March 7, 1967 S. FÜRST 3,307,794

AUTOMATIC YARN-PACKAGE WINDING MACHINE WITH TAKE-UP SPOOL EXCHANGING DEVICE

Filed June 1, 1964 4 Sheets-Sheet 1

FIG. 1

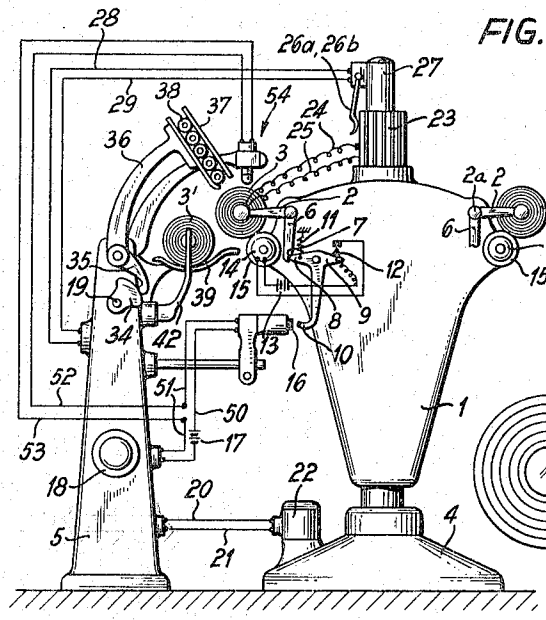


FIG. 1a

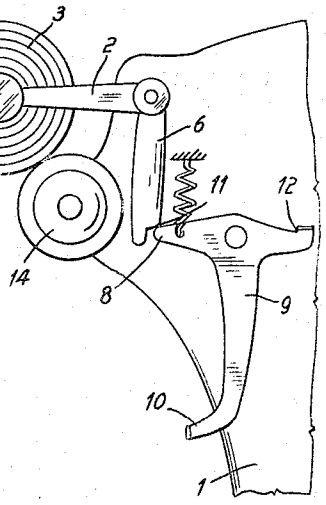


FIG. 2

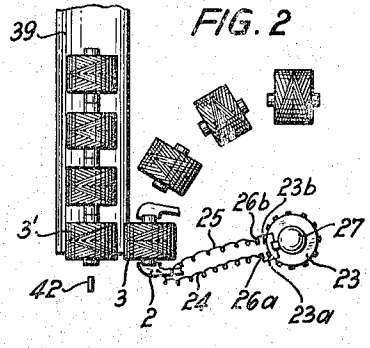


FIG. 3

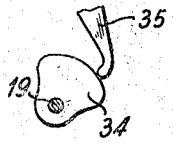


FIG. 4

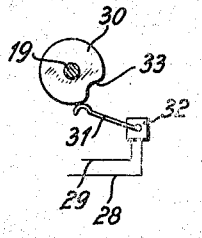


FIG. 5

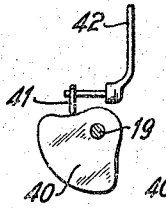
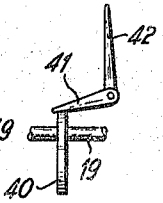


FIG. 6



INVENTOR

Stefan Fürst

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AUTOMATIC YARN-PACKAGE WINDING MACHINE WITH TAKE-UP SPOOL EXCHANGING DEVICE

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FIG. 7

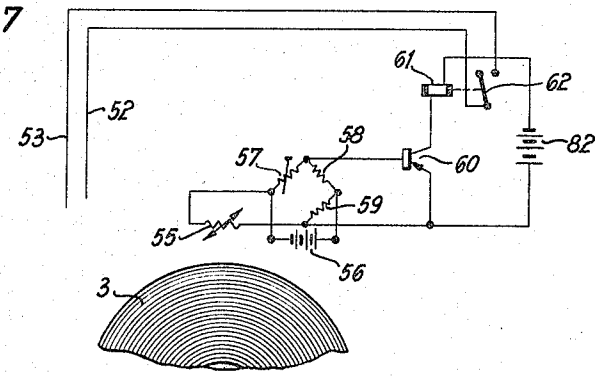


FIG. 8

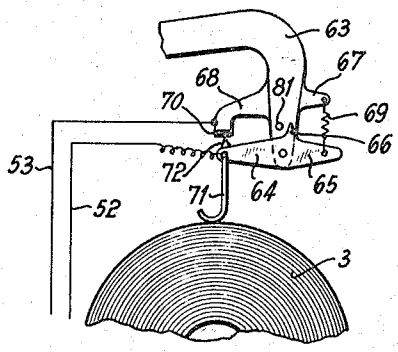


FIG. 9

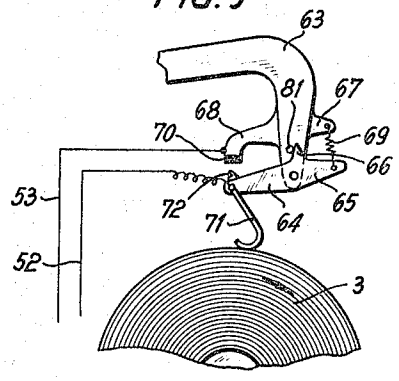
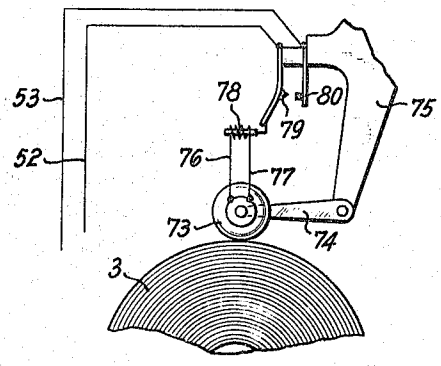


