

Aug. 2, 1960

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2,947,490

SPEED CONTROL SYSTEM FOR WINDING MACHINES

Filed Nov. 23, 1954

6 Sheets-Sheet 2

Fig. 2.

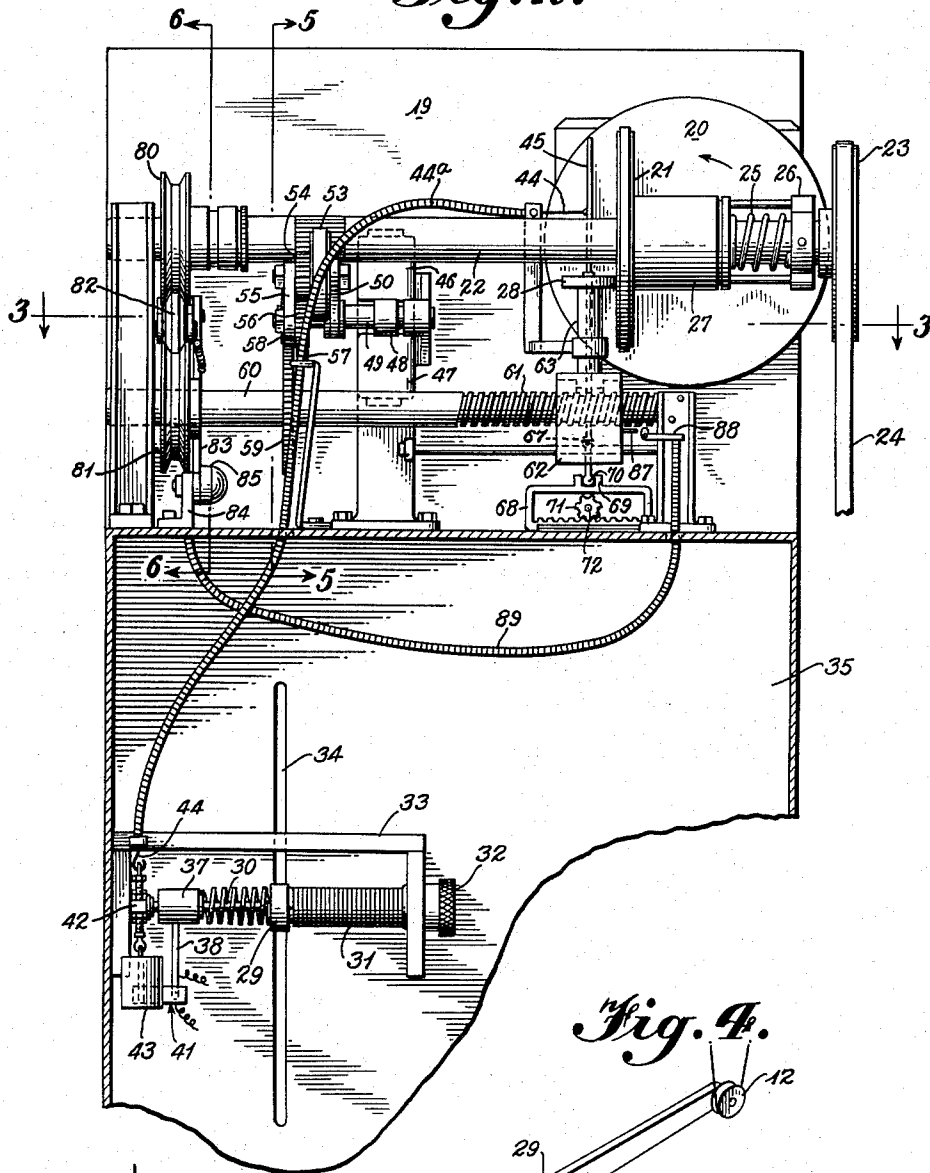
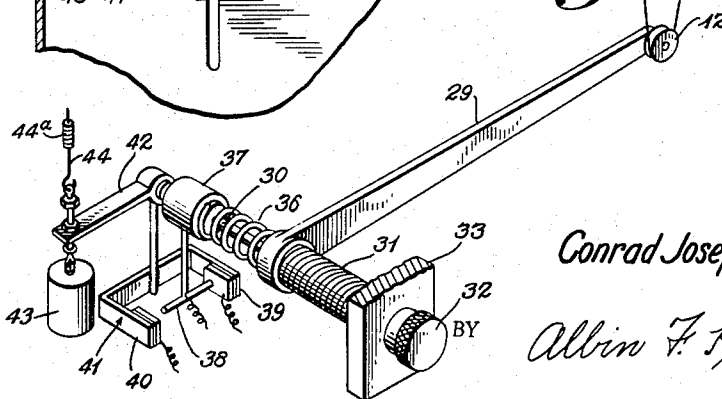


Fig. 4.



