United States Patent

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[33] **Japan**
[31] **43/57819**

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[54] **RING RAIL LIFTING METHOD AND EQUIPMENT FOR SPINNING MACHINERY**
11 Claims, 6 Drawing Figs.

[52] **U.S. Cl.** **242/26.4,**
57/54, 57/99
[51] **Int. Cl.** **B65h 54/36**
[50] **Field of Search** 242/26.1,
26.3, 26.4, 26.41, 26.43, 26.45; 57/95, 98, 99, 54

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ABSTRACT: A ring rail lifting method and equipment for spinning machinery, comprising a pulse-generating device for generating pulses according to the rotation speed of a frame motor of a spinning machine or the like without receiving power from the frame, and a pulse motor operated by the pulse supplied from said pulse-generating device; and, said ring rail lifting method and equipment for spinning machinery characterized in that an interlocking mechanism operated by said pulse motor is arranged so as to give vertical motion to the ring rail, and this motion is controlled according to the counted number of the pulses transmitted from said pulse generating device.

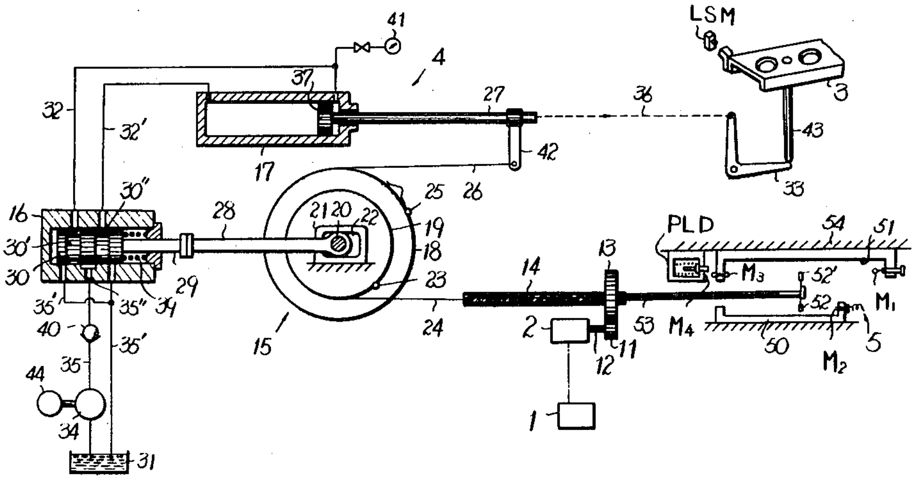
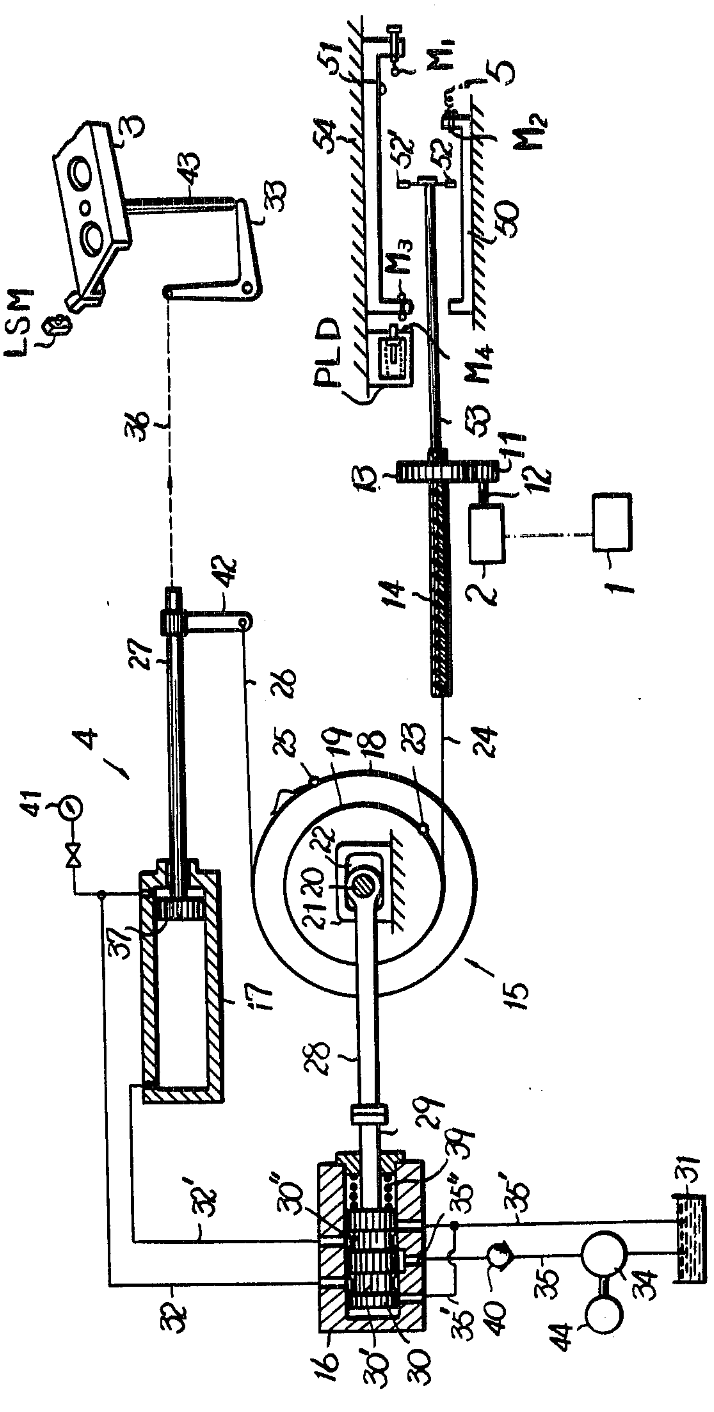


