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Pray et al.

[11] **3,786,621**

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[54] **GRASPER BAR POSITIONING MECHANISM FOR AUTOMATIC DOFFER**

[75] Inventors: **Lester W. Pray,** Clemson; **John H. Christeson,** Seneca; **Frederick A. Preston,** Clemson; **Herman D. Sheron, Jr.,** Seneca; **William H. Drake; Gordon C. Anderson,** both of Clemson, all of S.C.

[73] Assignee: **Maremont Corporation,** Chicago, Ill.

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[21] Appl. No.: **188,767**

Related U.S. Application Data

[63] Continuation of Ser. No. 864,399, Oct. 7, 1969, abandoned.

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

[51] **Int. Cl.** **D01h 9/00**

[58] **Field of Search** ..... 57/34 R, 52–54

[56] **References Cited**

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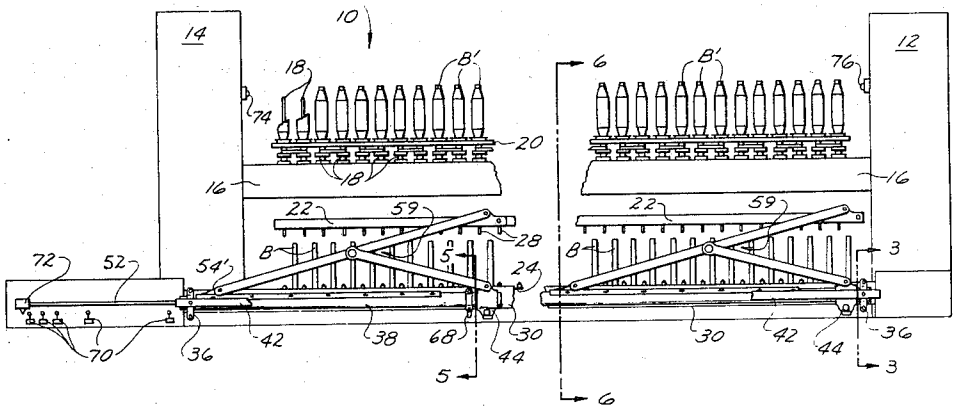
Primary Examiner—John Petrakes

Attorney, Agent, or Firm—Donald H. Feldman; Joseph H. Heard

[57] **ABSTRACT**

Bobbins are moved during doffing between a position upon and a position below the spindles of a textile spinning frame or like machine by a retractable mechanism disposed when not in use entirely below the spindles so as to not impede end-down or other servicing of the frame during normal spinning operations. Multiple guided connections with hydraulic cylinder and piston assemblies provide the smoothness and precision of grasper-bar movement necessary for successful performance of the bobbin doffing and donning operations. Critical components of the mechanism are shielded from the ambient atmosphere and from accidental impacts. Completion of each phase of the grasper bar's movement is verified before commencement of its next movement, and a photoelectric stop-motion device detects non-doffing of any bobbin.

10 Claims, 8 Drawing Figures



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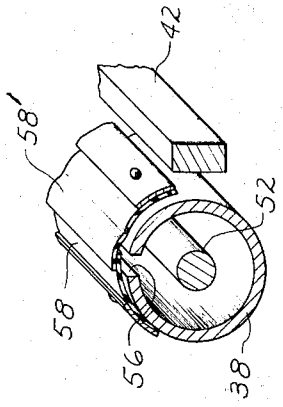

