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METHOD AND APPARATUS FOR SUPPLYING YARN COILS TO A
MULTI-STATION YARN-PACKAGE WINDING MACHINE 7 Sheets

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3 Sheets-Sheet 1

FIG. 1

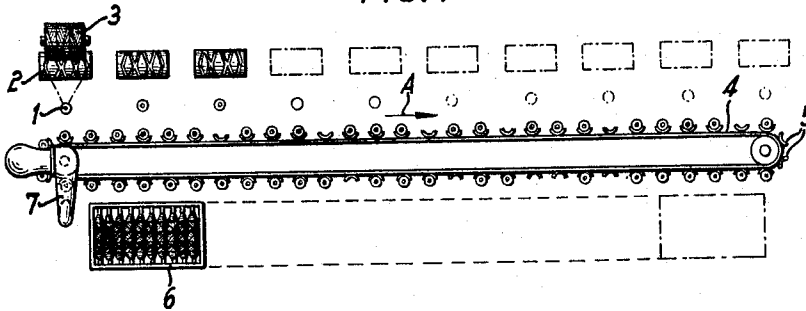
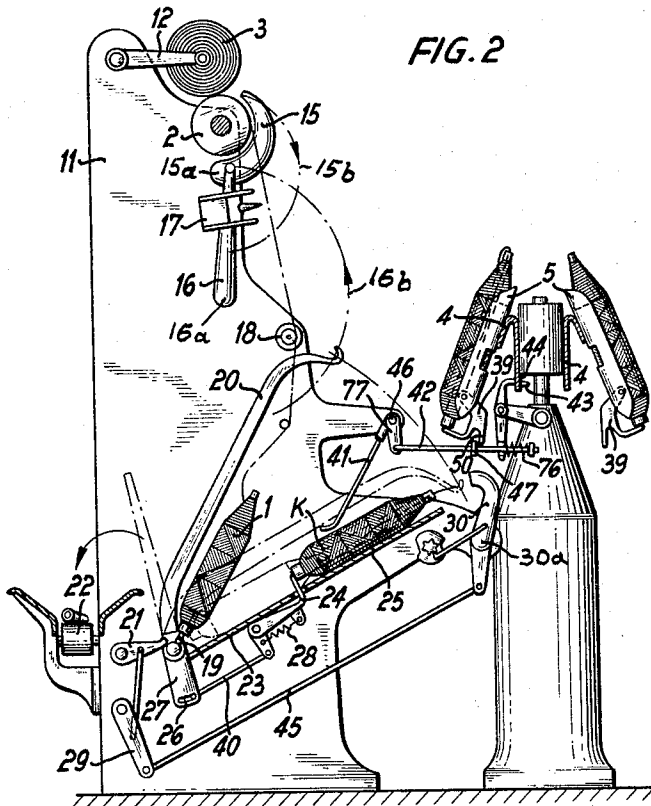


FIG. 2



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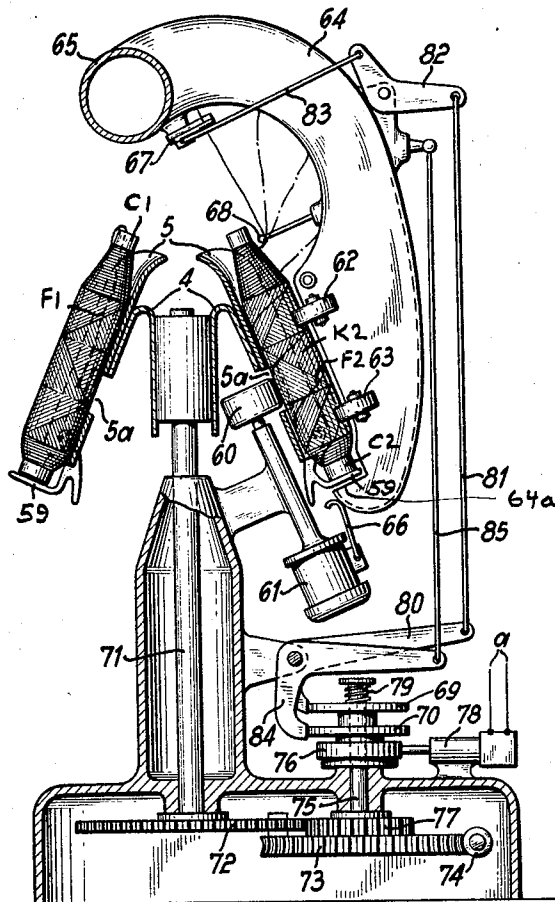
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FIG. 3



