Aug. 15, 1967 H. H. RICHTER 3,335,971

YARN TUBE DRIVING MEANS

Filed May 25, 1965 3 Sheets-Sheet 1

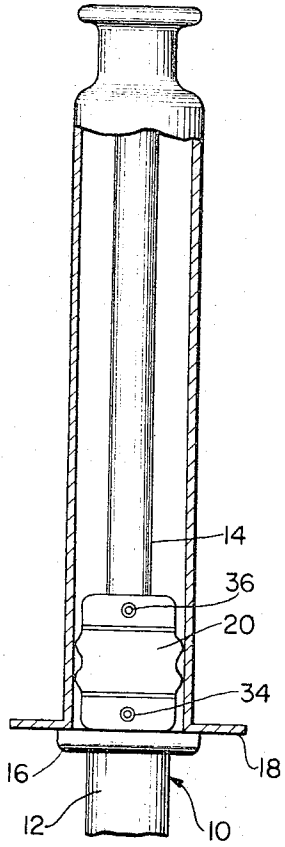


FIG. 1

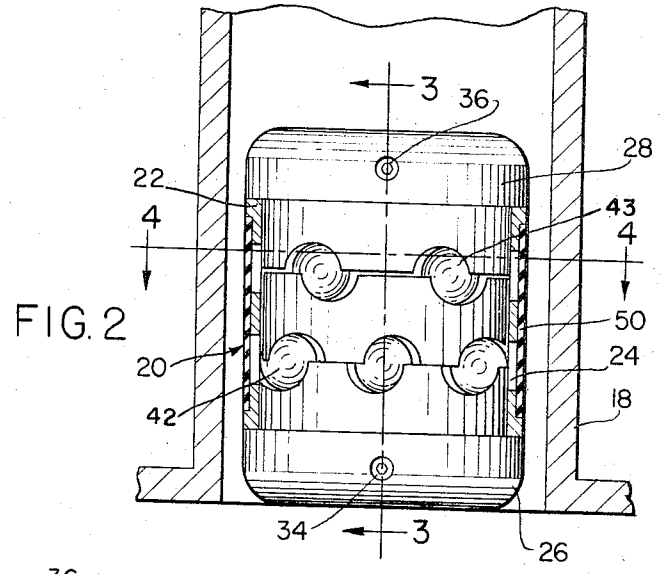


FIG. 2

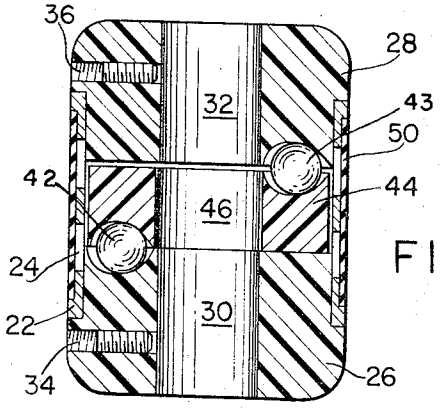


FIG. 3

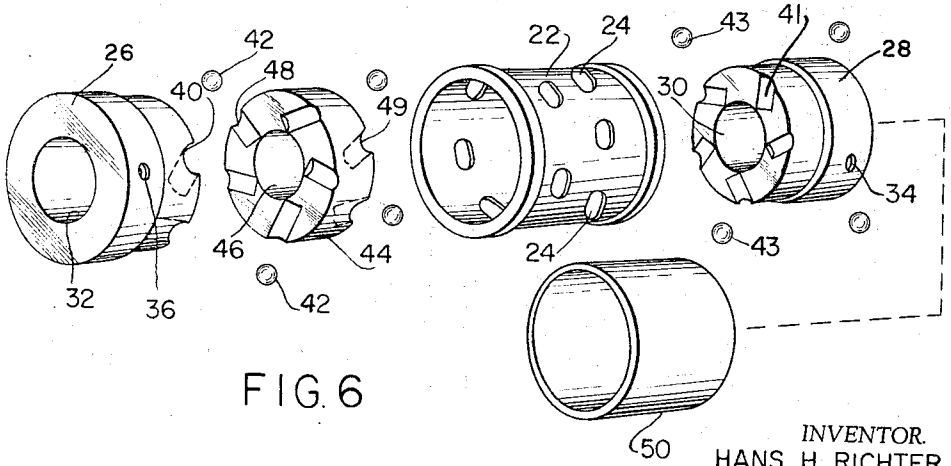


FIG. 6

