

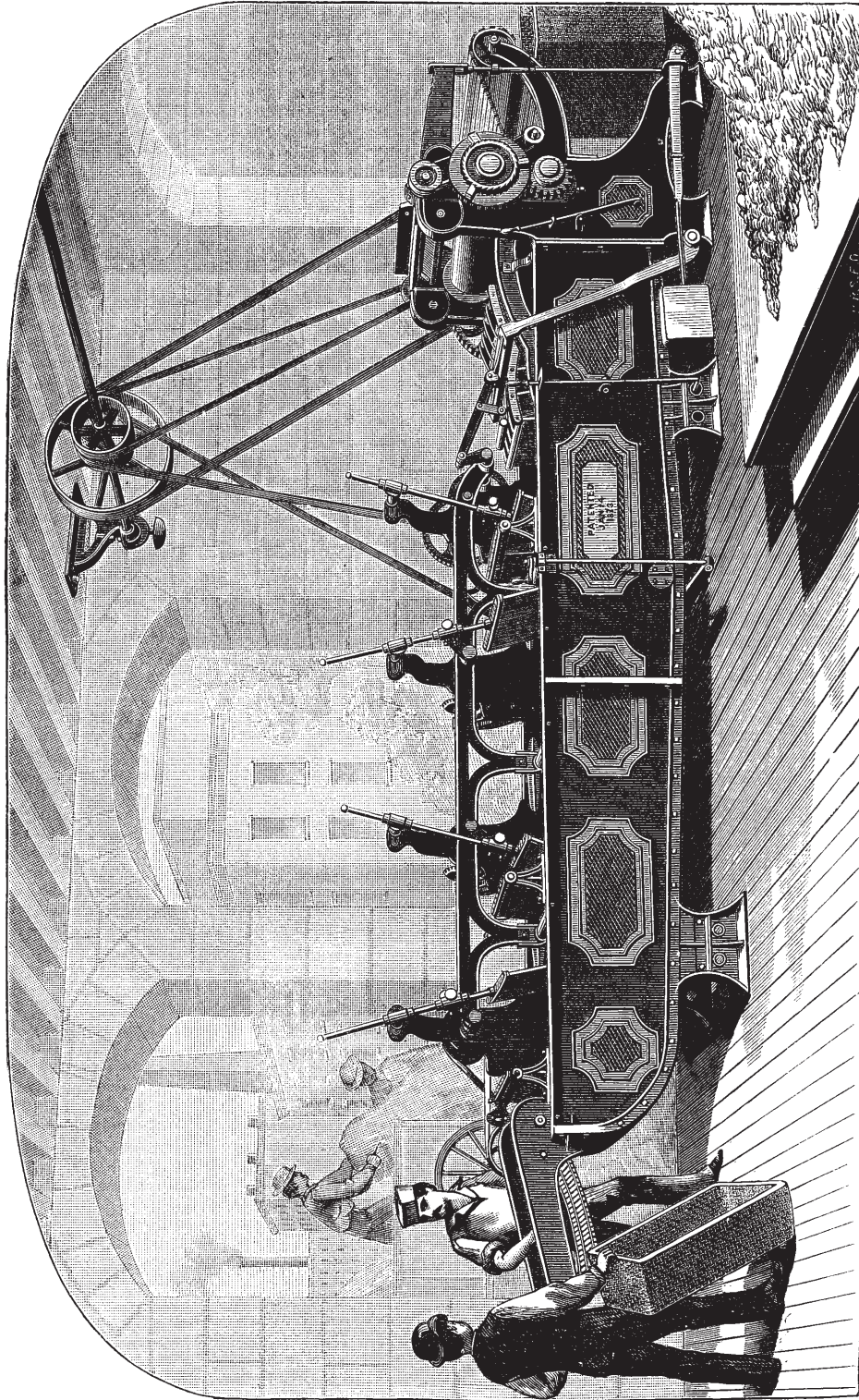
WOOL MACHINERY. The various operations of the woolen manufacture are as follows: The material is first sorted with reference to its weight, softness, fineness, strength, color, and cleanness, and the various qualities are separated in order to avoid unevenness in the working and in the fabric. The technical terms for the various kinds of wool are as follows: The first and finest quality is called *picklocks*; second, *prime*; third, *choice*; fourth, *super*. These are wools of the best kinds; while the remainder are inferior, and have the following designations: fifth, *head-wool*, or the chief of the inferior division; sixth, *downrights*; seventh, *seconds*, which is that grown on the throat and breast; eighth, an inferior kind to the last, called *abb*; ninth, *livery*, the long coarse wool about the belly; and tenth, *short coarse*, from the breast of the animal.

