

[54] **AUTOMATIC DOFFING APPARATUS FOR TEXTILE MACHINE HAVING ONE OR MORE WINDING UNITS**

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Dec. 28, 1968 Japan..... 43-371

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[51] **Int. Cl.**..... **B65h 54/20, B65h 54/26**

[58] **Field of Search**..... **242/35.5 R, 35.5 A, 18 A, 242/18 R, 18 DD, 18 PW, 35.6 R; 57/52, 53**

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[57]

ABSTRACT

A textile machine having a plurality of winding units arranged in a row is serviced by automatic doffing apparatus travelling on a track along the row of winding units. Each winding unit has means for sensing when a bobbin being wound in it is full. When the doffing apparatus comes to a winding unit with a full bobbin, it stops, the yarn is severed upstream of the bobbin and is sucked into a storage box and the full bobbin is released from the bobbin chuck and discharged. A new bare bobbin is thereupon delivered by the doffing apparatus to the chuck, the yarn is transferred to the new bobbin which thereupon starts to rotate and is severed by the severing means downstream of the bobbin. The doffing apparatus then proceeds to the next winding unit with a full bobbin. When stopping at a winding unit, the doffing apparatus first slows down so that shock is avoided and accurate positioning is achieved. The sequential steps of operation of the doffing apparatus are controlled by a group of coaxial programming cams actuating corresponding micro-switches.

