer, Pettee Machine Works, 1882-1897

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because it may be said to be the predecessor of the welded, pressed steel Flyer now produced by the Saco-Lowell Shops.

Among the more striking important improvements in textile machinery during the last thirty years have been the Automatic Loom, developed by the descendants of Ira Draper in 1894, the Hand Knotter, the Automatic Distributor for Cotton Openers, and the Warp-Drawing and Warp-Tying Machines.

But it is not only to improvements in machinery that the American Textile Industry has owed its progress; improved organization has also played its part.

It will be remembered how each of the shops began its life as a part of a cotton mill; how the first stage of specialization came with the separation of these machine shops; and how the wide variety of product of those early days when the Lowell Shop, for instance, turned out everything from textile machinery to locomotives and water wheels, was gradually reduced in the interest of greater efficiency. It has also been shown how each of these plants, not content with specializing entirely in textile machinery, tended to concentrate more and more on the manufacture of certain lines in which it had secured particularly satisfactory results. The final consolidation in 1912 made it possible to develop this specialization to the utmost, as each plant was now free to devote itself entirely to its most successful product.

The Saco-Lowell Shops, occupying some sixty-two acres of floor space and employing about 6800 men, is the largest builder of textile machinery in the United States, and an important competitor in foreign markets.

All opening and picking equipment for cotton mills is made at the Kitson Plant; Revolving Top Flat Cards and Drawing Frames at the Newton Plant; Roving and Spinning at Biddeford; Spinning and Twisting Rings at Pawtucket, Rhode Island, a plant which was acquired in 1920; and Twisters, Spoolers, Warp-ers, and Slashers at the Lowell Shop. A complete line of both Bradford and French System of Worsted Machinery is also made at Lowell, as well as machinery for Spun Silk. This makes possible a physical division by which only a limited number of machines is made at each Shop, so that the engineering force of each can devote its undivided attention to keeping pace with the specific requirements of the trade.

Until the last decade, the Textile Industry was concentrated almost entirely in New England, but since that time there has been a steady growth in the number of cotton mills in the South. The Saco-Lowell units were the first, among the textile machinery builders, to establish Southern offices for taking care of the needs of this rapidly growing textile section. In connection with this agency they have also maintained for almost twenty years, a shop for repairing and reclothing Cards.





FRANK J. HALE  
Vice-President, Saco-Lowell Shops  
General Agent, Saco-Lowell Shops, 1912-1923  
General Agent, Saco-Pettee Machine Shops, 1897-1912  
Agent, Pettee Machine Works, 1888-1897

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Following the general policy of the Shops to give as efficient and quick service as possible, a new building has been erected at Charlotte, North Carolina, part of which is used as quarters for the selling office, and the rest as a large supply and repair shop. This Department is now in a position to furnish Southern mills with almost immediate delivery of repair parts for all their machinery purchased from the Saco-Lowell Shops, thus eliminating delay and stoppage of equipment when worn out or broken parts have to be replaced. An efficient corps of field service men, trained in the operation and repair of textile machinery extends the service of the repair shop to the mills themselves.

The Textile Industry, with the variety and complexity of processes which it involves, is one to which Scientific Research has been applied with particularly good results. In England, a Cooperative Research Laboratory was founded for the Industry in 1921. It is supported by the various manufacturing companies and by a government grant in recognition of the value of the industry to the nation.

The "British Cotton Industry Research Association" aims to attack the fundamental problems of the botanical, chemical, and physical properties of cotton. It feels we do not know the "why" of many of the processes to which the fibre is subjected, though we may know the "how" with the greatest precision, and until the "why" is known with the same certainty, the industry cannot be said to rest on a sure scientific foundation.

In America, there have recently grown up, as an outcome of the success of the British idea, Research Divisions in the larger mills where experiments are constantly being made in the processing of the cotton fibre. In some cases the results are given to the Textile Trade, and in other cases kept for the benefit of the particular mill engaging in the experiments.

To keep pace with this development in textile manufactures, the Saco-Lowell Shops have maintained an "Experimental Room" at their Newton Shop, where mills are assisted in obtaining the most suitable methods for handling all kinds and types of Cotton.

