

Oct. 5, 1965

J. T. CARGILL

3,209,558

YARN FURNISHING DEVICE

Filed Dec. 3, 1963

3 Sheets-Sheet 1

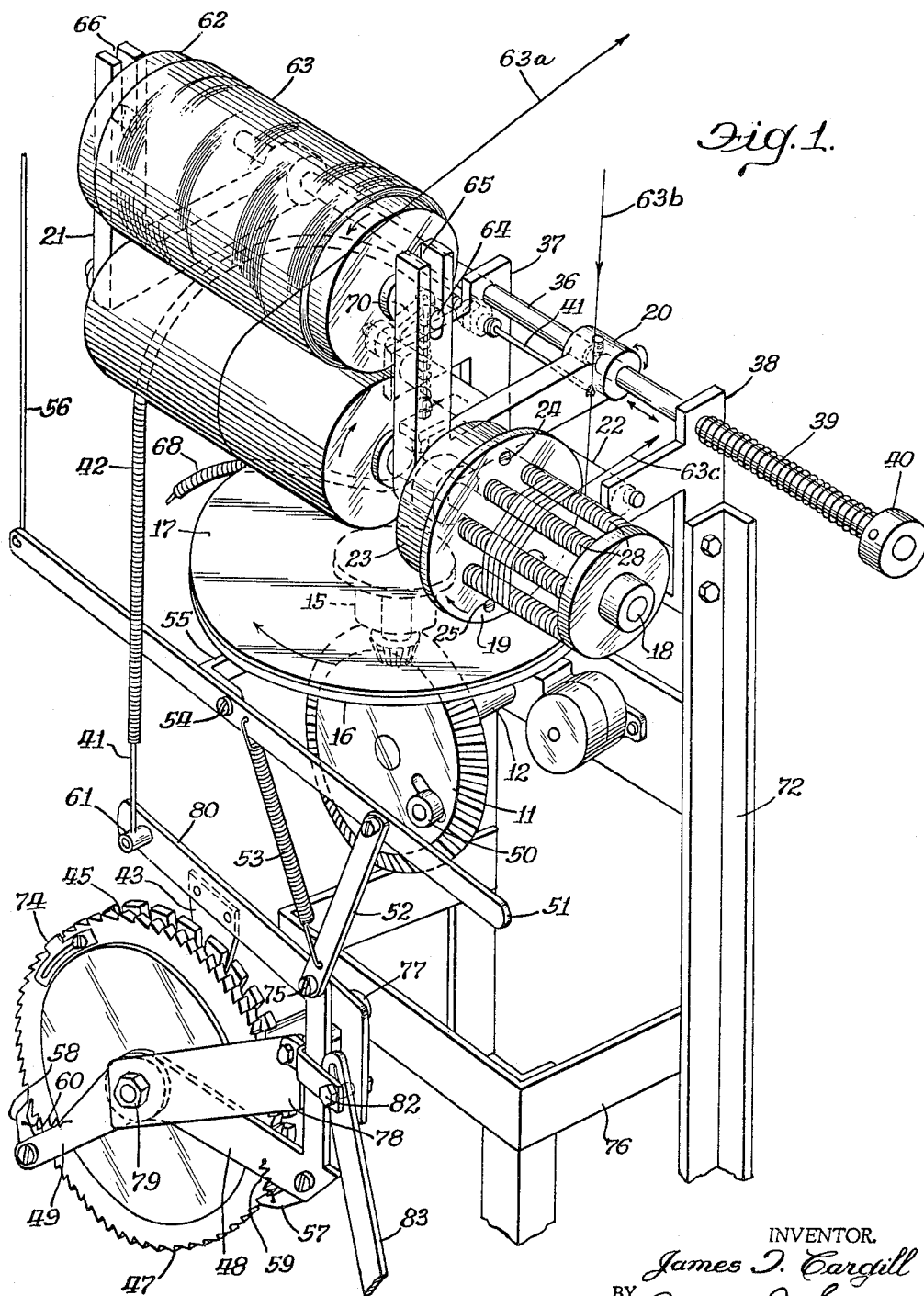


Fig. 1.

