May 2, 1967 L. W. PRAY ET AL 3,317,147

SPINNING FRAME FLUID OPERATED CONTROL MEANS

Filed Oct. 8, 1964 8 Sheets-Sheet 1

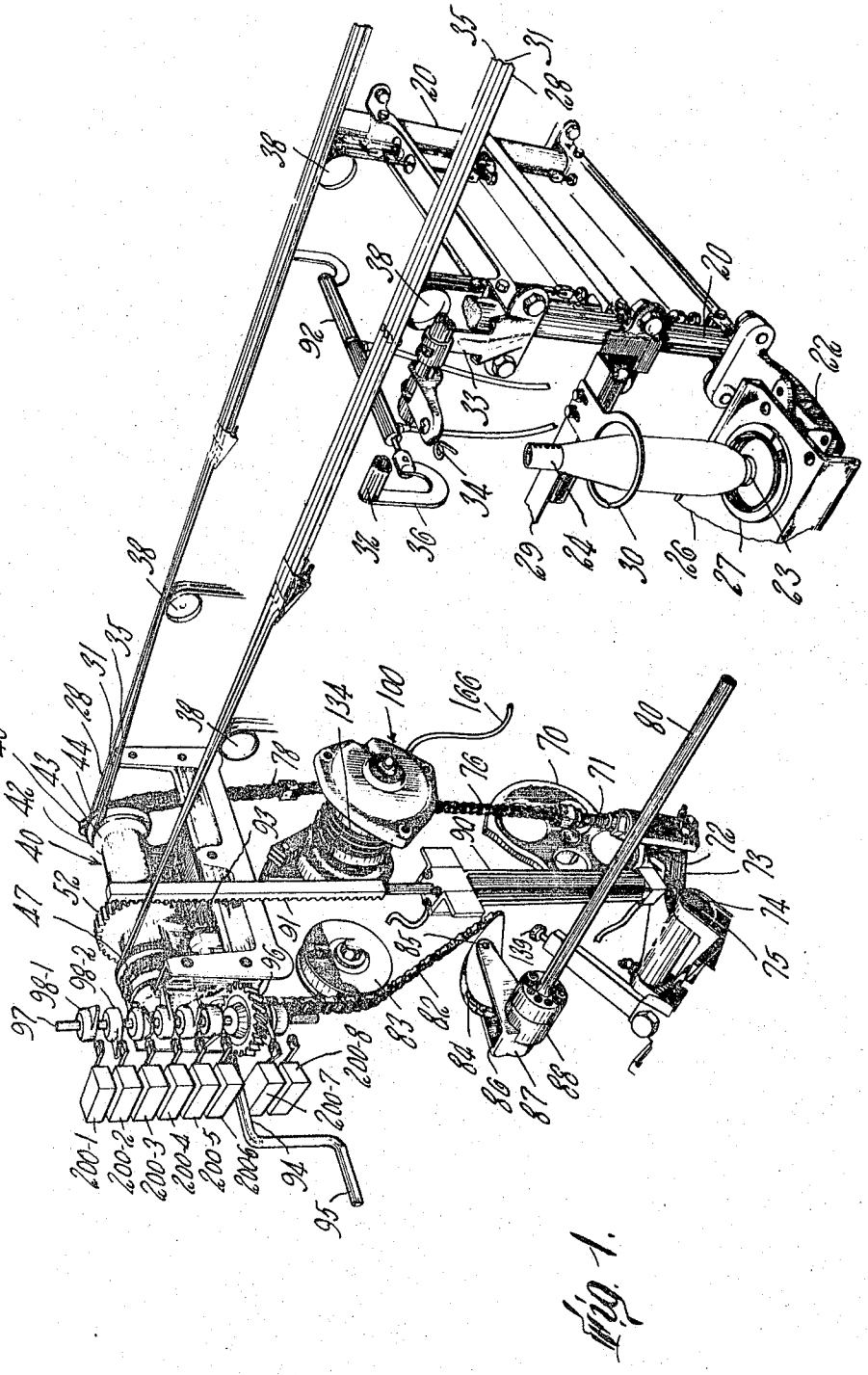


Fig. 1.

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SPINNING FRAME FLUID OPERATED CONTROL MEANS

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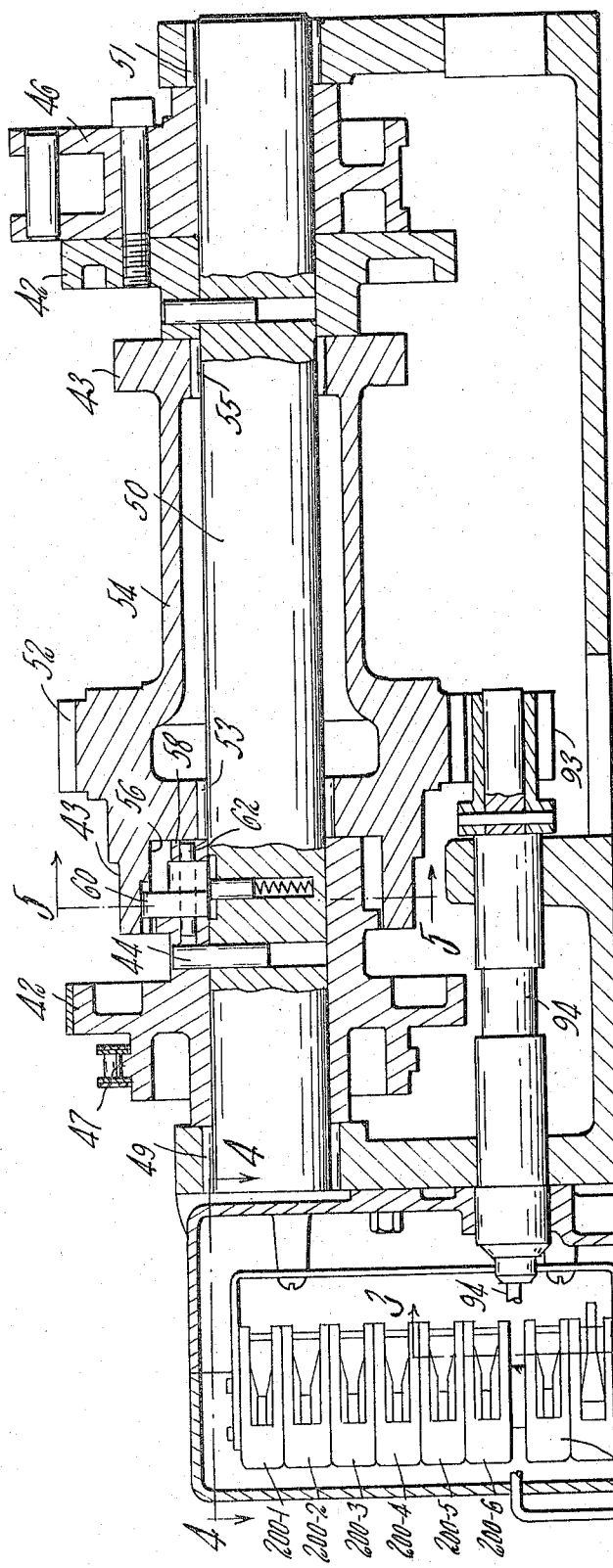


Fig. 2.

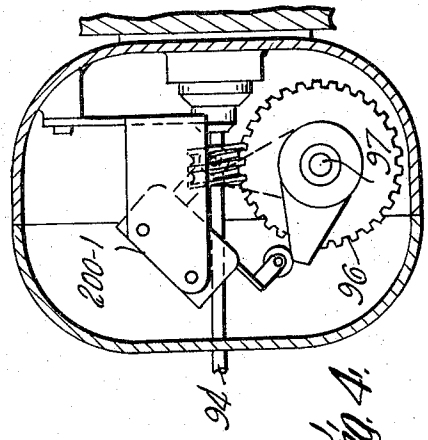


Fig. 4.

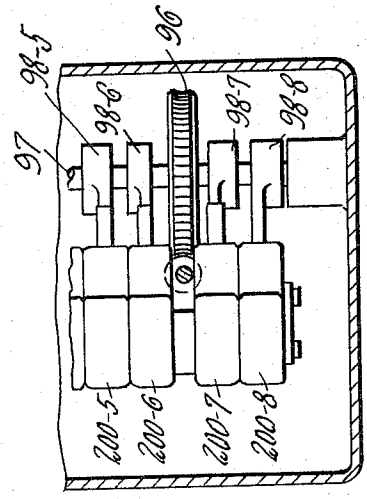


Fig. 3.

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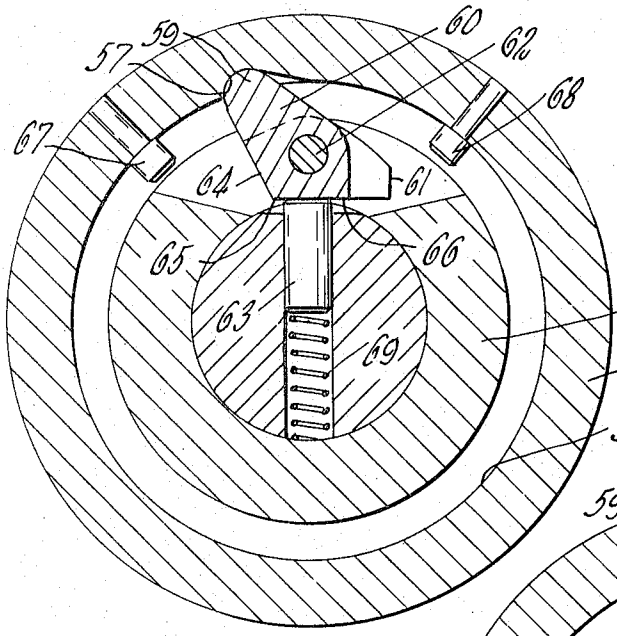


Fig. 5.