A new departure, for textile machinery builders, has been the establishment of a "Research Laboratory" at the Lowell Shop, which is constantly on the alert for new mechanical ideas and improved methods, and always ready to cooperate with the inventor in developing promising new devices. Inventions are now being developed, which will be of no less importance to the Textile Industry than the Rabbeth Spindle, the Hand Knotter, and the Automatic Loom. It seems safe to predict that scientific research offers bright prospects for the future, bringing about improvements which may perhaps equal or even surpass those of the last century.



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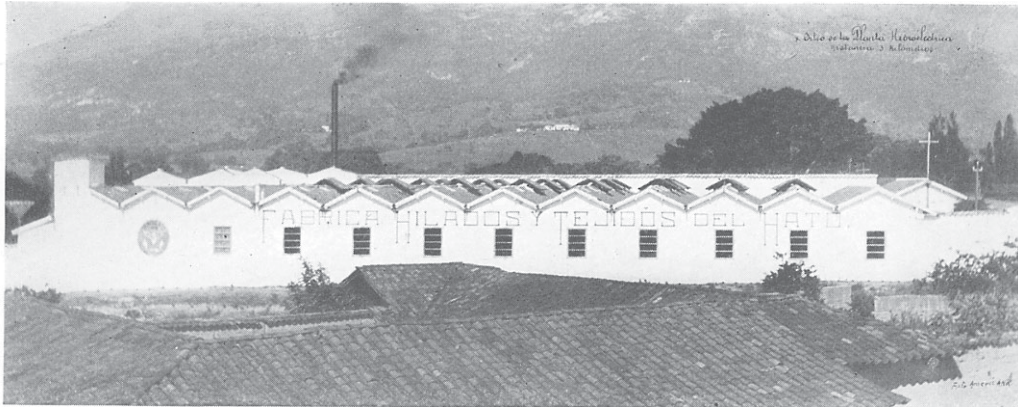
*A Century of Progress*

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In those remarkable improvements the early machine shops played a vital part. If Paul Moody, Kirk Boott, Otis Pettee, and the other stout-hearted pioneers who set up the first small shops could have a momentary resurrection, they would doubtless feel they had built better than they knew ; and yet no new invention, no improved organization, can detract from the glory of their achievements. Without their ingenuity, courage, and perseverance all that has come after them could never have been. At such a time as this, on the one hundredth anniversary of the small beginnings of what has come to be the largest organization of its kind in this country, it is well to pause for an instant to pay tribute to these founders, and then turn with renewed interest and a spirit akin to theirs to the duties, responsibilities, and opportunities for service to come with another century.

**AROUND THE WORLD WITH  
SACO-LOWELL**





FABRICA DE HILADOS Y TEJIDOS DEL HATO, MEDELLIN, COLOMBIA, S. A.

A typical South American Mill equipped in 1923 by the Saco-Lowell Shops. At the extreme right of the picture, halfway up the mountain, is the hydro-electric plant furnishing the power for the cotton mill

## CHAPTER V

### AROUND THE WORLD WITH SACO-LOWELL



FOR almost fifty years the Saco-Lowell Shops have been exporting cotton machinery to various countries throughout the world.

The first cotton mill ever built in China was equipped with machinery from Lowell some forty years ago, the order being placed by Li Hung Chang, the Minister of China in Washington. About the same time the first mill equipment to Brazil was shipped to the Companhia Uniao Caxiense. This mill was so successful that it paid dividends of over 100% in its first year of operation.

There is hardly a cotton manufacturing country in the world that is not operating some Saco-Lowell machinery. It can be found in

