Oct. 23, 1962 R. M. INGHAM, JR 3,059,406

DOFF-DON CARRIER ARRANGEMENT AND METHOD

Filed Dec. 17, 1957 4 Sheets-Sheet 1

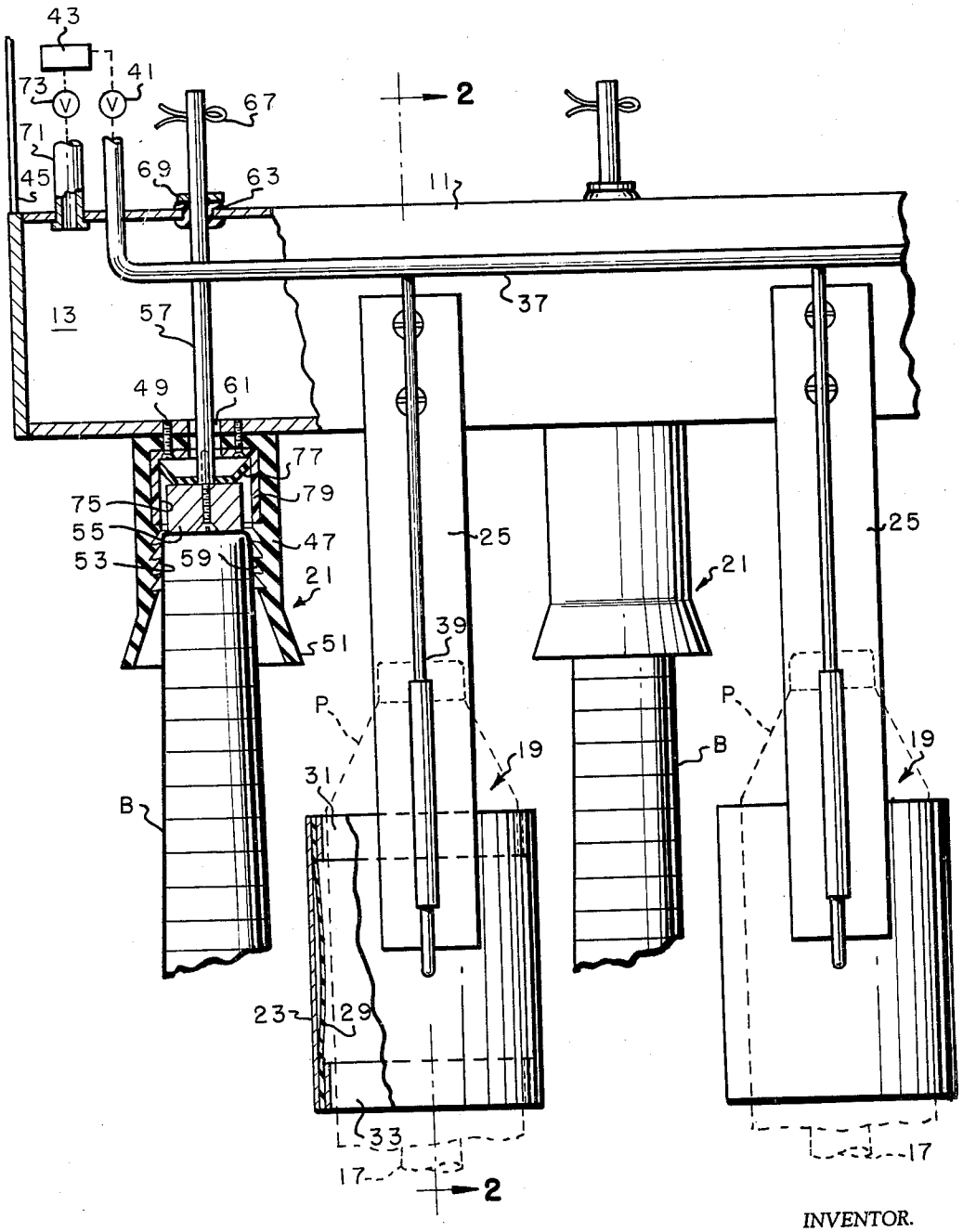



FIG. -1-

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DOFF-DON CARRIER ARRANGEMENT AND METHOD

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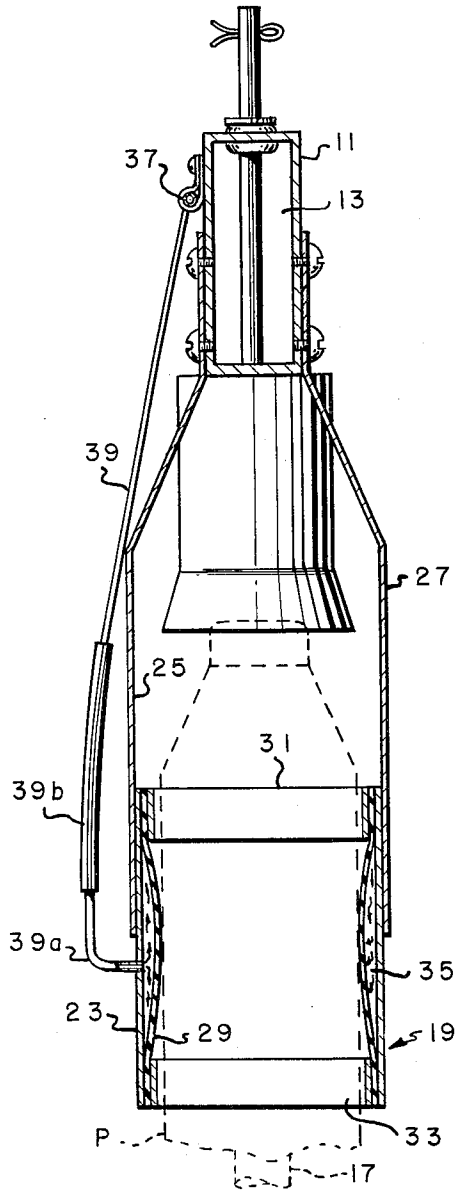



