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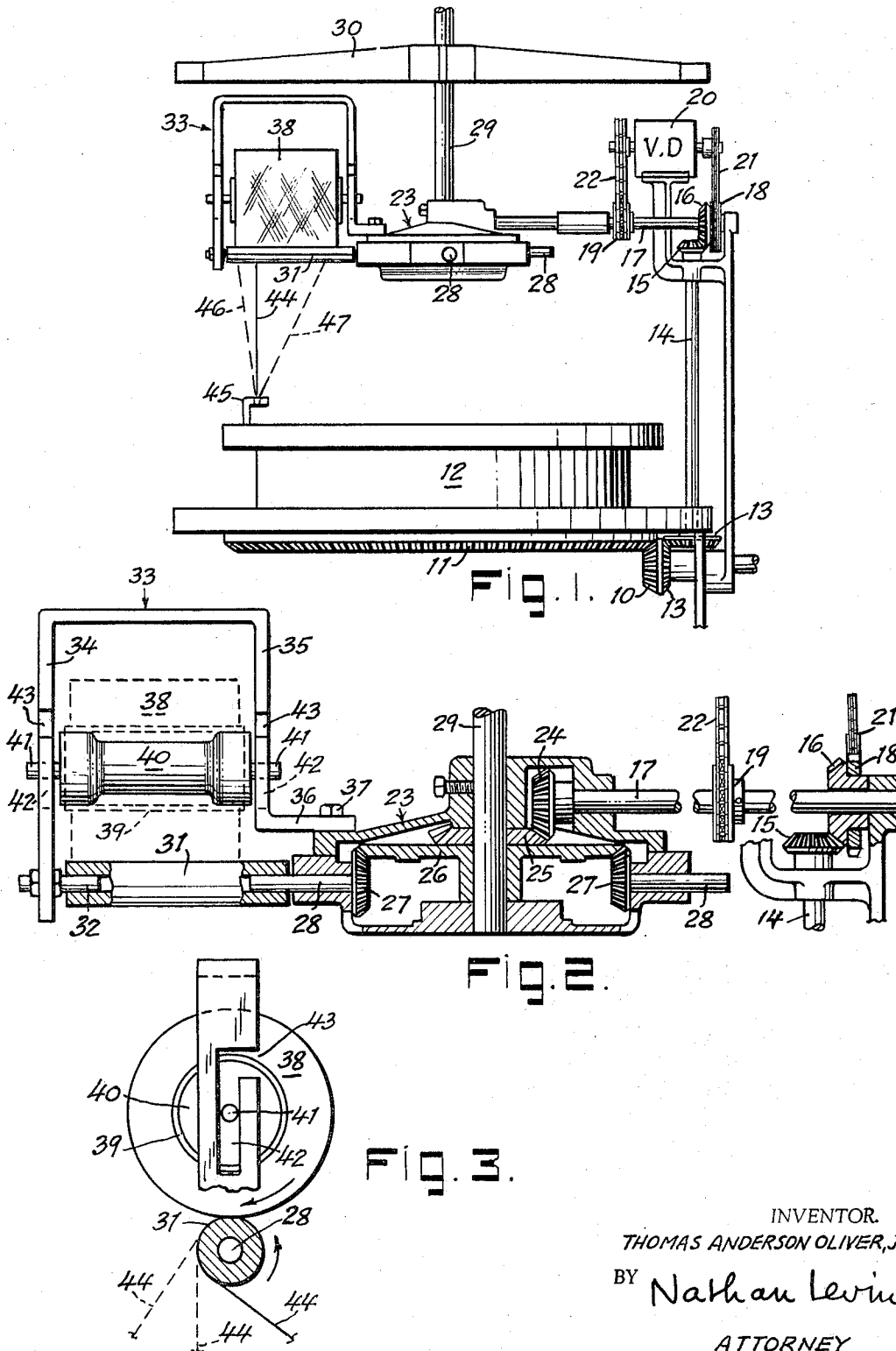
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YARN FEEDING MEANS FOR KNITTING MACHINES

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2 Sheets-Sheet 1



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YARN FEEDING MEANS FOR KNITTING MACHINES

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13 Claims. (Cl. 66—132)

This application is a continuation of my application Serial No. 326,112, filed November 26, 1963, now abandoned, and which is a continuation-in-part of my application Serial No. 233,257, filed October 26, 1962, also now abandoned.

