United States Patent [19]

Clemens

[11] **3,759,455**

[45] **Sept. 18, 1973**

[54] **FILAMENT FEEDING AND STORAGE DEVICE**

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[73] Assignee: **Wesco Industries Corp.**, Plainview, N.Y.

[22] Filed: **Sept. 28, 1972**

[21] Appl. No.: **293,147**

[52] **U.S. Cl.** ..... **242/47.12**, 66/125 R, 66/132 R, 242/47.01

[51] **Int. Cl.** **B65h 51/20**

[58] **Field of Search** 242/47.01, 47.02, 242/47.12, 47.03–47.11; 66/125, 132

[56] **References Cited**

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Assistant Examiner—Milton Gerstein
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[57] **ABSTRACT**

A filament feeding device in which filament from a supply thereof is tangentially wound about a storage drum from which said filament is axially withdrawn. A housing which is fixed has a cavity within which the storage drum is removably seated. The outer contour of the drum and the confronting inner contour of the cavity are matingly shaped so as to define a radial gap therebetween and also so as to prevent significant relative rotation between the drum and the housing whereby the drum is in effect floating within the housing, being unsecured thereto. The filament tangentially wound about the drum forms a plurality of windings which advance axially within the radial gap and is thereafter withdrawn axially through an aperture at the opposite end of the housing. The mating confronting contours of drum and housing may be oval shaped, polygonically shaped, or be shaped in any other non-circular contour which results in preventing relative rotation between the drum and the housing.

15 Claims, 7 Drawing Figures

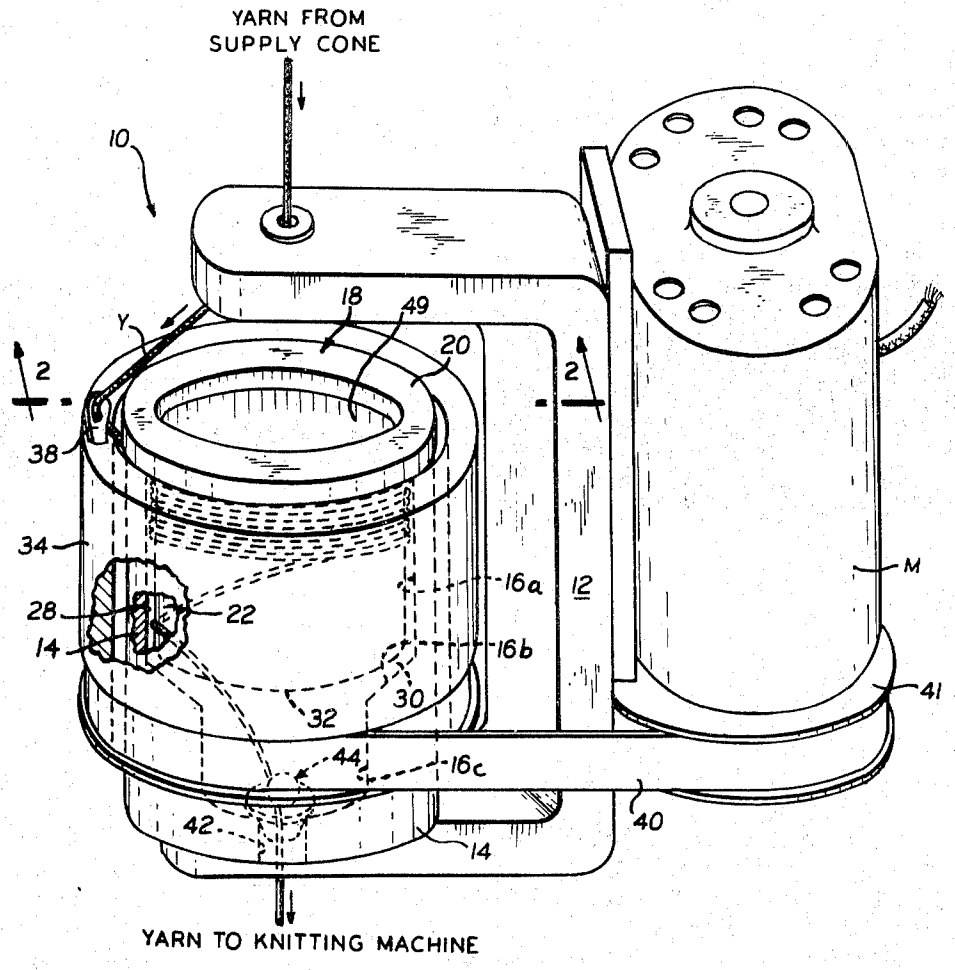


FIG. 1.

