

May 19, 1959

YUKIO URANO ET AL.
APPARATUS FOR AUTOMATICALLY MOUNTING AND
DISMOUNTING A BOBBIN FOR A SPINNING
MACHINE, A TWISTER AND THE LIKE

2,886,940

Filed May 17, 1957

3 Sheets-Sheet 1

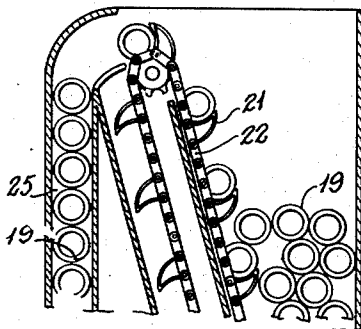
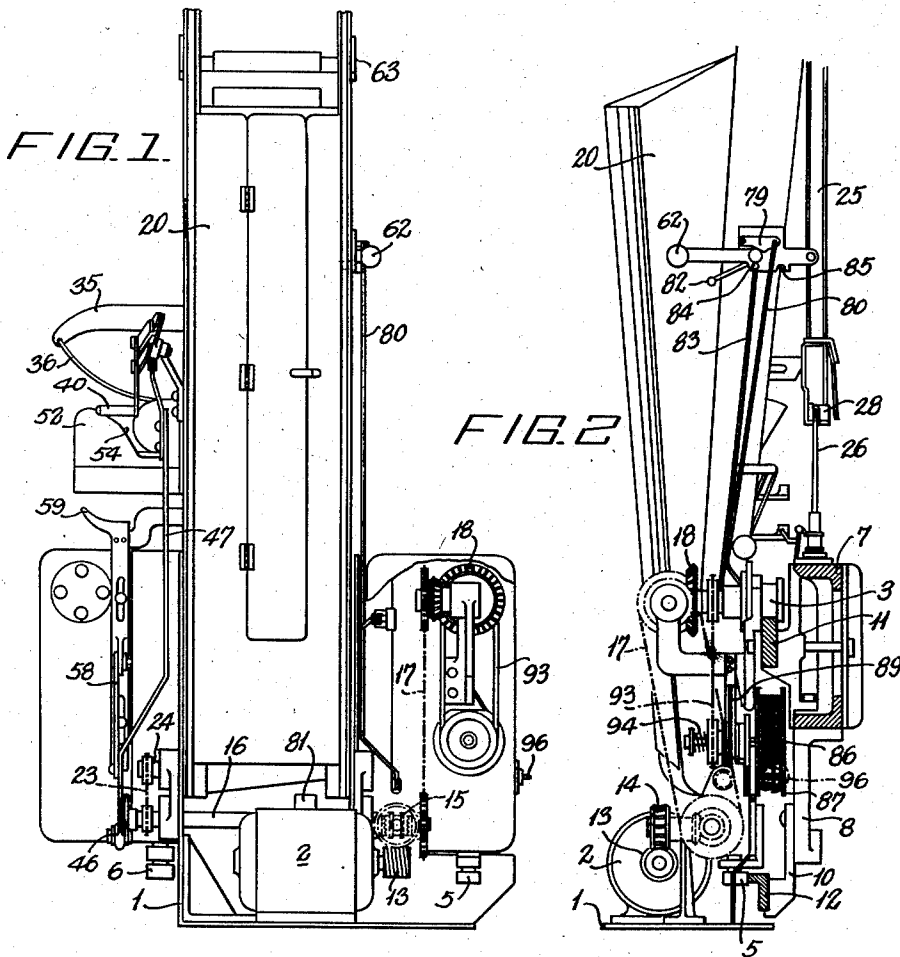


FIG. 5.

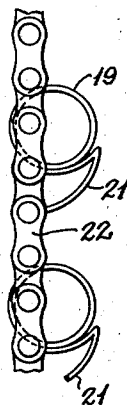


FIG. 6.

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3 Sheets-Sheet 2

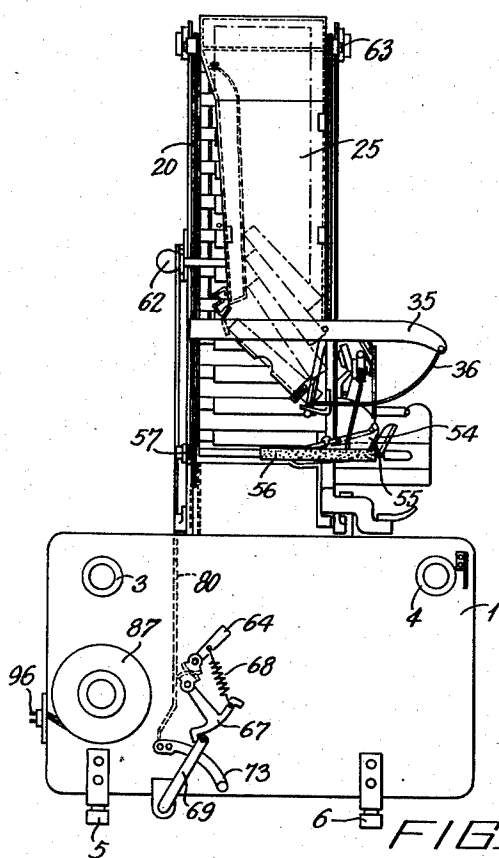


FIG. 3.