The present invention relates generally to the art of knitting and more particularly to means for feeding yarns of the spandex type to knitting machines. It also relates particularly to apparatus utilizing a well known yarn feeding means whereby the latter may be adapted to feed yarns of the spandex type to knitting machines.

Spandex yarns, examples of which are yarns presently known in the art as Vyrene and as Lycra, being inherently elastic, with a extensibility factor of 600 to 800 percent under relatively light tension, are extremely difficult to feed to knitting machines in such manner that satisfactory fabrics may be produced, whether the spandex yarns are incorporated alone or are incorporated with other yarns in the fabrics.

It is an object of the present invention to cause spandex yarn to be fed from its yarn package to the needles of a knitting machine by the provision of means to rotate said package to unwind the yarn therefrom. The yarn package, cylindrical in form, is rotated by contact with a rotating roller the regulated speed of which determines the rate at which the spandex yarn is unwound from its package. At the same time it also determines the tension or the amount of attenuation in the unwinding yarn. The unwinding yarn, which constantly traverses its package and drive roller, is in peripheral contact with said roller and is adapted to extend in a straight line direction therefrom to a yarn carrier of a feed of the machine.

It is also an object of the present invention to utilize portions of the yarn furnishing means shown in United States Patent No. 1,581,093 to rotate the unwinding rollers of the present invention, the latter rollers replacing the gears 56 on the spindles 59 of the said patent and being rotated thereby.

It is a further object of the present invention to provide a common unwinding roller for a plurality of spandex yarn packages whereby the yarns unwound therefrom are adapted to be fed to a plurality of feeds of a circular knitting machine.

The above and other objects of the present invention will be apparent from the following detailed description of a pair of preferred embodiments thereof to be read in connection with the accompanying drawings, and from the appended claims.

FIG. 1 is a front elevational view of portions of a multiple feed open top circular knitting machine of the well known Wildman type with the spandex yarn feeding means of the present invention applied thereto.

FIG. 2 is an enlarged view, partly in section, of the upper portion of the machine of FIG. 1 showing the yarn feeding means of the present invention and the drive means therefor.

FIG. 3 is an end elevational view of a package of spandex yarn positioned in its supporting cradle or bracket in driven contact with package unwinding drive roller.

FIG. 4 is a front elevational view of portions of a multiple feed circular rib knitting machine with a second embodiment of the yarn feeding means of the present invention applied thereto.

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FIG. 5 is a schematic view of the machine of FIG. 1 showing the relative disposition of a plurality of spandex yarn packages, the common unwinding roller therefor, and the feeds of the machine.

FIG. 6 is a side elevational view of one of the supporting cradles for the spandex yarn packages shown in FIG. 4.

FIG. 7 is a cross-sectional view of the cradle of FIG. 6 as taken on line 7—7 thereof.

A first embodiment of the spandex yarn feeding means of the present invention is shown in FIGS. 1, 2 and 3 wherein it is applied to an open top multiple feed spring needle circular body fabric knitting machine of the Wildman type, although it is to be understood that the invention is not limited thereto and may be used with any of the usual types of knitting machines including hosiery machines. This type of Wildman machine is often provided with yarn feeding or furnishing means of the kind disclosed in the United States Patent No. 1,581,093, of April 13, 1926, to K. Howie, wherein a pair of gears (for each feed) is adapted to positively draw off yarn from a cone or cones thereof and to supply the same at a predetermined rate of yarn feed to the needles. This first embodiment has been devised to be used in connection with portions of the means shown in the said Howie patent and this has been accomplished even though the principle of the yarn feeding means of the present invention and that of the Howie patent are entirely different.

Referring to the said patent and to the reference characters used therein, the driven bevel gear 34 drives the large ring bevel gear 35 (to rotate the needle cylinder inside cam ring 1) while bevel gears 33, 33 through vertical shaft 32 and bevel gears 31, 31 acts to drive the horizontal shaft 30. The shaft 30 acts through intermediate gearing, inside the housing 24, to drive the four spaced bevel gears 60 to thereby cause their attached spindle shafts 59 to turn, the latter extending radially outwardly of the housing 24. A gear 56, fast on each shaft 59, in engagement with companion gearing acts to draw yarns *a* and *a'* from the cones thereof to feed them through yarn carrier 2 to the needles of the machine. The spindles 59 as well as the supporting and driving means therefor are utilized in the first embodiment of the present invention as will become apparent from the following description thereof in connection with FIGS. 1, 2 and 3 of the present drawings.

