April 17, 1962 W. REINERS 3,030,040

AUTOMATIC YARN-COIL WINDING MACHINE

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FIG. 1

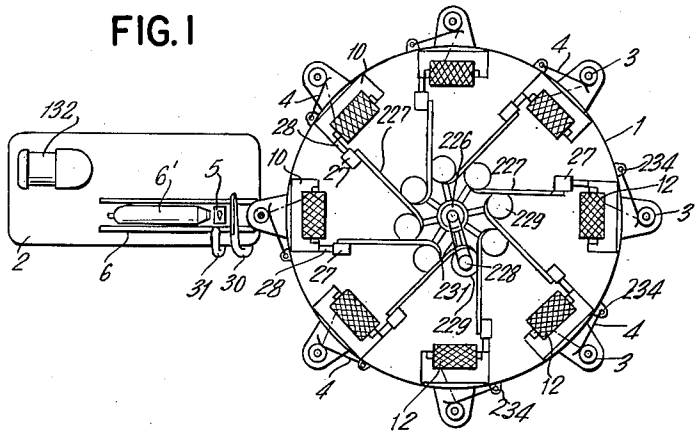
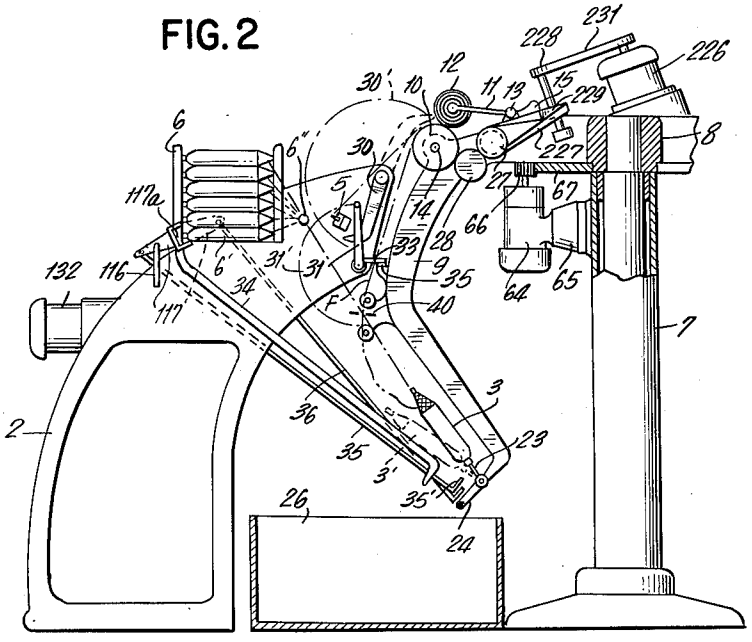


FIG. 2



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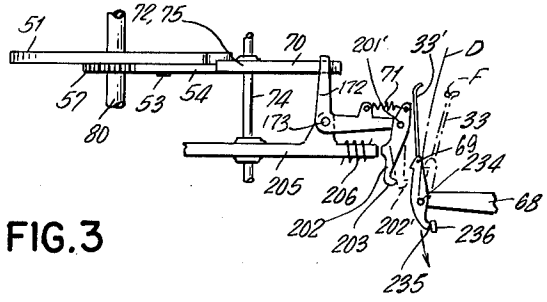
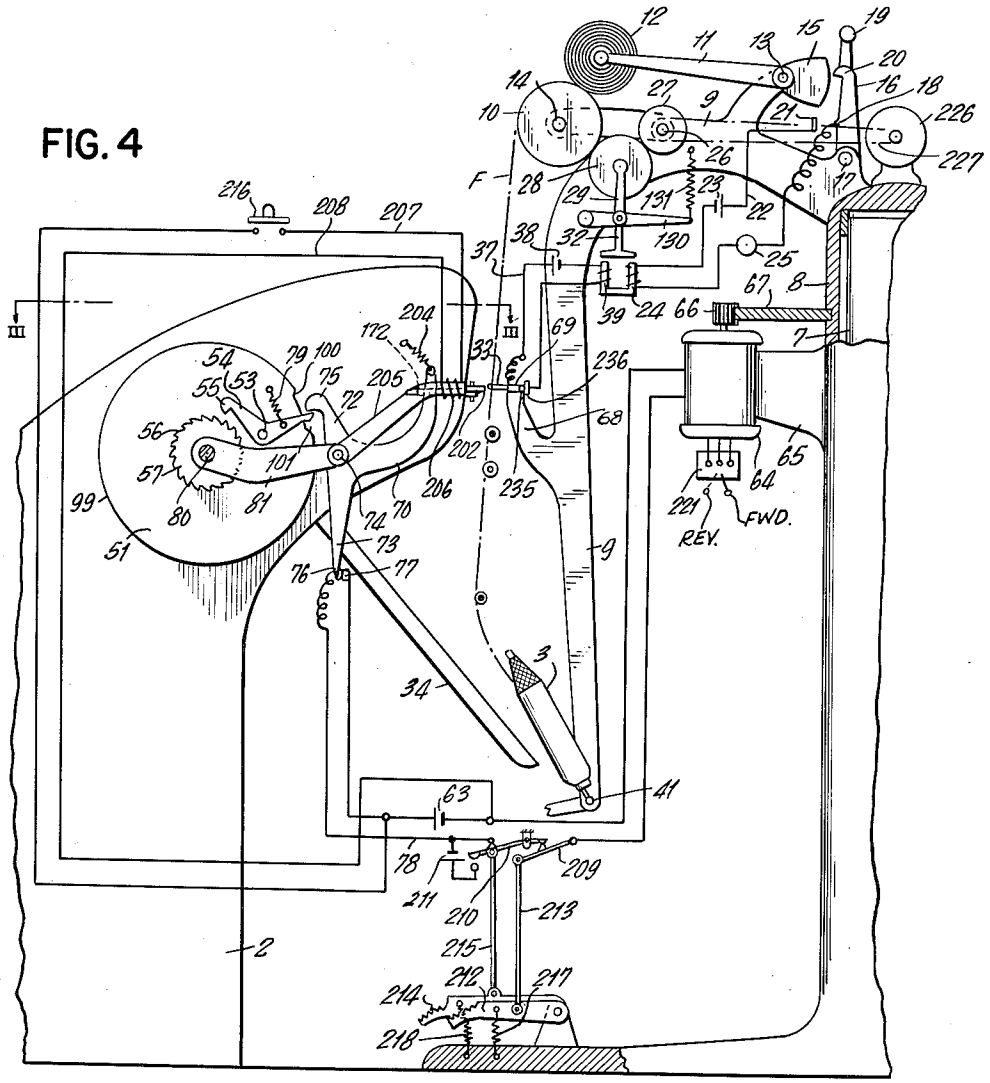


