# United States Patent

**Burgermeister et al.**

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[45] **Aug. 8, 1972**


[54] **METHOD AND APPARATUS FOR DOFFING FULL BOBBINS AND DONNING TUBES ON RING SPINNING AND RING TWISTING MACHINES**


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[52] **U.S. Cl.** .....**57/52,** 57/156

[51] **Int. Cl.** .....**D01h 9/04**

[58] **Field of Search** .....57/52–54, 156



[56] **References Cited**

UNITED STATES PATENTS

| | | | |
|---|---|---|---|
| 2,751,746 | 6/1956 | Busquets et al. | 57/52 |
| 3,059,406 | 10/1962 | Ingham, Jr. | 57/52 |
| 3,116,586 | 1/1964 | Ingham, Jr. | 57/52 |
| 3,132,463 | 5/1964 | Glastra et al. | 57/52 |
| 3,609,952 | 10/1971 | Chiari et al. | 57/52 |



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[57] **ABSTRACT**

A method of, and apparatus for, automatically doffing full bobbins and donning empty tubes at textile machines, especially ring spinning and ring twisting machines, wherein a support rail is moved from a idle position into a gripping position for full bobbins placed upon spindles. The full bobbins are gripped by means of the support rail while it is in such gripping position, and then the support rail is moved upwards so as to doff the full bobbins from the spindles. The support rail with the doffed full bobbins is moved substantially parallel to and away from the machine, each point of the support rail moving along a predetermined path. The support rail with the doffed full bobbins is lowered towards a transporting mechanism extending along the textile machine, and the full bobbins are substantially vertically deposited onto the transporting mechanism. The transporting mechanism is placed in motion along the machine, the support rail lifted, and the full bobbins deposited lengthwise onto the transporting mechanism in the direction of transport thereof. Empty tubes pre-arranged along the machine are gripped by the support rail, the support rail with the gripped empty tubes then is moved upwards and in a direction substantially parallel and towards the machine, each point of the support rail moving along a predetermined path, the empty tubes are donned onto spindles; and following completion of the donning operation the support rail is moved back into its idle position.


**43 Claims, 12 Drawing Figures**

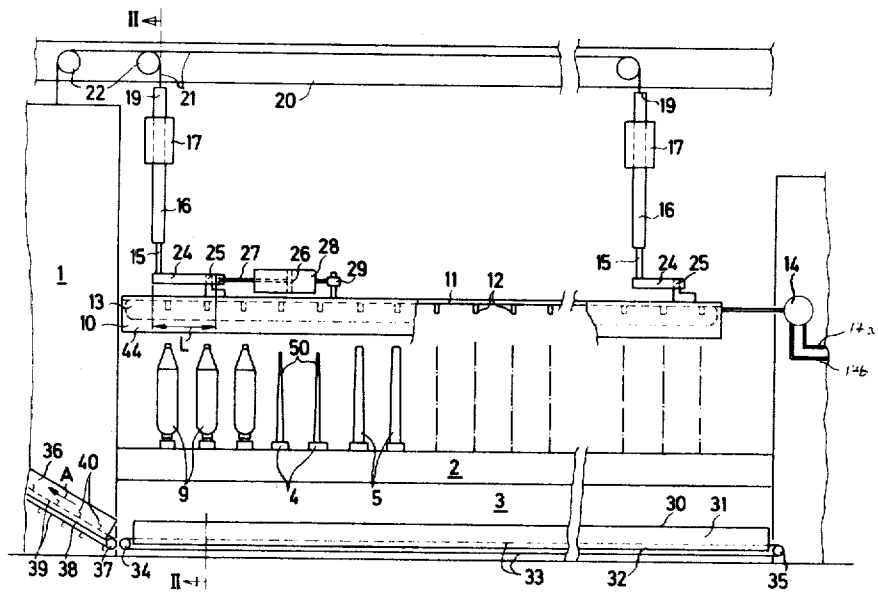

Fig. 1

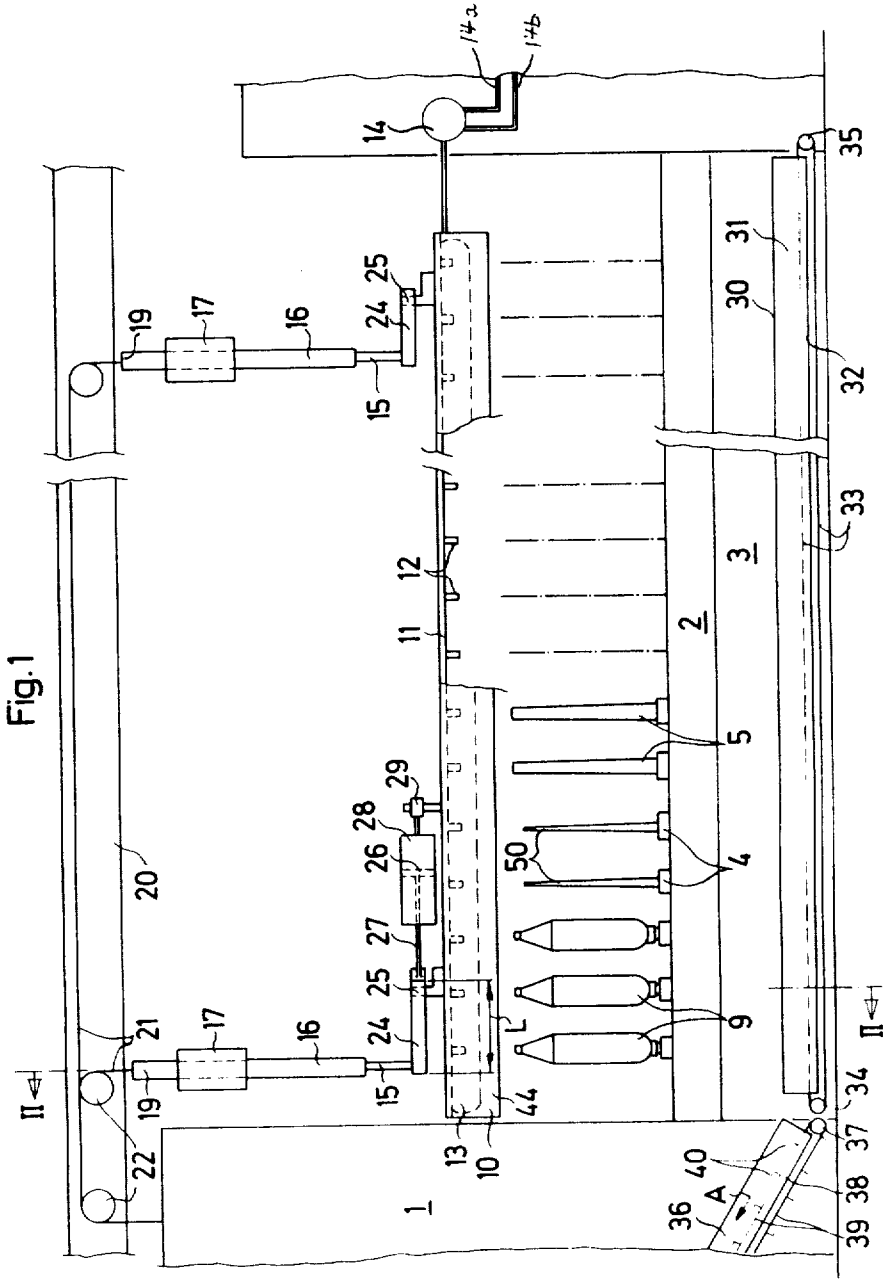


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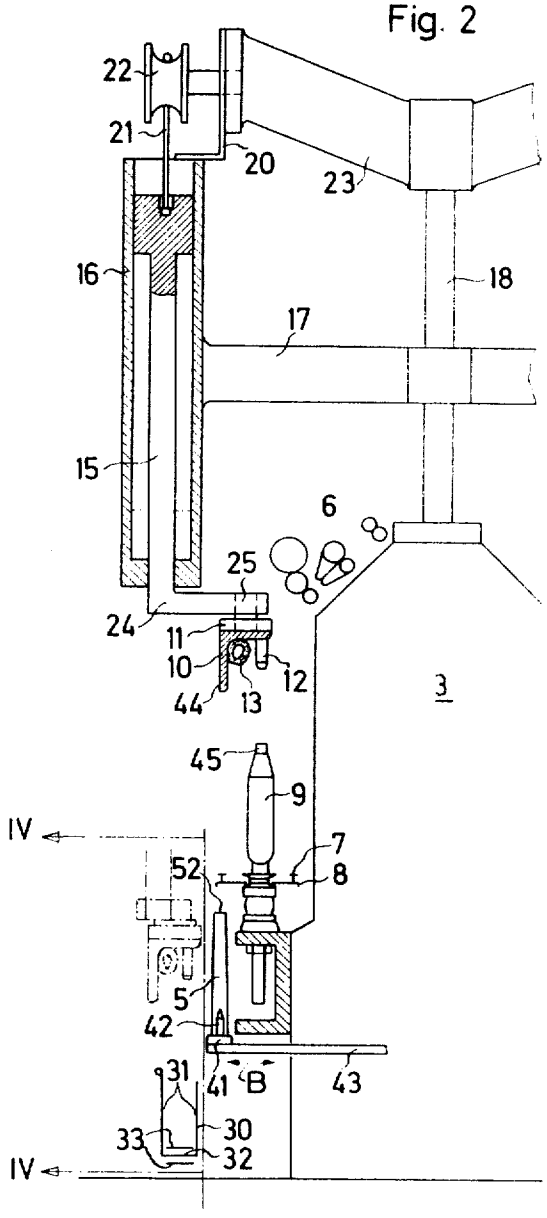
Fig. 2

