United States Patent [19]

Takai et al.

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[54] **APPARATUS FOR SIMULTANEOUSLY DOFFING AND DONNING APPARATUS**

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

[51] **Int. Cl.²** **D01H 9/08**

[58] **Field of Search** 57/52–54; 198/24, 23, 25

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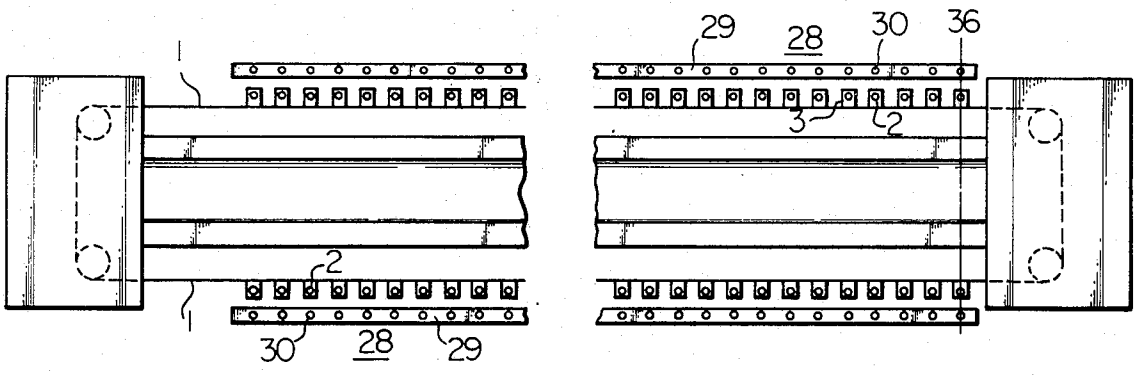
Primary Examiner—John Petrakes
Attorney, Agent, or Firm—Nelson E. Kimmelman; Allan Ratner; Paul Maleson

[57] **ABSTRACT**

Apparatus for simultaneously doffing full packages mounted on spindles of a textile machine such as a spinning frame onto a conveyor mechanism of a straight peg arrangement type and for donning bar bobbins mounted on an auxiliary peg apparatus onto the spindles, by carrying them on a transporting device provided with a pneumatically operated holding device, which transporting device is moved along prescribed routes by a combination of the pantograph motion of a pantograph mechanism of the transporting device, and of an outwardly and horizontally displacing motion. Auxiliary pegs are mounted on said auxiliary peg apparatus which apparatus is arranged in the same horizontal plane as the pegs of the conveyer mechanism. These auxiliary pegs may be swung to an operating position in which the pegs of the conveyer mechanism and the auxiliary pegs are respectively situated in the same vertical planes, within which the spindles of the spindle rows are also respectively situated.

6 Claims, 13 Drawing Figures



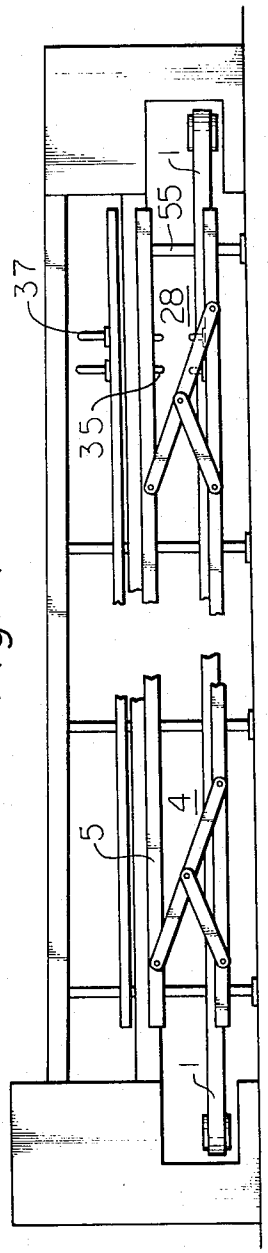


Fig. 1

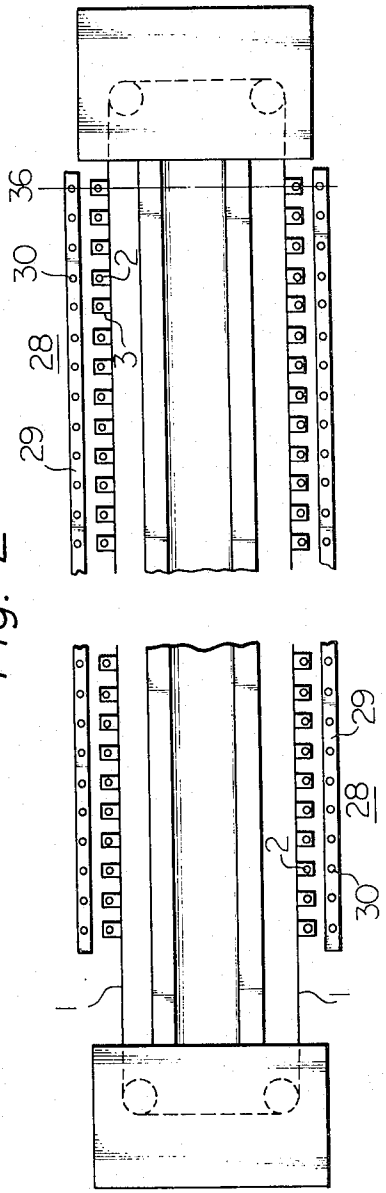
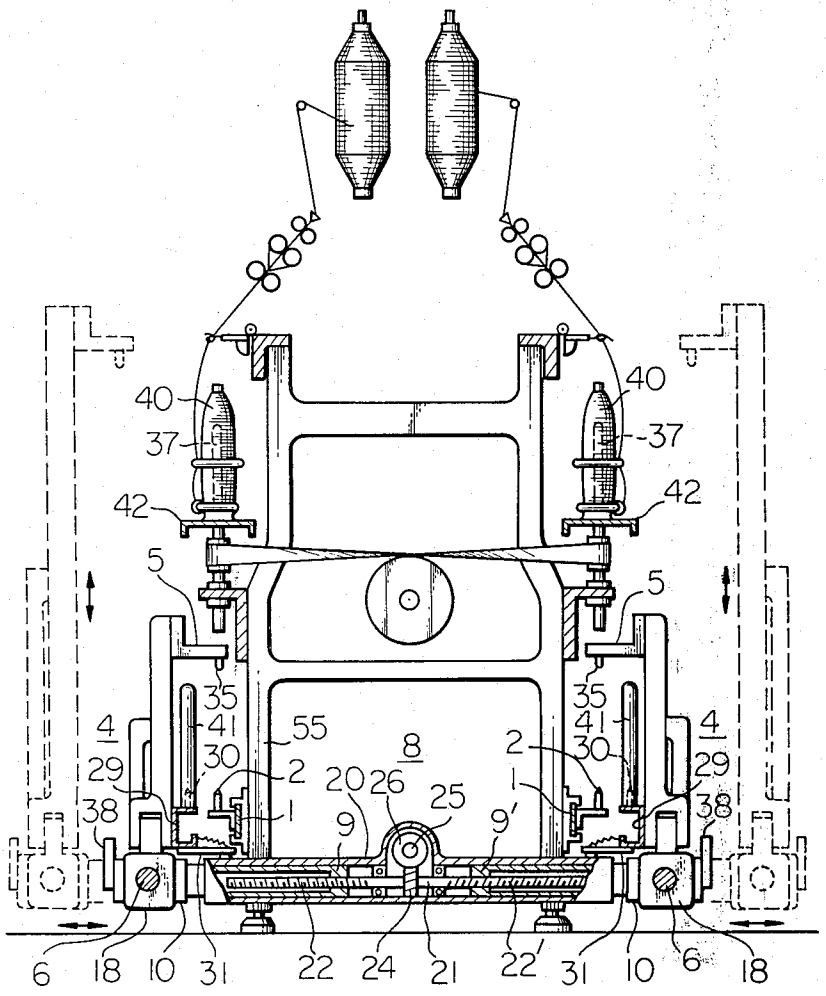


