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Deniega et al.

[11] **3,782,661**

[45] **Jan. 1, 1974**

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

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

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[21] Appl. No.: **210,492**

Related U.S. Application Data

[63] Continuation-in-part of Ser. No. 184,527, Sept. 28, 1971.

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

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

[58] **Field of Search** .....242/47.12, 47.01, 47.02, 242/47.04–47.09, 47.13; 66/132 R

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

There is disclosed a device for feeding a filament from a supply thereof to a machine wherein said filament may be used for knitting, weaving or spooling. A storage drum is fixedly mounted at one end thereof to a frame member. The filament is guided in a first direction, from a supply thereof to a position adjacent said one end of the drum, where it is wound about the drum to form a plurality of windings which advance in a second direction, opposite to said first direction, toward the other end of the drum. The filament is drawn off the drum in said second direction to the other end of the drum, where it reverses direction and travels through an internal passage in the drum, in said first direction, and through an aperture in the frame member, toward the machine requiring said filament, whereby the device operates as a storage feeder. Alternately, the filament may be unwound from the drum at the same rate as it is wound in which case the device operates as a positive feeder.

2 Claims, 13 Drawing Figures

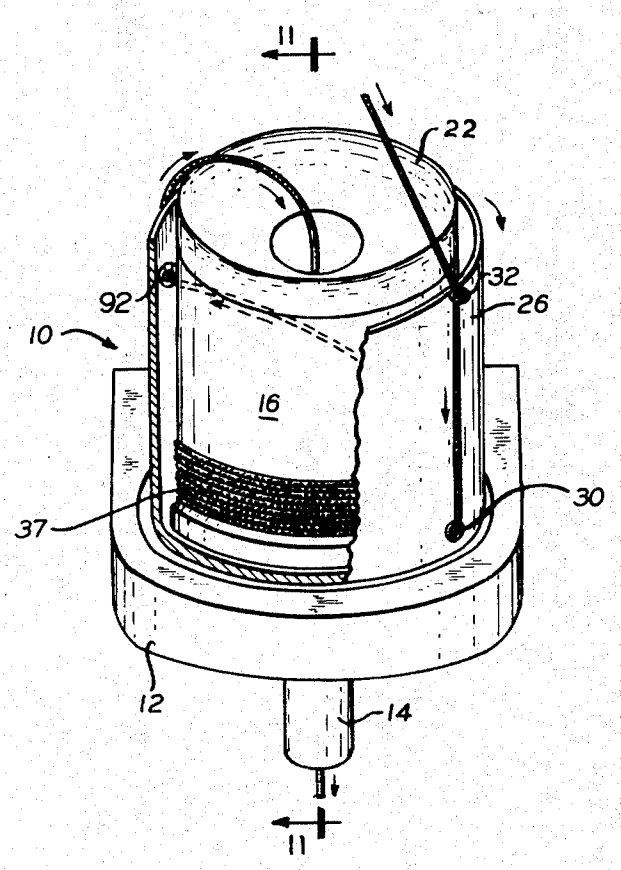


FIG. 1.

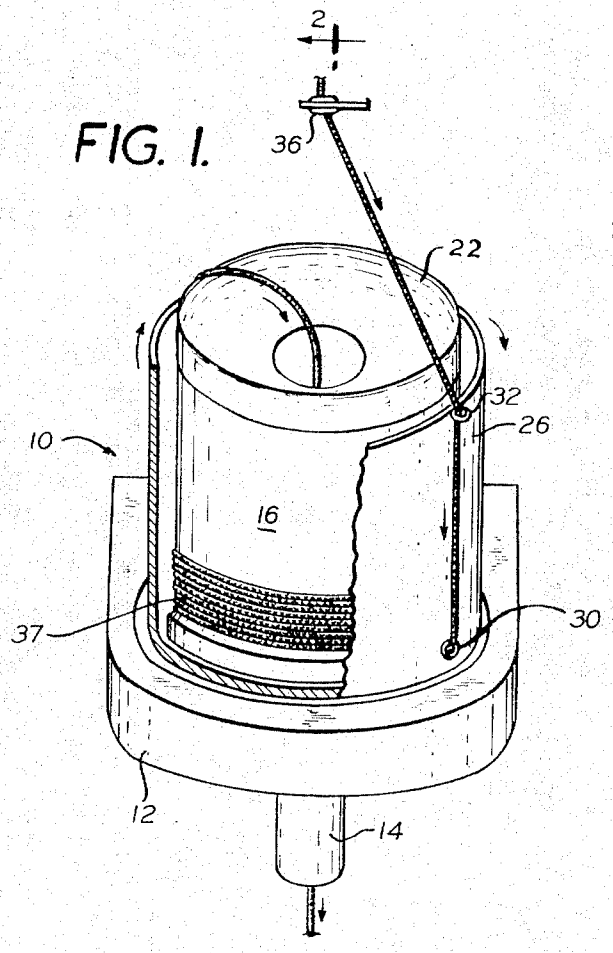


FIG. 6.

