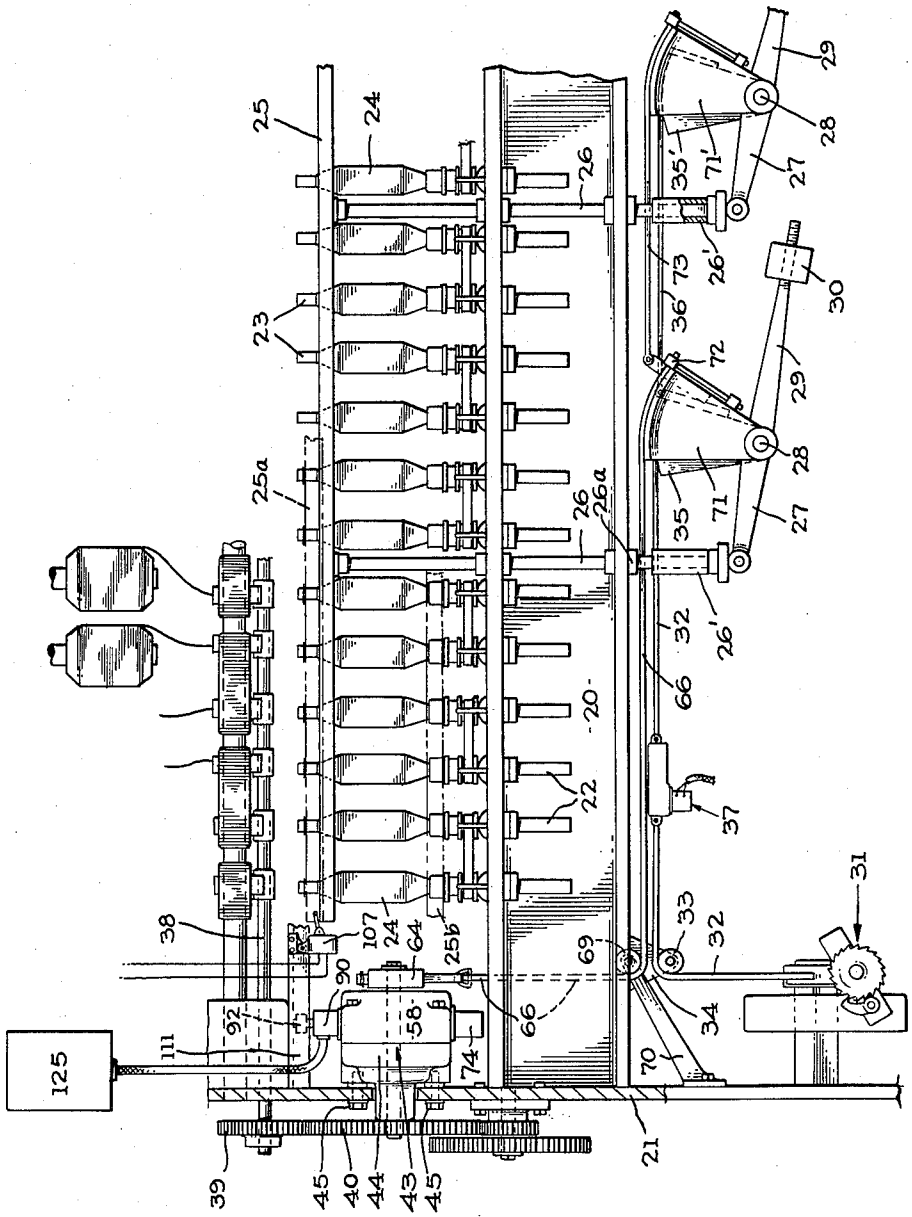
March 17, 1964 H. R. KENNEDY ETAL 3,124,925

AUTOMATIC CONTROL SYSTEM FOR SPINNING FRAMES

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FIG. 1.



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AUTOMATIC CONTROL SYSTEM FOR SPINNING FRAMES

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FIG. 3.

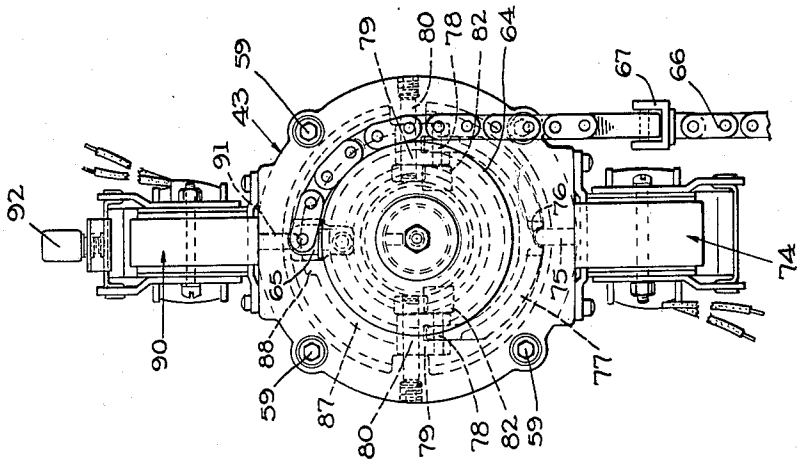
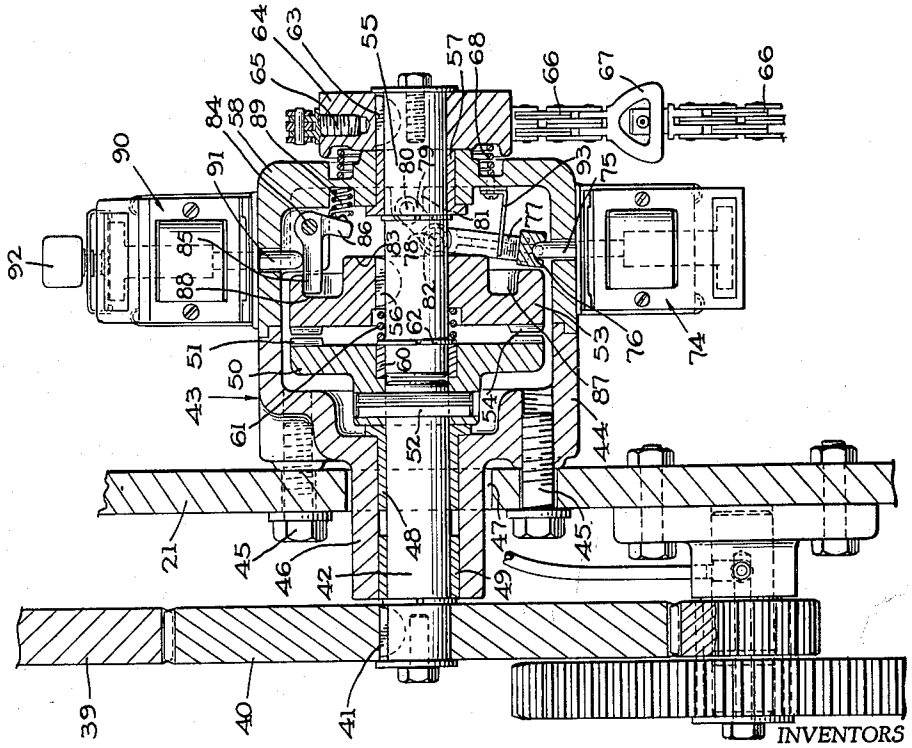


FIG. 2.



