

March 15, 1960

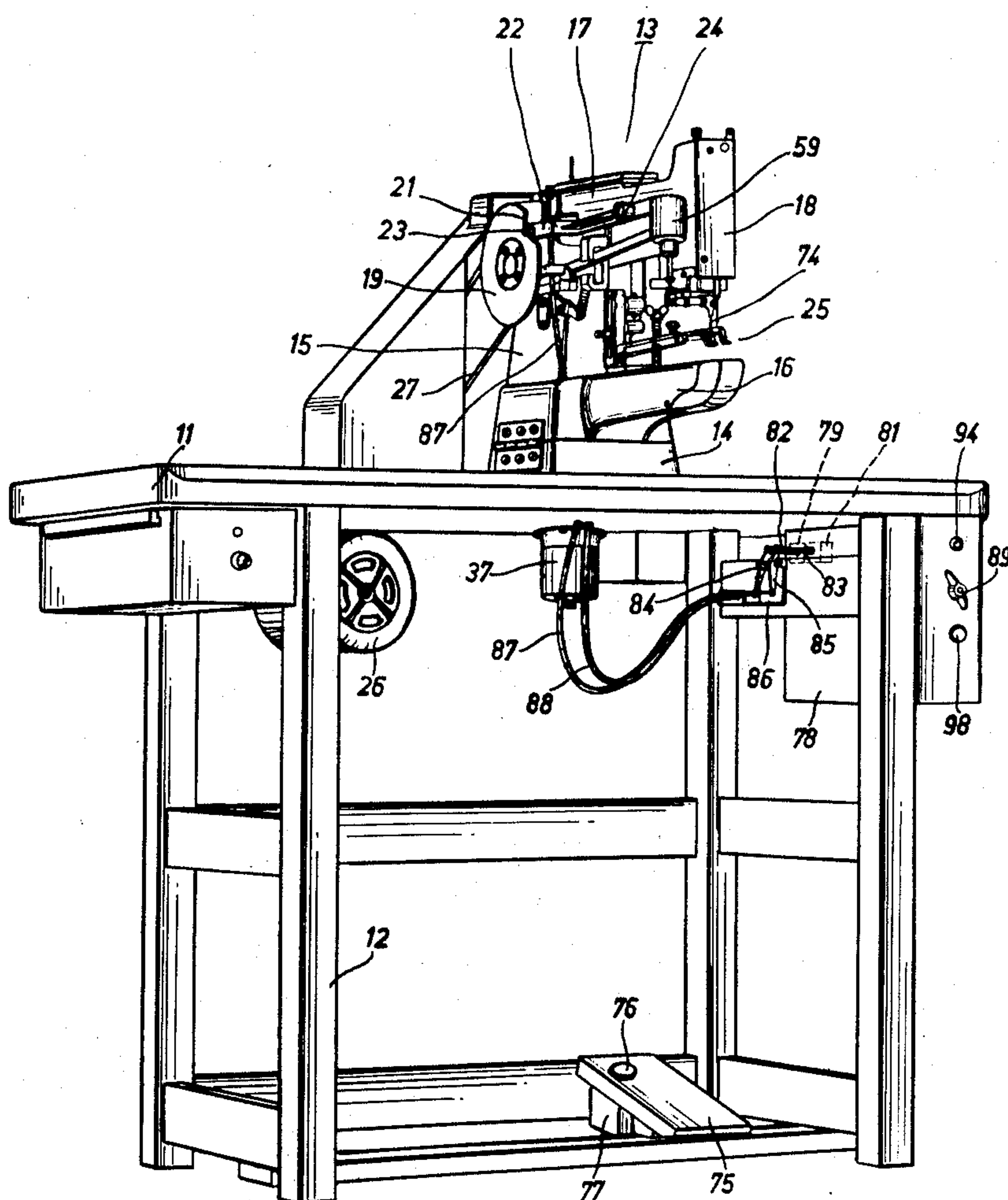
C. J. M. BENINK ET AL
ELECTRICAL CONTROL SYSTEM FOR GROUP
STITCH MACHINES AND THE LIKE

2,928,362

Filed May 29, 1956

4 Sheets-Sheet 1

Fig. 1



INVENTORS
CHRISTIAAN JOSEPH MARINUS BENINK
HELMUT GROSS
KARL WINZ
BY *Wm. H. H. H. H.* ATTORNEY

March 15, 1960

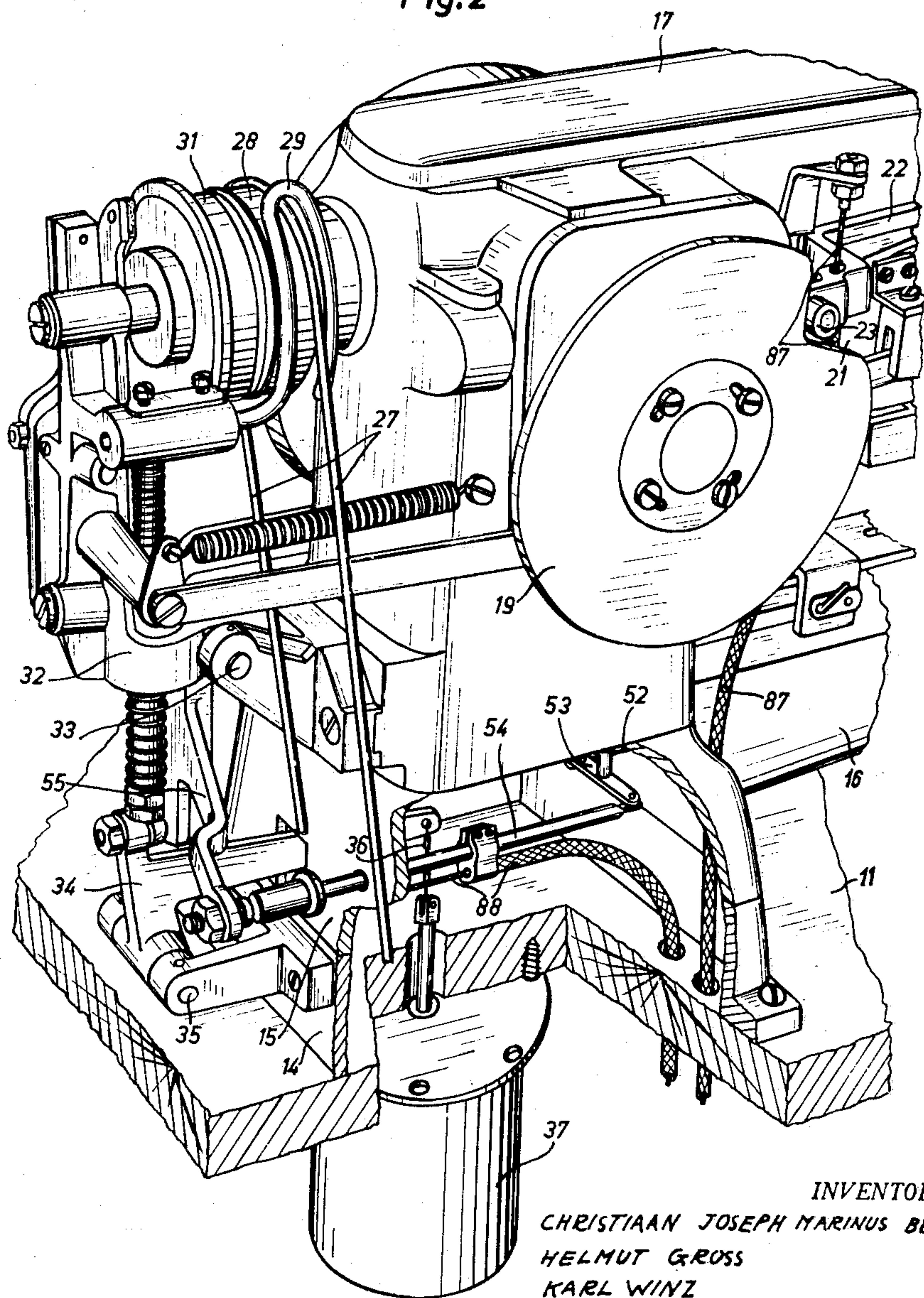
C. J. M. BENINK ET AL
ELECTRICAL CONTROL SYSTEM FOR GROUP
STITCH MACHINES AND THE LIKE