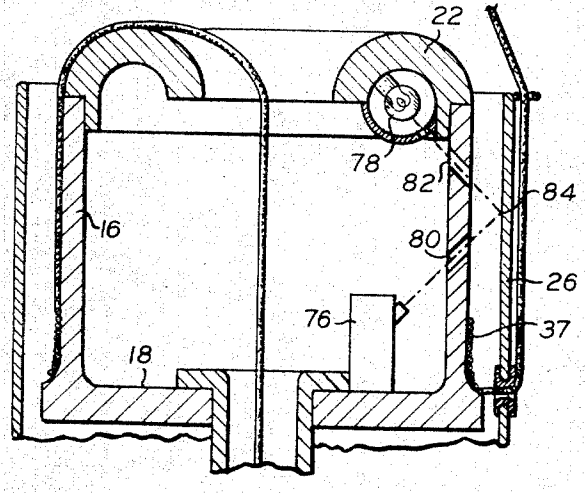


FIG. 7.

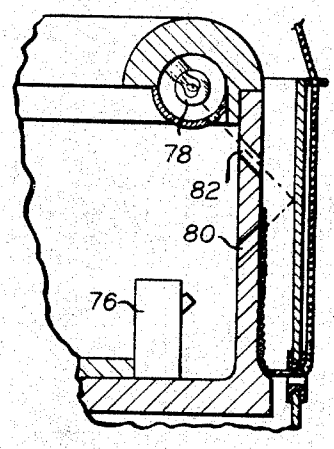


FIG. 2.

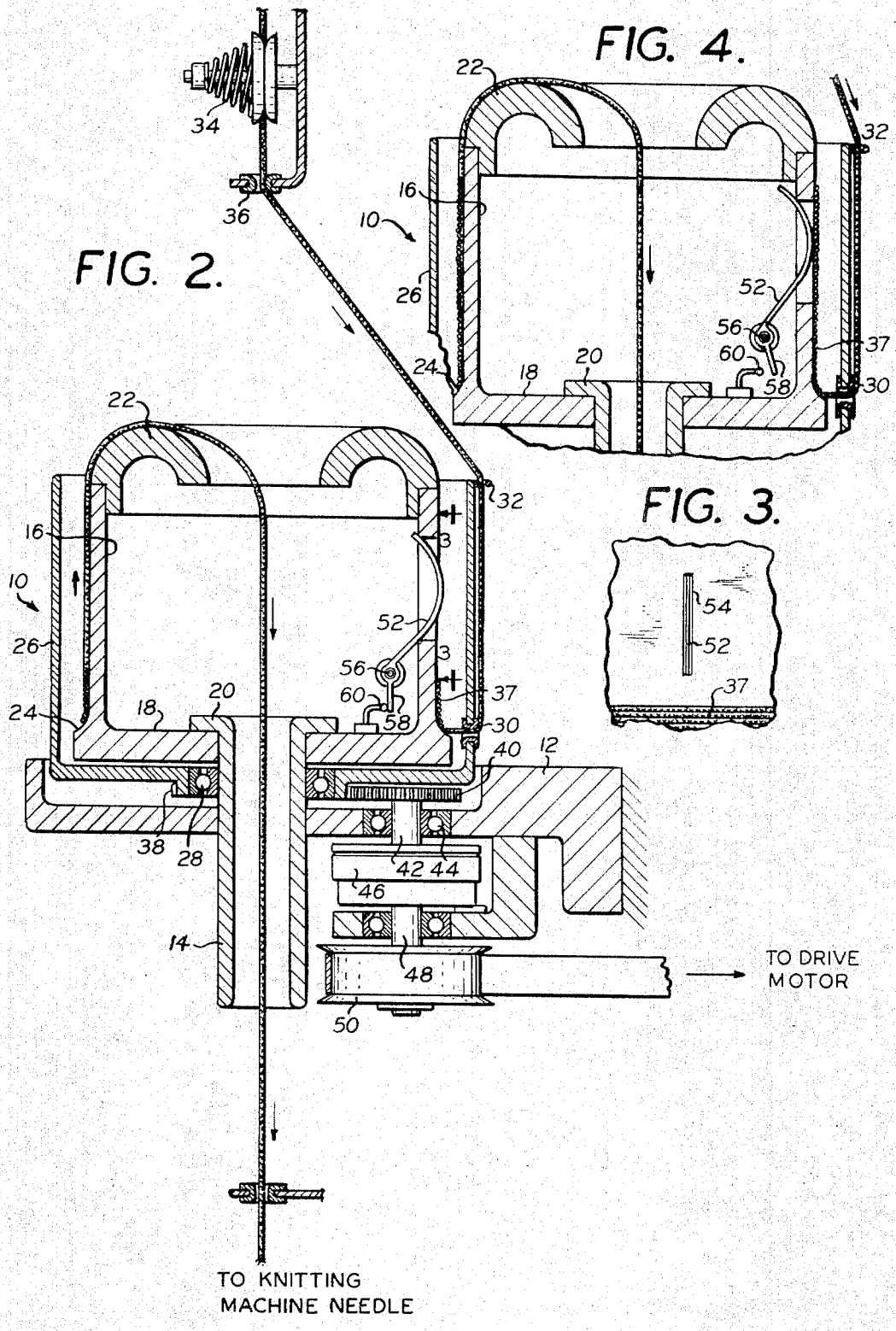


FIG. 4.