In this first embodiment, FIG. 1, a driven bevel gear 10 drives a large ring bevel gear 11 to rotate the needle cylinder inside the cam ring 12. Bevel gears 13, 13, one rotating with bevel gear 10 and the other fixed on an upright shaft 14, act to drive the latter and a bevel gear 15 fixed on the upper end thereof. The gear 115 then drives a bevel gear 16 which rotates freely on the horizontal shaft 17. (In the Howie patent his similar gear 31 is fixed to his similar shaft 30.) A first toothed chain sprocket 18 is fixed to gear 16 and a second toothed chain sprocket 19 is fixed to shaft 17 in spaced relation to gear 16. The sprocket 19 and shaft 17 are driven by the sprocket 18 through a suitably supported speed change drive 20, of any suitable type, by means of an endless chain 21 trained over sprocket 18 and over an input sprocket of speed changer 20 and by means of an endless chain 22 trained over an output sprocket of speed changer 20 and over the sprocket 19. Shaft 17, FIG. 2, extends into a housing 23 wherein a bevel gear 24 is fixed thereto. The bevel gear 24, via bevel gears 25 and 26, drives four equally circumferentially spaced bevel gears 27, the latter each being fixed on and driving a horizontally disposed spindle shaft 28 extending radially outwardly from the housing 23. The housing is fixedly supported by a vertical member 29, the latter being fixedly supported by a stationary frame 30 forming part of the machine. While four of the spindles 28 are indicated in the present draw-

ings, it will be understood that the Wildman machines may be supplied with a greater number thereof depending upon the number of feeds on the machine.

Each of the rotating shafts 28 has one end of a relatively long tubular roller 31 of relatively small diameter placed thereover and fixed thereto while its other end is adapted to be rotatably supported on a fixed pin 32 extending therein. Also associated with each shaft 28, is a generally inverted U-shaped bracket 33 having an outer vertical leg 34 and an inner vertical leg, the latter having a portion of its free end extending horizontally as at 36 by means of which bracket 33 may be suitably secured to the housing 23, as by a bolt 37 extending through 36 into threaded engagement with housing 23. The free end of leg 34 is of sufficient length to provide a base to which the pin 32 is suitably fixedly secured. Each bracket 33 is directly over each roller 31 and extends radially of the machine.

The bracket 33 provides a supporting cradle for a generally cylindrically shaped spool wound package of spandex yarn 38, the yarn of which is diagonally wound back and forth along and on an inner sleeve 39 forming part of the yarn package itself. A cylindrical core 40, to be placed inside sleeve 39, is provided with axially aligned oppositely outwardly extending pins 41, 41. The legs 34, 35 of bracket 33, FIG. 3, are each formed with a vertically extending slot 42 within which the pins 41, 41 of the core 40 may be placed, entrance to the upper ends of the slots 42 being afforded by transverse openings 43 in the legs 34, 35. In this manner, after each yarn package is mounted on a core 40, it is inserted in a bracket 33 to be cradled therein, by placing pins 41 of its core 40 in slots 42, FIGS. 2 and 3, and, since pins 41 are free to rotate and to move vertically in the slots 42, the yarn package assembly is also free to rotate within and to move vertically of the bracket 33. Each yarn package 38 rests upon and is frictionally rotated by its roller 31 to unwind yarn therefrom at a constant rate of feed as determined by the peripheral speed of the roller. As the yarn is unwound, each package moves downwardly in each bracket 33 as permitted by its slots 42, 42.

It is preferred, FIG. 3, that the unwinding spandex yarn, indicated at 44, be arranged to be fed from the line of contact between its yarn package and roller 31, so that it may be in peripheral contact with the surface of rotating roller 31 on its way to the needles, its path being in a substantially straight line direction thereto. This will serve to insure that the yarn unwinds properly in that it will act to overcome the tendency of the yarn to stick to the surface of the yarn package and to move therewith. The extent of such peripheral contact between roller 31 and the spandex yarn will depend upon the direction the yarn takes as it leaves said line of contact and is fed to the needles and this will depend upon the relative disposition of each feed and its associated bracket 33. With the yarn 44 fed in the direction shown by full lines in FIG. 3 there is more of said peripheral contact than when it is fed in the directions shown in dotted lines.