FIG. 3

FIG. 4

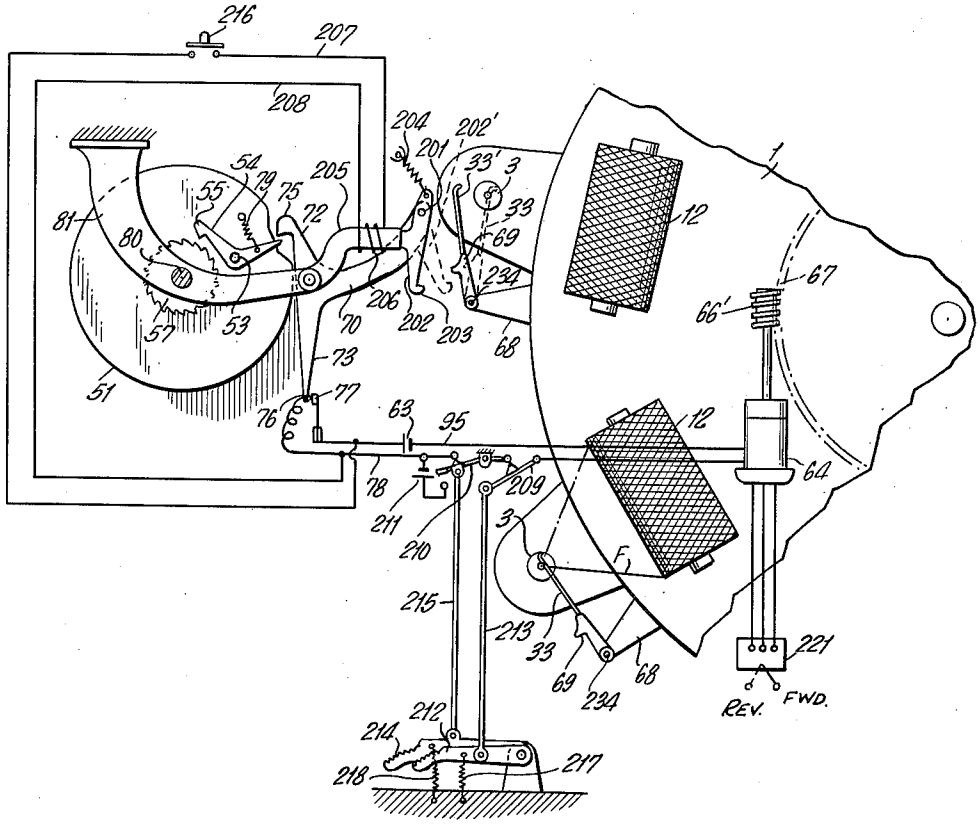


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AUTOMATIC YARN-COIL WINDING MACHINE

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FIG. 5

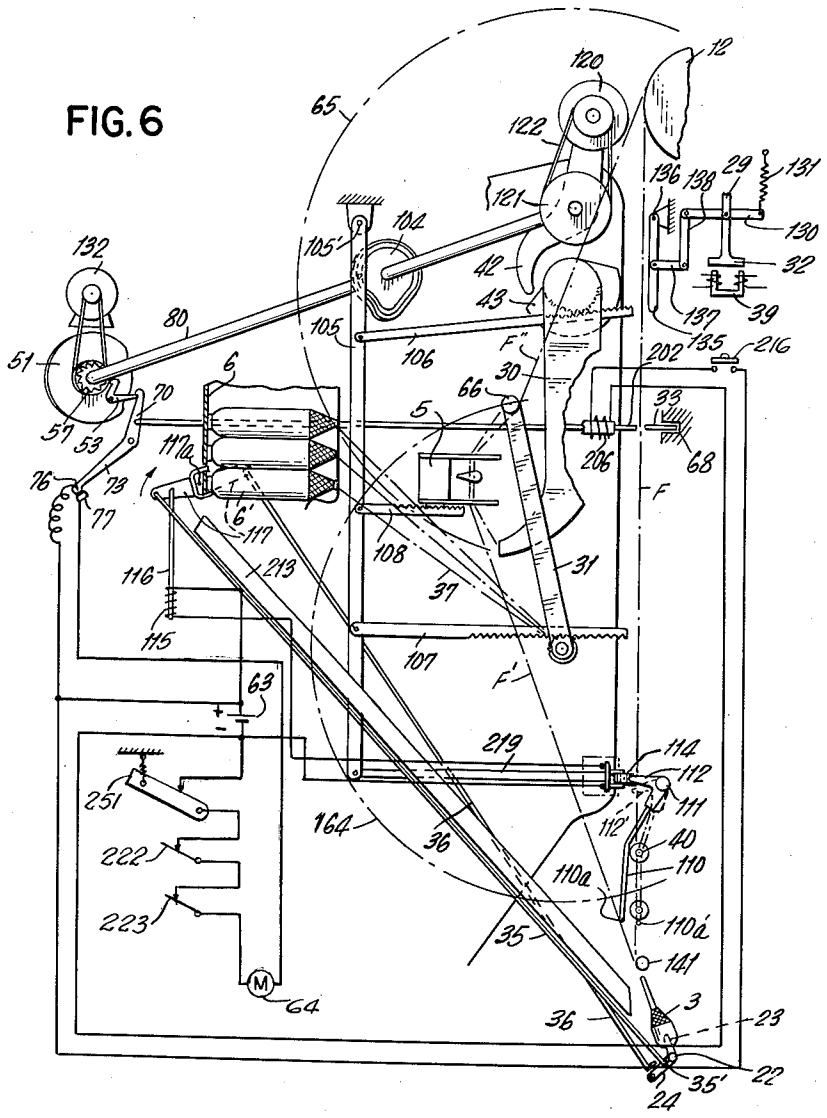


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AUTOMATIC YARN-COIL WINDING MACHINE

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FIG. 6



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3,030,040

AUTOMATIC YARN-COIL WINDING MACHINE

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Claims priority, application Germany Nov. 28, 1956
6 Claims. (Cl. 242—35.6)

My invention relates to machines for winding yarns into bobbins, cops and other wound yarn packages, herein all briefly referred to as "coils." This application is a continuation-in-part of my copending application Serial No. 696,495, filed November 14, 1957. More particularly, the present invention concerns coil winding machines of substantially automatic performance such as described in the copending applications of Stefan Fürst, Serial No. 675,773, filed August 1, 1957, now abandoned, and Serial No. 704,983, filed December 24, 1957.