FIG. 3.

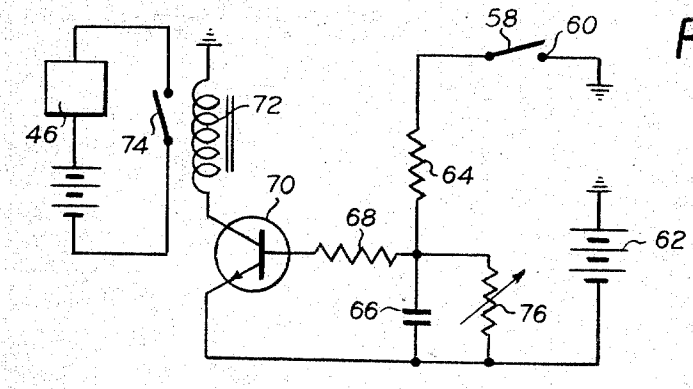


FIG. 5.

FIG. 8.

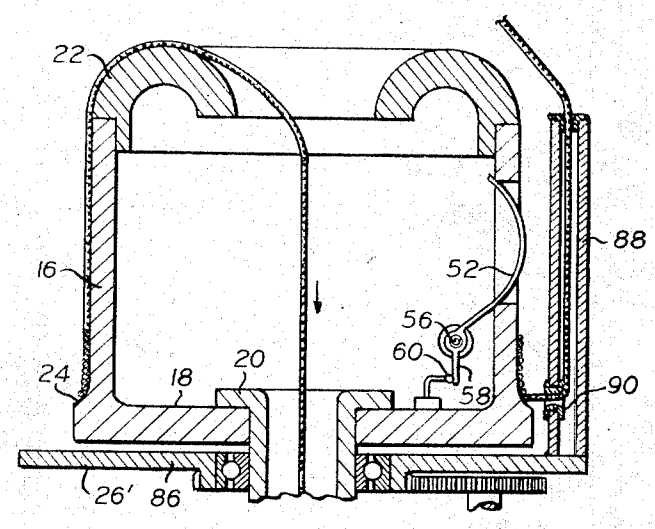
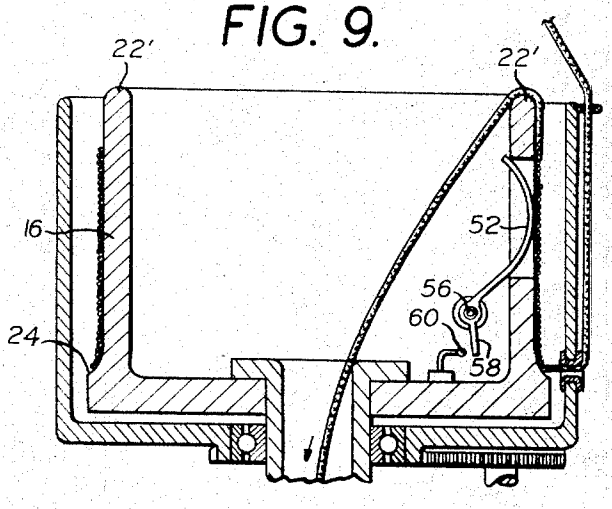


FIG. 9.



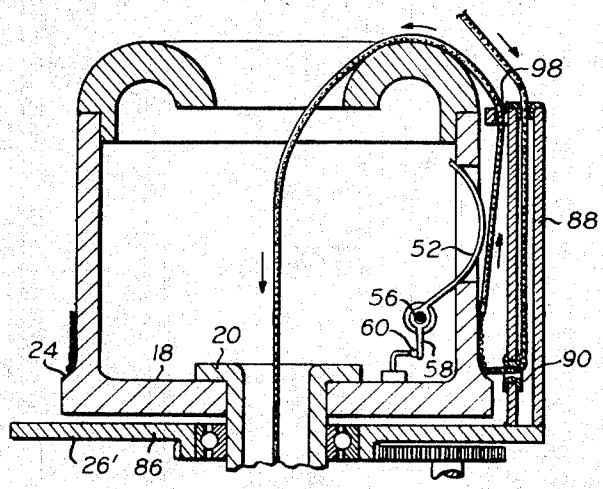


FIG. 13.

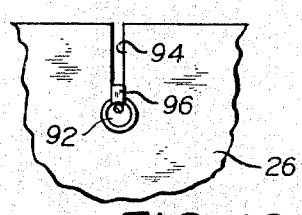


FIG. 12.

