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OLD CHINESE STORY OF THE ORIGIN OF SILK.

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One of the old philosophers said that there are only five fundamental principles which underlie all the activities of the human race, and that it is simply



THE BATHING OF THE SILK-WORMS' EGGS.

[Commentaries written by order of the Emperor Chien Lung.]

According to the "Li-ki," "In ancient times the seeds (eggs) are taken with festive ceremonies in the early morning of the first days of the third spring month and bathed in the river." Nowadays, it is customary to dip the eggs in salt water or in an infusion of ashes, in the middle of the twelfth month. * * * Or they may be laid in water and the wind may be allowed to go over them. * * * In the second tenth of the second month they are again sprinkled with flower-water. At the festival of Tsing-ming they are wrapped in heavy silk and laid in a warm place. When the eggs take on a green shade, they produce worms in the form of ants.

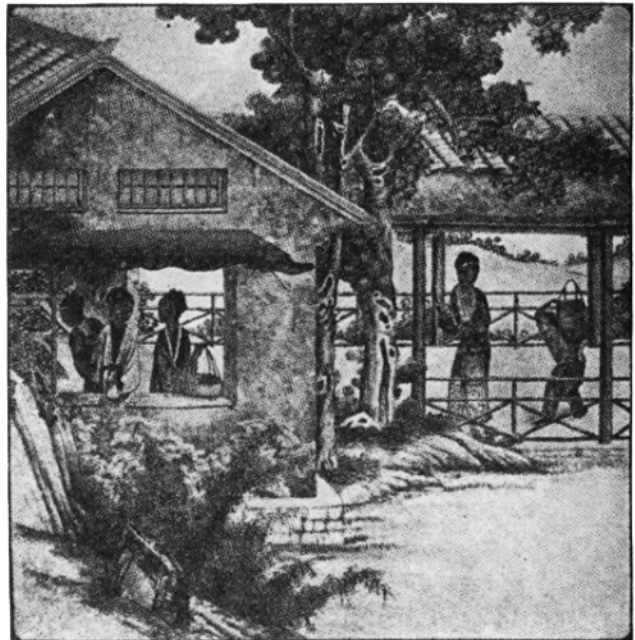
the expression of these, endlessly repeated and infinitely varied, which give rise to all the discoveries and inventions and developments which mark human progress. Whether this is so or not, and whether words of the still older philosopher, "There is no new thing under the sun." are true, it is certain that we must be impressed by the fact that the principles employed in the growth and manufacture of silk in the ancient days of the early Chinese dynasties, as illustrated in the succeeding series, are not vastly different than those which we may see in active use and employment in any modern Paterson or South Manchester mill.

It is the machinery only, by which these principles are operated, which is different. When we see such a bewildering mass of delicate shades and textures, as we saw in the silk exhibition held in New York last year, the innumerable kinds of finish and feel which these fabrics had, and the artistic creations into which they were made, we are very apt to forget what the origin of these silk tissues was.

All the various operations in the production of cocoons; the reeling of the silk from the cocoons into skeins of raw silk, the manufacture of spun silk or schappe from waste, and the manufacture of raw silk and spun silk into goods, are substantially the same, except for the improvements in methods of mechanical handling, as they have been from the earliest days of the industry.

The origin of silk is lost in the mists of antiquity. For ages its manufacture was regarded as a sacred secret, and all the raw silk used in Europe up to the Sixth Century, was brought from China. The export of silk worm eggs from China was punishable by death, and it was not until the Byzantine Emperor Justinian succeeded in inducing two monks to travel disguised through China, that a quantity of these eggs were brought back concealed in the hollow shafts of their pilgrim's staves, and the scrupulously guarded secret was revealed.

From Byzantium, silk cultivation spread into Greece and Syria, then into Spain, and finally became established in Italy in the sixteenth century. That has been, and still is, regarded as the home of the best manufactures of silk, although the industry has now grown to large proportions in Great Britain, the United States and Japan.



THE GREAT AWAKENING.

The last sleep of the silkworm is called the "great sleep." The awakening from this sleep is called the "great awakening." Three days afterward the worms eat very heavily and can consume an entire leaf. While eating, they make a noise like rain. The leaves in the huts can be piled up an inch and after a short time the silkworms eat them up. Although the silkworms love warmth, they cannot stand the hot season. When the heat comes, one must rip open the paper at the windows, in order to let the wind in. There must be an earthenware bowl placed at the door, in which fresh water is poured from time to time, so that cool air may come into the hut.