INVENTOR.  
*James J. Cargill*  
BY *James J. Lawrence*  
Att'y.

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3 Sheets-Sheet 2

James J. Cargill  
BY James J. Fawcett  
Atty.

Oct. 5, 1965

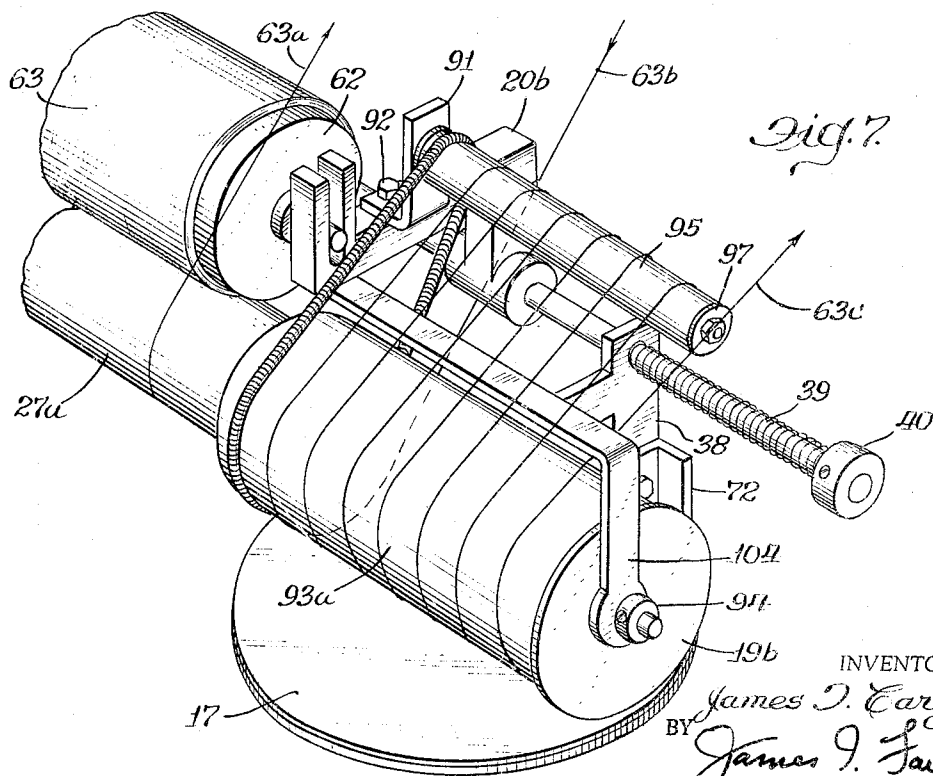
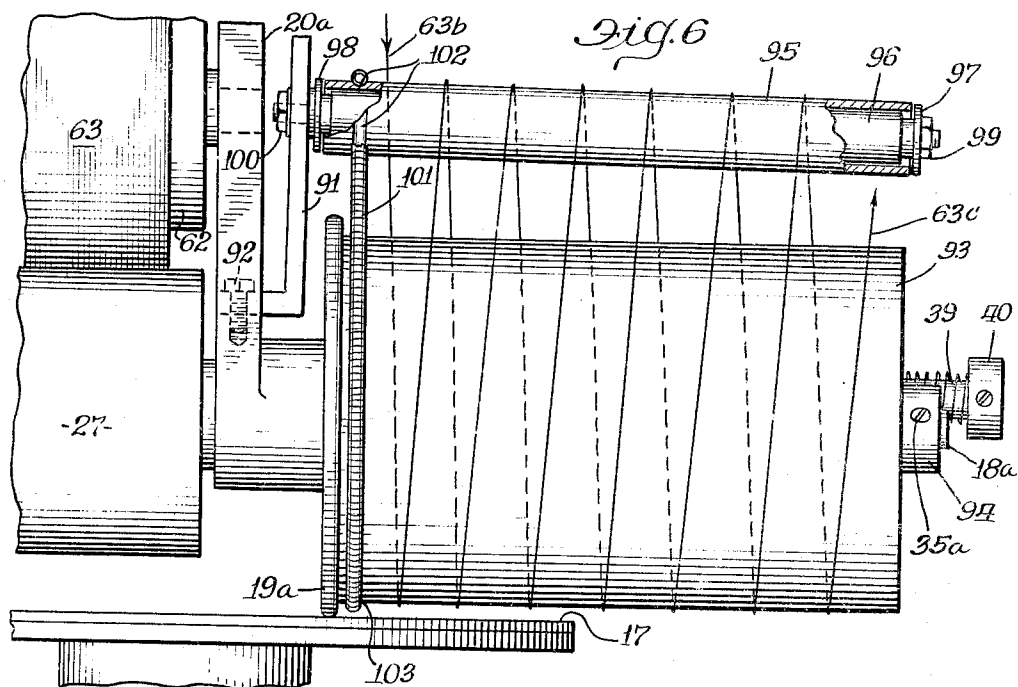
J. T. CARGILL