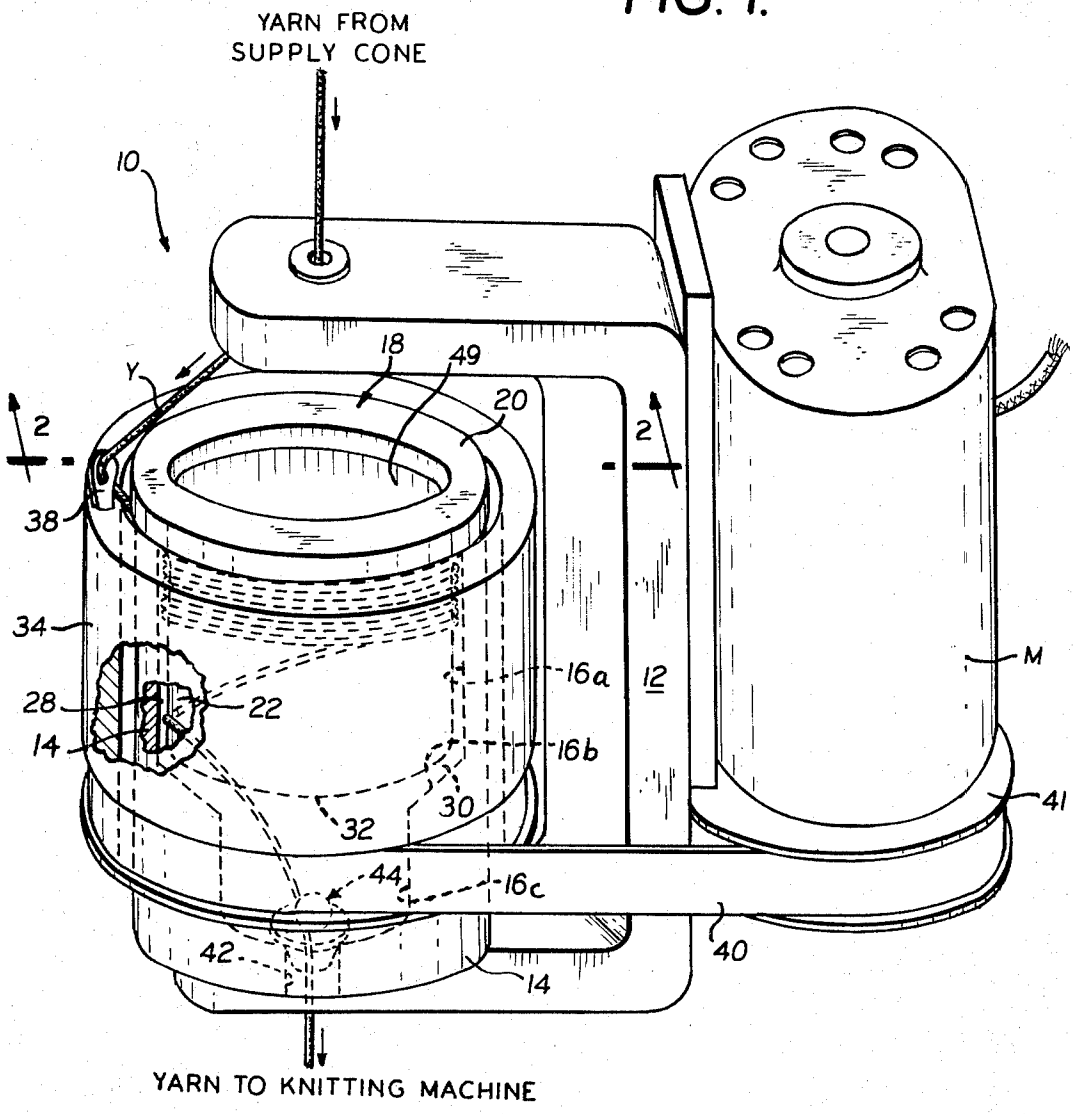


FIG. 5.