Scouring follows in washing machines, the object being to remove suint and grease. Alkaline water is first used, and then clear water. The wool then passes to the drying machine, where it is subjected to a blast of dry air, either hot or cold; and thence it is taken to the willowing or dusting machine, in which teeth, fixed on revolving cylinders, disentangle the locks, while a blast of air from a fan removes the dust and drives the wool through in a flocculent state. Most wool contains *burrs* (seed-vessels of plants), which become attached to the sheep while grazing; these are removed by a burring and picking machine, which is also often constructed to extract dust and other impurities at the same time. In order to prevent felting of the fibres during subsequent operations, the wool is oiled with some thin, clear vegetable oil, such as olive, rape, cotton-seed, etc. An ingenious oiling apparatus, constructed by Messrs. Charles G. Sargent's Sons of Graniteville, Mass., precipitates the oil in a finely atomized state upon the evenly-spread wool as it passes the feeding rolls of the carding engine. Usually the oil is mingled with water, the proportions for the above machine being about one part of oil to four of water, and the quantity of oil applied varying from one quart to ten quarts per 100 lbs. of wool, to suit the work in progress.

Scribbling is a preliminary carding in order to disentangle the fibres. The regular carding operations which follow leave the wool in the shape of fleece, slivers, rolls, or rovings, as the case may be. The drawing and spinning processes are not materially different from those used in cotton-cloth manufacture. Weaving woolen goods is described under LOOMS; and the various finishing operations are detailed under CLOTH-FINISHING MACHINERY and FULLING MACHINES.

The manufacture of felted cloth from wool has been brought to such perfection, that for many purposes the cloth rivals woven fabrics in utility. The washed and cleaned wool is first carded, and thus transformed into a sliver several feet broad, but not much thicker than a cobweb; and this is received and wound on a roller, until a sufficient length has been obtained. Then a number of these rollers are placed in another machine, in which they are made to unwind the slivers and deposit them one over another, until a lap of the required thickness is formed, this being often an inch, necessitating a great number of slivers. This lap is then made to pass through a series of wooden and tin rollers, arranged so that the upper rollers of wood are partly between the pairs of the lower tin rollers. The upper ones are of solid wood, the lower of tin, hollow and filled with steam, and all placed in a long, shallow, but broad trough of hot water. The lower rollers simply revolve on their

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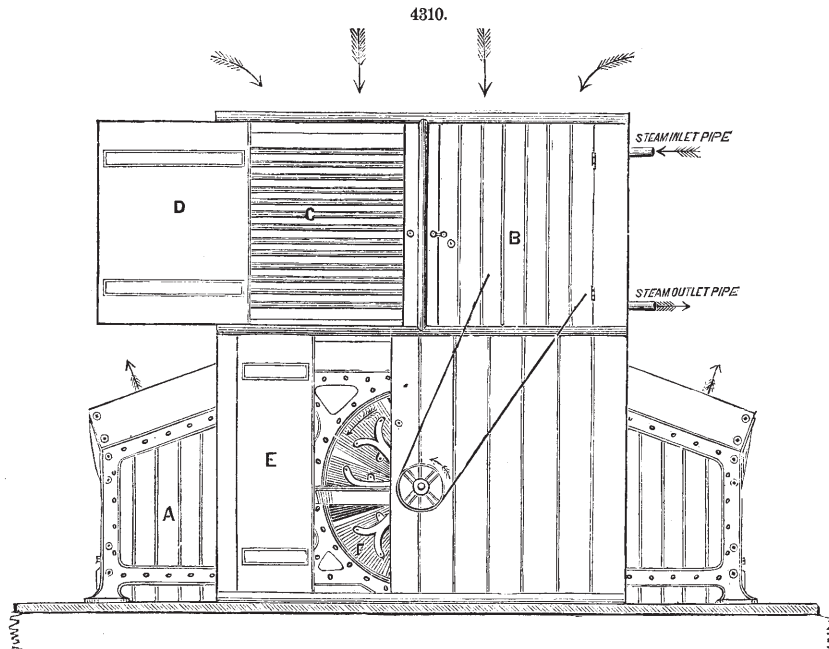


