

quantities of the several materials when the prices are given and the cost per lb. of the blend fixed; (3) Given the total weight of the blend, also the price per lb. to find the proportionate quantities; (4) The price per lb. and weight of the materials known, and also the prices of the remaining materials and their cost, to find the proportionate quantities which are not stated.

Ex. 1. A blend is composed of 40% of English cross-bred wool @ 8*d.*, 30% of New Zealand @ 1*s.* 6*d.*, and 30% of pulled waste @ 5*d.* ∴ $40 \times 8d. + 30 \times 18d. + 30 \times 5d. = 1,010d. \div 40 + 30 + 30 = 10\frac{1}{10}d.$ per lb.

Ex. 2. Required the proportionate quantities to give a blend @ 11*d.* per lb. Materials costing 8*d.*, 10*d.*, and 1*s.* 3*d.* per lb.

Rule.—Group the values under each other, placing the price per lb. of the blend required to the left; link a greater and a lesser value together, and opposite the greater state the difference between the lesser than the average (cost of blend), and opposite the lesser the difference between the greater and the average. Thus:

$$11 \left\{ \begin{array}{l} 8 \\ 10 \\ 15 \end{array} \right\} \begin{array}{l} = 4 @ 8d. \\ = 4 @ 10d. \\ 3+1=4 @ 15d. \end{array} = 132 \div 12 \text{ combined weights} = 11d. \text{ per lb.}$$

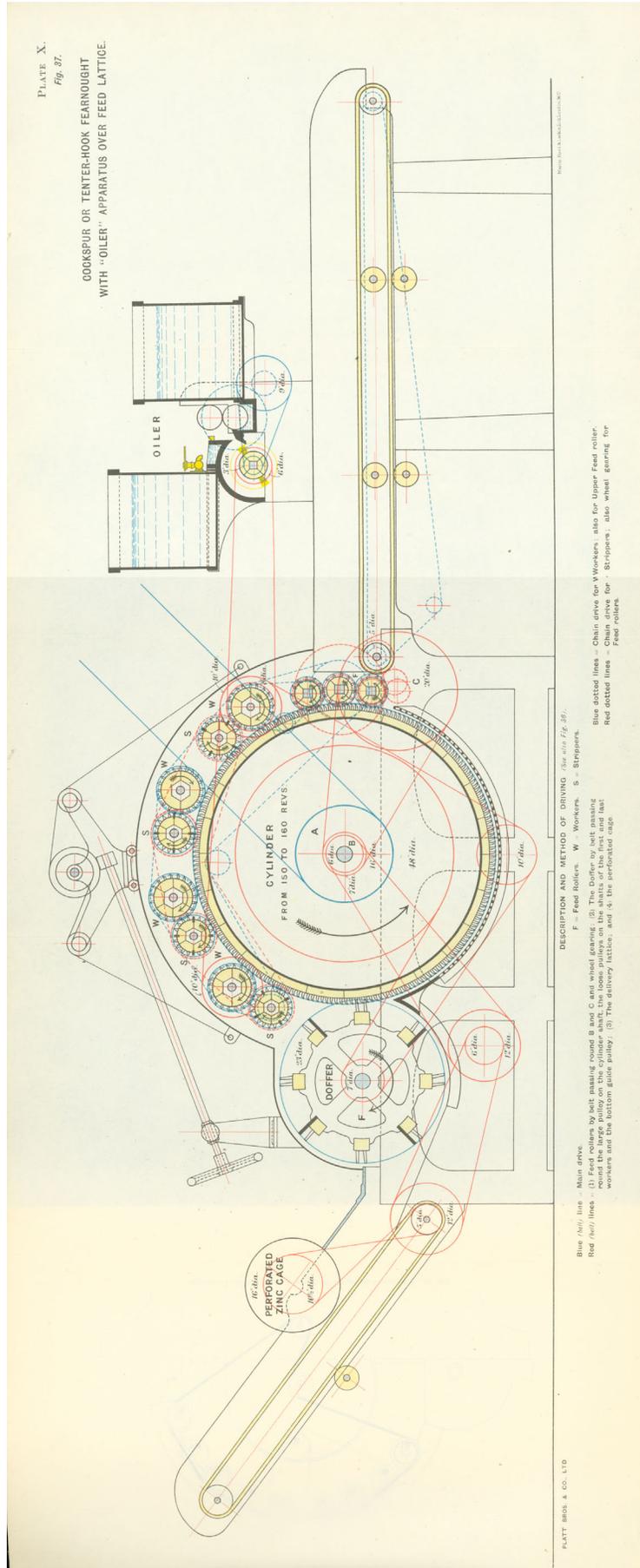
Ex. 3. A blend of 240 lbs. is required at 1*s.* per lb.; values (a) 1*s.* 8*d.*, (b) 1*s.* 4*d.*, and (c) 10*d.*: state the proportionate quantities. Proceed by the above rule, add the units of weight together and state as their total is to each, the weight of the blend is to each quantity. Thus:

$$12 \left\{ \begin{array}{l} (a) 20 \\ (b) 16 \\ (c) 10 \end{array} \right\} \begin{array}{l} = 2 \\ = 2 \\ 8+4=12 \end{array} 16 \quad \begin{array}{l} \text{Ans.} \\ \therefore (a) = \frac{240 \times 2}{16} = 30 \text{ lb.} \\ \therefore (b) = \frac{240 \times 2}{16} = 30 \text{ lb.} \\ \therefore (c) = \frac{240 \times 12}{16} = 180 \text{ lb.} \\ \hline 240 \text{ lb.} \end{array}$$

Ex. 4. There are three packs of wool (720 lb.) in stock

Fig. 37.

COCKSPUR OR TENTER-HOOK FEARNIGHT
WITH "OILER" APPARATUS OVER FEED LATTICE.



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DESCRIPTION AND METHOD OF DRIVING (See also Fig. 38).

F = Feed rollers. W = Workers. S = Strippers.

Blue (dot) line - Main drive.
 Red (dot) line - (1) Feed rollers by belt passing round B and C and wheel gearing; (2) The doffer by belt passing round D and E and wheel gearing; (3) The delivery lattice, workers and the bottom guide pulley; (4) The delivery lattice and 4th perforated cage.

Blue dotted lines - Chain drive for Workers; also for Upper Feed roller.
 Red dotted lines - Chain drive for Strippers; also wheel gearing for Feed rollers.

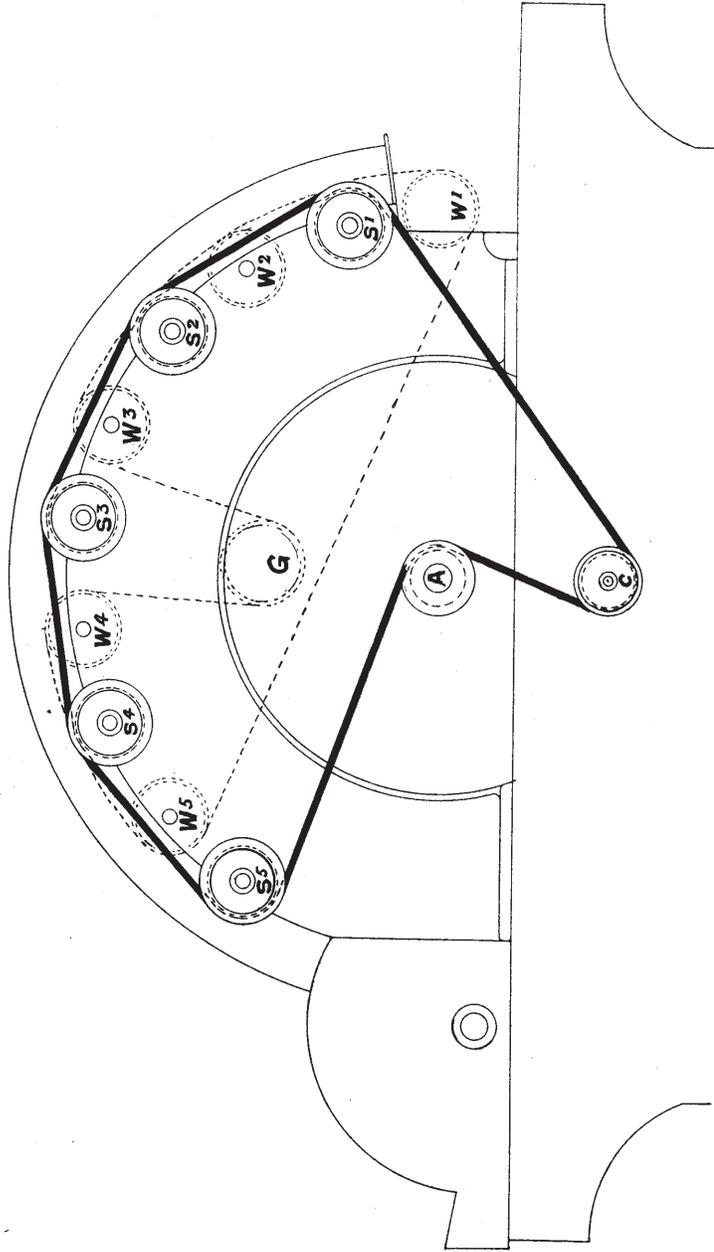


FIG. 38. A method of driving the Workers and Strippers of the Fearnought.

@ 1s. per lb., and a blend has to be produced @ 11*d.* The remaining materials being noils @ 10*d.* and mungo @ 8*d.* What quantities of noils and mungo should be used?

$$\begin{array}{r}
 \text{Ans.} \\
 (a) \text{ fixed quantity} = 720 \text{ lb.} \\
 (b) = \frac{720 \times 1}{4} = 180 \text{ lb.} \\
 (c) = \frac{720 \times 1}{4} = 180 \text{ lb.}
 \end{array}$$

$$11 \left\{ \begin{array}{l} (a) 12 \\ (b) 10 \\ (c) 8 \end{array} \right. \begin{array}{l} \dots\dots\dots 3+1=4 \\ \dots\dots\dots =1 \\ \dots\dots\dots =1 \end{array}$$

MIXTURES. Blending, as stated, in addition to allowing of various fibres being introduced into the same thread, also comprises a combination of several colours, or shades of the same or different materials. It thus affords ample scope for the origination of divers shades in mixture yarns for cheviots, worsteds, and other classes of fabrics.

One or two illustrations will clearly show how the process of blending can thus change the character of the yarn. Supposing, for example, that it is required to make three neutral grey mixture yarns, namely, dark, medium, and light grey respectively. Now, as black and white when mixed with each other produce grey, it will only be necessary to blend, card, and spin certain quantities of black and white wool together, varying in proportion, one to the other, according to the tone of the mixture yarn required. Thus, three parts of black wool blended with one part of white wool would give the dark grey (Fig. 35*b*); equal parts of black and white would give a similar shade to that represented in Fig. 35*a*; and the light grey (Fig. 35) would be formed by blending three parts of white wool with one part of black wool. Other colours might be added in practice to impart bloom and tone to the blends; but these examples adequately show the effect of combining black and white in the production of grey shades.

PREPARING THE BLEND. As the object in blending is to thoroughly mix the fibres together as they will form a thread in which they are not readily distinguished from each other, much care is exercised in preparing the materials for carding, condensing, and spinning. The materials

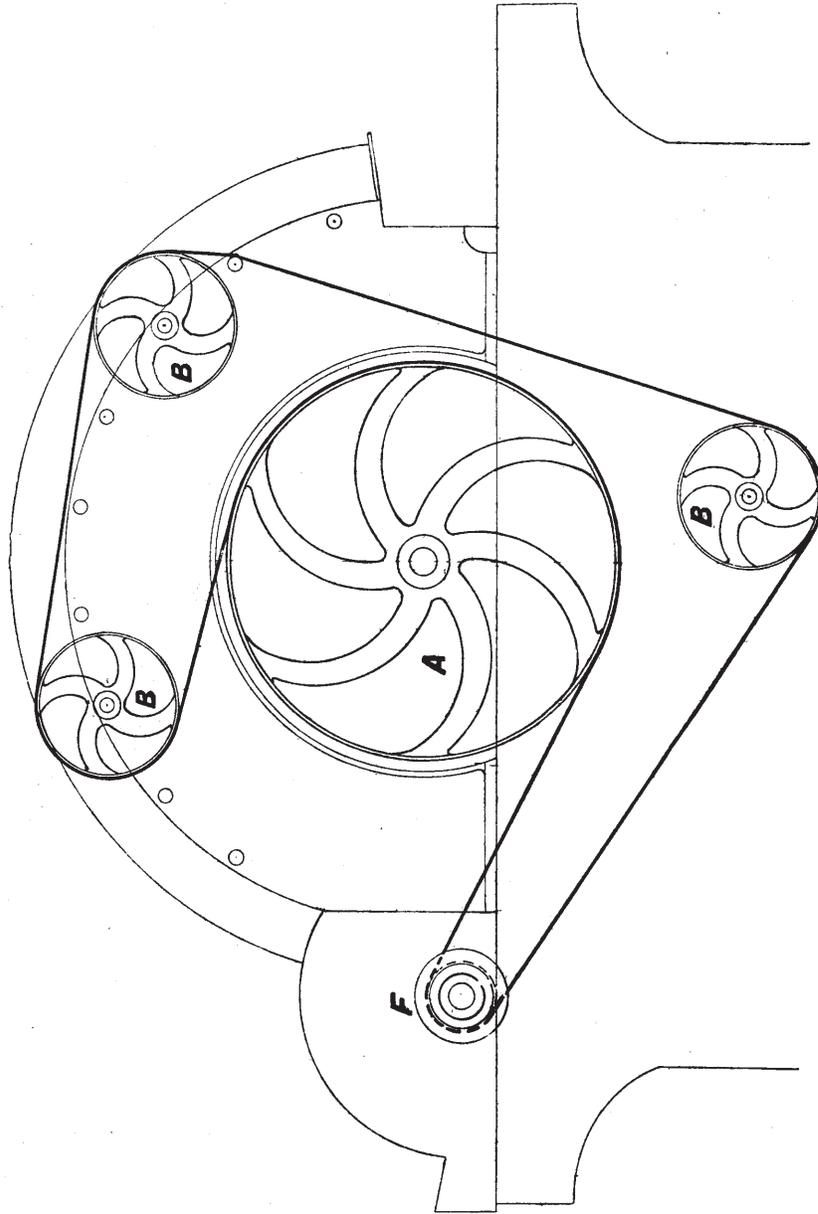


FIG. 39. Belt or Strap Drive for Fearnought.

for combination, after having been teased, are *bedded* or arranged in layers one above the other, in regular succession. Thus, if the blend consists of different classes of wools of the same shade, a foundation layer, some few inches in thickness, of one wool is distributed evenly over a prescribed space on the floor. This "spreading" having been oiled, a layer of a different class of wool is added and oiled, the processes of spreading and oiling being repeated to the completion of the "bed." In order to preserve the condition of the blend, when passing the material on to the teaser with the object of forming a more promiscuous mixture, the sheet is cut into vertically, and not transversely. When two or more colours—say, for instance, black, tan, and green—are introduced into the blend, the routine is as follows: a layer of black is uniformly spread; then comes a layer of tan, and lastly a layer of green, the order being repeated to the top of the pile. The thicknesses of the individual layers vary according to the quantity of each colour required to form the proper mixture. Each layer also receives its proportionate share of lubrication. A blend of this character, in order to insure the production of an even thread, may be passed through the teaser two or three times.