Fig. 5a

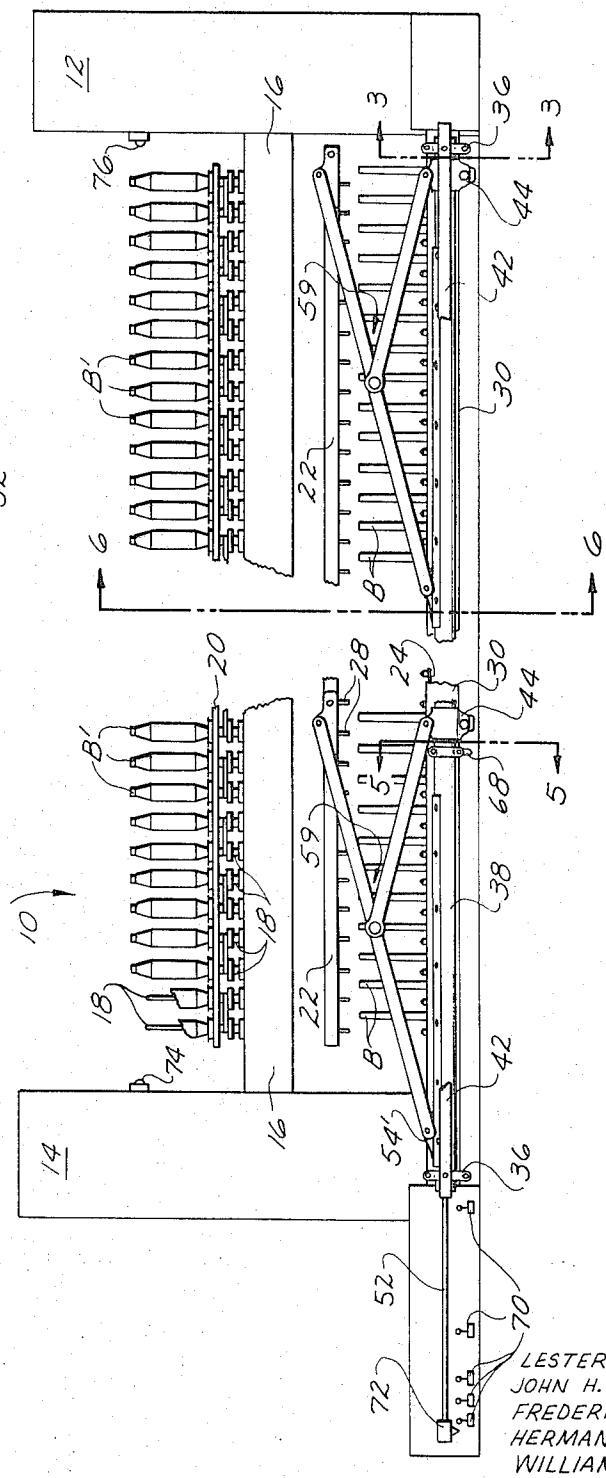

Fig. 1

INVENTORS
LESTER W. PRAY
JOHN H. CHRISTESON
FREDERICK A. PRESTON
HERMAN D. SHERON JR.
WILLIAM H. DRAKE
GORDON C. ANDERSON

BY Donald K. Feldman
THEIR AGENT

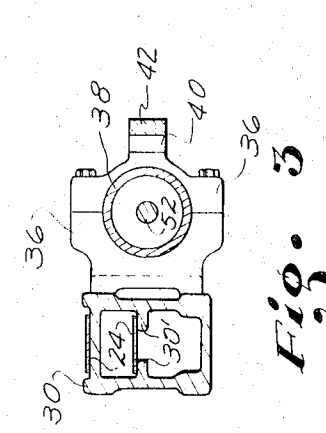

Fig. 3

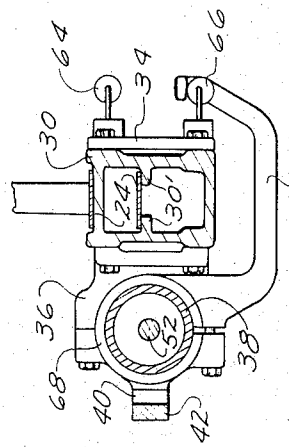

Fig. 5

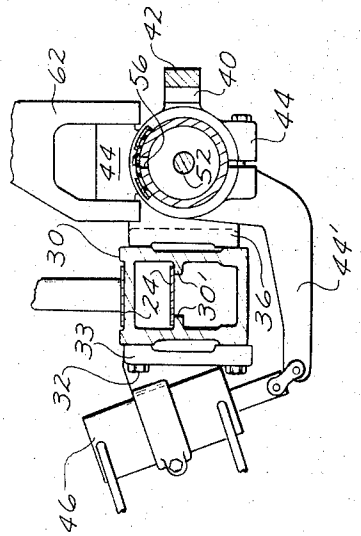

Fig. 4

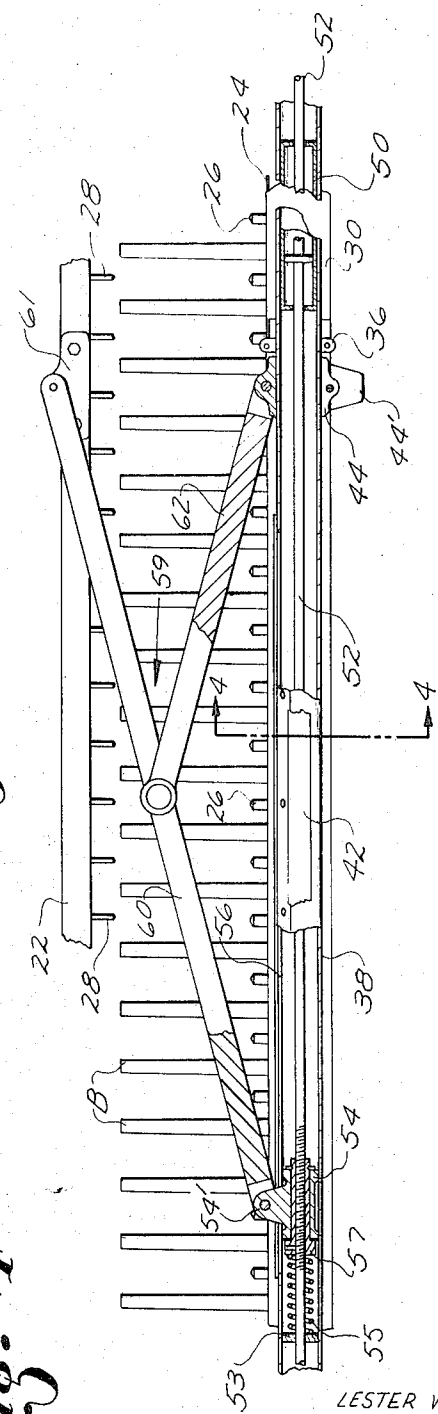

Fig. 2

INVENTORS
LESTER W. PRAY
JOHN H. CHRISTESON
FREDERICK A. PRESTON
HERMAN D. SHERON JR.
WILLIAM H. DRAKE
GORDON C. ANDERSON