SARGENT'S WOOL-WASHING MACHINE.

axes, but the wooden ones, besides this motion, have a slight movement from side to side, which causes them to rub the lap of slivers, and induces the fibres of wool to combine and felt together as they are carried along by the revolutions of the two sets of rollers, the heated water greatly helping in the operation. In the end, what went in as a thick sheet of wool, like wadding, comes out a compact thin cloth, in some instances as fine in appearance as a kerseymere, which, after being dyed or printed, is tentered and pressed, and is then ready for sale. This process admits of very inferior wools, and the noils of wool or even of flax, being mixed and made into low-class cloths for druggets and other coarse fabrics.

The manufacture of wool hats is described under HAT-MAKING MACHINERY. The principal machines used in the woolen manufacture are detailed hereafter.

The Wool-washing Machine.—The first machine used in the process of the woolen manufacture is the wool-washing machine. An example of this apparatus, as made by Messrs. C. G. Sargent's Sons, Graniteville, Mass., is represented in Fig. 4309. This machine consists of a series of stationary rakes, or racks, alternating with movable ones, which are actuated by a crank-motion, and arranged in a long box partially filled with scouring liquor. The wool is placed on the feed-apron, which carries it forward, and drops it into the box back of the first stationary rake. The rakes are suspended on pivots at each end and allowed to swing a short distance freely. The wool remains behind this stationary rake until the first moving rake comes forward, passes its teeth between the teeth of the stationary rake first mentioned, seizes a portion of the wool, and carries it forward to the action of the second rake. By the time the wool has arrived at the fourth rake (if that number is used), it has become thoroughly saturated with the liquor, the dirt, grease, and all foreign matter loosened ready for removal by the squeezing rolls. It remains to conduct the wool out from the liquor. By means of the last rake in the bowl the wool is carried upon the convex table and left, where it is held by a series of projecting teeth fixed in the face or top of said convex table, until the backward movement of the rake, which is connected by a connecting-rod to the swing-carrier, draws said carrier back, and, by means of the link-connection with the rear end of the carrier, lifts said lower or rear end of said carrier and teeth up, and passes it down over the wool on the convex table, ready for the return movement, which carries the wool up to the squeeze-rolls; the teeth in the carrier—being jointed, and free to swing upward in its backward movement—lift and slide over the wool without disturbing the same; when the motion is changed the teeth fall back against a stop, which holds them in a perpendicular position, so that in their upward passage they sweep and carry all the fibre upward to the squeeze-rolls, as before described. The advantage of this is that the wool is carried to the squeeze-rolls in an evenly distributed mass like a web. The more evenly the wool is delivered to the squeeze-rolls, the more perfectly the water is extracted or squeezed out. When more than one box or "bowl" is used, the liquor in the first box soon becomes dirty and is drawn off, and the liquor from the second box is forced back into its place by means of an injector attached to the side of the machine, and the second box is filled up with fresh liquor.