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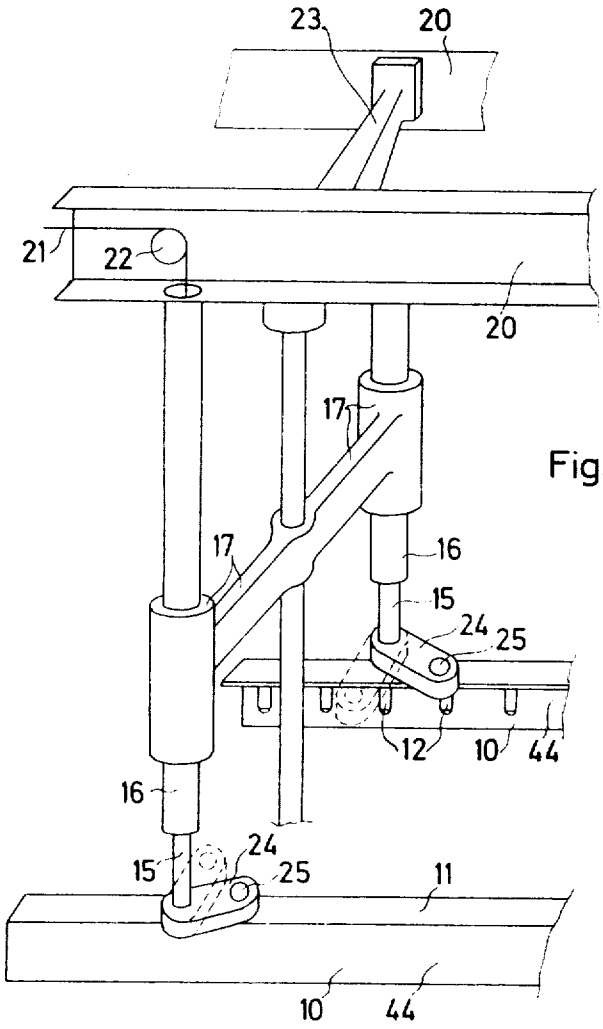


Fig. 3

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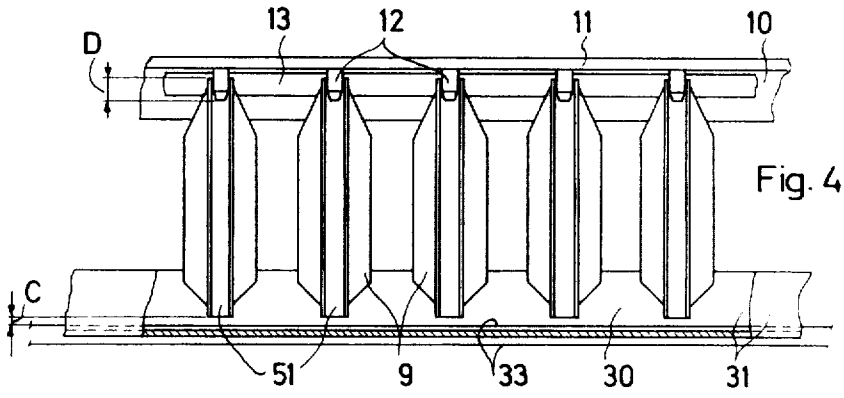


Fig. 4a

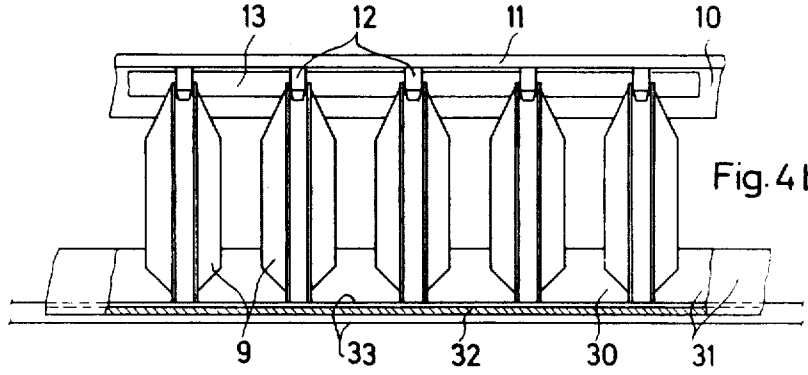


Fig. 4b

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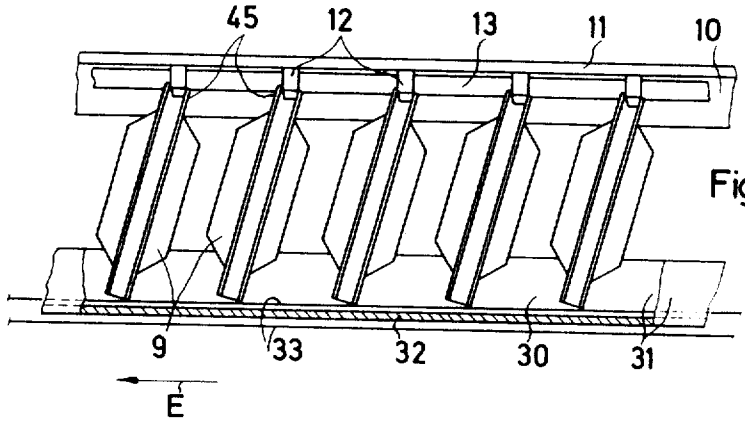



Fig. 4c

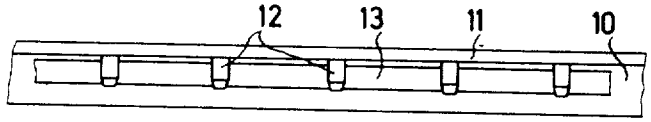
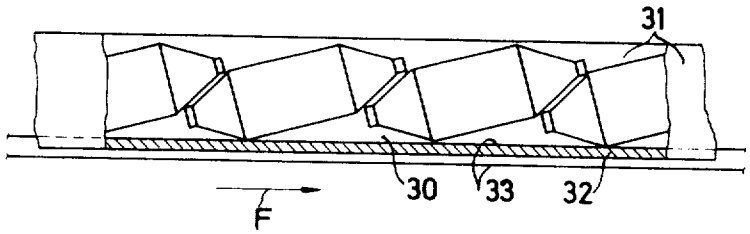



Fig. 4d

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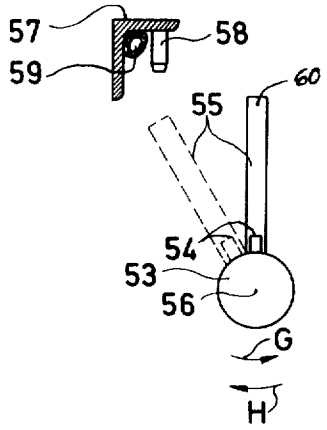


Fig. 5

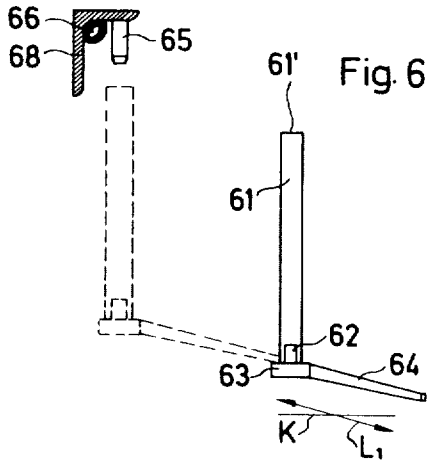


Fig. 6

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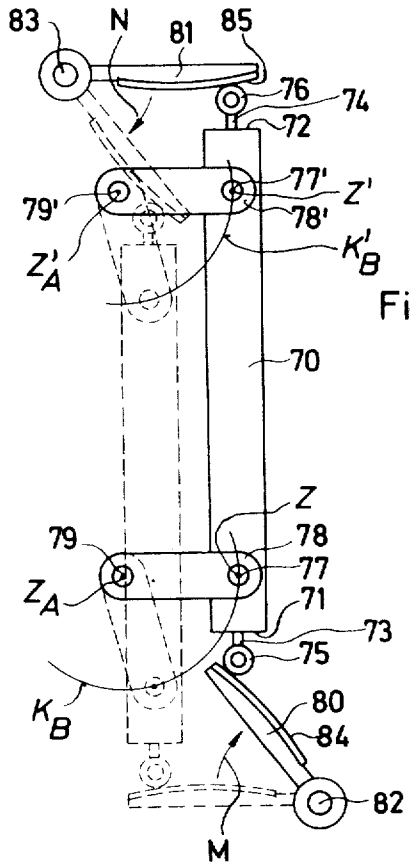


