Card'ing-ma-chine'. (*Fiber.*) A machine consisting of a congeries of toothed cylinders for drawing out and placing in parallel line the fibers of wool, cotton, or other staple.

The hand-card, which preceded the carding-machine, consisted of two brushes furnished with short, slanting, wire teeth, which all pointed in one direction. The wires were passed through leather, and the leather was nailed to a board. The brushes were grasped, one in each hand, and drawn past each other, so laying straight the fiber which was placed between them. The action is explained under CARD (which see).

In 1748, Lewis Paul patented two different machines for carding. In one of them the cards are arranged on a flat surface, and in the other they are arranged on the periphery of a drum. From what cause we know not, the invention seemed to have no repute or success at the time, but came out again twelve years afterward as the invention of Hargreaves, under the auspices of Robert Peel, of Bamber Bridge, the grandfather of the statesman, Sir Robert Peel. Hargreaves fixed one of the cards in a block of wood, and the other was slung from hooks fixed in a beam. The hooks remained in the kitchen at "Peel Fold" in 1850, but the cards were destroyed by a mob who came from Blackburn,—a part of the same wretched story of ignorant men opposing the introduction of machinery.

The same Robert Peel, or his son of the same name and the father of the statesman, employed Hargreaves in 1762 to erect the cylinder carding-machines in a mill at Blackburn.

Though the carding-machine was well and efficiently constructed in the time of Arkwright, it was not till after several attempts by different men, Paul, Hargreaves, and Arkwright, worked in such a manner that it is difficult now to determine what share each had in the matter. It was not till twenty years after Paul's invention that the cylinder carding-machine came into extensive use; and even then it performed intermittingly, and did not yield a continuous sliver.

The cards were arranged on the surface of the drum, parallel to its axis, a space being left between each. The cotton-wool was put on by hand, and when the cards were full the machine was stopped, the cardings taken off separately by a movable comb, the spaces between the cards regulating the substance of each carding. The cardings were then joined end to end, to make a continuous sliver. A more systematic and equable mode of feeding was adopted when a weighed quantity of cotton was made to cover a certain area of the travelling feed-apron, which moved at an even rate towards the throat of the machine.

Arkwright invented the plan, yet in use in some cases, of rolling up the feeder with the cotton spread upon it, and allowing it gradually to unroll to feed the cylinder.

Another improvement was to obtain a continuous

sliver from the cylinder. This was accomplished by the *doffer*, but the next point was to get it from the *doffer*. After many experiments, it appears that Arkwright hit upon the plan which is in use to the present time, the *crank* and *comb*. It is fair to say, however, that the invention is also claimed for Hargreaves. There seems to have been a rivalry of feeling between the two men, who were each highly meritorious, and we are much indebted to both. It is stated that Hargreaves obtained a sketch of it from one of Arkwright's men. Not likely; Hargreaves seems to have been made of better stuff.

The comb is a plate of metal toothed at the edge, and, reciprocating perpendicularly, detached the fleece from the teeth by slight reiterated strokes.

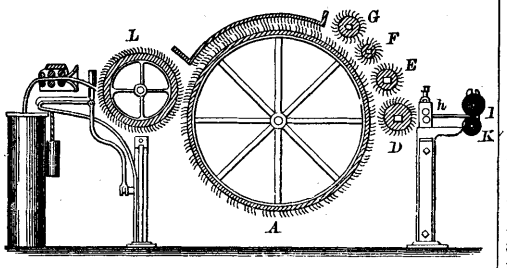
The action of the machine is substantially similar to that of the hand-cards, so far as the functional character is concerned; but it enables a number of cards to act upon a continuous *lap* and deliver continuous *slivers*.

The machine has a horizontal cylinder, whose entire circumference is covered with narrow fillet-cards wound spirally around it, a blank space intervening between each fillet, or is covered with strips lengthwise of the cylinder. The cylinder revolves beneath a concave shell, whose face is also lined with cards, and the teeth of each act coincidently upon the bunches of fiber to draw them apart and lay the individual fibers parallel, as explained under CARD.

The first carding-machines built in America were made for Mr. Orr, of East Bridgewater, Mass., in 1786.

The carding-machine consists of a number of rollers and drums, and one large cylinder all clothed

Fig. 1113.



Carding-Machine.

with *cards*, which are so arranged as to feed, card, doff, and deliver. A portion of the circumference of the large cylinder *A* is inclosed by smaller toothed rollers *D E F G*; then succeed wooden slats lying lengthwise of the cylinder, and supported by the side at such distance as to allow the wire teeth to come into the required proximity. These slats are called *card-tops*, *top-cards*, or *top-flats*. Beyond the flats is a toothed drum *L*, called a *doffer*, from whence the fleece is removed by the *doffing-knife*; the wide ribbon is then gathered in a thimble, consolidated by iron rollers, and delivered into a can.

