United States Patent [19]

Glazener

[11] **3,811,628**

[45] **May 21, 1974**

[54] **CONTROL MEANS FOR THE BUILDER MECHANISM OF TEXTILE YARN TWISTER OR LIKE MACHINE**

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[22] Filed: **Nov. 7, 1972**

[21] Appl. No.: **304,380**

[52] **U.S. Cl.**..... **242/26.1,** 242/26.2, 242/26.3, 242/26.4

[51] **Int. Cl.**..... **B65h 54/28**

[58] **Field of Search** ..... 242/26.1, 26.2, 26.3, 26.4, 242/43, 43.1, 158 R, 158.2, 158.4 R, 158.4 A; 57/99

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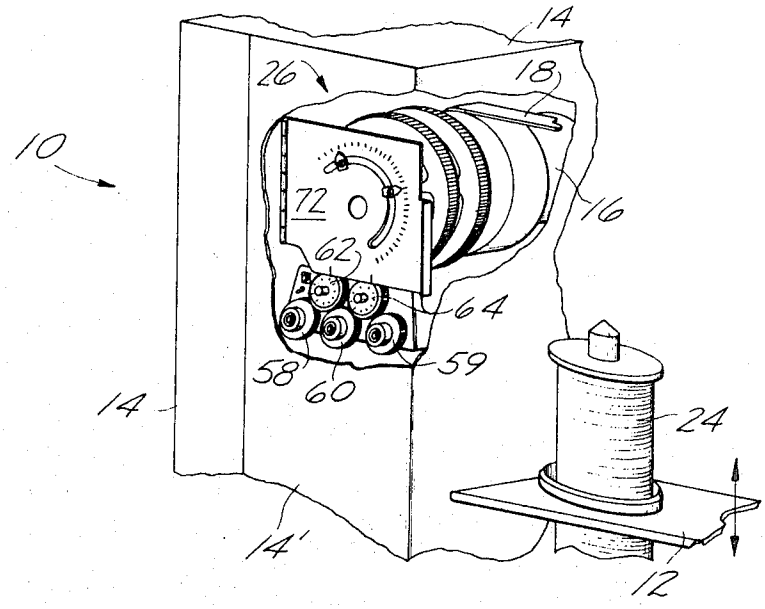
Primary Examiner—Stanley N. Gilreath

Attorney, Agent, or Firm—Joseph H. Heard

[57] **ABSTRACT**

The control means is characterized by versatility and reliability of operation, and in the disclosed embodiment includes proximity-type switching elements mounted within an end cabinet of the textile machine and movable by adjustable drive means along arcuate paths of travel about the axis of the shaft of the windlass of the builder mechanism.

18 Claims, 10 Drawing Figures



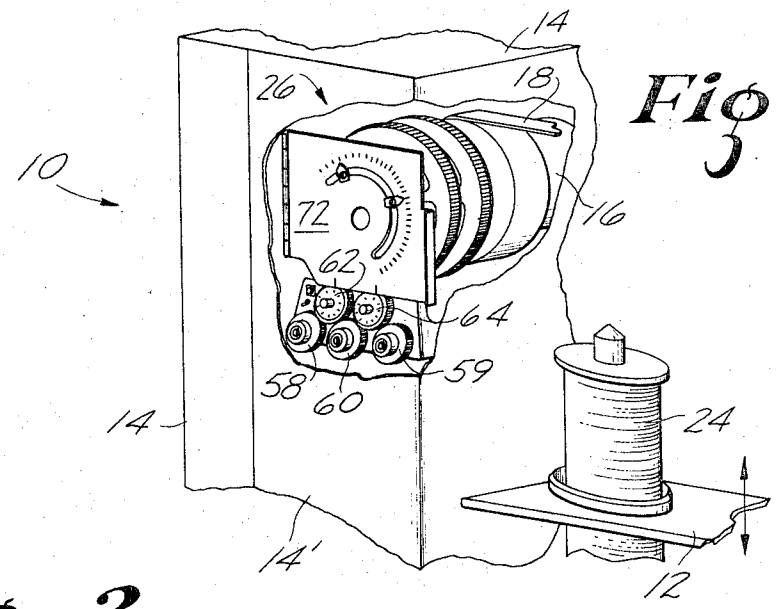

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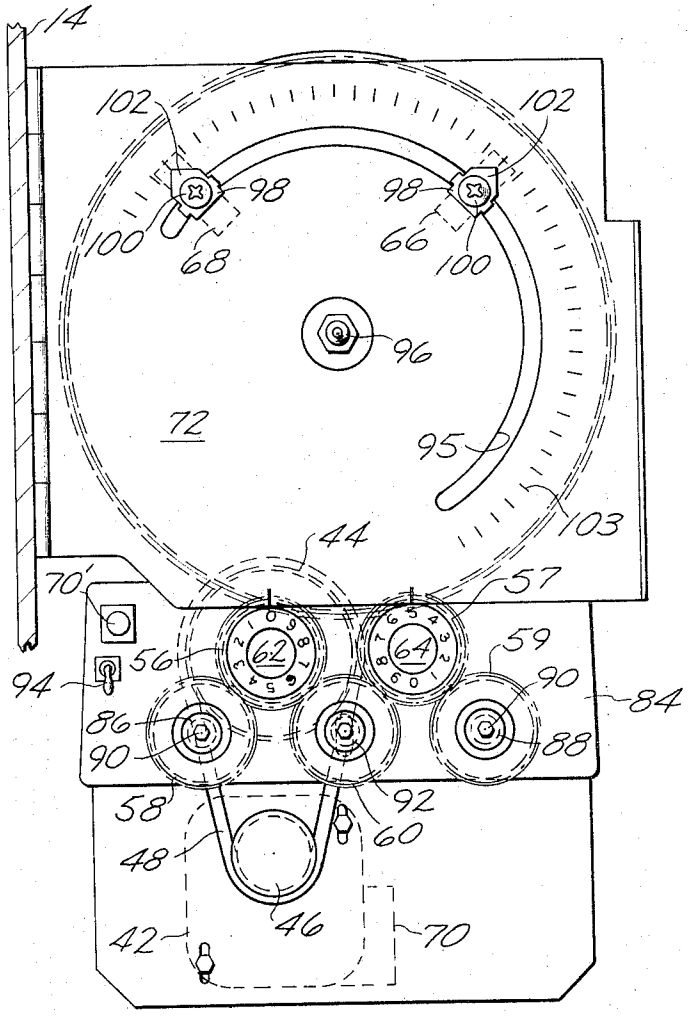
Fig. 1

