

[54] **ROTARY DOFFER IN AUTOMATIC DOFFING APPARATUS**

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[51] Int. Cl. **D01h 9/10**

[58] Field of Search. **57/34 R, 52, 53; 242/18 R, 242/35.5 R, 35.5 A, 35.6 R**

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[57] **ABSTRACT**

An automatic doffing apparatus adapted for use with spinning machinery having a plurality of spinning units arranged in side-by-side relation, for doffing full packages one by one from the respective spinning units during operation of the spinning machinery while travelling along the front of the spinning machinery. The doffing apparatus includes a rotary doffer, which comprises a cam for releasing a bobbin holder of each spinning unit holding the full package, a first package receiving and transporting plate for demounting the package from the bobbin holder and receiving the demounted package, and a second package receiving and transporting plate for receiving the demounted package from the first package receiving and transporting plate and transporting it to a predetermined position, from which the full packages are transferred to a package container. Both the plates are associated with respective cams so that they perform their abovedescribed functions sequentially according to a predetermined program.

5 Claims, 13 Drawing Figures

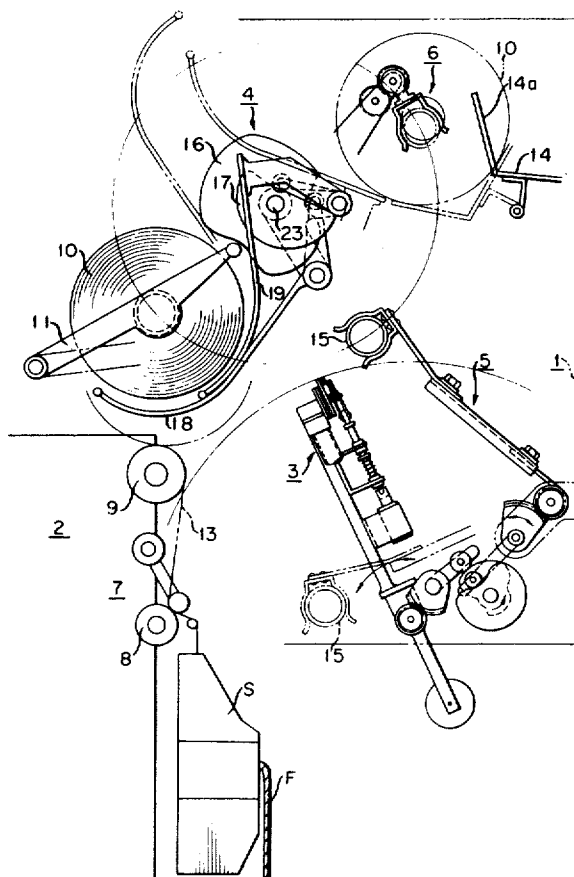


FIG. 1

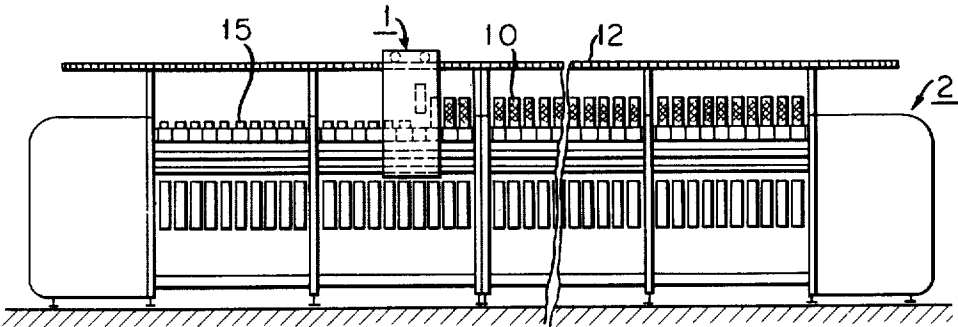
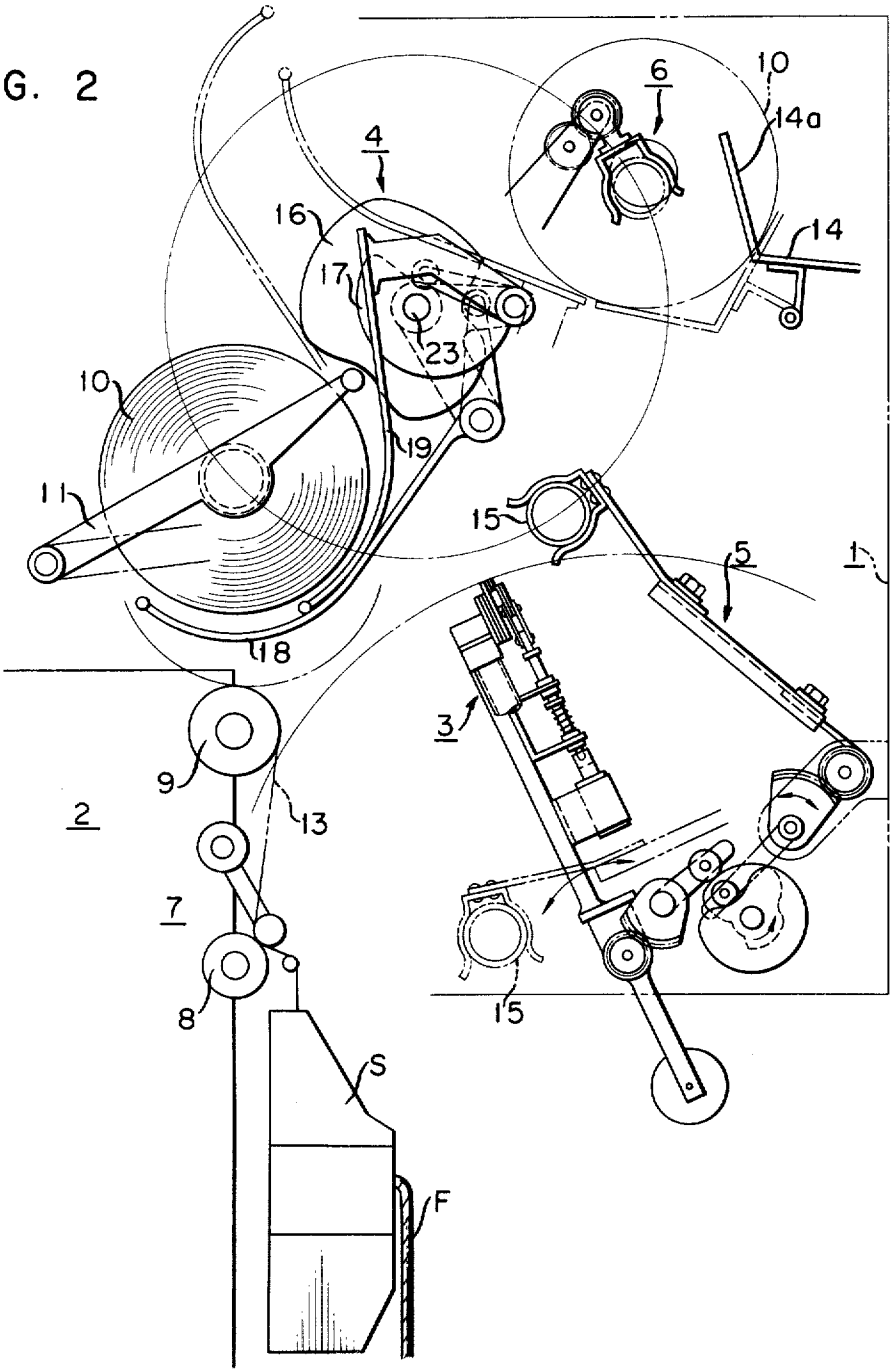
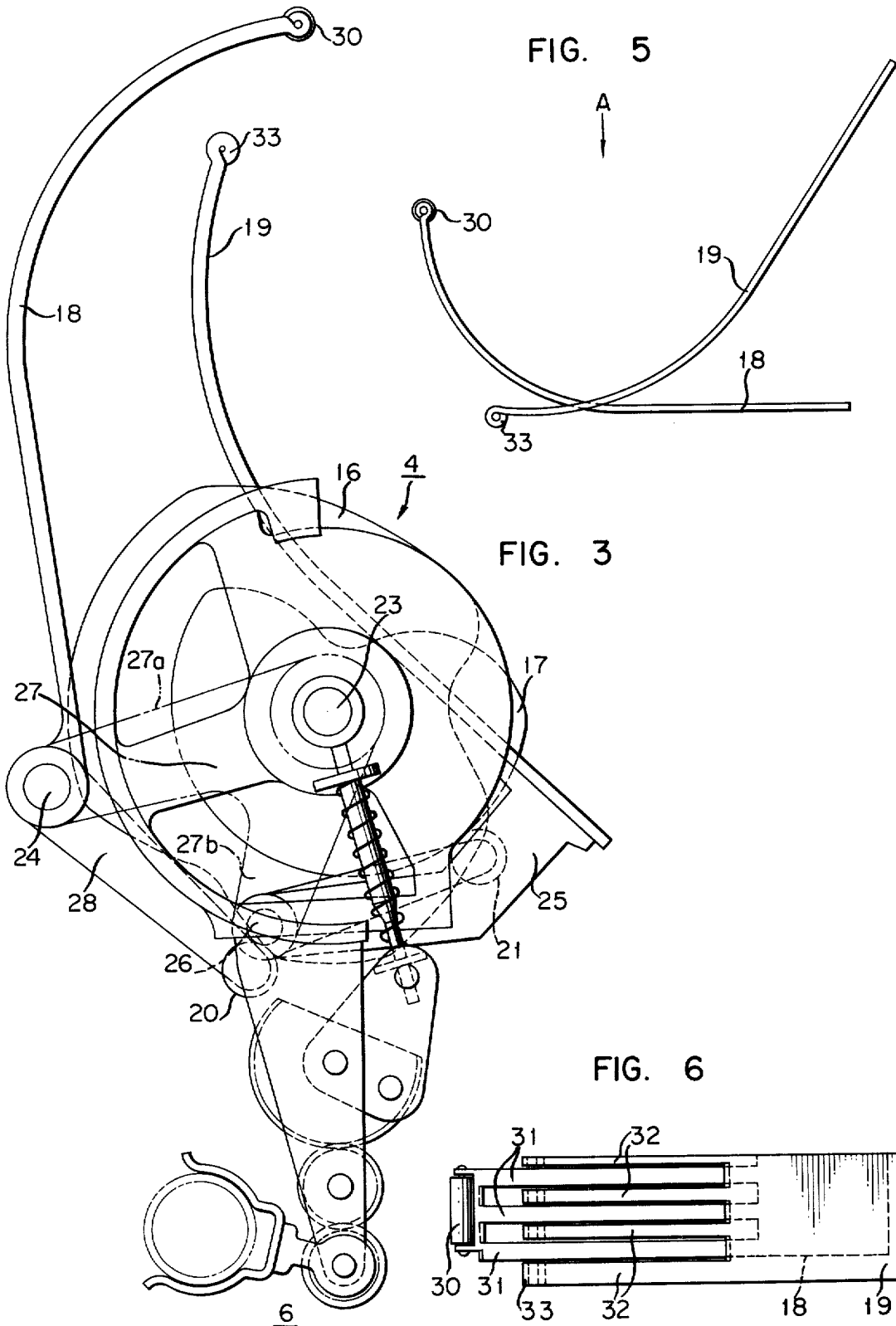


