Sept. 18, 1962 A. H. BAHNSON, JR 3,054,249

DOFFING AND DONNING MECHANISM FOR SPINNING FRAMES

Filed June 3, 1959 5 Sheets-Sheet 1

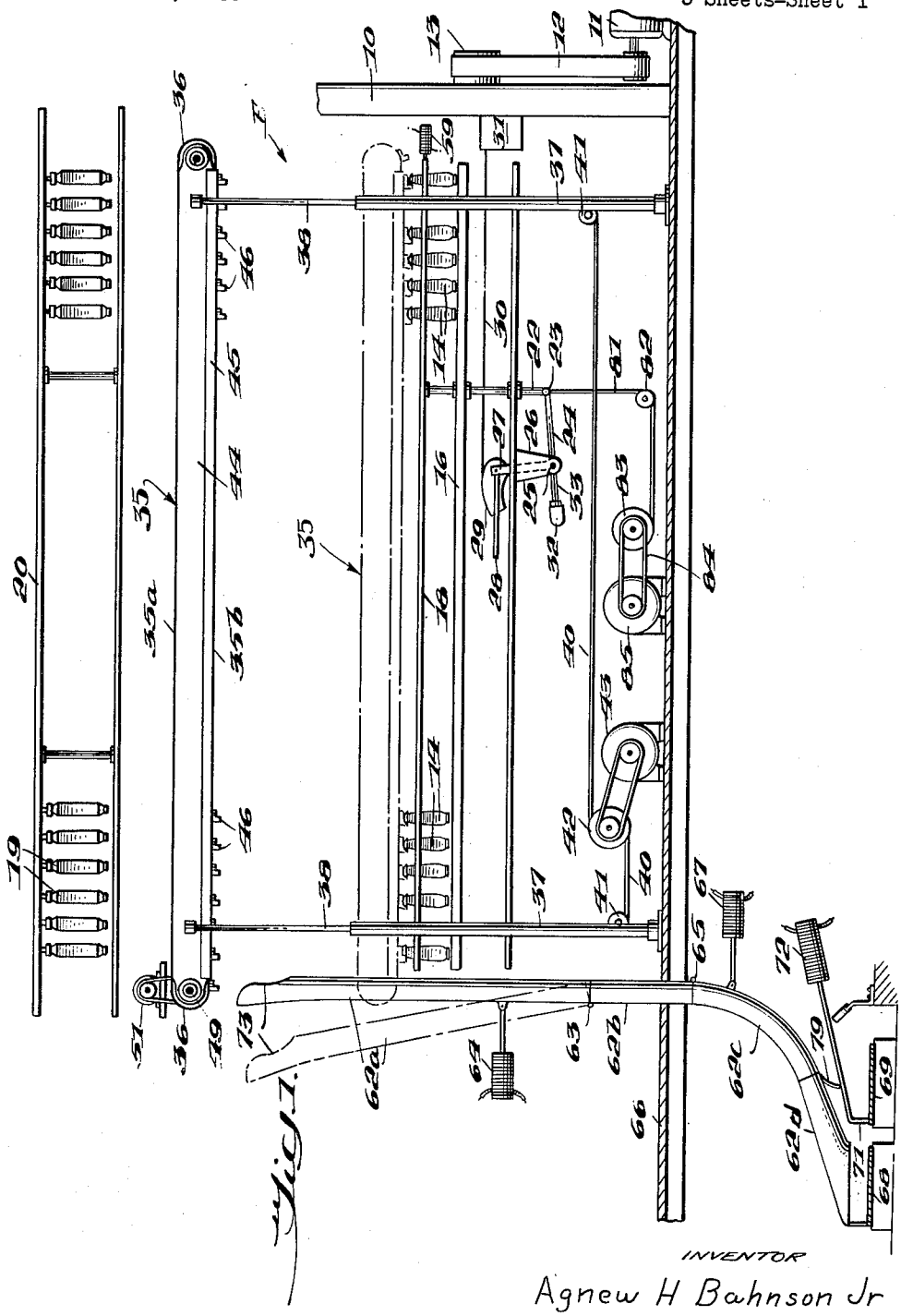


Fig. 1.

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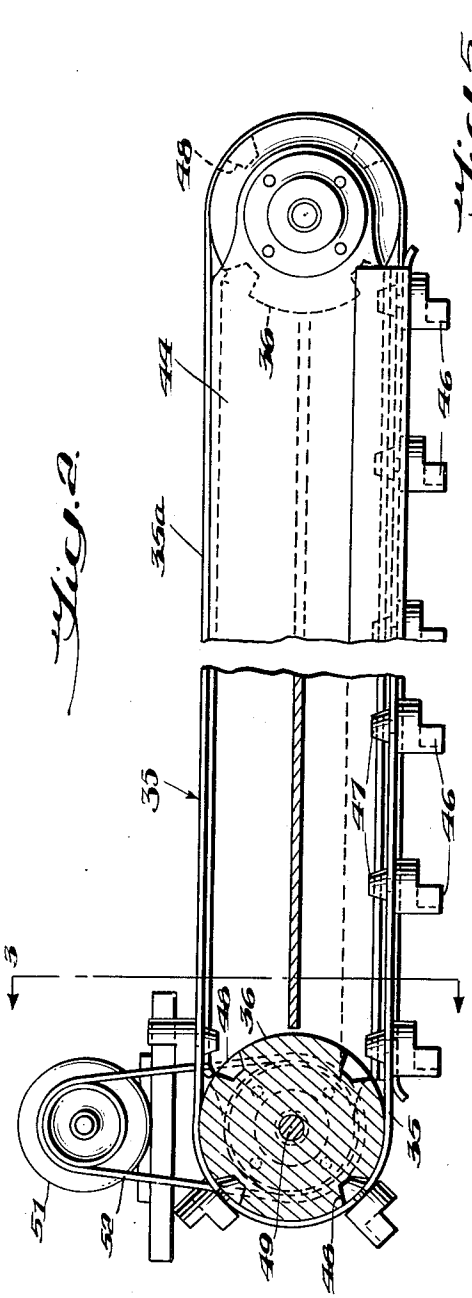


Fig. 2.

