

**Drawing-frame.** 1. A machine in which the *slivers* of cotton or other wool from the *carding-machine* are attenuated by passing through consecutive pairs of rollers, each successive pair rotating at a higher speed than its predecessors.

The device was first invented by Leon Paul, patented 1738; and perfected by Arkwright, patent 1769. It was called a *water-frame*, from the circumstance that Arkwright's machinery was driven by water-power.

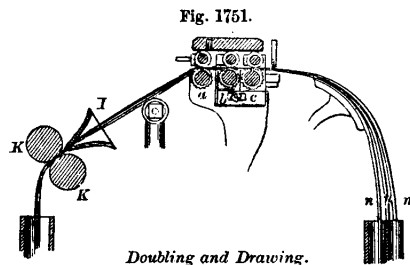
It was named a *throstle* from the brisk singing or humming sound made by it. See *THROSTLE*.

It is used in the process of doubling slivers (see *DOUBLER*), and is indispensable in the *bobbin-and-fly machine* and the *mule* (which see).

The *drawing-frame*, disconnected with any spinning operation, is a machine to elongate the spongy slivers produced by the carding-engine, to straighten the filaments and lay them parallel.

The drawing-frame is also used to equalize slivers by condensing a number into one (see *DOUBLING*), and then elongating them so as to overcome special defects. Filaments which have become doubled over the teeth of the carding-machine are also straightened in the process of doubling and drawing.

The *drawing-frame* consists of three pairs of roll-



Doubling and Drawing.

ers, the upper ones being covered with leather and the lower ones fluted longitudinally. The upper ones have an imposed weight, and the lower ones are driven by power, and carry those above. The rollers are driven with varying degrees of velocity; the second *b*, say, at a speed double that of the first *c*, and the third or delivery rollers *a* at a speed five times that of the second *b*.

The delivery-rollers, called the *front-rollers*, turn in brass lishes in fixed iron bearings, but the other roller-brasses are adjustable in grooves towards and from each other and the front roller, to adapt their distances to the length or staple of the cotton operated upon.

The *card-ends* or slivers *n m*, from separate cans, are united and pressed together between the rollers (*doubling*), and by the increased speed of the successive pairs are drawn out into a flat sliver, two of which are combined, passed through a funnel *I*, between compacting rollers *K K*, and thence to a can. A board above the upper rollers has flannel on its lower surface, and acts as a wiper.

The operation is as follows:—

Suppose six slivers from the carding-machine, or *card-ends*, to be inserted and passed through the first pair of rollers, the second pair, traveling at double the rate of the former, will elongate every inch of the compound sliver into two inches, and the third will make it ten inches, so that the combined sliver is formed into one of ten times the length and proportionate size; this process is repeated again and again, so that in very fine yarn the fibers are laid parallel to each other many thousands of times, and with coarse yarns as many as a thousand times. For instance:—

Ten card-ends formed into one ribbon of the same size and six times the length; six of these ribbons similarly treated and formed into one; six of the latter, by a third operation, formed into one sliver; and five of these drawn into one,— will have the ef-

fect of placing the fibers parallel to each other 1080 times ( $6 \times 6 \times 6 \times 5 = 1080$ ).

The drawing-frame for long-stapled wool is for drawing out and extending the slivers which have already been operated upon by the *BREAKING-FRAME* (which see). This is a repetitive operation, and it is usual to pass the wool through the *breaking-frame* and four times through the *drawing-frame* before *roving*. These slivers are united at each drawing, and are extended to, say, four times the length. The result is an actual extension and an oft-repeated laying of the slivers alongside of each other, so as to blend them and reduce inequalities.

2. (*Silk-machinery*.) A machine in which the fibers of floss or refuse silk are laid parallel, preparatory to being cut into lengths by the *cutting-engine*, to be afterwards worked like cotton.

The order of the machines is as follows:—

*Hackling*.

*FILLING-ENGINE* (which see).

*Drawing-frame*; the filaments are held firmly by one end, and a comb travels over the surface to remove impurities and short fibers.

*Cutting-engine* reduces the filaments to a staple about  $1\frac{1}{2}$  inches in length.

*Scutcher*.

*Cleanser and dryer*.

*Carding-machine*.

From whence the staple is treated like cotton. See *CARDING-MACHINE*; *DRAWING*; *DOUBLING*; *ROVING-MACHINE*; *THROSTLE*; *BOBBIN-AND-FLY FRAME*. etc. See list under *COTTON*. etc.. p. 631.