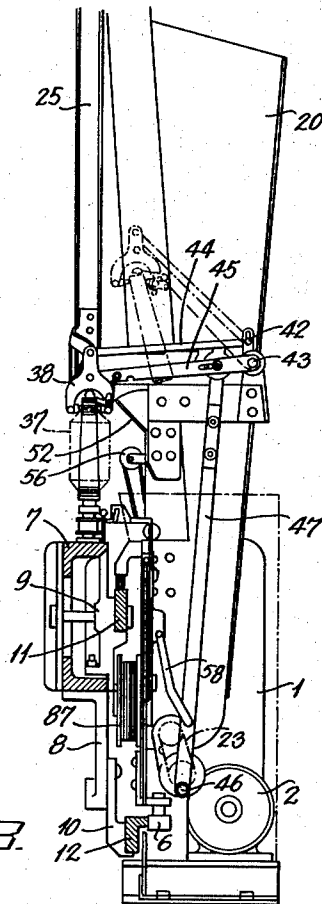


FIG. 4.

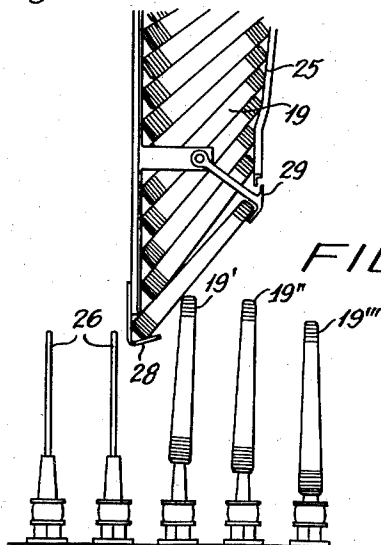


FIG. 7.

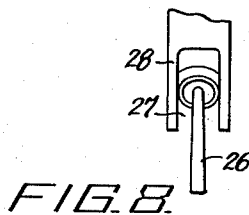


FIG. 8.