FIG. 10



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AUTOMATIC YARN-PACKAGE WINDING MACHINE WITH TAKE-UP SPOOL EXCHANGING DEVICE

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FIG. 11

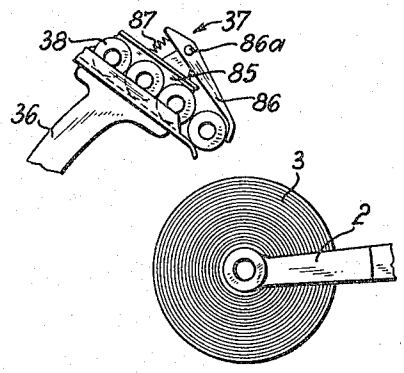
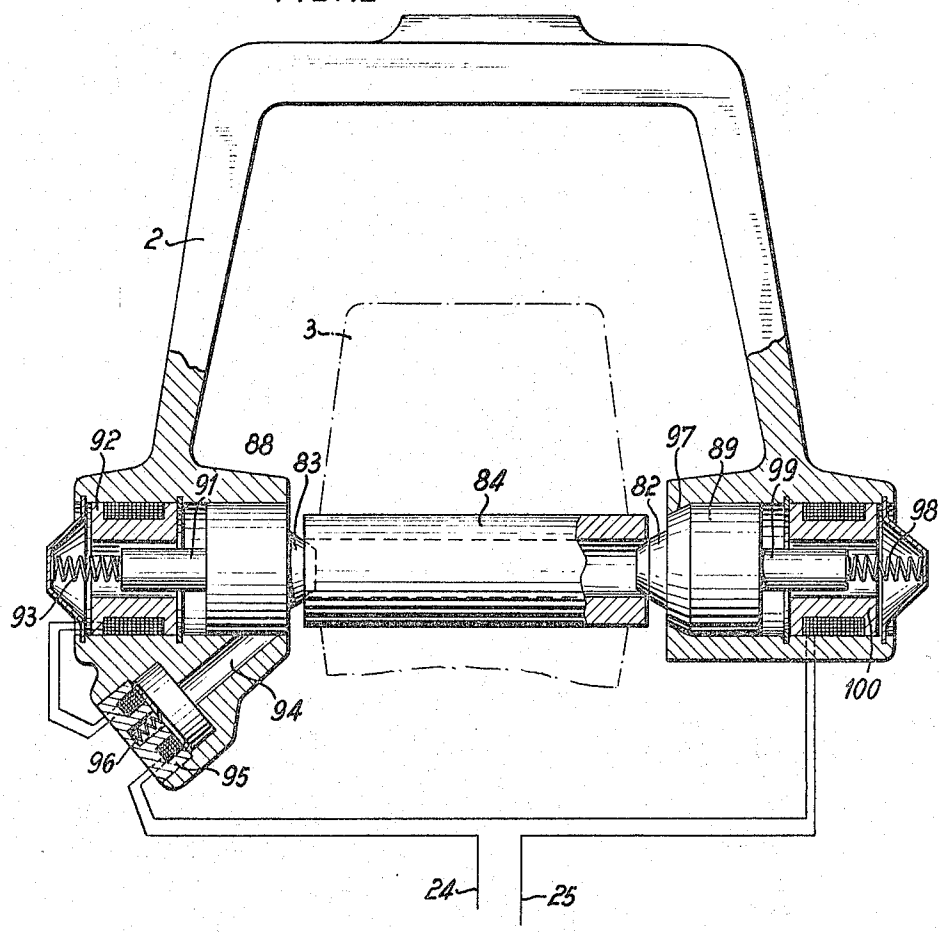


FIG. 12



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March 7, 1967 S. FÜRST 3,307,794