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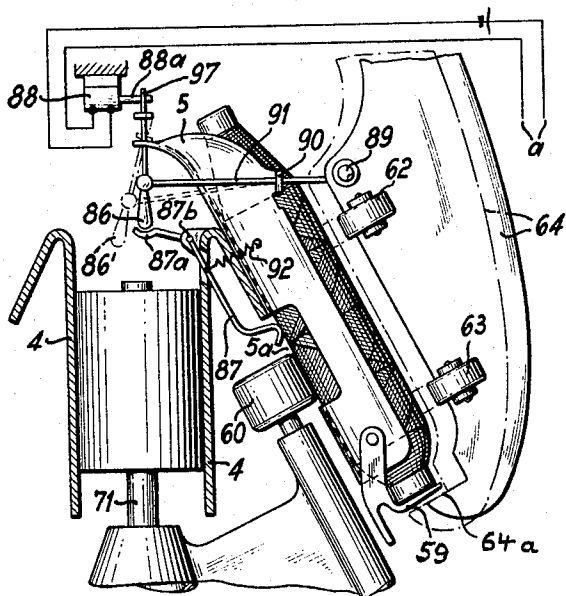
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FIG. 4



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METHOD AND APPARATUS FOR SUPPLYING YARN COILS TO A MULTI-STATION YARN- PACKAGE WINDING MACHINE

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Claims priority, application Germany, Dec. 21, 1963,
R 36,856

6 Claims. (Cl. 242—35.5)

My invention relates to a method and apparatus for supplying the winding stations of a multi-station yarn-package winding machine with bobbins, cops and the like yarn-supply coils individually placed in ready condition for automatic insertion of the coils into the stations and for automatic connection of their leading yarn ends with the tail end of yarn from the take-up spool or yarn package being wound.

To facilitate finding the leading yarn end from supply coils in a winding machine, especially those of the automatic type, it is known to prepare the individual yarn supply coils by placing the leading end of yarn in a ready position, for example at the tip of the coil core or in the bore of the tubular core. The supply coils then reach the respective unwinding positions in the winding stations of the machine with the leading yarn end in the proper position where it can be readily seized by a gripper which conveys the yarn end to a knotting device. For thus preparing the yarn supply coils, it has become known to pass them through a readying device which places the leading end of yarn in the desired position and then passes the prepared coils to the winding stations, if necessary by means of conveying equipment. The known readying devices of this kind, however, require the yarn supply coils to be repeatedly transferred from container to container with appreciable danger of damaging or disheveling the coils.

It is an object of my invention, therefore, to simplify the method of supplying properly prepared yarn supply coils to the individual winding stations of a multi-station yarn-package winding machine.

Another object of my invention is to provide a supply-coil readying and distributing method and apparatus which minimize the above-mentioned danger of damage to the coils.

According to the invention, the yarn supply coils are placed into a coil conveyor, such as a conveyor of the endless-belt type, which periodically travels along the serially arranged winding stations of a multi-station yarn-package winding machine and, as the coils on the conveyor are travelling on the conveying path, passes these coils through a readying device where they are checked and, if necessary, are readied in the above-described manner, whereupon all of the coils leaving the readying device and passing by the multiplicity of winding stations are in ready condition and are issued to those stations where a yarn supply coil has been doffed. According to another feature of the invention, the testing of the coils as to whether or not they are already in prepared condition is simplified by imparting to the coil conveyor a stepwise advancing motion, and the checking, as well as the issuing of the coils, is effected during the standstill intervals.

According to still another feature of my invention, the above-mentioned readying device is normally inactive and is connected with the sensing or checking means by a control system which causes the readying device to operate on a coil only when the sensing means respond to a non-readied coil.