Such machines are provided with a device for exchanging a depleted yarn-supply coil by a new, full coil, and also with a tying device for joining the torn yarn ends in the event of thread break, or for knotting the end of a new supply coil to the end of the yarn previously wound onto a take-up spool. Since in each individual winding station the supply-coil exchanging device and the tying device are used intermittently and each time for a short interval only, it suffices to provide a single exchanging and tying unit (servicing unit) for servicing a number of winding stations and to place the single servicing unit sequentially opposite the respective winding stations for performing any necessary yarn-tying or coil-exchanging operation. According to prior proposals, the relative travelling motion between the winding stations and the common servicing unit occurs in steps, each winding station being stopped a given interval of time in front of the servicing unit, before the relative travel is continued.

According to the above-mentioned copending application Serial No. 675,773, however, the machine is so designed that the relative motion between the winding stations and the servicing unit is interrupted only if, in response to proper sensing devices, it has become necessary to perform an automatic servicing operation, such as an exchange of the supply coil or the tying of a broken thread. This improves the efficiency of the multiple-station machine because no time is wasted by stopping a winding station in front of the servicing unit when an operation of the servicing unit is not needed.

It is an object of my invention to further improve machines of the above-mentioned type so as to permit superimposing an overriding control which will stop the winding-station or will modify its speed of travel independently of the thread sensing control so as to permit an attendant-supervised or attendant-executed activity to take place in addition to the automatic operations normally performed by the machine. One of these activities, for instance, is the manual exchange of a full take-up spool. Another example of an activity afforded by such superimposed extraneous control is the possibility of accelerating the winding-station travel for the purpose of placing a selected winding station rapidly into a given location accessible to the attendant for inspection or other work.

According to a feature of my invention, therefore, I provide the machine with means for temporarily interrupting the above-mentioned travel motion in response to a signal or command coming from a device extraneous of the winding machine proper, such as from a switch to be actuated by a person, i.e., manually or by a pedal. Such signal is either used to completely arrest the relative travel or to accelerate such travel to rapidly move a given winding station to the attendant's place.

According to still another feature of the invention, I provide the winding machine with speed control devices,

actuable from the outside, for retarding or accelerating the relative travel between the servicing unit and the group of winding stations. According to another feature, I also provide the machine with control means for reversing the direction of travel, either at the same speed or at decreased or increased speed.

According to more specific features of the invention, the above-mentioned extraneous control devices are made accessible for actuation from one or several locations within easy reach of the attendant. Particularly the device for excluding an automatic coil exchange in the event of thread break is preferably made serviceable from several convenient places. This, for instance, permits stopping the coil winding operation in any one station simply by actuating a push button at any one of a number of available control places. When such control is effected, the machine will rotate at increased speed, or the winding stations will rapidly travel past a desired servicing location until a given winding station reaches this location. The device for securing such operation can be so designed that when a given push button is actuated the relative motion is changed for a given number of travel steps. The control device may also be used for performing several control commands simultaneously or sequentially. For example, the machine may be accelerated for three steps of travel and may then stop automatically; or it may first stop and thereafter perform three steps in reverse before again stopping and then continuing its forward operation at the normal operating speed. For such performance the machine is to be provided with a device for counting and/or storing the commands.

It is also within the scope of the invention to control the drive for the relative travel motion between winding stations and servicing unit in such a manner that the travelling speed is modified only in response to manual actuation, for example by increasing the operating voltage of an electric drive motor, or by changing the transmission ratio of a driving transmission in steps or continuously. In such cases, it is desirable to provide electrical or mechanical means which prevent the coil-exchanging device of the servicing unit from being placed into operation by the coacting members of a winding station even when a thread break occurs in the winding station. This can be done, according to a more specific feature of the invention, by causing an electromagnet to displace a movable control member of the servicing unit out of the active range so that the displaced control member cannot engage a counter member of a winding station as that station travels past the displaced control member of the servicing unit.

The foregoing and other objects, advantages and features of the invention will be apparent from the following description in conjunction with embodiments of my invention shown by way of example on the accompanying drawings in which:

FIG. 1 shows schematically and greatly simplified a top view of a multi-station winding machine.

FIG. 2 shows a partly sectional side view of the same machine, illustrating on an enlarged scale the relative location of certain of the individual components, leaving out other components for the sake of clarity.

FIG. 3 shows a detail of the machine viewed in the direction of arrows III—III of FIG. 4.

FIG. 4 is a partial and partly sectional side view somewhat similar to that of FIG. 2 but shows schematically the control devices with which the machine is equipped in accordance with the invention.

FIG. 5 is in part similar to the schematic diagram of FIG. 1 on an enlarged scale and shows a somewhat modified form of control devices according to the invention; and

FIG. 6 illustrates schematically the supply-coil exchanging devices of machines according to the preceding illustrations.

The multi-station winding machine schematically shown in FIGS. 1 and 2 comprises a rotatable carrier structure 1 and a single stationary servicing unit 2. The structure 1 carries a number of individual winding stations uniformly distributed over its periphery. Each winding station is provided with a yarn-supply coil 3 from which the yarn F passes over a rotating yarn guiding drum 10 onto a take-up spool 12. Each winding station is further equipped with a thread guard or feeler 33 which rests resiliently against the yarn to initiate one of the operations mentioned below in the event the yarn is absent due to exhaustion of the supply coil 3 or due to yarn breakage.

The stationary serving unit 2 comprises a standard on which a yarn tying device 5 and a supply-coil magazine 6 with a coil exchanging device are mounted. The servicing unit 2 cooperates with the individual winding stations to exchange a depleted supply coil for a full coil from the magazine 6.

During operation of the machine the winding stations on the rotating carrier 1 travel counter-clockwise (FIG. 1) past the stationary servicing unit 2. This travel is continuous and uninterrupted as long as the respective thread guards 33 engage a thread F running from the supply coil 3 of the winding station onto the take-up spool 12. However, when the thread guard 33 becomes displaced upon absence of yarn due to breakage of the thread or depletion of the supply coil in any one winding station, guard 33 opens a switch in the circuit of motor 64, and the carrier 1 is stopped in a position where the particular winding station is in front of the servicing unit 2 and hence in condition to cooperate with the unit.

As shown in FIG. 2, the machine comprises a central vertical column 7 on which the carrier structure 1 is rotatably seated by means of a journalling sleeve 8. The carrier structure comprises for each winding station a mounting arm 9. A journalling frame 11 for accommodating the take-up spool 12 is pivotally mounted on arm 9 at 13. The shaft 14 of the guiding drum 10 is likewise journalled on arm 9. The guiding groove of drum 10 passes the incoming thread back and forth along the take-up spool 12 in order to wind a cylindrical package of yarn thereon of the type illustrated in FIGS. 1 and 5. During the winding operation, the drum 10 is driven by a friction roller 28 which is movable into and out of engagement with a drum 27 driven at constant speed by a belt drive 227 from a motor 226. The take-up spool 12, resting against drum 10, is thus entrained by drum 10 and causes the incoming thread to be wound upon spool 12 at a constant peripheral speed regardless of the diameter of the yarn package being built up.

