June 3, 1969 F. STAHLECKER ET AL 3,447,305

LOCKING DEVICE FOR SPINDLES OF SPINNING OR TWISTING MACHINES

Filed March 21, 1967 Sheet 1 of 2

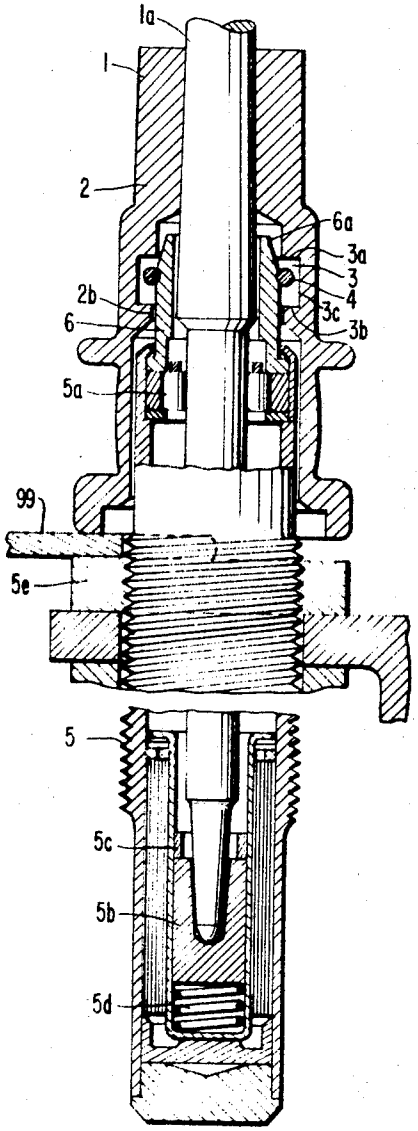


FIG. 1

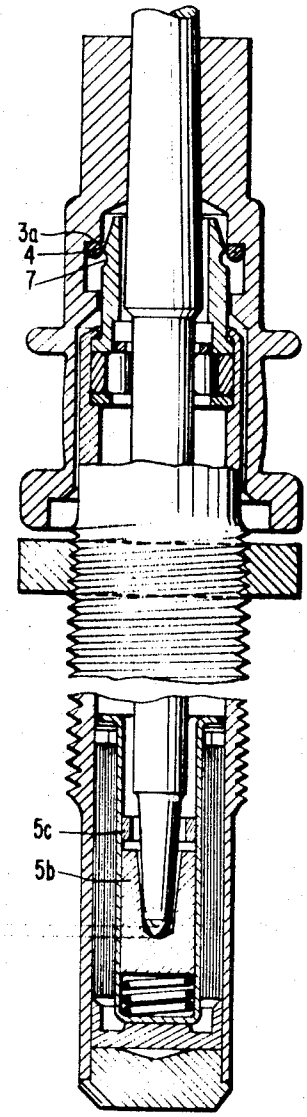


FIG. 2

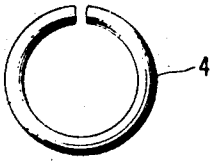


FIG. 3

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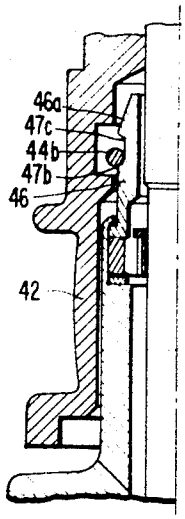