Fig. 7

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Fig. 8

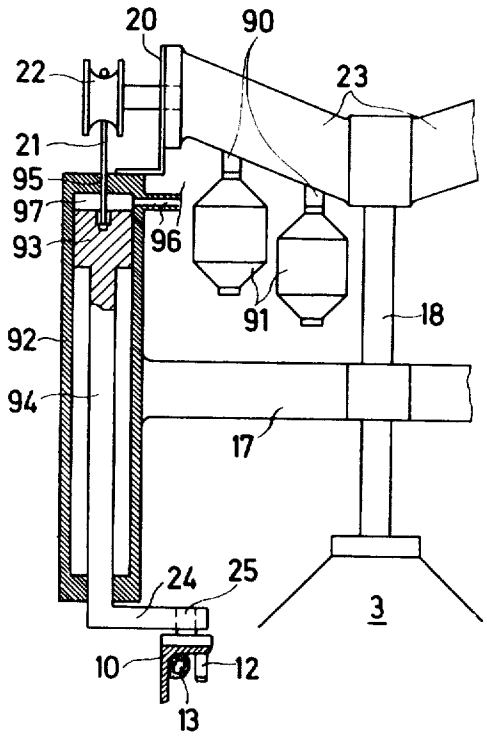


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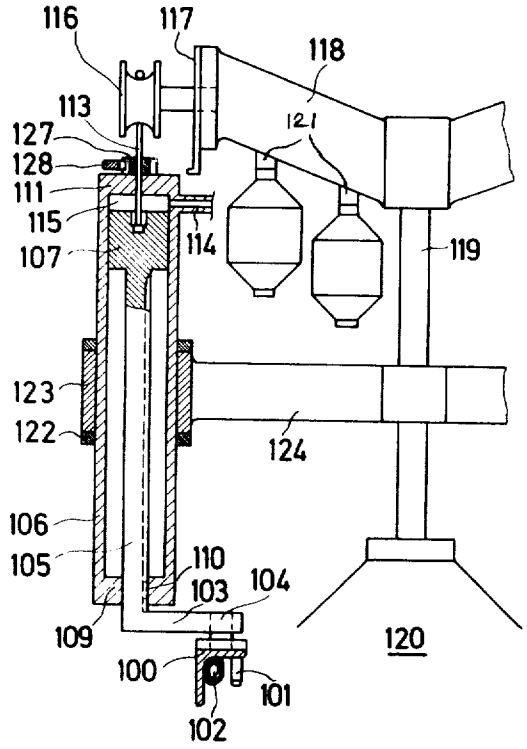
Fig.9

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# METHOD AND APPARATUS FOR DOFFING FULL BOBBINS AND DONNING TUBES ON RING SPINNING AND RING TWISTING MACHINES

## BACKGROUND OF THE INVENTION

The present invention relates to a new and improved method of, and apparatus for, automatically doffing full bobbins and donning tubes on ring spinning and ring twisting machines wherein a support rail equipped with gripping elements provided for a group of spindles for transporting the full bobbins and the tubes moves from an idle position to a gripping position for the full bobbins placed on the spindles, in which position the full bobbins are gripped and doffed from the spindles by an upward movement of said support rail and are pivoted about a vertical axis associated with each full bobbin and deposited onto a full bobbin dump, and wherein the tubes transported by said support rail are pivoted towards the machine about a vertical axis associated with each tube and donned onto the spindles by a downward movement of said support rail.

In a prior art method and apparatus of the general type mentioned above the tubes are placed by hand into tube-holding elements of the doffing device during the spinning cycle. These tube-holding elements are arranged at a mutual distance on a support rail extending along the machine. Each doffing element furthermore is equipped on its side opposite the tube-holding elements with gripping elements for gripping holding the full tubes, the doffing element being rotatable about a vertical axis through 180°. After doffing the full bobbins from the spindles all full bobbins are simultaneously pivoted about the vertical axis through 180° away from the machine by rotating the doffing elements and all tubes placed on the holding elements are pivoted towards the machine, so that these tubes are placed above the spindles. As the support rail is subsequently lowered for donning the tubes the full bobbins still held by the holding elements are deposited with their lower ends onto the machine frame before the support rail has reached its lowest position, and at the same time the tube holding elements are released, and as the support rail reaches its lowest position the full bobbins are gripped again and lifted as the support rail moves up to its idle position. Subsequently the doffing elements are again rotated through 180° back into the initial position, whereupon the full bobbins are released and deposited onto a full bobbin dump arranged above the spindles and made ready by tilting out.

This known method exhibits the disadvantage that the tubes must be donned onto the spindles before the full bobbins can be deposited, as the full bobbin dump can be readied only after the tubes are donned, otherwise the tube passage path for donning the tubes onto the spindles would be blocked by the full bobbin dump. After lifting the support rail, upon completion of tube donning, the full bobbins must be pivoted by rotating the doffing element back through 180 degrees into a position above the full bobbin dump which only just then can be readied. Thus, the full bobbins doffed from the spindles must be carried along, held by the doffing element, throughout all the subsequent steps of the method for donning the tubes, and only then can be deposited. Not only must each doffing element be controlled for the outward and inward pivoting of the full bobbins and the tubes, but also the release or loosening



of the full bobbins for a short period of time during donning of the tubes must be controlled. The doffed full bobbins thus not only undergo complicated steps of the operational method, but also apparatus of expensive design is needed for this. A further disadvantage of the known method and apparatus is the considerable space requirement above the machine. As the full bobbin dump is arranged above the spindles the support rail must be upwardly extended or lifted through a correspondingly great distance. Also in this known method the deposited full bobbins cannot be automatically removed from the machine as the tilt-out motion of the full bobbin dump does not permit this. Furthermore, in the known technique discussed above the full bobbins are moved into the region of the anti-balloon rings usually installed during donning of the tubes, and the tubes are brought into the region of the anti-balloon rings while the full bobbins are doffed. Thus, such anti-balloon rings must be moved out of such region by means of an additional control mechanism. Such method and apparatus are not only expensive but also, due to the complicated steps to be effected consecutively, are susceptible to disturbances, thus economically not feasible.

## SUMMARY OF THE INVENTION

Accordingly, there is still present in the art a real need for an improved method of, and apparatus for, doffing full bobbins and donning tubes onto ring spinning and ring twisting machines, which are not associated with the aforementioned drawbacks of the prior art techniques and equipment. Therefore, a primary object of the present invention is to provide just such novel method and apparatus for fulfilling the existing need in the art and effectively overcoming the aforementioned drawbacks of the prior art.

Still a further and more specific object of the present invention is to provide a novel method of the type under consideration which eliminates the disadvantages associated with the heretofore discussed prior art method, and specifically, deals with a new and improved method wherein all full bobbins doffed from the spindles are deposited and carried away from the machine prior to donning of the empty tubes.

Yet a further significant object of the present invention relates to novel type apparatus for doffing full bobbins and donning tubes on ring spinning and ring twisting machines embodying mechanism enabling deposition of the doffed full bobbins prior to donning of the tubes, and wherein the apparatus is designed and constructed in such a fashion that it is extremely compact and requires a minimum amount of space.

Yet a further significant object of the present invention relates to a new and improved type of apparatus for doffing full bobbins and donning tubes on ring spinning and ring twisting machines which is relatively simple in construction, extremely reliable in operation, not readily subject to breakdown, and requires a minimum of servicing and maintenance.

Now, in order to implement these and still further objects of the invention, which will become more readily apparent as the description proceeds, the method aspects of this invention for doffing full bobbins and donning tubes on ring spinning and ring twisting machines, is generally manifested by the features that:

a. the support rail with the doffed full bobbins is moved parallel to, and away from, the machine, each point of the support rail moving along a path which, as seen in a projection into a horizontal plane, is a substantially circular curve, the center of which is a point of a vertical axis corresponding to said point on the support rail;
b. after lowering of the support rail the full bobbins are deposited vertically onto a transporting mechanism extending along the machine;
c. the transporting mechanism is set into motion along the machine and the full bobbins are deposited lengthwise in the transporting direction onto the transporting mechanism as the support rail is lifted;
d. the tubes prearranged along the machine are gripped; and
e. the support rail with the gripped tubes is moved further up and parallel towards the machine, each point of the support rail pivoting in the manner described above, and after the donning of the tubes is completed, the support rail is moved back into its idle position.