The FIG. 1 shows a spandex yarn 44 being fed directly from an unwinding yarn package 38 to a yarn carrier 45 (from which it is taken by the needles of the machine) of one of the feeds or knitting stations of the machine, the yarn being preferably free of friction producing contact with any other part of the machine, although a stop motion may be associated with it it is so desired. Also it may pass over direction changing non-friction producing rollers, as may sometimes be desirable. Inasmuch as the spandex yarn is diagonally wound back and forth along its tube 39 in forming the yarn package, it follows that the unwinding yarn constantly moves back and forth along the yarn package and the roller 31 as it is being fed to the needles. Since each point along roller 31 (considering only that portion thereof in contact with package 38) is variously distant from the yarn carrier, it follows that the length of yarn 44

extending therebetween varies accordingly as the yarn traverses the roller 31. This may be observed in FIG. 1 where the shortest length of yarn 44 is shown in full lines while other lengths thereof are indicated at the ends of roller 31 by dotted lines 46 and 47. With no slippage between roller 31 and package 38, and a constant rate of feed of yarn 44, it follows that the spandex yarn extends and contracts (with according change of tension therein) as it traverses roller 31. While ordinarily the above described yarn feeding method would not be workable to produce satisfactory fabrics of non-stretch yarns or even of ordinary elastic yarns of rubber or the like, due to the line and point relationship between roller 31 and yarn carrier 45, nevertheless, I have discovered that the present yarn feeding method and means as used for spandex yarns permits the machine to produce satisfactory fabrics thereof. In the case of spandex yarns, the changes in tension therein as a result of the changes in elongation thereof as caused by the present feeding means, is so little in comparison to its great range of extensibility, that such changes are not even apparent in the fabrics knit therefrom.

It will be apparent that the speed of rollers 31 may be varied by means of the variable speed drive 20 to vary the rate of feed of the spandex yarn to thereby vary the feeding tension thereof, as may be required for various types of fabrics. It will also be apparent that the member 20 may be replaced with fixed ratio gearing to provide for a pre-determined speed of rollers 31.

A second embodiment using the principle of the present invention, is shown in FIGS. 4 through 7 wherein spandex yarn feeding means is applied to a multiple feed circular rib body knitting machine. The machine is provided with a base plate 50 within which is housed a ring gear 51 (to rotate the cylinder) and from which there are upstanding superstructure supporting members 52, 52, the latter having a plurality of radially extending yarn-cone-arms 53, 53 attached thereto to support yarn cones 54, 54 thereon.

In this embodiment, each assembly of yarn package and core is the same as in the first embodiment and primed reference characters have been used therefor, the spandex yarn packages at 38', the yarns leading therefrom at 44', the core at 40' and its pins at 41'. Series of aligned yarn packages are disposed on opposite sides of the machine outside the periphery thereof, FIG. 5, in generally spaced parallel relation and a description of one such series will suffice for both. Each series of yarn package is arranged in a common support with a common drive therein, the support comprising a spaced parallel pair of upright arms 55, 55 suitably secured at their upper ends to and depending from an interposed cross arm 56 with spacing blocks 57 therebetween. The lower ends of arms 55 are each provided with a bearing block 58 within which a relatively long and narrow roller 59 is rotatably supported therebetween, the roller 59 being secured to and driven by a suitable mounted flexible drive shaft 60. The cross arm 56 is secured to a plurality (here shown as three) of spaced yarn arms 53 by means of U-shaped bolts 61 passing around arms 53 and through the arm 56. A series of spaced parallel depending brackets (here shown as being eight in number) 62 is suitably secured to the cross arm 56, the lower ends of these brackets being U-shaped to receive the pins 41' of seven yarn package assemblies therein and thus to permit the yarn packages to move vertically and to be rotated while in driven contact with the common drive roller 59. The disposition of roller 59 and packages 38' and their directions of rotation, FIG. 7, is such that the yarns 44' are in substantially 180 degree peripheral contact with roller 59 as they are unwound and are fed to the arcuately arranged yarn carriers at each of the spaced feeds of the machine, one of these carriers of one of the feeds being shown at 63.