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AUTOMATIC CONTROL SYSTEM FOR SPINNING FRAMES

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FIG. 5.

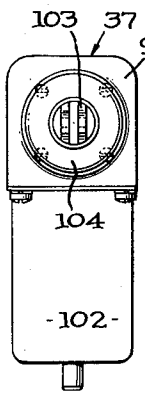


FIG. 4.

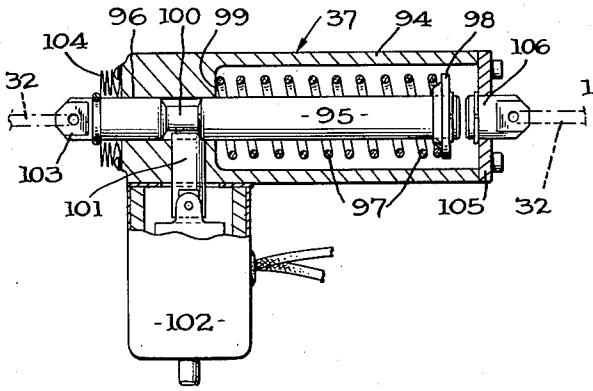


FIG. 6.

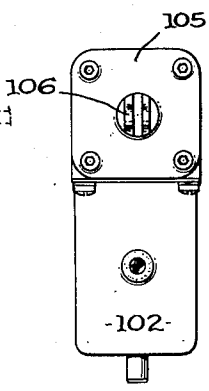


FIG. 8.

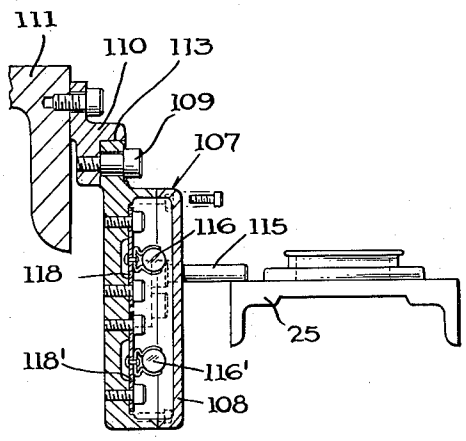
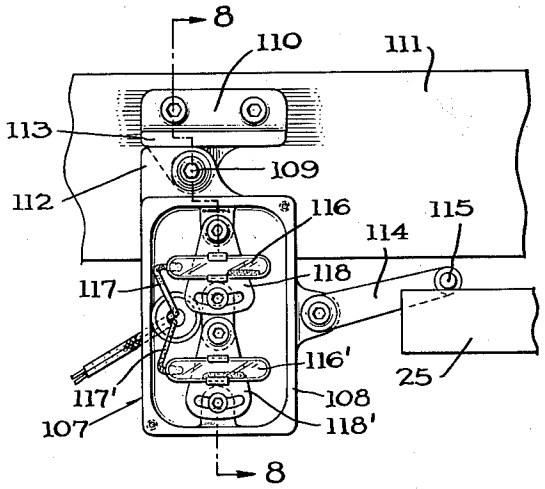


FIG. 7.



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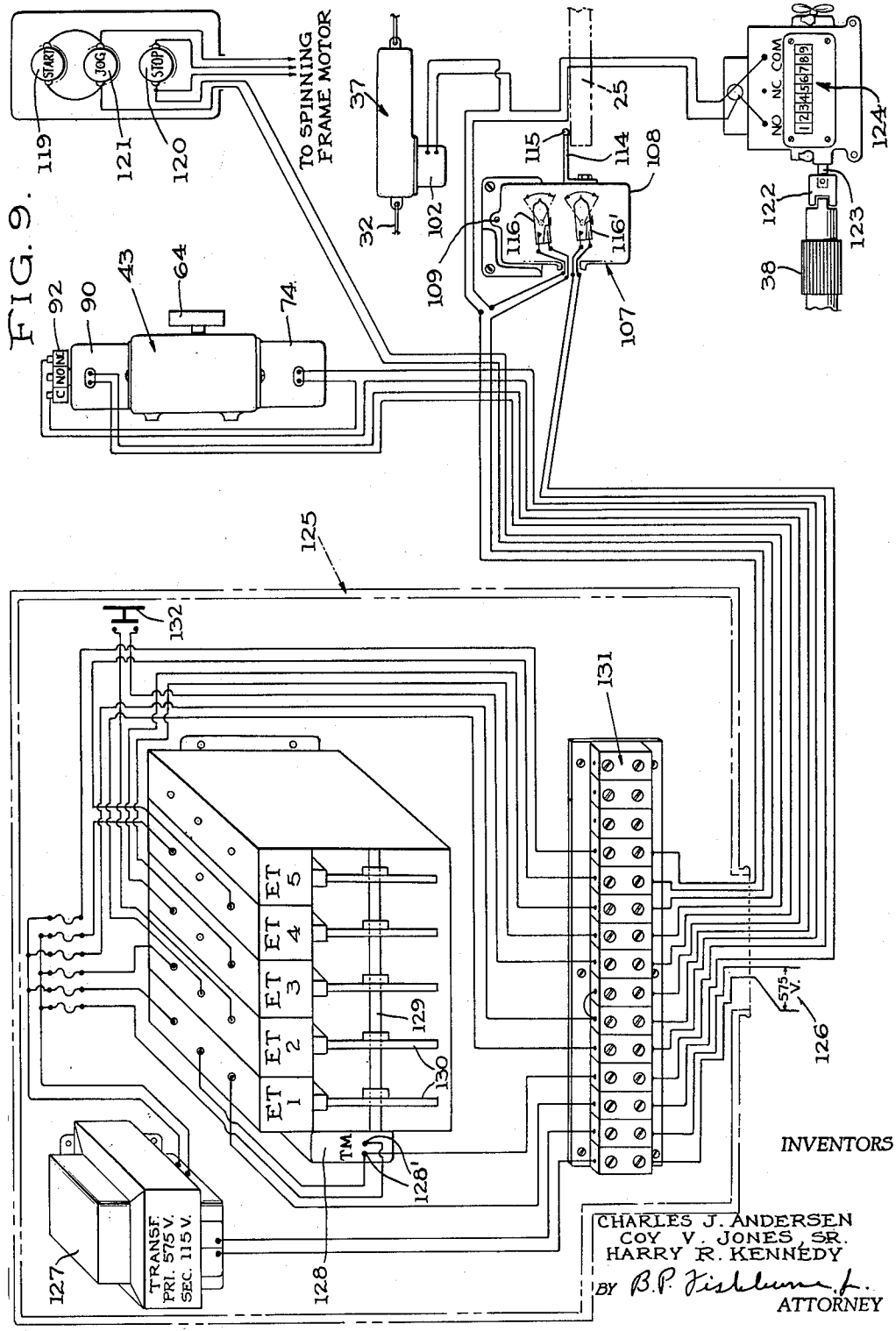
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AUTOMATIC CONTROL SYSTEM FOR SPINNING FRAMES