2,928,362

Filed May 29, 1956

4 Sheets-Sheet 2

Fig. 2



INVENTORS

CHRISTIAAN JOSEPH MARINUS BENINK

HELMUT GROSS

KARL WINZ

BY

WM NOLLE

ATTORNEY

March 15, 1960

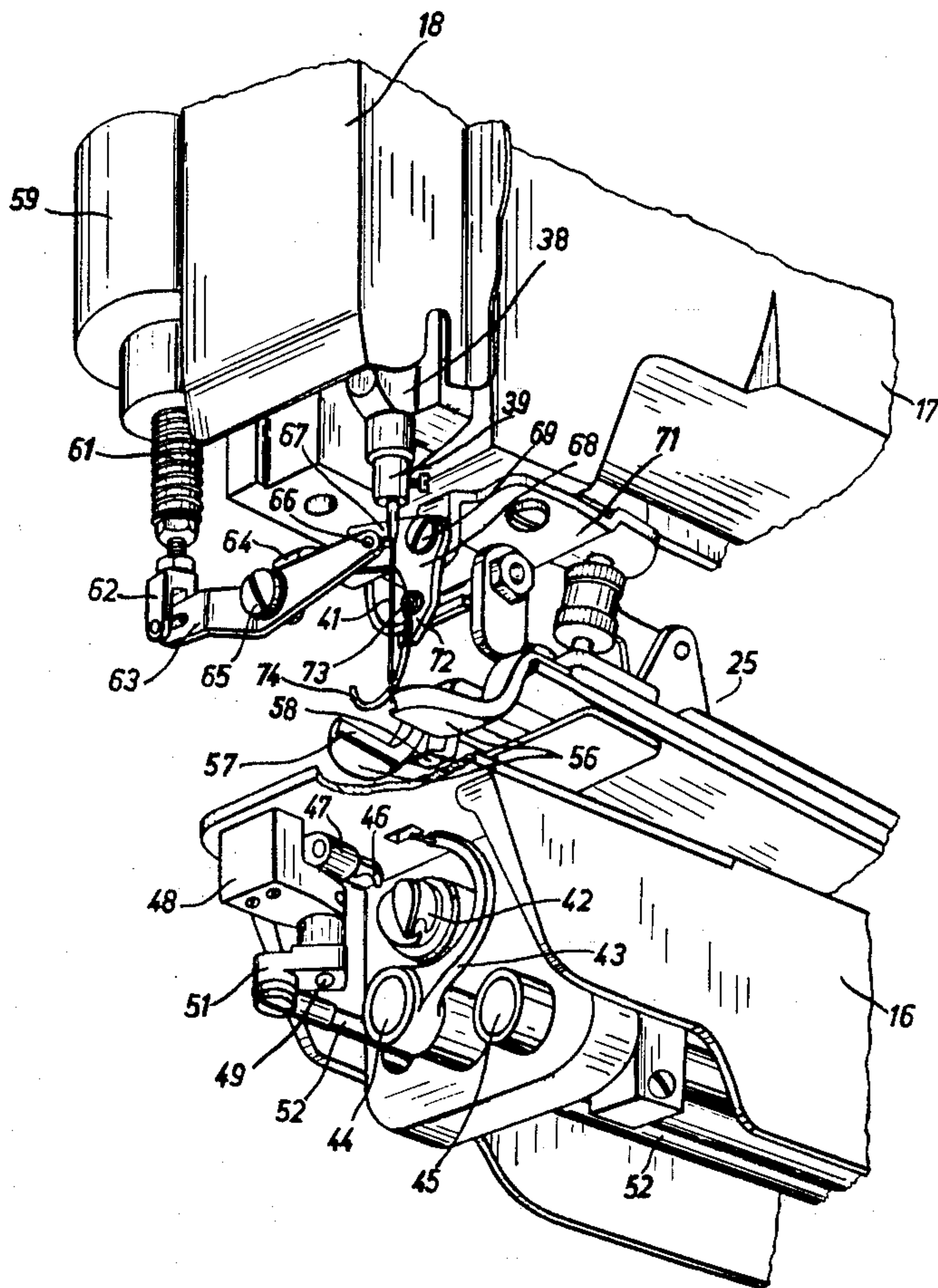
C. J. M. BENINK ET AL
ELECTRICAL CONTROL SYSTEM FOR GROUP
STITCH MACHINES AND THE LIKE

2,928,362

Filed May 29, 1956

4 Sheets-Sheet 3

Fig. 3



INVENTORS

CHRISTIAAN JOSEPH MARINUS BENINK
HELMUT GROSS

KARL WINZ
BY

Wm. H. R. Co.