The cultivation of the mulberry trees, and the feeding of the silk worms, is still a domestic industry in China and Japan, and it is only when the mechanical operations of de-gumming the cocoons and reeling and spinning the fibre, are reached, that the superior mechanical genius of the Occidental races is evident.

It is interesting to note, as indicative of the enormous amount of raw material nature employs in order to obtain an infinitesimal quantity of finished product, that one hundred female moths will produce about one ounce of eggs, numbering thirty-five to forty thousand, and that the cocoons resulting from this number of eggs will weigh, undried, about 160 to 190 pounds. It takes about eleven pounds of undried cocoons to produce one pound of raw silk, that is, from twenty-five hundred to three thousand cocoons.

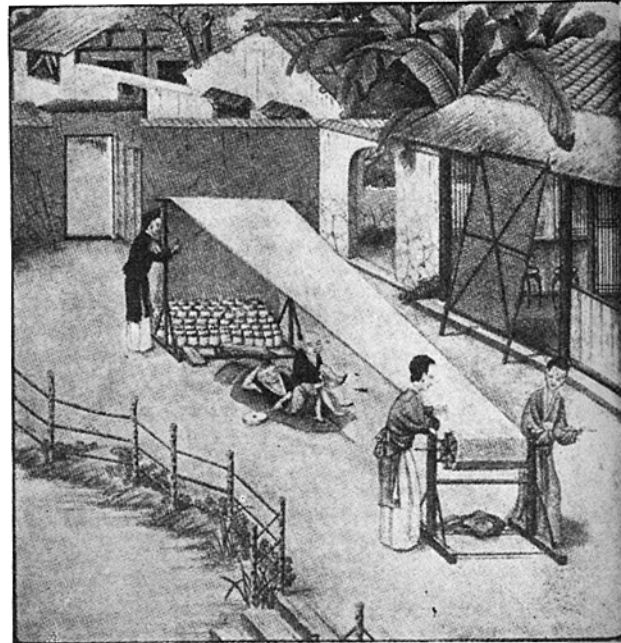
When it is remembered that it is simply single filament silk, and that before it can be used of a size and strength sufficient for weaving, it must be *thrown* or *twisted*, it is obvious that the amount of silk fabric, for instance, in a silk dress, must be the product of hundreds of thousands, and even millions of eggs.

And now we have synthetic silk. Out of thousands of minute nozzles arranged in proper series, there is ejected a viscous, mucilaginous composition, obtained by treating vegetable fibres with various chemicals, and this, as it dries, yields a fibre which compares well in brilliance, strength and coloring qualities with the natural fibre from the silk worm.

This is an age of synthesis; the period of analysis is passing. Modern organic chemistry is developing fields of research where the mysterious processes of nature can be duplicated with a Bunsen burner and a

test tube in a laboratory. The age-long processes wherein the rays of the sun, the unknown re-agents of the earth, the stupendous pressures and temperatures of the hidden places are being duplicated by man, and synthetic rubber, synthetic camphor, synthetic herb essences, as well as synthetic silk, are now in the recognized ranks of manufactures.

It is well within the range of probability that in the not distant future, even the mulberry tree and the silk worm will pass out of human use, as the madder

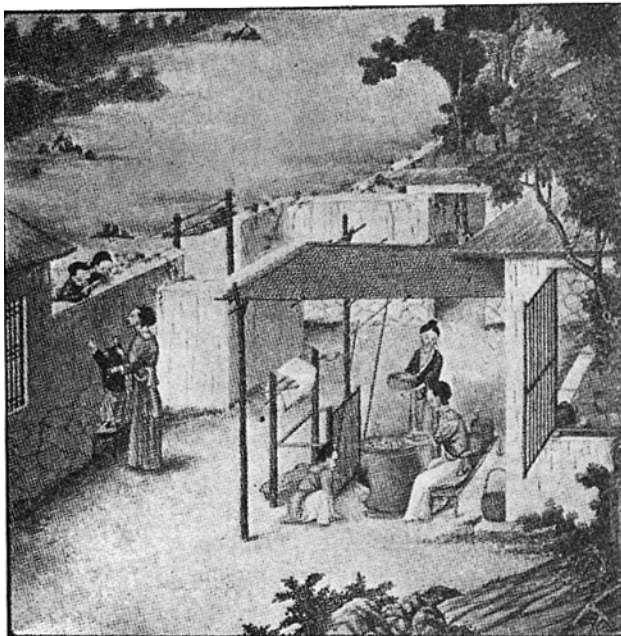


THE WARPING.