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FIG. 4

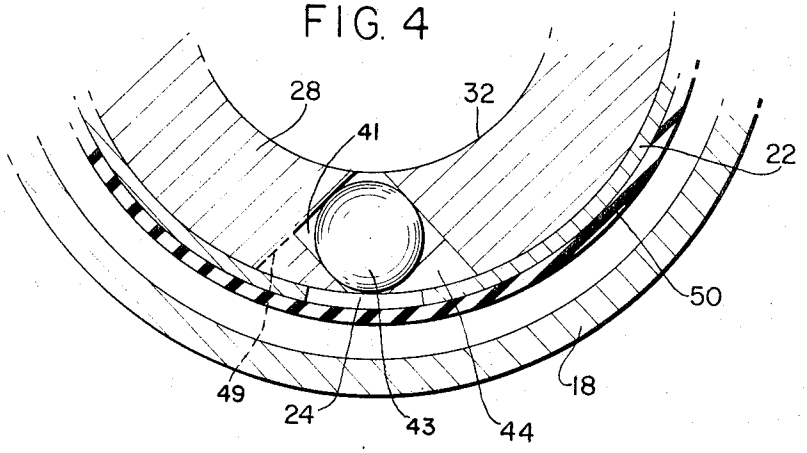
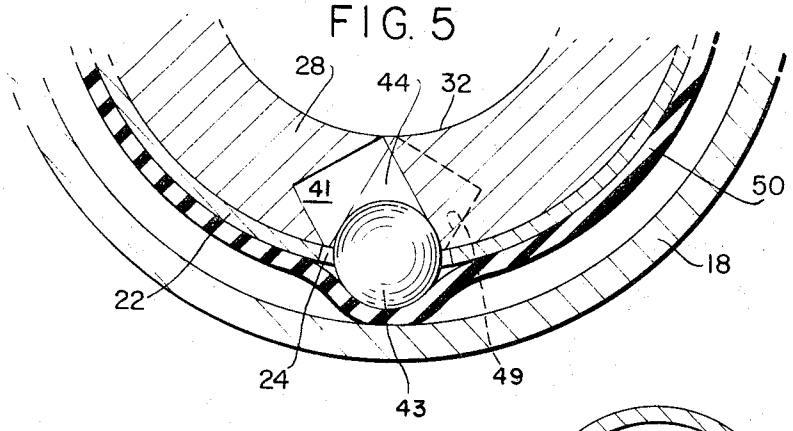


FIG. 5



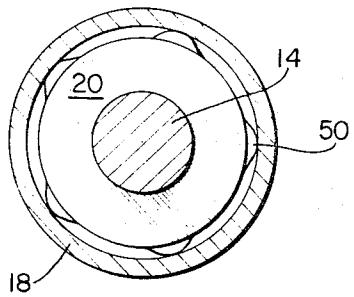


FIG. 8

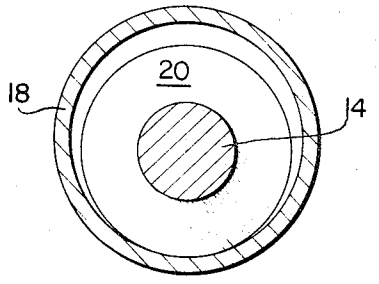


FIG. 7

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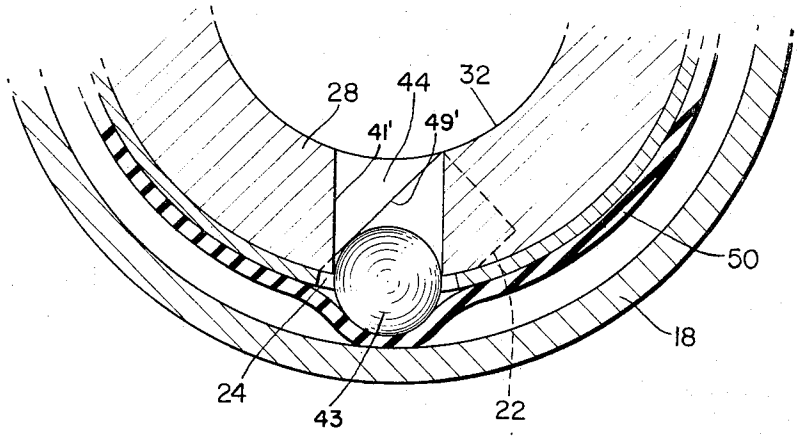


