

## CHAPTER XXVIII

### SILK MANUFACTURE

The Silk Industry—Silk Mills, Machinery and Operatives—Making Silk Ribbon—Looms—Velvets and Plushes

#### THE SILK INDUSTRY

THE silk maker's art, transplanted from Europe, has become thoroughly domesticated in the United States; while the manufacturers' capital and enterprise have been devoted to improving and cheapening all processes of manufacture and lowering the price of silk goods. Thus silk manufacture in this country has become established as a permanent branch of the textile industries. Setting forth the reason for the powerful development of this industry, a vice-president of the Silk Association says:

As reasons for the rapid as well as powerful development of the United States silk industry, notwithstanding the competition of well-introduced imported goods and the splendid organization of the importers, and in spite of the mistrust which was felt by consumers for a long time against the domestic goods, we find:

1. The natural capability of the American merchant and manufacturer, his common sense, enterprise, and self-confidence.
2. The capital which is always ready to support enterprise in this country in the form of extensive and liberal credits.
3. The support which is given all these undertakings by the people, by the city and state governments in form of tax privileges, donations of lots, putting up mill buildings, and renting same at a low rate of interest; even in some cases by subscribing a certain amount of the necessary working capital.
4. The intellectuality of the American technician, who through his inventions of time-saving machinery, which are simply constructed and easy to handle, is, perhaps, unequalled. The operative also is moderate and his common-sense makes him especially fit for the manufacturing business.
5. The easy intercourse between manufacturer and dealer which enables the first to get fully and promptly acquainted with the needs and wants of the consumer.

The product of the silk-worm is so intimately associated in our minds with warmer climates than ours, in Europe and Asia, that it is difficult to realize that now the United States ranks first among the nations in respect to the quantity of silk manufactured. Even France has no mills to compare in size with the great American establishments which have been built since the first little factory was started by John Ryle, the father of the silk industry in this country. These mills now supply four-fifths of the entire home demand. In 1900, their output amounted to more than one hundred million dollars as against a yearly silk production thirty years ago of only five

million dollars. Sixty-five thousand wage-earners are employed. The total number of silk factories is about five hundred. Of the silk stuffs consumed in this country, we make from eighty to eighty-five per cent of the piece goods and fully ninety per cent of the ribbons sold over our counters.

As to the relative position of France and the United States in silk manufacture, it may be stated that while the value of the annual production in France—\$122,000,000—is greater than the value of production in the United States—\$92,000,000—France at the same time consumes a trifle less raw silk than this country, the figures being 9,000,000 pounds for France, and 9,760,000 pounds for the United States.

To-day, the greatest raw silk market among the cities of the earth, next to Shanghai, is New York. More raw silk is consumed here annually than is consumed in all France, the largest silk-consuming country of Europe. In the finer fabrics, such as church ornaments and chasubles, and specialties for women's wear, the United States has not yet been able to compete with France, the principal reason being that most of the foreign specialties mentioned are made on hand looms, and their production in the United States on power looms would not be profitable. In 1900, American manufacturers imported not only \$49,000,000 worth of raw silk, but also \$26,000,000 worth of manufactured silk goods.

The countries that lead in silk culture and in the quantity and value of exports to the United States, are Japan first, China second, Italy third. The American manufacturers, as inferred above, import practically all of the raw silk used. As for American export trade in silk manufacture, there is none, and experts declare there never will be as long as wages are so low abroad and as long as the cost of production is so great here.

#### SILK MILLS, MACHINERY AND OPERATIVES

During the last decade larger silk mills have been built and equipped with every modern appliance for heating, lighting, power, and manufacturing; smaller mills have been consolidated into the larger establishments, thus lessening the general expenses.

Paterson, N. J., pre-eminent as the home of the largest mills and, in this industry, the manufacturing centre of the United States, producing twenty-five per cent of all the silk used in the entire country, owes its position, first, to its proximity to New York, the principal market for the sale of silk; second, to the early start of the power manufacture at this point; to the abundant waterpower furnished by the Passaic River; third, to the large supply of labor skilled in the hand processes of silk manufacturing, which was attracted thither from Italy and other European countries.

With American machinery an ordinary silk weaver accomplishes results equal to those of the most skilful and experienced weavers in other countries. With marvellous facility the character of the work in American factories can be changed day by day, from yarn to piece-dyed weaves, from simple to com-

plicated silks, and from light to heavy. No better evidence of the progress made in the development of American looms could be presented than the statement that of the forty-five thousand looms in operation here, less than two hundred are hand looms. American looms are conceded to be the world's best, and American dyeing and finishing machinery ahead of that in use in foreign mills.

In throwing machinery marked progress has been made in recent years, in the way of increasing labor efficiency, space and processes, saving waste, and other economies. Winding frames now produce perfectly wound spools at high speed. In spinning, in all the newly equipped plants, the endless belt is used instead of bands. This endless belt system, purely an American invention, is now used in silk factories abroad, and has been adopted by the technical schools of England and Switzerland as the best method of spinning organzine. A machine for this belt-drive system has been invented, by which the spinning, doubling and twisting of organzine can be done in one process, thus lowering the cost of production.

Altogether, American improvements in throwing machinery have resulted in a saving of forty per cent in floor space and of twenty per cent in the cost of production over the old system.

In weaving, the power loom has entirely superseded the hand loom, which speaks well for the skill of American labor. The looms now in use are of the highest efficiency, equipped with mechanical devices for saving time, labor and materials. Improvements have even been made in the great Jacquard loom, in the way of saving cards and increasing speed. One of the latest triumphs of American skill in the art of weaving is the perfection of a silk-velvet ribbon loom, which produces the best quality of ribbon at extraordinary speed.