AUTOMATIC YARN-PACKAGE WINDING MACHINE WITH TAKE-UP SPOOL EXCHANGING DEVICE

Filed June 1, 1964 4 Sheets-Sheet 4

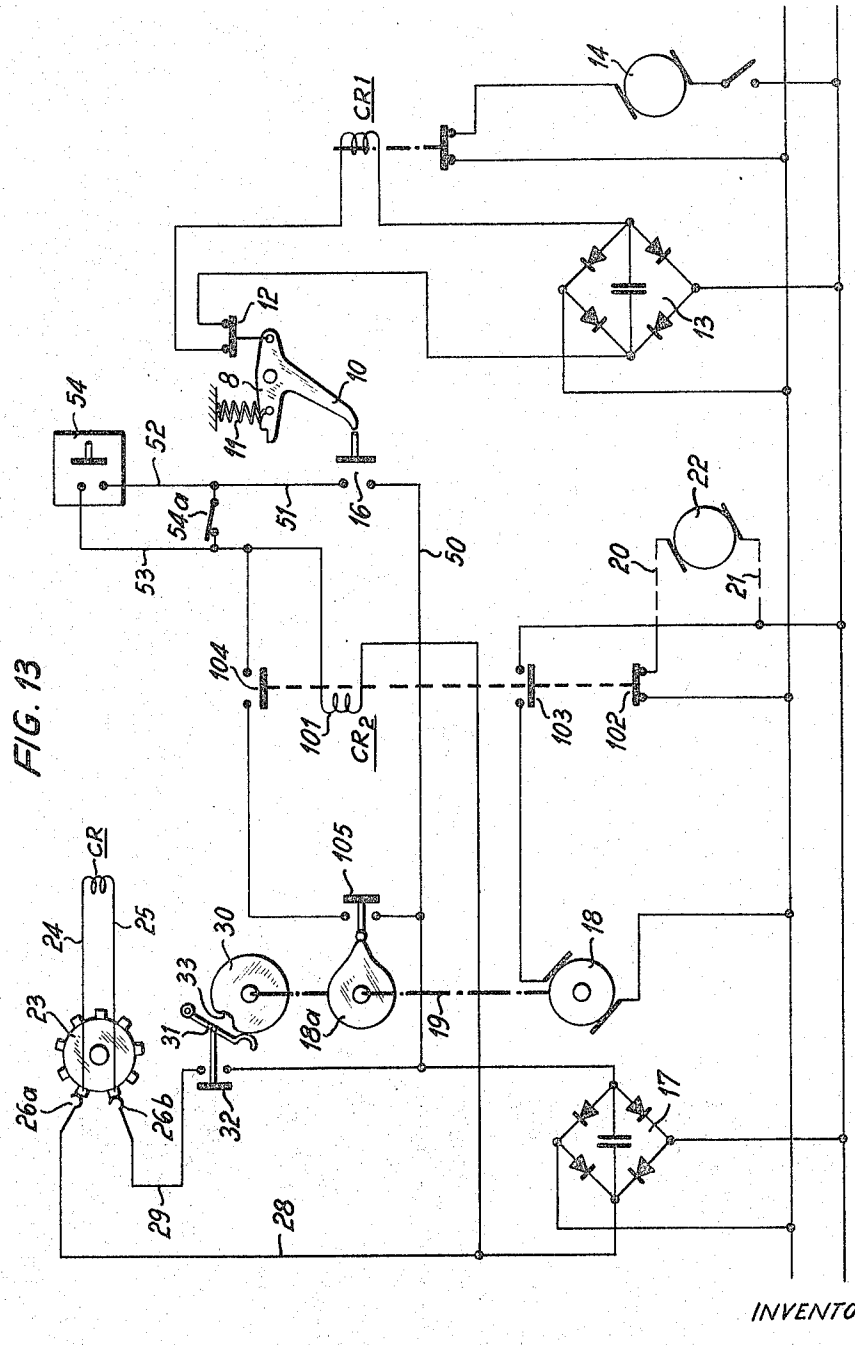

FIG. 13

INVENTOR

United States Patent Office 3,307,794
Patented Mar. 7, 1967

3,307,794

AUTOMATIC YARN-PACKAGE WINDING MACHINE WITH TAKE-UP SPOOL EXCHANGING DEVICE

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Filed June 1, 1964, Ser. No. 371,285
Claims priority, application Germany, Aug. 16, 1963, R 35,914; Aug. 19, 1963, R 35,932
10 Claims. (Cl. 242—35.5)

My invention relates to machines for winding cross-wound yarn packages, usually called "cheeses" or "cones," in which the winding operation is automatically discontinued when the yarn package on a take-up spool is completed, whereafter a spool exchanging device removes the completed take-up spool or package and substitutes an empty spool core before the machine resumes the winding operation to produce another yarn package on the core.

In one of its preferred aspects, my invention particularly relates to multi-station machines of the just-mentioned type in which a number of individually operable winding stations cooperate with a single take-up spool exchanging device relative to which the winding stations are placed into coactive position, one at a time, by relative movement between the winding stations on the one hand and the exchanging device on the other hand. The relative movement is produced by displacing the winding stations with respect to the exchanging device or vice versa, the travel being temporarily stopped during the period of time in which the device operates to effect the spool exchange.

It has been found that the completed cheeses or cones, particularly if they consist of delicate yarn and have a relatively large size, are impaired as they pass, during exchanging operation, from the wind-up journalling location to a lay-off location at the spool exchanging device, from which latter location they are removed from time to time by attending personnel or with the aid of mechanical conveying means. The impairment often observed involves an undesirable deformation at the surfaces and edges of the packages and sometimes also disarrangement or entanglement of the exposed yarn ends.

It is an object of my invention to avoid such deficiencies and to improve the take-up spool exchanging operations in such machines so as to secure a more gentle handling of the completed yarn packages as they pass from the winding location to the lay-off place. This, as well as further objects of the invention, will be more fully explained presently.

