March 6, 1956 L. BUSSIERE 2,737,008

APPARATUS FOR AND METHOD OF YARN SPINNING

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Fig. 2.

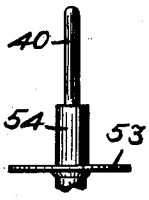


Fig. 4.

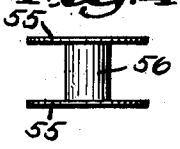


Fig. 5.



Fig. 6.



Fig. 7.

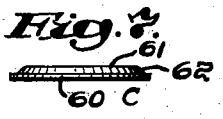


Fig. 3.

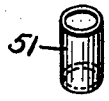


Fig. 1.

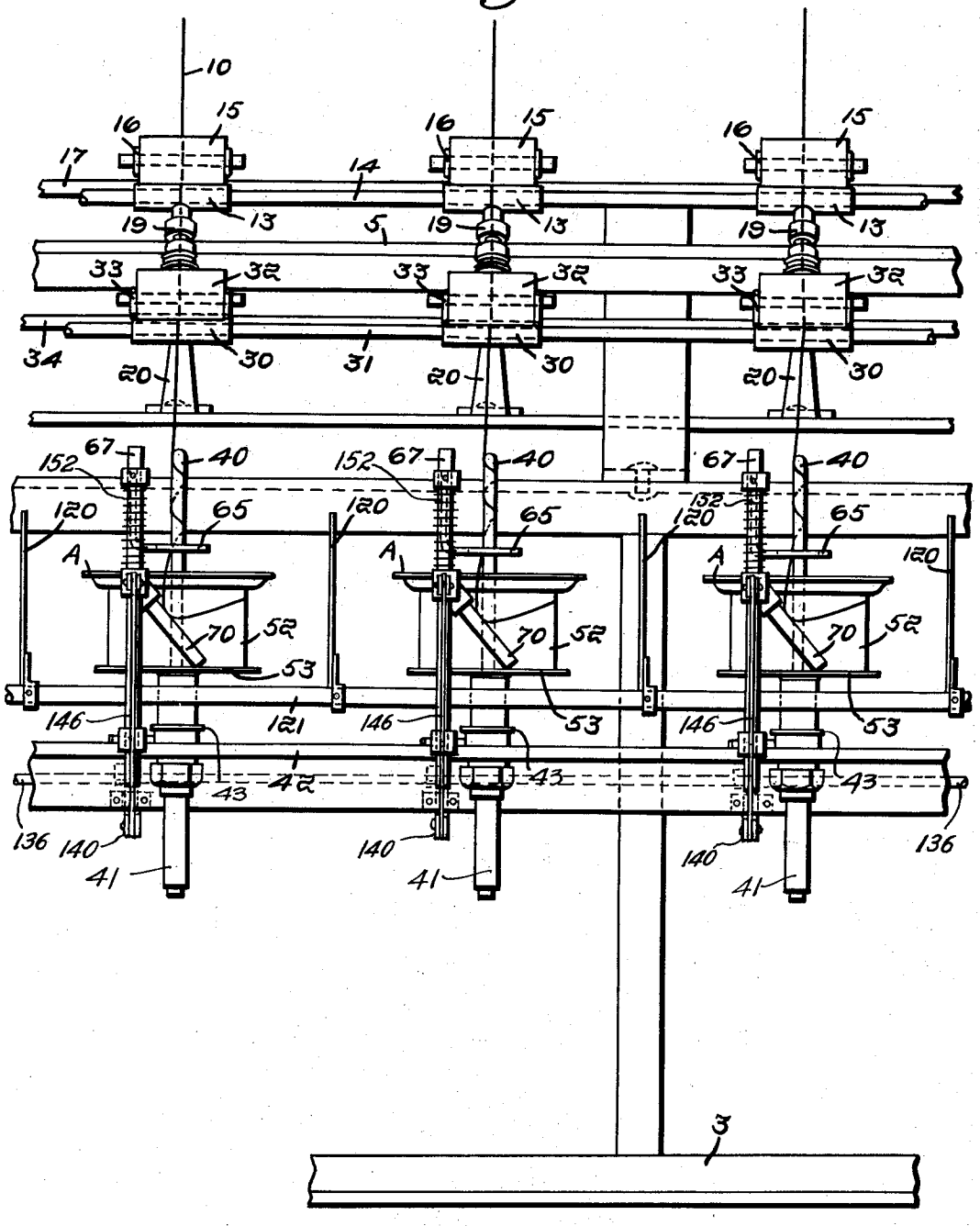
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APPARATUS FOR AND METHOD OF YARN SPINNING

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Fig. 8.



