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SOLENOID START OF GROUP-STITCH SEWING MACHINES

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2 Sheets-Sheet 1

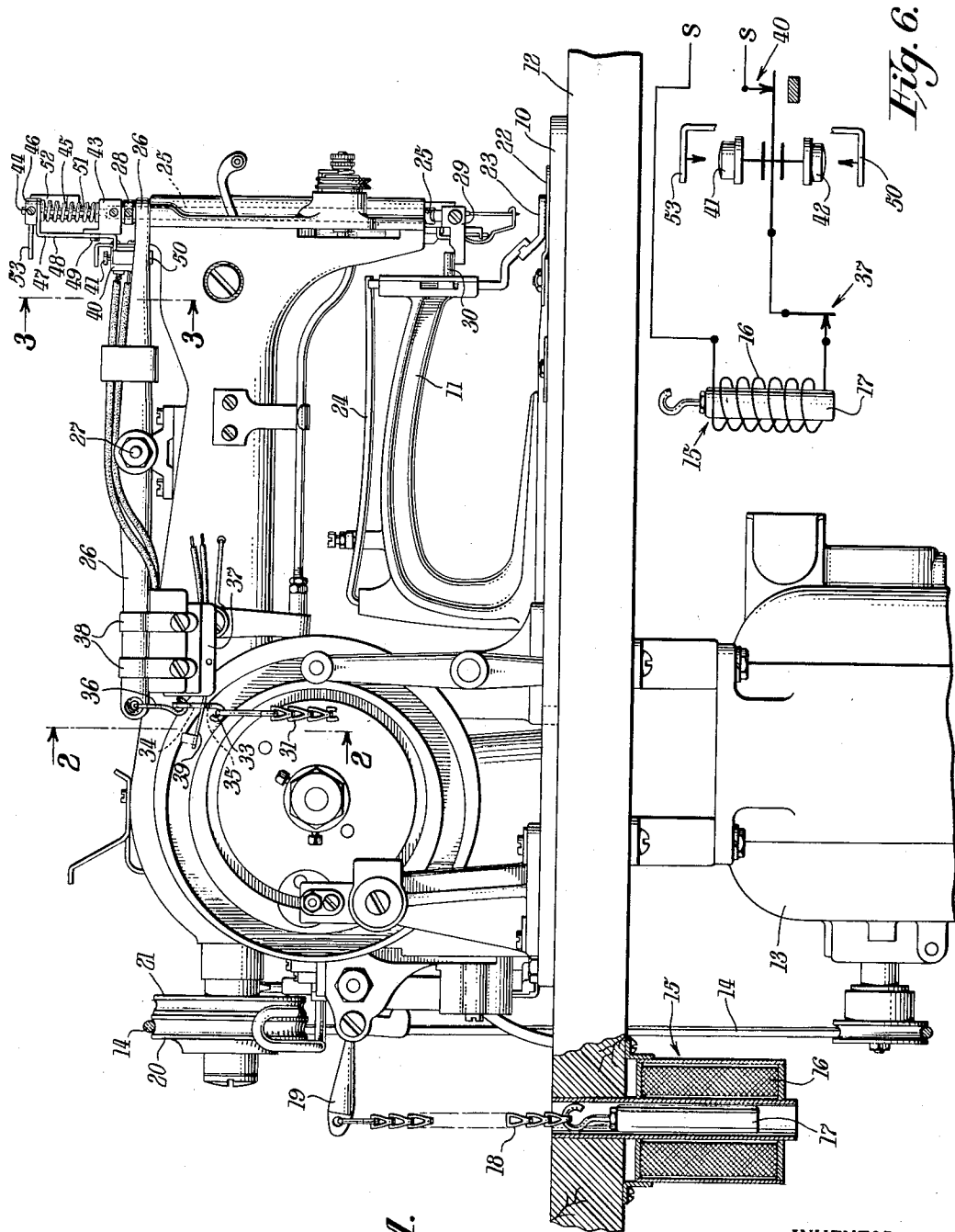


Fig. 1.

Fig. 6.