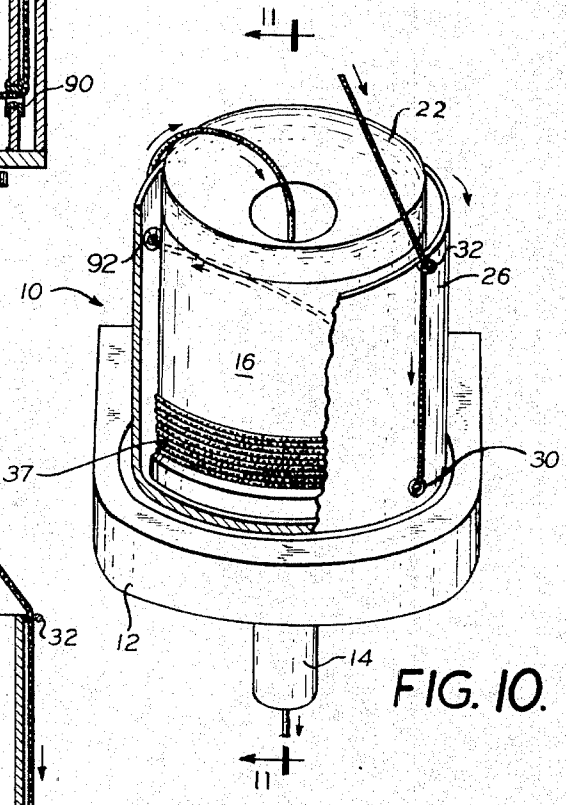


FIG. 10.

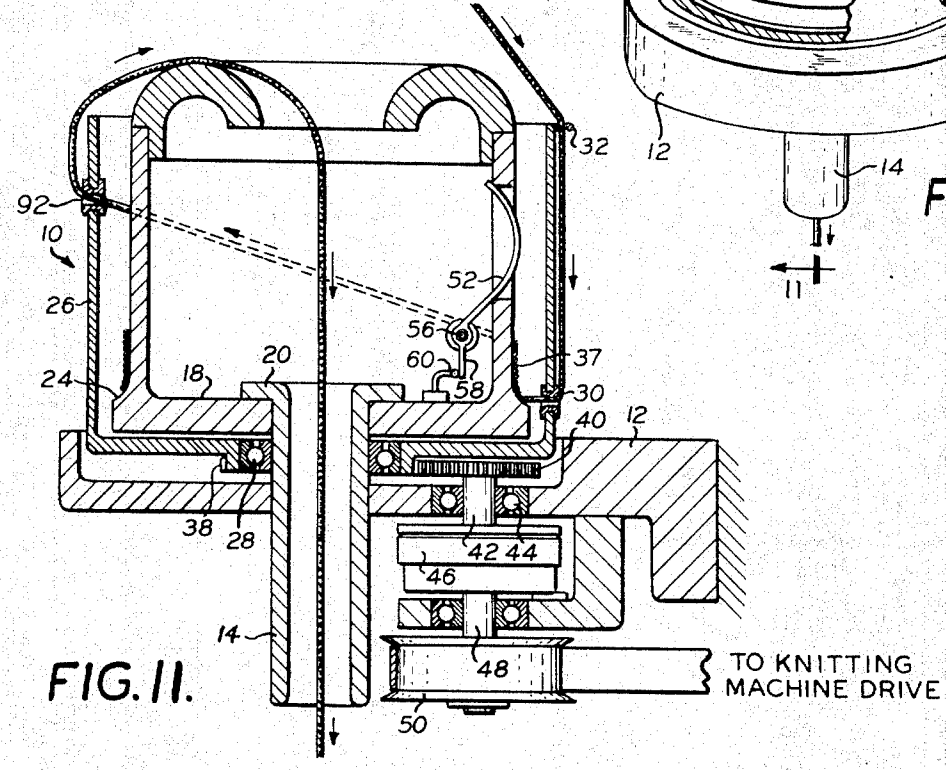


FIG. 11.

FILAMENT FEEDING AND STORAGE DEVICE

CROSS-REFERENCE TO RELATED APPLICATION

This application is a continuation-in-part of our application Ser. No. 184,527, filed Sept. 28, 1971.

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 as near zero as possible, 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

The prior art storage feeders have also proved to be less than entirely workable in other respects, including the manner in which the quantity of yarn wound onto the drum is controlled, the speed at which the drum can be rotated, the manner in which the rotational power for winding the yarn onto the drum is provided, as well as the presence of other deficiencies which affect the performance and cost thereof.

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. An example of such improved storage feeder is shown in application Ser. No. 136,939, assigned to the assignee hereof. 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 our above mentioned patent application Ser. No. 136,939, 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.

SUMMARY OF THE INVENTION

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.

In accordance with the invention, the storage drum is hollow or centrally apertured. The yarn is tangentially wound onto the drum adjacent one end thereof and, when being withdrawn, travels toward the opposite end of the drum where it reverses direction, travels through the drum, and leaves the drum in a direction opposite to the direction of movement of the accumulating yarn windings on the storage drum. Such withdrawal of the yarn by reversing its path from the outer periphery of the drum through the central aperture thereof defines a path for the yarn which does not interfere with the mounting of the storage drum at one end thereof, namely, the end adjacent which the winding takes place.

Such arrangement further facilitates the overall manner for feeding the yarn to a yarn winding element, and providing the rotational power to said winding means. In addition, the inside of the drum, which is either hollow or centrally apertured, defines a chamber for mounting the means for controlling the rotation of the

yarn winding means in order to maintain a predetermined quantity of stored yarn on the drum.

