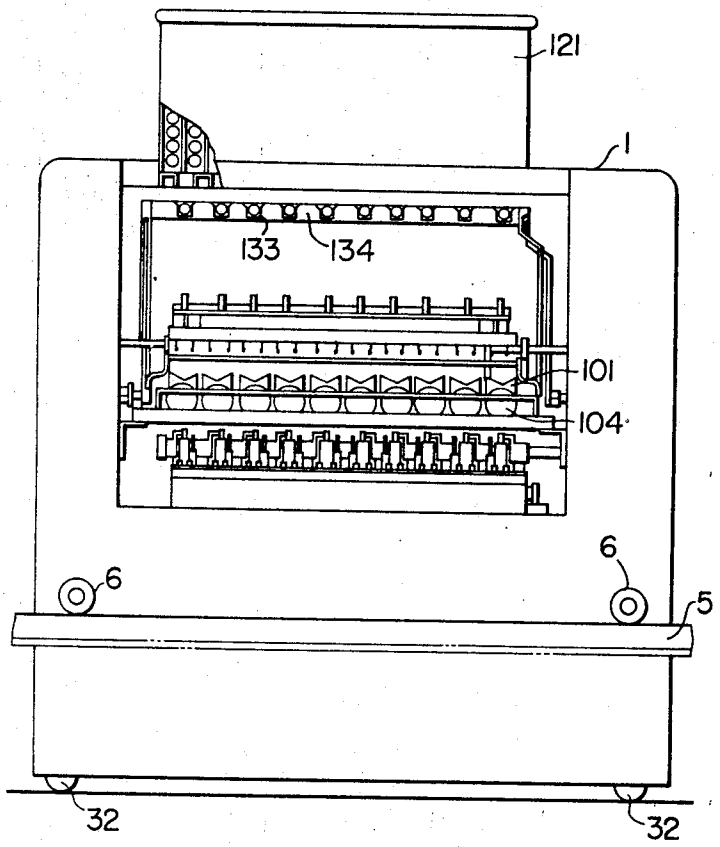
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AUTODOFFING MACHINE IN A RING SPINNING MACHINE

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Fig. 1



Takashi Morikawa,
Aritsune Moriyama,
Eiichi Yagita, and
Chuji Katsui,

INVENTORS

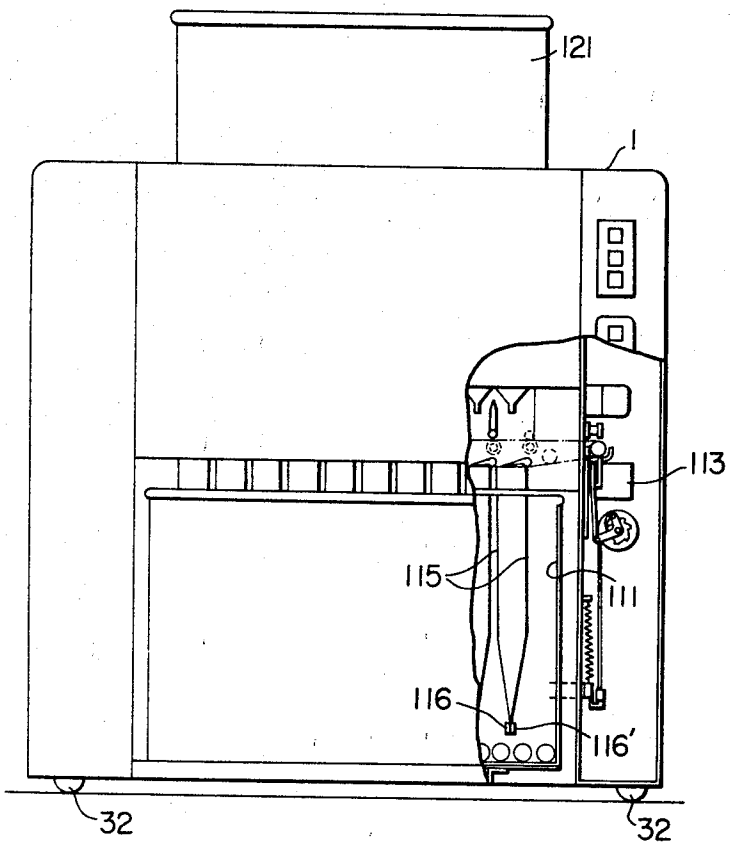
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Lind and Ponack ATTORNEYS

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AUTODOFFING MACHINE IN A RING SPINNING MACHINE

Filed July 20, 1964 12 Sheets-Sheet 2

Fig. 2



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AUTODOFFING MACHINE IN A RING SPINNING MACHINE

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Fig. 3

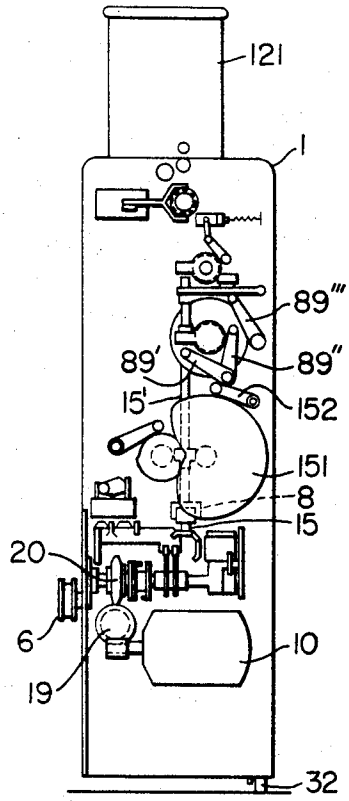
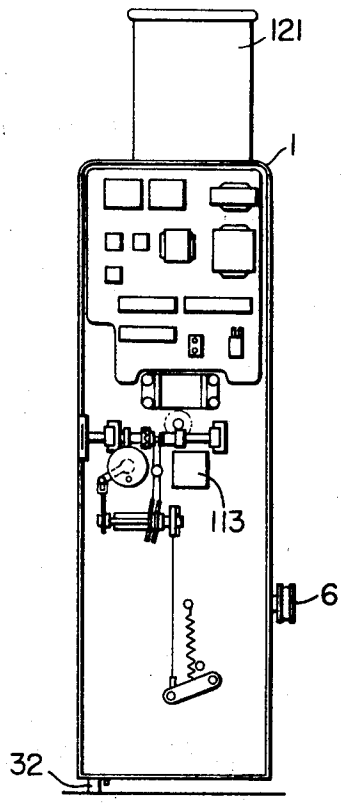


Fig. 4



Takashi Morikawa,
Aritsune Morisawa,
Eiichi Yagita and
Chu Okutani,
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AUTODOFFING MACHINE IN A RING SPINNING MACHINE

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Fig. 5

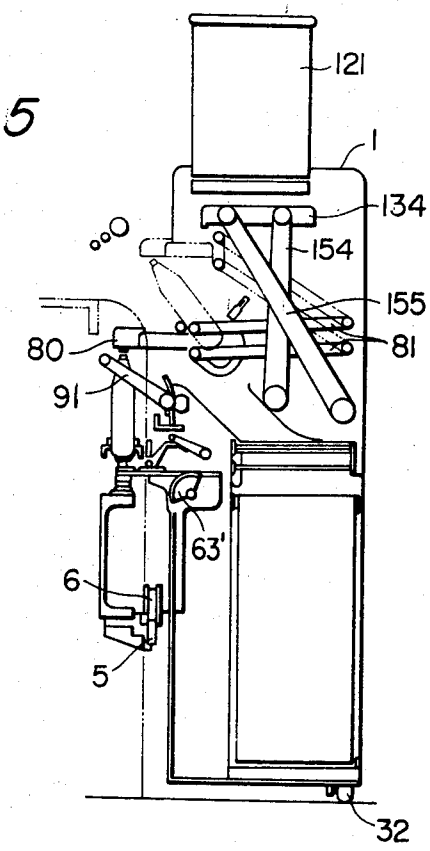
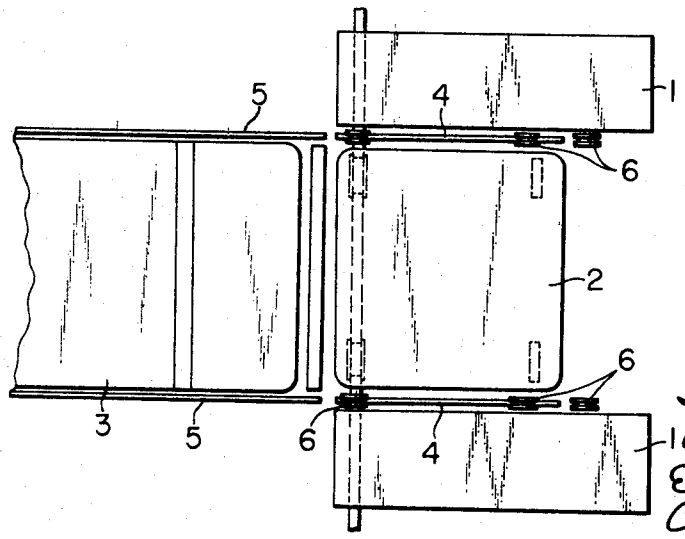