Fig. 2

Fig. 3



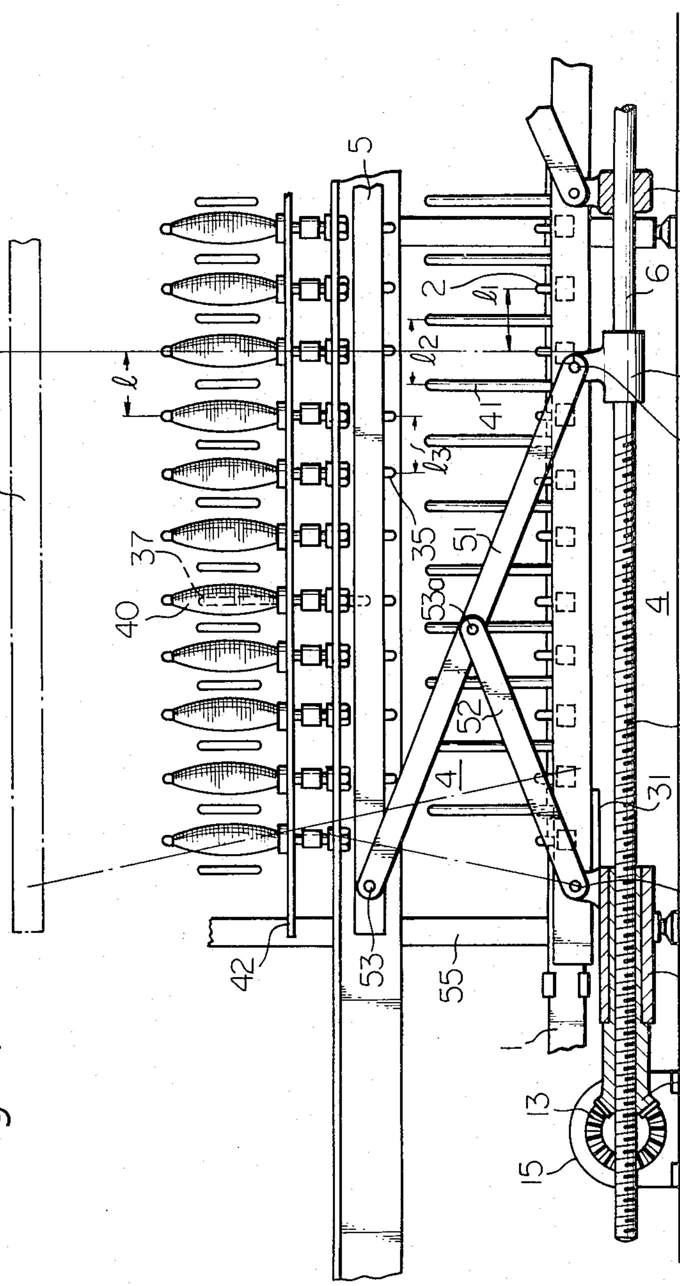
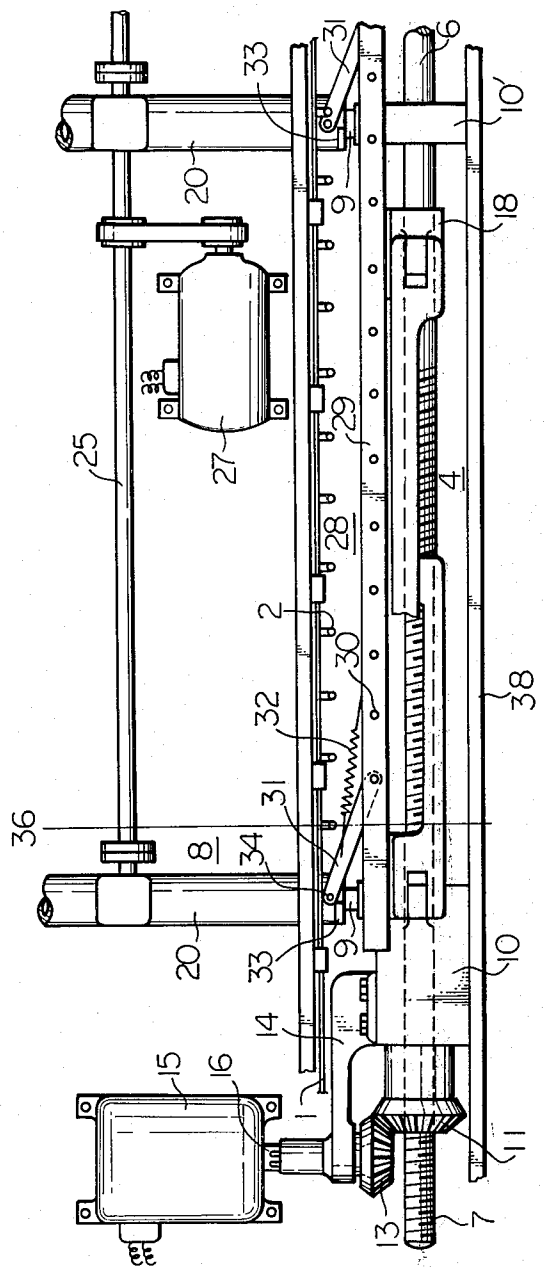