Filed Aug. 6, 1962 4 Sheets-Sheet 4

FIG. 9.



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3,124,925

AUTOMATIC CONTROL SYSTEM FOR SPINNING FRAMES

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Filed Aug. 6, 1962, Ser. No. 214,992
13 Claims. (Cl. 57—54)

This invention relates to textile spinning frames, and more particularly to automatic control and operating means for spinning frames.

This application contains subject matter common to application Serial Number 110,130, filed May 15, 1961, Ring Rail Lowering Mechanism for Textile Spinning Frames, Harry R. Kennedy et al., now Patent 3,080,701; application Serial Number 137,102, filed Sept. 11, 1961, Automatic Tip Bunch Building Mechanism for Spinning Frames, Harry R. Kennedy et al., now Patent 3,059,407; and application Serial Number 144,947, filed Oct. 13, 1961, Automatic Tip Bunch Building Mechanism for Spinning Frames, Harry R. Kennedy et al., now Patent 3,074,224.

With the automation of looms and other textile machinery, it has become increasingly important to wrap exactly the same yardage of yarn on each bobbin produced in a spinning frame, in order that the automatic features of the machines subsequently employing the bobbins may be operated most efficiently. It is also important in connection with automatic looms and the like that the tip bunch be applied uniformly and accurately to the bobbins, and it is important during lowering of the ring rail to the bobbin doffing position not to wrap excessive amounts of yarn around the bobbins or to break the yarn during lowering of the ring rail. The above and other requirements of modern-day textile manufacturing are difficult, if not impossible, to satisfy by the use of conventional prior art spinning frames which employ manually controlled and largely uncoordinated systems for building the bobbins, applying the tip bunches thereto, lowering the ring rail prior to doffing, and shutting off the power to the spinning frame upon lowering of the ring rail. These factors are accomplished in the conventional prior art in a rather haphazard or "hit-and-miss" manner by the manual operation of push button switches and the like, requiring a skillful operator to coordinate the overall operation of the spinning frame. According to such prior art practice, it is difficult, if not impossible, to produce bobbins which are exactly uniform in the above-mentioned respects, and no means is commonly employed to accurately control the yardage wound upon each bobbin.

Accordingly, the object of this invention is to provide substantially automatic means for shutting off the power to the spinning frame when an exactly specified yardage has been wrapped on each bobbin and after the lowering of the ring rail in a controlled manner and at a predetermined rate to the doffing position and after automatically locking the ring rail in such lowered position.

Briefly, according to the invention, a yardage predetermining counter driven directly from the front draft roll of the spinning frame is connected in the master control circuit of the spinning frame and completes or closes a circuit when the prescribed yardage is wrapped upon the bobbins. With this circuit closed, the ring rail upon reaching the top of its next upstroke engages and closes a switch instrumentality to activate another circuit thereby energizing a cycling control timer unit of the spinning frame and also activating an electro-mechanical means to effect the application of the tip bunch automatically to each bobbin.

After application of the tip bunches to the bobbins, the cycling control timer unit operates further electro-mechanical means to energize a ring rail lowering mechanism to bring the ring rail down to the bobbin doffing position and lock it in such position. The timer unit then substantially simultaneously opens a further switch, breaking a holding circuit to the spinning frame motor, thereby shutting off the power when the ring rail is locked in the lowered or doffing position. The master control circuit contains a manual switch which may be closed to operate electro-mechanical means to release the ring rail from its lowered locked position preparatory to starting a new automatic cycle of operation for building a new set of bobbins with exactly predetermined yarn yardage thereon.

A further object of the invention is to provide a spinning frame and spinning frame cycling means which is reliable and efficient in operation, relatively inexpensive to manufacture and maintain, and substantially fully automatic.

Other objects and advantages of the invention will be apparent during the course of the following detailed description.

In the accompanying drawings, forming a part of this application and in which like numerals are employed to designate like parts throughout the same,

FIGURE 1 is a fragmentary partly diagrammatic front elevation of a spinning frame equipped with the automatic control and operating means according to the invention, parts omitted for simplicity,

FIGURE 2 is an enlarged fragmentary central vertical section through a ring rail lowering mechanism and associated elements according to the invention,

FIGURE 3 is an end elevation of the mechanism shown in FIGURE 2, with parts omitted for simplicity,

FIGURE 4 is an enlarged fragmentary vertical section, partly in elevation, through an escapement device utilized in the invention to apply the tip bunch to each bobbin after the normal building of bobbins in the spinning frame,

FIGURES 5 and 6 are end elevational views of the device shown in FIGURE 4,

FIGURE 7 is a fragmentary side elevation of a limit switch and associated elements operated directly by the ring rail after the required yardage is wrapped on the bobbins,

FIGURE 8 is a fragmentary vertical section taken on line 8—8 of FIGURE 7, and

FIGURE 9 is a diagrammatic view showing the master control circuit and all of the major control instrumentalities for the spinning frame according to the invention.