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3 Sheets-Sheet 3

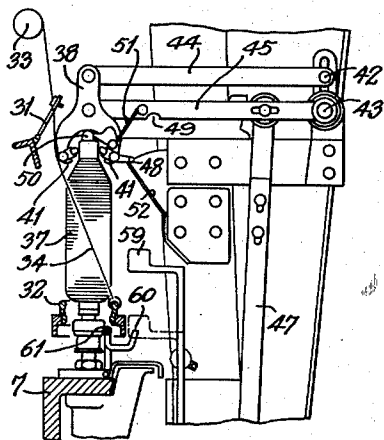


FIG. 9

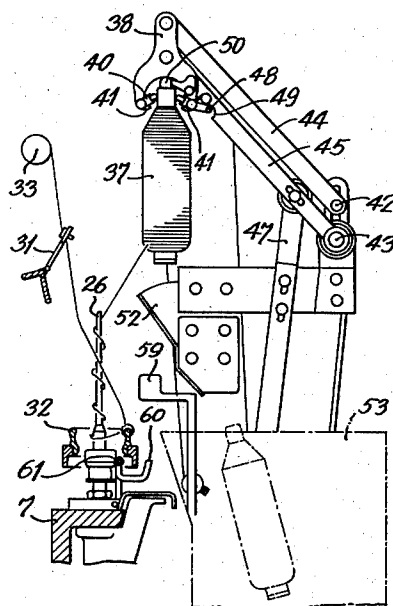


FIG. 10

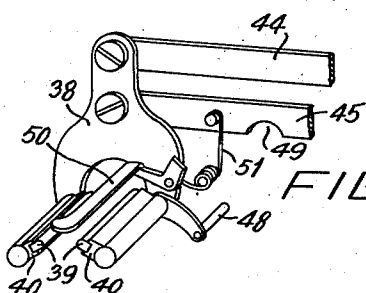


FIG. 11

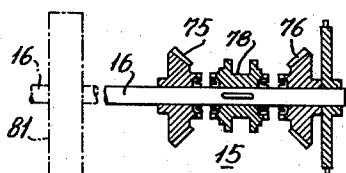


FIG. 13

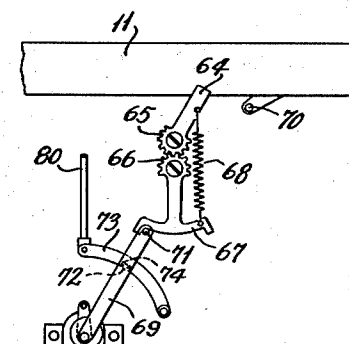


FIG. 12

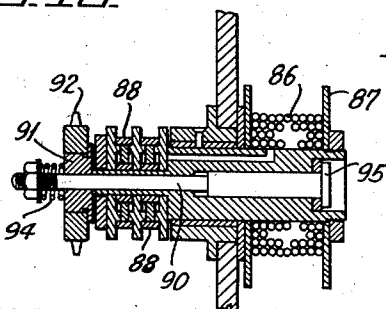


FIG. 14

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2,886,940

APPARATUS FOR AUTOMATICALLY MOUNTING AND DISMOUNTING A BOBBIN FOR A SPINNING MACHINE, A TWISTER AND THE LIKE

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Application May 17, 1957, Serial No. 659,972

Claims priority, application Japan June 16, 1956

12 Claims. (Cl. 57—53)

This invention relates to an apparatus for automatically mounting and dismounting a bobbin for a spinning machine, a twister and the like.

More particularly, the invention relates to an automatic and repeatable bobbin mounting and dismounting apparatus for a ring spinning machine or a ring twister and the like through such a process that an empty bobbin is mounted on the spindle from which a fully wound bobbin has just been dismounted, as a main body of the apparatus travels from one end to the other of the spinning machine, the twister and the like.

It is an object of the invention to provide for an apparatus for automatically mounting and dismounting a bobbin used in a ring spinning machine or a ring twister and the like, whereby the operation of dismounting a fully wound bobbin and mounting an empty bobbin may be effected simply, positively and quickly and without manual handling of the bobbin.

Still more particularly, it is an object of the invention to provide for an automatic and repeatable bobbin mounting and dismounting apparatus provided with reversing means of the main body of the apparatus and winding and unwinding means of lead wire for an electric motor, whereby the operation can be carried out safely and without disturbing the other operation of the spinning machine, the twister and the like.

Further objects of the invention will be understood by the following description.

The apparatus of the invention is characterized by dismounting means of a fully wound bobbin to pull out fully wound bobbins catching their upper ends and put them into a fully wound bobbin box with a vertical swing motion, feeding means of an empty bobbin to feed empty bobbins into a guide chamber picking them up one after another out of an empty bobbin hopper by an endless chain conveyor, bobbin mounting means to put the empty bobbins properly on the corresponding spindles of the spinning machine, the twister and the like, in accordance with the travel of the main body, picking up the empty bobbins from a guide chamber, reversing means to stop the main body automatically at the final end after finishing one stroke of the bobbin dismounting and mounting operations and then to return it back to the initial position ready for the following stroke, and lead wire winding and unwinding means to wind and unwind the lead wire for the electric motor mounted on the main body in accordance with the travel of the main body, by using a free wheel mechanism and a friction clutch.

The nature of the invention will be better understood by referring to the following description, taken in connection with the accompanying drawings.

Fig. 1 is a front view of the apparatus.

Fig. 2 is a side view of the apparatus taken from the right hand side.

Fig. 3 is a back view of the apparatus.

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Fig. 4 is a side view of the apparatus taken from the left hand side.

Fig. 5 is a detail front view showing the empty bobbin feeding part.

Fig. 6 is an enlarged detail view of the empty bobbin carrier.

Fig. 7 is a detail view illustrating the empty bobbin mounting means.

Fig. 8 is a partially magnified detail view of the lower holder for mounting empty bobbins.

Fig. 9 is a detail view showing the means for dismounting a fully wound bobbin.

Fig. 10 is a detail view showing how to dismount a fully wound bobbin.

Fig. 11 is a perspective view illustrating the fully wound bobbin picking up mechanism.

Fig. 12 is a detail front view of the reversing means.

Fig. 13 is a detail view showing the reversing clutch in Fig. 12.

Fig. 14 is a detail view showing the winding mechanism of the lead wire for the electric motor.

Making reference to the drawings, 1 in Figs. 1, 2, 3 and 4 is the main body of the apparatus which travels along the spindle line of the spinning machine, the twister and the like being driven by an electric motor 2 fixed therein. At the back of the main body 1, as shown in Fig. 3, two sets of rollers 3, 4, 5 and 6 are rotatably mounted to cause the main body 1 to travel along the rails 11 and 12 in Fig. 4 respectively which are fixed to the spinning machine, the twister and the like through a spindle rail 7, a locking device and brackets 8, 9 and 10. The driving roller 3 for driving the main body on the rails back and forth is driven by the motor 2 through such a power transmission system as a worm 13 shown in Fig. 2, a reversing clutch 15 to drive a driving shaft 16 shown in Fig. 13, a chain drive 17 and a bevel gear drive 18, as shown in Fig. 1 and Fig. 2.