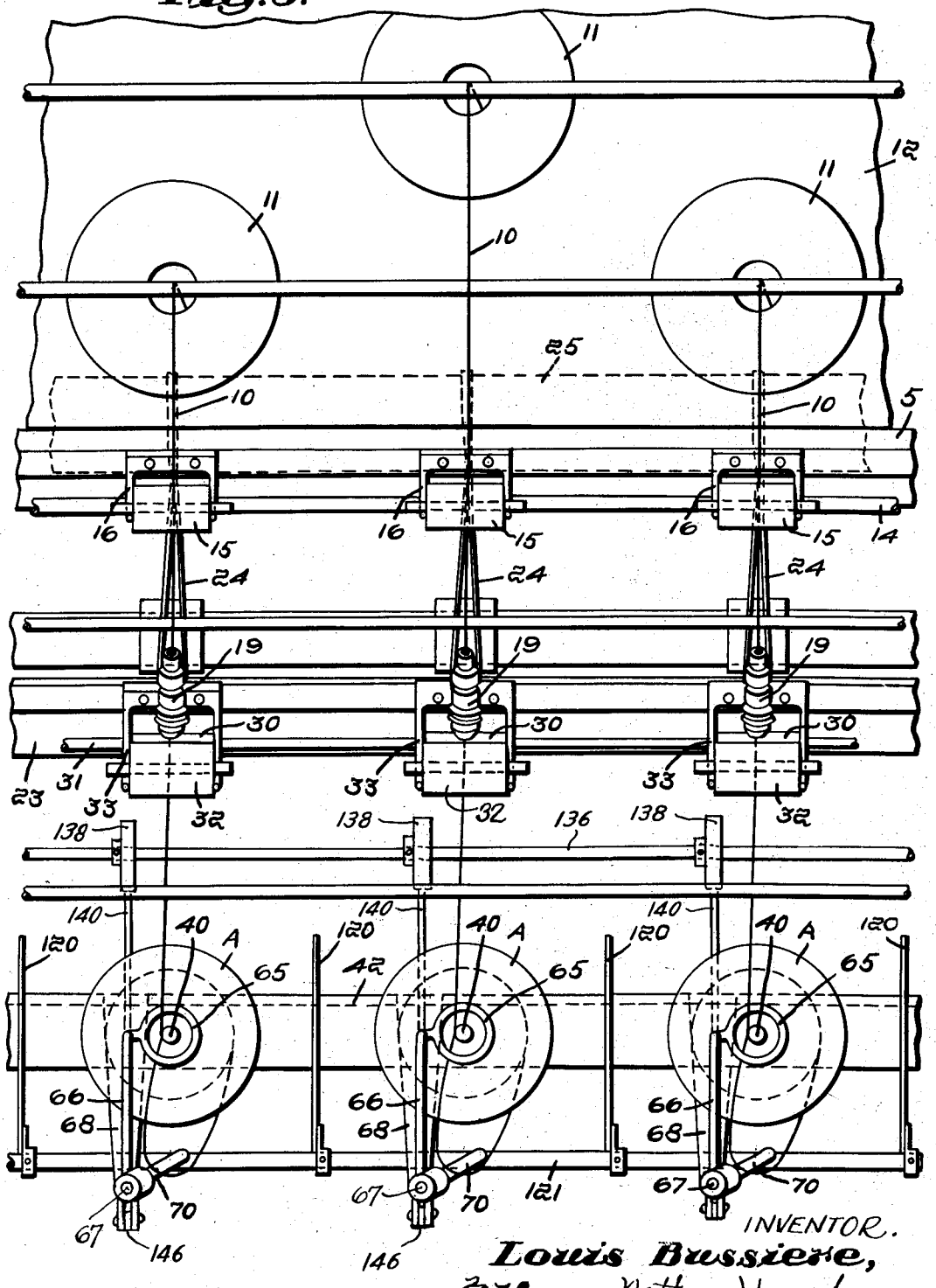
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APPARATUS FOR AND METHOD OF YARN SPINNING

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Fig. 9.



