June 2, 1959 C. H. GAIL 2,888,960

BED SPRING MACHINE

Filed Jan. 3, 1955 3 Sheets-Sheet 1

Fig. 1.

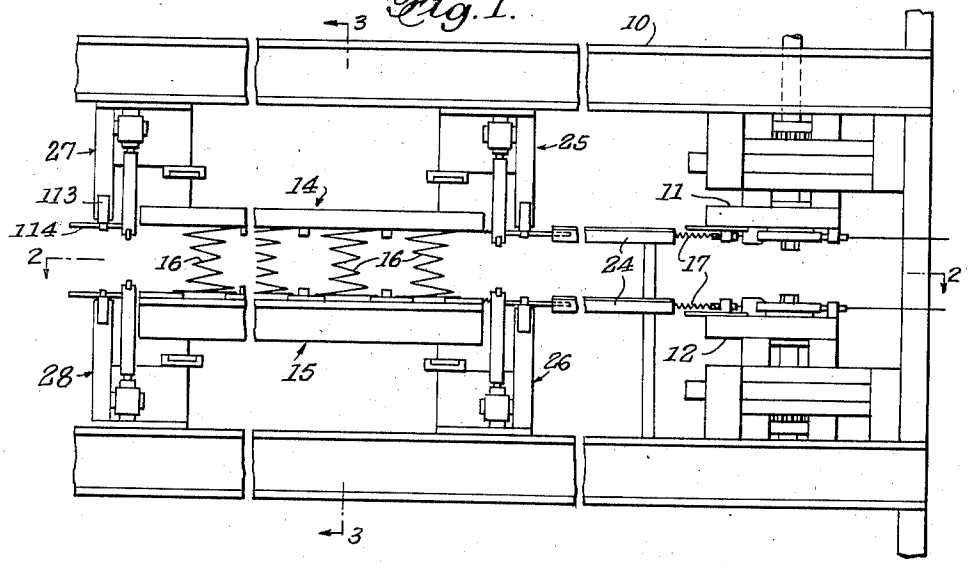
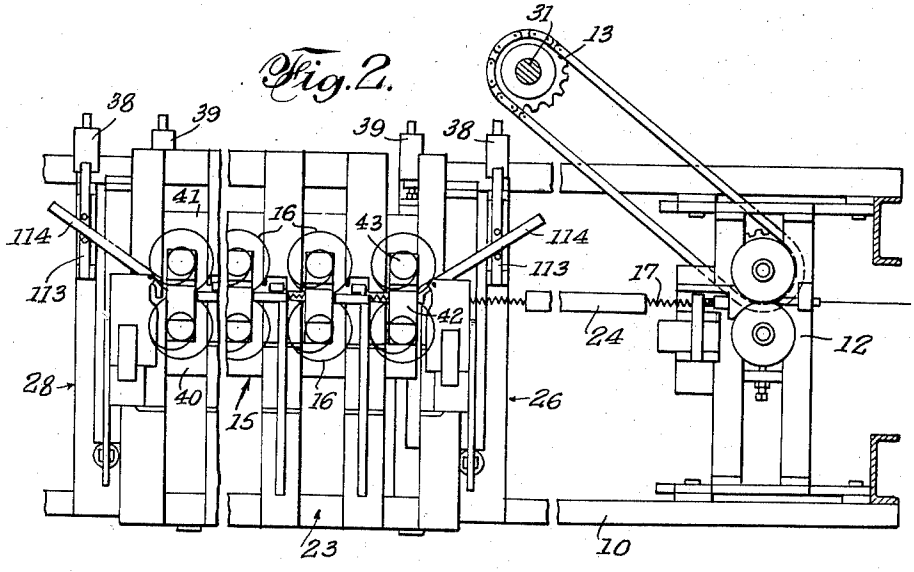


Fig. 2.