Fig. 6



Takeshi Morikawa,
Aritsune Morigawa,
Eiichi Yagita and
Chuji Sakutani,
INVENTORS,

BY Wenderoth,
Lind and Ponack ATTORNEYS

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AUTODOFFING MACHINE IN A RING SPINNING MACHINE

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Fig. 7

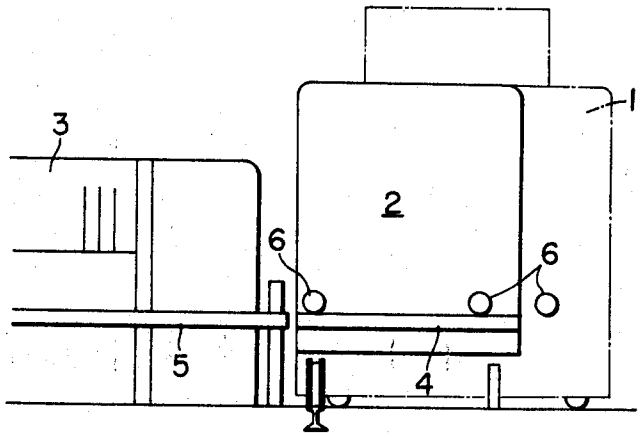
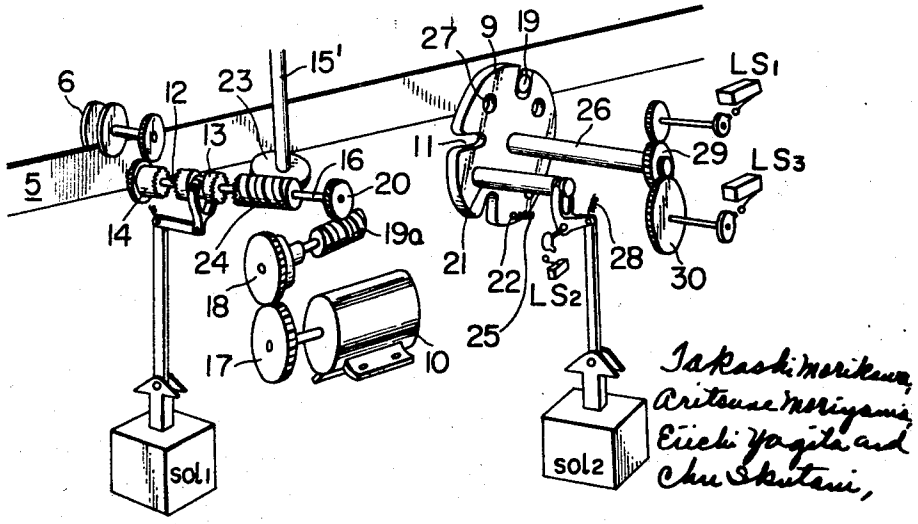


Fig. 8



Takashi Morikawa, Aritsune Moriyama, Eiichi Yagita and Chu Ikutani,

INVENTORS

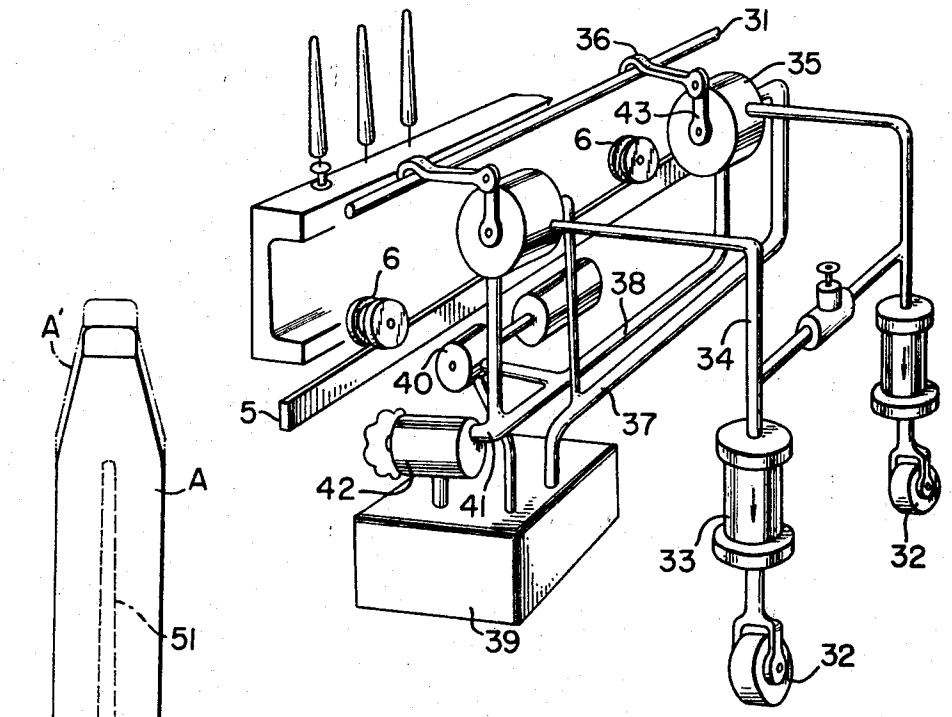
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AUTODOFFING MACHINE IN A RING SPINNING MACHINE

