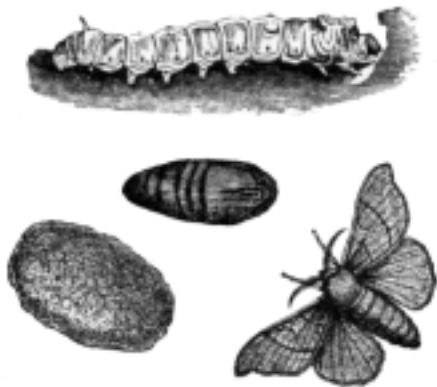


SILK FROM FIBRE TO FABRIC.

True Silk—Silk Throwing—Splitting and Sorting—Soaking—Winding—Cleaning—Doubling—Tram—Organzine—A Typical Silk Spinner—A Silk Doubler and Twister—Defects met with in Thrown Silk—Singles—Reeling—Numbering the Silk—The Denier System of Numbering Silk—Dram System of Numbering Silk—The Ounce System of Numbering Silk—Comparison of Denier and Dram—Denier Constant—Testing Silk as to Counts—Conditioning—Scouring—Boiled-off Silk—Tinting—Souple Silk—Ecrú Silk—Bleaching Silk—Soap—Testing Soap—Soap Economy—Water—Weighting—Dyeing—Washing—Lustering—Wild Silk—Spun Silk—Waste Silk—Statistics—Winding—Warping—Drawing-in—Quilling—Weaving—Finishing.

True Silk or Cultivated silk or (plain) silk is the lustrous, fine, but comparatively strong, thread spun by the silk worm (the larva of the silk moth *Bombyx mori*) at its entry into the chrysalis stage.

Silk differs from our other textile fibres in the fact that the silk worm produces a (double) delicate thread, hundreds of yards in length, and four, five or more of these threads, by means of a simple process of reeling, (at the places where the silk is raised, in order to produce a thread which can be commercially handled) are then united into one thread and wound in a skein, in which state, after having been carefully packed in bundles, the silk thread then reaches our manufacturers. The silk manufacturer thus dealing with a thread for his raw material, explains why the machinery and processes used in preparing silk for the loom are much simpler and less cumbersome than the machinery and processes necessary for preparing other textile fibres and making them into thread.



THE SILK WORM.

Larva,—Cocoon,—Chrysalis,—Moth.

The factors which make silk the most valuable fibre for textile fabrics are: (a) its high state of brilliant lustre, surpassing in that respect the other textile fibres; (b) its strength, which also surpasses that of the other fibres; (c) its elasticity, and (d) its great durability.

Peculiar characteristics of silk are: (1) When passed through an acid bath (acetic acid) and afterwards dried, when handled, it gives out a peculiar rustling, grating noise, termed "scoop." (2) It takes coal-tar dyes with ease, and (3) exhibits a very great affinity for weighting materials, which is made use of

by manufacturers to a great extent, in fact, in some instances is overdone, since such silk fabrics are mainly composed of metallic weighting matters with a very small percentage of silk fibre.

The quality of silk is judged, to a great extent, by its fineness and regularity of thread, and its clearness or freedom from knibs and badly attached filaments.

Like all other textile fibres, silk absorbs moisture from the atmosphere without appearing very damp to the touch of the hand, for which reason, on account of its high cost, when purchasing a lot of silk for his mills, the manufacturer must carefully look into this matter. The legal limit of moisture permissible is fixed at 11 per cent.

The countries that produce cocoons and silk are in the temperate zone. Starting from Japan to China and the belt of Central Asia, including a part of India, the silk-producing belt runs westward through Persia, the Caucasus, Syria, Asia-Minor, Turkey, and the countries of South and Western Europe, stopping at the Atlantic, which to any extent, it has not yet crossed, Asia and Europe being the two Continents on which the world has to rely for its silk supply.

The annual supply of raw silk throughout the world is approximately thus: China 40%, Japan 20%, Italy 20%, Levant 10%, France, Austria, Spain and Portugal 10%. Of the total silk supply of the world, this country consumes about one-third, and of which about 46% is furnished by Japan, 30% by China and 24% by Europe. The raw silk reaches this country in skeins made up into bundles, called "books," which are carefully packed in bales of linen, with an outer covering of rush matting.

China supplies two distinct kinds of silk, *viz.*: a silk shipped from Shanghai, known as "China silk" and a silk shipped from Canton, known as "Canton silk," both of these being either home-reeled, re-reeled or steam-reeled. Of these, home-reeled is the inferior silk, the reeler being careless whether one, two or more cocoons are run out—any old haphazard way of reeling will do. The term "re-reels" refers to home-reeled silk re-reeled, bad ends as well as poor piecings being taken out during the process; at the same time the silk thus treated is given a general cleaning, with the result of a pronounced improvement to the yarn, accompanied by a higher market value. Steam-reeled silk refers to the most even silk, consequently more valuable than either one of the kinds of silk previously mentioned, the reeler in this case being careful to keep the thread, as reeled, as uniform as possible, replacing any run out or broken down cocoons at once with new ones. The average weight of a silk bale, as coming from China, is 100 lbs., and each bale contains 12 books. The latter, in turn, are subdivided into 12 "mosses," and these again into "slips," which vary in length according to the quality of the silk. Coarse silks, not suitable for throwing, are used for tying up the books as well as for protecting the ends, and these coarse silks are used in Waste Silk spinning. Comparing China silk and Canton silk, the first thing we notice is a difference in their color, as well as the

difference in feel when handling both kinds. Chinas, as a rule, are white silks, whereas Cantons are of a variable greenish brown. Again, China silk is a firmer thread than Canton silk, a feature readily noticed at throwing, when the latter will work "fluffy." Steam-reeling in connection with both silks is fast superseding home-reeling.