In silk manufacture many more women than men are employed, the proportion being 34,000 women to 24,000 men. Nearly 6,500 children are also employed. In the mills in Pennsylvania alone 4,000 children toil. In the leading State in silk manufacture, New Jersey, employment is given to 24,000 persons, including, however, less than 2,000 children. Of the skilled operatives, principally weavers, 15,000 are men and 13,000 women. Nearly 700 children under sixteen years of age are classed as weavers, but naturally the greater number work as spinners, winders and warpers.

#### MAKING SILK RIBBON

If the reader has ever visited a ribbon mill, he may have exclaimed: "Surely this is where rainbows are made." From the office of the receiving clerk, where the raw silk arrives from Japan, China, Italy, and France, to the shipping department where the finished ribbons wound on hundreds of spools are packed ready for the "trade," may be found many more hues and shades than can be seen in a rainbow. In the mill are ribbons by the roll, rack, and roomful; red, pink, and yellow ribbons winding through looms; white, green, and blue ribbons, creeping their way through grooved

machines; ribbons on the floor, in the air, in the tresses of the loom-girls; garlands and clouds of ribbons—and more a-making at the rate of a mile a minute.

The testing of the raw silk is the first step in the process of making silk goods. It arrives at the mill in bales—the softest, silkiest stuff, cream color. The bales vary in weight, but the smallest is worth at least five hundred dollars, while the value of some run as high as fifteen hundred dollars. From the receiving room, in a ribbon mill, the raw silk goes to an expert, called a “throwster,” who separates the skeins into two parts—“organzine” for the warp, and “tram” for the woof. “Organzine” consists of two single threads of raw silk so twisted that there are sixteen turns to the inch; while “tram” is the union of two or more threads of raw silk so twisted that there are five turns to the inch. From the throwster the silk goes to the dyer. The next step is the extraction of the lisse, or cotton thread, from the skein. The skein is then put on a winding-machine, where the threads are run onto shuttle-spools, six hundred spools on one machine receiving the threads simultaneously. There are ten girls to each machine, each girl having sixty spools to watch.

Great delicacy of touch is required to manipulate the threads, which must be knotted together every time they break, and as a single fibre is like a cobweb and about the color of daylight, touch rather than sight is required to pick up the broken ends and knot them together again. After spooling the silk, the process of doubling begins; two, three, or five threads being twisted into one, according to the quality of the goods ordered, and the thickness of the warp required. This done, the quills are threaded or filled, and thus is made the woof which works across the warp, on the same principle as the shuttle in a sewing machine carries the thread and sews the cloth.

#### LOOMS

The Jacquard loom, in use in silk ribbon mills, has an attachment of heavy cards, through which holes for each thread have been punched; a box with many needles, pointing outward; and a revolving cylinder, every quarter revolution of which presents a new card to the needles; the whole forming a remarkable mechanical process, by which each thread is worked separately, as many as four thousand cards being used in some patterns. On the Jacquard loom are made ribbons that contain designs, such as hat-bands, silken trade marks, and fancy decorations. The process of weaving these designs into the ribbons is extremely complicated.

The ribbon girls prepare the thread for the loom, but there, for a time, their work stops. That is, they have nothing more to do with the silk till it comes from the loom in the form of ribbon, which they wind on reels ready for packing. Hence the ribbon-girls, after all, have no direct part in the making of ribbon. They weave piece goods, such as plain and brocaded silk for dresses, sashes, linings, and grenadines, but by intervention on the part of the labor organization they are debarred from the ribbon loom.

There is wisdom in the restriction, for the machinery is heavy, very hard to adjust, and requires a man's muscles.

A young Viennese has invented a device for simplifying the process of weaving silk designs—a machine that may, indeed, revolutionize the silk-weavers' art. The name of the inventor is Szczepanik. By utilizing photography for weaving purposes, Szczepanik can now, in a single quarter of an hour, accomplish what has taken the designer months, or even years, to complete, according to the size of the design. At present a design that is to be woven must first be resolved into squares. In the case of a large gobelin, the designer must fill up millions of such little squares before it is possible to puncture the pasteboard cards which are indispensable in the Jacquard loom. In his photographing apparatus, the Viennese inventor employs ruled screens containing the necessary intersections. These screens are on glass plates, prepared by photography, and are said to be the largest photographic negatives made. Each such screen contains a million squares corresponding with those which hitherto the designer, with infinite labor, covering a period perhaps of months, has filled in. Szczepanik proposes to photograph any pattern that may be selected directly on the sensitive plate. Two minutes' exposure, it is claimed, will suffice to produce an image on the sensitized paper showing the points of intersection needed in the Jacquard card. Bathing, developing, and fixing will occupy a quarter of an hour more, and then the design is finished. The young inventor claims that an electric Jacquard loom, as perfected by him, will weave a silk pocket-handkerchief in less than a minute. Within three minutes, the purchaser of the handkerchief can be photographed by an apparatus in the loom itself, the design-plate can be prepared by the same machine, and in half an hour the purchaser will be able to take away a silk handkerchief with his own portrait woven in it.

#### VELVETS AND PLUSHES

Though the consumption of velvets and plushes in this country is not as great as that of other wares, one ambition of the American silk manufacturer in recent years has been realized; that is, he is now manufacturing velvet on a paying basis. American mills are even supplying more than fifty per cent of the velvet used in this country, a statement which shows that the problem of successful production is being solved.

Plush manufacture in this country is a development of recent years. Previous to 1884 all plushes were imported. In that year American manufacturers for the first time put a satisfactory furniture plush on the market. Since then American furniture plush, mohair and car furniture plush have all successfully competed with foreign plushes; so much so that foreign manufacturers have been compelled to reduce the price of their goods in this country forty per cent. Seal plushes are used extensively in the cloak, cape, cap and trimmings trades.