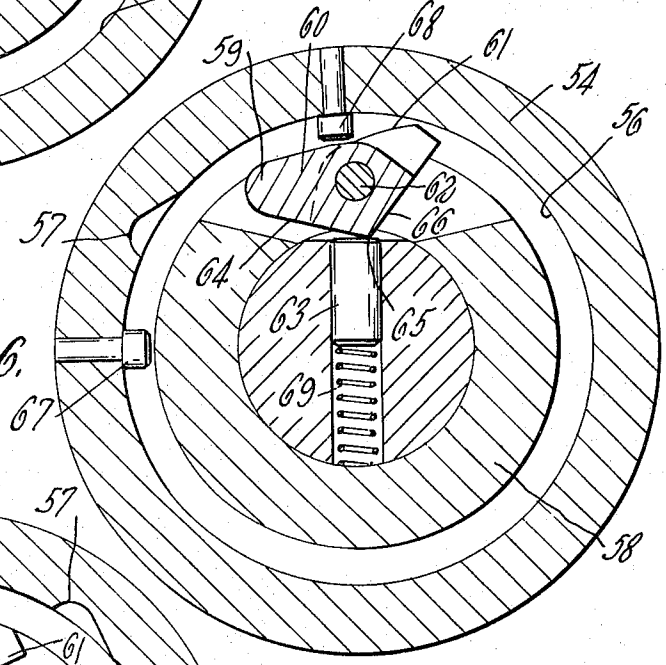


Fig. 6.

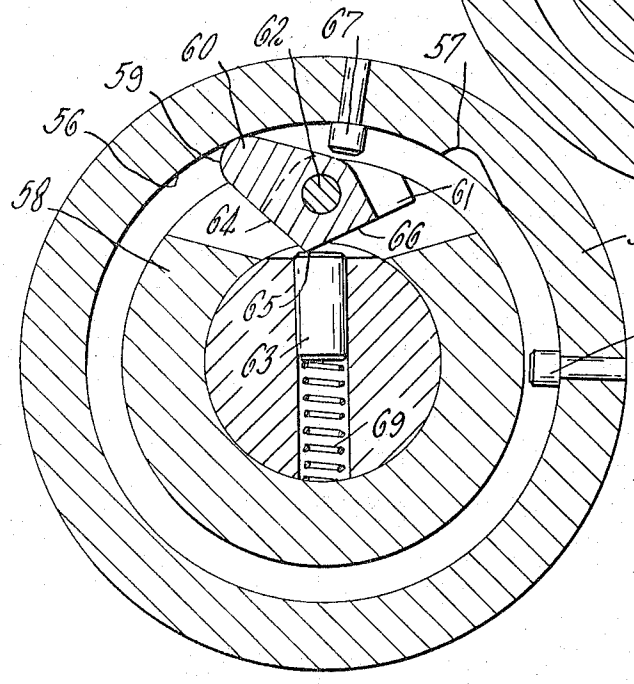


Fig. 7.

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SPINNING FRAME FLUID OPERATED CONTROL MEANS

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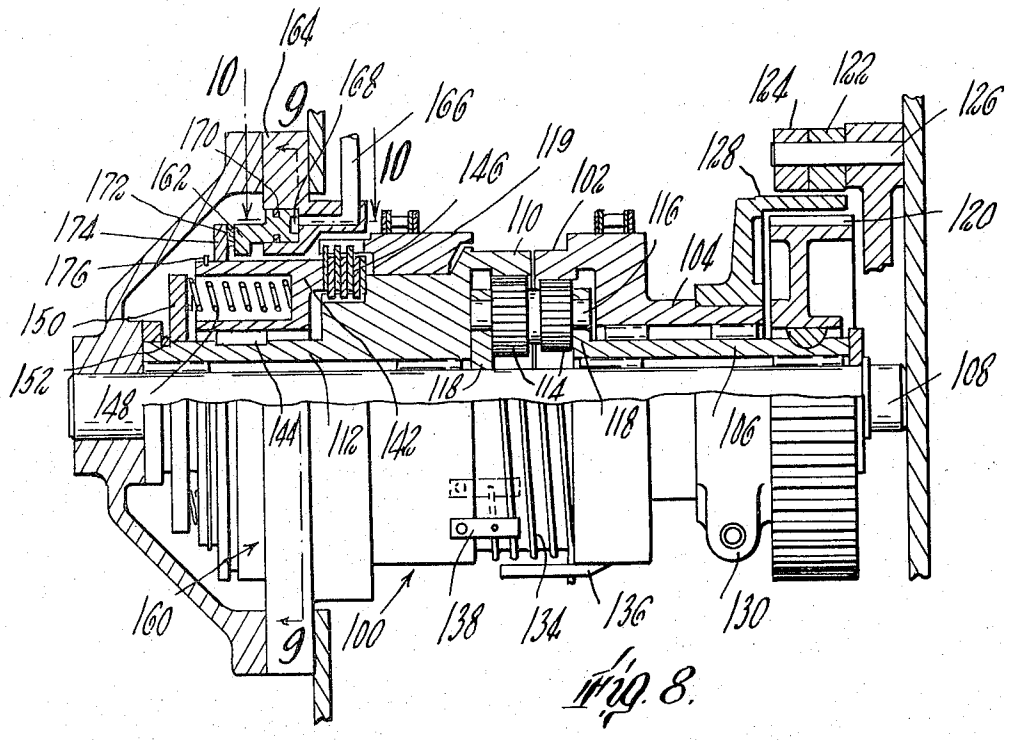


Fig. 8.

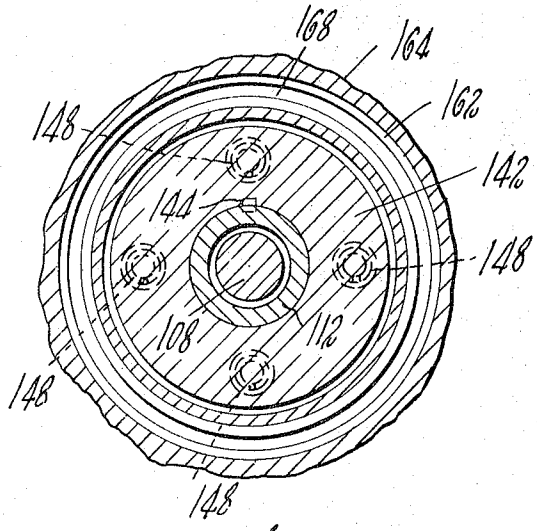


Fig. 9.

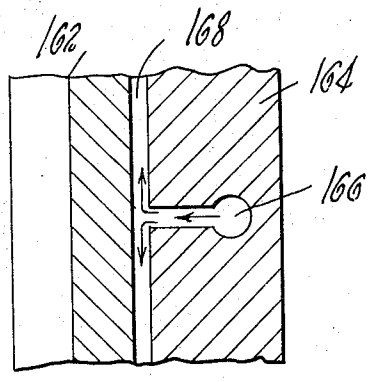


Fig. 10.

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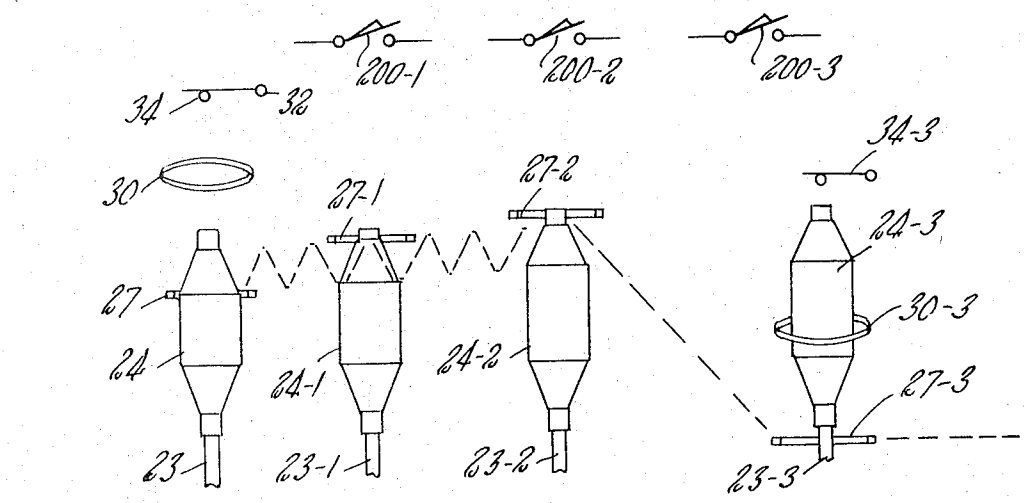


Fig. 11a

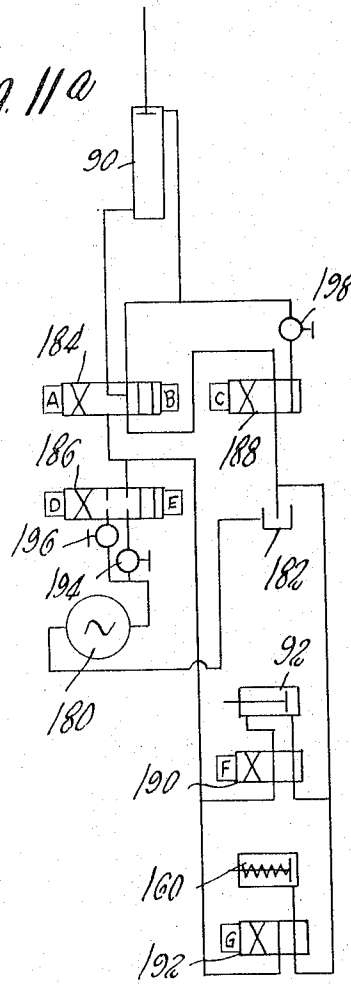


Fig. 12.

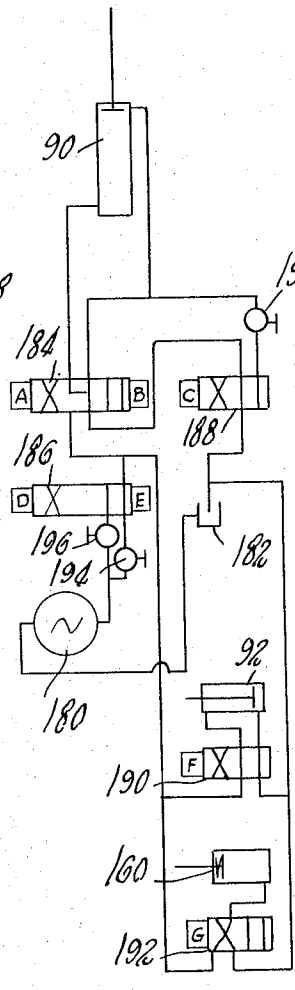


Fig. 13.