BY Donald K. Feldman
THEIR AGENT

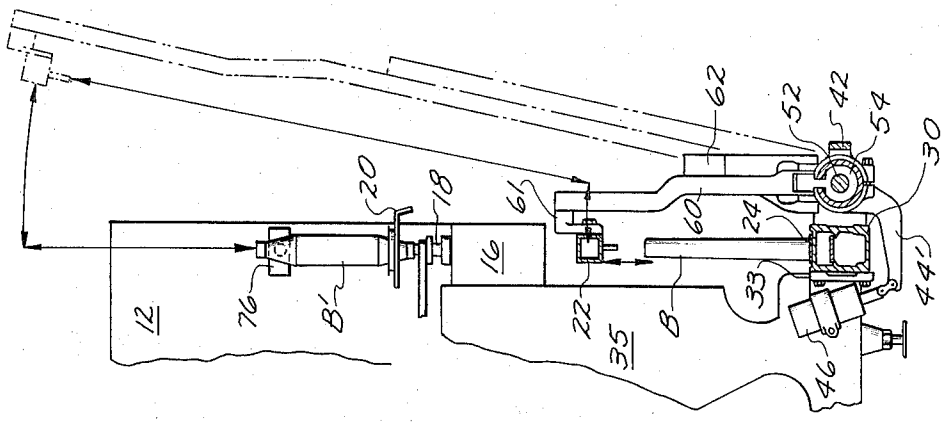

Fig. 6

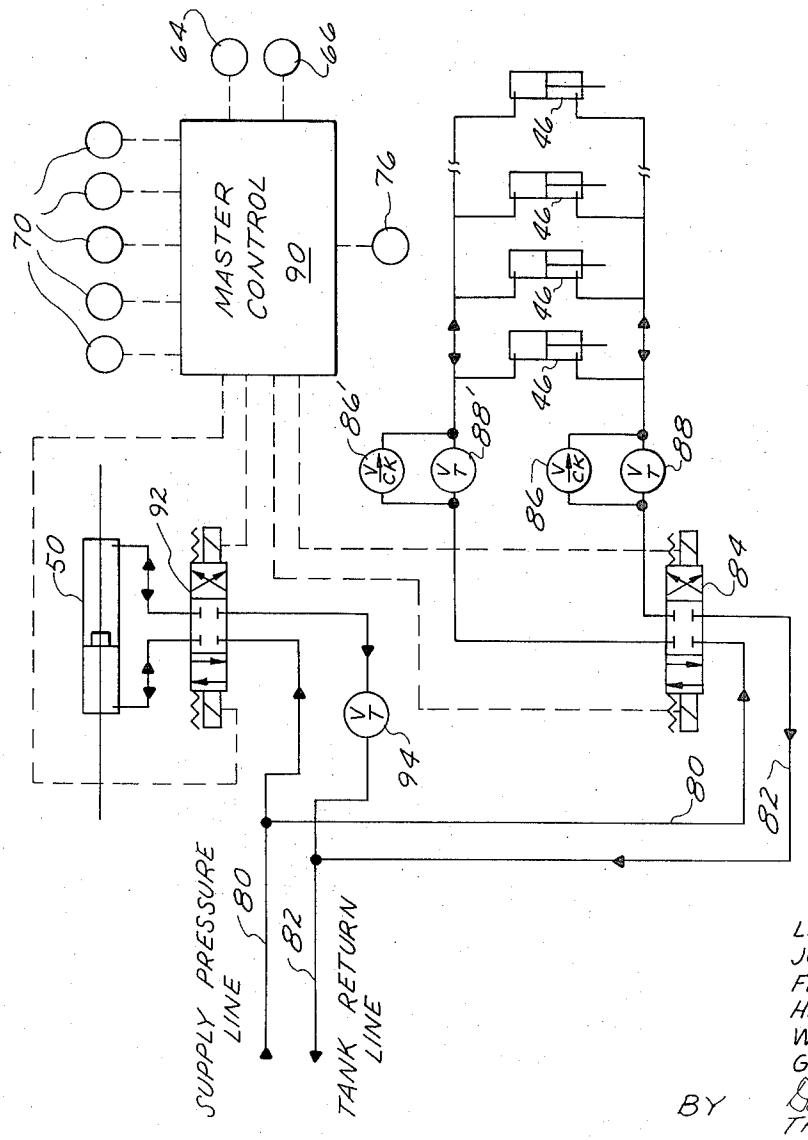

Fig. 7

INVENTORS
LESTER W. PRAY
JOHN H. CHRISTESON
FREDERICK A. PRESTON
HERMAN D. SHERON JR.
WILLIAM H. DRAKE
GORDON C. ANDERSON
BY Donald H. Feldman
THEIR AGENT

GRASPER BAR POSITIONING MECHANISM FOR AUTOMATIC DOFFER

This is a continuation of application Ser. No. 864,399, filed Oct. 7, 1969, now abandoned.

BACKGROUND OF THE INVENTION

This invention relates to automatic bobbin-doffing apparatus for textile spinning frames and like machines, such as twisters, and more particularly to the supporting and positioning mechanisms associated with the bobbin grasper bar of an automatic doffing apparatus such as disclosed in U. S. Pat. No. 3,370,411.

Such apparatus includes, on each side of the spinning frame being serviced, an elongate bobbin conveyor mounted beneath the spindle rail and the row of bobbin-receiving spindles thereon, and a vertically and laterally movable grasper bar having a plurality of depending bobbin-grasping elements corresponding in number and spacing to the spindles. During each doffing operation, the grasper bar doffs full bobbins from all of the spindles simultaneously, transports them downwardly, and seats them upon upstanding pegs provided upon the conveyor. The conveyor then indexes sufficiently to align empty bobbins, (tubes) previously mounted upon alternate pegs of the conveyor, beneath the bobbin-grasping elements of the grasper bar. The empty bobbins are then transported upwardly to and donned upon the spindles by the grasper bar, which thereafter returns to an inoperative position below the spindles and above the conveyor.