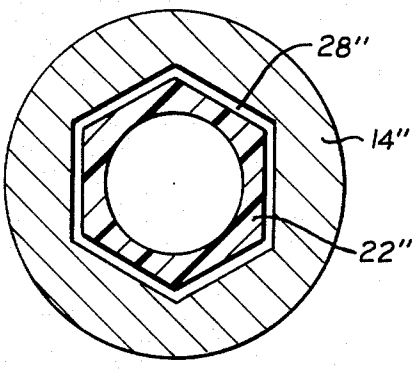


FIG. 6.

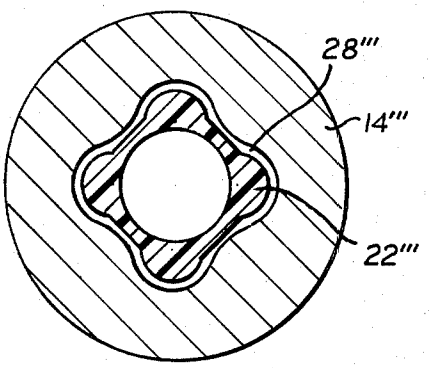


FIG. 2.

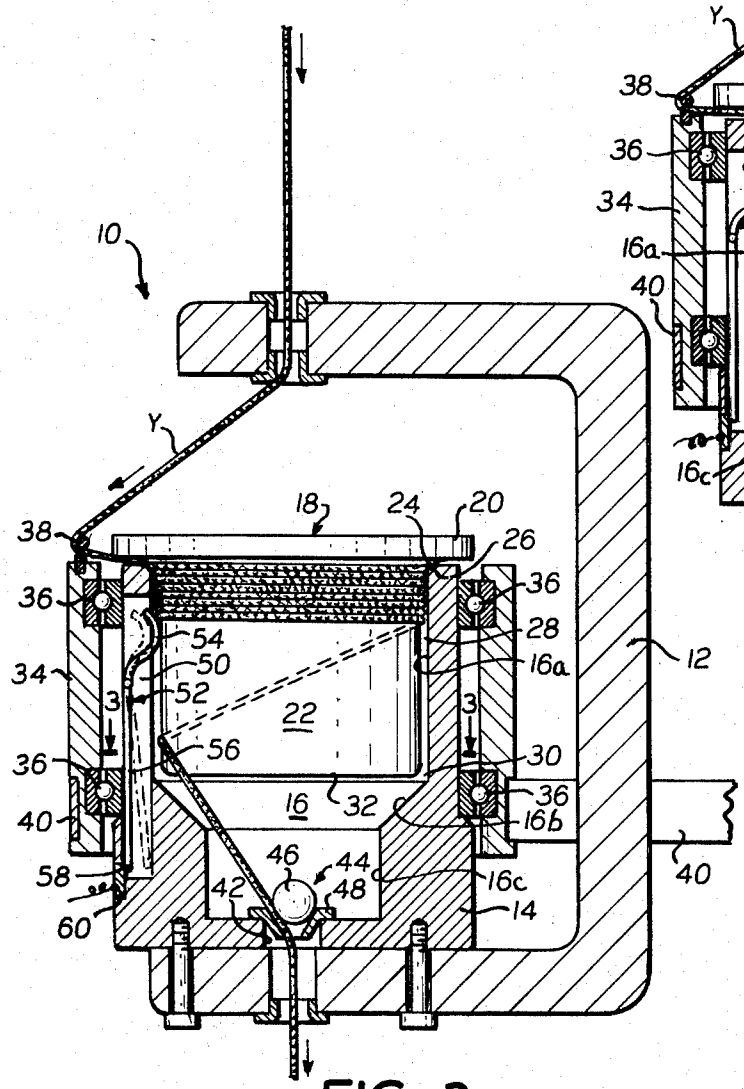


FIG. 7.

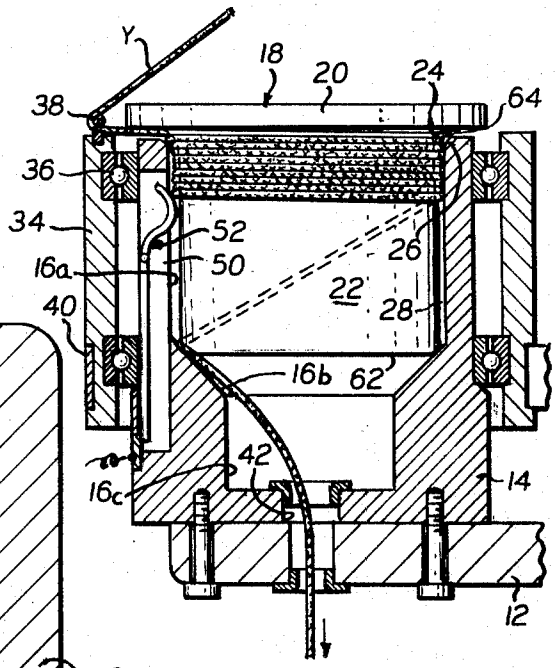


FIG. 3.

