Nov. 28, 1967 L. CIZEK ET AL 3,354,626

METHOD AND APPARATUS FOR STOPPING AND STARTING A SPINNING MACHINE

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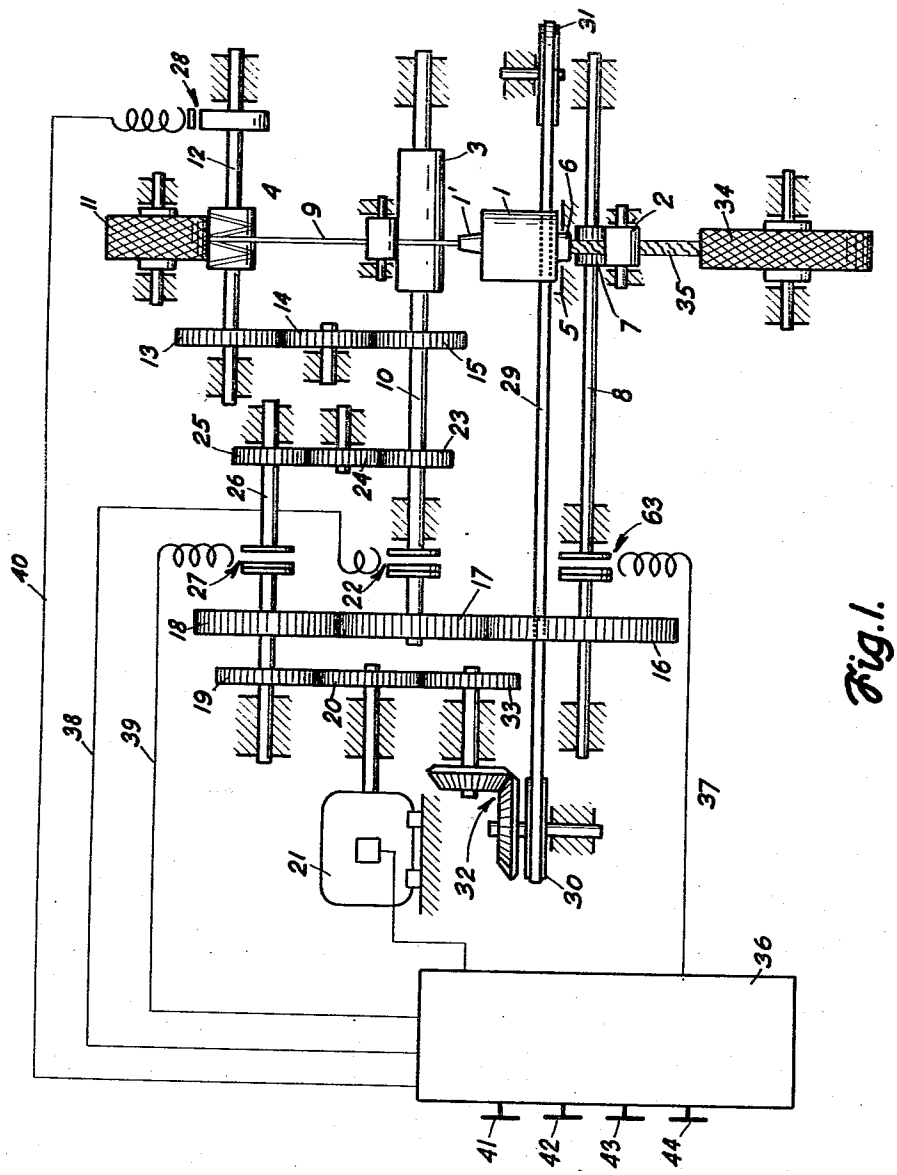


Fig. 1.