If the mixture thus obtained is intended to be used with other stock, that is, for combining with cotton, silk waste, etc., it is sheeted up till required, in which condition it is designated "mellowing."

In cases where cotton forms a portion of the bed the main point to be observed is to prevent, as much as possible, oil from getting on to this fibre. A layer of teased cotton is, in such blends, first spread for a foundation, then layers of wool and cotton alternately, the oil being distributed on the wool alone. Should "mellowing" be used, no oil is required. When wool, cotton, and mungo cotton are blended together the order is to deal with the two former first, by making a bed of teased wool and cotton in alternate strata—this is now run through the teaser and makes an "angola" mellowing, *i.e.*, a mixture

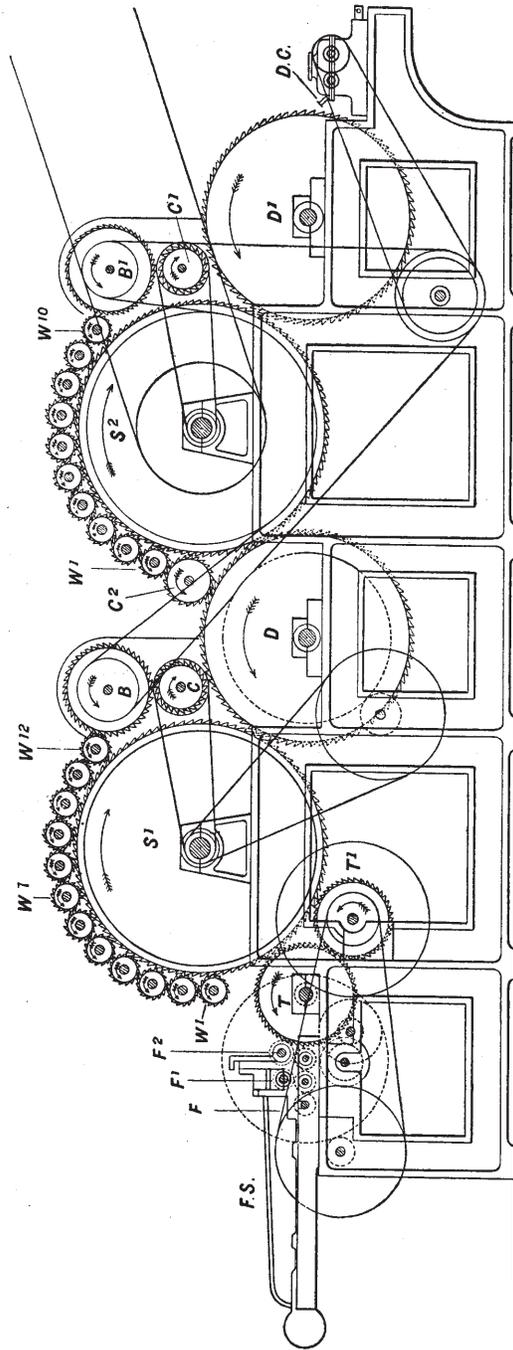


FIG. 40. Two-Cylinder Garnett Machine.

F S = Feed Sheet.
 F, F¹, F² = Feed Rollers.
 T = Taker-in.

T¹ = Second Taker-in.
 W¹, W⁷, W¹² = Workers.
 B = Fancy or Cleaner.

D, D¹ = Doffers.
 C, C¹, C² = Strippers.
 D C = Doffing Comb.

of wool and cotton. A new bed is next composed of this angola blend, and mungo of one or several shades, each being taken in succession in spreading the layers, however many colours are employed. If necessary, a little oil is imparted to the mungo. This bed complete, the whole is submitted to the action of the cylinders of the teaser, when it is ready for the scribbler.

36. *Fearnought*.—To better disentangle the fibres, and more perfectly mix the materials before carding proper, they are generally passed through the fearnought, or tenter-hook willey (Fig. 36). The latter name has been applied to this machine on account of the peculiar shape of the teeth inserted in the swift or main cylinder. The main cylinder (Fig. 37, Plate X) is some 48 inches in diameter, and makes from 150 to 160 revolutions per minute. The larger cylinders, w, are named “workers,” and those lettered s, “strippers.” There are four pairs of these rollers over the swift. The material, after having been spread on the feed-lattice, is passed forward to the main cylinder by the feed-rollers, when the workers and strippers engage the tufted and matted locks, and cross and intermix the fibres together. The fan, f, Fig. 39, or doffer, Fig. 37, draws the wool from the cylinder and casts it out of the machine. In order to prevent waste arising from loose fibres flying off the cylinders, the rollers are covered with a casing of sheet-iron when in operation. The machine is similarly enclosed underneath, but here there are perforations in the casement to allow any hard, dirty substances to escape, while the loose fibre remains on the grating.

The arrangement of the working parts of another type of machine and methods of driving are sketched in Figs. 38 and 39. The workers in this instance are chain-driven (dotted line), and the strippers rope driven off pulley A, the rope passing round guide G and strippers s^1 to s^5 . Motion is communicated to the doffer by the belt of the driving pulley passing over the upper guides B B, and the lower guide B and round pulley F. In certain makes of fearnoughts chain and gear driving is adopted.

or garnett clothing, with electrically hardened and tempered steel points, but set more open than in the ordinary Garnett machine. The cylinder is $24\frac{1}{2}$ " in diameter, and revolves at a high speed. Over this are placed seven workers driven by cogwheel gearing from the main shaft.

There are several types of "Garnetts." They do not differ essentially from each other in principle of action or construction but in the dimensions of the rollers, number of the swifts—one, two, or three, and in the number of the workers. The two latter are varied to suit the material to be opened. Fig. 40 is a line drawing of a two-swift machine, and Fig. 41 a view of a three-swift machine.

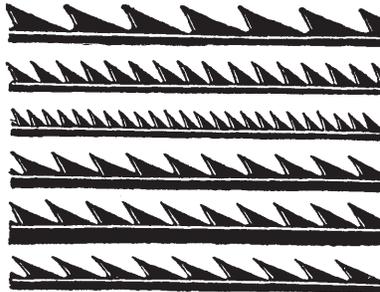


Fig. 41a. Garnett Wires for Rollers of Waste Opening Machine.

Front rollers have usually	12 to 16 teeth per inch.
Intermediate rollers	20 teeth per inch.
Back rollers	24 " "

Fig. 40 is the class of "garnett" employed for treating hard-twisted woollen, worsted, and silk waste. It may be built in two parts and converted into a single swift machine by removing s^2 with its complement of rollers.

The "waste" material is spread on the feed sheet F s , and conveyed to the first taker-in, T , by the feed rollers F , F^1 , and F^2 . The bulk of the material is conveyed by the swift to the workers. The small portion escaping its wire clothing is received by taker-in T^1 , and passed on to s^1 . The workers, w , which are all covered like the cylinder with Garnett wire—samples of which are shown in Fig. 41a—open the waste yarn reducing it to filaments, in

which condition it is carried forward to the first doffer, D. The fancy, B, raises the material on to the teeth of the clothing; and, in conjunction with angle roller c, facilitates its removal from the swift by the doffer. This roller conveys it to angle stripper, c², which places it on s², when the routine of opening the material is repeated. Reaching D¹ it is cleared from the clothing of that roller by a doffing comb having a like action to the doffing comb in a carding machine.

The diameters of the several rollers are as follows: Feed rollers, 2½"; 1st taker-in, 12"; 2nd taker-in, 9"; Swifts, 30"; Doffers, 24"; Workers, 4"; Fancies, 11" or 9"; Fancy Strippers, 6". The quantities of waste which may be "Garnetted" by a two-swift machine per ten hours varies with the width, namely, 36" on the clothing, 200 lb.; 48", 280 lb.; and 60", 350 lb.

The output necessarily varies on different materials; on fine, hard-twisted waste these quantities might be slightly reduced, but on more open materials considerably increased.

CHAPTER III

WOOLLEN YARN CONSTRUCTION: CARDING, CONDENSING, SPINNING AND TWISTING

38. Nature and Objects of the Process of Carding—39. Composition of Sets of Carding Machinery—40. Functions of the different Parts of a Carding Machine—41. Passage of the Material through the Machine—42. Carder for Producing a Woollen Thread with Worsted Characteristics—43. Speeds of the Cylinders—44. Relation of the Teeth of the Card Clothing on the different Rollers to each other—45. Card Clothing—46. Sets of Card Clothing—47. Setting or Proximity of the Rollers to each other—48. Automatic Feeds—49. Preparatory Motions for the Scribbler and Carder—50. Modes of conveying the Scribbled Wool from one Machine to another—51. Component Parts of Machines and Carding Surface—52. Examples and Applications of various sets of Machines—53. Methods of Driving Carding Machines—54. Condensing—55. Types of Condensers—56. Spinning—57. Compound Nature of Spinning—58. Winding the Yarn on the Spindles—59. Method of Driving—60. Continuous Spinning of Woollen Yarn—61. Comparison between Mule and Frame Spun Yarns—62. The Twisting Frame.—PRODUCTIVE POWER OF MACHINERY USED IN WOOLLEN YARN MANUFACTURE.

38. *Nature and objects of the Process of Carding.*—This process is a continuation, on a systematic principle, of the disentangling, opening, and mixing of the fibres of the material commenced in the teaser and fearnought. Carding completes the work of these two machines, and prepares the wool for condensing and spinning.

Summarizing the objects of the process they comprise :

(a) To separate fibre from fibre, open out the staple, and, to a certain degree, to comb the material; for as the wool is being propelled forward on the card clothing of the cylinder and successively taken up by the teeth of the rollers revolving adjacent to it, the filaments of the staple are more than disentangled—they are actually straightened.

(b) To effect perfect blending of the fibres whether of different qualities, thicknesses, or lengths.

(c) To produce an endless, flimsy sheet of fibres, free from neps and matted locks, of the same compactness and consistency throughout, with the various classes of fibres so perfectly mingled that the long, short, fine, coarse, straight, and curly are equally distributed.

(d) To form, when several shades or colours of fibres are blended together, a carded sheet of material, consisting of the same relative proportions of each shade of wool employed throughout the entire mixture.

39. *Composition of Sets of Carding Machinery.*—A set of carding machines may be composed of two, three, or four parts. The first section in each set is the scribbler or breaker. Should the set comprise three parts, the second part is termed the intermediate, and the third the carder and condenser. In a four-part machine the second and third are defined as the first and second intermediates. These several parts vary in composition, as will afterwards be explained, in adapting them for the carding of materials of different qualities, lengths, and fineness. The function of the cylinders and rollers, and nature of the process or work, are the same in scribbler, intermediate, and carder.

40. *Functions of the different Parts of a Carding Machine.*—Figs. 42, 42a, Plates XIII and XIV. ANGLE STRIPPERS, G, G¹, G². These rollers are not workers or openers of the wool, but are used for the purpose of passing it from one section to a following section of the machine. The first of the series, G, is fixed between the taker-in and the breast cylinder; the second, G¹, between doffer F and the main cylinder M¹, and the third, G², between doffer F¹ and the main cylinder M², and so on whatever number of cylinders there may be in the scribbler or carder.

WORKERS. These operate upon the wool at different parts on the breast and other cylinders. They are 8" or 9" in diameter. The points of the clothing with which they are covered should be sharp and fine to lay hold of the

wool. Workers and strippers are set closer to the cylinders, and increase in fineness of wire progressively, that is, according to the position they occupy in the machine.

STRIPPERS. These rollers—some 3" to 5" in diameter—are also termed cleaners. After opening the wool in conjunction with the workers, they yield it up to the clothing of the swift.

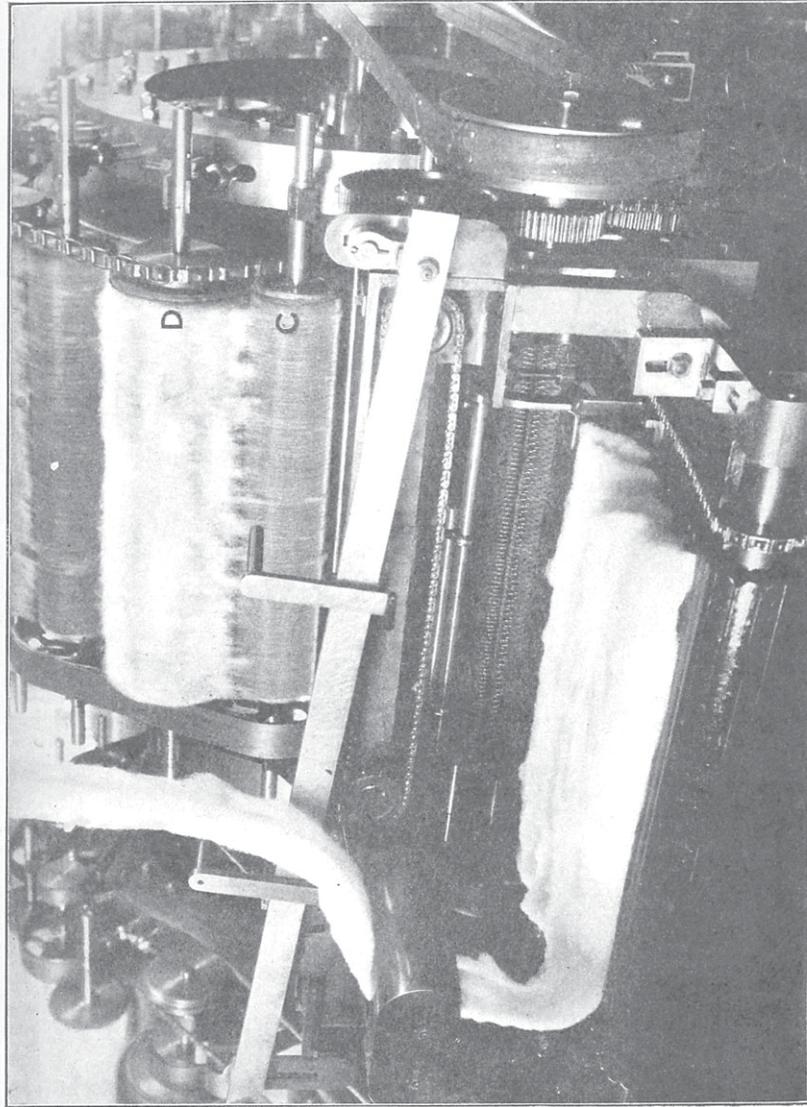
MAIN CYLINDERS or **SWIFTS** are some 48" to 50" in diameter, and make from 60 to 80 revolutions per minute. For instance, for the treatment of free and open wools, a surface speed of 1,000' per minute may be reached, but for fine wool and short-stapled material like mungo, 700' to 800' is a fair average. Strictly, the main cylinders are more "conveyers" than "carders" of the material, advancing it from worker to worker, and finally delivering it to the doffer.