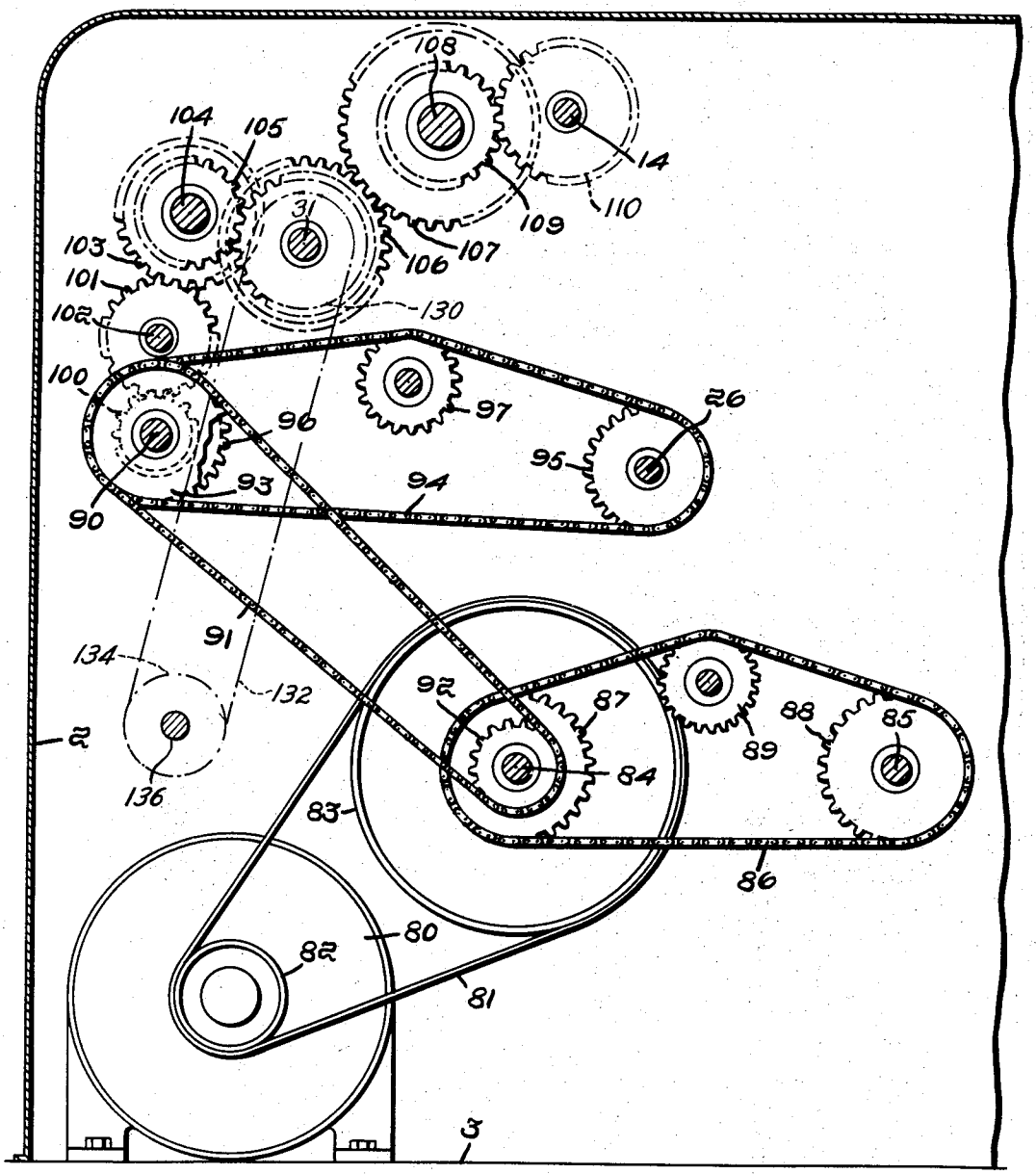
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APPARATUS FOR AND METHOD OF YARN SPINNING

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Fig. 10.