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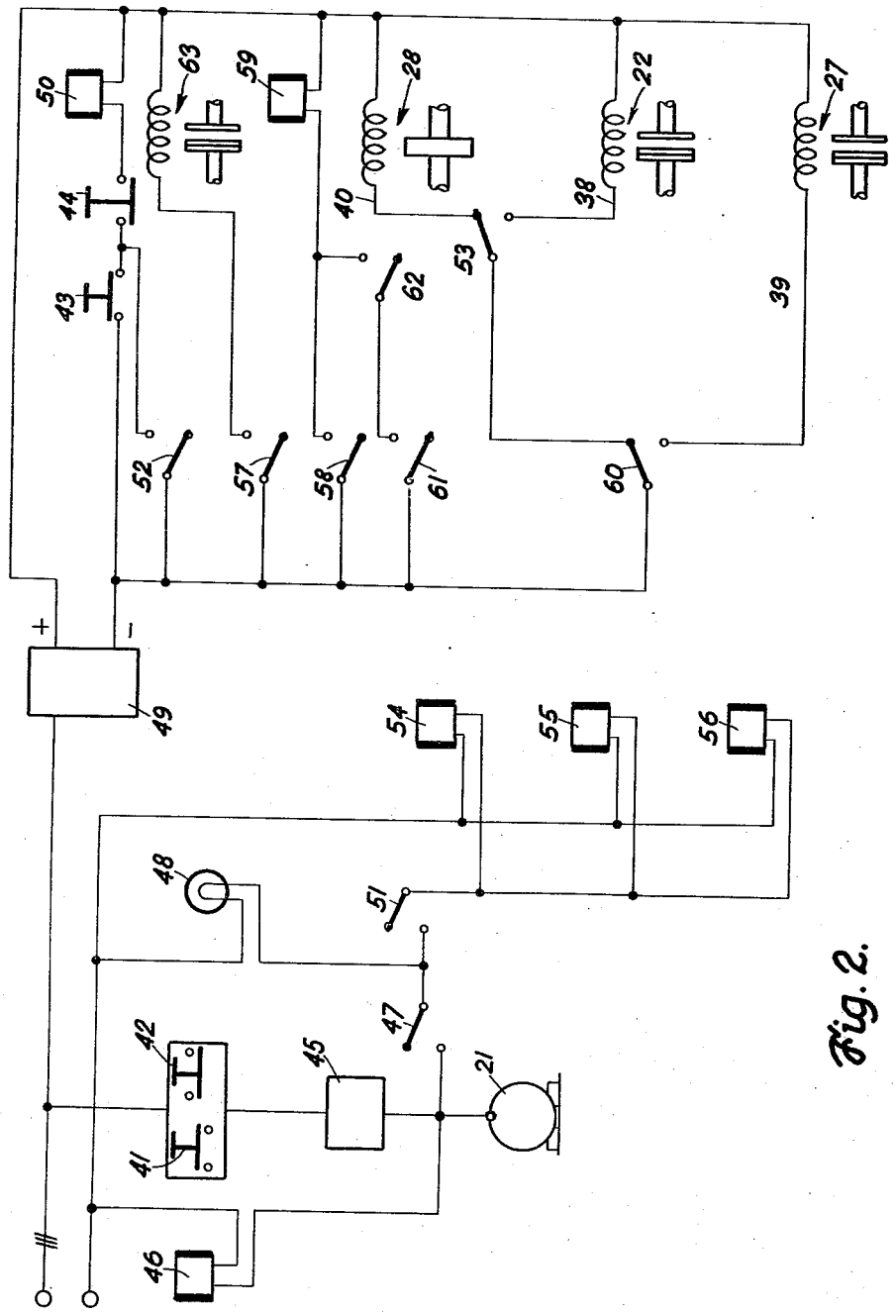


Fig. 2.

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METHOD AND APPARATUS FOR STOPPING AND STARTING A SPINNING MACHINE

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The present invention relates to a method and apparatus for stopping and starting a spinning machine, and more particularly to the automatic control of the starting and stopping of a spinning machine comprising several spinning units, each of which is provided with spinning means for spinning yarn of fibers, feeding means for fibers, and delivery means for transporting the spun yarn to take-up means.