As shown in Fig. 5, a hopper 20 mounted on the main body 1 contains a lot of empty bobbins 19 and is provided with an endless chain conveyor 22 having uniformly spaced bobbin carriers 21, which is driven by a shaft 24 connected with the driving shaft 16 through an endless driving chain 23 as seen in Fig. 1. When a bobbin carrier 21 of the endless chain conveyor 22 reaches the highest position, the empty bobbin brought by the bobbin carrier 21 is fed one after another into a guide chamber 25 as shown in Fig. 5.

The guide chamber 25 is provided with a bobbin holder 28 having a notch 27 so as not to be hit by the spindle heads as the main body 1 travels, and also provided with another swingable bobbin supporter 29 which supports the upper end of the empty bobbin 19 obliquely ready for being mounted on a spindle 26, as shown in Fig. 3 and Fig. 7. As the main body 1 travels the empty bobbin 19 is touched by the larger hole part of the empty spindle 26 so as to be mounted on the spindle 26 through the notch 27, as shown in Fig. 7 and Fig. 8. With a further travel of the main body 1, the empty bobbin 19 is released from the bobbin holder 28 and dropped off on the spindle 26 being guided by the swingable supporter 29 and then, said empty bobbin 19 is mounted properly on the spindle 26 as shown by 19', and 19'' and 19''' in Fig. 7.

Before the process for dismounting the fully wound bobbin, a lappet 31 must be lifted and at the same time the yarn between a ring 32 and a front roller 33 must be pushed away so that the main body 1 may advance without hitting both said lappet 31 and the yarn as shown in Fig. 9. For this purpose, a lappet lifting guide 35 and a yarn guide 36 are mounted on the guide chamber 25 as illustrated in Fig. 1 and Fig. 3. Thus, as the main body 1 advances, the lappets 31 are lifted one after another

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and the yarn 34 is pushed away not to interfere with the dismounting operation of the fully wound bobbin 37.

As to means for picking up the fully wound bobbin 37, as shown in Figs. 9, 10 and 11, a pair of catchers with rubber pieces 39 is rotatably connected with a Y piece 38, the pair of catchers being a little tilted upwardly toward the rubber ends 39, and is pressed by a spring against stoppers 41 mounted on the Y piece 38. Therefore, picking up the fully wound bobbin can be carried out easily and positively without fear of dropping off the fully wound bobbin 37 from the catchers 40.

A quadric link is formed by the Y piece 38, two parallel arms 44 and 45 rotatably jointed to the Y piece 38 and two axes of rotation 42 and 43 at the other ends of the two parallel arms respectively, so that the Y piece 38 can be swung up and down while being maintained to be vertical as shown in Fig. 10. As illustrated in Fig. 4 and Fig. 1, one of the parallel arms 45 is connected with an eccentric pin 46 fixed at the end of the driving shaft 16 by a connecting lever 47 so that one cycle of the vertical motion of the quadric link may be completed by one revolution of the eccentric pin 46 around the driving shaft 16. At the end of a downward motion of the pair of catchers 40, the fully wound bobbin 37 is caught up at the head by the pair of catchers 40 as shown in Fig. 9, and then it is pulled out of the spindle 26 almost vertically, resulting in the position as shown in Fig. 10. At this position, a lever 48 is pushed down by a notch 49 of the parallel arm 45, thereby the pair of catchers 40 is rotated to release the fully wound bobbin 37. At the same time the top of the fully wound bobbin 37 is pressed down by a button 50 connected with a spring 51, of which pressing force becomes strong enough at the position shown in Fig. 10 because at this time the angle between the Y piece 38 and the spring 51 decreases, and thereafter said fully wound bobbin is dropped down quickly into a fully wound bobbin box 53 while sliding on a guide plate 52. Now the yarn 34 wound on the spindle 26 enters into a slit 54 provided in the guide plate 52, as shown in Fig. 3, to be cut off by a knife edge 55 at the back of the guide plate 52. The yarn cut off is hung on a roller 56 due to its tension and is loosened with the rotation of the roller 56, which is driven by the endless chain conveyor 22 mentioned before through an idle pulley for example. As soon as a process of dismounting the fully wound bobbin 37 is finished, the lappet, 31 is returned back to the initial position.

In order that the fully wound bobbin 37 may be pulled out of the spindle 26 smoother, a pressing lever 59 for pressing down a ratch 60 swingable around an axis 61 is connected to the middle part of the connecting lever 47 by an auxiliary lever 53 as shown in Fig. 4. Thus, if the vertically movable lever 59 is lowered, as shown by the broken line in Fig. 9, the fully wound bobbin 37 may be pushed off upwardly to help the fully wound bobbin dismounting job.

As soon as the main body 1 is stopped automatically at the other end of the spinning machine, the twister and the like after a bobbin mounting and dismounting job, reversing means starts to be operated. Then, if a handle 62 shown in Fig. 2 and Fig. 3 is pulled forwardly by an operator, the guide chamber 25 is swung forwardly around an upper axis 63 to avoid the interference of the traveling main body and the spindles 26, or lappets 31 during the return stroke.