3,209,558

YARN FURNISHING DEVICE

Filed Dec. 3, 1963

3 Sheets-Sheet 3



INVENTOR.

James T. Cargill  
BY James P. Sawett  
Att'y

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3,209,558

## YARN FURNISHING DEVICE

James T. Cargill, Anderson, S.C., assignor to The Kendall Company, Boston, Mass., a corporation of Massachusetts

Filed Dec. 3, 1963, Ser. No. 327,759

4 Claims. (Cl. 66—132)

This invention is concerned with yarn furnishing devices particularly with those relating to proper feeding of very fine elastic strands to knitting machines. The device is particularly adapted to feeding bare or covered elastomeric yarn at varying speeds under controlled tensions in the manufacture of elastic hose, girdles and other circular-shaped elastic garments but it may also be used in furnishing very fine non-elastic yarns where tension is to be regulated or where a minimum of tension is to be applied.

Normally elastic or other fine yarns are wound on tubular or conical sleeves to provide supply packages. The problem is to draw the yarn uniformly from the package as it is needed. Obviously, where a shaped garment is being knitted, the rate of withdrawal of yarn must vary, being sometimes quite rapid and at other times less rapid. At any rate, prior to this invention various devices had been suggested for feeding elastic yarns notable among which is the capstan type feed device illustrated in the Lawson Patent No. 2,627,738. The capstan type feed device provides variable tension which is effected by changing the rate of rotation of the capstan by control from the cam or cams on the main cam drum of the machine. This device is adequate where the elastic yarn is not of the exceedingly fine type now being used in elastic garments, particularly elastic stockings. But prior to this invention, the elastic yarns were drawn from the package by the capstan or other feeding device over the end of the package. Unfortunately, yarns frequently catch on the cone or sleeve. With larger yarns this is not critical because such yarns require the application of considerable force before they stretch very much and such yarns pull loose from the sleeve before they are greatly extended. With fine yarns, however, the problem becomes acute because such yarns extend very readily and the uneven tension which results is not always removed by capstan or other feed devices.

It is an object of this invention to provide a yarn furnishing device which delivers yarn in which variation in tension caused by uncontrolled intermittent failure of the package to release the yarn is virtually eliminated.

It is an object of this invention to provide a yarn furnishing device which may operate with a very much reduced uniform tension between the yarn package and the yarn feed device or alternatively which may be adjusted to produce a selected higher tension between the yarn package and the yarn feed device.

Referring to the drawings:

FIGURE 1 is an isometric view of a typical device of this invention.

FIGURE 2 is a partial side view of the device of FIGURE 1.

FIGURE 3 is a detailed view partially in cross section showing a typical yarn feed capstan.

FIGURE 4 is a view partially in cross section taken along the line 4—4 and viewed in the direction of the arrows.

FIGURE 5 is a partial, detailed view of the variable cam whose settings control the feeding rate of the device.

FIGURE 6 is a detailed view showing a preferred type of feed capstan.