Fig - 1


LSM
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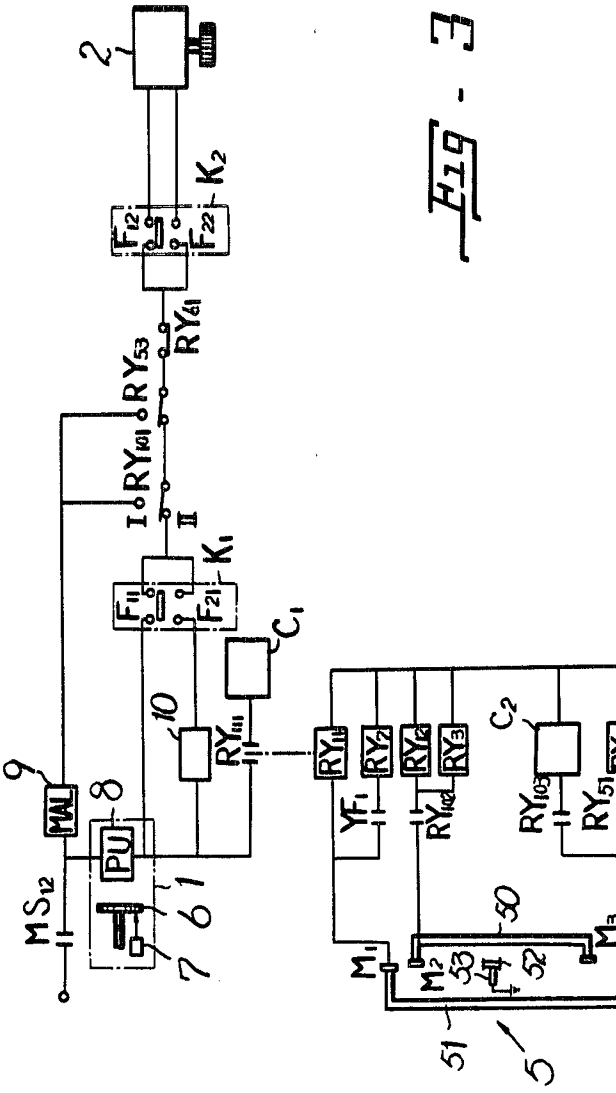
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K₁
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C₁
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RY₁₁₁
RY₁₁
RY₂
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Fig - 2

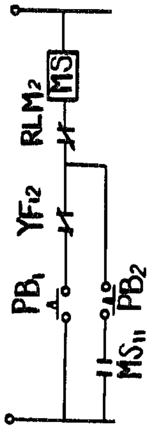
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Fig - 3

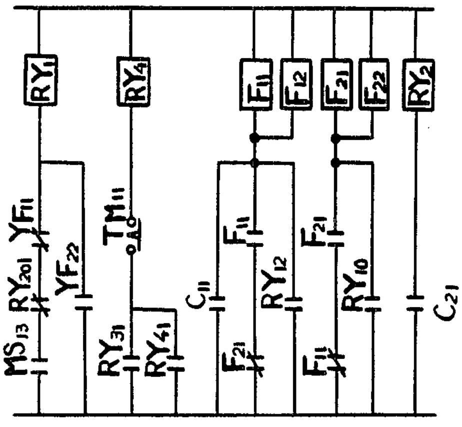

Fig. 4

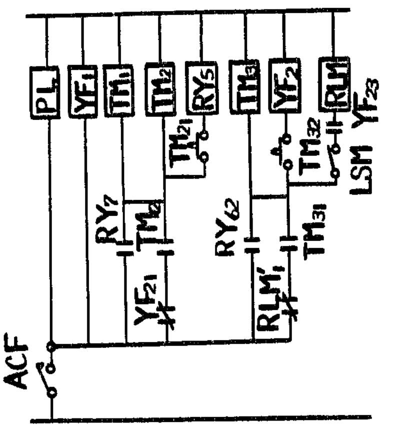

Fig. 5

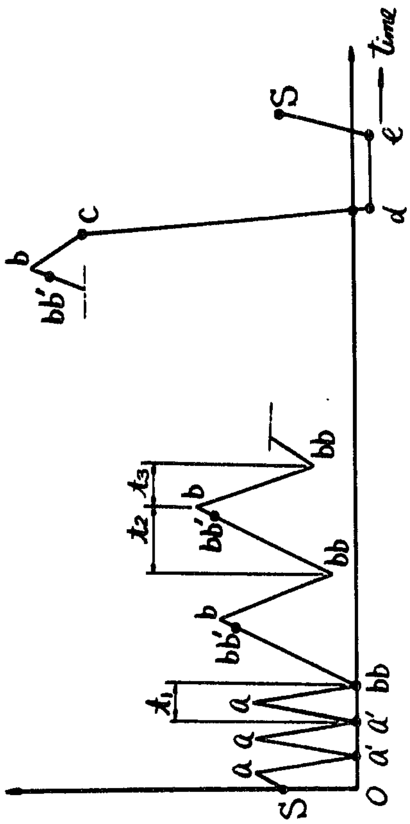

Fig. 6

RING RAIL LIFTING METHOD AND EQUIPMENT FOR SPINNING MACHINERY

DETAILED DESCRIPTION OF THE INVENTION

This invention relates to a method and its equipment in connection with the spinning machinery, such as the spinning machine, spinning frame, roving machine, twisting machine, etc., in which, for the purpose of winding the spun thread on the bobbin into a shape suitable for easy rewinding in the next process, the vertical motion of the ring rail which supports the ring is automatically controlled.

In the conventional spinning or twisting machine, the ring rail is given vertical motion in such manner that the lifting lever is moved with a certain definite amplitude by the use of a heart cam which is rotated with the tin roller mounted on the machine frame; and the shaper gear is rotated sequentially at each traverse, to wind up the chain linked with the ring rail, and traverse motion is given to the ring rail by the chain and, while doing this, the winding position on the bobbin is steplessly raised, thus forming the thread into a cop or cone shape.