With reference to Japan silk, most all of it is either re-reeled or steam-reeled silk, and is a clean, fairly even thread, of a grayish white color (not as white as China), the books weighing from $4\frac{1}{4}$ to $4\frac{3}{4}$ lbs., and are put up in bales weighing below 150 lbs. Most all Japan silk is shipped via Yokohama. The best grades of this silk closely rival European silk.

The various kinds of silks of India are collectively known as Bengal silk, and they differ from those previously referred to in color as well as in their mode of packing. The color is generally a bright yellow, and in a few cases a greenish white. The first is the more valuable. The skeins are not made up in books, but are packed with their heads loose, in bales weighing about 145 lbs.

The European silks, including those of the Levant, are the finest, and consequently highest priced silks in the market, the best of them, if demanded, running as fine as 480,000 yards to the pound. The usual color is yellow, although some varieties are of a grayish white. They are divided into four grades, *viz.*: (1) Extra classical, (2) classical, (3) sublime and (4) common, and are packed in bales of one hundred kilos, (about 220 lbs.).

New York City is the only raw silk market here, and now holds the first place among all the raw silk markets of the world, Shanghai alone excepted; more raw silk being now sold here than is consumed in France.

The standard sizes of swifts in our mills are 22 to 24", that is to suit skeins to measure 56 to 58" in circumference. Of the silks handled by our throwsters, Japan silk conforms more to this standard than Canton and Italian silk. China steam-reeled silk, is also quite uniform in the diameter of skein, but the common complaint amongst throwsters is that they put too little silk in their skeins, which makes them, in throwster's parlance, too "skinny," by this is meant not enough yards of silk in a skein, to suit production. There is little uniformity in the length and size of Canton skeins. However, with the general introduction of steam-reeling, all over the silk belt, the standard of the skein gets more uniform every year.

The counts of silk most in demand by our broad silk and silk ribbon mills are 13/15 deniers.

Silk Throwing. This is the name given to the series of operations through which the raw silk passes to transform it into what is known as thrown silk.

Splitting and Sorting. The raw, or hard, silk is received by the throwster in the shape of books or in large skeins, each skein in turn containing several matted parts, *i. e.*, sections of skeins, called slips or gums. If the silk is received in the form of books, the throwster separates them into their separate parts, called mosses, which is easily accomplished, since they

are entirely apart from each other in the book. The large skein would be too heavy to put upon the reel of the winding frame, *i. e.*, the strain on the single end in the winding process would be so great that it would continually break and thus cause endless trouble to the winder, with its consequent amount of waste to the mill. For this reason, the throwster splits up the large skeins into sections, generally from 3 to 6, and thus has a chance to handle them properly. The size of these splits or sections, as made from the large skeins, varies, although it is the throwster's object to have them as much alike as possible. It will be readily understood that this separating of the skein into slips is a most tedious work when handling poorly reeled silk. After thus separating the large skeins into workable slips for winding, the latter are then carefully sorted out as to counts, color and general condition, each kind being put in separate piles and worked separate.

It now depends on the throwster whether he will work the silk "bright" or with "soap." By the first is understood that he will work the slips as they are, whereas by the latter is understood that the slips are subjected to a general washing process first.

Soaking. This is not a very complicated operation, the slips being soaked in a solution of hot water and soap. The hot water, in connection with the alkali contained in the soap, will soften the natural gum of the silk, which makes the threads adhere to each other, in turn, separating the threads from each other, which, until soaked, more or less tenaciously adhere to each other. The fatty matter the soap contains is simultaneously deposited onto the thread and this prevents the matting together of the ends during the drying of the skeins of silk. The soap being the prime factor for this loosening of the silk threads from each other, and since it must be used, in order to facilitate winding, it must be a white curd soap of the best quality, since a cheap soap of poor color, will dry yellow on the silk, and consequently lower its quality and value. A poor soap used will thus not only act harmfully to the silk to be thrown, but also to the waste made during the process, cheapening both. The fatty matters of the soap thus deposited on the silk will naturally act as a weighting compound, some throwsters using more soap than others for this purpose, the most satisfactory plan being to use enough soap to cause a moderate weighting. Silk thus washed with a good white curd soap will lose about 28% during the boiling-off process later on, whereas silk thrown minus washing, *i. e.*, thrown bright, will lose only from 20% to 22%, showing a weighting of silk by the soap, of from 6% to 8%. Some throwsters also use special compounds in place of the soap, which they put on the silk skeins by means of a brush, the silk being left to lie in this state for a day, *i. e.*, until the gum gets softened. A good reliable soap, however, is preferable.

After washing, the skeins are wrung out, thoroughly hydro-extracted and somewhat dried, either in the open air or in a dryer.

(To be continued)