13 Claims, 29 Drawing Figures

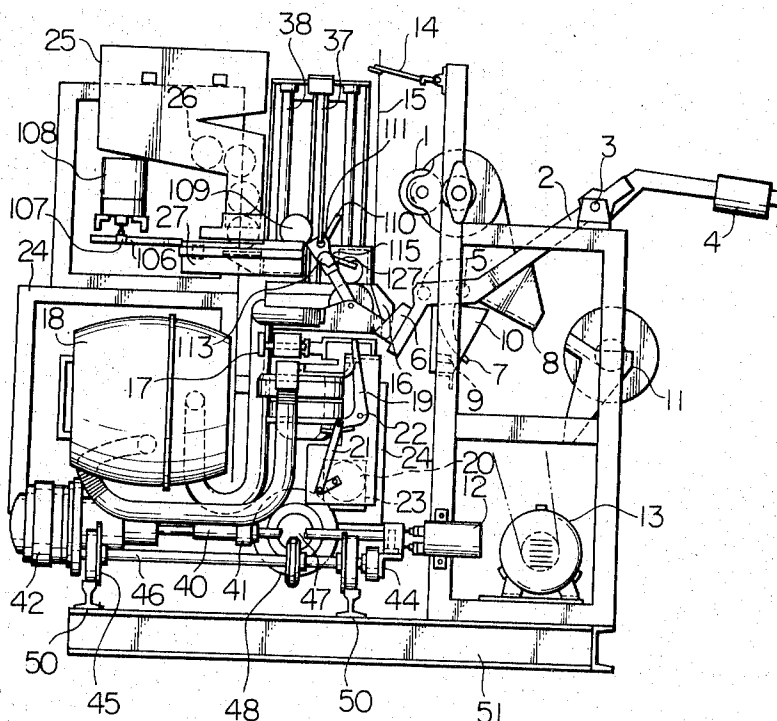


Fig. 1

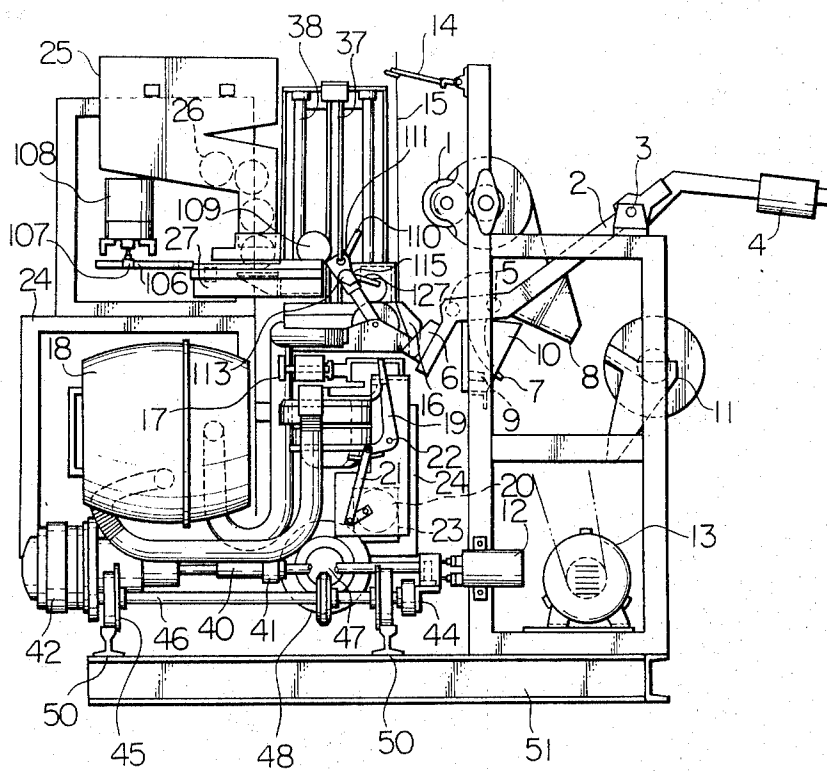


Fig. 1A

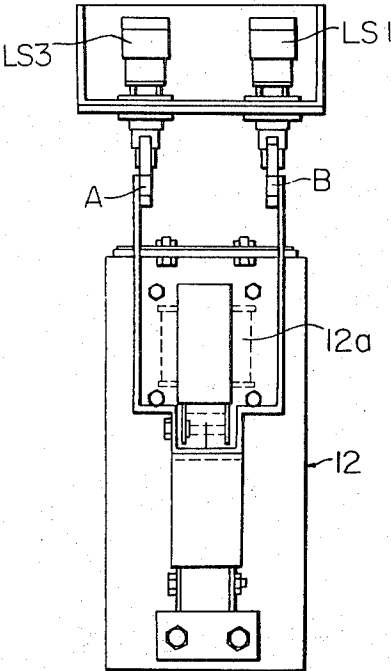


Fig. 1B

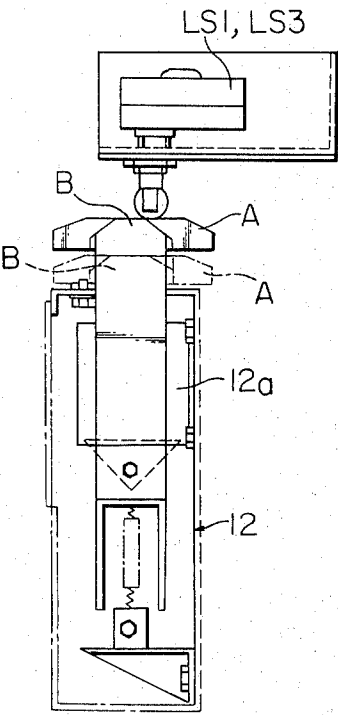


Fig. 1C

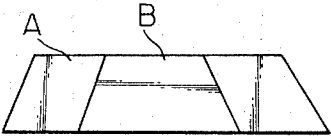


Fig. 2

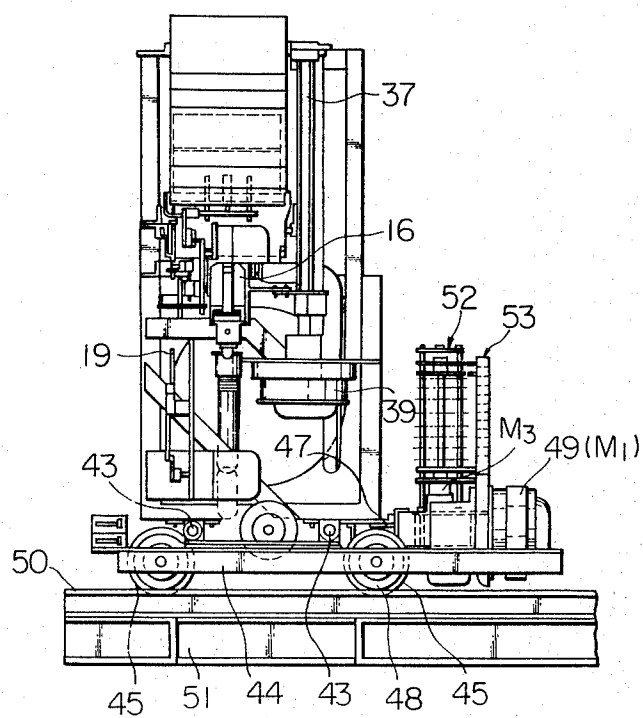


Fig. 3A

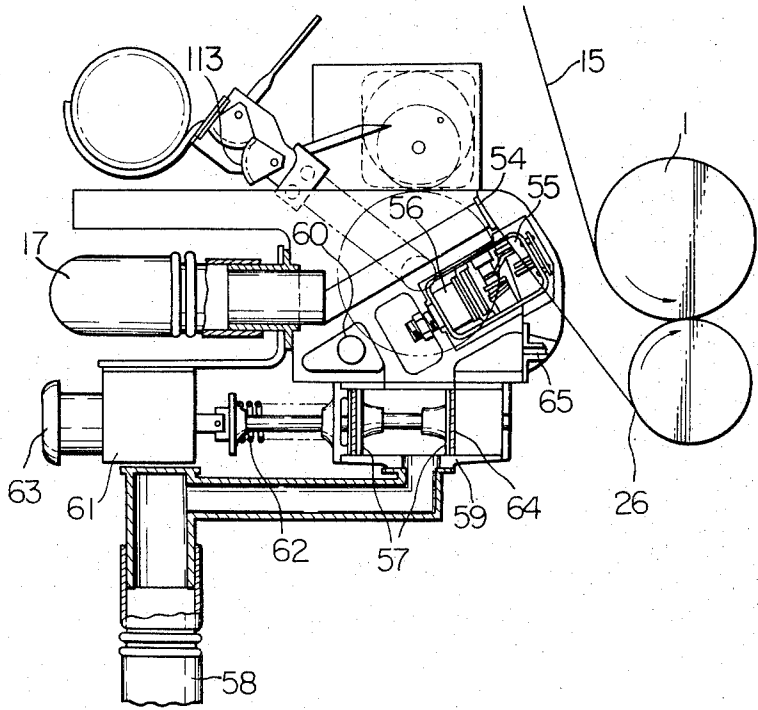


Fig. 3B

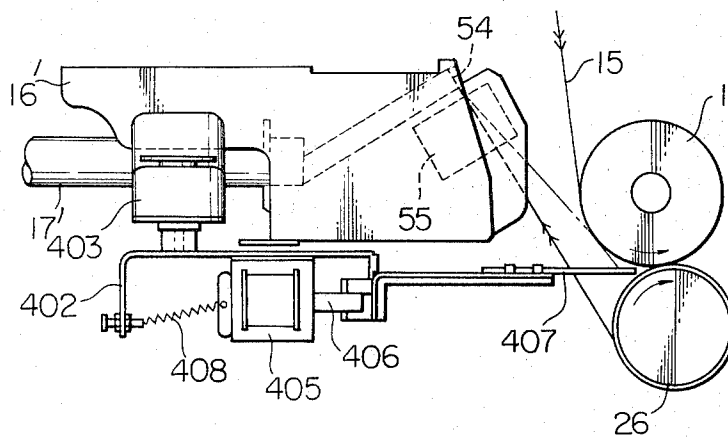


Fig. 3C

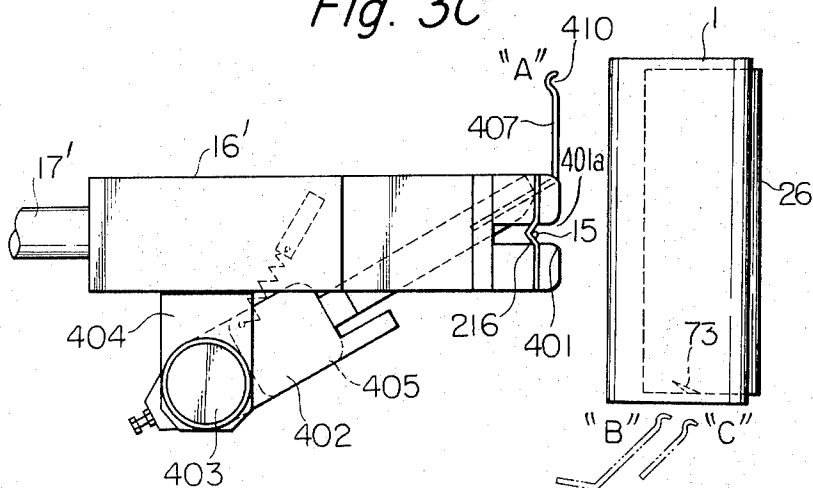