In accordance with another aspect of the invention, the storage feeder is easily converted to a positive feeder wherein yarn may be fed to a knitting machine at a fixed predetermined rate directly related to the rate of rotation of the knitting machine.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a perspective view of a storage feeder in accordance with the invention, with parts broken away for purposes of illustration;

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

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

FIG. 4 is a fragmentary view similar to FIG. 2, illustrating the operation of the switching device for controlling the storage feeder;

FIG. 5 is a schematic showing of an electrical circuit for controlling the quantity of yarn stored on the drum;

FIG. 6 is a view similar to FIG. 5 showing another means for controlling the operation of the storage feeder, in accordance with the invention;

FIG. 7 is a fragmentary view similar to FIG. 6, further illustrating the operation of the controlling means;

FIG. 8 is a view similar to FIG. 2, showing another embodiment of the invention;

FIG. 9 is a view similar to FIG. 4, showing yet another embodiment of the invention;

FIG. 10 is a view similar to FIG. 1 but showing a modification of the invention enabling use thereof as a positive feeder;

FIG. 11 is a sectional view taken along lines 11—11 of FIG. 10;

FIG. 12 is a fragmentary portion, on an enlarged scale, of a modification of FIG. 10; and

FIG. 13 is a view similar to FIG. 8 but modified to enable the invention to be used as a positive feeder.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

Referring now to the embodiments shown in FIGS. 1 through 4, numeral 10 identifies the storage feeder in accordance with the invention. The storage feeder 10 includes frame member 12 which is adapted in any suitable manner to be affixed to the knitting machine. Frame member 12 fixedly supports a tubular member 14 which, in turn, fixedly supports storage drum 16. Accordingly, when storage feeder 10 is mounted in position on the knitting machine by securing frame member 12 thereto, the storage drum 16 is fixed against any movement, rotational or otherwise. Storage drum 16, as best seen in FIG. 2, comprises a hollow cylindrical member closed at one end by wall 18 and open at its opposite end. Tubular member 14 extends through a central aperture in wall 18 and is then flanged as at 20 for securement to wall 18, in any conventional manner. It is understood that tubular member 14 and storage drum 16 could be formed as a unitary member rather than as two separate parts affixed to each other.

For reasons which will become clearer hereafter, the open end of storage drum 16 is provided with a peripheral annular member 22 of generally hemispheric cross section. Drum 16 is of generally uniform outer diameter which terminates, adjacent the closed end thereof into a generally conical section 24. A hollow cylindrical member 26 which envelops storage drum 16 is mounted for rotation about tubular member 14 by means of ball bearings 28. Cylindrical member 26 is apertured as at 30, generally confronting the conical section 24 of the storage drum. A yarn guide member 32 is provided on the outer periphery of member 26, adjacent the open end thereof. Yarn from a supply thereof (not shown) is fed through a conventional yarn tensioning device 34 past yarn guide 36, through yarn guide 32 and aperture 30 where it is in confronting relation with the conical section 24 of the storage drum. Upon rotation of cylindrical member 26, the yarn passing through aperture 30 is wound upon the conical section 24 whereby the turns 37 wound onto the storage drum gradually move towards the free end of drum 16 as rotation of cylindrical member 26 continues. While drum 16 is illustrated as having conical section 24 for advancing the windings on the drum, it will be understood that other means may be provided on the drum for advancing the yarn windings in the same direction, while still maintaining the drum, per se, fixedly mounted at one end thereof onto the frame as shown in FIG. 2. For example, the drum may be provided with portions which movably engage the yarn after it is wound thereon for advancing the windings on the drum, while the drum itself is fixedly mounted on the frame.

Withdrawal of the yarn from the storage drum 16 is effectuated as best illustrated in FIGS. 1 and 2, where the path of withdrawal is shown by the arrows. More specifically, under the pull exerted by the knitting machine needles, the yarn stored on drum 16 travels along the outer periphery of the storage drum towards its open end, around annular member 22 whereat the yarn reverses direction, through the hollow storage drum and the path defined within tubular member 14, and towards the knitting machine needles which exert the pull on the yarn.

It is seen, therefore, that cylindrical member 26 defines the means for winding the yarn about the fixed storage drum. In order to provide rotation for cylindrical member 26, it is provided with a gear 38 in mesh with gear 40 mounted for rotation on a shaft 42 supported in frame 12 by means of ball bearings 44. A magnetic clutch 46 carried by the frame is adapted, when energized, to interconnect shaft 42 with a shaft 48 which carries belt driven pulley 50. Accordingly, upon energization of magnetic clutch 46, as more fully discussed below, rotation of pulley 50 is transmitted to winding means 26 through the intermediary of meshing gears 38 and 40.

In order to control the minimum and maximum quantity of yarn to be stored on the storage drum, there is provided a feeler 52 resiliently urged outwardly of storage drum 16 through slot 54, as best shown in FIG. 3. Feeler 52 is mounted for pivotal movement as at 56 and is provided with a tail portion 58 movable therewith but electrically insulated therefrom. When feeler 52 projects through slot 54, (when such slot is not covered by yarn windings 37 as shown in FIG. 2,) tail portion 58 is in engagement with a contact element 60 secured to wall 18 of the storage drum. As the yarn is wound onto the storage drum, advancing the yarn windings 37 in an axial direction towards the open end of the storage drum, the leading windings will cover slot 54, thereby urging feeler 52 inwardly, as best shown in FIG. 4, in which condition the pivotal movement of feeler 52 causes displacement of tail portion 58 from its engagement with contact element 60. When the wind-

ings are removed from the storage drum, and expose slot **54**, feeler **52** will again be urged outwardly causing renewed contact between tail portion **58** and electrical contact **60**. Thus it is seen that tail portion **58** and electrical contact **60** collectively define a switch whose opening and closing is a function of the yarn stored on the storage drum.