Fig. 2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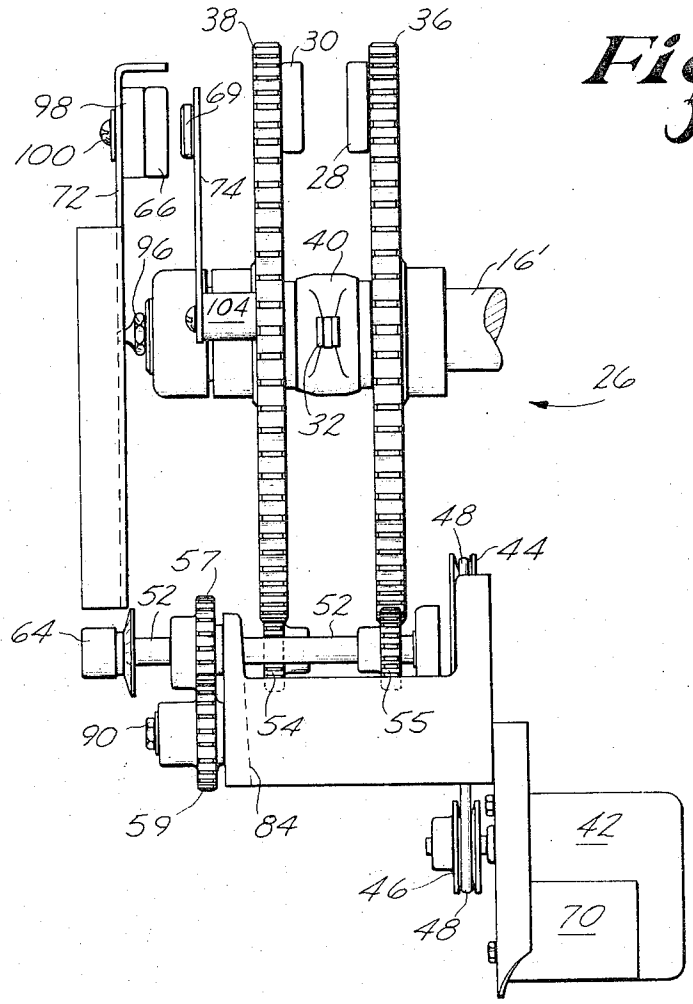


Fig. 3

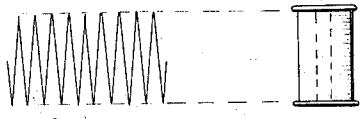


Fig. 6A

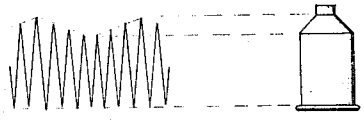


Fig. 6B

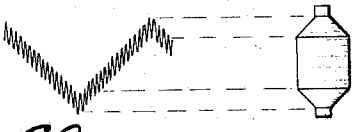


Fig. 6C

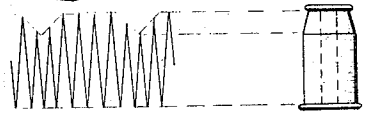


Fig. 6D

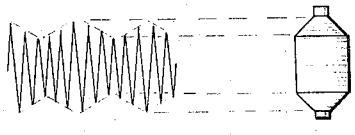
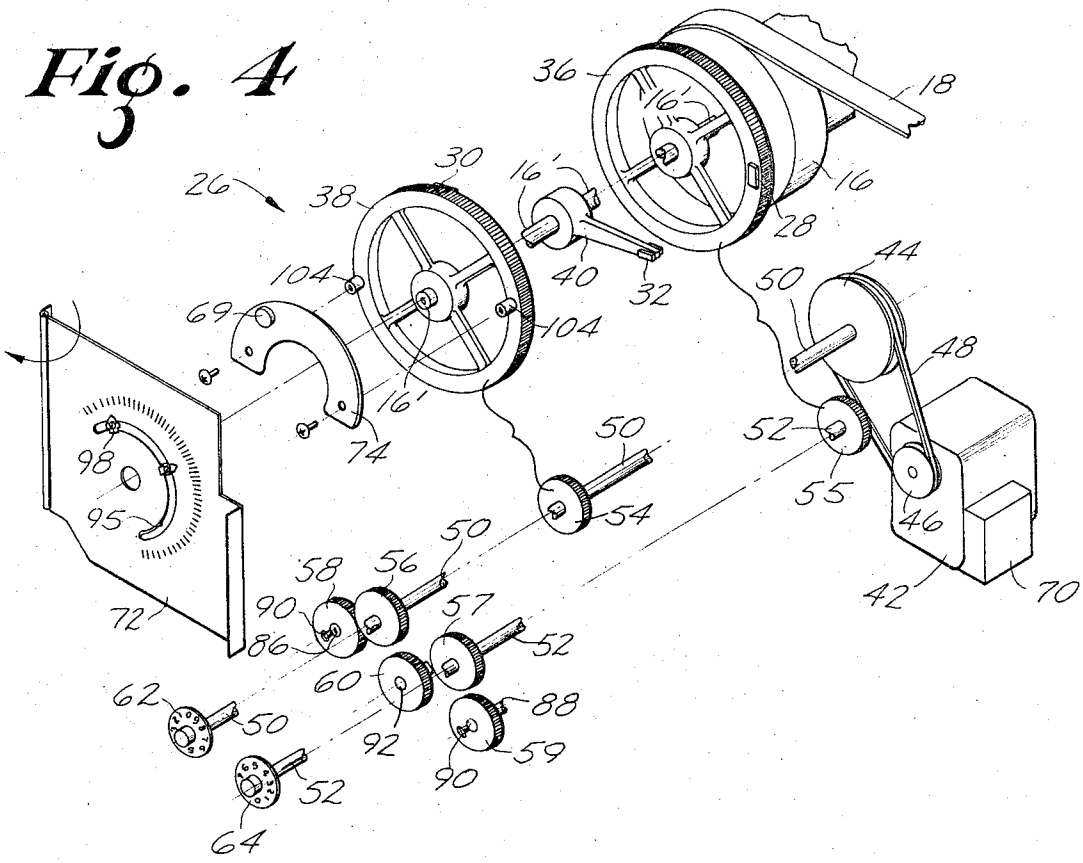