As explained above, the invention is not only concerned with method aspects but also with apparatus constructions for the implementation of the aforedescribed inventive method. Generally speaking, the apparatus construction of the invention embodies a suspended support rail which extends along the textile machine, the support rail being equipped with gripping elements for full bobbins and tubes associated with a group of spindles provided at the machine. Means for depositing full bobbins and means for prearranging tubes to place such in a preparatory position are located along the longitudinally extending side of the machine. Automatically operating means serve to ensure for the proper up and down movements of the vertically guided support rail and for pivoting the gripping elements of the support rail about an axis which extends vertically with respect to the lengthwise axis of the support rail and associated with each gripping element. The invention contemplates rotatably suspending the support rail upon pivotable or pivoting arms, the length of which is invariable. The pivoting arms are rigidly connected with up and down movable vertical rods, the lower ends of these rods extending freely downwards and the rods being rotatable about a given vertical axis. The means or mechanism for moving the support rail up and down is operatively connected with the vertical rods. Furthermore, the means for pivoting the gripping elements incorporates mechan-ism for rotating the vertical rods about such vertical axis and for causing the support rail to move substantially parallelly away from and towards the machine, as selectively desired. The invention also contemplates that the full bobbin dump or deposit area is constituted by a transport mechanism which extends along the textile machine, this transport mechanism can be driven in both longitudinal directions of the machine, while the tube prearranging device serving to locate the empty tubes in a preparatory position for donning onto the spindles extends along the textile machine and is separated from the transporting mechanism of the full bobbin dump.

The support rail is preferably moved upwards from its idle position beneath the spindles, then is moved parallel in a direction towards the machine, with each point of the support rail moving along the path described above, and thereafter the support rail is lowered onto the full bobbins into its gripping position for such bobbins. The support rail may also be moved from an idle position above the spindles into its gripping position for the full bobbins, in which case then the support rail can be simply lowered towards the spindles, or else moved from its idle position above the spindles parallel to and in the direction of the machine and then lowered towards the spindles. In order to retract the support rail back into its idle position upon completion of the doffing and donning operations it is only necessary, for instance, to carry out the reverse sequence of operational steps and movements.

In accordance with preferred manifestations of the present invention it is contemplated to move the support rail, simultaneously during its vertical up and down movement, parallel towards or away from the machine, or prior to or after performing its vertical movement to displace such support rail parallel towards and away from the machine.

Since the invention contemplates designing the length of the pivoting arms such that they are invariable, in other words constant, when the support rail carries out the first-described movement considered above each point thereof moves preferably along a helical curve, the projection into a horizontal plane, in other words the horizontal projection of which is a circle extending about a vertical axis associated with such point on the support rail. When the support rail carries out the second type of movement discussed above each point of the support rail preferably moves along a circular curve about a vertical axis associated with the point on the support rail. Preferably, each point of the support rail is moved along a path or curve, which when projected into a horizontal plane, forms an arc of a circle of, for instance, at least 75° and at most 120°, preferably 90°.

Now in order to grip the empty tubes the support rail is preferably moved up after the full bobbins have been deposited upon the transporting device or mechanism. The upper ends of the pre-arranged empty tubes are moved beneath the gripping elements of the support rail at right angles to the longitudinal axis of the textile machine and the support rail is then lowered. However, it is also possible to lift the support rail after the full bobbins have been deposited, then to move such support rail parallel to the machine in the manner discussed above and to such an extent that it is then located above the pre-arranged empty tubes, whereafter such support rail can then be lowered onto these tubes. In the last mentioned situation the support arm together with the gripped empty tubes must again be moved parallel to and away from the machine. The particular choice of one or the other type of movement for gripping the tubes largely depends upon the available space at the machine needed for this operation.

In accordance with a particular embodiment of the inventive apparatus there are provided guide elements for the vertical rods, these guide elements, for instance, being fixedly connected with the machine. The vertical rods are preferably suspended from the machine frame

upon cables or cords and are movable up and down, for instance, through the action of such cables or cords. However, these vertical rods may also be suspended, for instance, in any other suitable manner from the machine frame or from any other rigid frame and may be moved up and down by a rack and gear arrangement, for instance. The vertical rods are preferably rotatable about their respective vertical axis. However, the vertical rods may be also eccentrically rotatable about a vertical axis disposed externally of the axis of the vertical rod itself. In this latter situation an additional parallel movement of the support rail can be obtained apart from the parallel movement generated by the pivoting arms.

The transport mechanism is preferably designed as an endless transport band or belt located between lateral guide elements for the full bobbins, these lateral guide elements extending along the transport belt. It is preferable to provide side walls which extend upwardly along the transport belt, these side walls ensuring that the full bobbins released by the gripping elements are properly guided during such time as these full bobbins are deposited, so that such full bobbins are placed lengthwise in the transporting or conveying direction and are not deposited transversely across the transport belt.

The tube pre-arranging device can be constructed in the form of a rail member which extends along the machine. This rail member is preferably provided with upwardly protruding pins arranged at a mutual spacing from one another corresponding to the spindle gauge. The empty tubes are manually placed onto these pins during the spinning cycle and, therefore, these tubes can be properly pre-arranged in a preparatory position for the subsequent donning operation.

## BRIEF DESCRIPTION OF THE DRAWINGS

The invention will be better understood and objects other than those set forth above, will become apparent when consideration is given to the following detailed description thereof. Such description makes reference to the annexed drawings wherein:

FIG. 1 is a schematic partially broken side view of a ring spinning machine equipped with a full bobbin-changing device;

FIG. 2 is an enlarged cross-sectional view of the ring spinning machine depicted in FIG. 1, taken substantially along the line II—II thereof;

FIG. 3 is a fragmentary perspective view of a portion of the full bobbin-changing device employed in the ring spinning machine depicted in FIGS. 1 and 2;

FIGS. 4*a*, 4*b*, 4*c* and 4*d* are respective elevational views, taken substantially along the line IV—IV of FIG. 2, and illustrating different operational steps performed by a part of the full bobbin-changing device;

FIG. 5 is a schematic cross-sectional view showing details of a modified form of empty tube displacement device;

FIG. 6 is a schematic cross-sectional view of a further modified version of empty tube displacement device;

FIG. 7 is a schematic top plan view of an alternative embodiment of full bobbin-changing device which can be used in the arrangement of FIGS. 1 to 3 inclusive;

FIG. 8 is a schematic cross-sectional view of details of an alternative embodiment of the ring spinning machine depicted in FIGS. 1 to 3; and

FIG. 9 is a schematic cross-sectional view showing details of still a further alternative embodiment of ring spinning machine.

## DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

Describing now the drawings, in FIGS. 1 and 2 there is illustrated an exemplary embodiment of inventive ring spinning machine 3 which is equipped with a headstock 1 and spindle rails 2, at each side of which there is arranged in a row a plurality of spindles 4. To simplify the illustration in the drawings, only one side of the textile machine, here shown as the ring spinning machine 3, has been depicted. Empty tubes 5 are placed upon these spindles 4, and a non-illustrated yarn is delivered from an associated drafting arrangement 6 (FIG. 2) located above the spindles 4, this yarn then being wound by means of the rings 7 arranged upon a ring rail 8 which moves up and down, into a bobbin 9.

As best seen by referring to FIG. 3, a support rail 10 of great stability extends along each lengthwise extending side of the ring spinning machine 3. As clearly shown by referring to FIG. 2, each such support rail 10 is in the form of an angle member, and specifically the profile of each such support rail 10 substantially corresponds to the shape of an inverted L. Pin members 12 arranged at a mutual spacing from one another corresponding to the spindle gauge extend downwardly from the horizontal leg 11 of the associated support rail 10 and are fixedly connected to such rail. At the inside corner of the L-shaped support rail there is arranged a pressure hose 13 which extends lengthwise of the support rail 10, and when this pressure hose 11 is pressurized it bears against the tubes 5, or in the absence of such tubes against the pins 12. The pressure hose 13 and the pins 12 cooperate with one another to provide gripping means or elements serving to grip the full bobbins 9 or the empty tubes 5, as the case may be, and as will be more fully discussed hereinafter. The pressure hose 13 can be selectively connected through the agency of a control valve 14, as best seen by referring to FIG. 1, with a pressure source or with a vacuum source, of which only the respective pressure line and vacuum line have been indicated at 14*a* and 14*b* respectively. Actually, the gripping elements constitute subject matter which has been described in detail in the commonly assigned U.S. application, Ser. No. 95,180, filed Dec. 4, 1970, and entitled: "APPARATUS FOR CONJOINTLY DOFFING AND DONNING A PLURALITY OF BOBBINS OR TUBES PLACED ON SPINDLES OF RING SPINNING AND RING TWISTING MACHINES", of which also Ulrich Burgermeister and Carlo Gaggini are the inventors of that copending application. The details of the gripping elements will be considered herein to the extent necessary for fully understanding the underlying concepts of this development, but reference may of course be had to the aforementioned copending application for further details. Although the described construction of gripping elements has been found to be particularly suitable for the support rail 10, it is to be distinctly understood, however, that the support rail 10 can be equally well equipped with any other suitable type of gripping elements.