A supply-coil readying and distributing apparatus according to the invention thus operates in such a manner that, regardless of whether the coils reaching the readying device have their leading yarn end already placed

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in the proper ready position or are not yet processed in this manner, all of the coils that pass from the readying device to the winding stations are reliably prepared, although the readying device acts only once on each coil but remains inactive when a previously readied coil travels a second time or more often past the device. The conveying device thus also operates as a magazine in which at any time, a considerable number of coils are stored so that a continuous performance of the winding machine is secured even if new coils are charged onto the conveyor in intermittent intervals of time. Only those places of the conveyor from which coils have issued to the winding stations, are then filled with new, unprepared yarn supply coils. This may be done by hand or automatically.

Since not all of the readied coils are issued from the conveyor during a single pass along all of the winding stations, the readying device in apparatus according to the invention receives previously readied as well as unprocessed coils, in contrast to the above-mentioned known readying device which operates only on new coils whose leading end of yarn is not yet in the proper position. However, by virtue of the fact that the individual coils arriving at the readying device are tested by the above-mentioned sensing means upon which the control of the readying device is dependent, the readying device can act only upon coils actually requiring such activity.

The checking or sensing member may test the coils for presence of the readied yarn end at a given locality of the coil or coil core. For example the sensor may check the coil for the presence of reserve winding at the tip of the core (tip bunch), or for presence of the yarn starting end in the bore of the core.

According to another, preferred feature of the invention, however, a simplified and generally sufficient performance is achieved if the sensing means only ascertain whether a yarn supply coil entering into the readying device has previously passed through this device. To facilitate such testing, registering or marking means may be provided at the coils or the conveyor for identifying previously readied from unprocessed coils. Such registering or marking means may consist for example, of optical, electrical, magnetical or mechanical markers which are inserted or attached when the unprocessed coils are placed into the conveyor, and which are switched off, magnetically erased or otherwise eliminated when the readying device commences operating upon the coil. The marking means, however, may also be switched on or attached independently of the readying device and may be switched off or eliminated when the readied coils are issued to the winding stations. When the marking means are arranged at the coils themselves, for example in the form of a magnetic marking, such as a remanent magnetization, on the foot of the tubular core, the magnetized marker does not always require special means for its erasure because the iron components of the winding machine, or simply a permanent magnet mounted in the vicinity of the supply-coil holder, will perform this operation.

I have found that the use of the above-mentioned optical, electrical or magnetical registering or marking means often encounters difficulties with respect to properly applying and reliably distinguishing them by the sensor. As a rule, therefore, mechanical registering and marker means have been found particularly advantageous and preferable. According to a further feature of the invention, therefore, the registering or marking means comprise a displaceable mechanical member which is connected with the coil conveyor and is controllable by the readying device. The displaceable member may consist of a lever pivotally movable between two limit positions and turned to one of them when an unprocessed yarn supply coil is being placed into the coil conveyor, the lever being shifted to

the other position when the yarn end is placed in ready position by the operation of the readying device. If desired, however, the lever may also be placed to one limit position by operation of the readying device, and to the other limit position by issuance of the yarn coil from the coil conveyor to a winding station.

The above-mentioned and further 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 mentioned in, the following with reference to the embodiment of a yarn-supply coil readying and distributing apparatus for a multi-station yarn-package winding machine illustrated by way of example on the accompanying drawings.

FIG. 1 shows schematically a floor plan of the machinery.

FIG. 2 is a lateral and sectional view of one of the winding stations during a stage of operation in which the yarn supply coil is issued from the coil conveyor.

FIG. 3 shows schematically in section a lateral view of the apparatus at the locality of the readying device, showing this device during readying performance.

FIG. 4 shows in section a portion of a readying device in conjunction with the appertaining sensor-responsive control means.

In FIG. 1, a multi-station machine for winding yarn packages, such as cheeses, is schematically represented by a few individual stations, and only one of them will be described in detail, all others being of identical design and performance. As shown in FIG. 1, the yarn passes from a supply coil 1 over a yarn guiding drum 2 onto the take-up spool or yarn package 3. For further details of the winding station, reference may be had to the following description of FIG. 2. A conveyor 4 of the endless-belt type extends along all of the winding stations and is equipped with uniformly spaced pockets 5 for receiving respective supply coils to be issued to the winding stations. The conveyor travels in the direction of the arrow A closely along the front of the series of winding stations. While a straight arrangement of winding stations and consequently a straight conveyor run are shown, it will be understood that if the winding stations are arranged on a circle, the conveyor may consist of a correspondingly shaped circular device or magazine.