Fig. 6E

Fig. 4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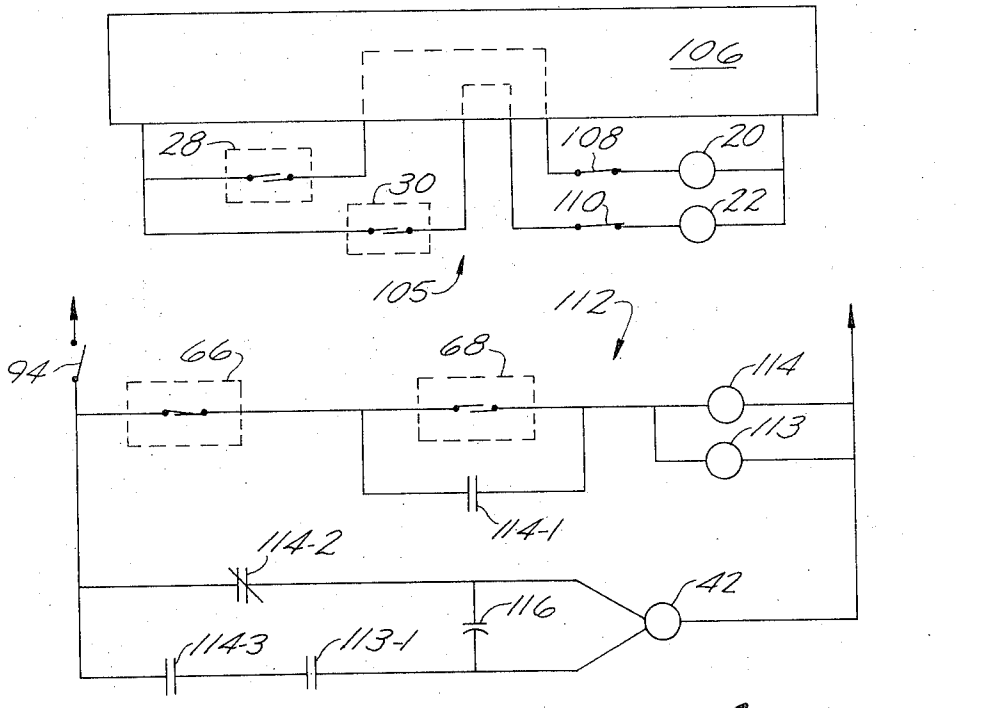
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114-3
113-1

Fig. 5

CONTROL MEANS FOR THE BUILDER MECHANISM OF TEXTILE YARN TWISTER OR LIKE MACHINE

BACKGROUND OF THE INVENTION

This invention relates to builder mechanisms for textile yarn twisters or like machines, and more specifically relates to an improved control means for builder mechanisms of the type including reversible drive means for imparting vertical reciprocatory movement to the ring rail of the textile machine.

Control means of the aforesaid general type have heretofore been proposed: see e.g., U. S. Pat. No. 3,484,050. However, none of the prior control means known to applicant have possessed all of the characteristics necessary for optimum commercial utilization. The prior control means frequently include abutment-type limit switches mounted in exposed locations upon the textile machine immediately adjacent one of its reciprocatorily movable ring rails for mechanical actuation by the ring rail or a mechanical actuator mounted upon it. This is undesirable for a variety of reasons. The ring rails of textile machines of the type in question at times undergo "bounce," "jiggle," or other erratic movement due to extraneous causes, which can easily occasion malfunctioning of the switching operation. Further, the exposed and wide-spread locations of the various components of the control means may impede or prohibit the utilization of desired accessory equipment, such as traveling cleaning apparatus or automatic dolfing apparatus, in association with the textile machine; and will in any event render the control means subject to unauthorized tampering, to accidental impacts, and to deterioration from the ofttimes humid and/or lint congested atmosphere prevalent in textile mills. Mechanical failure of the control means, in addition to possibly being hastened by one or more of the foregoing factors, also tends to ensue fairly rapidly due to wearing of the repeatedly abutting components of the mechanical-type switching elements.

Apart from the foregoing deficiencies, the prior control means have not in all instances possessed the desired degree of versatility of utilization and ease of adjustment in operation. In the latter connection, it is of course highly desirable that the control means be readily adjustable, by only semi-skilled textile mill employees, so as to permit the production by the textile machine of any desired one of numerous possible yarn-package "builds" or configurations.

OBJECTS OF THE INVENTION

With the foregoing in mind, the primary object of the present invention is the provision of improved control means, for a builder mechanism of the type described, which is highly versatile in operation and may be quickly and easily adjusted to permit the formation of many different yarn-package "builds" or structures, and which at the same time is quite durable and reliable in operation.

Another object is the provision of control means of the described type which in no way impedes or prohibits the utilization of automatic cleaning or dolfing apparatus, or any other desired accessory equipment, in association with the textile machine.