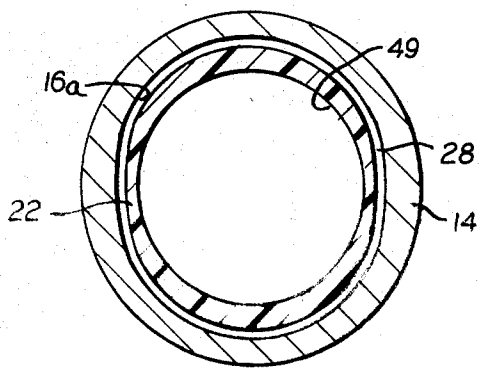
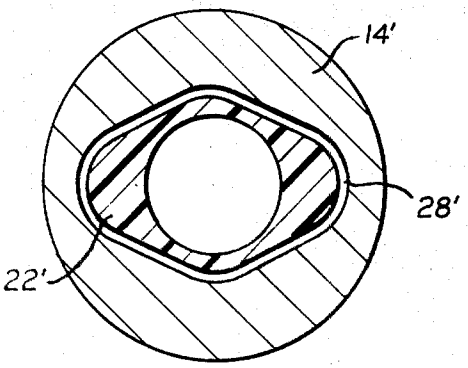


FIG. 4.



FILAMENT FEEDING AND STORAGE DEVICE

BACKGROUND OF THE INVENTION

The present invention relates to filament or yarn storage and feeding devices used in association with textile producing apparatus, particularly knitting machines, but relating as well to weaving and spooling apparatus.

In a knitting machine, the supply of yarn is in the form of a plurality of yarn cones with the yarn being drawn from the cone by the needles. As yarn is drawn off the cone, it undergoes substantial variations in tension due to the manner in which the yarn package is formed on the cone and unwound therefrom. Furthermore, the yarn supplied from any one cone is likely to be under different tension from that supplied to the needles at the same time from any of the other cones, resulting in the production of goods which are nonuniform, inferior in quality, and often considered as being defective. Efforts have previously been made to resolve the problems pointed out above by providing an intermediate yarn storage device disposed between the yarn cone and the needles. Examples of such storage device are shown in U.S. Pat. Nos. 3,225,446 and 3,419,225, each of which discloses the use of a drum of substantially uniform diameter which is rotated so as to tangentially wind a predetermined quantity of yarn thereon, which yarn is subsequently withdrawn axially from the drum. In this way all of the yarn from the cone is rewound around the uniform diameter storage drum and, being withdrawn axially from the drum, the tension of the yarn is reduced to a uniform magnitude, with the same condition simultaneously prevailing in all other yarns axially withdrawn, each from its own storage drum.

While said prior art storage devices constitute substantial improvement, they are not entirely free of deficiencies. More specifically, while the yarn tension condition has been measurably improved by the tangential winding about the rotating drum and axial withdrawing therefrom, new problems have arisen which contribute to the production of less than wholly uniform goods. This is due to the fact that the conditions under which the yarn is wound onto and unwound from the storage feeder during the knitting process are continuously varying. For example, under one condition, the yarn is wound on the rotating storage drum at the same exact rate that the yarn is withdrawn, in which case there is no twist imparted to the yarn. Under another condition, the yarn is withdrawn from the storage drum at a slower rate than that at which it is wound onto the storage drum, and in such condition, there is a twist imparted to the yarn in one direction. Under yet another condition, there may be yarn withdrawn axially from the storage drum when the latter is not rotating or rotating at a speed which causes the yarn to be wound onto the drum at a slower rate than that at which it is withdrawn, and in this condition there is a twist imparted to the yarn in the opposite direction. Since during the knitting process these three conditions occur repeatedly, each yarn is fed at times with no twist, twist in one direction, or twist in the opposite direction, again causing the production of goods which fall short of being entirely uniform.

Another drawback of prior art storage feeders is that a relatively large motor is required since the motor drives the storage drum whose mass is not unsubstantial.