CLEARER or **FANCY.** This roller—one for each part of the set of machines—is covered with long elastic clothing resembling a strong metallic brush. Its surface speed exceeds that of the swift by about one-fifth. As a rule, it is set moderately deep into the clothing of the cylinders in order to disturb the fibres which become, during the processes of carding, embedded between the teeth of the clothing of the cylinder; but it should not be set so deeply as to produce "fly," or throw the fibres off the cylinder, its function being merely to raise the material on to the points of the wire.

The **DOFFER** removes the carded fibres which collect on the surface of the swift. In fine work it is some 24" in diameter, but in coarse work 36", being set as close as possible to the swift. The points of its clothing should be both sharp and keen to secure a clean stripping of the fibres off the main cylinder.

THE DOFFING COMB is fixed slightly above the axle of the doffer. When carding short wools it requires a *high* up-stroke, but for long wools, with an increased speed of the doffer, a *low* up-stroke. The comb should not touch the clothing of the doffer, but be set quite close. Its

PLATE XI.



VIEW OF INTERMEDIATE (CARDING) MACHINE, SHOWING SCOTCH FEED ATTACHMENT WITH MATERIAL.

c = Stripper.

d = Worker.

action should also be as slow as consistent with a satisfactory delivery of the material.

On Plate XI a view is given of a section of an intermediate machine showing the feed rollers, and a stripper and a worker, c and d, as seen when in actual operation. The view on Plate XII is of the "Doffer" end of the machine, and shows the upper part of the doffer r, a small section of the swift m, the fancy e, a pair of workers d, and a stripper c. Observe in both illustrations the clean condition of the clothing of the strippers, but the quantity of fibre covering the workers, indicating that, in carding, such rollers remove the wool from the clothing of the strippers which the latter have received from the clothing of the cylinder, and which, after separating and straightening or combing between worker and stripper, is returned to the active cylinder to be carried forward to a succeeding pair of workers and strippers.

The brush quality of the clothing of the "fancy" e—which is almost free of fibre—is distinctly noticeable in the photograph on Plate XII. The part of the swift visible is near the point at which it comes in contact with the doffer, the material adhering to its clothing being in a suitable fleecy state to be effectually transferred on to the surface of doffer r.

41. *Passage of the Material through the Machine.*—Figs. 42, 42a, Plates XIII and XIV. The material is spread on the feed lattice either automatically or by hand, but almost invariably by the former method. Uneven or irregular spreading of the wool on the feed causes faulty and unsatisfactory carding. Before the material is transferred to the breast cylinder, m (Fig. 42), it undergoes a preliminary mixing which determines the quantity passed forward and opens the more matted locks of the wool. This is accomplished by five rollers, the "feeds" 1, 2, and 3, the taker-in, a, and the angle-stripper, g. As the material is carried into the machine by the "feed" it is collected by the wire clothing of No. 1, and a portion of it conveyed to the taker-in, a. Feed roller 2 also

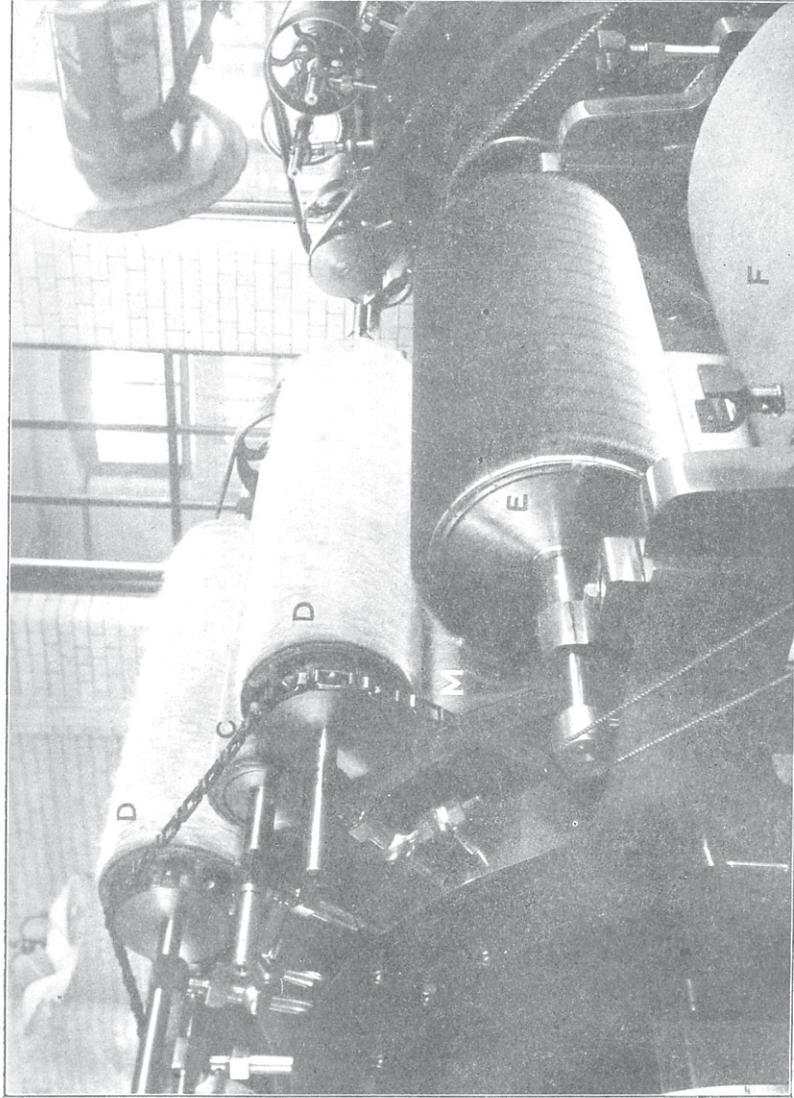
obtains its share of wool, which is opened between this roller and No. 3, being delivered also to the taker-in. The fibres are now yielded up to the angle-stripper, G, which by reason of its velocity cleans A.

At this juncture the actual or real process of scribbling begins. The wire teeth of the breast cylinder—having say a surface speed of 800' per minute—propel the material forward until it is met by the first pair of strippers and workers, C, D (Plate XI). The worker, which is placed behind the stripper is the larger roller, and removes a part of the wool off the cylinder, while the stripper—after some opening of the staple and separation of the fibres have been done—regains it from the worker and transfers it to the cylinder. This process is repeated by each pair of workers and strippers in the machine.

It is not the object of the scribbler to effect at a single process a perfect separation and re-blending of the fibres, for, in so doing, it would be liable to break the staple of the wool: hence the numerous pairs of rollers and the number of large cylinders forming a complete set of carding machines. The first pair of rollers deals with the more felted lots of the wool, being, as already explained, set farthest off the cylinder and also the coarsest in the wire, and containing the smallest number of teeth of any pair employed. The material escaping their clothing is dealt with by the second worker and stripper, while the less matted, or partially treated wools, are acted upon by the third pair, and so on throughout the operation. By this successive and frequent transfer of the wool from the wire teeth—gradually increasing in fineness of pitch from one pair of rollers to another—a continuous and increasingly effective opening of the material proceeds from its entering the machine to leaving the same at the doffer.

The principle on which the material is at various stages of the work released and recovered by certain rollers can only be followed when it is borne in mind that they are covered with fine, pliant, wire teeth, and that they have different velocities and are of different diameters. The

PLATE XII.



VIEW OF SCRIBBLER (DOFFER END).

c = Stripper. D = Workers. E = Fancy. F = Doffer. M = Main Cylinder.

principle of the operation is this: the teeth of one roller work against those of an adjoining roller in recovering and drawing out the material which they both possess, while a third roller, that is, the main cylinder, with a large surface velocity, is constantly propelling the fibres from one couple of rollers to another. Supposing, for illustration, the wire of any particular roller is charged with wool, and that it comes in contact with the teeth of an adjacent roller, revolving either at a different speed or in a contrary direction, then the material will necessarily be opened, straightened, crossed, and, in a measure, combed between their movements—a condition which is no sooner acquired than the propelling roller takes the fibres and conveys them a stage nearer the exit end of the machine. This is an epitome of what is repeatedly transpiring in the scribbling and carding operations.

42. *Carder for producing a Woollen Yarn with Worsted Characteristics.*—This (Brown's Patent) is illustrated in Fig. 43. The object is to pass the material through the machine in an unbroken fleece, shown by the thick black line. The material, as seen, is served into the machine in the ordinary way. From the taker-in, *r*, it is carried under the tumbler, *A*, below which is a grid through which vegetable and foreign matter falls into a receiver. This arrangement provides for any surplus fibres, on the cylinder being removed, worked, and again passed forward.

Reaching the first worker, *B*, the opening process commences between the action of this roller and the cylinder. The small plain rollers, *c*, prevent the wool from falling on the cylinder before it reaches the point of contact of the worker and the cylinder, by which means the fibres are equalized, and kept and delivered in a regular sheet or fleece on the doffer. The speed of the workers and rollers, *c*, is accelerated from *B* to the last worker on the cylinder. Only one stripper is employed and that placed at the end of each set of workers in the machine, only one stripper is applied, and that fixed at the end of each series of workers. In the carded fleece resultant, the fibres are more even

and straighter in arrangement than on the ordinary system, giving a spun thread with some of the level qualities of a worsted yarn.

43. *Speeds of the Cylinders.*—This in practical work requires careful adjustment. One series of speeds is not suitable for all classes of blends and wools. The main cylinders, for example, vary from sixty to one hundred revolutions per minute, and the doffers from three to ten or more. For all wool blends intended to be spun into fine yarns, eighty to ninety is a good average for the swifts; for coarse, strong wools, or blends of mungo and wool, seventy is the standard velocity. If the cylinders revolve too quickly when carding coarse blends, the quantity of fibres which fall underneath the machine in the form of “droppings” is largely increased. The fancies, for a like cause, have in such cases to be run slowly, otherwise they cast off a lot of loose fibres as “flyings.” The motion of the workers and strippers, on the other hand, should in this class of work be accelerated, the speed of these rollers generally being the highest when the materials are coarsest in quality; but in wools requiring well “working,” or much carding, the speed of these rollers is at the lowest, because the longer the material remains on the main cylinder the more effectively is it opened. In fine work the doffer should make from three to six revolutions per minute; in coarse work the first doffer might make as many as twenty; but the other doffers should be speeded somewhat more slowly. As this roller “doffs” the wool off the swifts, the lower its velocity the better are the fibres carded, opened, and blended.

In making calculations on the carding process, what is termed the “draft” must be understood. Assuming, for example, that a draft of forty were required, it would mean that for every lap spread on a yard of the feed-sheet, forty would be delivered by the doffer, minus the small loss occurring as the material passes through the machine. The rule for finding the draft is, that driven wheels multiplied by the diameter of the delivering roller, divided

Fold-out reduced to 33 % and rotated 90° to fit on page.

PLATE XIII
 SET OF SCRIBBLING, CARDING AND CONDENSING MACHINES FOR FINE WOOLS.

PLATE XIV
 SET OF SCRIBBLING, CARDING AND CONDENSING MACHINES FOR FINE WOOLS.

Fig. 42 and 42a.

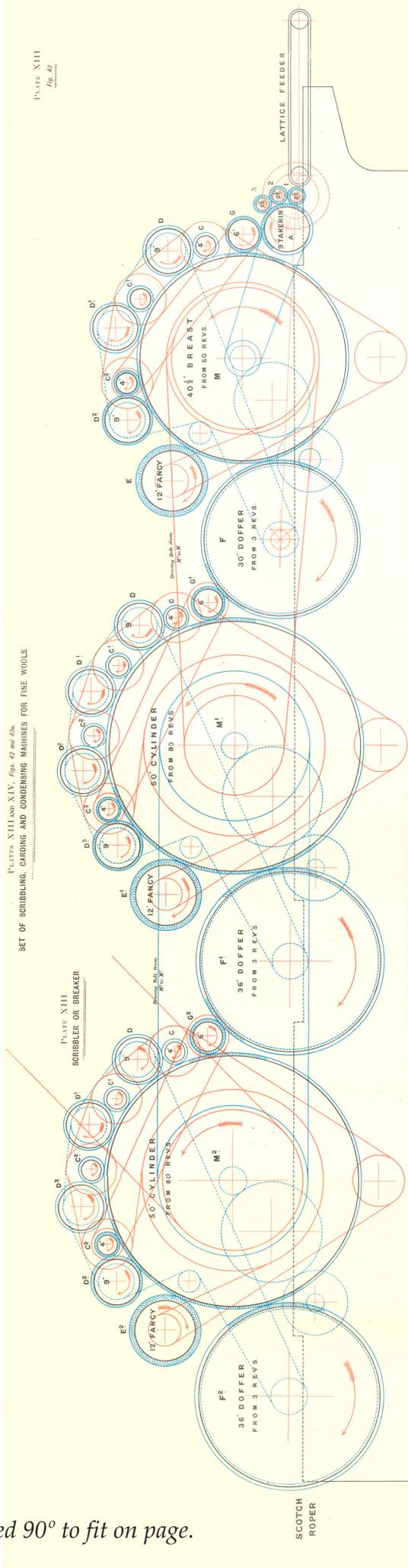


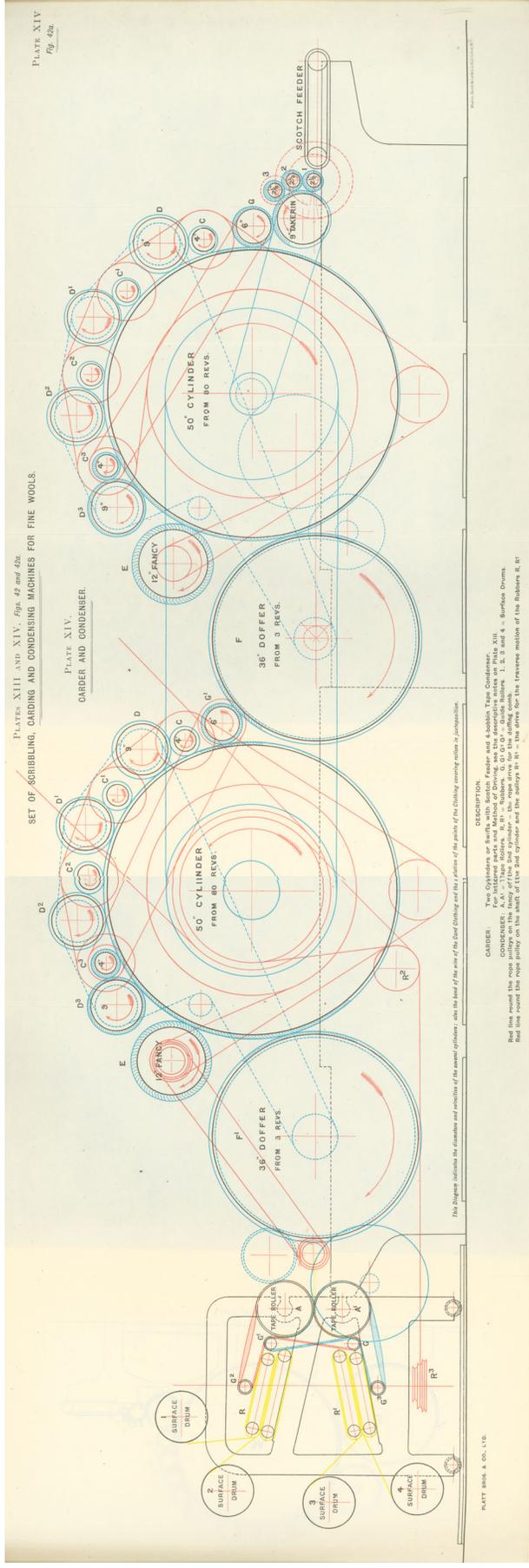
PLATE XIII
 Fig. 42

This diagram indicates the diameters and revolutions of the several cylinders, with the form of the gear cutting and the position of the points of the driving gearing when in juxtaposition.