Now, it will be seen that the entire support rail 10 is supported at the ring spinning machine 3 by substan-

tially vertically extending rods **15** which can be moved up and down within guides **16**, the vertical rods **15** also being mounted so as to be rotatable about a given respective lengthwise axis. The guides or guide elements **16** are supported by cross members **17** which extend downwardly from columns **18** of the ring spinning machine **3**, as best seen by referring to FIG. **3**. The upper ends **19** of the guide elements **16** are connected by a rail member **20** which extends lengthwise and above the sides of the ring spinning machine. The rods **15** are suspended at cables or cords **21** which are guided over freely rotatable rolls **22** attached to the associated lengthwise extending rail member **20**, and these cables are connected with any suitable drive arrangement, such as a conventional and therefore non-illustrated motor and capstan drive arrangement, so that the rods **15** and thus the support rail **10** can be reciprocated up and down. The rails **20** are supported by cross-members **23** which, in turn, are carried by the columns **18**.

Now, to the lower end of each vertical rod **15** there is attached a pivotal or pivoting arm member **24**, the outer end of each such arm member **24** being pivotably or rotatably connected with the associated support rail **10** via a bolt or pin **25**. Each vertical rod **15** is rotated by means of a reversible pneumatically actuated piston-cylinder drive **26, 28** incorporating a piston member **26** reciprocable within a drive cylinder **28**. Piston member **26** is equipped with a piston rod **27** which is connected to the associated pivoting arm **24** while the cylinder **28** is rotatably connected to the support rail **10** by a linkage means **29**. Depending upon the length of the textile machine a piston unit **26** may be provided for each suspended vertical rod **15** or for a few such vertical rods **15** there may be provided such piston unit **26**. As will be explained fully hereinafter, the cylinder-piston arrangement discussed above serves to inwardly and outwardly rock the corresponding support rail towards and away from the ring spinning machine **3**.

The invention further contemplates mechanism which provides a dump or deposit area for the full bobbins and in the embodiment under consideration such is constituted by an open-ended channel **30** of substantially U-shaped cross-sectional configuration which is arranged below and in front of the associated spindle rail **2**, as best seen by referring to FIG. **2**. Each such channel **30** will be seen to be equipped with lateral upstanding walls **31** extending along the sides of the ring spinning machine **3**. At the bottom **32** of each such channel **30** there is arranged a transporting or conveying belt **33** which can be driven in both lengthwise directions and which is guided about deflecting or diverting rolls **34** and **35** provided at the open ends of the U-shaped channel **30**, so that a run of the transport belt **33** extends back beneath the bottom **32** of such channel **30**. Further, it will be seen that at one end of the open-ended channel **30** there is arranged a further channel **36** which likewise has both of its face ends open. This further channel **36** is arranged so that it extends upwardly away from the first mentioned channel **30**, and here also channel **36** is similarly provided with a conveying or transporting belt **39** guided over rolls **37**, only one of which is visible in FIG. **1**, such that a run of the conveying or transporting belt **39** passes through and above the bottom or floor **38** of the further channel **36** while the other run of such transporting belt **39** passes beneath the bottom **38** of this channel **36**. The transporting belt **39** can be driven in a suitable manner in the direction of the arrow A.

Additionally, it will be observed that the transporting belt **39** is provided with suitable angled entrainment members **40** which protrude upwardly away from the surface of the transporting belt **39** and are arranged at the belt in such a manner as to be preferably mutually offset with respect to one another. The purpose of the transport belt **39** and the entrainment member **40** will be explained more fully hereinafter, but at this point it may be mentioned that such serve to convey away the full bobbins received from the full bobbin dump channel arrangement **30**.

Continuing, it will be recognized that the invention contemplates providing a rail member **41** between each spindle rail **2** and the associated channel **30**, rail member **41** extending along and lengthwise of the ring spinning machine **3** and being equipped with pins **42** which protrude upwardly for the purpose of receiving the empty tubes **5**. Rail member **41** is advantageously supported by means of at least two support members **43**, only one of which is visible in the drawings, and these support members are movable in the direction of the double-headed arrow B of FIG. **2** so that the tube prearranging rail member **41** can be moved at a right angle with respect to the lengthwise axis of the machine and specifically away from and towards the ring spinning machine **3**.

Having now had the benefit of the foregoing description of the general arrangement and construction of the inventive ring spinning machine equipped with the apparatus for doffing full bobbins and donning empty tubes, the method aspects of the invention will now be described in conjunction with the arrangement of FIGS. **1** through **3** inclusive, and is as follows:

Assuming that full bobbins **9** are to be doffed from the ring spinning machine **3**, then the support rail **10** is moved from its starting or idle position, for instance that position indicated in FIG. **2** in broken or phantom lines, upwardly to such an extent that the lower end of the downwardly protruding vertical leg **44** of the associated support rail **10** is located above the spindles **4**. Suitable control means which have not been particularly illustrated serve to actuate the piston member **26** by appropriately admitting a pressurized fluid medium into the cylinder **28** in such a way that the piston **26** moves in a direction out of the cylinder **28** so that the support rail **10**, in turn, is moved parallel to and towards the ring spinning frame **3**. This lateral movement of the support rail **10** continues until it reaches a plane extending vertically and parallelly in the longitudinal direction of the ring spinning machine **3** and determined by the rotational axis of the respective spindles **4**, in other words, until the gripping elements at the support rail **10** are located above the spindles **4**. This position corresponds to the solid lined position of the support rail **10** as shown in FIG. **2** and to the phantom or broken lined position of the pivoting arms **24** indicated in FIG. **3**.

Since, as shown in FIG. **1**, the length L of the pivoting arms **24** is invariable, in other words constant, the parallel movement of each support rail **10** is carried out in such a manner that each point of the support rail **10**

is pivoted along a circular curve about a vertical axis associated with this point on the support rail **10**, this vertical axis extending vertically with respect to the longitudinal axis of the support rail **10**. Furthermore, each gripping pin **12** is likewise pivoted along a circular curve about a vertical axis associated with each such pin **12**. It will be appreciated that the pivoting movement of all points on the associated support rail **10** follows circles having radii of identical length.

Thereafter, the support rail **10** is lowered by means of the motor and capstan drive arrangement actuated by control means so that the support rail **10** moves down to region of the spindles **4** and until the pins **12** are inserted into the upper ends **45** of the full bobbins **9**. Then the pressure hose **13** is pressurized so that it bears against the upper portion of the associated tube which has not been covered with yarn and against the conical upper part (not shown) of the full bobbin **9**, to thus press each bobbin **9** against the associated pin **12** as described in detail in the aforementioned U.S. patent application, Ser. No. 95,180. Now the support rail **10** is moved upwards so that the full bobbins **9** are doffed from the spindle **4**, and specifically until the lower rim of each of the full bobbins **9** is located above the associated spindle tip **50**. Then, by retracting the piston **26** back into the associated cylinder **28** and activated by the conventional control means, the pivotal arms **24** are moved from the position indicated in broken lines in FIG. **3** into the solid lined position of FIG. **3**, the vertical rods **15** being correspondingly rotated and the entire support rail **10** again being moved out of the previously discussed plane, with each point of the support rail **10** being pivoted in the manner similarly discussed above. As a result, the support rail **10** is moved parallel to and away from the ring spinning machine and thus from the spindles **4**. Owing to this operation the full bobbins **9** are placed in a position above the deposit channel **30** into which they are then deposited. Now, for the specific purpose of depositing the full bobbins **9** the support rail **10** is lowered until a lower rim **51** of each of the full bobbins **9** is in close proximity to and above the surface of the transporting belt **33**, as best seen by referring to FIG. **4a**, in other words until there appears a small clearance C between the lower rim **51** of each full bobbin **9** and the upper run of the transporting belt **33**. Then the full bobbins **9** are released by the gripping elements **12, 13** and dropped vertically onto the surface of the conveying or transporting belt **33** inasmuch as the gripper pins **12** are still partially inserted into the corresponding upper portions **45** of the full bobbins **9** and therefore serve to vertically guide such full bobbins onto the surface of the transporting belt **33**. This condition has been depicted in FIG. **4b**. In order to ensure that the full bobbins **9** are deposited freely and vertically onto the surface of the transporting belt **33** the small clearance C (FIG. **4*a***) between the lower rim **51** of each full bobbin **9** and the upper run of the transporting belt **33** is preferably chosen to be smaller than the length D (FIG. **4*a***) of the pins **12** inserted into the upper portions **45** of the full bobbins **9**. Depositing the full bobbins **9** onto the transporting belt **33** can also be undertaken in such a way that the support rail **10** with the full bobbins **9** is lowered until the full bobbins **9** touch the transporting belt **33**. Then the full bobbins **9** can be released from the gripping elements **12, 13** and the supporting rail **10** is moved up to such an extent that the pins **12** still guide the full bobbins **9** which are now freely and vertically deposited upon the surface of the transporting belt **33**, in other words, the pins **12** still prevent tilting of the full bobbins which have been deposited onto the surface of the transporting belt **33**. Also, in this last-explained situation the lift height through which the support rail **10** is raised is, for instance, also always chosen to be smaller than the length D of the gripper pins **12** as explained above.