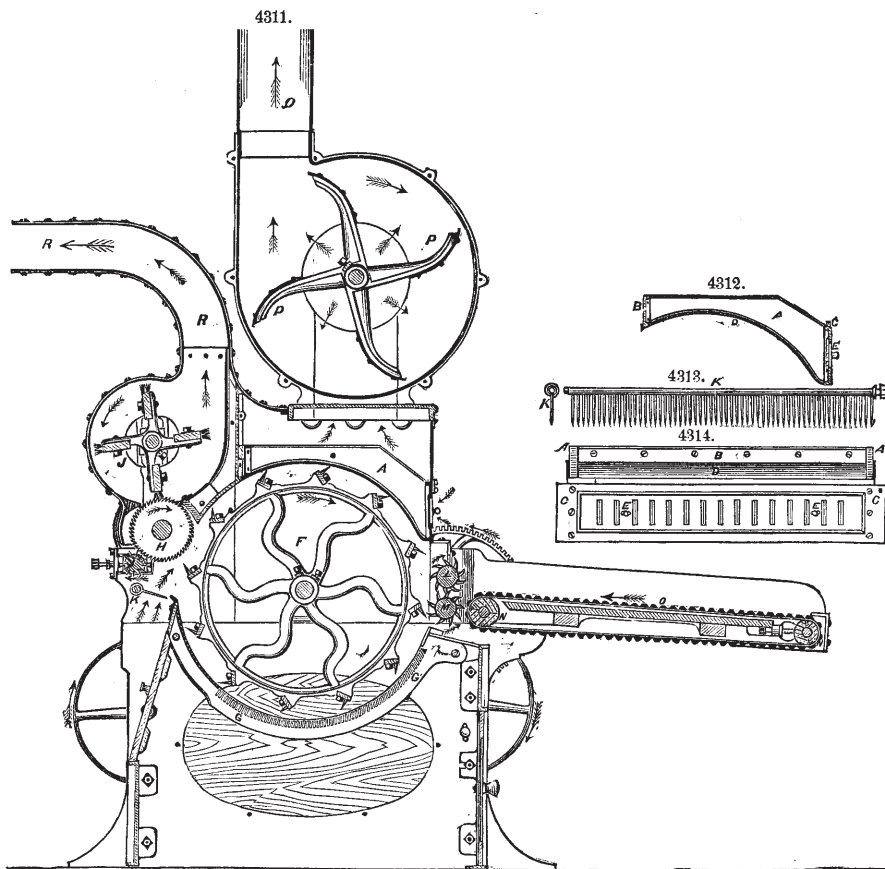


Wool-Drier.—From the washing machine the wool is taken to the "drier," shown in Fig. 4310, which can be used either as a hot- or cold-air drier by reversing the direction of the fan. The fan, being put in motion, sucks the air down through the top of the air-box (which is open), passes the

steam-pipes, and is heated in its passage to the fan, which forces it forward into the drier under the wire netting supporting the wool. The pressure of the air forces it up through the wool, and in its passage absorbs the moisture contained in the fibre. The air-box and coil can be placed under the floor, and take the air from the room below, if more convenient. In warm, dry weather, the steam can be shut off from the coil, and simply cold air used, or sufficient steam admitted to do the amount of work required.

The various parts are as follows: *A*, end view of drier-frame; *B*, air-box; *C*, coil of steam-pipe in the air-box; *D*, door that opens into the air-box for the purpose of examining the pipes, etc.; *E*, doors in the air-box opening into the fan, for oiling, etc.

Wool-Picking and -Burring.—From the drier the wool is taken to the wool-picker, which is a very simple machine, consisting of a pair of feed-rolls, which deliver the wool to the action of a toothed cylinder, or set of beaters armed with steel teeth, and supported at the end of radial arms attached