A related and more specific object is the provision of control means which is not affected by "bounce," "jiggle" or other erratic movements of the ring rail of the textile machine with which the control means is employed.

Still another related and more specific object is the provision of control means, of the type described, which is so situated within the textile machine as to not be readily subject to possible accidental impacts, unauthorized tampering and direct exposure to the offtimes humid and/or lint-congested atmosphere normally prevalent in a textile mill.

Still another object is the provision of control means of the type described which is of highly compact and economical construction, and which employs switching elements not prone to rapid mechanical failure due to repeated abutment of their components.

SUMMARY OF THE INVENTION

The present invention provides a builder-mechanism control means including switch means and switch-actuating means, which preferably are of a nonengaging proximity type operable by magnetic forces, mounted distal from the ring rail of the textile machine for arcuate movement relative to one another along generally concentric arcuate paths of travel toward and away from adjustably variable positions of nonengaging proximity to one another; and further includes adjustable switching drive means for effecting the aforesaid relative arcuate movement between the switch means and the switch-actuating means. The switch means is so connected to the reversible builder drive means of the builder mechanism of the textile machine as to, upon each proximity actuation of the switch means by the switch-actuating means, reverse the direction of the builder drive means and thereby reverse the direction of reciprocatory movement of the ring rail of the textile machine. Preferably all components of the control means are mounted within and enclosed by the end cabinet of the textile machine which normally houses the windlass of the machine's builder mechanism, so as to be shielded by such cabinet from impacts, tampering and the ambient air; and preferably the various switches and switch-actuators of the control means are mounted upon or in close association with the windlass shaft for exceedingly stable movement along arcuate paths of travel concentric with the axis of such shaft.

DESCRIPTION OF THE DRAWINGS

Other features and benefits of the invention will be apparent from the following description of an illustrative embodiment thereof, which should be read in conjunction with the accompanying drawing, in which:

FIG. 1 is a fragmentary perspective view, partially broken away, of an end cabinet and part of a ring rail of a textile yarn twister or like machine equipped with builder-mechanism control means embodying the invention;

FIG. 2 is an enlarged front elevational view of the control means shown in FIG. 1;

FIG. 3 is a side elevational view of the control means of FIG. 2;

FIG. 4 is an exploded and partially diagrammatic perspective view of the control means;

FIG. 5 is a schematic showing of the electrical circuitry of the apparatus; and

FIGS. 6A–6E are diagramatics representations of various yarn package builds achievable by use of the control means.

DESCRIPTION OF THE PREFERRED EMBODIMENT

Referring more particularly to the drawings, the textile yarn twister or like machine **10** fragmentarily shown in FIG. **1** includes a vertically movable ring rail **12** adapted to traverse yarn package **24,** and has a builder mechanism housed within an end cabinet **14** and including a rotatable windlass **16** connected to ring rail **12** by a lifter tape **18** and other conventional components (not shown). Cabinet **14** is provided with one or more access doors **14'**, which may be provided with a suitable lock (not shown), which may be opened to provide convenient access by authorized persons to the interior of cabinet **14.** The builder mechanism within cabinet **14** further includes builder drive means drivably connected to windlass **16,** and including electric reversing clutches **20,22** diagramatically shown in FIG. **5,** for rotating the windlass in alternate opposite directions to thereby cause vertical reciprocatory movement of rail ring **12.** As is well known to those skilled in the art, the reciprocatory movement of ring rail **12** determines the basic "build" or structural characteristics of the yarn packages **24** produced by machine **10.** It is of course understood that while only one ring rail **12** and yarn package **24** are fragmentarily shown in FIG. **1,** there would customarily be two ring rails **12,** disposed on and extending longitudinally of opposite sides of the textile machine, and each ring rail **12** would vertically traverse a plurality of yarn packages **24** spaced along the length thereof.

The builder-mechanism control means of the present invention is designated in its entirety in the drawings by the numeral **26** and, as is shown in FIG. **1,** preferably is also enclosed entirely within end cabinet **14** of machine **10.** As is more clearly revealed in FIGS. **2–4,** control means **26** generally comprises switch means including proximity-type switch elements **28,30** operatively connected to the reversing clutches **20,22** (FIG. **5**) of the builder drive means for, when actuated, reversing such drive means and thereby causing reversal of the direction of the reciprocatory movement of ring rail **12;** proximity-type switch-actuating means, in the form of an actuator element **32,** for actuating elements **28,30** when in nonengaging proximity thereto; mounting means including gear-like members **36,38** and an arm-like member **40,** which members are all supported upon and rotatable about the axis of a forwardly projecting portion of the center shaft **16'** of windlass **16,** for respectively mounting switch elements **28,30** and actuator element **32** adjacent one another for nonengaging arcuate movement relative to one another, along mutually spaced and substantially concentric arcuate paths of travel, toward and away from adjustably variable proximity positions of nonengaging actuation of switch elements **28,30** by actuator element **32;** switching drive means for effecting the aforesaid relative movement between switch elements **28,30** and actuator element **32,** such switching drive means including a reversible electric servo motor **42,** pulleys **44,46** and interconnecting belt **48,** shaft members **50,52** gears **54–60** and adjustment knobs **62,64;** and adjustable means for controlling the operation of reversible electric servo motor **42,** such means including proximity-type switch elements **66,68** for when actuated reversing the direction of operation of motor **42,** a proximity-type actuator element **69** for actuating switch elements **66,68** when in nonengaging proximity thereto, an adjustable timing element **70** for at desired times delaying reversal of motor **42,** and means including plate-like mounting members **72,74** respectively mounting switch elements **66,68** and actuator element **69** adjacent one another for relative nonengaging movement therebetween along arcuate paths of travel substantially concentric with the forwardly projected axis of windlass shaft **16'**.