It is known to have the completed cross-wound yarn packages automatically laid off upon an endless conveyor belt on which they are passed to a collecting box. It cannot be prevented with such equipment that the yarn packages become damaged, particularly as they drop down from the conveyor into the box. In the subsequent fabrication, the damage may manifest itself by unfavorable running properties of the package or by irregular coloration when the material is dyed. In the production of shuttle bobbins (weft cops) it has become known to prevent them from damaging each other by having the take-up spools laid off upon the pins of a pin board. However, the use of such and similar devices for the take-up spools in cheese and cone winding machines is economically infeasible since the latter type of packages are much larger and heavier and are completed in much longer intervals of time. Hence complicated stacking devices cannot be employed economically, aside from the fact that the larger dimensions

of this type of spools would require a considerably larger amount of equipment and space.

It is therefore another, more specific object of my invention to devise a take-up spool exchanging device with lay-off equipment of much simpler and more compact design that nevertheless reliably prevents the cheeses or cones from colliding against one another as they are being doffed by the spool exchanging device.

It has been found that another source of the above-mentioned trouble occurring during the take-up spool exchanging operation is the fact that the completed take-up spools, after the spool winder drive is shut off, will continue for some time to coast down to standstill, particularly if the cheese or other cross-wound package is relatively large. Thus, it may happen that the spool is being exchanged while still in rotary motion. The spool, due to its own kinetic energy, then can roll off in an uncontrolled manner, causing the above-mentioned damage.

To minimize such defects, it has been proposed to delay the initiation of the spool exchanging operation or to shorten the coasting-down time of the spool by braking. However, since the coasting-down period depends upon the rotary speed, the diameter, the winding hardness and in some cases also upon the yarn material, such devices must be readjusted whenever the spool diameter, the speed or the winding tension and hence the hardness of the spool is to be changed.

It is therefore another, more specific object of my invention to make certain that the automatic spool exchanging device will commence operating only when the take-up spool has fully or approximately reached standstill, regardless of the particular winding speed, spool diameter or other above-mentioned variables of the winding operation.

According to one of the features of my invention, a spool lay-off structure is provided at a take-up spool exchanging device in a cheese or cone winding machine generally of the above-mentioned type, the lay-off structure having a surface area which receives from the exchanging device the completed take-up spool issuing at a time from the spool journalling location prior to insertion of an empty spool core into that location; and I further provide an intermittently operating spool feed device which is engageable with the laid-off spool on the just-mentioned receiving area of the lay-off structure and has a feed stroke approximately equal to the dimension of the completed take-up spool relative to the feed direction, so that the spool receiving area on the structure is vacated by the action of the feed device prior to arrival of the next spool. The collecting structure can be arranged in such a manner that the arriving spools travel serially behind each other, either with their respective peripheral surfaces facing or engaging each other, or with their axial surfaces or cores facing or engaging each other. In the former case, the feed stroke of the above-mentioned feeder device corresponds at least approximately to the spool diameter, whereas in the latter case the feed stroke corresponds approximately to the full axial width of the spools.

For shifting the take-up spool from the receiving area of the collecting structure an amount corresponding to the axial width of the spool, a particularly simple design is achieved if the structure is shaped as a trough and the feeder device comprises a reciprocating pusher member which, actuated for example under control by the take-up spool exchanging device, shoves each arriving spool away from the arrival area.

In cases where the collecting structure is such that the cross-wound yarn packages may engage each other at the peripheral surfaces, these surfaces may possibly rub

against each other and become damaged if the structure is designed as a trough. In this case, therefore, it is preferable to design the collecting structure as a conveyor belt which is controlled by the spool exchanging device to move intermittently for shifting each spool away from the arrival location an amount at least equal to the spool diameter. Such a feed device in form of a stepwise operating conveyor belt may also be used if the spools are placed with their axial ends facing each other, in which case the conveyor belt moves, upon each spool exchange, an amount at least approximately equal to the axial length of the spool. A particularly gentle handling of the spools is secured if such a conveyor belt is equipped with individual trays or shells into which the yarn packages are placed at the arrival location.

By virtue of an intermittently operating feeder device at the spool receiving area of the exchanging device, the completed cross-wound spools are collected in a most gentle manner until they are removed from the collecting structure by the attending personnel and placed into suitable containers, such as transportation boxes.

According to another feature of my invention, the automatic take-up spool exchanging device in a yarn winding machine is provided with control means that comprise a sensing device responsive to rotation of the take-up spool on the wind-up journalling location of the machine, so that the spool exchanging operation is initiated only after the completed take-up spool, upon stopping of the winder drive, has fully or nearly reached standstill. Such a rotation sensing device may be provided for each of the winding stations in the machine, or a single sensing device may be employed and preferably mounted on the spool exchanging device for coaction with only the one winding station that is in coactive position relative to the exchanging device at a time.

According to another, more specific feature of my invention, the just-mentioned rotation sensing device comprises a feeler which mechanically engages the take-up spool at the journalling means, at least when the spool has reached a given diameter or size, and which is displaced or turned as long as the spool is in rotation, thus controlling an electric control circuit, such as by opening of a contact, when the spool reaches standstill.

The sensor, however, may also be of the proximity type so as to operate without entering into bodily contact with the spool. For example, the sensor proper may consist of a heat-responsive member which senses the change in temperature resulting from the motion of air that occurs near the spool surface as long as the spool has an appreciable speed of rotation. Preferably, such a heat sensor consists of a temperature-responsive electric resistance (thermistor) connected in a resistance bridge network. When the spool is in rotation, the thermistor is subjected to cooling, and under these conditions the bridge network is balanced by adjustment of one of its other resistors. When the spool stands still, the temperature in the thermistor increases and its resistance changes so that the bridge network becomes unbalanced with the effect of controlling a circuit to operate the spool exchanging device.