In the drawings, wherein for the purpose of illustration is shown a preferred embodiment of the invention, FIGURES 1 and 9 show the invention system substantially in its entirety. With particular reference to FIGURE 1, the spinning frame proper which is conventional includes the usual horizontal spindle rail **20**, supported at its opposite ends by vertical frame ends, the head end **21** only being shown in the drawings. The usual multiplicity of spindles **22** are mounted upon the spindle rail **20** for the support of a corresponding number of bobbins **23** adapted to have yarn **24** wrapped thereon during the formation of filling bobbins with a filling wind or warp bobbins with a filling wind. The usual vertically oscillating ring rail **25** which guides the yarn onto the bobbins during the gradual building thereof is provided, and this ring rail is bodily supported at plural points therealong by vertically shiftable lifter rods **26** having suitable guided engagement with the fixed spindle rail **20**. The ring rail and lifter rods **26** are biased upwardly by lifter arms **27**, secured to rock shafts **28** and including arm extensions **29** carrying adjustable counterweights **30**, as is conventional.

The ring rail 25 is continually oscillated during the building of the bobbins by a conventional builder motion 31, suitably mounted upon the spinning frame. This builder motion includes the usual escapement pawl mechanism and cams, not shown, to impart to the ring rail in conjunction with the action of the counterweights 30 the proper oscillatory movement to build the filling or warp bobbins with a filling wind. The builder motion 31 is connected with an alternately draws in and pays out a flexible chain or cable 32 engaging about a pulley 33, journaled upon a bracket 34, rigidly secured to the spinning frame structure. The flexible chain 32 is attached at its remote end to an arcuate sector 35 rigid with the rock shaft 28, and an extension link 36 connects the sector 35 with a like sector 35' on the next succeeding rock shaft 28, etc., so that all such sectors will be moved in unison about the axes of the rock shafts 28 under the combined influence of counterweights 30 and the builder motion 31. This construction and mode of operation is conventional.

Connected preferably in the chain or cable 32 between the pulley 33 and sector 35 is the escapement unit 37 to be described in detail hereinafter. The unit 37 is an electromechanical device operable to effect a sudden lengthening of the cable 32 at the proper time after the building of the bobbins is completed and the ring rail 25 is at the normal top of its travel as shown in full lines in FIGURE 1. At such time, the escapement unit 37 is actuated to lengthen the cable 32 slightly and allow the ring rail to shift up quickly under influence of the counterweights 30 to the tip bunch applying position shown in broken lines at 25*a* in FIGURE 1.

The spinning frame further includes the usual front draft roll 38 which revolves continuously during the operation of the spinning frame and has a gear 39 secured thereto, meshing with and driving the gear 40, FIGURES 1 and 2, keyed at 41 to the input or drive shaft 42 of an electro-mechanical ring rail lowering unit 43, which unit constitutes an important part of the invention.

With particular reference to FIGURES 2 and 3, the ring rail lowering unit 43 comprises a first casing section 44 rigidly secured to the inner face of the frame head end 21 by screws 45. The casing section 44 includes an integral hub extension 46 projecting through a clearance opening 47 in the head end 21 and containing therein spaced sintered metal bearings 48 and 49, within which the drive shaft 42 is journaled for free rotation under influence of the gear 40. The drive shaft 42 rotates continuously during operation of the spinning frame through the gearing 39—40 connected with the front draft roll, thereby assuring when the unit 43 is activated in a manner to be described that the ring rail 25 will be lowered at a constant ratio to the delivery of the yarn by the front draft roll.

Within the casing section 44 of unit 43, a first clutch head 50 having clutch teeth 51 is secured by a roll pin 52 to drive shaft 42 to turn therewith continuously. A second or mating clutch head 53 having clutch teeth 54 is mounted upon a driven shaft 55 of the unit 43 and keyed thereto at 56 for rotation therewith and axially shiftable thereon toward and from coupling engagement with the clutch head 50. The driven shaft 55 is journaled for rotation in a sintered metal bearing 57, secured within a bore of a second casing section 58, bolted to the first casing section 44 as at 59, FIGURE 3. The inner end of driven shaft 55 may be further journaled within a bushing 60, contained within a recess of the clutch head 50, as shown. An expansible coil spring 61 surrounding the shaft 55 bears against the shiftable clutch head 53 and against a snap ring 62 on the shaft 55 to maintain the two clutch heads normally separated or out of coupling engagement. While so separated, the constantly rotating drive shaft 42 imparts no rotation to the driven shaft 55, and this condition prevails during the normal building

of the bobbins under influence of the builder motion 31, ring rail 25 and associated elements.

Keyed at 63 to the driven shaft 55 exteriorly of casing section 58 is a ring rail lowering drive pulley 64, carrying a chain anchoring screw 65 having attached thereto a flexible chain 66, including a swivel link 67. A torsional coil spring 68 has one end connected with the pulley 64 and its other end connected with casing section 58, and this spring serves to bias the pulley 64 and driven shaft 55 in a direction for maintaining the chain 66 taut during the oscillation of the ring rail 25 for building the bobbins. The chain 66, FIGURE 1, extends downwardly from the unit 43 and passes about a directional pulley 69, journaled upon a bracket arm 70, rigidly secured to the head end 21. The chain 66 then extends horizontally and substantially parallel to the builder motion chain 32. Rigidly mounted upon the rock shafts 28 of the spinning frame in spaced relation to the sectors 35 and 35' are additional and like sectors 71, 71', etc. The chain 66 has its leading end engaging the sector 71 and secured thereto adjustably at 72. An extension element or chain 73 links the sector 71 with the sector 71', as shown, and a like connection is provided between all of the sectors and rock shafts of the spinning frame, whereby upon actuation of the chain 66 by the pulley 64, all of the sectors 71, 71', etc. will be turned in unison on the axes of the rock shafts 28. It may now be seen that the rock shafts 28 carrying lifter arms 27 may be caused to oscillate by the builder motion chain 32 during the normal building of the bobbins, and the rock shafts and associated elements may also be caused to turn by the winding up of the chain 66 on the pulley 64 when the ring rail lowering unit 43 is activated as will be described. The chain 66 simply overrides the builder motion chain 32 and takes over control of the lifter arms 27 to lower the ring rail 25 at the proper time as will be further described.

With reference ot FIGURES 2 and 3, means are provided to automatically shift the clutch head 53 into coupling engagement with the clutch head 50 so that rotation will be imparted to the shaft 55 and pulley 64 for winding up the chain 66 on this pulley and thereby effecting the lowering of the ring rail 25 to the bobbin doffing position shown in broken lines at 25*b* in FIGURE 1. Such means comprises a push type solenoid 74, suitably rigidly secured to the bottom of casing section 58 and having a plunger 75 engaging within a rounded socket 76 of a generally U-shaped yoke 77 contained floatingly within the casing section 58 between the clutch head 53 and bearing 57. The tops of the yoke arms or sides are pivoted at 78 to short links 79, which in turn have corresponding ends pivoted at 80 to spaced bosses 81, integral with the end wall of casing section 58. The tops of the yoke arms have rollers 82 freely journaled thereon and having rolling engagement with a smooth flat end face 83 on the hub portion of shiftable clutch head 53. The pressure links 79 are set at an angle to the yoke 77 so as to form a toggle linkage therewith. When the solenoid 74 is energized to thrust the plunger 75 toward the yoke 77, the latter is shifted inwardly toward shaft 55 which it surrounds and the pressure links 79 pivot in a manner to force the rollers 82 against the face 83 and thereby shift the clutch head 53 into coupling engagement with the clutch head 50. This action instantly causes the driven shaft 55 to rotate for winding up the chain 66 on the pulley 64 as previously indicated.