ATTORNEY

March 15, 1960

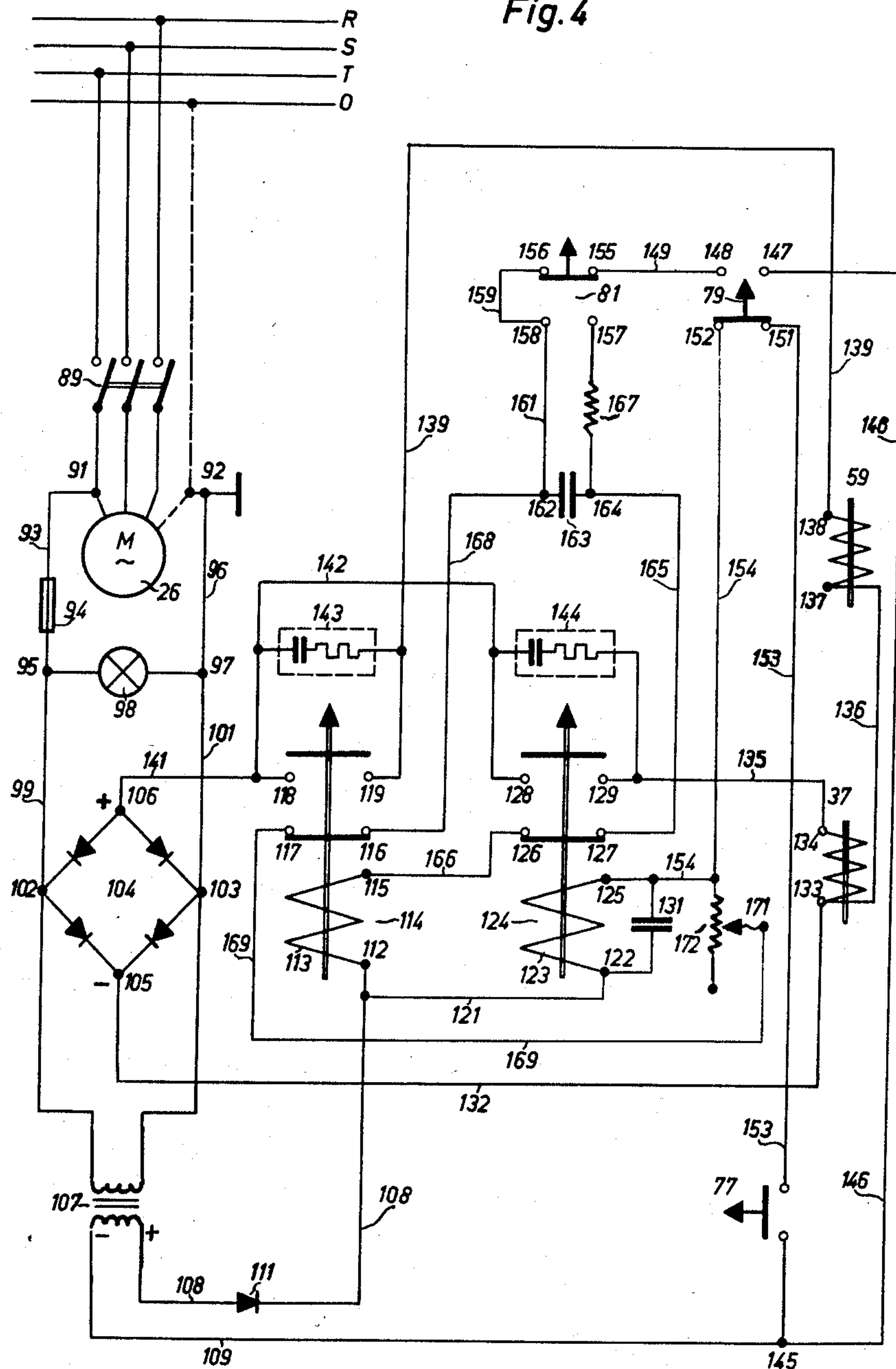
C. J. M. BENINK ET AL
ELECTRICAL CONTROL SYSTEM FOR GROUP
STITCH MACHINES AND THE LIKE

2,928,362

Filed May 29, 1956

4 Sheets-Sheet 4

Fig. 4



INVENTORS
CHRISTIAAN JOSEPH MARINUS BENINK
HELMUT GROSS
KARL WINZ
BY *Karl Winz* ATTORNEY

1

2,928,362

ELECTRICAL CONTROL SYSTEM FOR GROUP STITCH SEWING MACHINES AND THE LIKE

Christiaan Joseph Marinus Benink, Helmut Gross, and Karl Winz, all of Kaiserslautern, Pfalz, Germany, assignors to G. M. Pfaff A.G., Kaiserslautern, Pfalz, Germany, a corporation of Germany

Application May 29, 1956, Serial No. 588,123

Claims priority, application Germany June 1, 1955

14 Claims. (Cl. 112—67)

The present invention relates to an electrical control system for group stitch sewing machines, in particular machines of the type for sewing four-hole buttons to fabrics and other work pieces by means of two groups of stitches, one group passing through one pair of holes and the other group passing through the other pair of holes.

More specifically, the invention is concerned with button sewing machines of this type which are automatically stopped after the first group of stitches, whereby the thread is broken preparatory to the starting of the second group to prevent a cross-over stitch from one to the other pair of holes.

According to one type of machine of this character there are provided two separate foot treadles operating independently of one another. Upon depressing the first treadle, the machine is started and sews the first group of stitches which consists of a number of binding stitches followed by one or more knot tying stitches. After the last tying stitch the machine is automatically stopped. Subsequently the button or work clamp is lifted by operation of the second treadle, whereby to cause the thread to be broken at a point close to the last tying stitch and to cause the thread within the fabric to be pulled off by the thread extractor. The machine is then restarted by again depressing the first treadle to effect the second group of stitches in a similar manner. Finally, renewed operation of the second treadle again effects a breaking of the thread.

In the operation of machines of this type, the operator is compelled to perform four different operating steps during the sewing of a single four-hole button. This, among other disadvantages, is both time consuming and results in undue fatigue on the part of the operator.