The frame is erected in a spacious place and rolls are set at both ends. The reeled silk is then drawn through the heddle; the threads are arranged and slowly carried forward until they reach the roller. In contrast with the filling, one speaks of the vertical warp, which regulates the "ten thousand threads," placing them one after the other, until the piece of silk is finished. The length is somewhat diminished in this process and the width corresponds to that which is determined by the heddle.

[For the weaving, several types of looms are used. The loom for the weaving of plain cloth is handled by one worker; the brocade loom requires two.]

and indigo plants have done, in order to make way for the product of the laboratory.—*Dyestuffs*.



THE UNREELING OF THE SILK THREADS.

The softening of the cocoon in boiling water and the unwinding of the silk strands is the end of the cultivation and the beginning of the weaving. If more than three strands are reeled together the silk becomes coarse; if less, it is too weak. The "Piya" says: "That which the silkworm gives forth from its glands is a hu; ten hu makes a sse (thread), five sse make a mie, ten sse make a scheng, twenty sse make a yu." Herein is a short description of the standard of fineness of silk.

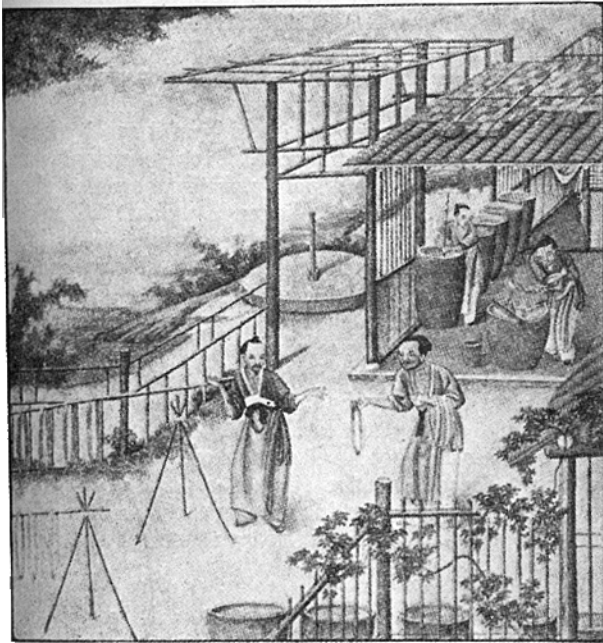
[After the reeling, the silk-grower brings his thank-offering to the divinity. The silk strands are twisted into threads, and the loom is erected.]

Modifying Influences in Textile Research

In the consideration of any problem involving textile fibres, distinction must be recognized between results which are directly due to some specific action under consideration, and those of a similar character that are due to atmospheric agencies, or indirectly due to some modifying influence which has no particular connection with the main problem. For instance, the apparent results obtained in many fibre tests, when expressed numerically, may be quite at variance with the actual figures or net results obtained when due allowance is made for certain variations which regularly occur for differences in relative humidity and temperature. This is particularly true for tests involving the tensile strength of textile material.

It might be well within the limits of possibility to report a certain textile fabric as being stronger than another, when, in reality, it is the stronger of the two. Such a discrepancy could easily come about, even with the use of accurate apparatus, by making one test on a

day when the relative humidity was low and the other on the following day when it might be extremely high. Within certain limits an increase in moisture content or hygroscopic moisture contained in cotton yarn, will increase its textile strength, while with worsted yarn the opposite is true, and the textile strength is lessened with an increase in hygroscopic moisture. As a result of these variations, it is to-day an accepted fact that all such tests, to be of indisputable value, should either be made with bone dry material or under the standard condition of 70° F. and 65 per cent relative humidity.



THE DYEING.

Ordinary silk is not dyed until it is finished. But brocade and gauze have the threads dyed before they are woven. In the "Customs of Pin," in the "Yue-ling" and in the "Tsi-yi," whenever silkworms are mentioned, dyeing is discussed very thoroughly. They speak of the beauty of colors, and of how one can improve upon the work of silkworms with red and green, and with black and yellow. A frame is made and connected by a cross-pole. The silk hung upon it gleams as in embroideries and forms an object of interest in the village market. Before dyeing, the silk must be laid in hot water, because the "Kao Kung-ki" says: "The silk-boilers prepare the silk for dyeing" and "The dyers dye it."