Fig. 4

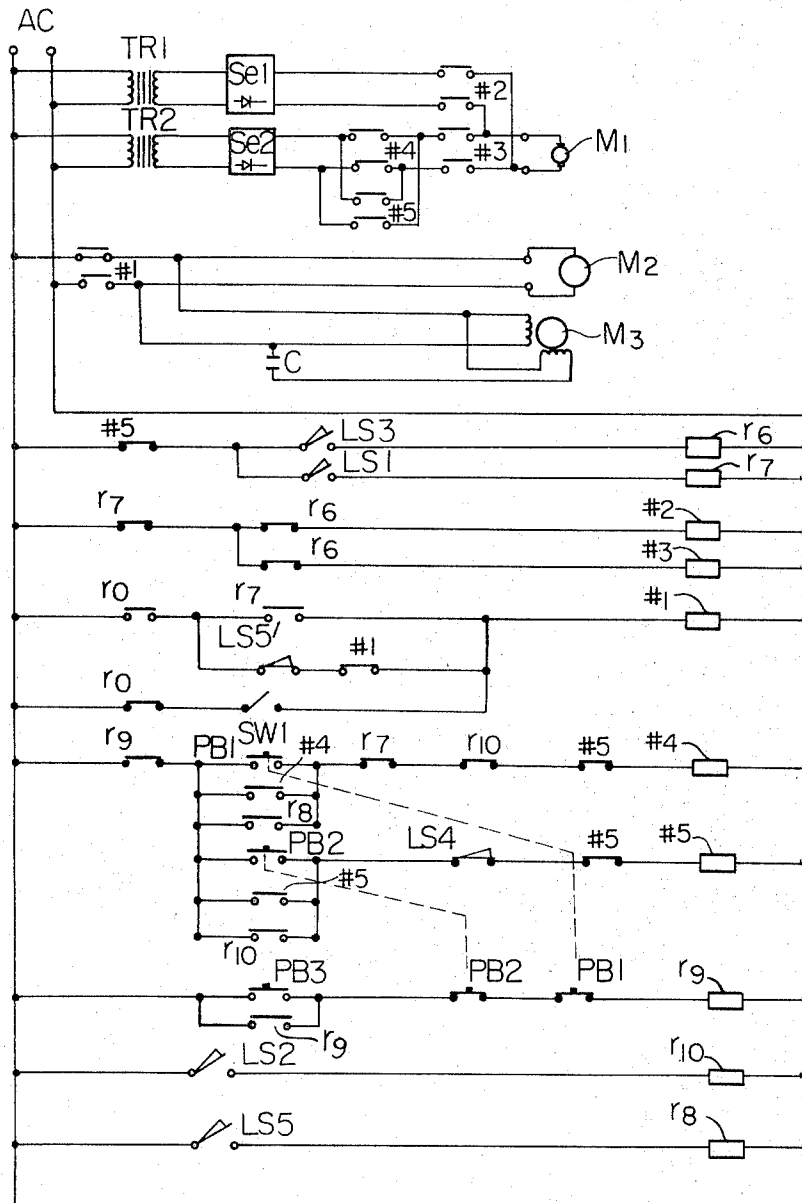


Fig. 4A

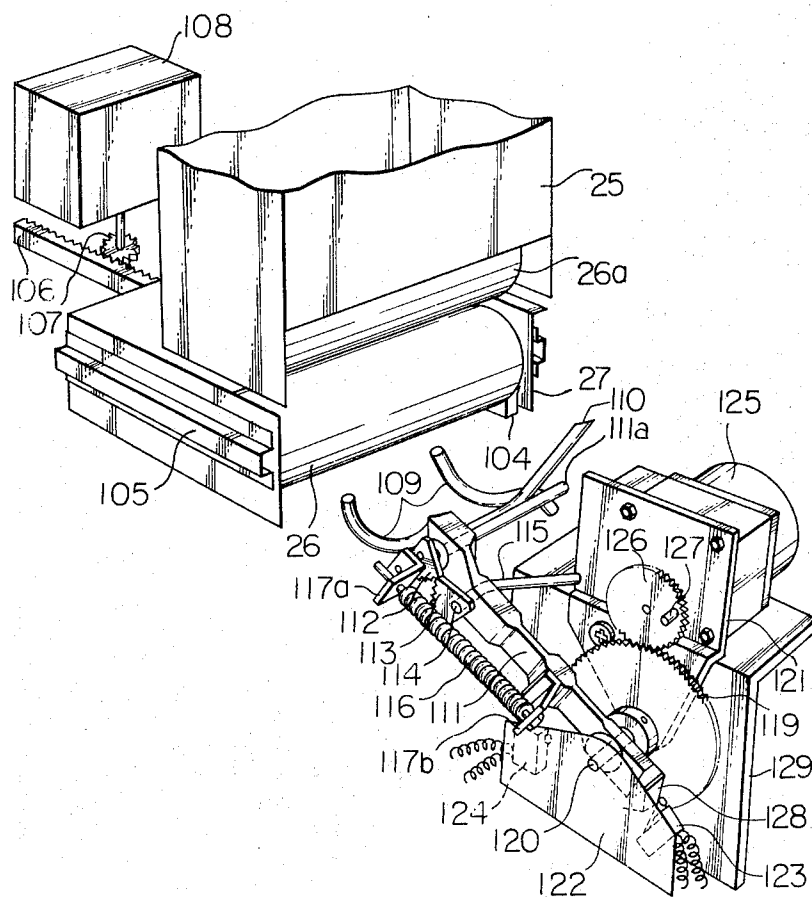


Fig. 4B

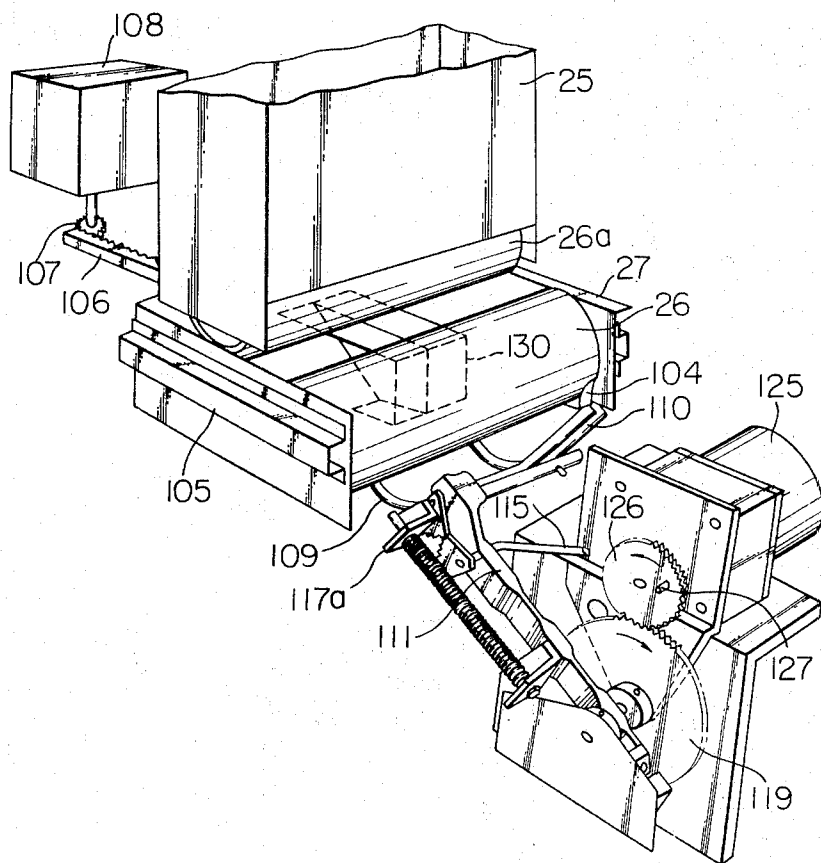


Fig. 4C

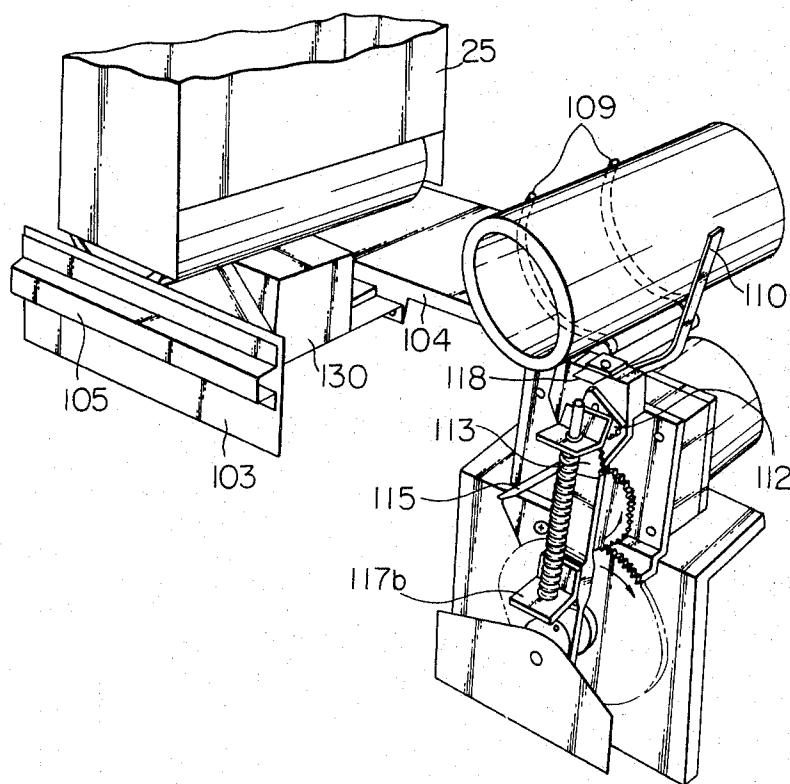


Fig. 4D

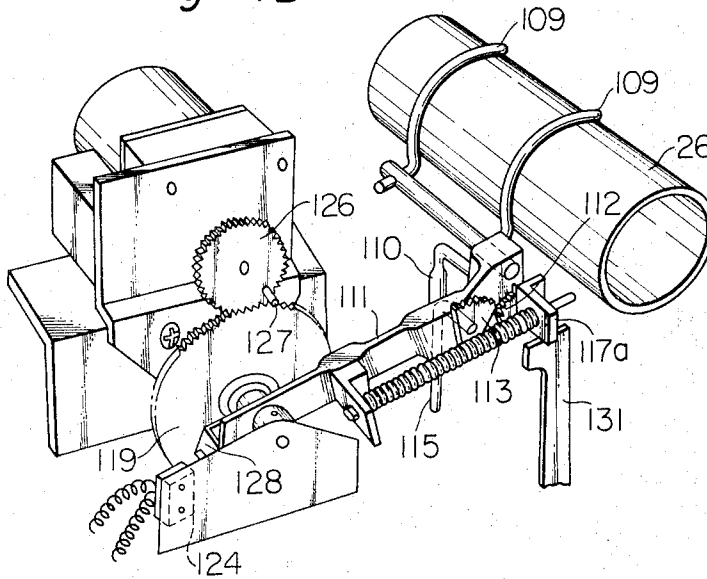
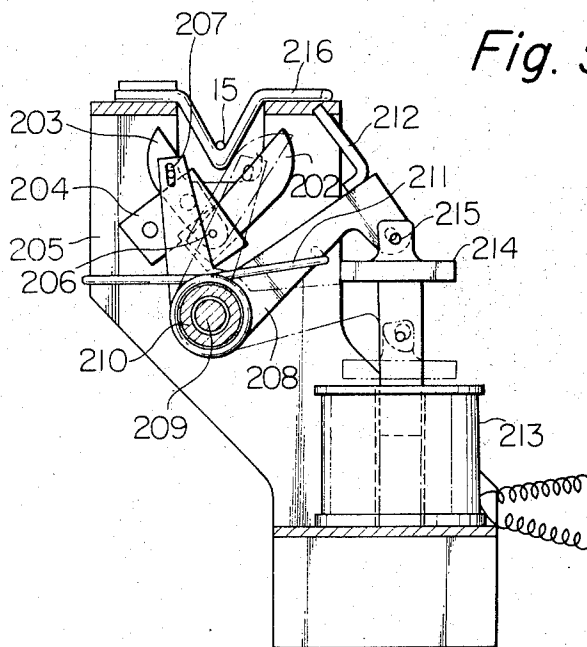
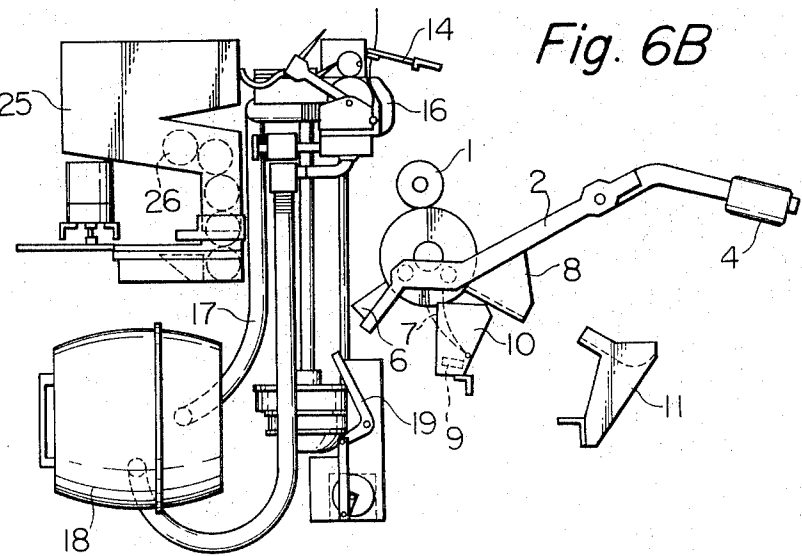
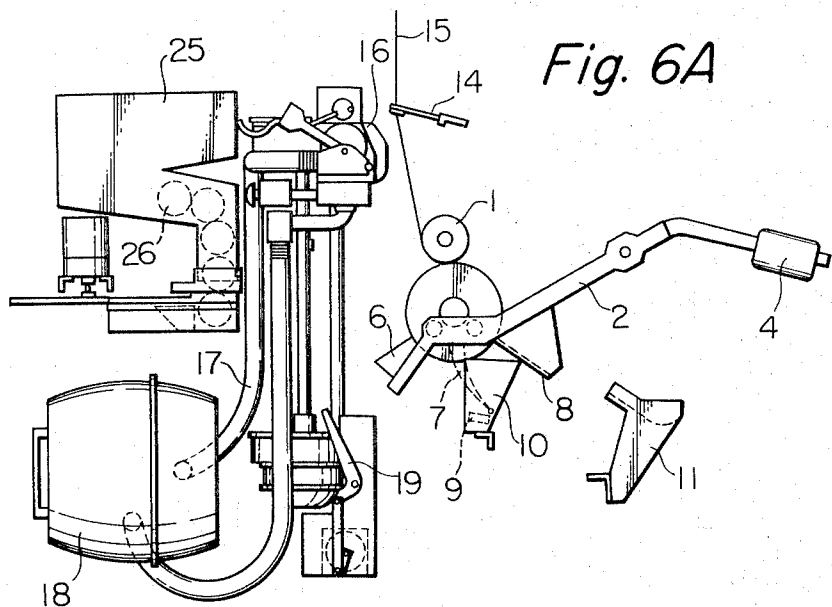


Fig. 5





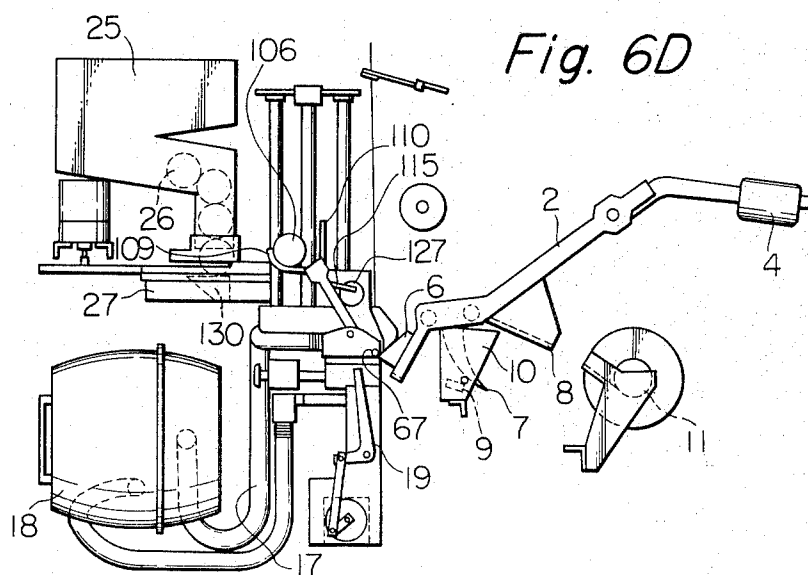
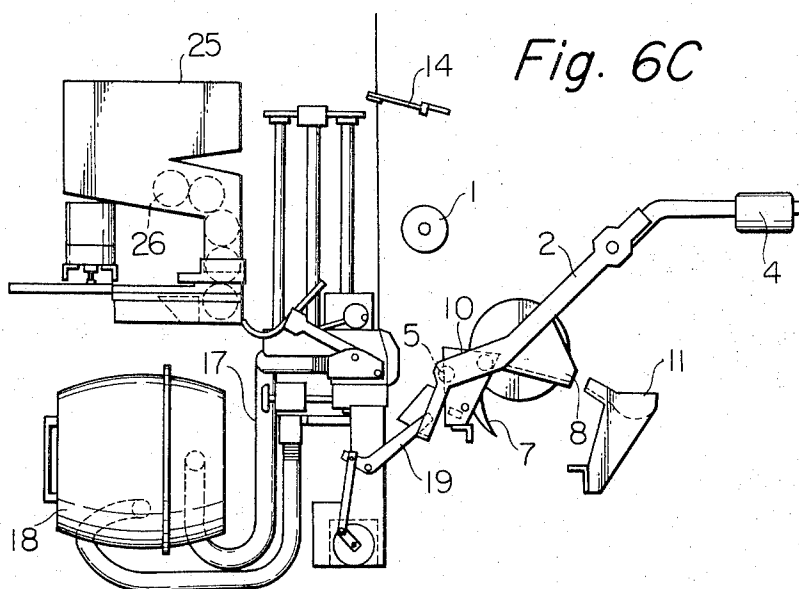