According to the prior art, it requires complicated procedures to change the shape of the cop which may differ according to the count of yarn (namely, the thickness of the yarn used) or the diameter of the ring. In addition, such change requires sophisticated mechanical redesign as a whole. Especially in the system using the lifting lever and heart cam, the machine must be large, and a large space is required for the installation of the machine. It is inevitable that the overall mechanical setup becomes complicated. Furthermore, in the mechanism using the heart cam, quick return action is not smooth when the vertical motion is switched in the traverse operation. This results in uneven winding, the thread runs irregularly, forming the cop into an undesirable shape. This trend increases as the heart cam wears. As a result, a specific portion of the cop becomes excessively thick, and the so-called "tangel-up" occurs in the winder process due to the thread entanglement. This limits the speed of operation in the next step process. In short, the mechanism according to the prior art is inconvenient and impractical and uneconomical; in practice, the conventional mechanism requires complicated operation and maintenance, and the costs of installation and operation are high.

An object of this invention is to eliminate the foregoing disadvantage of the prior art by simple arrangement, and to make it possible to realize easy and accurate vertical motion of the ring rail.

Another object of this invention is to provide a method in which the overall mechanism and maintenance procedures are simplified, the control on the vertical motion (so-called "-building motion") of the ring rail is simplified, the cop shape is easily changed, and thus the desired shape of the fine spinning cop, twisting cop or other type of cop can be formed according to the process of the thread used.

Another object of the invention is to provide a device capable of reversing the vertical motion of the ring rail at a high speed and permitting smooth and accurate quick return action and formation of a desirable thread shape of the cop.

Still another object of the invention is to provide an inexpensive device in which the jogging operation, building motion and other cop-forming processes are automatically carried out, and thus the productivity is markedly increased and full automatic operation can be realized.

To best achieve these objects, this invention provides a ring rail lifting method and equipment for spinning machinery, comprising a device for generating pulses at a rate corresponding to the rate of rotation of the front roller on the frame machine of a spinning machine without drawing power from the frame, and a motor operation by these pulses the ring rail lifting method and equipment include and make use of an interlocking mechanism operated by the pulse motor. The motor is connected to the equipment so as to move the ring rail vertically and this motion is controlled according to the number of pulses transmitted from the pulse-generating device.

According to this invention, it is not necessary to modify the composition of the machine when a different count of thread is to be used in forming a cop, and the cop can be formed into a desired shape suitable for use in the next step of the of the process. As a result, the complicated conventional spinning system can be greatly simplified.

According to the invention, the quick return action at switching the vertical motion of the ring rail can be performed surely and smoothly, and a stable operation and desirable formation of cop can always be carried out.

Said efficient cop formation according to this invention serves to increase the efficiency of the next process. Therefore it is not necessary to provide additionally a complicated and costly auxiliary equipment which has been in use for increasing the efficiency of the next process in accordance with the prior art. The equipment according to this invention can be easily operated, and maintenance is simplified. Also, the control of the building motion is remarkably simplified, and all the important processes can be operated automatically. As a result, the overall operating efficiency of a spinning system can be increased and the productivity can accordingly be improved.

The method and equipment of this invention provide reliable automatic operation ready adjustment of the operation, fully automatic operation prevention of thread breakage during operation elimination of effects due to uneven operating speed or failure and secure and efficient cop formation.

The invention is further featured by the point that the equipment is structurally simple and can be constructed into a small size and can be efficiently used for a long period of time. In addition, the equipment of this invention can be easily manufactured on a regular production basis. Furthermore, this equipment can be used in a wide application field.

The invention will be more concretely explained by referring to the appended drawings.

FIG. 1 is a schematic diagram showing a method and equipment embodying this invention,

FIG. 2 is a circuit diagram showing the operation of the equipment of the invention,

FIG. 3 is a circuit diagram showing a pulse generator used for the purpose of this invention,

FIG. 4 is a circuit diagram showing the operation for stopping the fully packed cop, and

FIG. 5 is a circuit diagram showing the operation of switching the machine to coasting when the cop is full,

FIG. 6 is a diagram showing the relationship between the ring rail displacement and time.

An embodiment of the invention will be described below.

Referring to FIGS. 1 and 2, the equipment shown therein comprises: a device 1 for generating timing pulses in response to the number of revolutions of the front roller on the machine frame; a pulse motor 2 operated by the pulses transmitted from the pulse generating device 1; an interlocking mechanism 4 which is operated by the pulse motor 2, to lift or lower a ring rail 3; a memory device 5 for storing the number of pulses necessary for vertical motion of the ring rail 3 so that the vertical motion is controlled in accordance with the number of pulses received; and a means for automatically reversing the upward and downward motions of the ring rail 3 when the predetermined number of said pulses is reached.

In order to interlock the above mechanism with a spinning machine, the pulse generating device which is to control the vertical motion of the ring rail 3 is arranged in such manner that, as shown in FIG. 2, a rotating disk 6 which serves as an interrupter and is connected to a front of a frame machine (not shown diagrammatically) is provided with many transparent portions (such as through holes) for the purpose of transmitting light in pulses in correspondence with the number of revolutions of the main machine; the disk 6 (FIG. 2) is located between a light source 7 and a light-receiving pickup

8, this pickup 8 generating one electrical pulse with the aid of an amplifier or the like for each light pulse transmitted by the disk 6 from the light source 7. The pulse motor 2 is rotated in the forward or reverse direction according to the number of pulses transmitted. A multipulse-generating device 9 is associated with the pulse-generator device 1. This multipulse-generating device 9 generates a high speed pulse regardless of the rate of revolution of the main machine.