FIG. -2-

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DOFF-DON CARRIER ARRANGEMENT AND METHOD

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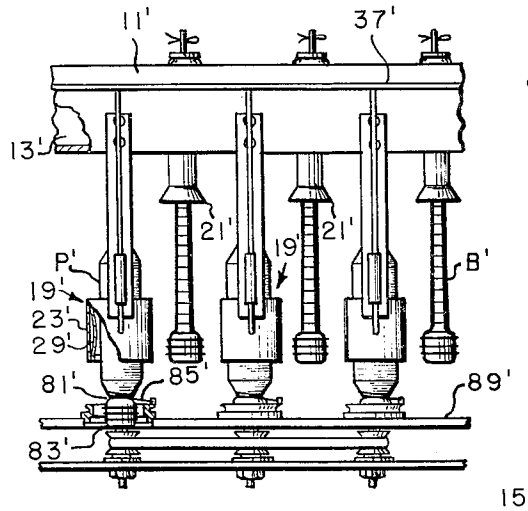



FIG. -3-

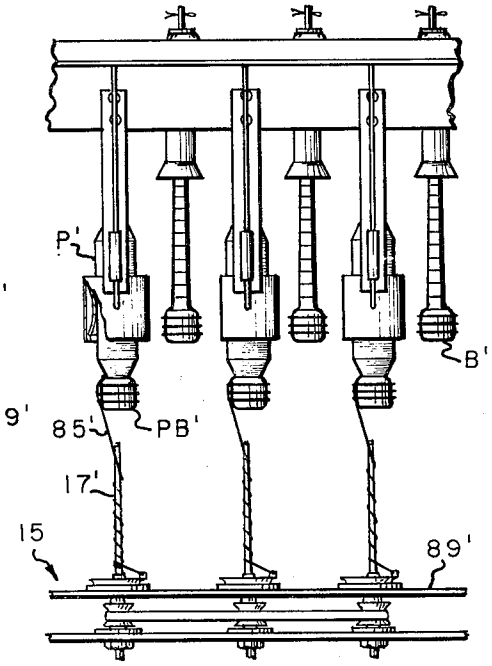



FIG. -4-

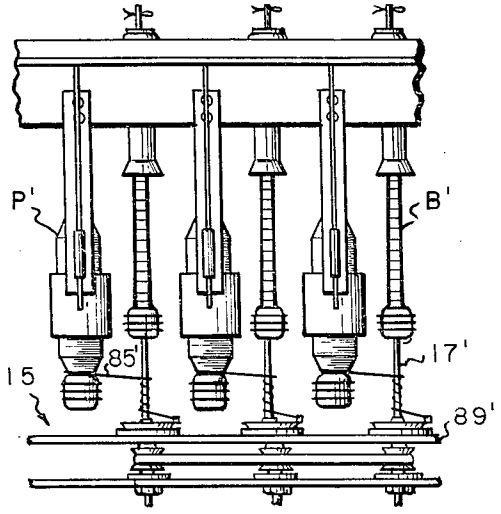



FIG. -5-

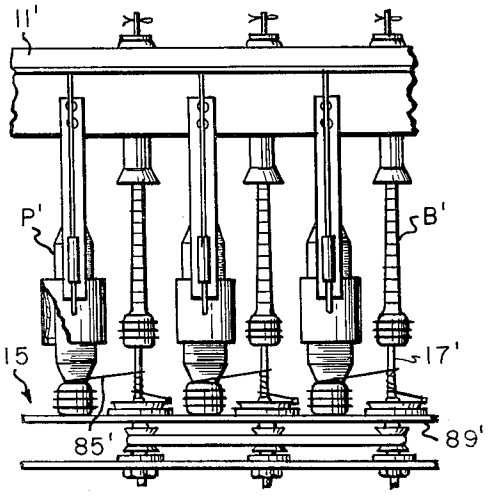



FIG. -6-

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DOFF-DON CARRIER ARRANGEMENT AND METHOD