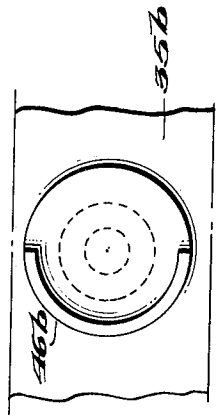


Fig. 5.

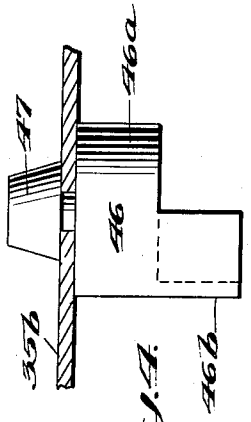


Fig. 4.

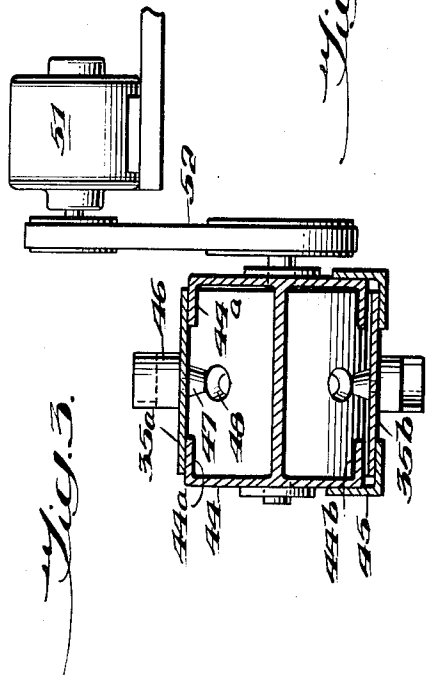


Fig. 3.

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Fig. 6.

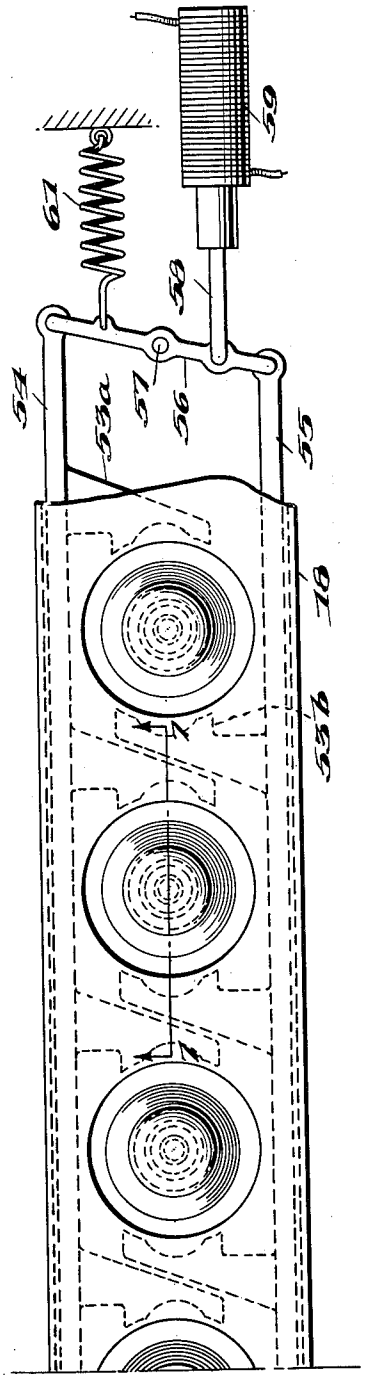
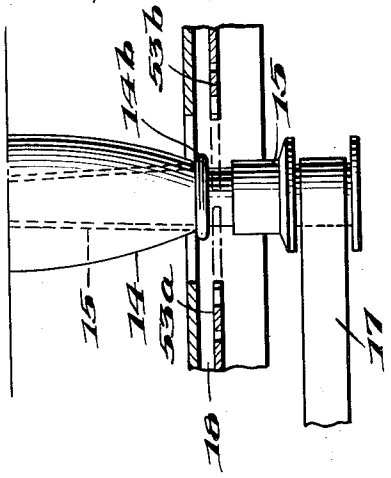


Fig. 7.



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Fig. 11.

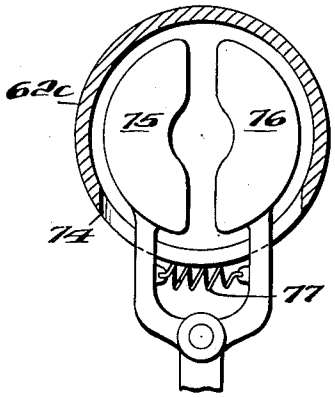


Fig. 12.

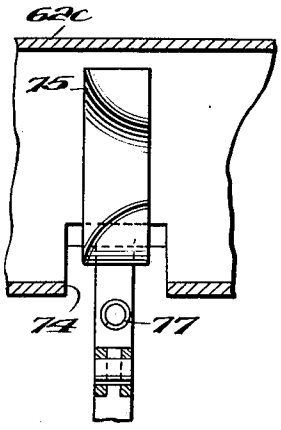


Fig. 8

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DOFFING AND DONNING MECHANISM FOR SPINNING FRAMES

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Fig. 10.

