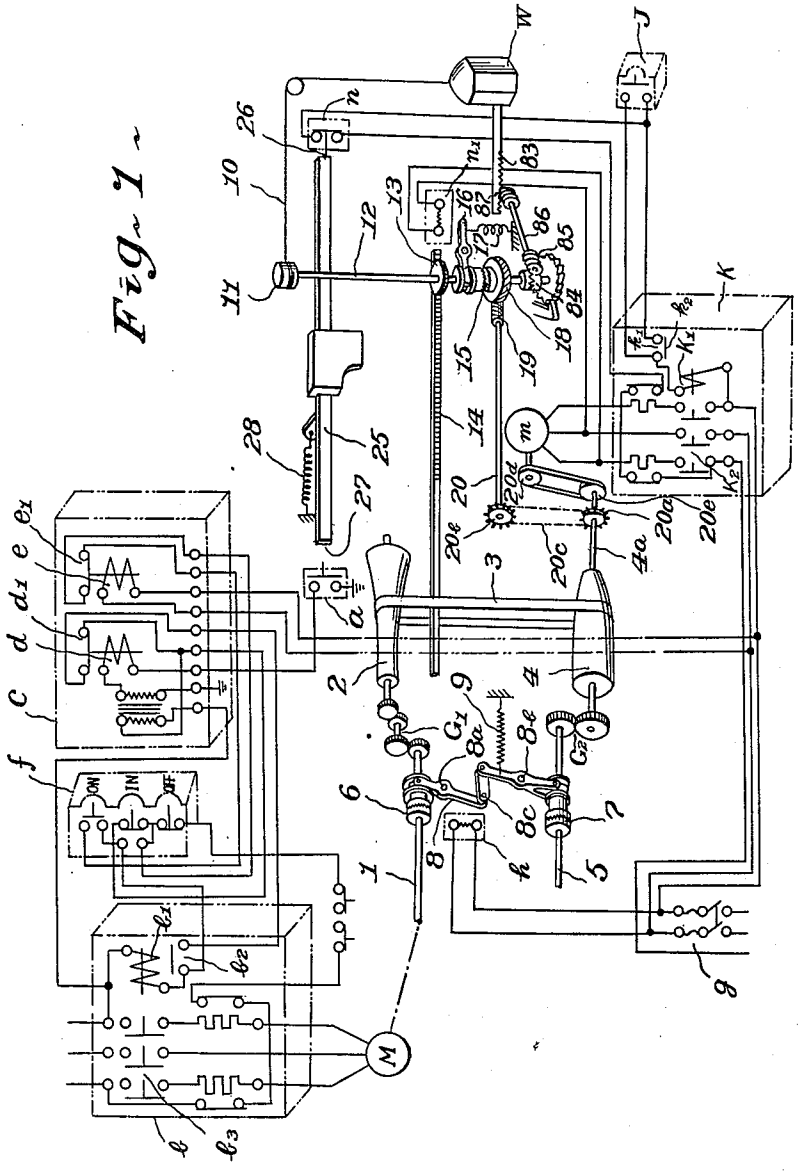
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APPARATUS FOR THE BACK MOTION OF THE CONE DRUM BELT IN A FLYER FRAME