According to another feature, the rotation sensing device may essentially consist of a generator driven from the take-up spool and connected with a magnet which, as long as the generator is in rotation, opens a contact in the control circuit of the exchange device.

The above-mentioned and more specific objects, advantages and features of my invention, said features being set forth with particularity in the claims annexed hereto, will be apparent from, and will be described in, the following with reference to embodiments of automatic yarn-package winding machines illustrated by way of example on the accompanying drawings in which:

FIG. 1 shows schematically a carrousel-type winding machine designed and operating according to the invention.

FIG. 1*a* is a fragmentary enlarged view of FIG. 1 showing the specific relationship of levers **6** and **8** therein.

FIG. 2 is a partial schematic view of the same machine seen from above.

FIGS. 3 to 5 show three respective cam mechanisms that form part of the spool exchanging device in the same machine, and FIG. 6 is a lateral elevation corresponding to FIG. 5.

FIGS. 7 to 10 illustrate four different embodiments of spool-rotation sensing devices for controlling the initiation of a spool exchange in a machine as shown in FIGS. 1 to 6.

FIG. 11 shows a spool-core magazine that forms part of the machine according to FIG. 1.

FIG. 12 is a part-sectional view of a spool holder in the same machine; and

FIG. 13 is an electric circuit diagram of the machine.

The illustrated carrousel-type machine comprises a supporting structure **1** which is rotatable on a base plate about a vertical standard and carries a number of individual yarn winding stations uniformly distributed over the periphery. Each winding station comprises a spool journalling frame **2** (FIGS. 1, 2, 12) which is pivoted at **2***a* to the machine structure **1** and carries the means for rotatably accommodating between its legs the core (**84** in FIG. 12) upon which a spool of yarn in form of a cross-wound package **3**, usually called "cheese" or "cone" is to be wound. The yarn in each winding station is supplied from a cop or other supply bobbin also mounted on the machine structure **1** but not shown. In this respect, as well as regards other details not essential to the present invention, reference may be had to my U.S. Patent 3,035,783 for Multi-Station Coil-Winding Machine Having an Automatic Servicing Unit, assigned to the assignee of the present invention. During operation, the machine structure **1** is slowly rotated about its vertical axis by means of an electric motor **22** (FIGS. 1, 13) so that the winding stations sequentially pass through a cooperative position with respect to a stationary servicing unit according to Patent 3,035,783 for exchanging a yarn-supply cop in the station if needed. The rotary travel is stopped only when a winding station calling for such servicing has reached the proper position, and is continued upon completion of the cycle of servicing operations performed by the unit.

Another stationary servicing unit **5** (FIG. 1) is located at least one station spacing away from the supply-cop exchanging unit, so that one of the winding stations at a time is also positioned opposite the spool-exchanging device **5**. Each winding station of the machine has an arm **6** joined with the spool-holder frame **2** so as to rotationally move together therewith about the same pivot axis **2***a* (FIG. 1). A recess **7** at the lower end of arm **6** normally catches behind a shoulder **8** of a lever **9** biased by a pull spring **11**, as shown more clearly in the enlarged view of FIG. 1*a*. The lever **9** controls a normally closed **12** (FIGS. 1, 13) in a control circuit energized from a current source **13**. For simplicity, the source **13** is represented by the symbol of a battery in FIG. 1, but is more fully shown in FIG. 13 as a full-wave rectifier energized from an alternating-current supply line. The circuit controls the operation of a drive motor **14**, for example by means of a control relay CR1 as shown in FIG. 13. The motor **14** drives the yarn-guiding drum **15** (FIG. 1) which rotates the spool **3** in the winding-up sense, due to the fact that the spool rests frictionally upon the drum **15** under the weight of the spool holder **2** and of the spool itself. As the diameter of the spool **3** increases during winding operation, the spool frame **2** is gradually lifted and moves the arm **6** away from the shoulder **8** of lever **9**. When the spool attains a predetermined size, the lever **9** is triggered by the force of the pull spring **11** and turns clockwise, thus opening the contact **12** so that the energizing circuit of the

winder drive motor **14** is interrupted and the spool decelerates to standstill.

Due to the just-mentioned clockwise movement of the lever **8**, its downwardly extending arm **10** is displaced to the left (FIGS. 1, 13) into a ready position. As soon as thereafter the winding station arrives at the locality of the take-up spool exchanging device **5**, the lever arm **10** closes a normally open switch **16** mounted on the stationary frame structure of the exchanging device **5**. The switch **16** now interconnects two leads **50** and **51** in another control circuit which is connected to a current source **17** illustrated in FIGS. 1 and 13 in the same manner as the above-mentioned source **13**. The lead **51** is connected with a sensing device **54** that opens a contact as long as the take-up spool is still rotating. The embodiment represented by the circuit diagram of FIG. 13 is provided with a selector switch **54***a* which, when in the illustrated closed position, keeps the sensing device **54** out of action. With this setting of switch **54***a*, the performance of the spool exchanging device is as follows.