WITNESS

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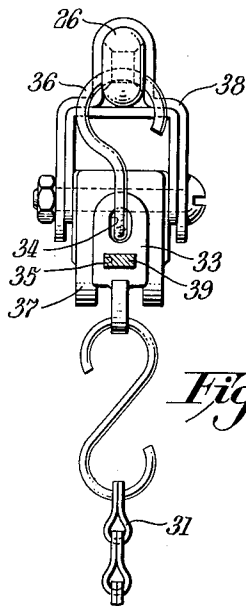


Fig. 2.

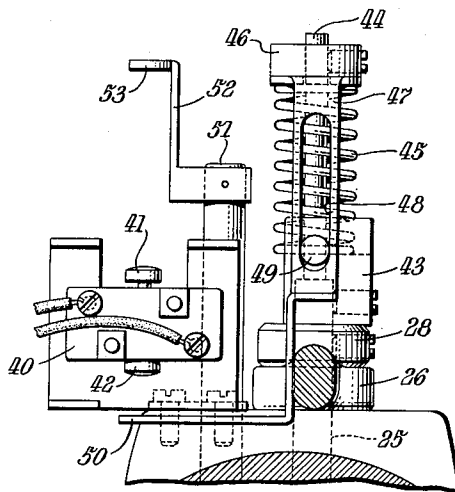


Fig. 3.

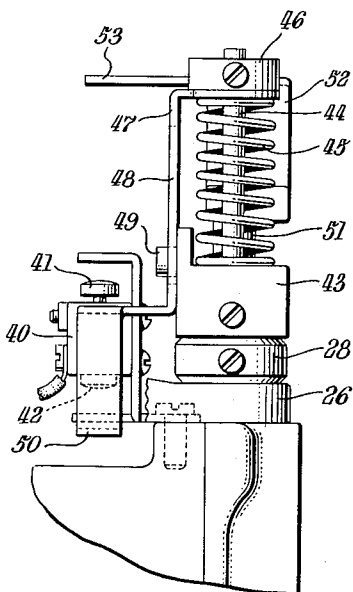


Fig. 5.

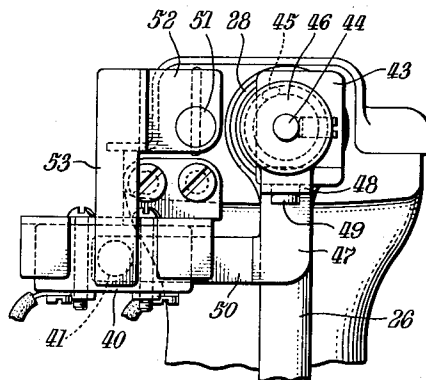


Fig. 4.

WITNESS

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SOLENOID START OF GROUP-STITCH SEWING MACHINES

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8 Claims. (Cl. 112—67)

This invention relates to group-stitch sewing machines and more specifically to a control system for starting such machines, in which the starting effort is supplied by an electromagnetic solenoid under the manual control of the operator.

Heretofore, where solenoids, with their quick action, have been used to actuate the starting levers of group-stitch sewing machines it has been too easy accidentally to start the machines with the work-clamp raised, with the result that feed control of the work was lost and spoilage resulted.

One of the objects of this invention is to provide a control system for starting a group-stitch sewing machine by actuating a single starting lever through a solenoid under the control of the operator and with means for preventing accidental starting with the work-clamp in a raised position.

From a practical standpoint, it is important that the solenoid be as small as possible in order to provide facility in mounting same in the limited space available, and this requires that the solenoid should be energized only long enough to trip the starting-lever latch. In this manner, the solenoid duty becomes intermittent; the heating is much reduced, and a smaller unit may be used.

It is a further object of this invention, therefore, to provide a control system for energizing a starting solenoid for sewing machines, which energization shall be automatically and quickly terminated by means responsive to further operation of the sewing machine.

These objects are attained according to the present invention by including in the electrical circuit for controlling the solenoid a normally-closed switch which is actuated by the lost-motion in a take-up link between the usual treadle chain and the arm for raising the work-clamp. Also preferably included in this circuit is a means for providing starting of the machine by simply lowering the work-clamp without other action by the operator. This is an on-off toggle switch which is turned on by raising the work-clamp, and is turned off by downward movement of the needle-bar. This latter insures that the solenoid is turned off as soon as the machine starts.