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Fig. 1

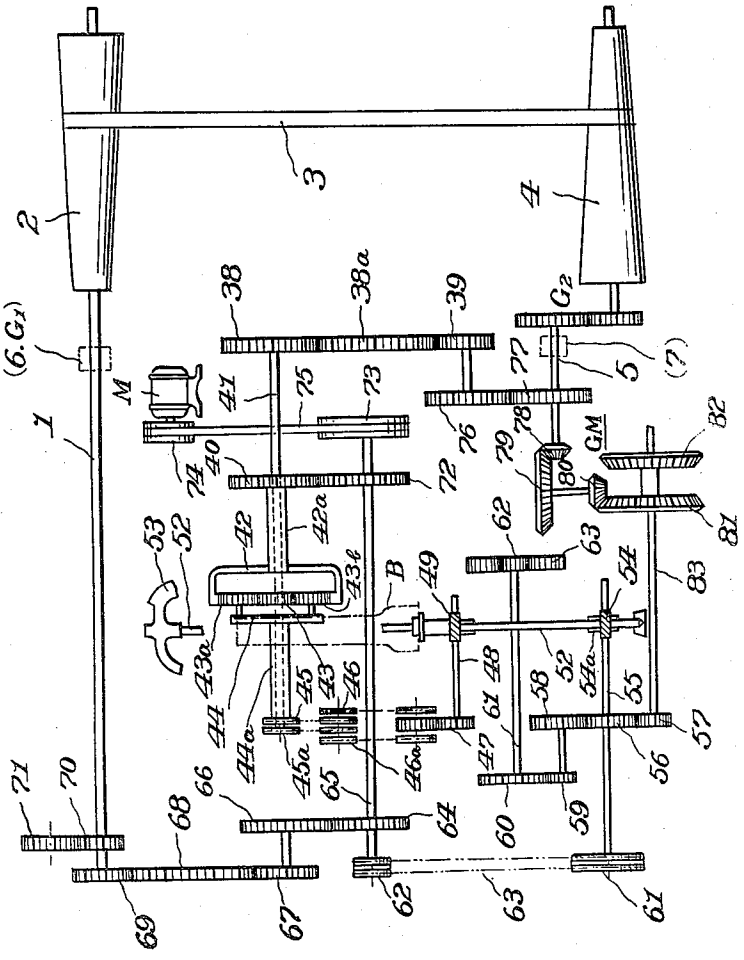


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APPARATUS FOR THE BACK MOTION OF THE CONE DRUM BELT IN A FLYER FRAME

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Fig. 2



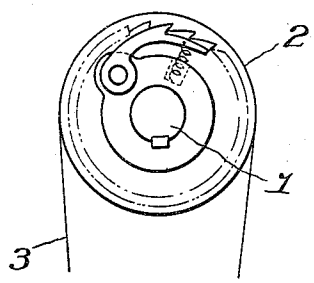
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APPARATUS FOR THE BACK MOTION OF THE CONE DRUM BELT IN A FLYER FRAME

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Fig. 5.

Fig. 3.



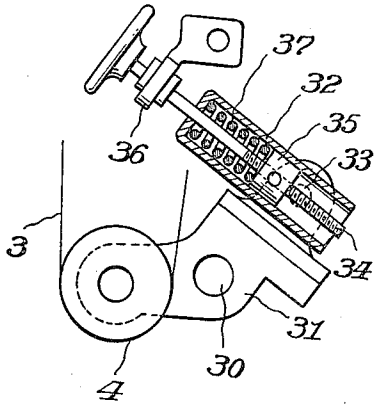
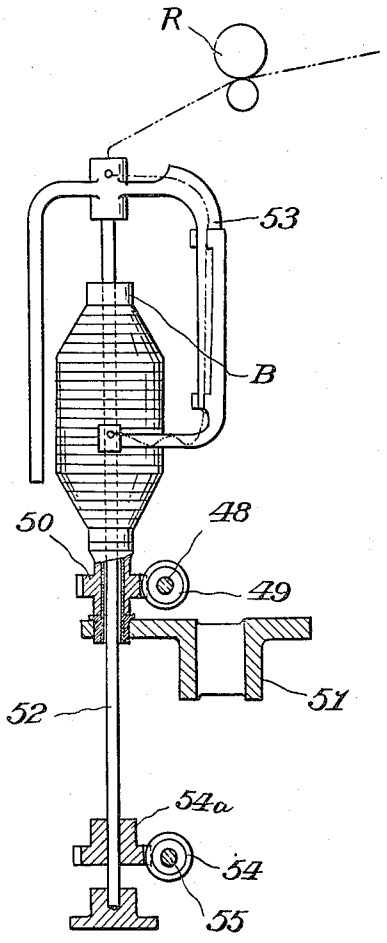


Fig. 4.



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APPARATUS FOR THE BACK MOTION OF THE CONE DRUM BELT IN A FLYER FRAME

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7 Claims. (Cl. 57—102)

This invention relates to an improved apparatus for the back motion of the cone drum belt in a flyer frame.