Fig. 4

Fig. 5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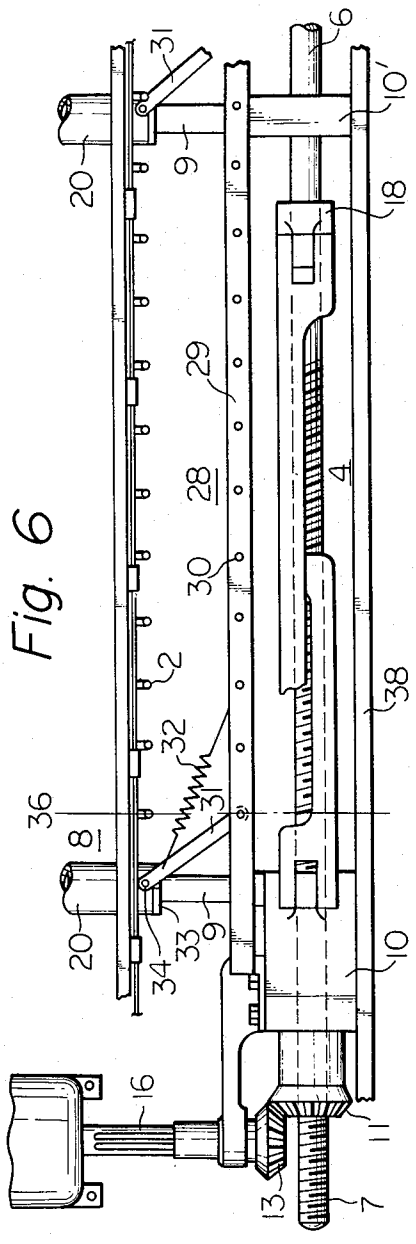
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Fig. 6

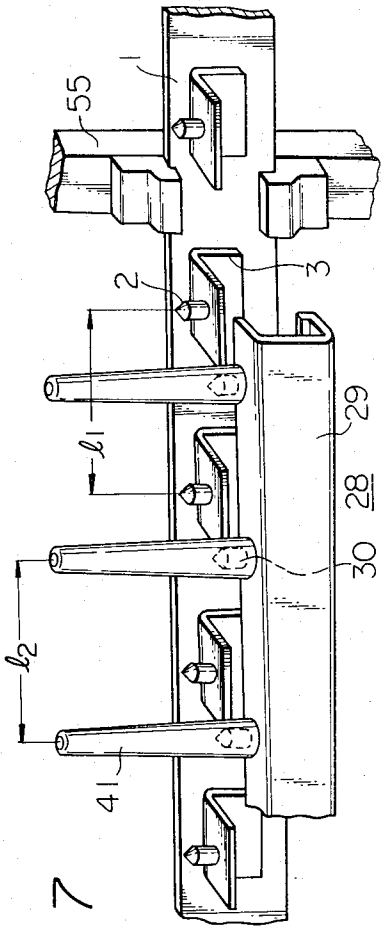
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Fig. 7

Fig. 8

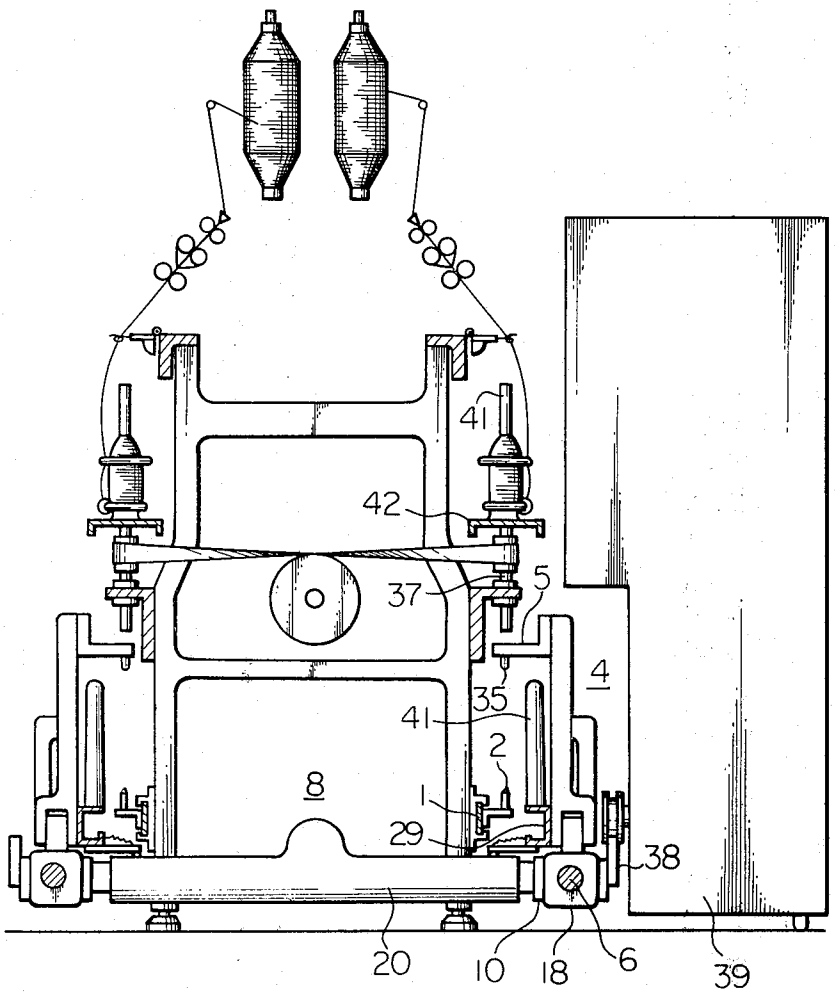


Fig. 9

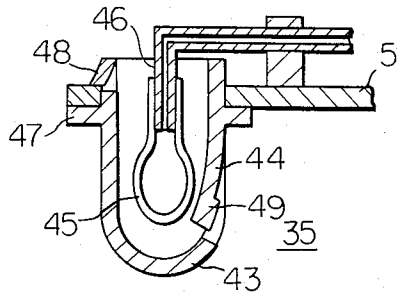


Fig. 10

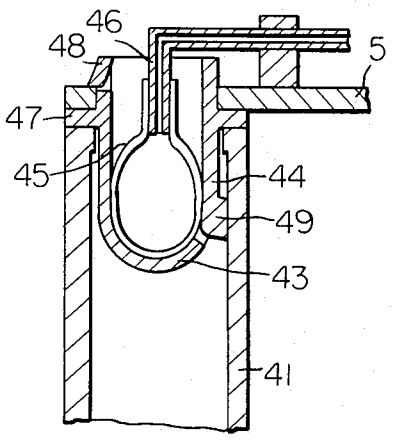


Fig. 11

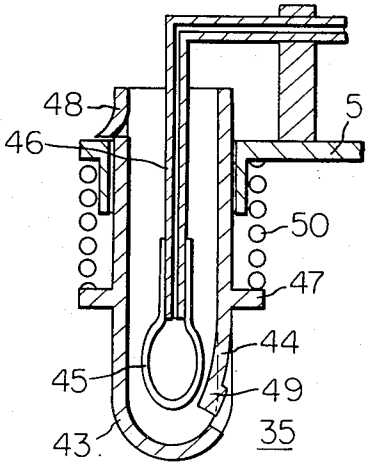


Fig. 12(1)