Those pockets 5 which have issued a readied coil to one of the winding stations are replenished with new coils. In the illustrated embodiment this is done from the front side of the conveyor belt by manual servicing. For this purpose, a wheeled box or carriage 6 is displaceable along the conveyor belt, this being indicated by broken lines. From time to time the attendant takes new, unprepared coils from the box 6 and places them into the empty pockets 5. A readying device 7 is mounted near the left reversing point of the conveyor belt and thus is reached by the coils shortly before they arrive at the first winding station. Preferably, the conveyor belt 4 is moved stepwise so that the readying operation of device 7 as well as the issuance of coils from the conveyor to the winding stations may take place during intervals of standstill.

The transfer of a readied coil from a pocket 5 of the conveyor to a winding station is apparent from FIG. 2 which shows only the essential components of the winding station. As regards further details, not relating to the present invention proper, reference may be had, for example, to U.S. Patents No. 2,936,130, No. 3,023,974, No. 3,092,340, No. 3,033,478. A supply coil 1, shown as a spinning cop, is illustrated in position for winding operation. The yarn from coil 1 passes through a tensioner 18 and over the yarn guiding drum 2 onto the take-up spool or package 3. During winding operation, the guiding drum 2 is kept in rotation at constant speed and, by means of its guiding groove, passes the oncoming yarn back and forth along the yarn package 3. The spool body of package 3 is journaled for free rotation on a journaled frame 12 which is pivoted to the machine

frame structure 11 so that the yarn package rests under its own weight upon the periphery of the yarn guiding drum and is entrained by the drum to rotate in the winding direction at constant peripheral speed. In the event of yarn breakage, or after a depleted supply coil has been substituted by a new coil, two yarn gripper members 15 and 16 seize the yarn ends from the take-up spool 3 and the supply coil 1 and convey these ends to a knoter 17 where the ends are tied together. During yarn-end conveying travel, the gripper 15 rotates about its pivoted end 15a and entrains the yarn along the circular path denoted by 15b. Analogously, the gripper 16 rotates about its pivoted end 16a and entrains the yarn upwardly along the circle denoted by 16b. After the yarn ends are knotted together and released from the knoter, the winding operation continues in the known manner.

The supply coil 1 is speared upon a peg 19 pivoted to the frame structure 11. The peg 19 is rotated counterclockwise for doffing a depleted coil, and clockwise to a lowered position for receiving a new coil. The mechanism for imparting such motion to the mandrel 19 is not illustrated because well known as such, for example from the above-mentioned Patents 3,023,974 and 3,033,478.

A doffer 21 is pivoted to the frame structure 11 near the peg 19. A transfer lever 20 serves to temporarily hold the seized yarn end and to pass this end into the travel path 16b of the yarn seizing member 16. The lever 20 is rigidly connected with the peg 19. A conveyor 22 extends along the multi-station machine closely behind the respective doffers 21 for removing the doffed empty coil cores. A slide trough 23 is mounted in front of the peg 19 for receiving the supply coils from the distributing conveyor and permitting them to slide onto the peg 19 when the peg is in the above-mentioned lowered position.

The trough 23 has a slot traversed by a latch 24 which is pivoted to the trough and whose upper end normally protrudes into the trough space to retain a coil in the upper portion of the trough. During coil exchange, the latch 24 is turned clockwise about its pivot and then permits the new coil K to slide from the upper portion 25 of the trough onto the peg 19. The latch 24 is actuated by a connecting rod 40 engaging an elongated slot 26 of an arm 27. For doffing a depleted core, the peg 19 is first turned counterclockwise so that the lower end of the coil core becomes engageable by the tip of the doffer 21. The doffer 21 then operates to throw the empty core off the peg 19 and onto the conveyor 22. During this stage of the exchanging operation, the latch 24 remains in the illustrated active position because, although the arm 27 is rigidly connected with the pivot shaft of peg 19 and participates in the counterclockwise movement, the left end of connecting rod 40 glides inactively in the elongated slot 26 so that no motion is transmitted to the latch 24.