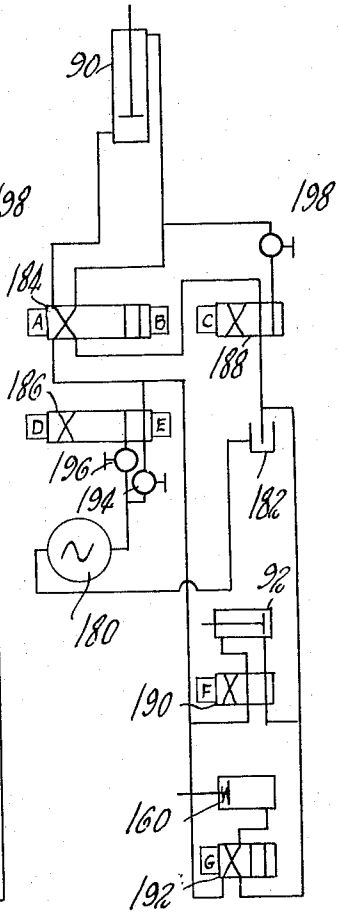


Fig. 14.

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SPINNING FRAME FLUID OPERATED CONTROL MEANS

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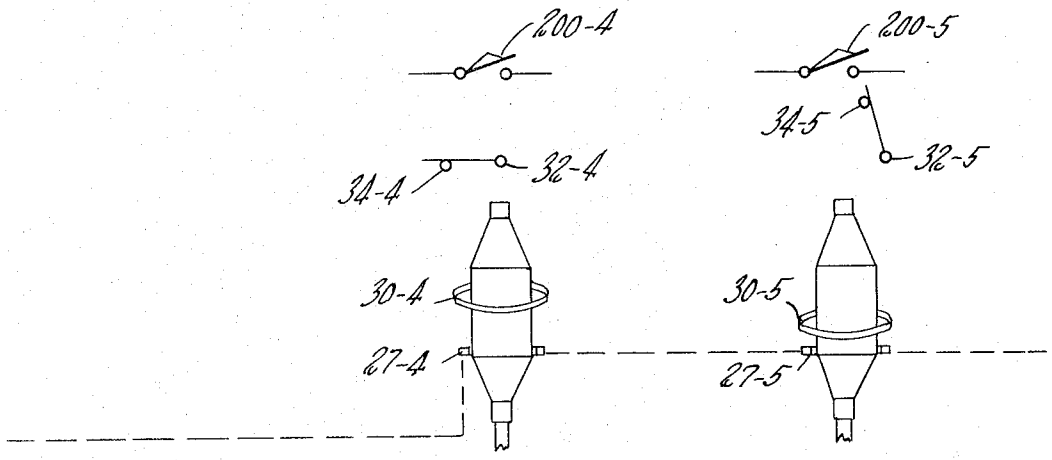


Fig. 11B

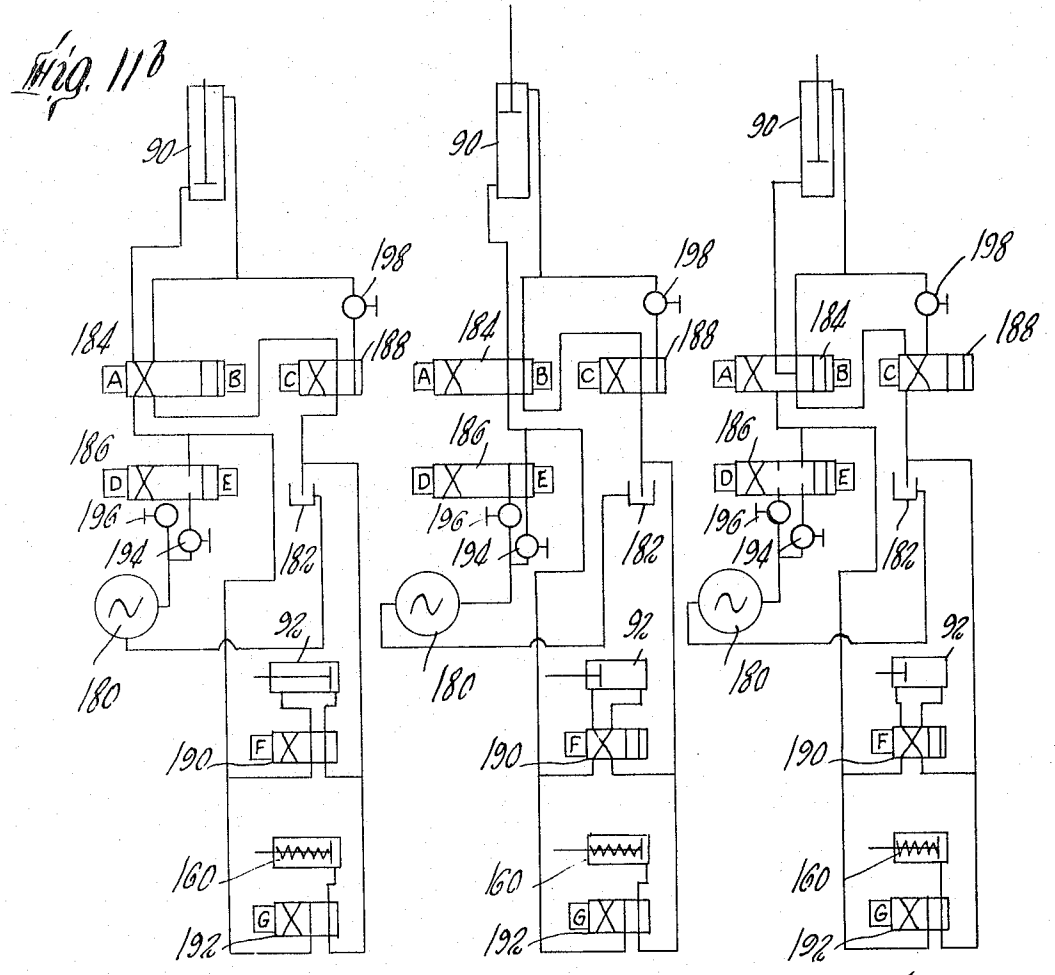


Fig. 15. Fig. 16. Fig. 17.

SPINNING FRAME FLUID OPERATED CONTROL MEANS

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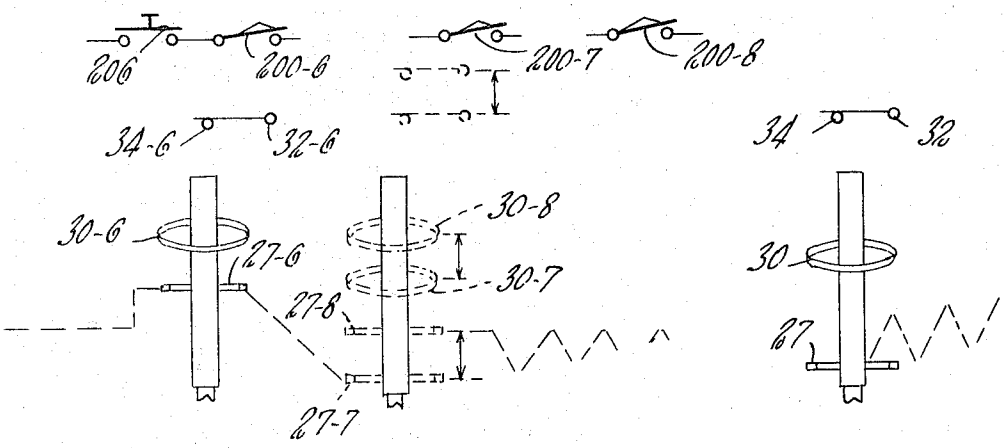