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Fig. 9



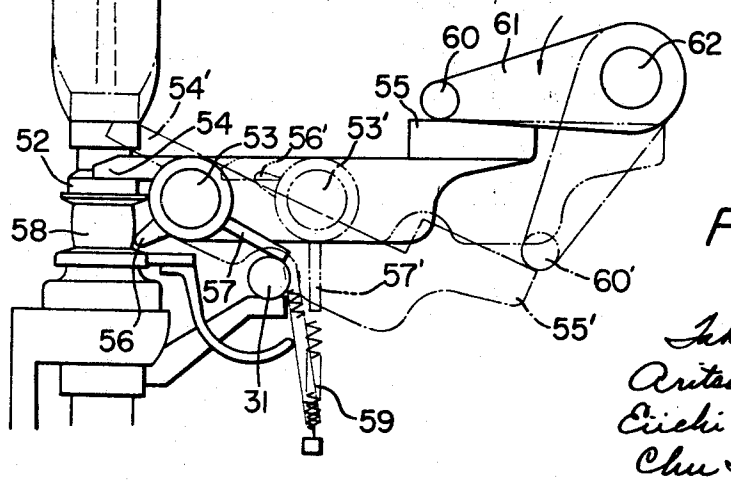


Fig. 10

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AUTODOFFING MACHINE IN A RING SPINNING MACHINE

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Fig. 11

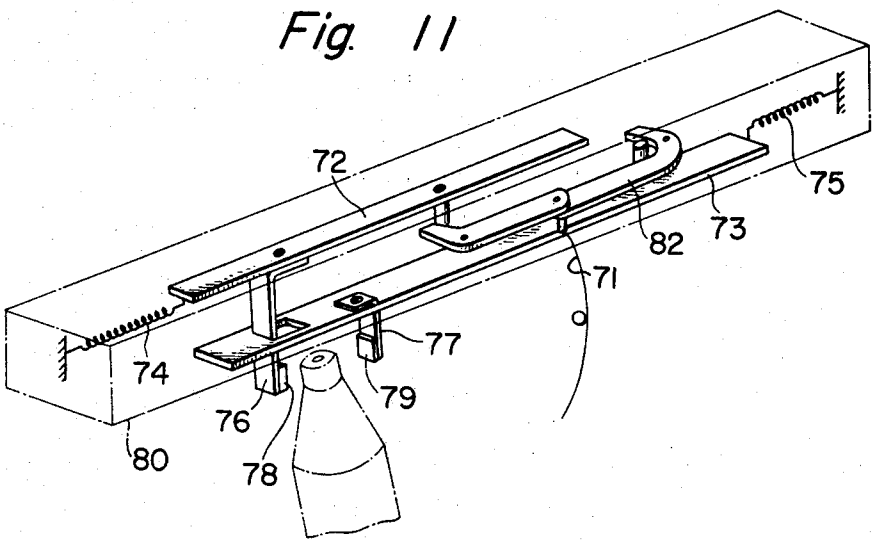
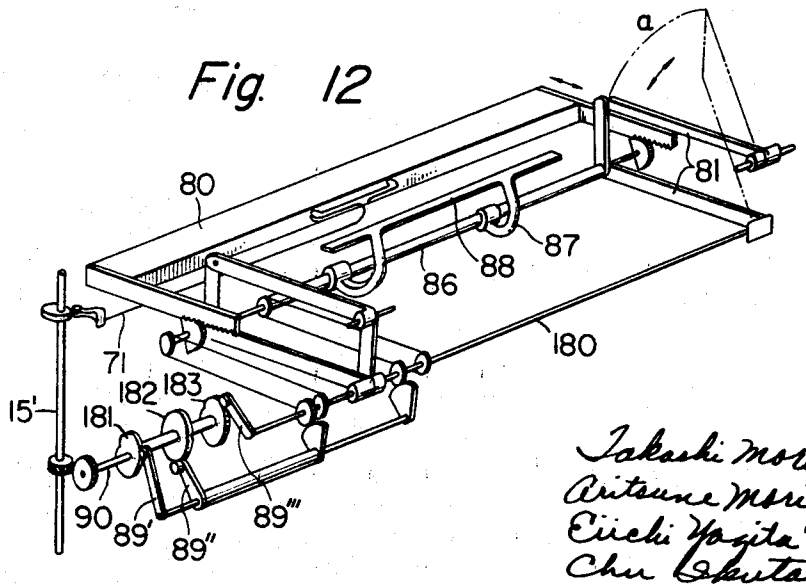


Fig. 12



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AUTODOFFING MACHINE IN A RING SPINNING MACHINE

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Fig. 13

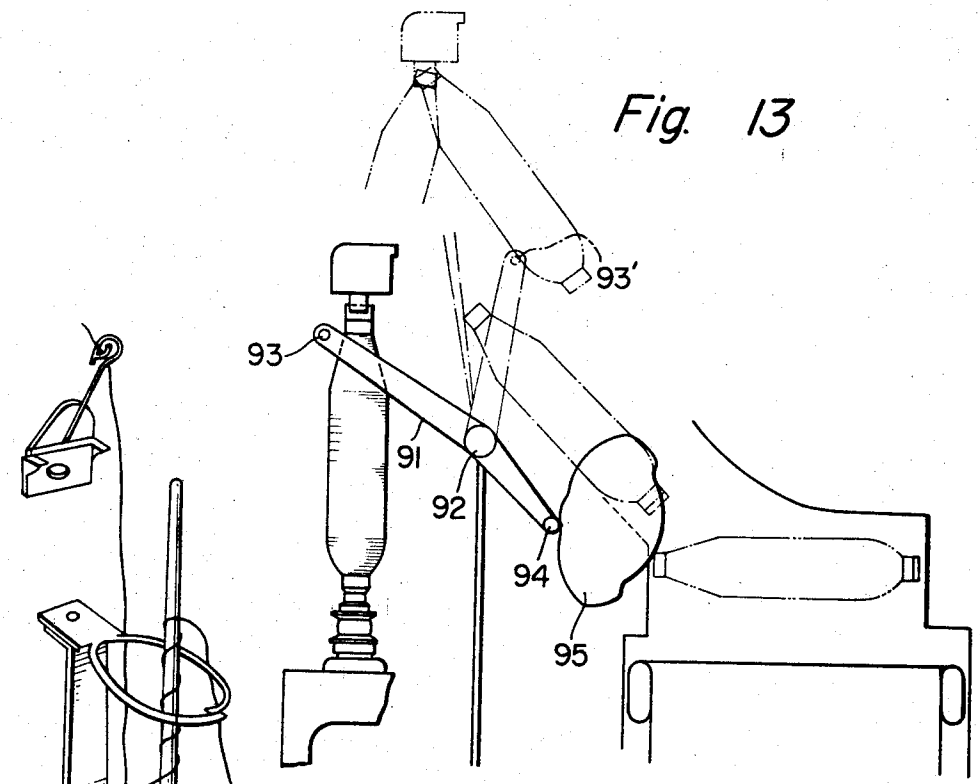
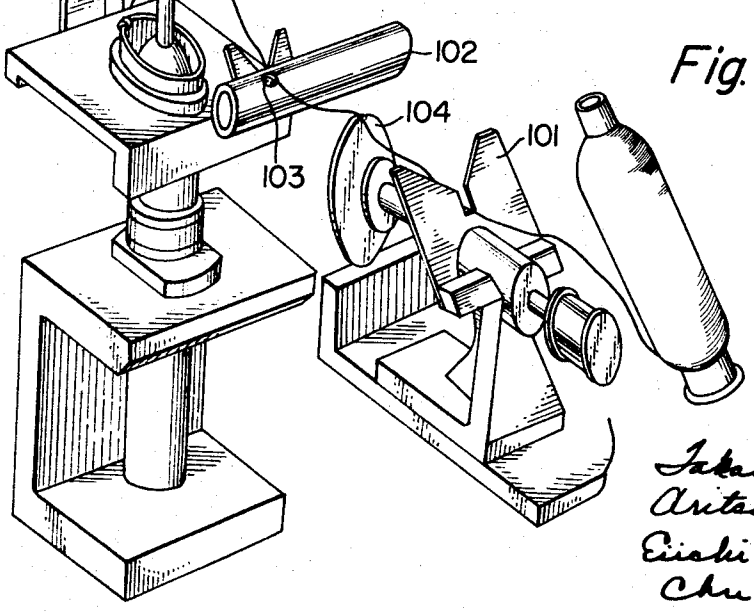


Fig. 14



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Aritsune Moriyama,
Eiichi Yazita and
Chu Okutani,
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AUTODOFFING MACHINE IN A RING SPINNING MACHINE

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Fig. 15

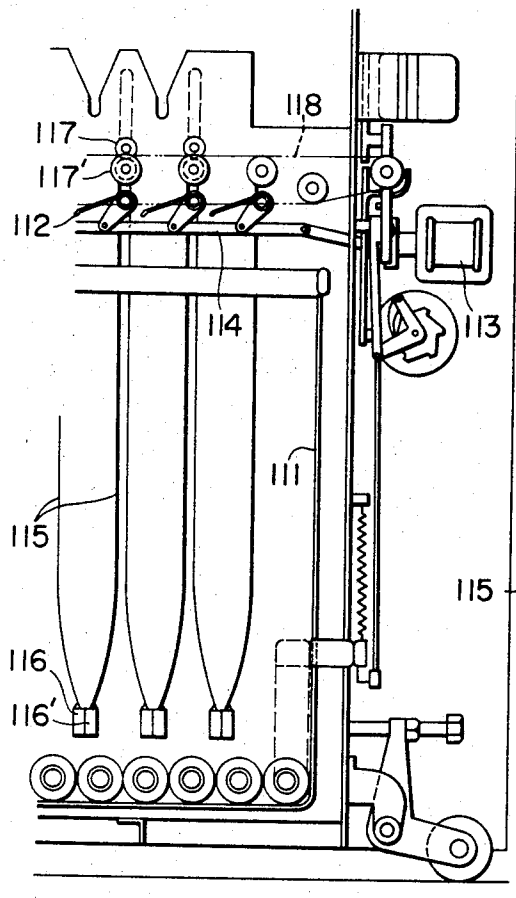
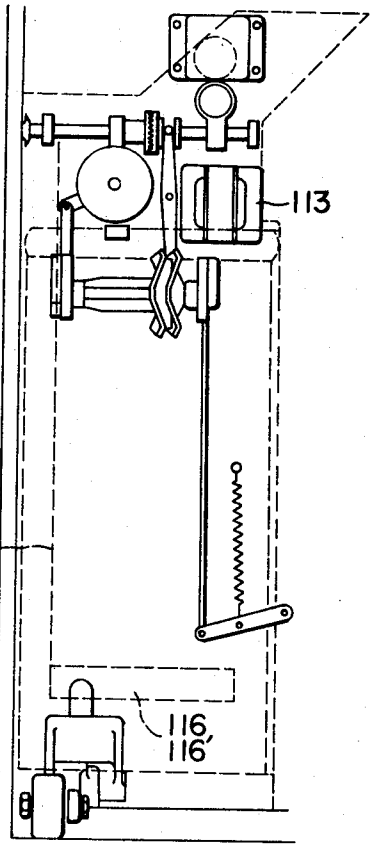


