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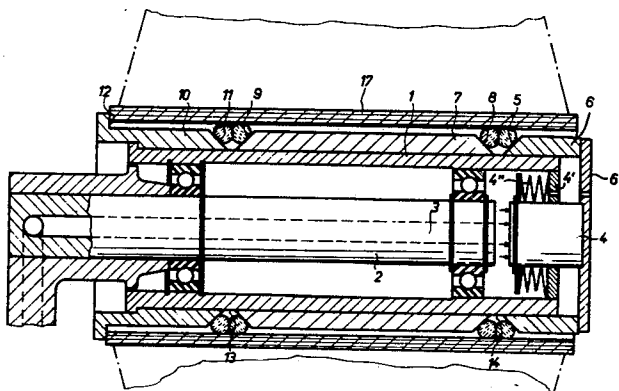
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[54] **EXPANDIBLE MANDREL FOR BOBBINS**
3 Claims, 3 Drawing Figs.

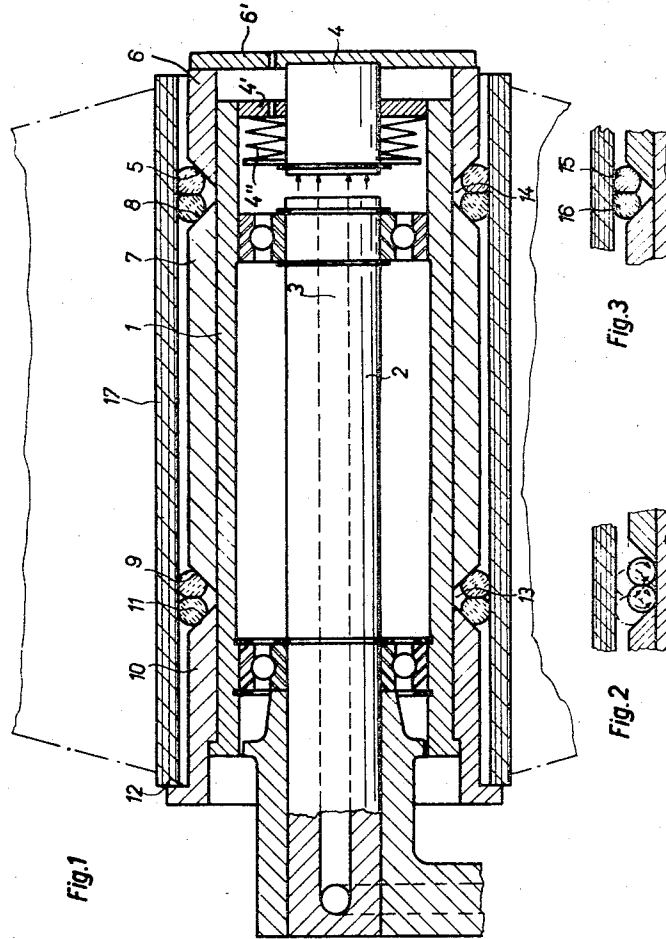
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ABSTRACT: A pair of elastic deformable rings are disposed in each annular groove between adjacent tubes on the sloped surfaces of the tubes. Upon bringing the tubes together to close the grooves, the rings roll up the sloped surfaces to engage the bobbin sleeve with a friction fit. Upon moving the tubes apart, the rings roll down the sloped surfaces of the tubes out of gripping engagement with the bobbin sleeve.



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EXPANDIBLE MANDREL FOR BOBBINS

This invention relates to an expandible mandrel for bobbin sleeves. More particularly, this invention relates to an expandible mandrel for locking a bobbin sleeve on a winding apparatus.