DEFINITION:
 Breast Cylinder, two Main Cylinders or Batts, with Scotch Roper delivery.
 D, D' = Angle Strippers, D, D' D' = Workings, D, C, C', C' = Strippers.
 E, E', F, F', F' = Gears.

SCHEMATIC OF MACHINES:
 All parts of the machine are driven by the main cylinder, with the exception of the Scotch Roper, which is driven by the main cylinder on the shaft of the breast cylinder. Also of M' of the pulley (shown on the shaft of Cylinder M) when the pulley is in the position of the Scotch Roper.

NOTES:
 Drive of the Scotch Roper and the pulley shown on the shaft of the breast cylinder. Also of M' of the pulley (shown on the shaft of Cylinder M) when the pulley is in the position of the Scotch Roper.
 Drive of the Scotch Roper and the pulley shown on the shaft of the breast cylinder. Also of M' of the pulley (shown on the shaft of Cylinder M) when the pulley is in the position of the Scotch Roper.



Fold-out reduced to 33 % and rotated 90° to fit on page.

by the drivers, multiplied by the diameter of the feed roller.

44. *Relation of the Teeth of the Card Clothing on the different Rollers to each other* (see Plates XIII to XIX).—These features may be examined. There are three ways in which the teeth of the card clothing of one cylinder may glide past those of the clothing of an adjacent cylinder, namely: (1) Point to point; (2) point to smooth side; and (3) smooth side to smooth side.

The workers, strippers, cylinders, and doffers, or the parts which accomplish the carding, are common to every set of machines.

(1) When point meets point, combing and opening of the wool is most effectively done, each roller gaining a quantity of fibre. This is what happens between the cylinders and workers; the higher speed of the cylinder giving to it a greater conveying power. There is the same relation existing between the wire teeth of the doffer and the cylinder, but little carding effected because the fibres have been lifted by the “cleaner” on to the points of the clothing of the cylinder, and, moreover, the doffer has comparatively a very low circumferential speed.

(2) When the point of one card works in a contrary direction to the smooth side of an opposing card, the roller using the points of the wire has the higher clearing capacity. In the case of the worker and the stripper, the latter uses its points against the smooth side of the wire of the worker, hence its power to strip the fibres off this roller. The relation of the cylinder and the stripper in this respect is important, the bend of the wire is the same as in the worker and stripper, plus the increased velocity of the swift, so that it passes opened wool forward.

(3) The clothing of the “fancy” (E, Plate XII) is illustrative of this. Its smooth side works against the smooth side of that of the cylinder, and, in addition, it has a high surface velocity so, as explained, it acts more as a brush or cleaner than a carding factor.

45. *Card Clothing*.—The wire teeth are inserted into

the foundation in pairs. The angle of the teeth affects the life of the card as well as its working utility. The points should not be damaged by operating upon the wool. On coming in contact with the hard, matted tufts of fibre they should bend under and not turn back.

One object in the manufacture of card clothing is to make the points as hard as a needle, but highly tempered below the bend, increasing their working efficiency. The hardened parts of the wire form the points of the teeth, and the bendable parts the "crown." Fine cards, such as 110's to 150's, are made of 26's to 36's wire, and mild tempered throughout.

Clothing varies in counts, or the number of teeth in a given width and length of card, according to the fineness of the material for which it is intended, and the place assigned to it in the machine.

Cards are of two classes, "sheet" and "fillet." Leather is the most suitable foundation for the clothing for main cylinder doffers, workers, and fancies. All sheet cards are set in leather, being from 4" to 6" in width, and long enough to extend from end to end of the cylinder. Fillet cards may have either a composition or leather foundation. The former allows of more elasticity or springiness in the "crown" of the card. It is made of three or four folds of a linen-warp and cotton-weft fabric, and a layer of vulcanized india-rubber, cemented together by a rubber solution. As oil is injurious to this kind of foundation, it is better adapted for worsted and cotton than for woollen cards. Filleting is a satisfactory clothing for rollers small in diameter, and varies from $\frac{1}{2}$ " to $2\frac{1}{4}$ " wide, being of any length required. A leather foundation is preferable in fillet cards for covering the feed rollers and taker-in of the scribbler, in which the teeth should be thick and strong.

The plan of pricking the cards, of inserting the metal teeth into the foundation of the clothing, may be plain, Fig. 44; twill, Fig. 45; or alternating, Fig. 46. In Fig. 45 each fourth row is a repetition of the twill, wire a^1 being identical with wire a . Twill setting produces a

card with the points well distributed, but when nailed on the cylinder a distinct line or break is formed where the strips join each other. To obviate this additional teeth are inserted at the edge.

To ascertain the counts of card clothing measure 5" on

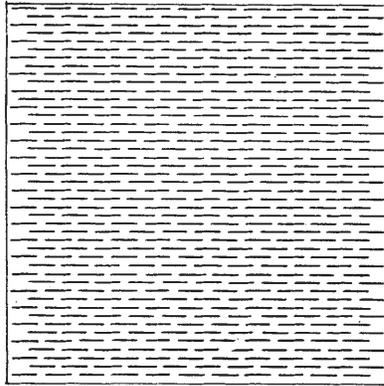


FIG. 44.

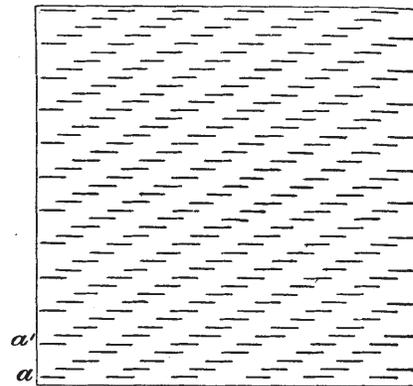


FIG. 45.

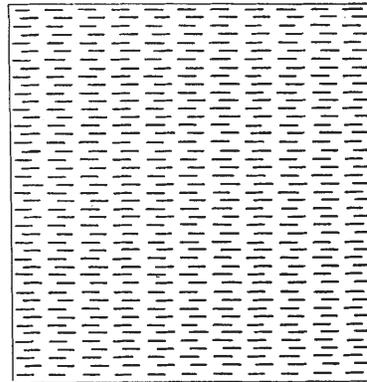


FIG. 46.

Samples of Card Clothing.

the back and take the number of teeth in a row. The crown is the number of teeth across the width of the card. The Continental system is based on the number of points in a \square centimetre.

Table II illustrates the relative variation in the "counts" and "crown" of card clothing in different parts of a set of machines, and also the counts of the wire employed.

Analysis of the table shows:

I. In relation to the counts of the card clothing:

(a) The greatest change in the counts occurs between the breast and the first cylinder or swift, namely, from 70's/7's to 100's/9's; the next change from the first swift to the second swift, 100's/9's to 125's/11's, which is also the counts of the first swift in the carder, that of the last swift being 135's/11's.

(b) Whereas the workers are of the same or higher counts as the clothing of the main cylinders to which they belong, those of the strippers are lower.

(c) The clothing of the doffers is several counts higher than that of the first and second swifts of the scribbler, and also of the first swift of the carder; and approximately the same counts as that of the second swift of the carder. In no instance is it lower than the swift to which it is attached.

II. In relation to the counts of the wire (Table I):

(a) The chief difference in the counts of the wire is made between the clothing of the breast cylinder and its workers, strippers, and doffer, and that of the main cylinder and its corresponding rollers. In this example in clothing, this difference is as stated below:

TABLE I
Card Clothing Contrasts—Scribbler and Carder

SCRIBBLER				CARDER			
	Counts of Wire.		Counts of Wire.		Counts of Wire.		Counts of Wire.
Breast Cylinder	26's	1st Main Cylinder	31's	2nd Main Cylinder	35's	1st Main Cylinder	35's
Breast Workers	28's	1st Main Workers	32's	2nd Main Workers	35's	1st Main Workers	35's
Breast Strippers	26's	1st Main Strippers	30's	2nd Main Strippers	30's	1st Main Strippers	32's
Breast Doffer	28's	1st Main Doffer	33's	2nd Main Doffer	35's	1st Main Doffer	36's
Breast Fancy	26's	1st Main Fancy	30's	2nd Main Fancy	34's	1st Main Fancy	34's

TABLE II
Example in the relative Fineness of Card Clothing in a Set of Machines

BREAST CYLINDER		BREAST WORKERS.		BREAST STRIPPERS.		BREAST DOFFER.		BREAST FANCY.	
Counts and Crown.	Counts of Wire.	Counts and Crown.	Counts of Wire.	Counts and Crown.	Counts of Wire.	Counts and Crown.	Counts of Wire.	Counts and Crown.	Counts of Wire.
70's/7's	26's	80's/8's	28's	70's/7's	26's	85's/8's	28's	50's/5's	26's
1st Swift. 100's/9's	31's	Swift Workers. 110's/10's	32's	Swift Strippers. 90's/9's	30's	Swift Doffer. 115's/10's	33's	Swift Fancy. 65's/7's	30's
2nd Swift. 125's/11's	35's	Swift Workers. 125's/11's	35's	Swift Strippers. 90's/9's	30's	Swift Doffer. 130's/11's	35's	Swift Fancy. 75's/8's	34's
CARDER									
1st Swift. 125's/11's	35's	1st S. Workers. 130's/11's	35's	1st S. Strippers. 110's/9's	32's	1st S. Doffer. 135's/11's	36's		
2nd Swift. 135's/11's	36's	2nd S. Workers. 150's/12's	36's	2nd S. Strippers. 110's/9's	32's	Ring Doffer. 140's/12's	36's		
						Ring Doffer Strippers. 120's/12's	34's		

(b) This further demonstrates the heavier nature of the opening work performed by the breast and its supplementary parts, as compared with corresponding parts in other sections of a set of carding machines.

It should be observed that flexibility in the card clothing is largely determined by the counts; the thicker the wire the less the points per inch, and consequently a diminished degree of elasticity. This, however, is affected by setting loosely in the crown, so that the amount of resistance is reduced.

“Clothing” for short wools should be characterized throughout by firmness; there must be flexibility in the cards covering the preparatory rollers in the machine, and the firmness and fineness must gradually and systematically augment as the work becomes more searching. For low class wools and open materials a lesser degree of these qualities is needed.

46. *Sets of Card Clothing.*—The following are the counts of clothing and other particulars for the sets of machines for the treatment of the materials, and their preparation for various counts and qualities of yarns:

TABLE III

SETS OF CARD CLOTHING

I

For the carding of fine wools for Saxony yarns, counts 20 to 40 yards per dram.

The set comprises two parts or machines, namely, *scribbler*, with breast cylinder and three swifts, and *carder*, with two swifts and double-doffer condenser.

SCRIBBLER. 60" on the Card Wire

Description of Parts.	Dia- meter of Rollers.	Counts and Crown of Clothing.	Counts of Wire.	Foundation of Clothing.
3 Feed Rollers . . .	2"	14's	Needle Point	Leather
Taker-in	12"	16's		Wood Lags
„ Angle Stripper	6"	40's/4's	23's	Vulcanized Fillet
Breast Cylinder . . .	40"	80's/8's	28's	Leather Sheets
3 „ Workers . . .	9"	85's/8's	28's	„
3 „ Strippers . . .	4½"	40's/4's	23's	Vulcanized Fillet
Angle Stripper . . .	6"	40's/4's	23's	„
First Swift	50"	110's/10's	31's	Leather Sheets
3 „ Workers	9"	115's/10's	31's	„
3 „ Strippers	4½"	60's/6's	26's	Vulcanized Fillet
„ Fancy	12"	60's/6's	28's	Leather Sheets
„ Doffer	36"	115's/10's	32's	„
Angle Stripper	6"	60's/6's	26's	Vulcanized Fillet
Second Swift	50"	125's/11's	34's	Felt
3 „ Workers	9"	125's/11's	34's	„
3 „ Strippers	4½"	80's/8's	30's	Vulcanized
„ Fancy	12"	30's/7's	29's	„
„ Doffer	36"	130's/11's	34's	Felt
Angle Strippers	6"	70's/6's	28's	Vulcanized
Third Swift	50"	135's/11's	35's	Felt
3 „ Workers	9"	140's/12's	35's	„
3 „ Strippers	4½"	80's/8's	30's	Vulcanized
„ Fancy	12"	35's/7's	32's	„
Last Doffer	36"	140's/12's	35's	Felt

CARDER. 60" on the Card Wire

Description of Parts.	Dia- meter of Rollers.	Counts and Crown of Clothing.	Counts of Wire.	Foundation of Clothing.
3 Feed Rollers	2"	No. 14's	Garnett Wire	
Taker-in	6"	16's	„	
Tumbler	9"	90's/9's	28's	Vulcanized Fillet
„ Worker	6"	135's/11's	35's	Felt
First Swift	50"	135's/11's	35's	„
4 „ Workers	9"	135's/11's	35's	„
4 „ Strippers	4½"	80's/8's	30's	Vulcanized
„ Fancy	12"	30's/7's	32's	„
„ Doffer	36"	140's/12's	35's	Felt
Angle Strippers	6"	70's/6's	28's	Vulcanized
Back Swift	50"	140's/12's	36's	Felt
3 „ Workers	9"	140's/12's	36's	„
3 „ Strippers	4½"	80's/8's	30's	Vulcanized
„ Fancy	12"	40's/8's	33's	„
Double Doffer	20"	130's/11's	34's	Leather Rings
2 Condenser Strippers	3½"	85's/8's	31's	Vulcanized Fillet

The set would yield 96 usable and 2 waste slivers.

WOOLLEN YARN CONSTRUCTION 113

II

For the carding of cross-bred and Cheviot wools, counts of yarns 8 to 22 yards per dram.

The set comprises two parts or machines, namely, *scribbler*, with breast cylinder and two swifts, and *carder*, with two swifts and double-doffer condenser.