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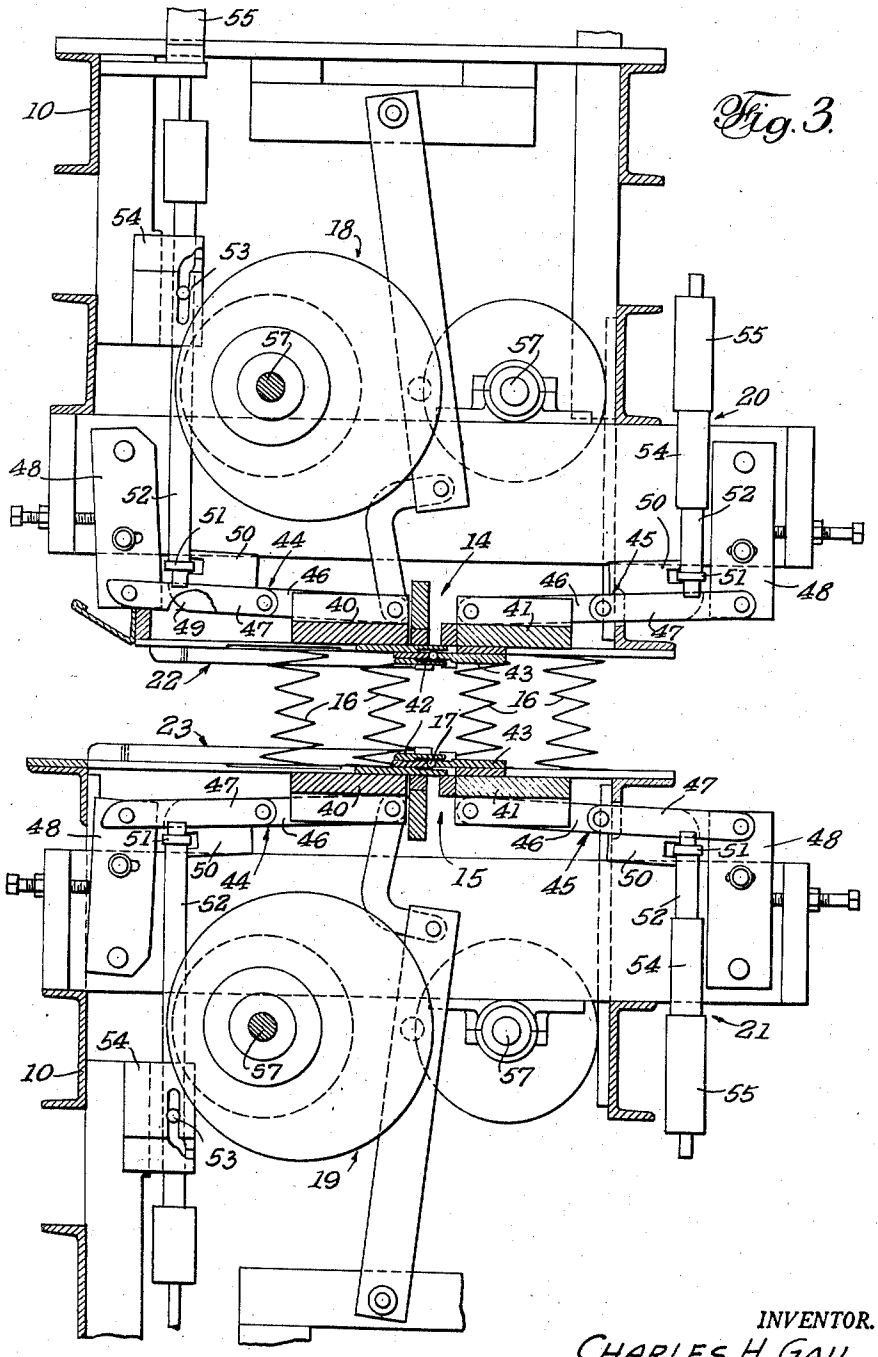


Fig. 3.