Expandible mandrels for holding bobbin sleeves in place on winding apparatus, such as used in batching machines for continuous filaments or in stretch winders, have been known. In some instances, the expandible mandrels have been constructed with annular grooves which taper inwardly and contain compressed helical draw springs. The annular grooves have been adjustable in width relative to the draw springs so that the draw springs could be pressed outwardly against the interior surface of the bobbin sleeve to grip the bobbin sleeve. However, the friction between the spring and the bobbin sleeve has been relatively small such that extremely undesirable axial displacements of the bobbin sleeve have frequently been possible. Further, the spring has been compelled to slide on the groove walls which act as a key bed due to the narrowing of the grooves during expansion of the spring so that not only does a phenomena of wear result but also an uncontrolled sliding results. That is, the individual windings of the spring precess toward the outside in a tangential direction while remaining within the groove. As a consequence, the outward pressure effect of the spring against the sleeve is greatly impaired. Further, the imbalance caused by the spring couple cannot be tolerated.

In order to overcome the above disadvantages, expandible mandrels have been provided with rubber rings, each of which is contained within a wedge-shaped annular groove, instead of draw springs. In these cases, upon narrowing of the grooves, the rubber rings are deformed in an outward manner so as to frictionally engage the interior surface of a bobbin sleeve. However, these expandible mandrels have had some shortcomings in that the centering of a bobbin sleeve has been perceptibly impaired due to the uncontrollable deformation of the rubber by the narrowing of the grooves. Further, since the rubber material is limited in cross section, the deformation of the rubber ring outwardly, i.e. its range of elasticity and consequence chuck capacity, is limited. Further, since the rubber ring has slid on the surfaces of the grooves during expansion and relaxation, relatively large control forces have been necessary to overcome the resultant sliding friction.

Accordingly, it is an object of the invention to reduce the control forces required to clamp an expandible mandrel in engagement with a bobbin sleeve.

It is another object of the invention to accurately center a bobbin sleeve on an expandible mandrel.

It is another object of the invention to increase the chucking capacity of an expandible mandrel.

Briefly, the invention provides an expandible mandrel having at least one wedge-shaped groove which can be narrowed with a pair of deformable elastic annular rings in the wedge-shaped groove. Each ring is positioned adjacent the other ring within the groove and is deformable in cross section. Upon narrowing of the groove to tighten the rings against a bobbin sleeve, the rings initially roll along the sloped surfaces of the groove as well as on each other in a radially outward direction without an essential change in cross-sectional shape. Subsequently, the rings deform in cross section to form the surface areas necessary for the static friction on the bobbin sleeve and the sloped surface of the groove.

The cross-sectional deformation of the rubber rings is thus controllable so that centering of the gripped bobbin sleeve can be effective with relatively no perceptible deviation. Further, the chucking capacity of the expandible mandrel is increased over that of single rings since the outward expansion of the rubber rings is increased.

These and other objects and advantages of the invention will become more apparent from the following detailed description and appended claims taken in conjunction with the accompanying drawings in which:

FIG. 1 illustrates a cross-sectional view of an expandible mandrel of the invention;

FIG. 2 illustrates a partial cross-sectional view of a pair of elastic deformable rings within a groove of the expandible mandrel before tightening against a bobbin sleeve; and

FIG. 3 illustrates a view similar to FIG. 2 of the rings when tightened against a bobbin sleeve.

Referring to FIG. 1, the expandible mandrel includes a cylinder 1 which is rotatably mounted on a shaft 2 as by roller bearings. The shaft 2 is provided with a central bore 3 for the passage of a pressure fluid, such as air, from a suitable source (not shown) into the chamber formed between the shaft 2 and the cylinder 1. A piston 4 is slidably mounted within the cylinder 1. For example, the piston 4 is slidably mounted in a closure plate 4' secured to the end of the cylinder 1 and biased by a compression spring 4''. A tube 6 having a sloped surface 5 at one end is secured to the piston 4 via a plate 6' and slidably mounted on the exterior of the cylinder 1 for simultaneous movement with the piston 4. A second tube 7 having correspondingly sloped surfaces 8, 9 at each end is slidably mounted on the cylinder 1 coaxially of tube 6 while a third tube 10 having a sloped surface 11 facing the second tube and an outwardly directed flange 12 at the opposite end is fixed to the cylinder 1. The adjacent sloped surfaces of the tubes 6, 7, 10 serve to define annular wedge-shaped grooves 13, 14 which taper inwardly in order to receive a pair of rings 15, 16 made of elastic material such as rubber or the like. The rings 15, 16 are deformed between the respective tubes 6, 7, 10 so as to frictionally engage the inside surface of a bobbin sleeve 17 abutting the flange 12.