In FIGS. 1 and 2, the motor 226 does not directly drive the roller 27 but operates the wheel 228 through a special belt 231. Located beneath this wheel 228, on the same shaft, is another wheel 229. There are as many of the latter wheels 229 around the periphery as there are winding stations. An endless belt 227 passes from this wheel 229 to the roller 27. From here the endless belt 227 (FIG. 1) passes back to the next middle wheel 229 and thence to the roller 27 of the adjacent spool and back through the middle wheel 229 and so forth. Since the motor 226 drives only the one wheel 228, the inclination toward the left as shown in FIG. 2, for better belt traction, is not detrimental, particularly since this motor is mounted on the rotating portion of the turntable 1.

The carrier structure 1 is driven by means of an electric motor 64 mounted on an arm 65 which is rigidly secured to column 7. The pinion 66 of the motor 64 meshes with a spur gear 67 mounted on the journaling sleeve 8.

Each supporting arm 9 carries one of the above-mentioned thread guards 33, a thread-tensioning device 40 and a pivot pin 22 upon which a coil holder for the supply coil 3 is rotatably mounted on a thorn or spear 23. The coil holder comprises an arm 24 rigidly joined with the holder spear 23. The holder structure together with the supply coil 3 is rotatable about pivot pin 22 so that the supply coil can be placed into the position shown by dot-and-dash lines at 3'. The thread running off the supply coil 3 passes through the thread tensioner 40 (FIGS. 2, 6) and past the thread guard 33 to the rotating guiding drum 10 and onto the take-up spool 12. Located beneath the supply coil 3 is a collecting box 26 to receive the emptied cores or quills of the supply coils after they are ejected from the winding station.

The stationary servicing unit 2 is provided with two suction devices 30 and 31 for finding and seizing the thread ends. The servicing unit 2 further carries a drive 132 to provide the power needed for the operation of the automatic devices and for the production of the vacuum needed for the suction devices 30 and 31. A number of full supply coils 6' are deposited in magazine 6. The starting ends of the threads coming from the respective coils 6' in the magazine are all placed in readiness by having them extend into the opening of a suction tube 6'' which communicates with a vacuum space within the standard of the servicing unit 2. An inclined slideway 34 extends downwardly from magazine 6 into the vicinity of the supply-coil holder structure 23, 24 of the winding station. A doffer rod 35 and a pusher rod 36 extend along the slide 34 and are longitudinally displaceable by means of the automatic control equipment housed within the standard of unit 2 and driven by the motor 132. When one of the arms 9 is located opposite the unit 2, as is the case in FIG. 2, the pusher rod 36, when actuated, swings arm 24 of the supply-coil holder and moves the supply coil or its empty core into the position 3'. Simultaneous lifting of the doffer rod 35 such as by means of link 116 connected to lock 117 (FIG. 2) causes hook 35' of rod 35 to pull the core off the spear 23, thus discharging the empty core into the collecting box 26.

The above described thread finding and seizing devices 30 and 31 consist essentially of tubular arms which communicate through their respective hollow pivot shafts with the suction chamber within the standard of the servicing unit 2. This suction chamber or space within the standard 2 is connected with a pump or other source of vacuum (not shown). Suction arm 30 communicates at its outer end with the atmosphere, and through its pivot end with the suction space within the standard 2. The suction end of arm 30 is rotatable along an arc denoted by 30'. The suction opening of arm 31, during rotation of that arm, travels along an arc denoted by 31'. Assume that the supply coil is depleted and exchanged for a full coil, or that the thread passing from the supply coil to the take-up spool is torn so that a tying operation is necessary. The absence of thread is sensed by the guard 33, as more fully described hereinafter, and initiates the following operations. The suction arm 30 moves clockwise and upward along the arc 30', while the friction roller 28 is temporarily reversed and unwinds some length of yarn from the take-up spool 12. The yarn end from spool 12 is then drawn into the suction opening of arm 30 so that when the arm 30 thereafter returns downward into the illustrated position of FIG. 2, the thread end seized from spool 12 is passed into the operating range of the tying device 5. Similarly, the downward motion of suction arm 31 causes the thread end then held at the tensioner 20 to be pulled into the suction opening. Thereafter, when suction arm 31 returns upwardly to the illustrated position of FIG. 2, this yarn end is also passed to the tying device 5, which is then effective to tie the two yarn ends together in a known manner.

As mentioned, the above described automatic operations are initiated by response of the thread guard 33.

Such respons is effected by means of the electric control system described presently with reference to FIGS. 3 and 4.

According to FIG. 4, the pivotally mounted frame structure 11 for journalling the take-up spool 12 carries a cam segment 15 which cooperates with a feeler lever 16. Lever 16 is pivoted to the supporting arm 9 at 17 and carries an electric contact 18 to cooperate with a stationary contact 21. Lever 16 is further joined with a manual actuating handle 19 and has a feeler nose 20 resting against the segment 15. The contacts 18 and 21 cooperate to open or close an electric circuit 22 comprising current source 23, a magnet 24 and a signalling device 25. A friction roller 27 has its shaft 26 journalled on the supporting arm 9 and cooperates with the above-mentioned friction roller 28. Friction roller 27 acts upon the intermediate roller 28 to drive the guiding drum 10. A common motor 226 drives respective belts 227 of each of the winding stations. The belt 227 is connected by a pulley to the shaft 26 on which roller 27 of the respective station is drivingly mounted. The friction roller 28 is journalled on a holder 29 which is pivotally linked to a lever 130 loaded by a spring 131. Also attached to the holder 29 is an armature 32 responsive to the above-mentioned magnet 24 or to another magnet 39 which may be combined with magnet 24 to form a single unit.

The thread guard 33 is pivotally mounted at 234 (FIGS. 3, 5) on an extension 68 of supporting arm 9. The guard 33 carries an electric contact 235 for cooperating with a contact 236 fixed relative to arm 9 (FIG. 4). Contacts 235 and 236 are connected in an electric circuit 37 which comprises a current source 38 (FIG. 4) and the above-mentioned magnet coil 39. The extension 68 of the supporting arm 9 in each individual winding station is further provided with a pawl 69 which is connected with the thread guard 33 and turns about pivot 234 together with guard 33 when the latter responds to absence of yarn.

Located opposite pawl 69, when the winding station is in front of the servicing unit, is a pawl lever 202 whose pawl nose 203 can engage the pawl 69. The lever 202 is linked with a lever 70 and is biased counter-clockwise about its pivot point by means of a spring 71. A spring 204 also has the effect of pulling the lever 70 upwardly, relative to FIG. 4.

