

drawing-frame is for attenuating *slivers* of fiber by passing them through consecutive pairs of rollers, each pair in the succession revolving at a higher speed than its predecessor. Leon Paul, by patent of 1738, claimed a mode of spinning by rollers, but the device did not come into use. (See SPINNING.) Richard Arkwright perfected the invention and patented it in 1769.

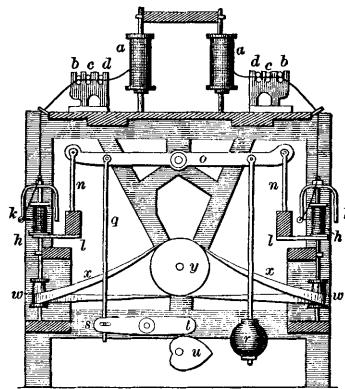
Arkwright's original spinning-frame was fed with rovings which passed between three pairs of rollers of successively increasing speed. The yarns were wound upon bobbins by means of flyers. It was the culmination of several attempts, and possesses the main features of the *throstle* and the *bobbin and fly-frame* in function, as well as in the relative positions of parts. See SPINNING, Fig. 5404, page 2271.

The *bobbin and fly-frame* is similar in principle to the *throstle*, and is adapted for giving a partial twist to the sliver as delivered from the carding-machine or the doubling-frame. The slivers in cans are fed to the *coarse bobbin and fly-frame*, where they are reduced and partially twisted so as to give them greater coherence, being elongated say $4\frac{1}{2}$ times. The rovings thus produced are wound on bobbins which are placed on the *creel* of the *fine bobbin and fly-frame*, by which they are still farther reduced and twisted.

These rovings on their bobbins are then transferred to the *throstle*, a transverse vertical section of which is shown in Fig. 6419.

a a are two of the bobbins. The thread, as it is drawn off from these, passes through the drawing-rollers *b c d*, and then to the spindles. Here it is twisted and wound upon the bobbins. The bobbins *h* have no rotatory motion imparted to them,

Fig. 6419.



Throstle.

but simply rest upon the trays *l*, and are dragged round by the thread as it twists itself round them, as the fork or fly *k* revolves much more rapidly than the thread is given out from the drawing-rollers. The up-and-down motion of the bobbins is effected in the following manner:—

The lever *o* turns at its center on a spindle fixed to the frame-work. At its ends it is connected by the rods *n n* to the trays *l l*, upon which the bobbins rest, and receives an oscillating motion from the heart-shaped cam *u* through the lever *s t* and rod *q*. The cam depresses the one side of the lever, which is pulled down on the other side, and therefore also the bobbins, are moved up and down. The spindles receive their motion from the drum *y* and the belts *x x* passing round the small pulleys *v v*. The speed of the rollers and spindles is proportioned to the required fineness of the yarn. For example, the drum *y* making 600 revolutions per minute, the spindles, whose pulleys are $\frac{1}{6}$ of the diameter of the drum, make 3,600 revolutions. There are usually from 75 to 150 spindles on each side of the *throstle*, and they are set about 3 inches apart, all being driven from the drum *y*, which extends the whole length of the machine.

The specific difference between the action of the *throstle* and the *mule* is that the former has a continuous action, *drawing, twisting, and winding*; while the *mule* has an alternate action, *drawing and twisting*, and then *winding*.

It is thus stated by Tomlinson:—
“The *mule* having made a definite length of yarn, the operation of spinning is suspended while the yarn is being wound up

on bobbins or spindles. In the *throstle* the yarn is both spun and wound at the same time. The *throstle-yarn* is smooth and wiry, while the *mule-yarn* is soft and downy. *Throstle-yarn* is employed for warps of heavy goods, and for making sewing-thread; *mule-yarn* is used for the weft of heavy goods, and for the warp and weft of soft and fine goods.” See BOBBIN and FLY-FRAME; DRAWING-FRAME; ROVING; MULE; DOUBLING; JENNY.

The *throstle* derived its name from the singing or humming which it occasioned. It was also called the *water-frame* from the fact that the machinery in Arkwright's mill, where it was first used, was driven by a water-wheel.

2. A spindle for wool.

Thros'tle. 1. (Cotton.) The *drawing-frame* of the cotton manufacture. The great invention which succeeded the *spinning-jenny* of Hargreaves. The