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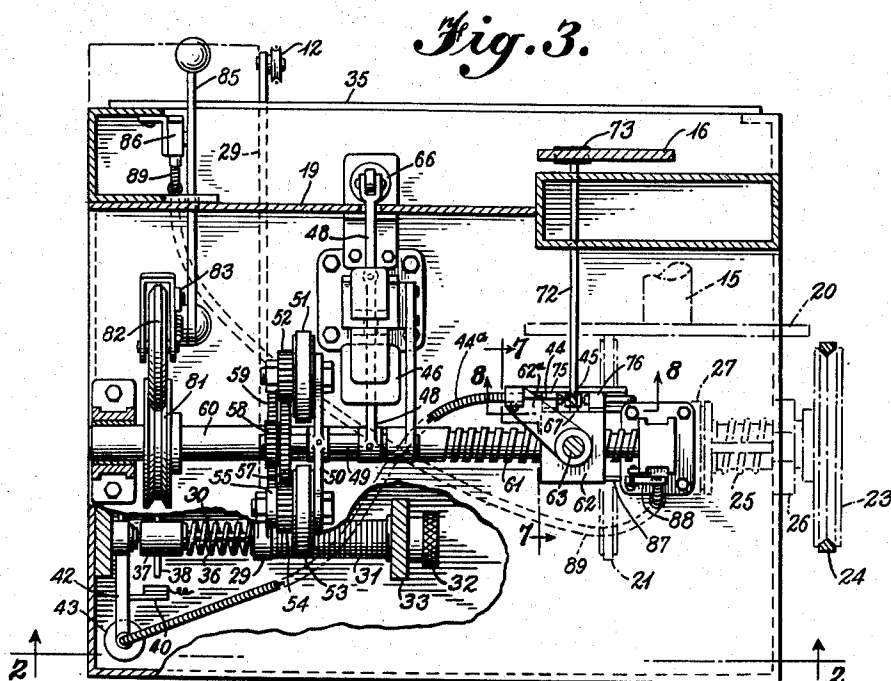


Fig. 8.

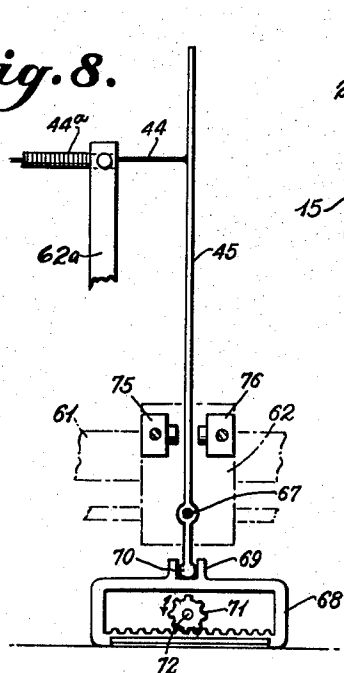
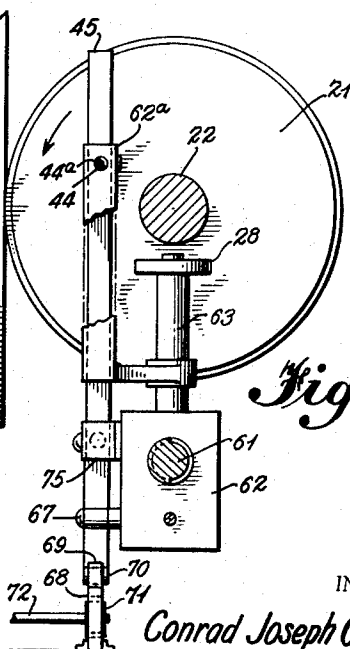


Fig. 7.



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Fig. 10.

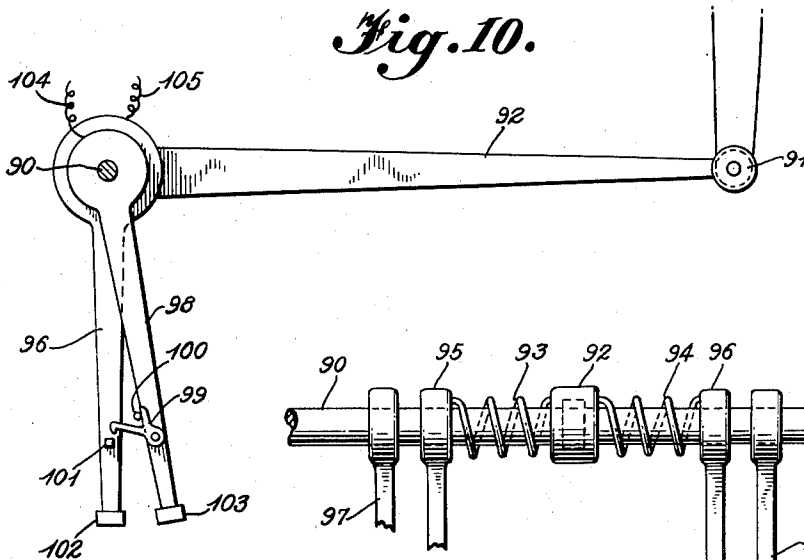


Fig. 11.

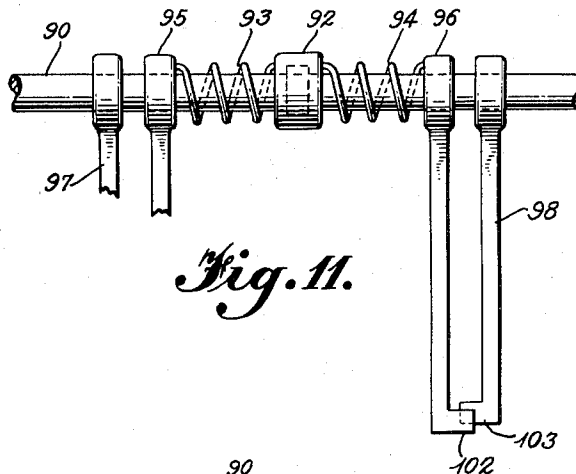


Fig. 12.