Among the many advantages of doffing apparatus of the foregoing type are its constant availability for operation when needed, stemming from its permanent affixation to the spinning frame being serviced. The apparatus is also quite rapid in operation, minimizing nonproductive down-time of the machine being serviced, since all bobbins are doffed from and donned upon the full row of spindles at one time, rather than singly or in groups as with manual doffing or of other types of automatic doffing apparatus. However, these very advantages also give rise to certain problems and difficulties not heretofore completely resolved.

Thus, the doffing apparatus' permanent affixation to the spinning frame occasions its constant exposure to the ambient and frequently lint-contaminated atmosphere, and also to possible impacts — as from cart traffic in the adjacent aisle — and/or other abuse arising from the normal activity transpiring about or attendant the servicing of a spinning frame during normal spinning operations. It is also most important that the doffing apparatus not obstruct or otherwise impede such normal servicing of the spinning frame. Various servicing operations, such as cleaning and end-down piecing, are now frequently performed automatically, rather than manually as previously, as by means of mobile servicing units mounted upon or adjacent the spinning frame and movable thereabout. In order not to impede or obstruct the movement of such units, as well as not to interfere with manual servicing, it is therefore particularly desirable that all components of the doffing apparatus be disposed, in their inoperative position and throughout the entire length of the spinning frame, at an elevation below that of the spindles, which define the lower extremity of that area of the spinning frame customarily requiring servicing attention during normal spinning operations.

Similarly, while doffing and donning bobbins upon all of the spindles on one side of a spinning frame simultaneously yields the advantages previously noted, large motive forces and highly precise movements and alignments are required for satisfactory performance of such procedure. If the grasper bar should fail to doff a bobbin from even a single one of the spindles, as by reason of unevenness in and/or insufficient guiding of the grasper bar's movement, and the doffing operation were allowed to proceed without correction of the failure, the doffing apparatus and/or spinning frame would be severely damaged. It is therefore highly desirable that the grasper bar's movement be precisely guided and directed at all times, that it be smooth and uniform, and that verification of the completion of each phase of the bar's movement and/or function be obtained before the doffing operation is allowed to proceed to a succeeding phase.

SUMMARY OF THE INVENTION

The present invention provides, in a doffing apparatus of the type described, a mechanism for smoothly and precisely moving and guiding the grasper bar during each doffing operation between an elevated position above the spindles being serviced and a lowered inoperative position wherein the grasper bar and all components of the mechanism are disposed in their entireties below the spindles so as to not obstruct or otherwise impede manual or automatic cleaning, end-down piecing and/or other servicing of the spinning frame during normal spinning operations. Critical components of the mechanism are shielded from the ambient atmosphere and also from accidental impacts and stresses to which they might otherwise be subjected. In a preferred embodiment of the mechanism, completion of each phase of the grasper bar's movement is verified before commencement of the succeeding movement-phase, and stop-motion means detect inadvertent non-doffing of a bobbin from any one of the spindles being serviced.

In its more specifid aspects, the present mechanism includes an elongate cylindrical housing mounted for pivotal movement about its central axis upon the bobbin-conveyor track of the doffing apparatus, which track is of a unitary extruded construction greatly facilitating manufacture and installation. A plurality of interconnecting lifter mechanisms support the grasper bar above the housing for pivotal movement with it inwardly toward and outwardly from the spindles of the spinning frame. The lifter mechanisms are each of a type realizing precise linear motion, and are simultaneously actuated by a hydraulic cylinder and piston assembly mounted within the cylindrical housing and operatively connected to a rod extending concentrically therewithin. Reciprocatory movement of the rod is transmitted to appropriate links of the lifter mechanisms by interconnecting brackets projecting upwardly through guide slots provided in the cylindrical housing, to impart vertical movement to the grasper bar carried at the upper ends of the lifter mechanisms. Flexible seal means prevent the entry of lint or other foreign matter into the cylindrical housing, yet freely permit guided movement of the projecting brackets longitudinally of the guide slots of the housing. The housing, in addition to preventing lint accumulation upon and possible damage to the components therewithin, shields the bobbin-conveyor and other components of the doffing

apparatus from accidental contact by carts and the like moving in the aisle adjacent the spinning frame, and is in turn shielded by a bumper member extending along the full length of the housing on that side thereof facing the aisle.

Limit Micro switches associated with the cylindrical housing and with the rod projecting therethrough sense the relative positions of these members at the completion of each of their various phases of movement, and are suitably connected to the master control circuitry of the apparatus. The presence of an undoffed bobbin upon any one of the spindles is preferably detected by photoelectric means, including a lamp source and receiver respectively mounted at opposite ends of the spinning frame so as to pass therebetween a light beam extending parallel to the row of spindles and above their free upper ends, but below the upper end of a bobbin left mounted on any one of them. Interruption of the beam by an undoffed bobbin upon any one of the spindles preferably stops the doffing operation immediately after the grasper bar has completed its movement upwardly away from the spindles, and prior to its commencement of lateral movement, and may if desired also actuate suitable audible and/or visual alarm means.