In operation, in order to remove the bobbin 17, pressure fluid is forced through the bore 2 into the chamber within the cylinder 1 to increase the fluid pressure on the piston 4. As the fluid pressure increases to a point sufficient to overcome the biasing force of the spring 4'', the piston 4 moves out of the cylinder 1. The tube 6 consequently moves to the right as viewed in FIG. 1. The wedging forces on the rings 15, 16 in the groove 14 between tubes 6 and 7 thus decreases to permit the rings 15, 16 to regain their normal circular cross section while returning to the bottom of the groove 14 due to their elasticity. During this time, the rings 15, 16 roll down the sloped surfaces 5, 8 in the direction indicated by the dotted arrows in FIG. 2. Similarly, the rings 15, 16 in the other groove 13 roll down the sloped surfaces 9, 11 as the intermediate tube 7 moves away from the fixed tube 10. When the rings bottom on the grooves 13, 14 the bobbin sleeve 17 can be axially extracted from the mandrel and replaced by a fresh bobbin sleeve.

In order to clamp the fresh bobbin sleeve to the mandrel, the pressure fluid feed is stopped and the pressure within the cylinder 1 relieved so as to permit the spring 4'' to retract the piston 4 into the cylinder 1. This causes the tube 6 to move to the left as viewed in FIG. 1 so that the pair of rings 15, 16 in each groove 13, 14 roll up the respective sloped surfaces as well as on each other. Upon contacting the bobbin sleeve, the rings begin to deform under the forces of the moving tubes 6, 7 so as to form gripping surface areas with the tubes and bobbin sleeve under sufficient pressures for statically holding the bobbin sleeve on the cylinder 1.

Alternatively, the rings can initially be placed against the inside surface of the bobbin sleeve and one of the sloped surfaces of a groove, as shown in dotted lines in FIG. 2, without cross-sectional deformation. Thereafter, the rings can be deformed, as indicated in FIG. 3, against the respective gripping surface areas.

It is noted that in deforming the pairs of rings that the bobbin sleeve 17 is moved safely into abutment with the flange 12 of the fixed tube.

Having thus described the invention, it is not intended that it be so limited as changes may be readily made therein without departing from the scope of the invention. Accordingly, it is intended that the foregoing Abstract of the Disclosure, and the subject matter described above and shown in the drawings, be interpreted as illustrative and not in a limiting sense.

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I claim:

1. An expandible bobbin mandrel for mounting a bobbin sleeve thereon comprising
a plurality of coaxial tubes, each said tube having a sloped surface on at least one end thereof in facing relation to an adjacent tube;
at least one pair of rings, said pair of rings being disposed between a pair of adjacent tubes and each said ring being in circumferential contact with one of said sloped surfaces and each other, each said ring being of elastic deformable material and having a circular cross section; and
means for moving at least one of said tubes relative to the remainder of said tubes whereby movement of said tubes towards each other causes said rings to roll up said sloped

surfaces and on each other into deformable frictional engagement with a bobbin sleeve mounted concentrically over said rings and movement of said tubes away from each other causes said rings to roll down said sloped surfaces and on each other out of frictional engagement with a bobbin sleeve.

2. An expandible bobbin mandrel as set forth in claim 1 wherein said pair of rings are made of rubber.

3. An expandible bobbin mandrel as set forth in claim 1 wherein said plurality of tubes includes a first tube connected to said means, a second tube adjacent said first tube and a third fixedly mounted tube adjacent said second tube opposite said first tube, and wherein a pair of said rings is positioned between adjacent tubes.

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