In the bobbin lead system in which the roving is coiled around a bobbin by means of a flyer, the most conventional method of mechanically decreasing the speed of the bobbin with the increase of the bobbin diameter, said decrease being proportional to the amount of the coiled sliver, is to use a pair of spaced cone drums coupled by a cone-belt to drive the bobbin and flyer and to shift the position of the cone drum belt step by step.

In said system, the usually adopted method for shifting the position of the belt has been to shift the position of said belt by shifting horizontally a long rack by use of a pinion so as to guide the position of the cone drum belt.

In said system, since the top and bottom cone drums are, respectively, located at the driving side and the driven side, a proper tension of said belt is obtained by adjusting the relative distance between the bottom cone drum and the top cone drum.

For satisfying the above-mentioned conditions, the following mechanism have been usually adopted.

(A) *First mechanism*

It is necessary to shift the position of the bottom cone drum up and down to exert a proper tension on the cone drum belt.

Therefore, this mechanism comprises an L-shaped lever having a pivotal shaft at the offset position of the bottom cone drum shaft, one arm of said lever supporting the shaft of the bottom cone drum, and the other arm of said lever being made to rotate around the center axis of said supporting arm.

Adjustment of this mechanism has been carried out by hand and the proper position of the bottom cone drum is usually confirmed by the touch as felt by the operator's hand, so that said adjustment cannot be accurately attained.

(B) *Second mechanism*

This mechanism comprises a long rack arranged so as to be shifted in the longitudinal direction thereof. In the embodiment of this mechanism, when the angle between an anchor bar and the horizontal surface becomes a predetermined angle at the top or bottom position of the bobbin rail, a stopper of a ratchet wheel which operates the long rack is made to disengage from said wheel by a so-called "Box-O-Trick" mechanism, whereby said ratchet wheel is made to rotate by its dead weight. This rotation is carried out by an angle corresponding to one tooth of said ratchet wheel.

By said rotation of the ratchet wheel, the long rack is moved by a spur gear fixed to the shaft of said wheel, and the anchor bar is moved by a vertical ratchet shaft through a pair of bevel gears, a horizontal shaft and a pinion, whereby the effective length of said anchor bar is adjusted.

If the length of the anchor bar is made short, the reverse motion is carried out by said shorter lift of the bobbin rail.

In the flyer frame provided with said mechanism, when the bobbin is coiled with a roving therearound until said bobbin is fully coiled with the roving, the length of the anchor bar becomes shortest, and the long rack takes the remotest position from the vertical ratchet shaft. Accordingly, for the purpose of making again the coiling of the roving start after removal of the full bobbin and mounting of an empty bobbin, it is necessary to make the long rack and the anchor bar move back to their starting positions.

The first step of the above-mentioned operations is carried out by shifting the position of the L-shaped lever by rotating a hand wheel by hand, said lever acting to lift the bottom cone drum as described already.

Next, the long rack and the anchor bar are made to move back to their starting positions by rotation of the other hand wheel which is fixed to the horizontal shaft of the "Box-O-Trick" mechanism.

Then, the bottom cone drum is made to descend by rotation of the L-shaped lever by means of rotation of said hand wheel by hand, and tension is gradually exerted on the cone drum belt. When said tension reaches a proper value, the hand wheel is set by an operator, whereby the preparation for the starting is completed.

Among the series of the above-mentioned operations which must be repeated for every exchange of the bobbin, the most important operation for consideration is the last operation. That is to say, said operation must be carried out so that the tension of the cone drum belt may be loosened and may be tightened again to a proper value.

If the tension of the cone drum belt is too weak, the cone drum belt will be rotated under a condition in which said belt is shifted from the desired position on the cone drum in spite of the provision of a fork-shaped guide for said belt, said disadvantage having been well known.

This condition results in the bottom cone drum not rotating with a predetermined speed.

Such a disadvantage can be avoided if the bottom cone drum cannot be shifted per doffing.

Therefore, the first object of this invention is to provide an apparatus having none of the above-mentioned disadvantages.

Said object has been attained by a mechanism capable of being started by pushing of a push button, whereby the cone drum belt as well as the long rack and anchor bar also are made to be restored to their starting positions.