The operation of the switch defined by tail portion **58** of feeler **52** and electrical contact element **60** mounted on grounded storage drum **16** is shown in circuit diagram, FIG. **5**. In accordance with this circuit, the closing of switch **58–60** provides current flow from positive terminal of DC supply **62** which is grounded, to contact element **60** which is equally grounded, through feeler tail portion **58**, limiting resistor **64**, charging condenser **66**, and back to negative terminal of DC supply **62**. There is also a current path established through resistor **68**, the triggering leg of transistor amplifier **70**, and back to the negative terminal of DC supply **62**. Such current flow through the triggering circuit of transistor amplifier **70** renders the latter conductive with current flow as follows: from grounded positive terminal of DC supply **62**, to grounded terminal of relay **72**, through transistor amplifier **70**, and back to negative terminal of the DC supply. The resulting energization of relay **72** closes a pair of contacts **74** to energize magnetic clutch **46**, causing winding means **26** to rotate about the drum to provide additional yarn thereon. As the winding of additional yarn onto the drum continues, ultimately reaching slot **54**, the yarn will urge feeler **52** inwardly causing the opening of switch **58–60**. This, however, will not immediately interrupt the conductivity of transistor amplifier **70** since the charge on condenser **66** will discharge into the triggering circuit of transistor amplifier **70** to maintain current flow therethrough and through relay **72** for a predetermined period of time during which the magnetic clutch will remain energized and winding means **26** will continue to wind. Thus, the circuit in FIG. **5** defines a time delay which determines the amount of yarn to be wound onto the drum following the opening of switch **58–60**. Accordingly, the use of feeler **52** in cooperation with the time delay circuit of FIG. **5** defines with great precision the minimum and maximum quantities of yarn provided on the drum at all times. Variable resistor **76** provides an alternate path for the discharge of condenser **66** whereby the time delay can be adjusted as may be desired. The use of this arrangement provides for much greater control and flexibility in the utilization of the storage feeder. FIG. **4** shows the condition of the storage feeder upon expiration of the time delay, in which condition a predetermined maximum amount of yarn has been stored on drum **16**.

While FIG. **5** illustrates an electronic time delay circuit for selectively controlling the amount of yarn wound on the drum, such time delay can be obtained, within the scope of this invention by other types of electrical or electronic circuits, as well as by mechanical or thermal means, all of which can provide a selective and adjustable time delay for the aforementioned purposes.

FIGS. **6** and **7** illustrate another means for controlling the minimum and maximum quantity of yarn to be stored on the storage drum. More specifically, the fixed storage drum **16** is provided adjacent end wall **18** thereof with a photocell **76** and at the opposite end thereof, within the hollowness of annular member **22**, with a light source **78**. Fixed drum **16** is provided with a pair of angularly extending slots **80** and **82**, the axes of which intersect at a point **84** along the inner surface of winding means **26**. In this connection, it is understood that the inner surface of winding means **26** is generally light reflecting and, since winding means **26** is adapted to rotate, point **84** defines a circle along the inner periphery of said winding means. In accordance with the arrangement of FIG. **6**, the light rays emanating from light source **78** will be reflected off the inner surface of winding means **26** and impinge upon photocell **76** to activate the latter. Thus, elements **76-78** define a switch which is the equivalent of previously described switch **58–60** in FIG. **5** operating in precisely the same manner. When the added turns wound onto the storage drum cover slot **80**, as shown in FIG. **7**, photocell **76** will be rendered non-conductive, in effect opening the switch defined by **76–78**, to produce the same result as obtained by the opening of switch **58–60** in FIG. **5**.

As described herein, winding means **26** comprises a hollow cylindrical member which envelops a major part of the storage drum. Such arrangement has been found desirable because it prevents any entanglement between the winding means, which rotates intermittently, and the yarn wound onto the drum and travelling during its withdrawal from the drum. More specifically, the rapid rate of withdrawal of the yarn may, under certain circumstances, provide a ballooning effect, and, with the arrangement described above, any ballooning yarn engages the smooth inner surface of the winding member, thus preventing any undesirable entanglement.

From a functional standpoint, however, winding of the yarn about fixed drum **16** could be accomplished, as shown in FIG. **8**, wherein winding element **26'** comprises a rotating disk **86** provided with a longitudinally extending tubular yarn guide **88**. In such embodiment, the yarn from the yarn supply passes through tubular member **88** and out of aperture **90** which condronts conical section **24** of the storage drum. Rotation of winding means **26'** is accomplished precisely in the same manner as previously described in connection with winding means **26** for winding the yarn onto the storage drum. Such arrangement can be as effective as that shown in the embodiment of FIG. **2** where the speeds involved and spacing between winding means and fixed drum are such that no entagnlement is likely to occur.