During normal winding operation, the lever 202 occupies the position 202' (FIG. 3) shown by dot-and-dash lines. A stationary arm 81 (FIG. 4) mounted on the standard of the servicing unit 2 is provided with an extension 205 which carries an electromagnet or solenoid 206. Magnet 206 is connected in a circuit 207, 208 which comprises a current source 63 and is controlled by a push button contact 216. The circuit is further controlled by an on-off switch 209 and also by a voltage control switch 210 with whose aid an additional current source 211 can be added into the circuit. Switch 209 is actuated by means of a foot pedal 212 through a pull member 213. Switch 210 is actuated by means of a foot pedal 214 through a pull member 215. The pedals are biased to the illustrated raised position by means of respective springs 217 and 218. It will be understood that, if desired, the pedals may be substituted by manually actuated switches. The above-mentioned motor 64 for driving the carrier 1 of the winding stations is energized from the current sources 63, 211 and is provided with a reversing switch 221 which is electrically or mechanically actuable to positions "FWD" and "REV," respectively (FIGS. 4, 5) to forwardly drive or to reverse the running direction of the motor 64.

The above-mentioned lever 70 (FIGS. 3, 4, 5) has three arms. The upper arm 72 (FIG. 4) forms a latch nose 75 for engaging an angular pawl lever 54 which is pivoted at 53 to a cam disc 51 so as to rotate together with the cam disc about the cam shaft 80. The lower arm 73 of lever 70 carries a contact 76 to cooperate with a stationary contact 77 for controlling the supply of current from the above-mentioned current sources to the drive motor 64. The cam disc 51, during a single revolution released by the control system, actuates the above-mentioned automatic supply-coil exchanging devices of the servicing unit 2. The pawl nose 55 of lever 54 is engageable with the teeth 56 of a ratchet gear 57 which is kept in continuous rotation by means of the above-mention drive 132 (FIGS. 1, 2). The pawl lever 54 is normally held by nose 75 in the illustrated position of FIG. 4 relative to cam disc 51 and biased toward ratchet wheel 57 by the force of a spring 79.

The peripheral cam contour 99 of disc 51 has a recess 100 (FIG. 4) which, at 101, merges gradually with the circular portion of the contour.

As long as the pawl lever 54 is kept in the illustrated position of FIG. 4 by engagement with the nose 75 of lever 70, the ratchet gear 57 rotates idly and the cam disc 51 remains at rest so that the supply-coil exchanging devices of the servicing unit remain inactive. However when nose 75 of lever 70 is withdrawn from lever 54, the nose 55 of lever 54 will engage the ratchet gear 57 thus causing the cam disc 51 to be entrained for counter-clockwise rotation, with the result that the coil exchanging devices 35, 36, etc. are operated to doff the depleted core and to substitute a new, full supply coil, as is more fully described below with reference to FIG. 6. The coil exchange comprises two operations, namely the exchange of the depleted coil core (quill or tubular core) for a fresh yarn-supply coil, and the joining of the yarn ends coming from the supply coil and the take-up spool respectively. This exchange is released by means of the switch 114 (FIG. 6) which closes the circuit of the solenoid 115 and thereby opens the lock 117 in the magazine 6. Simultaneously the thorn upon which the new coil 6' slides, is placed into the proper position at 3' by movement of arm 24 by rod 36. The remaining portion of the coil exchange, namely the joining of the yarn ends, is controlled by the shaft 80. The coil exchange is not considered actually completed unless the joining of the yarn ends is successfully terminated.

The thread guard 33 is normally in the dot-and-dash position shown in FIGS. 3 and 5 and, when responding to absence of thread, turns counterclockwise about pivot 234 into the full-line position 33' in which the nose 69 enters into the range of engagement with the pawl nose 203 of the lever 202.

The machine operates as follows:

During normal winding operation, the winding stations on carrier 1 travel continuously counter-clockwise past the stationary servicing unit 2 (FIG. 1). As long as the thread guard 33 of any individual winding station does not signal the absence of yarn at the location of feeler 33 between tensioner 40 and spool 12, that individual station will pass beyond the servicing unit 2 without being stopped. However, when the thread guard 33 becomes deflected to position 33' upon absence of yarn due to yarn breakage or depletion of the supply coil 3, then the particular winding station in which such failure of yarn occurs is immediately made inactive without, at first, interfering with the continuous travel of the winding stations as a whole. This comes about by the fact that the thread guard 33 upon such absence of yarn deflects about its pivot 234 into the position 33' (FIG. 3) and closes the contact 236 which energizes the electromagnet 39. The armature 32 is attracted and moves the intermediate friction roller 28 against the force of spring 131 away from the driving roller 27 and from the thread guiding drum 10. Consequently, the thread guiding drum 10 and the take-up spool 12 are arrested.

Such operation may take place at any time and at any point of rotary travel of the winding-station carrier 1. Assume for instance, that an individual winding station is thus rendered inactive while still remote from the stationary servicing unit 2. Then the carrier 1 will continue to be driven by its motor 64. As soon as the

inactive winding station is located opposite the servicing unit the carrier 1 is automatically arrested. This is done by electric control contacts which, at the proper moment or positional relation, stop the drive motor 64 of the carrier and initiate the coil-exchanging or tying operation as will be more fully described below.

However, while normally the carrier is arrested as soon as any one of the winding stations, when inactive, is located opposite the servicing unit 2, the above-described machine according to the present invention permits placing the automatic carrier-arresting devices out of operation by actuating the push button switch 216 (FIG. 4). This closes the circuit of magnet 206 which moves the lever 202 from the position 202' to the full-line position 202 shown in FIG. 3. The lever 202 is now shifted out of the active range of the nose 69 actuated by the thread guard 33 so that no coil-exchanging operation is initiated. The push button switch 216 can be released at any desired moment, or the pedals 212 and 214 and the switch 221 can be actuated in order to change the travelling speed of the rotating carrier to reverse its travelling direction. In this manner, any one of the winding stations can be moved rapidly into a given position where the station is readily accessible to an attendant for inspection, repair or other work, without the necessity of letting the machine pass through the normal cycle of carrier travel and without calling upon the servicing unit to perform an operation that may not be necessary or not desired at that time.

If an individual winding station has become inactive as described above and none of the control members 216, 212, 214, 221 is actuated by the attendant, then the following events will take place.

It will be remembered that due to absence of yarn the thread guard 33 in the inactive winding station now occupies the position 33' as shown in FIG. 3. As soon as the pawl nose 69 of the deflected thread guard, travelling with carrier 1 along the circular path denoted in FIG. 3 by D, abuts against the lever 202 which now is in the position 202', the lever 202 is entrained and, since the part 202 is pivotally connected at 201' with a bell-crank lever 172, the latter is turned clockwise (FIG. 3) about its own pivot 173 on extension arm 25 until lever 172 abuts against a lug on the lever 70, thus rotating the lever 70 clockwise (FIG. 4) about its pivot 74. The nose 75 releases the pawl lever 54 which then under force of spring 79 engages the continuously rotating ratchet gear 57. The cam disc 51 is entrained and performs a single full revolution together with the ratchet gear 57. During this rotation the cam disc 51 controls the automatic devices of the servicing unit as will be more fully described below with referencve to FIG. 6.