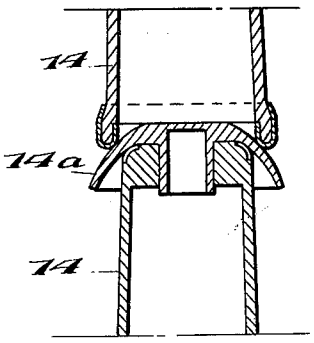


Fig. 9.

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3,054,249

DOFFING AND DONNING MECHANISM FOR SPINNING FRAMES

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Filed June 3, 1959, Ser. No. 818,500
17 Claims. (Cl. 57—52)

This invention relates to doffing and/or donning apparatus for textile working machines such as spinning frames and the like. The apparatus provides for doffing all the full bobbins from their spindles along a side of the frame and thereafter donning empty bobbins on the spindles.

More particularly, the apparatus is designed to effect simultaneous doffing and donning of full and empty bobbins, respectively along an entire side of the frame and is characterized principally by a travelling belt or the like positioned parallel with and above the row of spindles and which is provided with a plurality of longitudinally spaced gripping devices for holding the bobbins in a pendant manner, the spacing between the bobbin gripping devices being equal to the longitudinal spacing between spindles. Means are provided to lower the belt parallel to itself from a rest position above the drafting zone with the bobbin gripping devices in vertical alignment with their respective spindles so as to grip the entire line of bobbins simultaneously; to then raise the belt with the bobbins attached thereto; to then motor the belt longitudinally of itself; to then remove the bobbins in succession from the gripping devices as the bobbins reach one end of the frame; to then reload empty bobbins in succession onto the gripping devices as the belt is motored in the reverse direction, the belt being stopped when the empty bobbins are in direct alignment above their respective spindles; to then lower the belt with the empty bobbins attached so as to deposit those bobbins on the spindles; and to finally raise the belt again to the rest position where it will not interfere with operation of the frame. This completes one cycle of operation and the belt then remains in the rest position until the empty bobbins have been filled whereupon the doffing and donning operation is then repeated.

The full bobbins when removed in succession from the belt may be discharged into a suitable receptacle on a cart positioned at the end of the frame or they may be directed downwardly through a tube and transferred to a conveyor located below the floor of the spinning room for removal to a central collecting station.

Empty bobbins are reloaded in succession onto the belt in an automatic manner such as, for example, from a magazine which can be located on a cart brought to the end of the frame. Another means for automatically reloading the belt is to push the empty bobbins in end-to-end relation upwardly through a tube from a conveyor located below the floor to the reloading point on the belt. If desired, a single tube can be used both to discharge full bobbins from the belt onto a conveyor and reload empty bobbins onto the belt from that conveyor. The conveyor can be of the "single" type where the same conveyor element serves to carry away the full bobbins and to bring empty bobbins to the tube for upward movement therethrough, or the conveyor can be of the double type where one conveyor section carries away the full bobbins from the tube and a second conveyor section brings empty bobbins into position for injection into the tube.

The invention will become more completely understood from the following detailed description of one practical embodiment thereof in conjunction with the accompanying drawings wherein:

FIG. 1 is a view in elevation along one side of a spinning frame, the view being somewhat schematic and omitting conventional spinning frame construction not essential to an understanding of the invention in order to simplify the drawing;

FIG. 2 is a side elevation showing the travelling belt member which forms an important part of the inventive concept;

FIG. 3 is a view in vertical transverse section taken on line 3—3 of FIG. 2;

FIG. 4 is a view drawn to an enlarged scale and principally in elevation showing the details of the permanent magnet type device for gripping the bobbins;

FIG. 5 is a bottom plan view of the gripping device shown in FIG. 4;

FIG. 6 is a plan view showing a longitudinal portion of the ring rail structure with the mechanism for initially breaking loose the bobbins from their spindles;

FIG. 7 is a vertical longitudinal section taken on line 7—7 of FIG. 6;

FIG. 8 is a view in elevation at one end of the spinning frame where the full bobbins are removed in succession from the belt and passed downwardly through a tube for transfer to the carry-away conveyor;

FIG. 9 is a view similar to FIG. 8 but showing the empty bobbins being pushed in end-to-end relation upwardly through the tube for transfer to the belt;

FIG. 10 is an enlarged detail showing the structure at the upper and lower ends of the bobbins so as to prevent any telescoping therebetween when pushed upwardly through the tube; and

FIGS. 11 and 12 are enlarged views showing the expandable jaw mechanism located at the lower end of the tube and through which the empty bobbins are pushed, this mechanism serving to prevent the column of empty bobbins in the tube from moving downwardly between consecutive operations of the pusher device by which empty bobbins are transferred from the conveyor into the bottom end of the tube.

With reference now to FIG. 1, one end Samson for a conventional spinning frame F is shown at **10**, there being a motor **11** and belt transmission **12** for driving the power take-off cylinder **13** which extends longitudinally through the underframe. Bobbins **14** are mounted upon longitudinally spaced spindles **15** which extend for the length of the frame and these are supported for rotary movement about a vertical axis by means of a longitudinally extending spindle rail **16**. Spindles **15** are rotated by a tape type of transmission **17** which is driven from cylinder **13**.