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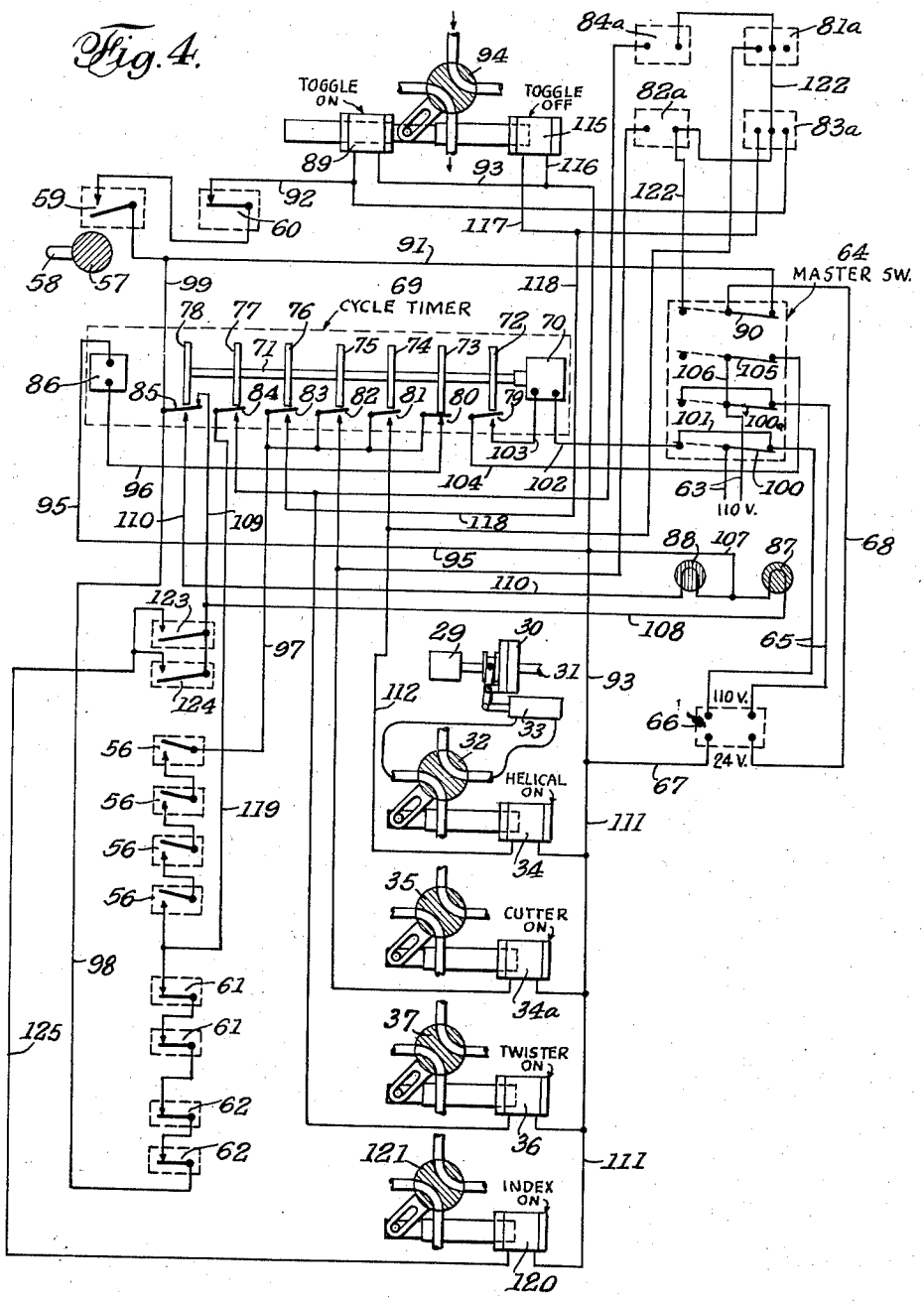
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Filed Jan. 3, 1955

3 Sheets-Sheet 3

Fig. 4.



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United States Patent Office 2,888,960
Patented June 2, 1959

2,888,960

BED SPRING MACHINE

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Application January 3, 1955, Serial No. 479,313

5 Claims. (Cl. 140—92.8)

This invention relates to a machine for producing bed springs of the type disclosed in Patent No. 2,663,038, issued December 22, 1953. The invention deals more particularly with novel means to control the operation of the machine components that form and feed helices to connect adjacent rows of spring coils, and cut and twist the ends of said helices.

An object of the present invention is to provide, in a machine that embodies means to hold two adjacent rows of spring coils in position to be connected, novel and improved means, started in operation by means moved to lock said holding means, for successively forming, feeding, cutting and twisting the ends of helical connectors for the spring coils thus held.

Another object of the invention is to provide means to time the cycle of operation of a bed spring machine, to institute operation of such cycle timing means only after two adjacent rows of spring coils are properly held in position, utilize said timing means to form, feed, cut and twist the ends of helices that connect said rows of spring coils and provide means to obviate the operation of means controlled by said cycle timing means, in the event of failure of portions of the machine to function properly, while the cycle timing means completes its cycle of operation and returns to initial or starting position.

A further object of the invention is to provide a machine, as indicated, that, optionally, may be manually operated, as when setting the machine in proper operating condition, or automatically operated in its normal manner.

The invention also has for its objects to provide such means that are positive in operation, convenient in use, easily installed in a working position and easily disconnected therefrom, economical of manufacture, relatively simple, and of general superiority and serviceability.