In this mechanism, however, another condition must be satisfied for sufficiently effective operation. That is to say, in the flyer frame system, it is necessary to leave previously a snack-shaped portion of the roving at the top of the flyer before the full bobbin is exchanged with an empty bobbin, said portion being necessary for coiling somewhat the roving around the surface of said empty bobbin.

Said snack-shaped portion of the roving can be obtained by rotating the flyer and bobbin at the same speed while the front rollers and the other parts are maintained at their normal running states.

In the conventional method for obtaining the above-mentioned desirable condition, the bottom cone drum is lifted by rotation of a hand wheel, and then the frame is slightly rotated.

Therefore, the second object of this invention is to

provide an apparatus, in which the above-mentioned snack-shaped portion of the roving can be formed automatically and effectively.

The novel features which I believe to be characteristic of my invention are set forth with particularity in the appended claims. My invention itself, however, both as to its manner of construction and manner of operation together with further objects and advantages thereof, may best be understood by reference to the following description taken in connection with the accompanying drawings, in which the same members are indicated by the same numerals and characters, and in which:

Fig. 1 is a schematic view for showing the relations of motions between various members and the electric connections between the main motor switches, magnets, submotors, etc. in one embodiment of this invention, said embodiment corresponding to only the modified portions of a conventional flyer frame system.

Fig. 2 is a schematic view for showing a part of a representative gear train of a conventional flyer frame system, said view indicating the gearing relations between the top cone drum, bottom cone drum and bobbin.

Fig. 3 is a front view of a one-way clutch to be used in this invention, said clutch being arranged between the top cone drum and cone drum shaft.

Fig. 4 is a side view of a spring tension device to be used in this invention, said device acting to maintain the tension of the cone drum belt at its proper magnitude.

Fig. 5 is a side view of the flyer and bobbin portions, in which the driving mechanism is sectioned.

Referring to the drawings, the top cone drum **2** is rotated, through a gear train G_1 and a clutch **6**, by a top cone drum shaft **1** which is driven by a main electric motor M through a gear train such as shown in Fig. 2. The main lines of the motor M can be closed by excitation of a magnetic coil b_1 in the switch box *b*, said excitation being established through the push button ON in the push button box *f*, the contacts e_1 of the relay *e* and the push button OFF in said box *f*, by pushing said button ON.

The switch box *b* is provided with contacts *b* which are closed by excitation of the coil b_1, so that the excitation of the coil b_1 is maintained, after opening of the button ON, through the contacts b_2, the contacts d_1 of the relay *d*, and the push buttons IN and OFF. A short cone shaft **5** which drives a bobbin through a conventional mechanism is rotated by said drum **2** through a bottom cone drum **4**, a belt **3** placed around said drums **2** and **4**, a gear train G_2 and a clutch **7**, said bobbin and mechanism being shown in Fig. 2; in which the bobbin B is rotated by the motor M through a pulley **74** supported by the motor shaft, another pulley **73**, a belt **75** placed around said pulleys **74** and **73**, a gear **72** supported by the shaft **65** of said pulley **73**, a gear **40** meshed with said gear **72**, a differential gear mechanism composed of a rotor **42** having a hollow shaft **42***a* which is fixed to the gear **40**, two gear wheels **43***a* and **43***b*, an idle gear wheel **43** meshed with said gear wheels **43***a* and **43***b*, and another rotor **44** supporting said gear wheels **43***a* and **43***b* and having a hollow shaft **44***a*, conventional swing gear mechanism (**45**, **46** and **47**), a worm shaft **48**, a worm **49** fixed to said shaft **48**, and a bobbin supporter **50** which is provided with a worm wheel meshed with said worm **49** (Fig. 5). The gear mechanism (**45**, **46** and **47**) is constructed so that the portion **45** may be rotatable at a constant position, but the gear portion **47** may be swung up and down while rotating at its center shaft **48**. As clearly shown in Fig. 5, the bobbin supporter **50** is supported by a bobbin rail **51** which can be moved up and down by a conventional device not shown. On the other hand, the bobbin B is rotated by the motor M through the pulley **74**, the pulley **73**, a belt **75** placed around said pulleys, the shaft **65**, gears **64** and **66**, a gear **67** fixed to the shaft of said gear **66**, a gear **69** meshed with said gear **67** through an idle gear **68**, the shaft **1**, the device (**6**, G_1) which is clearly shown in Fig. 1, the drums **2** and **4**, the belt **3** placed around said drums, the gear train G_2, the clutch **7** which is clearly shown in Fig. 1, gears **77** and **76**, a gear train (**39**, **38***a*, **38**), a shaft **41** fixed to the gear **38**, the intermediate gear **43** fixed to said shaft **41**, pulleys **45***a* and **46***a*, the gear **47**, and a worm shaft **48**. Said mechanism is so designed that when the driving by the shaft **41** is effective due to coupling between the drums **2** and **4**, the bobbin may rotate faster than the flyer, but when said coupling is released, the speed of the flyer may become equal to that of the bobbin.