The forward or reverse revolution of the pulse motor 2 is related to the vertical motion of the ring rail 3. The circuit of this pulse motor 2 is provided with switching holding devices K1 (FIG. 2) and K2 having contacts F11, F21, and F12, F22 respectively so as to rotate the pulse motor 2 in the forward or reverse direction. The circuit is also provided with switching relays RY1 (FIG. 4) RY5 (FIG. 5) so that the multipulse-generation device 9 (FIG. 2) is selectively connected to the pulse motor 2. The pickup 8 is connected directly to the contact F11 of the holding device K1, and a frequency converter 10, [which generates one shot of pulse for two input pulses in this embodiment] related to the contact F12 is connected to a counter C1 operated by memory device 5.

A fluid pressure servo mechanism, for example, is utilized for the mechanism 4 (FIG. 1) which is interlocked with the vertical motion of the ring rail and is located between the pulse motor 2 and the ring rail 3. The mechanism 4 consists of a gear 13 engaged with a pinion 11 which is mounted on the rotating shaft 12 of the pulse motor 2, threaded rod 14 moved axially by rotation of the gear 13, a control mechanism 15 which is controlled by the shift of the threaded rod 14, and a hydraulic cylinder 17 for reciprocating the ring rail 3 by way of a changeover valve 16. In order to cause the piston rod 27 to traverse the hydraulic cylinder 17 and thus cause the building motion of the ring rail, an operation control mechanism 15, namely a feedback device, is employed. This control mechanism 15 is such that two disks are used for force amplification; specifically, these disks may have equal diameters or, for example, the disk 18 may be larger in diameter than the disk 19. Both are integrally mounted rotatively on the shaft 20. A rope 26 such as a steel tape or wire is extended from part 42 of a piston rod 27 of the cylinder 17 which reciprocates the ring rail. This steel tape or wire 26 is wound on the larger disk 18; for example, the wire is wound less than one turn on the circumference of the disk. The wire is fixed to the disk 18 at a stopping position 25. Also, a rope 24 such as a steel tape or wire is connected to the tip end of the screw rod 14 and wound less than one turn on the circumference of the smaller disk 19 and then fixed to a stopping position 23. Thus the operation of the pulse motor 2 is related to the vertical motion of the ring rail 3.

A shaft 20 which supports the disks 18 and 19 is slidably mounted in a guide groove 22 of a bearing 21. A link bar 28 is connected to the supporting shaft 20 and to a rod 29 of a piston 30 of the changeover valve 16 and linked with said hydraulic cylinder 17 by way of piping 32 and 32′. The shaft 20 is thus related to the hydraulic system. When the threaded rod 14 is shifted toward the right (on the drawing) by the rotation of the pulse motor 2, the supporting shaft 20 is pulled and moved along the guide groove 22. By this action, the piston 30 of the changeover valve 16 is displaced from the neutral position to the right via the rod 29. A high pressure oil supply port 35 is opened at one end of a hollow groove 30′ of the piston 30. This high pressure oil is supplied from the oil tank 31 via a pump 34 of the hydraulic system to the right chamber of a piston 37 of the hydraulic cylinder 17 by way of piping 35 and 32. By this, the piston 37 is moved to the left, the rope 26 of the piston rod 27 is loosened, the rod 29 is returned by a spring 39, the disk is rotated and, at the same time, the movement of the piston and 27 is transmitted, by way of chain 36 to the arm 33 which reciprocates the ring rail 3, and thus the vertical motion of the support rod 43 and the ring 3 is carried out by strong force of the hydraulic pressure. More specifically, the piston 30 of the changeover valve 16 returns to its neutral position when the disk is rotated by the built-in spring 39. In this operation a faint force of pulse motor 2 is amplified. The piston 37 of the hydraulic cylinder 17 is moved with increase in the length of the movement of the screw rod 14 actuated by the pulse motor 2. The force of this piston 37 is suitably amplified by the hydraulic system. Thus the vertical motion of the ring rail 3 is securely controlled.

The memory device 5 stores the number of given pulses and generates a signal current when the number counted reaches the predetermined value. In this embodiment, the number of pulses is mechanically stored so as to prevent failure at restart of operation after power failure or stop of operation. A control rod 53 is moved according to the number of revolution of the pulse motor, and the number of pulses corresponds with the length of the movement of the control rod 53. The memory device comprises a slide-type count memory part 50 for use in jogging motion, in which the displacement of the control rod 53 corresponding to the predetermined number of pulses is detected; a slide-type count memory part 51 for use in the building motion; and the control rod 53 provided with contacts 52 and 52′ which give out detecting signals to said memory parts 50 and 51. The control rod 53 is linked with the threaded rod 14 which is moved by the pulse motor 2, and is operated by the threaded rod 14. The memory part 50 for use in the jogging motion consists of an insulated box one end of which is provided with an adjustable contact M2. The memory part 51 for use building motion, consists of a box of insulation material, at one end of which contact M3 is provided and at the other end of which an adjustable contact M1 is provided facing the contact M3. A guide 54 of said box is provided with a fixed contact M4 which determines the position of the end thread winding. The distance between the contacts M1 and M3 is equal to the sum of the moving length of the control rod 53 which corresponds to the length of the down run of the ring rail in the building motion, and the width of the contact 52. The distance between the both ends of said memory part 50 is equal to the sum of the jogging width and the width of the contact 52. The function of the memory parts 50 and 51 is to store the moving length of the ring rail in the step-feed and the jogging, namely, the memory parts 50 and 51 store the number of pulses.

In FIG. 2, the contact M1 is connected to the relay RY11 having the normally open switch RY111 which connects to the counter C1. Also, the contact M1 is connected to the relay RY7 via the normally open switch to the relay YF1. The contact M2 is connected to the relays RY12 and RY3 by way of the normally open switch RY102 to the relay RY1 (FIG. 4) and the relay RY12 (FIG. 2). The contact M3 is connected to the circuit consisting of a counter C2 which counts the number of the jogging windings and to the normally closed switch RY51 and the relay RY10, by way of the normally open switch RY103 of the relay RY1. The contact M4 is connected to the circuit consisting of the normally open switch RY52 and the relay RY5 (FIG. 5) and the relay RY6. These relays are incorporated thereinto to establish a mutual relationship.