According to another kind of sewing machine of this type, the movement of the starting lever or the like upon stopping the machine is utilized to effect an automatic severance of the thread. In this case only a single treadle has to be operated after completion of each group of stitches.

In general it has been found that machines functioning with two separate operating cycles for effecting both groups of stitches, have great advantages compared with continuously operating machines or machines functioning with a single operating cycle, due mainly to the fact that the severance of the thread and the subsequent extraction of the thread after each partial cycle or group of stitches may be effected in a much more secure and efficient manner.

An important object of the present invention, is, therefore, the provision, in connection with a group stitch sewing machine of the type described for the sewing of four-hole buttons to fabrics and other work pieces by means of two groups of stitches, of a control system enabling an automatic and continuous operation for the sewing of a single button and without producing any cross-over stitch between one to the other pair of holes.

2

A more specific object of the invention is the provision of an electrical control system of this type including timing means operating conjointly with the operating parts or organs of the sewing machine for effecting a complete button sewing operation, that is, to automatically perform a series of operating steps, upon initial operation of a manual starting switch by the operator, in such a manner as to sequentially effect the first group of stitches, stop the machine, break and remove the thread, restart the machine in predetermined, preferably adjustable, sequence to the preceding steps, to effect the second group of stitches and again stop the machine, break the thread and to restore the machine to its original condition ready for renewed manual starting by the operator for the sewing of another button during the next operating cycle.

In order to carry the invention into effect and to achieve these objects and results, the control circuit according to the invention includes suitable electrical delay or timing means in order to effect the desired sequence of operating steps. More particularly, after the operation of the manual starting switch to initiate a complete button stitching cycle, the subsequent operating steps are fully automatic and continuous and under the control of a pair of switching devices cooperating and synchronized with the adjusting movement of the starting lever or the like for starting and stopping the machine, on the one hand, and the lever for lifting and depressing the work or button clamp of the machine as well as the thread extracting means, in the manner described in greater detail hereafter.

The foregoing and ancillary objects, as well as novel aspects and features of the invention, will be better understood from the following description taken in reference to the accompanying drawings, forming part of this specification and wherein:

Fig. 1 is a general isometric view of a button sewing machine embodying novel control means in accordance with the invention;

Fig. 2 is a partial isometric view on a larger scale of the machine of Fig. 1, viewed at an angle from the rear and shown with parts broken away to reveal the inside construction of the machine;

Fig. 3 is another partial isometric front view of the machine shown with the cover removed to indicate the thread extractor and stitch forming mechanism; and

Fig. 4 is a wiring diagram of the electrical control system according to the invention.

Like reference numerals identify like parts throughout the different views on the drawings.

Referring more particularly to Fig. 1, the button sewing machine collectively denoted by the numeral 13 is shown mounted upon a table top 11 supported by a frame 12. The machine shown comprises in a known manner a base 14, an upright or standard 15, a fabric or cloth supporting arm or bed 16 and an upper arm 17 terminating in a head 18. Mounted within the latter is a reciprocating needle for cooperating with the stitch forming mechanism, in a manner further described in the following.

Rotatably mounted upon the standard 15 is a control disc or cam 19 arranged in driving connection with the main drive shaft of the machine not visible in the drawing. The transmission ratio between the disc 19 and the drive shaft is so chosen that the disc performs a single revolution during a full two-cycle operation, that is, during both groups of stitches for sewing a single four-hole button.

The cam 19 is formed at one point of its periphery with a notch or depression 21 which in the inoperative or rest condition of the machine 13 assumes the position as shown in Figs. 1 and 2. Cooperating with the cam 19

3

by engaging the peripheral rim thereof is a roller or cam follower 23 being rotatably secured to one end of a double-arm work clamp lift lever 22. The lever 22 is fulcrumed about a pin 24 secured to the arm 17 and has its opposite end (not visible in the drawing) connected to the button or work clamp 25, in such a manner that the clamp 25 is lifted when the cam follower 23 engages the depression 21 of the cam 19 and that the clamp 25 is released or depressed upon the fabric or work, when the clamp follower 23 engages the peripheral rim of the cam 19. In the latter case the clamp engages the arm 16 or the work thereon under spring pressure, in a manner well known and understood by those skilled in the art.

Mounted upon the underside of the table top 11 is an electric motor 26 which is connected to an idler pulley 28, Fig. 2, through a driving belt 27 in the inoperative position or condition of rest of the machine. Upon starting the machine, the belt 27 is shifted to the driving pulley 31 by means of a belt shifter 29. The belt shifter is in turn actuated by the starting lever 32 which is rotatably supported upon the standard 15 about a shaft 33. The lower portion of the starting lever 32 is furthermore connected to one of the arms of an angular shifting lever 34 pivoted about a shaft 35. The other arm of the shifting lever 34 has connected to it the end of a chain 36 whose opposite end is attached to the magnetic armature or plunger of an electromagnetic solenoid 37 mounted underneath the table top 11.

Secured to the head 18 of the machine, Fig. 3, is an oscillating member 38 arranged for lateral movement and carrying a reciprocating needle bar 39 to which is secured a needle 41. The needle cooperates in a known manner with the looper 42 and auxiliary looper or loop former 43 of the stitch forming mechanism and mounted below the bed 16 for effecting a series of single chain stitches, in a manner well known to those skilled in the art.

In order to automatically stop the machine after each stitching group or cycle, there may be provided in a known manner a further control disc or cam mounted on the side opposite from the cam 19 and which also serves to control the reciprocating movement of the needle bar 38 as well as the backward and forward shift of the work clamp 25 for effecting the two groups of stitches in sewing a four-hole button. This control disc which is arranged to make a single revolution during a double operated cycle, similar to the disc 19, may be provided at its periphery with diametrical projections or cams which actuate a two-arm lever serving to retain the starting lever 32 in the coupled position upon actuation of the shifting lever 34. One of the cams of the control disc serves to release the starting lever 32 to stop the machine after completion of the first group of stitches while the other cam serves to release the starting lever and stop the machine after sewing of the second group of stitches. These and other known details of construction may be varied in accordance with the design and type of machine used and have been omitted from the drawings as being immaterial for the understanding of the present invention.