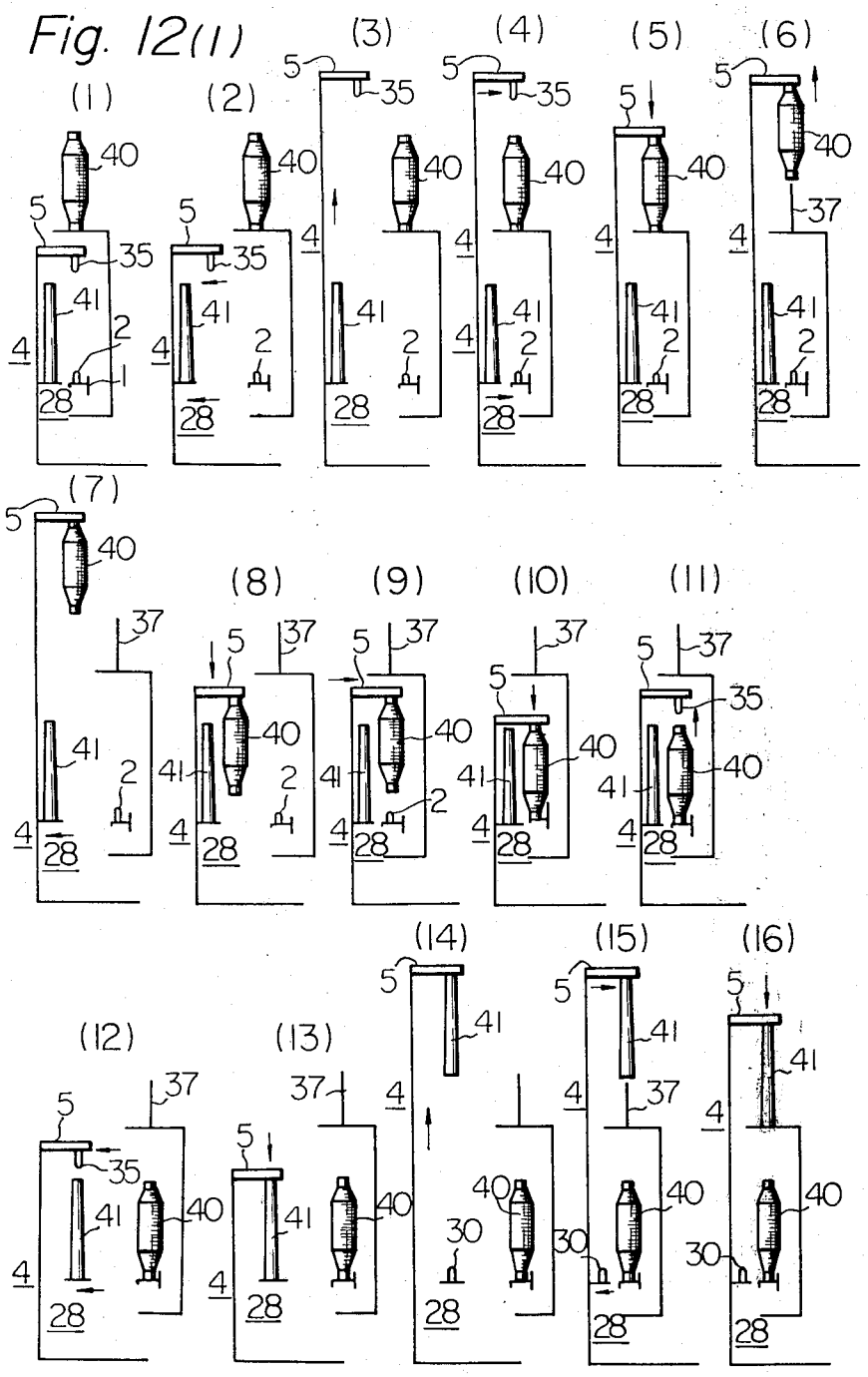
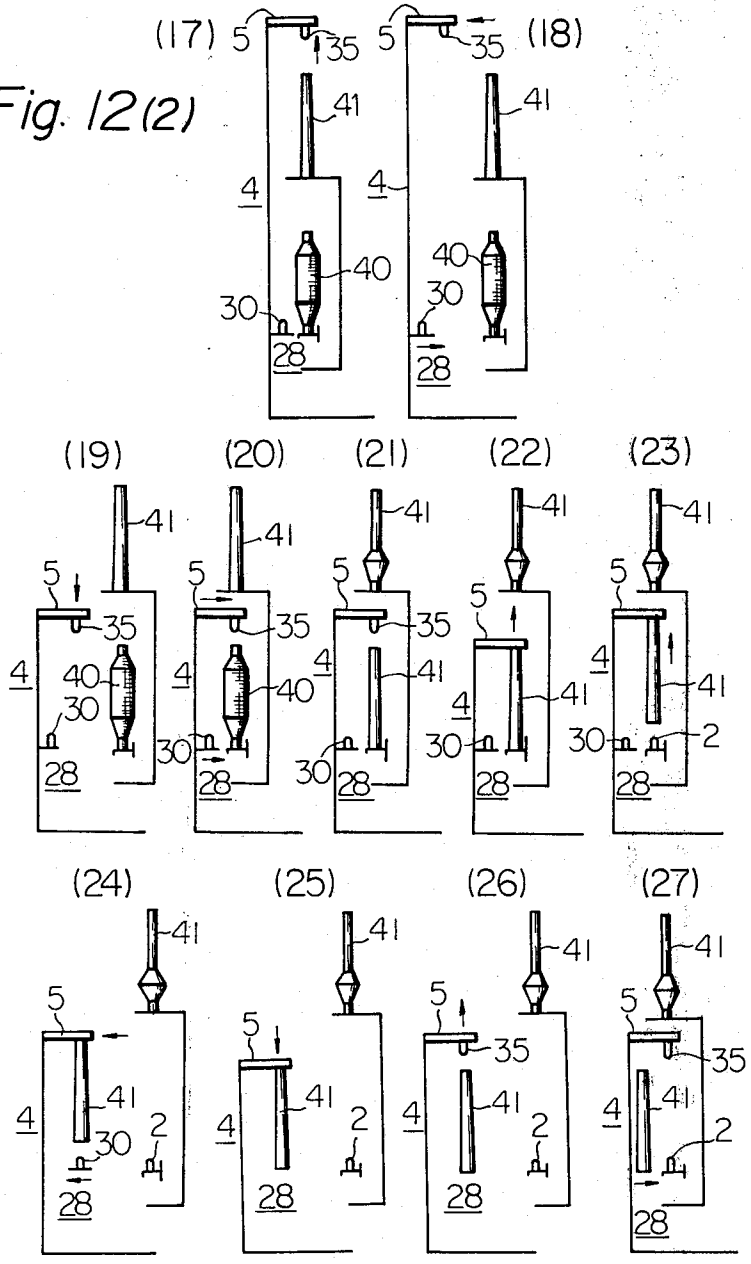


Fig. 12(2)



APPARATUS FOR SIMULTANEOUSLY DOFFING AND DONNING APPARATUS

The present invention relates to a simultaneous doffing and donning type apparatus usable for textile machines such as a ring spinning frame or a ring twisting frame. When all of the cops in said textile frame are filled, said apparatus doffs full packages from corresponding spindles on said frame and dons a number of empty bobbins equal to that of the full packages onto said spindles simultaneously and automatically.