The circuit diagrams shown in FIGS. 3 through 5 will be explained. In FIG. 3, a pulse transmission circuit is shown, wherein when a start pushbutton PB1 is depressed, a main relay MS is actuated to close the circuit contact MS12 (FIG. 2) of the multipulse-generating device 9 (FIG. 2) and pickup 8. At the same time, the relay MS (FIG. 3) closes the self-holding contact MS11. The circuit comprises normally closed switches YF12 (FIG. 3) and RLM2 released by the operation of the relay YF1 (FIG. 5) and RLM and a release push button PB2 (FIG. 3).

FIG. 4 shows an operating circuit for controlling the vertical motion of the ring rail. This circuit comprises a switching relay RY1 for switching a timing pulse transmitter 1 (FIG. 2) and a multipulse-generating device 9 for the pulse motor 2, a relay RY4 for on/off of the circuit of the machine motor, and relays F11, F12, and F21, F22 for switching the switching holding devices K1 and K2, and a relay RY2 (FIG. 4) of which the contact C21 is closed by the operation of the counter C2 (FIG. 2) which counts the necessary number of punching, and said relay RY2 (FIG. 4) for releasing said relay RY1.

FIG. 5 shows a circuit for operation where the machine is switched to coasting when the cop is full; the ring rail is quickly lowered to wind the end of the thread on a suitable portion, and the ring rail is stopped at a suitable position. In other words, this circuit is designed to stop the winding operation when the cop is complete. The circuit comprises a relay YF1 operated when the contact ACF of the counter is closed at completion of the cop, a timer TM1 for releasing the machine motor circuit after a certain time interval, a timer TM2 which determines the timing for quickly lowering the ring rail and which operates the relay RY5 connected to the multipulse-generating device 9 (FIG. 2) to rotate the pulse motor 2 (FIG. 2) quickly, a timer TM3 (FIG. 5) which determines the timing for relifting (or relowering) the ring rail to a position suitable for the doffing operation; when the ring rail has been lowered to the thread end winding position, the timer TM3 operates the switching relay RY1 (FIG. 4) which connects the multipulse-generating device 9 (FIG. 2) to the pulse motor 2 (FIG. 2). The circuit further comprises a relay RLM (FIG. 5) which is operated when the switch LSM is pushed closed at a suitable position, and the relay RLM (FIG. 5) releases the pulse transmission control circuit (FIG. 3).

In FIG. 1 35 PL denotes a pilot lamp, 35 is the oil return piping of the hydraulic system, 40 is a pressure-adjusting check valve, 41 is a detecting meter, 42 is a link piece, 43 is a lifting rod of the ring rail 3, 44 is a motor for driving a pump 34.

RY101 (FIG. 2) and RY53 are switching contacts operated by the switching relays RY1 (FIG. 4) and RY5 (FIG. 5), and MS13 (FIG. 4) is a circuit contact operated by the main relay MS (FIG. 3), the contact MS12 (FIG. 4) of which corresponds to the relay RY1 (FIG. 4). RY201 (FIG. 4) and YF11 (FIG. 4) are the normally closed switches (FIG. 4), YF22 (FIG. 4) is a contact of the circuit of the relay RY1 (FIG. 4) RY31 (FIG. 4) and RY41 (FIG. 4) are normally open switches connected to the relays RY3 (FIG. 2) and RY4 (FIG. 2) C11 (FIG. 4) is a contact of the conductor C1 (FIG. 2), TM11 (FIG. 4) and TM12 (FIG. 5) are self-holding contacts of the timer TM1 (FIG. 5), TM21 (FIG. 5) is the contact of the timer TM2 (FIG. 5), TM31 (FIG. 5) and TM32 (FIG. 5) are the contacts of the timer TM3 (FIG. 5), YF21 (FIG. 5) is the contact of the timer TM2 (FIG. 5), YF22 (FIG. 4) is the contact of the circuit of the relay RY1 (FIG. 4), YF23 (FIG. 5) is the contact of the relay YF2 (FIG. 5) RY61 (FIG. 2) is the normally closed switch in the circuit of the pulse motor 2 (FIG. 2), RY62 (FIG. 5) is the contact of the timer TM3 (FIG. 5), and RLM1 (FIG. 5) is the contact of the relay RLM (FIG. 5).

The motion of the ring rail 3 will be explained below. This motion consists of five major motions, such as the jogging motion in which the thread is wound quickly on the bobbin in a manner such that the thread cannot come off the bobbin. For example, the thread is wound two to three turns on the bobbin. The next process is the building motion (cop-forming motion). In this motion, vertical motion is repeated to form a cop or other shape and the winding position is raised step by step. Then the ring rail 3 is quickly lowered when the winding process is terminated, thus forming a complete cop. At this instant, the end of the thread is wound thereon. In the lowering operation at times of full package, namely, when an empty bobbin comes in after the full bobbin, the end of the thread is securely wound on the empty bobbin. In order to keep the thread linked for restart of operation, the thread is wound two to four turns on the bobbin so that the thread remains on the spindle. Practically, the thread is wound on the portion about 3 mm. below the bobbin or wound on the head portion of the wrap. After this motion, if necessary, the operation may proceed to the motion for stopping the ring rail at a suitable position, namely at a position which is not necessarily for start of the winding (or in other words, the position convenient for the doffing operation). According to the embodiment, the ring rail is lifted to a suitable position and stopped there in order to insert a kicker into the bottom of the bobbin for kicking up the full-wound bobbin. By a series of these operations, the ring rail is vertically reciprocated and thus performs its function.

Each motion will be more specifically explained by referring to FIG. 6. At the beginning of the operation, the ring rail 3 is in the stop position represented as S (in FIG. 6 and the switch LSM (FIG. 5) is in closed position); the position is suitable for the doffing operation. The contact ACF (FIG. 5) for the counter is released, and the holding devices K1 (FIG. 2) and K2 (FIG. 2) are held on the F21 (FIG. 2) and F22 (FIG. 2) sides.