FIG. 4

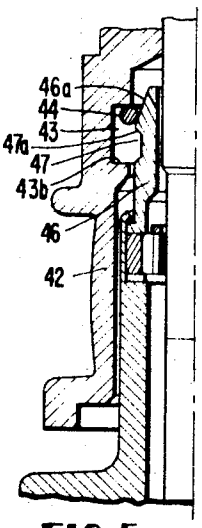


FIG. 5

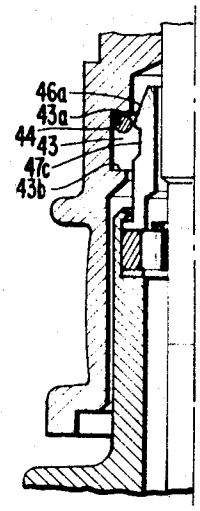


FIG. 6

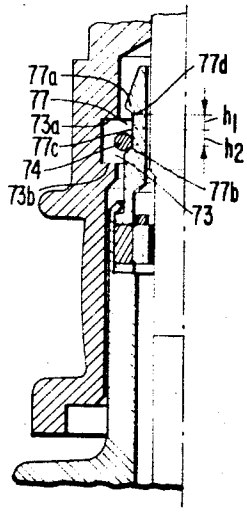


FIG. 7

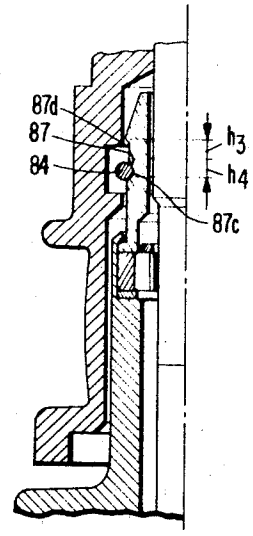


FIG. 8

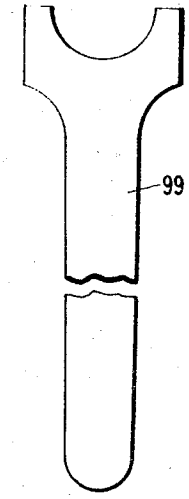


FIG. 9

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LOCKING DEVICE FOR SPINDLES OF SPINNING OR TWISTING MACHINES

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Int. Cl. D01h 7/14, 7/22
U.S. Cl. 57—132 7 Claims

ABSTRACT OF THE DISCLOSURE

A locking device for spindles of spinning and twisting machines, having a stationary housing containing a collar bearing and a footstep bearing for rotatably mounting therein a center shaft secured to a wharve. The wharve has a downwardly opening axial bore and annular recess. A locking unit is provided for preventing unintentional axial movement of the rotary unit and includes a bushing around the shaft, secured to the housing unit and having an annular locking recess near its free end containing a split locking spring ring. The bushing is provided with a cam for radially expanding the ring during disassembly and assembly. The rotary unit recess is provided with sidewalls to engage the ring and push it into or out of the bushing recess when the rotary unit is moved with sufficient force downwardly into the housing unit or upwardly out of the housing unit, respectively.

Background of the invention

The present invention relates to a locking device for preventing the rotary unit of a spindle of a spinning or twisting machine from being unintentionally withdrawn from the stationary part of the spindle which comprises a resilient locking member within the wharve of the spindle which is operatively associated with a rigid retaining member on the bearing housing and is adapted to be actuated by an axial movement of the rotary unit.

For preventing the rotary unit of a spindle from being unintentionally withdrawn from the bearing housing of the spindle it has already been proposed by the German Patent No. 1,102,020 (FIGURE 2) to provide a locking member in the form of a resilient washer which is inserted into the wharve on the center shaft of the spindle and is operatively associated with a rigid retaining member on the upper part of the bearing housing. When the rotary unit is being inserted into the housing and especially also when it is being removed therefrom, the resilient locking member of this known device is deformed in the axial direction and thereby subjected to considerable shearing at least until it starts to be deformed. These shearing stresses may cause the resilient locking member to be damaged, especially because the particular resilient materials of which this locking member is made is subject to aging which impairs its solidity and elastic properties. These damages to the locking member may render the locking member inoperative and in addition they may cause an unbalance of the rotary unit.

The reverse arrangement of the parts of such a locking device in which the ring-shaped locking member is disposed within a groove in the bearing housing of the spindle and projects into a recess in the wharve has also already been disclosed by the German Patents 1,102,020 (FIGURE 1) and 1,149,652. However, these devices also have the disadvantage that the locking member is subjected to dangerous shearing forces and may thus be easily damaged which might render it inoperative. Such

a locking member may also cause an unbalance of the rotary unit if, for example, it has been damaged during the insertion of the rotary unit into the bearing housing and the torn-off parts pass into the recess of the wharve and rotate together with the latter as an eccentric weight.

There have been other locking devices disclosed in the German Patent No. 1,102,020 (FIGURES 3 and 5) in which the resilient deformable locking member is located within the bearing housing. These devices, however, do not permit the locking member to be exchanged so that, when the latter is damaged, the bearing housing also becomes useless. The reverse arrangement as shown in FIGURES 4 and 6 of the mentioned German patent according to which the resilient ring is located on the center shaft has likewise the disadvantage that this ring, when destroyed by the mentioned shearing stresses, or parts thereof will remain within the bearing housing and cause interferences in the proper rotation of the center shaft. The known locking devices as above described have the further disadvantage that, if the retaining force of the locking device against a withdrawal of the rotary unit of the spindle is increased, this will also cause an increase in the shearing stresses upon the locking member so that the danger of damage to the locking member is still further increased.