In the preferred embodiment of the apparatus shown in the drawings, proximity switch-actuators **32,69** comprise small but relatively powerful magnets, while proximity switches **28,30,66** and **68** each are of the type actuable by magnetic forces. Magnetically actuable proximity switches are known to those skilled in the art and are commercially available, one suitable model being sold by the Reed Switch Developments Company, Inc. (Greenwich, Connecticut) under the catalog designation V1-D. The reed-like contacts of such switches are permanently encased within a capsule formed of plastic and/or glass material, so as to be completely shielded from dust, lint and similar materials which might impede operation of the switches and/or shorten their useful lives. The durability and reliability of switch elements **28,30** and **66,68,** and of their respective associated actuators **32,69,** is further enhanced by the fact that actuation of the former by the latter ensues from only nonengaging proximity therebetween, as a result of which the switches and actuators can be and are all mounted such that wear-inducing physical contact between them never occurs.

The mounting means for the aforesaid switching elements includes, as previously noted, gear-like members **36,38** and arm-like member **40.** Gear-like members **36,38** are each mounted by suitable bushings (not shown) upon windlass shaft **16'** for free rotative movement relative to that shaft and about its axis. Switch elements **28,30** are secured to confronting side faces of members **36,38** respectively, for movement therewith along arcuate paths of travel concentric with the axis of shaft **16'**, and flexible electrical leads (not shown) extend therefrom to electrical circuitry to be subsequently described. Intermediate gear-like members **36,38,** arm member **40** is clamped, key and/or otherwise fixedly secured to shaft **16'** for oscillatory movement in unison with the shaft and windlass **16.** Magnetic switch-actuator element **32** is mounted upon the outer end of arm member **40** for movement therewith about the axis of shaft **16'**. Elements **28,30** and **32** are disposed approximately equidistant in a radial direction from the axis of shaft **16'**, and are in spaced adjacent relationship to one another along the length of shaft **16'**. Relative arcuate movement between switch elements **28,30** and actuator element **32** therefore brings the switch elements toward and away from positions of nonengaging switch-actuating proximity to actuator element **32.** Dispersion of the relatively concentrated magnetic field produced by element **32** is prevented by forming members **36,38** and **40** of non-magnetic material, preferably aluminum. This further insures that switch elements **28,30** will be actuated only when in close proximity to actuator element **32,** and not at other times by "stray" magnetic flux.

Shaft members **50,52** of the switching drive means are rotatively mounted by suitable bearings (not shown) in laterally spaced and generally parallel relationship to each other beneath and substantially paral-

lel to forwardly projecting shaft portion 16' of windlass 16. Gears 54,55 are keyed or otherwise fixedly secured to shafts 50,52, respectively, in respective meshing engagement with gear-like members 38,36. Pulley 44 is keyed or otherwise fixedly secured to shaft 50 rearwardly of gear 54, and is connected by drive belt 48 to output pulley 46 of reversible servo motor 42, which is mounted in any suitable manner beneath shaft 50. Adjacent their forwardmost end portions, shafts 50,52 pass through a frame-plate 84 (FIGS. 2 and 3). Additional gears 56,57 are respectively keyed or otherwise fixedly (but removably) secured to the respective shafts 50,52 forwardly of frame-plate 84 but rearwardly of the adjustment knobs 62,64 removably affixed to the free outer ends of the shafts. Non-rotatable stub shafts 86,88 carried by and projecting forwardly from frame plate 84 mount idler gears 58,59 in meshing engagement with gears 56,57, respectively. By tightening or loosening locking elements 90 (FIG. 2) provided at the other ends of stub shafts 86,88, gears 58,59 may alternatively be locked in place or made freely rotatable about the axis of the stub shafts mounting the same. A third stub shaft 92 having gear 60 mounted for rotation at its outer end is secured at its inner end by frame-plate 84 for adjustive vertical movement between a lower position, shown in FIG. 4 and wherein gear 60 is out of meshing engagement with gears 56,57, and an elevated position shown in FIG. 2 and wherein gear 60 meshes with and interconnects gears 56,57. Suitable detent means or the like (not shown) is provided in association with frame plate 84 for releasably maintaining stub shaft 92 in one or the other of its aforesaid adjustive positions.

As is best shown in FIGS. 1 and 2, gears 56–60 and knobs 62,64 are all readily accessible from the front of cabinet 14 of machine 10 once cabinet door 14' is opened. The same is also true with respect to the various adjustable control members associated with reversible servo motor 42. Both the manually operable master switch 94 (FIGS. 2 and 5) for motor 42 and the control knob 70' (FIG. 2) for its timer 70 are mounted in the vicinity of knobs 62,64, as upon frame-plate 84, while the plate-like member 72 mounting proximity switches 66,68 is disposed thereabove.

Plate-like member 72 is hingedly mounted along one side edge to cabinet 14 for forward pivotal movement when access to the components rearwardly of it is desired. An arcuate slot 95 provided through plate 72 is concentric with the projected axis of windlass shaft 16'. The forward terminal end of shaft 16' is disposed rearwardly of plate 72, and is provided with a lubrication fitting 96 thereon. Proximity switch elements 66,68 are mounted upon the rear face of plate 72 by a pair of identical bracket members 98, each of which is provided with a releasable locking screw 100 and a pointer 102 upon its forwardmost part. Brackets 98 are mounted within arcuate slot 95 for adjustive sliding movement longitudinally of such slot upon loosening of locking screws 100. Each switch 66,68 of course moves with its associated bracket 98 along slot 95, and therefore along an arcuate path of travel concentric with the projected axis of windlass shaft 16'.

As is best shown in FIGS. 3 and 4, the plate-like member 74 mounting, upon its forwardmost face, the magnetic actuator element 69 associated with switches 66,68, is secured to the forward face of gear-like member 38, for movement in unison therewith. To prevent magnetic flux from actuator 69 possibly affecting operation of the proximity switch 30 mounted on the opposite, rear face of member 38, plate 74 is spaced from member 38 by bosses 104 and is formed of steel or similar material capable of performing a magnetic-shunt function. Bosses 104 also serve to position plate 74 and actuator element 69 in spaced adjacent relationship to plate 72 and its switch elements 66,68. All of the elements 66,68 and 69 are approximately equidistant in a radial direction from the projected axis of windlass shaft 16'. Relative arcuate movement of the elements about such axis therefore brings switch elements 66,68 toward or away from proximity positions of actuation by actuator 69.