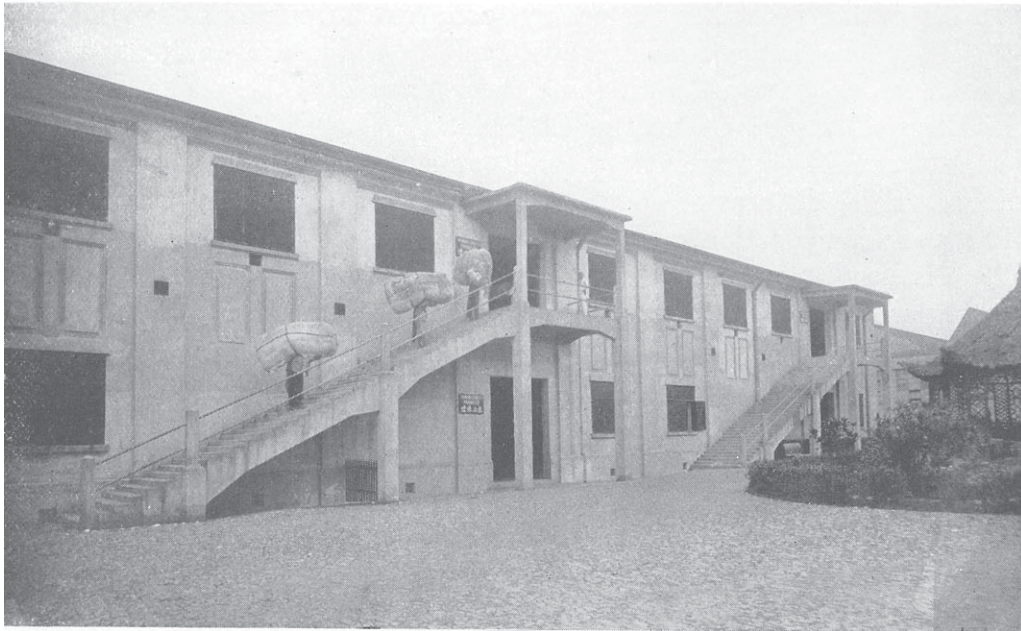
ARGENTINE	CHINA	INDIA	MEXICO
AUSTRIA	COLOMBIA	INDO-CHINA	PERU
BRAZIL	ECUADOR	IRELAND	SPAIN
CANADA	FINLAND	ITALY	SWEDEN
CHILE	FRANCE	JAPAN	VENEZUELA

The development of this export business has resulted from the general satisfaction of the foreign manufacturers with the quality of the machinery and the efficiency of service which the Shops have given. This department of our work is taken care of by a group of experienced engineers and the Company maintains its own offices or is represented by agents in practically all cotton manufacturing countries in the world.



#### HOU SUNG COTTON MILLS

This typical Chinese Mill of 50,000 spindles entirely equipped by the Saco-Lowell Shops, was the first installed by them in Shanghai. The large building is the Administration Building and in the Canal in the foreground can be seen a Chinese scow loaded with cotton



#### HOU SUNG

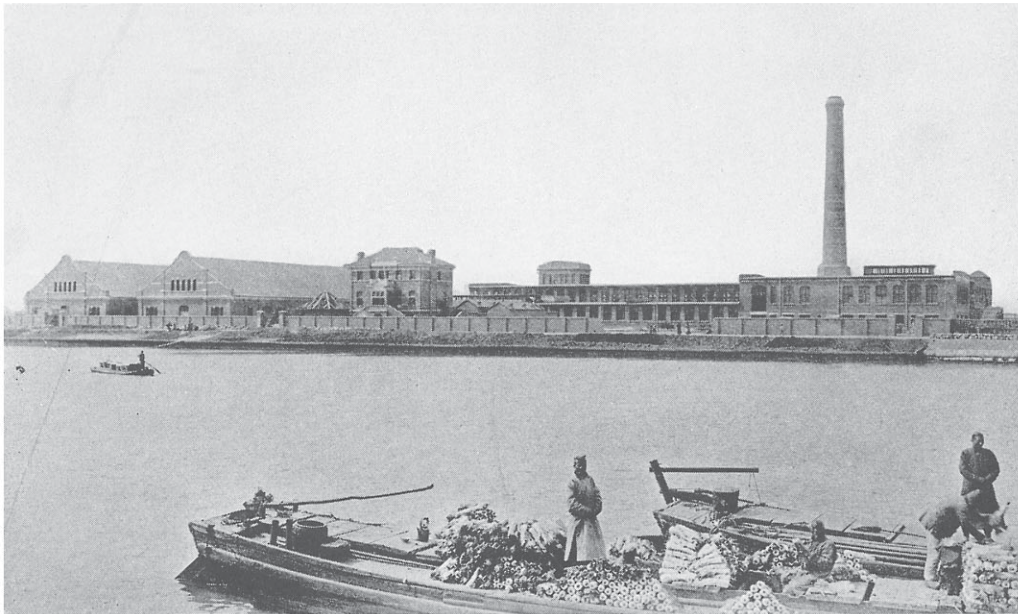
The above picture shows the cotton storehouse of the Hou Sung Cotton Mills and coolies carrying bales of cotton weighing about 400 pounds to the upper level