The reversing means consists of a reversing lever 64 having a gear part 65 rotatably pivoted on the back side of the main body 1, a T lever 67 provided with a gear part 66 engaged with the former gear part 65, said T lever 67 being also rotatably pivoted on the main body 1 and being connected with the reversing lever 64 by a spring 68 with an adequate tension, a clutch shifting lever 69 rotatably jointed to the T lever 67 at a connecting pin 71, and an arc lever 73 rotatably pivoted on the main body 1, as shown in Fig. 12 and Fig. 3. At the end of an

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advance of the main body 1, the reversing lever 64 is hit and rotated by a stopper 70 fixed on the rail 11. So that the T lever 67 is rotated clockwise increasing the tension of a spring 68, resulting in a quick rotation of the T lever 67 beyond the dead point of the both members 64 and 67. Thus a notch pin 72 fixed on a clutch shifting lever 69 is put into a notch 74 in the arc lever 73 so that a clutch 78 may be neutral and the main body 1 may be stopped.

As illustrated in Fig. 13, the reversing clutch 15 consists of two bevel gears 75 and 76 loosely mounted on the driving shaft 16, and the clutch 73 which can be shifted freely along the driving shaft 16 but is enforced to be rotated with the shaft 16, free with regard to the bevel gears 75 and 76 at the neutral point and connected to the bevel gears to transmit power when necessary.

When the main body 1 is stopped at the end of the spinning machine, the twister and the like, the handle 62 shown in Fig. 2 is pulled forwardly by an operator, thereby the guide chamber 25 can be moved forwardly to avoid the interference with the spindles 26 and lappets 31. At the same time a vertically movable lever 80 is lifted up by a projection 79 in order that the arc lever 73 in Fig. 12 connected with said lever 80 at its end may be raised up to be disengaged from the notch 74 for a return stroke. Thus the clutch shifting lever 69 is rotated by the spring tension to shift the clutch into the reversing side so that the main body 1 can be returned backwardly.

In order to cut off the power transmission for the empty bobbin feeding and the fully wound bobbin dismounting means during the return stroke of the main body 1, the driving shaft 16 is divided into two parts coupled by an anti-reversing coupling 81, one of which is seized during the return stroke not to transmit the power to the bobbin feeding and dismounting means, but is driven together with the other part for the driving roller 3 during the advancing stroke, as shown in Fig. 1.

When the main body 1 is returned back to the initial position, the reversing lever 64 is hit by the stopper 70 fixed on the rail 11 for the clutch 78 to be shifted to the neutral point for stopping the main body 1 as illustrated in Fig. 13. When the handle 62 in Fig. 2 is pushed backwardly by an operator so that the guide chamber 25 may be pushed back for the next stroke, the vertically movable lever 80 is lifted by the projection 79 to shift the clutch 78 from the neutral point to the advancing side for the next stroke as mentioned before. A starting handle 82 in Fig. 2 is provided for starting the motor 2 through a lever 83. A pin 84 attached to the lever 83 is settled in a notch 85 at the bottom of the handle 62 while the motor is running to avoid back and forth movements of the guide chamber 25 during the operation.

As the electric motor 2 is moved together with the main body 1, lead wire 86 connected with it must be wound or unwound by a specially designed winding device. As shown in Figs. 2, 3, 4 and 14, the lead wire 86 is wound up on a lead wire spool 87 and is connected with two terminal rings 88 which are rotated with the lead wire spool 87 and are touched by fixed brushes 89 to complete an electric circuit as shown in Fig. 2.

Both the lead wire spool 87 and the rings 88 are mounted loosely on a shaft 90. The shaft 90 is also furnished with a free wheel mechanism 91 connected with a chain wheel 92 driven by the shaft of the driving roller 3 through an endless chain 93 as shown in Fig. 2, so that the chain wheel 92 may be loose during a lead wire unwinding stroke. The shaft 90 and the lead wire spool 87 are coupled by friction with each other due to a spiral spring 94 and a friction disc 85 mounted at both ends of the shaft 90 respectively as shown in Fig. 14. As the main body 1 advances while carrying out the operation, the lead wire is unwound smoothly with the rotation of the lead wire spool 87, because the chain wheel 92 is designed so as to be rotated slower than the minimum speed of the lead wire 86 during the return stroke, the lead wire 86 is wound up by the lead wire spool 87 while

being driven by the chain wheel 92. During this stroke the lead wire 87 can be wound up on the lead wire spool 87 at a constant speed and be wound up completely to its end when the main body 1 is returned back to the initial position, because slip occurs between the lead wire spool 87 and the shaft 90 when the rotation speed of the lead wire spool 87 decreases as the thickness of the lead wire 86 wound increases.