The foregoing and other features and advantages of the invention will be apparent from the following description of an illustrative embodiment thereof, which should be read in conjunction with the accompanying drawing, in which:

FIG. 1 is a partially schematic front elevation of a textile spinning frame equipped with automatic doffing apparatus embodying the invention, with various components broken away to indicate indeterminate length or to better reveal details of construction;

FIG. 2 is an enlarged fragmentary front elevation of one of the lifter mechanisms and immediately adjacent components of the doffing apparatus, some of the components being broken away or shown in section;

FIG. 3 is an enlarged fragmentary vertical section taken approximately along line 3—3 through the bobbin conveyor track and the cylindrical housing at the bottom of the apparauts of FIG. 1, showing one of the interconnecting brackets mounting the housing for pivotal movement;

FIG. 4 is a similar enlarged fragmentary vertical section taken approximately along line 4—4 of FIG. 2, showing one of the assemblies and brackets for imparting pivotal movement to the cylindrical housing;

FIG. 5 is a similar enlarged fragmentary vertical section taken approximately along line 5—5 of FIG. 1, showing the means for detecting the pivotal positions of the cylindrical housing;

FIG. 5A is an enlarged fragmentary perspective view of one of the slotted portions of the cylindrical housing, showing the slot sealing means and also the bumper bar extending along the housing;

FIG. 6 is an enlarged fragmentary perspective view taken approximately along line 6—6 of FIG. 1, showing in full lines the bobbin grasper bar in its inoperative position, and indicating by arrows and by phantom lines the path of movement thereof; and

FIG. 7 is a schematic representation of part of the hydraulic circuit of the apparatus, also schematically showing by broken lines a related part of the apparatus' electrical circuitry.

Referring more particularly to the drawings, the spinning frame or like machine **10** schematically and fragmentarily shown in FIG. 1 is of a conventional construction including opposite head and foot ends **12, 14** between which there extend, on each side of the machine and intermediate its height, a stationary spindle rail **16** mounting a row of upright bobbin-receiving spindles **18** which during operation of the machine **10** are rotated about their axes and traversed by a vertically movable ring rail **20** as yarn is directed thereto from the machine's drafting elements and creel (not shown) disposed thereabove. Machine **10** is permanently equipped with automatic bobbin-doffing apparatus generally of the type disclosed in U. S. Pat. No. 3,370,411 and including, on each side of the machine, a bobbin grasper bar **22** and an endless bobbin conveyor **24** extending horizontally beneath the full length of the row of spindles **18.** Spaced along the length of conveyor **24** are a plurality of bobbin-supporting pegs **26,** on alternate ones of which empty bobbins B are mounted in upright fashion by a loading mechanism (not shown) at foot end **14** of machine **10** as the upper flight of conveyor **24** is moved, during each loading operation, toward head end **12.** Upon completion of each bobbin-loading operation, which may transpire at any convenient time between doffs of machine **10,** conveyor **24** is halted with the alternate empty pegs **26** thereon positioned beneath and in precise vertical alignment with corresponding ones of the spindles **18** and also corresponding ones of a plurality of bobbin grasper elements **28** spaced longitudinally of and depending downwardly from the grasper bar **22** then disposed in its inoperative position beneath the lower ends of spindles **18** and above the upper ends of the empty bobbins B upon conveyor **24.** While grasper elements **28** may be of other constructions, they preferably are of the inflatable type adapted to be inserted into the open upper ends of bobbins and then expanded, as by pressurized air directed to their interiors from a suitable source (not shown) communicating with the hollow interior of bar **22,** into firm grasping engagement with the bobbins' interior surfaces.

When machine **10** has completed a spinning cycle, a doffing operation is commenced either manually or automatically by appropriate signals from master control **90** (FIG. 7) of the doffing apparatus. Upon completion of certain preliminary steps in the doffing operation, grasper bar **22** is moved from its inoperative position (see FIG. **6,** wherein double-headed arrows indicate the paths of grasper bar movement) in a forward or outward direction a distance sufficient to clear the overlying spindle rail **16,** then upwardly to an elevation above the full bobbins B′ upon spindles **18,** then inwardly a distance sufficient to again bring its depending grasper elements **28** into precise vertical alignment with spindles **18** and the full bobbins B′ mounted thereon, and finally downwardly a distance sufficient to insert grasper elements **28** within the open upper ends of bobbins B′. Bobbins B′ are then grasped by inflation of elements **28,** doffed from spindles **18** and placed upon the empty alternate pegs **26** of conveyor **24.** This is achieved by grasper bar **22** returning along the aforesaid path of movement to its original inoperative position, and then moving downwardly a distance sufficient to seat the lower ends of the bobbins upon the empty conveyor pegs **26** in alignment therewith. Elements **28** are now deflated, and bar **22** moves upwardly from the

released full bobbins B' to its original inoperative position, after which conveyor **24** moves longitudinally the slight distance necessary to vertically align the empty bobbins B thereon with grasper elements **28.** Bobbins B are then grasped, transported upwardly and donned upon spindles **18** by bar **22,** which thereafter returns to its original inoperative position beneath spindles **18,** in a sequence of movement steps such as described previously. At any convenient time during normal spinning operations of machine **10,** which are then resumed, the upper flight of conveyor **24** is moved back toward foot end **14** of machine **10** as the full bobbins B' are removed therefrom by an unloading mechanism (not shown) there located.