FIG. 9

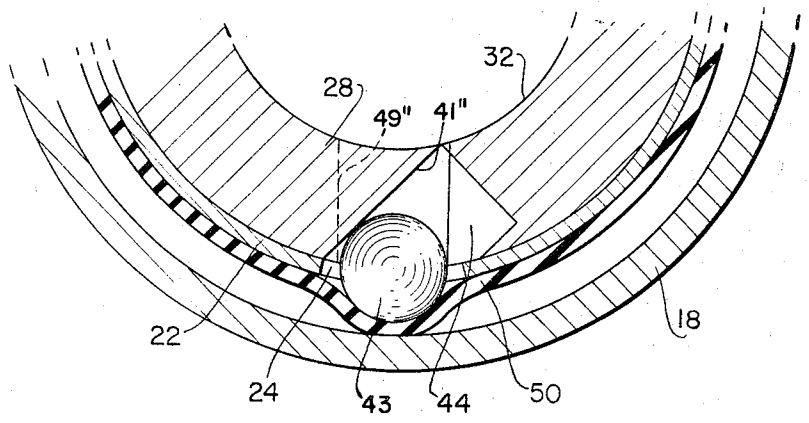


FIG. 10

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YARN TUBE DRIVING MEANS

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11 Claims. (Cl. 242—46.5)

ABSTRACT OF THE DISCLOSURE

A driving unit to be secured on a textile spindle for mounting and driving a yarn tube. Centrifugal force resulting from rotation of the spindle causes spherical gripping elements to move outwardly and distend a resilient sleeve for gripping the yarn tube. A control ring assures simultaneous and uniform outward movement of the gripping elements to accurately center the yarn tube.

The present invention relates to textile machines for twisting and winding yarn and relates, more particularly, to a driving means for supporting a yarn tube on the spindle of a textile machine for rotation, especially at high speeds.

In the following specification and claims the term "yarn" is employed in a general sense to apply to all kinds of strand materials, either textile or otherwise, and the designation "package" is intended to mean the product of a winding or twisting machine whatever its form.

With the advent of high speed textile machines such as ring twisters capable of operating at spindle speeds of 9000 r.p.m. and higher, the requirements for securing a yarn collecting tube on its driving spindle so that the tube is firmly held in a position concentric with the spindle blade have become increasingly important. For successful operation yarn-collecting tubes must be mounted concentrically on their spindles to prevent imbalance as yarn is wound thereon. Moreover, the connection between the driving spindle and the yarn-holding tube must be constant and unyielding as the tube is driven.

A variety of yarn tube driving means have been proposed. These conventional units have generally proven inadequate in the range of increased speeds such as that mentioned above. This is usually because they have been incapable of maintaining the tubes in dynamic balance, a defect leading to pronounced vibration and failure of bearings and other elements of the spindle during prolonged operation. Also, this shortcoming leads to consequent destruction of the tubes, loss of production, and safety hazards to machine operators.

In an effort to overcome some of the foregoing faults it has been proposed in the past to provide yarn tube driving units having a plurality on constantly biased, radially arranged gripping shoes. These shoes customarily are urged outwardly by a heavy spring or the like to engage the tube and secure it on the spindle. While it is true that such units do contribute to maintaining the tubes securely on the spindle, nevertheless, it becomes a difficult and time-consuming task for the operator to donn the tubes against the spring force and, particularly, to doff the tubes when wound with yarn. This is due to the significant restriction to movement of the tubes caused by the weight of the packages intensifying the gripping force of the shoes.