The closing of contact **16** energizes the coil **101** of a control relay or contactor CR2 from source **17** through leads **50** and **51**. Relay CR2 actuates main contacts **102**, **103** and a normally open interlock contact **104**. Contact **103** now energizes a stepping motor **18** (FIGS. 13, 1) which is mechanically connected with a control shaft **19** and remains energized only during the period of time needed to rotate the shaft **19** 360°, thus also imparting a single full rotation to a number of control cams mounted on the shaft **19** as will be explained in a later place. The relay contact **102** simultaneously opens the circuit **20**, **21** of the above-mentioned motor **22** (FIGS. 13, 1) for driving the machine structure **1**, so that the winding station remains stopped opposite the servicing unit **5** (FIG. 1) until the exchange of the take-up spool is completed.

As soon as the control shaft **19** commences rotating, a cam **18***a* on this shaft closes a normally open contact **105**, thus completing a self-holding circuit through the now closed self-holding contact **104** of relay CR2. Consequently, when during the spool exchanging operation still to be described a new spool core (**84** in FIG. 12) is inserted into the spool holder **2** so that the lever **9** (FIGS. 1, 13) returns to its original position and opens the contact **16**, the relay CR2 nevertheless remains energized until the control shaft **19** with cam **18***a* has completed its 360° rotation, whereupon the contact **105** opens and interrupts the self-holding circuit so that the relay CR2 drops off to deenergize the stepping motor **18** at contact **103** and to re-energize the drive motor **22** at contact **102**. Lever **9** is returned to its original position after a new spool core is inserted into the holder **2** by any conventional means, such as a cam on shaft **19** operating, through suitable linkage, a pusher rod or tappet, such as disclosed in U.S. Patent 3,033,478, which engages lever **9** and pivots it to its original position whereupon shoulder **8** is again engaged in recess **7** of arm **6**.

Mounted on the machine structure **1** is a hood **23** which rotates together with the machine structure (FIGS. 1, 2, 13). Fastened on the hood for each individual winding unit are two contact bars **23***a* and **23***b* from which respective leads **24**, **25** extend to a releasing device for opening the spool journalling frame in order to release a previously completed take-up spool now constituting a fully wound yarn package. While various spool releasing devices are applicable, those operating electrically or electromagnetically are preferred; and since the one shown in FIG. 12 and more fully described hereinafter is of the electromagnetic type, the releasing device of the spool frame is schematically represented as a magnet coil CR in FIG. 13. It will be understood that the device CR may also consist of a relay which in turn energizes the spool releasing components proper.

The contact bars **23***a* and **23***b* are engageable by respective brush contacts **26***a* and **26***b* mounted on a stationary holder **27**. Leads **28** and **29** are connected to respective brush contacts **26***a* and **26***b* for energizing the spool releasing device CR from the current source **17**. The energizing circuit is normally interrupted by a contact **32**. Another cam **30** (FIGS. 13, 4) fastened on the above-mentioned single-turn shaft **19** to rotate together therewith, is engaged by a follower **31** which controls the contact **32**. During the single rotation of cam **30**, the follower **31** enters temporarily into a cam recess **33** thus closing the contact **32** and energizing the spool releasing device CR through leads **28**, **24**, **25** and **29**. The completed spool now drops out of the holder **2** and rolls onto a collecting support such as a trough or glide structure **39** (FIGS. 1, 2).

A further cam **34** (FIG. 3) on control shaft **19** cooperates with the arm **35** of a lever **36** which is pivoted to the housing structure of the servicing unit **5** and carries at its upper end a magazine **37** (FIGS. 1, 11) for empty spool cores of tubular shape. The above-mentioned single turn of shaft **19** causes the cam **34** to swing the magazine **37** downward toward the journalling location of the spool-holder frame **2**. Since the full spool previously completed has already been released, the lowermost core in the magazine now reaches the journalling location where it remains for a short interval of time, sufficient for the spool releasing device to become deenergized by opening of the above-mentioned contact **32**. As a result, the core becomes now clamped in the frame and remains held and journalled therein when thereafter the magazine **37** is swung upwardly back to the starting position illustrated in FIG. 1.

To reliably secure the just-mentioned operation, the outlet opening of the magazine is normally closed partially by a flap member **86** (FIG. 11) pivoted at **86***a* and biased to closing position by a spring **87**. The flap **86** can open in opposition to the force of spring **87** to only such an extent that a single empty core **84** can be removed at a time. For this purpose, the magazine **37** is laterally open near its lower end at the respective axial ends of the lowermost core **84**. Consequently, these ends of the tubular core can readily be engaged by the clamping dowels of the journalling device in the spool holder frame. The magazine just described is in accordance with the one known from my U.S. Patent 3,092,340 for yarn-package winding machine, assigned to the assignee of the present invention.