Fig. 16



INVENTOR

BY

ATTORNEY

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AUTODOFFING MACHINE IN A RING SPINNING MACHINE

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Fig. 17

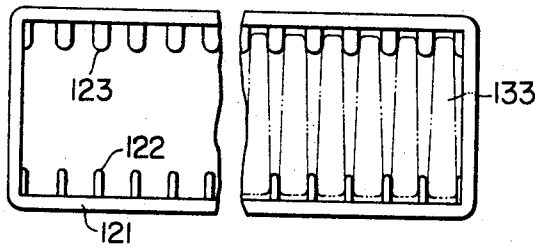


Fig. 18

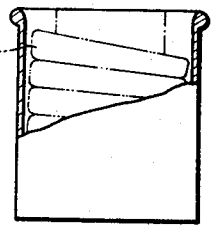


Fig. 19

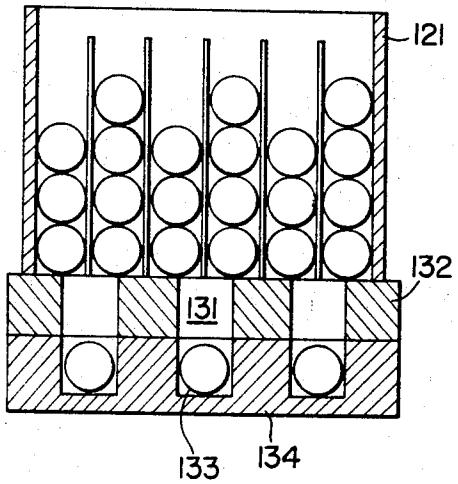
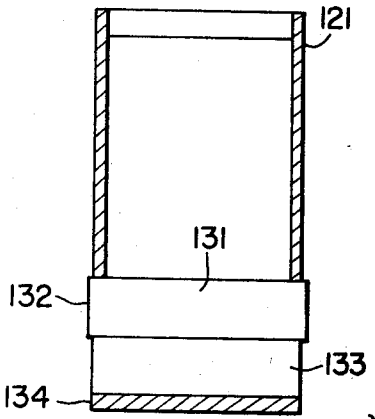


Fig. 20



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Eiichi Yagita + Chu Ikutani, INVENTORS

BY Wenderoth,
Lind and Ponack ATTORNEYS

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AUTODOFFING MACHINE IN A RING SPINNING MACHINE

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Fig. 21

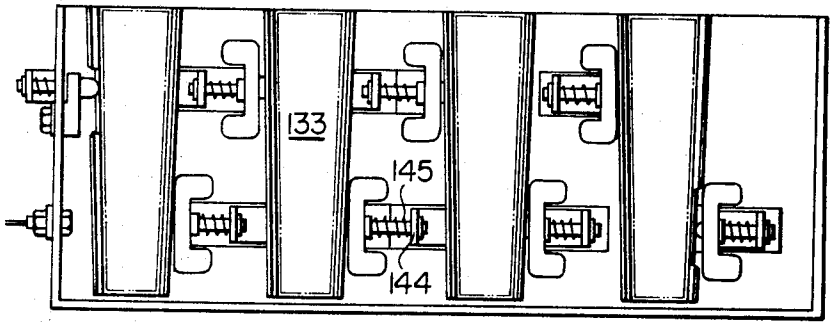


Fig. 22

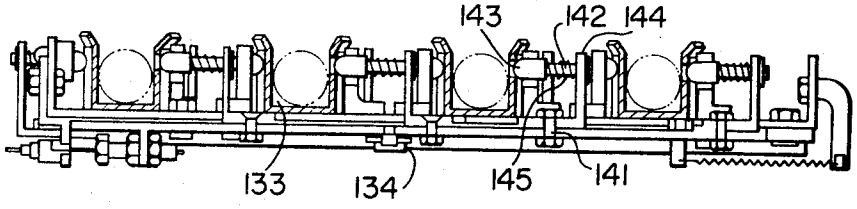
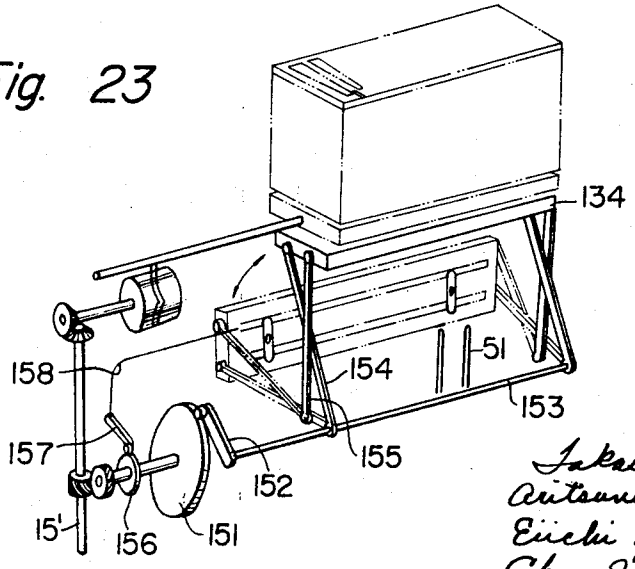


Fig. 23



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Aitsune Moriyama,
Eiichi Yogita and
Chu Ikutani.
INVENTORS

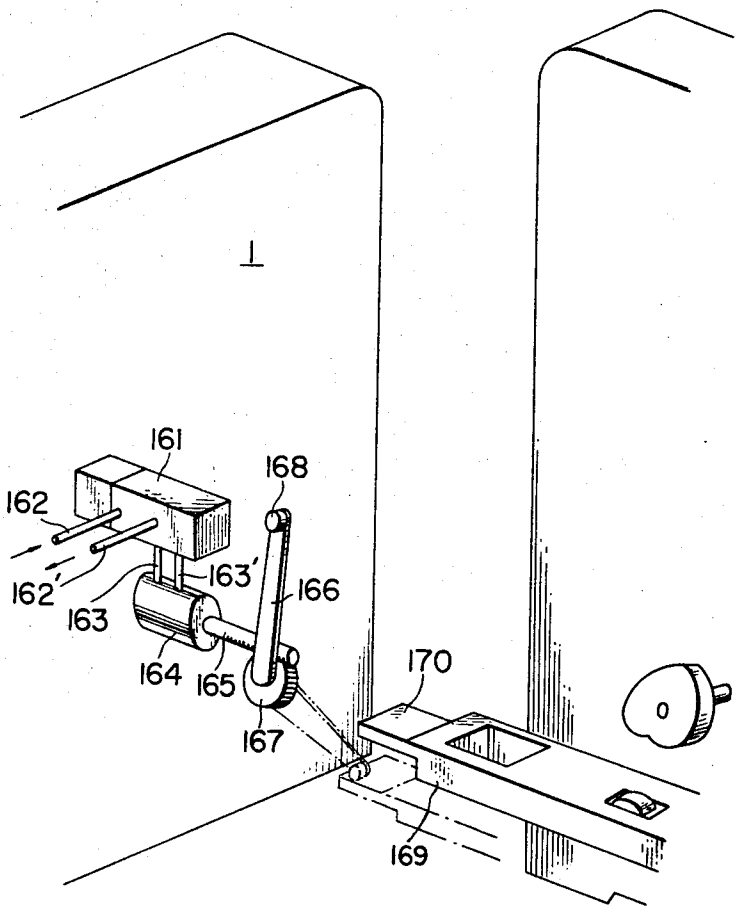
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AUTODOFFING MACHINE IN A RING SPINNING MACHINE

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Fig. 24



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Eiichi Yajita and
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INVENTORS

BY Wenderoth,
Lind and Ponack, ATTORNEYS

United States Patent Office 3,394,539 Patented July 30, 1968

3,394,539

AUTODOFFING MACHINE IN A RING SPINNING MACHINE

Takashi Morikawa, Hyogo-ken, Aritsune Moriyama, Osaka-fu, Eiichi Yagita, Wakayama-ken, and Chu Ikutani, Nara-ken, Japan, assignors to Daiwa Boseki Kabushiki Kaisha, Osaka, and Itami Machine Works, Limited, Hyogo-ken, Japan, both corporations of Japan

Filed July 20, 1964, Ser. No. 383,874
Claims priority, application Japan, July 22, 1963, 38/39,292; Mar. 26, 1964, 39/17,195
10 Claims. (Cl. 57—53)

This invention relates to an autodoffing machine in a ring spinning machine, twisting machine and other similar machines.