The invention also comprises novel details of construction and novel combinations and arrangements of parts, which will more fully appear in the course of the following description. However, the drawings merely show and the following description merely describes, one embodiment of the present invention, which is given by way of illustration or example only.

In the drawings, like reference characters designate similar parts in the several views.

Fig. 1 is a front elevational view of a bed spring machine, the same, quite generally, showing some of the components that are controlled by the means of the present invention.

Fig. 2 is a cross-sectional view as taken on line 2—2 of Fig. 1.

Fig. 3 is an enlarged vertical sectional view as taken on line 3—3 of Fig. 1, the view being extended to show upper and lower portions of the machine not shown in Fig. 1.

Fig. 4 is a wiring diagram of the instrumentalities of the spring machine shown in the previous figures and embodying the novel control features herein contemplated.

For a clearer understanding of the means disclosed in Fig. 4, reference will first be made to Figs. 1, 2 and 3 as an example of a machine that constitutes the basis for the control means of Fig. 4.

The bed spring machine that is illustrated comprises, generally, a frame 10 which carries all of the hereinafter enumerated means; similar upper and lower helix-forming and -feeding units 11 and 12; a drive 13 for said units; similar upper and lower means 14 and 15 cooperating to engage rows of spring coils 16 therebetween to hold said coils in fixed position in side-by-side adjacent rows to receive helices 17 fed thereto by units 11 and 12; similar upper and lower means 18 and 19 for moving upper and lower portions, on one side, of the means 14 and 15; similar upper and lower means 20 and 21 for moving upper and lower portions on the other side; fixed upper and lower means 22 and 23 for guiding the manual positioning between them of rows of spring coils for subsequent movement by the means 18, 19, 20 and 21; means 24 responsive to an obstruction to the feed of the helices to stop operation of the units 11 and 12; and upper and lower front units 25 and 26 and upper and lower rear units 27 and 28 for cutting both ends of both helices and for forming said ends into closed loops.

The foregoing, disclosed in detail in said patent, may be varied in different ways and is here used to set a typical environment in which the present improvements are used. Except as follows, said means will not be detailed.

Drive 13 is connected to a suitable driver such as an electric motor 29, a clutch 30 being interposed in this driving connection to couple or uncouple shaft 31. A valve 32 controls supply of air to an air cylinder 33 connected to control said clutch. A solenoid 34, when energized, operates said valve to move the same to cause air flow to that end of cylinder 33 that moves the clutch to clutched position. When the solenoid is deenergized, a spring returns said valve to the position that declutches said clutch. This control of clutch 30 is shown in the diagram, Fig. 4, and is typical of air cylinders that operate the cutters of units 25, 26, 27 and 28 by means of solenoid 34*a* and valve 35, and operate the twisters of said units by means of solenoid 36 and valve 37. In Fig. 2, two of the cylinders that operate two of the four cutters are shown at 38 and two of the cylinders that operate the twisters are shown at 39.

Each of the means 14 and 15 comprises side-by-side longitudinal bars 40 and 41 that carry means 42 and 43 which cooperate, when the bars 40 and 41 are together as in Fig. 3, to hold two adjacent rows of coils 16 in position to receive and be connected by helices 17. Said bars 40 and 41 are locked in said position by toggle means 44 and 45, respectively. Thus, since there are two bars above and below, there are four toggle means, each of which must be straightened, as shown, to insure that the bars are firmly in position before helix feed is instituted.

Each toggle means 44 and 45 comprises pivotally connected links 46 and 47, the former pivotally connected to bar 40 or 41, as the case may be, and the latter pivotally connected to an adjustable block 48 carried by the machine frame. Link 46 is formed with an extension 49 and the same carries a bifurcated block 50 that is engaged by a lug 51 on a vertically extending rod 52. It will be clear that an upward shift of said rods, in the upper portion of the machine, will cause the toggles to break from the straightened position shown.

Since the arcuate movement of the link 47, when moving to a folded position, is substantially greater than the longitudinal movement of rod 52, means 53 is provided in a guide block 54 for said rod to rotate lug 51 out of the bifurcation of block 50. Said upward movement of rod 53 is effected by means of an air cylinder 55 which also is used to depress rod 52, after lug 51

has been brought into engagement with the bifurcations of block **50**, and straighten the toggle links **46** and **47**.