In the known simultaneous doffing and donning type systems, a conveyor member is arranged parallel to and in front of the row of spindles on the machine, pegs are fixed on said member surface in alignment, with intervening distances equal to half the distance between neighbouring spindles (spindle pitch) and empty bobbins are mounted on alternate pegs. In the doffing sequence, full cops on the spindles are dismounted therefrom and transferred onto empty pegs on the conveyor member. After completion of doffing, the conveyor member is moved over a distance equal to half the spindle pitch so that the positions of the empty bobbins carried thereby are situated at positions just below the spindles which are now empty. In the subsequent donning sequence, empty bobbins are dismounted from the conveyor member and then transferred onto the spindles on the machine.

One of the drawbacks of such a simultaneous automatic doffing and donning apparatus, is that the diameter of a full package is inevitably limited by the arrangement of the pegs on the conveyor member.

To eliminate such a drawback, there was an attempt to arrange a row of auxiliary pegs between the spindle rail and the conveyor member onto which a row of pegs was arranged. In this arrangement, the necessity of moving the member over a distance equal to half the spindle pitch could be eliminated, but another drawback arose:

more space to be occupied by said auxiliary pegs was required, and at some time, the rearrangement of the spindle rail needed to be higher than ever from the floor surface.

In another arrangement of the auxiliary row of pegs, they were arranged parallel to and in front of the row of pegs on the conveyor member. One drawback of this arrangement is that, more floor space is required to be occupied by the apparatuses on both sides of the frame, because said auxiliary rows of pegs must be situated outside of the transporting apparatus for the full packages or empty bobbins so that the moving path of the full packages being transported will not be disturbed by the empty bobbins. An additional drawback is the difficulty in arranging an automatic machine attached to the frame, such as an automatic yarn piecing apparatus or automatic cleaning machine, to travel longitudinally along the sides of the frame.

An improved apparatus which eliminated the above-mentioned drawbacks, is provided with two kinds of holding devices, one for full packages and another for empty bobbins, at the top of the apparatus, so that either a full package or an empty bobbin can be held simultaneously and said apparatus is able to doff the full package from a spindle and also can don the empty bobbin thereon. But even with this apparatus, there are accompanying drawbacks. The mechanical structure is complicated by the provision of two kinds of holding devices within one apparatus and the size of the apparatus head is consequently increased.

The object of the present invention is to provide a simultaneous automatic doffing and donning apparatus with none of the above drawbacks. Furthermore, the aim is to provide good preparation of the empty bobbins and efficient conveying of the full packages out of the frame, together with simple construction and highly reliable operation of said apparatus. The peg arrangement of the present invention includes one row of auxiliary pegs for the empty bobbins, arranged outside of the longitudinal row of pegs on the conveyor member and a mechanism to make the auxiliary pegs swing within the horizontal plane, in such a way that when said pegs swing far away from the pegs on the conveyer member, said auxiliary pegs enter the same respective vertical planes as both side spindles and pegs on both conveyer members. In addition to this, a transporting apparatus for the full packages or the empty bobbins is provided, so that by means of the pantograph mechanism and the outwardly displacing device of said apparatus said package or bobbin can be displaced vertically, while the horizontal displacement of it takes place although the vertical arrangement of the pantograph mechanism is maintained.

In the present invention, by providing that the auxiliary row of pegs can swing horizontally when full packages are transported from the spindle to the pegs on the conveyor member, their movement is by no means disturbed by the empty bobbins already mounted on the auxiliary pegs. Furthermore, when the transporting device approaches the pegs on the conveyer member, the arrangement of the pegs on the conveyer member to the auxiliary pegs is angled, which means that full packages of larger diameter can be accommodated by this apparatus. In addition, when the apparatus is in operation, the maximum width occupied by both sides of the apparatus becomes greater than when the apparatus is not in operation. Thus no space problems are encountered in performing maintenance on the spinners during the normal spinning operation, because the entire width of the apparatus is sufficient to permit such maintenance. This is because during the normal spinning operation the auxiliary pegs on the apparatus are located as close as possible, in an angled arrangement, to the pegs on the conveyer member.

A feature of the apparatus of the present invention, is its easy accommodation to the frame of automatic machines, such as automatic yarn piecing machines, because the apparatus of the present invention is situated beneath the spindle rail, and may be as close as possible to the frame.

Another feature of the apparatus of the present invention is that it can be accommodated to any type of existing frame with a minimum of additional floor space.

Still another feature of the apparatus of the present invention is that it is provided with an improved air-operated holding device, which can easily be inserted into the top hole of the bobbin with no chance of damage to the holding member and even if compressed air is supplied to this device in the absence of a bobbin, no damage to said device occurs.

Further features of the present invention will become clear from the ensuing description, reference being made to the accompanying drawings, wherein:

FIG. 1 is a side view of a spinning frame accommodating the apparatus of the present invention;

FIG. 2 is a plan view of the frame of FIG. 1, showing the arrangement of the pegs and auxiliary pegs in their operating positions;

FIG. 3 is a sectional view of the frame shown in FIG. 1;

FIG. 4 is a more detailed side view of the frame shown in FIG. 1;

FIG. 5 is a partial plan view of the two kinds of pegs in non-operating positions;

FIG. 6 is a similar view to FIG. 5, showing the pegs in operating positions;

FIG. 7 is an enlarged perspective view of the arrangement of two kinds of pegs;

FIG. 8 is sectional view similar to FIG. 3 but with an automatic yarn piecing machine included;

FIG. 9 is a sectional view of the holding device of the present invention;

FIG. 10 shows the relation of the holding device to the empty bobbin when both are engaged with each other;

FIG. 11 shows a sectional view of another embodiment of the present invention;

FIGS. 12 (1) and 12 (2) include rough sketches showing each step of the operation in sequence within one cycle of the automatic doffing and donning operation.

The endless conveyer belt 1, shown in FIGS. 1, 3 and 7, can be moved by a driving apparatus (not shown in the drawings) and is guided by a plurality of guide brackets arranged at the lower part of the frame 55. As shown in FIGS. 4 and 7, a row of pegs 2 is mounted on said conveyer belt 1 in such a manner that the pegs 2 are spaced from each other at a distance l_1 equal to the distance l between neighbouring spindles on the machine as shown in FIG. 4. This distance l is hereinafter referred to as the spindle pitch l. The conveyer belt 1 is arranged as shown in FIG. 3, beneath the line of spindles 37. In such an arrangement all of the pegs 2 on the conveyer belt 1 can be situated below of and in line with the respective spindle 37 during doffing and donning operations. Within the cycle of the doffing and donning operation, after the full package doffed from the spindle is inserted on the peg 2 of the conveyer belt 1, the conveyer belt 1 begins to travel along the side of the frame 55, so that the full package can be removed from the peg 2 and a new empty bobbin can be installed on said peg 2 by means of a suitable automatic device, while the conveyer belt 1 is moving. When the conveyer belt 1 completes one cycle of movement, all of the pegs are all situated in line with the spindles respectively.