Fig. 6E

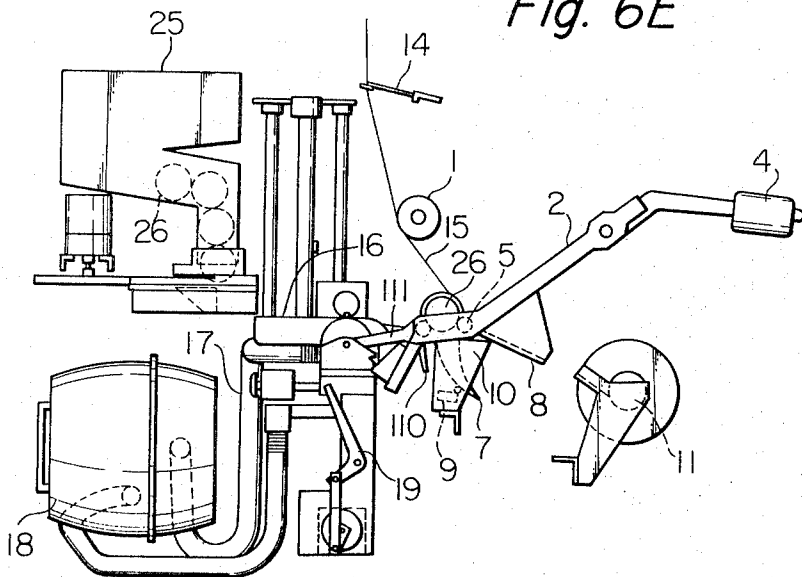


Fig. 6F

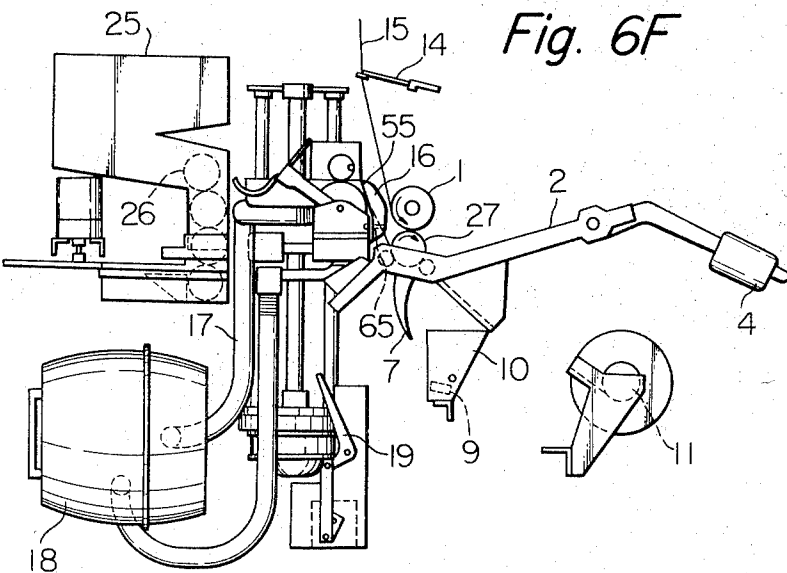


Fig. 7A

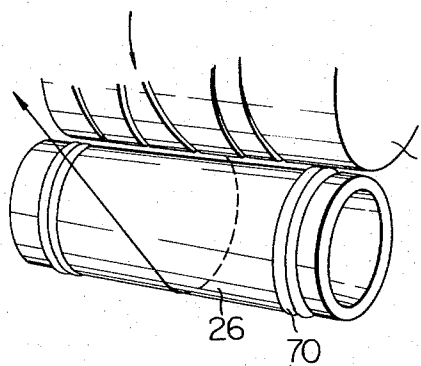


Fig. 7B

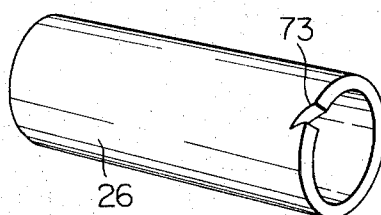


Fig. 7C

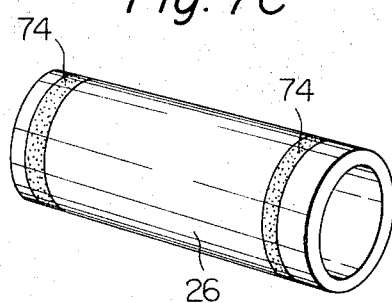


Fig. 8

TIME IN SEC	A	B	C	DE	F		
OPERATION	0	10	20	20	30	40	
INDICATION OF FULL PACKAGE	—	—	—	—	—		
MOVEMENT OF CARRIAGE	—				—		
PNEUMATIC SUCTION		—	—	—	—		
MIDDLE FRAMEWORK MOVEMENT		FORWARD			BACKWARD		
YARN SEVERING		—			—		
RETURNING OF SEVERING DEVICE			—		—		
MOVEMENT OF THE DOFFING ARM			—				
MOVEMENT OF THE DOFFING HEAD		DOWNWARD			UPWARD		
MOVEMENT OF THE DOFFING FEEDER		FORWARD		BACK			
SWITCHING OF THE EJECTION VALVE					—		
ROTATION OF THE PROGRAMMING CAMS		—	—	—	—		

Fig. 9A

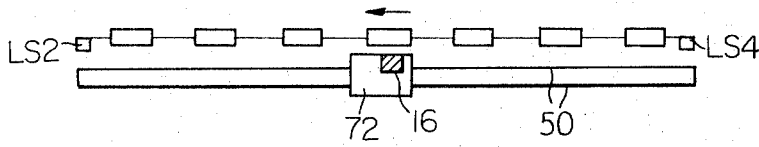


Fig. 9B

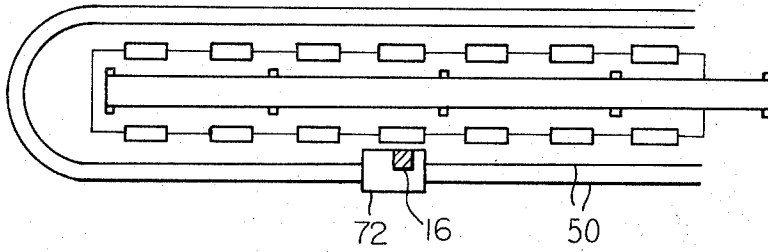


Fig. 10

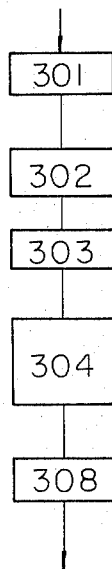


Fig. 11A

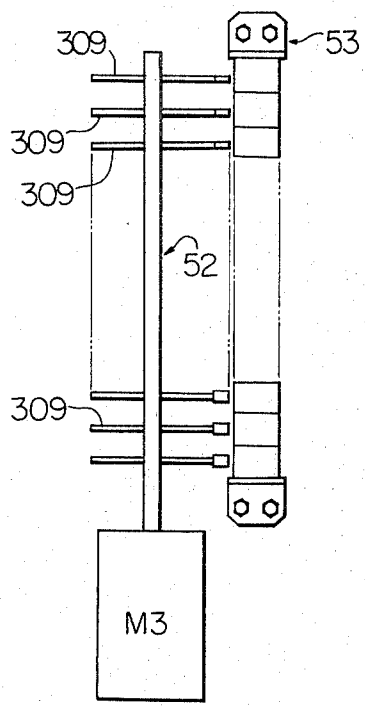
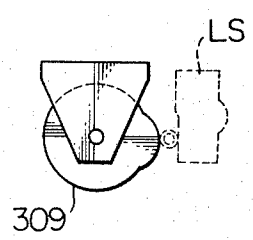


Fig. 11B



AUTOMATIC DOFFING APPARATUS FOR TEXTILE MACHINE HAVING ONE OR MORE WINDING UNITS

This application is a continuation-in-part of application Ser. No. 885,174 filed Dec. 15, 1969, now abandoned.

The present invention relates to an improved automatic doffing method and apparatus for a textile machine having one or more winding units, and more particularly relates to an improved automatic method and apparatus for selectively carrying out doffing operations without interrupting the yarn supply on textile machines provided with a plurality of aligned winding units.

The method of the present invention is advantageously applicable to such textile machines as a take-up machine for extruded filaments, a take-up machine for drawn filaments, a false-twisting machine, a stuffing-box type crimping machine, an edge-method type crimping machine, an air-jet type bulking machine, a heat setting machine for crimped fibers or an open-end type spinning machine. The method of the present invention is also applicable to a textile machine having only one winding unit without any serious mechanical modification. Especially, the method of the present invention is most advantageously adapted for such cases wherein an operational complexity exists in the yarn retrieving operation at the moment of stopping or restarting the machine or it is particularly undesirable to interrupt the yarn supply even during the doffing operation, that is, to stop the advancement of the yarn from the supply source.

In the conventionally known type of doffing system, advancement of the yarn has to be stopped for carrying out the doffing operation and for a certain length of time after the restarting of the yarn advancement, it is necessary to eliminate the supplied yarn using such a device as a waste spool. In case the yarn supply does not stop, it is necessary to preliminarily cause the yarn to wind around the waste spool or to cause the yarn to be sucked into a specially disposed suction nozzle so as to perform the doffing and bobbin exchanging operations together. All of this work must be performed manually. Furthermore, a highly trained technique is generally required to carry out the operations with fewer malfunctions. In addition to this, an increase in the yarn speed or yarn strength often tends to cause an operational hazard.

Recently, another type of doffing and bobbin exchanging system has been proposed. In this system, a single yarn stream unit is provided with a pair of suitably arranged winding units. When one of the winding units become fully packaged, the yarn is automatically transferred from that fully packaged winding unit to the other winding unit previously and manually provided with a bare bobbin. However, this arrangement requires relatively wide floor space and the manufacturing cost of the equipment inevitably increases considerably. Therefore, actual utilization of the equipment of this type is limited to a particular use.

With the above-described disadvantages of conventional doffing equipment, there has long been a need of improved doffing apparatus on which, without interrupting the advancement of the yarn, the fully packaged bobbin is automatically doffed, a new bare bobbin is automatically supplied replacing the fully packaged bobbin, and the yarn is automatically wound onto the

thus supplied new bar bobbin, being transferred from the fully packaged bobbin.

A principal object of the present invention is to provide a method and apparatus for carrying out automatic doffing of a wound bobbin, substitution of a newly supplied bare bobbin for the wound bobbin and transfer of the yarn from the wound bobbin to the bare bobbin without any interruption in the yarn supply.

Another object of the present invention is to provide a method and apparatus for automatically and selectively carrying out doffing operations on textile machines having a plurality of aligned winding units.

Still another object of the present invention is to provide a method for automatically carrying out doffing operation without requiring any skilled manual operations.

A further object of the present invention is to provide an automatic doffing apparatus not requiring large floor space and being manufactured at a relatively low manufacturing cost.

A still further object of the present invention is to provide an automatic method and apparatus capable of carrying out a doffing operation with fewer malfunctions while effecting a considerable increase in the operational efficiency.

A still further object of the present invention is to provide an automatic doffing method and apparatus advantageously adaptable for a high speed processing of the yarn and for yarns of high strength without any possibility of operational hazards.

In order to achieve the above-described objects of the invention, the method of the present invention includes positively severing the processing yarn at a suitable position upstream of a package-carrying bobbin and a leading end of the severed yarn is sucked into a suction nozzle so as to be received successively within a suitably disposed waste yarn box. Concurrently with the doffing of a wound bobbin out from the winding unit, a new bare bobbin is supplied thereto and, upon starting of the rotation of the new bare bobbin, the yarn previously sucked into the yarn box now starts to be pneumatically transferred to the bare bobbin. Almost simultaneously with this, the yarn is again positively severed at a point slightly upstream of the suction nozzle. Throughout the whole process, the supply of the yarn from the supply source is not interrupted.

The apparatus of the present invention for carrying out the above-explained method is movable along a plurality of aligned winding units. When the apparatus arrives at a winding unit of fully packaged bobbin, it automatically detects the fully packaged condition of the unit and starts to perform the above-described method. The time-functional sequence of the operations is controlled by a suitably profiled programming cam disposed in the apparatus. In the case of malfunction in the yarn transfer to the new bobbin, the above-described operational steps may be automatically repeated only once more.