SCRIBBLER. 60" on the Card Wire

Description of Parts.	Dia- meter of Rollers.	Counts and Crown of Clothing.	Counts of Wire.	Foundation of Clothing.
3 Feed Rollers . . .	2"	12's	Needle {	Leather Fillet
Taker-in	12"	12's		Point {
Angle	6"	40's/4's	22's	Vulcanized Fillet
Breast Cylinder . . .	44"	70's/7's	26's	Leather Sheets
3 " Workers	9"	75's/7's	26's	"
3 " Strippers	4 $\frac{1}{2}$ "	40's/4's	22's	Vulcanized Fillet
" Fancy	12 $\frac{7}{8}$ "	50's/5's	24's	Leather Sheets
" Doffer	36"	75's/7's	26's	"
Angle Stripper	6"	40's/4's	22's	Vulcanized Fillet
First Swift	50"	100's/9's	30's	Leather Sheets
3 " Workers	9"	100's/9's	30's	"
3 " Strippers	4 $\frac{1}{2}$ "	60's/6's	26's	Vulcanized Fillet
" Fancy	12 $\frac{7}{8}$ "	50's/5's	26's	Leather Sheets
" Doffer	36"	110's/10's	31's	"
Angle Stripper	6"	60's/6's	26's	Vulcanized Fillet
Second Swift	50"	125's/11's	34's	Felt
3 " Workers	9"	125's/11's	34's	"
3 " Strippers	4 $\frac{1}{2}$ "	80's/8's	30's	Vulcanized
" Fancy	12 $\frac{7}{8}$ "	30's/7's	30's	"
" Doffer	36"	130's/11's	34's	Felt

CARDER. 60" on the Card Wire

Description of Parts.	Dia- meter of Rollers.	Counts and Crown of Clothing.	Counts of Wire.	Foundation of Clothing.
3 Feed Rollers	2"	No. 14's	Garnett Wire	
Taker-in	6"	No. 16's	"	
Tumbler	9"	90's/9's	28's	Vulcanized Fillet
" Worker	6"	130's/11's	34's	Felt
First Swift	50"	125's/11's	34's	"
3 " Workers	9"	130's/11's	34's	"
4 " Strippers	4 $\frac{1}{2}$ "	80's/8's	30's	Vulcanized Fillet
" Fancy	12 $\frac{7}{8}$ "	30's/7's	30's	"
" Doffer	36"	130's/11's	35's	Felt
Angle	6"	70's/6's	28's	Vulcanized
Back Swift	50"	135's/11's	35's	Felt
3 " Workers	9"	135's/11's	35's	"
3 " Strippers	4 $\frac{1}{2}$ "	80's/8's	30's	Vulcanized
" Fancy	12 $\frac{7}{8}$ "	35's/7's	31's	"
Double Doffer	20"	130's/11's	34's	Leather Rings
2 Condenser Strippers	3 $\frac{1}{2}$ "	85's/8's	31's	Vulcanized Fillet

The set would yield 72 usable and 2 waste slivers.

III

For the carding of coarse and medium materials for blanket yarns, average counts 70 yards per oz.

The set comprises two parts, *scribbler*, with breast cylinder and two swifts, and *carder*, with two swifts and double-doffer condenser.

SCRIBBLER. 60" on the Card Wire

Description of Parts.	Dia- meter of Rollers.	Counts and Crown of Clothing.	Counts of Wire.
3 Feed Rollers	21 $\frac{1}{2}$ "	12's	Needle Point
Taker-in	12"	12's	
Angle over Taker-in	6"	40's/4's	20's
Breast Cylinder	50"	50's/5's	22's
3 Workers	10"	55's/5's	22's
3 Strippers	5"	40's/4's	20's
Breast Fancy	13"	40's/4's	20's
" Doffer	36"	55's/5's	22's
" Angle Stripper	6"	40's/4's	20's
First Swift	50"	80's/8's	26's
3 " " Workers	10"	85's/8's	26's
3 " " Strippers	5"	50's/5's	22's
" " Fancy	13"	50's/5's	22's
" " Doffer	36"	85's/8's	26's
Angle Stripper	6"	50's/6's	24's
Second Swift	50"	100's/9's	29's
3 " " Workers	10"	105's/9's	29's
3 " " Strippers	5"	60's/6's	25's
" " Fancy	13"	60's/6's	27's
" " Doffer	36"	110's/10's	31's

CARDER. 60" on the Card Wire

Description of Parts.	Dia- meter of Rollers.	Counts and Crown of Clothing.	Counts of Wire.
3 Feed Rollers	21 $\frac{1}{2}$ "	14's	Needle Point
Taker-in	12"	14's	
Tumbler	10"	60's/6's	26's
First Swift	50"	110's/10's	32's
4 " " Workers	10"	115's/10's	32's
3 " " Strippers	5"	70's/8's	26's
" " Fancy	13"	60's/6's	28's
Doffer	36"	115's/10's	32's
Angle	6"	60's/6's	26's
Second Swift	50"	120's/10's	33's
3 " " Workers	10"	125's/10's	33's
3 " " Strippers	5"	70's/8's	28's
Fancy	13"	60's/7's	28's
2 Ring Doffers	20"	120's/10's	31's
2 Strippers	3 $\frac{1}{2}$ "	80's/8's	28's

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To yield 40 usable and two waste slivers. On the counts of yarn named, 70 yards per oz., and condensing to 50 yards per oz., the set should be capable of carding 2,750 lb. of material per week of 50 hours running.

IV

For the carding of mungoes and medium qualities of materials, such as blends of mungoes and cotton, pulled waste, etc.

The set comprises two parts or machines, namely, *scribbler*, with breast cylinder and three swifts, and *carder*, with breast cylinder and two swifts.

SCRIBBLER. 72" on the Card Wire

Description of Parts.	Diameter of Rollers.	Counts and Crown of Clothing.	Counts of Wire.
3 Feed Rollers	2 $\frac{1}{2}$ "	Diamond Point Filleting	
Taker-in	12"	"	"
Angle Stripper	6"	60's/5's	25's
Breast Cylinder	40"	70's/7's	26's
2 " " Workers	9"	80's/7's	27's
2 " " Strippers	4 $\frac{3}{4}$ "	60's/6's	25's
Fancy	12"	50's/5's	24's
Breast Doffer	24"	80's/8's	28's
Angle Stripper	6"	60's/6's	25's
First Swift or Cylinder	50"	100's/9's	31's
3 Workers	9"	100's/10's	31's
3 Strippers	4 $\frac{3}{4}$ "	70's/7's	27's
First Fancy (twill set)	13"	65's/6's	28's
First Doffer	32"	110's/10's	32's
Second Angle	6"	70's/7's	26's
Second Swift or Cylinder	50"	120's/10's	33's
3 Workers	9"	125's/10's	33's
3 Strippers	4 $\frac{3}{4}$ "	80's/8's	28's
Second Fancy	13"	65's/6's	29's
Second Doffer	32"	120's/11's	33's
Angle Stripper	6"	70's/7's	27's
Third Swift or Cylinder	50"	125's/11's	34's
3 Workers	9"	130's/11's	34's
3 Strippers	4 $\frac{3}{4}$ "	80's/8's	30's
Back Fancy (twill set)	13"	70's/7's	32's
Back Doffer	32"	130's/12's	35's

CARDER. 60" on the Card Wire

Description of Parts.	Diameter of Rollers.	Counts and Crown of Clothing.	Counts of Wire.
2 Feed Rollers	2 $\frac{1}{2}$ "	Diamond Point	Filleting
Stripper	4 $\frac{3}{4}$ "	70's/7's	25's
Breast Cylinder	40"	120's/10's	33's
2 " " Workers	9"	125's/10's	33's
2 " " Strippers	4 $\frac{3}{4}$ "	70's/7's	29's
" " Angle Stripper	6"	70's/7's	28's
First Swift or Cylinder	50"	130's/11's	34's
3 Workers	9"	135's/11's	34's
3 Strippers	4 $\frac{3}{4}$ "	80's/8's	31's
Fancy (twill set)	13"	70's/7's	33's
Doffer	32"	135's/11's	34's
Angle Stripper	6"	90's/9's	33's
Second Swift or Cylinder	50"	125's/12's	35's
3 Workers	9"	130's/12's	35's
3 Strippers	4 $\frac{3}{4}$ "	90's/9's	32's
Ring Doffer (34 rings)		130's/12's	35's

Average production, condensing to about 48 yards per oz., 35 to 45 lb. per hour.

47. *Setting or Proximity of the Rollers to each other.*—Setting is the adjustment of the various parts so that the best carding results may be attained with the least injury to the staple of the wool. Gauges are employed for this purpose. Practice and experiment are necessary, but a few suggestions may be given.

The *workers* and the *doffers*, which, in combination with the *cylinder* have the heaviest work to effect in opening, blending, and equalizing the fibres, should be set sufficiently close to eliminate the possibility of the material not being thoroughly operated upon; but there must be no actual contact, or the points of the clothing will be damaged. The points of the wire of the *strippers* must clear those of the cylinder, allowing the wool to pass round and round without being immediately released—in other words they should retain the fibres during momentary combing action. Such points should slightly touch those of the *workers*, otherwise the latter would be liable to be bent back by the clothing of the cylinder.

The following example in gauge setting affords a notion of the graduation in the proximity of the rollers to one another from the feed to the delivery parts of the scribbler :

- Taker-in* $\frac{1}{4}$ " from cylinder.
- No. 1 Feed Roller.* 24 gauge between it and the taker-in.
- No. 2 Feed Roller.* 24 gauge between it and the taker-in and slightly resting on No. 1.
- No. 3 Feed Roller.* 24 gauge between it and No. 2 and between it and No. 1.
- Angle Stripper* . . . 26 gauge between it and the cylinder and so near the taker-in as to clear the wool off it.

Strippers and Workers 26 gauge between them and the cylinder.

Strippers and Workers Just in contact.

Fancy Slightly dipping into the clothing of the cylinder, keeping the working point of the latter in effective condition.

Doffer 26 gauge between it and the cylinder.

In other parts of the machine finer gauges are used, as, for example, in this set :

- Intermediate.* 1st cylinder and workers and strippers, 28 gauge.
- 2nd cylinder and workers and strippers, 31 gauge.
- Carder* . . . 1st cylinder and workers and strippers, 32 gauge.
- 2nd cylinder and workers and strippers, 33 gauge.

The setting of the fancy or cleaner is most important. If not properly done it is highly detrimental to efficient carding, for the fibres would be rolled and formed into

neps. The rule for correctness is the highest speed, not making extra fly, with the least setting within the teeth of the cylinder capable of clearing the wool from the latter.

48. *Automatic Feeds*.—Figs. 47, 48, 49, 50, 51, and 52. The advantages of automatic feeds for the scribbler over

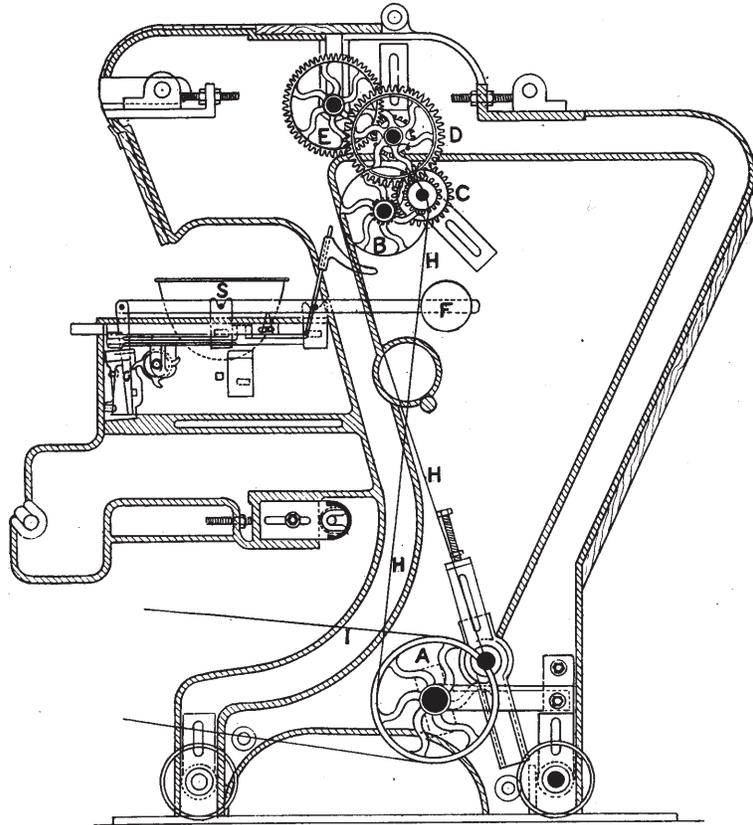


FIG. 47. Haigh's Hopper Feed. Driving side. Pulley A is driven off a pulley on Scribbler Shaft and imparts motion to the train of wheels, C, D, and E, by the pinion on the shaft of pulley B. Wheel E gives movement to the spiked lattice A (Fig. 48).

hand spreading are obvious. As it is impracticable to produce a level condensed sliver with an uneven and irregular supply of material to the machine, it is apparent that no system can be satisfactory which does not effectually and automatically deliver to the feed lattice a fixed weight of material on a fixed length of the lattice, at uniform intervals.

The Hopper Feed, as now constructed, also serves another function: it further mixes the blend and opens the material, presenting it to the rollers of the scribbler in a more lofty and better condition for carding than weighing and spreading by hand.

In Haigh's machine the wool is carried by an endless

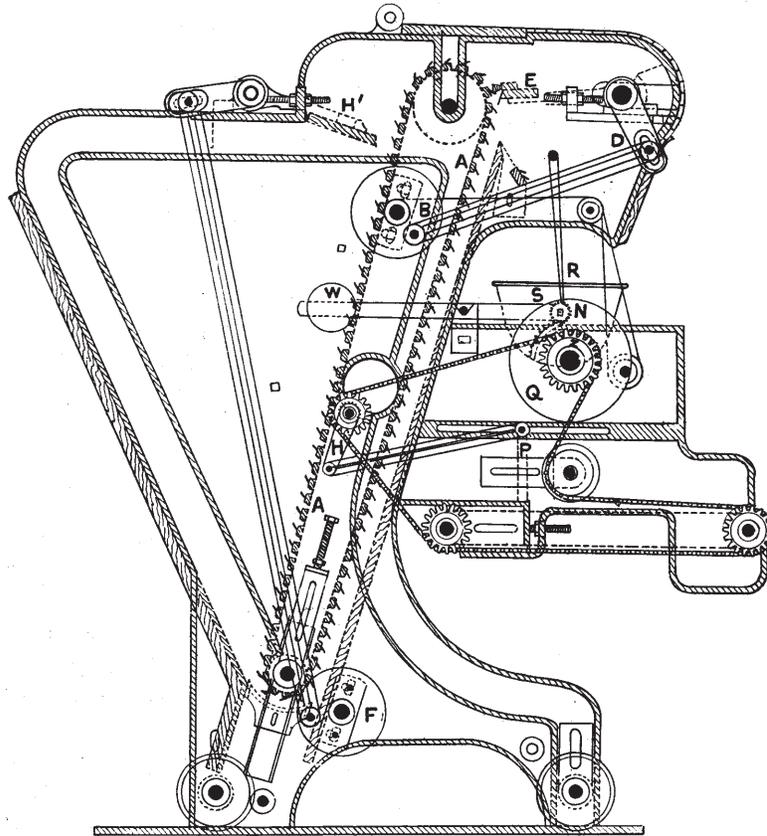


FIG. 48. Haigh's Hopper Feed. Showing mechanism for driving spiked lattice A and for operating the Pan s.

lattice or creeper, which has an intermittent motion, from the hopper, when it is removed by a brush, toothed bar or comb, and fed into the pan. This pan is balanced, and on the lever carrying it there is a weight for adjusting the quantity of material to be transferred into the pan, which at the proper moment is opened to allow the material to drop on to the lattice of the scribbler.

