Feb. 23, 1954

E. J. HEIZER

2,670,146

WINDING MACHINE

Filed Dec. 24, 1952

Fig. 1.

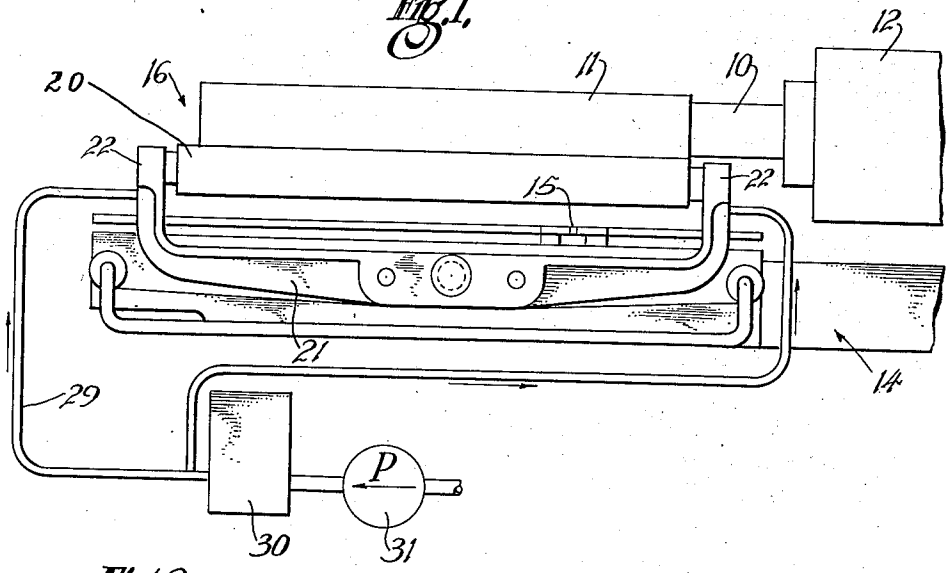


Fig. 2.

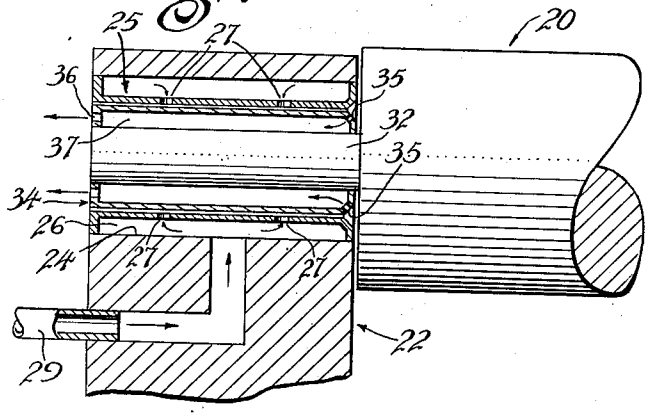


Fig. 4.

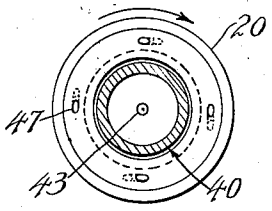
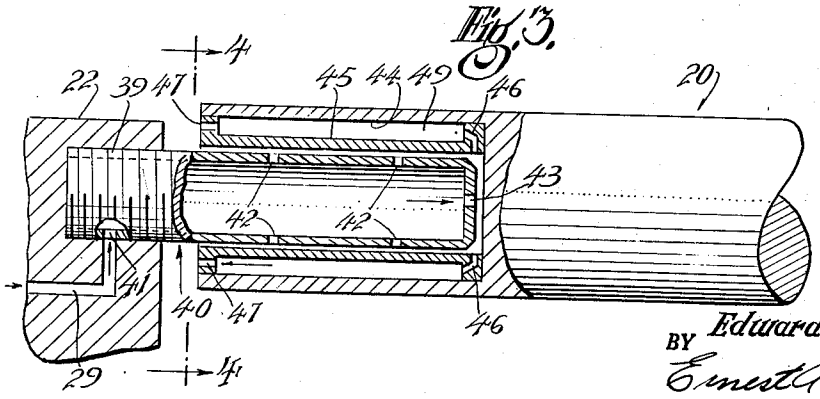


Fig. 3.



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WINDING MACHINE

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17 Claims. (Cl. 242—18)

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The present invention relates to yarn package winding machines, and, more particularly, to an improved pressure roller or roller bail for such machines.