Although numerous autodoffing machines have been developed to date, few can be used immediately in the spinning machines now in operation. Further it is common of the known autodoffing machines that their operation is complicated, and also in order to use the machines the costs involved in the conversion of the spinning machine and installation thereto of the machines considerable. In addition, the management of the autodoffing machines was difficult. In view of the foregoing reasons, these machines are not in wide use as yet.

According to the present invention there is provided a bobbin autodoffing machine adapted to travel step-by-step along the front of a spinning machine, twisting machine or the like, for doffing a group of fully-wound bobibns from a group of spindles and mounting a group of empty bobbins on such group of spindles, said autodoffing machine comprising means for manipulating the yarn, means for severing the end yarn, means for kicking up fully-wound bobbins, means for making preparatory arrangement of empty bobbins, means for delivering empty bobbins, means for holding empty bobbins, and means for mounting empty bobbins, a bobbin case being disposed below said means for extracting bobbins, and means for gently placing said fully-wound bobbins in said case, said last mentioned means comprises a plurality of flexible elements hung downwardly into said bobbin case and loosely drawn towards one another in pairs at the bottom, and means for winding up said flexible elements step-by-step as the case is filled up. In the above machine, the means for manipulating the yarn is to manipulate the yarn toward a spinning machine when extracting bobbins, the means for severing the end yarn is to cut end yarns of the extracted full bobbins, the means for kicking up full-wound bobbins is to loosen from spindles the full bobbins to be extracted, the means for making a preparatory arrangement of empty bobbins is to arrange the empty bobbins to be supplied to the spindles in a certain direction, the means for delivering empty bobbins is to deliver the empty bobbins to be supplied to the spindles one by one to bobbin holding members, the means for holding empty bobbins is to hold the bobbins within the bobbin holding members, the means for mounting empty bobbins is to transmit the bobbin holding members toward the spindles, to release the bobbins from said members and to mount them on the spindles, and the means for gently placing full-wound bobbins is to discharge the doffed full bobbins to a bobbin case without damaging the yarn or thread wound thereon.

Accordingly, this invention has improved on the various defects of the autodoffing machines which have been developed to date and makes possible the immediate use of the machine with the spinning machines now in operation. Since the construction of the invention autodoffing machine is very simple the expenses involved in the conversion of the spinning machines now in operation and

installation thereto of this autodoffing machine can be accomplished at low cost.

As principal features of the invention, the following can be given: First, since the travel of the autodoffing machine is not, as heretofore, by means of the engagement of a rack provided in the spinning machine and a pinion in the doffing machine but by the doffing machine traveling over a single guide rail of the spinning machine by its wheels being driven, the autodoffing machine can travel horizontally at its established height irrespective of the unevenness of the floor of the room housing the spinning machines. Secondly, the autodoffing machine is provided with means for loosening the full bobbins from the spindles when dismounting the bobbins, this loosening means also being so adapted to catch the lower end of the empty bobbins when the empty bobbins fall by gravity for impalement on the spindles, and thus prevent damage to the lower end of the bobbins as well as preclude the breakage of the spun yarn at this time. Further, this machine is provided with a most simple means for arranging the doffed full-wound bobbins in a bobbin case, with the consequence that the yarn wound on the bobbins is not damaged. In practice, these are most desirable features for an autodoffing machine to possess.

Although a preferred embodiment of the invention will be described herein with reference to the accompanying drawing, it is not intended to limit the invention to the embodiment illustrated and described but to include all variations and modifications within the spirit of the invention and scope of the appended claims.

FIG. 1 is a front elevation of an autodoffing machine; FIG. 2 being a rear view thereof; FIG. 3, a right side view; FIG. 4, a left side view; and FIG. 5, a right side view showing the interior of the machine.

FIG. 6 is a simplified plan view illustrating the machine in use; FIG. 7 being a front elevation thereof; FIG. 8, a simplified perspective view of the means for stopping the machine at the prescribed position; and FIG. 9, a simplified perspective view of the means for controlling the level of the machine.

FIGS. 10–24 illustrate the various means that have been installed in the autodoffing machine; FIG. 10 being a side view of the means for kicking up the full-wound bobbins; FIGS. 11 and 12 being perspective views of the means for dismounting the full-wound bobbins; FIG. 13, a side view of the means for manipulating the yarn; FIG. 14, a perspective view of the means for severing the fining yarn; FIG. 15, a front elevation of the means for arranging the full-wound bobbins; FIG. 16, a side view thereof; FIG. 17, a plan view of the means for making preparatory arrangement of the empty bobbins; FIG. 18, a side view thereof in vertical section; FIG. 19, a front elevation in vertical section of the means for delivering the empty bobbins; FIG. 20, a side view in vertical section thereof; FIG. 21, a plan view of the means for holding the empty bobbins; FIG. 22, a front elevation in vertical section thereof; FIG. 23 a perspecttive view of the means for impaling the empty bobbins; and FIG. 24, a perspective view of the means for oscillating a lifting lever.

Autodoffing machines **1** shown in FIGS. 1–5 are mounted on two sides of carriage **2** shown in FIGS. 6 and 7 and conveyed to the gear or outer end of a spinning machine **3** requiring the exchange of bobbins. After bringing the fixed rails **4** of carriage **2** in alignment with the guide rails **5** of spinning machine **3**, the driving wheels **6** of the autodoffing machine **1** are rotated to effect the transfer of the autodoffing machines **1** from fixed rails **4** of carriage **2** to the guide rails **5** of spinning machine **3**

and cause the autodoffing machines **1** to travel over the latter rails.

Means for stopping the autodoffing machine at prescribed position

The means for stopping the autodoffing machine (ADM) at prescribed positions, the mechanism of which is shown in FIG. 8, is for stopping ADM accurately and with certainty at the prescribed positions after travelling a given distance. When ADM, which being mounted on guide rail **5** disposed in front of the spinning machine in parallel with the line of spindles, travels by means of the rotation of driving wheels **6** along the line of spindles of the spinning machine and approaches the prescribed position at which it is to stop, a recess **11** in a disk **9** of ADM having a plurality of recesses **11** slips at an angle of 45 degrees around pins **19** disposed along the side of the guide rail at given intervals and thus the recess containing disk **9** rotates about 45 degrees around shaft **26** while recess **11** slips relative to pin **19**. When the disk **9** rotates, a gear **29** secured to the same shaft **26** on which said disk **9** is fitted also rotates and by rotation of gears engaging with said gear **29** operates limit switches LS1 and LS2 successively and stops the ADM.

The means for stopping the machine at prescribed positions, as provided in the invention ADM will now be further described as to its operation with reference to FIG. 8.