Fig. 11C

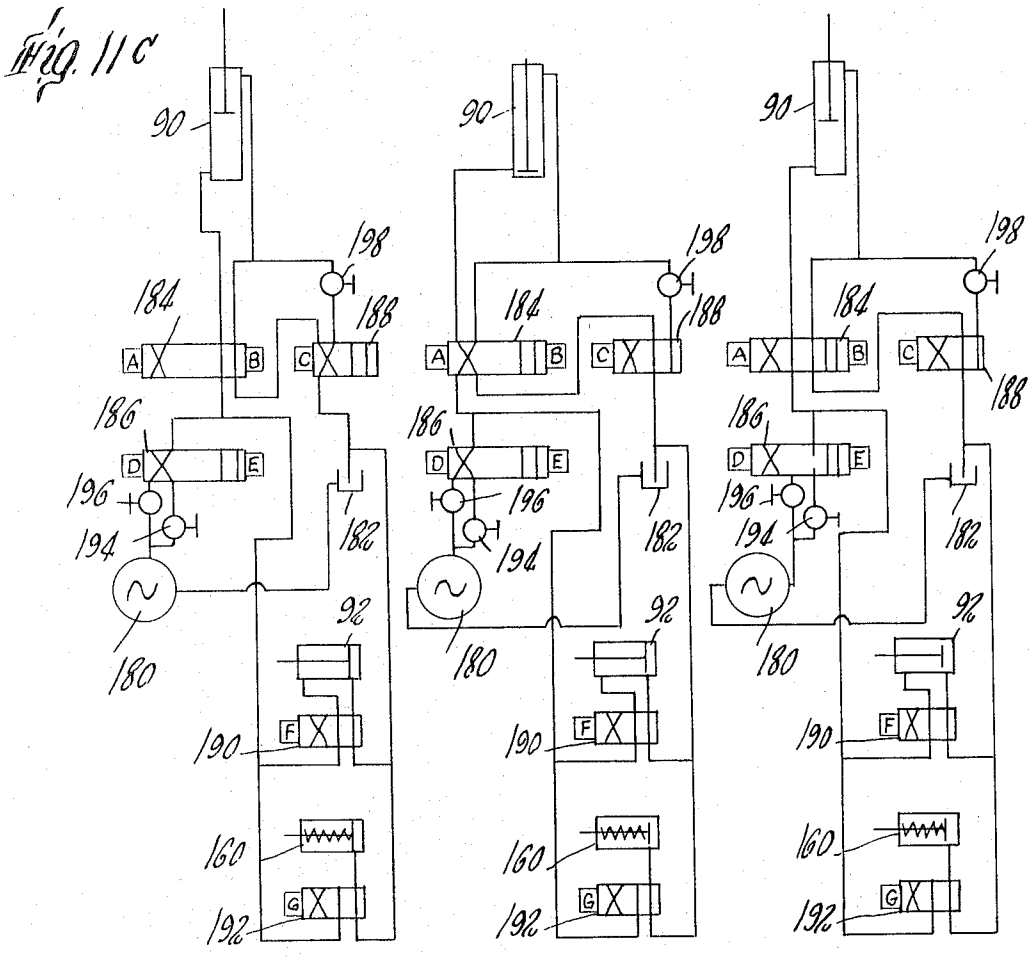


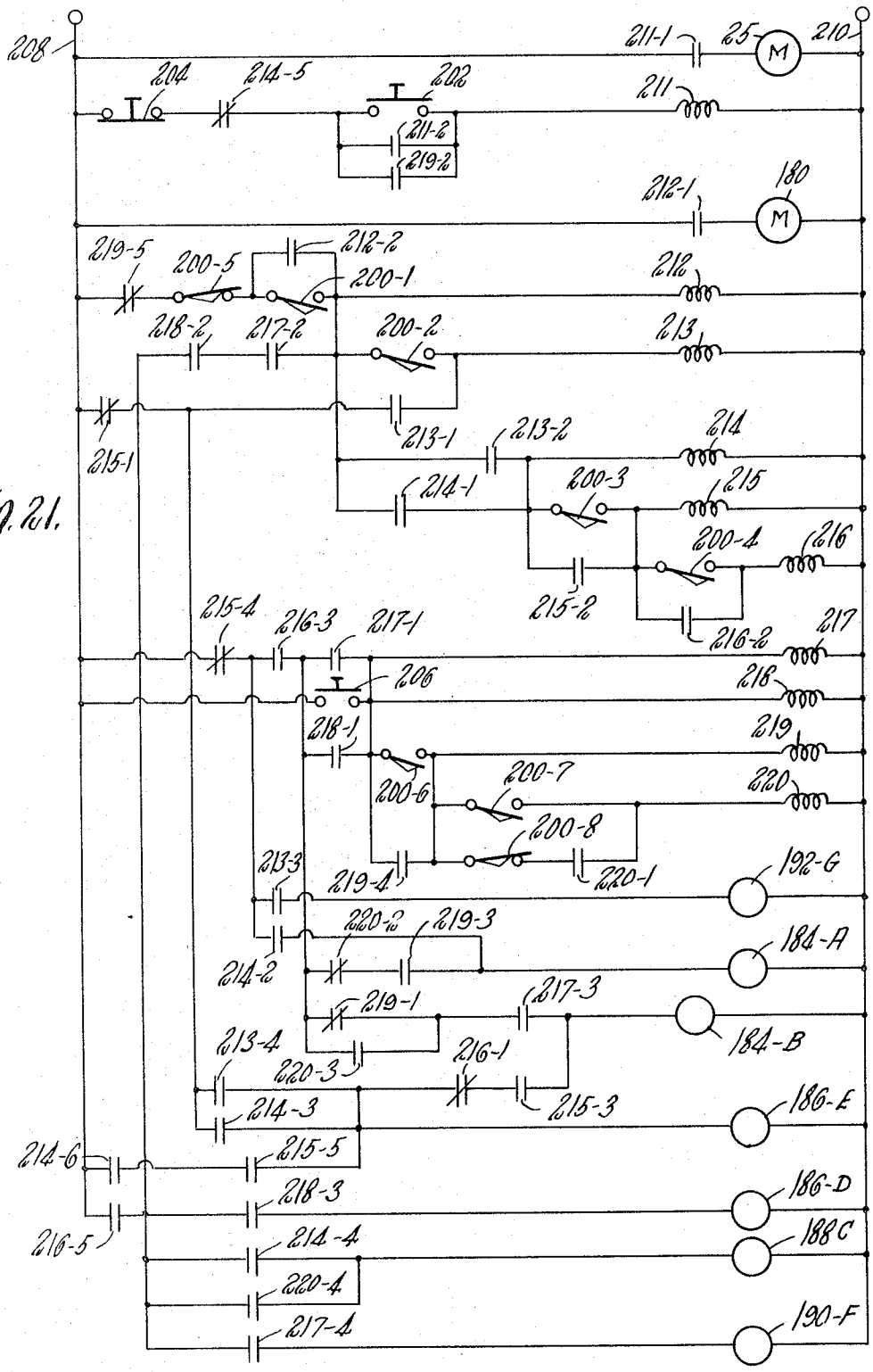
Fig. 18. Fig. 19. Fig. 20.

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Fig. 21.



United States Patent Office 3,317,147 Patented May 2, 1967

3,317,147

SPINNING FRAME FLUID OPERATED CONTROL MEANS

Lester W. Pray and Gordon C. Anderson, Clemson, Herman D. Sheron, Seneca, and William H. Drake, Clemson, S.C., assignors to Maremont Corporation, Chicago, Ill., a corporation of Illinois

Filed Oct. 8, 1964, Ser. No. 402,384
16 Claims. (Cl. 242—26.4)

The invention relates to textile fiber spinning and twisting frames and the like, having yarn guiding and winding elements which are vertically traversed with relation to bobbin supporting spindles in accordance with a rising builder pattern, and more particularly to fluid mechanisms on such frames and control means therefor for operating such yarn guiding and winding elements at the conclusion and initiation of bobbin winding, for replacement of full with empty bobbins as well as for other purposes.

With the introduction of apparatus for automatically doffing full bobbins from spinning and twisting frames and replacing them with empty bobbins, there has been a need for a spinning and twisting frame which will automatically ready its yarn guiding and winding elements and then stop them for removal of the full bobbins and have the ability to restart after replacement of the full bobbins with empty ones without the necessity of starting the winding operation of any of the individual yarns by piecing up.

In addition, there has also been a need for operating the spinning or twisting frame at the conclusion of the winding cycle to produce a bobbin tip wind if the full bobbin are to be used in automatic rewinding equipment, such being accomplished by raising the spinning rings to an unusually high position for a time sufficient to add a few turns of yarn to the upper tip of the bobbin before lowering the spindle rings for spindle bottom winding and doffing.

Although spinning and twisting frames have been described as having one or more of the above described functions, they have in general been deficient in several respects, principally in their inability to restart without breaking an undue number of yarn ends, making extensive piecing up necessary, but also in their mechanical complexity, making them difficult to manufacture and to keep running in production.

Accordingly, it is a major object of the present invention to provide a novel fluid operating system for a spinning or twisting frame or the like having a fully automatic bobbin replacement sycle, with bobbin tip wind if desired, providing a system highly simplified over heretofore known frames.

It is another object of the invention to provide in such a frame, novel fluid mechanism for lowering the balloon control rings relatively to the spinning rings for full bobbin removal, useful in manually operated as well as automatically operated frames.

It is still another object of the invention to provide novel fluid mechanism for automatically moving the thread guides to an out of the way position for full bobbin removal.

It is still another object of the invention to provide a novel mechanism having a hydraulic actuator for automatic bobbin tip winding and resetting therefrom.

It is still further object of the invention to provide a novel fluid jogging system for rapidly reciprocating over a limited distance and time the spinning rings relatively to the empty bobbins upon restarting of the frame.

In general, the invention accomplishes these and other objects automatically by the use of fluid actuators and

their controls by raising the spinning rings to a tip winding position, if such be desired, followed by lowering the spining rings beyond their usual bottom winding position to wind a few turns of yarn around the bottom of the spindles beyond the lower ends of the bobbins for restarting the winding on an empty bobbin, and, for bobbin clearance, lowering the balloon control rings as well to a position close to the lowered spinning rings and preferably moving the thread guides to a position clear of the bobbins so that they may be readily removed. Upon restarting with empty bobbins, the spinning rings, balloon control rings and thread guides are automatically restored to their starting positions by said fluid actuators and controls. The spindle bottom wind permits bobbin winding to begin without piecing up, and the additional use of a rapidly traversing jogging of the spinning rings and bobbins aids to a substantial degree in reducing yarn breakage during restarting, these general functions, but not the fluid actuator and control system of the present invention, being disclosed in U. S. patent application Ser. No. 310,109, filed Sept. 19, 1963, now Patent No. 3,231,209, dated January 25, 1966, and of common assignee with the present application.

For the purpose of more fully explaining the above and further objects and features of the present invention, reference is now made to the following detailed description of a preferred embodiment thereof, together with the accompanying drawings, in which:

FIG. 1 is a diagrammatic view in perspective of a spinning frame embodying the invention;

FIG. 2 is a side section of the windlass portion of the frame of FIG. 1 including the electrical switch mechanism operated thereby;

FIGS. 3 and 4 are detail views of the switch mechanism of FIG. 2;

FIGS. 5, 6 and 7 are cross sections of the windlass of FIG. 2 taken on the lines **5—5** thereof;

FIG. 8 is a side section of the pick mechanism portion of the frame of FIG. 1 including the hydraulic clutch thereof;

FIGS. 9 and 10 are cross sections of the pick mechanism of FIG. 8, taken on the lines **9—9** and **10—10** thereof;

FIGS. 11*a*, *b* and *c* comprise a sequence diagram illustrating the complete sequence of operation of the yarn guiding and winding elements of the frame of FIG. 1;

FIGS. 12 through 20 illustrate the hydraulic circuit of the frame of FIG. 1 throughout its complete sequence of operation; and

FIG. 21 is an electrical circuit diagram of the frame of FIG. 1.