The spindle rail **16** is held stationary and hence the necessary progressive reciprocatory motion for building the thread onto the bobbins as they rotate is imparted to a ring rail **18** which likewise extends longitudinally of the frame, the ring rail being provided with a ring and traveler for each bobbin in accordance with conventional construction and which therefore has not been illustrated. Reciprocation of the ring rail **18** in a vertical plane parallel to itself is effected through a conventional builder mechanism. Cotton for spinning is drawn from roving **19** on creel **20** through drafting rolls, not shown, for winding on the bobbins **14** as the latter rotate and the ring rail **18** moves upwardly.

The builder mechanism includes a lifting rod **22** extending to the ring rail **18** from a pivotal connection as at **23** on a lifter arm **24**. The lifter arm **24** is carried by a rock shaft **25** mounted in a suitable bracket as at **26**. The rock shaft **25** also carries an arm **27** which is angularly disposed with respect to the lifter arm **24**. This arm **27** extends to a connection with a traverse rod **28** which runs for substantially the entire length of the spin-

ning frame for connection to as many lifting assemblies for the ring rail 18 as are necessary.

The arm 27 also carries an arc element 29 to which a builder chain 30 is fastened. The builder chain 30 runs from this arc element 29 to a builder motion mechanism indicated at 31 from which, as is familiar in the art, the necessary reciprocating motion is imparted for building the bobbins. The chain 30 is held taut by means of a weight 32 carried by the rock shaft 25 on an arm 33, and the reciprocating motion is obtained by taking up and releasing the chain 30 at the builder motion 31. The builder motion 31 is arranged so that while the amplitude obtained through this take up and release of chain 30 is maintained constant, the chain 30 is progressively let off so as to provide progressive reciprocation as mentioned above.

As chain 30 is progressively let off in this manner it will be understood that arc element 29 and arm 27 will rock on shaft 25 through a displacement which shifts progressively to the left as shown in FIG. 1. Correspondingly, the rocking action imparted to lifter arm 24 will shift progressively upward and this motion will be transferred to ring rail 18 through lifter rod 22. As the operation of the building mechanism proceeds in this manner the yarn will be directed onto the bobbins 14 from ring rail 18, and the bobbins will be built as the ring rail 18 is raised with respect to the bobbins 14 by virtue of the progressive reciprocation just described. Accordingly, when the ring rail 18 has been raised through the height of the bobbins 14, the bobbins will be completely built; and this fully raised position of ring ring 18 corresponds to full bobbin position.

The improved doffing and donning mechanism in accordance with the present invention comprises a travelling belt member 35 or the like extending parallel with and above the spindles 15 and bobbins 14. One practical construction for the travelling member is an endless belt, as shown, mounted on sheaves 36 which are journalled in suitable bearing structure carried by upright supports which are arranged for vertical sliding movement so that belt 35 may be lowered and raised parallel to itself. The supports for the belt are located at each end of the frame and each support is comprised of a vertically extending stationary tube 37 which is suitably anchored to the floor of the spinning room and an inner tube 38 which is arranged within the outer tube 37 for telescopic sliding movement. The bearing structure for each end of the belt is carried at the upper end of the corresponding inner tube, and a helical biasing spring 39, see FIG. 9, is arranged within the telescopic tube structure so as to bear upwardly against the lower end of tube 38 and hence bias the belt 35 and its supporting structure to a raised or rest position above the drafting zone of the frame so as not to interfere with its normal operation. To lower the belt 35, the present embodiment provides a cable drive 40 connected to each of the inner tubes 38 and which extends upwardly through the outer tube 37, being guided by sheaves 41. The cables 40 connected to the inner tubes 38 are wound upon a drum 42 and the latter is arranged to be driven by an electric motor 43. As the drum 42 rotates to wind the cables 40 upon it, the inner tubes 38 at the opposite ends of the frame and hence the belt structure 35 secured thereto are drawn downwardly from the rest position shown in solid lines in FIG. 1 to the doffing and donning position indicated in dashed lines, against the counter biasing action provided by springs 39. If necessary, one or more intermediate upright supports, not shown, may be provided between the end supports 37—38 if the spinning frame F is too long to enable the belt 35 to be adequately carried by only the end supports. To prevent sagging of the upper and lower flights of belt 35, a longitudinally extending guide structure is preferably provided therefor as shown in FIGS. 2 and 3.

The belt guide structure consists of an essentially H-shaped structure element 44 which extends between and also supports the belt bearing structure at each end of belt 35. The H-shaped guide 44 includes a pair of inturned flanges or rails 44*a* which underlie opposite edge portions of the upper flight 35*a* of belt 35 and similar flanges 44*b* in conjunction with angle irons 45 spaced parallel with the flanges 44*b* establish guide slots or rails therebetween for receiving and supporting the opposite edge portions of the lower flight 35*b* of the belt.

Fastened to the belt so as to extend downwardly from the lower flight 35*b* thereof are a plurality of bobbin gripping devices arranged longitudinally along the belt in spaced relation, the distance between adjacent gripping devices being the same as the longitudinal spacing between the spindles 15 and these gripping devices being located in the vertical plane containing the spindles 15. One function of these gripping devices is to attach themselves to the upper ends of the bobbins 14 when the latter have been filled as the belt 35 is lowered and to pull the bobbins off the spindles as the belt is thereafter raised. The other function is to carry a line of empty bobbins in a pendant manner back to the row of spindles as the belt 35 is again lowered at a later stage in the operating sequence.