WING ON TEXTILE MFG. CO., LTD.

This mill of 30,000 spindles is one of the latest in Shanghai equipped by the Saco-Lowell Shops. It is owned by the Wing On Company, who conduct a chain of department stores in China somewhat after the idea of the Woolworth stores in America



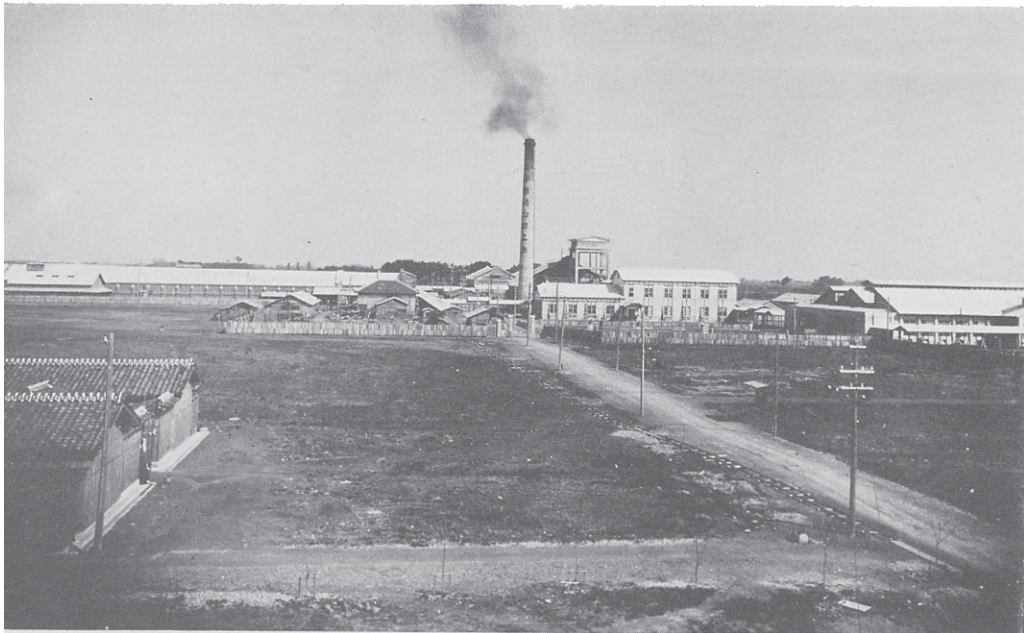
YU YUEN TEXTILE CO.

This mill, which has about 75,000 spindles, all furnished by the Saco-Lowell Shops, and about 500 American looms, was the first cotton mill to be built in Tientsin, the prosperous port of North China. The mill was erected from complete plans furnished by one of the leading engineering firms in Boston



**HENG YUEN TEXTILE CO.**

The above view shows the interior of a typical Chinese mill in Tientsin. It has 30,000 spindles furnished by Saco-Lowell Shops and 200 looms, some of them of the heaviest pattern for making canvas and sail cloth



**TOYO COTTON SPINNING CO., LTD.**

This mill, at Yamada, Japan, is a typical Japanese mill of 30,000 spindles. This Company operates over 100,000 spindles furnished by Saco-Lowell Shops