Summary of the invention

It is an object of the present invention to provide a locking device which is located within the spindle wharve and is designed so as to overcome the above-mentioned disadvantages and to operate very reliably, and which may be easily exchanged when necessary and is also adapted to exert a strong locking action. This may be attained according to the invention by providing the locking member in the form of a resilient locking ring which, when in its operative position, engages with its inner side into an annular locking groove in a bushing which is secured to the bearing housing, while the outer side of this ring projects into an annular recess at the inside of the wharve without engaging with the wall thereof when the spindle is in operation. When the rotary unit of the spindle is being lifted by force off the bearing housing, the wall of this recess in the wharve engages upon the locking ring and pushes the same out of the locking groove and then off the free end of the bushing, and the locking ring thereafter remains loosely within the recess in the wharve.

A very simple and reliable locking device according to the invention may be attained by providing the locking ring in the form of an open spring ring. According to another preferred feature of the invention, this spring ring may engage with a small amount of tension into a concave locking groove in the bushing so that in its operative position it is held firmly within this groove in the radial and axial directions. According to a modification, it is, however, also possible to retain the locking ring in its operative position with a small amount of radial play within the locking groove which in this case may have a width amounting to at least 1.5 times the width of the locking ring. The position of the locking ring is then determined by its own weight which has the advantage that, when the rotary unit of the spindle is being inserted into the bearing housing and the locking ring has been passed over the end of the bushing forming the upper shoulder of the locking groove, the locking ring will drop by itself upon the lower shoulder of the locking groove and thus to its operative position in which its outer side projects into the annular recess in the wharve without engaging with the latter.

Another feature of the invention consists in making the part of the locking groove which in the operative position of the spindle is located above the locking ring of a slightly larger diameter than the inner diameter of the locking

ring. This has the advantage that when the rotary unit of the spindle, i.e. the center shaft and the wharve thereon, is being lifted, for example, when a yarn cop is being withdrawn, the impact will be softened with which the locking ring, which is taken along by the lower shoulder of the wharve recess, then hits against the upper shoulder of the locking groove. This is due to the fact that before the impact occurs and when the locking ring is pushed over the thicker part of the locking groove, the locking ring is resiliently expanded and moved with a strong friction along the bottom of the groove. This embodiment of the invention has the further advantage that when the rotary unit of the spindle is being lifted, the lower shoulder of the wharve recess moves the locking ring to an accurately central position before the ring abuts against the upper shoulder of the locking groove and may then possibly be pushed over the same. It has also been found advisable especially when the locking ring in its operative position engages with a small amount of tension into a concave locking groove to facilitate this engaging movement during the insertion of the rotary unit of the spindle into the bearing housing by permitting the footstep bearing to move in the axial direction against the action of a spring.

One feature of the locking device according to the invention which applies to all embodiments thereof consists in the fact that the maximum diameter of the annular recess in the spindle wharve is larger and the minimum diameter of this recess is smaller than the diameter of the locking ring in its operative position.

The features and advantages of the present invention will become more clearly apparent from the following detailed description thereof which is to be read with reference to the accompanying drawings, in which—

FIGURE 1 shows a longitiudinal section of a spindle with a locking ring in its operative position in which this ring engages with spring tension into a concave locking groove in a bushing which is secured to the bearing housing;

FIGURE 2 shows a similar longitudinal section of the spindle according to FIGURE 1, but in a position during the insertion of the rotary unit into the bearing housing of the spindle;

FIGURE 3 shows a plan view of the locking ring according to FIGURE 1;

FIGURE 4 shows a longitudinal section of a part of a spindle, in which the locking ring rests in its operative position in a release condition and with a small play within an elongated locking groove;

FIGURE 5 shows a longitudinal section of the part of the spindle according to FIGURE 4, but in a position during the insertion of the rotary unit into the bearing housing when the locking ring engages upon the conical end of the bushing which is secured to the bearing housing;

FIGURE 6 shows a longitudinal section of the part of the spindle according to FIGURE 5, but in the position shortly before the locking ring snaps into the locking groove;

FIGURE 7 shows a longitudinal section of a part of a spindle similar to that as shown in FIGURE 4, but in which the bottom of the locking groove is provided with a conical upper surface and the locking ring is shown in its operative position;

FIGURE 8 shows a longitudinal section of a part of a spindle similar to that as shown in FIGURE 7, but in which the upper part of the bottom of the locking groove has a larger diameter than the lower part and the locking ring is shown in its operative position; and

FIGURE 9 shows a plan view of a lever for unloading the locking device so as to permit the rotary unit to be lifted off the bearing housing of the spindle.