The drawings and above description, are directed to one embodiment of the peg conveyer member wherein a conveyer belt 1 is used, however, other types of conveyer members may be similarly used for the apparatus of the present invention.

As shown in FIGS. 5 through 7, the auxiliary peg apparatus 28 provides a peg supporting bar 29 of the same length as the ring rail 42, shown in FIG. 4, onto which the same number of auxiliary pegs 30 as there are spindles 37 are arranged at a distance l_2 as shown in FIGS. 4 and 7, which is equal to the spindle pitch l as shown in FIG. 4. As shown in FIGS. 5 and 6, said bar 29 is supported by a housing bracket 20, via a plurality of hinged arms 31, one end of each arm being pivotally mounted on the housing bracket 20 by means of a stud 34, and the other end of each arm being pivotally connected to the peg supporting bar 29. There is provided a tension type spring 32 arranged between said housing bracket 20 and the peg supporting bar 29 as shown in FIGS. 5 and 6. By the provision of this spring 32, the peg supporting bar 29 is always urged toward the transporting device to move the bar away from the pegs 2 on the conveyer belt 1.

Such horizontal swing of the peg supporting bar 29 can be restricted by providing a stopper 33 on the housing bracket 20. The vertical plane 36 shown in FIGS. 5 and 6 represents a plurality of corresponding vertical planes 36 which are perpendicular to the length of the frame and equal in number to the number of spindles 37 within one row. Consequently the provision of said stopper 33 acts to stop movement of the peg supporting bar 29 after anyone of the auxiliary pegs 30 on it enters the respective vertical plane 36. The swinging movement of the peg supporting bar 29 takes place following the outward displacement of the transporting device and continues until said auxiliary peg 30 can enter the vertical plane 36. Consequently, the swinging movement of said peg supporting bar 29 takes place from the ready position as shown in FIG. 5 to the operating position as shown in FIG. 6, along with the outward displacement of the transporting device. After the stopper 33 acts to restrict the swinging movement of the peg supporting bar 29, no further swinging movement of the peg supporting bar 29 occurs even if further outward displacement of the transporting device takes place. This means that, in the ready position as shown in FIG. 5, the auxiliary pegs 30 of the auxiliary peg apparatus 28 are situated out of their respective vertical planes 36, while the pegs 2 of the conveyer belt 1 are situated within their respective vertical planes 36, i.e., the same as their operating position shown in FIG. 6. In said operating position, the holding devices, which are hereinafter described, are preferably situated between respective spindles 37 and pegs 2 and all three of these in each respective group are located in line with each other. Within the horizontal plane the distance between one of the auxiliary pegs 30 and the closest pegs 2 on the conveyer belt 1 is preferably more than half of the spindle pitch l, but more preferably, the auxiliary pegs 30 are located halfway between pegs 2 in an angled relation.

A transporting device for the full package or the empty bobbin 41, as shown in FIGS. 3 and 4, comprises a pantograph mechanism 4 provided with a doffing bar 5 at its top portion, so that said doffing bar 5 is displaced vertically by the pantograph motion, and an outwardly displacing device 8 which displaces the pantograph mechanism 4 horizontally and away from the frame while maintaining the vertical arrangement of said mechanism. The outwardly displacing device 8, as shown in FIG. 3, comprising a housing bracket 20, is mounted on the frame 55, horizontally and perpendicular to the longitudinal axis of the frame 55. Into the two side cylindrical guide holes of said housing bracket 20 the horizontally extendable pipes 9 and 9', are slidably mounted respectively, and onto said pipes 9 and 9', a supporting bracket 10 is fixed. Both left hand 22 and right hand 22' threads of the threaded shaft 21 are screwed into holes of said pipes 9 and 9' and at the center of said threaded shaft 21 a helical gear 24 is mounted thereon. A longitudinal shaft 25 driven by

motor 27, as shown in FIG. 5, is provided and onto said shaft 25 a helical gear 26 which is in gear with helical gear 24 is mounted. The motor 27 can selectively rotate in either a clockwise or counterclockwise direction. Both helical gears 24 and 26 are housed within the housing bracket 20 so as to be always in gear with each other.

The pantograph mechanism 4, as shown in FIG. 4, includes a doffing bar 5, a plurality of first link arms 51, the top end of each arm being pivotally connected to said doffing bar 5 by means of a pin 53, and a plurality of second link arms 52 half the length of the first link arms 51, the top end of each second link being pivotally connected to the center of each first link arm 5 by means of pin 53*a*. The bottom ends of the first and second link arms are respectively pivotally connected to the arm bracket 18 fixedly mounted on the longitudinal rod 6 and to a support arm provided on the housing bracket 20 as shown in FIGS. 3, 5 and 6 by means of pins 53*b* and 53*c*. Said longitudinal rod 6 is supported by a plurality of supporting brackets 10, 10′ and slides lengthwise within the bearing holes of said supporting brackets 10, 10′. As shown in FIGS. 4 through 6, an end portion of said longitudinal rod 6, which extends approximately the whole length of the frame, is provided with a long thread 7. A bevel gear 11 with a threaded hole is mounted on said long screw 7 in threaded engagement and longitudinal movement of said bevel gear 11 is restricted by the side face of the supporting bracket 10. A bevel gear 13 which is in gear with the bevel gear 11 is mounted on a spline shaft 16 of a motor 15, as shown in FIGS. 5 and 6, by means of splined engagement. This motor 15 can selectively rotate in either a clockwise or counterclockwise direction. In this construction, if the bevel gear 11 is turned in either direction, the longitudinal rod 6 may move to the left or right, and an arm bracket 18 fixed on the rod 6 may approach or move away from the supporting bracket 10. As a result of this action, the doffing bar 5 can be displaced upwardly or downwardly, via the pantograph mechanism 4.

On the doffing bar 5 are provided a row of holding devices 35, the number of which is equal to the number of spindles 37, and pitch l_3 of holding devices 35, which is equal to the spindle pitch l, separates each holding device. These holding devices 35 are always positioned in their respective vertical planes 36. The holding device 35 is preferably a device which is operated by compressed air supplied from a compressor (not shown), to firmly hold the full bobbin 40 or empty bobbin 41 or to release them.