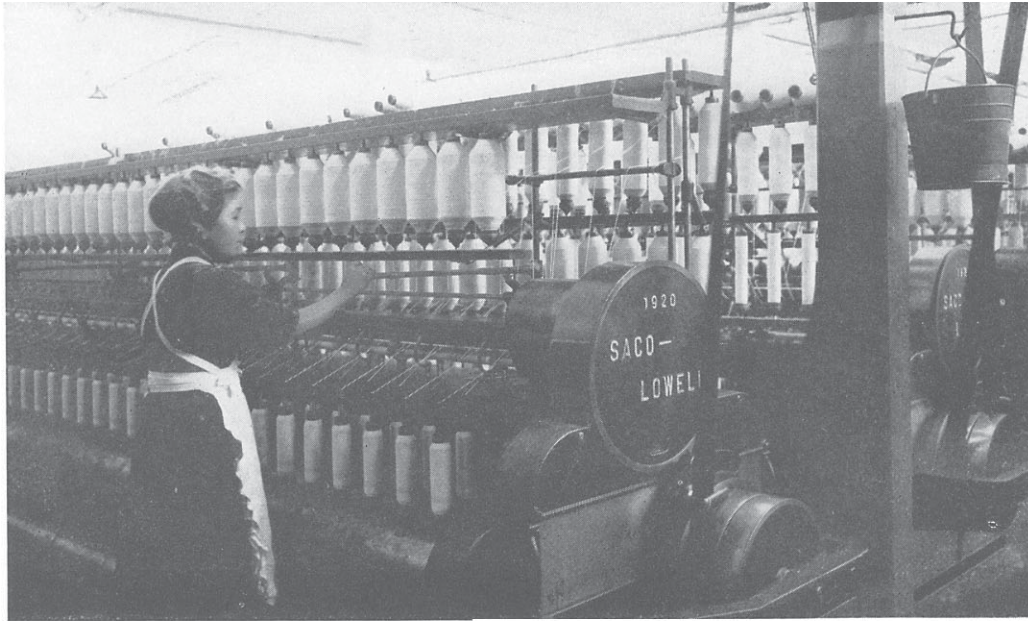




**SAGAMI SPINNING COMPANY, LTD.**

The above mill, which has some 60,000 spindles, furnished mostly by the Saco-Lowell Shops, was directly in the earthquake area in Japan, and was completely destroyed. It is being rebuilt at the present time



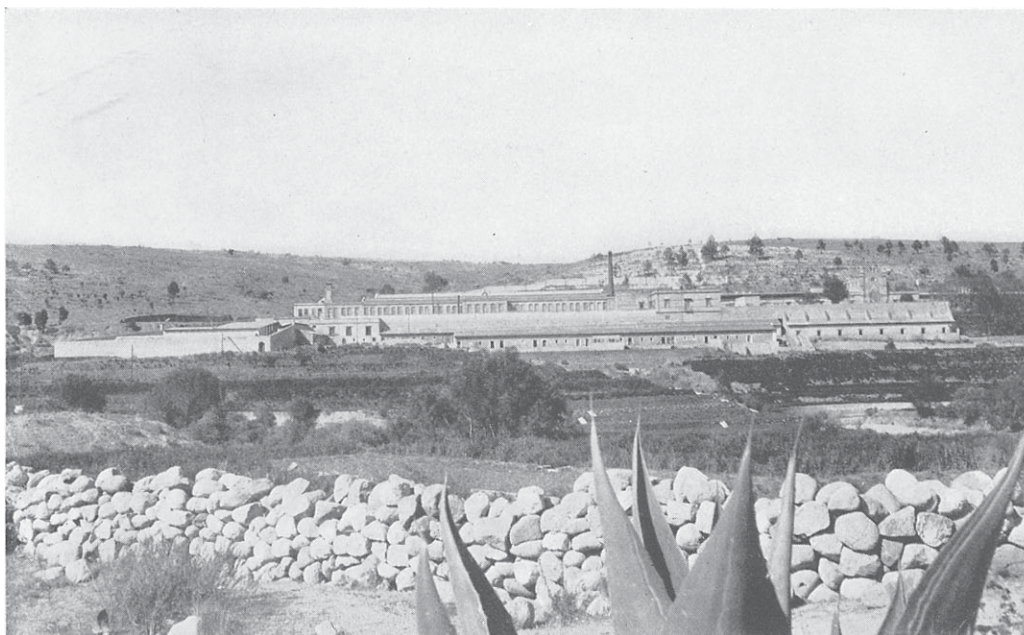


CARD ROOM OF SANKO COTTON SPINNING COMPANY  
Card Room of the Sanko Cotton Spinning Company in Japan