FIGURE 7 is a detailed view showing a preferred type of feed capstan with an alternative method of support.

The objects of this invention are obtained by providing means whereby a cylindrical yarn package is rotated at such speed as to provide yarn from the package at a selected uniform tension in a rolling action directly from the wound coils thereof to the yarn feed device.

Referring once more to the drawings, 10 is a yarn feed device which in the particular embodiment illustrated in the drawings is driven by a bevel gear 11 directly connected by a shaft extension 12 from the selector drum. The bevel gear 11 in turn drives the smaller bevel gear 13 which drives the vertical shaft 14 supported in bearings in the frame mounting 15. The shaft 14 carries on its upper end a horizontal platform disc 16 which is faced by a rubber or leather disc 17. This platform constantly revolves at a uniform speed in the direction of the arrow, FIGURE 1, when the selector drum is activated. A friction wheel 19 makes peripheral contact with the platform during the time that the feed device 10 is operative. The friction wheel is fastened by screws 24 and 25 to the housing 23, FIGURE 3, which in turn is fastened to shaft 18 by key 26. The shaft 18 is supported in bearings in the main support bracket 20 and in the auxiliary support bracket 21. The main and auxiliary support brackets rest at times upon the cylinder 22 which is eccentric in its bearings in support members 37 and 38 which are bolted to the frame 72. The cylinder 22 revolves to lift the friction wheel 19 out of contact with the disc 17 thus deactivating the yarn furnisher as will be more fully explained hereinafter.

Fastened to the shaft 18 and revolving with it are the housing 23 and the feed roller 27 which latter is preferably of hard maple. The feed roller does not contact the disc 17 as is shown in FIGURES 2 and 3. The diameter of the feed roller 27 is critical in determining the amount of yarn removed from the package and hence the tension on the yarn between the yarn package and the yarn feed device.

Rollers with diameters in the range of 2.338 to 2.342 inches have proven to be exceptionally useful on the Scott & Williams AMF machine with bare spandex yarn in the range of 70–110 denier wound with the usual low winding tension but obviously depending upon the yarn used, the tension with which it is wound, the conditions of knitting and other factors, widely different rates of unrolling yarn from the yarn package may be required and hence rollers of considerable variation in diameter are within the scope of the invention.

The yarn feed device may be of the capstan type 10 shown in FIGURES 3 and 4. When this device is in operation the whole device turns with the friction wheel 19, the shaft 18 and the housing 23. But, in addition to this, the spindles 28, of which in the particular embodiment there are six, also turn about their individual axes as best shown in FIGURE 1. The spindles which are helically grooved have their shafts supported on one end by the plate 34, FIGURE 3, which is pinned to shaft 18 by pin 35. The spindle shafts at the other end are supported by the solid housing 23 which has a recess into which the individual spindle gears 29, as well as stationary gear 30, fit. The rim of housing 23 has a slight clearance from the plate 33. The plate 33 is fastened to the stationary gear 30 and to the bracket 20 by screws 31 and 32. As the friction wheel 19 turns, it revolves the housing, the spindles, and the shaft as a unit. The spindle gears 29 also revolve but since they are meshed with the stationary gear 30, they turn about their individual axes as well and hence cause individual rotation of their respective spindles.

In the preferred embodiment shown in FIGURE 6, the elaborate yarn feed device 10 shown in FIGURE 3 is replaced by a cylinder 93 preferably of hard maple wood

but the material is not critical and the cylinder may be of rubber or plastic or metal. The friction wheel 19a is fastened to the shaft 18a and turns the shaft as it is driven by the rotating surface 17. The cylinder is cut away to provide a recess for the locking hub of friction wheel 19a. The cylinder turns with the friction wheel being held tightly between it and locking collar 94 which is also fastened to the shaft by screw 35a. A spring belt 101 operating in a groove in the cylinder and in sleeve 95 of a thread spreader causes inclined sleeve 95 to rotate on the shaft 96 between the collars 97 and 98. The thread spreader is fastened to an arm 91 by the nut 100. Arm 91 is fastened to support bracket 20a by bolt 92. The sleeve 95 and the collar 97 are held in place by the nut 99. The surface speed of feed roller 27 and the circumferential relationship between it and cylinder 93 determines the tension at which the yarn is furnished to the needles. Normally, the cylinder 93 would be somewhat larger than the feed roller.