Numerical 44 shows the shaft of the auxiliary looper and 45 indicates the shaft of the main looper 42, the looper shaft itself being invisible in the drawing. Furthermore, secured to an arm 47 is a hook-shaped thread breaker 46, said arm being secured to a shaft 49 supported by an angular bracket secured to the arm 16. Secured to the free end of the shaft 49 is a further arm 51 which is linked to a spring urged rod 52, the spring not being shown in the drawing. The rod 52 is connected by way of a two-arm lever 53 with the rod or shaft 54, Fig. 2, which is actuated by the arm 55 of the starting lever 32.

In Fig. 3 the thread breaker 46 is shown in the operative position of the starting lever 32, that is, while the machine is running and effecting a stitching operation. When the machine is stopped, the shaft 52 is released

4

by the starting lever 32 and moved in a direction towards the end of the arm 16 by the effect of the spring bias mentioned above. As a result, the thread breaker 46 is rotated about the shaft 49 and engages the loop of the thread formed by the main and auxiliary loopers 42 and 43, thus causing a breakage or severance of the thread at a point close to the last tying stitch.

The work or button clamp 25 comprises in a known manner a pair of resilient jaws 56 provided with opposed inner grooves 57 for gripping and holding a button. Further secured to the jaws 56 is a stop 58 for properly positioning the button in relation to the stitch forming mechanism.

Secured to the head 18 of the machine is an electromagnet or solenoid 59 comprising a spring-urged plunger 62 balanced by a coil spring 61 or the like and connected through a fork joint or the like to one arm of a double lever 63 rotatably mounted upon a bracket 64 secured to the head 18 about a screw or pivot 65. The opposite end of the lever 63 has secured to it a pin 66 engaging the bifurcated arm 67 of an angular lever 68 which is rotatably mounted upon a plate 71 secured to the head 18 about a screw or pivot 69. Furthermore, secured by means of a screw 73 to the lower arm 72 of the lever 68 is a curved thread extractor 74 which serves to pull off the end of the severed thread from the fabric or work upon completion of the first stitching group.

Secured to the frame 12 is a foot rest 75, Fig. 1, from which projects a push button 76 or the like actuating member of an electric switch 77. Furthermore, mounted underneath the top 11 is a box 78 housing the various switches and parts of the control system, excepting the switch 77.

The electrical control system is so designed and operates with the operative organs of the machine in such a manner that the only operation to be performed by the operator is the closing of the switch 77 by depressing the push button 76, whereby the machine is started and both groups of stitches together with the breaking and extraction of the thread at the end of the first stitch cycle are performed automatically and in proper time sequence and the machine restored to its initial position upon the completion of a full button sewing operation.

For this purpose, upon closing of the switch 77, the operation is controlled exclusively by a first switch 79 actuated by or synchronized with the work clamp lift lever 22 and a second switch 81 actuated by and synchronized with the operation of the starting lever 32. Both switches, which may be in the form of snap action or micro-switches, are mounted within the housing 78 and controlled by suitable actuating members such as buttons 82 and 83, which are in turn operated by a pair of control levers 84 and 85, respectively, mounted upon a support plate 86 and connected with the operative parts of the machine through suitable remote control coupling links in the form of pull chains or strings 87 and 88 as shown in the drawing. More specifically, the string 87 is connected with the work clamp lifting lever 22 and the string 88 is connected with the shaft 54 of the thread severing mechanism actuated by the arm 55 of the starting lever 32. As a result, the position of the switches 79 and 81 is correlated with the position or operation of the levers 22 and 32 in a predetermined manner more clearly described and understood from the following.

Referring to the electric wiring diagram shown in Fig. 4, operating voltage is applied from the three-phase network R-S-T by way of a main or master switch 89 to the driving motor 26 which may be a squirrel-cage induction motor or the like. Operating voltage for the control circuit is derived, in the example shown, from a terminal 91 of one of the supply phases and a terminal 92 of the neutral conductor O connected to ground or the metal frame of the machine.

More specifically, terminal 91 is connected by a lead

93 and by way of a fuse 94 to a terminal 95 and a further lead 96 connects terminal 92 with a terminal 97.

Connected between terminals 95 and 97 is a pilot lamp 98 which serves to indicate that the system is in proper operating condition. Terminals 95 and 97 are, in turn, connected through leads 99 and 101 to one pair of apices 102 and 103, respectively, of a bridge rectifier 104 comprising four rectifiers preferably of the dry type, such as selenium, copper oxide, germanium, etc. rectifiers, connected in a conventional manner to effect a two-wave rectification of the alternating current. The rectified voltage derived from the coordinated pair of apices or terminals 105 and 106 of the bridge serves to energize the solenoid 37 controlling the belt shifter 29 and the solenoid 59 controlling the thread extractor 74.

The leads 99 and 101 are further extended from the terminals 102 and 103 to the primary winding of a step-down transformer 107 which serves to supply operating voltage for a pair of relays 114 and 124 energized by the secondary winding of the transformer 107. The lead 103 from one of the terminals, shown as the plus pole, of the secondary of the transformer includes a rectifier 111 to provide D.C. energizing current for the relays 114 and 124 and is connected to one of the terminals 112 and 122 of the relay windings 113 and 123, respectively. The opposite or negative pole of the transformer secondary is connected through a lead 109 and by way of a terminal 145 to the switch 77 mounted in the foot rest 75.

The relay 114 has two pairs of contacts 116, 117 and 118, 119, respectively. In the inoperative or rest position of the machine as shown, the contacts 116 and 117 are closed by the relay armature and the relay winding 113 is in its open or deenergized state, while the relay contacts 118 and 119 are in open position as shown in the drawing. Lead 108 is furthermore connected through lead 121 with the terminal 122 of the winding 123 of the relay 124. The latter has a first pair of contacts 126 and 127 which are closed and a second pair of contacts 128 and 129 being open in the deenergized or open condition of the winding 123. Shunted across the terminals 122 and 125 of the relay winding 123 is a capacitor 131 whose purpose and function will be described later.

The negative pole 105 of the rectifier 104 is connected through a lead 132 to one terminal 133 of the solenoid 37 whose other terminal 134 is connected through a lead 135 to the contact 129 of the relay 124. The minus pole of the rectifier 105 is furthermore connected to a branch circuit leading from the terminal 133 of the solenoid 37 to the terminal 137 of the solenoid 59 by way of a lead 136, the remaining terminal 138 of the solenoid 59 being connected through a lead 139 to the contact 119 of the relay 114. Furthermore, the plus pole 106 of the rectifier 104 is connected through a lead 141 to the contact 118 of the relay 114, on the one hand, and through a further lead 142 to the contact 128 of the relay 124, on the other hand. The contacts 118 and 119 of the relay 114 and the contacts 128 and 129 of the relay 124 are shunted by spark suppressor circuits 143 and 144, respectively, each comprising a capacitor in series with a resistor and serving to reduce or eliminate arcing or sparking in a manner well known.