Now, after the full bobbins **9** are freely deposited in one or the other manner as considered above onto the surface of the transport belt **33**, this transport or conveying belt **33**, as best seen by referring to FIG. **4c**, is then initially moved somewhat in the direction of the arrow E so that the full bobbins **9** are still held by the gripper pins **12** but in an inclined position, with the upper bobbin tips **45** each being directed away from the just considered movement direction E. Now the support rail **10** is moved upwards so that the pins **12** move out of the tips **45** of the full bobbins **9**, the full bobbins **9** then dropping onto the transporting belt **33**. By virtue of the guiding action afforded by the side walls **31** of the deposit channel **30** and owing to the inclination of the full bobbins which has been established prior to the time that the full bobbins are released from the gripper pins **12** and deposited in overlapping roof-tile fashion upon the transporting belt **33**, all the bobbin tips **45** are caused to point in the direction of the arrow F (FIG. **4d**) which represents a subsequently started transport movement for the transporting belt **33**. The full bobbins **9** which have been deposited onto the transporting belt **33** can also be guided, instead of using the substantially U-shaped channel and its side walls **31**, for instance by one or more guide rods extending along the transporting belt **33**, these guide rods being arranged laterally of and at a height above the transporting belt **33** suitable for guiding the full bobbins. Thereafter, the transporting belt **33** starts moving in the direction of the arrow F, thus conveying the full bobbins **9** towards the transporting belt **39** running in the channel **36**, the full bobbins **9** then being engaged by the transporting belt **39** of FIG. **1**. The leading or frontmost full bobbin **9**, viewed in the direction of the arrow F, is entrained by one or more of the entrainment members **40** of the transporting or conveying belt **39** and, thus, is pulled away from below the subsequent full bobbin **9**, each full bobbin **9** being successively entrained one after the other by the further transporting belt **39**.

Depositing the full bobbins **9** with their bobbin tips **45** oriented in the conveying direction F and with these bobbin tips directed away from the surface of the transporting belt **33** renders possible an oriented deposition of the bobbins upon the transporting belt **33** and preferably allows for a trouble-free takeover of these bobbins by the transporting belt **39** at the end of the transporting or conveying belt **33**. On the other hand, if the full bobbins **9** are deposited, for instance, in random fashion upon the surface of the transporting belt **33**, then these bobbins cannot be positively conveyed without disturbances by the transporting belt **33**, and furthermore, there is not ensured for a proper transfer of the bobbins from the transporting belt **33** to the

transporting belt 39. Furthermore, if the full bobbins 9 are deposited, for instance, in a controlled arrangement, but with their lower ends 51, however, deposited onto the surface of the transport band 33 so as to be leading and facing the transport band 33 in the conveying direction F, then the full bobbins 9 cannot be transferred without disturbance from the end of the transport or transporting belt 33 to the transporting or conveying belt 39. In this case what really happens is that the full bobbins tend to slide back and topple over the carrier or entrainment members 40 of the transporting belt 39 and back into the channel 30, thus no longer can be carried away by the entrainment members 40. Such a damming-up or build-up of full bobbins 9 can result in a blockage of the delivery end of the transporting belt 33 such that further passage of bobbins is interfered with. Therefore, deposition of the full bobbins 9 after lifting the support rail 10 in the manner described in accordance with FIGS. 4*c* and 4 *d* is most preferred.

Lifting of the support rail 10 during deposition of the full bobbins 9 upon the transporting belt 33 as explained above is carried out to such an elevational height that the lower ends of the pins 12 are located above the tips 52 (FIG. 2) of the empty tubes 5 pre-arranged manually upon the pins 42 at the rail member 41. Then the support rails 43 are moved away from the machine to such an extent that the empty tubes 5 and their tips 52 are located vertically beneath the gripping elements 12, 13 of the associated support rail 10, this support rail then being lowered. Thereafter, the support rail 10 with the tubes thus gripped by the gripping elements 12, 13 is moved upwards and parallel into the plane defined by the axes of the spindles 4 of the associated spindle rail 2. Then by lowering the support rail 10 the empty tubes 5 are now donned onto the spindles 4, and if needed additional weighting can be applied. After lifting the support rail 10 and again moving it parallel out of the aforementioned plane defined by the axes of the spindles 4, each point of such support rail 10 is again pivoted in the manner discussed heretofore, that is, in a direction parallel and away from the machine, the support rail 10 subsequently being lowered into its idle or starting position.

FIG. 5 illustrates a modified embodiment of the invention wherein, instead of using the empty tube-prearranging rail 41 depicted in FIG. 2, there is employed a shaft member 53 which is arranged along the machine, which for purposes of preserving clarity in the showing of FIG. 5 has not been particularly shown therein. This shaft member 53 is provided at its surface with pins 54 for receiving the empty tubes 55. Shaft 53 is rotatable about its axis 56 in both directions of rotation as indicated by the arrows G and H respectively. During a spinning cycle the empty tubes are, for instance, placed onto the tube receiving pins 54 and, after a support rail 57 equipped with the downwardly protruding pins 58 and with the pressure hose 59 serving as the gripping elements, similar to the construction of support rail 10 considered above in conjunction with FIGS. 1 to 3 inclusive, has been lifted to an appropriate height following completion of deposition of the full bobbins as heretofore described in conjunction with FIGS. 4*a* through 4*d*, the shaft 53 is rotated in the direction of arrow G. Hence, the tip 60 of each tube is thus moved substantially at right angles to the lengthwise axis of the textile machine and specifically into a position beneath the gripping elements 58, 59 of the associated support rail 57, as indicated in broken or phantom lines for the tube 55 of FIG. 5.

A further modification of the equipment insofar as a possible constructional form of tube-prearranging mechanism is concerned has been disclosed in conjunction with FIG. 6. There it is possible to arrange the empty tubes 61 upon pins 62 provided at a rail member 63 extending along a ring spinning machine which has not been particularly shown in FIG. 6. The rail member 63 can be moved through the action of supporting rods or tubes 64, only one of which has been shown in FIG. 6, parallel along a plane inclined with respect to a horizontal plane K and in the direction of the double-headed arrow $L_1$. The tips 61' of the tubes 61, here also only one such tube 61 being shown, thus are moved at right angles to the lengthwise axis of the textile machine and specifically into a position beneath the gripping elements 65 and 66, namely the pins and pressure hose, of the associated support rail 68.

Turning now to FIG. 7, there is depicted therein an embodiment of a drive arrangement for rotating for instance the rods 15 and therefore carrying out the previously discussed parallel placement of the support rail 10 of FIGS. 1 to 3. Here the support rail has been referenced by numeral 70 and is similarly provided with the gripping elements in the form of the pressure hose and gripper pins for the full bobbins and empty tubes. To preserve clarity in illustration these gripping elements have not been particularly shown in FIG. 7. It will, however, be seen that the end faces 71 and 72 of the support rail 70 are provided with the support members 73 and 74, at each of which there is mounted to be freely rotatable a respective roller 75 and 76, as shown. Support rail 70 is pivotably or rotatably linked by means of the bolt members 77 and 77' with the pivot arms 78 and 78' respectively. The pivot or pivoting arms 78 and 78' are arranged at rotatable rods 79 and 79' respectively, which, in turn, are suspended along a lengthwise extending side of the ring spinning machine, for instance in the manner discussed above in conjunction with FIGS. 1 to 3. A respective actuation lever member 80 and 81 bears against the associated rollers 75 and 76 respectively, actuation levers 80 and 81 being mounted to be pivotable about the associated shafts 82 and 83 respectively. Further, each actuation lever member 80 and 81 will be seen to be equipped with an associated slide or roll surface 84 and 85 upon which can roll the associated roller members 75 and 76 respectively. Actuation lever 80 can be positively driven in the direction of the arrow M and serves for the parallel displacement of the support rail 70 away from the ring spinning machine. Thus, the points of the support rail 70 represented, for instance, by the centers Z and Z' of the corresponding bolts or pins 77 and 77', respectively, are moved along a circular path or curve $K_B$ and $K'_B$ respectively, about the respective vertically extending central axes $Z_A$ and $Z'_A$ of the rods 79 and 79' respectively. The centers Z and Z' and therefore also each point of the support rail 70 are moved along a circular path or arc, which in the case of simultaneously up and down movement of the support rods 79 and 79' and parallel displacement of the support rail 70, and with the circular arc projected into a horizontal

plane, will be seen to constitute a circular arc of at least 75° and at most 120°, but preferably through an arc of about 90°. While the actuation lever **80** can be positively displaced in the direction of the arrow M, in other words from the phantom lined position into the full lined position of FIG. 7, the other actuation lever **81** can be displaced positively in the direction of the arrow N, in other words from the full lined position into the phantomed lined position of FIG. 7, and therefore is utilized for displacing the support rail **70** parallel towards the ring spinning machine and into the position of the support rail **70** shown in broken lines in FIG. 7. During the last-mentioned movement of the support rail **70** the actuation levers **80** and **81** assume the pivoted positions indicated in broken or phantom lines in FIG. 7 with rollers **75** and **76** rolling along the cam or rolling faces **84** and **85** of the actuation levers **80** and **81** respectively.