GRASPER BAR SUPPORTING AND POSITIONING MECHANISM

Referring now primarily to FIGS. **2–6,** conveyor **24** is in accordance with the present invention supported by a track **30** of unique construction and placement. Track **30** has a hollow and generally rectangular cross-sectional shape, and preferably is formed, from a suitable metal such as aluminum, in a single unitary length by extrusion techniques, joined rigidly to adjacent samsons **35.** When so formed, problems of joint alignment and sealing are minimized and the track **30** is of sufficiently rigid construction and accurate dimensions as to permit other components, hereinafter described, to be readily supported therefrom. The recessed outer surface of the upper wall of track **30** seats and guides the upper flight of conveyor **24,** while the lower conveyor flight is supported within track **30,** where it is shielded from lint and the like, by inwardly projecting flanges **30'** there provided. Track **30** extends substantially the full length of machine **10** parallel to and directly beneath spindle rail **16,** and is rigidly secured to the machine's frame at longitudinally spaced intervals by another bracket (not shown) to its samsons **35.**

The forward or outer vertical face of track **30** provides an accurate mounting surface for a plurality of bearing blocks **36** bolted or otherwise rigidly secured to it at longitudinally spaced intervals. A cylindrical housing **38** extends horizontally substantially the full length of the row of spindles **18** through the aligned bores of bearing blocks **36** and is supported thereby for controlled pivotal movement about its central axis. Studs **40** connected to blocks **36** mount a bumper bar **42** in spaced parallel relationship to housing **38,** on that outer side thereof adjacent the servicing aisle customarily provided next to machine **10,** which bumper **42** extends the full length of housing **38** and shields the same from being accidentally engaged by carts and like traffic customarily moving along such an aisle.

Pivotal movement is imparted to housing **38** by a plurality of hydraulic piston and cylinder assemblies **46** connected to conveyor track **30** by brackets **33** and bolts **32,** and also to housing **38** at spaced intervals along its length by means of suitable brackets **44** rigidly secured thereto. As is best shown in FIG. **4,** each bracket **44** includes a bell-crank arm **44'** extending downwardly and inwardly from housing **38** to a pivotal connection with the piston rod component of the associated assembly **46.** All of the assemblies **46** are connected for simultaneous operation in parallel branches of a hydraulic circuit (see FIG. **7**) including fluid supply and return lines **80, 82,** solenoid-actuated valve **84,** check valves **86, 86'** and adjustable throttle valves **89, 88'.** As is schematically indicated by broken lines in FIG. **7,** valve **84** is operatively connected to the master electrical control **90** of the doffing apparatus and, upon receiving an appropriate electrical signal therefrom, directs fluid from line **80** through check valve **86** to the lower ends of each assembly **46,** causing simultaneous retraction of their pistons and rods and thus causing brackets **44** to pivot housing **38** in a clockwise direction, as viewed in FIGS. **4** and **6,** through an arc of approximately 12°. Valve **88'** so throttles the exhaust flow of hydraulic fluid passed from the upper ends of assemblies **46,** through valve **84** and to return line **82,** as to insure smoothness and uniformity of the aforesaid movement. Upon receipt of another appropriate signal from master control **90,** valve **84** directs fluid from line **80** through check valve **86'** to the upper ends of assemblies **46,** similarly causing return pivotal movement of housing **38** in a counter-clockwise direction to its original position, the exhaust fluid passing at this time from the lower ends of assemblies **46** being throttled by valve **88.** Secured in any suitable manner to conveyor track **30** (see FIG. **5**), as by brackets **34,** are a pair of vertically spaced limit switches **64, 66** connected to master control **90** and disposed in the path of movement of an inwardly extending arm **68** secured to and pivotally movable with housing **38.** When housing **38** reaches the end of its outward pivotal movement, tripping of switch **64** by arm **68** notifies master control **90** of such occurrence. A signal is similarly directed to master control **90** upon return pivotal movement of housing **38** to its inward position, by arm **68** then engaging and actuating switch **66.**

While for purposes of illustration only four assemblies **46** are shown in FIG. **7,** more of the assemblies and of the associated brackets **44** would be provided if required, by the length of machine **10** and housing **38,** to prevent objectional torsional deflection of housing **38** during its aforesaid pivotal movement.

A larger hydraulic piston and cylinder assembly **50** mounted concentrically and rigidly within housing **38** (see FIG. **2**) has its piston component connected to a rod **52** which extends from both ends thereof axially of housing **38** through longitudinally spaced supporting bearings **53** and spool-like guide brackets **54** respectively secured to housing **38** and threaded portions of rod **52,** and also through coil springs **55** disposed for reasons subsequently discussed between each bracket **54** and bearing **53.** At head end **12** of machine **10,** rod **52** terminates inwardly of the closed end of housing **38,** but at the opposite end of the housing projects through a suitable seal (not shown) and along foot end **14** of machine **10** in adjacent relationship to a plurality of frame-mounted limit switches **70.** Switches **70** are engaged and tripped upon reciprocation of rod **52** by an actuating element **72** secured to the projecting rod portion. As is shown in FIG. **7,** switches **70** are electrically connected to master control **90,** as is the solenoid-operated valve **92** producing reciprocatory movement of rod **52** by selectively directing hydraulic fluid to and from opposite ends of assembly **50** via hydraulic pressure and return lines **80, 82** and adjustable throttle valve **94.**