Each toggle means **44** and **45**, as it straightens, closes a switch **56**. Fig. 4 shows four such switches connected in series—one for each toggle means. Since switches **56** are normally open and are closed only when two adjacent rows of spring coils are in proper position to be connected by helices, closing of all four switches is necessary to enable the machine to carry out its cycle of operation.

It will be understood that the shafts **57** of the means **18** and **19** are driven by a suitable motor or the like to move bars **40** and **41** to and from spring coil holding position. One of said shafts **57** is shown in Fig. 4 and is provided with a cam lug or the like **58** for momentarily closing a switch **59**.

A switch **60** is connected in series with switch **59**, the same being normally closed, and is opened only when a bed spring is completed by the machine and said spring embodies a predetermined number of helical-connected rows of spring coils. In other words, the completed bed spring or any suitable counting mechanism driven from one of the shafts **57** opens switch **60**.

As seen in Figs. 1 and 2, the helices **17** pass through means **24**, the same comprising troughs having displaceable lids or covers. Should the feed of the helices be abnormally resisted, as when the ends of said helices cannot properly thread around the convolutions of the spring coils that are to be connected, buckling of the helices results and the same displace the trough lids. This movement of the lids, when the same occurs, opens one or both of the normally-closed switches **61** connected in series with the toggle-operated switches **56** (Fig. 4).

A second pair of normally-closed switches **62** (Fig. 4) is so placed as to be opened by the end of each helix **17** after the same have effected connection of two rows of spring coils. These latter switches are connected in series with switches **56** and **61**.

Power is provided for the machine from a 110 volt line **63** that is connected to a master switch **64** and which, through conductors **65** connecting said switch to a step-down transformer **66**, provides low voltage power in conductors **67** and **68**. Said master switch is shown with four central terminals to which the switch blades are connected, four terminals at the right adapted to be connectel by said blades with the aligned central terminals, and four terminals at the left also adapted to be connected by said blades to the central terminals. Thus, master switch **64** actually comprises a gang of four single-pole double-throw switches. The full-line position of the blades, as shown, connects the machine for normal or automatic operation. The dotted-line position connects the machine for manual or setting-up operation.

The machine, as contemplated herein, includes a cycle timer **69** which is shown in Fig. 4 as comprising a motor that drives a shaft **71**, a set of individually-adjustable cams **72**, **73**, **74**, **75**, **76**, **77** and **78** mounted on said shaft, a set of switches **79**, **80**, **81**, **82**, **83**, **84** and **85** controlled by the respective cams **72** to **78**, and a solenoid **86**. Of these switches, switch **80** is normally closed, switch **85** is a double-pole single-throw switch, and the others are normally open when the timer is at rest and before the institution of a cycle of operation.

The machine is provided with a green tell-tale light **87** that is lit when the machine has completed its cycle of operation, and a red tell-tale light **88** that is lit during the cycle of operation.

The manner of electrical connection of the above elements will be described in connection with the following description of a cycle of operation:

The master switch **64** is thrown to "automatic," the full-line position of Fig. 4. The machine is then set into operation to cause the means **14** and **15** to bring two adjacent rows of spring coils **16** into position, as in Fig. 3, to be connected by upper and lower helices **17**. Hence, shafts **57** rotate and, during the cycle of operation, make one complete revolution.

After the cam means **18** and **19** have brought the bars **40** and **41** and the cooperating means **42** and **43** thereon toward each other, the cam lug **58** on one of said shafts **57** momentarily closes switch **59**. If normally-closed switch **60** is closed, a low voltage electric circuit to energize solenoid **89** is closed from conductor **68**, master switch blade **90**, conductor **91**, series switches **59** and **60**, conductor **92**, solenoid **89**, conductor **93**, to conductor **67**. This energization of solenoid **89** moves a valve **94** to a position—the one shown—that directs pressure air to cylinders **55** to project the upper rods **52** downwardly and the lower rods **52** upwardly and, thereby, straighten toggle means **44** and **45** and lock the means **42** and **43** of bars **40** and **41** in spring coil-holding position. If all is normal, the toggle means, when straightening, will close the four toggle switches **56**.

Since switches **61** and **62** are normally closed, closing of toggle switches **56** closes a low voltage electric circuit to energize solenoid **86** from conductors **67**, **93** and **95**, solenoid **86**, conductor **96**, cam-closed switch **80**, conductor **97**, series switches **56**, **61** and **62**, conductors **98**, **99** and **91**, switch blade **90** to conductor **68**.