The driving of the flyer **53** is carried out as follows. The flyer shaft **52** is driven by the motor M through said shaft **65**, the pulleys **62** and **61**, a belt placed around said pulleys, a shaft **55**, a worm **54** and a worm wheel **54***a* fixed to said shaft **52**. The front roller R such as shown in Fig. 5 is driven by the motor M through the shaft **65**, the gears **64** and **66**, the gear train (**67**, **68** and **69**), the gear **70**, and a gear **71** meshed with said gear **70**.

When the cone drum belt **3** is shifted gradually toward the left side, the speed of the bottom cone drum **4** decreases; thus causing slower rotation of the bobbin. However, when the bobbin is coiled with the roving up to its full state, a projection of the bobbin rail **51** strikes a stop of the knocking off bar **25**, whereby said knocking off bar is suddenly released and shifted toward the leftward by the spring **28**.

The knocking off bar **25** and a long rack **14** are related so that the bar **25** may be restored to its hooked position by means of the long rack **14** just before the termination of the rightward movement of said long rack **14** to its starting position. By the leftward movement of the knocking off bar **25**, the switch *a* is closed by the end **27** of said bar **25**.

The above-mentioned mechanism for the movement and knocking of the knocking off bar is conventionally well-known, so that this mechanism is omitted in the drawing. By said closing of the switch *a*, the relay *d* in the relay box *c* is excited and the contacts d_1 are opened, so that the magnetic coil b_1 of the main magnetic switch box *b* is opened, whereby the main lines of the electric motor M are opened at the contacts b_3, and the frame is made to stop. In this case, the motor M does not start as long as the switch *a* is in its closed state and the relay *d* in the relay box *c* is in operation even though the push button ON is pushed. In this condition, only the inching start of the motor M due to pushing of the inching push button IN is possible.

After establishment of the above-mentioned condition, the magnet *h* is operated by closing the switch *g* inserted in the sub-main lines, whereby the lever **8** composed of two parts pivoted, respectively, at the pivotal shafts **8***a* and **8***b* is attracted against the force of a spring **9**, said two parts being pivoted at a pivotal shaft **8***c*. By said attraction, the clutch **6** is cut off, thereby the coupling of the top cone drum **2** with the shaft **1** is released, and the clutch **7** is cut off, thereby the coupling of the bottom cone drum **4** with the shaft **5** is released.

In said condition, the main motor M can be made to carry out the inching start by pushing the inching push button IN, but the top cone drum **2** and the bottom cone drum **4** cannot start, while the other mechanisms are made to rotate in the normal states. In this condition the flyer and bobbin are made to rotate at exactly the same speed because the rotation speed of the bobbin is constant and it is not effected by the cone drum mechanism.

Such a gear train as shown in Fig. 2 and as described already is generally indispensible for the flyer frame system. That is to say, when the motor M is rotated, the roving is drawn out by the front rollers R and a snack-shaped coil portion of the roving is formed at the flyer

top. This action also is an indispensible element for the bobbin doffing operation.

For preventing the movement of the cone drum belt 3 back to the starting position, a very effective method is to cut off the top cone drum 2 and the bottom cone drum 4 from their driving sides by means of the clutches 6 and 7. In this state, if the cone drum belt backing push button J is pushed, the magnet K_1 in the magnetic switch box K is excited and operates, and the switch K_2 is closed, thereby making the sub-motor *m* start as well as bringing the bottom cone drum 4 into the driving side through pulleys 20*d* and 20*e* and a belt placed around said pulleys, and the top cone drum 2 into the driven side. The contacts k_1 are closed by the contacts piece k_2 when the magnet K_1 is excited, whereby the excitation of the magnet K_1 is maintained even after the button J is released.