Pivotally mounted upon a pin 84, anchored within the upper portion of casing section 58, as shown, is a generally L-shaped locking dog having a long arm 85 and a relatively short arm 86. The arm 85 projects into an annular passage 87 formed in clutch head 53 and provided at one radial point therein with a locking notch 88. An expansible coil spring 89 contained within the casing section 58 bears upon the short arm 86 of the locking dog and biases the latter in a direction causing the long arm 85 to drop into the notch 88 when

the clutch head 53 turns sufficiently with shaft 55 to move the notch 88 into alignment with the locking dog. As will be more completely described, when the locking dog arm 85 enters the notch 88, the clutch head 53 and pulley 64 are instantly locked against further rotation and the ring rail 25 is correspondingly locked in the lowermost or doffing position shown at 25*b* in FIGURE 1.

A second solenoid 90 having a push type plunger 91 is rigidly secured to the top of casing section 58, and this solenoid carries a plunger type switch 92 whose contacts may be opened by movement of the plunger 91 to de-energize solenoid 74. The plunger 91 engages the arm 85 of the pivoted locking dog as shown in FIGURE 2, and when the solenoid 90 is energized, the plunger 91 is thrust inwardly and shifts the arm 85 out of notch 88 to thereby release the clutch head 53 and pulley 64, rendering it possible to again move the ring rail 25 for the building of additional bobbins in another complete cycle of operation. Prior to energizing the solenoid 90, and when the locking dog arm 85 drops into the recess 88 under influence of spring 89, the arm 85 also raises the solenoid plunger 91 to separate the contacts of normally closed switch 92, thus breaking the circuit to solenoid 74 and de-energizing the latter.

When the solenoid 74 is de-energized, the pressure of the plunger 75 on pivot yoke 77 is relieved, and the spring 61 will immediately separate the clutch heads 53 and 50. This clutch throw-out action is aided by the tapered construction of the clutch teeth 51 and 54 which tend to separate or disengage. The automatic disengagement of the two clutch heads may be further assisted by a leaf spring 93, secured within casing section 58 and bearing downwardly upon the floating pivot yoke 77. Thus, when the solenoid 74 is de-energized, the shiftable clutch head 53 is immediately separated from the clutch head 50. This allows the ring rail 25 to be brought to the desired lowered position, and if the momentum of the spinning frame is not overcome, there will be no danger of damage resulting to the mechanism due to over-travel or coasting of the spinning frame.

In FIGURES 4–6, the previously-identified escapement unit 37 in the chain 32, utilized to shift the ring rail upwardly to the tip bunch applying position 25*a*, FIGURE 1, is shown in detail. This unit embodies casing 94 having a reciprocatory plunger pin 95 slidably mounted therein by engagement with a guide bore 96 of the casing. An expansible coil spring 97 surrounds the pin 95 and has one end engaging a head element 98 on the pin and its opposite end engaging a wall or shoulder 99 of the casing 94. The plunger pin 95 has an undercut portion 100 receiving a locking plunger 101 of a solenoid 102, suitably rigidly secured to casing 94. Exteriorly of one end of the casing 94, the pin 95 has an integral connector 103, permanently attached to chain or cable 32 and constantly subjected to the tension in this chain or cable, tending to pull the plunger pin 95 axially against the spring 97. The locking plunger 101 of the solenoid 102 while engaged with the undercut portion 100 resists this axial extension of the pin 95 as shown in FIGURE 4. A dust bellows 104 surrounds the exterior portion of pin 95 to exclude dust or other foreign matter from the bore 96 of the unit. The opposite end of casing 94 is covered by an end plate 105, detachably rigidly secured thereto, and rigidly secured within an opening in this end plate is a connector 106 separate from the pin 95 and forming a positive stop for the latter when the spring 97 returns the same to the retracted position shown in FIGURE 4. The connector 106 is permanently attached to the chain 32 as indicated. When the solenoid 102 is energized to retract locking plunger 101 from the undercut portion 100, the tension in the chain 32 causes immediate extension of the plunger pin 95 to the left in FIGURE 4 against the force of spring 97, and a corresponding immediate lengthening of the chain 32 by an amount accurately and positively limited by engagement of stop collars 26′ on the lifter rods 26 with the bottoms of lifter rod bearings 26*a*, rigidly secured to the spindle rail 20. This instantaneous increase in the effective length of chain 32 allows the counterweights 30 to elevate the lifter rods 26 sufficiently to shift the ring rail up to the tip bunch applying position shown at 25*a*, FIGURE 1. When the ring rail is subsequently lowered through the medium of chain 66 and associated elements as will be further described, the tension in the chain 32 is relieved and the spring 97 automatically retracts the plunger pin 95 to the normal position shown in FIGURE 4 where it is again latched by the plunger 101 after de-energizing of the solenoid 102, thus returning chain 32 to its normal length for the subsequent building of the bobbins under influence of the builder motion 31.

FIGURES 7 and 8 illustrate a limit switch directly acted upon by the ring rail 25 when the latter reaches the top of its travel, subsequent to the wrapping of exact yardage of yarn on the bobbins and after the yardage predetermining counter, to be described, completes a circuit to the unit 37 and to a control timer unit, to be described. This limit switch designated generally by the numeral 107, FIGURES 1, 7 and 8, comprises a switch casing 108, freely pivotally suspended at 109 from a support bracket 110, rigidly secured to a stationary frame part 111 of the spinning frame. The suspension pin 109 is arranged off-center, FIGURE 7, so that the switch casing 108 tends to gravitate to the position shown in FIGURE 7, wherein a stop lug 112 on the switch casing engages the bottom flange 113 of bracket 110 to arrest turning of the switch casing in a clockwise direction. A striker arm 114 rigid with the casing 108 carries a striker pin 115, directly in the path of travel of the ring rail 25, so that the latter when moving to its normal uppermost position upon completion of the bobbin building will engage and elevate the striker pin 115 thereby tilting the entire casing 108 and swinging the same in a counter-clockwise direction, FIGURE 7, upon the axis of pivot pin 109. The casing 108 contains a pair of mercury switches 116 and 116′ of the closed tubular type, each such switch being connected with a two element wire 117 and 117′, FIGURE 7. These wires extend outside of the casing 108 for connection in circuitry yet to be described. Each mercury switch 116 and 116′ is carried by a separately adjustable mounting bracket 118 and 118′, FIGURE 7, whereby the two switches can be independently adjusted to close in response to different degrees of tilting of casing 108 under influence of the rising ring rail. This differential action of the two mercury switches 116 and 116′ for closing a circuit to the control timer unit to be described, assures a holding position of the limit switch 107 when the ring rail 25 rises to the tip bunch applying position. The switch 116 closes first during the tilting of casing 108 to release the escapement unit 37, and immediately thereafter the switch 116′ will close to start the control timer unit motor yet to be described.