The gripping devices may be mechanical or pneumatic in operating principle or they may be attached to the upper ends of the bobbins by means of magnetic attraction. The magnets may be electromagnets, if desired, but in the present embodiment, those of the permanent type are used in view of the simplification over electromagnets which would entail the problem of energizing them. FIGS. 2–5 show details of the travelling belt component with the anti-sagging guide structure and permanent magnets 46 constituting the bobbin gripping devices. Magnets 46 are secured to the outer face of belt flight 35*b* by means of studs 47, the heads of which extend inwardly from the inner face of the belt flight 35*b* so as to engage complementary configured notches 48 provided around the periphery of one of the sheaves so that the latter functions as a drive sprocket to effect a positive drive for belt 35. The sheave 36 which acts as the drive sprocket is splined to its shaft 49 and the latter is driven by means of a motor 51 and belt transmission 52, these latter being suitably supported upon the belt assembly so as to move with the latter.

Each permanent magnet 46 is made from any suitable magnet material such as Alnico and, as shown in FIGS. 4 and 5 includes a base portion 46*a* and an arcuate depending shoulder portion 46*b* which extends for 180° or less so as to extend downwardly and partially embrace that side of the top portion of the bobbin 14 in the direction of travel of the lower flight 35*b* of belt 35 to the left as viewed in FIGS. 1, 8 and 9. The bobbin 14 as shown in FIG. 10 includes a steel cap 14*a* at the upper end and hence magnet 46 functions to attract it with sufficient force to support the weight of the full bobbin as the latter is lifted off the spindle. Such caps would not, of course, be necessary in the event that pneumatic or mechanical types of gripping devices are used on the belt.

As will become more clearly understood, belt 35 is lowered parallel to itself to the position shown in dashed lines so as to effect engagement between each of the magnets 46 and the upper end 14*a* of its associated bobbin 14. Belt 35 is then raised so as to lift all of the full bobbins simultaneously from their seats on the spindles. When empty bobbins are seated upon their spindles by downward movement of belt 35, they may exhibit a tendency to stick frictionally to the spindles due to the tapered fit therebetween. Since this holding friction may be too great to be overcome by the pulling power of the magnets, the present invention provides means associated with ring rail 18 for breaking the bobbins loose from their spindles prior to raising the belt. With reference now to FIGS. 6 and 7 which show these details, it will be seen that ring

rail **18** is provided with a plurality of fingers **53***a*, **53***b* which are adapted to be slid beneath the flange **14***b* at the lower end of each bobbin so as to apply the desired lifting force to the bobbin as the ring rail is raised a slight amount. One pair of these fingers **53***a*, **53***b* is provided for each bobbin and the fingers of each pair are arranged to be actuated towards each other so as to slide beneath the bobbin flange **14***b* from a retracted position clear of the bobbin. All of the fingers **53***a* at the right side of the bobbins as viewed in FIG. 6 are made integral with a slide bar **54** extending longitudinally along one side of ring rail **18** and all of the fingers **53***b* at the left side of the bobbins are made integral with a similar slide bar **55** extending longitudinally along the other side of the ring rail. Slide bars **54**, **55** are coupled together for simultaneous movement in opposite directions by means of a lever **56**, the slide bars being articulated to opposite ends of lever **56** and the latter being actuated about its intermediate pivot mounting **57** by means of a drive rod **58** articulated thereto at one side of the pivot **57**. Drive rod **58** is actuated by a solenoid **59** positioned at one end of the ring rail **18** so as to slide the fingers **53***a*, **53***b* beneath the bobbin flanges **14***b* against the counter action of a tension spring **61** which automatically returns the fingers to their rest position clear of the bobbin flanges as soon as solenoid **59** is deenergized.

As explained at the beginning of the specification, after the belt is lowered so that the gripping devices attach themselves to a line of full bobbins, is then raised and motored longitudinally of itself, the full bobbins are detached automatically and in succession from their respective gripping devices as they reach one end of the frame. After all full bobbins have been removed, empty bobbins are reloaded in succession onto the belt as the latter is motored in the opposite direction. When the belt has taken on a full line of empty bobbins and these are in vertical alignment with the line of spindles, the belt is then lowered again, the empty bobbins are deposited upon the spindles and the belt is then raised to a rest position out of the way.

Also, as indicated at the outset, various expedients may be utilized for unloading the full bobbins in succession from the belt and for feeding empty bobbins in succession onto the belt. The full bobbins can be removed from their respective gripping devices as they reach the end of the frame and deposited into a cart, and empty bobbins can be fed onto the belt from a magazine placed at the end of the frame. Another expedient is to provide a tube at the end of the frame into which the full bobbins are deposited, the tube leading downwardly to below floor level and terminating at a conveyor to which the bobbins are transferred and carried away to the desired collecting point in the mill. The same or a different tube can be used to feed empty bobbins upwardly from the same or a different conveyor for loading onto the belt.

In the embodiment illustrated in the present applica- a single tube arrangement is used both for carrying away full bobbins from the belt and for feeding empty bobbins onto the belt, this tube operating in conjunction with two conveyors, one of these conveyors being used to carry away full bobbins from the bottom of the tube and the other conveyor being used in conjunction with a pusher device for effecting a transfer of empty bobbins in succession into the bottom of the tube for movement upward in end-to-end relation and transfer to the belt. These tube and conveyor elements are shown most clearly in FIGS. 8 and 9. FIG. 8 shows the arrangement employed for discharging full bobbins from the belt through the tube onto one conveyor, and FIG. 9 shows the arrangement employed for feeding empty bobbins upwardly through the tube in end-to-end relation following transfer from the other conveyor. The spindles have been omitted in FIGURES 8 and 9 for sake of clarity.