FIG. 2





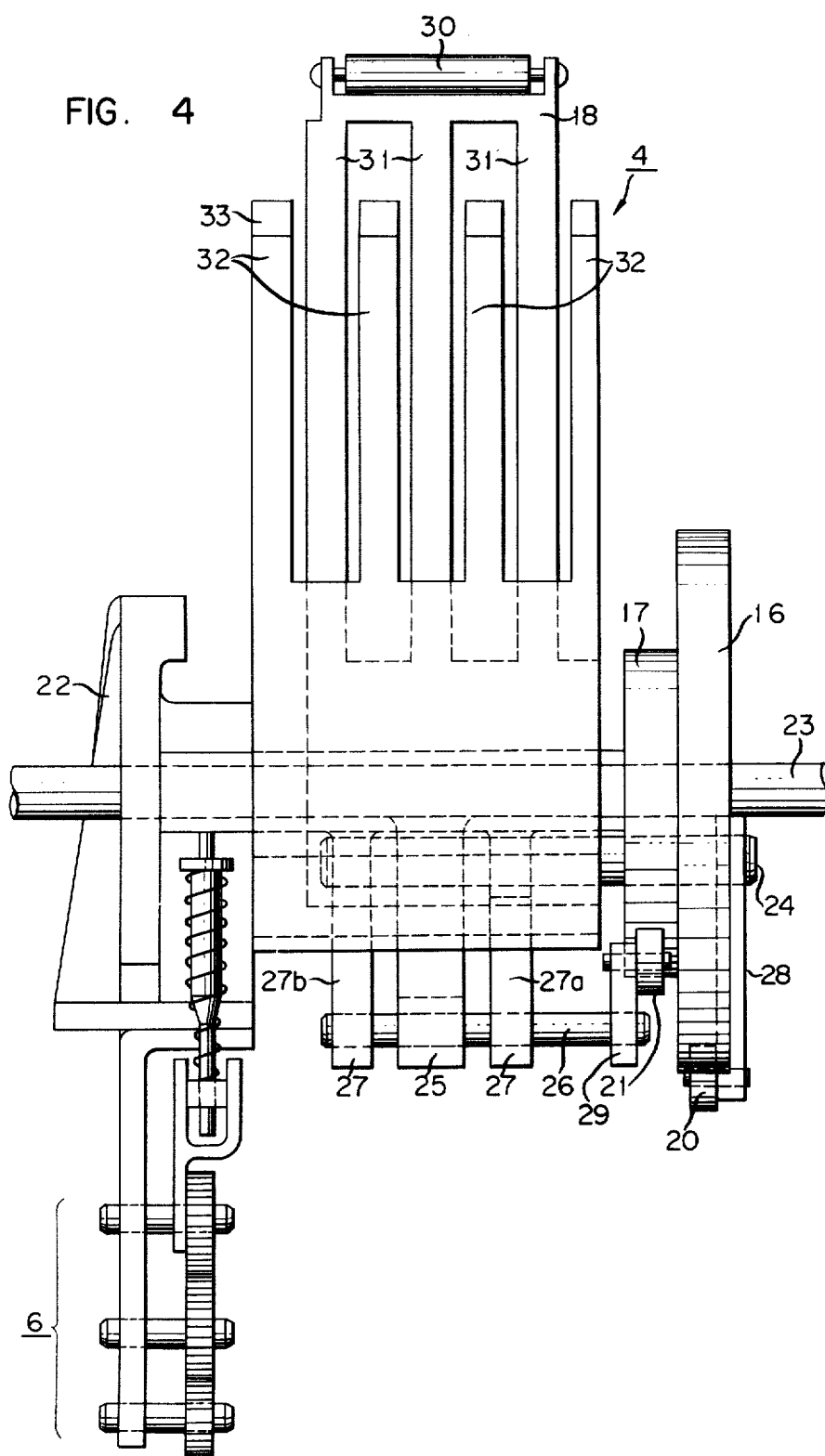


FIG. 7

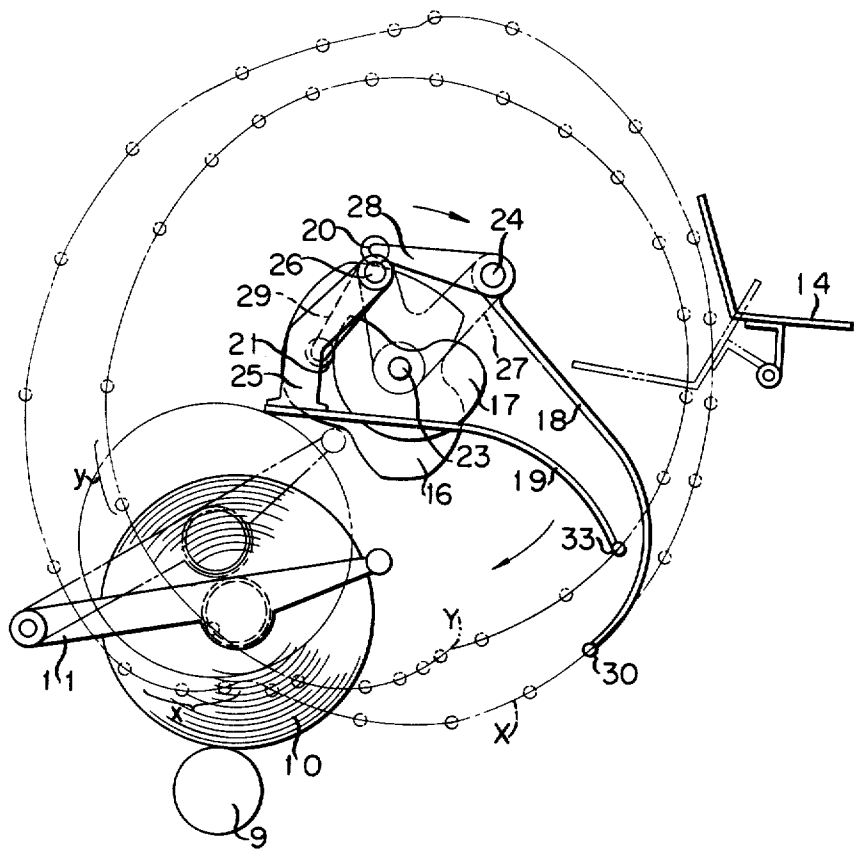


FIG. 8

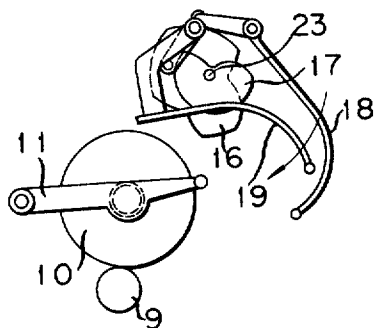


FIG. 9

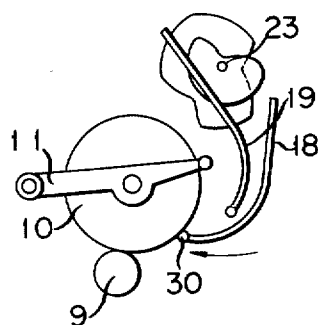


FIG. 10

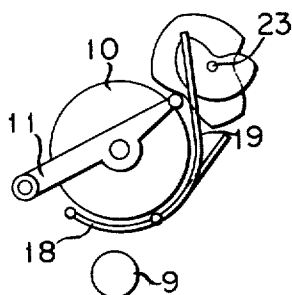


FIG. 11

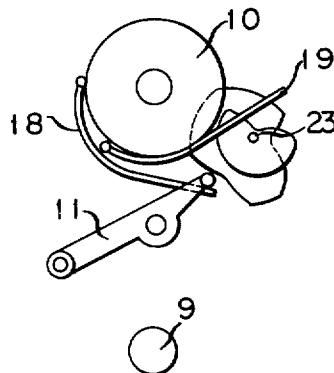


FIG. 12

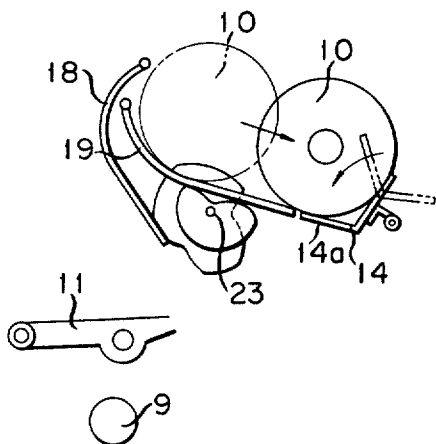
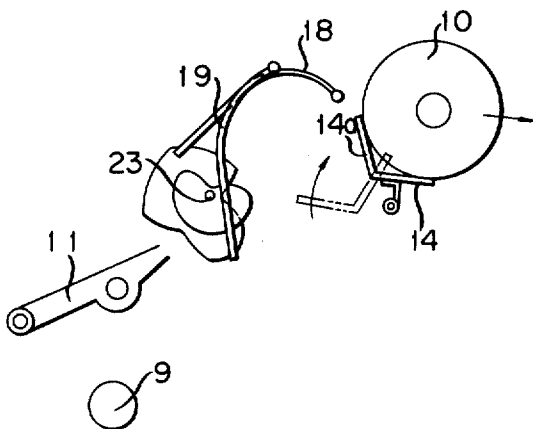


FIG. 13



ROTARY DOFFER IN AUTOMATIC DOFFING APPARATUS

BACKGROUND OF THE INVENTION

This invention relates to an automatic doffing apparatus adapted for use with spinning machines, such for example as, an open end spinning machine, a cheese or package winding machine, and the like and more particularly to a rotary doffer of the doffing apparatus of the type described.

In general, an automatic doffing apparatus, mounted on a spinning machine having a plurality of spinning units arranged in side-by-side relation, operates to demount full packages one by one from the respective spinning units and apply empty bobbins to the spinning units, from which the full bobbins or packages have been doffed, during operation of the spinning machine while travelling along the front of the spinning machine. As is known, the spinning units of the spinning machine are disposed at small intervals along the front of the spinning machine and the doffing apparatus takes short time to pass through each space between the adjacent spinning units. Therefore, it is very difficult to perform the doffing operation during such a short time. Especially, in the case of an open end spinning machine wherein each package is held by a bobbin holder, the doffing apparatus and the package which have just been demounted from the holder and are being carried by the doffing apparatus are apt to frequently abut against a portion of the bobbin holder during the doffing operation and travel along the front of the open end spinning machine and therefore the doffing operation must be completed before the package and the doffing apparatus come in contact with the bobbin holder. In order to achieve this requirement, it has been required to provide an automatic doffing apparatus capable of completing a doffing operation in a very short time.

SUMMARY OF THE INVENTION

It is accordingly an object of this invention to provide an automatic doffing apparatus including an improved rotary doffer by which a doffing operation can be accomplished speedily, smoothly and accurately.