The motions have the following sequence: (1) the wool having been placed in the hopper, its vertical endless lattice lifts up the material from the same; (2) the action of the comb, fixed and operating behind the hopper lattice, straightens and evens the locks of wool adhering to the pins, that in front of this lattice drawing and clearing the wool off the pins which is received by the pan; (3) the

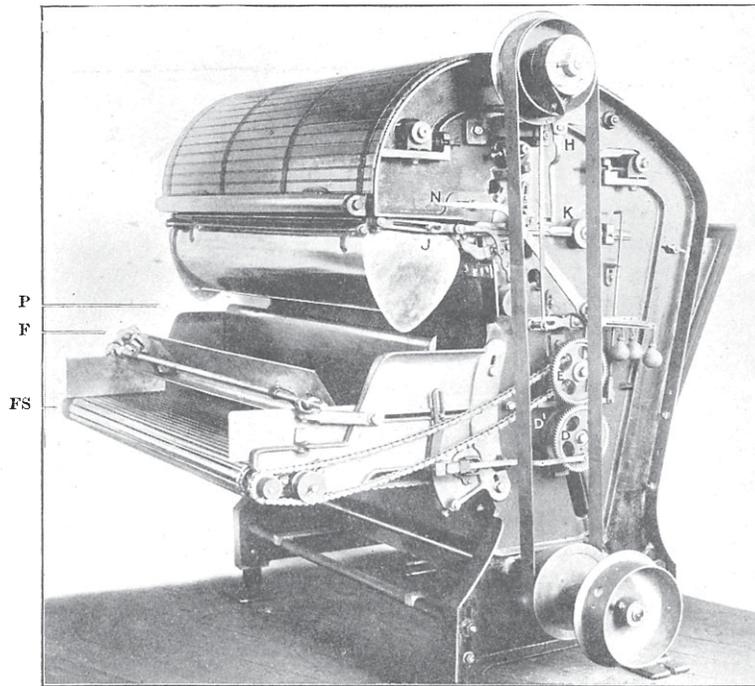


FIG. 49. Hopper Feed (Automatic Machine Co.). Front View, showing Feed Sheet FS, Pushing Board P, Leveller F, and part mechanism for opening the Pan J, namely, Levers K and N.

motion of the hopper lattice is stopped; (4) the pan is either opened at the sides or turned over; (5) the pan is re-adjusted; (6) the hopper lattice is restarted and also the feed sheet which is active during the filling of the pan, and stationary during changing.

Motion in Haigh's type of Hopper (Figs. 47 and 48) is given to the lattice by a train of wheels, B, C, D, and E (Fig. 47). Pulley A is driven off the scribbler, belt H passes

round this pulley, and pulley B imparting motion to this train of wheels. The material, as indicated, is put into the hopper and conveyed to the pan by the endless lattice. Wheel B (Fig. 48) carries a lever which by crank lever D and arm E, combs or brushes the material off the lattice laths. As the wool is lifted by the lattice, it is slightly combed by the action of H¹, receiving motion from

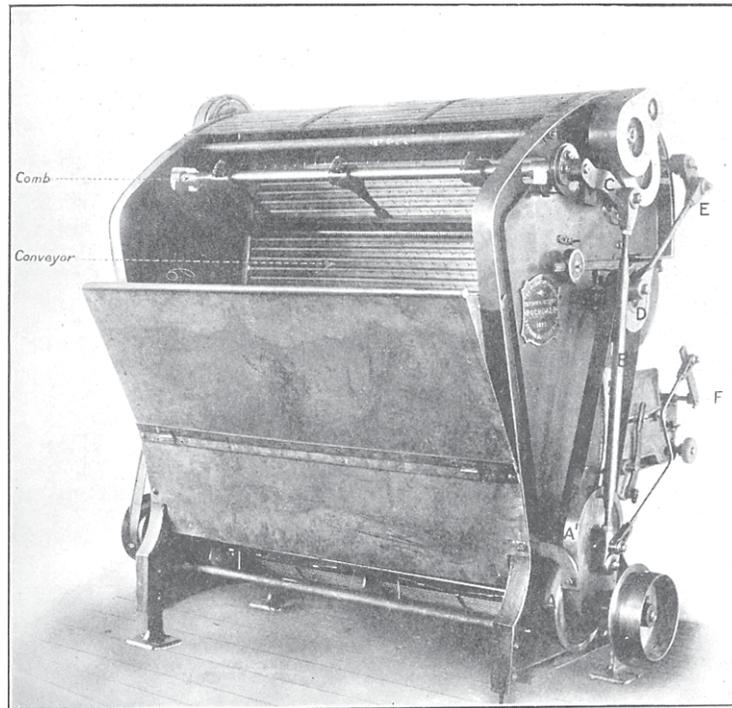


FIG. 50. Hopper Feed (Automatic Machine Co.). View of the back part of the machine at which the wool or material is introduced.

wheel F and the upright lever. When the pan is charged with wool it is lowered in the slot, and, in doing so, is engaged by the catch R, the end of the pan pin carrying the pinion N drops beneath the catch and is held in gear. The pan being emptied, the pin projecting on the rack, forces the catch R backwards; the pin on which the catch wheel is mounted (Fig. 48) is pushed forward by the cam on wheel Q, beyond the catch, so that the weight on the

lever causes the pan, *s*, to rise. A spring draws the lever of the strap guide, transferring the belt on to the fast pulley, and holding it in position until the proper quantity of material has been fed on to the creeper. The pushing board is controlled by lever *н* and upright *р*.

The separate weighings should drop out of the scale side by side, and not overlapping; but, on the other hand, the pushing board should not force such weighings too close to each other. In either case uneven work is liable to result.

The points for adjustment are:

I. Distance of the combs from the hopper creeper or lattice.

II. Speed of the creeper. This is regulated by change wheels. For long wool, the hopper comb is worked slower, preventing the wool from being rolled, and from passing forward matted, because a longer and more effective stroke is given to the comb.

III. Weight of material fed into the pan. This is adjusted by the position of the weights on the lever. Two of the weights are for balancing, and the third for governing the quantity which is fixed for actuating the pan. After balancing and fixing the quantity of material to deposit at each turn of the pan, the required weight is placed on the lever.

Corresponding motions in the hopper type of feed made by the Automatic Feed Company may be also described. This machine is illustrated in Figs. 49 and 50 and by the sectional drawings in Figs. 51 and 52.

The hopper combs—back and front—and the lever for pressing the material on to the feed lattice is done by cam motion, *A*, fixed on the shaft at the bottom of the machine (Figs. 50 and 51). It is connected to the bellcrank lever *B* (Fig. 51), which imparts motion to the comb fixed behind the creeper, and through the connecting arm *c* and lever *D* to comb *G*¹, in front of the creeper. The leveller, *F*, is also operated by cam *A* through the parts shown. If the

mechanism is for carrying heavy quantities to the scribbler feed, the combs should be driven independently to allow of their separate adjustment.

In setting the combs the spiked sheet is turned round, until the part where it has been jointed is opposite the comb, this being the thickest part. The comb G^1 should be set to clear the spikes, and the brush which it carries to clear the laths to the bottom of the pins. It should have a stroke of about 9". This is modified by adjusting the levers B and D (Fig. 51). Comb G should be set $\frac{3}{4}$ " from the points of the pins, striking level with the top of the spiked sheet when reaching the highest point of its traverse. Both combs are speeded about 80 strokes per minute.

The opening of the pan is primarily effected by wheel D (Fig. 52), which carries an eccentric or cam and pin. The latter comes in contact with the lower projection on F , forcing down the lever N (Figs. 49 and 52) which engages the projection J , and causes the pan to open at the sides like a pair of shears. When lever N is resting on the surface of J , after the pan has been opened, the pin in wheel D engages a finger causing lever H to release the clutch wheel C , and thus allowing the creeper to move forward.

By this arrangement of feed the pan is approximately balanced by the combination of levers and weights, and the quantity of material delivered to the feed sheet of the scribbler chiefly controlled by regulating the speed of the lattice and the proximity of the combs to the pins.

49. *Preparatory Motions for the Scribbler and Carder.*— There is no part of carding that is more important or requires more careful judgement than the treatment of the material on the first cylinders of the scribbler. As is now understood, the main object of the "breast" is to separate the more entangled and felted masses of the fibres of the material, and preserve the length of the staple by passing the wool on to the first swift in an open condition. Much serious mutilation of the staple would ensue in dealing with neppy, burry, and matted wool if it were transferred

directly from the feed rollers to the swift. The stronger and coarser counts of wire on the breast cylinder as shown is intended to effect a preparatory separation of the fibres. But this is not always satisfactory, hence several supple-

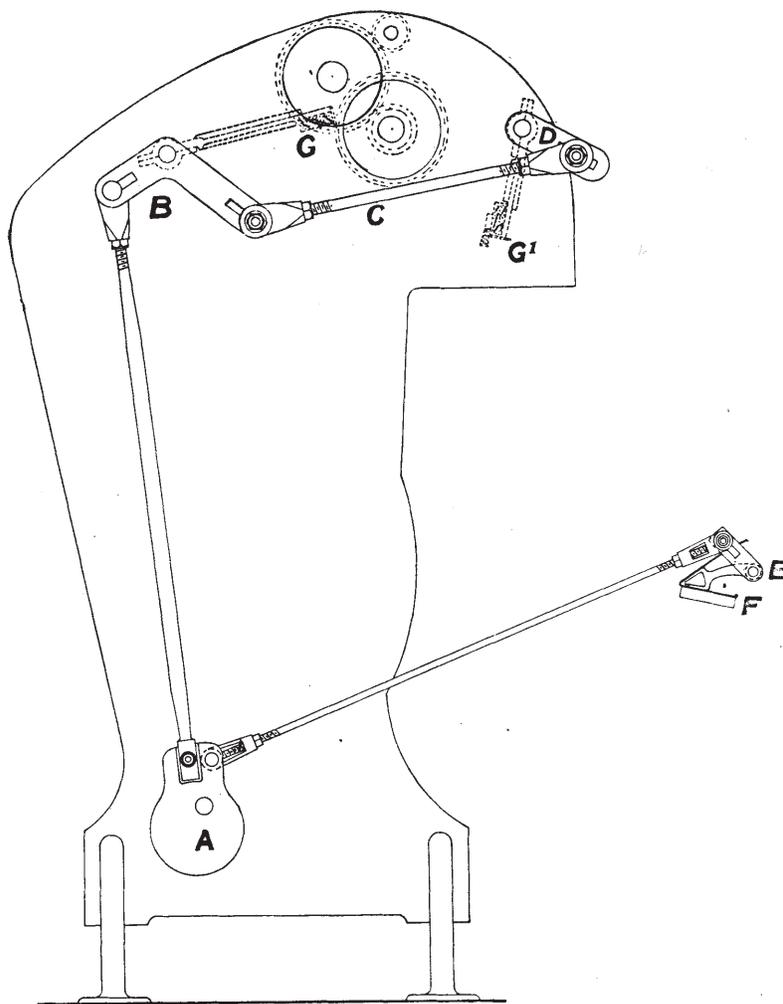


FIG. 51. Hopper Feed. Mechanism for operating the Combs.

mentary forms of mechanism have been applied by continental and English carding machine makers to obviate this difficulty.

The three arrangements sketched in Figs. 53, 54, 55, are of French invention, and are constructed specially for

the treatment of neppy and burry wools. In Fig. 54, section F¹ is the automatic feeding apparatus. It will be observed that in Fig. 53 there is the usual complement of feed rollers, followed by a Garnett roller A, over which is placed the burr roller for beating the burrs out of the wool

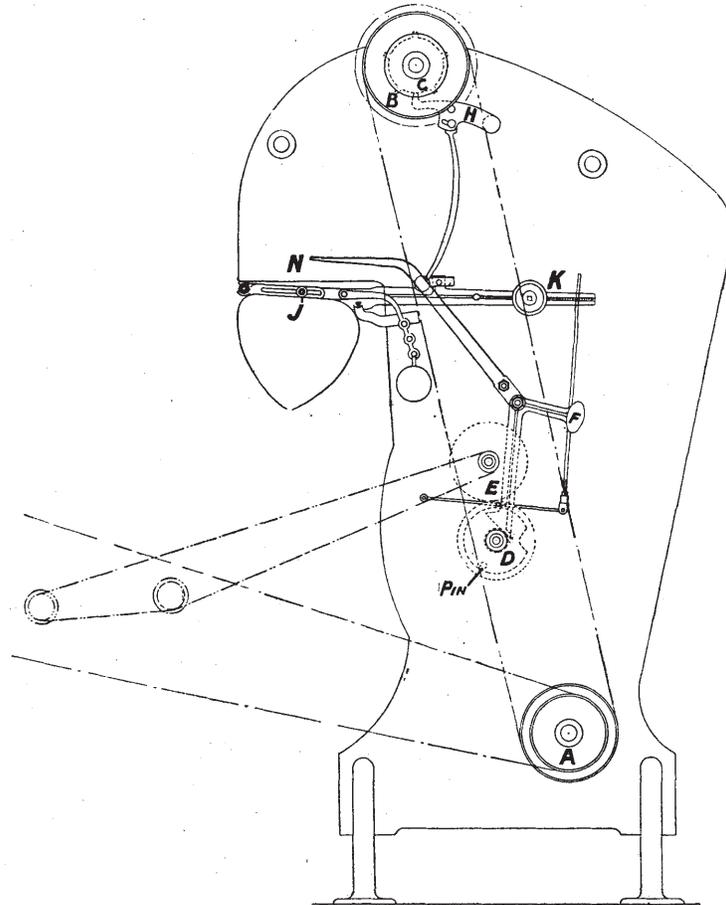


FIG. 52. Hopper Feed. Section of Mechanism for opening Pan, J.

as they cling to the teeth of A. The clothing of B removes the wool from A, and transfers it to the cylinder D; C, in turn, clearing B. This motion is applied to sets of machines for the carding of South American wools, for the production of yarns for army cloths.

An extension of the arrangement is shown in Fig. 54,

where the first roller A is garnetted, but the second roller A¹ acts as a miniature breast cylinder. The wool is removed off A by c and passed on to A¹, roller D assisting in the clearing of A and yielding the wool to c. Between c and A¹ a certain amount of opening of the fibres takes place, and also between c and E. Rollers F and G are worker and stripper. The large angle stripper H gleans the wool from A¹ and transmits it to the cylinder J.