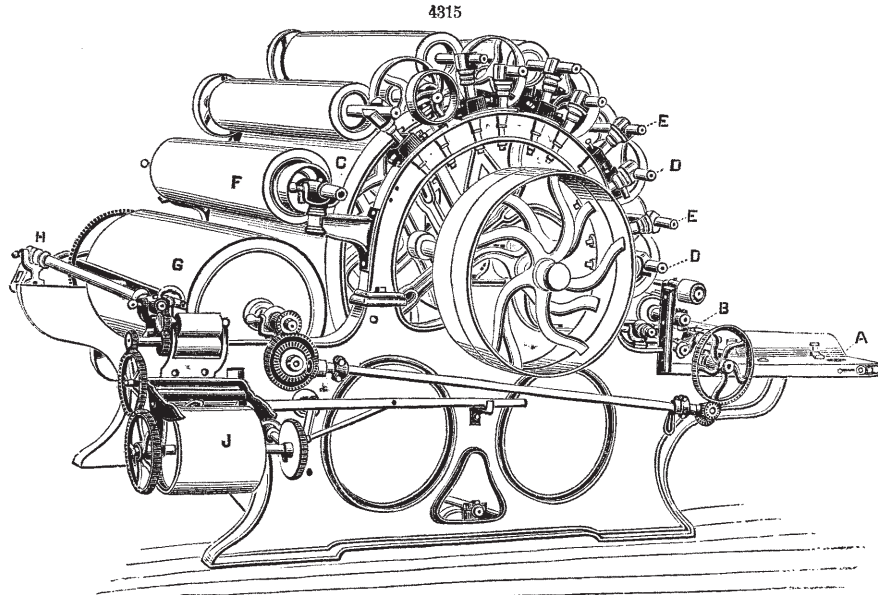


to a central shaft. This cylinder or beater is usually 36 in. in diameter and from 30 to 36 in. wide, and revolves from 500 to 700 times per minute, detaching the fibres of the wool from the clotted masses in which they are left by the washer, and preparing them for the card. Where wools containing many burrs are used, the form of picker represented in Fig. 4311 is used, as built by Messrs. C. G. Sargent's Sons of Graniteville, Mass. In this machine, the wool taken from the feed-rolls by the picker-cylinder is carried by it to the burr-cylinder, which is composed of a series of circular saws, very similar to those of the cotton-gin, bolted together on an axle, and separated from each other by thin washers, which admit of the entrance of the wool between the saws, but not of that of burrs or other foreign substances. This cylinder is sometimes formed by winding a saw-toothed wire, with a flange on the edge opposite to the saws, in a spiral direction around a solid cord, instead of using circular plates. The wool, which is received by this from the picker-cylinder, is carried round with it, passing between the teeth of the saw, while the burrs and other foreign matters adhering to the wool are knocked off by a revolving beater, the blades of which just clear the teeth of the saws, as shown at *H* and *I*. A revolving brush and fan clears the wool from the teeth of the burr-cylinder and delivers it to the wool-burr, in readiness for the card.

The parts of this machine are as follows: In Fig. 4311, *A* is a side view of the perforated screen; *B* shows the back girt of the screen, seen in section in Fig. 4312; *C* indicates the front girt of the screen. *D*, Fig. 4312, also shows the screen. *E* shows the front girt and register of screen *A*. This