The above and further objects of this invention can be achieved by providing a rotary doffer for an automatic doffing apparatus adapted for use with a spinning machine having a plurality of spinning units arranged in side-by-side relation, for performing a doffing operation of demounting full packages one by one from the respective spinning units and applying empty bobbins to the spinning units, from which the full packages have been demounted, while travelling along the front of the spinning machine during operation of the same, the rotary doffer comprising a rotary shaft, a support fixedly secured to said rotary shaft, a pair of first and second package receiving and transporting members mounted for pivotal motion on said support, and a pair of cam means associated respectively with the first and second members to cause the first and second members to move with different motions so that a portion of the doffing operation is shared by the first and second members and the shared portion of the doffing operation is performed sequentially when the rotary shaft rotates.

The first and second cam means comprise cam surfaces, which cause the different motions of the first and

second members. That is, during a constant speed rotation of the rotary doffer about the rotary shaft, the free end of the first member comes, in advance of the second member, in contact with the package to be doffed and pushes the package upwardly to a predetermined position and then moves substantially horizontally. Thus the package is received by the first member located below the package substantially in the predetermined position. In the meantime, the second member follows the first member and attains such a state that it also contacts the package substantially in the predetermined position. Incident to further rotation of the rotary doffer, the first and second cam means impart particular motions respectively to the first and second members so that the package carried on the first member is transferred onto the second member. The first and second cam means further operate to impart the quick pivotal motions to the first and second members after completion of the transfer of the package between the first and second members.

BRIEF DESCRIPTION OF THE DRAWINGS

The invention will become more readily apparent from the following detailed description taken in conjunction with the accompanying drawings in which:

FIG. 1 is a diagrammatical front view showing a spinning machine with an automatic doffing apparatus;

FIG. 2 is a side elevational view showing a spinning unit of the spinning machine and essential parts of the automatic doffing apparatus shown in FIG. 1;

FIG. 3 is a side elevational view of a rotary doffer in the doffing apparatus according to the present invention;

FIG. 4 is a front view of the rotary doffer shown in FIG. 3;

FIG. 5 is a side elevational view of first and second package receiving and transporting plates of the rotary doffer, the plates being shown intersected with each other;

FIG. 6 is a view of the first and second package receiving and transporting plates as viewed from a direction A shown in FIG. 5;

FIG. 7 is a view illustrating loci of the first and second package receiving and transporting plates; and

FIGS. 8 to 13 are views illustrating the doffing operation of the rotary doffer in sequence.

DESCRIPTION OF THE PREFERRED EMBODIMENT

Referring to the drawings, and more particularly to FIG. 1, there is diagrammatically shown, by way of example, an open end spinning machine 2 comprising an automatic doffing apparatus 1 adapted to be mounted on the spinning machine 2 to move along the front thereof while engaging a rack 12 for doffing full packages 10 one by one from respective spinning units and applying empty bobbins 15 to respective bobbin holders 11 (see FIG. 2), from which the full bobbins or packages 10 have been doffed.

In FIG. 2, part of the open end spinning machine 2 and essential parts of the doffing apparatus 1 are shown on an enlarged scale. The spinning machine 2 has a plurality of spinning units 7 arranged in side-by-side relation. In the spinning unit 7, reference numeral S designates a spinning part including a feed roller, a fiber opening mechanism, a rotary spinning chamber and a yarn outlet tube, by which a sliver F from a sliver can

(not shown) is spun into a yarn 13; the yarn passes over a spun yarn take-up roller 8 and 9 a grooved traversing roller 9 to a bobbin holder 11 for holding the bobbin 15 on which the yarn package or cheese 10 is formed by winding the traversing spun yarn 13 therearound.

The automatic doffing apparatus 1 to which this invention is applicable comprises a yarn cutting mechanism 3 turnable into a yarn cutting position for cutting, prior to doffing, the yarn 13 at the mid point between the yarn take-up roller 8 and the grooved traversing roller 9; a rotary doffer 4 for demounting the full packages 10 from the spinning machine 2 and mounting the empty bobbins 15 thereon by using a bobbin catcher 6, the demounted packages 10 being fed on to a turnable gutter 14 which is in communication with a package storage container (not shown) to store the demounted packages therein; and an empty bobbin transmission mechanism 5 for transferring the empty bobbins 15 from an empty bobbin accommodating part (not shown) of the doffing apparatus to a predetermined position on the locus of the bobbin catcher 6 of the rotary doffer 4. The empty bobbin transmission mechanism 5 positions the empty bobbin 15 to be picked up by the bobbin catcher 6 which supplies it to the bobbin holder 11, from which the full package 10 has been doffed.