As has been shown in the embodiments of FIGS. **1** and **2**, annular member **22** defines the means for guiding the yarn during the reversal of its direction as it is withdrawn. Accordingly, annular member **22** has a smooth outer surface which is shaped so as to provide the change of direction to the yarn in a gradual manner. Furthermore, annular member **22** also controls the path of the yarn inside the drum, thereby defining within the hollowness of the storage drum a chamber free and clear from the path of movement of the withdrawn yarn. Such chamber is desirable as it provides the room for mounting the means for sensing the quantity of yarn on the storage drum as shown in FIGS. **2** and **6**. It will be understood however, that, from a functional standpoint, the outer rim of the storage drum, as best shown in the embodiment of FIG. **9**, could be sufficiently smooth and have sufficient curvature as shown at **22'** to satisfactorily guide the yarn during its reversal as it is being withdrawn. As shown in FIG. **9**, such ar-

rangment would still provide sufficient room inside drum **16** for mounting feeler **52** and its associated mechanism.

The most salient feature of the subject invention, present in all the embodiments described and illustrated herein, is the provision of a storage drum which is absolutely stationary by fixedly mounting it directly onto the frame. Such arrangement has heretofore not seemed possible because of the resulting problems of entanglement of the yarn either prior to its winding onto the drum, during its withdrawal from the drum, or both. This has been resolved in accordance with all the embodiments of the present invention by regulating the path of travel of the yarn in such a way that there is no possible interference with the travel of the yarn, while still maintaining the drum fixed in a most effective and most economical manner, namely, by fixing one end thereof to the frame. In this connection, reference is made to FIG. **1** from which it is clear that the yarn which is fed from beyond the free end of the drum is guided by the winding means **26** (or **26'**) to the end of the drum which is secured to the frame. As the winding means rotate about the stationary drum to form the stored windings upon the drum, there is clearly no interference from the yarn supply, nor any problem created by the fact that the end adjacent which winding takes place is fixed, since the windings, as they are formed, move as a body towards the free end of the drum. As the yarn is withdrawn, it is evident from FIG. **1** that it moves along the outer periphery of the drum in a path which is clearly spaced and thus in non-interfering relation with the yarn supply. When the yarn reaches the free end of the drum, it reverses direction and passes internally of the drum, through an aperture in the frame, as it is being pulled by the needles. Thus, the final path of the withdrawing yarn is totally removed from the yarn supply, and from the rotating winding means, without however creating any problem in withdrawing the yarn from the feeding device, directly through the frame, in a direction opposite to the direction of yarn supply, as desired, for normal operation of the storage feeder.

The simplicity of construction and of operation render the subject invention highly effective as well as extremely economical. Further, and with reference to FIG. **2**, it will be noted that the arrangement of the subject storage feeder is such that drive means for winding means **26**, or **26'**, are easily provided directly onto the side of the frame member, opposite the side which carries the winding means and storage drum, again without interference with the yarn supply or the withdrawn yarn, since the latter exits the feeding device through tubular member **14**, and is thus isolated from the drive means. It will be noted, with reference to FIG. **2**, that instead of using belt driven pulley **58** for driving winding means **26**, through magnetic clutch **46**, the shaft **48** can be connected directly to a drive motor, or to another type of clutching means.

While the embodiments of FIGS. **1–9** have been described in connection with yarn being fed to a knitting machine, the same embodiments are applicable for use in connection with yarn or filament being fed to weaving apparatus or to a spooling machine. In this connection the "yarn" or "filament" referred to herein may be made of natural or synthetic fibers or may be metallic.

It will also be noted that in all the embodiments of FIGS. **1–9**, the filament travels in a first direction (downwardly viewing FIGS. **1** and **2**) toward a position adjacent the end of the drum which is fixedly mounted, at which end the filament is wound onto said drum forming windings which advance in a second direction, opposite the first direction (upwardly viewing FIGS. **1** and **2**). The wound filament is then drawn off and proceeds in the second direction up to the other end of the drum, where it reverses direction, travelling through the internal passage of the drum and an aperture in the frame member, thereby proceeding again in the first direction towards the machine to which the stored filament is fed. In this connection, it will be understood that the characterization of the first and second direction as used herein is not limited to geometrically linear directions which are precisely 180° apart from each other but directions which are generally opposed to each other, such as upwardly and downwardly as shown in the illustrated embodiments, or from left to right and from right to left if the device of FIG. **1** were mounted so that the axis of the drum was horizontal instead of vertical.

The embodiments of FIGS. **1** through **9** illustrate the invention used as a storage feeder wherein a predetermined quantity of filament is always available to be withdrawn axially of the storage drum at a rate and at intervals such as may be demanded by the machine requiring such filament. Certain knitting applications, however, require positive feeding of yarn, i.e., the continuous feeding of yarn at a predetermined rate which is directly proportional to the speed of the knitting machine. An example of a positive yarn feeding device is shown in U.S. Pat. No. 3,090,215 wherein the yarn fed to the knitting machine passes between a roller and a tape whose linear speed is directly related to the speed of the knitting machine.