Although solenoid **86** is shown remote from switch **79**, said switch is closed by said solenoid when the latter is energized. Closing of switch **79** closes a high voltage electric circuit through motor **70** from one side of the 110 volt line **63** to switch blade **100**, switch connection **101**, conductor **102**, motor **70**, conductor **103**, switch **79**, conductor **104**, switch blade **105**, to switch connections **106** and the other side of line **63**. After rotation of shaft **71** is instituted by the motor circuit thus closed, said circuit is maintained by cam **72** holding switch **79** closed while switch **80** is permitted to open by cam **73** to deenergize solenoid **86**. Hence, regardless of any of the switches **56**, **61**, or **62** opening, the motor **70** will continue to operate until cam **72** permits switch **79** to open, the same being at the end of one revolution of shaft **71**. At that time, cam **73** will close switch **80** to ready the cycle timer for the next operation cycle.

Before the motor **70** started operation of the cycle timer, the closed contact of switch **85** held the circuit through the green light **87** closed. This circuit is closed from conductors **67**, **93** and **107**, lamp **87**, conductors **108** and **109**, switch **85**, conductors **99** and **91**, switch blade **90**, to conductor **68**. As soon as shaft **71** starts rotation, cam **78** opens the green light circuit by shifting switch **85** to engage the other terminal thereof and close the circuit through the red light. Thus, the light circuit includes conductor **110** instead of conductors **108** and **109** and red lamp **88** instead of green lamp **87**. The red light circuit maintains until the cycle is completed, when switch **85** shifts back to the green light circuit, as permitted by cam **78**.

Now that the cycle timer has been set into operation, the cams **74**, **75**, **76** and **77**, in succession and according to the time-setting of their switch-controlling lobes, close the respective switches **81**, **82**, **83** and **84**.

Switch **81**, when closed, energizes solenoid **34** to move valve **32** in position to direct air to cylinder **33** and couple motor **29** with shaft **31**, thus instituting operation of helix-forming and -feeding units **11** and **12**. The low voltage electric circuit that energizes solenoid **34** comprises conductors **67** and **111**, said solenoid, conductor **112**, switch **81**, and then through switches **56**, **61** and **62**, as before, to conductors **68**. A similar circuit is made through solenoid **34***a* and switch **82** to move valve **35**. Thus, in proper sequence, as controlled by cams **74**, and **75**, first the helix units **11** and **12** and then the helix cutters **25**, **26**, **27** and **28** are operated, the former through cylinder **33** and the latter through cylinder **38** (Fig. 2) that project slides **113** which control cutters **114**.

Since the helices **17** now connect adjacent rows of coils **16**, opening movement of the means **14** and **15** may

be started. However, since the toggle means **44** and **45** are straight, they cannot be broken except by breaking the joints thereof between links **46** and **47**. This is accomplished by raising upper rods **52** and lowering the lower rods (Fig. 3). The movement of these rods is effected by cylinders **55** under control of valve **94** which, then, must be moved so that air is directed to said cylinders in a manner to move said rods as stated. Energization of a solenoid **115**, aligned with solenoid **89**, by closing of switch **83** by cam **76**, provides a low voltage electric circuit which includes conductors **67**, **93** and **116**, solenoid **115**, conductors **117** and **118**, switch **83**, and, as before, switches **56**, **61** and **62**, conductors **98**, **99** and **91**, switch blade **90**, and conductor **68**.

While this latter circuit is breaking the toggle means, cam **77** may close switch **84** to close a low voltage circuit through solenoid **36** that controls valve **37** which, in turn, directs air to cylinders **39** (Fig. 2) so as to operate the twister heads that are parts of units **25**, **26**, **27** and **28**. Since the toggle means **44** and **45** are in the process of being opened or broken at this time, the toggle switches **56** will be open. Therefore, the circuit established by closing of switch **84** includes a conductor **119** between switch **84** and switches **61** and **62**. Thus the circuit for solenoid **36** varies from that of solenoids **34** and **34***a* by omitting switches **56**. In other respects, the three circuits are alike.

It will be noted that valve **94** retains the position to which moved by solenoid **89** or **115**. However, valves **32**, **35** and **37** always seek the positions shown, as by suitable springs, except when moved by the solenoids to which connected. Therefore, the duration of energization of each said solenoid **34**, **34***a* and **36**, as controlled by the lobes of the respective cams **74**, **75** and **77**, determines the engaged period of clutch **30** and the time of operation of units **11** and **12**, and the time periods necessary to operate the cutters and the twister heads.