In the embodiment shown in FIGURE 7, the friction disc 19b is at one end of the yarn feed device and the feed roller 27a and the cylinder 93a are integral. The support bracket 20b continues to support the yarn package spindle but the feed roller shaft is supported on the friction disc end by an extension bracket 104. The opposite end of the shaft 18 is supported by the arm 21.

The main support bracket 20 and the auxiliary support bracket 21 are fastened so that they move both in partial rotation and in longitudinal motion with control shaft 36. A compression spring 39 surrounds the control shaft so that when the latter moves to the left, as shown in FIGURE 1, the spring 39 is compressed between the support member 38 and the end stop 40. A control wire 41, FIGURE 1, is fastened to main support bracket 20. The wire moves within its sheath 42 which latter is fastened by fittings 67 to support member 37 and otherwise fastened to the frame as to be restrained at its other end. The wire 41 is fastened by rotatable fitting 61 to a heavy crank member 80 which pivots about the pivot 82. A cam rider plate 43 is rigidly attached to the crank member 80 between the fitting 61 and the pivot. The cam rider plate rests on the camming surfaces 44, FIGURE 5, which together form an adjustable cam, the individual camming surfaces being movable in the slots 73 in the cam plate 45 to which they are fastened by nuts 46. The cam plate is attached to the ratchet wheel 47 and both turn about the fixed shaft 77 which is attached to the frame 76. The ratchet wheel is actuated by ratchet pawls 57 and 58 which pivot about the ends of ratchet pawl crank 48 and pawl arm 49 respectively and are held in engagement with the teeth of the ratchet wheel by tension springs 59 and 60 respectively. Pawl crank 48 is movable about the fixed shaft 77 but pawl arm 49 is keyed or otherwise secured to the fixed shaft. Movement clockwise of the ratchet wheel, because of clockwise movement of pawl crank 48 with its pawl in engagement, causes pawl 58 to slip over the ratchet teeth against the pull of spring 60. Pawl 58 engages each tooth of the ratchet in succession and prevents counterclockwise rotation of the ratchet wheel. Pawl crank 48 is given its clockwise motion through a linkage which includes link members 51 and 52. Link 51 is pivoted to frame member 55 at pivot point 54. Attached to bevel gear 11 is an adjustable cam roller 50 which protrudes from the face of the gear. On each revolution of the gear 11, the roller 50 strikes the link member 51 causing it to pivot about the pivot point 54, but also forcing the link 52, the pivot point 75 and the pawl crank 48 to move downward against the spring 53. The clockwise movement imparted to pawl crank 48 causes the engaged pawl 57 to turn the ratchet wheel one tooth. The pawl 58 holds the ratchet wheel in this new position and the cam rider plate 43 rises, or lowers or remains unchanged depending upon the particular camming surface which has been introduced beneath it by the turn of the ratchet wheel. The wire 41 is thus

caused either to move downward pulling the main support bracket 20 to the left in FIGURE 1 compressing spring 39 or wire 41 moves up and spring 39 pulls the main support bracket 20 to the right or wire 41 does not move. When wire 41 moves up, the friction wheel 19 is caused to move to the higher rim speed of disc 17 and hence its speed is increased. Where wire 41 moves down, friction wheel 19 is caused to move closer to the center of disc 17 where the speed is less and hence wheel 19 decreases its speed.

As soon as cam roller 50 has lost contact with link member 51, spring 53 retracts, pulling the linkage back to its normal position. During this retraction, pawl crank 48 is caused to move counterclockwise and pawl 57 slips over the tooth immediately above its engagement position to a new position of engagement with the ratchet wheel, one tooth counterclockwise.