When the doffing stage is completed, the peg 19 moves clockwise to the lowered position in which it is receptive for a new coil. During such movement of the peg 19, the arm 27 moves far enough to entrain the connecting rod 40 and to withdraw the latch 24 from the illustrated latching position so that now the coil K can slide from the top portion 25 of the trough onto the peg 19. When thereafter the peg 19 returns to the winding position shown in FIG. 2 by full lines, a spring 28 biases the latch 24 back to the illustrated latching position.

A suction tube 30 is pivotally mounted at 30a to the frame structure 11 and has its tubular pivot portion connected to a source of negative pressure. The suction opening of tube 30 is opposite the tip locality of the cop K, but is normally spaced therefrom. The tube 30 is connected by a rod 45 with an arm 29 linked to the doffer 21. When the doffer 21 operates in the above-described manner by moving counterclockwise about its pivot axis, the rod 45 simultaneously turns the suction tube 30 clockwise and thus places the suction opening over the tip of the coil K. The leading end of yarn is in

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ready position by having been previously placed into the bore of the tubular core. Consequently, the suction tube 30 is now effective to draw the readied yarn end into its suction channel.

A feeler 41 is mounted above the trough portion 25 to be actuated by the individual pockets 5 of the conveyor 4. The feeler 41 is rotatable about a pivot pin 46. A lug or finger 44 connected with each conveyor pocket 5 presses upon a lever 43 when the pocket passes by that lever. The pivoting motion of the lever 43 is transmitted through a spring 76 upon a rod 42 which is connected by an arm 77 with the feeler 41. As long as a coil K is located in the top portion 25 of the trough, the feeler 41 engaging the coil cannot follow the swinging movement of the lever 43, and the spring 76 absorbs the motion of the lever 43. However, when no coil is located in trough portion 25, the motion of lever 43 has the effect of shifting the rod 42 to the right and to place a shoulder ring 47 beneath a nose 50 on a closure flap 39 linked to the same conveyor pocket 5 whose travel caused the lever 43 to be actuated. The pocket 5 is thus opened and releases a new coil which then drops into the top portion 25 of the trough, where it is kept arrested by the latch 24 for subsequent release in the manner already described.

FIGS. 3 and 4 show the readying device 7 of FIG. 1 in conjunction with the magazine conveyor 4. The supply coil K1 shown in the conveyor pocket at the left of FIG. 3 has its leading end of yarn F1 in ready position, namely tucked over the tip into the bore of the tubular core C1. The coil K2 located in the right-hand pocket 5 of the conveyor is not yet prepared. The leading end of yarn F2 still forms a steep helical winding from the tip portion about the main body of yarn down to the foot of the core C2, and may also form a number of turns about the core foot (foot bunch).

As soon as a conveyor pocket 5 enters into the readying device, a friction roller 60 passes through a slot 5a into the pocket space and is placed in rotation by a motor 61. The roller 60 slightly lifts the coil K2 in the pocket against pairs 62 and 63 of stabilizing rollers, only the two forward rollers of each pair 62 and 63 being visible (FIGS. 3, 4). The rollers are freely rotatable in bearings attached to an arcuate suction arm 64 which is pivotally rotatable about the axis of a suction tube 65 between an inactive position shown by full lines in FIG. 4 and an active position shown by a dot-and-dash line in FIG. 4 and also shown in FIG. 3. When the suction arm 64 is turned downwardly to the position shown in FIG. 3, the arm 64 actuates a switch 66 which controls the motor 61 to start driving the friction roller 60. The supply coil, here shown as a spinning cop, is now kept in rotation about its own axis while the elongated nozzle opening of the suction arm 64, this opening extending along the peripheral surface of the cop, is effective to induct an air current. Due to the simultaneous rotation and suction, the leading end of yarn is removed from the cop and drawn into the suction arm 64. If desired, the suction effect may be supported by subjecting the core to a flow of blowing air directed against the core foot C2. This is sometimes of advantage for facilitating the removal of any turns of yarn wound about the core foot.