FIGURE 9 illustrates diagrammatically the entire automatic control and operating system for the spinning frame in accordance with the invention. In this figure, the ring rail lowering unit 43 with its pulley 64 and solenoids 74 and 90 is shown. The escapement unit 37 with its solenoid 102, connected in the chain or cable 32 is also shown. The limit switch 107 having striker arm 114 to be engaged by the ring rail as previously described is also shown in FIGURE 9. The conventional start, stop and jog switches 119, 120 and 121 directly connected with the spinning frame motor are illustrated in FIGURE 9, although the motor proper is omitted for simplification. The front draft roll 38 of the spinning frame is shown in FIGURE 9, directly coupled at 122 with the rotary shaft 123 of a predetermining yardage counter 124, which may be preset to close a circuit when the prescribed yarn yardage has been wrapped on the bobbins during the normal building thereof. The counter 124 in and of itself is conventional and need not be described in detail. However, it constitutes a very important feature of the inven-

tion in combination with the other control and operating components which make up the complete and automatic operating and control system for the spinning frame. The counter 124 contains a set of switch contact points which are open when the counter is preset to accurately gage the yardage to be wrapped upon the bobbins. When exactly the correct yardage is wrapped on the bobbins, the contact points of the counter are closed, as stated, to complete a circuit with the limit switch 107 and a conventional control timer unit 125 shown diagrammatically in FIGURE 5, thereby rendering it possible for the limit switch 107 under influence of the rising ring rail 25 and in conjunction with the control timer motor to set into action in the proper sequence the various other control instrumentalities of the invention.

The control timer unit 125 derives its power from a 575-volt source indicated at 126 in FIGURE 5. This voltage is stepped down to 115-volts through a suitable step-down transformer 127 contained within the unit 125. The control timer unit motor 128 receives its power through terminals 128', and this timer motor drives a cam shaft 129 having a plurality of adjustable cams 130 thereon. Control switches labeled ET1, ET2, ET3, ET4 and ET5 in FIGURE 5, are directly actuated in the proper sequence by the cams 130, as will be described. In practice, switch ET5 is blank. A junction block or terminal strip 131 is provided in the unit 125 for the connection of the various wires in the overall control circuit with the control timer unit. The unit 125 also includes a manual push button switch 132, which when closed energizes solenoid 90 on ring rail lowering unit 43 to release the ring rail from its locked position or doffing position shown at 25*b* in FIGURE 1.

The operation of the invention during a complete cycle of operation of the spinning frame is as follows:

In the building of warp or filling bobbins with a filling wind and a predetermined exact yardage of yarn on each bobbin, first the yardage counter 124 is preset for the desired yardage of yarn being constantly delivered by the front draft roll 38. The electrical contacts of the counter 124 are now opened. The ring rail lowering unit 43 is declutched and the ring rail 25 is in the unlocked condition subsequent to doffing. The control timer 125 has cycled to a position where the contacts for the spinning frame motor are closed to allow the normal start, jog, stop switches 119, 121 and 120 to be effective.

The spinning frame begins to operate and the bobbins are built in the normal or conventional manner under control of the builder motion 31 operating in conjunction with counterweights 30 to oscillate the ring rail 25 vertically. At this time, the unit 43 continues to be declutched and the drive shaft 42 transmits no power to the driven shaft 55 carrying pulley 64. However, the vertical oscillation of the ring rail 25 causes the pulley 64 and shaft 55 to oscillate under influence of chain 66, and this chain is kept taut by the torsional spring 68. The escapement unit 37 remains in the normal retracted and latched condition within the chain 32, as depicted in FIGURE 4.

When the spinning frame has produced the predetermined exact yardage on the bobbins, as regulated by the counter 124, the contacts of the counter will close automatically, establishing a circuit between the counter and escapement unit 37 and between the counter and the limit switch 107, whose individual switches 116 and 116' are as yet unclosed. That is to say, the closing of the electrical contacts in counter 124 conditions an electrical circuit so that the circuit may be completed to the control timer 125 when the mercury switches 116 and 116' are closed by the ring rail 25. The ring rail at this time is operating through its normal stroke at the tops of the bobbins as indicated in full lines in FIGURE 1. On the next upstroke of the ring rail, after the closing of the counter electrical contacts, the ring rail will engage and lift the striker pin 115 and the mercury switch casing 108 will be tilted upon its pivot 109, causing the mercury in the switches 116 and 116' to bridge the contacts of these switches and complete a circuit to the control timer motor 128. When this circuit is completed by the closing of the counter contacts and the mercury limit switches, the control timer motor will start to operate turning the cam shaft 129 and the several cams 130 mounted thereon, and these cams will begin to operate the electrical timer switches ET1, ET2, ET3, etc. at the proper time and in the proper order or sequence.

First, switch ET2 is closed by the adjacent cam to energize solenoid 102 of escapement unit 37, allowing the ring rail 25 to shift upwardly to the tip bunch applying position 25*a*. When solenoid 102 is energized, the locking plunger 101, FIGURE 4, is retracted and the pin 95 is extended from the casing 94 to effect the lengthening of chain 32, thereby enabling the counterweights 30 to quickly raise the ring rail to the tip bunch applying position.

The closing of switch ET2 also energizes the solenoid 74 of ring rail lowering unit 43 to thereby couple the clutch heads 50 and 53 in the manner previously described, causing rotation of shaft 55 and pulley 64, winding chain 66 on said pulley and thereby lowering the ring rail toward its lowermost or doffing position 25*b* in a controlled manner and at the proper rate. Switch ET2 of the control timer unit will also control the time before the solenoid 74 is energized thereby controlling the number of wraps of yarn on each tip bunch. The ring rail will remain elevated at the tip bunch applying position for the proper predetermined time and will then be lowered by the automatic action of the unit 43.