Accordingly, it is one object of the present invention to provide a novel and improved driving unit for rotating a yarn tube supported on a spindle.

A further object of the present invention is to provide a driving unit which will grip a yarn tube mechanically

when the spindle upon which the tube is carried is rotated and will automatically release the tube so that it may be removed easily from the spindle when rotation of the spindle is stopped.

Still a further object of the present invention is to provide a driving unit which may be positioned upon existing spindles for use therewith to rotate a yarn tube.

An additional object of the present invention is to provide a driving unit for gripping and driving a yarn or bobbin tube carried on a spindle, said unit including a plurality of segments operated simultaneously, cooperatively with a sleeve having a high coefficient of friction to securely seize the bobbin and align it concentrically with the spindle.

Yet, a further object of the invention is to provide a driving connection having a minimum number of operating parts and which is quickly and easily operated, and durable and reliable in use.

Other objects and advantages of the invention will, in part, be obvious and will, in part, become more apparent from a study of the following description and drawing wherein:

FIG. 1 is an elevational view of a conventional textile spindle of a ring twister incorporating the present invention therewith to support a yarn tube thereon, the tube being shown partially in section to reveal the driving unit;

FIG. 2 is an enlarged elevational view of the driving unit of the present invention;

FIG. 3 is a sectional view taken along lines III—III of FIG. 2;

FIG. 4 is a fragmentary cross-sectional view taken along lines IV—IV of FIG. 2 illustrating one of the gripping elements in its inoperative position;

FIG. 5 is a view similar to FIG. 4, illustrating the gripping element in its operative position;

FIG. 6 is an exploded view of the driving unit of FIG. 2;

FIG. 7 is a plan view of a textile spindle provided with the driving unit of the instant invention, the unit being shown in its inoperative position, the bobbin being freely supported eccentrically to the axis of the spindle;

FIG. 8 is a view similar to FIG. 7 illustrating the gripping elements of the driving unit in their operative positions to seize the yarn collecting tube and position it concentrically with the spindle;

FIG. 9 is a view generally similar to FIG. 5 illustrating a modified form of the present invention; and

FIG. 10 is a view similar to FIG. 9 illustrating a further modified form of the present invention.

Briefly, the present invention affords an integral assembly comprising a main body member, a rotatable control ring contained within the body member, opposing end caps pressed into the body member, and a plurality of gripping elements movable in cooperative tracks or slots in the control ring and end caps for gripping the interior wall of a yarn tube or bobbin. The unit is secured to the blade of a textile spindle in a manner whereby the control ring is free to rotate about the axis of the blade. Centrifugal force developed by rotation of the spindle causes the elements to move outwardly and rotate the control ring. In turn, the control ring insures simultaneous movement of the elements outwardly to grip the tube. Due to this simultaneous movement, gripping force is applied equally to opposing portions of the tube thereby locating the tube concentric with the spindle and causing the tube and spindle to rotate together. When the spindle ceases rotation the force originally serving to bias the gripping elements against the tube is relieved and the

tube can be removed readily off the spindle. A resilient sleeve is provided between the gripping elements and the tube. This sleeve, which has a high coefficient of friction advantageously forms an area contact between the gripping elements and the tube, distributing the gripping load and affording a secure grip to the tube as it is rotated.

Referring now to FIG. 1 of the drawing, a spindle **10** of the yarn collecting section of a conventional ring twister is illustrated. The spindle **10** includes a whorl **12** engageable with a driving belt (not illustrated) for rotating the spindle, a blade **14**, and a flange or step **16** which limits the downward movement and serves as a seat for a yarn collecting tube **18**. Yarn collecting tubes of the type illustrated in FIG. 1 commonly are manufactured of paper or other soft materials and during prolonged use may tend to become eccentric and unbalanced. The present invention is capable of use with tubes having a certain amount of eccentricity. These eccentric tubes can still be slid onto the driving unit of the present invention since the gripping elements which hold the core are drawn inwardly until the unit is rotated. Upon rotation of the unit the elements protrude to seize the tube, locate it concentrically on the spindle and hold it for rotation.