To clarify the apparatus of this invention in detail, a further explanation throughout the whole operation will be described hereafter.

After a lot of empty bobbins which are regularly oriented are piled up in the hopper 20 so that the larger hole parts of the bobbins are put on a definite side of said hopper 20, the guide chamber 25 is located at the position for operation by pushing the handle 62 backwardly as shown in Fig. 2. In accordance with the displacement of the handle 62, the clutch 78 is shifted to the advancing side from the neutral point through the actions of the vertically movable lever 80 and the arc lever 73. When the motor 2 is switched on by the starting handle 82, the driving power is transmitted to the worm 13, the worm wheel 14, the reversing clutch 15, the driving shaft 16, the chain drive 17, the bevel gear drive 18 and finally to the driving roller 3 in order, as shown in Fig. 1 and Fig. 2, thereby the main body 1 is started to advance toward the other end of the spinning machine, the twister and the like along the rails 11 and 12 by the driving roller 3, the main body being supported by the idle rollers 4, 5 and 6 in Fig. 4 and Fig. 5 as well. At the same time, the other end of the driving shaft 16 is driven by the electric motor 2 through the anti-reversing coupling 81 to transmit the power to the shaft 24 through the endless chain drive 23, thereby the endless chain conveyor 22 with the empty bobbin carriers 21 in Fig. 5 provided in the hopper 20 is driven for picking up the empty bobbins 19 and feeding them into the guide chamber 25 to be ready for mounting the empty bobbins 19 on the spindles 26 as shown in Fig. 7.

In accordance with an advance of the main body 1, each lappet 31 is turned upwardly by the lappet lifting guide 35 with a curved surface and at the same time the yarn 34 is pushed backwardly by the yarn guide 36 not to interfere with the fully wound bobbin dismounting operation. When the pair of catchers 40 is brought right above a fully wound bobbin 37 in accordance with the advance of the main body 1, the parallel arms 44 and 45 are lowered to be almost horizontal, because then the connecting lever 47 is lifted up by the eccentric pin 46 of the driving shaft 16, and the head of the fully wound bobbin 37 is caught up between the rubber pieces 39 attached to the ends of catchers 40 respectively as shown in Fig. 9.

Now the pressing lever 59 for rotating the ratch 60 downwardly is lowered by an auxiliary lever 58 connected to the connecting lever 47, thereby the fully wound bobbin 37 is under a situation to be easily pulled out from the spindle 26 being pushed upwardly by the action of the ratch 60 at the bottom of the fully wound bobbin 37, as shown in Fig. 9. And then the fully wound bobbin 37 is lifted upwardly from the spindle 26 being held by the pair of catchers 40 with the upward swing motion of the parallel arms 44 and 45 as shown in Fig. 10. After a little further upward motion of the parallel arms 44 and 45 the lever 48 fixed to the end of the pair of catchers is hit by the notch 49 of the parallel arm 45, so that the pair of catchers 40 is opened for the fully wound bobbin 37 to be loosened. On the other hand the fully wound bobbin 37 is pressed at the head downwardly by the button 50 connected to the compression spring 51 of which compressive force increases with an upward swing motion of the parallel arms 44 and 45, thereby the fully wound bobbin 37 can be dropped quickly into the fully wound bobbin box 53 through the guide plate 52. The yarn 34 hung on the spindle 26 enters into the slit 54 provided in the guide plate 52 to be cut off by the knife edge 55

therein. The yarn cut off loses its tension as it slides on the roller 56.

Toward the empty spindle 26 from which a fully wound bobbin 37 has been dismounted, an empty bobbin 19 supported obliquely with its larger hole down by the bobbin holder 28 and the swingable bobbin supporter 29 shown in Fig. 7 is brought with the advance of the main body 1, and if the spindle head 26 is hit by the empty bobbin 19 at the inside wall of its larger hole through the notch 27 of the bobbin holder 28 as shown in Fig. 8, the empty bobbin 19 is inserted onto the spindle 26 almost vertically by a guidance of the swingable bobbin supporter 29, through the steps shown by 19', 19'' and 19''' in Fig. 7.

On the other hand the following empty bobbin 19 in the guide chamber 25 drops by itself due to its weight and reaches the lowest position of the guide chamber 25 to be supported at the both ends by the bobbin holder 28 and swingable bobbin supporter 29 and ready to be mounted on the spindle 26.

After a bobbin mounting operation, the lappet 31 is released from the lappet lifting guide 35 to be returned back to its regular position.

In accordance with the advance of the main body 1, the lead wire 86 connected with the electric motor 2 is unwound from the lead wire spool 87. Because the chain wheel 92 mounted at the end of the spool 87 is rotated to its unwinding direction by the endless chain 92 slower than the lead wire speed, the spool 87 can be rotated by the lead wire 86 satisfactorily by slipping in the part of the free wheel 91 by the difference of both speeds, thereby the lead wire 86 can be unwound smoothly.