As the yarn end is being sucked into the arm 64, the removed length of yarn is forced toward the inner contour along the bight of the arcuate arm which is provided with a slot along this contour. As a result, the yarn end is guided by the air suction to move in the upward direction, passing sequentially through the positions shown by dot-and-dash lines in FIG. 3, until in the uppermost position, the yarn end enters into a shear-type cutter 67. The curved and slotted suction arm is in accordance with those illustrated and described in my copending applications Serial No. 243,546, filed December 10, 1963, and Serial No. 353,692, filed March 23, 1964.

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Shortly after the leading end of yarn is placed into the cutter 67, the cutter closes and shortens the yarn end to the proper length. The severed excess is sucked away through the tube 65, and the yarn end extending from the cop upwardly to the cutter 67 is now sucked into the bore of the tubular core C2 due to the suction which the lower nozzle portion 64a of the arm 64 now applies through the apertured or perforated closure flap 59. Thus, a proper length of yarn is placed in ready position inside the tubular bore as indicated by the yarn end F1 at the cop K1 in the left conveyor pocket shown in FIG. 3.

To prevent an excessive amount of yarn to be pulled off the cop, the yarn end is preferably passed about a stationary stop 68. During the further travel of the conveyor pocket 5 with the cop K2 in the direction toward the observer of FIG. 3, the loop of yarn becomes disengaged from the stationary stop 68.

The above-described turning motion of the suction arm 64 and the actuation of the cutter 57 are controlled by cams 69 and 70. The current of suction air may be switched on and off either by the turning motion of the suction arm 64 about the suction pipe 65, or by means of another cam actuating a control valve (not illustrated). The cams 69, 70 are rotated from a worm 74 through a worm gear 73 and a gear shaft 75, a controllable friction clutch 76 being interposed. A further gear 77 is coaxially mounted on the shaft 75 and meshes with a gear 72 on a shaft 71 which drives the endless belt of the conveyor 4. The control clutch 76 is of the single-revolution type and latched by an electromagnetic device 78. When released by the electromagnet 78, the clutch permits cams 69 and 70 to be frictionally entrained by the shaft 75 to perform a single full rotation. The clamping force for the friction clutch is provided by means of a helical compression spring 79 mounted above the cams. Upon completion of a single rotation, the frictional engagement of the control clutch 76 is terminated so that the cams 69 and 70 are blocked. During the released single rotation of cams 69 and 70, the cam 69 actuates a bell crank lever 80 which is linked by a connecting rod 81 with a bell crank lever 82 acting through a linking rod 83 upon the cutter 67. The cam 70 actuates a bell crank lever 84 linked by a rod 85 to the suction arm 64 for shifting the nozzle opening of the arm toward and away from the cop K2 as described above.

As mentioned, FIG. 4 shows the suction arm 64 swung away from the cop to the inactive position, the active suction position according to FIG. 3 being indicated in FIG. 4 by a dot-and-dash line. A displaceable member 86 is connected with the conveyor pocket 5 and controllable by the readying device, namely by the suction arm 64 in the illustrated embodiment. The displaceable member 86 serves as the registering or marking means for distinguishing readied cops from those not yet prepared. As shown, the member 86 consists of a lever pivoted to a rod 91 to move between two limit positions. When a cop is being placed into the conveyor pocket 5, a feeler 87 engaging the cop swings the lever 86 to the position shown by full lines. In this position, the lever 86 lifts a control rod 97 into operative relation to the actuating arm 88a of an electric switch 88. The switch 88 is thus actuated by means of the control rod 97 when the conveyor pocket 5, during subsequent travel, enters into the readying device. The switch 88 then closes the electric circuit "a" (FIGS. 4, 3) for the electromagnetic device 78 which controls the operation of the cams 69 and 70. It will be understood that the electric leads denoted by "a" in FIG. 4 are connected with the respective leads which are also denoted by "a" in FIG. 3, a suitable source of electric current being interposed in one of the connections.