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APPARATUS FOR AND METHOD OF YARN SPINNING

Louis Bussiere, North Andover, Mass., assignor to Davis & Furber Machine Company, North Andover, Mass., a corporation of Massachusetts

Application April 26, 1954, Serial No. 425,585

13 Claims. (Cl. 57—73)

This invention presents a radically novel apparatus and method for the continuous spinning of yarn and is a continuation-in-part of the patent application of Louis Bussiere, Serial No. 243,262, filed August 23, 1951, now abandoned, for Apparatus for, and Method of, Yarn Spinning.

In spinning there are essentially three operations, namely, the drafting of the strand, the twisting of the strand, and the winding of the thus drafted and twisted strand upon a suitable yarn receiver. In the case of the mule, following the ancient principle of hand spinning, these three operations are performed independently and successively and produce a high quality of yarn, but the operation is necessarily relatively slow and requires a complicated form of apparatus. The demand for speed in the spinning operation has long since resulted in the development of spinning frames in which these three essential operations take place continuously and without interruption. Three principles have long been employed in continuous spinning identified chiefly by the means employed in the winding operation. These are the flyer type, the ring and traveler type, and the cap type, each of which has involved various forms. The main problem involved in the winding operation has been due to the fact that the spindle must rotate at a speed relatively high with respect to the speed of the yarn delivered from the drafting mechanism in order to put the required twist in the yarn and the twisted yarn, notwithstanding the yarn packages steadily increasing in diameter, must be wound on the yarn receiver no faster than it is delivered from the drafting mechanism. It is obvious that in order to obtain X twists per inch in the yarn, the spindle, and consequently the receiver, must rotate X times during the winding of 1" upon the receiver regardless of the diameter of the receiver, and the steadily increasing diameter of the package. It is clear therefore that with spindles running at the high speed required for high production, say for example at 10,000 R. P. M., there is a great difference between the length of yarn delivered from the drafting mechanism and the circumference of the yarn package during a rotation of the spindle and further that this circumference increases in length at each rotation of the spindle.

The present invention has for its object primarily to provide a new mechanism and method in this winding operation in continuous spinning whereby the yarn in a simple and efficient manner is readily wound upon the receiver irrespective of the drafting speed, the speed of the spindle or the size of the yarn package.

The invention has for its further object to combine with the novel winding operation a twisting operation of the type found so highly efficient in mule spinning and further to combine therewith any suitable form of drafting mechanism.

The invention has for its further object to provide an apparatus and method in the winding operation involving a minimum of movable parts with the only reciprocating element being that part which is engaged by the ballooning yarn and which moves up and down with a traversing motion to direct the yarn properly to form a cylindrical package.

The invention has for its further object to enable the yarn to be wound in cylindrical packages of practically any depth and diameter. Heretofore in continuous spinning yarn packages weighing 24 ounces are about as large as can be practically produced, but with the present invention packages weighing several pounds are readily produced. The invention permits a much higher spindle speed readily to be obtained and thus high production with low cost to be secured in spinning.

The invention has for its object to produce a yarn package of cylindrical or "cheese" form. This form of package not only greatly reduces the cost of spinning, but also the cost of warping and other subsequent processes, since with these packages mounted in a creel the yarn may be readily delivered therefrom over-end in the warping operation. If the yarn is desired for filling or weft, the yarn from these packages may readily be rewound on shuttle bobbins at small expense with the high speed automatic bobbin winders now on the market. Whether, therefore, the yarn be for warp or filling the spinning into the large package form produced by this invention is highly advantageous.

It is well recognized that the profit in textile mill operations today is largely a matter of package sizes, that is, the amount of yarn wound into the package form in each doff.

The present invention has for its object also to eliminate any difficulty with tension on the yarn during the winding operation such as occurred with the previous types of mechanism employed in continuous spinning.

With the present invention the only movement of the spindle is that of rotation about its vertical axis and the relative revolution of the yarn with respect to the spindle is controlled entirely by air delivered radially above the yarn receiver by centrifugal force. In the apparatus, this action of the air causing the yarn to balloon and revolve with respect to the spindle is produced by a disk-like element secured to the spindle immediately above the yarn receiver mounted on the spindle.