When the driving switch (not shown) of ADM is turned on, the driving motor **10** is rotated and the starting switch (not shown) is turned on. Then, through the medium of *Sol*1 the movable clutch **13** is moved over to the left side thereby engaging clutch **13** with the clutch face of gear **14** to rotate driving wheel **6** and effect the travel of ADM along guide rail **5**. During the travel of ADM, recessed disk **9** has a ball stopper **22** in engagement with rounded recess (not shown) disposed at four places in said disk **9** at 90° angular intervals in a position opposite to the stopper **22**, whereby said disk **9** is held stopped with the four recesses **11** of the disk respectively inclined at an angle of about 45 degrees to the vertical, and thus it enables the pins **19** provided on guide rail **5** to enter the openings of recesses **11** during the travel of the ADM and the disk **9** is resiliently stopped by the spring biased stopper **22**. Upon movement of the ADM, recesses **11** of said disk **9** first engage the pins **19** at an angle of 45 degrees and as the ADM travels said disk **9** starts angular displacement against the biasing action of a spring **25** of the ball stopper **22**. Thus, the recesses **11** of said disk **9** engage with the pins **19** during the progress of the ADM and the disk **9** is angularly displaced (about 45 degrees) so that the recess is about perpendicular to the rail. Meanwhile the gear **29** fixed to a shaft **26** of said disk **9** also rotates together with the shaft **26** to rotate gears engaging with said gear **29** and first of all operates a limit switch (LS1). *Sol*1 is energized by the operation of LS1, and a driving clutch **13** of a driving wheel **6** which supplies the driving force for the travel of the ADM is disengaged by *Sol*1, and simultaneously said clutch **13** is shifted to the right side to rotate a doffing shaft **15** which is provided with a doffing operation clutch **8** (see also FIG. 3).

At this instant, one of the stop holes **27** provided in disk **9** is positioned immediately before the tip of a stop pin **21**. ADM, which has been cut off its driving source, continues by means of its invertial energy to travel slowly and upon stop pin **21**, which presses against disk **9** by means of the biasing action of spring **28**, being thrusted into stop hole **27**, ADM comes to a complete stop at its prescribed position.

Limit switch LS2 detects the thrusting of stop pin **21** into stop hole **27** by means of a suitable interlocking means. Accordingly, the doffing operation clutch **8** (FIG. 3) is actuated to transmit the driving force from the doffing shaft **15** to the doffing drive shaft **15'**. Thus, the doffing operation of the ADM starts. *Sol*2 receives an order from a separately provided limit switch (not shown) at a suitable place on the ADM to indicate that the doffing and mounting operation has been completed, and said *Sol*2 removes a stop pin **21** from a stop hole **27** against the biasing action of a spring **28**, whereupon the limit switch LS2 opens and *Sol*1 is actuated to shift a movable clutch **13** to the left side thereby rotating a driving wheel **6** to cause the ADM to resume its travel. As the ADM starts travelling, the disk **9** is again displaced in the same direction as before by about 45 degrees because of the fixed pin **19** sliding in the recess **11**, and when the pin **19** leaves the recess **11**, a stopper engages with said disk **9** as it is being displaced, and the ADM continues to travel until the next fixed pin **19** enters a recess **11** of said disk **9**.

Since the main motor **10** is in constant rotation, the gears **17**, **18**, worm **19***a*, worm wheel **20**, and the movable clutch **13** slidably mounted on shafts **12** and **16** also rotate constantly. On the other hand, worm **24**, which meshes with gear **23** secured to the doffing shafts **15**, is mounted on shaft **16** at a fixed position in an idling state, and similarly gear **14**, which transmits rotation to driving wheel **6**, is also fitted to its shaft **12** in an idling state. Thus, both worm **24** and gear **14** are so adapted to be transmitted rotationally by means of movable clutch **13**.

In the figure, limit switch LS3 closes by the rotation of gear **30** via shaft **26** and has as its purpose to detect the number of doffings performed, i.e., the number of times ADM has stopped at its prescribed stopping position, and to give orders to the memory means (not shown). For example in the case of a 400-spindle spinning machine, when the doffing of 200 spindles on one side has been completed, i.e., by doffing 10 spindles each time for 20 times, an order is given to reverse the rotation of motor **10**, thereby reversing the travel of ADM.

Level controlling means

A level controlling means is provided in ADM for rectifying the relative positions between the spinning machine and ADM so as to make it possible for the doffing operation to be carried out properly when ADM has come to a stop at its doffing position in those cases where there is a relative difference in the height between the guide rail disposed along the front of the spinning machine and the floor over which wheels **32** of ADM travel. For this purpose, a guide rod **31** is installed in parallel with guide rail **5** spaced apart from and above the latter. (See FIG. 9.) ADM being supported by driving wheels **6** mounted on guide rail **5** and wheels **32** which travel over the floor, travels with guide rail **5** as a base. The shafts of wheels **32** of ADM which travel over the floor, connect with pistons of cylinder **33** and are so adapted by means of hydraulic pressure exerted on cylinders **33** to make contact with the floor with the length of the shafts contracting or extending in conformance with the height of the floor. Cylinders **33** are connected with pipe **34**, rotating or shifting valve mechanism **35** and level detecting levers **36**. The distal portion of detecting levers **36** fit over guide rod **31** in such a manner as to be slidable over said rod **31**.

Valve mechanism **35** is in direct communication with oil tank **39** via pipe **37**. On the other hand, it also communicates with oil tank **39** via pipe **38** with a pump **40** intervening. Further, a pipe **41** branched from pipe **38** communicates with the oil tank with a relief valve **42** intervening. Hence, the oil tank delivers at all times oil under suitable pressure to valve **35** via pipe **38** by means of relief valve **42**. Valve **35** is provided with communications with three places—one being with cylinder **33** via of pipe **34** and the others being with the oil tank via pipes **37** and **38**—and it is so adapted that when detecting lever **36** moves from its proper position, arm **43** turns to open the communicating part to pipe **34** and either oil under pressure is fed to cylinder **33** via pipe **38** or the oil under

pressure of the cylinder is discharged to the oil tank via pipe **37**.

Now, supposing that the floor happens to be elevated with respect to guide rail **5**, then with wheel **6** on top of guide rail **5** as the turning point that part of ADM upwards of that point will incline towards guide rod **31**. Thereupon the rotating or shifting valve mechanism **35** is turned by means of the detecting lever **36** riding on top of guide rod **31** to cause the oil in cylinder **33** to flow out into oil tank **39** via pipe **34**, thereby retracting wheel **32**, which travels over the floor, with the consequence that the position of ADM is rectified, whereupon the detecting lever **36** and the rotating or shifting valve mechanism **35** revert to their normal positions. On the other hand, when the converse happens, i.e., when the floor becomes lower with respect to guide rail **5**, with wheel **6** on top of guide rail **5** as the turning point that part of ADM upwards of that point will incline to that side opposite to that of guide rod **31**. Thereupon the rotating or shifting valve mechanism is turned to the opposite side from the mentioned hereinabove by means of detecting lever **36** riding on top of guide rod **31** to cause the oil under pressure delivered from hydraulic pump **40** to flow into the top part of cylinder **33**, thereby intending **32**, which travel over the floor, downwardly, with the consequence that the position of ADM is rectified whereupon the detecting lever **36** and rotating or shifting valve mechanism **35** revert to their proper positions.

Thus, ADM is able to maintain itself in a level position no matter how uneven the floor may be.

Bobbin kicking up means

As the bobbin chucking means must be provided with a considerably strong chucking force in order to pull off without assistance the full wound bobbins A from spindles **51** on which they are impaled, a bobbin kicking up means, as illustrated in FIG. 10, is used whereby the fit between the base **52** of the spindle and the bobbin bottom is loosened and picked up to simplify the extraction of the bobbins. As shown in FIG. 10, the bobbin kicking up means consists of a kicker shaft **53** which makes to-and-fro movements between the 2-dot-and-dash line and real line, to which are secured a plurality of kickers **54** and at least one kick lever **55**, and to which kick lever **55** are loosely fitted whorl pressers equal in number to kickers **54**. The whorl pressers have at their front ends whorl hooks **56** and at their rear ends hook tails **57**, and the latter at their ends are biased with springs **59**. Hence, hook tails **57** are pulled downwardly perpendicularly during the travel of ADM.