In known spinning machines of the type with which the present invention is concerned, fibers or fibrous material are supplied into a rotary spinning chamber in which subatmospheric pressure is produced by rotation of the spinning chamber. The yarn produced in the rotary spinning chamber, is transported from the spinning chamber by take-up means preferably including delivery rollers and winding means for winding up the yarn on a tube to form a bobbin. The feeding means, the delivery rollers, and the wind up means are mounted on separate shafts which are driven from a common motor by means of transmission gears. The several spinning chambers of the spinning machine are driven by another motor, usually through a common drive belt.

When the spinning machine is stopped, the feeding means, spinning chambers, delivery rollers, and winding means are simultaneously stopped, which causes breaking of the yarn simultaneously in all spinning chambers.

When the spinning machine is to be started again, it is necessary to manually introduce the broken off yarn ends into the delivery tubes of the respective spinning chambers. The yarn end is drawn into the spinning chamber by the effect of the subatmospheric pressure in the same which draws the yarn end to the circular inner surface of the spinning chamber. Thereupon, the feeding means have to be started to feed fibers into the spinning chambers where the newly spun yarn is connected with the yarn end previously introduced into the spinning chamber by a manual operation. The manual operations required for starting a spinning operation again after stopping of the machine, are time-consuming and difficult, and reduce substantially the output of the machine.

It is one object of the invention to overcome this disadvantage of known spinning machines, and to provide a method and apparatus for controlling the stopping and starting of a spinning machine in such a manner that no manual operation is required for producing continuous spun yarns irrespective of stopping and starting of the spinning machine during the spinning of the yarn.

Another object of the invention is to stop spinning operations in such a position of the spun yarn end that a yarn newly spun after starting of the machine, is automatically connected to the yarn end spun during the stopping of the machine.

Another object of the invention is to substitute an automatic operation for the manual operation required for eliminating a yarn breakage occurring upon the stopping of the spinning machine.

The present invention relates to a spinning machine which includes rotary spinning means having an outlet portion, such as a delivery tube, feeding means for supplying fibers into the spinning chamber of the spinning means, and reversible delivery means for transporting a

yarn spun by the spinning means in forward and rearward directions.

A control apparatus according to one embodiment of the invention comprises manually operated first control means for stopping and starting the feeding means and spinning means; second control means automatically actuated by the first control means to stop the forwardly operating delivery means a predetermined time period after stopping of the feeding means, the time period being selected so that the fibers remaining in the spinning means are spun into a yarn end which is located in the outlet portion of the spinning means whereupon the spinning means is stopped; manually operated third control means for causing reversal of said delivery means after start of said spinning means so that said spun yarn end is transported from the outlet portion into the spinning means; fourth control means actuated by the third control means a predetermined time period after reversal of the delivery means to start the feeding means so that fibers are connected in said spinning means to said yarn end; and fifth control means for automatically again reversing the delivery means after a predetermined time period so that the spun yarn is again transported in forward direction.

A preferred method according to the invention comprises a series of steps for stopping the spinning operations, and another series of steps for starting the spinning operations.

A spinning operation is terminated by stopping the feeding of fibers into the spinning means so that only the fibers remaining in the spinning means are spun into a yarn end; stopping forward transport of the spun yarn; and stopping operation of the spinning means.

The spinning machine is again started by starting operation of the spinning means; transporting the spun yarn end back into the spinning means; feeding fibers into the spinning means so that the previously spun yarn end is connected with the yarn newly spun of fed fibers; and transporting the spun yarn forwardly to a take-up station.

More particularly, when a machine comprising several spinning units is controlled in accordance with the invention, the supply of fibers into the several spinning chambers of the spinning unit is simultaneously stopped, whereupon the spinning of the remaining fibers in all spinning chambers is completed, and then the delivery rollers and wind up rollers are stopped at a moment in which the yarn ends are still under the suction effect of the rotary spinning chambers. In this position, the rotation of the spinning chambers is stopped. The timing is such that the yarn ends remain in the delivery tubes or outlet portions of the several spinning chambers, in the region of the effect of the subatmospheric pressure prevailing in the rotating spinning chambers.