Under this condition, the jogging operation is initiated by pressing the pushbutton PB1 (FIG. 3) to actuate the main relay MS (FIG. 3). The multipulse-generating device 9 (FIG. 2) also starts operation and, at the same time, the circuit contact MS13 (FIG. 4) of the relay RY1 (FIG. 4) is closed. By this, the moving contactor of the switching contact RY101 (FIG. 2) is switched to the I side, namely to the side of the multipulse-generating device 9. As a result, the pulse motor 2 is operated to move the ring rail 3 upward. At the same time, the circuit contact RY102 (FIG. 2) connected to the contact M2 of the memory part 50 (FIG. 2) for jogging, and the circuit contact RY103 connected to the contact M3 are closed. When the ring rail is raised, the control rod 53 (FIG. 1) is moved. At the uppermost point *a* (FIG. 6) of the jogging, the rod 53 comes in contact with the contact M2 (FIG. 1). By this operation, the relays RY12 (FIG. 2) and RY3 (FIG. 2) are actuated. The relay RY3 actuates the relay RY4, to start the machine operation. At the same time, the relay RY12 (FIG. 2) switches the holding devices K1 and K2 to the F11 and F12 sides. As a result, the pulse motor rotation is reversed, and the ring rail 3 is lowered.

When the ring rail 3 reaches the lowermost position a' during jogging, the rod 53 is linked with the contact M3 (FIG. 1) of the memory device 5 by way of the other end of the memory part 50. Then, the holding devices K1 (FIG. 2) and K2 are switched to the F21 and F22 sides again by the relay RY10 (FIG. 2), rotation of the pulse motor 2 is reversed, and the ring rail 3 is lifted. At the same time, the number of contacting actions the rod 53 has had with the contact M3 is stored in the counter C2 (FIG. 2). As described above, when the number of the repetitive jogging actions reaches the predetermined number, the counter C2 (FIG. 2) closes its contact C21 (FIG. 4), to actuate the relay RY2 (FIG. 4). As a result, the contact RY201 (FIG. 4) of the relay RY1 (FIG. 4) is released, and the moving contactor of the switching contact RY101 (FIG 2) is changed over to the II side. The circuit of the multipulse-generating device 9 (FIG. 2) is disconnected, an attenuated pulse is supplied to the pulse motor 2 from the timing pulse generator 1 by way of the converter 10 (FIG. 2), and the ring rail 3 starts rising at a slow speed. In short, jogging is done to the number equal to the counted number of the counter C2, at which point the switching holding devices K1 and K2 are changed over to the F21 and F22 sides. Then the attenuated pulse is supplied to the pulse motor 2 from the timing pulse generator 1 by way of the converter 10, the pulse motor 2 is operated at a slow speed, the ring rail starts going up, and then building motion starts. In other words, the ring rail is in the position suitable for the doffing operation at the beginning of the operation. Then, in order to prevent breaking the thread, the ring rail is raised to its top position (point *a* of FIG. 6) at start of the operation. When the ring rail is lowered, the motor of the machine frame is linked with the mechanism for the succeeding operation.

Now the building motion will be explained. The building motion starts when the ring rail 3 is lifted at a slow speed by the pulse motor 2. At the same time, the control rod 53 (FIG. 2) of the memory device 5 is moved to come in contact with the contact M2 of the memory part 50. (In this state, since the contact RY102 (FIG. 2) is in the open state, the relays RY12 (FIG. 2) and RY3 (FIG. 2) are not operated.) The rod 53 is further moved to come in contact with the contact M1 of the memory part 51 (FIG. 2), the relay RY11 is thereby actuated. When the relay RY11 is actuated, the counter C1 for counting the pulses is operated, and the switching holding devices K1 (FIG. 2) and K2 (FIG. 2) are switched to the sides of the contacts F11 (FIG. 2) and F12 (FIG. 2) when the counter C1 (FIG. 2) counts the predetermined number of pulses. Therefore, the pulse motor 2 receives the pulse directly from the timing pulse generator 1 (not by way of the frequency converter 10 (FIG. 2) to let the ring rail 3 fall at a higher speed than in the rising motion. In other words, the building motion starts from *bb* immediately after the jogging operation. The pulse motor 2 is operated to lift the ring rail 3 at a slow speed. At the same time, the control rod 53 is moved and, when the ring rail 3 reaches the point *bb'* from the point *bb*, the rod 53 comes in contact with the contact M1 (FIG. 2) of the memory part 51 by way of the contact M2.

Thus the relay RY11 (FIG. 2) actuated, and the contact circuit of the RY111 of the counter C1 is closed. The counter C1 counts the pulses transmitted from the timing pulse generator 1. During counting the pulses, the ring rail 3 keeps rising. At the same time, the control rod 53 moves the memory part 51 and, when the number of pulses comes to a definite count, the counter C1 (FIG. 2) closes the contact C11 (FIG. 4).