The holding device 35 as shown in FIG. 9, consists of an inserter 43 and an expandable member 45 with an air inlet pipe 46. The inserter 43 is fixed to the doffing bar 5 by inserting its cylindrical end into the corresponding holes provided on the doffing bar 5 and fixing it to the doffing bar 5 by means of a flange 47 of said inserter 43 and a displaceable lip 48 provided on the upper part of said inserter 43. In the center cavity of said inserter 43, an expandable member 45 connected to an air inlet pipe 46 is arranged, and this pipe 46 is fixed to the doffing bar 5 by means of some type of pipe holder which is provided on the upper surface of the doffing bar 5. Onto one side of the inserter 43, a flexible hinge 44 with a jaw 47 thereon is provided so that said flexible hinge 44 may be outwardly deformed when compressed air is injected into the expandable member 45 enabling the hinge to come into contact with the inner surface of the hole of the empty bobbin 41, as shown in FIG. 10. In such a case, the exterior of said deformed expandable member 45 is in close contact with the inner surface of the cavity of the inserter 43. The outside of said hinge 44 closely contacts the inner surface of the empty bobbin 41 when the expandable member 45 expands, after said inserter 43 passes through the top of the hole of the empty bobbin 41.

As the empty bobbin 41 is provided with an inwardly projecting ring, as shown in FIG. 10, of smaller diameter that the inner surface of the empty bobbin 41, when the doffing bar 5 is moved vertically by the pantograph mechanism 4, the hinge 44 will be slid vertically along the axis of said bobbin 41 and finally the hinge 44 will engage the under surface of the inwardly projecting ring. After engagement of the bottom surface of said inwardly projecting ring and the jaw 47 is accomplished, the empty bobbin 41 may be displaced vertically upward by the further upward displacement of the doffing bar 5.

This means that with vertical displacement of the doffing bar 5 together with the bobbin, after engagement of the inserter 43 and the full bobbin 40 or the empty bobbin 41, takes place, doffing the full package 40 from the spindle 37 and also taking up an empty bobbin 41 from the auxiliary peg 30 can be accomplished.

When compressed air is released from said expandable member 45, disengagement of the inserter 43 and the empty bobbin 41 occurs immediately and the inserter 43 may be moved vertically out of the empty bobbin 41 with no difficulty. The injection and the release of compressed air into and from the expandable member 45 via the air inlet pipe 46 can be controlled at will.

As shown in FIGS. 9 and 10, the construction of this holding device is very simple and its operation is reliable as long as the expandable member 45 is enlarged by compressed air.

In the improved embodiment shown in FIG. 11, an additional helical spring 50 is provided between flange 47 of the inserter 43 and the lower surface of the doffing bar 5 to compensate for any difference in height between the tops of the bobbins 41 after they are mounted onto the respective spindles 37.

The holding device 35 of the present invention is provided with an expandable member 45 which is housed within the inserter 43, allowing no opportunity for said expandable member 45 to be damaged, even in the event that the compressed air is charged into said expandable member 45 in the absence of a bobbin. Furthermore no damage will occur to the top of the empty bobbin 41 when said inserter 43 is inserted into the top of the hole of the empty bobbin 41. Insertion, in this case can be accomplished free of trouble because said inserter 43 may be easily guided by the top of the hole of the empty bobbin 41.

The present doffing and donning apparatus operates in the following manner. In the ready position of the mechanism, as indicated by solid lines in FIGS. 3 and 4, the pantograph mechanism 4 is situated at its innermost position and the doffing bar 5 is situated at its lowered position. All of the empty bobbins 41 mounted on the auxiliary pegs 30 are situated out of their respective vertical planes 36, while the pegs 2 on the conveyer

belt 1 are situated in their respective vertical plane 36. In such a case, as shown in FIG. 12–(1), within each vertical plane 36 are a spindle 37 mounted with a full package 40, a holding device 35 of the doffing bar 5, and a peg 2 on the conveyer belt 1, but the auxiliary pegs 30 on the auxiliary peg apparatus 28 with the empty bobbins 41 are located out of their respective vertical planes 36.

When package 40 is filled, the doffing operation for said full package begins after the operation of the frame is stopped. Firstly, motor 27 as shown in FIGS. 3 and 5 turns the longitudinal shaft 25, the gears 24 and 26, and the threaded shaft 21, as shown in FIG. 3, toward one given direction. Then the horizontally extendable pipes 9 and 9' project outwardly from the housing bracket 20. By this operation, the doffing bar 5 of the pantograph mechanism 4 is displaced to the position shown in FIG. 6 and FIG. 12–(2). This displacement of the mechanism 4 is accompanied by the outward swing of the peg supporting bar 29 until the stopper 33 stops this movement, i.e., each of the auxiliary peg 30 with empty bobbin 41 enters the respective vertical plane 36.

If motor 15 in FIG. 5 turns in one given direction, the longitudinal rod 6 will be moved toward the left of the drawing via the rotations of the bevel gears 11 and 13. Consequently, the arm bracket 18 fixed on said longitudinal rod 6 approaches the supporting bracket 10 and as a result of this movement, the doffing bar 5 can be lifted upwardly and can enter the position 5a shown by the bar and dot line in FIG. 4 and also as shown in FIG. 12–(3).

Next, motor 27 rotates in a reverse direction and both horizontally extended pipes 9, 9' more closer to each other, enabling the holding device 35 to be directly above and in line with the axis of the full package 40 as shown in FIG. 12–(4). In this case, the peg supporting bar 29 is displaced by the movement of the pantograph mechanism 4 and finally, can return to its ready position, on which position the auxiliary peg 30 with the empty bobbin 41 moves outwardly from the vertical plane 36 as shown in FIG. 12–(1).

If the doffing bar 5 is lowered vertically by the reverse rotation of the motor 15, the holding device 35 can hold the full package 40, after inserting said device 35 into the top of the hole of the full package 40, as shown in FIG. 12–(5).

If the motor 15 again rotates in one given direction, the doffing bar 5 will be lifted vertically to the height indicated by 5a in FIG. 4. This means that the holding device 35 together with the full package 40 is moved away from the spindle 37 as shown in FIG. 12–(6).

By the rotation of the motor 27 in one given direction, the doffing bar 5 will be displaced outwardly and horizontally to the position shown in FIG. 12–(7).

Then, by the reverse rotation of the motor 15, the doffing bar 5 together with the holding device 35 and the full package 40 will be lowered to the height shown in FIG. 12–(8).

When the motor 27 turns in the reverse direction, the doffing bar 5 will be moved horizontally to the position shown in FIG. 12–(1), and the full bobbin 40 held by the holding device 35 is positioned just above and in line with the peg 2 as shown in FIG. 12–(9).

Then, by reverse rotation of the motor 15, the doffing bar 5 will be lowered vertically and the full package 40 can be transported to and inserted on the peg 2 as shown in FIG. 12–(10), after which the full package 40 is released from the holding device 35.

By the rotation of the motor 15 in one given direction, the doffing bar 5 will be lifted vertically and will enter the position shown in FIG. 12–(11), which is the same as that shown in FIG. 12–(1).

During the cycle of operation as depicted by FIG. 12–(1) through FIG. 12–(11), the full package 40 is doffed from the spindle 37 and is transported to the peg 2.