The full-wound bobbin kicking up means of the hereinabove described construction works in the following manner. When ADM stops at its prescribed stopping position, kicker shaft **53** moves forward from its **53'** position to **53** position under the action of a segment gear **63'** (FIG. 5) and by means of its kicker part **54** loosens the tight fit between bobbins A and spindle bases **52**. Simultaneously, hook tails **57**, which had been pulled downwardly perpendicularly (position **57'**) by means of springs **59** make abuttable contact with guide rod **31** provided in the spinning machine. As kick shaft **53** proceeds in its forward movement, the hook tails **57** change their position against the biasing action of springs **59** and the whorl hooks **56** of the whorl pressers assume the state wherein they are pressing against whorls **58** of spindles **52**. When kicker shaft **53** moves forward to its prescribed position, a lever **61** having a cam ball **60** pivots by transmission of a pivoting motion from the drive by means not shown about a shaft **62**, and as shown by means of the dot-and-dash line, depresses the kick lever to position **55'**, whereby the kicker part turns upwardly to position **54'** to kick up full-wound bobbin A to the A' position, in which state the kicker part remains awaiting the impalement of an empty bobbin.

The tendency of the spindle whorls **58** to rise along with bobbins A during the action of kicking up the bobbins as hereinbefore described is restrained by the whorl hooks **56** and the rising force of spindle whorls **58** is transmitted to hook tails **57** to be transferred to and absorbed by rod **31** provided in the spinning machine. Since a part of the kicking up force exerted by the kickers in kicking up the full wound bobbins is absorbed by rod **31** by means of this action, the force that falls on the kick lever can be reduced.

Full-wound bobbin extraction means

The means for extracting the full-wound bobbins as shown in FIGS. 11 and 12, is for pulling off the bobbins from the spindles and conveying them to a prescribed position. Sliding members **72** and **73** disposed in parallel one on top of the other are held in a chucking head **80** with the respective members being biased by means of springs **74** and **75** from the opposite directions. The sliding members **72** and **73** are provided respectively with chucking members **76** and **77** to which ends are affixed elastic pieces **78** and **79**. The sliding members **72, 73** along with a clapping arm **82** are mounted in the aforesaid chucking head **80** and are so adapted that by pulling a wire **71** attached to the pivotal point of said arm the chucking members **76, 77** approach each other to chuck the top of the bobbins at two points. By this 2-point chucking, the full wound bobbin can be swung while held in this manner and moreover since the chucking is by means of an elastic member, the chucking can be carried out with certainty even though there may exist errors in the diameter of the bobbins and spindle pitch.

Further, these chucking heads **80** can carry out an arcuate movement indicated by the line *a* when a four-member linkage **81** is swung by an angular rotating shaft **180** by the action of a cam **183** fixed to a rotating shaft **90** driven from the doffing driving shaft **15'** and the action of a cam lever **89'''** engaging therewith, and also the chucking heads **80** are made to move to-and-fro by the action of a cam **182** fixed to a shaft **90** and of a lever **89'''**. By the combination of these movements the extraction of full-wound bobbins is conducted.

The full-wound bobbin whose top end has been gripped from two sides by means of the foregoing chucking members **76, 77** is pulled off the spindle by the arcuate action of the 4-member linkage **81**, retracted by means of a suitable mechanism, then its bottom end is swung by means of a yarn manipulating means (hereinafter described) and thereafter lowered by means of the 4-member linkage **81** and conveyed to the full-wound bobbin arranging mechanism (hereinafter described).

Yarn manipulating means

The yarn manipulating means, as shown in FIG. 13, is for preventing during the extraction of the full-wound yarn the breakage of the yarn which stretches from the front roller to the traveller and the bobbin via the snail wire or yarn guide **105** having a tab **106** (FIG. 14) on the spinning frame.

A rotating shaft **92** of a lever **91** is arranged horizontally within the ADM, and at one end of the rotating shaft **92** there is a cam lever **96** equipped with a portion **94** urged against an edge of a cam **95**, and at the tip of the lever **91** there is a rod **93** parallel with a chucking head. When the cam **95** rotates, the rod **93** swings about the shaft **92** as a fulcrum. Said cam **95** is driven from the doffing driving shaft **15'** by shafts (not shown). Said lever **91** when in the position indicated by the solid line pushes the spun yarns to the side of the spinning machine, in which condition the aforementioned full-wound bobbin extraction means is actuated to extract the full-wound bobbins. When the full-wound bobbins are pulled up, the bobbins swing to a position indicated by the reference numeral **93'** and

the lower portions of the full-wound bobbins are pushed by said rod **93** to incline said bobbins and introduce them gently into a full-wound bobbin arranging means described later.

End yarn serving means

The full-wound bobbins which are transferred from the spindles **51** to a position above a plate **112** above a container to be described by the afore-mentioned full-wound bobbin extraction means have their end yarns connected with spindles. An end yarn severing means adapted to sever these end yarns and for holding the severed end yarns until empty bobbins are inserted over the spindles **51** is shown in FIG. 14. The extracted full-wound bobbins and the yarns connected with the spindles **51** are positioned over the suction holes **103** of a pneumatic pipe positioned on the ADM in the middle of a pair of thread guides or yarn guides **101, 101'**, one on the ADM and the other on the frame **3**. The end yarns are held by the suction action of the suction holes **103** and at the same time the end yarns are cut by cutters **104** rotating at a high speed and positioned between said pneumatic pipe **102** and one guide **101** and remain on the side of spindles **51** are held lightly by the suction action of the suction holes **103** until the empty bobbins are positioned on the spindles **51**, thereby preventing the yarns from coming off the traveler.

Full-wound bobbin arranging means

If the arrangement of the doffed full wound bobbins in its case is haphazard, the bobbin case for receiving the bobbins must be made unnecessarily large and hence would be an impediment to the rationalization of the automatic doffing process. Accordingly, a bobbin arrangement means, as illustrated in FIGS. 15 and 16, is provided. Roughly this mechanism comprises an assembly consisting of a pair of sheets **115, 115** to which bottom ends are installed magnets **116, 116'** of unlike polarity. Plates **112** equal in number to the pairs of sheets are disposed horizontally above the sheets, the plates being attached as to be rotatable to a rod **114** which makes reciprocative movements horizontally by means of the operation of a solenoid.

The full-wound bobbins, which having been chucked between bobbin chucking members **76, 77**, conveyed and dropped above the full-wound bobbin case **111**, first are placed horizontally on top of plates **112**, following which they are dropped between the sheets **115, 115** as a result of the plates **112** having been rotated by way of rod **114** by means of the operation of solenoid **113**. Said solenoid **113** is actuated by an order from a limit switch (not shown) which perceives the completion of the doffing operation. The full-wound bobbins then while pushing the magnets **116, 116'** apart drop into the full-wound bobbin case **111**. As the falling speed of the bobbins are retarded when they are pushing magnets **116, 116'** apart, the bobbins which drop into the bobbin case are arranged therein as if they were placed there gently.

As described before, the full-wound bobbins on plates **112** pass between sheets **115, 115** by the simultaneous movements of said plates **112** and fall into a case **111**. Each time the bobbins fall another motor (not shown) rotates, by which movement a wind-up roller **117'** is rotated by way of a chain **118** and the sheets **115, 115** are sequentially wound up. The reference numeral **117** shows a roller pressing on the roller **117'**. When the doffing of all the full-wound bobbins on one side of a spinning machine has been completed, only the arranged full-wound bobbins remain in the case **111**, and the sheets **115, 115** are wound up on the circumference of the wind-up roller **117'**, the bottom end portion thereof being positioned on the upper side of the case **111**. Accordingly, it is easy to take the case **111** which has received the full bobbins out of the ADM. When sheets are used, the sheets that are adjacent to that of a neighboring pair of sheets must be wound up on separate windup rollers **117'**, but when the foregoing cords are used, the row of cords that are adjacent to that of a neighboring pair of rows of cords can be wound up on a single wound up roller each time a full bobbin passes.