Filed Dec. 17, 1957 4 Sheets-Sheet 4

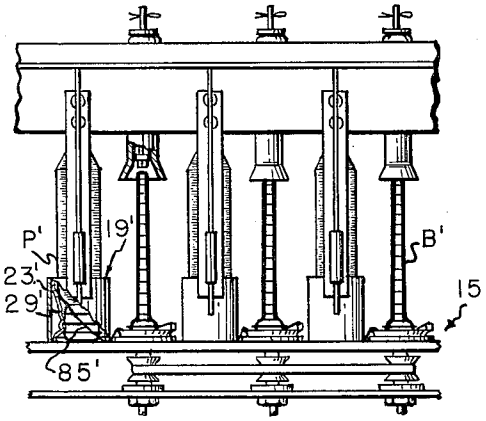



FIG. -7-

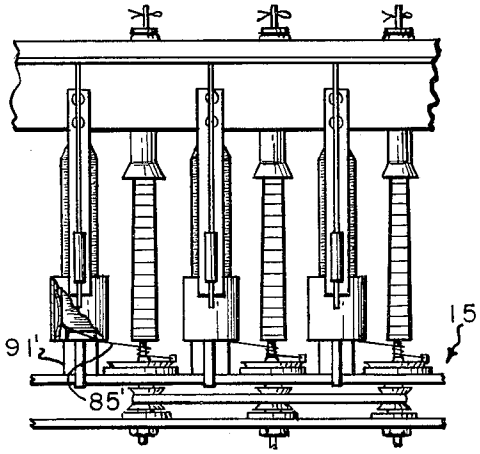



FIG. -8-

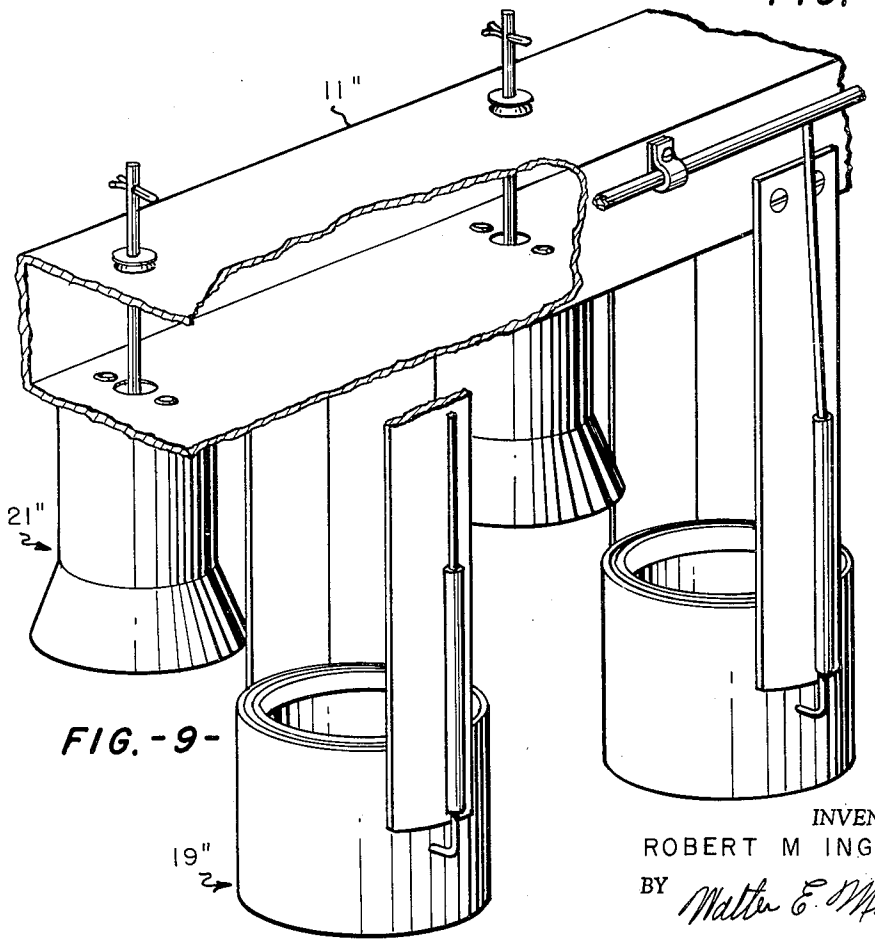



FIG. -9-

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United States Patent Office 3,059,406 Patented Oct. 23, 1962



3,059,406

# DOFF-DON CARRIER ARRANGEMENT AND METHOD

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Filed Dec. 17, 1957, Ser. No. 703,353
30 Claims. (Cl. 57—52)

This invention relates to doffing and donning full and empty bobbins and the like, and more particularly to an improved apparatus and method adapted to doff and to don a plurality of bobbins on a frame in a facile and economical manner.

In the past a number of attempts have been made to reduce the time and labor cost involved in doffing and donning textile frames. Some of these attempts have been directed to apparatus for doffing a plurality of bobbins substantially simultaneously and then donning a corresponding plurality of empty bobbins. Other attempts have taken the approach wherein the several positions of the textile frames are doffed and donned on an individual basis in sequential order. However, to the best of my knowledg none of the previous apparatus has been commercially satisfactory, due particularly to such factors as complexity, high cost, difficulty in maintenance, and rough and improper handling of the full and empty bobbins by the apparatus involved. The present invention is directed to a method and apparatus particularly adapted to the first mentioned type, although some aspects of it may be adapted to the second or other types of apparatus.

It is a particular feature of this invention that the full and empty bobbins are gently yet firmly handled during the entire operation of doffing and donning, and that a relatively small gauge frame may be doffed and donned according to this invention.

It is a further feature of the invention that a combination doff-don carrier is provided wherein the full bobbin packages are doffed through a soft, gentle, yet firm, pneumatic gripping of the full yarn packages and the empty bobbins are donned through the gripping of their head ends, to the end that the spindle positions may be of much smaller gauge than would be possible where both the full and empty bobbins were engaged at their midsections, yet providing the advantage of full resilient gripping action on the full yarn packages about their midsections during the doffing operation.

A still further novel feature of the invention is the provision of a unique grasper for full and empty bobbins, and particularly adapted for full bobbin packages.

A further feature is the provision of a unique method of alternate head-end grasping and intermediate body grasping of empty and full bobbins respectively in doffing and donning bobbins from a spinning frame or the like.

Still other objects, features, and attendant advantages will become apparent to those skilled in the art from a reading of the following detailed description of a preferred embodiment constructed according to the invention, taken in conjunction with the accompanying drawings, wherein

FIGURE 1 is a schematic view in front elevation and partial section illustrating a portion of a multiple position carrier according to the invention.

FIGURE 2 is a cross-section view taken along line 2—2 of FIGURE 1, with the bobbin holder inflated and a bobbin package illustrated in phantom therein, and

FIGURES 3–7 illustrate one method of doffing and donning according to the invention,

FIGURE 8 illustrates a modified form of doffing and donning according to a further aspect of the invention, and



FIGURE 9 illustrates a further modified arrangement wherein the bobbin holders are staggered at alternate positions.

Briefly, according to one aspect the invention broadly includes a common horizontal carrier having alternate head-end suspending empty bobbin holders and resilient pneumatically actuated midsection-grasping yarn package holders for respectively donning empty bobbins onto and removing full yarn packages from a textile frame, particularly a frame of the downtwist type such as is commonly employed for spinning frames, twister frames, etc. According to the preferred embodiment the yarn package grasper-holders are connected to a common source of air pressure by a common conduit and each includes a selectively inflatable complete annulus of elastic material open at both its top and bottom ends and which annulus ends are individually secured in airtight relation to a surrounding substantially rigid annular tube also open at both its bottom and upper ends, each rigid tube being suspended from the common carrier by two substantially rigid front and rear bracket members depending from the common carrier. Also, in the preferred embodiment the empty bobbin holders each include a downwardly open flared cup which preferably holds the bobbin heads by an annular elastic gripping contact therewith. This elastic gripping contact is preferably effected by elastic annular rings formed in the cup and having greater resistance to withdrawal therefrom than to entry thereinto.