The negative pole of the relay control voltage is further connected by way of terminal 145 and lead 146 to a contact 147 of the switch 79 actuated by the work clamp lift lever 22. The cooperating switch contact 148 is connected to a lead 149, while a further pair of contacts 151 and 152 of the switch 79 is connected by way of a lead 153 to the manual control switch 77, on the one hand, and through a lead 154 to the terminal 125 of the relay 124, on the other hand. The lead 149 is connected to a contact 155 of the switch 81 actuated responsive to movement of the starting lever 32 and having a cooperating contact 156. The switch 81 has a further pair of cooperating contacts 157 and 158, with the contact 156

being connected to contact 158 through a lead 159. Contact 158 is connected through a lead 161 to one terminal 162 of a pulse forming capacitor 163 whose opposite terminal 164 is connected through a lead 165 to the contact 127 of relay 124, while contact 126 cooperating with contact 127 is connected through lead 166 to the contact 115 of the winding 113 of relay 114.

Further connected between the contact 157 of the switch 81 and terminal 164 of the capacitor 163 is a leak or discharge resistor 167. Terminal 162 to the capacitor is further connected through a lead 168 to the contact 116 of the relay 114, whose cooperating contact 117 is connected through a lead 169 and adjustable resistor 172 to the terminal 125 of relay winding 123. Resistor 172 has an adjusting contact 171 and together with the capacitor 131 forms a variable time delay circuit in series with the relay 124, in the manner and for the purpose described in detail hereafter.

The operation of the system aforescribed is as follows. Figs. 1 to 4 show the machine and the various switching devices in the inoperative position, that is, with no voltage applied and with both the motor and machine being at rest. Under this condition the starting lever 32 is in a position, whereby releasing the pull wire 88, results in a closing of the contacts 155 and 156 of the switch 81. Furthermore, the cam follower 23 carried by the lever 22 engages the depression 21 in the cam 19, thus placing the pull wire 87 under tension and resulting in closing of the contacts 151 and 152 of the switch 79. As a result, the work clamp 15 connected to the lever 22 is in its raised position in relation to the arm or bed 16.

If now the main switch 89 is closed, operating voltage is impressed upon both the motor 26 and the control circuit. The motor starts to rotate and drives the idler pulley 28 of the machine 13 by way of the belt 27. At the same time, the pilot lamp 98 is lit apprising the operator that the system is in proper operating condition.

A button to be sewn is then inserted between the jaws 56 of the work clamp 25 and the fabric or other work inserted between the clamp and the bed 16. The machine can now be started by pressing the push button 76, thus closing the switch 77. As a result, the winding 123 of the relay 124 is energized by the secondary of the transformer 107 through a circuit traced as follows: From the plus pole of the secondary of the transformer 107, rectifier 111, lead 108, lead 121, terminal 122, winding 123, terminal 125, lead 154, contacts 152 and 151 of switch 79, lead 153, switch 77, terminal 145, lead 109 and back to the minus pole of the transformer secondary. As a result, relay 124 attracts its armature, thereby closing the contacts 128 and 129. This in turn results in a closing of the energizing circuit of the solenoid 37 controlling the belt shifter 29 through a circuit traced as follows: From the plus pole 106 of the rectifier 104 through leads 141, 142, contacts 128 and 129 of relay 124, lead 135, terminal 134, winding of solenoid 37, terminal 133, lead 132 back to the minus pole 105 of the rectifier.

Energization of the solenoid 37 results in attraction of the plunger into the solenoid field, thus exerting a pull on the chain 36 and actuating the starting lever 32. As a consequence, the belt 37 is shifted from the idler pulley 28 upon the driving pulley 31, thus causing the machine 13 to start running. At the same time the work clamp 25, released by the starting lever 32 and the clamp-lift lever 22, is depressed upon the fabric or work upon the bed 16, while the starting lever 32 actuates the pull wire 88, thus opening the contacts 155 and 166 and closing contacts 157 and 158 of the switch 81. This results in the bridging of the capacitor 163 by the resistor 167, to effect a complete discharge of the capacitor and to ensure constant operating conditions during the subsequent operating cycle.

After the machine 13 has been started, the cam follower 23 carried by the lever 22 rides out of the de-

pression 21 of the cam 19, thereby causing the lever 22 to move the work clamp 25 to its operative condition. At the same time the pulling wire 87 connected to the lever 22 actuates the switch 79, thus causing opening of the contacts 151 and 152 and closing of the contacts 147 and 148. As a result, the entire control circuit is now freed from the control by the switch 77 and all subsequent operations are subject exclusively to the action of the switches 79 and 81 operated by and synchronized with operative organs of the machine.

Upon opening of the contacts 151 and 152 the relay 124 becomes deenergized, thus in turn deenergizing the solenoid 37. The machine now proceeds to sew the first group of stitches during which period the contacts 147 and 148 of the switch 79 and the contacts 157 and 158 of the switch 81 are in closed position.

After sewing the first group of stitches the machine is automatically stopped by the automatic control of the starting lever 32 and the thread broken and severed, in the manner described. At the same time switch 81 is actuated through the pull wire 88, resulting in opening of the contacts 157 and 158 and in reclosing of the contacts 155 and 156. Switch 79, however, retains its previous position, that is with the contacts 147 and 148 closed and contacts 151 and 152 opened, due to the fact that the cam disc 19 makes only a single revolution during the two cycle operation or sewing of the two groups of stitches within a complete button sewing operation. In other words, the cam follower 23 of the clamp-lift lever 22 at the end of the first half cycle or stitching group is at a position diametrically opposite to the depression or notch 21 of the disc 19.