The invention also has for its further object to combine with this novel winding operation a twisting operation having all advantages of the mule type of twisting and this is secured by positioning the tip of the spindle below and forward of the point at which the yarn issues from the drafting mechanism, so that the twist runs from the tip of the spindle clear back to this point and with the front rolls usually employed back practically to the bite of these rolls.

The invention also has as a further object to combine with the novel winding operation and the highly desirable twisting operation of the mule type a drafting operation employing a twister tube so that during the drafting a false twist is employed which runs back to the back rolls and thus insures even drafting.

While the present invention is therefore primarily directed to the spinning of yarn, it is obvious that in its principal feature involving the winding operation and its combination therewith of the best form of the twisting operation, it is applicable also to the twisting of one or two or more strands previously spun or unspun.

These and other objects and features of the invention will appear more fully from the accompanying description and drawings and will be pointed out in the claims.

The drawings illustrate a preferred form of the invention as embodied in a standard form of wool spinning frame and are sufficient to disclose the broad features of the invention. Since the various mechanisms of such a spinning frame, in addition to those features with which the present invention is particularly concerned, are well

known to those skilled in the art, it is only necessary to illustrate and describe such features to the extent necessary for an understanding of the present invention. It will be understood also that the other features of a spinning frame with which the invention is not particularly concerned may be of various standard types such as employed not only in spinning frames for wool spinning, but also in spinning frames for the spinning of other fibers. In all such spinning frames the units for drafting, twisting and winding the yarn into package form are duplicated in a longitudinal row throughout the length of the frame either at one side only or at both sides and various gearing, driving mechanisms, shaft bearings, etc., are located in the end frames of the machine and the same is true when the units consist simply of the features required for twisting a plurality of yarns as in a twisting frame, all as is well known to those skilled in the art. The drawings, therefore, illustrate only a few of the units embodying the present invention at one side of the frame and more or less diagrammatically the main gearing and driving mechanisms located in the end frames.

It will be understood that in the broader scope of the invention various drafting mechanisms may be employed. The drafting mechanisms here illustrated are of the type ordinarily employed in the wool spinning frame comprising back or delivery rolls, front or drafting rolls, and an intermediate false twister tube.

The roving or strands fed to the frame may be taken from cheeses, jack spools, or other sources, and as illustrative are shown as taken from cheeses.

In the drawings:

Fig. 1 is an end elevation, partially in vertical cross section, illustrating the main portion of a wool spinning frame embodying a preferred form of the invention.

Fig. 2 is a detail in side elevation of a support for the yarn receiver shown in Fig. 1.

Fig. 3 is a view in perspective of the yarn receiver shown in Fig. 1.

Fig. 4 is a side elevation of another form of yarn receiver.

Fig. 5 is a view in transverse cross section of the disk-like element shown in Fig. 1.

Figs. 6 and 7 are side elevations of other forms of the disk-like element.

Fig. 8 is a front elevation of the main elements of the frame.

Fig. 9 is a top plan view of the portion of the frame shown in Fig. 8.

Fig. 10 is an end elevation of a portion of the frame to illustrate the general plan of gearing, driving mechanism, etc. employed.

The spinning frame illustrated comprises the usual end frames **1** and **2** supported from the floor **3** in the usual manner and connected by various girts such as **4**, **5**, and **6**, with the usual samsons **7** interposed between the end frames.

Each unit of the mechanism is of the same construction. A roving **10** is shown running from a cheese **11** resting upon a bed plate **12** carried by the end frames. This roving is shown running to the delivery rolls of a drafting mechanism. The lower delivery roll **13** is carried by a shaft **14** shown extending into the end frame in Fig. 10, while the gudgeons of the top roll **15** in each case are held by the usual brackets **16** mounted on the bar **17** which is given the usual traversing movement.

From the delivery or back rolls the strand **10** passes over a vertically adjustable rod **18** and through the twister tube **19** shown as of a standard form journaled in a bracket **20**. These brackets are mounted upon a plate **21** extending longitudinally of the frame and rest upon rollers **22** journaled in the brackets **23** mounted on the girt **4** and the plate **21** is given the usual traversing movement. Each twister tube is driven by a belt **24** from a cylinder or drum **25** carried by the shaft **26** extending into the end frame, as shown in Fig. 10. The twister tube

is shown as of the usual type having the little pins **27** and with its nose extending close to the bite of the front rolls.