According to a further aspect of the invention, full bobbin packages are doffed from a ring spinning frame and empty bobbins donned onto the spindles by simultaneously pneumatically grasping the full packages, each separately about its midsection, while simultaneously supporting a corresponding plurality of empty bobbins by their head ends at alternate positions between the full packages, then raising the full packages and empty bobbins simultaneously and moving them longitudinally of the frame to align the empty bobbins with the empty spindles, next lowering the empty bobbins and seating them onto the spindles, and then again raising the full packages, and subsequently releasing the full packages at a discharge station.

Various modifications and additional aspects according to the invention are set forth in the following detailed description.

Referring now in detail to the figures of the drawings, a horizontal longitudinally extending beam **11** is supported for vertical movement above one side of a spinning or twisting frame or the like in order to provide for doffing of the full yarn packages P and donning of empty bobbins B onto the spindles **17** of the frame. One end of the beam **11** is illustrated in FIGURE 1, wherein two full yarn package graspers **19** and two empty bobbin end holders **21** are shown, there being disposed along the length of the beam **11** a plurality of each of graspers **19** and end holders **21** corresponding in number to all or a portion of the number of spindles on one side of the spinning frame **15**.

As shown most clearly in FIGURES 1 and 2, each of the full bobbin graspers **19** comprises a metallic or other substantially rigid tubular member **23** substantially rigidly secured to the beam **11** through the medium of a pair of front and rear brackets **25, 27**. The tube **23** is open at its upper and lower ends and has mounted therein a length of elastic substantially air-impermeable tubing **29**, such as rubber or the like, which is secured thereto in airtight relation at the upper and lower ends of the tube **23**, as shown, as through the medium of two expansion rings **31, 33**. An annular closed chamber **35** is thus formed between the annular walls of the rubber tube **29** and the stiff tube **23**. Each of the annular chambers **35**, at each

grasper position 19 is suitably connected to a common air pressure supply line 37, through the medium of a branch conduit 39, including a fixed inlet tube 39*a* formed in the midsection of the tube 23, and an interconnecting length of flexible tubing 39*b*, for ease of assembly and disassembly. A suitable control valve 41 is provided between an air pressure supply source 43 and the common air supply line 37, in order to effect selective enlargement of the chambers 35, as shown in FIGURE 2, or to exhaust the pressure from the chambers 35 to permit elastic tubing 29 to return to its normal deflated positions as indicated in FIGURE 1. Thus, through the inflating of the annular elastic tubing 29 and the consequent enlargement of the chamber 35, the elastic annulus 29 becomes an effective resilient form-fitting annular grasper which is employed to grasp a fully wound yarn package P and lift the full yarn package from its respective spindle 17. Through the substantially simultaneous inflation of each of the doffing graspers 19, the full bobbins of one entire side of a frame may be gently yet firmly doffed, by the raising of the carrier beam 11 as by spaced cables 45 on a suitable motorized or manually operated cable hoist (not shown) during the period when the elastic annulus graspers 29 are in inflated gripping relation about the full bobbin packages P.

The distance between the doffing graspers 19 corresponds to the distance between the individual positions or spindles on the spinning or twisting frames 15. To the end that a sequential doffing and donning operation may be effected a corresponding plurality of empty bobbin end holders 21 is provided, these empty bobbin holders 21 being spaced alternately between the full bobbin graspers 19, as will be seen in FIGURE 1 and FIGURES 3–7, the space between the empty bobbin holders 21 corresponding to that between the full bobbin graspers 19.

Each of these empty bobbin end holders 21 includes an annular sheath which in the preferred embodiment is an inverted cup 47 formed of rubber or the like, secured to the beam 11 as by screws 49 and having a flared skirt 51 formed at the lower end thereof. The flared skirt 51 serves to guide the upper end of an empty bobbin B into the resilient gripper section 53 of the cup 47, where it contacts an ejecting and seating disc 55, which may be secured to or formed on the lower end of a plunger 57 for guidance. The resilient gripper section 53 may have elastic smooth internal walls, but preferably, as shown in FIGURE 1, has spaced annular upwardly tapered elastic rings, lips or ridges 59 formed on its internal walls for ease of entry of the bobbin heads with relatively greater force required for removal of the bobbin therefrom, as may be necessary or desirable in any particular application. Plunger 57 is vertically movable in an over-sized aperture 61 formed in the upper end of the cup 47 and the adjacent wall of beam 11 and a contiguously surrounding rubber bushing or grommet 63 mounted in a further aperture formed in the top wall of the beam 11. The plunger and disc assembly 57, 55 is afforded limited downward movement through the medium of a cotter pin 67, which upon downward movement of the plunger and disc engages a metal washer 69 resting upon grommet 63.

