COTTON SPINNING.

RING SPINNING:—A General Description of the Modern Ring Frame—The Creel—Roll Stands—Weighting Rolls—Top Rolls—Bottom Rolls—Clearers—Care of Rolls and Roll Stands—Faulty Work of Rolls—Thread Boards—Rings—Ring Holders—Size of Ring to Use—Traveler Clearers—Setting Rings—Care of Rings—Finishing of Rings—Ring Travelers—The Action of the Traveler—How Travelers are Made—Weight of Travelers—Spindle Rails—Spindles—Setting Spindles—Lubrication of Spindles—Bobbins—Bobbin Clutches—Banding—Banding Machines—Band Tension Scale—Tin Cylinders—Ballooning and Separators—Winding—Builder Motions—The Warp Builder—How to Set the Builder Motion—The Filling Builder—Spinning Filling on Paper Tubes—The Combination Builder—The Care of Ring Rails and Lifter Rods—Some Causes for Badly Shaped Bobbins—Doffing.

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CALCULATIONS:—A general Description on the Subject of Draft, Twist, Production and Gearing—Calculating the Draft from the Gearing—To find the Draft—To find a Constant—To ascertain Draft Change Gear—To Ascertain Hank Roving—To Ascertain Draft—Twist—Standard Twists—Contraction Due to Twist—Notes on Twist—Calculating Twist—To Ascertain Speed of Spindles—Calculating Twist from Gearing—Traverse Gear—Taper—Sizing the Counts—The Grading of Cotton Yarns, Single, Two or More Ply—Production—Programs for Spinning Yarns of Various Counts, from Bale to Spun Thread—Illustrations with Descriptive Matter of the Different Makes of Ring Frames.

The Ring Frame.

The object sought for in the preliminary processes of cotton spinning, as practised in the carding department, has been the production of a strand of cotton, the roving, cleansed from all impurities, etc., with its fibres perfectly parallelized and uniformly distributed throughout its entire length and section. Having obtained this perfect evenness in the rough strand (the roving) there is next required a process for imparting to yarn its other essential feature, strength, which is given to the strand by twisting the roving received from the fly frames, after first subjecting it to a drafting process by which it is still further evened and attenuated. This twisting may be done in two ways:—The intermittent process, as practised in mule spinning, and the continuous process, ring frame spinning; each method having its points of merit in the production of the separate kinds and varieties of yarns demanded by the trade for various uses.

The ring frame, for spinning yarns, is rapidly replacing the mule, both in this country and abroad, on account of its greater economy in operation and greater production, so that it may be considered the standard method of to-day, especially in our Southern mills, where yarn spinning by the ring frame is practically universal and mules are used only in a very few mills. However, the mule will always find use and favor when the quality of the yarn spun is an important consideration, and this is more particularly the case where higher grade yarns are required, because the operation of the mule is based on a principle, correct both in theory and practice.

The advantageous features of the ring frame, that have caused it to largely supersede the mule, are chiefly the absence of complicated parts and the smaller floor space required. The former feature permits its operation by younger or less experienced help (with a consequently great saving in cost of labor) while the latter enables a larger number of spindles (and therefore increased output) to be secured from a given area of mill room, since the ring rail upon which the spindles are fitted has a vertical movement, whereas in the mule, the spindle carriage moves in a horizontal direction, to and from the roll stand. In addition to these advantages, there are no intermittent changes in the motion of the ring frame, as are peculiar to the mule, consequently there is no loss of time from backing-off, and the yarn therefore has a less distance to traverse before it is wound upon the bobbin, *i. e.*, a greater quantity of yarn can be wound in a given time. However, it must be remembered that in order to spin the roving on the ring frame, somewhat more twist must be introduced into the thread than compared to the same yarn if spun on the mule, in order to hold the fibres together during the spinning process, the extra twist thus necessitated giving in turn to the resultant yarn a somewhat harder feel. Coarse yarns up to and including 26's can be spun from single roving, and it will be strong enough, owing to the size of the thread; however, since higher counts of yarns must be stronger in proportion, the proper way to do is to spin such yarns from double roving, not with an extreme draft, although the double roving will allow for a larger draft, not possible with a single roving. Double roving, usually, will result in a stronger yarn than such as spun from single roving, the yarn besides being more smooth and even.

In its theory and mechanical operation, the ring frame is a comparatively simple machine. Its duties are similar to those of the roving frame, draft being introduced in practically the same manner as in the latter. In addition, however, the strand of cotton is twisted and wound upon a bobbin in an entirely different manner from fly frame winding.