The lower front rolls **30** are carried by the shaft **31** extending into the end frame, as shown in Fig. 10, while the top front rolls **32** rest against the individual supporting brackets **33** mounted on the longitudinally extending bar **34**.

From the front rolls the now drafted strand passes against a vertically adjustable bar **35** to the tip of the spindle **40**.

In the present invention the spindles **40** are vertically journaled in suitable bolsters **41** secured to a girt **42** rigidly mounted and extending the length of the machine. The spindles are thus mounted in fixed position and have only rotary movement, each being provided with a whirl **43** driven by a belt **44** from a drum or cylinder **45** and each belt is preferably provided with a belt tightener shown as a bell crank fulcrumed at **46** with one arm carrying a roller **47** engaging the belt and the other arm carrying a weight **48**.

The twist is imparted to the yarn on the same principle that the twist is imparted by a mule and therefore the tip of the spindle should be at such a height that the twist will run back as close to the bite between the front rolls **30** and **32** as possible. The vertically adjustable rod **35**, which may either be above as shown or below the run of the strand, assists in taking care of this requirement and also serves to tension the strand when necessary.

The yarn receiver on which is wound the yarn package **52** is mounted upon the lower portion of the spindle so as to rotate therewith. Various provisions for this purpose may be employed. As illustrated in Figs. 1, 2 and 3, a tubular core **51** is provided upon which the yarn package **52** is directly wound. A support comprising a flat base **53** with an upwardly projecting hub **54** is secured to the spindle and the core **51** is pressed over the hub **54**.

Another form of yarn receiver is illustrated in Fig. 4 consisting of two flat plates **55** connected by a central tubular core **56** also adapted to be pressed over the hub **54**. But these are but examples of yarn receivers that may be employed.

The disk-like element of the invention is coaxially mounted upon and rotated with the spindle at the upper end of the yarn receiver. Three forms are illustrated, one A in Figs. 1 and 5, another B in Fig. 6, and a third C in Fig. 7. The preferred form is that illustrated in Figs. 1 and 5 and this has been found to act with the greatest efficiency. It, as shown, is of the general shape of an ordinary pie plate and is made of sheet aluminum, or other highly finished metal, presenting a substantially flat central portion **57** with an upwardly inclined, slightly outwardly curving perimeter **58**. A plain flat circular disk, as shown at **59** in Fig. 6, and also a construction such as shown in Fig. 7 consisting of a bottom flat circular plate **60** with a parallel top plate **61** sloping downwardly at its perimeter **62** and merging in the bottom plate **60**, both have been found satisfactory.

The strand after leading at an obtuse angle to the spindle at its tip maintains a few turns around the upper portion of the spindle and then passes through a guide ring **65** mounted in fixed position concentric with the spindle. This guide ring is shown as having an arm **66** adjustably mounted upon a vertical post **67** carried in a bracket **68** mounted upon the girt **42**.

From the guide ring the strand extends to the yarn receiver. The rotation of the spindle with the disk-like element and yarn receiver secured thereto and rotating therewith all at high speed causes air to be discharged by centrifugal force from the disk-like element over its perimeter and results in the yarn leading from the guide ring to the yarn receiver ballooning and revolving about the yarn receiver and winding steadily thereon independently of the speed of the drafting mechanism and the speed of the spindle.

A simple means for insuring the up and down movement of the yarn as it winds upon the yarn receiver is provided by the engagement of the ballooning yarn with a downward inclined arm adjacent the yarn receiver. Such an arm is shown at 70 vertically slidable on the post 67. Appropriate mechanism for reciprocating arm 70 up and down so that the ballooning yarn will be wound in a traversing fashion between the top and bottom of the yarn receiver is shown in Figs. 1, 8, 9 and 10.

Shaft 31 as shown in Fig. 10 carries a sprocket 130 driving chain 132 and sprocket 134 mounted on shaft 136. Shaft 136 extends the length of the frame and as shown in Figs. 1, 8 and 9 has a plurality of suitably spaced cams 138 secured thereon. Rotation of each cam 138 causes oscillation of related lever 140 pivoted at 144 and having a cam follower 142. The outer end of lever 140 has a vertically extending link 146 pivotally secured thereto at 148 and having its upper end pivoted at 150 to the outer end of arm 70 which as shown is slidable vertically on post 67. A spring 152 continuously urges arm 70 downwardly so that follower 142 will at all times be in engagement with the face of cam 138.