To the end that the empty bobbins B may be effectively discharged and seated on their respective spindles of the spinning or twisting frame, a pneumatic arrangement is provided to selectively impart downward movement of the disc and plunger assembly 55, 57 at any desired time. In order to effectively and economically effect the pneumatic connection of each of the empty bobbin holders 21, the carrier beam 11 is formed as a hollow beam, rectangular in cross section and closed at each end. A suitable supply conduit 71 including a suitable control valve 73, is connected from the source of air pressure supply 43 to the closed chamber 13 formed by the hollow carrier beam 11 and connects through the medium of apertures 61, with the upper chamber 75 at each individual empty bobbin holder 21. This chamber 75 is rendered substantially airtight through the medium of a rubber cup-shaped washer 77 disposed on the upper surface of the disc 55 and which contacts the inner walls of a smooth cylinder insert 79, of plastic or other suitable material, in the cup 47. As will be apparent, the upward pressing of an empty bobbin into each of the cups 47, or vice versa the downward pressing of the cups 47 about the upper ends of the empty bobbins B, will result in the disc and plunger assemblies 55, 57 being pushed upwardly to or near their uppermost position, at which point the upper end of each empty bobbin B is resiliently held within the resilient gripper portion 53, of its cup 47, as shown in FIGURE 1. After the removal by the graspers 19 of the full yarn packages P from their respective spindles on the spinning frame, it is thus only necessary to raise the carrier beam 11 and its associated graspers 19 and end holders 21, then to move the carrier beam longitudinally a distance corresponding to one-half the gauge length between spindles to thereby align the empty bobbins B and end holders 21 with the corresponding empty spindles 17. The carrier beam 11 may then be again lowered with the full bobbins still in place in their respective graspers 19, and the empty bobbins B may be donned onto the respective empty spindles 17 and firmly seated thereon by the application of air pressure through the supply line 71 and the chamber 13 in the closed carrier beam 11 to each of the chambers 75 at the individual empty bobbin holder positions 21. After or substantially simultaneous with seating of the empty bobbins onto the spinning frame spindles the carrier 11 may then be again raised and moved to a suitable location for doffing of the full yarn packages P and loading of a new set of empty bobbins B in the empty bobbin end holders 21. A considerable advantage is achieved through use of these elastic bobbin holders for the empty bobbins, with pneumatically actuated plungers, particularly in positively seating the bobbins B onto their respective spindles with substantially uniform seating pressure being exerted thereby on the empty bobbins during seating.

Referring now to FIGURES 3–7, there is shown a modified method of doffing and donning full yarn packages P′ and empty bobbins B′ respectively, particularly adapted for application to filling bobbins, such as quills and the like having abruptly enlarged base ends or butts 83′, although such may be employed with other bobbins in many instances. According to this modified method the empty bobbins B′ are first loaded onto the carrier beam 11′ in their respective alternate empty bobbin end holders 21′, and the carrier beam is then moved to align the full bobbin package graspers 19′ with the respective spindles on which the full bobbin packages P′ are seated. The yarn packages are wound at their completion with a number of transfer wraps 85′ about the narrow neck 81′ of the bobbin between the enlarged base or butt 83′ and the package P′ or at the intersection of the package and the base (see FIGURE 3), in order to provide the maximum number of transfer tail wraps 85′ per length of tail yarn to thereby have the maximum number of wraps of the yarn pulled about the spindle upon vertical removal of the full package P′ from the spindle a given distance. After positioning the carrier beam 11′ with the full bobbin graspers 19′ in alignment with the spindles the carrier beam is then lowered to the position shown in FIGURE 3 wherein each rigid tube 23′ and annular elastic annulus 29′ is about the midsection of a respective yarn package P′. The full package graspers 19′ are then inflated by applying pneumatic air pressure thereto through the common air supply line 37′, and the carrier beam 11′ is then raised whereupon the full bobbin packages are removed from their respective spindles 17′ to the position as shown in FIGURE 4. Also, as shown in this figure, several wraps of yarn 85′ which originally lay in the groove formed at the intersection of the package and the bobbin base have been pulled off the bobbin during the removal thereof from

the spindle and such turns form a plurality of transfer or anchor turns about the empty spindle for later anchoring of the yarn end upon donning an empty bobbin onto the spindle.

The carrier beam 11' is next shifted longitudinally of the frame 15 to align the empty bobbins B' over the spindles 17' and is then lowered as shown in FIGURES 5 and 6 to position the empty bobbins onto the respective spindles. The carrier beam is lowered until the full bobbin packages $P_1$ rest upon the conventional ring rail 89', as shown in FIGURE 6, with the empty bobbins being positioned above their seated position. The air pressure is then released from the full bobbin package graspers 19' to release the full packages P' which are then supported by the ring rail 89'. The carrier beam is then lowered to the position shown in FIGURE 7, in which position each full bobbin package grasper 19' surround the neck 81' of its full package P' at its lower end. The full bobbin package graspers 19' are then again inflated, whereupon each elastic annulus 29' grasps both the yarn package $P_1$ and the enlarged base or butt 83' of the package bobbin P' to entrap and prevent further pulling off of any remaining wraps of yarn 85' which are formed about the neck of the bobbin and the yarn forming the main body of the package $P_1$, as shown in FIGURE 7. At this time, or previous to or slightly subsequent to this time, the empty bobbin holders 21' have air applied thereto through the application of air pressure to the interior chamber 13' of the carrier beam 11', thereby forcefully seating the empty bobbins B' on their respective spindles 17'. Preferably this action is accomplished simultaneous with the raising of the carrier beam 11' and simultaneous with or slightly subsequent to the inflation of the resilient graspers 19' for the full bobbin packages, whereby the empty bobbins B' will be seated and ejected during the raising of the carrier beam and the full bobbin packages.

The grasping of both the full bobbin package P' and the base 83' of the bobbin about the remaining wraps of the yarn at the base of the package effectively secures these turns of yarn whereby upon raising the full packages by the carrier beam the tails extending between the full packages and the respective spindles will be broken relatively short, as distinguished from relatively long tails which might be formed between the packages and the spindles if the packages are not held in such a manner as to restrict the continued pulling of yarn from the yarn packages during raising of the packages by the carrier beam. This is a distinct advantage in the subsequent handling of the full bobbin packages since there are no substantially long tails formed to cause entanglement and the like, thus not requiring further operator care to remove or separate these tails. The carrier beam 11' with its full bobbin package $P_1$ is subsequently moved to a suitable discharge station where the full bobbin graspers 19' are released to permit the full bobbin packages to drop therefrom for further handling.