With the above and other objects in view, as will hereinafter appear, the invention comprises the devices, combinations and arrangements of parts hereinafter set forth and illustrated in the accompanying drawings of a preferred embodiment of the invention, from which the several features of the invention and the advantages attained thereby will be readily understood by those skilled in the art.

In the drawings—

Fig. 1 is a longitudinal view, partly in section, of a group-stitch sewing machine to which has been applied a starting control system embodying the invention.

Fig. 2 is an enlarged vertical detail view taken on the line 2—2 of Fig. 1.

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Fig. 3 is an enlarged vertical detail view taken on the line 3—3 of Fig. 1.

Fig. 4 is an enlarged plan detail view taken at the head end of the machine of Fig. 1.

Fig. 5 is an enlarged vertical detail view taken at the head end of the machine of Fig. 1.

Fig. 6 is a schematic wiring diagram of the control circuit embodying the invention.

Referring to Fig. 1, 10 denotes the bed of a group-stitch sewing machine of the type shown and described in the U. S. Patent No. 1,051,998 of February 4, 1913, and to which reference may be had for a more complete description thereof. This machine is equipped with a work-clamp 11 of the general type shown and described in the U. S. Patent No. 1,151,535 of August 24, 1915, to which reference may be made for a more complete understanding thereof.

The machine is mounted on a table top 12, from the under side of which is suspended an electric motor 13 which drives said machine through the agency of a shiftable belt 14. A solenoid 15 is secured to the under side of the table top 12 and comprises an annular coil of wire 16 surrounding a vertically movable magnetic armature 17. The armature is connected by a chain 18 to a conventional starting lever 19. As is well-known in the art, when the coil 16 is energized preferably from a suitable D. C. source, the tendency is for the armature to be drawn to and held at a position of symmetry end-to-end of the coil. Thus, in the position shown in Fig. 1, when the coil 16 is suitably energized, the armature 17 moves downwardly towards a position of symmetry within the coil, and in so doing, pulls down on the chain 18 and actuates the starting lever 19 to shift the belt 14 from an idler pulley 20 to a driving pulley 21 connected to the arm-shaft of the machine to start said machine in a manner well-known in the art.

Work to be stitched is held in the work-clamp 11 between a lower jaw 22 and an upper jaw 23. The upper jaw is movable vertically but is biased to a downward and clamped position by the spring 24. The usual clamp-bar 25 is journaled in the head for vertical movement and is operated by a clamp-lift lever 26 pivoted at 27 and connected to said clamp-bar through a fork engagement and a stop bushing 28 adjustably secured to the clamp-bar 25. The upper jaw 23 is operatively connected to the clamp-bar 25 through a strut 29 cooperating with a pin 30 as clearly seen in Fig. 1 so that, when the clamp-bar is raised, the strut 29 lifts the pin 30 and, with it, the jaw 23. A chain 31 connected at one end to a conventional treadle (not shown) and at the other end to the clamp-lift lever 26, enables the operator to control at will the position of the clamp-lift lever and, with it, the clamping and unclamping of the material as desired. This is well-known structure, but, to adapt it to the purposes of this invention, the following modifications and additions are made.

In making the connection between the chain 31 and the lever 26, a special link 33 is employed as seen best in Fig. 2. This link is provided with two apertures 34 and 35. Aperture 34 is vertically elongated and loosely engages a hook 36 connected to the lever 26. That is to say, the link must be moved vertically to take up the play or lost motion due to the loose fit between the aperture 34 and the hook 36. A normally-closed pressure-sensitive switch 37 is mounted securely to the lever 26 by means of clamps 38—38 and has a leaf-spring actuator 39 which reaches through but fits snugly in the aperture 35. The parts are so arranged that, in the normal or undepressed position of the treadle, the spring actuator 39 biases the link 33 to its raised position, as shown, so that, when the treadle is depressed to raise the clamp, the ini-

tial downward movement of the link 33 to take up the lost motion, first actuates the switch 37 to open position after which the lever 26 is actuated to raise the clamp in the usual way.