The above-described clockwise rotation of lever 70 about pivot 74 has the further effect of lifting contact 76 off the contact 77 so that the carrier drive motor 64, energized from current source 63, is stopped, thus terminating the rotary travel of the winding-station carrier. This travelling motion of carrier 1 is interrupted during the rotation of cam disc 51 until the yarn F is again tied and is made taut enough to occupy the position F shown in FIG. 4 whence the yarn urges the thread guard from 33' back into the position 33 shown in FIG. 3. This releases the lever 202 and permits the lever 70 to return to the position illustrated in FIG. 4. The nose 55 of lever 54 becomes disengaged from ratchet gear 57 and the cam disc 51 is stopped. Simultaneously, the contacts 76, 77 again close so that the carrier drive motor 64 is energized and continues the traveling motion of the carrier 1 until any one of the thread guards 33 responds and again causes stoppage of the carrier travel and performance of the above described servicing operations.

The embodiment illustrated in FIG. 5, though somewhat modified in structural respects, performs substantially the same operation as the embodiment described above with reference to FIG. 4; functionally similar elements being denoted in FIG. 5 by the same reference numbers as in FIG. 4.

According to FIG. 5, a lever arm 70 in the stationary servicing unit carries a pivot pin 201 on which a pawl 202 is pivotally mounted. Pawl 202 has a latch nose 203 and is biased counter-clockwise by a spring 204 which also pulls the lever 70 upwardly. During normal winding operation the pawl 20 occupies the broken-line position 202'. The supporting structure 81 has an extension 205 on which is mounted an electromagnet 206 connected in an electric circuit 207, 208 which comprises the current source 63 for energizing the drive motor 64. Connected in series with lead 78 of that circuit are a disconnect switch 209, and a voltage control switch 210 which permits adding an additional current source 211. The disconnect switch 209 is actuated by means of a foot pedal 212 through a pull member 213. Switch 210 is similarly actuated from a pedal 214 through a pull member 215. The pedals are biased upwardly by respective springs 217 and 218. The pedals, of course, may be substituted by manually operable devices. Inserted into the electric circuit 207 is a push button switch 216. An electrically or mechanically controlled switch 221 permits reversing the running direction of the drive motor 64.

During operation of the machine, the thread guard, when responding, moves from position 33 to position 33' and, when next arriving at the stationary servicing unit, causes the nose 69 to hit against the pawl 202 which is in position 202'. This causes the lever 70, 72, 73 to turn clockwise. The nose 75 releases the lever 54, whose latch nose 55 catches into the teeth of the continuously rotating ratchet gear 57. This initiates the single-turn rotation of cam disc 51 and its shaft 80 to actuate the knotting and/or coil-exchanging operation by means of knotter 5 and/or doffer rod 35 and their respective related devices, as more fully described below with reference to FIG. 6.

However, the machine permits selectively preventing such initiation of the tying and coil-exchanging movements and, if desired, also affords accelerating the rotary travel of the winding stations. In order to prevent actuation of the tying and exchanging devices during passage of the turned-out thread guard 33 past the servicing unit, the attendant depresses the push button switch 216 thus closing the circuit 206, 207, 208 energized from current source 63. This causes the electromagnet 206 to pull the pawl 202 clockwise about pivot 201 into the full-line position of FIG. 5, where the pawl nose 203 is outside of the range of pawl nose 69. Consequently, when the particular winding station passes by the stationary unit, it cannot initiate the operation of the automatic devices of the unit.

For acceleraing the travel of the winding stations, the attendant actuates the pedal 214. This turns the changeover switch 210 downwardly and connects the current source 211 in voltage-adding relation with the source 63. Due to the increased operating voltage the running speed of the drive motor 64 is increased, thus causing it to impart accelerated rotary travel through worm 66' and spur gear 67 to the rotary table assembly 1. Analogously, the actuation of pedal 212 operates switch 209 with the effect of stopping the travel.

When a particular winding station in which, for instance, a full cross-wound take-up spool 12 is to be exchanged by the attendant, enters into the accessibility range of the attendant, he actuates the pedal 212 to open the switch 209. This interrupts the circuit 95, 78, and the drive motor 64 is stopped. After completion of the necessary manipulations at the particular winding station, the attendant releases the pedal 212, and the automatic performance of the various operations is again permitted to take place; that is, the machine will now continue to operate at the normal operating speed, and any one turned-out thread guard 33 has the effect of causing elimination of a thread break as above described with reference to FIG. 3.

As mentioned, the single-turn rotation of the cam disc

51 in the machines described above causes the automatic devices of the servicing unit to perform a thread-tying or coil-exchanging operation. This will now be more fully described with reference to FIG. 6 which schematically illustrates the supply-coil exchanging devices of the preceding illustrations.

When the ratchet gear 57, continuously driven by a motor 132, is coupled by pawl lever 54 with cam disc 51 as above described, the shaft 80 of disc 51 rotates a cam 104 whose groove is engaged by a follower pin of a lever 105 pivoted at 105', so that the lever 105 will perform oscillations toward the left and right. Three racks 106, 107 and 108 follow the oscillatory movements of lever 105. Rack 106 meshes with a pinion of a cam disc 43 appertaining to suction arm 30. Rack 107 meshes with a pinion secured to the pivot of suction arm 31. Rack 108 drives the tying device 5.

Aside from the above-mentioned thread guard 33 (located at 68 in FIG. 6), each winding station is equipped with a thread feeler 110 which is pivoted at 111 in each winding station. This switch 110, as shown in FIG. 6, occupies two positions. The position illustrated in solid lines in FIG. 6 is that in which the coil exchange is initialed and takes place. The normal yarn path F extends directly from the supply coil 3 through a deflecting or guide member 141 past the yarn tensioner 40. Thence the yarn passes on a straight path F up to the take-up spool 12. The yarn tensioner 110 has the tendency to move toward the left or clockwise about pivot 111 into the position illustrated in solid lines. However, if the yarn is first knotted by knotter 5 while in the position F' and thereafter pulled taut into position F, then the yarn guard 110 moves counterclockwise about pivot 111, in opposition to spring force or gravity, into a position in which its frontal arm 110*a*, extending transverse to the yarn direction, is placed at the right side in position 110*a*' beside the yarn path F. The yarn guard 110 thus always attempts to turn toward the left or clockwise, but it is prevented from moving in this direction by presence of the yarn F. The position of the switching arm 112 in the normal working position 112' is directed slantingly downward as shown in dotted lines in FIG. 6, but the arm 112 in solid lines is shown in the position it occupies when the yarn is absent from its normal path F. The position illustrated in solid lines is thus the one occupied when no yarn F extends between the tensioner 40 and the supply coil 12. The winding stations, each having its own yarn guard 110, travel past the stationary servicing unit which carries the switch 114. During such traveling motion the arm 112 operates the switch 114 if the yarn guard 110 is in the illustrated solid-line position. However, when the yarn is present, the yarn guard 110 is placed into its active position, and the switching arm 112 in position 112' is no longer within the range of the switch 114 so that these two components pass by each other without coming into mutual engagement.