Referring now to FIG. 5, and initially to the upper portion thereof, reversing clutches 20,22 of the builder control means are disposed in a circuit 105 which further includes normally open proximity switches 28,30, a conventional circuit-holding device 106, and normally closed limit switches 108,110. Actuation of switch 28 by actuator 32 (FIGS. 3 and 4) energizes clutch 20, which in turn causes the builder drive means (not shown) to rotate windlass 16 (FIG. 1) in a counterclockwise direction effecting upward movement of ring rail 12 (FIG. 1). Device 106 maintains clutch 20 in an energized condition, notwithstanding deactuation of switch 28, until switch 30 is actuated by actuator 32 (FIGS. 3 and 4). When this occurs, clutch 20 becomes deenergized and clutch 22 energized, which causes reversal of the builder drive means, clockwise rotation of windlass 16, and downward movement of ring rail 12. Device 106 maintains the foregoing conditions, notwithstanding deactuation of switch 30, until another cycle of operation is initiated by switch 28 being again actuated.

Limit switches 108,110 are those customarily provided for safety purposes upon textile machines of the type in question. They are mounted for engagement by any convenient portion of ring rail 12 or some suitable component of the builder control mechanism if movement of the ring rail should for any reason exceed safe operating limits. Excessive upward movement of ring rail 12 causes limit switch 108 to open and thereby deactuate clutch 20, while excessive downward movement of the ring rail similarly causes opening of limit switch 110 and deactuation of clutch 22. During normal operation both switches 108,110 remain closed at all times.

The servo-motor circuit 112 shown in the lower portion of FIG. 5 includes master switch 94 and a first branch wherein normally closed proximity switch 66 and normally open switch 68 are arranged in series with a conventional relay 114, and time-delay relay 113 forming part of timing device 70. A normally open holding contact 114-1 of relay 114 is arranged in parallel with switch 68. A second branch of circuit 112 includes a normally closed contact 114-2 and another normally open contact 114-3 of relay 114, normally open contact 113-1 of time-delay relay 113, reversible servo-motor 42 and a capacitor 116 operatively associated with the servo-motor. Relay contacts 114-3 and 113-1 are in series with one another and in parallel with relay contact 114-2, such that servo-motor 42 will always be caused to operate in one direction or the other when master switch 94 is closed and relay 113 has timed out. By adjustment of the control knob 70' (FIG. 2) of timing device 70, the delay between energization

of relay **113** and closure of its contact **113-1** can be varied from zero (no delay) to any desired period of time. Energization of motor **42** of course causes its output pulley **46** (FIGS. **2–4**) to rotate at a substantially uniform low speed, illustratively 0.48 RPM.

Operation of the apparatus will now be described with reference to all of the figures of the drawings, including FIG. **6,** which diagramatically illustrates various of the movements of ring rail **12** and resulting yarn-package builds achievable by use of the present control means.

To achieve the "straight wind" ring rail movement and yarn-package build shown in FIG. **6A**, the lower limit thereof is set by placing gear **60** in its downward inoperative position and then manually rotating control knob **64** (FIGS. **2–4**), which through shaft **52,** gear **55** and gear-like member **36** causes arcuate movement of proximity switch **28** about the axis of windlass shaft **16'**. Once switch **28** has reached the desired position, it is fixed in place by tightening the locking element **90** associated with the idler gear **59** meshing with gear **57** upon shaft **52.** The upper limit of the ring rail movement and yarn-package build is similarly realized by appropriate rotation of control knob **62,** which through shaft **50,** gear **54** and gear-like member **38** moves proximity switch **30** about the axis of windlass shaft **16'**, and then by tightening the locking element **90** of the idler gear **58** meshing with the front gear **56** upon shaft **50.** To assist in rapid realization of the aforesaid adjustments, appropriate indicia may be provided upon the forward faces of knobs **62,64,** as shown in FIGS. **2** and **4.** Servo-motor master switch **94** is opened so as to render the motor and its associated components inoperative. During operation of machine **10** under the foregoing conditions, proximity switch-actuator **32** oscillates in unison with windlass shaft **16'**, due to the fixed connection between such shaft and the arm **40** supporting actuator **32,** between the then-stationary proximity switches **28,30.** Upon each actuation of switch **28** or **30** by movement of actuator **32** into nonengaging proximity therewith, energization of the reversing clutch **20** or **22** associated with such switch causes reversal of the direction of movement of windlass **16** and ring rail **12.**