A member 78 which acts as a guide for pawl crank 48 is retained with the latter and pawl arm 49 on an extension of shaft 77 by nut 79. A brace 83 fastened to the frame locates the pivot bolt 82 and steadies the member 78.

Where there are portions of the garment being knitted in which no change in the yarn furnished is needed, a ratchet tooth may be blocked off by an adjustable bridge 74. This can be made to contact only the tooth of pawl 57 by projecting the pawl tooth beyond the ratchet face somewhat. At any rate, when the pawl strikes the bridge it engages the ratchet tooth clockwise of the bridge only at the end of its clockwise travel. The ratchet wheel does not rotate under such circumstances until the pawl crank is given sufficient clockwise movement beyond its normal travel that this ratchet tooth is moved. This is accomplished through the wire 56 which receives its impetus directly from the cam or cams of the main drum.

In the particular embodiment of the invention illustrated in the drawings, the yarn 63 is wound upon a hollow cylindrical shell which fits over a core 62 preferably of hard maple. The core is preferably equipped with a metal spindle 64 which projects through the core 62. The respective ends of the spindle fit into vertical-aligned slots 65 and 66 in the upright arms of main support bracket 20 and auxiliary support bracket 21. The yarn package, with its core, turns as the spindle turns in the slots 65 and 66, the yarn surface making frictional contact with the feed roller 27. In essence, the yarn package is rolled by the feed roller in a direction opposite to that which it turned in winding the yarn. As a result, the yarn is literally rolled from the package without going over either end. The yarn leaves the yarn package at the nip between the yarn package cylinder and the feed roller and goes around under feed roller 27 shown as 63a. After ranging through positioning eyes, the yarn 63b enters the capstan from the needle cylinder side and winds several turns around the spindles of the capstan following the helical grooves in the spindles and leaves 63c for the yarn furnishing finger.

The yarn furnisher is deactivated as has been previously indicated by partial rotation of the cylinder 22 which is eccentric in its bearings. The deactivation signal is given from the main cam drum and the wire 81 is caused to move downward in its sheath 68 compressing the spring 69. The sheath 68 is fastened to the frame by fitting 71. In its downward movement, the wire 81 causes rotation of the arm 70 which is pinned to the eccentric shaft projection of cylinder 22. The cylinder 22 is thus rotated eccentrically and a more remote portion of the cylinder from its eccentric axis is caused to rise under the main and auxiliary support brackets 20 and 21 lifting them and with them the friction wheel out of contact with the disc 17. The shaft 35 is thus no longer caused to turn and no yarn is furnished. The yarn furnisher is reactivated by reversing the process with the signal again coming from the main cam drum.

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The drawing illustrates a feed roller 27 which is directly attached to the shaft 18. Obviously the feed roller with the supports for the yarn package may be separated from the shaft 18. The roller 27 may be driven by a belt or a chain from the shaft 18. Obviously, too, the roller 27 which is shown as having a fixed diameter may be made to have an adjustable diameter. For instance, the roller might be a tight tubular coil spring slightly smaller in outside diameter than the roller 27 and having about 1½ convolutions. Such a spring might be expanded by conical end pieces inserted into the open spring ends and caused to approach each other. Such a spring might be covered with an elastic sleeve to provide a smooth friction surface.

In most cases a wooden roller of the size previously indicated will be found satisfactory but for unusual cases or experimental purposes where an adjustable roller is not available, it may be practical to shield the machine from dust and to grind or sand an oversize roller while it is operating functionally until the desired unrolling rate is achieved. Otherwise a series of rollers of progressively increasing diameters may be utilized to determine the best diameter.

This application is a continuation-in-part of my co-pending application Serial No. 245,326, filed December 17, 1962, now abandoned.