Empty or bare bobbin impaling means

The arrangement of the empty bobbins is carried out by a means shown in FIGS. 17 and 18. This means supplies the empty bobbins in the same direction to a hereinafter described bobbin holding member **134**, in which guide members **122** and **123** having different widths are positioned so as to be opposed to each other on the inside walls of a bobbin preparation case to prevent the intermingling of the empty bobbins facing in opposite directions. The bobbins which have been arranged in the bobbin preparation case in the aforementioned manner are then fed to the bobbin holding means which holds the bobbins and feeds them to the spindles. In this case, however, it is necessary that the several bobbin holding means are on each occasion supplied from the aforesaid case with one bobbin each. For accomplishing this purpose, the empty bobbins are delivered successively and with certainty from the case to the holding means by a means shown in FIGS. 19 and 20. Since the foregoing bobbin preparation case is without a bottom, on its underside is disposed a sliding member **132** having passages **131** at given intervals (spindle interval) and further on the underside of this sliding member a bobbin holding member **134** (hereinafter described) is provided facing upwardly. Thus, when sliding member **132** is slidably moved, its passages **131** become positioned below the bobbins in the bobbin preparation case **121** to allow the bobbins to drop into the passages **131**. Then, when by slidably moving the sliding member **132** the passages **131** are positioned above receiving troughs **133** of bobbin holding member **134**, the bobbins in passages **131** drop into the receiving troughs **133**.

The empty bobbin holding means illustrated in FIGS. 21 and 22 is for holding the bobbins delivered from the bobbin preparation case and to hold them until the bobbins are mounted to the spindles by the hereinafter described bobbin mounting means.

The several bobbins which have been introduced into the plurality of receiving troughs **133** provided in the bobbin holding member **134** by means of the above-described delivery means are pressed against the inner walls of the several receiving troughs **133** with the heads **143** of push rods **142** as a result of the sliding movement of sliding member **141**.

In accomplishing this pressing, since a spring **145** has been installed between each head **143** and its bracket **144**, the several bobbins can be held with certainty though there may be differences in the gaps between the several bobbins and the troughs receiving them.

Further, the foregoing bobbin holding member **134**, is attached to cross-links **154, 155** which are rotated by the angular rotation of a shaft **153**, and is adapted to be swung over the spindles after the full-wound bobbins have been extracted from the spindles by the aforementioned full-wound bobbin extraction means (see FIG. 23). A cam lever **152** contacts a peripheral edge of a cam **151** which is rotated by doffing driving shaft **15'** and the rotation of the cam **151** makes a shaft **153** carry out an angular displacement of the bobbin holding member **134** in a direction indicated by an arrow by way of the cross-links **154, 155**. Further a cam **156** secured to the same rotating shaft as the cam **151** actuates a cam lever **157** the end of which is connected with a wire **158** and releases the pressure on the empty bobbins by loosening the wire **158** when the bobbin holding member **134** swings to be positioned perpendicularly above the spindles, thereby to make the empty bobbins fall onto the spindles.

Lifting lever oscillatory means

In order to wind on the spun yarn to the bobbin with certainty and to prevent the breakage of yarn by adjusting the uneven tension and snarls when starting up the spinning machine on which have been mounted the empty bobbins. Usually a spinning machine is provided with a lifting lever **169** to move the ring rail of said machine up-and-down. Said lifting lever **169** is manually oscillated at the time of starting of movement to move said ring rail up-and-down, thereby to prevent the cutting of yarns at the time of starting of the movement. The present ADM is also provided with a lifting lever oscillatory means for oscillating vertically a lifting lever for oscillation of a ring rail upwardly and downwardly (see FIG. 24).

The oil under pressure from a source of oil under pressure (not shown) reaches the pistons of cylinder **164** by means of oil pipes **162**, **162'** and **163**, **163'** via a valve mechanism **161**. Piston rod **165** projecting from cylinder **164** and capable of reciprocative movements is provided at its distal portion with a rack which meshes with pinion **167** which is mounted on the same shaft as lever **166**. In concomitance with the rotation of pinion **167** by the reciprocative movement of piston rod **165**, the distal portion **168** of lever **166** is adapted to make pressing contact with the top of pedal **170** of lifting lever **169**. Thus, by feeding oil under pressure to the valve mechanism **161** and adjustment thereof to effect the inflow and outflow of the oil in the pipes **163**, **163'** the distal portion **168** of lever **166** is reciprocated up and down to oscillate the lifting lever **169** between the full line and dash line positions. This lifting lever oscillatory means is installed in ADM at one side of the spinning machine and by electrically connecting ADMs on both sides of the spinning machine it is adapted to function after receiving a signal, indicating the completion of the bobbin exchanging operation of all the spindles by ADM on the opposite side.

What is claimed is:

1. An automatic bobbin doffing machine adapted to travel step-by-step along the front of a spinning machine, twisting machine or the like, for doffing a group of fully would bobbins from a group of spindles and for mounting a group of empty bobbins on such group of spindles, said machine comprising driving means for driving said machine in stepwise fashion along the spinning machine, yarn manipulating means coupled to said driving means for manipulating the yarn, yarn severing means coupled to said driving means for severing the end yarn, bobbin kicking means coupled to said driving means for kicking a group of fully wound bobbins up off the spindles, bobbin extracting means coupled to said driving means for extracting the fully wound bobbins of the group from the spindles, empty bobbin arranging means above said bobbin extracting means and coupled to said driving means for making a preparatory arrangement of a group of empty bobbins prior to donning the empty bobbins on the spindles, bobbin mounting means coupled to said driving means and positioned adjacent said empty bobbin arranging means for receiving the group of arranged spindles from said empty bobbin arranging means and swinging them over said spindles and dropping them onto the spindles, a bobbin case below said bobbin extracting means, and a bobbin movement damping means between said bobbin extracting means and said bobbin case for damping the movement of the fully wound bobbins between said extracting means and said bobbin case so as to place the fully wound bobbins gently into said bobbin case.

2. A machine as claimed in claim **1** in which said bobbin movement damping means comprise a plurality of flexible elements hung downwardly into said bobbin case, means at the bottoms of said flexible elements for drawing said bottoms of pairs of said flexible elements toward each other, and winding means at the tops of said flexible elements from which said flexible elements are suspended and coupled to said driving means for winding said flexible elements up step by step as the bobbin case is filled up.

3. A machine as claimed in claim **2** in which said flexible elements are flexible sheets, and the means at the bottoms of the flexible elements are magnets.

4. A machine as claimed in claim **2** in which said flexible elements are rows of flexible cords, and the means at the bottoms of said flexible elements are magnets on the bottoms of the individual cords of the cords in the rows, all of the cords in a row being hung from a single winding means, and adjacent rows of cords in adjacent pairs of rows of cords being suspended from a common winding means.

5. A machine as claimed in claim **1** further comprising level control means for controlling the level of said machine, said level control means comprising hydraulic cylinders, rods coupled to said cylinders, wheels supporting said machine and mounted on the ends of said rods, level sensing means engaging the spinning machine, level adjusting valves coupled to said level sensing means and actuated thereby and controlling flow of hydraulic fluid to said hydraulic cylinders, and source of hydraulic fluid coupled to said cylinders through said valves.

6. A machine as claimed in claim **1** in which said bobbin kicking means comprises kicking levers movable toward and away from the spinning machine and engageable between the bobbins and the spindle whorls and lifting the bobbins away from the spindles while holding the spindle whorls down, and means for moving said levers coupled between said driving means and said levers and comprising means for holding said levers engaged with said spindle whorls until empty bobbins have been positioned on the spindles.

7. A machine as claimed in claim **1** and further comprising an oscillating lever on said machine and engageable with the lifting lever actuating the ring rail on the spinning machine for preventing yarn breakage when starting up the spinning machine after completion of the doffing operation.

8. A machine as claimed in claim **7** in which means are provided for oscillating said lever and comprise a piston and cylinder means having a piston rod, a rack on the free end of the piston rod, a pinion on said lever coaxial with the rotational axis of said lever, said rack being engaged with said pinion, and means for supplying hydraulic fluid to said piston for reciprocating said piston rod when the doffing operation is completed.

9. A machine as claimed in claim **1** in which said means for manipulating the yarn comprise a lever pivotally mounted on the machine, a rod on the tip of said lever, said lever being pivotable to swing the end having the rod thereon toward the spindles to manipulate the yarns and swing during the extraction of the bobbins to push the bottoms of the bobbins toward the bobbin movement damping means.

10. A machine as claimed in claim **1** in which said bobbin extraction means comprises a pair of juxtaposed sliding members, each of said members having a plurality of protrusions thereon for engaging the bobbin, the members being slidable to move pairs of the protrusions composed of a protrusion on one member and a corresponding protrusion on the other member toward each other with a bobbin between the protrusions of each pair engaged by the protrusions of the pair.

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