As the bed spring builds up in size with successive rows of spring coils connected to rows already helically connected, it is desired to omit feed of the helices thereby separating a finished bed spring from the first row of the next spring being built up. Such omission is effected by not starting operation of units **11** and **12** and results from switch **60** being opened by either the finished bed spring or by a suitable device that is operated by a predetermined number of revolutions of one of the shafts **57**. Since switch **60** is open, solenoid **89** remains deenergized and the mechanical components of the machine go through the cycle of operation that brings a new row of spring coils **16** in position to be connected by helices. However, since none of the devices **11**, **12**, **25**, **26**, **27** or **28** will operate due to non-operation of the cycle timer, said new row of spring coils will remain unconnected.

If, once the operation of the cycle timer is instituted, one of the switches **61** or **62** is opened, the former, by a faulty feed and the latter by an overfeed, then said timer will complete its full revolution of shaft **71** to end in starting position again. However, switches **81** to **84** will be in open circuit because the circuits thereof depend on all switches **61** and **62** being closed. Therefore, all of said devices will cease to function although the cycle timer **69** restores itself to starting position.

The present machine is also provided with means whereby the components thereof may be manually operated. This is accomplished through the medium of master switch **64** having its blades moved to the dotted position shown and through the medium of an index solenoid **120** and an air valve **121** controlled thereby. It will be noted that blade **105** of master switch **64**, when moved to manual position, is out of circuit and takes motor switch **79** out of circuit. Hence the cycle timer **69** cannot operate. However, the switch blades **100** and **100***a* still connect the 110 volt line **63** to transformer **66** by means of conductors **65**.

Since switches **81**, **82**, **83** and **84** cannot be closed,

because of inoperation of the cycle timer, the same are replaced in the circuits that energize the respective solenoids by switches **81***a*, **82***a*, **83***a* and **84***a*. These latter switches are normally open and, when closed, energize the solenoid to which connected in the same way that the switches **81** to **84** energize said solenoids.

All of the switches **81***a* to **84***a* are commonly connected to low voltage by a conductor **122**. Switch **81***a* is connected to the conductor **112** in the circuit of which switch **81** and solenoid **34** are connected. Similarly, switch **82***a* is in circuit with solenoid **34***a* and across switch **82**; switch **83***a* (a double-throw switch) is connected to energize solenoids **89** or **115**, selectively; and switch **84***a* is in circuit with solenoid **36** and across switch **84**.

Also two (or more, if desired) manual switches **123** and **124** may be connected in parallel, as shown, and placed in a low voltage circuit with solenoid **120** as follows: conductor **68**, master switch blade **90**, conductors **91** and **99**, normally-closed contact of switch **85**, conductor **109**, either switch **123** or **124** (when manually closed), conductor **125**, solenoid **120**, and conductors **111** and **67**.

Switches **123** and **124** are preferably placed at different or at opposite ends of the machine so as to be accessible where desired. The air valve **121** controlled, through solenoid **120**, each time one of said switches is closed, controls mechanism for driving the machine. Release of the switches stops the machine, which, therefore, can be operated intermittently and as desired. During such intermittent drive of the machine, the switches **81***a* to **84***a* may be manually closed and released to effect a manually-controlled cycle of operation that enables servicing, adjusting, timing, etc. of the machine.

The foregoing contemplates that the helix cutters and the twisters be separately controlled mechanisms, the cutters being controlled through the medium of solenoid **34***a* and valve **35**, and the twisters through the medium of solenoid **36** and valve **37**. It will be evident that a separate control circuit for the twisters may be omitted if the twisters and cutters are mechanically connected so that they act in sequence upon closing of the operating circuits for the cutters. Under such conditions, the valve **37**, solenoid **36** and cam **77** together with its switch **84**, may be omitted and the control connections made through the medium of cam **75** and switch **82**. In effect, the functions of the twister and cutter operators are combined in the diagram of Fig. 4.

Also, the machine will function satisfactorily if the toggle means **45** were to be omitted and the toggles thereof replaced by simple levers or arms pivotally mounted on blocks **48** at the right of Fig. 3 and the ends of said arms pivotally connected to bars **41**. In such case, the means **20** and **21**, on the right, may be omitted also.