The rollers 59 are shown as being driven, via flexible shafting 60, 60 from ring gear 51 of the machine, FIG. 4,

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however, any other suitable drive means in timed relation to the rotation of the machine may be used. Each shaft 60 has a spur gear 64 at the end thereof, the gears 64 being disposed on opposite sides of a spur gear 65 interposed therebetween. The gear 65 is the output gear of a variable speed changing device 66, of any usual construction, which has an input gear 67 in engagement with the ring gear 51. The speed changer 66 is suitably mounted upon the base plate 50 which also provides support for a suitable bracket 69 the end of shaft 60 and the gears 64. It may be noted that gear 65 causes gears 64, 64 to be rotated in opposite directions to provide the proper direction of rotation for each of the rollers 59, 59.

I claim:

1. The combination with a rotary circular knitting machine of means to feed attenuated yarn of the spandex type from at least one wound package thereof to said machine to be taken by the latter at a first rate of yarn travel as determined by the rate of its consumption by said machine for incorporation into fabric being knit thereby, the said means causing each said package to rotate to unwind its yarn therefrom at a selected second rate of yarn travel to be fed to and to be taken by said machine for the purpose aforesaid, said first rate of yarn travel being greater than said second rate of yarn travel, the disposition of said means relative to said machine and the relationship between the unwinding of said yarn and the taking of the same by said machine providing for the movement of said yarn from said package to said machine in such manner that the difference in said rates of yarn travel in itself is the cause of and determines the desired amount of attenuation in said yarn as it is being taken by said machine.

2. The combination set forth in claim 1 wherein each said wound package is cylindrically shaped and wherein said means includes a rotating roller in peripheral frictional driving contact with the wound yarn of each said package to cause the latter to rotate to unwind its yarn therefrom, said roller rotating in selected timed relation to the rotation of said machine.

3. The combination set forth in claim 1 wherein each said wound package is cylindrically shaped, wherein a plurality of said yarns are individually fed to and are taken by said machine from a plurality of said packages, wherein said means includes at least one rotating roller in common peripheral frictional driving contact with the wound yarn of a plurality of said packages to cause the latter to rotate to unwind their yarns therefrom and wherein each said roller is driven in selected timed relation to the rotation of said machine.

4. The combination set forth in claim 1 wherein each said wound package is cylindrically shaped, wherein a plurality of said yarns are individually fed to and are taken by said machine from a plurality of said packages, wherein said means includes a rotating roller individual to and in peripheral frictional driving contact with the wound yarn of each of said plurality of packages to cause the latter to rotate to unwind their yarns therefrom, wherein said machine has a ring gear rotating in timed relation to its rotation and wherein each of said rollers is driven from said ring gear.

5. The combination set forth in claim 1 wherein each said wound package is cylindrically shaped, wherein a plurality of said yarns are individually fed to and are taken by said machine from a plurality of said packages, wherein said means includes a rotating roller individual to and in peripheral frictional driving contact with the wound yarn of each of said plurality of packages to cause the latter to rotate to unwind their yarns therefrom, wherein said machine has a rotary needle cylinder and a rotary ring gear disposed thereabove and rotating in timed relation therewith, wherein said rollers are radially disposed relative to said cylinder and wherein each thereof is driven from said ring gear.

6. The combination set forth in claim 1 wherein each said wound package is cylindrically shaped, wherein a

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plurality of said yarns are individually fed to and are taken by said machine from a plurality of said packages, wherein said means includes at least one rotating roller in common peripheral frictional driving contact with the wound yarn of a plurality of said packages to cause the latter to rotate to unwind their yarns therefrom, wherein said machine has a needle cylinder and has a superstructure disposed thereabove, wherein each said roller and its said associated packages are supported by said superstructure and wherein each said roller is driven in selected timed relation to the rotation of said machine.

7. The combination as set forth in claim 1 wherein each said wound package is cylindrically shaped, wherein said means includes a rotating roller in peripheral frictional driving contact with the wound yarn of each said package to cause the latter to rotate to unwind its yarn therefrom, said roller rotating in selected timed relation to the rotation of said machine and wherein the disposition of said roller and its said associated package relative to said machine is such that said unwound yarn may thereby travel in a straight line direction from said roller to said machine.