The closing of the contacts 155 and 156 results in the establishment of the following circuit after the completion of the first half cycle or stitching operation. The winding 113 of the relay 114 is now energized by a circuit traced as follows: From the plus pole to the transformer secondary through lead 108 and rectifier 111, terminal 112, winding 113, terminal 115, lead 166, contacts 126 and 127 of relay 124, lead 165, terminal 164, capacitor 163, terminal 162, lead 161, terminal 158, lead 159, contacts 156 and 155 of switch 81, contacts 148 and 147 of switch 79 (being in close position during entire operation) lead 146, terminal 145, lead 109 and back to the negative pole of the transformer secondary. Since this circuit is through the capacitor 163, the relay winding 114 will be energized intermittently or by a relatively short current pulse, that is, during the charging period of the capacitor 163. As a result, the relay armature is attracted momentarily and again released during the charging period of the capacitor 163, thus causing a momentary pulse-like energization of the solenoid 59 operating the thread extractor, in the manner described. During the energized period of the relay armature contacts 118 and 119 are closed, thereby establishing the energizing circuit of the solenoid 59 as traced in the following: From the plus pole 106 of rectifier 104 through lead 141, contacts 118 and 119 of relay 114, lead 139, terminal 138, winding of solenoid 59, terminal 137, lead 136, terminal 133, lead 132 and back to the minus pole 105 of the rectifier.

During the energization of the relay 114 by the charging current of the capacitor 163 winding 123 of the relay 124 is also energized by the closing of a branch circuit traced as follows: From terminal 162 through lead 168, contacts 116 and 117 of relay 114, lead 169, variable adjusting contact 171, series resistor 172, lead 154, terminal 125, relay winding 123, terminal 122 and leads 121 and 108. The relay 124 is prevented, however, from operation during this intermittent energization by the fact that the delay circuit comprising the series resistor 172 and parallel capacitor 131 prevents the current to rise to a value sufficient to energize the winding and to attract the armature of the relay. Only after the armature of the relay 114 has again been released at the end

of the capacitor charging current pulse, that is, after extraction or pulling-off of the thread, will the exciting current through the winding 123 be enabled to build up to a value sufficient to effect attraction of the relay armature and closing of the contacts 128 and 129. As a result, the machine is re-started to effect the second stitching operation in the same manner as for the first stitching operation, with this difference however, that starting of the second group is effected purely automatically and in proper time sequence after the automatic stopping of the machine upon completion of the first stitching group. Starting of the latter is effected manually by operating the switch 77 at the beginning of a complete button sewing cycle or operation.

Again, as in the case of the first half cycle, the switch 81 is operated by the start-stop lever through the pull wire 88, whereby to open the contacts 155 and 156. The armature of relay 124 is therefore again released and the solenoid 37 de-energized. At the same time contacts 157 and 158 are closed, thus causing a discharge of the capacitor 163 through the resistor 167.

At the end of the second stitching group the machine is again stopped automatically. At the moment of stopping the cam follower 23 carried by the lever 22 engages the depression 21 of the cam 19. The lever 22 being suitably spring biased then effects a quick lifting of the work clamp 25 resulting in breaking of the thread. Furthermore, the pull wire 87 actuates the switch 79, whereby to deenergize the circuits of the relays 114 and 124 by opening the contacts 147 and 148, thus preventing any further switching operations. In other words, no thread extraction occurs or is necessary upon completion of the second stitching group.

By the actuation of the starting lever 32 the switch 81 is returned to its initial position shown in Fig. 4, thus placing the machine in a condition for the next operation or complete button sewing cycle to be initiated by the renewed operation of the switch 77.

In the foregoing the invention has been described with reference to a specific illustrative device and circuit. It will be evident, however, that numerous modifications and variations, as well as substitution of equivalent elements and parts for those shown for illustration, may be made without departing from the broader spirit and scope of the invention as set forth in the appended claims.

The specification and drawings are accordingly to be regarded in an illustrative rather than in a limiting sense.

We claim:

1. In a group stitch sewing machine of the type comprising a starting member, stop-motion means to automatically stop the machine and means to break the thread upon effecting a predetermined number of stitches and thread extracting means for removing the broken thread; a control system comprising first electrical actuating means to operate said starting member, second electrical actuating means to operate said thread extracting means, circuit connections including a source of electric energy for energizing said actuating means, first and second relay means controlling said first and second actuating means, respectively, a source of direct current and a pair of branch circuits connectable thereto and each including one of said relay means, electrical time delay means connected to said first relay means, and electrical capacitor means connected in series with said second relay means, switch means to connect said branch circuits to said direct current source upon and during stopping of the machine by said stop-motion means whereby to intermittently operate said second actuating means by the capacitor charging current, to extract the thread, and to subsequently energize said first actuating means, to start the machine, upon energization of said relay means by said direct current source.

2. In a control system for group stitch sewing machines as claimed in claim 1, further electrical control means for operating said first actuating means, to man-

ually start said machine, and means controlled in response to operative movement of said machine to disable said further control means during at least two consecutive group stitching cycles, upon initially manually starting said machine.

3. In a control system for group stitch sewing machines as claimed in claim 1, means to temporarily disconnect said first relay means during the energization of said second relay means by said capacitor charging current.

4. In a control system for group stitch sewing machines as claimed in claim 1, wherein said time relay means is comprised of a high ohmic resistor connected in series with and an electrical capacitor connected in parallel to said first relay means.

5. In a control system for group stitch sewing machines as claimed in claim 1, wherein said second relay means has a first pair of normally open contacts operable to close, to energize said second actuating means, and a second pair of contacts being normally closed and inserted in series with said first relay means, whereby to temporarily disconnect said first relay means during the energization of said second relay means by said capacitor charging current.

6. In a group stitch sewing machine of the type comprising a starting member, stop-motion means to automatically stop the machine and means to break the thread upon effecting a predetermined number of stitches and a thread extractor to remove the broken thread; a control system comprising a first solenoid having an armature connected to said starting member, a second solenoid having an armature connected to said thread extractor, circuit connections including a source of electric energy to energize said solenoids, a first and second relay to control said first and second solenoids, respectively, a source of direct current and a pair of branch circuits connectable thereto and each including one of said relays, electrical time delay means connected in series with said first relay, and an electrical capacitor connected in series with said second relay switch means to connect said branch circuits to said direct current source upon and during stopping of the machine by said stop-motion means, whereby to intermittently energize said second solenoid by the capacitor charging current, to operate said thread extractor, and to subsequently energize said first solenoid, to start said machine, upon energization of said relays by said direct current source.

7. In a control system for group stitch sewing machines as claimed in claim 1, further electrical control means for energizing said first solenoid, to manually start said machine, and means controlled in response to operative movement of said machine to disable said further control means during at least two consecutive group stitching cycles, upon initially manually starting said machine.