First, as to FIG. 8 which shows discharging of full bobbins, it will be seen that a generally vertical tube structure **62** is located at the left end of the spinning frame adjacent the left end of belt **35**. The tube is constituted by several sections, some of which are stationary while others are pivotally mounted. The uppermost tube section **62***a* is hinged at **63** to the upper end of the next below stationary tube section **62***b*. Tube section **62***a* is arranged to be actuated by a solenoid **64**, being articulated to the plunger rod **64***a* thereof, from a vertical position shown in full lines to an outwardly slanted position shown in the dashed lines. The vertical position is employed when unloading full bobbins or loading empty bobbins, and the slanted position is taken so as to provide sufficient clearance for the belt structure to be lowered from the position shown in FIGS. 8 and 9 to the position shown in dashed lines in FIG. 1.

The next below tube section **62***c* is hinged at **65** to the lower end of stationary tube section **62***b* which passes through the floor **66**, and section **62***c* is arranged for actuation by a solenoid **67**, being articulated to the plunger rod **67***a* thereof, from a position shown in FIG. 8 wherein the lower discharge end thereof is aligned with the entrance to the stationary tube section **62***d* which leads to conveyor **68** so as to discharge full bobbins onto this conveyor, to a position shown in FIG. 9 wherein the lower discharge end is aligned with the other conveyor **69** and a pusher device **71** for transferring empty bobbins from conveyor **69**. Pusher device **71** is arranged to be actuated by a solenoid **72**.

The upper end of the top tube section **62***a* is partially cut away at **73** on the side facing the oncoming bobbins so that the bobbins enter the tube and are stopped by the rear wall thereof. This movement of the bobbin in conjunction with the substantially simultaneous change in direction of the bobbin gripping magnet **46** as the latter changes from a rectilinear path to a curved one in the direction away from the bobbin indicated by the arrow as it starts around the sheave **36** serves to release the bobbin cap **14***a* from the magnet **46** thus permitting the bobbin to fall by gravity through the aligned tube sections **62***a*–**62***d* and be transferred to conveyor **68**.

When all of the full bobbins have been transferred from the belt to the conveyor **68**, tube section **62***c* is shifted to the position shown in FIG. 9 by energizing solenoid **67**. This brings the lower end of tube section **62***c* into position for loading empty bobbins onto the belt from conveyor **69**. As shown in FIGS. 11 and 12, a portion of the wall at the lower end of tube section **62***c* is cut away at **74** so as to permit entry of a pair of spring loaded jaws **75**, **76** when tube section **62***c* is shifted to the empty bobbin loading position of FIG. 9. The jaws **75**, **76** are urged in the direction towards each other by a spring **77** and are carried by a support arm **78** which is mounted in a fixed position, with the jaws at the proper angle such as will enable them to enter and be withdrawn from the tube section **62***c*. The function served by the jaws **75**, **76** is to prevent the column of empty bobbins in the tube as shown in FIG. 9 from shifting backward between consecutive actuations of the pusher device **71** and this is effected by having the empty bobbins pass through the jaws **75**, **76** which press around the body of the lowermost bobbin in tube section **62***c* and hold it against backward movement as the bobbin is pushed through the tube. An arcuate extension **79** at the lower end of tube section **62***c* is provided so as to guide the top end of each bobbin into the tube when transferred from conveyor **69** by the pusher **71**.

As is evident from FIG. 9, the empty bobbins are pushed upward through the tube sections **62***c*–**62***a* in end-to-end relation. As previously explained, and as shown clearly in FIG. 10, a steel cap **14***a* is fixed to the upper end of each bobbin. This cap is provided with a spherically curved surface which has a diameter greater than that of the lower end of the bobbin so as to prevent telescoping therebetween as the bobbins are pushed upwardly.

In loading empty bobbins onto the belt **35**, the speed

of the belt will be so coordinated to periodic operation of the pusher **71** that the cap **14***a* on the topmost empty bobbin will be presented to the magnet **46** as the latter moves downward and around the sheave **36** in the direction indicated by the arrow in FIG. 9, thus causing the magnet to attract and hold onto the bobbin in a pendant manner.

It has been explained that when the bobbins have been filled and the frame made ready for doffing, spindle rail **18** will be at the upper end of the bobbin. In order to effect operation of the bobbin releasing fingers **53***a*, **53***b* so as to break loose the bobbins from their spindles, the ring rail **18** must be run back down to the position shown in FIG. 7 wherein the fingers **53***a*, **53***b* will be located beneath the bobbin flange **14***b*. This run-down of the spindle rail is effected by means of a cable drive shown in FIG. 1 comprising a cable **81** attached to ring rail lifter rod **22** and which extends downwardly therefrom and around a guide pulley **82** for winding upon a drum **83** which is driven by a belt transmission **84** from electric motor **85**. As cable **81** is wound upon drum **83** it pulls down upon the lift rod **22** and hence lowers the ring rail **18** to a position generally indicated in FIG. 7 which results in the wrapping of a few turns of the thread around the lower end of the spindle by the ring and traveller mechanism, not shown, so as not to break the thread from the drafting rolls when the bobbins are pulled off.

Operation

The operating principles underlying the present invention are believed to be understandable from the foregoing detailed description of the component parts and their respective functions. However, by way of conclusion, one complete operating cycle of the automatic doffing and donning mechanism will now be explained.

When the frame has been running long enough to fill the entire line of bobbins along the same with thread, motor **85** is energized so as to wind cable **81** upon drum **83** and hence lower ring rail **18** to its lowermost position. At the same time, power to the frame is shut off. Lowering of ring rail **18** brings the travelers thereon, not shown, to a position below the respective bobbins and puts several turns of thread around the base of the spindle. As soon as the frame mechanism coasts to a stop thus bringing the drafting rolls and spindles with the bobbins thereon to a halt, solenoid **59** is energized so as to actuate the sets of bobbin releasing fingers **53***a*, **53***b* supported by the ring rail structure inwardly against the bobbins below the bobbin flanges **14***b*. Ring rail **18** is then released from the lowermost position by releasing a locking clutch on motor **85**, the rail **18** then moving up a short distance because of the counterweight **32** action on lifter arm **24**. This causes the sets of fingers **53***a*, **53***b* to strike upward against the bobbin flanges **14***b* and hence loosen them from their respective spindles. Solenoid **64** is then energized so as to shift the pivotally mounted tube section **62***a* from a vertical position to the outwardly slanted position shown in dashed lines in FIG. 1 where it will not interfere with the lowering of belt **35**.

