Bob'bin and Fly Frame. The ordinary *roving-machine* of the cotton manufacture. Its duty is to draw and twist the *sliver*, and wind the roving on a bobbin.

The *bobbins* containing the *slivers* are mounted in several rows on a *creel* which has *skewers* for their reception. Each sliver passes between a pair of guides, which give it a horizontal traversing motion, so that it shall not bear upon a constant part of the surfaces of the drawing-rollers between which it next passes. These drawing-rollers are arranged in pairs (see DRAWING-FRAME), and have a relatively increasing rate of speed, the second revolving faster than the first and the third faster than the second. This proportion may be, say, first rollers 1 inch in diameter and 60 turns per minute; delivering rollers, 1¼ inches in diameter and 180 turns per minute. By this proportion the first roller would deliver 188.4 inches per minute, while the *front* or delivery pair passes 705.5 inches per minute, the roving becoming elongated 3¾ turns by the operation.

After leaving the rollers the sliver is received by the spindles, which are arranged in two rows for economy of room. The vertical spindles are driven by bevel-wheels from bevel-pinions, or horizontal shafts extending the whole length of the machine. Supported upon each spindle is a *flyer*, which has a hollow axis and a hollow arm, through both of which the roving passes in order to reach the bobbin, which is placed upon the spindle, and revolves loosely thereon by its own positive motion, derived from bevel-gearing, shown beneath it in the figure. The lower bevel-gearing is for the rotation of the *spindle* and *flyer*, and gives the twist. The upper bevel-gearing is for the rotation of the *bobbin*, and winds the *roving* thereon. The flyer has one tubular arm to lead the roving, and one solid arm which acts as a counterbalance to the former to prevent agitation during the rotation at high speed, say 1,300 revolutions per minute.

The bobbin has two motions, — one around the spindle on which it is sleeved, and one up and down on the spindle. The former is for the winding on of the roving, and the latter to distribute the roving in coils alongside each other along the length of the bobbin.

There are three inequalities to the motion of the bobbin, — one in the rate of its revolution, another in the length of its vertical traverse, and a third in the rate of its traverse. The inequality of rotation is for the purpose of winding equal roving in equal time, notwithstanding the increasing diameter of the *cop*. The rate of winding on is of necessity equal to the rate of delivery from the *front* pair of drawing-rollers, and it follows that the rate of winding must be uniform. As layer after layer of coils accumulates upon the bobbin, the latter receives a decrease of speed exactly equivalent to its increase of diameter. This is accomplished by *cone*-pulleys by which the driving-band is shifted to a part of the *driven*-pulley having a larger diameter, the band having a constant rate. See CONE-PULLEYS.

The vertical motion of the bobbins is by means of raising and lowering the *copping-rail* on which the whole row or the two rows of bobbins rest, sliding the bobbins up and down on the spindles. The inequality of *length* of vertical motion is for the purpose of giving a gradually decreasing length to each successive layer of coils, giving a conical end to the completed cop, so that each layer contains an equal length of roving, its diminution in length counterbalancing its increase in diameter. The inequality of *rate* of vertical motion is to enable the yarns to lie compactly side by side in the coils, notwithstanding the changes in the rate of revolution due to changes in the diameter of the *cop*.

While the *twist* depends upon the rotation of the *spindle* and *flyer*, the degree of twist depends upon the ratio between the delivery at the front pair of *drawing-rollers* and the revolutions of the spindle. "The winding on of the twisted roving upon the bobbin is effected by giving to the bobbin such a velocity that the difference between the motion of the surface of the bobbin and the motion of the delivering end at the arm of the flyer shall equal the surface-motion of the roller or the supply of the sliver. The spindle and bobbin being driven by different movements and at different rates, the winding is effected either by making the bobbin revolve a little faster than the spindle, or the spindle faster than the bobbin. If, for example, the bobbin revolves 50 times while the spindle only revolves 40, 40 turns of

the bobbin will have nothing to do with the winding; but there are 10 turns of the bobbin above those of the flyer, which will perform the winding. Hence the 40 turns of the spindle produce twist, while the 50 turns of the bobbin produce 10 coils of the roving upon its barrel."— TOMLINSON.

Bobbin and fly frames are of two kinds, *coarse* and *fine*, or *first* and *second*.

The *coarse*, or *first*, *bobbin and fly frame* acts upon *slivers* from cans filled at the *drawing-frame* and placed at the back of the machine.

The *fine*, or *second*, *bobbin and fly frame* acts upon *rovings*, or *slubbings* as they are often called, from *bobbins* filled at the first frame and placed on the *skewers* of the *creel* placed behind the *roller-beam*.