In a spinning frame, the roving is drawn out 6 to 15 times its original length, according to roving and yarn under consideration, by three lines of drafting rolls, the same as in the roving frame. In the same manner, twist is put in by means of revolving spindles, however, the winding is altogether different, although it could be done in the same way, as is shown by the fact that coarse counts of cheap yarn are occasionally spun on a roving frame.

Drawing, twisting, and winding are carried on simultaneously in both ring and fly frames, the only difference being that in the fly frame, the speed of the flyer, (the equivalent of the traveler in the ring frame) in connection with what is known as "bobbin leads" arrangement, and which is the one generally used, (see page 200, 201, etc. of Part 2) is less than that of the bobbin, the winding then being due to this faster speed of the bobbin; while in the ring frame, the speed of the bobbin being constant, the winding is due to the lag or slip of the traveler. If, every minute, a length of roving equal to the product of the speed of the bobbin and its circumference were delivered by the drafting rolls, the traveler then would remain stationary upon its ring, and the roving receive no twist, but be merely wrapped upon the bobbin, that is, provided it would stand the strain. The same as in the roving frame, the amount of twist in ring spinning may be regulated by altering the speed of the delivery roll of our set of drafting rolls, that of the spindle remaining constant. When every minute a quantity of roving less than the surface speed of the bobbin is then delivered to the spindle, it is taken up by the bobbin as before, and the traveler pulled around upon its ring, in order to compensate for what is wanting in length.

THE PRINCIPLES UPON WHICH THE RING FRAME IS CONSTRUCTED ARE AS FOLLOWS:—

1st. The strand to be spun into yarn—the roving—is attenuated to the proper degree by means of drafting rolls.

2nd. Twist is then imparted to this roving by means of a mechanical principle, peculiar to the ring spinning frame, namely, by having the yarn, after leaving the front roll, pass through a traveler before being wound on the bobbin. The traveler is made to rotate at a high speed around a ring, which encircles the bobbin, and the rotations made by this traveler, in conjunction with the revolutions of the spindle, give the twist to the thread.

3rd. The winding or building of the yarn, in suitable form for the next process, is attained by traversing one part of the machine (the ring rail), while the other parts (spindle and bobbin) remain stationary. The ring rail, which carries the rings and travelers, is traversed so as to wind the yarn in layers on the bobbin, which is stationary so far as any vertical movement is concerned.

The ring frame is a comparatively simple machine, both in operation and construction. If any one of the modern standard types be examined, the various working details will be found simple in construction and movement, conveniently located, so as to be readily accessible, and composed of few parts, so that there is no difficulty in understanding the theory and operation of the ring frame and the functions of each separate part of its mechanism. It is only when several different styles of machines are considered and compared at one time, that special explanations become necessary, since each frame has some details of mechanism or operation (or both) peculiar to itself, consequently, the general description of a standard type will apply in principle to all ring frames. It should be clearly understood, that while different frames have different details, the underlying principle is the same in all, and the object aimed at is the most efficient and economical spinning of yarn by means of the rotation of traveler and spindle.

To simplify the description, and to explain the process of ring spinning, a standard type of ring frame will be shown and its parts described, omitting here, for the sake of clearness, any reference to the builder motion and its mechanism. A detailed description of all the separate parts of the frame and their modifications in different makes and styles, including the builder motion, will be given later in due order, these being more easily explained after the principles of ring frame spinning are understood. Fig. 226 gives an illustration of a standard type of ring frame in perspective view, showing its general appearance when set up in the mill.

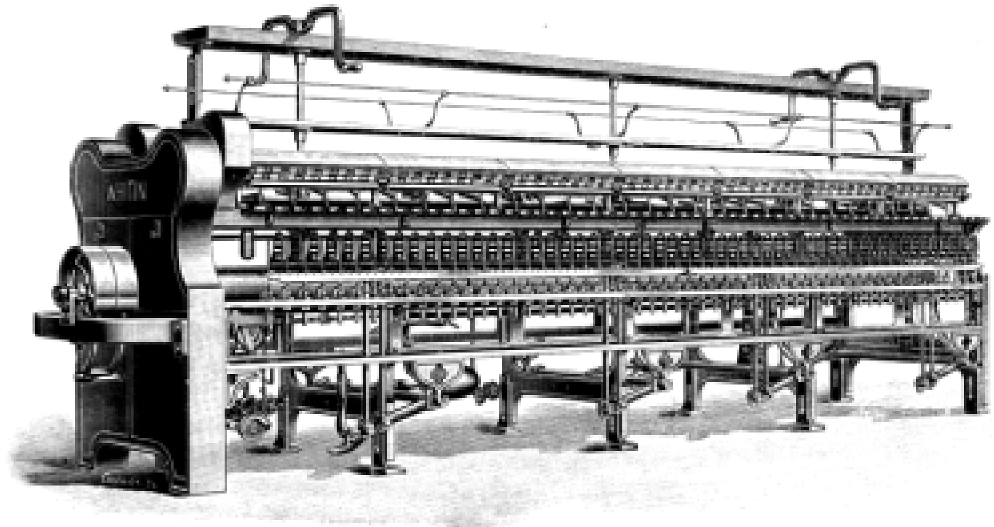

FIG. 226.