Each bracket **54** includes an outer portion having an upstanding fin **54'** projecting therefrom, and an inner portion **54''** which is concentric and adjacent an interiorally threaded sleeve **57** to facilitate precise initial positional adjustment of the bracket longitudinally of the

threaded portion of rod **52** encircled thereby. Each fin **54'** projects upwardly from housing **38** through one of a plurality of elongate guide slots **56** provided through it. Slots **56** are provided with resilient seal means which prevent the passage of lint and other foreign matter into housing **38,** yet do not impede guided movement of fins **54',** during axial reciprocation of rod **52,** by and longitudinally of the slots. Each such seal comprises two strips of rubber or similar resilient material **58, 58'** (see FIGS. **4** and **5A**) extending the full length and secured in any suitable manner upon opposite sides of the slot **56** sealed thereby, the strips being of such a width that their adjacent longitudinal edges overlap or at least abut intermediate the width of the slot. The resiliency of strips **58, 58'** is such that immediately adjacent bracket fin **54'** they deflect upward to permit its passage, but elsewhere along the slot's length retain their overlapped and shielding positions.

A plurality of identical lifter mechanisms **59,** two of which are shown in FIG. **1,** of the Scott-Russell straight-line type extend upwardly from housing **38** at equally spaced intervals throughout its length. As is better shown in FIG. **2,** each lifter mechanism **59** includes a first link **60** connected at its lower end to a corresponding one of bracket fins **54'** for unitary movement with bracket **54** longitudinally of and pivotally about the axis of housing **38,** and for pivotal movement relative to bracket **54** and housing **38** in a generally vertical plane. The upper end of link **60,** which as shown in FIG. **6** is inwardly offset somewhat from its lower end, supports and is pivotally connected to grasper bar **22** by a bracket **61.** The second link **62** of each lifter mechanism **59** is similarly connected, for relative pivotal movement in a generally vertical plane, at its upper end to an intermediate portion of link **60** and at its lower end to one of the brackets **44** through which pivotal movement is imparted to housing **38** by piston and cylinder assemblies **46.** Reciprocatory movement of rod **52** produces unitary guided movement of brackets **54** and the lower ends of links **60** toward or away from brackets **44** and the lower ends of links **62,** which by the interaction between the links produces linear upward or downward movement of the upper ends of links **60** and the grasper bar **22** supported thereby.

The desired movement of grasper bar **22** during the doffing operation and along the previously-described path indicated by the arrows in FIG. **6** is produced through the aforesaid linkages and mechanisms by selective actuation of valves **84, 92** and hydraulic assemblies **46, 50** by master control **90.** Actuation of assemblies **46** produces inward and outward grasper bar movement through brackets **44,** housing **38** and the edges of guide slots **56,** brackets **54,** links **60, 62** and brackets **61.** Actuation of assembly **50** produces upward and downward grasper bar movement through rod **52,** brackets **54, 44,** links **60, 62** and brackets **61.** Verification of the completion of each phase of the grasper bar's movement is obtained, and transmitted to master control **90** before the latter permits commencement of the next succeeding movement phase, by actuation of an appropriate one of the limit switches **70** by actuator **72,** in the case of upward and downward movement of bar **22,** and by actuation of switch **64** or **66** by actuator arm **68,** in the case of inward and outward bar movement. Such verification greatly lessens the possibility of the doffing apparatus and/or machine **10** being severely damaged if a malfunction should inadvertently occur.

Removal of full bobbins B' from spindles **18** constitutes one of the more difficult steps in each doffing operation. As grasper bar **22** is moved upwardly from spindles **18,** following insertion and inflation of its grasper elements **28** within the open upper ends of the bobbins B' mounted upon such spindles, all bobbins B' should be raised with bar **22** to an elevated position wherein their lower ends are above the tips of the spindles. It is possible, however, that due to a faulty bobbin, spindle clutch or other uncontrollable variable, one or more bobbins B' might be inadvertently left fully or partially seated upon its respective spindle **18.** If that condition existed and the doffing operation proceeded without its correction, considerable damage would be done either to the doffing apparatus and/or to machine **10,** either during the next-succeeding outward movement of grasper bar **22** or at that subsequent time in the doffing operation when an attempt would be made to seat an empty bobbin B upon the then still undoffed spindle **18.** To prevent such an occurrence, the present invention provides reliable but inexpensive stop-motion means for detecting the presence of any undoffed bobbin still remaining upon any of the spindles **18** at the aforesaid point in the doffing operation. This is preferably of the photoelectric type, including a light source **74** and light receiver **76** (FIGS. **1** and **6**), respectively mounted at opposite ends of the machine **10,** as upon the cabinets of head end **12** and foot end **14,** for passage therebetween of a light beam parallel to and closely adjacent the row of spindles **18.** Preferably the beam is directed immediately above the upper ends of spindles **18,** where it would underlie the lower ends of the doffed bobbins B' suspended from grasper bar **22** but would be blocked by any bobbin B' left undoffed upon any one of the spindles, but the beam might be directed adjacent any portions of the spindles where a similar result could be obtained. Receiver **76,** which may be of either the light or dark-actuated type, forms part of a suitable stop-motion circuit which preferably, as indicated in FIG. **7,** is connected to master control **90** in a manner causing the doffing operation to be immediately stopped if an undoffed bobbin B' should be detected. Alternatively or additionally, the stop-motion circuit may actuate suitable visual and/or audible alarm means (not shown).