GENERAL

As shown in the drawings, especially in regard to the overall schematic showing of FIG. 1, the invention is herein disclosed as embodied in a spinning frame which may be of the type generally shown in Patent No. 2,770,093, for example, consisting of an elongated frame structure having at each side thereof vertical posts **20** extending upwardly from duplicate fixed spindle rails **22** on which are mounted a series of spindles **23** on which bobbins **24** are carried. A main frame motor **25** (FIG. 21) is provided for driving spindles **23** in the usual manner. The spindles together with their drive mechanism are well known and form specifically no part of the present invention, and need not be further described.

The movable yarn traversing, guiding and control elements by means of which the yarns are guided for winding on the bobbins on the spindles comprise, associated and mounted for vertical movement along posts **20** with

each spindle rail **22**, a spinning ring rail **26** having mounted thereon along the length of the machine a series of spinning rings **27**, a control ring support bar **29** on which are mounted a series of control rings **30**, and a thread guide supporting rod **32** rotatably mounted in brackets **33** on which rod is mounted a series of thread guides **34**.

The spinning ring rail **26** is supported at intervals along its length by means of tapes **28** which extend along the length of the machine and are provided at intervals with extensions passing around idler pulleys **38**. Each tape **28** is secured at the base end to a pulley **42** mounted on a windless, generally designated **40** and hereinafter more fully explained, which extends transversely across one end of the frame.

The control ring bar **29** is similarly supported by tapes **31** which at their base ends are secured to pulleys **43** mounted on windlass **40** and toward their outer ends are similarly provided with extensions which pass around pulleys **38**.

The thread guide supporting rod brackets **33** are mounted on tapes **35**, each of which also extends along the length of the machine and is provided at intervals with extensions which pass around pulleys **38**. The tapes **35** are secured at their base ends to pulleys **44** mounted on windlass **40**.

The illustrated machine is provided with a builder mechanism for producing the traversing movement of the yarn guiding and control elements which is similar in many respects to that shown in Anderson et al. Patent No. 3,072,350, dated Jan. 8, 1963, for Builder Mechanism. As generally shown in FIG. 1, the builder mechanism comprises a builder cam **70** mounted on a builder cam shaft **71** driven by main frame motor **25** and adapted to be engaged by a follower **72** on a builder cam lever **73** extending horizontally beneath the builder cam. The cam lever turns about a pivot **74** on a machine bracket **75**, and is connected with the lower end of an adjustable link chain **76**. At its upper end the chain **76** is connected with a pick mechanism, generally designated **100** and hereinafter more fully explained, which is in turn connected by means of a link chain **78** with a pulley **45** secured to the windlass **40**.

There is also connected to the windlass **40** the compensating tension assembly including a torsion bar **80** which acts to rotate the windlass in a direction counter to the thread guide, control ring and spinning ring supporting tapes. Said compensating tension assembly comprises a chain **82** which is connected at its upper end to a pulley **47** mounted on windlass **40**. The chain **82** extends downwardly around a guide roller **83** and is connected at its lower end to a cam member **84** which is adjustably mounted on a pivot pin **85** between a pair of arms **86** formed on a bracket **87** which is rotatably supported on a bearing member **88** and is rigidly secured at one end to torsion bar **80** to rotate therewith about the torsion bar axis. The torsion bar **80** is placed under a twisting or torsion strain which serves to exert a downward bias on the chain **82** sufficient to overbalance the bias of the several tapes attached to windlass **40**. An adjustable stop **139** is provided for cam member **84**.

The builder mechanism above generally referred to is arranged to operate in the following manner:

The builder shaft **71** and cam **70** are positively driven by motor **25** to produce a cyclical up-and-down movement of the builder cam follower lever **73** to produce a reciprocatory movement of the spinning ring rail **26**, control ring bar **29** and thread guide rod **32** with a recurring winding pattern. At regular intervals during this operation, the pick mechanism **100** is operated to increase slightly the length of chain **78** and thereby to gradually lift the reciprocating pattern of winding effected by the operation of the builder cam follower **72**.

For a more complete illustration and description of the builder mechanism, reference may be had to the Anderson et al. Patent No. 3,072,350, above referred to.

INVENTION

According to the present invention, a novel means including hydraulic and mechanical operating means with their controls are provided for operating the spinning frame of the invention at the conclusion and initiation of the operation of winding a bobbin **24**. The resulting functions at the conclusion of bobbin winding may include raising the spinning rings **27** for tip winding if desired, followed by lowering the spinning rings beyond their usual bottom winding position to wind a few turns of yarn around the bottom of the spindle **23**, and then, for bobbin removal, further lowering the control rings **30** to a position close to the lowered spinning rings and tipping back the thread guides **34**. Upon restarting the spinning frame with empty bobbins, the spinning rings, control rings and thread guides are automatically restored to their initial bobbin winding positions, the spindle bottom wind and jogging making possible initiation of winding withiut piecing up. This complete sequence is illustrated in FIGS. 11*a–c*.

As shown in FIG. 1, the means for accomplishing this sequence includes a main hydraulic piston and cylinder **90** having a rack **91** for moving windlass gear **52** mounted on windlass **40**, a double ended hydraulic thread guide piston and cylinder **92** having its relatively movable ends connected to arms **36** of thread guide rod **32** for moving thread guides **34** from a horizontal to a generally vertical position, a hydraulic clutch control of pick mechanism **100** through its inlet **166**, and electric control means including a multiple cam driven switch mechanism including switches **200–1** through **8** driven from windless gear **52** by means of transverse shaft **94** having a gear **93** cooperating with windlass gear **52** and cooperating gears **96** driving vertical cam shaft **97** on which switch cams **98–1** through **8** are mounted. Handle **95** is provided for manual operation of windlass gear **52**.

WINDLASS

The novel windlass **40** of the present invention, best shown in FIGS. 2 to 7, differs from heretofore known windlasses to provide for movement of control rings **30** independently of the movement of the spinning ring rail **26** and thread guide rod **32** to a lowered position with respect thereto for removal of a full bobbin from its spindle.

In this regard, the windlass of the present invention has a main shaft **50**, suitably mounted for oscillation in bearings **49**, **51** on the sprinning frame, with a countershaft in the form of a central sleeve **54** rotatably mounted thereon by spaced bearings **53**, **55**. The ring rail pulleys **42**, thread guide pulleys **44**, pick motion chain pulley **46** and torsion bar chain pulley **47** are all mounted on windlass shaft **50** in rotatable positions. Windlass gear **52** and control ring pulley **43** are mounted on rotatable windlass sleeve **54**.

A latch mechanism is provided for rotating sleeve **54** for oscillation in synchronism with windlass shaft **50** during normal operation of the spinning frame and for rotating sleeve **54** independently of shaft **50** for lowering control rings **30** for removal of full bobbins. To accomplish this result, a collar **58** is mounted in fixed position on shaft **50** within and spaced from a surrounding cylindrical surface **56** in sleeve **54**, said collar having a heart shaped latch member **60** pivotally mounted thereon by pivot member **62**. Latch member **60** is maintained with one of its lobes **59**, **61** in contact with surface **56** by radially extending pin **63** which is pressed outwardly by its spring **69** into contact with one of the angularly disposed latch surfaces **64**, **66** which intersect at inner latch point **65**. A recess **57** is provided on sleeve surface **56** for receiving one lobe **59** or latch **60** and preventing further angular relative movement of windlass shaft **50** and sleeve **54** in the direction of said lobe **59** while permitting relative movement in the opposite direction toward lobe **61**. Latch operating elements **67**, **68**

are positioned angularly spaced from one another on sleeve surface **56** on each side of recess **57**, and are slightly offset with respect to one another along the length of sleeve **54** so as to actuate the similarly offset lobes.

The operation of the latch mechanism is best seen from FIGS. 5 to 7. Thus, in FIG. 5, the latch mechanism is shown in its latched normal operating position with one of its lobes **59** received within recess **57** for rotating sleeve **54** in synchronism with shaft **50**, sleeve **54** in effect being a countershaft for main shaft **50**. In FIG. 6, latch **60** is shown in an unlatched position caused by rotating sleeve **54** relatively to windlass shaft **50** by holding windlass shaft **50** as by contact of builder cam **70** and cam follower **72** providing a ring rail stop, while rotating gear **52** by means of handle **95** or rack **91** under the influence of piston and cylinder **90** in a direction to move latch lobe **59** toward and past latch operating element **68** to operate the latch to move pin **63** from latch surface **66** to **64** and so press lobe **61** into contact with sleeve surface **56**. Sleeve **54** can then be moved in the opposite direction, with lobe **61** passing beyond recess **57** without engaging it to a position past the other latch operating element **67**, when the latch is again operated so that its lobe **59** is again in contact with sleeve surface **56**, as is shown in FIG. 7. Movement in the same direction may continue at least until control ring bar **29** is in the fully lowered position, but reverse movement will result in lobe **59** being received within recess **57** into the latched position for synchronous operation of sleeve **54** with windlass shaft **50**.

PICK MOTION

The pick motion mechanism of the present invention, as best shown in FIGS. 1 and 8 through **10** provides a novel hydraulically actuated clutch release operable effectively to disconnect the traversing spinning ring rails **26**, control ring bars **29** and thread guide rods **32** from the builder mechanism for additional movement of such elements to an elevated tip winding position.

Thus, the differential pick mechanism **100** herein disclosed as embodying features of the invention comprises an input differential gear **102** mounted on a sleeve member **104** which is in turn freely rotatable on an inner sleeve **106** carried on a core shaft **108** of the pick assembly. An output differential gear **110** formed with a sleeve extension **112** rotatable on the core shaft **108** is mounted in parallel relation to the input differential gear **102**. Both said gears are provided with internal gear teeth, the output gear **110** having a slightly smaller number of teeth than the input gear **102**. A divided planet gear **114** is arranged to mesh continuously with both said internal gears, being mounted to turn on a pivot **116** carried by an offset frame **118** attached to the inner sleeve **106** above referred to. The output gear **110** is normally connected to rotate a driving sleeve member **119** supported externally of the output gear **110** and sleeve **112** and normally connected to turn as a unit therewith—by means of a hydraulically operated clutch hereinafter to be described.