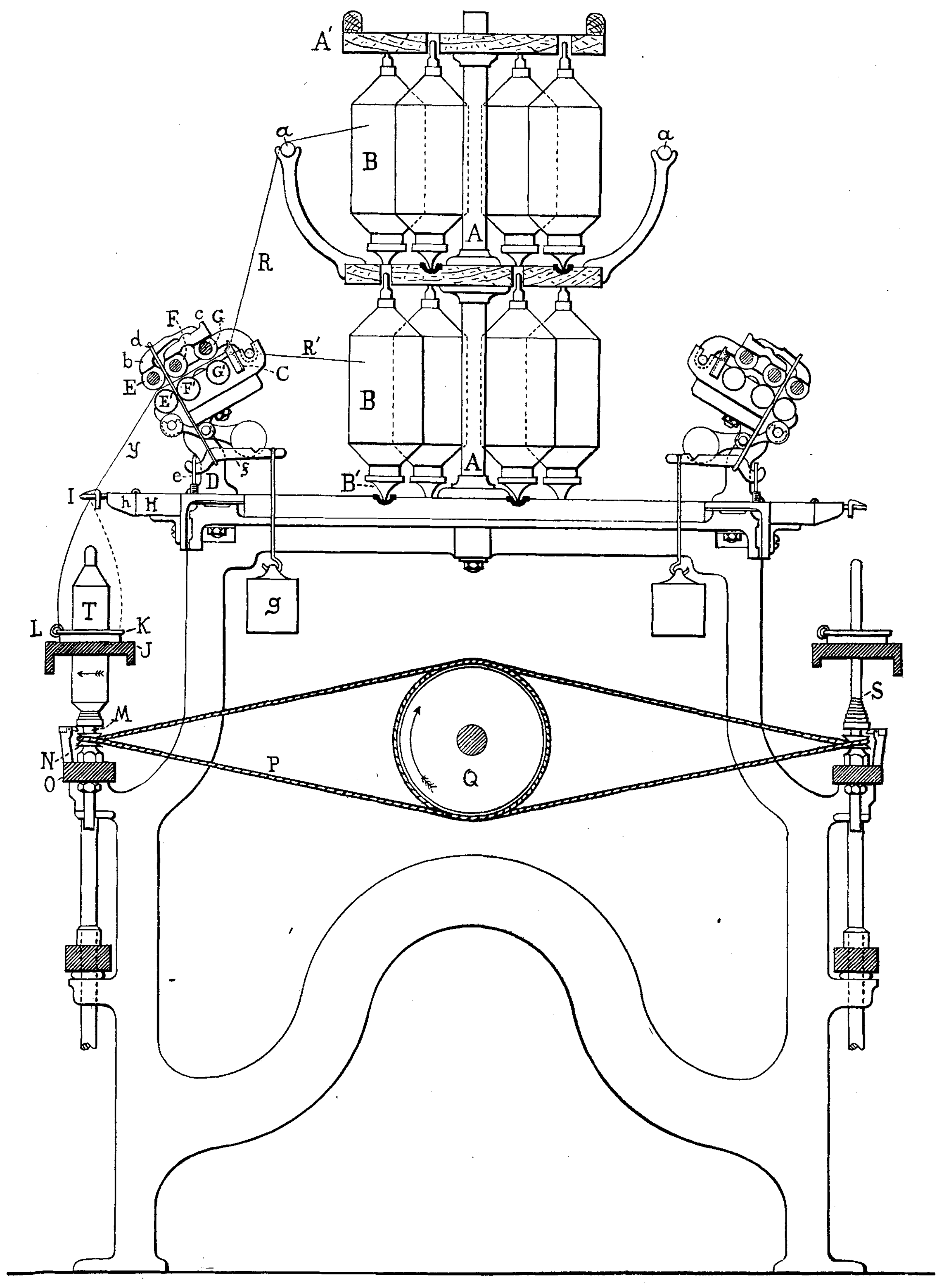

FIG. 227.

Fig. 227 is a sectional view of the side elevation of a ring frame without the builder motion mechanism, which is here omitted to simplify the explanation of this machine. The various parts are lettered to correspond with the text following, and should be referred to in connection with later illustrations, as given in detail of the working parts, treated separately.