In other instances results may be directly accredited to an agency, which, fundamentally at least, has nothing to do with the case. The tendering of fabric is sometimes attributed to continued exposure to a moist atmosphere, when a growth of mildew is the real cause. Retain the moisture for the same length of time and under the same conditions, with the same fabric, but eliminate the spores which generate the growth of mildew and no tendering will take place.

Moisture Often Blamed When Mildew is Real Cause.

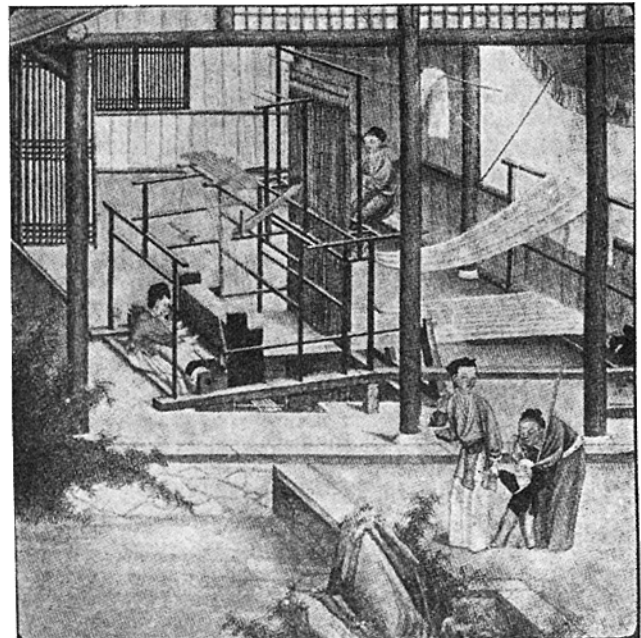
A manufacturing concern was once experiencing considerable difficulty in properly carrying out one of its processes, and finally traced the trouble to yarn which had been stored in a building previously used as a cold storage plant. It was immediately assumed that dampness might be the chief cause of the trouble. This view was held until it was discovered that another lot of cotton yarn stored the same length of time in the building caused no trouble whatever. A laboratory investigation of the whole matter soon located the trouble without any doubt. The paste used in making the paper cones upon which the yarn was

wound in the first case was found to abound with mildew spores. Pieces of the pasteboard cone from this lot developed an abundant growth of mold when exposed to a moist atmosphere in a dark room for a few days, but pieces of cone from the second lot of yarn which had caused no trouble exposed under the same conditions showed no signs whatever of mold. It was thus shown that although the dampness of the store house might have aided the development of the mildew, moisture, as such, was not a direct factor.

Action of Light Sometimes Mistaken.

Even the resultant action of light upon textile material may be confused with wholly independent causes. The author once worked in a laboratory in a fireproof building where safety had been still further augmented on the upper floor by hanging a rope fire escape at each window. As has apparently been the case in all generations, students, in the way of relaxation, frequently resort to some form of side play, and this particular time it took the rather unusual form of playing with one of the fire escape ropes. It was discovered that an energetic twist of this half-inch rope caused it to be readily broken in two. Examination of the rope at the next window showed that it was completely rotten and possessed practically no tensile strength. As a result the recreation soon developed into a serious and decidedly interesting investigation. The ropes first examined hung directly in a window where they had received the direct action of the sunlight ever since the building had been erected, a matter of ten years, more or less, and it was immediately assumed that this was the cause of the deterioration.

(Continued on page iii)



THE WEAVING IN OF THE PATTERN.

In the simple days of antiquity all the silks were plain and of one color. Yet the books of "Wu" speak of the twelve symbols that were painted upon the outer garment and embroidered upon the inner garment. The symbols of the ax and of the ya sign are given in "Kao Kung-ki" and other coloring is there established. The "linear weaves" and the "rare weaves" of the "Yu Kung" belong, however, in the class with the brocades and gauzes. The art of weaving patterns had its origin in early times. The silk damask with the design of the crane head and the brocade with the design of the pepper tree are only things that are a further elaboration of something that existed before.