As soon as the main body 1 is brought to the other end of the spinning machine after the bobbin dismounting and mounting operations, the reversing lever 64 is hit by the stopper 70 fixed on the rail 11 to shift the clutch 78 into the neutral position through the reversing means as shown in Fig. 12, where all the motions in the main body 1 are stopped except that of the electric motor 2. When the handle 62 is pulled by an operator for the guide chamber 25 to be withdrawn from the spindle line of the main body 1, the clutch 78 is shifted to the reversing side automatically. So that the driving roller 3 is rotated reversely to return the main body 1 back to the initial position while winding the lead wire 86 on the spool 87, although during the return stroke the driving power is not transmitted to the bobbin dismounting and feeding means by the anti-reversing coupling 81. The lead wire spool 87 is mounted on the shaft 90 through the friction disc 95, thereby the lead wire 86 can be smoothly wound up while being helped by slipping in accordance with the movement of the main body 1.

As mentioned above, this invention relates to an automatic bobbin mounting and dismounting apparatus characterized by fully wound bobbin dismounting means which pulls out the fully wound bobbins catching them by the pair of catchers and puts them into the fully wound bobbin box, empty bobbin feeding means which feeds the empty bobbins into guide chamber one after another picking them up out of the hopper with the carriers provided on the endless chain conveyer, empty bobbin mounting means which puts the empty bobbins properly on the spindles one after another picking them from the guide chamber, reversing means which stops the main body automatically when it reaches the other end of the spinning machine after finishing the bobbin dismounting and mounting operations and then returns it back to the initial position ready for the next stroke, and lead wire unwinding and winding means which unwinds and winds the lead wire of the electric motor by using the free wheel and the friction clutch, in accordance with a travel of the main body. The main body is mounted on the rails fixed in front of the spinning machine, the twister and the like by four rollers, one of which is

driven by the electric motor fixed on the main body to drive the main body.

The operations for dismounting the fully wound bobbins, feeding the empty bobbins and mounting the empty bobbins can be done automatically being related with an advancing motion of the main body. Dismounting the fully wound bobbins is accomplished by the pair of catchers specially designed to be swingable vertically, feeding the empty bobbins can be carried out by the carriers provided on the endless chain conveyor, and mounting the empty bobbins can be done automatically by the specially designed bobbin holder and the swingable bobbin supporter.

As it is understood above, the apparatus has such effectiveness as simplicity of its main mechanisms, positivity and speediness of its motions and safety to be handled because of its automatic operations as understood in stopping and returning the main body or unwinding and winding the lead wire for example.

As many apparently widely different embodiments of this invention may be made without departing from the spirit and scope thereof, it is to be understood that this invention is not to be limited to the specific embodiments thereof, except as defined in appended claims.

We claim:

1. An apparatus for automatically mounting and dismounting a bobbin for a spinning machine, a twister and the like; comprising means for dismounting a fully wound bobbin comprising a vertically swingable pair of catchers for gripping the head of the fully wound bobbin and for pulling out the latter bobbin, and means for releasing and discharging the fully wound bobbin from the catchers and into a fully wound bobbin box; means for feeding the empty bobbins comprising a guide chamber, a hopper for the empty bobbins, an endless chain conveyor for picking up said empty bobbins in said hopper and delivering them one after another into said guide chamber; means for mounting the empty bobbins on a series of spindles as the main body of the apparatus carrying said guide chamber advances from an initial position, comprising means for supporting the empty bobbins in an inclined direction in said guide chamber with their base holes at their lower ends and in position to be guided on and impaled on said spindles successively as said main body of the apparatus advances; means for reversing said main body of the apparatus comprising means for stopping said main body automatically when said main body reaches one end of its advance and means for returning said main body to its initial position; and means for advancing the main body of the apparatus and comprising rails, a driving roller between said main body and one of said rails, an electric motor on said main body for driving said main body through said driving roller, a flexible wire conductor for said motor, and means for winding and unwinding said conductor as said main body advances in one direction and then in an opposite direction.

2. An apparatus as set forth in claim 1, in which said means for dismounting said fully wound bobbin from a spindle includes a Y piece with said pair of catchers adapted to be opened and closed and being rotatably pivoted at the ends of two vertically swingable parallel arms driven by an eccentric pin of a driving shaft through a connecting lever, so that said fully wound bobbin may be caught up at the head by said catchers and pulled out by the upward swing motion of said catchers, a ratch supported for downward rotation for pushing the bottom of said fully wound bobbin upwardly to help said fully wound bobbin dismounting operation, and means for rotating said ratch downwardly comprising a pressing lever, and an auxiliary lever connected to said pressing lever and pivoted to a middle point of said connecting lever.