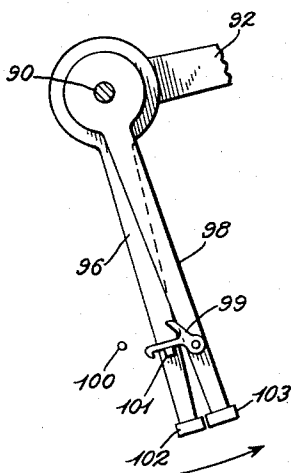
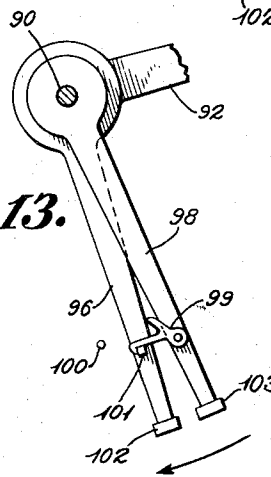


Fig. 13.



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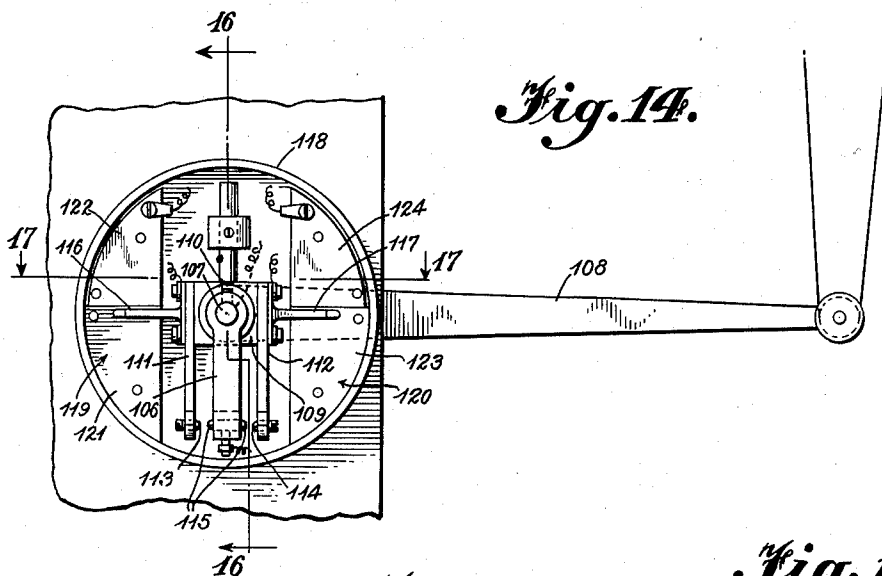


Fig. 14.

Fig. 15.

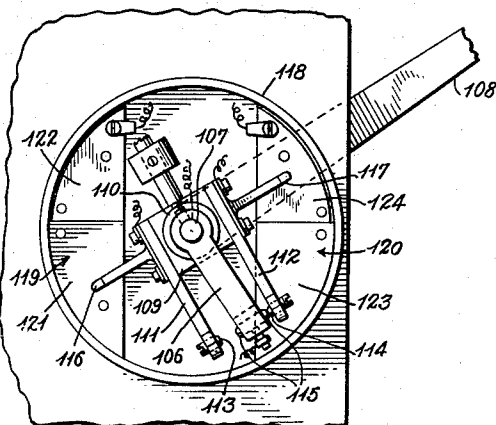


Fig. 16.

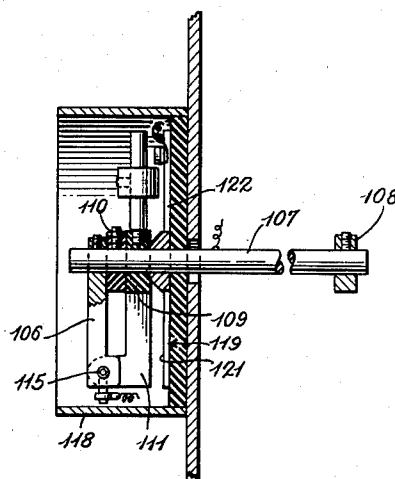
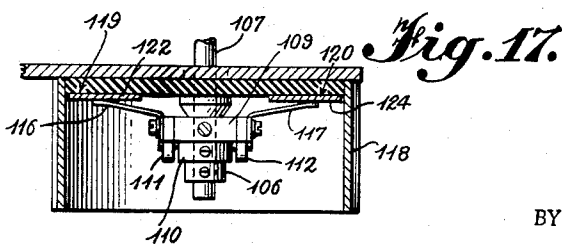


Fig. 17.

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SPEED CONTROL SYSTEM FOR WINDING MACHINES

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Claims priority, application Netherlands Nov. 28, 1953

8 Claims. (Cl. 242-45)

This invention relates to winding machines and more particularly to an automatic speed control for a winding machine.