When coil 3 is exhaused, or whenever yarn is absent from path F, lug 112 closes the switch 114 of the servicing unit and in passing thus energizes a control solenoid 115 from source 63. Solenoid 115 then acts through a rod 116 to rotate a lock 117 about pivot 117*a* in the direction of the arrow, to release the lowermost of the supply coils 6' from the magazine 6 and also to operate the above-mentioned doffer rod (35 in FIG. 2) and the control rod 36, so that the empty core is discharged and a new coil 3 placed upon the spear 23 of the coil holder.

Doffer rod 35 operates simultaneously with actuation of rod 36 and may be driven by any suitable mechanism such as from shaft 80 by conventional cam and lever means (not shown) or by a lever 116 connected to lock 117. When the lock 117 turns clockwise, the arm 36 is pushed downwardly, thereby turning the spool 3 counterclockwise. The doffer rod 35, 35' is linked to the pivoting part 117, as is rod 36. When this part 117 turns clockwise about its pivot 117*a*, the thorn 23 for receiving the supply coil is turned counterclockwise about pivot 22 and the rod 35 is simultaneously pulled upwardly to the left so that its doffer end 35' can disengage the depleted coil core from the thorn 23.

At that time, the pawl 69 of the upper thread guard 33 (FIGS. 3, 4) has coacted with levers 202 and 70 (FIGS. 3, 4, 6) to cause rotation of cam 104. The suction arm 30 turns upwardly, and the arm 31 downwardly. Concomitantly with the turning of the seeker arm 30 upwardly, the cam disc 43 causes a lever 42 to pivot a friction roller 120 to the right. The roller 120 is driven from a sheave 121 by a belt 122 and, now resting against the take-up spool 12, drives the spool 12 in reverse, i.e. in unwinding direction, so that some length of yarn is unwound. At the same time, the suction nozzle of arm 30 has reached the spool 12, so that during return motion of the arm the thread end is seized by the suction current and is entrained downwardly by the suction arm, as soon as this arm moves downwardly during further rotation of shaft cam 104. During the same interval of time, the suction arm 31 also turns downwardly. The arm 31 thus finds the thread of the new supply coil 3 and passes it, during next following upward movement, to the tying device 5 so that the thread passes to the intermediate position F'. At this time the tying device 5 is being actuated by the rack 108. When the knot is completed, the winding operation proper can be continued. The continuance of the winding operation is controlled by the thread guard 33 (FIGS. 4, 5) or 110 (FIG. 6) which again closes its contacts.

The automatic coil winding machine described thus requires two yarn guards 33 and 110 to supervise the yarn for its presence or absence. The one yarn guard 110 checks for presence of the yarn between the supply coil 3 and the tensioner 40. In this range, the yarn is not yet subjected to stress but can freely run off the coil 3. If the yarn is missing in this particular range, then the supply coil 3 must be exchanged. This is done by means of the illustrated and above-described mechanism comprising the switch 114 and the solenoid 115. However, the yarn guard 110 does not respond when the yarn is broken only in the range between the tensioner 40 and the take-up spool 12. This latter condition is taken care of by the second yarn guard 33 which is located between the tensioner 40 and the take-up spool 12. In this latter range, the yarn F possesses a tension caused by the yarn tensioner 40 so that the strain imposed upon the yarn in this range of its path is relatively great. When the supply coil 3 is exhausted, this particular range from tensioner 40 to spool 12 is likewise not occupied by the yarn. On the other hand, if the yarn is only broken in this range but the supply coil 3 is not yet depleted, then only the yarn guard 33 will respond. This guard 33 alone initiates the operations required for knotting the yarn. The knotting mechanism 5 is put into operation by the control action of the cam disc 51. The arm 31 moving with its suction nozzle 31*a* along path 31' seizes the yarn at a location beneath the tensioner 40. The upper yarn end, as already mentioned, is taken along from above by member 30, and both yarn ends are joined with each other in the knotter. Upon completion of the knotting operation and return of the individual components into the position of rest, the winding operation can then be continued.

The above-described coil-exchanging operation takes place only upon response of the feeler 110, i.e. when the supply coil 3 is exhausted. In the event of yarn break occurring when the supply coil 3 is not yet depleted, the feeler 110 does not deflect so that no coil exchange will take place. In this case, however, the thread guard 33 and its pawl 69 are effective to release the yarn seeking and tying operations.

As described above with reference to FIGS. 4 and 5, the automatic yarn tying operation can be suppressed at will by actuating the push button switch 216 (FIG. 6). Similarly, the automatic coil-exchanger solenoid 115 can

be suppressed by actuating a push button or pedal switch 251. Preferably, a number of such switches are series connected, as shown at 222 and 223, or are located at respective different locations readily accessible to the operator. It will be understood that the machine may also be equipped with the devices 212, 214, 221 shown in FIGS. 4 and 5.

The following describes how the winding operation is again switched on.

When the shaft 80 (FIG. 6) with its cam discs, particularly the cam 104, terminates one revolution, the control rod 106 pushes against a lever 135 located at the winding station and rotatable about the pivot pin 136. This motion of lever 135 is transmitted by a linking rod 137 to an arm 138 which in turn is pivotaly linked with the arm 130. The force of the spring 131 in conjunction with the pressure acting upon the rod 138 are sufficient to pull the armature 32 upward off the magnet 24 (FIG. 4), and to place the intermediate roller 28 into the active position shown in FIG. 4 in which it transmits the driving motion from drum 27 to the yarn-guiding drum 14. As a result, the yarn, which in the meantime has become knotted, is pulled taut along path F so that it is placed against the yarn guards 33 and 110 and thus brings them into their active positions to the right of yarn path F in FIG. 6. This disconnects the contacts 235 and 236 (FIGS. 3, 4) from each other and the pulling force of the solenoid 39 on armature 32, in effect up to that moment, is eliminated. Linked to the control rod 205 is a rod 219 which, at the termination of the motion of cam 204, returns the switch 114 to the right from the active position to the ready position. The winding operation now again commences, and the taut yarn F holds the yarn guard 33 in its active position.