Switch ET3 will now break the circuit to the spinning frame motor adjacent the switches 119–121. When the ring rail reaches its lowermost position at 25*b*, the locking dog arm 85 will drop into the notch 88 of clutch head 53 locking the same against further rotation, and simultaneously locking the ring rail in the lowered position. Simultaneously, the arm 85 will lift the solenoid plunger 91, FIGURE 2, opening the contacts of switch 92, thereby de-energizing solenoid 74 and automatically de-clutching the ring rail lowering unit 43 in the manner previously explained.

Switch ET4 of the control timer unit 125 is a holding switch. It serves to maintain the electrical circuit through the control timer unit energized or completed when the mercury switches 116 and 116' are reopened by the lowering of the ring rail 25. When the ring rail is lowered automatically, it disengages the striker pin 115 and the switch casing 108 returns automatically by gravity to the position of FIGURE 7 where the two mercury switches are opened.

After doffing of the bobbins and the application of fresh bobbins to the spindles 22, the locked-down ring rail must be released prior to the next complete cycle of operation. To accomplish this, the operator depresses and closes push button switch 132 to energize solenoid 90 of the ring rail lowering unit 43. When this occurs, the solenoid plunger 91 pushes the locking dog arm 85 out of the notch 88, thereby releasing the pulley 64 and releasing the ring rail at the lowermost position. The control timer unit will continue to operate until it has cycled one complete revolution of the cam shaft 129, and then the circuit through the control timer unit is broken by switch ET1. At this time, the circuit through the spinning frame motor and start, jog and stop switches is again established and the system is then back to the initial condition for starting a new complete cycle of operation, namely, the regular building of the bobbins with predetermined exact yardage, the automatic release of the ring rail allowing the latter to shift up to the tip bunch applying position, the subsequent automatic lowering and locking of the ring rail at the doffing position, and finally the automatic unlocking of the ring rail by the operation of the switch 132. By means of the master circuitry shown diagrammatically in FIGURE 9, all of the essential con-

trol instrumentalities of the system are coordinated and operated automatically at the proper time and in the proper sequence to produce uniform bobbins with exactly predetermined yarn yardage and with uniform and accurate tip bunches thereon. The detailed wiring of the control circuit is straight-forward and simple and in view of the foregoing description, it is believed to be unnecessary to further describe the control circuitry which is indicated clearly in FIGURE 9 to enable anyone skilled in the art to fully understand the operation of the control system.

It is to be understood that the form of the invention herewith shown and described is to be taken as a preferred example of the same, and that various changes in the shape, size and arrangement of parts may be resorted to, without departing from the spirit of the invention or scope of the subjoined claims.

Having thus described the invention, what is claimed is:

1. In a spinning frame and automatic control system therefor, a vertically oscillating ring rail adapted to traverse bobbins during the building thereof, builder motion means including counterweight means to oscillate the ring rail during the building of the bobbins, an electromagnetically operated escapement device connected in the builder motion means and operable after the building of the bobbins to allow the ring rail to shift upwardly to a tip bunch applying position, a continuously driven front draft roll to deliver yarn, a ring rail lowering unit including a clutch device mounted upon the spinning frame, gearing drivingly interconnecting said front draft roll and ring rail lowering unit, electromagnetic means on the ring rail lowering unit to clutch and de-clutch the same, a pulley on the ring rail lowering unit and driven thereby when the unit is clutched, a flexible element connected with said pulley and adapted to be wound thereon for lowering the ring rail to a doffing position after application of the tip bunch to the bobbins and connected with the builder motion means and adapted to override the latter for taking over control of the ring rail, a yarn yardage predetermining device connected with and driven by the front draft roll and including switch contacts, a limit switch in the path of travel of the ring rail to be engaged thereby for completing a circuit subsequent to the closing of said switch contacts of the yardage predetermining device, a rotary control timer unit including cam operated switches to control and cycle the operation of the escapement device, ring rail lowering unit and spinning frame after closing of said limit switch, and control circuitry electrically interconnecting said control timer unit, ring rail lowering unit, escapement device, limit switch and yardage predetermining device.

2. In a spinning frame and control system therefor, an oscillatable ring rail to guide yarn onto a plurality of bobbins during the building thereof, builder motion means connected with said ring rail and causing it to oscillate relative to the bobbins during the building of the bobbins, a continuously driven front draft roll on the spinning frame to deliver yarn to the ring rail and bobbins, a ring rail lowering unit on the spinning frame connected with and driven by said front draft roll and also connected with the ring rail to lower the same independently of the operation of the builder motion means and adapted to override the latter, a yardage regulating device connected with and driven by the front draft roll for assuring that equal and exact amounts of yarn are applied to the bobbins during the building thereof, a control timer unit for coordinating the operation of the ring rail, ring rail lowering unit and yardage regulating device, and a limit switch in the path of travel of the ring rail and operated thereby when the building of the bobbins is completed to energize said control timer unit.

3. In a spinning frame and spinning frame control system, as a sub-combination, a ring rail lowering unit, said unit comprising an input drive shaft, gearing connected with said drive shaft to rotate the same continuously during operation of the spinning frame, a first clutch head on said input drive shaft, an output driven shaft on said unit, a second clutch head on said output driven shaft to turn therewith and shiftable axially toward and away from coupling engagement with the first clutch head, resilient means engaging the second clutch head to maintain it normally separated from the first clutch head, whereby no rotation will be imparted to the output driven shaft, a pulley secured to said output driven shaft to turn therewith, a flexible element connected with said pulley and adapted to be wound thereon and also connected with means on the spinning frame supporting the ring rail so that the latter may be lowered when said flexible element is wound upon the pulley, a first electromagnetic means on said unit operable to shift the second clutch head into coupling engagement with the first clutch head and to maintain such engagement while the ring rail is being lowered, a second electromagnetic means on said unit, a resiliently biased locking means for the second clutch head on said unit to lock the second clutch head against further rotation when the ring rail is fully lowered thereby locking the ring rail in the fully lowered position, said locking means engaging said second electromagnetic means while the latter is de-energized and when the locking means is active for locking the second clutch head, a switch associated with said second electromagnetic means and operated by the latter under influence of the locking means to de-energize said first electromagnetic means when the ring rail is locked in the fully lowered position, and circuit means connected with the second electromagnetic means to energize the same to move said locking means out of locking engagement with said second clutch head thereby releasing the ring rail from said lowered position thereof.