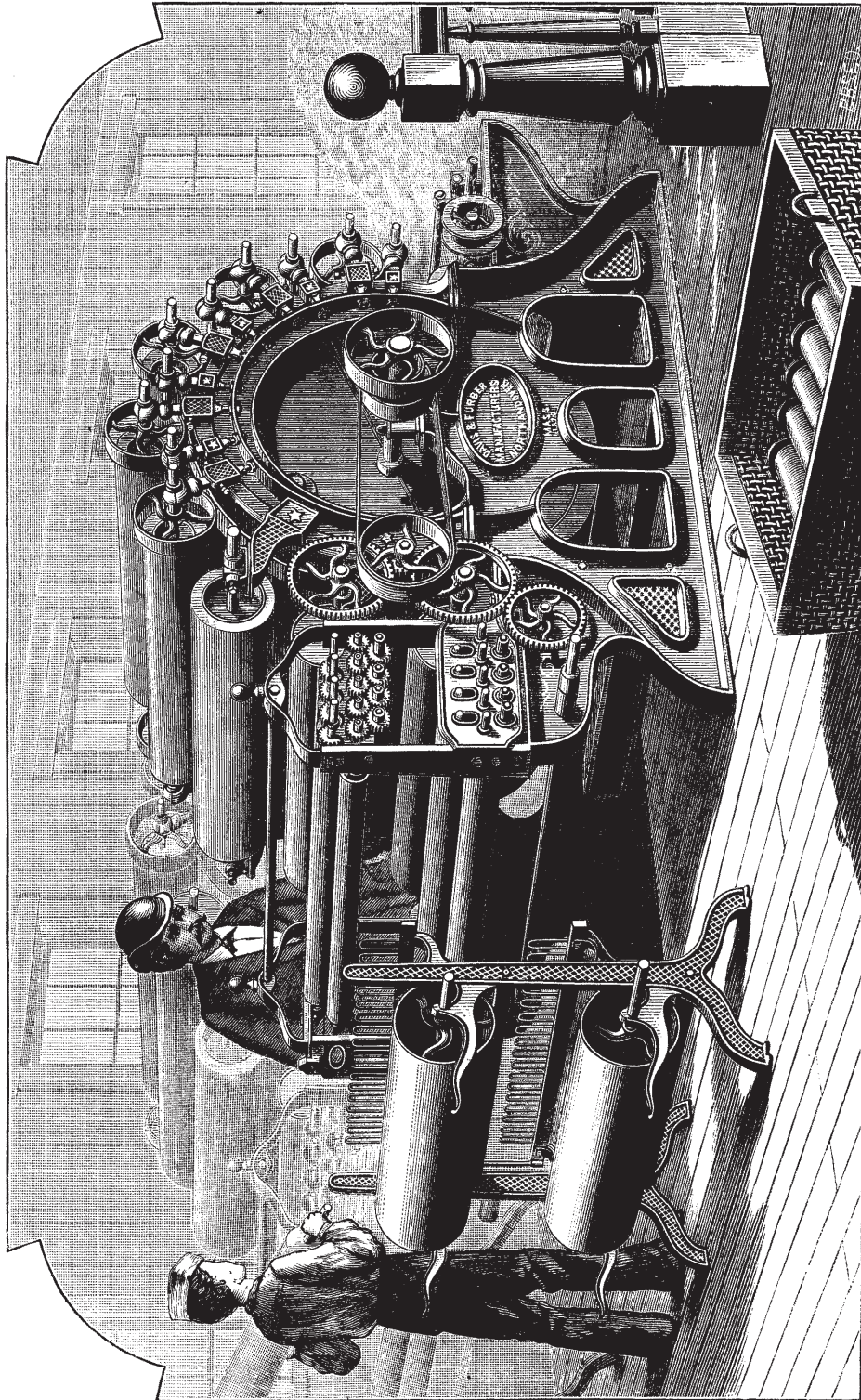
register, or air-passages, can be opened or closed by a slide which regulates the draught under the burr-cylinder *H* and guard *I*. *F* shows the picking cylinder, which takes the wool from the feed-rolls *L* and *M* and carries it forward, combing it into the burring cylinder *H*. *G* shows the rack under the picking cylinder *F*. *H* is the burr-cylinder, on which the burrs are separated from the wool by the guard *I*, the burrs dropping through the fingers of rack *K*. *J* is the brush which keeps the burr-cylinder constantly clear, moving all cleansed wool, passing it out from the machine through spout *R* as indicated by arrows. *K* is an adjustable rack, of which a front view is seen in section in Fig. 4313, removed from the machine. *L* indicates the top feed-roll, and *M* the bottom feed-roll, both of which are filled with cockspur teeth. *N* shows the apron-roll. *O* represents the feed-apron, which carries the wool into the feed-rolls. *P* indicates the fan, which sucks off all light impurities, dust, etc., liberated from the wool being cleansed by the currents of air passing under the feed-rolls *L* and *M*, and under the guard *I*, up through screen *A* into the fan, as shown by arrows. *Q* shows the pipe through which the light dust is carried out.