The driving unit of the instant invention, referenced at **20** in FIG. 1, includes a tubular, central body member **22** (see FIG. 6) which has a plurality of apertures **24** punched through its side wall. Although a single driving unit is shown and described herein it will be understood that additional units **20** could be provided at further positions axially along blade **14**, if desired. The apertures **24** are seen to be ten in member in the drawing although it will be obvious that any suitable number of such apertures could be provided. However, desirably the apertures are spaced equidistantly around body member **22** consistent with the location of gripping elements yet to be described, all to the end that equally distributed opposing forces will be applied on a yarn tube to centralize the tube on the spindle. As illustrated, the ten apertures are segregated into two sets of five, each set aligned on its own common circle on body member **22**. The spacing of the two sets of apertures from each other is arranged to coincide with the arrangement of the gripping elements and their control member, all as will be more fully set forth hereafter.

A pair of end caps **26**, **28** are provided, each being press-fitted into an opposite end of body member **22**. Each end cap **26**, **28** has a respective central bore **30**, **32** therethrough, the size of which is only slightly larger than that of the spindle onto which the driving unit is to be mounted. Thus, the unit is mounted on spindle blade **14** by the blade being slipped through the bores **30**, **32**. Set screws **34**, **36** are provided in end caps **26**, **28**, respectively, to be drawn against blade **14** and fix the unit **20** in position on the blade for rotation therewith.

Viewing particularly FIGS. 4, 5 and 6 it will be observed that the inner end face of each end cap **26**, **28** has a plurality of tangential, equiangular, and equidistant grooves **40**, **41** respectively therein, each groove dimensioned to receive a spherical gripping element **42**, **43**, respectively, therein for free rolling movement therealong. While grooves **40**, **41** are shown as being offset about 45° from a line radial to the longitudinal axis of the respective caps, this specific construction is not considered limiting. Equally successful results have been attained with the present invention where the angularity of the grooves **40**, **41** has varied from this specific tangency. However, in order that the load on the tube from elements **42**, **43** may be distributed equally, the angularity of all of the grooves in each end piece should be the same. While the gripping segments shown and described are spherical, it will be apparent to those skilled in the art that the segments may be of various other configurations capable of movement along grooves **40**, **41**.

Referring to FIG. 3 it will be seen that the interior ends of end caps **26**, **28** terminate apart from each other to afford a cavity therebetween. A control ring **44** is disposed in the cavity between end caps **26**, **28** for free rotation about blade **14**. To this end control ring **44** has a bore therethrough at **46**, this bore being sufficiently oversized to admit blade **14** loosely therethrough. Furthermore, the outside diameter of ring **44** is slightly reduced in order that clearance will exist between the ring and the internal diameter of body member **22**. Additionally, some clearance is afforded between the end walls of ring **44** and the end faces of end caps **26**, **28**. Hence, it will be evident from the foregoing that control ring **44** is essentially free of frictional restriction from the end caps **26**, **28** and body member **22**.

With continuing reference to FIG. 3 the opposite end walls of control ring **44**, as illustrated, have a plurality of tangential, equiangular and equidistant grooves **48**, **49** therein. These latter grooves **48**, **49** correspond in number, and thus in spacing, to opposing grooves **40**, **41**, respectively. Similarly, the grooves, as shown, **48**, **49**, have the same angularity as their associated grooves **40**, **41**. However, as best shown in FIGS. 4 and 5 it is important to note that the tangent line of groove **48** intersects that of groove **40** and, likewise, groove **49** intersects groove **41**. Thus, the grooves **48**, **49** of member **44** incline oppositely to their related grooves **40**, **41**. Furthermore, as is apparent in FIGS. 2–6, the several apertures **24** are aligned to open into the mouths of the mating grooves **40**, **48** and **41**, **49**, these mouths being formed when the outer ends of the grooves in the end caps and control ring are in alignment.