The rotary doffer 4 is rotated a full turn each time it is shifted between two adjacent spinning units 7 and completion of every cycle of operation by the empty bobbin transmission mechanism 5.

According to the present invention, the rotary doffer 4 comprises, as shown in FIGS. 3 and 4 in detail, first and second cams 16 and 17 loosely mounted on one end of a common shaft 23 and fixedly attached to a suitable part of the spinning machine so as not to rotate with the shaft 23, first and second package receiving and transporting members 18 and 19 fixedly mounted on separate rotatable pins 24 and 26, and first and second cam followers 20 and 21 arranged respectively between the first cam 16 and the first package receiving and transporting member 18 and between the second cam 17 and the second package receiving and transporting member 19. Mounted on the other end of the shaft 23 away from the cams 16 and 17 is a cam 22 for releasing the bobbin holder 11. The detailed descriptions of the cam 22 and the bobbin holder 11 will be omitted since they are not the subject matter of this invention. It is noted that the cam 22 may be disposed at a suitable position other than on the shaft 23.

The second package receiving and transporting member 19 is provided with a bracket 25 connected at one end to the tail portion of the second package receiving and transporting member 19 and at the other end to the rotatable pin 26. Fixed to the shaft 23 is a four-legged support member 27 having a pair of radially outwardly extending legs 27a through which the pin 24 extends for rotation, and a pair of radially outwardly extending legs 27b through which the pins 26 similarly extends for rotation. Secured to the right hand extension of the pin 24 (FIG. 4) is a cam lever 28 provided at the extremity with the rotatable cam roller 20, which contacts the cam surface of the first cam 16. Further, secured to the right hand extension of the pin 26 is a similar cam lever 29 provided at the extremity with the rotatable cam roller 21, which contacts the cam surface of the second cam 17. Therefore, when the shaft 23 is rotated by any suitable driving mechanism (not shown) along with the four-legged support mem-

ber 27, the cam rollers 20 and 21 roll on the respective cam surfaces of the cams 16 and 17, causing the first and second package receiving and transporting plates 18 and 19 to rotate with the shaft 23 while pivoting respectively about the pins 24 and 26 so that they make particular combination motions necessary for performing the desired doffing operation.

In order to prevent the package 10 from being injured by the first and second plates 18 and 19 and to facilitate the receipt of the package by the first and second plates 18 and 19, as shown in FIGS. 4, 5 and 6, the extremity of the first plate 18 is provided with a roller 30 and the extremity of the second plate 19 is rounded as shown at 33. Further, the first and second plates 18 and 19 are formed with multi-forked end portions 31 and 32 so that they can intersect with each other as shown in FIG. 5. This allows the rotary doffer to accomplish the doffing operation without causing any interference between the first and second plates. The cam 22 is secured to the shaft 23 to rotate therewith and is adapted to maintain the holder 11 released until the empty bobbin 15 is applied to the released holder 11. In addition, the bobbin catcher 6 is connected to the cam 22 to rotate with the shaft 23.

In FIG. 7, the motions of the first and second plates 18 and 19 are shown by phantom lines X and Y, wherein the extremities 30 and 33 thereof are selected as reference points of the motions respectively. When the shaft 23 rotates, the first plate 18 comes in contact with the package 10 in advance of the second plate 19 and pushes up or transports the package 10 together with the holder 11 to a position shown by the phantom line and then moves so that its top end or extremity makes a substantially horizontal motion as shown at x to be ready for the receipt of the package 10 from the holder 11 onto the first plate 18. In the meantime, the extremity of the second plate 19 traces the locus Y, and when it reaches approximately a position y (at this time, the package 10 has already been released from the holder 11 by the action of the cam 22), the package 10 carried on the first plate 18 is transferred onto the second plate 19. Then, the latter further moves along the locus Y to transport the package 10 to a predetermined position, i.e., onto the gutter 14. The first and second cams 16 and 17 comprise cam surfaces for imparting the quick pivotal motions to the first and second plates after completion of the package between the first and second plates, thus quickly raising the package 10.