In winding machines it is customary to provide a rotating shaft on which a package support is placed. The shaft is driven at a constant speed and as successive courses of thread are laid up the effective diameter of the take up package increases. This, of course, causes an increase in the peripheral speed of the wound body.

In order to prevent progressively increasing thread speed in the case when the thread is supplied with constant speed, it is known to lead the thread being wound across a dancer roll and to use movements thereof to control speed.

The known devices do not make it possible to adapt the speed of the winding accurately to the supply speed and at the same time to keep the thread under a substantially constant tension.

It is an object of this invention to accurately maintain a predetermined winding speed of a winding machine throughout the entire winding on period automatically compensating for any local speed varying factors.

Other objects and advantages of this invention will be apparent upon consideration of the following detailed description of several embodiments thereof in conjunction with the annexed drawings wherein:

Figure 1 is an end view in elevation of a winding machine according to the present invention;

Figure 2 is a view in vertical section taken at the plane of the line 2-2 of Figure 3 and showing the winding speed control mechanism of the present invention;

Figure 3 is a horizontal sectional view taken at the plane of the line 3-3 of Figure 2;

Figure 4 is a fragmentary perspective view further illustrating the electric switch mechanism shown in Figure 2;

Figure 5 is a view in section taken on the line 5-5 of Figure 2;

Figure 6 is a view in section taken on the line 6-6 of Figure 2;

Figure 7 is a view in section taken on the line 7-7 of Figure 3;

Figure 8 is a view in section taken on the line 8-8 of Figure 3;

Figure 9 is a fragmentary view partially in section and partially in elevation showing a releasable interlock between the traverse mechanism and the take up speed control mechanism;

Figure 10 is a view in end elevation of a modified switch mechanism to prevent hunting of the control mechanism;

Figure 11 is a view in side elevation of the mechanism of Figure 10;

Figure 12 is a fragmentary view showing one operating position of the mechanism of Figure 10;

Figure 13 is a fragmentary view showing another operating position of the mechanism of Figure 10;

Figure 14 is a view in side elevation of a modified

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mechanism for preventing hunt in response to a demand for speed correction;

Figure 15 is a view similar to that of Figure 14 but showing the apparatus in a different position;

Figure 16 is a view in section taken on the line 16-16 of Figure 14; and

Figure 17 is a view in section taken on the line 17-17 of Figure 14.

From a consideration of Figure 1 it can be seen that thread 10 to be wound into the form of a crosswound package is led from a source, not shown, through a supply roll or delivery system 11, with constant speed under a dancer roll 12, through a traverse mechanism 13 and onto a bobbin or spool 14 on a drive shaft or spindle 15.

The traverse mechanism is entirely conventional and hence is shown only schematically. It is of the type in which a traverse button actually contacts the package surface, being held thereagainst by a counterweight 16 pivoting about a pivot 17. While the delivery system 11 is only schematically shown it will suffice to say that, whatever type is used, the delivery of thread to the winding machine will be at a generally constant speed so that the winding speed will be controllable by the peripheral or take up speed of the package 18 on the bobbin 14, this, in turn, being a function of the speed of spindle 15 and the diameter of package 18.

According to this invention, the speed of the thread 10 is controlled by controlling the speed of the spindle 15. This spindle extends behind the panel 19 shown in Figure 1 and terminates in a disc 20 which is keyed thereto, see Figures 2 and 3. The disc 20 is driven by frictional contact with a driving wheel 21 which is keyed to but axially slidable on a shaft 22. Shaft 22 is provided with a sheave 23 which is driven by a belt 24 from a power source, not shown.

The driving wheel 21 is biased to the left of its Figure 2 position by a coil spring 25 which coaxially surrounds shaft 22. The spring 25 extends in compression between a fixed bearing block 26 and a movable collar 27 which is freely slidable axially of the shaft 22. A positioning roller 28 limits the action or effect of the spring 25 on the wheel 21. It can be seen that if roller 28 is moved to the right of the Figure 2 position wheel 21 will move to the right against the thrust of spring 25 and disc 20 and spindle 15 will be driven faster due to the increase in ratio between the radius of driving wheel 21 and the effective radius of driven disc 20. Conversely, if roller 28 is moved to the left of its Figure 2 position, spring 25 will act to displace wheel 21 to the left and the speed of disc 20 and hence spindle 15 will be reduced. This reduction, of course, affects take up speed. It can now be seen that the winding speed of the thread is controlled by the position of the roller 28 which in turn controls the position of the driving wheel 21 on the driven disc 20, the wheel and disc constituting a variable speed transmission between the drive shaft 22 and the driven spindle 15.

Actually there are two broad reasons for variation in speed. One of these is the steady increase in winding on speed due to increase in package diameter and the other is an intermittent one due to minor factors such as small variations in the speed of delivery of the yarn to the system. In either case the effect of an increase in winding speed is an upward or counterclockwise bias of the dancer roll 12 while the effect of decrease in speed is a downward or clockwise bias thereof, see Figure 4. The dancer roll 12 is therefore used to sense variation in the delivery speed of yarn supplied by system 11 and to control the movements of the roller 28. To this end the dancer roll 12 is mounted on a lever 29 which is, at its other end, rotatably mounted on a fixed shaft 30. A spring 31 is connected at one end to the lever 29 and its

other end is anchored in screw 32 by which the torque exerted on the lever 29 is made adjustable.