The particular spool journalling and releasing device of the spool holder frame **2** shown in FIG. 12 is also known as such from U.S. Patent 3,131,885 (Serial No. 27,403, filed May 6, 1960) assigned to the assignee of the present invention. It has the two ends of its bifurcated portion provided with coaxially aligned sleeves **88** and **89** seated in respective bores. The sleeve **88** carries a clamping dowel **83** and is provided with a magnet armature **91** on the side facing away from the tubular spool core **84**. The armature **91** is located in the magnetic field of a solenoid **92**. A spring **93** returns the armature **91** and thus the sleeve **88** to the clamping position when the electric circuit **24–25** (FIGS. 12, 13, 1) of the solenoid is opened. The sleeve **88** (FIG. 12) further cooperates with an arresting member **94** which forms part of another magnetic armature and cooperates with an electromagnet **95**. When the above-mentioned energizing circuit, common to the electromagnets **95** and **92** is interrupted, a spring **96** forces the arresting member **94** against the sleeve **88**, thus securing the sleeve **88** in the clamping position. The opposite dowel **82**, seated in the sleeve **89**, is detractable. For this purpose the sleeve **89** has a conical front face engaging an annular conical seat **97** of the frame structure **2** under the biasing force of a spring **98**. The sleeve **89** is connected with an armature **99** movable in the field of a magnet coil **100**. Both sides of the spool frame are electrically controlled from the above-mentioned source **17** with the aid of the control switch **32** (FIG. 13).

As mentioned, a completed spool 3, previously released from the spool holder frame 2 in the manner described, rolls to the position 3' (FIGS. 1, 2) on the collecting structure preferably shaped as a trough 39. The above-mentioned control shaft 19 carries a further cam 40 (FIGS. 5, 6) engaged by an arm 41 of a lever 42 (FIG. 1) which is pivotally mounted on the housing structure of the servicing unit 5. During the single-turn rotation of the control shaft 19, cam 40 actuates the lever 42 by moving its upper portion against the spool 3'. The top portion of lever 42 thus acts as a pusher member and shoves the spool 3' along the trough 39 an amount at least equal to the width of the spool.

It will be recognized that by virtue of the invention the yarn packages completed on the winding machine, when being exchanged for an empty core, are so laid off upon the collecting or transporting structure that a collision between the packages is reliably prevented. Such packages as cheeses and cones can therefore be removed from the collecting location by the attending personnel in larger intervals of time than previously permissible, without the danger that the yarn turns of the packages may become entangled or otherwise disarranged, until they are placed upon suitable transporting racks, creel carriages, conveyor carriages, boxes, pin boards or the like auxiliary devices.

As mentioned, a further improvement with respect to careful handling of the yarn packages is achieved by additionally controlling the spool exchanging operation in response to the absence of appreciable spool rotation on the holder frame. In the illustrated embodiment it is only necessary for this purpose to keep the switch 54*a* (FIG. 13) in the open position so that the speed-responsive sensing device 54 is active. The normally open contact of sensor 54 is serially connected between the control contact 16 and the relay coil 101 so that the relay CR2 can pick up only when the completely wound spool has fully or nearly reached standstill upon deenergization of the spool drive motor 14 so that the contact in sensor 54 closes.

In the embodiment according to FIG. 13, the sensor 54 may simply consist of a commercially available centrifugal switch mounted on the spool journaling frame so as to close its contact only when the spool has almost come to standstill. However, various other types of sensors are likewise applicable, as will be apparent from the embodiments described presently with reference to FIGS. 7 to 10.

According to FIG. 7, a thermistor 55 is mounted above the spool surface and connected to a current source 56 to be heated by the current flowing through the thermistor. The thermistor forms part of a Wheatstone bridge whose other three branches are constituted by resistors 57, 58 and 59. By means of resistor 57 the bridge network can be adjusted for balancing the bridge diagonal when the thermistor 55 is subjected to a certain amount of cooling resulting from the turbulent flow of air caused by the rotation of the spool. Then, when the spool is at least approximately at standstill, the thermistor 55 increases its temperature and thereby disturbs the balance of the bridge network. The unbalance voltage in the bridge diagonal controls a transistor 60 to issue an amplified current through a relay 61 which closes its contact and thereby interconnects the two control leads 52 and 53. The relay circuit is energized from a voltage source 82. The transistor is preferably controlled to operate essentially as an on-off switch.

In the embodiments according to FIGS. 8 and 9, a bracket 63 carries a pivotally mounted three-armed lever 64, 65, 66. Preferably the bracket 63 is lowered onto the spool 3 only when a spool 3, during the relative travel motion between winding station and serving unit 5, passes beneath the bracket 63. The bracket 63 has two extensions 67 and 68. A pull spring 69 attached to extension 67 tends to turn the lever counterclockwise. The extension 68 carries a contact 70 to which a lead 53 is attached. Articulately joined with the arm 64 is a feeler 71 which carries a contact 72 connected with a lead 52. When the spool 3 stands still, the contacts 70 and 72 touch each other thus closing the control circuit. However, when the spool is still in motion, the friction between feeler 71 and spool 3 causes the feeler to turn counterclockwise. As a result, the lever also turns counterclockwise against a stop 81. This turning motion is supported by the action of the pull spring 69. The two contacts 70 and 72 are thus separated and open the control circuit (FIG. 9). The above-mentioned lowering of bracket 63 may be made additionally dependent upon the diameter of spool 3 reaching a given size.

In the embodiment according to FIG. 10, the rotary motion of the spool is measured by means of a generator 73 which is mounted on a linkage of levers 74, 75 and rests upon the spool 3 to be entrained by friction. A magnet 78 is energized from the generator through leads 76, 77. The magnet 78 holds a contact 79 in the open position. As soon as the rotary motion of spool 3 stops, the generator ceases to supply current to the magnet 78 so that contact 79 engages a fixed contact 80 and closes a control circuit through leads 52 and 53.