The object of the repetition is to obtain a greater degree of *drawing* and *twist* than could be safely imparted at the first operation, when the *sliver* or *card end* had but little coherence.

In the coarse bobbin and fly frame it is usual to make the spindle revolve quicker than the bobbin, and in the fine frame to make it go slower. The relation of the speed and proportions are well explained by Dr. Ure with an elaborateness impossible within our limits.

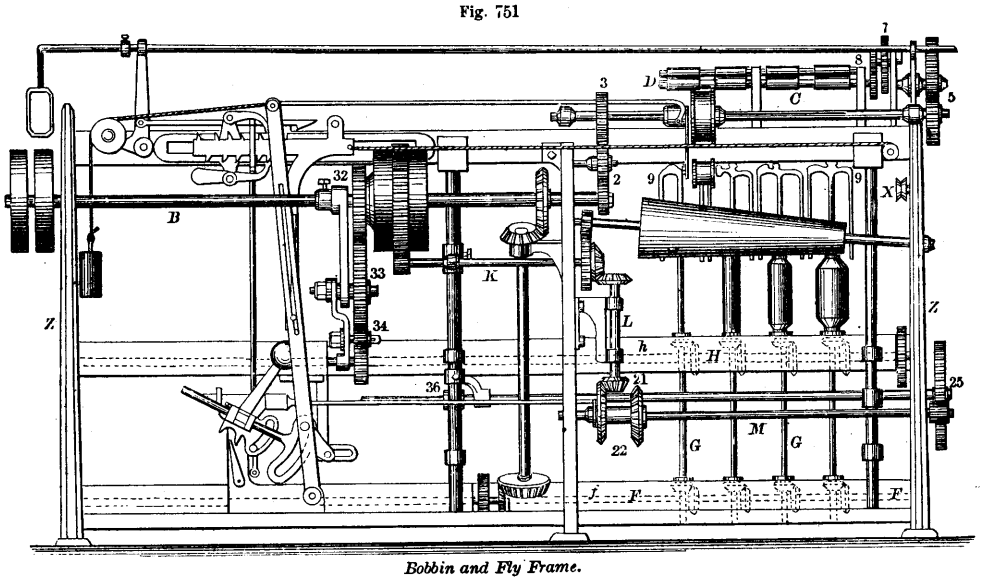
In the coarse roving-frames the spindles make on an average 750 revolutions per minute, turning off for each spindle 400 inches per minute or 666⅔ yards per hour. In the fine frame there is more twisting power, and this produces about 533 yards per hour. In the coarse frame the *sliver* is elongated from four to six times, one quarter of the draft being between the first and second pairs of rollers, and the remaining three quarters between the second and the delivery pairs of rollers.

As the drawing-rollers and the spindles are driven by positive though determinate motions from the same shaft, the number of twists to an inch of the sliver delivered from the front pair of drawing-rollers is uniform after the work is started, irrespective of the rate of winding on the bobbin or the actual speed of the machine. The relation is adjustable before starting by changeable gearing intervening between the main shaft and the spur-wheels of the drawing-rollers. If the drawing-rollers pay out 706 inches of sliver and the flyers make 1,300 revolutions, the amount of twist will be nearly 1¾ to an inch. This is but slight, but is usual in the *first roving-machine*, a draw and twist being afterwards given in the *second roving-machine;* the processes being repeated either in the *throstle* or the *mule*, in one of which the yarn is finished.

For the adjustment of different degrees of twist in different yarns a differential gearing is used. See EQUATIONAL BOX.

B, main shaft, driven by a band from the engine.

Fig. 751



Bobbin and Fly Frame.

2, 3, 5, 7, 8, *C*, *D*, train for driving drawing-rollers.

F F, long horizontal shaft below the beam *f*, driven by gearing from the main shaft, and driving the spindles *G*.

h, copping-beam on which the bobbins rest, and which is fitted with slides to the end frames *Z*.

9, flyer pressed on to the top of the spindle.

X, pulley for the chain of the weight which counterbalances the weight of the copping-rail.

H, horizontal shaft carrying the bevel gears by which are rotated the disks in the copping-rail *h*, on which the bobbins are fixed to rotate as they traverse up and down on the spindles *G*.

C, *K*, *L*, 21, *M*, 22, 25, shafting and train driving the pinion and rack 36, by which the copping-rail is vertically actuated; right and left bevel-wheels 22 (and another not shown), sliding on shaft *M*, to engage alternately with pinion 21, to give the motions of the copping-rail.

32, 33, 34, train connected with the *cone-pulley* for variable speed, and driving-shaft *H*, which revolves the bobbins by the intervention of bevel-gears. The wheels are connected by elbow-links, so as to mesh, irrespective of the vertical position of the copping-rail *h* and its adjuncts.