The shaft 30 is supported by a bracket 33 which in turn is supported from the frame of the machine. A vertical slot 34 is cut in the housing wall 35 to accommodate the movements of the lever 29.

The lever 29 is connected by a torque transmitting coil spring 36 to a hub 37 which carries thereon a T switch element 38. The cross bar of the T switch 38 contacts with poles 39 or 40 of a switch element 41 carried on one arm of a bell crank 42 which is pivoted to the shaft 30. The other arm of the bell crank 42 is biased in one direction by counterweight 43 and in the other direction by a flexible rod or cable 44 slidable in a spiral sheath 44a. The cable 44 is connected to a lever 45. It can now be seen that if winding speed increases lever 29 is moved counterclockwise and, through spring 36, T switch 38 moves to circuit closing position with pole 39. On the other hand a decrease in winding speed causes lever 29 to move clockwise from the Figure 4 position to cause T switch to move to circuit closing position with pole 40.

The circuit that includes the pole 40 also includes solenoid 46, see Figure 5, and the circuit that includes the pole 39 also includes the solenoid 47. These solenoids selectively act on a lever 48 which is pivoted on a shaft 49. Fixed on the end of the lever 48 there is located a V supporting bracket 50. On one arm of the V bracket 50 there is pivotally mounted an assembly including a friction drive pickup wheel 51 and a coaxial gear 52. On the other arm of the V bracket 50 there is pivotally mounted a second friction drive pick up wheel 53 and a coaxial gear 54. Also depending from the arm of the V bracket which has the wheel 53 thereon is a rigid arm 55 having an idler gear 56 thereon in mesh with the gear 54. Gears 52 and 56 both mesh with a gear 57 which with a gear 58 is mounted for free rotation on shaft 49. Gear 58 meshes with a gear 59 which is mounted on a shaft 60. The shaft 60 is threaded at 61 (see Figures 2 and 3) and carries thereon an internally threaded block 62 from which the roller 28 is supported by a stud or stub shaft 63. It can now be seen that the position of the dancer roll 12 will control the energization of the solenoids 46 and 47 and that these solenoids control the rotation of shaft 60 which in turn positions roller 28 and wheel 21.

Control of the transmittal of driving torque to the shaft 60 is effected by angular displacement of the lever 48 about the shaft 49. If the winding speed is lower than the desired predetermined value, then the circuit including pole 40 and solenoid 46 is closed by the T element 38. This causes lever 48 to move clockwise from the Figure 5 position. This clockwise movement causes wheel 51 to bear frictionally against shaft 22 to be rotated thereby. When wheel 51 rotates, gear 52 rotates and drives gear 57 which through gears 58 and 59 drives shaft 60 in a clockwise direction, as viewed in Figure 5, to cause the block 62 to move to the right as viewed in Figure 2 and thereby to increase the speed of spindle 15.

If the winding speed of thread 10 is too high the circuit including pole 39 and solenoid 47 is closed causing pick up wheel 53 frictionally to engage and to be driven by shaft 22. Due to the idler gear 56, this movement causes shaft 60 to turn in a counterclockwise direction, as viewed in Figure 5. The block 62 moves to the left of the Figure 2 position to decrease the speed of spindle 15.

If neither of the solenoids 46 or 47 is energized the lever 48 will be held in the Figure 5 position by balancing springs 64 and 65. The end of the lever 48 remote from the point of pivot is connected to an oscillation damping dashpot 66 located outside the panel 19.

It is apparent that when the solenoid 47 is actuated and the block 62 is moved to the left, as it is viewed in Figure 2, the resulting reduction in the speed of spindle 15, if

allowed to continue too long, will cause closure of the circuit including the pole 40 and the solenoid 46. When that happens, correction occurs in the opposite direction. To prevent hunting, the lever 45 is pivoted at 67 to the thread block 62 which carries the positioning roller 28. Thus, when the block moves to the left, as viewed in Figures 2 and 8, the cable 44 is paid out or slackened causing the weight 43 to pivot the bell crank 42 to hasten the opening of the circuit including the pole 39 whereby to bring to an early conclusion a hunting tendency on the part of the sensing mechanism.

The starting position of the lever 45 at any given stage of the winding period is controlled by a rack 68 which receives, in a socket 69, the free end 70 of the lever 45. The rack 68 is driven by a pinion 71 mounted on a shaft 72 which extends through the front wall of the machine and has mounted thereon a pinion 73 which meshes with a rack 74 at the bottom end of the counterweight 16 (see Figure 1). As the package 18 increases in diameter the counterweight 16 is rotated clockwise as viewed in Figure 1. This tends to move the rack 68 to the left, as it is viewed in Figure 8, to tighten the rod or cable 44, thereby to move the bell crank 42 in the direction to close the circuit including the pole 39 and the solenoid 47 to reduce the speed of spindle 15. It can be seen that the space between the switch element 38 and the poles 39 and 40 controls the amount of lost motion before the circuit is closed and hence the amount of permissible variation from the predetermined winding speed of the thread.