It will be noted that when grasper bar **22** is disposed in its inoperative position, not only it but also all components of the lifter and associated mechanisms are at an elevation below that of spindle rail **16** and the spindles **18** carried thereby. This affords free access to the spindle, drafting and creel areas of machine **10** for servicing purposes during normal spinning operations. End-down piecing, cleaning and/or other servicing functions can if desired be performed by mobile units suspended from or above spindle rail **16** of machine **10,** in accordance with practices now followed in some mills, without the doffing apparatus in any way constituting an obstruction. The inward offset provided at the upper end portions of links **60** of each of the various lifter mechanisms **59** (FIG. **6**) affords additional clearance for any such servicing unit which might extend downwardly somewhat from spindle rail **16** of machine **10.**

It will also be noted that while grasper bar **22** is in its inoperative position, as well as at other times, conveyor

24 is shielded from accidental impacts from carts and the like by housing 38, which also shields the hydraulic assembly 50 and rod 52 therewithin and is in turn shielded from such impacts by bumper bar 42. The accumulation of lint and other debris upon the lower flight of conveyor 24, assembly 50, rod 52, bearings 53 and brackets 54 is discouraged by the enclosure of these components within track 30 or housing 38.

The coil springs 55 disposed within housing 38 between adjacent bearings 53 and brackets 54 exert a biasing force upon the brackets insuring that bar 22 will not inadvertently drop downwardly from its inoperative position even if the hydraulic flow to assembly 50 should fail or be shut off for some reason. Springs 55 also assist initial upward movement of bar 22 by assembly 50 through mechanisms 59, at which time the positions of links 60, 62 affords the least mechanical advantage.

While a specific embodiment of the invention has been shown and described, it will be appreciated that this was for purposes of illustration only, and not for purposes of limitation, the scope of the invention being in accordance with the following claims.

That which is claimed is:

1. In an automatic bobbin doffing and tube donning apparatus for servicing a textile machine having a plurality of upright bobbin tube receiving spindles mounted in a row extending longitudinal said machine, said apparatus including a grasper bar extending parallel to and the entire length of said row and having thereon a plurality of bobbin tube grasping elements for at desired times grasping bobbins to be doffed from or empty bobbin tubes to be donned upon said spindles, the improvement comprising

support means, respectively,

for moving said grasper bar laterally into and out of vertical alignment with said row wherein said grasping elements are positioned into and out of alignment with said spindles and

for moving said grasper bar vertically between a lowered position wherein said grasper bar and said support means are entirely beneath said row and an elevated position wherein said grasper bar is above said row,

said support means being pivotally interconnected at a lower end thereof to said machine for said lateral moving and at an upper end thereof to said grasper bar for said vertical moving.

2. The improvement as in claim 1, wherein said support means comprises

a rod extending longitudinally the lower end of said machine and interconnected therewith for axially reciprocatory movement relative thereto,

a plurality of hinge-linked lifter mechanisms attached to said rod at an end, interconnected with said machine at an end and hingedly-linked to said grasper bar at another end for unitary pivotal movement of said lifter mechanisms and said grasper bar and for reciprocatory movement of said lifter mechanisms with said rod,

pivotal movement means for imparting said pivotal movement to said lifter mechanisms and said grasper bar in unison about the axis of said rod, and

reciprocatory axial movement means for imparting said reciprocatory movement to said rod and said lifter mechanisms to move said grasper bar vertically between said lowered and elevated positions.

3. The improvement as in claim 2, wherein said reciprocatory axial movement means includes a hydraulic piston and cylinder assembly attached to said rod to impart reciprocatory movement thereto.

4. The improvement as in claim 2, wherein said pivotal movement means includes a hydraulic cylinder and piston assembly carried by said machine and interconnected with said lifter mechanisms for imparting said pivotal movement to said lifter mechanisms and said grasper bar in unison about the axis of said rod.

5. The improvement as in claim 2, further including switch means for detecting the pivotal and vertical positions of said grasper bar.

6. The improvement as in claim 5, wherein said switch means includes a switch actuating member interconnected with and pivotally movable with said lifter mechanisms and a coacting member mounted in the path of pivotal movement of said switch actuating member to coact therewith for sensing pivotal positions of said lifter mechanisms and said grasper bar.

7. The improvement as in claim 5, wherein said switch means includes sensing means operatively associated with said rod for sensing reciprocatory positions thereof and thereby vertical positions of said grasper bar.

8. The improvement as in claim 2, wherein said support means further comprises

an elongate housing interconnected with said machine, extending adjacent the lower end thereof, and generally parallel to and substantially the entire length of said row,

wherein said pivotal movement means mounts said housing,

wherein said rod extends longitudinal of and is mounted within said housing and is reciprocatable relative thereto, and

wherein said hinge-linked lifter mechanisms interconnected at an end thereof to said machine are interconnected therewith through said housing such that said housing is pivotable with said lifter mechanisms.

9. The improvement as in claim 8, wherein said hinge-linked lifter mechanisms attached at an end thereof to said rod are so attached through bracket means, wherein said housing is formed with a slot means extending longitudinal thereof, wherein said bracket means projects through said slot means, wherein said housing has flexible seal means displaceable by said bracket means projecting through said slot means, and wherein said seal means overlays said slot means to shield it and the interior of said housing.

10. The improvement as in claim 9, wherein said seal means includes a plurality of strips of resilient material secured to and extending longitudinal said housing on opposite sides of said slot means, said opposing strips thereof having longitudinal edges in at least abutting relation to one another intermediate the width of said slot means.

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