To start the spinning machine, rotation of all spinning chambers is simultaneously started, whereupon the delivery rollers are rotated in rearward direction to push the yarn ends from the delivery tubes into the spinning chambers, whereupon new fibers are supplied into the spinning chambers so that the newly spun yarn is directly spun together with the previously spun yarn end. When the yarn is no longer interrupted, the delivery rollers are again driven in forward direction so that the yarn is continuously spun and transported to the take-up or winding station.

The automatic operation of the several control means of the apparatus of the invention is effected by an electric circuit including time delay relays closing contacts after predetermined time periods required for the spinning of a yarn end of the remaining fibers, and for the spinning of the newly supplied fibers to the returned yarn end.

In the preferred embodiment of the invention, all spinning chambers of the machine are simultaneously driven

at the same speed by a pulley and belt drive operated by a motor. The feeding means include a feeding shaft and feeding rollers, and the delivery means include a delivery shaft and delivery rollers. Electromagnetic clutches are operated by relay contacts to drive the delivery rollers either in forward or in rearward direction, both shafts being driven by the same motor which rotates the spinning chambers.

Preferably a brake is provided which blocks rotation of the delivery rollers while spinning operations are interrupted, and yarn ends are located in the delivery tubes of the spinning chambers, ready to be returned into the spinning chambers by the reversed delivery rollers.

The control apparatus has four pushbuttons, two of which are used for starting and stopping the motor, while the other two pushbuttons control a main relay provided with three relay contacts. One of the three relay contacts controls three time delay relays, a second relay contact is a holding contact, and the third relay contact controls the electromagnetic brake and the electromagnetic clutch of the delivery shaft of the delivery rollers. One of the time delay relays controls by its contact, the clutch by which the shaft of the feeding means is connected with the motor. The second time delay relay determines the energization of an auxiliary relay which controls by its contact on one hand a clutch by which the shaft of the delivery rollers is connected with the motor, and on the other hand the brake by which the delivery rollers are blocked. A further relay determines the end of the function of the auxiliary relay.

The novel features which are considered as characteristic for the invention are set forth in particular in the appended claims. The invention itself, however, both as to its construction and its method of operation, together with additional objects and advantages thereof, will be best understood from the following description of specific embodiments when read in connection with the accompanying drawings, in which:

FIG. 1 is a fragmentary schematic view illustrating one unit of a spinning machine and a control apparatus according to the invention; and

FIG. 2 is an electric circuit diagram illustrating the electric circuit of a control apparatus according to the invention.

Referring now to the drawings, and more particularly to FIG. 1, an electric motor **21** drives through gears **20** and **33**, a pair of bevel gears **32**, one of which rotates a pulley **30** of a belt **29** which passes over other pulleys **31** of which only one is shown. The machine includes several spinning chambers **1**, only one of which is shown in FIG. 1, all of which are driven by belt **29**.

The spinning chamber is of the well known type in which fibers supplied through a stationary supply tube into the interior of the spinning chamber, are deposited on a surface of revolution due to the action of the centrifugal force, which also drives air from the interior of the spinning chamber through openings, not shown, so that a subatmospheric pressure prevails in the spinning chamber. The suction draws fibers from the supply tube **6** into the interior of the spinning chamber, which forms a yarn passing through the outlet portion **1'** in the form of a delivery tube.

Fibers are taken in the form of a sliver or roving from a package **34**, and the strand **35** is transported into supply tube **6** by feeding means including a shaft **8**, and feed rollers **7**, **2**. The feed roller on shaft **8** is fluted, while the other feed roller is resiliently pressed into engagement with the strand, sliver, or roving which is transported by feed rollers **7**. Shaft **8** transports the feed rollers of all spinning units, and is mounted in bearings, not shown, on the frame of the machine. One end of shaft **8** is connected by an electromagnetic coupling **63** to a gear **16** of a gear train **16**, **17**, **18** which is connected by an auxiliary shaft **26** to a gear **19** meshing with gear **20** which is driven by motor **21** so that the same drives the feeding means when the electromagnetic coupling **63** is engaged.

The yarn **9** spun by each spinning chamber **1**, is transported in a forward direction by delivery rollers **3** toward a winding roller **4** provided with crossing grooves for winding a package **11** on a rotating take-up roller.