For example, as disclosed in United States Patent No. 2,171,758, roller bails have been utilized heretofore in connection with winding machines to provide yarn packages intended to have an even density throughout so that they will be suitable especially for use in knitting machines and the like. As shown in this patent, the roller bail is mounted on the frame of the back of the winder, and is urged into contact with the yarn package being wound on the spindle of the winder under light, but sufficient, pressure to cause the friction between the yarn of the package and the bail to effect rotation of the latter.

It has been found that the bearing friction of the roller bail, even though relatively slight, imposes a drag on the bail, whereby the bail, in being rotated by the package, tends to iron the yarn as it is laid on the package. This effect is particularly undesirable at the sides or ends of the package where the lay of the yarn is reversed by the traverse, because ironing of the yarn moves the reversed sections thereof sidewise in an outwardly direction of the ends of the package with the result that "stitches" or "press-offs" occur which impair the even unwinding of yarn when the package is used in a knitting machine or the like. The foregoing causes considerable difficulty in the winding of mono-filament type yarn, which, by reason of its circular cross-section, cannot be flattened under ironing influence and thus must move sidewise.

Also, the frictional resistance to free rotation of the roller bail causes the yarn to be dragged about the bail rather than to run with the same. Such drag puts tension in the yarn as it is being wound onto the package, and thereby causes a harder or more tightly wound package to be produced which lacks the desired softness. Such tensioning is particularly undesirable in connection with the more recently developed synthetic fiber or filament type yarns.

Accordingly, an object of the present invention is to provide a roller bail or pressure roller assembly for winding machines, which is not subject to the foregoing difficulties.

Another object is to provide such a roller bail assembly which does not have any tensioning effect on the yarn and yet produces a soft package having a desired uniform density to render it suitable for handling, shipping, and use in a knitting machine or the like.

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Another object is to provide such a roller bail assembly wherein the bail is rotatably supported by practically frictionless bearing means which enable the bail to be rotated at a surface speed identical to that of the package while in extremely light contact with the package.

A further object is to effect rotation of the roller bail at a desired speed independently of its rotation by the package in contact therewith to thereby overcome any possible bearing friction tending to cause the bail to put tension in the yarn.

A still further object is to provide such a roller bail assembly which is simple, economical, and durable in construction, and can withstand constant use at high speeds without repair or replacement of parts.

Other and further objects of the invention will be obvious upon an understanding of the illustrative embodiment about to be described, or will be indicated in the appended claims, and various advantages not referred to herein will occur to one skilled in the art upon employment of the invention in practice.

In accordance with the present invention, the foregoing objects and advantages are accomplished by providing a roller bail assembly for yarn package winding machines comprising a roller bail, means for rotatably supporting the ends of the bail, and a gas bearing associated with the supporting means and the ends of the bail. This bail, in one of its forms as about to be described, is constructed and arranged to be rotated by jet propulsion means associated with its bearings, in addition to being in driven contact with the package.

A preferred embodiment of the invention has been chosen for purposes of illustration and description, and is shown in the accompanying drawing, forming a part of the specification, wherein:

Fig. 1 is a schematic plan view of a portion of a conventional type package winding machine embodying the present invention.

Fig. 2 is an enlarged fragmentary sectional view, illustrating one form of bearing construction in accordance with the invention.

Fig. 3 is a view similar to Fig. 2, illustrating another form of such bearing construction.

Fig. 4 is a sectional view taken along the line 4—4 of Fig. 3.

Referring to the drawing in detail and more particularly to Fig. 1 thereof, a portion of a conventional type package winding machine provided with a roller bail is shown. This machine,

in general, comprises a spindle 10 for receiving a tube or the like on which a yarn package 11 is wound, a spindle supporting housing 12 on the frame of the machine, a back 14 adapted to move away from the package as the package grows in size, a yarn traverse 15 supported by the back, and a roller bail assembly 16, in accordance with the invention, mounted on the back. Although not shown, the winding machine includes mechanism for effecting rotation of the spindle and reciprocation of the traverse in any suitable or conventional manner.

As shown herein by way of example, the roller bail assembly comprises a roller 20, and a generally U-shaped frame or holder 21 secured to the back and formed with a pair of arms 22 having bearing means for rotatably supporting the ends of the roller 20.