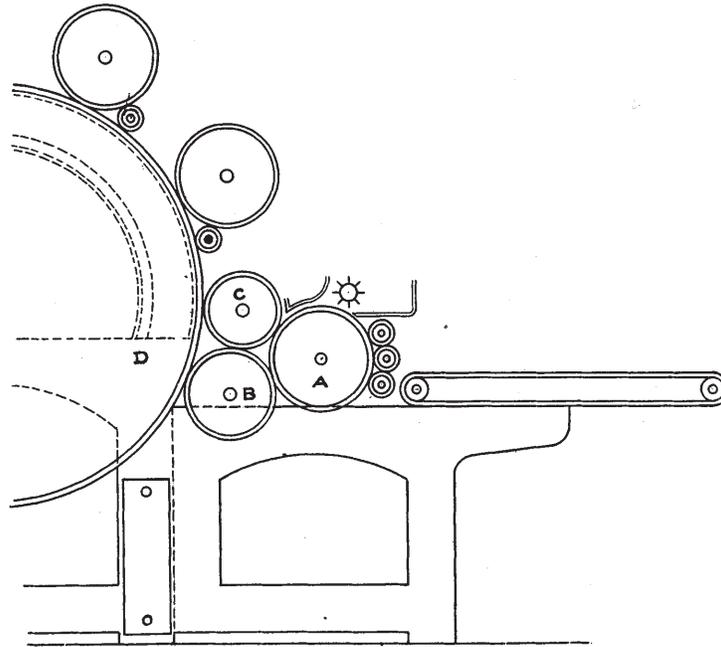


FIG. 53.

Fig. 55 affords increased preparatory scribbling. The use of a supplementary small breast in combination with the arrangement sketched in Fig. 54 is practised on the Continent in treating River Plate, Buenos Ayres, Monte Video and similar wools. Here, over A is the ordinary burr roller B, followed by three rollers equal in size; D strips from A and conveys some of the fibres to F; c also strips from A giving it up to D, then the material is worked between D and F, thence reaching the card clothing of the breast F, which carries the wool to the worker G, between which and H, the usual process of stripping and working

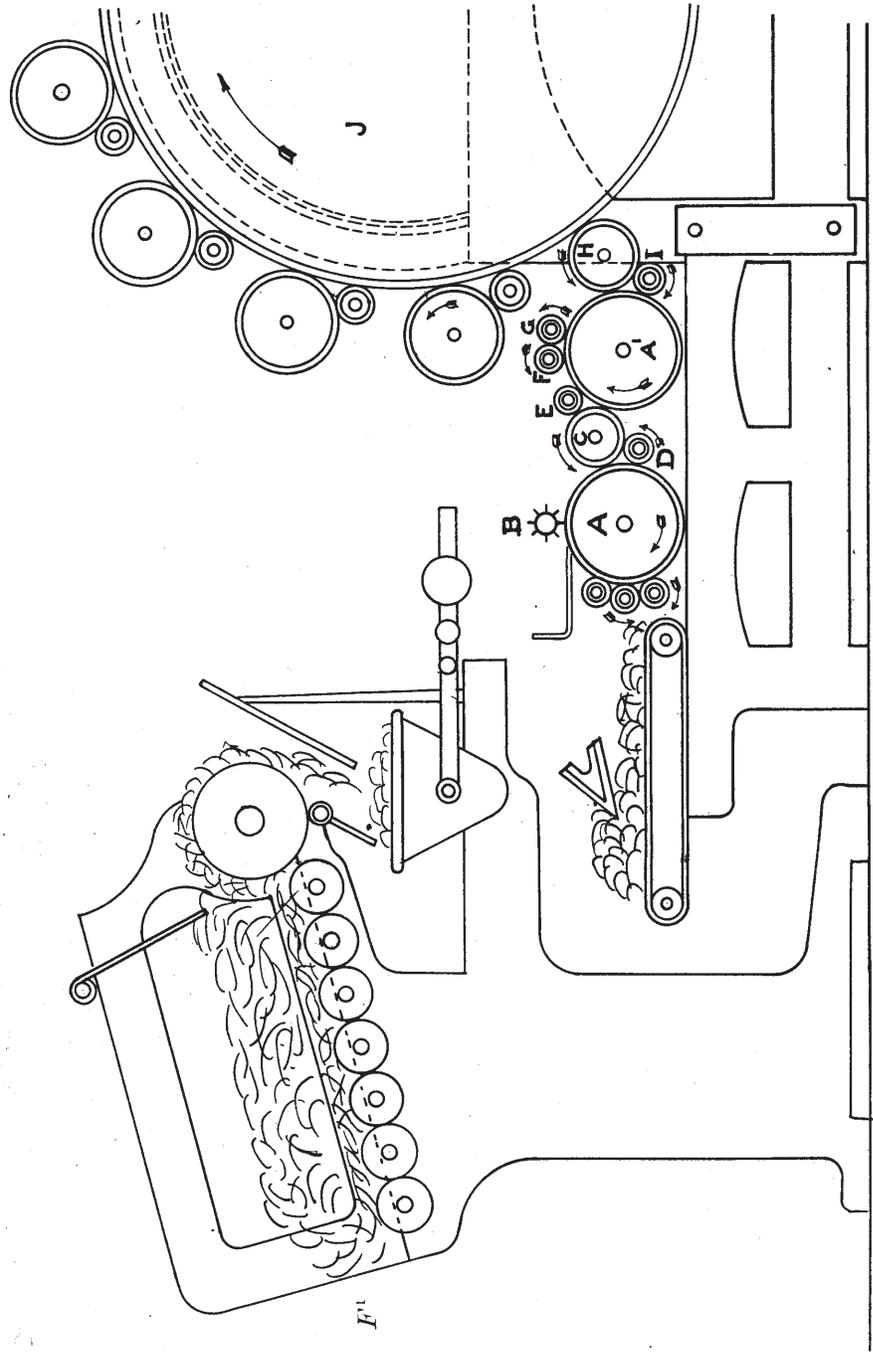


FIG. 4.

transpires. Intervening F and L, there is a similar compound of rollers as between A and F; J is the principal stripper the filament escaping being cleared by I to be re-transferred to F, and from it back to J and thence to the main cylinder; K collects the material which escapes the cylinder, works it in conjunction with J, and finally replaces it in a more open state on the cylinder.

On this system, as in Fig. 54, there is a compound action (1) that of the removal of the burrs; and (2) sufficient preliminary carding to open the neppy staple and get the material into a suitable condition for the action of

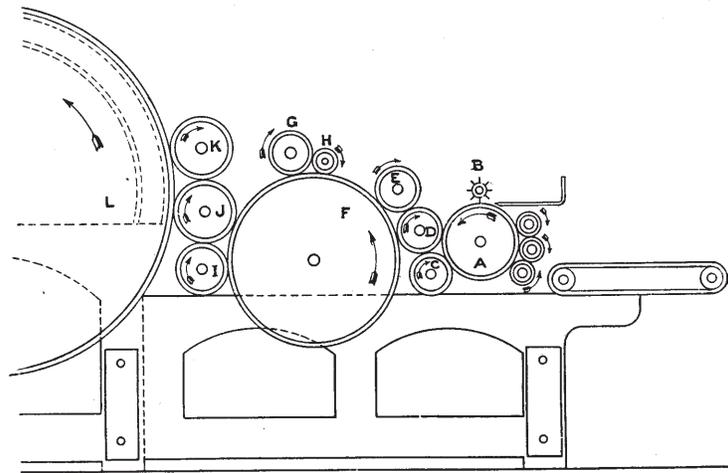


FIG. 55.

the swifts, workers and strippers in subsequent sections of the machine.

Haigh's device (Fig. 56) may be employed on the carder or scribbler. It comprises three feed rollers covered with Garnett clothing, and a fourth roller or taker-in, A, some 4" diameter, and also Garnetted; the burrs are broken between these rollers.

Following the routine of treatment by the feed rollers and the taker-in, the wool is acted upon by the tumbler B, its clothing carrying the fibres downwards, so that the loosened burrs may fall into the perforated receiver C. The material is now presented to the cylinder D, the

worker *w* also assisting in opening and conveying it off the tumbler on to this roller.

The "Garnett" breast apparatus (Fig. 56*a*) is applicable to both scribbler and carder, and consists of breast cylinder 20" diameter; three workers, 6 $\frac{1}{4}$ " diameter; three strippers,

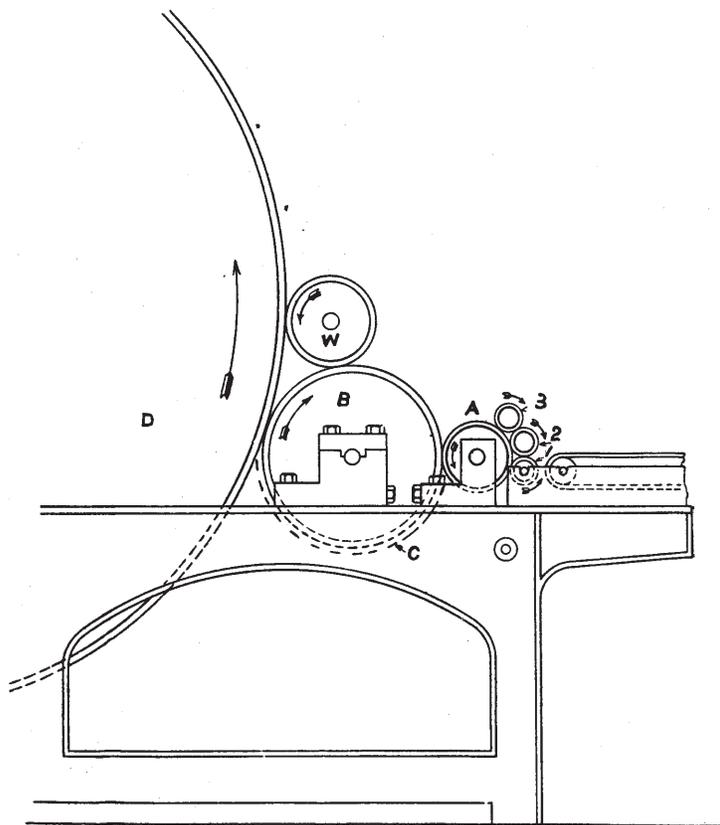


FIG. 56.

3 $\frac{1}{4}$ " diameter; one taker-in, 6 $\frac{1}{4}$ " diameter; one under taker-in, 4 $\frac{1}{2}$ " diameter; and a set of three-feed rollers.

It forms a complete front part of the machine. In working, the teeth of the feed rollers intersect each other. The workers are wheel driven and independently, and can, therefore, be varied as to speed to suit the class of material being treated. By running the workers slowly, the teeth of their clothing is retained in contact with the teeth of the cylinder for a sufficient length of time to effectively

separate the matted filaments of wool or of mungo and shoddy. It sometimes happens that felted bits of rag are left in the shoddy coming from the rag-grinding machine. These are only partially opened by the strong durable wire teeth of the feed rollers, but, for good carding results, these hard portions of rag must be completely disintegrated. This process takes place between the breast and three pairs of workers and strippers. The workers having sharp pointed teeth, the unopened bits of rag are fastened to the teeth of their clothing, and are thereby operated upon by the wire teeth of the cylinder.

In the illustration, $F S$ is the feed sheet; F the feed rollers; s^1, s^2, s^3 , the strippers; T , the taker-in; and $U T$ the lower taker-in; and w^1, w^2, w^3 , the workers. The parts are wheel driven either by belt off a pulley on the shaft of the first swift of the scribbler passing round pulley A of Fig. 56*a*, or by counter shaft and pulley, the belt passing round pulley A^1 carrying a pinion gearing with wheel $B W$.

A scheme of parts for breaking up the material prior to carding on the cylinder, and also an auxiliary set of rollers for the further treatment of the wool, before finally removing by the doffer, is sketched in Fig. 57, and made by Messrs. Platt Bros. The wool passing from the taker-in, A , is passed on to the small cylinder, or second taker-in, B , over which is a pair of rollers, w^1 and s^1 , corresponding in their functions to an ordinary worker and stripper. After treatment on B , the wool is removed by s^2 , from which it is transferred by s^3 on to the main cylinder. An auxiliary working is done by the doffer, $S D$, which takes up part of the material and passes it, by the intermediate roller, s^4 , to the supplementary cylinder, $s C$. The main doffer, D , stripping from the main cylinder and also from the small cylinder, $s C$.

Fig. 57*a* is another double doffer arrangement made by the same firm, there being an upper and lower doffer, D^1 , and D^2 , between cylinders c and c^1 ; and also attached to cylinder c^1 , namely, D^3 and D^4 —each doffer having its fancy and stripper rollers, F, F^1 and s, s^1 . The wool from

doffers D and D^2 is conveyed by angle strippers A^1 and A^2 to the last cylinder. The object and advantage of this arrangement are greater production, and more effective clearing of the cylinders.

Beran's patent supplementary arrangement comprises doffer, fancy, stripper rollers, and a small cylinder, placed under the doffer for the main cylinder. The auxiliary

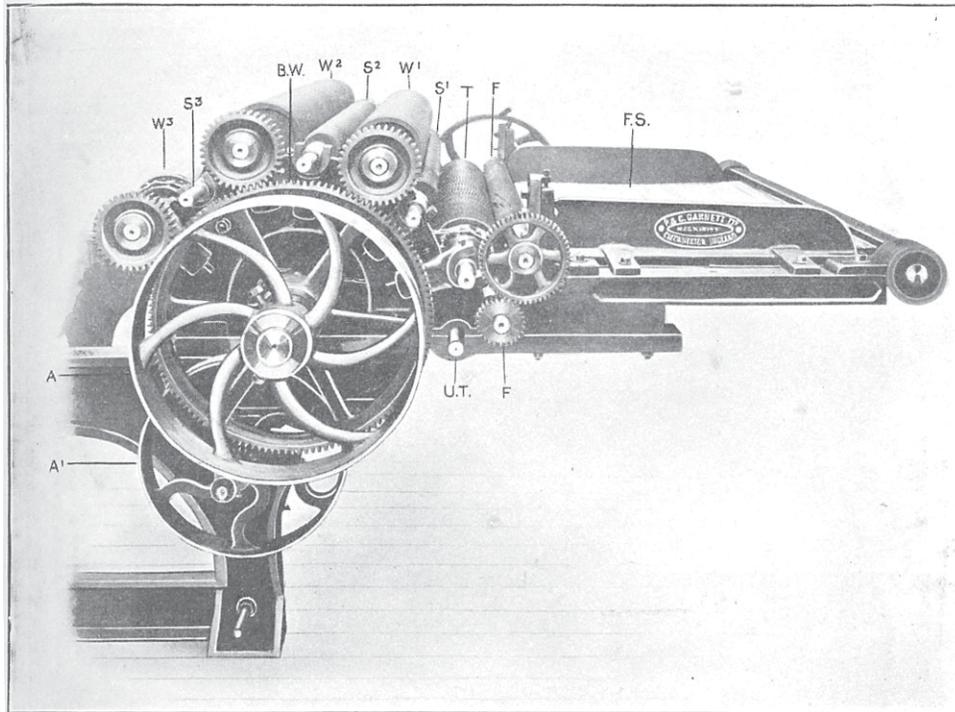


FIG. 56a. The Garnett Breast Cylinder.

cylinder further cards and mixes the wool, feeding it up to the doffer. The lower fancy is in contact with both the main and the supplementary cylinders. The utility of the lower fancy is to further raise up the fibre on the cylinder, so that, after stripping, it may be passed on to the main cylinder, resulting in better clearing of the latter and also increased carding of the material.