Some of the drawbacks described above have been eliminated by providing a storage feeder wherein the storage drum is prevented from undergoing any significant rotation, with the yarn being tangentially wound onto the storage drum by providing a yarn guide which rotates about the storage drum. By so winding the yarn onto the drum, there is deliberately imparted to the yarn stored on the drum a certain amount of twist. Since the yarn, however, is always withdrawn from the drum while the latter is substantially stationary, the identical amount of twist is imparted in the opposite direction to the yarn during the withdrawal for a net effect of zero twist. One of the main problems encountered, however, in a storage feeder wherein the yarn is wound about a drum is that of keeping the drum relatively stationary, since the manner of winding and unwinding the yarn onto the drum makes it impossible to fixedly support the drum in conventional manner. In accordance with the known prior art, preventing rotation of the storage drum is accomplished by the use of a weighted drum, or the use of an eccentrically mounted drum, or the use of planetary gearing. While said means for preventing rotation, as well as magnetic means, are technically feasible, they render the storage feeder relatively complex, cumbersome and above all very costly.

In accordance with the invention, there is provided a yarn storage feeder which is void of the deficiencies pointed out above and which is generally a greatly improved storage feeder both in effectiveness and the quality of performance, while the cost thereof is substantially reduced.

SUMMARY OF THE INVENTION

In accordance with the invention, the storage drum is supported within the device by being seated in the cavity of a support member therefor. The confronting contours of the storage drum and its seat are shaped so that the drum is prevented from having any significant rotation with respect to the seat, without requiring any means for fixedly securing the drum within the device. Thus, the drum, in accordance with the invention, can be characterized and is hereafter referred to as a floating drum, being freely removable and insertable within the device. In accordance with one embodiment, the outer contour of the drum surface is oval shaped, as is the inner contour of the support therefor, there being a small radial clearance between said contours to enable yarn wound onto the drum to be advanced axially therealong. At the same time, the oval configuration of the drum and support therefor prevents any significant relative rotation between the floating drum and its support. Since the support is fixedly mounted on the knitting machine, the drum remains substantially stationary without requiring independent securing means which otherwise have to be devised so as not to interfere with the path of the yarn. In other respects, the storage feeder in accordance with the invention operates substantially similarly to storage feeders in which the drum is held stationary and wherein the yarn is wound tangentially onto the drum and withdrawn axially therefrom, as shown for example in U.S. Pat. application Ser. No. 136,939 and U.S. Pat. application Ser. No. 184,527, assigned to the assignee hereof.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a perspective view of a storage feeder in accordance with the invention;

FIG. 2 is a sectional view taken along line 2—2 of FIG. 1;

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

FIGS. 4, 5 and 6 are views similar to FIG. 3 but showing various modifications thereof; and

FIG. 7 is a view similar to FIG. 2 showing another embodiment of the invention.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

Referring now to FIGS. 1 through 3, there is shown a storage feeder 10 in accordance with the invention. Storage feeder 10 includes a frame member 12 which is adapted to be affixed to the knitting machine in any suitable manner. Frame member 12, as best shown in FIG. 2, fixedly mounts a hollowed out member 14 whose cavity 16 comprises a first section 16*a* of uniform cross section, best shown in FIG. 3, a conical second section 16*b*, and a third section 16*c* having a reduced cross section. A storage drum 18 is supported by member 14 within its cavity section 16*a*. Storage drum 18 comprises a flange 20 at its upper end, a uniform cross section main body portion 22 and a short generally conical section 24 between flange 20 and main body portion 22. As best shown in FIG. 3, cavity section 16a has an inner contour which is oval shaped and complementary to the oval shaped radially spaced confronting outer contour of storage drum main body portion 22. Accordingly, and as best shown in FIG. 2, when the storage drum is inserted within cavity 16 of its support member 14, the inner upper rounded edge 26 of cavity section 16*a* will supportingly engage conical section 24 of the drum so that the outer surface of drum portion 22 will be spaced from cavity section 16*a* with a radial gap 28 surrounding the storage drum. Also, the axial length of drum 18 is related to the dimensions of cavity 16 so as to provide a clearance 30 between bottom edge 32 of the drum and cavity 16. It will be evident that with the storage drum so supported within cavity 16 of support member 14, the mating confronting contours of storage drum and support therefor, being oval, prevents any significant relative rotation therebetween.