From the foregoing it will be seen that when the machine is in operation, arm 70 will be continuously reciprocated vertically so that the ballooning yarn will be wound in a proper traversing fashion on the yarn receiver.

Suitable means of any desired form may be provided for driving the various elements of the frame and providing for the necessary adjustments of the length of the draft, of the speed of the drafting mechanism, the speed of the twister tube rotation and the speed of the spindle rotation. A standard form of such mechanism as modified for the requirements of the present invention in the form illustrated is indicated in Fig. 10. As there shown, a motor 80 drives as by a belt 81 and suitable pulleys 82 and 83, a main shaft 84. The cylinder 45 driving the spindle belts 44 is carried by a shaft 85 and driven by a sprocket chain 86 from sprockets 87 on the main shaft 84 and 88 on the cylinder shaft 85 with a suitable interposed take-up sprocket 89.

A jack shaft 90 is driven by chain 91 from the main shaft by a sprocket wheel 92 on the main shaft 84 and a sprocket wheel 93 on the jack shaft. The shaft 26 carrying the cylinder 25 which drives the belts 24 for the twister tubes is driven from the jack shaft by a sprocket chain 94 engaging a sprocket wheel 95 on the cylinder shaft 26 and a sprocket wheel 96 on the jack shaft 90 shown behind the sprocket wheel 93 in Fig. 10 and in interposed take-up sprocket wheel 97 is provided.

The drafting rolls of the type illustrated are driven by a system of gearing in the usual manner from the jack shaft 90. For this purpose a gear 100 on the jack shaft 90 drives a gear 101 on a fixed shaft 102. The gear 101 drives a gear 103 on a shaft 104 adjustable concentrically of the shaft 102. A gear 105 on the shaft 104 drives a gear 106 on the lower front roll shaft 31 and this gear 106 drives a gear 107 on the shaft 108 adjustable concentrically of the shaft 31. A gear 109 on the shaft 108 drives a gear 110 on the shaft 14 carrying the lower delivery rolls 13.

The sprocket wheels 87 and 88 are replaceable in different sizes thus to enable the speed of the cylinder 45 and consequently the spindle speed to be changed as desired. The sprocket wheels 96 and 95 are similarly replaceable in different sizes thus to enable the speed of the cylinder or drum 25 driving the twister tubes to be changed as desired. The gear 105 on the shaft 104 which is adjustable about the shaft 102 is also replaceable thus to vary as desired the speed of the shaft 31 carrying the lower front rolls 30 and consequently the speed at which the drafted strand is delivered from the drafting mechanism. The gear 110 on the shaft 14 carrying the lower back or delivery rolls 13 is also replaceable in different sizes with the shaft 108 swinging about the shaft 31, thus to enable the speed of the shaft 14 with respect to that of the shaft 31 to be adjusted as desired to provide for the length of the draft.

Usual type of separator plates 120 are illustrated carried by a rod 121 by means of which they may simultaneously be swung out of and into position and these and the several units should be so spaced as not to interfere with the ballooning yarn.

The doffing operation, because of the large size of the yarn packages produced, takes place much less frequently than with the types of spinning frames heretofore in use. All that is necessary to do is to remove the ring guide from the post 67 and the disk-like element from the spindle and these should in each case be provided with quick locking elements so that they may be readily removed and replaced. Then the yarn receiver with the yarn package wound thereon is lifted from the spindle. A fresh yarn receiver is then replaced and the guide ring and disk-like element replaced.

The principles of the invention are of advantage in a twisting frame as well as a spinning frame. For the former purpose little more is required than to remove the drafting mechanism and guide the yarns to be twisted to a point corresponding to the bite of the front drafting rolls.