8. A control system comprising first and second independent and electrically operable devices, a first and a second relay for controlling the operation of said devices, respectively, a source of direct current, first and second branch circuits simultaneously connectible to said source and including said first and second relays, respectively, electric time delay means in said first branch circuit being comprised of a high ohmic resistor connected in series with and a capacitor connected in parallel to said first relay, and a further electrical capacitor connected in series with said second branch circuit, whereby to first intermittently energize said second relay by the charging current of said capacitor and to subsequently energize said first relay, upon connection of said branch circuits to said source, to operate said first device in predetermined time sequence to the operation of said second device.

9. A control system comprising first and second independent and electrically operable devices, a first and a second relay for controlling the operation of said devices, respectively, a source of direct current, first and second branch circuits simultaneously connectible to said source and including said first and second relays, respectively,

electric time delay means in said first branch circuit being comprised of a high ohmic resistor connected in series with and a capacitor connected in parallel to said first relay, and a further electrical capacitor connected in series with said second branch circuit, whereby to first intermittently energize said second relay by the charging current of said capacitor and to subsequently energize said first relay, upon connection of said branch circuits to said source, to operate said first device in predetermined time sequence to the operation of said second device, said second relay having a first pair of normally open operating contacts, to control said second device, and a second pair of auxiliary contacts being normally closed and inserted in series with said first relay, whereby to temporarily interrupt said first relay during energization of said second relay by said capacitor charging current.

10. In a group stitch sewing machine of the type comprising a starting member, stop-motion means to automatically stop said machine and to break the thread upon effecting a predetermined number of stitches and a thread extractor to remove the broken thread; a control system comprising a first solenoid having an armature connected to said starting member, a second solenoid having an armature connected to said thread extractor, circuit connections including a source of electric energy to energize said solenoids, a first relay having an exciting winding and a pair of contacts being normally open and inserted in the circuit of said first solenoid, a second relay having an exciting winding and a pair of contacts being normally open and inserted in the circuit of said second solenoid, a source of direct current exciting energy for said relays, a pair of branch circuits each including one of said relay windings and connected to said direct current source, electrical time delay means in series with said first relay winding and an electrical capacitor in series with said second relay winding and switch means to connect said branch circuits to said direct current source upon and during stopping of the machine by said stop-motion means, whereby to intermittently energize said second relay by the charging current of said capacitor, to operate said thread extractor, and to subsequently energize said first relay, to start the machine, upon energization of said relays by said direct current source.

11. In a two-cycle group stitch sewing machine embodying a control system according to claim 10, comprising a common lead between said branch circuits and one pole of said direct current source, a first switch responsive to operative movement of said machine and having two pairs of contacts, one pair being closed and the other pair being open, and vice versa, in the rest position and during a full two-cycle operating period of the machine, respectively, a second switch controlled responsive to operative movement of the machine and having a pair of contacts being closed and opened, respectively, in the rest position and during each single operating cycle of the machine, one pair of contacts of said first switch and the contacts of said second switch being inserted in said common lead in series relation to one another, a manual starting switch, a further control circuit including said direct current source, the other pair of contacts of said first switch, said first relay and said manual starting switch, to enable manual starting of the machine, to effect a first group of stitches, while interrupting said further control circuit, upon starting of the machine, and closing said common lead by said first and second switch, upon stopping the machine after completion of the first stitching cycle.

12. In a control system for group stitch sewing machines as claimed in claim 11, means for temporarily discharging said capacitor during starting of the machine by said first solenoid.

13. The combination with a group stitch sewing machine of the type having a starting member, stop-motion

11

means to automatically stop the machine and means to break the thread upon effecting a predetermined number of stitches and a thread extractor; of a control system comprising first and second electrically controlled actuating means for said starting member and said thread extractor, respectively, a first and a second relay to control said first and second actuating means, respectively, a manual starting switch, a source of direct operating current for said relays, a first circuit connectable to said source including said first relay and said manual starting switch, a second circuit connectable to said source having first and second branch circuits including, respectively, said first and second relay, a time delay network in series with said first branch circuit, an electrical capacitor in series with said second branch circuit, multiple switch means and control means therefor responsive to operative movement of said machine, to interrupt said first circuit and to close said second circuit during at least two consecutive group stitching cycles of said machine, upon initially manually starting said machine, and further switch means in said second circuit and control means therefor responsive to operative movement of said machine, to close said second circuit in the rest position and to open said second circuit in the operating condition of said machine, respectively.

14. The combination with a group stitch sewing machine of the type having a starting member, stop-motion means to automatically stop the machine and means to break the thread upon effecting a predetermined number of stitches and a thread extractor; of a control system comprising first and second electrically controlled actuating means for said starting member and thread extractor, respectively, a first and second relay to control said first and second actuating means, respectively a, source of direct operating current for said relays, a manual starting switch, a first circuit connectable to said source including said first relay and said manual starting switch,

12

a second circuit connectable to said source having a first and second branch circuit including, respectively, said first and second relay, a resistance-capacitor time delay network in said first branch circuit, an electrical capacitor in series with said second branch circuit, multiple switch means and control means therefor responsive to operative movement of said machine, to interrupt said first circuit and to close said second circuit during two consecutive group stitching cycles of said machine, upon initially manually starting said machine, and further switch means in said second circuit responsive to operative movement of said machine, to close said second circuit in the rest position and to open said second circuit in the operating condition of said machine, whereby the thread is automatically extracted and the machine restarted to effect a second group stitching operation, upon stopping of the machine by said stop-motion means, after manually initiating a first operating cycle by means of said manual starting switch.

References Cited in the file of this patent

UNITED STATES PATENTS

2,080,273	Holmes	May 11, 1937
2,232,782	Gunther	Feb. 25, 1941
2,433,254	Aiken	Dec. 23, 1947
2,515,968	Shanklin	July 18, 1950
2,540,730	Hayes	Feb. 6, 1951
2,549,307	Griffes	Apr. 17, 1951
2,685,664	Visconti	Aug. 3, 1954
2,722,183	Hayes	Nov. 1, 1955
2,722,184	Sweet	Nov. 1, 1955
2,764,112	Happe	Sept. 25, 1956

FOREIGN PATENTS

448,549	Great Britain	June 10, 1936
---------	---------------	---------------