One of the delivery rollers **3** is mounted on a shaft **10**, while the other delivery roller is resiliently pressed against the yarn **9** and roller **3** to transport the same.

Shaft **10** carries a gear **15** which is connected by gears **14** and **13** with the shaft **12** of the winding roller **4** so that delivery rollers **9** and winding roller **4** are simultaneously operated. The end of shaft **12** is connected with an electromagnetic brake **28** which, when energized by a line **40**, stops rotation of winding roller **4**, and thereby rotation of delivery roller **3** with shaft **10**.

Shaft **10** is connected by gears **23**, **24**, **25** with shaft **26**. An electromagnetic clutch **22** connects shaft **10** with gear **17**, and another electromagnetic clutch **27** connects shaft **26** with gear **18**. Gear **18** is driven from motor **21**, and when the electromagnetic clutch **27** is energized by line **39**, shaft **10** is rotated by the gear train **23**, **24**, **25** in forward direction so that delivery rollers **3** transport the yarn **9** toward the winding roller **4**, provided that electromagnetic coupling **22** is disengaged.

When electromagnetic coupling means **22** is energized by line **38**, and electromagnetic coupling means **27** is deenergized, shaft **10** is driven by gears **18** and **17** so that its direction of rotation is reversed, and the feeding roller **3** is driven in the reverse direction for transporting the yarn back in the delivery tube or outlet portion **1'** of the spinning means **1**.

It will be understood that all feeding rollers **7** of the several spinning units are driven by shaft **8**, that all delivery rollers **3** of the several spinning units are driven by shaft **10**, and that all winding rollers **4** of the several units are driven by shaft **12** so that brake means **28** must be arranged at the remote end of shaft **12**.

During normal spinning operations, all spinning chambers **1** are simultaneously rotated at the same speed by belt **29**, and spin a yarn **9** of the strand, roving or sliver **35** which is supplied by the feeding rollers **7** of the respective spinning units into the spinning chambers, respectively. Electromagnetic coupling means **22** is deenergized, and electromagnetic coupling means **27** is energized so that shaft **10** drives all delivery rollers **3** of the several units in forward direction for supplying the yarns **9** to their respective winding rollers **4**.

A control apparatus **36** is operated by four pushbuttons **41**, **42**, **43**, and **44** and is connected by line **37** to electromagnetic coupling means **36**, by line **38** to electromagnetic coupling means **22**, by line **39** to electromagnetic coupling means **27**, and by line **40** to the electromagnetic brake **28**.

The electric circuit of control apparatus **36**, and the circuit element including relays and switches will now be described with reference to FIG. 2.

A power source is connected to a transformer and rectifier unit **49** by which the voltage of the power source is reduced and rectified for providing a low voltage for operating relays.

The power source is connected to motor **21** by contactor **45** operated by start button **41** and stop button **42**. Consequently operation of stop button **42** causes stopping of motor **21**. An auxiliary time delay relay **46** is energized together with motor **21** and operates at a delay, a relay switch **47** closing the circuit of a signal lamp **48** which indicates that the motor rotates at full speed.

Pushbutton **43** starts spinning operations, and pushbutton **44** stops spinning operations. The switches of pushbuttons **43** and **44** are in the line connecting transformer and rectifier **49** with the main relay **50**. Main relay **50** controls three relay contacts **51**, **52**, and **53**. Relay contact **52** is a holding contact which bridges the switch of pushbutton **43** so that the same can be immediately released when relay **50** is energized.

The second relay contact **51** of main relay **50** connects three time delay relays **54**, **55** and **56** to the power source. The third relay contact **53** of main relay **50** is moved from

its normal position connecting a contact 60 of an auxiliary relay 59 with the electromagnetic brake 28, to a shifted position connecting contact 60 to the electromagnetic reversing coupling 22.

When auxiliary relay 59 is energized, switch 60 is shifted, and connects the electromagnetic coupling means 27, instead of brake 28 and coupling means 22, to the negative terminal of the transformer and rectifier 49. The free terminals of the brake 28 and of the electromagnetic couplings 22 and 27 are connected with the positive terminal of the transformer and rectifier 49.