It will be appreciated that during the winding period the diameter of the package progressively increases. In order for the peripheral speed thereof always to remain the same, the control system described above progressively decreases the rotational speed of spindle 15 by shifting block 62, roller 28 and driving wheel 21 progressively from right to left, as viewed in Figure 2.

A bracket 62a, which is fixed to the block 62 (see Figures 3 and 7), acts to support the spiral sheath 44a of the flexible rod or cable 44. Thus, the movement of the block 62 bends the cable or flexible rod 44 but does not change the effective distance between its ends, i.e., it does not change the amount of the cable which is projecting from the sheath at any given time. It follows, therefore, that throughout the winding period the speed of spindle 15, and hence the winding speed, is separately controlled by both the dancer roll and the traverse mechanism. In this way, the speed of spindle 15 is always responsive not only to both local thread speed and the diameter of the wound body but also to the algebraic sum of the movements of switch element 41, caused by increase in package diameter, and T-switch element 38, caused by variations in thread speed. The sensitivity of the dancer roll, therefore, is exactly the same throughout the winding period so that the same amount of displacement thereof will cause the circuit to close irrespective of whether the winding is just beginning, is midway finished, or nearly finished.

Micro pressure switches 75 and 76 (see Figures 3 and 8) are located in the path of the lever 45 and if the lever moves too far in either direction one or the other of these switches is actuated. The switch 75 functions to open the circuit which includes the solenoid 46 and the switch 76 functions when actuated to open the circuit of the solenoid 47. When the lever 45 is moving counterclockwise from the Figure 8 position and is paying out the cable 44, the bell crank 42 is moving counterclockwise (as viewed in Figure 4) in a direction to close the circuit which includes the pole 40. Closing of this circuit energizes the solenoid 46 which functions to increase winding speed by causing the spindle 15 to be driven at an increasing speed. If this increase is excessive, switch 75 opens the circuit and stops the corrective action. Switch 76 operates the same way in the other direction.

It will be realized that during the winding period the wheel 21 gradually moves to the left, gradually to reduce

the speed of spindle 15 as the package 18 increases in diameter. At the end of the winding on, it is necessary to restore the parts to a starting position. This can be done either before or after the package 18 is removed from the spindle 15.

Therefore, it is necessary to release the counterweight 16 from the rest of the traverse mechanism 13. This is done by moving bell crank 77 counter-clockwise from the Figure 9 position so that spring 78 can move latching pin 79 from the position shown to a retracted position disconnecting the counterweight from the traverse mechanism. When this is done, the pinion 73 can be driven backwards restoring counterweight 16 with its rack 74 to starting position. In Figure 1, counterweight 16 is shown in just about the position it will occupy at the end of the winding on period.

Once the shaft 72 is free to turn by release of the latching pin 79 all that is necessary is to run the block 62 to the extreme right of the threaded portion 61 of the shaft 60, as viewed in Figure 2. To see how this operation is accomplished reference should be made to Figure 6. It will be seen that there is a driving wheel 80 which is mounted at the end of shaft 22 opposite from sheave 23. This wheel has a grooved periphery and can be placed in driving engagement with a like wheel 81 on shaft 60 by a coupling or transmission wheel 82 having a convex periphery. Wheel 82 is brought into position selectively by a bell crank 83 which is pivoted at 84 and which is provided with a weighted operating handle 85. In the full-line position of Figure 6 wheel 82 is out of contact with wheel 80. Hence, although wheel 80 is being driven from sheave 23, wheels 81 and 82 are stationary. When it is desired to run block 62 back to starting position, lever 85 is raised to the broken-line position of Figure 6 and engaged in a latch 86 having jaws which can be retracted electrically, or mechanically. When the lever 85 is raised the bell crank rotates counter-clockwise about the axis 84 and pushes coupling wheel 82 into peripheral frictional engagement with wheel 80. The rotation of wheel 80 is now imparted from wheel 82 to wheel 81 and block 62 moves to the right of the Figure 2 position until a pin 87 thereon strikes an electric switch or mechanical device 88 which is connected through conduit 89 to the latch 86. When latch 86 is opened, the weight of lever 85 causes it to fall to the full line position of Figure 6, again disconnecting wheels 80 and 81. At this point, the package 18 is doffed and the latching pin 79 re-engaged.

A modification of the switch mechanism of Figures 4 and 8 is shown in Figures 10 to 13 inclusive. In these figures the shaft 90 corresponds to shaft 30 and the dancer roll 91 is mounted on the end of a lever 92. Coil springs 93 and 94 surround shaft 90 and for flexible transmission purposes connect the lever 92 to levers 95 and 96, see Figure 11. To the left of lever 95 there is located an arm 97 which can turn on shaft 90 but with resistance. A similar arm 98 is paired with lever 96. Arms 97 and 98 are each provided with a pivoted pawl, the pawl 99 on the arm 98 being typical of both. A fixed pin such as the one shown at 100 normally holds the pawl 99 in unlatched position with respect to the coacting latch 101 on the lever 96.

In case the dancer roll moves up and lever 96 is moved counter-clockwise to a position close to arm 98 (in the angular sense) the small interfering switch projections 102 and 103 on the lever 96 and arm 98, respectively, will engage and lever 96 will displace arm 98 enough so that pawl 99 will fall from the normal or Figure 10 position to the Figure 12 position. The projections 102 and 103 are wired and provided with contact faces so that they may function as an electric switch corresponding to parts 38, 39 and 40 discussed hereinabove.