WOOL-CARDING.—The wool-cards shown in Figs. 4315 and 4316 are fair types of the form of machines in common use in the United States, and are taken from drawings furnished by the makers, Messrs. Davis & Furber of North Andover, Mass. The wool is weighed out by the tender, and spread on the feed-apron *A*, from which it passes between a pair of feed-rolls at *B*, and is delivered by a “licker-in” to the main cylinder *C*, from which it is lifted by the strippers *D*, and passed to the “workers” *E*, by which it is again returned to the main cylinder. It is then loosened from the cylinder by the “fancy-roll” *F*, which is clothed with long straight teeth, and is finally taken from the cylinder by the doffer *G*, from which it is in turn removed by the doffing comb *H*, and passes through the drawing rolls *I I*, to be wound into a roving or sliver on the balling roll *J*. This ro-



ing or sliver is then transferred to the second breaker-card in some cases, and in some directly to the finisher, either by setting up a sufficient number of spools or bobbins of the roping to fill the width of the card, or, by what is known as the “Apperly feed,” delivered continuously by a diagonal motion to the feed-apron, so as to form a continuous lap. A traveling tube or trumpet receives the sliver as delivered from the first card, and is traversed by a screw forward and back along a slide-rod in a diagonal direction to the feed-apron, carrying the roving with it, and distributing it so as to form a sheet upon the apron. A spring-catch at either end of the slide holds down the roving as delivered, till it is taken up by the feed-rolls, which deliver it to the card-cylinder as before. The operation of the second breaker and finisher cards is the same as that of the first breaker; but the doffing is very different, there being two doffing cylinders as seen in Fig. 4316, with narrow strips of card-clothing so arranged upon them as to receive the wool from alternate zones on the main cylinder. The narrow strip of wool-sliver or roving thus received is taken from the doffer by the rotation of a roller covered with leather, seen at *C* in Fig. 4315. An under roller geared to and revolving with this carries the roving forward to a second pair of “rubbers,” so called, and these deliver it to another pair. Each of these pairs of rubbers receives a vibratory motion in the direction of its axle, from a crank-shaft at the opposite end of the frame from that shown, acting in opposite directions on the top and bottom rollers of the pair, so as to condense and roll the loose sliver into a spongy roving, in which form it is received upon the spools and taken to the spinning jack or mule.

Metallic waste-cards are used for working or reducing yarn, thread-waste, and soft flannels to wool. These machines in principle are a carding machine, clothed with strong, sharp-pointed, steel



4316.

DAVIS & FURBER'S WOOL-CARDING MACHINE.

teeth, so adjusted as to work on the twist of yarn or thread-waste, combing or teasing out gradually the twist holding the fibre of wool together, and forming it into a thread. This gradual removing of the twist, by the combing or carding process, leaves the fibres of wool composing the thread-waste long and strong, with nearly the original length of staple.

The Woolen-Mule.—The operation of this machine is very similar to that of the cotton-mule, except that the delivery of the roving is not continued for the whole length of time occupied by the carriage in "drawing out," the motion of the feed-rolls being arrested before the carriage has completed its stretch. By this action the yarn is made more even, as the twist, which at first tends to run into the finer parts of the roving, and which is continued during the whole length of the draught, also holds these parts from yielding when the delivery from the rollers is stopped, and permits of the stretch of the coarser and more spongy portions, which, as they are reduced and elongated, also take up their proper share of the twist. The other motions are very similar to those of the cotton-mule.

Wool-warping Machine.—The preparation of woolen yarns for weaving differs from that of cotton yarns. Fig. 4317 represents the wool-warping machine built by Messrs. Davis & Furber of North Andover, Mass. The yarn is first wound on spools *A*, which are placed in a proper frame or "creel" in such number as may be needed to form a section of the warp, and the yarn is taken from them through the size-rolls *B*, dried over the copper cylinders *C*, and wound upon the reel *D*. This reel is mounted in a frame, which travels longitudinally on a railway *E*, fixed in the floor so that when one section is filled the reel can be moved so as to bring another division opposite to the centre of the dresser. This plan affords great facilities for preparing the particolored warps so common in woolen goods, and admits of the repetition of the necessary pattern for shawls, plaid, cassimeres, etc., until the reel is filled to the width necessary for the goods to be produced. After the reel is filled, the belt connecting it with the dresser is removed, and yarn is transferred from it on to the loom-beam in a continuous sheet. S. W. (in part).