In Fig. 2, an air bearing embodying the present invention is shown as associated with one of the arms 22 and one end of the roller 20. In this embodiment, the arms have a bore 24 into which is fitted a flanged bearing bushing 25 having an air inlet channel 26 and a series of radially inwardly facing outlet apertures 27. Compressed air is supplied to the inlet 26 by suitable conduit means 29 from a source such as an accumulator 30 and a compressor 31 (Fig. 1). The roller 20 has a section 32 of reduced diameter at each end over which is fitted a bearing sleeve 34. This sleeve is rotatably disposed in the bushing 26; and has air inlet apertures 35 at its end adjacent the roller 20, a series of air outlet apertures 36 at its other end, and an annular passageway 37 for establishing fluid flow communication between the apertures 35 and 36.

As the package 11 rotates the roller 20, the sleeves 34 at the ends of the roller float, in a sense, on the air entering the space between adjacent cylindrical bearing surfaces of the bushings 25 and the sleeves 34 by way of the apertures 27 and leaving primarily by way of the apertures 35. This air provides a practically frictionless film between the bearing surfaces, whereby the roller 20 can be rotated at very high speeds without any drag on the yarn being wound.

In Fig. 3, another form of air bearing embodying the present invention is shown as associated with one of the arms 22 and one end of the roller 20. In this embodiment, the arms 22 have a threaded bore 39 into which is secured a hollow stud or axle 40. This stud has an air inlet 41 in communication with conduit means 29, outlet apertures 42 in the side wall thereof, and an outlet aperture 43 in the end wall thereof.

The roller 20 has a bore 44 at each end thereof into which is fitted a bearing sleeve or bushing 45 rotatably supported by a stud 40. This bushing has radial air inlet apertures 46 adjacent the closed end of the bore, generally axially directed air outlet apertures 47 adjacent the open end of the bore, and an annular passageway or channel 49 for establishing fluid flow communication between the apertures 46 and 47.

As the package 11 rotates the roller 20, the sleeves 45 float, in a sense, on the air entering the space between adjacent cylindrical bearing surfaces of the axles 40 and the sleeves 45 by way of the apertures 42 and leaving mostly by way of the apertures 46. Also, the aperture 43 in the end wall of the stud 40, by facing the closed end of the bore 44 of the roller, provides for the introduction of air between these surfaces which minimizes end thrust friction. In this manner, air provides a practically frictionless film between all adjacent bearing surfaces.

As shown in Fig. 4, the outlet apertures 47 are angularly disposed to a plane perpendicular to the axis of rotation of the roller 20 whereby to provide propulsion jets for creating a torque which serves to drive the roller in the same direction and at about the same speed that the package 11 tends to rotate the roller. For example, by proper proportioning and arrangement of the jets and the clearances between adajcent surfaces, the roller may be driven at a speed of about 18,000 revolutions per minute by means of air at a pressure of about 50 pounds per square inch. This drive further eliminates any tendency of drag being imposed on the yarn by the roller.

It will of course be understood that the apertures 36 (Fig. 2) could be similarly constructed and arranged to provide for jet propulsion of the roller. It will also be appreciated that an air bearing formed with jet propulsion means could be provided at only one end of the bail which would overcome the friction drag of a conventional bearing at the other end of the bail.

In view of the foregoing description, it will be seen that the present invention provides a novel, useful and improved roller bail assembly for winding machines which is practical, economical and durable in construction, and which can be applied to newly manufactured machines or machines already in the field.

As various changes may be made in the form, construction and arrangement of the parts herein, without departing from the spirit and scope of the invention and without sacrificing any of its advantages, it is to be understood that all matter herein is to be interpreted as illustrative and not in any limiting sense.

I claim:

1. In a yarn package winding machine, the combination of a roller bail, means for rotatably supporting the ends of said bail, and a gas bearing associated with said supporting means and the ends of said bail.

2. In a yarn package winding machine, the combination of a roller bail, a pair of rotor elements each at one end of said bail having a bearing surface, and a pair of stator elements each having a bearing surface rotatably supporting one of said rotor elements, one pair of elements having passageway means for introducing a gaseous medium between the bearing surfaces of said rotor and stator elements, and the other of said elements having passageway means extending from between the bearing surfaces of said rotor and stator to the exterior thereof for discharging the gaseous medium.

3. In a machine according to claim 2, wherein said stator elements have said passageway means for introducing the gaseous medium, and said rotor elements have said passageway means for discharging the gaseous medium.

4. In a machine according to claim 3, wherein said passageway means of said rotor elements have propulsion jets at the discharge ends thereof.