3. An apparatus as set forth in claim 2, in which said means for releasing and discharging the fully wound

bobbin into a fully wound bobbin box comprises a releasing lever for swinging said catchers about their pivot supports into opened position, one of said parallel arms having a lever engaging conformation adapted when said parallel arms carrying a fully wound bobbin are swung upwardly to engage the releasing lever and operate the latter lever to swing said catchers into opened position, and means for simultaneously pressing down on the head of the fully wound bobbin on said catchers and comprising a spring pressing against said head, means mounting said spring to increase its elastic force pressing down on the head of the latter bobbin as the angle between said parallel arms and said Y piece is decreased by the upward swinging of said parallel arms, whereby said fully wound bobbin is released and dropped from the catchers, and means including a guide plate for guiding the released fully wound bobbin into the fully wound bobbin box.

4. An apparatus as set forth in claim 2, characterized by a guide plate provided with a slit into which yarn of a fully wound bobbin dropped into a fully wound bobbin box is guided, a knife edge for cutting off said yarn guided into said slit, and a roller on which said cut off yarn is hung to reduce its tension.

5. An apparatus as set forth in claim 3, characterized by a guide plate provided with a slit into which yarn of a fully wound bobbin dropped into a fully wound bobbin box is guided, a knife edge for cutting off said yarn guided into said slit, and a roller on which said cut off yarn is hung to reduce its tension.

6. An apparatus as set forth in claim 1, in which said endless chain conveyor is driven by an electric motor mounted on the main body through a worm, a worm wheel, a reversing clutch, an anti-reversing coupling, a driving shaft and an endless chain drive in order, and has a number of carriers which are provided on said endless chain conveyor to pick up said empty bobbins in hopper and feed them one after another from above into the guide chamber mounted at the back of said hopper in accordance with the advance of said endless chain conveyor.

7. An apparatus as set forth in claim 1, in which said empty bobbin mounting means comprises a bobbin holder for supporting an empty bobbin at the end of its base hole, said holder being located at the bottom of the guide chamber, and being provided with a notch freely passable through the heads of the spindles, and a swingable bobbin supporter on the opposite side of said holder, said swingable bobbin supporter supporting said empty bobbin at the head in an inclined direction with its base hole down, and swinging said empty bobbin in vertical position when the inside wall of the base hole of said empty bobbin is hit by the head of one of said spindles and the lower end of said bobbin is released from said bobbin holder, whereby said empty bobbin can be mounted properly on said spindle as the main body advances.

8. An apparatus as set forth in claim 1, in which lappets are provided to guide the yarns towards respective twister rings, characterized by means preparing for the dismounting of a fully wound bobbin, comprising a lappet lifting guide carried by the main body for withdrawing the lappets successively as the main body is advanced and before the fully wound bobbins associated with said lappets respectively are dismounted, to avoid interference of the lappets with the dismounting of the fully wound bobbins, and a yarn guide also carried by said main body for pushing back the yarns successively as the main body is advanced to avoid interference of the yarns with the dismounting of the fully wound bobbins.

9. An apparatus as set forth in claim 1, in which said reversing means comprises a reversing lever provided on the main body and adapted to be rotated when being hit by a stopper fixed near one end of one of said rails, a T

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lever geared with said reversing lever by gear parts of both of said levers, a spring stretched between said levers, a clutch shifting lever with a notch pin in the middle of it, said shifting lever being rotatably jointed to said T lever at a connecting pin, and an arc lever with a notch, said arc lever putting a clutch on a driving shaft into the neutral position to stop the main body when said notch pin on said clutch shifting lever is engaged with said notch of said arc lever.

10. An apparatus as set forth in claim 9, wherein the guide chamber is rotatably jointed to the empty bobbin hopper at an upper axis thereof, and wherein there is provided a handle, a vertically movable lever having a connection to the arc lever, means responsive to the manual operation of said handle for withdrawing the guide chamber about said axis from the line of spindles to avoid the interference of said guide chamber with said spindle line during the return movement of the main body and for lifting said vertically movable lever to swing said arc lever and to release thereby the notch pin on the clutch shifting lever from the notch in said arc lever, whereby the clutch shifting lever through the in-

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creased tension on said spring is moved into clutch reversing position.

11. An apparatus as set forth in claim 1, in which said winding and unwinding means comprises a spool shaft, a lead wire spool with two electric terminal rings loosely mounted on said shaft, a chain wheel mounted on said spool shaft through a free wheel device and driven by an endless chain from the shaft of the driving roller, and a friction disc mounted on said spool shaft and spring-pressed against said spool, whereby said spool is driven through friction contact.

12. An apparatus as set forth in claim 1, wherein power from the electric motor mounted on the main body is transmitted to the driving roller for advancing and returning said main body along the rails through a transmission comprising a driving shaft, a reversing clutch on said driving shaft, a worm and worm wheel drive between the shaft of the motor and said reversing clutch to drive said driving shaft, a bevel gear drive to said driving roller, and an endless chain between said driving shaft and said bevel gear drive.

No references cited.