4. An automatic control system for a spinning frame of the movable ring rail type comprising in combination a source of power for operating a spinning frame motor and for operating said spinning frame control system, a control timer unit having a transformer for reducing the voltage supplied by said source of power, said control timer unit including a rotary shaft having a plurality of cams thereon and a corresponding number of electrical timing switches operated in a predetermined sequence and at predetermined times by said cams, a predetermining yardage counter including electrical contacts driven by the spinning frame and electrically connected with the control timer unit for conditioning a circuit to said unit when the correct yardage of yarn is produced by the spinning frame, a coacting limit switch in the path of travel of the movable ring rail and engaged thereby to complete said circuit to the timer unit subsequent to the closing of said electrical contacts of said counter, an electromagnetic means for releasing the ring rail at the normal upper limit of its travel so that the ring rail may move up to a tip bunch applying position and connected in said circuit and operable subsequent to the closing of said counter contacts, an electromagnetic means to lower the ring rail and releasably lock the same in the doffing position subsequent to the application of tip bunches to the bobbins and electrically connected in said circuit and operable subsequent to the closing of said limit switch, and a manually operated switch in said circuit to condition said electromagnetic ring rail lowering and locking means to release said ring rail at said doffing position prior to starting a new complete cycle of operation.

5. In a spinning frame and control system therefor, a ring rail adapted to oscillate relative to a group of bobbins to build the latter, builder motion means including a flexible element and counterweights connected with the ring rail to oscillate it, an electrically operated escapement device connected in said flexible element to cause extension thereof subsequent to the building of the bobbins so that the ring rail may rise automatically to a tip bunch applying position, a ring rail lowering rotary device mounted upon the spinning frame, gearing driven by the

spinning frame and connected with the ring rail lowering device to continually power the same, electrically operated clutch means in said ring rail lowering device including a driven shaft having a pulley mounted thereon and operable subsequent to the applications of tip bunches to the bobbins to cause rotation of said pulley, a flexible element secured to said pulley and windable thereon and connected with the builder motion means and overriding the latter to lower the ring rail to a doffing position, a locking dog in said ring rail lowering device to arrest rotation of the pulley when the ring rail has been fully lowered and thereby locking the ring rail at the doffing position, separate electromagnetic means on said ring rail lowering device to subsequently move the locking dog out of locking engagement with the pulley thereby releasing the ring rail at its lowered position, a control timer means for said system including electrical timing switches, a yardage measuring switch device driven by the spinning frame, a limit switch in the path of travel of the ring rail and engaged and enclosed thereby when the ring rail is near the top of its normal travel after completely building the bobbins, and electrical circuit means interconnecting the yardage measuring switch device, limit switch, escapement device, ring rail lowering device and control timer means allowing the latter to automatically dictate the cycle of operation of said system subsequent to the closing of said limit switch by said ring rail.

6. In a spinning frame and spinning frame control system, an oscillatable ring rail to traverse bobbins during the building thereof with yarn, electro-mechanical means driven by the front draft roll of the spinning frame to accurately control the yarn yardage placed on each bobbin during the building of the bobbins so that all of the bobbins will contain a predetermined exact amount of yarn, electro-mechanical means connected with the ring rail and operable when the bobbins are fully built to cause shifting of the ring rail to a tip bunch applying position and the application of tip bunches to the bobbins in a uniform manner, an electro-mechanical ring rail lowering and locking unit on the spinning frame driven by the front draft roll thereof to lower and lock the ring rail at a bobbin doffing position automatically subsequent to the application of the tip bunches to the bobbins and lowering the ring rail at a fixed ratio to the delivery of the yarn by the front draft roll, an electro-mechanical control timer unit for cycling the operation of the second-named electro-mechanical means and ring rail lowering and locking unit, and electrical limit switch means in the path of travel of the ring rail and engaged and actuated by the ring rail when the latter is at the top of its travel after building of the bobbins to energize said control timer unit.

7. The invention as defined by claim 6, and wherein said control timer unit includes a plurality of electrical timing switches and rotary cams to actuate said switches in properly timed sequence, and circuitry interconnecting said timing switches with said second-named electro-mechanical means, ring rail lowering and locking unit and limit switch means.

8. The invention as defined by claim 7, and wherein said ring rail lowering and locking unit includes a normally uncoupled mechanical clutch and solenoid-operated means connected in said circuitry under control of the timer unit to couple and activate said clutch, and additional electrical means connected in said circuitry and mounted upon said unit to subsequently release said clutch after lowering of the ring rail.

9. The invention as defined by claim 3, and wherein said first electro-magnetic means comprises a solenoid on said unit having a plunger, a yoke floatingly mounted inside of said unit and engaging the plunger, pressure links pivoted to said yoke and to said unit and forming with the yoke a toggle linkage within said unit engaging said second clutch head and operable upon energizing of the solenoid and the thrusting of the solenoid plunger against the yoke to shift the second clutch head toward coupling engagement with the first clutch head.

10. The invention as defined by claim 9, and roller means on said yoke engageable with a smooth face of the second clutch head to roll thereon during the shifting of the second clutch head.

11. The invention as defined by claim 3, and wherein the second electro-magnetic means on said unit comprises a solenoid having a plunger projecting into the unit and engaging said locking means and operable when the solenoid of the second electro-magnetic means is energized to release the locking means from locking engagement with the second clutch head.

12. The invention as defined by claim 11, and wherein the second electro-magnetic means also includes a switch operable to de-energize the first electro-magnetic means for disengaging the second clutch head from coupling engagement with the first clutch head due to shifting of the plunger of the solenoid of the second electro-magnetic means by the resiliently biased locking means and while the second electro-magnetic means is de-energized when the locking means moves into locking engagement with the second clutch head.

13. In a spinning frame of the movable ring rail type and an automatic control system therefor, builder motion means to oscillate the ring rail during the normal building of bobbins, electro-mechanical means driven by the front draft roll of the spinning frame to predetermine and measure substantially exactly the yarn yardage applied to the bobbins during the building thereof, an electro-mechanical ring rail lowering unit including a rotary part driven by the front draft roll of the spinning frame and operable after the completion of bobbin building and connected with the ring rail to then lower the same to a bobbin doffing position at a constant ratio to the delivery of the yarn by the front draft roll, electrically operated means actuated by the ring rail in the upper position of the latter at the completion of bobbin building to set into motion said ring rail lowering unit, and means constituting a part of said ring rail lowering unit and operable after the ring rail is fully lowered to the bobbin doffing position to releasably lock the ring rail in such position and to subsequently unlock the ring rail prior to another complete cycle of operation of the spinning frame.

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