It will be obvious to those skilled in the art, upon study of the present disclosure, that my invention permits of various modifications as regards structural components and operations, and may be embodied in devices other than specifically illustrated and described herein, without departing from the essential features of my invention and within the scope of the claims annexed hereto.

I claim:

1. A yarn-coil winding machine, comprising a carrier unit having a number of mutually spaced winding stations, a single servicing unit having a supply-coil magazine and thread tying means, one of said two units being movable relative to the other, a main drive motor connected with said movable unit for cyclically placing said stations in registry with said servicing unit for temporary servicing operation, each of said stations having take-up spool means and having supply-coil means for passing a thread to said take-up spool means, each of said stations having a sensing member responsive to thread failure ahead of said take-up spool means, said servicing unit having a driving mechanism actuatable by said sensing member in responded condition for performing said temporary servicing operation when said unit is in registry with one of said respective stations, drive control means connected with said main drive motor and with said driving mechanism, said driving mechanism having an element engageable in one position thereof with said sensing member in responded condition to place said sensing member into controlling connection with said drive control means when said unit registers with said station to stop said main drive motor and operate said driving mechanism only upon occurrence of thread failure in said station; overriding control means actuable independently of said controlling connection of said sensing member and connected with said main drive motor for temporarily modifying the travel of said movable unit independently of the operation of said sensing member, said overriding control means comprising a drive control circuit having an auxiliary power supply connectable to said main drive motor for operating said motor at an increased speed, and selective switch means optionally controllable by the attendant for temporarily connecting said auxiliary power supply to said main drive motor, for advancing said motor, and for reversing said motor.

2. A yarn-coil winding machine, comprising a rotatable carrier having a group of mutually spaced winding stations, a single stationary servicing unit located at a given point of travel of said group and having a supply-coil magazine and thread tying means, a main drive motor connected with said carrier for cyclically moving each of said stations past said unit and into registry therewith for temporary servicing operation of said unit with said respective stations, each of said stations having take-up spool means and having supply-coil means for passing a thread to said take-up spool means, each of said stations having a sensing member responsive to thread failure ahead of said take-up spool means, said servicing unit having a driving mechanism actuatable by said sensing member in responded condition for performing said temporary servicing operation when said unit is in registry with one of said respective stations, drive control means connected with said main drive motor and with said driving mechanism, said driving mechanism having a lever engageable in one position thereof with said sensing member in responded condition to place said sensing member into controlling connection with said drive control means when said unit registers with said station to stop said main drive motor and operate said driving mechanism only upon occurrence of thread failure in said station, and overriding control means actuable independently of said controlling connection of said sensing member and connected with said main drive motor for temporarily modifying the travel of said carrier independently of the operation of said sensing member, said overriding control means comprising a drive control circuit, an electromagnet connected to said control circuit, switch means comprising a first selectively operable switch connected in series with said electromagnet for moving said lever out of said one position, contact means in said motor circuit for automatically opening the latter circuit when said lever is in said one position and is engaged by said sensing member in responded condition, said selectively operable switch being connected in parallel with said contact means for closing said motor circuit at will independently of the condition of said contact means, and a disconnect switch in said control circuit for stopping said main drive motor.

3. In a winding machine according to claim 2, said overriding control means further comprising a reversing device connected to said motor and controllable by the attendant for temporarily reversing the running direction of said carrier.

4. In a system according to claim 2, said main drive motor and said drive mechanism having an electric system in common which includes said drive control means, said first selectively operable switch being connected for controlling the movement of said main drive and simultaneously rendering said drive mechanism non-actuatable by said sensing member.

5. A yarn-coil winding machine, comprising a rotatable carrier having a group of mutually spaced winding stations, a single stationary servicing unit located at a given point of travel of said group and having a supply-coil magazine and thread tying means, a main drive motor connected with said carrier for cyclically moving each of said stations past said unit and into registry therewith for temporary servicing operation of said unit with said respective stations, each of said stations having take-up spool means and having supply-coil means for passing a thread to said take-up spool means, each of said stations having a sensing member responsive to thread failure ahead of said take-up spool means, said servicing unit having a driving mechanism actuatable by said sensing member in responded condition for performing said temporary servic-

ing operation when said unit is in registry with one of said respective stations, drive control means connected with said main drive motor and with said driving mechanism, said driving mechanism having a lever engageable in one position thereof with said sensing member in responded condition to place said sensing member into controlling connection with said drive control means when said unit registers with said station to stop said main drive motor and operate said driving mechanism only upon occurrence of thread failure in said station, said main drive motor and said drive mechanism having an electric system in common which includes said drive control means, said system having a motor control circuit provided with a first current source for energizing said main drive motor, an electromagnet connected to said control circuit, an additional current source connectable in series with said first current source for operating said drive motor at an increased speed, switch means comprising a first selectively operable switch connected in series with said eletcromagnet for moving said lever out of said one position, a voltage control switch for selectively connecting said additional current source in series with said first current source, and a disconnect switch in said motor control circuit for stopping said main drive motor, said switch means being accessible at each of said winding stations to the attendant for disconnecting said energizing system at will.

6. A yarn-coil winding machine, comprising a rotatable carrier having a group of mutually spaced winding stations, a single stationary servicing unit located at a given point of travel of said group and having a supply-coil magazine and thread tying means, a main drive motor connected with said carrier for cyclically moving each of said stations past said unit and into registry therewith for temporary servicing operation of said unit with said respective stations, each of said stations having take-up spool means and having supply-coil means for passing a thread to said take-up spool means, each of said stations having a sensing member responsive to thread failure ahead of said take-up means, said servicing unit having a driving mechanism actuatable by said sensing member in responded condition for performing said temporary servicing operation when said unit is in registry with one of said respective stations, drive control means connected with said main drive motor and with said driving mechanism, said driving mechanism having a lever engageable in one position thereof with said sensing member in responded condition to place said sensing member into controlling connection with said drive control means when said unit registers with said station to stop said main drive motor and operate said driving mechanism only upon occurrence of thread failure in said station, said main drive motor and said drive mechanism having an electric system in common which includes said drive control means, said system having a motor control circuit provided with a first current source for energizing said main drive motor, an electromagnet connected to said control circuit, an additional current source connectable in series with said first current source for operating said drive motor at an increased speed, a switch means comprising a first selectively operable switch connected in series with said electromagnet for moving said lever out of said one position, a voltage control switch for selectively connecting said additional current source in series with said first current source, and a disconnect switch in said motor control circuit for stopping said main drive motor, contact means in said motor circuit for automatically opening the latter circuit when said lever is in said one position and is engaged by said sensing member in responded condition, said selectively operable switch being connected in parallel with said contact means for closing said motor circuit at will independently of the condition of said contact means, said switch means being accessible at each of said winding stations to the attendant for optionally connecting said additional power supply to said main drive motor, for advancing said carrier, and for reversing said carrier.

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