Referring to FIGURE 8 there is shown a modification for carrying out the method as illustrated in FIGURES 3–7, and particularly adapted to utilization with warp-type bobbins and the like. In this arrangement the ring rail has mounted or formed thereon support members such as blocks 91' between each of the rings and extending up to support the lower ends of the bobbins on which the full packages are wound. The method of carrying out the doffing and donning is similar to that described in connection with FIGURES 3–7, the exception being that the full bobbin packages P' are supported on the blocks 91' or other raised support members rather than directly on the lower portion of the ring rail 89' as in FIGURES 3–7. This permits the full bobbin graspers 19' to be lowered to the bottom of the package warp bobbins P', in order to grasp the bobbins and thereby entrap the lower wraps of yarn at the bottom of the packages and prevent the formation of long tails upon the raising of the full bobbin packages during the breaking of the yarn tails after donning of the empty bobbins onto the spindles. It will be seen that this is particularly adapted to long bobbins and packages such as warp bobbins and the like, although such may be employed otherwise as may be desired or necessary.

It will be seen that the foregoing-described doff-don carrier arrangement is highly advantageous in a number of ways, particularly in its adaptability and utility for small or large gauge frames while yielding a complete annular gentle pneumatic grasping of the full packages about their midsection for gentleness and ease of handling and permitting stationary in-line mounting of the full midsection graspers and empty end holders, due particularly to the stationary alternate positioning of end holders for the empty bobbins and midsection pneumatic annulus graspers for the full bobbin packages. This permits doffing and donning by simple longitudinal and vertical movement of the common carrier support member for the empty holders and full package graspers.

In some instances, however, the desired package diameter may be so large compared to the gauge of the frame as to render impossible or impractical the use of direct in-line arrangement of the end holders and midsection graspers, and in such instances a modified construction such as shown in FIGURE 9 may be employed. In this modification the end holders 21'' are diagonally spaced from the full package graspers 19'', with the full graspers 19'' being centered in depending supported relation and the empty holders 21'' being off-center relative to the longitudinal center line of the common carrier beam. The centering of the full package graspers 19'' is most desirable since these graspers occupy substantially more lateral room than the empty bobbin end holders, and off-centering of these graspers would result in protrusion of the graspers laterally beyond the side of the carrier beam 11'', whereas off-centering of the end holders 21'' may be effected without such result. The net overall effect is that the stationary mounting of alternate end-holders 21'' and pneumatic midsection-annulus-graspers 19'' is retained with substantially no widening of the effective carrier width, while accommodating a smaller gauge frame relative to package diameter. One advantage of the minimum width feature is a resulting minimum of lateral movement being required during vertical movement of the doff-don carrier assembly to prevent interference with conventional protruding parts of the spinning frame such as the clearer rolls, umbrella creels, etc.

While various embodiments and modifications of the apparatus and various methods of carrying out the invention have been described in detail, it will be understood that both the apparatus and specific modes of carrying out the method are set forth for purposes of illustration, and that many modifications and improvements may be made within the scope and spirit of the invention. Accordingly, it is to be understood that the invention is not to be limited by the specifically described embodiments and applications according to the invention, but only by the scope of the appended claims.

That which is claimed is:

1. Apparatus including a plurality of bobbin holders, each comprising an annular substantially rigid tube open at both ends and arranged with its axis substantially vertical, an elastic annular tube diaphragm open at both ends and secured in concentric relation within said rigid tube in annular airtight relation to the inner annular wall of said tube at longitudinally spaced apart positions adjacent both the upper and lower ends of said elastic tube, an air orifice formed in said rigid tube, an air pressure conduit connecting with said air orifice and adapted to be connected in flow relation to a source of air pressure, movable support means spaced from and above the open upper ends of said rigid tubes, and a rigid connection between each said rigid tube and said support means each of said holders being rigidly connected to said

movable support means in laterally mutually spaced apart relation along the longitudinal length of said movable support means, and a corresponding plurality of end-grasping bobbin holders rigidly connected to said movable support means in laterally mutually spaced apart relation along the longitudinal length of said movable support means and in staggered relation between said first mentioned bobbin holders.

2. Apparatus according to claim 1, wherein each of said end-grasping holders comprises an inverted cup-shaped member having a flared lower end, said cup-shaped member having an annular frictional bobbin-holding surface formed on its inner peripheral surface above said flared lower end.

3. Apparatus according to claim 2, wherein each of said inverted cup-shaped holders has an air orifice at its upper end, and a common conduit operatively connected to each of said orifices and adapted to be connected to a common source of air pressure for ejection of bobbins from said inverted cup-shaped holders when held thereby.

4. Apparatus according to claim 3, wherein each of said inverted cup-shaped holders includes a plunger movably disposed therein and movably responsive to air pressure exerted thereon through said air orifice to eject a bobbin from its respective holder when held thereby.

5. Apparatus including a plurality of bobbin holders, each comprising an annular substantially rigid tube open at both ends and arranged with its axis substantially vertical, an elastic annular tube diaphragm open at both ends and secured in concentric relation within said rigid tube in annular airtight relation to the inner annular wall of said tube at longitudinally spaced apart positions adjacent both the upper and lower ends of said elastic tube, an air orifice formed in said rigid tube, an air pressure conduit connecting with said air orifice and adapted to be connected in flow relation to a source of air pressure, movable support means spaced from and above the open upper ends of said rigid tubes, and a rigid connection between each said rigid tube and said support means each of said holders being rigidly connected to said support means in longitudinally mutually spaced apart relation, and a corresponding plurality of end-grasping bobbin holders rigidly connected to said movable support means in laterally mutually spaced apart relation along the longitudinal length of said movable support means and in staggered relation between said first mentioned bobbin holders, each of said end-grasping bobbin holders comprising an inverted cup-shaped member having a flared lower end, said cup-shaped member having an annular frictional bobbin-holding surface formed on its inner peripheral surface above said flared lower end, each of said inverted cup-shaped holders including an ejecting plunger movably disposed therein, and means for moving said plungers to eject bobbins when held by their respective holders.

6. Apparatus according to claim 5 wherein said means for moving said plungers includes a common air pressure source, and conduit and valve means operatively selectively connecting said common air pressure source in downwardly moving force-exerting relation to said plungers.