Motor **43** is then started so as to cause cable **40** to wind upon drum **42** and pull tubes **38** at opposite ends of the frame downwardly thus lowering belt **35** parallel to itself from the upper, out-of-the-way position shown in full lines in FIG. 1 to the dashed, doffing and donning position whereupon the bobbin gripping magnets **46**, which are in vertical alignment with bobbins **14**, become attached to the bobbin caps **14***a*. A locking clutch on motor **43** is then released so as to permit cable **40** to unwind from drum **42** and the belt **35** to be raised to its upper position, carrying the bobbins with it, as the compressed springs **39** push upwardly against the belt supporting tubes **38**. The sets of fingers **53***a*, **53***b* can then be retracted clear of the spindles by deenergizing solenoid **59**. The tube section **62***a* is then shifted back to its vertical position.

As soon as belt **35** reaches its upper position with the bobbins attached and after tube section **62***a* has been restored to its vertical position, motor **51** is then started in a direction such as will cause the lower belt flight **35***b* to motor longitudinally of itself to the left as viewed in FIGS. 1 and 8. With reference now to FIG. 8 which shows the apparatus in the act of discharging full bobbins from the belt, it will be seen that each bobbin as it reaches the end of the belt will enter the cut-away wall portion **73** at the top of the upper discharge tube section **62***a* and then be stopped by the opposite wall. This action takes place substantially at the same time that the magnet **46** which had been holding this particular bobbin begins to move upward and away as it starts around the sheave at the end of the belt. This action serves to slide the magnet off the bobbin cap **14***a* and hence release the same for downward movement through the tube sections **62***a*–**62***d* and transfer to conveyor **68** which then transports the bobbins to a desired central collecting point.

When all of the full bobbins have been dropped from the belt, the latter is then stopped by stopping motor **51**. Solenoid **67** is then energized so as to shift tube section **62***c* to the position shown in FIG. 9 thus making the apparatus ready for reloading empty bobbins from conveyor **69**. Operation of the pusher device **71** by means of periodic operation of solenoid **72** then serves to push empty bobbins in succession from the conveyor **69** upwardly through the tube sections **62***c*–**62***a* in end-to-end relation. At this time motor **51** has been reversed thus motoring the lower belt flight **35***b* to the right and the empty bobbins will be transferred from the upper end of the tube to the magnets **46** as the latter move down and around the sheave **36** into a zone of magnetic attraction for the bobbin caps **14***a*.

After an entire line of empty bobbins has been placed upon belt **35**, the tube section **62***a* is again shifted to the outwardly slanted position by energizing solenoid **64** and belt **35** is then again lowered, with the empty bobbins in vertical alignment with their corresponding spindles, so as to deposit the bobbins on the spindles. If there is insufficient frictional engagement between the bobbin and its spindle to hold the former in place as the belt is again raised, the required release between magnet and bobbin cap may be effected by motoring the lower belt flight **35***b* a short distance to the left and thus slide the magnet off the bobbin cap.

When all empty bobbins have been placed upon the spindles, belt **35** is again raised to its upper position and this completes one cycle of operation.

The frame is then restarted and the operating cycle for automatically doffing and donning is repeated after this line of empty bobbins has been filled.

In the description which has been given, all operations have been explained with respect to one side only of the frame. A spinning frame is conventionally provided with two working sides, and hence it will be understood that a like organization of elements for automatic doffing and donning will be provided for each side in accordance with the invention.

The various motors, solenoids, conveyors, etc. which have been described may be controlled as to their required sequence of operation by any suitable means such as a program timer or they may be controlled by an operator.

In conclusion, it is desired to be understood that the foregoing embodiment which has been described is to be considered typical rather than limitative of the structural organizations by which the invention may be put into practice. Consequently, various modifications and equivalents may be utilized without, however, departing from the spirit and scope of the invention as defined in the appended claims.

I claim:

1. Doffing and donning apparatus for a spinning frame and the like having a line of spindles adapted to have bobbins seated thereon and a vertically movable ring rail comprising a horizontal support member extending longi-

tudinally of the frame and located above said line of spindles, means for moving said support member parallel to itself between an upper position and a lower doffing and donning position adjacent said spindles, bobbin gripping means depending from said support member in vertical alignment with said spindles and having the same longitudinal spacing as said spindles, said bobbin gripping means serving to raise an entire line of full bobbins from said spindles as said support member is raised and also serving thereafter to carry an entire line of empty bobbins to said spindles for seating thereupon as said support member is lowered, means for motoring said support member longitudinally of itself to carry the line of full bobbins to a point of discharge, means unloading the full bobbins in succession from their respective bobbin gripping means as they reach said point of discharge, and means reloading an entire line of empty bobbins in succession onto said gripping means.

2. Doffing and donning apparatus as defined in claim 1 and which further includes finger means carried by the ring rail of the frame and actuatable when said ring rail occupies a lower position adjacent the lower end of the bobbins on said spindles for engaging the bobbins and unseating them from said spindles simultaneously with a subsequent lifting of the ring rail.