When time delay relay 54 is energized by contact 51 of main relay 50, it operates its contact 57 which is connected in series with the electromagnetic coupling means 63 by which the feeding means 2, 7 are controlled.

The second time delay relay 55 operates a contact 58 connected in series with the auxiliary relay 59 by which a contact 62 is controlled in addition to contact 60, as explained above.

The third time delay relay 56 controls a contact 61 connected in series with contact 62 and auxiliary relay 59.

Relay 55 causes energization, and relay 56 causes deenergization of auxiliary relay 59 which controls the forward delivery of yarn 9 by electromagnetic coupling 27, or the reversal of the direction of movement of yarn 9 by energization of electromagnetic coupling 22.

In order to start the spinning machine by the control apparatus in accordance with the invention, it is necessary that the spinning machine was stopped by the control apparatus in a manner which will be described hereinafter so that all elements of the machine are stopped in a predetermined sequence and at predetermined time intervals.

Assuming that the machine was stopped in accordance with the invention, a yarn end of yarn 9 is located in the delivery tube 1' of each spinning means 1, the end of the sliver or roving 35 is located between the feeding rollers 2, 7 and in the inlet portion 6, and the yarn is engaged by the winding roller 4 and by delivery rollers 3.

Starting operation

The operator depresses pushbutton 41 so that contactor 45 connects motor 21 to the power source. When the motor has reached its full rotary speed, time relay 46 closes its contact 47 so that signal lamp 48 lights up, indicating that the spinning chambers 1 are rotated by belt 29 which is driven from motor 21 through gears 20, 33, 32 and pulley 30.

Drive motor 21 also drives gears 16, 17 and 18 and the coupling parts of electromagnetic couplings 63, 22, 27 connected thereto. Electromagnetic brake 28 is engaged since contacts 53 and 60 connect the same to the transformer and rectifier 49. Winding roller 4 and delivery rollers 3 are blocked, and the yarn 9 is held in the previously assumed position in which its end is located in the delivery tube 1'.

In order to start the spinning operation, the operator depresses pushbutton 43. Main relay 50 is connected into the low voltage circuit since the switch of pushbutton 44 is normally closed.

Main relay 50 operates relay contact 51 to energize the three time delay relays 54, 55 and 56, contact 53 to deenergize brake 28 and to energize electromagnetic coupling 22 so that shaft 10 is driven from motor 21 in rearward direction to push the end of yarn 9 from outlet tube 1' into the rotating spinning chamber 1. Holding contact 52 is also operated by main relay 50 to bridge switch 43 so that the respective pushbutton can be released by the operator.

The rearward movement of yarn 9 by the reversed delivery rollers 3 is aided by the suction produced in the rotating spinning chamber 1, and the yarn end in the spinning chamber is pressed by the centrifugal force against the rotating inner surface of the spinning chamber.

After a predetermined time period, time delay relay 54 operates its contact 57 to connect electromagnetic coupling 63 into the circuit so that the energized electromagnetic coupling 63 couples gear 16 and motor 21 to shaft 8 of the feeding means 2, 7 so that the fibers of the roving or sliver are driven forwardly into the spinning chamber and deposited on the inner rotating surface of the same to form a connection with the yarn end. After a predetermined time period, required for establishing the connection between the newly fed fibrous material and the previously spun yarn end, contact 58 of time delay relay 55 is closed and connects the auxiliary relay 59 into the circuit so that the same is energized and operates switch 60 which disconnects the electromagnetic coupling 22 so that yarn 9 is no longer driven in rearward direction, and connects electromagnetic coupling 27 into the circuit so that shaft 10 is driven over gears 25, 24, 23 in forward direction for rotating the delivery rollers in such a direction of rotation as to transport the yarn 9 toward winding roller 4 which winds the package 11.

Since the feeding means, delivery means, winding means, and spinning means of all units are connected, the "spinning-in," that is the connection of the end of the previously spun yarn with the newly formed yarn, is simultaneously carried out in all spinning units.