Further features and advantages of the present invention will be made more explicit from the ensuing description, reference being made to the accompanying drawings, wherein;

FIG. 1 is a schematic side view of an embodiment of the apparatus of the present invention in combination with a winding unit,

FIG. 1A is an enlarged front view of the full package indicator assembly shown in FIG. 1 and the co-

operating limit switches provided for the doffing apparatus;

FIG. 1B is a side view of the assembly shown in FIG. 1A;

FIG. 1C is a detailed side view of the limit switch actuating means shown in FIGS. 1A and 1B,

FIG. 2 is a schematic view of the apparatus shown in FIG. 1 seen in a direction perpendicular to the direction of movement of the apparatus,

FIG. 3A is an enlarged side view of the doffing head used in the apparatus shown in FIG. 1,

FIGS. 3B and 3C are side and top views of another embodiment of the doffing head.

FIG. 4 is a diagram of the electric circuit of the doffing apparatus of the invention.

FIGS. 4A to 4D are perspective views showing the mechanism and the operation of the bare bobbin feeder arm arrangement used in the apparatus shown in FIG. 1,

FIG. 5 is an enlarged view of a yarn severing device used in the apparatus shown in FIG. 1, seen in the advancing direction of the processing yarn,

FIGS. 6A to 6F are explanatory side views for showing time sequential operations of the doffing apparatus of the present invention in combination with those of the corresponding winding unit,

FIGS. 7A, 7B and 7C are perspective views of several modified embodiments of the package carrying bobbin advantageously usable for the apparatus shown in FIG. 1,

FIG. 8 is a graphical representation of a time sequential relationship between the several operations carried out by the apparatus shown in FIG. 1,

FIG. 9A is a schematic plan view, of the apparatus of the present invention used in combination with a textile machine having a plurality of aligned winding units,

FIG. 9B is a similar view showing a textile machine with two lines of winding units.

FIG. 10 is a diagrammatic block diagram of apparatus of the present invention.

FIGS. 11A and 11B are respectively schematic side and plan views of the programming cam assembly of the apparatus.

As mentioned above, the present invention relates to a method and apparatus for automatic doffing and is further characterized as follows.

1. The apparatus travels along a plurality of winding units disposed in an aligned arrangement.
2. Upon detection of a fully packaged winding unit during the travel, the apparatus stops at that location so as to perform a doffing operation.
3. The apparatus is provided with a yarn severing mechanism and a yarn sucking mechanism located upstream of the yarn severing position. After the mechanism is put in a pre-designed operational disposition, the yarn is severed and the yarn continuously supplied from the given supply source and received by the yarn sucking mechanism to be stored within a suitably disposed waste yarn box.
4. A fully packaged bobbin is automatically released from a bobbin chuck and suitably removed off from the winding unit.
5. A bare bobbin is supplied to the winding unit so as to be clamped by the bobbin chuck while preserving the suction of the supplied yarn in such a manner that the path of the sucked yarn is located in between the bare bobbin and the winding unit.

6. The chucked bare bobbin starts to rotate and, when the rotation reaches to a normal rotational speed, the yarn being sucked is transferred onto the bare bobbin and the yarn is again severed at a point just upstream of the suction inlet of the yarn sucking mechanism.

7. The bobbin surface is partially provided with means for easily catching the yarn at the moment of yarn transfer. The catching means may be in the form of hook fabric tape of the kind used in "Velcro" fasteners. Such fabric comprises a multiplicity of hooks formed, of monofilaments of thermoplastic material projecting from a fabric or sheet base as disclosed, for example, in U.S. Pat. No. 2,717,437.

Referring to FIGS. 1 and 2 the entire structure of an embodiment of the apparatus of the present invention is shown in combination with a winding unit. In the arrangement shown, a roller bail 1 having a yarn traversing groove or grooves is rotationally mounted on a framework of the winding unit. Also on the framework, a swingable cradle arm 2 is mounted at a pivotal support 3. A weight 4 is disposed to one end of the cradle arm 2 so as to effect a clockwise moment upon the cradle arm 2 in the arrangement shown in the drawing. Near the other end of the cradle arm 2, two pairs of bobbin supporting rollers 5 are rotationally disposed to the cradle arm 2 so as to rotationally carry the bobbin thereof. The cradle arm 2 is further provided with an arm plate 6, a full package indicator and actuator 7 and a bobbin rail 8, all the members being secured thereto. In the vicinity of the bobbin supporting rollers 5 assembly, a full package detector micro-switch 9 and a side plate 10 is disposed to the framework of the winding unit. Apart from the aforementioned members, a package holder 11 is mounted on the framework. Below the above-described members, a full package indicator assembly 12 having a solenoid therein is mounted on the framework. The winding unit is further provided with a motor 13 for effecting yarn winding and a yarn guide 14 mounted on its framework, respectively. The operational features of the above-mentioned members will be explained later in detail. Further, the winding unit such as disclosed in U.S. Pat. No. 3,370,798 can advantageously be used in combination with the apparatus of the present invention.

In combination with the above-described arrangement on the side of the winding unit, the apparatus of the present invention is provided with a doffing head 16 having a suction inlet for receiving yarn 15 being processed. Detailed structure of the doffing head 16 will be clarified later on. A flexible tube 17 extends from a vacuum generator 18 towards the main operational portion of the apparatus. At a location downward of the doffing head 16, a doffing arm 19 is pivotally mounted on a pivotal support 22 and connected to a servo-motor 20 by way of a connecting link 21. Both the pivotal support 22 and the servo-motor 20 are secured to a bracket 23 which is stationary on a middle framework 24 of the winding unit.

Apart from the above-described arrangement, a bobbin box 25, containing bare bobbins 26 therein, is disposed above the framework 24 and is provided with a bobbin feeder 27 disposed relative to a bottom opening of the bobbin box 25 in a horizontally slidable arrangement. Sliding movement of the bobbin feeder 27 is actuated by a servo-motor 108 by means of a pinion 107 and a rack 106. A bare bobbin 26 on the bobbin feeder 27 is transferred therefrom to the predesigned position

of the swingable cradle arm 2 by a feeder arm 111, whose mechanical structure will be explained later on in detail with reference to the accompanying drawings.

The afore-mentioned doffing head 16 is vertically and slidably moved along a guide bar 38 by a lead screw 37 which is actuated selectively in two directions of rotation by a downward located servo-motor 39. The structural features of this arrangement will be apparent by reference to FIG. 2.

All the afore-mentioned members are mounted on the middle framework 24 which is movable horizontally toward and from the winding unit in the drawing and this horizontal movement of the middle framework 24 is effected by transmitting the rotation of a lead screw 40 to a nut 41 secured to the middle framework 24. Two directional rotation of the lead screw 40 is actuated by a servo-motor 42. The above-mentioned servo-motor 42, lead screw 40 and a guide bar 43, which is shown in FIG. 2, are all mounted on a carriage framework 44 provided with four carriage wheels 45 disposed to a rotational wheel shaft 46. Two directional rotation of the wheel shaft 46 is effected by a servo-motor 49 by way of an engagement of a worm 47 with a worm wheel 48. In the present embodiment, two out of four carriage wheels 45 are driven. The carriage wheels 45 travel along a rail 50 fixed on the floor base 51 which also supports the winding unit.

Deceleration and stopping of the carriage are carried out by providing the full package indicator assembly with a solenoid 12a the armature of which carries a pair of switch actuators A and B. When the diameter of the package reaches a desired value, the full package indicator dog 7 pushes the micro-switch 9, electric current flows through a solenoid 12a and the switch actuators A and B are pushed out forwardly into operative position.

The switch actuator A is longer than the switch actuator B, the switch actuator A providing for deceleration and the switch actuator B for the stopping of the carriage. On the side of the doffer, two micro-switches LS-1 and LS-3 are disposed in an arrangement contactable with the switch actuators A and B of the solenoid 12a when in operative position. The micro-switch LS-3 contacts the switch actuator A whereas the micro-switch LS-1 contacts the switch actuator B.

When the doffer comes along the rail 50, the micro-switch LS-3 first comes into contact with the switch actuator A of the solenoid 12a and the driving motor of the carriage is shifted to a lower running speed so as to decelerate the traveling speed of the carriage. Slowing down of the driving motor rotation can be performed in any known manner. In the present invention, the electric voltage applied to the DC motor is lowered. At the moment of the deceleration of the carriage traveling speed, the micro-switch LS-1 is pushed by the switch actuator B of the solenoid 12a and the motor stops its rotation. Because the stopping of the carriage is carried out in two stages as explained above, there is no accidental shock in the stopping of the carriage, and less deviation will exist as to the position of stopping of the carriage.

In FIG. 2, the doffing apparatus of the present invention is shown as viewed in a direction perpendicular to the traveling direction of the doffing apparatus. The apparatus is provided with a programming cam assembly comprising a plurality of programming cams operable

upon corresponding micro-switches 53 and horizontally secured to a vertical shaft rotated at a constant rotational speed. Upon turning-on of the micro-switches 53 by the rotating cams 52, corresponding electric signals are generated for effecting operations of the respective parts of the apparatus with a pre-designed timing as will be described below.

Referring to FIG. 3A, the doffing head 16 shown in FIG. 1 is presented in an enlarged illustration. In the disposition shown in the drawing, the yarn 15 is shown in the condition just before being wound around the bare bobbin 26. In this disposition, the yarn 15 is sucked by a suction inlet 54 and conducted into the yarn box (not shown) through the flexible tube 17. Disposed in the vicinity of the suction inlet 54, is a yarn severing device 55 having a pair of scissor-type severing blades. One of the blades, that is, a movable blade, severs the yarn 15 in cooperation with another of the blades, that is, a stationary blade, when an electromagnetic force is applied thereto by a flow of electric current through a solenoid coil 56. Under the doffing head mechanism, a pneumatic ejection shifting valve 57 is disposed. For this pneumatic ejection in the present embodiment, exhaust air discharged from the vacuum generator 18 is utilized. This exhaust air is constantly supplied through a flexible conduit 58 to a cylinder 59 having an ejection outlet 60 for discharge into the atmosphere. When an electric current flows through a solenoid coil 61, a magnetic member 63 is attracted towards the solenoid coil 61 against the expanding force of a spring 62 connected thereto and the location of a piston 64 within the cylinder 59 changes. Due to this displacement of the piston 64 within the cylinder 59, the exhaust air is more discharged into the atmosphere through an ejection nozzle 65. When the ejection nozzle 65 reaches a position adjacent to a contact point of a bare bobbin 26 with the roller bail 1, the yarn severing device 55 is actuated so as to sever the yarn 15. Then, the yarn 15 is carried toward the contact point of the bare bobbin 26 with the roller bail 1 floating in the air stream discharged from the ejection nozzle 65. Once being brought to the contact point, the yarn 15 tends to be directed downwards due to its own weight and follows the peripheral surface of the bare bobbin 26 to be wound there-around.

