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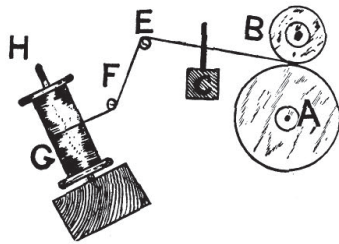
### A Fiber of Silk:

FROM THE WORM TO THE FINISHED FABRIC.

BY GEO. DAMON RICE, JR.

V.

The raw (reeled) silk must pass through several

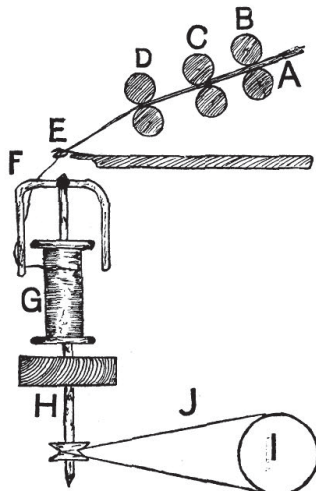


**Principle of the Device Used for Removing Lumps and Specks from the Surface of the Silk Strands.**

more operations before it can be woven into cloth, the first of which consists in transferring the material from the skeins on to spools. This is accomplished by submitting the skeins to a bath in which the temperature stands at 110° or 115° Fah. This tends to loosen the fibers, thus allowing them to wind off on to the spools when the proper mechanical work is performed.

**Cleaning.**—Cleaning is substantially for the purpose of removing all the lumps, specks, and similar substances which remain adhering to the surface of the filaments. These are effectually removed by a contrivance, the principle of which is shown in the accompanying sketch.

The silk in this case is transferred from one bob-



**Principle of the Silk-Spinning Operation.**

bin to the other. The spool B revolves on the drum A, and thus draws the silk from the spool G under F and over E through the cleaner C. The spool G turns loosely on the spindle H, while motion is im-

parted to the spool B by the drum A. The cleaner consists of a narrow opening just sufficiently wide to permit the free passage of the silk strand. Anything in the form of a lump or speck is immediately caught by the bars of the cleaner and either knocked off or the silk broken, therefore nothing but good, smooth and uniform filaments are wound on the spool B.

**Doubling.**—The object of the next process, which is that of doubling, is to bring two or more strands from the spools of the cleaned silk and wind them on to the circumference of one spool. No twist is applied during this operation, consequently the next process is to communicate the twist, which is effected on the spinning machine.

**Spinning.**—The mission of the spinning process is to impart a twist to the strands of doubled silk, and thus render them sufficiently strong and elastic to resist the strain which necessarily occurs during the weaving process. The twist is communicated to these strands by the use of the machine shown. In the sketch, the silk, as it enters the machine, is represented by A, from which point it passes to the draft rollers B, C and D. The arrangement of the speed of these rollers is such, that what is termed a "draft" is effected—that is, the revolutions of the pair C exceed those of B, while the last pair revolve still faster. The result is that the untwisted strands of silk are slightly elongated. The draft in the case of silk, however, is exceedingly small when compared with that of cotton, wool or worsted. In fact, but little, and sometimes none at all, is applied in connection with silk. From the draft rollers the silk enters the guide E, then passes around one leg of the flyer F, then on to the bobbin G. The flyer is attached to the spindle H, therefore when the latter is turned through the agency of the cylinder I and the band J, the flyer goes with it. The revolutions of the flyer twist the yarn and wind it on the bobbin. This device is certainly a great step toward improvement over the old-style devices which were invented during the first history of the textile industry. The apparatus used previous to 1750 was exceedingly crude, and but a single end could be spun at one time. James Hargraves made the first improvement in spinning by constructing a device for spinning eight threads simultaneously. This was followed by what was termed the "mule jeany," invented by Samuel Crompton, of Bolton, in 1775 or 1776. The advantage of this apparatus was due to the fact that one hundred ends could be successfully spun on it at once. The bobbins for spinning these ends were set on spindles arranged in a continuous line in a carriage which moved in and out during the spinning operation. A magnified view of a strand of silk thread is herewith shown.

A casual examination of this sample will readily show that the twist tends to impart a degree of solidity to the strand which could not otherwise be attained. It consolidates the filaments into a firm body, and makes the thread durable, elastic and capable of resisting the usual forces which occur when weaving it into the textual form. From the spinning department the yarn goes to that of the

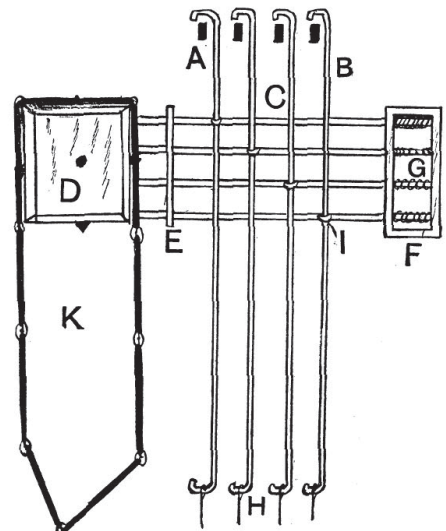
dressing, or warping, where it is formed into a warp on a loom beam. This work consists in arranging the yarns on the loom beam according to the pattern devised, after which the warp is taken to the loom for weaving.