The gripping means of the present invention have already been described as a plurality of spherical gripping elements **42**, **43**. Each element **42** is retained in the track provided by cooperative grooves **40**, **48**. In like fashion, elements **43** are seated in cooperative grooves **41**, **49**. A resilient sleeve **50** of a material such as rubber having a high coefficient of friction is engaged around the outside diameter of body member **22** in the plane of overlie apertures **24** and has, as one of its purposes to prevent escape of elements **42**, **43** through apertures **24**. As best shown in FIG. 5, sleeve **50** is deformable under the outward pressure of gripping elements **42**, **43** to bear against the interior wall of yarn tube **18**. Hence, quite advantageously, as the elements **42**, **43** are thrust outwardly from a retracted position (FIG. 4) to a gripping position (FIG. 5), they carry sleeve **50** into contact with tube **18**. This affords an area contact between the unit **10** and tube **18** at each gripping zone. By virtue thereof the load is distributed on the tube and the tube is securely held for rotation.

In operation, the several gripping elements **42**, **43** are responsive to centrifugal force developed when spindle **10** is rotated, to be thrown radially outward, guided by the tangential grooves. In consequence thereof, control ring **44** is pulled around the axis of blade **14** for a part of a revolution, the elements riding further outwardly until the outer ends or mouths of the respective grooves **40**, **48** and **41**, **49** are aligned (see FIG. 5) at which time the elements thrust radially and partially through apertures **24** to expand sleeve **50** to grip the interior wall of tube **18**, see FIGS. 5 and 8. In view of the fact that sleeve **50** is deformable the sleeve affords an area contact with the internal tube wall. Furthermore, since sleeve **50** has a high coefficient of friction the tube **18** is held securely to spindle **10** for rotation therewith. Because control ring **44** is dimensioned to move freely without significant retarding force exerted thereagainst, the unit is highly responsive to grip the tube almost immediately upon commencement of rotation of spindle **10**. Moreover, due to the fact that the various gripping elements **42**, **43** are controlled by a common means, control ring **44**, all the elements must move simultaneously and, thus, a biasing force equally distributed at opposing portions of the tube. This uniformity of movement positions the tube con-

centrically with the spindle and prevents imbalance from developing as the core is rotated. No element may move independent of the remaining elements since movement of any element must generate rotation of control ring **44**, in consequence of which all other elements must also move. Therefore, lateral shifting of the tube leading to an imbalanced condition during rotation is foreclosed.

Up to this point, the description of the invention has been confined to a yarn tube driving means in which all of the grooves, i.e., grooves **40**, **41**, **48** and **49** are tangential to the major axis of the unit **10**. However, it will be readily apparent to those skilled in the art that the several grooves may be arranged in other ways to guide the gripping elements simultaneously to seize the yarn tube.

To this end there is shown in FIGS. 9 and 10 two such modifications. These views may be considered to correspond generally to the sectional view of FIG. 5. That is to say, each represents a fragmentary section of the driving unit only, it being understood that each complete unit would include several such grooves and elements in radial symmetry around the circumference of the unit.

In the modification of FIG. 9 each of the grooves **41'** of end cap **28** is radial to the major axis of the unit **10**. Yet, each of the corresponding grooves **49'** of control ring **44** is tangent to said axis. The tangency of the groove **49'** may be any angle wherein the axis of said groove **49'** intersects with that of groove **41'** at an acute angle. It will be appreciated that in this modification the further grooves of the unit all would be arranged similarly to those illustrated, in order that the gripping elements **43** seated in the grooves may be shifted outwardly simultaneously through apertures **24** at a uniform rate to exert pressure on sleeve **50** and cause this sleeve to seize tube **18** as the unit is rotated.

In the modification of FIG. 10 the grooves **41''** of end cap **28** are seen to be tangent to the long axis of the driving unit whereas the groove **49''** of control ring **44** are situated radially to said axis. Thus, as the unit is rotated elements **43** are thrust outwardly by centrifugal force causing them to protrude through apertures **24** and bear against sleeve **50**, pushing this sleeve against tube **18**.

It will be apparent that in operation with either of the modifications of FIGS. 9 or 10, as with the embodiment firstly described and shown in FIGS. 1–8, all of the gripping elements are moved outwardly simultaneously and at a uniform rate to grip the yarn tube. By virtue of the advantageous arrangement where at least one of the grooves guiding each element is tangential, the gripping elements are all controlled for simultaneous movement.