At this moment, the ring rail reaches the point (FIG. 6) when the contact C11 (FIG. 4) is closed, the holding devices K1 (FIG 2) and K2 (FIG. 2) are changed over to the F11 (FIG. 2) and F12 (FIG. 2) sides, the pulse motor 2 is given the pulse directly from the timing pulse transmitter 1, the ring rail starts falling at a higher speed (twice higher, in the embodiment) than in the rising motion, the control rod 53 (FIG. 1) is moved reversely and brought into contact with the other contact M3 (FIGS. 1, 2) the memory part 51 (FIGS. 1, 2). During this operation, the ring rail 3 comes down to the point *bb* (FIG. 6). Namely, the ring rail 3 is lifted during the operation where the control rod 53 is moved from the contact M3 of the memory part 51 to the contact M1 and also during the operation where the counter C1 (FIG. 2) counts the pulses. The ring rail 3 comes down during the operation where the rod 53 is moved back from the contact M1 to the contact M3. The length of the rise of the ring rail during the counting operation of the counter C1 is the distance of chase. The memory part 51 is moved by this increment at each step motion. In this way, as shown in FIG. 6, the building motion is carried out. The counter C1 counts pulses during *bb'* to *b*; in practice the time *bb'* to *b* is 0.3 second when one chase is assumed as 30 seconds. When the bobbin on the spindle becomes full by the building motion, the lowering the ring rail is stopped. In this case, the stopping position differs according to requirement. In this embodiment, the operation during the coasting run is utilized after the machine operation is stopped. In practice, during the coasting run, the ring rail is lowered to a position a little below the winding start position, the end of the thread is wound on the lower part of the bobbin, and the ring rail is lifted to a position suitable for the doffing operation and then stopped there, in the manner as been described. The above operation will be more specifically explained below by referring to FIGS. 2 and 5. The counter (not shown diagrammatically) interlocked with the front roller closes the contact ACF (FIG. 5) when the cop becomes full. By this, the relay YF1 (FIG. 5) which generates an instruction signal for stopping the machine motor and for lowering the ring rail is actuated. In this state, the ring rail continues building motion and rising. When the control rod 53 comes in contact with the contact M1, the full package operation starts. Namely, the relay RY7 (FIG. 2) is actuated by the contact M1 (FIG. 2), and the timers TM1 (FIG. 5) and TM2 (FIG. 5) are accordingly actuated. These timers close their respective self-holding contacts TM11' (FIG. 4) and TM21' (FIG. 5). Then, the timers keep these states even if they relay RY7 (FIG. 5) is released. After a certain definite time, the timer TM1 (FIG. 5) is operated, the normally closed switch TM11 (FIG. 4) is released, the relay RY4 (FIG. 4) for the machine motor is released, and thus the machine operation is stopped and the machine goes into coasting motion. After a certain time, the other timer TM2 (FIG. 5) is actuated, the contact TM21 (FIG. 5) is closed, and the relay RY5 (FIG. 5) is actuated. At this moment, the holding device K2 (FIG. 2) switches the pulse motor 2 to the downward direction, or in other words, the holding device K2 (FIG. 2) is switched to the side of the contact F12 (FIG. 2). The pulse motor 2 (FIG. 2) is connected to the multipulse-generating device 9 (FIG. 2) by the switching relay RY5 (FIG. 5), and rotated at a high speed, to lower the ring rail 3 quickly. Because the normally closed switch (FIG. 2) is kept opened, the relay RY10 (FIG. 2) is not actuated even when the contact 52 of the control rod 53 is brought into contact with the contact M3. Therefore the switching holding devices K1 (FIG. 2), and K2 are not switched; the devices K1 and K2 remain unchanged. The ring rail 3 is kept lowered until it comes in contact with the contact M4 (FIG. 2). Then, the relay RY6 is actuated, the normally closed switch (FIG. 2) of the circuit of the pulse motor 2 is opened, the contact RY62 (FIG. 5) is closed, the timer TM3 (FIG. 5) is actuated, the contacts TM31 (FIG. 5) and TM32 (FIG. 5) are closed after a certain time (namely, a certain time interval after stoppage of the machine operation), and the relay YF2 (FIG. 5) is actuated. When the relay YF2 (FIG. 5) is operated, the contact YF21 (FIG. 5) of the circuit of timer TM2 (FIG. 5) is opened, and thus the relay RY5 (FIG. 5) is restored. By this, the relay RY10 (FIGS. 4, 2) related to the contact M3 (FIG. 2) is actuated, the switching holding device K2 (FIG. 2) is switched to the side of the contact F22 (FIG. 2), the relay YF2 (FIG. 5) closes the contact YF22 (FIG. 4) of the circuit of relay RY1 (FIG. 4), and the pulse motor 2 is operated for lifting the ring rail quickly. As a result, the ring rail 3 is brought into contact with the control switch LSM (FIG. 1) which is placed at a suitable position of the machine frame. Also, since the contact YF23 (FIG. 5) closed by the act of the relay YF2 (FIG. 5), the relay RLM (FIG. 5) is operated to open the contact RLM1' (FIG. 5). Accordingly, the timer TM3 (FIG. 5) and relay YF2 (FIG. 5) are released. By this, the relay RY1 (FIG. 4) is released. In the other circuits of the relay RY1 (FIG. 4), the normally closed switch YF11 (FIG. 4) is released because the relay RY1 (FIG. 5) is operated by the closing of the full package counter ACF (FIG. 5). When thus the relay RY1 (FIG. 4) is released, the ring rail 3 completes its quick rising action. At the same time, the normally closed switch RLM2 (FIG. 3) for the main switch relay MS (FIG. 3) is released, and the transmitting part of the pulse-generating device 1 is stopped to be ready for the next step operation.

The memory part 51 (FIG. 2) is pressed by the push rod PLD (FIGS. 1, 2) with rise of the control rod 53, the contact M3 (FIG. 2) is parted from the contact M4 (FIG. 2), and the memory part 51 (FIG. 2) is stopped at a suitable position (namely, the position at which the contact 52 (FIG. 2) comes in contact with the contact M4 (FIG. 2) when the control rod 53 comes down to the lowermost position of the cop). In other words, the push rod PLD determines the lowermost position in the cop-forming motion. After the doffing operation, the counter is reset to be ready for the next operation.