**Weaving.**—Hand looms were the only devices



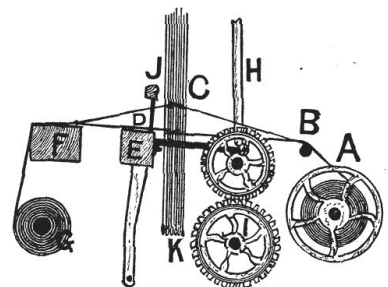
**A Silk Thread (Magnified).**

used for weaving the fine silk yarns into a textual form for many generations. A Mr. Kaye, of Bury, invented an ingenious device for throwing a loom shuttle in, in 1750, but it was some twenty-five years



**Principle of the Jacquard Attachment.**

later before a mechanical cloth-weaving apparatus was successfully operated for practical purposes. Dr. Cartwright invented a loom for automatically



**Principle of the Silk Loom.**

weaving cloth, in 1784. He devoted nearly three years to the work, and after many failures finally



succeeded in producing a loom which revolutionized the old hand system of weaving.

*The Jacquard Loom.*—Although thousands of yards of silk material are annually woven into cloth on the common harness loom, yet the greater proportion is made on the Jacquard loom, or, properly speaking, the common loom, with a Jacquard head-motion attached to it. The principle of the Jacquard attachment is demonstrated in the accompanying diagram.

Here the upright wires B are furnished with hooks at both ends. The upper series of hooks rest over the knives A, while the mission of the lower set is simply for holding the heddles or strings which lower and elevate the warp yarns for the construction of the pattern. Each of these upright wires is fitted with a corresponding cross-wire, or needle C, the front end E of which comes in contact with the cylinder D. The upright wires and the needles are held together by the rings I. The cylinder D carries a series of cards K around its surface, as shown in the sketch. These cards are punched according to the pattern to be woven. When a blank space comes in contact with a needle, that needle is pressed forward, carrying the upright wire with it, thus, when the knives A rise, they do not touch the hook of that wire, for the inward pressure of the blank card on the cylinder has forced it beyond that point. The springs G in the case F cause the needles to return as soon as the pressure is removed. Therefore, when the next card is presented, it may contain two or more holes, in which case the needles slip through and the hooks remain in position over the knives, and when the latter rise they take the hooks up with them, and consequently elevate the upright wires and the heddles H. This view simply represents one series of the wires employed in the whole attachment, there being about two hundred altogether. As the holes in the cards can be punched at pleasure, it is very evident that any style of figured design may be produced.

In order that the principle of the loom may be fully understood, an additional view of the main working parts is given in the next illustration. In this diagram the silk warp is represented by A; the yarn passing over the whip roll B, is drawn into the eyes of the heddles C, as shown. The shed D is automatically formed by the mechanical movement of the connecting rod H, whose mission is to communicate the motion from the crank shaft to the Jacquard attachment above, a description of which has just been given. E is the lathe, the object of which is to sustain the reed J in position while it beats the filling yarns into place. It also furnishes a raceway upon which the shuttle may travel to and

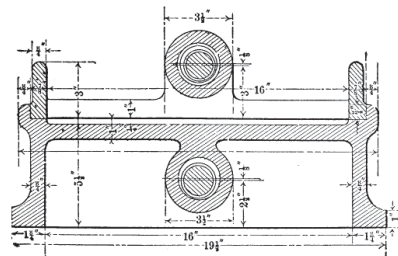


Fig. 64.—Pusey & Jones Co. Valve.

fro; F is the breast-beam, over which the fabric of woven silk passes on its way to the cloth-beam G. An automatic device is employed for winding the cloth on the beam as fast as it is woven. The lathe is made to move forward and backward through the agency of a crank shaft with a connecting arm between. The crank shaft, in turn, is operated by the gears I. In fact, every movement of the power loom is successfully operated by mechanical means, and the power loom of to-day is indeed a marvelous piece

of ingenuity. The object of the small leaden weights K is to depress or lower the heddles to which they are attached, after the latter have been raised by the action of the head motion.

*Advantages of the Jacquard Attachment.*—The Jacquard method of manipulating the warp threads, en-

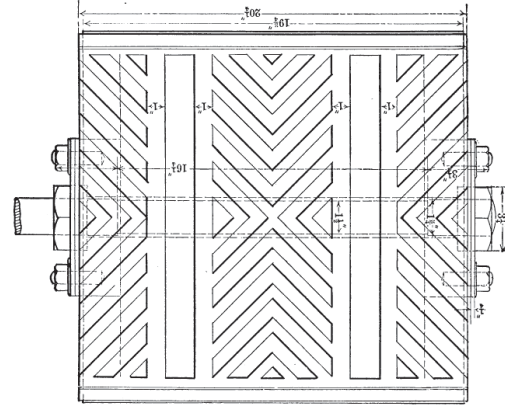


Fig. 62.—Pusey & Jones Co. Valve.

tirely dispenses with the crude witch, or treadle, motions, and the attachment is so ingeniously constructed that it affords unlimited scope for the weaving of a wide range of complicated weaving effects. Patterns may be woven on this machine in which from 100 to 1,200 ends are used. It is an ordinary occurrence to weave a figured design containing 650

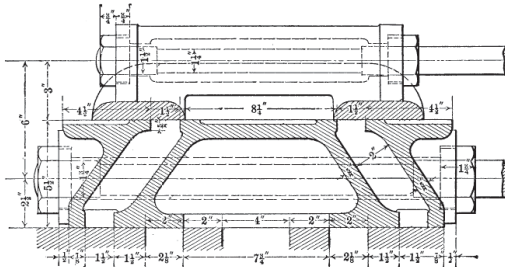


Fig. 63.—Pusey & Jones Co. Valve Seats.

or 700 ends when making elaborately-displayed silk goods. The Jacquard attachment favors the weaving of these intricate designs without any special complication of parts, in which respect it is indeed an advantageous addition to the textile trade, whether it be in the line of silk, wool, cotton or any other fiber. Considerable trouble was experienced in obtaining satisfactory results in weaving intricate patterns before the advent of the Jacquard attachment, hence the name of its inventor should occupy a prominent place in the records of the history of textile manufactures.