Generally, the cone drum belt 3 can be shifted smoothly toward the smaller diameter driving side of the drum, but said shifting toward the larger diameter side is difficult.

In the normal running condition, the top cone drum 2 is in the driving side, so that the belt 3 can be smoothly shifted toward the left side in the drawing; and in the back motion, the bottom cone drum 4 becomes the driving side, so that said belt 3 can be smoothly shifted toward the right side in the drawing.

When the bottom cone drum 4 is driven by the auxiliary motor *m*, the cone drum belt 3 is restored to its starting position as well as a worm wheel 18 is rotated by the shaft 4*a* of said drum 4 through a chain wheel 20*a* fixed to said shaft 4*a*, a chain wheel 20*b*, a chain 20*c* placed around said wheels 20*a* and 20*b*, a horizontal shaft 20 supporting said wheel 20*b*, and a worm 19 supported by said shaft 20. In this state, a vertical ratchet shaft 12 is made to engage with the worm wheel 18 through a clutch 15, said engagement being established by attraction of the lever 16 against a spring 17 due to excitation of an electromagnet n_1, so that the vertical ratchet shaft 12 is rotated in a direction. This direction is selected so as to be opposite to the self-rotation of said shaft 12 due to a dead weight force exerted on a drum 11 fixed to said shaft 12 by a weight W through a wire 10 coiled around said drum, so that the long rack 14 meshed with a pinion 13 fixed to said shaft 12 is shifted toward the right side so as to make the cone drum belt 3 return to its starting position, and the knocking off bar 25 is restored toward the right side as described already. With said backward movement of said bar 25, an anchor bar 83 coupled with said shaft 12 through a worm gear 84 attached to said shaft, a worm gear 85 meshed with said gear 84, a shaft 86 supporting said gear 85, and a pinion gear 87 fixed to said shaft 86, and meshed with the rack of said anchor bar 83, is also restored toward the right side. By this movement of the bar 25, the switch *n* is pushed by the right side end 26 of the bar 25, whereby the circuit of the magnet K_1 in the box K is opened at the said switch *n*, and the feeding circuit of the sub-motor *m* and the electromagnet n_1 are cut off. Accordingly, the clutch 15 is released and the vertical shaft 12 receives only the torque due to the dead weight force caused by the weight W.

After said operations, the cone drum belt, long rack, anchor bar and knocking off bar are restored to their starting positions. In this condition, when the switch *g* is opened, the magnet *h* is demagnetized, and the clutches 6 and 7 are engaged again by the force of the spring 9, whereby the driving couplings of the top cone drum 2 and the bottom cone drum 4 with the shafts 1 and 2 are established, and the frame can be brought into its normal running state by pushing the starting push button ON in the push button box *f*.

In the above embodiment of this invention, if desired, the clutch 6 belonging to the top cone drum 2 may be substituted by such a coupling capable of being made to

idle in one direction as shown in Fig. 3. However, this mechanism must not be used in the case in which there is a possibility that a driving torque will be exerted by some accident from the bottom cone drum 4 to the top cone drum 2 during normal running.

Furthermore, driving of the vertical ratchet shaft 12 and driving of the bottom cone drum 4 may be carried out by different driving motors.

In the embodying of this invention, the following care should be taken;

(*a*) The re-engaging of the clutches 6 and 7 after their release must be done at the time when the coiling of the roving around the flyer top has just been completed.

(*b*) In the main lines, only the inching push button must be operated and the other push buttons must be maintained at their idle state as long as the sub-main switch *g* is in its closed state.

(*c*) Unless the cone drum belt 3 and the other elements are restored to their starting positions, the main motor must not be started even though the switch *g* is opened, and the push button ON of the push button box *f* is pushed.

The reason for this is that the various members are not yet restored to their starting positions as long as the knocking off bar 25 pushes the push button *a*, and said bar 25 detaches from the push button *a* upon the complete restoration of said members to their starting positions, whereby the main circuit is brought in the condition suitable for normal running. In this condition, the connection capable of obtaining the normal running of the motor is established.