The donning sequence of the empty bobbin 41 onto the spindle 37 is accomplished by the following steps.

When the motor 27 turns in its one given direction, the doffing bar 5 will be displaced outwardly and horizontally as shown in FIG. 6 and in this position, both doffing bars arranged at the both sides of the frame are maximally separated from each other. During this horizontal displacement of the doffing bar 5 of the pantograph mechanism 4, initially the horizontal swing of the auxiliary peg apparatus 28 takes place until its swing is restricted by the stopper 33, so that any one of the auxiliary peg 30 can enter and locate in the respective vertical plane 36. But, by further horizontal movement of the pantograph mechanism 4, the auxiliary peg apparatus 28 can be completely freed from the influence of the movement of the pantograph mechanism 4 and both are completely separated from each other. Thus, the holding device 35 on the pantograph mechanism 4 can enter the position wherein both the holding device 35 and the auxiliary peg 30 are in line with each other, as shown in FIG. 12–(12).

By the reverse rotation of the motor 15, the doffing bar 5 will be lowered vertically to the position, which allows the holding device 35 to engage with the empty bobbin 41, as shown in FIG. 12–(13).

The empty bobbin 41 thus held by the holding device 35 of the pantograph mechanism 4 can be transported from the auxiliary peg 30 and donned on the spindle by the steps depicted in FIG. 12–(14) through FIG. 12–(16), by rotations in either the one given or reverse direction of the motors 15 and 27.

After releasing the empty bobbin 41 from the holding device 35, the doffing bar 5 of the pantograph mechanism 4 can be returned to its ready position by the steps depicted in FIG. 12–(17) through FIG. 12–(20), by rotations in either the one given or reverse direction of the motors 15 and 27, and thus, a cycle involving the doffing of the full package 40 and the donning of the empty bobbin 41 can be completed.

The normal spinning operation of the frame can be started from the step shown in FIG. 12–(19).

During the normal spinning operation of the frame, the conveyer belt 1 moves in its given direction and carries the doffed full package 40 on its peg 2, so that the full package 40 can enter the convenient automatic replacing station, not shown in the drawings. In this station, the full package 40 can be removed from the peg 2 and transported away from the frame to be conveyed to a given position, or to be packed into a given container. And on the bare peg 2, new empty bobbin 41 will be placed. By the movement of the conveyer belt 1, all of such empty bobbins 41 can be positioned in their given respective vertical planes 36, as shown in FIG. 12–(21).

The transportation of the empty bobbin 41 from peg 2 to the auxiliary peg 30 can be accomplished by the steps depicted in FIG. 12–(22) through FIG. 14–(27)

by means of the rotation of the motors **15** and **27** in either their one given or reverse directions. The preparation of the empty bobbin **41** would then be complete and said bobbin **41** would be ready for the next donning operation.

The above-mentioned sequences of rotations of the motors **15** and **27** and time intervals can be controlled by a conventional controlling apparatus not shown in the drawings.

If provision of a guide rail **38** for the automatic yarn piecing apparatus **39** is required, said guide rail **38** can be attached to the side of the supporting brackets **10**, 10', as shown in FIG. **8**. This arrangement can strengthen the construction of the pantograph mechanism **4**.

The auxiliary peg apparatus **28** of the present invention is designed to be very simple, but its operation is highly reliable. Furthermore, the moving path of the full packages being transported will not be disturbed by the empty bobbins, due to the arrangement of the auxiliary peg apparatus **28**, which provides a horizontally swingable peg supporting bar **29**, and the swing of said peg supporting bar **29** occurs relative to the horizontal displacement of the pantograph mechanism **4**. Furthermore, any one of the auxiliary peg **30** of the apparatus **28** can enter the respective vertical plane **36** in its operational position, while the auxiliary pegs **30** and pegs **2** are arranged zig-zag when both rows of pegs are in a position closest to each other.

The floor space occupied by the automatic doffing apparatus of the present invention is widened only when the doffing and donning operation are taking place. Otherwise, when said operation is completed, the required space becomes rather narrow. After such space occupied by the apparatus is narrow, there is no trouble in accommodating a travelling automatic device to the frame. Furthermore there is no space trouble when maintenance on the spinners is performed.

As for the holding device of the empty bobbin, in the present invention, it is provided with an inserter **43** and an expandable member **45**, into which compressed air is injected, rendering construction very simple and engagement to the empty bobbin flexible, and eliminating any chance of damage to either the holding device or the empty bobbin.

In addition to this, the advantage of the automatic doffing and donning apparatus of the present invention is such in that the apparatus can be easily assembled to the conventional spinning frame already installed, without the need for vast changes in the frame.

What is claimed is:

1. In a simultaneous doffing and donning apparatus usable for textile machines, such as a ring spinning frame, the combination comprising:

a conveyer mechanism including a conveyer member (**1**) movable along the sides of the frame and parallel to a row of spindles (**37**), on which conveyer member a row of pegs (**2**) are disposed and are spaced longitudinally along said member, their pitch being equal to the spindle pitch;

an auxiliary peg apparatus (**28**) arranged parallel to the row of pegs (**2**) on the conveyer member (**1**), and movable horizontally so as to change the distance between the row of pegs and the row of auxiliary pegs (**30**), i.e., the closest position being the ready position and the outermost position being the operating position.

2. The combination as defined in claim **1**, wherein:

said auxiliary peg apparatus (**28**) is constructed to move the auxiliary pegs in the same horizontal plane in which the row of pegs (**2**) on the conveyer belt is located and wherein said combination further includes,

a stopper (**33**) for arresting the movement of the auxiliary peg apparatus (**28**) when the auxiliary pegs (**30**) enter the respective vertical planes (**36**).

3. The combination of claim **1** wherein, when the auxiliary pegs (**30**) are in the closest position to said frame, they respectively are in an angled relation to said pegs (**2**) and when said auxiliary pegs (**30**) are in the outermost position the auxiliary pegs (**30**) are respectively in the same vertical planes as the pegs (**2**), said planes being substantially perpendicular to the axes of the sides of said frame.

4. The combination of claim **1** with the addition of:

a doffing bar (**5**) provided with a row of spaced holding devices (**35**) respectively aligned with and parallel to said row of spindles, the pitch of the holding devices being equal to the pitch of the spindles, said bar being horizontally and vertically movable so that the holding devices can be respectively displaced within the said respective vertical planes.

5. The combination as defined in claim **4** wherein each holding device (**35**) comprises

an inserter (**43**) made of flexible material provided with a flexible hinge (**44**) which projects into a cavity in said inserter, said inserter being attached to the doffing bar (**5**); and

an expandable member (**45**) arranged in the center of and within the cavity of said inserter (**43**) and connected to an air inlet pipe (**46**).

6. The combination according to claim **4** with the addition of a displacing mechanism for displacing the doffing bar (**5**) vertically as well as outwardly or inwardly from the frame.

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