Stopping operation

In order to stop the spinning machine in accordance with the invention, pushbutton 44 is depressed, and the respective switch interrupts the circuit of main relay 50 so that contact 51 opens, and the time delay relays 54, 55 and 56 are deenergized. Contact 57 of time delay relay 54 opens and deenergizes electromagnetic coupling 63 so that the feeding means 8, 2, 7 are no longer driven, and the delivery of fibers into the spinning chambers 1 stops. Relay 55 opens contact 58 in the circuit of the auxiliary relay 59, and time delay relay 56 begins to measure a predetermined period of time. After the feeding of fibers into the spinning chambers 1 has been stopped, the fibrous material remaining in the spinning chambers is completely spun and the thus produced yarn 9 is transported by the delivery rollers 3 and wound up by winding roller 4.

After a predetermined time, time relay 56 opens its switch 61 so that relay 59 is deenergized, and its contact 60 deenergizes the electromagnetic coupling 27 associated with forward movement of the yarn, and energizes the electromagnetic brake 28 since the deenergization of main relay 50 has caused return of relay contact 53 to the position connecting brake 28 with contact 60, and disconnecting electromagnetic coupling 22 from contact 60.

Brake 28 stops the rotation of winding rollers 4 and delivery rollers 3.

During the time determined by the time delay relay 56, yarn 9 is transported by delivery rollers 3 such a distance that the yarn end does not leave the delivery tube 1' of the spinning means 1. The movement of the delivery rollers 3 is stopped before the end of yarn 9 is pulled out of the delivery tube 1'.

When the delivery rollers and winding rollers are stopped in their required position in which the yarn end is still located in the delivery tube 1', the operator depresses pushbutton 42 which controls the contactor 45 to stop motor 21 and thereby the rotation of all spinning chambers 1. The machine is ready for the next start in which the end of yarn 9 in delivery tube 1' is automatically connected with the newly spun yarn.

It will be understood that each of the elements described above, or two or more together, may also find a useful application in other types of spinning machines differing from the types described above.

While the invention has been illustrated and described as embodied in a method and apparatus for automatically connecting a yarn end spun in a spinning device with a

newly spun yarn in the spinning device, it is not intended to be limited to the details show, since various modifications and structural changes may be made without departing in any way from the spirit of the present invention.

Without further analysis, the foregoing will so fully reveal the gist of the present invention that others can by applying current knowledge readily adapt it for various applications without omitting features that, from the standpoint of prior art, fairly constitute essential characteristics of the generic or specific aspects of this invention and, therefore, such adaptations should and are intended to be comprehended within the meaning and range of equivalence of the following claims.

What is claimed as new and desired to be secured by Letters Patent is:

1. A method of terminating spinning operations of a spinning means by the steps of: stopping the feeding of fibers into said spinning means so that only the fibers remaining in said spinning means are spun into a yarn end; stopping forward transport of the spun yarn; and stopping operation of said spinning means; and of starting a spinning operation by the steps of: starting operation of said spinning means; transporting the spun yarn end back into said spinning means; feeding fibers into said spinning means so that the previously spun yarn end is connected with the yarn newly spun of fed fibers; and transporting the spun yarn forwardly to a take-up station.

2. A method according to claim 1 wherein the forward transport of the spun yarn is stopped a predetermined time period after the stopping of the feeding of fibers into the spinning means so that the yarn end is still connected with the spinning means when forward transport of the spun yarn is stopped.

3. A method according to claim 1 wherein the spun yarn is transported forwardly to a take-up station a predetermined time period after the start of feeding of fibers into the spinning means so that sufficient time is available for connecting the previously spun yarn with the newly spun yarn.

4. A method according to claim 1 wherein the forward transport of the spun yarn is stopped a predetermined time period after the stopping of the feeding of fibers into the spinning means so that the yarn end is still connected with the spinning means when forward transport of the spun yarn is stopped; and wherein the spun yarn is transported forwardly to a take-up station a predetermined time period after the start of feeding of fibers into the spinning means so that sufficient time is available for connecting the previously spun yarn with the newly spun yarn.