In the modified version of equipment depicted in FIG. **8**, wherein the same reference characters have again generally been employed for the same components depicted in the arrangement of FIG. **2**, the cross members **23** of the machine also serve to support the creel **90** for the bobbins **91**. The guide members **16** depicted in the embodiment of FIGS. **1** to **3** and having open upper ends can here also be replaced in the arrangement of FIG. **8** by guide means **92** in the form of a cylinder receiving an associated support rod **94**, the upper end of which is formed as a piston member **93** reciprocable within the guide cylinder **92**. The upper end of the guide element **92** is closed and is equipped with an opening for receiving the cable or cord **21**. Additionally, guide member **92** is provided with a lateral connection **96** communicating with any suitable and therefore non-illustrated pressure source, such as a source of compressed air. By generating a pressure within the piston chamber **97** the empty tube can be pressed onto the associated spindle during such time as it is donned. To achieve this purpose the throughpassage opening **95** is constructed in such a way that it sealingly engages and surrounds the throughpassing cord or cable **21**. Moreover, the cross-section of the cord **21** is chosen preferably to be of circular or round configuration and is advantageously provided, for example, with a sheave of plastic material so that the desired sealing of the piston chamber **97** is guaranteed.

Finally, the mechanism serving to rotate the vertical support rods as contemplated by the present invention and thus for carrying out the desired parallel movement of the associated support rail can be designed in a different way from that heretofore described, and as specifically shown in the arrangement of FIG. **9**. There the support rail **100** provided with the gripper pins **101** and with the pressure hose **102**, serving as the gripping elements for the full bobbins and the empty tubes, both of which have not been here shown in this Figure but similar to what has been discussed above, is rotatably suspended from the pivoting arm members **103** by means of pins **104**. Here also to preserve clarity in illustration only one such pivoting arm **103** and only one such pin **104** have been shown in FIG. **9**. Pivoting arm **103** is rigidly attached to a vertical support rod **105** which is guided to be movable elevationally, in other words up and down within the guide cylinder **106** provided for the upper part of the vertical support rod **105** which is designed in the form of a piston member **107**. A groove **108** extends the length of the vertical support rod **105**, and a cam member **110** arranged at the lower end **109** of the guide member or guide cylinder **106** protrudes into groove **108** in such a fashion that there is positively prevented any rotation of the vertical rod **105** which is surrounded and guided by the lower end **109** of the guide cylinder **106**. The upper end of this guide cylinder **106** is closed by an upper cover **111**, this cover **111** being provided with a sealed opening of, for instance, the type discussed above in conjunction with FIG. **8**, and serving to receive a cord or cable **113** from which the vertical support rod **105** is suspended so that it can be moved elevationally up and down together with the cord or cable **113**.

Continuing, in this embodiment it will be seen that a connection nozzle or conduit **119** connected to a suitable and therefore non-illustrated source of pressurized fluid medium, such as compressed air, merges with the piston chamber **115** of the guide cylinder **106**, which chamber **115** is located between the upper face of the piston member **107** and the confronting top cover **111**. In this way, pressure can be exerted onto the top face of the piston member **107** of the vertical support rod **105** and the tubes can be pressed onto the associated spindles during the tube donning operation. The cable or cord **113** is placed upon a suitable roller **116** which is supported so as to be freely rotatable and connected with the rail member **117** extending above the ring spinning machine **120**. The driving cable or cord **113** can be operatively connected with any suitable drive, such as for instance the previously considered motor and capstan drive arrangement serving to raise and lower the vertical rod **105** and thus also to carry out corresponding movements at the supporting or support rail **100**. The upper situated rail member **117** is supported by the cross member **118** which, in turn, is attached to a column **119** arranged at the ring spinning machine **120**. This cross member **118** also here serves to support the bobbin creel **121**. In the arrangement under consideration it will be observed that the guide cylinder **106** is rotatably suspended at a support **123** through the agency of rings **122** arranged along its outer circumference, support **123** being connected via a cross member **124** with the column **119**. The end wall or cover **111** carries a gear **127** which is arranged coaxially with respect to the guide member **106**, gear **127** meshing with a gear rack **128** extending lengthwise of the machine and which gear rack can be moved in both longitudinal directions so that the meshing gear **127** and thus the guide cylinder **106** and the vertical rod **105** can be appropriately rotated.

Since the support rail for the gripping elements for the full bobbins and empty tubes is suspended along the lengthwise extending sides of the textile machine by means of columns, the actual operation of the machine is facilitated and cleaning of the underwinding crowns can be performed without interference. Furthermore, pre-arranging the tubes into a preparatory position onto the tube-prearranging device is similarly facilitated by virtue of the arrangement of the support rail. It is possible to move each support rail at any time up and down into any desired position so that all parts, especially those in front of the machine, are readily ac-

cessible when needed. Furthermore, parallel movement of the entire support rail, complete with all of the gripping elements for transporting the full bobbins or empty tubes respectively, away from and towards the machine, enables a much more simple design than would otherwise be needed in the case of carrying out an individual control or rotation, respectively, of the individual gripping devices associated with each spindle. Additionally, arranging the tubes in their preparatory position to be seized for the donning operation is preferably undertaken manually, since this allows the tubes to be simultaneously inspected to ensure that only clean and undamaged tubes will be used. Furthermore, pre-arranging the tubes manually, as carried out in accordance with a particular manifestation of the inventive method, enables simple and reliable distribution of the tubes. A further advantage of the inventive method is constituted by the fact that, for instance, the full bobbins can be deposited quite reliably onto a small transporting belt which is devoid of pins. It will be understood and quite readily appreciated that transporting full bobbins which have been deposited, for instance, upon pins arranged at a transporting belt or chain tends to cause disturbances, since the full bobbins cannot always be centrally placed onto the pins of the transporting belt by the action of a support rail. Thus, by depositing the full bobbins, as contemplated by the invention, onto a small transporting belt which is not equipped with pins, it is possible to positively and reliably avoid any uncontrolled or random bobbin arrangement.

While there is shown and described present preferred embodiments of the invention, it is to be distinctly understood that the invention is not limited thereto but may be otherwise variously embodied and practiced within the scope of the following claims.

What is claimed is:

1. In a method of automatically doffing full bobbins and donning empty tubes at textile machines, especially ring spinning and ring twisting machines, comprising the steps of:

a. moving a support rail from an idle position into a gripping position for full bobbins placed upon spindles;

b. gripping the full bobbins by means of the support rail while in said gripping position;

c. upwardly moving the support rail to doff the full bobbins from the spindles;

d. moving the support rail with the doffed full bobbins substantially parallel to and away from the machine, each point of the support rail moving along a predetermined curved path;

e. lowering the support rail with the doffed full bobbins towards a transporting mechanism extending along the textile machine;

f. substantially vertically depositing the full bobbins onto the transporting mechanism;

g. placing the transporting mechanism into motion along the machine, lifting the support rail, and depositing the full bobbins lengthwise onto the transporting mechanism in the direction of transport thereof during such time as the support rail is lifted;

h. gripping by means of the support rail empty tubes which have been pre-arranged along the machine;

i. moving the support rail with the gripped empty tubes upwards and in a direction substantially parallel and towards the machine, each point of the support rail moving along a predetermined curved path;

j. donning the empty tubes onto spindles; and

k. following completion of the donning operation moving the support rail back into its idle position.

2. In a method of automatically doffing full bobbins and donning empty tubes at textile machines, especially ring spinning and ring twisting machines, wherein a support rail equipped with gripping elements and operatively associated with a group of spindles serves to selectively transport the full bobbins and the empty tubes, the support rail moving from an idle position to a gripping position for the full bobbins placed on the spindles and at which gripping position the full bobbins are gripped and doffed from the spindles by an upward movement of the support rail and are pivoted about a vertical axis associated with each full bobbin and are deposited onto a full bobbin dump, and wherein the empty tubes transported by the support rail are pivoted towards the machine about a vertical axis associated with each empty tube and are donned onto the spindles by a downward movement of the support rail, the improvement comprising the steps of:

a. moving the support rail with the doffed full bobbins substantially parallel to and away from the machine, each point of the support rail moving along a path, which, as seen in a projection into a substantially horizontal plane, is a substantially circular curve, the center of which is a point of a vertical axis associated with said point of the support rail;

b. lowering the support rail with the doffed full bobbins towards a transporting mechanism extending along the textile machine;

c. substantially vertically depositing the full bobbins onto the transporting mechanism;

d. placing the transporting mechanism into motion along the machine, lifting the support rail, and depositing the full bobbins lengthwise onto the transporting mechanism in the direction of transport thereof during such time as the support rail is lifted;

e. gripping by means of the support rail empty tubes which have been pre-arranged along the machine;

f. moving the support rail with the gripped empty tubes upwards and in a direction substantially parallel and towards the machine, each point of the support rail moving in the manner set forth in step (a);

g. donning the empty tubes onto spindles; and

h. following completion of the donning operation moving the support rail back into its idle position.