In accordance with the present invention, the feeding device described in FIGS. **1** through **9** is easily converted to a positive feeding device as best shown in FIGS. **10** through **13**. In FIGS. **10** and **11**, there is shown a filament feeding device identical in all respects to that shown in FIGS. **1** and **2**, except only for the provision in cylindrical member **26**, the filament winding member, of an aperture **92** through which the filament leaving the drum passes before entering the passage within the storage drum **16**, as shown. Accordingly, it is clear that member **26** which winds the yarn onto one end of drum **16** simultaneously unwinds the yarn passing through aperture **92**, and at exactly the same speed. Thus, yarn is being fed to the knitting machine at a fixed and uniform rate, since the presence on the drum of a plurality of yarn windings prevents any slippage thereof. Since in any positive yarn feeding application the rate of yarn supply is related to the rotation of the knitting machine, pulley **50** is belt or tape driven by drive means directly related to the rotation of the knitting machine. It will also be understood that when the device operates as a positive feeding device, member **26** must be continuously rotating, with the yarn being tangentially wound onto the drum at exactly the same rate as it is being unwound by the drum, while maintaining constant the amount of yarn on the drum. Such continuous rotation will prevail by unwinding the yarn from the drum when the number of windings thereon is insufficient to activate feeler **52**, as shown in FIGS. **10** and **11**. Continuous rotation can also be maintained by providing in the circuitry of FIG. **5** a switch across switch **58–60** which is closed when the device is in-

tended to operate as a positive feeding device thus shorting out switch **58–60** and maintaining magnetic clutch **46** continuously energized throughout the operation of the feeding device as a positive feeder.

Thus, it is seen that by merely threading the withdrawing yarn through aperture **92** in the winding member and maintaining continuous rotation of winding member **26,** the storage feeder of FIGS. **1** and **2** has been converted to a positive yarn feeding device. In this connection, it will be noted that aperture **92** may be provided with a narrow slit extending to a peripheral edge of the winding member to enable threading through aperture **92** without breaking the yarn, with the mouth of the slit being appropriately closed by plug **96** after threading has been effectuated as shown in the modification of FIG. **12.**

It will be noted that the general filament path when the device is used as a positive feeder is similar to the path of the filament when the device is used as a storage feeder, wherein there is no interference between the yarn supply to be wound onto the drum and the yarn being unwound from the drum. While aperture **92** is shown in FIGS. **10** and **11** as situated diametrically opposite to yarn guide member **32,** such is not necessary as the two may be situated in much greater proximity to each other without creating any entanglement or interference.

Referring now to FIG. **13,** there is shown an embodiment similar to FIG. **8** wherein winding member **88** is provided at its free end with an inner guide aperture **98** through which the yarn is fed for converting the embodiment of FIG. **8** into a positive feeding device. In such embodiment, though the yarn being wound is in close proximity to the yarn being unwound by winding means **88,** there is no entanglement therebetween.

Thus, it is seen that the novel filament feeding device in accordance with all of the preferred embodiments are easily convertible from a storage feeder in which the stored yarn is withdrawn axially or endwise into a positive feeding device in which the filament is positively unwound at a uniform rate.

While there is herein shown and described the preferred embodiments of the invention, it will be undetstood 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 our invention, what we claim and desire to secure by letters patent is:

1. A device for positively feeding yarn from a yarn package to a textile producing machine, comprising:

a. a frame adapted for securement to said machine,

b. a yarn storage member,

c. support means having a passage therethrough fixedly mounted on said frame means and having secured thereto said storage member with one of its ends proximate to said frame member and the other of its ends distal thereto, whereby said storage member is fixed against rotation relative to said frame member,

d. yarn winding means mounted for rotation on said support means between said frame member and said storage member, and having first yarn guide means for winding said yarn about said storage member adjacent said one end thereof, for forming on said storage member a plurality of yarn windings which advance toward the other end of the storage member, said yarn being withdrawn from said yarn package in response to the rotation of said yarn winding means,

e. said yarn winding means having second yarn guide means spaced from said first means and movable in unison therewith for unwinding said filament at the same angular velocity as the winding velocity,

f. said storage member having an internal passage in communication with the passage through said support means whereby the yarn unwound from said storage member travels toward the other end of said storage member, reverses direction, and enters said passages in said storage member and said support means, respectively, as said yarn is delivered to said machine,

g. said yarn winding means comprising sleeve means extending axially of said storage member and substantially covering the yarn windings on the drum, and said first and second yarn guide means being adjacent the opposite ends, respectively, of said sleeve means.

2. A device in accordance with claim **1** wherein there is further provided means carried by said frame member for rotating said yarn winding means.

* * * * *

UNITED STATES PATENT OFFICE
CERTIFICATE OF CORRECTION

Patent No. 3,782,661 Dated January 1, 1974

Inventor(s) Jose Castillo Deniega and Edward M. Tellerman

It is certified that error appears in the above-identified patent and that said Letters Patent are hereby corrected as shown below:

Column 10, line 41, "drum" should read -- storage member --.

Signed and sealed this 30th day of July 1974.

(SEAL)
Attest:

McCOY M. GIBSON, JR.
Attesting Officer

C. MARSHALL DANN
Commissioner of Patents

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