

Mule. A spinning-machine in which the rovings are delivered from a series of sets of drawing rollers to spindles placed on a carriage, which travels away from the rollers while the thread is being twisted, and returns toward the rollers while the thread is being wound.

It was invented by Samuel Crompton, and perfected in 1779, so far as to make it an excellent working machine. Subsequent improvements by Roberts, Mason, and others have brought it to its present state, in which it is automatic, and is known in some parts of England as the "iron man," in allusion to its singularly deft and delicate action.

The combination which gave rise to the term *mule* was the junction of the *drawing-rollers* of Arkwright with the *jenny* of Hargreaves. The hybrid scarcely came within the definition of a *mule*, which is declared by Senator Nesmith of Oregon to be "a being without pride of ancestry or hope of posterity." The object of the machine is to deliver the roving with the required degree of attenuation and twist it as delivered. For this purpose, the spindles, instead of being stationary, are placed on a movable carriage, which is wheeled out to twist the threads and wheeled in again to wind on the spindles.

Mr. Kennedy, the friend and biographer of Crompton, states:—

"The great and important invention of Crompton was his spindle-carriage and the principle of the thread having no strain upon it till it was completed. The carriage with the spindles could, by the movement of the hand and knee, recede just as the rollers delivered out the elongated thread in a soft state, so that it would allow of a considerable stretch before the thread had to encounter the stress of winding on the spindle. This was the corner-stone of the merits of his invention."

Crompton's mule was also termed the *muslin machine*, from its producing yarn finer and softer than was obtained from any other machine then known, more nearly to the standard of the India muslins, which are yet the admiration of the cotton-trade.

Crompton gave up his invention to the public in 1780. Thirty-two years afterward he received £5,000 from government as a compensation for his services. This was unfortunately frittered away in starting his sons in business, and the father was again in poverty. A subscription was raised for him which supported him during the last two years of his life. He died in 1827.

Crompton obtained no patent, and his poverty was not rendered additionally miserable by vexatious litigations and hopes deferred. There seems to have been no conscience among manufacturers as to the right of property in patents during the period marked by the inventions of Hargreaves, Arkwright, and Watt. The latter two, by indomitable energy and the possession of partners of skill, capital, and business tact, survived the attack of the Ishmaelites, and left honored names and good estates. (See SPINNING.) Crompton's first machine contained only 20 or 30 spindles, and was built to supply his own loom with good yarn. The traverse of the mule-carriage was only 5 feet. The distance traveled is now much greater, and the carriage sometimes carries 1,000 spindles.

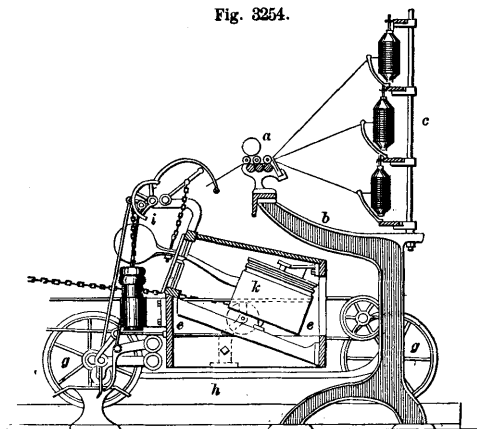
Previous to the invention of the mule few spinners could make yarn of 200 hanks to the pound, the hank being always 840 yards. The natives of India were at the same time making yarns of numbers ranging from 300 to 400. Houldsworth of Manches-

ter, England, has lately succeeded in making No. 700, which was woven in France.

Mr. Roberts invented the self-acting mule in 1825. By this, the carriage, after the thread is spun, is automatically returned to the rollers, requiring no attendance, except for the purpose of joining threads which may be accidentally broken. This is performed by children.

In Fig. 3254, *a* is the triple set of drawing rolls, working in heads fixed on the roller-beam *b*. *c* is the creel for holding the bobbins in three rows. *e e* is the carriage, resting on wheels *g g*, which run on the railway *h*. Spindles *i* are set in a nearly upright po-

Fig. 3254.



Mule.

sition. *k* is one of a series of drum-cylinders with grooves around the upper end for the driving band.

This machine is not self-acting, but illustrates the principle of action.

The drawing and stretching action of the *mule-spinner* makes the yarn finer and of a more uniform tenacity than the mere drawing and twisting action of the *throstle*. As delivered by the rollers, the thread is thicker in some parts than in others; these thicker parts, not being so effectually twisted as the smaller parts, are softer and yield more readily to the stretching power of the mule; by this means the twist becomes more equable throughout the yarn. Throstle-spinning is seldom employed for numbers higher than 40 or 50 hanks to the pound, because smaller yarn would not have strength to bear the drag of the bobbin, but in mule-spinning the yarn is built upon the spindles without subjecting it to appreciable strain.

The mule-carriage carrying the spindles recedes from the rollers with a velocity somewhat greater than the rate of delivery of the reduced roving, the rapid revolution of the spindles giving a twist to the yarn, which stretches it farther. When the rollers cease giving out the rovings, the mule-spinner still continues to recede, its spindles still revolving, and thus the stretching is effected.

The distance to which the spindles recede from the rollers while both are in action is called a *stretch*. This is usually about 54 to 56 inches.

The space over which the carriage moves in excess of the paying out of the rollers is called the *gaining* of the carriage.

The space traversed by the carriage after the paying-out action of the rollers is stopped is called the *second stretch*; during this latter the spindles are revolved very rapidly, to save time.

When the *drawing*, *stretching*, and *twisting* of the yarn are thus accomplished, the mule disengages itself from the parts of the machine by which it has been driven, and the carriage is returned to the rollers, the thread being wound in a *cop* upon the spindle as the carriage returns.

The specific difference between the action of the throstle and the mule is, that the former has a continuous action upon the roving, *drawing*, *twisting*, and *winding* it upon the spindle; while the mule *draws* and *twists* at one operation as the carriage runs out, and then *winds* all the lengths upon the spindles as the carriage runs in.