Any of the devices described with reference to FIGS. 7 to 10, as well as other transducers suitable to respond to motion of the spool, can be employed in lieu of the sensor 54 in a control system of a machine according to the invention, thus avoiding any damage as may occur if the spool exchanging operation is initiated or performed while a spool is still in rotating motion. It will be understood that the latter advantage is also secured if the above-described pusher device is not used, for example when the cam and follower mechanism according to FIGS. 5 and 6 is set out of action.

To those skilled in the art it will be obvious, upon a study of this disclosure, that my invention permits of various modifications and can be given embodiments other than particularly illustrated and described herein, without departing from the essential features of the invention and within the scope of the claims annexed hereto.

I claim:

1. A machine for winding cross-wound yarn packages, comprising winding stations with respective take-up spool journalling means, a spool exchanging device common to said winding stations for exchanging completed spools for empty spool cores, drive means for imparting relative motion between said winding stations and said exchange device to place said device in spool exchanging relation to one of said stations at a time, control means responsive to spool completion and connected with said drive and said exchange device for stopping said drive and actuating said exchange device when a spool is completed, a spool collecting surface structure having a lay-off area at said exchange device for receiving the completed spools from said journalling means, and an intermittently operating spool feed device engageable with a spool on said lay-off area and having a feed stroke approximately equal to the dimension of the completed spool in the feed direction, whereby said lay-off area is vacated by action of said feed device to receive another spool.

2. A machine for winding cross-wound yarn packages, comprising winding stations with respective take-up spool journalling means, a spool exchanging device common to said winding stations for exchanging completed spools for empty spool cores, drive means for imparting relative motion between said winding stations and said exchange device to place said device in spool exchanging relation to one of said stations at a time, control means responsive to spool completion and connected with said drive and said exchange device for stopping said drive and actuating said exchange device when a spool is completed, a spool lay-off structure at said device for receiving the completed spools from said journalling means, an intermittently operating spool feed device mounted at said structure and

feedingly engageable with the spool received thereupon, said feed device being connected with said spool exchanging device and controlled thereby to intermittently operate upon completion of each spool exchange, said feed device having a spool feed travel corresponding approximately to the dimension of the completed spool in the feed direction, whereby the spool receiving place on said lay-off structure is vacated prior to arrival of the next spool.

3. A machine for winding cross-wound yarn packages, comprising winding stations with respective take-up spool journalling means, a spool exchanging device common to said winding stations for exchanging completed spools for empty spool cores, drive means for imparting relative motion between said winding stations and said exchange device to place said device in spool exchanging relation to one of said stations at a time, control means responsive to spool completion and connected with said drive and said exchange device for stopping said drive and actuating said exchange device when a spool is completed, a spool collecting trough structure forming a lay-off area at said exchange device for receiving the completed spools from said journalling means, an intermittently operating spool feed device mounted at said structure and feedingly engageable with the spool on said lay-off area, actuating means connecting said feed device with said spool exchanging device and controlled thereby to intermittently operate upon completion of each spool exchange, said feed device having a spool feed travel corresponding approximately to the dimension of the completed spool in the feed direction, whereby said area of said trough structure is vacated prior to arrival of the next spool.

4. In a yarn-package winding machine according to claim 2, said feed device comprising a reciprocable pusher member, and a drive mechanism in driving connection with said pusher member, and means connecting said drive mechanism with said spool completion-responsive control means for causing said pusher member to perform a feed stroke upon occurrence of a spool exchange.

5. In a yarn-package winding machine according to claim 2, said control means comprising a sensing device mounted at said journalling means and responsive to spool rotation for preventing said exchange device to operate until the spool on said journalling means has substantially reached standstill.

6. A machine for winding cross-wound yarn packages, comprising take-up spool journalling means, a spool exchanging device for exchanging completed spools for empty spool cores, drive means for imparting wind-up rotation to the spool on said journalling means, control means responsive to spool completion and connected with said drive and said exchange device for stopping said drive and actuating said exchange device when a spool is completed, and a sensing device mounted at said journalling means and responsive to spool rotation, said sensing device forming part of said control means to prevent actuation of said exchange device until the spool on said journalling means has substantially reached standstill.

7. In a yarn-package winding machine according to claim 6, said sensing device including a mechanical feeler engageable with the completed spool on said journalling means.

8. In a yarn-package winding machine according to claim 6, said sensing device including a proximity-type sensor member responsive to the spool peripheral surface reaching a given distance from said sensor member.

9. In a yarn-package winding machine according to claim 6, said sensing device including a heat sensor mounted near but spaced from the spool to be cooled by air flow due to spool rotation.

10. In a yarn-package winding machine according to claim 6, said sensing device including a voltage generator in driven connection with the spool to rotate together therewith.

References Cited by the Examiner

UNITED STATES PATENTS

1,700,425	1/1929	Abbott et al.	242—35.6
2,160,810	6/1939	Abbott	242—35.5
3,030,040	4/1962	Reiners	242—35.6
3,035,783	5/1962	Furst	242—35.6
3,092,340	6/1963	Furst	242—35.5
3,131,885	5/1964	Furst	242—129.51
3,160,359	12/1964	Furst	242—35.5

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