bevel-wheel *n,* and thereby to the shaft o, which crosses the end of the machine ; each end of this shaft carries a bevel-wheel *p,* which drives a bevel-wheel *h,* fixed on the end of the shaft, on which the little spur-wheels that drive the spur-wheels of the bobbins are fixed. On this last shaft is also fixed a pinion, to work the traverse guide­bar; this it effects by giving motion to a small wheel, round which another pinion revolves, in the manner of the sun and planet-wheels, and, being connected by a short rod with the traverse-bar, the latter is consequently moved through a space equal to the added diameters of the wheels, In the usual mode of constructing this machine, there is a want of a mean of lessening the velocity of the drawing­bobbin, as its diameter increases by the accumulation of silk. In consequence of this want, the thread is very un­equally twisted ; for although at the commencement of the process the drawing or upper bobbin may, by appropriate toothed-wheels, be made to turn with the velocity requisite to allow of the thread receiving, say twelve twists in the inch, yet, after a very short time, the silk will have accu­mulated on it, and increased its diameter so much, that for every revolution which it now makes, it will take up and draw away a much greater length of thread from the revolving bobbin, whose speed remains constant, so that the number of twists are constantly on the decrease, and, at the end of the operation, may be no more than eight in the inch. A very ingenious mode of equalizing the draw of the bobbin has been put in practice In place of driving the drawing-bobbins by toothed-wheels, they are here driven by friction-rollers ; the part of the bobbin on which the silk is wound rests on the roller, and receives motion from it ; and, as the diameter of this part increases by the accu­mulation of silk, its velocity, of course, diminishes in pre­cisely the same ratio ; thus, the surface on which the silk is wound has a uniform rate of motion from the beginning to the end of the process, insuring, what has ever been a desideratum, perfect equality in the twist of the thread.

The next operation is doubling. Fig. 15 is an end view of the doubling-machine. In this machine the bobbins *a a a,* containing the spun silk, are arranged along the lower platform ft, in little brackets capable of each con­taining three bobbins ; from these the threads are car­ried over the guide-rods *d,* of which there are two on each side of the machine, and, after being passed through the eyes of an apparatus called the falling-wires, and the tra­verse-guides *e e,* are then attached to the bobbins *ff* to which motion is given by friction-pullies, as in the first machines, and on them the threads are thus wound up in combination.

In all former­ly described machines the break­ing of the thread causes no in jury, but, in the doubling process, were one of the three threads to break, and the upper bobbin to continue to re­volve, the other two threads would be wound up separately, and so spoil the work ; to pre­vent this is the use of the falling-wires described above, which, on the breaking of the thread, stop the bobbin until the damage is repaired. The subjoined sketch (figs. 16, 17), shews a side view and plan of this apparatus: *a a* are the two guide-rods, with the threads passing over them; between the rods are seen the eyclets of three bent wires, whose other extremi­ties are hinged to a piece of brass at *c*. The threads are pass­ed through these eye­lets, and support the wires in the horizontal position shewn in the sketch. Hinged to the same supports as the wires is a brass lever, *bb,* bent at right angles horizontally under the wires; the straight end or tail of the lever is a little hea­vier than the bent end, and it consequently lies in the oblique position of our drawing. On the end of the bob­bin is fixed a little ratchet-wheel, moving as indicated by the arrow. Now, when one of the threads sustaining the bent wires happens to break, the wire falls down on the bent part of the lever, which, by this additional weight, is depressed, and its opposite end consequently rises into the position shewn by the dotted line, and acts as a paul to the ratchet-wheel, effectually stopping the bobbin until the attendant has leisure to lift it out of its working-groove, repair the damaged thread, and again set it in motion.

When the lighter kinds of silk have to be doubled, they would be injured by being made to drag round the heavy bobbins ; therefore, for such kinds a modification of the apparatus is required. In place of the bobbins being placed horizontally in bearers, they are placed vertically on spindles, as shewn in figs. 12, 13, 14 ; the spindles project be­yond the upper end of the boobins, and carry a little wheel of hard wood, which is made to turn freely ; this wheel has two flyers with eyelets at their extremities ; the thread being put through these, and drawn by the upper bobbins, causes the light flyers to revolve round the vertical bobbin, and unwind the thread without straining it.

The next is the throwing machine. As this machine closely resembles the spinning-machine shewn in fig. 12, we here only sketch such a portion of it as will shew wherein they do not agree. Fig. 18 is an end view, and fig. 19 is a side view of one of the working parts: *a a* is a vertical bob­bin with its loose flyer *bb;* the bobbin being driven by a band acting on the spindle pulley as in the spinning-ma­chine ; *c* is a traverse guide wire, through the eye of which the thread is passed ; *d* a reel on which, in this case, the thread is wound into hanks as it is twisted by the revolution of the vertical bobbins.

The traverse guide bars have, in this machine, a very short range of lateral motion, so as to confine each hank within a very narrow limit on the reel’s surface. The motion of the reel can be so regulated in relation to that of the twist­ing bobbin, as in any way to modify the amount of twisting received by the thread.

In the case of the heavier silk threads used for sewing, fringing, and the like, the doubling and throwing pro­cesses are both performed by one machine, called a throstle frame, which is similar to the machine of the same name used in the cotton and linen thread manufacture. The