In this invention, as described above, it has become possible to eliminate the handle wheel for adjusting the bottom cone drum and the handle wheel for the back movement of the vertical ratchet wheel which have been necessary in the conventional mechanism. This fact contributes to reduction of troublesome hand operation.

In this invention, a proper tension may be additionally exerted on the cone drum belt 3 by means of a spring. An illustrative mechanism for said object is shown in Fig. 4, in which the bottom cone drum 4 is supported by a lever 31 capable of rotating around the axis of a pivotal shaft 30, a spring case 32 is pivotally connected to said lever 31 by means of a pin 33, a screw pin 34 is provided with a nut 35, and a spring 37 is arranged between the case 32 and the nut 35, said screw pin 34 being constructed so as to be supported by a bracket 36. In the mechanism in Fig. 4, the upward force of the spring 37 acts to rotate the lever 31 counterclockwise around the pivotal shaft 30 through the case 32. That is to say, said force acts to lower the shaft of the bottom cone drum 4, and this lowering force generates a proper tension of the cone drum belt 3 which is placed around said drum 4.

While I have described particular embodiments of my invention, it will, of course, be understood that I do not wish my invention to be limited thereto, since many modifications may be made and I, therefore, contemplate by the appended claims to cover all such modifications as fall within the true spirit and scope of my invention.

I claim:

1. In a roving machine having a rotatably driven bobbin for winding roving thereon, a rotatably driven flyer for twisting the roving and delivering it to the bobbin, and means to deliver roving to the flyer, in combination, drive mechanism comprising a prime mover, first means cooperative with the prime mover for driving the delivery means, bobbin and flyer at varying, dissimilar, correlated speeds for winding twisted roving on said bobbin, other means cooperative with the prime mover for selectively driving the delivery means at a given speed and the bobbin and flyer at a same speed, said first means comprising a pair of spaced cones, a cone-belt operably connecting the cones and laterally movable from a start position to a stop position, a cone-

rack cooperative with said cone-belt and longitudinally movable from an initial start position to a second position for moving the cone-belt between said start and stop positions, means for automatically stopping the prime mover when said cone-belt reaches said stop position, said start position corresponding to a position when the bobbin is empty and the stop position corresponding to a position when the bobbin is filled, disconnecting means to operably disassociate the first means from the drive mechanism subsequent to the stopping of the prime mover to allow the prime mover to drive the bobbin and flyer at the same speed, semi-automatic means for imparting back motion to said cone-rack to return it to its start position thereby to automatically restore said cone-belt from said second position to its start position, and said means for automatically stopping the prime mover having means cooperative with said cone-rack for automatically restoring said disconnecting means to an operative position in which said first means including the cones are operably associated with prime mover when said cone-rack is restored to its initial position and for starting the prime mover automatically whereby the roving machine is restored to a condition of readiness for winding roving on a bobbin.

2. A roving machine according to claim 1, in which said disconnecting means comprises a clutch mechanism for disconnecting one of said cones from the drive mechanism.

3. A roving machine according to claim 1, in which said means to impart back motion to said cone-rack comprises an auxiliary prime mover and a gear train operably connected with said cone-rack.

4. A roving machine according to claim 1, in which

said disconnecting means comprises a clutch, means constantly biasing the clutch to a clutched position, electromagnetic means operably connected to said clutch and energizable for declutching said clutch.

5. A roving machine according to claim 4, in which said prime mover comprises a main motor and an auxiliary motor, an electrical circuit for energizing said motors and said electromagnetic means, a first switch in said circuit operable by said means to stop the prime mover when the cone-rack reaches said second position for deenergizing said main motor placing it in an inching condition and a second switch in said circuit operable by said last mentioned means to deenergize the electromagnetic means and the auxiliary motor when the cone-rack reaches its initial position.

6. A roving machine according to claim 1, including means to adjustably control the spacing between the cones thereby to control tension on said cone-belt.

7. A roving machine according to claim 1, including means operable to control the build-up of roving on said bobbin including an anchor bar operable from a start position, means operably connecting said anchor bar to said means to impart back motion to said cone-rack to restore said anchor bar to said start position when said cone-rack is returned to a start position.

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