A is the creel, usually of wood, supporting the roving bobbins *B*, with a top board *A'* for holding the extra supply of full roving bobbins. Creels used may be one tier or two tier creels. The creel which is shown is a two tier creel. The upper creel board is used for storing full bobbins. The creel boards are adjustable so that the distance between can be changed so as to accommodate bobbins of longer or shorter lift. Two tiers of roving bobbins, as shown, are usually used, the roving from a bobbin in each tier being carried to the drafting rolls (*E, F, G—E', F', G'*) and there united to form the yarn, but for lower grades of yarn, only one roving bobbin is put up in back, and consequently only a one tier creel is required. The bobbins are held in place on the creel by being slipped over skewers *B'*, the lower end of which rests in a glass or porcelain cup, set into the creel board, the upper end fitting into a ring or in a socket in the respective upper board, so that the bobbins will revolve with the least amount of friction as the roving unwinds itself from it. Creels should be roomy so as to allow plenty of space for creeling. The roving *R*, from the upper bobbin is directed by the guide rod *a*, to the traverse guide rod *C* where it joins the roving *R'* from the lower bobbin, and both pass into the drafting rolls together. This guide rod *C*, has a reciprocating motion, to and fro, in front of the rolls, so that the roving is shifted a slight distance along the rolls, continuously, and prevents them from being worn unevenly, or into ruts, by friction of the roving.

The drafting rolls, 3 pairs, the upper *E, F, G* leather covered, the lower *E', F', G'* of fluted steel, are carried on the roll stand *D*, which is supported by a bracket on the thread board *H*. The upper tier of rolls is here shown as being weighted by means of a weighted lever system, which consists of the top saddle *b*, back saddle *c*, stirrup *d*, lever fulcrum *e*, lever *f* and weight *g*. This method of regulating the pressure between the drafting rolls is known as top weighting, in distinction from the other system, possibly met with in reading foreign literature on ring spinning—self weighting—in which the top rolls are themselves given the required weight. The usual cleaner, for removing lint, etc. from the rolls is not shown in our illustration, as the several styles in common use can be better shown by detail views which will be given in the chapter on "Clearers."

The thread board *H* may be either wood or metal, rigid or hinged; usually the thread board is hinged, so that it can be lifted up when doffing the frame. At the outer edge of the thread board is set the thread-guide *I*, commonly a twisted piece of wire, through the opening of which the yarn passes down to the yarn bobbin, fixed so as to be in perfect vertical alignment over the spindle *M*, its functions being to guide the yarn *Y* to the traveler *L*, and to prevent it from whipping and breaking, by restricting the length that revolves with the bobbin and traveler. The thread-guide eyes should be directly over the tip of the spindles, so that the yarn as it revolves will move in the path of a perfect cone, that is, the line formed by the yarn from the thread-guide to the traveler will be the same length regardless of the part of the ring which the traveler may be moving over. If the guide eye should be too far to one side, the yarn, when it revolves on that side, is liable to strike against the adjacent thread.

The separators shown in Fig. 226 between the bobbins are omitted in Fig. 227 so as not to obscure the details of the ring rail.

Below the thread rail comes the ring rail *J*, having open spaces through which the yarn bobbin (shown at *S*) projects, the ring *K*, a circular piece of metal being fastened on this ring rail in such a manner that it encircles the bobbin. The ring rail is capable of vertical motion, up and down the height of the bobbin, and which is given to it by the builder motion mechanism. The ring rail must be set perfectly level, both longitudinally and transversely.

Around the top flange of the ring is fitted the traveler *L*, a piece of wire, so shaped that it can be sprung and clasped over the flange in such a manner that it will travel freely around the ring and yet be prevented from flying off. The yarn *Y*, in coming from the drafting rolls, passes through the traveler before it is wound upon the bobbin *S*, the motion of the traveler around the ring and bobbin imparting the characteristic twist to the yarn, the traveler also guiding the yarn as it is wound upon the bobbin. At *S* is shown the yarn bobbin empty, at *T*, on the opposite side of the frame, is shown a full bobbin. The bobbin fits over the spindle *M*, by which it is revolved, motion being secured by friction or by a locking device between bobbin and its spindle. The yarn is wound on the bobbin by the traveler, the bobbin itself being stationary, as far as any vertical movement is concerned.

The seat of the spindle *M* is secured to the spindle rail *O*, which is a stiff metal bar extending the full length of the frame, and the spindle is caused to revolve rapidly in a vertical plane by means of the spindle band *P*, passing around the whirl *N* from the tin cylinder *Q*, the spindle band being usually a soft twisted cotton yarn.

The tin cylinder *Q* extends the full length of the frame and revolves all the spindles on both sides of the machine, by means of similar spindle bands.

(*To be continued*)