FIGS. 3B and 3C show another embodiment of the means attached to the doffing head 16 so as to mechanically enable the yarn 15 to be wound around the bare bobbin 26. A bracket 402 is rotatable about the axis of a rotary solenoid 403 attached to a mounting member 404. To this bracket 402, a solenoid 405 is attached so as to provide reciprocal movement to a movable piece 406 thereof and at the forward end of this movable piece 406, a yarn guide member 407 with a yarn engageable portion 410 is fixed. The solenoid has a return spring 408. At first, yarn guide member 407 is positioned at the position "A" shown in FIG. 3C and when the rotary solenoid is operated, the yarn guide member 407 rotates to the position "B." While the yarn guide member 407 is carrying out this rotary motion, the yarn sucked into the suction inlet 54, engages with the yarn engageable portion 410 of the yarn guide member 407. Then, upon operation of the solenoid 405, the yarn guide member 407 advances to the position "C" and causes the yarn 15 to be hooked up by a notch 73 provided in the bare bobbin 26. Also, a cover 401 having a recess 401a is disposed on the guide member 216 in

order to prevent the yarn from being caught in the false portions and further, the recess 401a serves to guide the yarn to the suction inlet 54 and the severing device 55 along with the guide member 216.

FIGS. 4A to 4D show a mechanism for feeding a bare bobbin to the winding unit when a full bobbin is doffed. The feeding of the bare bobbin is performed by cooperation of a feeder arm, stationary fingers and an auxiliary finger. Upon turning of the feeder arm, the auxiliary finger holds an already supplied bare bobbin in cooperation with the stationary fingers. When the feeder arm has completed its turning of a pre-designed extent, the auxiliary finger releases its hold on the bare bobbin and the bare bobbin is placed at a position corresponding to the performed turning of the feeder arm, that is, the bobbin is now caught by the bobbin chuck of the winding unit.

In the disposition shown in FIG. 4A, the mechanism is in a condition just before starting its operation. Although not entirely shown in the drawing, a plurality of bare bobbins are contained within the bobbin box 25 above the lowest positioned bare bobbin 26a. The bobbin box 25 is provided with a bottom opening facing the bobbin feeder 27 and, in the disposition presented in the drawing, the new bare bobbin 26 is received by the bobbin feeder 27 in a condition supported by a pair of bobbin rails 104. A pair of slide guides 105 disposed on both sides of the bobbin feeder 27 slide along respective stationary guides (not shown) during the horizontal movement of the bobbin feeder 27. In combination with the bobbin feeder mechanism, so as to effect the horizontal movement of the bobbin feeder 27, a rack 106, a pinion 107 meshing with the rack 106 and a reversible motor 108 for effecting rotation of the pinion 107. Both the motor 108 and the bobbin box 25 are mounted stationary on the framework of the doffing apparatus.

In the feeder arm assembly, the feeder arm 111 is turnably mounted on a stationary shaft 120, which is secured to a motor bracket 121, and is firmly consolidated with a large-diametral gear 119 in a coaxial relationship. A micro-switch mounting plate 122 is secured to a free end of the stationary shaft 120 and the plate 122 is provided with a pair of micro-switches 123 and 124 disposed thereon in a spaced arrangement sandwiching the stationary shaft 120, one is for stopping the turning of the feeder arm 111 and the other is for reversing the turning of the feeder arm 111. In a meshing engagement with the large diametral gear 119, a small-diameter gear 126 is firmly mounted on a rotational shaft of a reversible driving motor 125 and a guide pin 127 is fixed on a side surface of the small-diametral gear 126 extending towards the feeder arm 111. One end of the feeder arm 111 is provided with a switch actuator 128 secured thereto and operable upon the micro-switches 123 and 124. The motor bracket 121 is fixed to a supporting framework 129.

Another end of the feeder arm 111 is provided with a pair of stationary fingers 109 and a movable auxiliary finger 110. The stationary fingers 109 are fixedly connected to the feeder arm 111 by a connecting rod 111a extending therefrom. Although a pair of stationary fingers 109 are used in the present embodiment, more than two fingers may be used in conformity to the actual operation. The auxiliary finger 110 is rotationally disposed through the feeder arm 111 and one end of the auxiliary finger 110 is fixedly combined with a sec-

tor gear 112. In meshing engagement with the sector gear 112, another sector gear 113 is firmly mounted on a shaft 114 rotatably disposed through the feeder arm 111 and an end of the rotational shaft 114 is connected to a lever 115. A supporter bracket 117a is pivotally disposed on a side surface of the sector gear 112 in an off-center disposition and, in combination with the supporter bracket 117a, another supporter bracket 117b is pivotally disposed on an intermediate portion of the feeder arm 111. Being sandwiched by both supporter brackets 117a and 117b, a compression spring 116 is disposed embracing a rod supported by the supporter brackets 117a and 117b. Due to the off-center disposition of the supporter bracket 117a with respect to the pivotal center of the sector gear 112, the sector gear 112 is always urged into a clockwise pivotation in the drawing by the expanding force of the compression spring 116. In the disposition shown in FIG. 4A, pivoting of the sector gear 112 is obstructed by a stop 118, which is clearly seen in FIG. 4C.

In the disposition shown in FIG. 4B, the bare bobbin 26 is pushed out towards the feeder arm assembly by the horizontal sliding of the bobbin feeder 27. At this moment, successive falling of the next bare bobbin 26a is prevented by the bobbin supporter 130 inserted beneath the next bare bobbin 26a by horizontal sliding of the bobbin feeder 27. When the bobbin feeder 27 reaches the prescribed position, the driving motor 125 starts to rotate in the direction shown by an arrow in the drawings and, accordingly, the feeder arm 111 pivots in a clockwise direction so that the stationary fingers 109 scoop up the bare bobbin 26 from the bobbin feeder 27.

Upon further turning of the feeder arm 111, the bare bobbin 26 comes to a location shown in FIG. 4C and the lever 115 comes in contact with the guide pin 117. Due to this contact, the lever 115 is pivoted in a clockwise direction as seen in the drawing and this pivotal force is transmitted to the sector gears 112 and 113. By the force thus transmitted, the auxiliary finger 110 turns in a counterclockwise direction so as to tightly hold the bare bobbin 26 in cooperation with the stationary fingers 119. By adequately adjusting the contact timing of the lever 115 with the guide pin 27, the above-described bobbin holding action can take place before the bare bobbin drops off from the stationary fingers 109 due to the turning of the feeder arm 111. At this moment, because the directional line of the expanding force of the compression spring 116 has already passed over a virtual line connecting the pivotal center of the sector gear 112 and the pivotal center of the supporter bracket 117b, the auxiliary finger 110 is still urged towards the held bare bobbin 26 by the spring force even when the engagement between the lever 115 and the guide pin 127 is cancelled.

As the turning of the feeder arm 111 further advances, the disposition becomes as shown in FIG. 4D. That is, the supporter bracket 117a of the compression spring 116 comes in contact with an abutment 131 secured to the framework of the apparatus (not shown) and the sector gear 112 is now pivoted in a clockwise direction overcoming the spring force. Due to this pivoting of the sector gear 112, the auxiliary finger 110 turns away from contact with the held bare bobbin 26 and the bare bobbin 26 is released. Simultaneously with opening of the auxiliary finger 110, an actuator 128 disposed on another end of the feeder arm 111 pushes the

micro-switch 124 and, by the electric signal generated by this pushing of the micro-switch 124, the feeder arm 111 starts its reverse turning and, upon pushing of the other micro-switch 123 (FIG. 4A) by the switch actuator 128, the feeder arm 111 ceases its reverse turning. During this reverse turning of the feeder arm 111, the sector gear 113 may be maintained free from meshing with the sector gear 112 so that no cooperation of the lever 115 with the guide pin 127 will take place during this reverse turning procedure. Meanwhile, the bobbin feeder 27 returns to its initial disposition shown in FIG. 4A.

Referring to FIG. 5, a detailed arrangement of the yarn severing device 55 used in the apparatus shown in FIG. 1 is illustrated. In the shown arrangement, a stationary blade 202 is fixedly disposed on a supporter bracket 204 secured to a framework 205 of the yarn severing device 55. In combination with this stationary blade 202, a movable blade 203 is mounted on a pivotal support 206. The movable blade 203 is provided with a pin 207 protruding therefrom in a direction of the yarn path. A swing arm 208 is pivotally mounted on a shaft 209 and its movement into the yarn path direction is limited by a collar 210 also mounted on the shaft 209. Due to a disposition of a helical spring 211, the swing arm 208 is always urged in a counterclockwise direction as seen in the drawing. However, the swing arm 208 is usually placed in a condition shown by solid lines in the drawing due to the presence of a stop 212 fixed to the framework 205. One end of the swing arm 208 is provided with a long aperture receptive of the pin 207 of the movable blade 203.

When an electric current flows through an electro-magnet 213, a magnetic member 214 is attracted towards the magnet 213 overcoming the spring force provided by the helical spring 211 and the swing arm 208 performs a clockwise turning around a pin 215 disposed on the magnetic member 214 so as to come to the position shown with chain-and-dot lines in the drawing. In this disposition, the movable blade 203 comes in combination with the stationary blade 202 so as to sever the yarn 15 advancing along a guide member 216. By interrupting the electric current's flow through the electro-magnet 213, the magnetic member 214 is released from attraction by the magnet 213 and returns to its original position due to the spring force by the helical spring 211. With this returning of the magnetic member 214, the movable blade 203 also returns to its initial disposition shown by solid lines in the drawing.

Referring to FIGS. 6A to 6F, time sequential operational features of the doffing apparatus of the present invention are shown in combination with those of the corresponding winding unit.

In the disposition shown in FIG. 6A, the bobbin has already been fully packaged and the full package indicator member 7 pushes the full package detector micro-switch 9 to make the doffing apparatus stop in front of the fully packaged winding unit. It is necessary to have a precise determination of the position in which the apparatus stops in view of the subsequent bobbin feeding operation. In case the apparatus travels at a relatively high speed, it is recommendable to preliminarily lower the speed prior to stopping thereof. With the start of the rotation of the programming cams 52 described more fully below, the middle framework 24 approaches towards the winding unit and the vacuum

generator 18 is turned on. Upon arriving at a predetermined location, the middle framework 24 automatically stops at the location. With the approach of the middle framework 24 towards the winding unit, the traversing yarn 15 automatically falls into a recess formed in the cover of the doffing head 16 and is severed by the severing device 55.

The disposition just after completion of the yarn severing by the severing device 55 is shown in FIG. 6B, wherein the successively supplied yarn 15 is sucked into a yarn box of the vacuum generator 18 passing through the flexible tube 17.