I claim:

1. A yarn furnishing device for a knitting machine supported by the framework of said machine comprising a rotatable shaft and a control shaft, frame members supporting said control shaft and permitting axial movement thereof, an auxiliary pivot arm at one rotatable shaft end and a main pivot arm centrally positioned supporting said rotatable shaft and including bearings within which said rotatable shaft rotates, a roller fixed to said rotatable shaft intermediate said pivot arms, said pivot arms including upwardly projecting portions slotted to guide the spindle of a wound cylindrical yarn package whereby the package is guided into axially parallel relationship and frictionally rotatable surface engagement with said roller, rotation of said roller in proper direction causing rotation of such a yarn package so disposed to unroll yarn from said package, a capstan attached to said shaft at the free end thereof and a friction wheel intermediate said capstan and said main pivot arm, said rotatable shaft, roller, friction wheel and capstan having a common axis and turning as a unit and being movable axially of said rotatable shaft as said pivot arms so move and being moved arcuately as said pivot arms pivot about said control shaft, a main bevel gear turning at constant speed on the selector drum shaft, a second bevel gear meshing with said main bevel gear, a turntable positioned with its axis intersecting the axis of the rotatable shaft at right angles and with its flat surface in frictional engagement with the edge portion of said friction wheel, said turntable driving said friction wheel and said rotatable shaft at angular speeds increasing as said friction wheel is positioned progressively outwardly from the center of said turntable, a projecting lug carried by said main bevel gear, an adjustable camming surface including individual adjustable cam portions, a ratchet wheel fixed to turn with said camming surface, a pawl intermittently turning said ratchet wheel when actuated and hence said camming surface, a linkage including said pawl actuated from a neutral position by said lug on each revolution as said lug revolves, a second pawl engaging said ratchet wheel to prevent reverse rotation thereof, spring means returning said linkage to neutral position, a control wire, a crank member pivoted at one

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end and fastened to said control wire at the other, a cam rider plate fixed to a central portion of said crank member and engaging said individual cam portions in succession as said camming surface moves intermittently, said control wire being fastened at its other end to said main pivot arm and being guided in its sheath, said control wire when said cam rider plate lowers pulling said main pivot arm and said control shaft axially of the latter, a spring surrounding said control shaft and compressed between a control shaft end stop and a frame member when said cam rider plate lowers and pulling said control shaft axially in the opposite direction as limited by said control wire when said cam rider plate rises, thus causing said friction wheel to be positioned on said turntable in accordance with the adjustments made in said adjustable camming surface and hence controlling the speed of unrolling yarn from said yarn package, said capstan including a plurality of individually threaded guide rollers each turning on its axis in the rotational direction of the rotatable shaft, the outwardly facing surfaces of the threaded guide rollers forming contact surfaces with the yarn unrolled from the yarn package and wound in a plurality of convolutions therearound prior to being drawn to the knitting needles, a second control wire actuated by camming means of the main drum, an eccentric shaft underlying and in contact with said main pivot arm and turning in bearings in the frame members supporting said control shaft, a lever arm fixed to said eccentric shaft and fastened to said second control wire, movement of said second control wire in one direction rotating said lever arm and said eccentric shaft to raise said main pivot arm deactivating said yarn furnisher, a lever arm spring compressed by said second control wire in raising said main pivot arm, reverse movement of said control wire causing said lever arm spring to expand and said pivot arm to lower activating said yarn furnisher.

2. The yarn furnishing device of claim 1 wherein the capstan is a smooth cylinder and the yarn is wound back and fourth around the cylindrical capstan and an inclined rotating sleeve which acts to separate the windings.

3. A yarn furnishing device for a knitting machine comprising a cylindrical roller, a second cylinder, said cylindrical roller having a common shaft with and rotating at the same angular speed as said second cylinder, means driving said roller at varying surface speeds in accordance with the needs of said machine for a given yarn, structural means for guiding a wound cylindrical package of said given yarn into axially parallel relationship and frictionally rotatable surface engagement with said roller, rotation of said roller causing rotation of such a yarn package so disposed to unroll yarn from said package, said second cylinder being connected to drive a yarn spreading rotatable sleeve having an axis inclined to said common shaft.

4. The yarn furnishing device of claim 3 wherein the cylindrical roller and the second cylinder are integral.

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DONALD W. PARKER, *Primary Examiner*.

RUSSELL C. MADER, *Examiner*.