8. The combination set forth in claim 1 wherein each said wound package is cylindrically shaped, wherein a plurality of said yarns are individually fed to and are taken by said machine at a plurality of circumferentially spaced feed-points thereabout from a plurality of said packages, wherein said means includes at least one roller in common peripheral frictional driving contact with the wound yarn of a plurality of said packages to cause the latter to rotate to unwind their yarns therefrom, wherein each said roller is driven in selected timed relation to the rotation of said machine and wherein the disposition of each said roller and its said associated packages relative to said machine is such that said unwound yarns may thereby travel in straight line directions from each said roller to individual ones of said spaced feedpoints of said machine.

9. The combination set forth in claim 1 wherein each said wound package is cylindrically shaped, wherein a plurality of said yarns are individually fed to and are taken by said machine at a plurality of circumferentially spaced feed-points thereabout from a plurality of said packages, wherein said means includes a rotary roller individual to and in peripheral frictional driving contact with the wound yarn of each of said plurality of packages to cause the latter to rotate to unwind their yarns therefrom, wherein said machine has a needle cylinder and a superstructure disposed thereabove, wherein each said roller and its said associated package is supported from said superstructure, wherein each of said rollers is driven in selected timed relation to the rotation of said machine and wherein the disposition of each of said rollers and its said associated package is such that the unwound yarn from each said package may thereby travel in a straight line direction from the roller unwinding the same to one of said spaced feed-points of said machine.

10. The combination set forth in claim 1 wherein each said wound package is cylindrically shaped, wherein a plurality of said yarns are individually fed to and are taken by said machine at a plurality of circumferentially spaced feed-points thereabout from a plurality of said packages, wherein said means includes at least one rotating roller in common peripheral frictional driving contact with the wound yarn of a plurality of said packages to cause the latter to rotate to unwind their yarns therefrom, wherein said machine has a needle cylinder and has a superstructure disposed thereabove, wherein each said roller and its said associated packages are supported by said superstructure, wherein each said roller is driven in selected timed relation to the rotation of said machine and wherein the disposition of each said roller and its said associated packages relative to said machine is such that said unwound yarns may thereby travel in straight line directions from each said roller to individual ones of said spaced feed-points of said machine.

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11. The combination set forth in claim 1 wherein each said wound package is cylindrically shaped, wherein said means includes a rotating roller in peripheral frictional driving contact with the wound yarn of each said package to cause the latter to rotate to unwind its yarn therefrom, said roller rotating in selected timed relation to the rotation of said machine and wherein the direction of rotation of said roller and its associated package and their disposition relative to said machine is such that said yarn is trained about and is in peripheral traveling contact with said roller as it is being unwound from said package to be fed to and to be taken by said machine, the said relationship with said roller serving to overcome the tendency of said yarn to stick to its wound portion thereof as it is being unwound from said package.

12. The combination set forth in claim 1 wherein each said wound package is cylindrically shaped, wherein a first plurality of said yarns are individually fed to and are taken by said machine at a first plurality of circumferentially spaced feed-points thereabout from a first plurality of said packages, wherein a second plurality of said yarns are individually fed to and are taken by said machine at a second plurality of circumferentially spaced feed-points thereabout from a second plurality of said packages, wherein said means includes a first rotating roller in common peripheral frictional driving contact with the wound yarns of said first plurality of said packages to cause the latter to rotate to unwind their yarns therefrom, wherein said means also includes a second rotating roller similar to said first roller in similar contact with said second plurality of said packages for a similar purpose, wherein said machine has a needle cylinder and has a superstructure disposed thereabove, wherein said rollers and the said packages associated with each thereof are supported by said superstructure, wherein said rollers are driven at the same rate of speed in selected timed relation to the rotation of said machine, wherein the disposition of said first roller and its said associated package relative to said machine is such that the yarns unwound thereby may travel in straight line directions from said first roller

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to individual ones of said first spaced feed-points of said machine and wherein the disposition of said second roller and its said associated packages relative to said machine is such that the yarns unwound thereby may travel in straight line directions from said second roller to individual ones of said second spaced feed-points of said machine.

13. A method of feeding yarn of the spandex type from a wound package thereof in a desired state of attenuation to a rotary circular knitting machine wherein it is taken at a first rate of yarn travel as determined by the rate of its consumption by said machine for incorporation into fabric being knit thereby including the step of rotating said package to unwind its yarn therefrom at a selected second rate of yarn travel which is less than said first rate of yarn travel and the step of feeding the yarn unwound from said package to said machine in such manner that the difference in said rates of yarn travel is in itself the cause of said desired state of attenuation in said yarn as it is being taken by said machine.

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