3. The method as defined in claim 2, including the step of moving the support rail from an idle position located beneath the spindles in an upward direction and then parallel towards the machine, with each point of the support rail moving along the path as set forth in step (a), and then lowering the support rail towards the full bobbins into its full bobbin-gripping position.

4. The method as defined in claim 2, further including the step of moving the support rail from an idle position located above and in front of the spindles in a

direction substantially parallel and towards the machine, each point of the support rail moving along the path as specified in step (a), and then lowering the support rail towards the full bobbins into its full bobbin-gripping position.

5. The method as defined in claim 2, including the step of lowering the support rail from an idle position located above the spindles towards the full bobbins and into a full bobbin-gripping position.

6. The method as defined in claim 2, further including the step of gripping and holding the full bobbins and the empty tubes, respectively, by means of one and the same gripping elements which respectively grip such full bobbins and empty tubes over a certain length of their respective upper portion.

7. The method as defined in claim 2, further including the step of lowering the full bobbins towards the transporting mechanism in a controlled manner such that a clearance is maintained above the transporting mechanism which is smaller than the length of the gripping elements gripping the full bobbins, then releasing the full bobbins from the gripping elements so that such full bobbins are deposited substantially vertically onto the surface of the transporting mechanism as they drop thereon, and then placing into motion the transporting mechanism.

8. The method as defined in claim 7, further including the steps of initially placing into motion the transporting mechanism in a direction opposite to the transporting direction, and then subsequently placing into motion the transporting mechanism in a direction corresponding to the transporting direction for the full bobbins.

9. The method as defined in claim 2, further including the steps of lowering the full bobbins downwardly towards the transporting mechanism, releasing the full bobbins from the gripping elements of the support rail, lifting the support rail through a distance which is smaller than the gripping length of the gripping elements thereof, and then placing into motion the transporting mechanism.

10. The method as defined in claim 9, further including the step of initially placing into motion the transporting mechanism in a direction opposite to the transporting direction, and then placing into motion the transporting mechanism in a direction corresponding to the transporting direction for the full bobbins.

11. The method as defined in claim 2, wherein the parallel movement of the support rail set forth in steps (a) and (f) is carried out during a point of time which differs from the elevational movement of the support rail set forth in steps (b) and (f).

12. The method as defined in claim 2, wherein the parallel movement of the support rail set forth in steps (a) and (f) is carried out conjointly with the elevational movement of the support rail as set forth in steps (b) and (f).

13. The method as defined in claim 2, further including the step of manually pre-arranging the empty tubes.

14. The method as defined in claim 2, further including the step of upwardly moving the support rail following deposit of the full bobbins onto the transporting mechanism, moving the upper tips of the empty tubes pre-arranged along the machine at substantially right angles with respect to the lengthwise axis of the machine and into a position beneath the gripping elements of the support rail, and then lowering the support rail towards the empty tubes.

15. The method as defined in claim 14, including the steps of moving the upper tips of the full bobbins at substantially right angles to the longitudinal axis of the support rail and into a position beneath the gripping elements thereof.

16. The method as defined in claim 2, further including the steps of upwardly moving the support rail following deposition of the full bobbins onto the transporting mechanism and into a position where such support rail is arranged above the pre-arranged empty tubes, then moving the support rail in a direction substantially parallel and towards the machine, each point of the support rail moving along the curve set forth in step (a) and into a position directly above and in substantial alignment with the empty tubes, then lowering the support rail towards the empty tubes.

17. The method as defined in claim 2, wherein following step (g) where the empty tubes are donned onto the spindles a pressure is exerted upon the support rail to press the empty tubes onto the spindles.

18. The method as defined in claim 2, wherein each point of the support rail moves along the path during steps (a) and (f), the corresponding curve of which in the horizontal plane is an arc of a circle extending through an angle of at least 75° but not greater than 120°.

19. The method as defined in claim 18, wherein said circular arc extends through an angle of approximately 90°.

20. The method as defined in claim 2, wherein each point of the support rail moves along a substantially circular curve during steps (a) and (f), which curve is part of a respective circle, the radius of which is identical with the radii of the partial circles of all other points of said support rail.

21. An apparatus for automatically doffing full bobbins and donning empty tubes at textile machines equipped with one or more groups of spindles, especially ring spinning and ring twisting machines, comprising:

a. at least one support rail extending along the machine;

b. gripping elements provided for said support rail, said gripping elements serving to selectively engage with full bobbins and empty tubes for the respective doffing and donning thereof;

c. means operatively connected with said gripping elements for operating said gripping elements;

d. means for rotatably suspending said support rail, said rotatably suspending means incorporating pivoting arm means of invariable length engaging with said support rail, elevationally displaceable substantially vertically extending rod means with which said pivoting arm means are operatively connected, said vertical rod means having freely extending lower ends, and means for mounting each said vertical rod means to be rotatable about an axis;

e. means cooperating with said vertical rod means for rotating said vertical rod means about said axis and for substantially parallelly displacing said support rail towards and away from the machine;

f. means providing a full bobbin dump for receiving full bobbins, said last-mentioned means comprising at least one transporting mechanism extending along the machine and capable of being driven in both longitudinal directions thereof; and

g. a device for pre-arranging empty tubes, said device extending along the machine in spaced relationship from said transporting mechanism.

22. The apparatus as defined in claim 21, further including a substantially vertically extending guide element provided for each vertical rod means, each said vertical rod means being arranged to be vertically movable within its associated guide element.

23. The apparatus as defined in claim 21, further including a respective guide element within which each vertical rod means is arranged to be vertically movable and rotatable.

24. The apparatus as defined in claim 21, further including a respective guide element for each said vertical rod means, and a rigid frame with which each said guide element is connected.

25. The apparatus as defined in claim 21, further including means for elevationally displacing said vertical rod means, said elevational displacing means including a cord with which each vertical rod means is connected for raising and lowering such associated vertical rod means.

26. The apparatus as defined in claim 25, further including a rail member extending along the length of the machine above the machine, each of said cords for all of the vertical rod means being suspended from said rail member.

27. The apparatus as defined in claim 26, wherein said rail member is supported by the machine.

28. The apparatus as defined in claim 25, further including a guide cylinder within which is housed each of said vertical rod means, each of said vertical rod means being provided with a piston displaceably arranged within the associated guide cylinder, means closing the upper end of each guide cylinder and equipped with an opening for the throughpassage of the associated cord from which the vertical rod means within such guide cylinder is suspended, and means providing a source of pressurized air communicating with each guide cylinder.

29. The apparatus as defined in claim 21, wherein said means for rotating said vertical rod means comprises at least one cylinder and piston arrangement, means for rotatably securing said cylinder of said cylinder and piston arrangement to said support rail, said piston of said cylinder and piston arrangement including a piston rod rigidly connected with one of said pivoting arm means.

30. The apparatus as defined in claim 21, wherein said means for rotating said vertical rod means comprise actuation lever means arranged at the end faces of said support rail, said actuation lever means being capable of being driven in opposite directions.

31. The apparatus as defined in claim 21, further including a respective rotatable guide element within which is arranged an associated vertical rod means.

32. The apparatus as defined in claim 21, wherein each vertical rod means is mounted to be rotatable about its central axis.

33. The apparatus as defined in claim 21, wherein each vertical rod means is mounted to be rotatable about an axis which is offset from its central axis.

34. The apparatus as defined in claim 21, wherein each vertical rod means is mounted to be rotatable about its own axis through an angle of at least 75° and no greater than 120°.

35. The apparatus as defined in claim 34, wherein each vertical rod means is mounted to be rotatable through an angle of 90°.

36. The apparatus as defined in claim 21, wherein said transporting mechanism comprises an endless transporting belt, lateral guide members for the full bobbins extending along and to both sides of said transporting belt.

37. The apparatus as defined in claim 36, wherein an upper run of said transporting belt is arranged within a substantially U-shaped channel means.

38. The apparatus as defined in claim 37, wherein said upper run of said transporting belt is disposed in close proximity to the bottom of said channel means.

39. The apparatus as defined in claim 21, wherein said gripping elements extend downwardly from said support rail over a length sufficient to grip the upper portion of the full bobbins or empty tubes respectively.

40. The apparatus as defined in claim 39, wherein said gripping elements protrude from said support rail over a length sufficient to grip both the inside and outside of the upper portion of the full bobbins or empty tubes respectively.

41. The apparatus as defined in claim 21, wherein said pre-arranging device for the empty tubes enables said empty tubes to be arranged such that their upper tips can be moved substantially at right angles to the longitudinal axis of the support rail.

42. The apparatus as defined in claim 21, wherein said device for pre-arranging the empty tubes comprises a rail member extending along the machine beneath the spindles, said rail member being provided with upwardly protruding pins for receiving the empty tubes, said pins being arranged at a mutual spacing from one another substantially corresponding to the spindle gauge.

43. The apparatus as defined in claim 21, further including a guide element provided for each vertical rod means, each said guide element being connected with a frame of the machine.

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