Secured to the top of the head of the machine is a toggle switch 40 having a top actuator button 41 and a bottom actuator button 42. Pressing the top button 41 opens the switch 40 and pressing the bottom button 42 closes the switch 40 as indicated in Fig. 6. A bushing 43 secured to the clamp-bar 25 carries a vertical guide stud 44 surmounted by a spring 45 and capped by a stop collar 46 secured to the stud. An actuator finger 47 is clamped at one end between the end of the spring 45 and the collar 46 and is formed with a slotted portion 48 entered by a headed pin 49 for guiding the actuator in its vertical movement. The actuator finger 47 is bent to avoid interference with the lever 26 and terminates in a horizontal limb 50 located in an operative position relative to the button 42. Thus, when the lever 26 is moved to raise the clamp, the actuator finger 47, through the limb 50, engages the button 42 and closes the switch 40. When the button 42 is moved as far as it will go, further movement or overtravel of the clamp-bar 25 is permitted without effect on the button and switch by compression of the spring 45, and the switch parts are thus not subjected to undue strain.

The sewing machine has the usual vertically reciprocating needle-bar 51, to the top end of which is secured an actuating finger 52 which is terminated in a horizontally-disposed limb 53 which cooperates with the button 41 of the switch 40. Thus, when the needle-bar is lowered, the finger 52, through the limb 53, engages the button 41 and opens the switch 40. There is no need of overtravel protection in this case inasmuch as the extreme needle-bar positions are fixed for a given machine and the switch may be pre-set to avoid overtravel difficulties.

It will be noted that the machine of the invention has but one treadle, which, through the chain 31, directly controls the work-clamp 11, the starting lever being indirectly and automatically controlled by the solenoid 15 as will now be described.

Referring to Fig. 6, it will be seen that the pressure-sensitive switch 37, the toggle-switch 40 and the coil 16 of the solenoid 15 are connected in series-circuit relation with a source of electrical energy $s-s$. The source is preferably D. C. but may be A. C. if an A. C. solenoid is used. When any effort is applied to the treadle to raise the clamp, the switch 37 will be opened immediately and no current can be applied to the winding 16. Normally then, with the treadle depressed, i. e. with the work-clamp raised, the toggle-switch 40 is closed and the switch 37 is open. As the operator releases the treadle to clamp the work, the switch 40 remains closed and the switch 37 closes due to the spring-actuator 39 being unopposed by the pull on the chain 31. The coil 16 is energized, the solenoid 15 actuates the starting lever, and the machine starts and runs through its stitching cycle and stops, all in the same manner as though the starting lever were manually operated. However, when the machine starts, the needle-bar is instantly moved downwardly and, in so doing, the actuator finger 52, through the limb 53, engages the button 41 and opens the switch 40, thus cutting off the current to the coil 16 and preventing undue heating of the solenoid 15.

At the end of the stitching cycle, when the treadle is depressed to raise the work-clamp in order to manipulate the work in loading and unloading the machine, the raising of the clamp-bar causes the finger 47, through the limb 50, to engage the button 42 and to close the toggle-switch 40 to prepare the circuit through the coil 16 for ultimate closing by the switch 37 when the treadle is completely released, and the stitching cycle is then repeated as described above.

While the system above described is the preferable one, this invention is not to be construed as limited there-

to, but includes within its scope one wherein the automatically operated toggle-switch 40 is merely replaced by a manually-operated momentary push-button switch which may be placed on the table near to and approximately level with the feed-plate and in a position such that the operator may use both hands to hold and adjust the material while lowering the clamp by foot or knee, and then start the machine by operating the switch momentarily by a flick of the wrist or forearm. The switch 37 is maintained in the circuit as before and affords the same protection against accidental starting with the work-clamp in a raised position. It will be noted that, in the systems of the invention, the operator still maintains proportional control of the clamp-lift and, at the same time, enjoys the advantage of the single treadle operation.

Having thus set forth the nature of the invention, what I claim herein is:

1. In a group-stitch sewing machine having a work-clamp and a needle-bar, a starting lever for starting said machine, a clamp-lift lever for raising said work-clamp, a solenoid, an armature actuated by said solenoid and operatively connected to said starting lever, and circuit means including a source of electrical energy for supplying electric current to said solenoid, comprising a normally-closed switch actuated to open responsive to the movement of raising said work-clamp, and a toggle switch which is turned on only by raising the clamp-lever and is turned off only by downward movement of the needle-bar, said switches being in series circuit relation with said solenoid and said source of electrical energy whereby the solenoid is energized only when the clamp is lowered.