In FIGURES 1 and 2 of the drawings, the rotary unit **1** of the spindle consists of the center shaft **1***a* and the wharve **2** which is pressed thereon and is provided with an inner annular recess **3**. This recess **3** is adapted to receive an open spring ring **4** with a gap of such a size between its ends (see also FIGURE 3) that when the ring is compressed and, if necessary, slightly tilted, it may be slipped through the bore **2***b* in the wharve **2**. The bearing housing **5** of the spindle containing the collar bearing **5***a* and footstep bearing **5***b* contains and is flanged over the lower end of a bushing **6** which also serves as the upper limitation of the roller bearing **5***a* and has a conical upper end **6***a* and an annular locking groove **7** underneath this end. When the rotary unit **1** of the spindle is being inserted into the bearing housing **5**, the spring ring **4** which is loosely inserted into the recess **3** will slide over the conical end **6***a* of bushing **6** and will then be pressed downwardly by the upper shoulder **3***a* of the wharve recess **3** and thereby be expanded by the conical end **6***a*, as shown in FIGURE 2. The footstep bearing **5***b* which is axially movable against the action of spring **5***d* and in its operative position as shown in FIGURE 1 abuts against the stop ring **5***c* may then be pressed slightly downwardly for a distance S so as to permit the spring ring **4** to be pressed sufficiently downwardly to snap into groove **7**. When the footstep bearing **5***b* is then returned by spring **5***d* to its operative position as shown in FIGURE 1, spring ring **4** will be located within groove **7** and can then no longer engage with the surfaces **3***a*, **3***b*, and **3***c* and therefore cannot affect the rotary unit **1** either by frictional engagement or by causing an unbalance of this unit.

By providing the safety device within the upper part of the wharve, this device is safely protected from fly and, if necessary, the spring ring **4** may also be easily exchanged without danger that the bearing unit of the spindle may thereby be damaged. An exchange of the spring ring for one with a stronger locking effect may be advisable, for example, if automatic withdrawing devices are employed which press the yarn cops with a greater force upon the center shafts so that when they are withdrawn the locking devices also have to resist greater axial forces.

For removing the rotary unit **1** from the bearing housing **5**, a bifurcated lever **99** as shown particularly in FIGURE 9 may be inserted between the lower edge of the wharve and the spindle flange **5***e* as shown in FIGURE 1, and a pressure in the upward or downward direction may be exerted upon the handle of this lever. The shoulder **3***b* in housing **5** will then press against the spring ring **4** and push it out of the groove **7**. The amount of force which is required for this operation depends upon the depth of groove **7** and the spring force of ring **4** which may be made of such values as to prevent the rotary unit **1** from being unintentionaly lifted from housing **5**, but to permit such lifting by the application of a greater force without danger of causing any damage.

According to the modification of the invention as illustrated in FIGURES 4, 5, and 6, the spring ring **44** is located within an annular recess **43** in wharve **42**. When fully released, spring ring **44** has an inner diameter slightly larger than the diameter of the bottom **47***c* of the locking groove **47**. In the operative position, as shown in FIGURE 4, the released spring ring **44** therefore engages upon the lower shoulder **47***b* of groove **47**. When the rotary unit of the spindle is being inserted into the bearing housing, ring **44** which then lies loosely within the wharve recess **43** at first slips over the conical end **46***a* of bushing **46**, and when the rotary unit is then moved further downwardly, as shown in FIGURE 5, the upper shoulder **43***a* of recess **43** engages upon and presses the ring **44** downwardly which is thereby expanded by the conical end **46***a*. Since in the operative position of the rotary unit, as shown in FIGURE 4, shoulder **43***a* is located at approximately the same level as the maximum diameter of the conical end **46***a* of bushing **46**, ring **44** will also be pushed over the level of this maximum diameter and will then snap into the groove **47** of

bushing **46** in which, due to its own weight, it will engage upon the lower shoulder **47***b* of this groove. The locking ring **44** can thereafter no longer engage with the rotary unit of the spindle. When a pull in the upward direction is then exerted upon the rotary unit, when in the operative position as shown in FIGURE 4, for example, when a yarn cop is being withdrawn, ring **44** will be disposed between shoulder **43***b* of recess **43** and shoulder **47***a* of groove **47** in bushing **46** and prevent any further movement. If the rotary unit is to be removed from the bearing housing, ring **44** must first be expanded by the outer edge of shoulder **47***a* which is possible only if the outer diameter of this edge is smaller than one half of the sum of the inner and outer diameters of ring **44**. If this were not true, ring **44** would act as a positive locking member between the shoulders **47***a* and **43***b*. The amount of force required for withdrawing the rotary unit may be varied to any desired extent depending upon the sizes of the outer and inner diameters and the cross-sectional shape of ring **44** so that the rotary unit cannot be unintentionally lifted, but the locking effect may surely be overcome when desired without damage to the material by applying the lever **99** according to FIGURE 9. If the locking device according to FIGURES 4 to 6 is employed, there is no need to design the footstep bearing so as to be movable in its longitudinal direction in the manner as shown in FIGURES 1 and 2.