The position of the divided planet gear **114** with relation to the input differential gear **102** is controlled to impart an oscillatory movement to the output differential gear **110** and, in addition thereto, a stepped advancing movement of the output differential gear **110** with relation to the input differential gear **102** for each oscillation of the input gear **102** through connections which include a ratchet wheel **120** secured to the inner sleeve **106** to turn as a unit with the planet gear supporting frame **118**. A pair of pawls **122**, **124** mounted on a stationary pivot **126** are arranged when engaged with the ratchet wheel **120** to lock the ratchet wheel **120** and planet gear supporting frame **118** against rotational movement with the input differential gear **102** so that the planet gear **114** is caused to rotate on its pivot to advance the output differential gear **110** with relation to the input differential gear **102**.

The operation of the pawls **122** and **124** is controlled by means of a shield **128** secured by means of a split clamp **130** to the supporting sleeve member **104** for the input differential gear **102**. The shield **128** is of substantial size causing the pawls **122**, **124** to be held in a raised inoperative position at all times during reciprocatory movement of the input differential gear except for a small portion of said movement at one end of the stroke when the pawls are permitted to engage the ratchet wheel **120**. With this arrangement, the planet gear normally moves bodily as a unit with the two input and output differential gears **102** and **110** operating as a locking device to oscillate said gears as a unit. When the ratchet wheel **120** and planet gear supporting frame **118** are held by said engagement of said pawls **122**, **124** therewith, the planet gear is rotated by the continued movement of the input differential gear **102**, thus producing a small increment of advancing movement of the output differential gear **110** with relation to the input differential gear **102**.

The arrangement of the pick mechanism, builder cam assembly, the windlass assembly, the compensating take-up mechanism and the several operating connections therebetween is such that the overbalancing bias imparted by the torison bar **80** acts normally to keep the follower **72** in operative engagement with the builder cam **70**, and at the same time maintains a torque strain on the elements of the differential mechanism which is normally effective to prevent rotating or walking of the planet gear **114** with relation to the input and output differential gears during the reciprocatory movement of the input differential gear **102**.

The means for automatically resetting the pick mechanism **100** comprises a coiled rewind torsion spring **134** which wraps around and extends along the periphery of the input and output differential gears **102** and **110**, being secured at one end to a bracket **136** on the input differential gear **102** and at its other end to a bracket **138** in the driven sleeve member **119** connected to operate the windlass shaft assembly of the frame. The torsion spring **134** tends to rotate the driven sleeve member **119** in the opposite direction from the bias exerted by the compensating torsion bar **80** to a start wind position of the pick mechanism in which the bracket **138** is moved downwardly.

In the winding of bobbins **24** on the spinning frame, the continued operation of the pick mechanism **100** will cause the continuously oscillating output differential gear **110** and driven sleeve member **119** to be gradually moved ahead with relation to the continuously oscillating input differential gear **102** in the same direction as, and under the influence of the bias exerted by the compensating torsion bar **80**. This movement of the driven differential gear **110** and driven sleeve member **119** with relation to the input differential gear **102** winds the reset torsion spring **134** which as above noted is of less strength than the bias exerted by the compensating torsion bar **80**. At the end of the winding operation the bracket **138** will have moved ahead to about the position indicated in dot-and-dash lines in FIG. 8.

In the illustrated construction the output differential gear **110** is connected with the driven sleeve member **119**, chain **78** and windlass shaft **40** by means of a hydraulically operated clutch release mechanism as follows:

The sleeve extension **112** of the output differential gear element **110** provides support for a sleeve clutch member **142** connected by a key **144** to turn with, and for a limited axial movement relative to, the sleeve extension **112** of output differential gear **110**. The sleeve clutch element **142** carries a series of clutch plates **146** which are adapted for engagement with cooperating plates mounted on the driven sleeve member **119** having connected thereto the chain **78**. The sleeve clutch member **142** is normally supported in clutching relation to the driven sleeve element **119** by means of a series of coiled compression springs **148** supported in recesses formed in an end face of the clutch element **142** for engagement with a ring

stop member **150** backed by a locking ring **152** on the sleeve extension **112**. The fluid pressure operated mechanism for releasing the clutch comprises a piston and cylinder, generally designated **160** (FIG. 12) including a ring shaped plunger **162** which is supported exterior to, and is operatively connected with the clutch member **142**. The ring plunger **162** is fitted into an annular groove forming a ring shaped pressure chamber in one end face of a heavy ring support **164** which forms a part of the pick mechanism casing. Fluid pressure is supplied to the face of the ring plunger **162** through an inlet fluid pressure supply line **166** which connects with the inner face of the ring shaped pressure chamber, and is thence distributed around the periphery of said chamber is an annular recess **168**. Two O-rings **170** interposed between the side walls of the ring shaped pressure chamber and the ring plunger **162** act as pressure seals. At its left hand end as shown in FIG. 8 the ring plunger **162** is connected by needle thrust bearings **172** with an abutting flange **174** which is in turn backed by a stop ring **176** fitted into a groove in the periphery of the slidable clutch sleeve **142**. With this arrangement, sleeve element **119** is free to rotate under the influence of either chain **78** or torsion spring **134**.

The pick motion mechanism **100** above described with its hydraulically operated clutch release to facilitate a rapid movement of the traversing elements including the ring rail **26** to the high tip winding position in general operates in the following manner:

It is assumed that the winding operation has proceeded to normal completion in which the packages or bobbins are fully wound, with the spinning ring in raised position **27–1** in FIG. 11*a* and in which the driven differential gear **110** is fully extended with relation to the driving differential gear **102**. In this position there is normally no way in which the pick mechanism including the differential gears **102, 110** and planet gear **114** can be operated to further extend the connections between the builder cam **70** and windlass **40** to move the spinning ring from its highest builder controlled winding position at **27–1** to its tip winding position at **27–2** (FIG. 11a). At ths point the clutch piston and cylinder **160** is released by applying hydraulic fluid under pressure to the cylindrically shaped clutch pressure chamber and piston **162** through line **166**, thus disconnecting the driven sleeve **119** and chain **78** from the differential gears of the pick mechanism. The traversing elements including the ring rail **26** will now be moved to the extreme tip winding position in which cam member **84** is engaged against a stop bracket **139** on the input differential gear **102** under the influence of the torsion bar **80** and windlass **40** connected thereto. The rewind torsion spring **134** is thus still further extended. The windlass shaft and traversing elements will now be wound down to their doffing and starting position as hereinafter fully described. During this wind down operation the torsion reset spring **134** causes the driven sleeve member **119** and chain **78** to be moved in the rewind direction to the initial starting position in which the element **138** on the sleeve driven member **119** is engaged against the stop element **136** on the input differential gear **102**. The clutch is permitted to reengage only after the completion of the tip winding operation and the traversing elements have been fully wound down by exhausting fluid pressure by the control means from the inlet pipe **166** hereinafter described causing the clutch sleeve member **160** to return to the engaged position under the influence of spring **148** and so reset.

HYDRAULIC CIRCUIT

The hydraulic circuit as shown in FIG. 12 and the sequential FIGS. 13 through 20 for operating main hydraulic piston and cylinder **90**, thread guide piston and cylinder **92** and pick mechanism clutch piston and cylinder **160** derives its power from hydraulic pump and motor assembly **180** which draws hydraulic fluid from hydraulic reservoir **182** and pumps it to said cylinders through a plurality of electric solenoid operated valves and adjustable orifices as controlled by cam operated switches **200–1** through **200–8** through electrical circuitry to be hereinafter described.

The valves are shown in FIG. 12 in their normal position with the frame running solely under the influence of builder cam **70**. Said valves include a 3-position main cylinder valve **184** operated from its central position shown to its two energized side positions by solenoids **184–A** and **184–B**, respectively, a main cylinder pilot valve **186** operated from its central position shown to its two energized positions by solenoids **186–D** and **186–E**, respectively, a 2-position jog valve **188** operated to its energized position by solenoid **188–C**, a 2-position thread guide valve **190** operated to its energized position by solenoid **190–F** and a two position tip winding clutch valve **192** operated to its energized position by solenoid **192–G**. Said valves are all of a type having two pairs of access lines through their housings which lines may be connected through desired flow paths by passages in the sliding valve core which may be positioned in two or three positions relatively to said access lines to provide different flow paths therebetween at predetermined times to cycle cylinders **90, 92** and **160** as desired. The structures of suitable valves is well understood and hence need not be further explained herein except as to their function as hereinafter appears.

For adjustably controlling the speed of movement of the spinning ring rail and rings **27**, both during wind down and during jogging, as is hereinafter explained in more detail, three adjustable orifices are included in the hydraulic circuit, wind down orifice **194** and jog orifices **196** and **198**, such being appropriately connected through valves **184, 186** and **188** to main piston and cylinder **90**. The structure of such orifices is well known, and hence need not be further explained herein except as to their function in connection with the operation of the spinning frame which follows.

ELECTRICAL CIRCUIT

The electrical circuit for operating hydraulic valve solenoids **184A** and B, **186D** and **188C**, and **190F** and **192G** as well as main frame motor **25** and hydraulic pump and motor assembly **180** is shown in FIG. 21.

In general, it includes, connected between power terminals **208** and **210**, in addition to said solenoids and motors, windlass cam driven switches **200–1** through **200–8**, stop, start and restart switches **202, 204** and **206**, respectively, and relays **211** through **220** with their contacts similarly numbered with further identifying reference numerals. A complete description thereof appears in the description of the operation of the entire spinning frame of the invention which follows immediately.

OPERATION

The operation of the spinning frame above described, insofar as concerns the movement of its traversing yarn guiding and winding elements—spinning rings **27**, control rings **30** and thread guides **34**—relatively to a spindle **23** and bobbin **24**, is shown in sequential steps in FIGS. 11*a, b* and *c*, cam operated switches **200–1** to **200–8** and restart switch **206** also being included in the sequence since the steps thereof are initiated by such switches. For clarity, the yarn guiding and control elements in FIGS. 11*a, b* and *c* are numbered with additional identifying numerals which correspond to their position following operation by each one of the switches numbered **200–1** through **8**, the path of motion of spinning ring **27** is shown as a dotted line, and the corresponding hydraulic diagram of FIGS. 12 to 20 of the hydraulic circuit in the particular condition effected by the operation of one of said switches is positioned below the appropriate sequential step of FIGS. 11*a, b* and *c*.