3. Doffing and donning apparatus for spinning frames and the like having a line of spindles adapted to have bobbins seated thereon comprising a horizontally extending belt located above the line of spindles, means for moving said belt between an upper position and a lower doffing and donning position adjacent said spindles, bobbin gripping means depending from the lower flight of said belt in vertical alignment with said spindles and having the same longitudinal spacing as said spindles, said bobbin gripping means serving to raise an entire line of full bobbins from said spindles as said belt is raised and also serving to thereafter seat an entire line of empty bobbins on said spindles as said belt is lowered, means for motoring said belt, means for unloading full bobbins in succession from said gripping means as said belt is motored, and means reloading empty bobbins in successions onto said gripping means.

4. Doffing and donning apparatus as defined in claim 3 wherein said means for unloading full bobbins from said gripping means and said means for reloading empty bobbins in succession onto said gripping means are located at the same end of said belt, said belt being motored in one direction longitudinally of itself when full bobbins are being unloaded and being motored in the opposite direction when empty bobbins are being reloaded.

5. Doffing and donning apparatus as defined in claim 3 wherein said bobbin gripping means are constituted by magnets secured in spaced relation along said belt by means including a stud protruding from the opposite face of the belt, said studs serving as teeth and being engageable with correspondingly spaced notches in the periphery of a drive sheave for motoring the belt longitudinally of itself.

6. Doffing and donning apparatus as defined in claim 3 wherein said belt is supported by sheaves at the opposite ends thereof and which further includes guide means extending between said sheaves and which serve to prevent the lower flight of said belt from sagging.

7. Doffing and donning apparatus as defined in claim 3 wherein said bobbin gripping means are constituted by permanent magnets.

8. Doffing and donning apparatus for spinning frames and the like having a line of spindles adapted to have bobbins seated thereon comprising a horizontally extending belt located above the line of spindles, means for moving said belt parallel to itself between an upper position and a lower doffing and donning position adjacent said spindles, bobbin gripping means carried by the lower flight of said belt in vertical alignment with said spindles and having the same longitudinal spacing as said spindles, said bobbin gripping means serving to raise an entire line of full bobbins from said spindles as said belt is raised and also serving thereafter to carry an entire line of empty bobbins to said spindles for seating thereupon as said belt is lowered, a generally vertical tube located at one end of said frame, means for motoring said belt when in said upper position in one direction to carry full bobbins to said tube, means discharging said full bobbins in succession from said bobbin gripping means on said belt when reaching said tube, said full bobbins being carried away through said tube, and means for reloading empty bobbins in succession onto the bobbin gripping means on said belt in timed relation with motoring of said belt in the opposite direction.

9. Doffing and donning apparatus as defined in claim 8 wherein said means for reloading empty bobbins onto said bobbin gripping means on said belt comprises means for pushing empty bobbins upwardly through said tube in end-to-end relation for engagement in succession with said bobbin gripping means.

10. Doffing and donning apparatus as defined in claim 8 wherein said bobbin gripping means are constituted by a magnet for and attracting each bobbin.

11. Doffing and donning apparatus as defined in claim 8 wherein said bobbin gripping means are constituted by a permanent magnet for and attracting each bobbin.

12. Doffing and donning apparatus as defined in claim 11 wherein each said permanent magnet includes a semicircular depending sleeve portion opening in a direction away from said tube located at the end of the frame.

13. Doffing and donning apparatus as defined in claim 8 wherein said bobbin gripping means are constituted by a permanent magnet for and attracting each bobbin and wherein said means for discharging full bobbins in succession from said magnets is constituted by a wall portion of said tube opening to and forming a stop for the full bobbins as they reach the end of said belt.

14. Doffing and donning apparatus for spinning frames and the like having a line of spindles adapted to have bobbins seated thereon comprising a horizontally extending belt located above the line of spindles, means for moving said belt parallel to itself between an upper position and a lower doffing and donning position adjacent said spindles, bobbin gripping means carried by the lower flight of said belt in vertical alignment with said spindles and having the same longitudinal spacing as said spindles, said bobbin gripping means serving to raise an entire line of full bobbins from said spindles as said belt is raised and also serving thereafter to carry an entire line of empty bobbins to said spindles for seating thereupon as said belt is lowered, a generally vertical tube located at one end of said frame, means for motoring said belt when in said upper position in one direction to carry full bobbins to said tube, means discharging said full bobbins in succession from said bobbin gripping means on said belt when reaching said tube, said full bobbins being carried away through said tube, conveyor means at the lower discharge end of said tube and onto which the full bobbins are transferred in succession, and means for pushing empty bobbins from said conveyor means upwardly through said tube in end-to-end relation for engagement in succession with and transfer to said bobbin gripping means in timed relation with motoring of said belt in the opposite direction.

15. Doffing and donning apparatus as defined in claim 14 wherein said conveyor means includes a first conveyor onto which full bobbins are transferred from the lower end of said tube and a second conveyor from which empty bobbins are transferred into the lower end of said tube.

16. Doffing and donning apparatus as defined in claim 15 wherein the lower end portion of said tube is hingedly mounted for movement from a first position associated with said first conveyor to a second position associated with said second conveyor.

17. Doffing and donning apparatus as defined in claim 16 and which further includes expandable jaw means located in the lower end portion of said tube when in said second position and through which the empty bobbins are pushed, said jaw means embracing the empty bobbins as they pass through the same and preventing backward movement of the column of empty bobbins in said tube.

References Cited in the file of this patent

UNITED STATES PATENTS

1,810,754	Buddecke	June 16, 1931
2,661,948	Montgomery	Dec. 8, 1953

FOREIGN PATENTS

339,874	Great Britain	Dec. 18, 1930