The memory device 5 (FIGS. 1, 2) may be formed by combination of a device for mechanically storing the count of pulses, for example, a memory device for counting a specific number of the pulses in the rising motion, and a memory device for storing only a specific number of count in the falling motion. (The number of counts stored in the memory device in the rising motion serves as the step feed between the chases). If required, a mechanical memory device may be used wherein a cylinder is arranged to be interlocked with the pulse motor 2 and, utilizing this arrangement, a pulse-counting pointer is disposed to indicate an instruction by which the power of the pulse motor 2 is switched by a clutch (electromagnetic clutch). The pulse-generating device may be so arranged that different pulses are generated, or plural numbers of pulse generators (for low frequency, high frequency or medium frequency) are suitably combined for use in the control of various motions. For example, two kinds of pulse generators (high frequency and low frequency) are used whereby the ring rail lifting motion is controlled by the low frequency pulse, and the lowering motion by the high frequency pulse. In this case, it is arranged so that the time required for the rising motion is longer than that required for the falling motion. (Note: The number of pulses required for the ring rail to move a certain specific length in the rising motion is equal to that in the falling motion). If desired, three kinds of pulse generators (low, medium and high frequencies) may be provided; the low frequency is used for the rising building motion, the medium frequency for the falling motion, and the high frequency for the quick falling (chip jogging of the ring rail in the jogging and full cop operation, and thus a suitable operating speed can be maintained for each motion.

We claim

1. A method of controlling the winding of a cop onto a bobbin on a ring-twisting machine, comprising the steps of generating electrical pulses at rates related to the speed at which thread is supplied to said cop, feeding pulses in a sequence of predetermined rates to a pulse motor driving a thread-carrying ring rail along said cop and thereby controlling the velocity at which the ring rail traverses said cop at all stages of winding said cop, counting the number of pulses in each specific traverse, terminating each specific traverse when the predetermined number of pulses corresponding to the specific traverse has been reached, thereby controlling the distance covered by said ring rail in each traverse, and reversing the direction of travel of said ring rail at the end of each traverse.

2. The method as defined in claim 1 wherein said rates at which said pulses are generated include a higher rate and a lower rate, and, initially applying said higher rate to said motor in a direction such as to bring said ring rail toward an end of said cop, carrying out several short traverses, alternating in direction at said higher pulse rate, thereby starting the thread carried by said ring rail on said bobbin.

3. A method as defined in claim 2 wherein said rates at which said pulses are generated further include a highest rate, said highest rate being used for bringing said ring rail to an end suitable for the doffing of said bobbin.

4. A method as defined in claim 2 wherein the direction of travel of said ring rail is vertical, and following starting of the thread on said bobbin, upward traverses are carried out at said higher pulse rate and downward traverses are carried out at said lower pulse rate.

5. A method as defined in claim 2 wherein said higher pulse rate is twice said lower pulse rate.

6. A method as defined in claim 1 wherein the length of each traverse, the point at which each traverse is ended, and the number of traverses are predetermined as a means for controlling the shape of the completed cop.

7. An apparatus for winding a cop onto a bobbin on a ring-twisting machine, comprising means for generating electrical pulses at rates related to the speed at which thread is supplied to said cop, a pulse motor operated by said pulses at rates corresponding to said pulse rates, a thread-carrying ring rail driven by said pulse motor, a bobbin on which thread is wound in a sequence of traverses by said ring rail onto a cop, first means for counting the pulses to said motor in each traverse, second means for counting the traverses, and means for regulating the length of each traverse and the number of traverses in accordance with a predetermined pattern, whereby the length of each traverse may be controlled to produce a cop of a desired shape.

8. Apparatus as defined in claim 7, further comprising a threaded rod axially movable by said pulse motor, a lifting rod supporting said ring rail, and hydraulic means for positioning said ring rail in accordance with the position of said threaded rod.

9. Apparatus as defined in claim 8, further comprising feedback means for determining and correcting the position of said ring rail and lifting rod relative to the position of said threaded rod.

10. Apparatus as defined in claim 9 wherein said feedback means includes a first flexible line, one end of which is operatively connected to said ring rail, a second flexible line operatively connected to one end of said threaded rod, a hydraulic cylinder having a piston operatively connected to the other end of said first flexible line, a third flexible line operatively connected at one end to said piston, a first disc to the rim of which the other end of said second flexible line is fastened, a second disc to which the other end of said third flexible line is fastened, the discs being coaxial, rigid with respect to each other, and so placed that movement of said lines causes rotation of said discs, a shaft on which said discs are mounted, a yoke in which said shaft can be displaced, the displacement corresponding to error in positioning of said lifting rod relative to the position of said threaded rod, and a changeover valve connected to said shaft for sensing the position of said shaft within said yoke as a means of controlling the position of said piston of said hydraulic cylinder and thus the position of said ring rail, the feedback means and hydraulic system thereby amplifying the power output of the pulse motor to provide positive positioning of the ring rail.

11. Apparatus as defined in claim 7 wherein said counting means include a guide receiving said threaded rod in a lengthwise direction, first and second slides mounted in said guide so as to be movable in said lengthwise direction, electrical contacts mounted on said slides and on said guide and connected with said pulse motor, the contacts being activatable by said threaded rod, the distance between said contacts on said first slide serving to count the pulses which control the distance traversed by said ring rail in a first direction, and the position of one of said contacts mounted on said second slide serving to control the distance traversed by said ring rail in the opposite direction, said slides being displaced by a predetermined amount after each pair of oppositely directed traverses, and a contact mounted on said guide activatable to terminate the action of the apparatus when the total of said displacements reaches a predetermined value, thus providing for replacement of the cop-laden bobbin with a fresh bobbin.

UNITED STATES PATENT OFFICE
CERTIFICATE OF CORRECTION

Patent No. 3,604,643 Dated September 14, 1971

Inventor(s) Tsuneo Kimura; Tooru Moriguchi, Shigeaki Takahashi
Katsumasa Nerio

It is certified that error appears in the above-identified patent and that said Letters Patent are hereby corrected as shown below:

Column 4, line 53, change "and" to --of--.

Claim 4, line 4, change "higher" to --lower--.

line 5, change "lower" to --higher--.

Fig. 1 is in error in that rod 53 with its contacts 52 and 52' though shown in intermediate position should be in left-most position.

Fig. 2 is in error in that "RY4" should read --RY6--.

Signed and sealed this 13th day of June 1972.

(SEAL)
Attest:

EDWARD M.FLETCHER,JR.
Attesting Officer

ROBERT GOTTSCHALK
Commissioner of Patents