To produce the ring-rail movement and yarn-package build diagramatically shown in FIG. **6B**, lower-limit proximity switch **28** is fixed in position in the same manner as described above, and adjustable gear **60** is left in its inoperative lower position. Locking element **90** of the idler gear **58** associated with shaft **50** is loosened so that gear-like member **38** is susceptible to being driven by servo-motor **42** through pulleys **44,46,** belt **48,** shaft **50** and gear **54.** The arcuate positions of proximity switches **66,68,** which switches are mounted upon plate-like member **72** and control reversal of servo-motor **42,** are adjusted by sliding their brackets **98** longitudinally of plate-Slot **95** and then tightening the locking screws **100** associated with such brackets. The desired positions of switches **66,68** may be indicated by the bracket pointers **102** and suitable indicia **103** provided upon the forward face of plate **72** adjacent slot **95** thereof. The arcuate position of switch **66** determines the elevation of the major "valleys" of the motion-diagram portion of FIG. **6B**, while the arcuate position of switch **68** determines the elevation of the major "peaks" of such diagram. Master switch **94** of servo-motor **42** is closed, and control knob **70'** of timing device **70** is set to zero (no delay). When machine **10** is then set into operation, the function of proximity switches **28,30** and reversing clutches **20,22** is the same as that previously described with respect to FIG. **6A.** However, in the present mode of operation, gear-like element **38** and the proximity switch **30** carried by it do not remain stationary, but rather are oscillated about the axis of shaft **16'** by servo-motor **42** through pulleys **44,46,** belt **48,** shaft **50** and gear **54.** Proximity switch-actuator **69,** being connected by plate **74** to gear-like member **38,** of course undergoes oscillatory movement in unison with member **38** and therefore moves into and out of positions of proximity to the proximity switches **66,68** mounted upon plate **72.** Each time actuator **69** moves into proximity with switch **66** or **68,** actuation of the latter causes reversal of servo-motor **42** and ensuing reversal of the direction of oscillation of gear-like member **38.** Thus, when master switch of the circuit **112** shown in the lower portion of FIG. **5** is initially closed, motor **42** is then energized through relay contact **114-2** and rotates gear-like member **38** and actuator **69** (FIG. **4**) in a counterclockwise direction. The aforesaid movement eventually brings actuator **69** into proximity with normally open switch **68,** the actuation of which energizes relay **114** and time-delay relay **113.** Energization of relay **114** causes closure of its holding contact **114-1,** such that both relays remain energized notwithstanding subsequent deactuation of switch **68.** Additionally, energization of the relays causes contact **114-2** to open and contact **114-3** and **113-1** to close, thereby reversing motor **42** and causing reversal of the direction of oscillatory movement of gear-like member **38** and actuator **69.** Actuator **69** continues arcuate movement in its new, clockwise direction, under the impetus of servo-motor **42,** until it eventually comes into nonengaging proximity with normally closed switch **66.** When this occurs actuator **69** momentarily opens switch **66,** thereby deenergizing relays **113,114.** Immediately upon deenergization of relays **113,114,** the various contacts thereof again assume the conditions illustrated in FIG. **5,** thereby again reversing the direction of servo-motor **42.**

The yarn-package build schematically shown in FIG. **6D** is produced in essentially the same manner as described above with reference to FIG. **6B.** However, control knob **70'** of timing device **70** is adjusted so as to cause a desired time-delay between each energization of time-delay relay **113** and closure of the latter's contact **113-1.** When timer **70** is thus brought into operation, each actuation of switch **68** by actuator **69** causes complete interruption of the power to servo motor **42,** and stoppage thereof, until time-delay contact **113-1** times in. During the intervals while motor **42** is stopped, which are indicated by the "plateaus" intermediate the "peaks" of the motion diagram of FIG. **6D**, gear-like member **38** and the proximity switch **30** carried by it remain stationary.

The procedure for producing the "filling wind" yarn-package build shown in FIG. **6C** differs from that described with respect to FIG. **6B** in the following respects. The initial spacing between proximity switch elements **28,30** is decreased to the desired extent, by appropriate manipulation of control knobs **62,64,** and the initial circumferencial spacing between proximity switch elements **66,68** is suitably increased, by movement of brackets **98** along slot **95** of plate **72.** Additionally, adjustable gear **60** is moved from its lowered inop-

erative position (FIG. 4) to a raised operative position of interconnecting meshing engagement with gears **56,57** (FIG. 2). Operation of servo-motor **42** then oscillates gear-like members **36,38,** and the proximity switches **28,30** respectively carried thereby, in unison with one another and, at any given point in time, in the same direction.

The yarn-package build shown in FIG. **6**E is also producable in much the same manner as that described with respect to FIG. **6**B, with the following difference. After adjustment of the initial circumferencial spacing between proximity switch elements **28,30,** by appropriate manipulation of knobs **62,64,** gears **56,57** are removed from their respective shafts **50,52** and larger-diameter intermeshing gears (not shown) are substituted therefor. If necessary for such substitution, idler gears **58,59** may be removed from the apparatus or moved to a non-interfering position. When directly intermeshing gears are substituted for gears **56,57,** servo-motor **42** oscillates gear-like members **36,38** in unison with one another, but in opposite directions. If desired, gears **56,57** and the larger-diameter substitutes therefor (not shown) could of course all be permanently but adjustively mounted upon shafts **50,52** for movement of desired pairs of them into and out of operating position, in which event complete removal of the gears from the shafts would not be required.

The various yarn-package builds schematically illustrated in FIGS. **6** are of course only illustrative of the many different types producable by use of the present control means. Among the other types of builds which could be realized are those which would result from providing the capability for a time delay between actuation of proximity switch **66** and reversal of servo motor **42,** in addition to or in lieu of the hereinbefore described capability for a time delay between actuation of proximity switch **68** and reversal of the servo motor. Such added capability could be readily achieved by the addition of standard components to the electrical circuitry of the apparatus, as will be realized by those skilled in the art.

While a preferred embodiment of the invention has been specifically shown and described, this was for purposes of illustration only and not for purposes of limitation, the scope of the invention being in accordance with the following claims.

That which is claimed is:

1. In a textile yarn twister or like machine having a vertically recirprocatable ring rail, and a builder mechanism including reversible builder drive means for vertically reciprocating said ring rail, improved control means for at desired times reversing said drive means and thereby reversing the direction of reciprocatory movement of said ring rail, comprising:

proximity-type switch-actuating means;

proximity-type switch means operatively connected to said builder drive means for reversing said builder drive means and the direction of reciprocatory movement of said ring-rail upon actuation of said switch means by said switch-actuating means when the same are in positions of nonengaging proximity to one another;

mounting means for mounting said switch-actuating means and said switch means distal from said ring rail and adjacent one another for nonengaging arcuate movement relative to one another, along mutually spaced and substantially concentric arcuate paths of travel, toward and away from adjustably variable proximity positions of nonengaging actuation of said switch-means by said switch-actuating means;

and switching drive means operatively associated with said mounting means for effecting said relative movement between said switch-actuating means and said switch means.