5. A method according to claim 1 wherein said spinning means produces subatmospheric pressure for sucking said spun yarn into said spinning means when the spun yarn end is transported back into the spinning means.

6. In combination with a spinning machine including drive means; rotary spinning means having at least one outlet portion, feeding means for supplying fibers to said spinning means, and reversible delivery means for transporting a yarn spun by said spinning means in forward and rearward directions; a control apparatus for starting and stopping the spinning machine, comprising manually operated first control means for stopping and starting said feeding means, and said spinning means; second control means automatically actuated by said first control means when stopping said feeding means to stop said delivery means operating in forward direction, a predetermined time period after stopping of said feeding means selected so that the fibers remaining in said spinning means are spun into a yarn end which is located in said outlet portion of said spinning means whereupon said spinning means is stopped; manually operated third control means for causing reversal of said delivery means after start of said spinning means so that said spun yarn end is transported from said outlet portion into said spinning means; fourth control means actuated by said third control means a predetermined time period after reversal of said delivery means to start said feeding means so that fibers are connected in said spinning means to said yarn end; and fifth control means for automatically again reversing said delivery means after a predetermined time period so that the spun yarn is again transported in forward direction.

7. A control apparatus according to claim 6 wherein said first control means include a main relay, and a time delay relay energized by said main relay to disconnect and connect said feeding means with said drive means.

8. A control apparatus according to claim 7 wherein said feeding means include rotary feed rollers, and a shaft for driving said feed rollers; and wherein said first control means include an electromagnetic coupling energized by a contact of said time delay relay to connect said shaft with said drive means.

9. A control apparatus according to claim 6 wherein said second control means include a time delay relay.

10. A control apparatus according to claim 9 wherein said delivery means include delivery rollers, and a shaft for rotating the same; and wherein said third control means include reversible coupling means for connecting said shaft with said drive means.

11. A control apparatus according to claim 10 wherein said third control means include a time delay relay for actuating said fourth control means a predetermined time period after reversal of said delivery means.

12. A control apparatus according to claim 11 wherein said fifth control means include a time delay relay.

13. A control apparatus according to claim 6 including a power source, and an electric circuit connecting said control means and including time delay relays for determining said time periods.

14. An apparatus according to claim 6 wherein said feeding means include feeding rollers and a first shaft for driving said feeding rollers; wherein said delivery means include delivery rollers and a second shaft for driving said delivery rollers; wherein said rotary spinning means includes a plurality of rotary spinning chambers having outlet portions, and a belt for driving said spinning chambers and driven from said drive means; and including a first electromagnetic coupling for connecting said first shaft with said drive means; and reversible electromagnetic coupling means for connecting said drive means with said second shaft for driving said feeding rollers in forward or rearward directions.

15. An apparatus according to claim 14 wherein said reversible electromagnetic coupling means include two electromagnetic couplings, an auxiliary shaft supporting one of said couplings, the other coupling being connected with said second shaft, two gear means connecting said auxiliary shaft with said second shaft for rotating the latter in opposite directions depending on the engagement or disengagement of said couplings.

16. An apparatus according to claim 15 and including brake means for braking said second shaft for holding said delivery rollers in a position in which the yarn end is located in said outlet portion.

17. An apparatus according to claim 6 wherein said manually operated first control means include manually operated switch means, a main relay connected in series with said switch means and having a plurality of relay contacts, a time delay relay operated by one of said relay contacts and having a contact; wherein said feeding means include an electromagnetic coupling, and feeding rollers connected by said electromagnetic coupling with said drive means when said contact of said time delay relay is operated; wherein said second control means include another time relay controlled by said contact of said main relay and having another contact, an auxiliary relay connected in series with said other contact and controlling a third contact; including reversible electromagnetic coupling means for connecting said delivery means with

said drive means and controlled by said third relay contact; wherein said feeding means include an electromagnetic coupling connecting the same with said drive means; wherein said fourth control means include a time delay relay for engaging said electromagnetic coupling of said feeding means after a predetermined time period; and wherein said fifth control means include a time delay relay.

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