The operation of the rotary doffer 4 during its full turn will be described in detail step-by-step with reference to FIGS. 8 - 13. When the doffing apparatus 1 moving along the front of the spinning machine reaches the spinning unit to be doffed, in the outset of the doffing operation, the cutting mechanism 3 of the doffing apparatus is rotated counterclockwise in FIG. 2 to the predetermined yarn cutting position so as to locate the cutter between the take-up roller 8 and the traversing roller 9 and becomes operative to cut the spun yarn 13. The cut end of the yarn 13 leading to the traversing roller 9 is taken up by the package 10 and the other cut end of the yarn 13 leading from the take-up roller 8 is sucked into a suction nozzle (not shown) provided on the cutting mechanism 3. Incident to rotation of the shaft 23, the first and second plates 18 and 19 turn toward the package 10. This stage is shown in FIG. 8. When the shaft 23 further rotates, the roller 30 pro-

vided on the extremity of the first plate 18 is brought into contact with the lower surface of the package 10 earlier than the second plate 19 as shown in FIG. 9. Then, the roller 30 of the first plate 18 forces the package 10 upwardly along with the holder 11 and the first plate 18 is located in a position as shown in FIG. 10 below the package 10. Upon further rotation of the shaft 23, the first plate 18 moves so that its top end or extremity makes the substantially horizontal motion as shown at x in FIG. 7 to be ready for the receipt of the package 10 thereon, while the second plate 19 is moved so that it intersects the first plate 18. About at this time point, the cam 22 acts to open or expand one arm (not shown) of the holder 11 relative to the other (not shown) arm to allow the package 10 to drop on the first plate 18. The package 10 can be completely released from the holder 11 by further small rotation of the first plate 18. Upon further rotation of the shaft 23, the second plate 19 quickly moves upwardly and causes the package 10 to be positively lifted up thereby as shown in FIG. 11 instead of by the first plate 18. Thus, the package 10 is transported and guided by the second plate 19 onto the gutter 14 as shown in FIG. 12. At this stage, the gutter 14 is rotated to the solid line position so that its package receiving part 14a comes into alignment with the tail portion of the second plate 19, facilitating the transmission of the package 10 from the second plate 19 onto the gutter 14. Thereafter, as shown in FIG. 13, the gutter 14 is turned in the reverse direction shown by the arrow, so that the package 10 is fed to the package storage part and the gutter 14 is moved out of the paths of the first and second plates 18 and 19. In the meantime, the empty bobbin 15 (FIG. 2) is transferred to the predetermined position on the locus of the bobbin catcher 6 by the empty bobbin transmission mechanism 5 to be caught by the bobbin catcher 6, which rotates integral with the shaft 23 and supplies the empty bobbin 15 to the holder 11, which is still maintained open by the cam 22 and from which the package 10 has been doffed in the aforesaid manner. Thus, one cycle of the doffing operation is completed and the doffing apparatus starts another cycle of the doffing operation for the next adjacent spinning unit successively thereafter.

What we claim is:

1. In an automatic doffing apparatus, a rotary doffer adapted for use with a spinning machine having a plurality of spinning units arranged in side-by-side relation, for performing a doffing operation of demounting full packages one by one from the respective spinning units and applying empty bobbins to the spinning units, from which the full packages have been demounted, while travelling along the front of the spinning machine during operation of the same: said rotary doffer com-

prising: a rotary shaft; a support fixedly secured to said rotary shaft; a pair of first and second package receiving and transporting members pivotally mounted on said support; a pair of first and second cam means operatively associated with said first and second members respectively and having cam surfaces for giving to said first and second members different rotational and pivotal combination motions so that a portion of the doffing operation, which portion comprises at least demounting and receiving each full package from the respective spinning unit and transporting it to a predetermined position from which each full package is brought out of a path of said rotary doffer, is shared by said first and second members, said cam surfaces having shapes advancing said first member to come into contact with the full package earlier than said second member, for pushing up each full package by the free end of said first member, for locating said first member in a package receiving position below the package while moving the free end of said first member substantially horizontally, for advancing said second member so as to be ready to contact the package when said first member reaches substantially the package receiving position, for further advancing said first and second members so as to transfer the package from said first member to said second member, and for rapidly advancing said second member to the predetermined position from which the package is brought out of the path of said rotary doffer.

2. The rotary doffer as set forth in claim 1, wherein said first and second members have multi-forked end portions so that the end portions of the second member can pass between the end portions of the first member, whereby the doffing operation is performed without any interferences between said first and second members.

3. The rotary doffer as set forth in claim 1, wherein said first member has a roller at the free end thereof to prevent the package from being injured by the free end when it pushes up the package.

4. The rotary doffer as set forth in claim 1, wherein the free end of said second member is rounded to facilitate the transfer of the package from said first member to said second member.

5. The rotary doffer as set forth in claim 1, wherein each of said first and second cam means comprises a cam plate loosely mounted on said rotary shaft and fixedly secured to a portion of the doffing apparatus, and a cam follower mounted on a lever fixedly connected with the associated package receiving and transporting member so as to roll on the cam surface of said cam plate.

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