Thus, it is apparent that the foregoing invention provides a driving means wherein equal driving force is exerted simultaneously against opposing sections of the interior wall of tube **18**. This force is exerted to grip the tube promptly upon rotation of the spindle **10**, which said force is constantly applied over opposing areas throughout the rotational period of the spindle. Since this holding force of gripping elements is balanced, i.e., it is applied equally to opposing portions of the tube, the tube is maintained in a position concentric to the axis of spindle **10** (see FIG. 7) even though it may have been donned in an eccentric location on the spindle (see FIG. 6). The uniform movement and engagement of the various gripping elements to centralize the tube on the spindle sets the tube in a balanced position during rotation, thereby obviating undesirable vibrations which would arise when the tube is rotated in an unbalanced condition.

A further feature of the invention resides in the fact that upon cessation of rotation of the spindle the several gripping elements no longer have any outward biasing force and, therefore, automatically relieve their gripping pressure on tube **18**. Elastic sleeve **50** serves as a means for urging the gripping elements inwardly and for containing these elements within their respective grooves when the unit is not surrounded by a tube.

Since certain changes may be made in the instant invention without departing from the scope of the invention herein involved, it is intended that all matter contained in the above description or shown in the accompanying drawing shall be interpreted as illustrative only, and not in a limiting sense.

What is claimed is:

1. A driving unit adapted to be mounted on a rotatable textile spindle for driving a yarn tube, comprising, a plurality of gripping elements, guide means adapted to be secured to said spindle and receiving said elements for movement of the elements between a retracted position and a position in gripping engagement with the yarn tube, means including a control ring providing positive uniform positioning of said elements in the gripping position responsive to centrifugal force exerted by rotation of said spindle for accurately centering the yarn tube on the spindle, and a deformable member interposed between said gripping elements and said tube, said deformable member being urged outwardly, for gripping engagement with said tube, in response to outward movement of said elements.

2. Apparatus as set forth in claim **1** wherein said guide means includes a first groove for each said element.

3. Apparatus as set forth in claim **2** wherein said control ring includes a second groove for each said element, said grooves cooperating for guiding said elements outward simultaneously to urge said deformable member into engagement with said tube.

4. A driving unit adapted to be mounted on a rotatable textile spindle for driving a yarn tube comprising, a centerless body member having apertures therein, first and second end caps having inner ends engaged in said body member, said end caps having aligned bores therethrough to receive said spindle, the inner ends of said end caps being spaced from each other, at least the inner end of said first end cap having first grooves therein, outer ends of said grooves being generally radially aligned with said aperture, means for securing the end caps to said spindle, a control ring disposed interiorly of said body member and positioned between the inner ends of said first and second end caps for free rotation around the axis of said spindle, a plurality of movable gripping elements disposed between said control ring and at least the inner end of said first end cap, said gripping elements being engaged in said grooves, and means on said control ring for providing uniform positioning of said elements outward of said groove ends to protrude through said apertures for gripping said tube in response to centrifugal force exerted by rotation of said spindle.

5. Apparatus as set forth in claim **4** wherein said means on said control ring includes second grooves receiving said elements cooperatively with said first grooves for movement of said elements outward simultaneously.

6. Apparatus as set forth in claim **5** wherein said first grooves are disposed tangentially to the axis of said spindle, and said second grooves are disposed radially to the axis of the spindle.

7. Apparatus as set forth in claim **5** wherein said first grooves are disposed radially to the axis of said spindle, and said second grooves are disposed tangentially to the axis of said spindle.

8. Apparatus as set forth in claim **5** wherein said grooves are disposed tangentially to the axis of said spindle, said first and second grooves being oppositely inclined to have intersecting axes.

9. Apparatus as set forth in claim **4** including a deformable member enclosing said apertures, said deformable member being moved into engagement with said tube in response to outward movement of said elements.

10. Apparatus as set forth in claim **4** wherein the inner end of said second end cap has grooves therein, a plurality of second gripping elements are disposed between said control ring and the inner end of said second end

cap, said second gripping elements being engaged in the grooves of said second member, and means on said control ring providing uniform positioning of the last said gripping elements in the gripping position and simultaneous positioning of all said gripping elements.

11. Apparatus as set forth in claim **10** wherein the last said means on said control ring includes grooves receiving said second gripping elements.

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