The operation is as follows: —

The lap-cylinder is placed in the bearings *I*, and rests on the roller *K*; the end *h* of the lap is brought to the rollers by which it is presented to the toothed drum *D*, which draws the cotton into the machine, and is called the *licker-in*. The filaments thus torn from the end of the lap are immediately seized by the large cylinder *A*, which revolves at a much higher speed, and are teased out by the teeth of the second roller *E*, which moves more slowly than *D*, and picks the knots off the cylinder. These knots are carried round by *E* and are caught by *D*, which presents them again to *E* along with fresh material from the lap. This is the first round which the knots take, but several more are in store for them if they are obdurate or if they escape the first attack.

The tufts or knots which pass the first pair of rollers *D E* are arrested by the fourth roller *G*, which is placed closer to the cylinder *A*, and moves with the same speed as *E*. The knots caught by *G* are teased out by *F*, and returned to the cylinder *A*, and may be again caught by *G*, if they exist.

Passing the combination of rollers, the fibers are next brought into contact with the cards of the *top flats*, which arrest knots and hold them till the entanglement is removed, or till the flat is taken out and cleaned, which is occasionally done.

After all these obstacles have been passed, the filaments lie in parallel rows among the teeth of the cylinder card, and are removed therefrom by the *doffer L*, which is covered with a spiral fillet of cards, revolving at a much slower rate than the cylinder and in a different direction. The fine fleece thus stripped from the cylinder by the *doffer* is removed from the latter by a vertically reciprocating comb, called the *doffer-knife*, which has a rapid vertical motion tangentially to the points of the teeth. A fine fleece the whole length of the cylinder is thus obtained, and is gathered up into a ribbon, and passed in at the funnel, whence it passes to three consecutive pairs of condensing rollers, which, revolving at a relatively greater velocity as the sliver proceeds, slightly draw it, and tend to parallelize the fibers. It thence passes as a light, downy, coherent sliver into the can, in which it is transported to the *throstle*, *doubler*, or *bobbin and fly frame*, as the case may be.

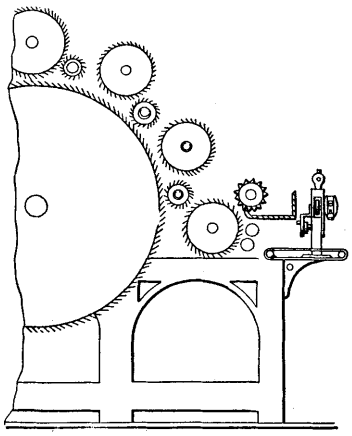
For fine spinning, the operation is repeated, the first machine being called a *breaker-card* and the second a *finishing-card*.

For the preparation of fine yarns, the cards have closer set wires than is necessary for ordinary or coarse work.

The carding-machine as just described is particularly adapted for cotton, but does not differ materially from the wool-carding machine.

There are some adjuncts to the latter, however, which have no place in the cotton-carding machines. Among these are the devices for oiling wool, which is necessary to keep the fibers loose and prevent their becoming felted.

Fig. 1114.



Wool-Oiling Attachment.

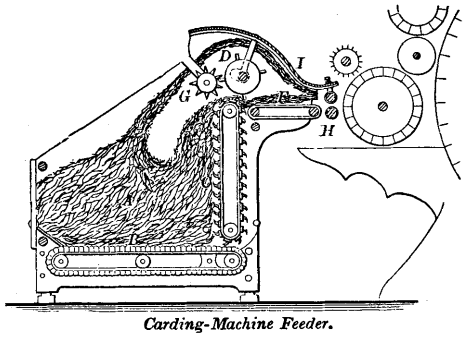
The *wool-oiling machinery for carding-machines* has a dripping oil-tank which has a transverse and rotary motion above the feed-apron of the machine, so as to drop oil upon the wool as it proceeds towards the card.

The transverse motion is given by a crank and pitman, and the reciprocating rotary by a toothed wheel acting against the edge of the trough.

The wool carding-machine has a large cylinder surmounted by smaller ones called *urchins*, which work in pairs, and are called *workers* and *cleaners*. These act in succession to remove knots and tangles from the main drum, and return the fiber to the latter again to undergo the action of the next set, if still obdurate.

In the feeder shown in Fig. 1115, the material thrown into the box *A* is carried forward and upward by the aprons *B C F* to the feed-rolls *H*. *G* is a

Fig. 1115.



Carding-Machine Feeder.

picker-roll, which serves to prevent the fan *D* from becoming fouled, and also to prevent flocks of wool from passing unopened between the plate *I* and apron *F*. The fan *D* blows the wool into the passage *F*, whence it passes to the carding-machine.

The various rollers in a carding-machine are known by names which indicate their functions, — or perhaps we may say appearance, in one case.

Feeding-rollers.	Urchins.
Distributing-rollers.	Clearers.
Workers.	Doffers.
Strippers.	Fly-rollers.

The material which went in as a *lap* comes out as a *fleece* or as *slivers*.