FIGURE 7 illustrates another modification of the invention, in which the bottom **77***c* of the locking groove **77** is provided with a conical surface **77***d* which has an upper diameter larger than the inner diameter of spring ring **74**. In the operative position of the spindle, the upper shoulder **73***a* of the wharve recess **73** is disposed at a slightly lower level than the upper shoulder **77***a* of the locking groove **77**. The difference amounts to slightly more than the height h_1 of the conical surface **77***d* minus one half of the diameter of ring **74**. This produces the result that, when the upper part of the spindle is being inserted into the lower part, ring **74** after passing over the edge of shoulder **77***a* will move to the area h_2 of the bottom **77***c* of groove **77** which has a diameter smaller than the inner diameter of the released spring ring **74** so that due to its own weight the ring will rest on the shoulder **77***b*. When the rotary part of the spindle is lifted, ring **74** will be lifted by the shoulder **73***b* and pushed upon the conical part **77***d* and will thereby be slightly expanded and tightened so as to slide under friction up to the shoulder **77***a*. Due to this friction, a part of the axially directed forces will be eliminated so that the impact which occurs, for example, when a yarn cop is being withdrawn will be softened. The conical part h_1 of the bottom of groove **77** also has the advantage of accurately centering the ring **74** so that, when the rotary unit is being withdrawn, the ring will uniformly engage upon the shoulders **77***a* and **73***b* and cannot become wedged between them. In order to overcome the locking action on the shoulder **77***a*, the lever **99** according to FIGURE 9 may be employed in the same maner as previously described.

In the modification of the invention according to FIGURE 8, the bottom **87***c* of the locking groove **87** has an upper part **87***d* of a height h_3 and an outer diameter larger than the inner diameter of the released locking ring **84** which lies loosely within the lower part h_4 of the bottom **87***c* of the locking groove. The effect of this embodiment is otherwise similar to that of the embodiment according to FIGURE 7, except that the holding action of the spring ring is increased by its longer distance of travel when the rotary unit is being lifted and by the increased tension of the ring shortly after the lifting movement has started, so that the impact as previously described will be considerably reduced.

Having thus fully disclosed our invention, what we claim is:

1. In a spindle of a spinning or twisting machine: a stationary bearing housing unit; a collar bearing and a footstep bearing mounted in said housing unit; a rotary unit comprising a center shaft rotatably mounted in said bearings and projecting upwardly from said housing unit and a wharve secured to said shaft and having a lower part with an axial bore of a diameter larger than the diameter of said shaft, the wall of said bore having an annular recess; locking means for preventing said rotary unit from being unintentionally lifted from said housing unit below a predetermined force and being operative for assembly and disassembly solely by relative bodily movement between said housing unit and said rotary unit, said locking means comprising a bushing around said shaft secured to and projecting upwardly from said housing unit into said bore and having an annular locking recess near its free end, and a split locking spring ring within said recesses; one of said units having an inclined fixed axially facing cam surface forming one side wall of its recess and another inclined fixed axially facing cam surface spaced from said recess to form means for radially expanding said ring during disassembly and assembly, respectively; the other of said unit recesses having fixed axially opposed side walls to engage with said locking ring and to push the same into or out of said one unit recess when said rotary unit is moved with sufficient force downwardly into said housing unit or upwardly out of said housing unit, respectively.

2. A spindle as defined in claim **1**, wherein one of said recesses includes means for holding said ring completely out of engagement with the unit of the other recess in the assembled position.

3. A spindle as defined in claim **1**, wherein said ring includes metal throughout its entire circumference.

4. A spindle as defined in claim **1**, wherein said locking ring when in its operative position engages with a certain spring tension into said locking recess, said locking recess having a shape substantially in accordance with the inner part of said ring so as normally to maintain said ring immovably therein.

5. A spindle as defined in claim **1**, wherein said locking ring when in its operative position engages with small radial play into said locking recess, said locking recess having a width at least 1.5 times as large as the width of said locking ring.

6. A spindle as defined in claim **5**, wherein the part of said locking recess which in said operative position is located above said locking ring has a diameter slightly larger than the inner diameter of said ring.

7. A spindle as defined in claim **1**, further comprising a spring in said housing unit, said footstep bearing being slidable in the axial direction within said housing unit against the action of said spring to facilitate the insertion of said locking ring into said locking recess during the insertion of said rotary unit into said housing unit.

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U.S. Cl. X.R.

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