In the disposition shown in FIG. 6C, the doffing head 16 descends vertically and the doffing arm 19 pushes the swingable cradle arm 2 down. At this moment, the fully packaged bobbin is lifted off from the bobbin supporting roller 5 by the side plate 10 and is doffed towards the package holder 11 rolling along the bobbin rail 8. The fully packaged bobbin thus doffed onto the package holder 11 may be collected by the operators or an adequate belt conveyer can be substituted for the package holder 11 so as to mechanically collect the full packages at a termination of the conveyer belt.

Next, the doffing arm 19 returns to its initial position from its tilted position as is shown in FIG. 6D and the cradle arm 2 pivots in a clockwise direction until the arm plate 6 abuts against a stop bar 67. On the bobbin box side, a bare bobbin 26 is delivered from the bobbin box 25 by the bobbin feeder 27 and the feeder arm 111 scoops it up from a downside direction. An end of the bobbin feeder 27 is provided with a central cut-off so as to permit the prescribed movement of the feeder arm 111. As already mentioned, falling-down of the succeeding bobbins in the bobbin box is prevented by the provision of the bobbin supporter 130. Upon further turning of the feeder arm 111, the guide pin 127 on the small diameter gear 126 operates the lever 115 and, by way of the sector gears 112 and 113, the auxiliary finger 110 is turned in a counterclockwise direction so as to press the bare bobbin 26 onto the stationary fingers 109. During this operation, the bare bobbin not yet starting its rotation, there will be a frictional contact between the yarn and the peripheral surface of the bare bobbin. In this connection, it should be noted that excessive friction between the two forms a bar to a smooth sucking of the yarn. However, the inventors' experimentation has confirmed the fact that, when a false-twisted textured yarn was wound on an ordinary paper bobbin at a yarn speed of 150 MPM, the yarn could be sucked pneumatically by using a pneumatic stream of 30 MPS flow speed without any malfunction.

In the disposition shown in FIG. 6E, the feeder arm 111 has already brought the bare bobbin 26 to the position of the bobbin supporting rollers 5 of the swingable cradle arm 2. At this moment, the auxiliary finger 110 releases the bobbin 26 from its clamping action automatically. During this operation, it should be noted, the yarn 15 is put in a condition partially wound on the peripheral surface of the bare bobbin 26 as is shown in the drawing. After releasing the bare bobbin 26, the feeder arm 111 returns to its initial position with the auxiliary finger 110 in a still opened condition. Concurrently with this returning movement, the doffing head 16 starts to ascend and, following this ascending movement, the cradle arm 2 turns in a counterclockwise di-

resection while holding the bare bobbin 26, which starts to rotate upon contact with the roller bail 1.

In the disposition shown in FIG. 6F, the doffing head 16 is put in a position slightly higher than the position whereon the bare bobbin 26 starts to rotate in a direction shown by an arrow in the drawing. As is shown in the drawing, the yarn 15 again passes through the yarn severing position of the yarn severing device 55 during its transfer from the bare bobbin to the suction inlet and passes in front of the ejection nozzle 65 located under the yarn severing position, shown with dotted lines in the drawing. At this very moment, an air stream is ejected from the ejection nozzle 65 and the yarn is severed following the pneumatic ejection. Then, the leading end portion of the severed yarn is pneumatically blown towards the contact point of the bare bobbin 26 with the roller bail 1. As the bare bobbin 26 is already put in a rotational condition, the blown yarn end portion is wound on the periphery of the bare bobbin 26.

In order to smoothly carry out this yarn transferring action without any malfunction, it is necessary to adequately select the flow speed of the ejected air stream, width of the ejection nozzle outlet, yarn severing position and yarn tension value. Following are processing specifications of one of the examples which were carried out with 95 percent operational success.

Processed yarn — Polyester false-twisted yarn

Yarn speed — 150 MPM

Air Flow speed — 6 MPS

Nozzle width — 60mm

Severing position — Contact point of the bobbin with the roller bail.

Yarn tension — Approximately 1 gr.

When the ejected air stream arrives at the contact point of the bobbin 26 with the roller bail 1, the air stream tends to be dispersed thereabout and, thereby, the yarn's leading end brought thereto tends to whip thereabout. This whipping of the yarn end makes it difficult for the two contacting members to catch the yarn end at the nip of their mutual contacting point. In order to eliminate this accidental yarn-end whipping movement caused by the air dispersion, an improvement is illustrated in the embodiment shown in FIG. 7A. In this embodiment, the bare bobbin 26 is provided with a pair of elastic rings 70 inserted over both ends thereof so as to provide a slight clearance at the contact portion thereof with the roller bail 1. Due to presence of this clearance, the ejected air stream passes therethrough smoothly without being dispersed in the vicinity of the contact portion and accidental whipping of the yarn end can be successfully avoided.

The above-described yarn transfer can also be carried out without utilizing the pneumatic system.

One of the examples of this non-pneumatic type yarn transfer is shown in FIG. 7B. In this embodiment, the bare bobbin 26 is provided with a notch 73 formed on one end thereof. Using the bare bobbin 26 of this type, the yarn is guided after starting of the bobbin's rotation so as to be caught in this notch.

Another example of this type embodiment is shown in FIG. 7C, in which example the bobbin 26 is provided with a pair of yarn catching members 74, for example, bands of hook fabric as described above at both ends of the bobbin. Then, almost simultaneously with the starting of the bobbin's rotation, the traversing yarn

will be caught, at its traversing terminals, by either of these yarn catching members 74.

A time sequential relationship between the above-explained several operations of the respective elements of the apparatus of the present invention is graphically shown in FIG. 8, wherein location A corresponds to the disposition shown in FIG. 6A, location B to FIG. 6B, location C to FIG. 6C, location D to FIG. 6D, location E to FIG. 6E and location F to FIG. 6F. In the case of the illustrated example, one operational cycle is completed within 40 seconds. It may be possible to shorten the entire cyclic period by escalating the operational speeds in every operational step.

In the embodiment shown in FIG. 9A, the doffing apparatus 72 of the present invention is applied to a textile machine having a plurality of winding units in an aligned arrangement. The doffing apparatus 72 travels along a rail 50 disposed in relation to the aligned winding units as shown in the drawing. In case an approximately simultaneous doffing is attainable, doffing of all the winding units can be completed only by one circulation of the doffing apparatus along the aligned winding units. In case the length of the time needed for making a full package is relatively long in view of the productivity of the winding unit, it is rather advantageous to making a doffing apparatus responsible for two or more sets of textile machines as illustrated in FIG. 9B.

FIG. 4 is an electric circuit diagram for the operation of the doffing apparatus of the present invention. Referring to the upper portion of FIG. 4, A.C. power from an electric power source is transformed from the initial high voltage to an appropriate lower voltage by transformers TR1 and TR2 and then, is rectified by rectifiers Se1 and Se2, respectively, and the resulting electric D.C. power is applied to D.C. servo-motor M1 (refer to numeral 49 of FIG. 2) which is used for driving the carriage by way of the relay-contacts No. 2, No. 3, No. 4 and No. 5 shown.

The circuit TR1 to Se1 to No. 2 is arranged to drive the motor M1 at a reduced rotational speed, and the circuit TR2 to Se2 to No. 4 to No. 3 is arranged to drive the motor M1 at a predetermined regular rotational speed higher than the reduced rotational speed, and moreover, the circuit TR2 to Se2 to No. 5 to No. 3 is arranged to drive the motor M1 at the same regular rotational speed but in the reverse direction. That is to say, the transforming ratio of the transformer TR1 is larger than that of transformer TR2.

In the above-mentioned three circuits, when the circuit TR2 to Se2 to No. 4 to No. 3 is operated, the carriage travels on the rail 50 at the regular speed. When the carriage comes to one of the winding units, the limit switch LS3 contacts the switch actuator A of the full package indicator assembly 12 (see FIGS. 1 to 1C) and is closed. By this operation of LS3 an auxiliary relay r6 is energized so that relay No. 3 is deenergized so as to open the contact No. 3 and simultaneously, relay No. 2 is energized so as to close the contact No. 2. Now, the circuit TR2 to Se2 to No. 4 to No. 3 changes to the circuit TR1 to Se1 to No. 2 so that D.C. servo-motor M1 is operated at a reduced rotational speed and accordingly, the speed of the carriage is decelerated. Successively, when the limit switch LS1 contacts the switch actuator B of the indicator assembly 12 and operates to close LS1, the auxiliary relay r7 is energized. By energizing relay r7, a normally closed contact r7 is opened

so that the relay No. 2 is deenergized so as to open the contact No. 2 thereby stopping the rotation of D.C. servo-motor M1 and accordingly, stopping the travel of the carriage. By energizing the relay r7, another normally closed contact r7 is also opened so that the relay No. 4 is deenergized so as to open the contact No. 4 in the circuit TR2 to Se2 to No. 4 to No. 3 of D.C. servo-motor M1. Because the stopping of the carriage is carried out in two stages as explained above, there is no shock in the stopping of the carriage, and less deviation will exist as to the stopped position of the carriage. Further, the above-mentioned energizing of the relay r7 closes the contact r7 disposed in the circuit of relay No. 1 and therefore relay No. 1 is energized so as to close the contacts No. 1 thereby applying A.C. electric power from the A.C. electric power source to a single-phase condenser motor M3 for providing the rotation of the programming cam assembly 52 (refer to FIG. 2) and to an A.C. motor M2 for actuating the vacuum generator 18.

The cam assembly now begins to rotate and the traversing yarn 15 begins to be sucked by the suction inlet 54 and the doffing operation proceeds. When a new bare bobbin 26 is mounted in the position where the yarn is to be wound around the bare bobbin 26, the cradle arm 2 returns from the full package detecting position to the initial position whereby the full package detector micro-switch 9 is restored to the normal state and therefore, the solenoid 12a of the full package indicator assembly 12 is deenergized so as to retract the switch actuators A and B.

When the switch actuators A and B are retracted to the initial states, the limit switches LS1 and LS3 of the carriage open whereby the auxiliary relays r6 and r7 are simultaneously deenergized and the contacts r7 are again closed thereby energizing the relay No. 3 so as to complete the preparation for the operations of the circuits of the D.C. servo-motor M1 and the relay No. 4. This preparation means that as soon as the remaining contacts are actuated, the circuits are in operation.

Because of the presence of the normally closed limit switch LS5', the driving circuits of the A.C. motor M2 and the condenser motor M3 retain their self-holding states, so that the programming cam assembly 52 and the vacuum generator 18 continue to operate, even after relay r7 is deenergized. Also, in the circuit of the relay No. 1, there are inserted contacts r0 of an auxiliary relay r0, (not shown), which is energized so as to effect automatic operation of the circuit, so that the circuit of the relay No. 1 can be selected for automatic operation or manual operation.

A switch SW1 is provided so that manual operation is not effected merely by deenergizing the auxiliary relay r0. When the doffing operation sequence with respect to one winding unit comes to an end, the limit switches LS5 and LS5' are pushed by the stop cams in the programming cams 309 of the programming cam assembly 52 (refer to FIG. 11A) so that the limit switch LS5' is opened and, the limit switch LS5 is closed. The opening of the limit switch LS5' deenergizes the relay No. 1 so as to open the contacts No. 1 whereby the rotations of A.C. motor M2 and condenser motor M3 are stopped. Therefore, the rotation of the programming cam assembly 52 and the suction operation of the vacuum generator 18 is stopped.