In case the winding speed decreases due to the regulation by means of a servomotor and becomes smaller than the supply speed the dancer roll descends and at this moment (a very small overregulation is sufficient) the

lever 96 moves away from arm 98, interrupts the contact and the regulation stops, see Figure 13.

The return movement causes the lever 96 to pull along the arm 98 by means of the pawl and latch until the pawl strikes the pin 100 to release the connection between the arm 98 and lever 96. While lever 96 is pulling arm 98 the switch is open but the switch elements are kept close together.

It will be understood that the lever 96, arm 98 and their switch elements 102—103 correspond to the switch 38—39 of Figure 4. The similar parts, not shown, on the lever 95 and arm 97 function in the same way to replace the switches 38—40 of Figure 4. Hence, the leads 104 and 105 in Figure 10 are in circuit with the solenoid 47 when this modification is used.

It will be appreciated that the device of Figures 10 to 13, inclusive, controls winding speed only as a function of dancer roll position. In the form of the invention shown in these figures, there is no use of both the package diameter and the dancer roll position as speed control factors acting cumulatively. The arrangement of Figures 10 to 13, inclusive, is in effect a slow make quick break one in which the levers 95 and 96 each move through a predetermined arc before closing a switch but, after closure, a very small movement in the other direction opens the switch. See in Figure 10 that the lever 96 moves counterclockwise through a considerable arc before switches 102 and 103 close. On the other hand, these switches open immediately upon any clockwise movement of the lever 96 from the Figure 12 position.

In Figures 14 to 17, inclusive, another slow make quick break arrangement is shown. In this case, a switch lever 106 is fixed on a shaft 107 which carries at its opposite end the dancer roll lever 108. Also mounted on the shaft 107 but free to rotate thereon is a block 109. Between the block 109 and the switch lever 106 there is located a spacer or shim 110 which is fixed to the shaft 107. The block 109 supports two dependent parallel switch arms 111 and 112 which lie on either side of the switch lever 106. The arm 111 carries a switch point 113 which faces a switch point 114 on the arm 112. The lever 106 carries oppositely extending switch points 115 which are positioned to register with the points 113 or 114 depending upon the direction of movement of the lever 106. Mounted on the block 109, in electrical circuit with the arm 111 and extending at right angles thereto, is a wiper brush 116. A similar wiper brush 117 extends from the opposite side of the block 109 and is in electrical circuit with the arm 112. By any convenient arrangement, arms 111 and 112 and their respective brushes 116 and 117 are insulated from one another. At the back of a housing 118 which receives the various parts heretofore discussed there are segments 119 and 120 which are wiped respectively by brushes 116 and 117. The segment 119 includes an insulated sector portion 121 and a conductive sector portion 122. Similarly, the segment 120 includes an insulated sector portion 123 and a conductive sector portion 124. The circuits are so arranged that the current flows through the lever 106, through the arm 112, through the brush 117 and through the sector 124 when the dancer roll moves sufficiently upwardly to require that compensation be made for the increase in speed. The circuit includes a solenoid such as those shown in Figure 5 and, in the case depicted in Figure 15, the circuit is connected to solenoid 47 to make the take up occur somewhat more slowly to compensate for the increase in speed. On the other hand, if the lever 108 had moved clockwise from the Figure 14 position, the circuit would have been established from lever 106 through arm 111, brush 116 and sector 122 to the solenoid 46 or its equivalent.

It is very important to note that when lever 106 first moves from the equilibrium position of Figure 14, it contacts one or the other of the switch arms 111 and 112. This, however, does not close the circuit because at this stage brushes 116 and 117 are on the insulated

sectors 121 and 123, respectively. If, however, the movement of the dancer roll persists, the lever 106 acting through the particular switch arm 111 or 112, which it is contacting, drives the block 109 and with it the brushes until the appropriate one of them completes the circuit through the appropriate conductive sector. Once the correction begins, however, the circuit is instantly broken as lever 106 moves away from the switch arm which it had been driving.

If reference is made to Figure 15, it will be noted that the circuit was closed when brush 117 first contacted conductive sector 124. However, if the lever 108 begins to move clockwise from the Figure 15 position, the circuit will be instantly broken between the lever 106 and switch arm 112. In other words, 115 will move away from the point 114. If the lever 106 swings over to contact with switch point 113 it will not oppositely energize the system unless enough movement should occur to cause the brush 116 to register with the sector 122. The effect of this construction is to make a slow make quick break system to which is restored the equilibrium with a minimum of hunting. The switches to both solenoids are in series so that to close the circuit both must be closed but to open the circuit either may be opened.

The device according to the invention is suitable for the winding of any kind of thread or yarn and is preferably used for winding threads of low denier.

The device is especially suitable for winding threads or yarns, especially artificial silk, with constant speed on cylindrical or conical spools and in which a continuous adaptation of the speed of rotation of the winding device to the speed of the supplied thread must take place.

The device may not only be used for winding a single supplied thread on a winding device such as a spool but may also be used for the separate winding of the threads from a plurality of threads supplied in the form of a warp. In such a case the winding speed of each separate winding spool may be regulated by the thread to be wound the driving of the individual winding spools being derived from a common head drive.