As soon as the cams 69, 70 have started rotating and the suction arm 64 has moved from the full-line position to the dot-and-dash position near the cop (FIG. 4), the

roller 89 journaled on the suction arm 64 acts upon the rod 91 which is displaceable in a guiding lug 90 of the conveyor pocket 5. The rod 91 then pushes the lever 86 away from the supporting portion 87a of the feeler 87, and the lever 86 drops to the dot-and-dash position 86' in which the control rod 97 can no longer actuate the switch 88 and in which the lever 86 remains latched in front of the supporting portion 87a of feeler lever 87. Consequently, the lever 86 remains in the latched and inactive position 86' until the cop is issued from the conveyor pocket 5, for example supplied to a winding station, as described with reference to FIG. 2.

As soon as the conveyor pocket 5 is emptied, the feeler lever 87 swings under the force of a spring 92 clockwise about its pivot 87b so that the supporting portion 87a of the feeler lever 87 turns downwardly. Now the discriminating marker lever 86 can return, for example by gravity, from the dot-and-dash position 86' to its vertical starting position from which it is again lifted to the full-line position shown in FIG. 4, when a new cop is being placed into the conveyor pocket 5. Consequently, the switch 88 for operating the readying device shown in FIG. 3 can be put into action only once by any particular conveyor pocket for each new cop placed into the pocket. If the cop in pocket 5 has previously been processed in the readying device, the lever 86 remains in the inactive position 86 until the cop is issued from the pocket 5. As long as a cop, once readied, remains travelling on the conveyor, the control rod 97 remains in the lowermost position in which it cannot actuate the switch 88. The conveyor thus serves as a magazine, and the readying device is called upon to enter into activity only at conveyor or magazine places where a new coil has been added to those previously readied.

To those skilled in the art it will be obvious upon a study of this disclosure that my invention permits of various modifications and may be given embodiments other than particularly 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. The method of supplying a multi-station winding machine with yarn supply coils having the leading end of yarn in a ready position, which comprises charging unprepared supply coils into vacant spaces of a conveyor, repeatedly passing the coil-carrying conveyor in a given cycle along the winding stations and substituting depleted coils in respective station by issuing replacement coils from the conveyor; passing the coils on the conveyor past a readying locality behind the charging location and ahead of the winding stations, and actuating the readying device for placing in the ready position the yarn end of still unprepared coils passing the readying locality for the first time.

2. In the method according to claim 1, the steps of advancing the conveyor intermittently in equal steps, and readying the coils, as well as issuing the coils to the winding stations, during standstill intervals of the conveying travel.

3. With a multi-station yarn-package winding machine, in combination an apparatus for supplying the winding stations of the machine with yarn supply coils having the leading end of yarn in a ready position, said apparatus comprising a coil conveyor having a cyclical travel periodically extending along the winding stations and forming a coil magazine for said stations, a readying device situated at the travel path of said conveyor ahead of the winding stations and engageable with the respective coils on said conveyor for readying said coils by placing said yarn end in said ready position and control means for controlling said device to operate only on coils still to be readied passing said readying device for the first time.

4. An apparatus according to claim 3, said conveyor having pockets for receiving respective supply coils, discriminating means for determining if a coil has previously passed said readying device, said discriminating means comprising respective control devices disposed on said pockets and variable between active and inactive conditions, and means on said readying device for changing said control devices from active to inactive condition in dependence upon readying operation of said device, said readying device being controllable only when said control devices are in said active condition, whereby coils once readied travel past said readying device without causing operation of the latter.

5. An apparatus according to claim 4, each of said control devices comprising a movable mechanical feeler means engageable with a coil when the coil is placed into a conveyor pocket, a displaceable member disposed at each of said pockets and engageable by said readying device during operation of the latter, said displaceable member cooperating with said movable feeler means for controlling said control means when the pocket reaches said readying device, and blocking means comprising said displaceable member and interposed between said feeler means and said control means to permit only one operation of said readying device upon each coil-feeling operation of said feeler means.

6. An apparatus according to claim 3, said control means comprising an electric controller for operating said readying device, said controller having an electric circuit with control switch means, each of said conveyor pockets having feeler means responsive to insertion of a coil into said pocket, and each of said pockets having blocking means engageable by said readying device for preventing operation of said readying device after said pocket has travelled past said readying device, said blocking means being resettable so as to cooperate with said feeler means to actuate said switch means for controlling said readying device to operate when said pocket reaches said readying device, whereby said readying device operates only once upon each response of said feeler means.

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STANLEY N. GILREATH, *Primary Examiner*.