50. *Modes of conveying the Scribbled Wool from one*

Machine to another.—The object aimed at in transferring the material from one carding machine to another is, as much as feasible, to prevent the production of an unevenly carded material, by presenting the fibres in a new form to the cylinders of the *intermediate* or *carder*, as the case may be. There are three distinct systems of doing this. First, there is the *lap* or Blamire system, in which the material, as it leaves the scribbler, is conveyed in successive layers by a travelling apron, set at right angles to the doffer, on to a huge drum; hence the fibres are distributed on to the carder in the opposite direction to that in which they are delivered. Second, there is the *Scotch feed*, a contrivance which reduces the scribbled material into a flat ribbon or band (Plate XI) some 5 inches broad, and from a quarter to half an inch thick. This “sliver” is laid on the feed of the carder by the carriage, in a slightly diagonal sense, each layer being arranged to overlap its predecessor to such an extent as to ensure a level and uniform distribution of the material. Third, the *balling* or *side-drawing* system, so called on account of the fibres being delivered in the form of a rope to which a little twist is imparted as it passes through the funnel, on its way to the balling machine, where it is conducted between guide-pins on to bobbins 3 inches across. These bobbins, when full, are placed in the creel, and the separate ends passed between another series of guides on to the feed-rollers of the carder. A feature of this system consists in the fibres being spread in the same direction on the carding engine as they leave the doffer of the preceding machine; whereas, in both the lap and Scotch systems the fibres are delivered, say, lengthways, and fed on to the carder transversely. Another characteristic of the balling feed is that the fibres are twisted into a rope condition, and that in this state the material goes on to the cylinder of the carder, where the primary object is to reduce the wool into one thin, level film of fibres.

51. *Component Parts of Machines and Carding Surface.*

—Compare the sets of machines in Figs. 42 and 42a,

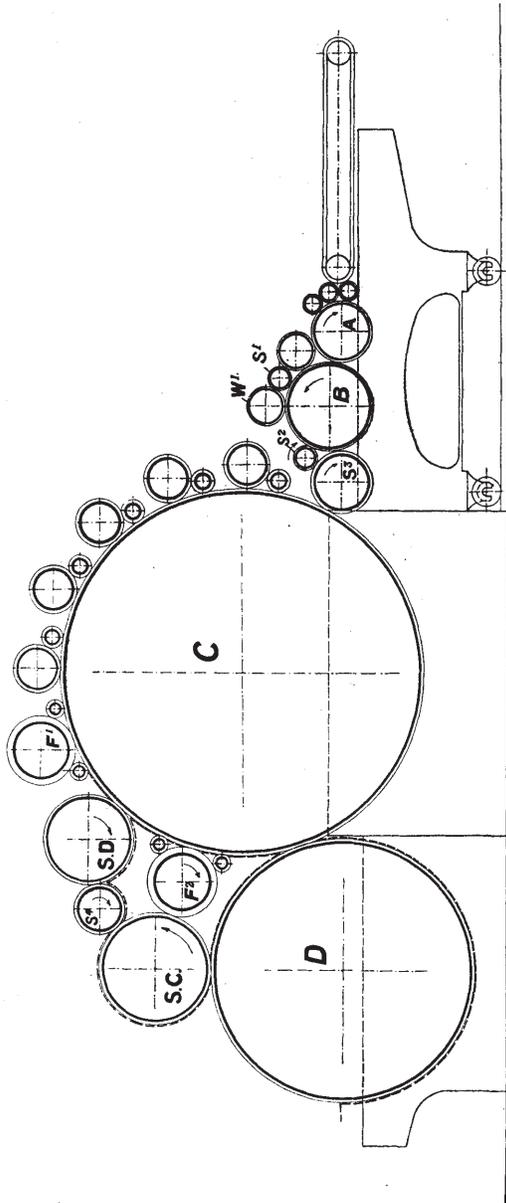


FIG. 57.

Plates XIII and XIV; Figs. 63, 64, and 65, Plates XV, XVI and XVII; and Figs. 66 and 66*a*, Plates XVIII and XIX. The number of cylinders or swifts, workers, strippers, and other parts in a set of carding machines varies largely with the class of material—length, quality, and condition of the staple—for which it is to be employed. In treating short-fibred material—*e.g.*, mungo—the separation and re-blending of the fibres must be done most thoroughly to secure perfect mixing, and a carded fleece of the requisite adhesiveness and evenness of texture. For wools of the Cheviot and Cross-bred character, sound, open and free of staple, a lesser number of repetitions of the opening, re-crossing and mingling of the fibres is practised. The fibres in such wools are readily separated, straightened, re-blended and reduced to a suitable condition for spinning. On the other hand, in the case of short and neppy wools, such as Cape and South American, the work of carding should be more gradually done, otherwise the staple will suffer and the fibres will be mutilated. While no hard and precise rules as to the constitution of a set of machines may be laid down, yet one principle prevails, namely, the shorter the staple, the more matted the wool, the more frequent opening and mixing necessary to attain a satisfactory sliver and regular spun yarn.

Hence the greater the carding surface in a set of machines the more even the condensed sliver and the more level and uniform in diameter the spun yarn. It follows that in a set consisting of a small number of operative parts, the material is more rapidly treated and there is higher productive power, but this may result in two distinct drawbacks:

(1) Unnecessary and wasteful breakage of the staple of the material.

(2) Ineffectual carding, clusters and neps of curly filaments not being properly opened.

As illustrating these features of the operation, contrast Figs. 58 and 59. Clearly, in both, the condensed sliver, A,

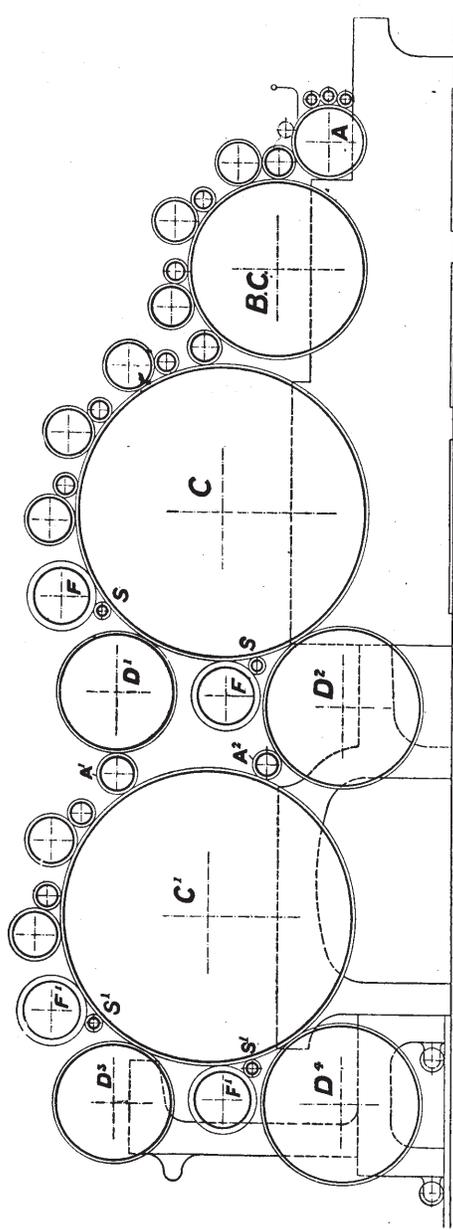


FIG. 57a.

and the spun yarn, B—Fig. 58—there are groups or patches of fibres which have not been satisfactorily separated in the scribbler and carding machines. Additional operative parts, in either one or the other of the machines, would have reduced, if not completely removed, this defect. The utility of these supplementary parts is seen in the condition of the condensed slivers and spun yarns in Figs. 58 and 59, A and B. The slivers in Fig. 58 are the results of preparation on a scribbler with a breast cylinder and *one* swift; and those in Fig. 59 from a scribbler with a breast cylinder and *two* swifts. Though A and B (Fig. 59)

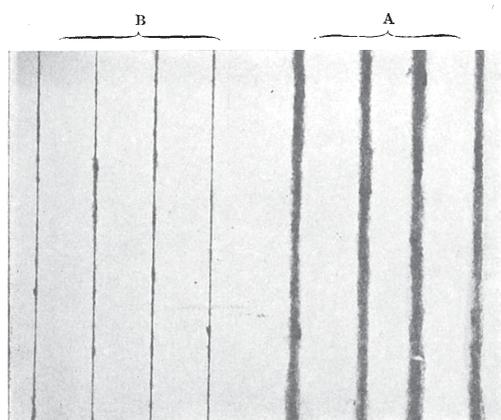


FIG. 58.

A = Condensed Sliver.

B = Spun Yarn.

are composed of finer and more matted materials than those used for the slivers and yarns in Fig. 58, yet they are more free from neppiness and more even in structure. For the latter, the set also included an intermediate in addition to a scribbler and carder, giving the increased carding facility essential.

The Josephy Carding Machinery (German) is constructed on the single, double, or three-swift plan, with large workers, *w*, and small strippers, *s*, all parts revolving rapidly to attain high productive results. A section of the cylinder in such a set of machines, mounted with a pair of covered-in fancies \mathfrak{r} , \mathfrak{r}^1 , is sketched in Fig. 60, the former

being placed on the cylinder immediately after the several pairs of strippers and workers, and the latter behind the supplementary doffer L D, and just above the main doffer D.

The doffer arrangement, and clearing rollers for removing vegetable and other impurities from the wool, are distinctive features of the machine, comprising rollers L D, A, L S, O and P. Part of the material that hangs loosely on the surface of cylinder C is removed by L D, and passed by angle roller A to L S, and by this roller given up to the

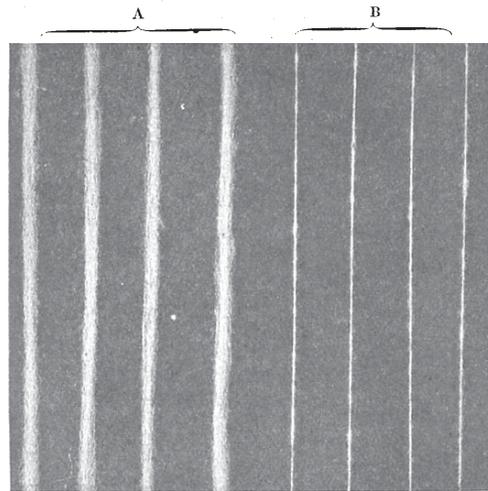


FIG. 59.

A = Condensed Sliver.

B = Spun Yarn.

doffer, so that at the point where L S and D are approximately in contact, the sheet of fibres stripped from the cylinder C by the doffer, is combined with that from the supplementary doffer L D. The loose filament collected by this roller from the cylinder, contains most of the impurities, and any neppy fibres not sufficiently carded, and these are passed by rollers O and P into receiver R. What still remains after passing P is delivered by the action of a stripping comb on the wire of L S into R².

This type of machine has been successfully used by English manufacturers in the carding and condensing of

materials for flannels. It is claimed to be adapted to the treatment of wools for Cheviots and Saxonies, and also for mungo, shoddy, cotton waste, etc. On fine wools condensed to twenty skeins and spun to thirty skeins, it is said a set of three cards, in a working day of ten hours, is capable of producing 580 lb. of carded material.

The condenser attached to such sets of machines are of the tape design and construction, delivering from 160 to 240 threads on to six bobbins.

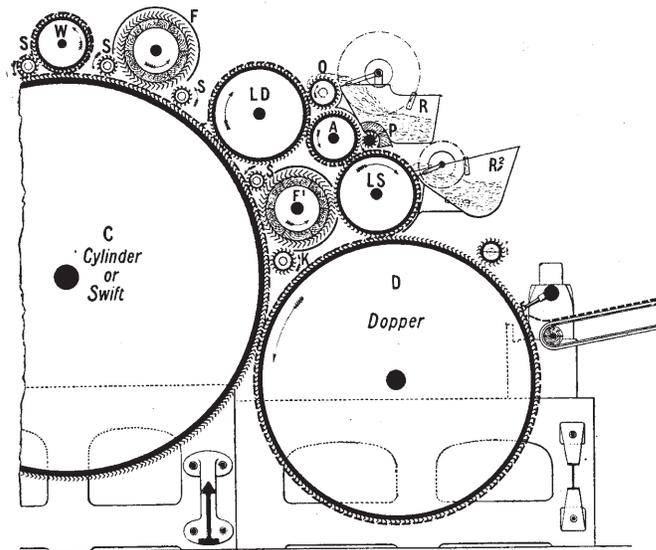


FIG. 60.

52. *Examples and applications of various sets of machines.*—The composition and arrangement of “sets” of carding machines may be considered under the following heads:

- A. Sets of machines for the treatment of medium and fine wools.
- B. Sets of machines for the treatment of Cheviot and cross-bred wools.
- C. Sets of machines for the treatment of blends of wool and cotton.

D. Sets of machines for the treatment of mungo, pulled waste, and blends of low qualities of materials.

E. Sets of machines for the treatment of coarse and strong-haired wools for carpets, rugs, etc.

A. SETS OF MACHINES FOR FINE WOOLS

FIRST EXAMPLE (Figs. 61, 61a, and 62). Comprising scribbler, intermediate and carder with Scotch feed from

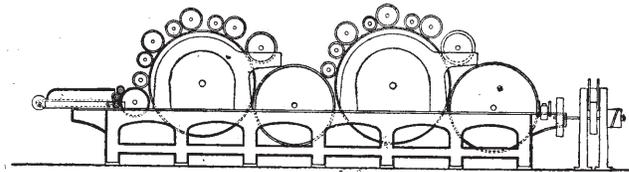


FIG. 61.

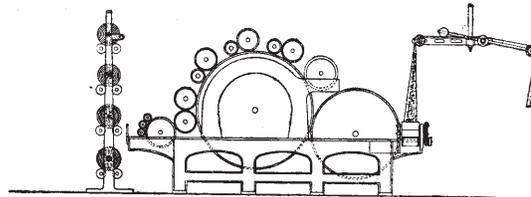


FIG. 61a.

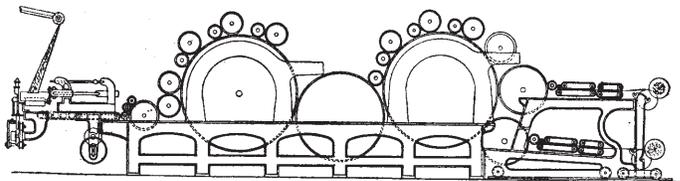


FIG. 62.

scribbler to intermediate, and from intermediate to carder, and with tandem condenser.

Width on the card wire 60".

Application.—To the carding of fine wools for the production of Saxony yarns from 20 up to 40, or 44 yards per dram, and suitable for the manufacture of wool or piece-dye doeskins, beavers, dress-face cloths and high-class woollen fancies.