Referring now to FIG. 11*a*, FIG. 12 and FIG. 21, the various elements are shown in their normal operating condition under the sole influence of builder cam **70** and pick mechanism **100**, as biased by the torsion bar **80** which acts as a counter force mechanism, the main shaft **50** and sleeve countershaft **54** of windlass **40** being latched for oscillating movement in synchronism and pick mechanism clutch engaged so that the spinning frame is operating in a conventional manner approaching a fully wound bobbin condition with the spinning ring **27** being reciprocated along the upper end of bobbin **24** and gradually being advanced upwardly therealong by the pick mechanism **100**. The switch cam shaft **97** is being similarly reciprocated.

When the bobbin **24** has been wound to the extent desired, such will be sensed by the preset condition of switch cam **98–1**, which will at that time have advanced far enough to operate normally open switch **200–1** and begin the operation of the spinning frame mechanism with which the present invention is concerned.

Switch **200-1** starts the hydraulic pump motor **180** through contacts **212–1** by energizing relay **212** through normally closed contacts **219–5** and normally closed switch **200–5**. It also operates parallel contact **212–2** to keep relay **212** energized when switch **200–1** is released.

The position of the ring rail **27–1** (FIG. 11*a*) is shown in its normally most elevated position at this time, a more elevated position being achieved only if tip winding is to be used.

Switch **200–2** operates upon the next builder motion cycle to energize relay **213** by reason of the previous closing of contacts **212–2**. Its contacts **213–4** energize solenoid **186–E** to provide hydraulic fluid to the input ports of the other valves. Relay **213** operates contacts **213–1** to maintain itself energized. Its contacts **213–3** energize pick mechanism clutch solenoid **192–G** for flow of hydraulic fluid to pick mechanism clutch piston and cylinder **160** to disengage its clutch so that the spinning ring will be raised to a higher position at **27–2**, as explained above with reference to the operation of pick mechanism **100**, for winding a number of turns of yarn on the tip of the bobbin at **24–2**. FIG. 13 shows the hydraulic circuit in this condition with the tip winding position of the spinning ring being shown at **27–2** of FIG. 11*a*.

After a predetermined time for winding the desired number of tip turns, time delay contacts **213–2** operate to energize relay **214** which locks itself in by contacts **214—1**. Contacts **214—2** close and energize solenoid **184–A**. Contacts **214–3** have no function at this time since they are in parallel with contacts **213–4** which are already closed. Contacts **214–4** also close but have no function at this point. Solenoid **184–A** moves valve **184** to provide hydraulic fluid under pressure to the top of windlass piston **90** to move the spinning ring down, the hydraulic fluid passing through adjustable winddown orifice **194** so that the speed of winddown and hence the number of turns of yarn wound on bobbin **24** during winddown can be predetermined. FIG. 14 shows the hydraulic circuit in this condition.

About this time contacts **214–5** open to cut off power to main frame motor **25** which causes the spindle at position **23–3** to slow down and stop after the spinning ring reaches its lowered bottom position at **27–3** to provide a few wraps of yarn around the bottom of the spindle at **27–3** so that the spindle can subsequently be restarted with a new bobbin without the necessity of piecing up the yarn.

When the spinning ring reaches its bottom position at **27–3**, as shown in FIG. 11*a*, switch **200–3** is operated by its cam **98–2**. It energizes relay **215** which latches in through contacts **215–2**. Contacts **215–1** open, deenergizing solenoid **186–A** which shifts valve **186** to stop hydraulic piston and cylinder **90** in its lowered position (FIG. 15). Contacts **215–3** are closed but are without power since contacts **215–1** are open. When relay **215** times out to give main frame motor **25** time to stop, contacts **215–4** are opened, deenergizing solenoid **192–G** to move valve **192** for release of hydraulic fluid from pick mechanism piston and cylinder **160** for reengagement of its clutch (FIG. 15) in the reset condition of the pick mechanism. Solenoid **186–E** of valve **186** is also deenergized at this time. Contacts **215–5** then close to energize solenoid **184–B** through contacts **214–6**, **215–5**, **216–1**, and **215–3**, and solenoid **186–E** is again energized. The energization of solenoids **184–B** and **186–E** shifts valves **184** and **186** and causes main cylinder **90** to go up (FIG. 16), lifting the control ring and spinning ring to positions at **30–4** and **27–4** (FIG. 11*b*) until the ring rail **27** is stopped by builder cam follower **72** having come into contact with builder cam **70** (FIG. 1) while the control ring bar **29** continues to rise. Relative movement is thus produced between the windlass main shaft **50** and sleeve countershaft **54**, operating releasable latch **60** to swing it to its unlatched position and release it as explained above in connection with the operation of windlass **40** (FIGS. 5–7).

After control ring bar **29** has been raised beyond the unlatch point, cam **98–4** operates switch **200–4** which energizes relay **216**, which latches in through its contacts **216–2**. Contacts **216–3** also close but nothing happens at this point because contacts **215–4** are open. Contacts **216–1** open, dropping out solenoid **184–B**, shifting valve **184** which stops further upward movement of main cylinder **90**. Contacts **216–5** then close, energizing solenoid **188–C** through closed contacts **214–4**. Valve **188** is thus shifted, opening up a bypass through adjustable orifice **198** so hydraulic fluid can flow from main cylinder **90** as the control rings drops by gravity to a lowered position at **30–5** adjacent to the spinning ring position at **27–5** for bobbin clearance. At the same time solenoid **190–F** is operated by contacts **216–5**, shifting valve **190** for flow of pressurized hydraulic fluid to thread guide cylinder **92**, tilting the thread guide arm back to a raised thread guide position at **34–5**. The condition of the hydraulic circuit at this point appears in FIG. 17. When the control ring reaches its down position, at **30–5** (FIG. 11*b*), switch **200–5** is operated, since the rotation of its cam shaft **97** is synchronized with that of windlass sleeve **54**. Switch **200–5** stops hydraulic pump motor **180**, and drops out contacts **212–2** and relays **213**, **214** and **215** so their contacts shift.

The frame is now in condition to be doffed by either manual or machine replacement of the full bobbins with empty bobbins, the spinning ring, control ring, and thread guide being positioned for bobbin clearance at **27–5**, **30–5**, and **34–5**, respectively, as shown in FIG. 11*b*.

With the full bobbins replaced by empty bobbins, the frame is restarted by pushing restart switch **206** either manually or by the automatic doffer. This energizes relays **217** and **218**, locking them in through contacts **217–1** and **218–1**. Contacts **218–2** and **217–2** also close to energize relay **212** to start hydraulic pump and motor **180** through its contacts **12–1**. Contacts **218–1** close energizing solenoid **186–D**, operating valve **186** so that hydraulic fluid under pressure passes through the adjustable jog down control orifice **196**. Contacts **217–4** open, deenergizing solenoid **190–F** and shifting valve **190** to operate thread guide cylinder **92** to return the thread guide to its normal position at **34–6**. Contacts **217–3** close, energizing solenoid **184–B** and shifting valve **184**. This causes main cylinder **90** to go up, raising the control ring bar **29** and rotating windlass sleeve **54** relatively to its shaft **50** until latch **60** operates to once more latch the windlass elements upon being received in its recess **57**. Further raising of cylinder **90** rotates cam shaft **97** sufficiently to close switch **200–6** which operates relay **219** which locks in through its contacts **219–4**. Contacts **219–1** open, deenergizing solenoid **184–B**, shifting valve

184 and stopping further upward motion of cylinder 90. FIG. 18 shows the hydraulic circuit at this point and FIG. 11c the raised spinning ring at 27–6, control ring at 30–6 and thread guide at 34–6. Contacts 219–2 close, restarting main frame drive motor 25 to again rotate spindles 23 and builder cam 70.

With the frame starting up to wind yarn onto the empty bobbins, the jogging of the spinning rings is initiated between spinning ring positions 27–7 and 27–8 (FIG. 11c) to prevent yarn breakage as the spindles accelerate to full speed. This takes place upon the closing of contacts 219–3 energizing solenoid 184–A and shifting valve 184 which causes main cylinder 90 slowly to go down, with fluid passing through the adjustable down jog orifice 196 to the bottom winding position of the spinning ring at 27–7 (FIGS. 19 and 11c) until switch 200–7 is operated.

Switch 200–7 energizes relay 220 which latches in through its contacts 220–1. Its contacts 220–2 open, deenergizing solenoid 184–A and shifting valve 184 which stops cylinder 90. Contacts 220–4 close, energizing solenoid 188–C, shifting valve 188 which bypasses hydraulic fluid through the adjustable up jog orifice 198. Contacts 220–3 close, energizing solenoid 184–B which shifts valve 184 and causes main cylinder 90 to go up, but slowly, at a predetermined rate since the hydraulic fluid must pass through adjustable up jog orifice 198. FIG. 18 shows this condition of the hydraulic circuit.

Switch 200–8 operates at the top of cylinder travel, and deenergizes relay 220, the contacts 220–1 of which deenergize solenoid 184–B, shifting valve 184; contacts 220–4 deenergize solenoid 188–C, shifting valve 188, and contacts 220–2 energize solenoid 184–A, which shifts valve 184 causing piston and cylinder 90 to go down until switch 200–7 again operates, this down condition of the hydraulic circuit being shown in FIG. 19.

This jogging cycle as controlled by switches 200–7 and 200–8 repeats for a limited time until timer relay 219 times out, upon which ocurrence its contacts 219–5 open, shutting off hydraulic motor 180 and resetting all contacts for next doff cycle.

The spinning frame continues running under effect of builder cam 70 alone, with cylinder 90 deenergized as shown in FIG. 20 until switch 200–1 is again actuated.

It will be apparent to those skilled in the art that the spinning, twisting and the like frame of the invention is susceptible to modification. For example, it is contemplated that the tip winding function may not be needed in a particular frame, in which case its operating elements including the pick mechanism clutch and its controls may be omitted. Certain aspects of the invention are applicable to other types of textile frames than that described, for example, in which the spindles rather than the spinning rings are traversed, and in such case the control rings and their operating elements and controls are unnecessary. Other elements, such as the positioning of control switches and the type of fluid drive may also be modified, all of the above recited modifications and others as well being within the scope of the invention and the appended claims.