7. Apparatus including a plurality of bobbin holders, each comprising an annular substantially rigid tube open at both ends and arranged with its axis substantially vertical, an elastic annular tube diaphragm open at both ends and secured in concentric relation within said rigid tube in annular airtight relation to the inner annular wall of said tube at longitudinally spaced apart positions adjacent both the upper and lower ends of said elastic tube, an air orifice formed in said rigid tube, an air pressure conduit connecting with said air orifice and adapted to be connected in flow relation to a source of air pressure, movable support means spaced from and above the open upper ends of said rigid tubes, and a rigid connection between each said rigid tube and said support means each of said holders being rigidly connected to said support means in laterally mutually spaced apart relation along the longitudinal length of said support means, and a corresponding plurality of end-grasping bobbin holders rigidly connected to said support means in laterally mutually spaced apart relation along the longitudinal length of said support means and in alternate relation between said first mentioned bobbin holders, the center-to-center spacing between each two mutually adjacent ones of said end-grasping bobbin holders corresponding to the center-to-center spacing between said first mentioned holders, said first mentioned holders and said end-grasping holders being disposed in zig-zag plan relation on said support means, whereby a relatively small gauge may be accommodated by said support means and holders.

8. Apparatus for doffing full bobbins from spindles and donning empty bobbins onto said spindles, comprising a common longitudinally extending substantially horizontal vertically and longitudinally movable carrier, a plurality of periphery-grasping yarn package holders each having a yarn package-periphery-grasping section rigidly connected to and supported by said carrier in depending relation therefrom, and a corresponding plurality of empty bobbin end-grasping holders rigidly connected to and supported by said carrier in depending relation therefrom, said end-grasping holders each being in alternate relation between said periphery-grasping yarn package holders and disposed substantially above said package-periphery-grasping section of each of said package holders, the gauge of said end-grasping holders and said package holders being identical.

9. Apparatus according to claim 8, wherein said end-grasping holders and said package holders are in substantially laterally aligned mutual relation.

10. Apparatus according to claim 8, wherein said end-grasping bobbin holders and said periphery-grasping package holders are disposed in staggered relation on said common carrier, said end-grasping holders being in mutual lateral alignment and said periphery-grasping package holders being in mutual lateral alignment.

11. Apparatus according to claim 8, wherein each of said periphery-grasping yarn package holders comprises a pneumatically responsive elastic encircling annulus of larger inner deflated circumference than the exterior circumference of a bobbin package to be grasped and held thereby, said annulus being open at both its upper and lower ends to permit the passage of a bobbin package therethrough.

12. Apparatus according to claim 11, wherein each of said end-grasping holders comprises an inverted cup-shaped member having a flared lower end and a friction-grasping inner annular surface, and a pneumatically responsive plunger movably disposed within said cup-shaped member for ejecting and seating bobbins having their ends disposed within said cup-shaped member.

13. The method of doffing full yarn packages from and donning empty bobbins onto take-up spindles of a textile frame, comprising resiliently grasping said yarn packages about their main body periphery and lifting said packages substantially simultaneously vertically off said spindles while holding a corresponding plurality of empty bobbins by their heads and in alternate relation one between each adjacent two said yarn packages, moving said packages and empty bobbins simultaneously longitudinally of said frame and aligning said empty bobbins with said spidles, then vertically lowering said packages and empty bobbins and depositing said empty bobbins on said spindles, again raising said yarn packages above said spindles and subsequently moving said packages to a container.

14. The method according to claim 13 including substantially simultaneously applying a vertical force to the head ends of each of said empty bobbins during said depositing of said empty bobbins to don and seat said bobbins onto said spindles.

15. The method according to claim 13, wherein each

of said yarn packages is grasped by application of a grasping force derived from pneumatic pressure, said packages being subsequently released en masse by release of said pneumatic pressure.

16. The method of doffing and donning a frame having a twister spindle with a rotatable yarn guide supported on a reciprocable rail and adapted to twist and lay yarn on a bobbin on said spindle, comprising forming a plurality of doffing curls on the lower end of a yarn package on said spindle at the conclusion of formation of said package, grasping the periphery of said full package at a position above a substantial number of said curls, vertically raising said full package to a point above the top of said spindle whereby a portion of the doffing curls below said grasped position will be distributed helically along and about said spindle and connecting between said full package and said yarn guide, moving said full package laterally to one side of said spindle, lowering said full package beside said spindle while lowering an empty bobbin onto said spindle and over the doff curls drawn off onto said spindle, then seating said empty bobbin on said spindle and grasping said full package periphery at a longitudinal position lower on said package than said first mentioned grasping position and about the package-to-spindle interconnecting yarn at the lower end of said package and raising said full package while so grasped to thereby break the yarn connection between said full package and said spindle.

17. The method of doffing and donning a frame having a twister spindle with a rotatable yarn guide supported on a reciprocable rail and adapted to twist and lay yarn on a bobbin on said spindle, comprising forming a plurality of doffing curls on the lower end of a yarn package on said spindle at the conclusion of formation of said package, grasping the periphery of said full package at a position above a substantial number of said curls, vertically raising said full package to a point above the top of said spindle whereby a portion of the doffing curls below said grasped position will be distributed helically along and about said spindle and connecting between said full package and said rail, moving said full package laterally to one side of said spindle, lowering said full package beside said spindle while lowering an empty bobbin onto said spindle and over the doff curls drawn off onto said spindle, releasing said full package and supporting said full package by said rail, lowering said empty bobbin further onto said spindle, then seating said empty bobbin on said spindle and grasping said full package periphery at a longitudinal position lower on said package than said first mentioned grasped position and about the lower end of said package and raising said full package while so grasped to thereby break the connecting yarn between said full package and said spindle.

18. The method according to claim 17 wherein a plurality of twister spindles on said frame are doffed substantially simultaneously according to the steps of said method.

19. The method according to claim 17 wherein said full package is supported substantially above said yarn guide on said ring rail during support of said package by said rail.