2. In a system for controlling the starting of a group-stitch sewing machine having a work-clamp, a starting lever normally spring biased to a stop position, a latch for holding said starting lever in a starting position, a source of electrical energy, a solenoid, an armature operated by said solenoid and operatively connected to said starting lever to move it to a starting position, and a circuit for selectively energizing said solenoid comprising a manually-operated switch and a switch operative to open in response to the movement of raising said work-clamp, said switches being in series circuit relation with said solenoid and said source of electrical energy whereby the solenoid is energized only when the clamp is lowered.

3. In a system for starting a group-stitch sewing machine having a starting lever for starting said machine and a work-clamp for controlling the work upon which the machine performs a predetermined group of stitches, a source of electrical energy, a solenoid, an armature actuated by energizing said solenoid and operatively connected to said starting lever, a clamp-lever for raising and lowering said work-clamp, a manually actuatable connection with said clamp-lever for raising said clamp, a normally-closed switch connected for opening actuation by said connection, a toggle switch connected for closing responsive to movement of said clamp-lever to raise said clamp and for opening responsive to a predetermined further operation of said machine, said switches, said solenoid and said source of electrical energy, all being connected in series circuit relation, whereby the machine may be started by the single act of lowering the clamp.

4. In a group-stitch sewing machine having a clamp-lift lever and a reciprocating needle-bar, a system for starting said machine by the manual operation of said lever, comprising a starting lever, a solenoid, an armature actuated by said solenoid and connected to operate said starting lever, a normally-closed pressure-sensitive switch responsive to open upon initiating the actuation of said clamp-lift lever but before said lever moves, a toggle switch responsive to close upon actuation of said clamp-lift lever and to open upon subsequent actuation of said needle-bar, and a source of electrical energy connected in series relation with said switches and said solenoid.

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5. In a group-stitch sewing machine having a clamp-lift lever and a reciprocatory needle-bar, an electrical system for starting said machine responsive to movement of the clamp-lift lever, comprising a source of electrical energy, a solenoid, an armature actuated by said solenoid, a starting lever actuated by said armature, a treadle, a lost-motion connection between said treadle and said clamp-lift lever, a normally-closed switch actuated to open by the take-up movement in said lost motion connection, a toggle switch actuated to close responsive to movement of the clamp-lift lever and to open responsive to subsequent movement of the needle-bar, said solenoid and said switches being connected in series circuit relation with said source of electrical energy.

6. An electrical system for starting a group-stitch sewing machine having a clamp-lift lever, comprising a source of electrical energy, a manually-operated switch, a solenoid, an armature actuated by said solenoid, a starting lever actuated by said armature, a treadle, a lost-motion connection between said treadle and the clamp-lift lever, a normally-closed switch actuated to open by the take-up movement in said lost-motion connection, said switches and said solenoid being connected in series relation whereby said solenoid can be energized to start the machine only in a predetermined condition of said clamp-lift lever.

7. An electrical system for controlling the starting of a group-stitch sewing machine having a work-clamp and a clamp-lift lever for raising and lowering said work-clamp, comprising a source of electrical energy, a solenoid, an armature actuated by said solenoid, a starting lever actuated by said armature, a treadle for manually operating said work-clamp, a lost-motion connection between said treadle and the clamp-lift lever, a normally-

closed switch actuated to open by the take-up movement in said lost-motion connection, a toggle switch actuated to a closed position responsive to movement of said clamp-lift lever and to an open position responsive to a predetermined further operation of said sewing machine, said switches, said solenoid and said source of electrical energy all being connected in series circuit relation, whereby the machine may be started by the single act of lowering the work-clamp by manual operation of said treadle.

8. In a group-stitch sewing machine, a system for controlling the starting thereof comprising a source of electrical energy, a solenoid, an armature actuated by said solenoid, a starting lever operated by said armature, a work-clamp, a clamp-lift lever for operating said work-clamp, a treadle, a lost-motion connection between the treadle and the clamp-lift lever, a normally-closed switch actuated to open responsive to the take-up movement of said lost-motion connection, a reciprocatory needle-bar, a toggle switch actuated to close responsive to clamp-raising movement of the clamp-lift lever and to open responsive to subsequent downward movement of said needle-bar, said switches and solenoid being connected in mutual series circuit relation with said source of electrical energy.

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