2. Apparatus as in claim **1,** wherein said switch means comprises a plurality of proximity switch elements actuable by magnetic forces, and said actuator means comprises at least one magnet element.

3. Apparatus as in claim **2,** wherein said plurality of said proximity switch elements includes two of said elements mounted by said mounting means for movement thereof in spaced and substantially parallel planes, and wherein said magnet element is mounted by said mounting means for movement thereof in a plane intermediate and substantially parallel to said spaced parallel planes and is movable in correlated unison with said reciprocatory movement of said ring rail.

4. Apparatus as in claim **1,** wherein said builder mechanism includes a windlass having a center shaft, and said arcuate paths of travel of said switch-actuating means and said switch means are generally concentric with the axis of said windlass shaft.

5. Apparatus as in claim **4,** wherin said machine includes an end cabinet enclosing said windlass, said windlass shaft, said switch-actuating means, said switch means, said mounting means and said switching drive means.

6. Apparatus as in claim **5,** wherein said mounting means mounting said switch means and said switch-actuating means are carried by said windlass shaft.

7. In a textile yarn twister or like machine having a vertically reciprocatable ring rail, an end cabinet, a builder mechanism including a windlass shaft housed within said end cabinet and operatively connected to said ring rail, and reversible builder drive means for rotating said windlass shaft in opposite directions to thereby cause said reciprocatory movement of said ring rail, the improvement comprising:

control means operatively connected to said builder drive means for at adjustably variable desired times during operation of said machine reversing said drive means and thereby reversing the directions of movement of said windlass shaft and said ring rail, said control means including a plurality of switch and switch-actuating elements mounted within said end cabinet for movement along arcuate paths of travel each generally concentric with the axis of said windlass shaft, at least one of said elements being connected to said shaft for movement thereby and in unison therewith, and at least a second of said elements being movable along said path of travel thereof relative to said shaft and to said one element.

8. Apparatus as in claim **7,** wherein said elements are of a nonengaging proximity type, and include at least one magnetically actuable switch element and at least one magnetic actuator element for actuating said switch element when said elements are in nonengaging proximity to each other.

9. Apparatus as in claim **7,** wherein said control means further includes manually operable means for adjustably varying the position of said second element along said path of travel thereof.

10. Apparatus as in claim 7, wherein said control means further includes switching drive means for when desired moving said second element along said arcuate path of travel thereof.

11. In a textile yarn twister or like machine having a vertically reciprocatable ring rail, a builder mechanism including a windlass shaft operatively connected to said ring rail, and reversible builder drive means for rotating said windlass shaft in opposte directions to thereby cause said reciprocatory movement of said ring rail, the improvement comprising:

a switch actuator element mounted upon said windlass shaft for rotation in unison with said shaft about the axis thereof;

a pair of switch elements operatively connected to said reversible drive means and each adapted when actuated by said actuator element to cause reversal of said builder drive means and thereby of the direction of rotation of said windlass shaft;

means mounting said switch elements upon said windlass shaft in adjacent relationship to said actuator element for rotative movement about the axis of said shaft independently of and relative to each other and said actuator, each of said swtich elements being actuable by said actuator element when the same occupy adjacent positions about the axis of said shaft;

reversible switching drive means operatively associated with said switch-element mounting means for when desired imparting arcuate movement to at least one of said switch elements about the axis of said shaft;

and adjustable means associated with said switching drive means for reversing the direction of said movement of said one of said switch elements when the same reaches a preselected position during its arcuate movement about the axis of said shaft.

12. In a textile yarn twister or like machine having a vertically reciprocatable ring rail, a builder mechanism including a windlass having a center shaft, and reversible builder drive means operatively connected to said windlass for rotation said windlass in opposite directions to thereby cause reciprocatory movement of said ring rail, the improvement comprising:

a switch actuator mounted upon said windlass shaft of said builder mechanism and movable therewith along an arcuate path of travel in corrolation with said ring rail movement;

first and second switch elements operatively connected to said builder drive means for reversing said builder drive means and thereby the direction of movement of said ring rail upon actuation of either of said switch elements by said switch actuator;

first and second mounting members respectively mounting said first and second limit switches adjacent said path of travel of said actuator for actuation by said actuator and for independent movement of each of said switch elements generally parallel to said actuator path of travel;

and adjustable switching drive means operatively associated with said mounting means for, alternatively and when energized, moving both of said switch elements in the same direction generally parallel to said actuator path of travel, moving both of said switch elements in opposite directions generally parallel to said arcuate path of travel, and moving one of said switch elements generally parallel to said actuator path of travel while allowing the other of said switch elements to remain stationary.

13. Apparatus as in claim 12, wherein said switch elements are each proximity switches actuable by magnetic forces, and said actuator comprises at least one magnet element.

14. Apparatus as in claim 12, wherein said textile machine includes an end cabinet enclosing said windlass shaft, said actuator, said switch elements, said mounting means and said switching drive means.

15. Apparatus as in claim 12, wherein said first and said second mounting means respectively comprise first and second gear-like members carried by and freely rotatable about the axis of said windlass shaft on opposite sides of said actuator, and said adjustable switching drive means includes a servo-motor, and means including a selectively variable gear train for drivably interconnecting said drive motor with one or both of said gear-like members.

16. Apparatus as in claim 15, wherein said interconnecting means includes, in association with each of said gear-like members, a gearing shaft, a first gear on said gearing shaft meshing with the corresponding one of said gear-like members, and a second gear on said shaft forming part of said gear train.

17. Apparatus as in claim 16, wherein said gear train further includes an idler gear movable as desired into and out of meshing relationship with said second gears.

18. Apparatus as in claim 16, wherein said interconnecting means further includes belt and pulley means interconnecting one of said gearing shafts and said servo-motor.

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