5. In a machine according to claim 3, wherein said rotor elements each include a bearing sleeve secured to said rotor elements formed with an annular passageway, orifices extending from said annular passageway to between the bearing surfaces, and orifices extending from said annular passageway to the exterior.

6. In a machine according to claim 5, wherein said sleeves extend about an end portion of said roller bail and said stator elements extend about said sleeves.

7. In a machine according to claim 5, wherein said roller bail has a coaxial bore at each end thereof and said sleeves are secured within said bores, and said stator elements extend into said sleeves.

8. In a machine according to claim 7, wherein said stator elements each have a coaxial bore constituting the inlet of said passageway means thereof.

9. In a yarn package winding machine, the combination of a roller bail; and gas bearings for said bail including a rotor element at each end of said bail having a passageway, and having radial openings and end openings in fluid flow communication with said passageway, and including a stator element for supporting said rotor element having a passageway for supplying a gaseous medium and having radial openings in communication with said supply passageway and in fluid flow communication with said radial openings of said rotor element.

10. In a machine according to claim 9, wherein said end openings of said rotor elements are angularly disposed to a plane perpendicular to the axis of rotation whereby to provide propulsion jets.

11. In a yarn package winding machine, the combination of a roller bail having a bore at each end thereof provided with passageway means extending from the closed end to the open end thereof, and an axle disposed in each of said bores for rotatably supporting said bail, said axles having apertures for introducing air between adjacent surfaces of said axles and said bores.

12. In a yarn package winding machine, the combination of a roller bail having a bore at each end thereof, a bushing in each bore having air inlet apertures adjacent the closed end of said bore and having air outlet apertures adjacent the open end of said bore and having means for establishing fluid flow communication between said inlet and outlet apertures, and an axle disposed in each of said bushings for rotatably supporting said bail, said axles having apertures for introducing air between adjacent bearing surfaces of said axles and said bushings at points intermediate the ends of said bushings.

13 In a yarn package winding machine, the combination of a roller bail having a bore at each end thereof, a bushing in each bore having radially facing air inlet apertures adjacent the closed end of said bore and having generally axially directed air outlet apertures adjacent the open end of said bore and having means for establishing fluid flow communication between said inlet and outlet apertures, and an axle disposed in each of said bushings for rotatably supporting said bail, said axles having apertures for introducing air between adjacent bearing surfaces of said axles and said bushings at points intermediate the ends of said bushings.

14. In a yarn package winding machine, the combination of a roller bail having a bore at each end thereof, a bushing in each bore having air inlet apertures adjacent the closed end of said bore and having air outlet apertures adjacent the open end of said bore and having means for establishing fluid flow communication between said inlet and outlet apertures, and an axle disposed in each of said bushings for rotatably supporting said bail, said axles having apertures for introducing air between adjacent bearing surfaces of said axles and said bushings at points intermediate the ends of said bushings, said axles having an aperture facing the closed end of said bores for introducing air.

15. In a yarn package winding machine, the combination of a roller bail having a bore at each end thereof, a bushing in each bore having radially facing air inlet apertures adjacent the closed end of said bore and having generally axially directed air outlet apertures adjacent the open end of said bore and having means for establishing fluid flow communication between said inlet and outlet apertures, and an axle disposed in each of said bushings for rotatably supporting said bail, said axles having apertures for introducing air between adjacent bearing surfaces of said axles and said bushings at points intermediate the ends of said bushings, said axles having an aperture facing the closed end of said bores for introducing air.

16. In a yarn package winding machine, the combination of a roller bail having a bore at each end thereof, a bushing in each bore having radially facing air inlet apertures adjacent the closed end of said bore and having generally axially directed air outlet apertures adjacent the open end of said bore and having means for establishing fluid flow communication between said inlet and outlet apertures, and an axle disposed in each of said bushings for rotatably supporting said bail, said axles having apertures for introducing air between adjacent bearing surfaces of said axles and said bushings at points intermediate the ends of said bushings, said axles having an aperture facing the closed end of said bores for introducing air, said air outlet apertures of said bushings being angularly directed with respect to a plane perpendicular to the axis of rotation of said bail to provide propulsion jets for effecting rotation of said bail.

17. In a yarn package winding machine, the combination of a roller bail, means for rotatably supporting the ends of said bail, one of said supporting means having means for introducing air between the adjacent bearing surfaces and said supporting means and said bail, said bail having air outlet means at one end thereof and in fluid low communication with said air inlet means constructed and arranged to provide propulsion jets for effecting rotation of said bail.

EDWARD J. HEIZER.

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