A tubular sleeve 34 is mounted for rotation about fixed support member 14 by means of bearings 36, said sleeve being provided with a yarn guide 38 through which yarn Y from a supply thereof can be threaded. Sleeve 34 is thus mounted for rotation about fixed support member 14 and may be driven by means of belt 40 which is in engagement with pulley 41, the latter being driven by a motor M or any other suitable driving member. Thus, tubular sleeve 34, when driven, defines a winding member whereby yarn passed through guide means 38 is wound tangentially about drum 18, at conical section 24 whereby the turns wound onto the drum advance within gap 28 towards the free end of the drum as the winding continues. The yarn stored on the drum may be withdrawn axially therefrom by the pull exerted by the knitting machine needles, and the yarn so withdrawn passes through central aperture 42 at the bottom of fixed member 14. If desired, a tensioning device 44 comprising a weighted ball 46 and socket 48 for seating said ball may be provided, to apply preselected tension to the yarn as it passes between the ball and socket on its way toward the knitting machine needles. It is apparent that though storage drum 18 is floatingly supported by member 14, being unsecured thereto, the respective contours of drum and support therefor prevents any significant rotation of the storage drum. Thus, to all intents and purposes the drum is stationary without however being required, as in the prior art, to be fixedly secured to the yarn storage device. It will also be noted that the sole physical engagement of the storage drum within the storage feeder is along conical section 24, with the yarn being wound passing between conical section 24 and upper edge 26 of support member 14. In this connection, it should be noted that storage drum 18 is preferably hollow, as shown at 49, and made of lightweight material whereby the tension applied to the yarn as it passes between the drum and its supporting member 14 is maintained at an acceptable level which does not interfere with the winding of the yarn onto the drum.

In order to control the minimum and maximum quantity of yarn to be stored on the storage drum, there is provided as shown in the embodiment of FIG. 2 within a cavity 50 in support member 14, a feeler 52 having a curved sensing portion 54 resiliently urged against the storage drum and a switch arm portion 56 terminating in an electrical contact member 58. The full lines in FIG. 2 show feeler 52 in a first position in which electrical contact 58 is in engagement with another electrical contact 60 (suitably insulated from the housing) to complete a circuit (not shown) which is operative to maintain rotation of winding member 34. In the event that the quantity of yarn stored on the storage drum reaches a predetermined maximum, sensing portion 54 assumes the dotted line position shown in FIG. 2 wherein electrical contact 58 is moved out of engagement with electrical contact 60 to interrupt the drive of winding member 34. Thus, in a manner similar to that shown in aforementioned U.S. Pat. applications Ser. Nos. 136,939 and 184,527, the maximum and minimum amounts of yarn stored on the drum can easily be controlled.

It will be understood that photo electric means and other means such as shown in said aforementioned U.S. Pat. applications Ser. Nos. 136,939 and 184,527, may be easily adapted for controlling the minimum and maximum quantities of yarn to be maintained on the storage drum regardless of the yarn demand made on the storage feeder by the knitting machine needles.

The essential feature of the present storage feeder is in the provision of a floating storage drum which, though unsecured to the storage feeder itself, and removable therefrom if so desired, nevertheless remains substantially stationary to enable yarn to be wound thereabout tangentially for subsequent removal axially. This object is accomplished by providing mating noncircular contours for the drum and its supporting member whereby to simultaneously define a radial gap therebetween to permit winding and advancing of the yarn onto the drum while preventing the drum from having any significant rotation other than incidental minute back and forth motion which does not interfere with the unimparied advancement of the yarn as intended.

In FIG. 3, the confronting contours of the drum and its fixed support are essentially oval shaped. The same result, however, can be accomplished by using other

mating confronting contours so long as they are shaped to prevent relative rotation of one with respect to the other while still defining a substantially uniform width gap between the drum and its fixed surrounding support member. Illustrations of other embodiments of the invention are shown in FIGS. 4 through 6. In FIG. 4, the contour is a multi lobe conic. In FIG. 5, the contour is a polygon and particularly a hexagon, and in FIG. 6, the contour is of a hybrid nature. In each case, however, it will be noted that a gap 28', 28'', and 28'''is provided between the storage drum main body portion 22', 22'', 22'''and its associated support 14', 14'', and 14''', respectively, of sufficient width to prevent any significant relative rotation therebetween.