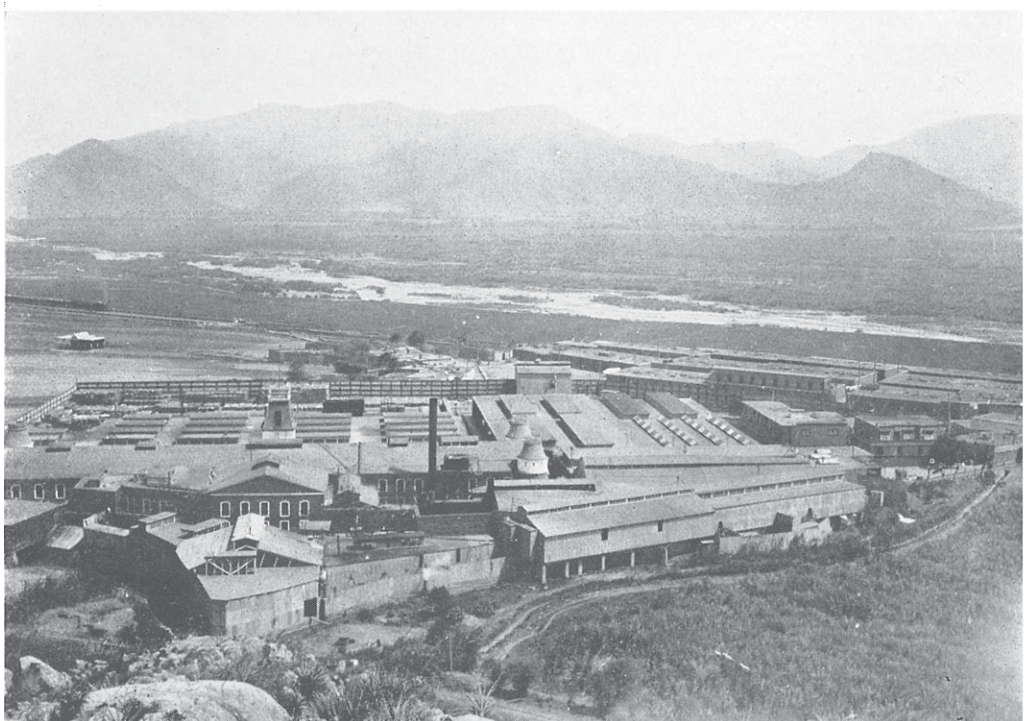
A COMPLETE MILL OF TEN THOUSAND SPINDLES IN STORAGE IN SHANGHAI  
The above view shows how a complete 10,000 spindle mill looks when boxed for export. This picture was taken in a storehouse in Shanghai immediately after the arrival of the machinery





**MANUEL M. CONDE'S FACTORY AT PUEBLA, MEXICO**

The cotton factory of Manuel M. Conde, Sues., Puebla, Mexico, one of the first users of Saco-Lowell machinery in that country