Also, the closing of the limit switch LS5 energizes an automatic start-relay r8 so as to close contact r8

whereby the relay No. 4 is energized while closing the contact No. 4, thereby effecting rotation of D.C. servo-motor M1, and the carriage again starts to travel. When the carriage comes to the next winding unit having a fully wound bobbin, the same doffing operation sequence is repeated.

When the carriage travelling in the direction shown by the arrow in FIG. 9A, comes to the end of the rail 50, a limit switch LS2, the disposition of which is shown in FIG. 9A, is closed thereby energizing an auxiliary relay r10. By energizing the relay r10, the relay No. 4 is deenergized and at the same time, the relay No. 5 is energized. Therefore, the circuit TR2 to Se2 to No. 4 to No. 3 is changed to the circuit TR2 to Se2 to No. 5 to No. 3, and the reverse rotation of the D.C. servo-motor M1 is started so that the carriage travels in the reverse direction to the arrow shown in FIG. 9A. While the carriage is travelling in the reverse direction, the auxiliary relays r6 and r7 are not energized due to the opening of a normally closed contact of No. 5 and as a result, the carriage continues to travel without performing the doffing operation. When the carriage travelling in the reverse direction to the arrow shown in FIG. 9A, comes to the end of the rail 50, a normally closed switch LS4 is actuated thereby deenergizing the relay No. 5, and the reverse rotation of D.C. servo-motor M1 is stopped so as to stop the travel of the carriage in the reverse direction. By pushing a push-button switch PB1 as required, the carriage can be again operated. A push-button switch PB2 is provided so that the carriage may be made to travel in the reverse direction to the arrow shown in FIG. 9A manually. Also, a push-button switch PB3 is provided so that the carriage may be stopped at any desired position. There are contacts in parallel with the push-button switches PB1, PB2 and PB3 respectively so as to keep the self-holding states of the relays.

In all of the above-described embodiments, operations of the apparatus are controlled by the programming cams and, upon completion of one cyclic operation, the apparatus moves from the winding unit to the next fully packaged winding unit. In other words, the apparatus leaves the winding unit regardless of success in the doffing operation. So, once a malfunction takes place in the doffing operation, the winding unit has to wait for the next arrival of the travelling doffing apparatus without performing its yarn winding operation.

The detailed control for one winding unit will hereinafter be explained with reference to FIGS. 10, 11A and 11B while referring again to the electric circuit diagram shown in FIG. 4. In FIG. 10, block 301 represents a mechanism for detecting a fully packaged bobbin and for lowering the speed of travel of the carriage. The mechanism 301 has an arrangement in which the pivotal movement of cradle arm 2 causes the switch actuator A to be pushed into the path of travel of the carriage so as to operate the limit switch LS3 of the carriage. By the operation of LS3, the circuit of the motor M1 for driving the carriage is switched to the speed reduction circuit and therefore, the speed of travel of the carriage is reduced (see also FIGS. 1A and 1B). In a mechanism 302 for stopping the travel of the carriage, there is disposed a switch actuator B which is pushed into the path of travel corresponding to the pivotal movement of the above-mentioned cradle arm 2, so that the limit switch LS1 is operated at a predesigned position so as to be delayed with respect to the opera-

tion of LS3. The operation of LS1 opens the circuit of the motor M1 for driving the carriage so as to stop the carriage. Therefore, shifting the state of operation from block 301 to block 302 is carried out by travel of the carriage.

A cam 303 for effecting the operation of the vacuum fan 18, and a mechanism 304 for carrying out the doffing operation by the doffing apparatus start to operate in response to the stoppage of the carriage. In other words, by closing the above-mentioned limit switches, the motor M2 for the vacuum fan and the motor M3 for the programming cam begin to rotate.

FIGS. 11A and 11B show the programming cam assembly 52 for systematically carrying out the doffing operation. In the assembly 52, a number of cam discs 309 are fixed to the shaft connected to the cam motor M3, and the respective cam discs 309 actuate the corresponding limit switches of the switch assembly 53 in order to carry out the doffing operation. Block 308 represents a mechanism for stopping the rotation of the programming cam and for starting the travel of the carriage. In the mechanism 308, stop cams in the cam discs 309 actuate the limit switches LS5 and LS5'. The actuation of the limit switch LS5' effects the stopping of the motors M2 and M3 so that the programming cam assembly 52 and the suction of the yarn stop. The actuation of limit switch LS5 effects the starting of the rotation of D.C. servo-motor M1 so that the carriage starts to leave the winding unit.

It will be understood that the provision of the control means represented by the programming cams effect a smooth automatic transition from the stoppage of the carriage to the start of the doffing operation.

Normal traversing condition of the yarn may be checked by a photoelectric detector (not shown) disposed in the vicinity of the yarn guide 14 shown in FIG. 1. When the yarn traversing condition is normal, the signal from the photoelectric detector is a periodic pulse. This yarn traversing condition may also be detected through a photoelectric observation on the surface of the bobbin whose luminous reflection changes as the yarn is wound thereonto. This kind of yarn traverse detecting mechanism is especially required so as to enhance the yarn processing efficiency of the doffing apparatus when there is a possibility of malfunctions in the doffing operation. By the provision of this kind of detecting mechanism, a highly automatic operation can be expected for the apparatus of the present invention.

It should be understood that the apparatus of the present invention is applicable to a winding system also, wherein both ends of the bobbin are held by a chuck. In this case, suitable mechanical modifications are necessarily applied to the arrangement of the roller bail 1 and the swingable cradle arm 2.

Further, the apparatus of the present invention is usable in combination with a bobbin feeding system other than set forth in the foregoing discussion. For example, an escalator belt-type bobbin feeding mechanism can be used if a suitable design modification is applied thereto so as to conform to the mechanical arrangement of the doffing apparatus of the present invention.

Further, as to the pneumatic yarn sucking mechanism, it is not always necessary to dispose the vacuum generator and the yarn box on the doffing apparatus. That is, they can be disposed on the side of the winding

units. In this arrangement, they are centrally disposed on the textile machine and are connected to respective winding units by an air-tight conduit for each unit. The winding unit side outlets of the conduits are provided with suitable shutters. When the middle framework 24 of the doffing apparatus approaches a winding unit, the tip of the flexible tube 17 is engaged with a conduit outlet and the sucked yarn is transported toward the yarn box through this engagement.

What we claim and desire to secure by Letters Patent is:

1. In combination with a textile machine having at least one winding unit comprising chuck means for successively holding bobbins on which yarn is to be wound, means including a roller bail for supplying yarn to a bobbin held by said chuck means to be wound on said bobbin and means for sensing a fully packaged bobbin; automatic doffing apparatus comprising:

- a. means for severing said supplied yarn,
- b. means for releasing and discharging a fully packaged bobbin from said chuck means,
- c. means for pneumatically sucking a leading end of said severed yarn and storing said yarn,
- d. means for supplying bare bobbins,
- e. means for delivering a bare bobbin from said supply means to said chuck means of said winding unit,

f. means for starting rotation of said newly fed bare bobbin,

g. means for transferring said yarn to the peripheral surface of said newly fed bare bobbin to be wound thereon and,

h. programming means controlled by said sensing means for operating said severing means, releasing and discharging means, sucking and storing means, bobbin supply and delivery means, rotation starting means and transferring means in predetermined sequence including means for operating said severing means to sever said yarn at the start of the doffing operation and again prior to or concurrently with the winding of said yarn on said newly fed bare bobbin.

2. Apparatus according to claim 1, in which said textile machine comprises a plurality of said winding units arranged in a row and said doffing apparatus comprises a carriage running on a track along said row and means for propelling said carriage along said track and means controlled by said sensing means for stopping said carriage at a winding unit having a fully packaged bobbin.

3. Apparatus according to claim 2, in which said propelling means comprises means for propelling said carriage normally at a first selected rate and for propelling said carriage at a lower second selected rate prior to stopping said carriage at a winding station.

4. Apparatus according to claim 2, in which said carriage comprises a horizontally movable framework on which said severing means, sucking means, bobbin supply means and bobbin delivery means are mounted, and means for moving said framework toward and away from said winding unit.

5. Apparatus according to claim 4, further comprising means for moving said sucking means vertically.

6. Apparatus according to claim 1, in which said yarn severing means comprises two scissor-like blades of which one is fixed and the other is movable, means for biasing said movable blade to open position and means

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controlled by said programming means to move said movable blade toward said stationary blade to sever a yarn disposed between said blades.

7. Apparatus according to claim 1, in which said bobbin supply means comprises a bobbin box for holding a plurality of empty bobbins, and said bobbin delivery means comprises slide means horizontally movable under said bobbin box to move one bobbin at a time from said bobbin box toward said winding unit.

8. Apparatus according to claim 7, in which said bobbin delivery means further comprises a swingable arm carrying bobbin holding means and means for operating said arm to take a bobbin from said slide means and deliver it to said winding unit.

9. Apparatus according to claim 1, in which said yarn transferring means comprises a nozzle and means for supplying air under pressure to said nozzle at a selected time, said nozzle being positioned to direct a stream of air to deflect said yarn to the surface of a bobbin in said winding unit.

10. Apparatus according to claim 1, in which said

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yarn transferring means comprises a movable arm carrying a yarn-engaging finger, and means for moving said arm to transfer a yarn engaged by said finger to the surface of a bobbin in said winding unit.

11. In apparatus according to claim 1, a bobbin having a portion of its peripheral surface covered with hook fabric for holding a yarn brought into engagement with the periphery of said bobbin by said transferring means.

12. In apparatus according to claim 1, a bobbin having a notch at one end to catch and hold a yarn brought into engagement with said bobbin by said transferring means.

13. Apparatus according to claim 1, in which said programming means comprises a plurality of coaxial programming cams, means for rotating said cams together at a selected speed and switch means actuatable respectively by said cams and controlling the sequential operation of said severing means, sucking and storing means, bobbin delivery means and transferring means.

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UNITED STATES PATENT OFFICE
CERTIFICATE OF CORRECTION

PATENT NO. : 3,820,730
DATED : June 28, 1974
INVENTOR(S) : ENDO et al

It is certified that error appears in the above-identified patent and that said Letters Patent are hereby corrected as shown below:

On the title page in column 1, Item [76], line 3 change
"Migashiyama-ken" to --Higashiyama-ku--;
Item [76], line 6 change "Mangaku-Ryo" to --Nangaku-Ryo--;

On the title page in column 1, Item [30] change
Dec. 28, 1968 Japan 43-371 to
--Dec. 28, 1968 Japan 44-371--.

Signed and sealed this 1st day of July 1975.

(SEAL)
Attest:

RUTH C. MASON
Attesting Officer

C. MARSHALL DANN
Commissioner of Patents
and Trademarks