20. The method of doffing and donning a textile frame having a spindle with a yarn guide adapted to lay yarn or the like on a bobbin on said spindle, comprising forming a plurality of doffing curls on the lower end of a yarn package on said spindle at the conclusion of formation of said package, grasping the periphery of said full package at a position above a substantial number of said curls, vertically raising said full package to a point above the top of said spindle whereby a portion of the doffing curls below said grasping position will be distributed helically along and about said spindle and connecting between said full package and said yarn guide, moving said full package laterally to one side of said spindle, lowering said full package beside said spindle while lowering an empty bobbin onto said spindle and over the doff curls drawn off onto said spindle, then seating said empty bobbin on said spindle and raising said full package to thereby break the yarn connection between said full package and said spindle.

21. Bobbin handling apparatus comprising a plurality of bobbin holders each comprising an annular substantially rigid tube open at both ends and arranged with its axis substantially vertical, an elastic annular tube diaphragm open at both ends and secured in concentric relation within said rigid tube in annular airtight relation to the inner annular wall of said tube at longitudinally spaced apart positions adjacent both the upper and lower ends of said elastic tube, an air orifice formed in said rigid tube, an air pressure conduit connecting with said air orifice and adapted to be connected in flow relation to a source of air pressure, a movable support spaced from and above the open upper ends of said rigid tubes, and a rigid connection between each said rigid tube and said support, said movable support comprising a longitudinal substantially horizontally extending vertically and longitudinally movable carrier member, each of said holders being rigidly connected to said carrier member in laterally mutually spaced apart relation along the longitudinal length of said carrier, and a corresponding plurality of end-grasping bobbin holders rigidly supported in laterally mutually spaced apart relation corresponding to the spacing between said first mentioned bobbin holders and in lateral side-by-side relation, each adjacent a respetcive one of said first mentioned bobbin holders.

22. Apparatus according to claim 21 wherein each of said end-grasping holders comprises an inverted cup-shaped member having a bobbin end stop member at its upper end and a flared lower open end, said cup-shaped member having an internal bobbin-holding surface formed above said flared lower end.

23. Apparatus according to claim 22 wherein each of said inverted cup-shaped holders has an air pressure connection thereto for effecting a pneumatic force on a bobbin when held therein.

24. Bobbin doffing and donning apparatus comprising a plurality of first bobbin holders, each having a bobbin-midsection grasping diaphragm and rigid backing member assembly, an air pressure conduit operatively connected to said diaphragm for selective holding and release of a bobbin package, longitudinal substantially horizontally extending vertically and longitudinally movable carrier means, each of said holders being connected to said carrier means in longitudinally mutually spaced apart relation, and a corresponding plurality of end-grasping bobbin holders connected to said carrier means in laterally mutually spaced apart relation along the longitudinal length of said carrier means and in laterally adjacent relation to said first mentioned bobbin holders, each of said end-grasping bobbin holders comprising an inverted cup-shaped member having an open lower end, said cup-shaped member having an annular bobbin-holding surface formed therein above said open lower end.

25. The combination according to claim 24 wherein each of said inverted cup-shaped holders includes an ejecting member movably disposed therein, and means for moving said ejecting member to eject a bobbin from said cup-shaped holder when held thereby.

26. The method of doffing full yarn packages from and donning empty bobbins onto take-up spindles of a textile frame, comprising resiliently grasping said yarn packages about their main body periphery and lifting said packages substantially simultaneously vertically off said spindles while holding a corresponding plurality of empty bobbins solely at their head ends and in laterally adjacent relation to said yarn packages, moving said packages and empty bobbins laterally and aligning said empty bobbins with said spindles, then lowering said empty bobbins and depositing said empty bobbins on said spindles, and subsequently moving said packages to a package discharge station, and resiliently applying a vertical force to the head

ends of each of said empty bobbins during said depositing of said empty bobbins to don and seat said bobbins onto said spindles.

27. The method according to claim 26 wherein each of said yarn packages is grasped by application of a grasping force derived from pneumatic pressure, said packages being subsequently released en masse by release of said pneumatic pressure.

28. The method of doffing and donning a textile frame having a plurality of spindles each with a yarn guide adapted to lay yarn or the like on a bobbin on said spindle, comprising forming a plurality of doffing curls for a corresponding yarn package on each of said spindles at the conclusion of formation of said package, grasping the periphery of said full packages at a position above a substantial number of said curls, substantially simultaneously vertically raising said full packages to a point above the top of said spindles whereby a portion of the doffing curls below said grasped position will be distributed helically along and about each respective said spindle and connecting between the respective said full package and yarn guide, substantially simultaneously moving said full packages laterally to one side of their respective said spindles, lowering said full packages beside their respective said spindles and lowering an empty bobbin onto each of said spindles and over the doff curls drawn off onto said spindles and raising said full packages to thereby break the yarn connection between said full package and said spindle.

29. The method of doffing and donning a textile frame having a spindle with a yarn guide adapted to lay yarn or the like on a bobbin on said spindle, comprising forming a plurality of doffing curls on the lower end of a yarn package on said spindle at the conclusion of formation of said package, grasping the periphery of said full package at a position above a substantial number of said curls,



vertically raising said full package to a point above the top of said spindle whereby a portion of the doffing curls below said grasped position will be distributed helically along and about said spindle and connecting between said full package and said yarn guide, moving said full package laterally to one side of said spindle, lowering said full package beside said spindle while lowering an empty bobbin onto said spindle and over the doff curls drawn off onto said spindle, then seating said empty bobbin on said spindle and raising said full package to thereby break the yarn connection between said full package and said spindle.

30. Apparatus for doffing full bobbins from spindles and donning empty bobbins onto said spindles, comprising longitudinally extending substantially horizontal vertically and longitudinally movable carrier means, a plurality of periphery-grasping yarn package holders each having a yarn package-periphery-grasping section rigidly connected to and supported by said carrier means in depending relation therefrom, and a corresponding plurality of empty bobbin end-grasping holders rigidly connected to and supported by said carrier means in depending relation therefrom, said end-grasping holders each being beside said periphery-grasping yarn package holders and disposed substantially above said package-periphery-grasping section of each of said package holders, the gauge of said end-grasping holders and said package holders being identical.

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