FIG. 7 shows another embodiment of the invention wherein a floating drum is provided. The embodiment of FIG. 7 is substantially identical to that of FIG. 2 except only that the axial length of storage drum 18 is slightly greater in the embodiment of FIG. 7 than it is in the embodiment of FIG. 2. Accordingly, when the storage drum is inserted within cavity 16 of support member 14, the bottom edge 62 of the drum will engage and be supported by conical section 166 of cavity 16, and conical section 24 of drum 18 will be spaced from upper rounded edge 26 of cavity section 16a to define a clearance 64 therebetween for passage of the yarn as it is wound onto the floating drum. In accordance with this embodiment, the yarn being withdrawn axially from the drum passes between drum 22 and cavity wall section 16*b* on its way out of the storage device. Thus, the drum and support member 14 collectively define a tensioner for the exiting yarn making it unnecessary to provide an additional tensioning device for the exiting yarn. In this connection, it will be understood that the weight of the floating drum can be selected so as to provide the requisite level of tension on the exiting yarn.

As is the case with the embodiment of FIG. 2, the confronting contours of drum 22 and cavity section 16*a* may be oval or of other matching shape so long as the contours are such as to prevent any significant relative rotation between drum and support member 14, and a gap is provided between the drum and the support to enable unimpaired axial advancement of the yarn wound onto the drum by winding member 34.

While there is herein shown and described the preferred embodiments of the invention, it will be understood that the invention may be embodied otherwise than as herein specifically illustrated or described, and that in the illustrated embodiments certain changes in the details of construction and in the form and arrangement of parts may be made without departing from the underlying idea or principles of this invention within the scope of the appended claims.

Having thus described my invention, what I claim and desire to secure by letters patent is:

1. A filament feeding device comprising,
   a. a drum,
   b. support means for said drum,
   c. said support means comprising a housing fixed to a frame member and being open ended at one end thereof to define a cavity within which said drum is removably supported,
   d. the outer contour of said drum and the confronting inner contour of said cavity being matingly shaped so as to define a radial gap therebetween and prevent significant relative rotation between said drum and said support means; and
   e. means for winding said filament about said drum adjacent one end thereof for forming on said drum a plurality of windings which advance toward the other end of said drum within said radial gap.

2. A filament feeding device in accordance with claim 1, wherein said support means is provided with an aperture opposite said one end thereof through which the filament wound about said drum travels as it is withdrawn axially of the drum.

3. A filament feeding device in accordance with claim 2, wherein a peripheral edge is defined at said one end of said housing about said cavity and said drum is provided with a peripheral flange at one end thereof whereby said peripheral edge supportingly engages said peripheral flange for supporting said drum within said cavity.

4. A filament feeding device in accordance with claim 2, wherein said winding means comprise a tubular sleeve mounted for rotation about said support means and having yarn guide means adjacent said one end of said drum.

5. A filament feeding device in accordance with claim 4, wherein there is further provided means for detecting a predetermined quantity of filament wound onto said drum, said detecting means being operative to control the operation of said winding means.

6. A filament feeding device in accordance with claim 1, wherein said cavity includes a first and second section, extending, respectively, from said open end, said first section having said confronting inner contour and said second section being radially converging to define a seat supportingly engaging the peripheral edge at the other end of said drum.

7. A filament feeding device in accordance with claim 6, wherein said support means is provided with an aperture opposite said one end thereof through which the filament wound about said drum travels as it is withdrawn axially of the drum.

8. A filament feeding device in accordance with claim 7, wherein said winding means comprise a tubular sleeve mounted for rotation about said support means and having yarn guide means adjacent said one end of said drum.

9. A filament feeding device in accordance with claim 8, wherein there is further provided means for detecting a predetermined quantity of filament wound onto said drum, said detecting means being operative to control the operation of said winding means.

10. A filament feeding device in accordance with claim 1, wherein said contours are oval shaped.

11. A filament feeding device in accordance with claim 1, wherein said contours are polygonically shaped.

12. A filament feeding deivce in accordance with claim 1, wherein said contours are multi lobe conic shaped.

13. A filament feeding device in accordance with claim 2, wherein said drum is hollow.

14. A filament feeding device in accordance with claim 6, wherein said support means is provided with an aperture opposite said one end thereof through which the filament wound about said drum travels as it is withdrawn axially of the drum, and wherein the peripheral edge at the other end of said drum and said seat define a filament tensioner for the filament passing therebetween as it is withdrawn from the drum.

15. A filament feeding device in accordance with claim 14, wherein said drum is hollow.

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