What is claimed is:

1. In a spinning frame and the like having means for building bobbins including spindles, bobbins on said spindles, yarn traversing and guiding elements including spinning rings, and means for rotating said spindles,

automatic control and operating mechanism comprising:

a builder motion mechanism, providing traversing movement of said spinning rings,

a counter force mechanism,

a windlass mechanism connected between said builder motion mechanism and said counter force mechanism for oscillating said windlass mechanism in synchronism with said builder motion mechanism,

said spinning rings being connected to said windlass mechanism for traversing said spinning rings in synchronism with said windlass mechanism,

fluid power operating means for operating said windlass mechanism,

said operating means rotating said windlass mechanism for moving said spinning rings downwardly independently of said builder motion mechanism,

control means initiating operation of said operating means when said bobbins are fully built first automatically to lower said spinning rings, and

automatically to stop rotation of said spindles,

restart means operable to start rotation of said spindles and said builder motion mechanism to produce traversing of said spinning rings after replacing full bobbins with empty bobbins.

said control means operating said operating means automatically to locate said spinning rings in an initial bobbin winding position.

2. In a spinning frame and the like as claimed in claim 1, wherein said fluid power operating means includes adjustable means for varying the rate of moving said spinning rings downwardly.

3. In a spinning frame and the like as claimed in claim 1, wherein said control means initiates operation of said operating means when said bobbins are fully built to lower said spinning rings to a bottom winding position beyond the bobbins to wind yarn around the spindles.

4. In a spinning frame and the like as claimed in claim 1, further including

means operable automatically by said control means when said bobbins are fully built automatically first to shift said spinning rings to a tip winding position at the upper tip of the bobbin to wind yarn around the upper tip of the bobbin.

5. In a spinning frame and the like as claimed in claim 1, wherein

said control means operates said operating means to jog said spinning rings by reciprocating said operating means and said spinning rings upon initiation of rotation of said spindles.

6. In a spinning frame and the like as claimed in claim 5, wherein said fluid power operating means includes adjustable means for varying the rate of reciprocation of said operating means and spinning rings.

7. In a spinning frame and the like as claimed in claim 6, wherein said adjustable means includes means for independently varying the upward and downward rate of said reciprocation.

8. In a spinning frame and the like having means for building bobbins including spindles, bobbins on said spindles, yarn traversing and guiding elements including spinning rings and yarn control rings, and means for rotating said spindles,

automatic control and operating mechanism comprising:

a builder motion mechanism, providing traversing movement of said spinning rings and yarn control rings,

a counter force mechanism,

a windlass mechanism having a main shaft, a countershaft rotatable relatively thereto, and releasable means connecting said shafts for synchronous rotation of said main shaft and said countershaft when said releasable means connects said shafts and relatively free rotation thereof when said releasable means releases said shafts from one another,

said main shaft being connected between said builder motion mechanism and said counter force mechanism for oscillating said main shaft in synchronism with said builder motion mechanism,

said spinning rings being connected to said windlass mechanism main shaft for traversing said

spinning rings in synchronism with said main shaft, and

said yarn control rings being connected to said windlass mechanism countershaft for traversing said yarn control rings in synchronism with said countershaft,

fluid power countershaft operating means for operating said windlass countershaft,

said countershaft operating means rotating said countershaft for moving said spinning rings and said control rings downwardly independently of said builder motion mechanism, when said releasable means connects said main shaft and said countershaft and additionally for traversing said control rings independently of said spinning rings upon release of said releasable means to lower said control rings to a lowered position adjacent said spinning rings facilitating removal of full bobbins from said spindles,

control means initiating operation of said countershaft operating means when said bobbins are fully built automatically to lower said spinning rings, and

to lower said control rings independently of said spinning rings to said lowered position adjacent said spinning rings facilitating removal of full bobbins from said spindles, said control means operating automatically to stop rotation of said spindles,

restart means operable to start rotation of said spindles and said builder motion mechanism to produce traversing after replacing full bobbins with empty bobbins,

said control means operating said countershaft operating means automatically to shift said control rings to an initial bobbin winding position after operation of said restart means.

9. In a spinning frame and the like as claimed in claim **8** further including

thread guides and

thread guide fluid power operating means operable to move said thread guides to a position remote from their running position facilitating removal of full bobbins from said spindles,

said control means operating said thread guide fluid power operating means to move said thread guides to said remote position after stopping of rotation of said spindles, and to return said thread guides to said running position after operation of said restart means.

10. In a spinning frame and the like as claimed in claim **9**, wherein

said countershaft operating means operates said releasable means.

11. In a spinning frame and the like as claimed in claim **9**, further including

stop means preventing rotation of said windlass mechanism main shaft beyond a main shaft position corresponding to a maximum raised position of said spinning rings, and

wherein said countershaft operating means operates said releasable means upon rotation of said countershaft means in one direction to a countershaft position beyond said main shaft position, said countershaft upon operation of said releasable means being free to move relatively to said main shaft in the opposite direction to said one direction for movement of said control rings by gravity to said lowered position.

12. In a spinning frame or the like as claimed in claim **11**, wherein said releasable means includes a two position latch means operating in said one direction alternately to release and to connect said shafts.

13. In a spinning frame or the like as claimed in claim **12**, wherein said countershaft is a sleeve surrounding said main shaft, and said latch means is interposed therebetween.

14. In a spinning frame and the like having means for building bobbins including spindles, bobbins on said spindles, yarn traversing and guiding elements including spinning rings and yarn control rings, and means for rotating said spindles,

automatic control and operating mechanism comprising:

a builder motion mechanism, providing traversing movement of said spinning rings and yarn control rings,

a counter force mechanism,

a windlass mechanism having a main shaft, a countershaft rotatable relatively thereto, and releasable means connecting said shafts for synchronous rotation of said main shaft and said countershaft when said releasable means connects said shafts and relatively free rotation thereof when said releasable means releases said shafts from one another,

said main shaft being connected between said builder motion mechanism and said counter force mechanism for oscillating said main shaft in synchronism with said builder motion mechanism,

said spinning rings being connected to said windlass mechanism main shaft for traversing said spinning rings in synchronism with said main shaft, and

said yarn control rings being connected to said windlass mechanism countershaft for traversing said yarn control rings in synchronism with said countershaft,

fluid power countershaft operating means for operating said windlass countershaft,

said countershaft operating means rotating said countershaft for moving said spinning rings and said control rings downwardly independently of said builder motion mechanism, when said releasable means connects said main shaft and said countershaft and additionally for traversing said control rings independently of said spinning rings upon release of said releasable means to lower said control rings to a lowered position adjacent said spinning rings facilitating removal of full bobbins from said spindles,

control means initiating operation of said countershaft operating means when said bobbins are fully built automatically to lower said spinning rings to a bottom winding position beyond the bobbins to wind yarn around the spindles, and

next automatically to lower said control rings independently of said spinning rings to said lowered position adjacent said spinning rings facilitating removal of full bobbins from said spindles, said control means operating automatically to stop rotation of said spindles after winding yarn around said spindles,

restart means operable to start rotation of said spindles and said builder motion mechanism to produce traversing after replacing full bobbins with empty bobbins,

said control means operating said countershaft operating means automatically to shift said spinning rings to an initial bobbin winding position, to shift said control rings to an initial bobbin winding position after operation of said means operable to start rotation of said spindles and to jog said elements by reciprocating said operating means and said spinning rings upon initiation of rotation of said spindles.

15. In a spinning frame and the like as claimed in claim **14**, wherein said fluid power operating means includes,

adjustable means for varying the rate of moving said spinning rings downwardly and for varying the rate of jogging said spinning rings.

16. In a spinning frame and the like having means for building bobbins including spindles, bobbins on said spindles, yarn traversing and guiding elements including spinning rings and yarn control rings, and means for rotating said spindles,

automatic control and operating mechanism comprising:

a builder motion mechanism, providing traversing movement of said spinning rings and yarn control rings,

a builder cam and

a resettable pick mechanism having a relesable clutch,

a counter force mechanism,

a windlass mechanism having a main shaft, a countershaft rotatable relatively thereto, and releasable means connecting said shafts for synchronous rotation of said main shaft and said countershaft when said releasable means connects said shafts and relatively free rotation thereof when said releasable means releases said shafts from one another,

said main shaft being connected between said builder motion mechanism and said counter force mechanism for oscillating said main shaft in synchronism with said builder motion mechanism,

said spinning rings being connected to said windlass mechanism main shaft for traversing said spinning rings in synchronism with said main shaft, and

said yarn control rings being connected to said windlass mechanism countershaft for traversing said yarn control rings in synchronism with said countershaft,

fluid power countershaft operating means for operating said windlass countershaft,

said countershaft operating means rotating said countershaft for moving said spinning rings and said control rings upwardly independently of said traversing builder motion mechanism upon release of said clutch and downwardly independently of said builder motion mechanism, when said releasable means connects said main shaft and said countershaft and additionally for traversing said control rings independently of said spinning rings upon release of said releasable means to lower said control rings to a lowered position adjacent said spinning rings facilitating removal of full bobbins from said spindles,

control means initiating operation of said countershaft operating means when said bobbins are fully built first automatically to raise said spinning rings to a tip winding position to wind yarn around the tips of said bobbins and then to lower said spinning rings to a bottom winding position beyond the bobbins to wind yarn around the spindles, and

next automatically to lower said control rings independently of said spinning rings to a lowered position adjacent said spinning rings facilitating removal of full bobbins from said spindles, said control means operating automatically to stop rotation of said spindles after winding yarn around said spindles,

restart means operable to start rotation of said spindles and said builder motion mechanism to produce traversing after replacing full bobbins with empty bobbins,

said control means operating said countershaft operating means automatically to shift said spinning rings to an initial bobbin winding position, to shift said control rings to an initial bobbin winding position after operation of said means operable to start rotation of said spindles and to jog said elements by reciprocating said operating means and said spinning rings upon initiation of rotation of said spindles.

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