**A TYPICAL COTTON MILL IN PERU**

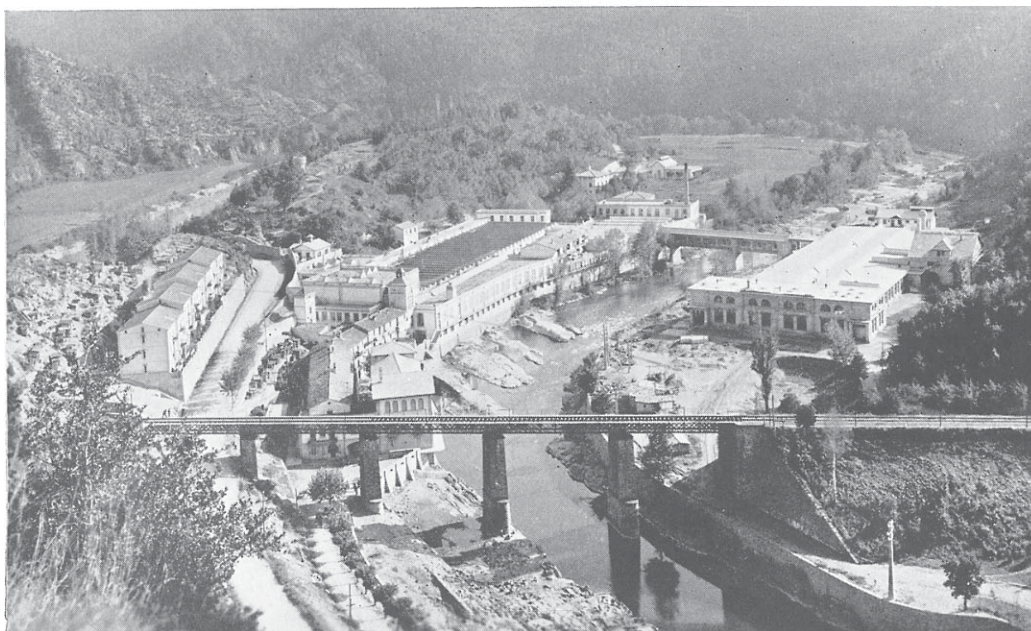
A typical cotton mill in Peru, operating Saco-Lowell machinery. The Andes Mountains appear in the background





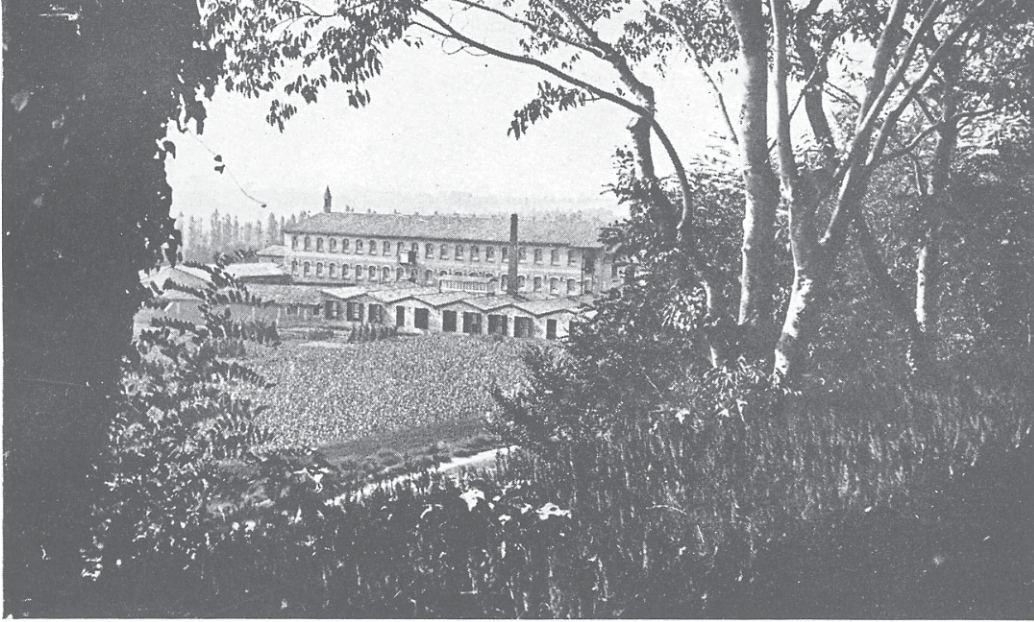
**ARRIVAL OF SACO-LOWELL MACHINERY AT SALTO, BRAZIL**

Saco-Lowell machinery arriving at Salto, Brazil. The complete equipment for the mill of the Companhia Industrias Textis in this town, was furnished by Saco-Lowell Shops



**MILL OF EDMUNDO BEBIE AT SAN QUIRICO DE BESORA**

A view in the foothills of the Pyrenees, showing the mill of Edmundo Bebie at San Quirico de Besora. This mill was one of the first customers of the Saco-Lowell Shops in Spain



RIVA Y E JAICIA SAN HIPOLITO DE VOL TRIGA, SPAIN