Having thus described the invention, what is claimed as new, and desired to be secured by patent, is:

1. A spinning frame comprising drafting rolls, a spindle mounted for vertical rotation in the frame with its tip positioned below and forward of the nip of the front drafting rolls, a guide ring fixedly mounted concentric the spindle well below its tip to receive the yarn after making a few turns on the spindle and being twisted off the tip of the spindle, a yarn receiver co-axially mounted upon and rotative with the spindle below the guide ring and a disk-like element co-axially mounted upon and rotative with the spindle above the receiver and below the guide ring, the said elements acting upon rotation of the spindle to discharge air by centrifugal force over the perimeter of the disk-like element and cause the yarn leading from the spindle through the guide ring to the receiver to balloon, revolve above, and be wound upon, the receiver.

2. A spinning frame having the construction and operation defined in claim 1, in which the disk-like element presents a substantially flat central portion with an upward inclined perimeter.

3. A spinning frame having the construction and operation defined in claim 1, in which the disk-like element is upwardly concave.

4. A spinning frame having the construction and operation defined in claim 1, in which the disk-like element is of greater diameter than the fully wound receiver.

5. A spinning frame having the construction and operation defined in claim 1, together with means acting to direct the ballooning yarn up and down as it is wound upon the receiver.

6. A spinning frame having the construction and operation defined in claim 1, together with a vertically reciprocating downward inclined arm adjacent the receiver engaged by the ballooning yarn and directing it up and down as it is wound upon the receiver.

7. A winding mechanism for spinning or twister frames comprising a spindle mounted for vertical rotation in the frame with the yarn fed to the spindle at its tip which is located in front of and below the yarn feeding means, a guide ring fixedly mounted concentric the spindle well below its tip to receive the yarn after making a few turns on the spindle and being twisted off the tip, a yarn receiver coaxially mounted upon and rotative with the spindle below the guide ring, and a disk-like element mounted upon and rotative with the spindle at the upper end of the receiver, the said elements acting to discharge air by centrifugal force over the perimeter of the disk-like element and cause the yarn leading through the guide ring to the receiver to balloon, revolve about, and be wound upon, the receiver.

8. A winding mechanism for spinning or twister frames having the construction and operation defined in claim 7, together with a vertically reciprocating downward inclined arm adjacent the receiver engaged by the ballooning yarn and directing it up and down as it is wound upon the receiver.

9. A spinning frame comprising drafting means, a spindle mounted for vertical rotation in the frame with its tip positioned below and forward of the discharging point of the drafting means, a guide ring fixedly mounted concentric the spindle well below the tip, a disk-like element coaxially mounted upon and rotative with the spindle below the guide ring, and a yarn receiver mounted on and rotative with the spindle, the said elements acting to discharge air by centrifugal force over the perimeter of the disk-like element and cause the yarn leading through the guide ring to the receiver to balloon outwardly with respect to the receiver, and means acting to direct the ballooning yarn up and down to be wound in a cheese form upon the receiver.

10. A winding mechanism for spinning or twister frames comprising a spindle mounted for vertical rotation in the frame, a guide ring fixedly mounted concentric the spindle well below its tip, a yarn receiver mounted upon and rotative with the spindle below the guide ring, and a disk-like element coaxially mounted upon and rotative with the spindle between the guide ring and the upper end of the receiver with the said elements acting to discharge air by centrifugal force over the perimeter of the disk-like element and cause yarn leading through the guide ring to the receiver to balloon, revolve about, and be wound upon, the receiver.

11. The method of winding yarn upon a yarn receiver which consists in rotating the receiver on its vertical axis, in holding the yarn as it travels from above to the receiver within an annular path concentric with and above the receiver and in projecting air by centrifugal force against the traveling yarn between said annular path and the receiver and radially thereof while rotating to cause the yarn extending from said annular path to the receiver to balloon and revolve about the receiver and be wound thereon when the linear speed of the yarn traveling to the receiver is slower than the circumferential speed of the yarn mass on the receiver.

12. The method of winding yarn upon a yarn receiver as defined in claim 11, together with the step of engaging the yarn adjacent the receiver and directing it up and down as it winds on the receiver.

13. The method of winding yarn feeding from turns on the upper section of a rotating vertical spindle to a yarn receiver mounted upon its lower section which consists in projecting air by centrifugal force, while the spindle with the receiver is rotating, radially of and above the receiver and below the point at which the yarn leaves the spindle to cause the yarn leading from the spindle to the receiver to balloon and revolve about, and be wound upon, the receiver.

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