The device according to the invention has important advantages in comparison to the known devices for the same purpose and which are provided with a separate electromotor for each thread. The device according to the invention works more accurately than the known devices and acts on small deviations of the thread length of the loop and not on fluctuations in the tension of the thread. The tension may therefore be kept very accurately and extremely low which is of great importance in the winding of very thin threads.

While Figures 10 to 17, inclusive, are concerned with switch mechanisms under control of a dancer roll, it is possible to use these in combination with a control responsive to increase in package diameter.

What is claimed is:

1. An automatic speed control system for a yarn winding machine comprising a package support for collecting into package form yarn delivered thereto at an approximately constant speed, a constant speed drive source, a variable speed transmission interconnecting said package support and said drive source, first means operative in response to variations in speed of yarn delivered to said package support for varying the input-output speed ratio of said transmission, additional means operative in response to increase in diameter of said package also for varying the input-output speed ratio of said transmission, and means operative in response to variations in the input-output speed ratio of said transmission for maintaining the sensitivity of said first means irrespective of the diameter of the wound package.

2. An automatic speed control system for a yarn winding machine comprising a package support for collecting into package form yarn delivered thereto at an approximately constant speed, a spindle on which said support is mounted, a constant speed drive source, a vari-

able speed transmission interconnecting said spindle and said drive source, first sensing means engaged by the yarn and movable in response to variations in the speed of delivery for varying the input-output speed ratio of said transmission, additional sensing means engaging the yarn package and movable in response to increase in the diameter thereof for varying the input-output speed ratio of said transmission, and means operative in response to variation in the input-output speed ratio of said transmission for maintaining the sensitivity of said first sensing means irrespective of the diameter of the wound package.

3. An automatic speed control system for a yarn winding machine comprising a package support for collecting into package form yarn delivered thereto at an approximately constant speed, a spindle on which said support is mounted, a constant speed drive source, a variable speed transmission interconnecting said spindle and said drive source, a first pivotally mounted switch element, a second pivotally mounted switch element which cooperates with said first switch element for selectively varying the input-output speed ratio of said transmission, means operative in response to variations in speed of yarn delivered to said package support for shifting said first switch element into contact with said second switch element, and means operative in response to increase in diameter of said package for shifting said second switch element into contact with said first switch element.

4. An automatic speed control system as set forth in claim 1 and further comprising manually selectable means deriving power from said drive source for restoring said variable speed transmission to starting position at the completion of a winding operation.

5. An automatic speed control system as set forth in claim 4 and further comprising means for automatically disengaging said manually selectable means upon complete restoration of said variable speed transmission to starting position.

6. An automatic speed control system for a yarn winding machine comprising a package support for collecting into package form yarn delivered thereto at an approximately constant speed, means to drive said package support, a first pair of normally open switches connected in series, means operative in response to closure of said first pair of switches for increasing the speed of said drive means, a second pair of normally open switches connected in series, means operative in response to closure of said second pair of switches for decreasing the speed of said drive means, means alternately responsive to a decrease in the speed of yarn delivered to said package support for moving one switch of said first pair to closed position and to an increase in the speed of yarn delivered to said package support for moving one switch of said second pair to closed position, and means responsive to additional movement of the one switch of each pair for closing the other switch of that particular pair.

7. An automatic speed control system for a yarn winding machine comprising a package support for collecting yarn delivered thereto at an approximately constant speed, a constant speed drive source, a variable speed transmission interconnecting said package support and said drive source, said transmission including a rotatable shaft and a block movable to vary the input-output speed ratio thereof, two pairs of normally open switches, the switches of each pair being connected in series, normally inactive, reversible means for establishing a driving connection between said rotatable shaft and said block, directional actuating means in circuit with each pair of switches for operating said reversible means in a direction dependent upon which pair of switches is closed, and speed responsive means engaged by the yarn delivered to said package support alternately movable from a neutral position to close first one and then the other switch of each pair dependent upon the direction of speed variation from normal of the delivered yarn.

8. In an automatic speed control system for a yarn

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winding machine having a package support for collecting into package form yarn delivered thereto at an approximately constant speed and means to drive said package support, an improved slow make, quick break speed control circuit comprising a rotatable shaft, a switch lever 5 fixed to said shaft and depending therefrom, a block mounted for free rotation on said shaft, first and second mutually insulated switch arms attached to and depending from said block in generally parallel relationship with respect to said switch lever, a wiper brush extending from 10 each switch arm, mutually insulated conducting means, one in the path of movement of each wiper brush, means in circuit with said switch lever and one of said conducting means for increasing the speed of said package support drive means, means in circuit with said switch lever and 15 the other of said conducting means for decreasing the speed of said package support drive means, sensing means engaged by the yarn delivered to said package support and connected to said shaft for moving said switch lever into contact with the first of said switch arms and thereafter 20 to pivot said block, thereby causing the corresponding wiper brush to contact one of said conducting means when

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the yarn delivery speed is below a predetermined normal, and for moving said switch lever in the opposite direction into contact with the second of said switch arms and thereafter to pivot said block, thereby causing the other corresponding wiper brush to contact the other of said conducting means when the delivery speed is above a predetermined normal.

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