While the foregoing illustrates and describes what is now contemplated to be the best mode of carrying out the invention, the construction is, of course, subject to modification without departing from the spirit and scope of the invention. It is, therefore, not desired to restrict the invention to the particular form of construction illustrated and described, but to cover all modifications that may fall within the scope of the appended claims.

Having thus described the invention, what is claimed and desired to be secured by Letters Patent is:

1. In a control apparatus for use with a spring assembling machine having releasable holding means for holding two rows of spring coils together in position to be tied, helix forming and feeding means for threading a wire helix onto said coils, cutting means for cutting off said helix, and twisting means for twisting the ends of said helix, the combination comprising switch means adapted to be operated in response to full actuation of said holding means, a cycle timer having an operating motor, a motor control switch for energizing said motor, means responsive to operation of said switch means for operating said motor control switch, a cam operable by said

motor and effective upon initial movement of said cam to hold said motor control switch in operated position for a predetermined cycle, first, second, third and fourth cam means operable by said motor, first, second, third and fourth switch means operable sequentially by the corresponding cam means, first control means operable by said first switch means and adapted to actuate said helix forming and feeding means, second control means operable subsequently by said second switch means and adapted to actuate said cutting means, third control means operable subsequently by said third switch means and adapted to release said holding means, and fourth control means operable subsequently by said fourth switch means and effective to actuate said twisting means.

2. In a control apparatus for use with a spring assembling machine having releasable holding means for holding two rows of spring coils together in position to be tied, helix forming and feeding means for threading a wire helix onto said coils, cutting means for cutting off said helix, and twisting means for twisting the ends of said helix, the combination comprising switch means adapted to be operated in response to full actuation of said holding means, a cycle timer having an operating motor, means for energizing said motor in response to operation of said switch means, first, second, third and fourth cam means operable by said motor, first, second, third and fourth switch means operable sequentially by the corresponding cam means, first control means operable by said first switch means and adapted to actuate said helix forming and feeding means, second control means operable subsequently by said second switch means and adapted to actuate said cutting means, third control means operable subsequently by said third switch means and adapted to release said holding means, and fourth control means operable subsequently by said fourth switch means and adapted to actuate said twisting means.

3. In a control apparatus for use with a spring assembling machine having releasable holding means for holding two rows of spring coils in position to be tied together, tying means for feeding and cutting helical tie wires to said coils, and twisting means for twisting the ends of said wires, the combination comprising switch means adapted to be operated in response to full actuation of said holding means, a cycle timer having an operating motor, means for energizing said motor for a predetermined cycle in response to operation of said switch means, first, second and third cam means operable by said motor, first, second and third control switch means operable sequentially by the corresponding cam means, first control means operable by said first switch means and adapted to actuate said tying means, second control means operable subsequently by said second control switch means and adapted to release said holding means, and third control means operable subsequently by said third control switch means and adapted to actuate said twisting means.

4. In a control apparatus for use with a spring assembling machine having releasable holding means for holding two rows of spring coils in position to be tied together, and tying means for forming, feeding, cutting and twisting helical tie wires to tie said coils together, the combination comprising switch means adapted to be operated in response to full actuation of said holding means, a cycle timer having an operating motor, a motor control switch for energizing said motor, means responsive to operation of said switch means for operating said motor control switch, a cam operable by said motor and effective upon initial movement of said cam to hold said motor control switch in operated position for a predetermined cycle, cam means operable by said motor, control switch means operable by said cam means, control means operable by said control switch means and adapted to actuate said tying means, additional cam means operable by said motor, additional control switch means operable by said additional cam means, and additional control means operable by said additional control switch means and adapted to release said holding means.

5. In a control apparatus for use with a spring assembling machine having releasable holding means for holding two rows of spring coils in position to be tied together, and tying means for forming, feeding, cutting and twisting helical tie wires to tie said coils together, the combination comprising switch means adapted to be operated in response to full actuation of said holding means, a cycle timer having an operating motor, means for energizing said motor for a predetermined cycle in response to operation of said switch means, cam means operable by said motor, control switch means operable by said cam means, control means operable by said control switch means and adapted to actuate said tying means, additional cam means operable by said motor, additional control switch means operable by said additional cam means, and additional control means operable by said additional control switch means and adapted to release said holding means.

References Cited in the file of this patent

UNITED STATES PATENTS

2,625,963	Bronstien	Jan. 20, 1953
2,640,958	Davis	June 2, 1953
2,663,038	Gail	Dec. 22, 1953