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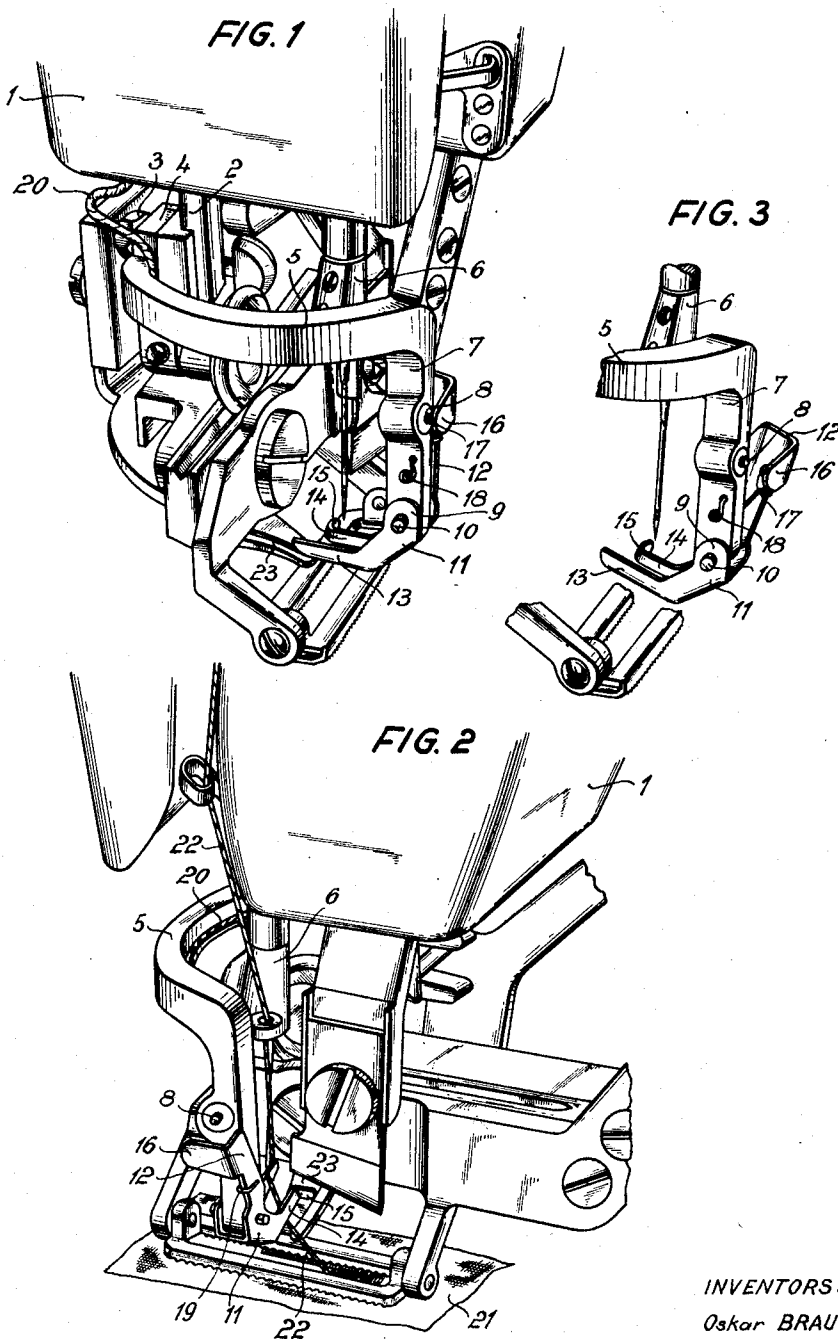
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2,910,028

ELECTRICAL CONTROL SYSTEM FOR SEWING AND THE LIKE MACHINES

Filed May 19, 1958

2 Sheets-Sheet 1



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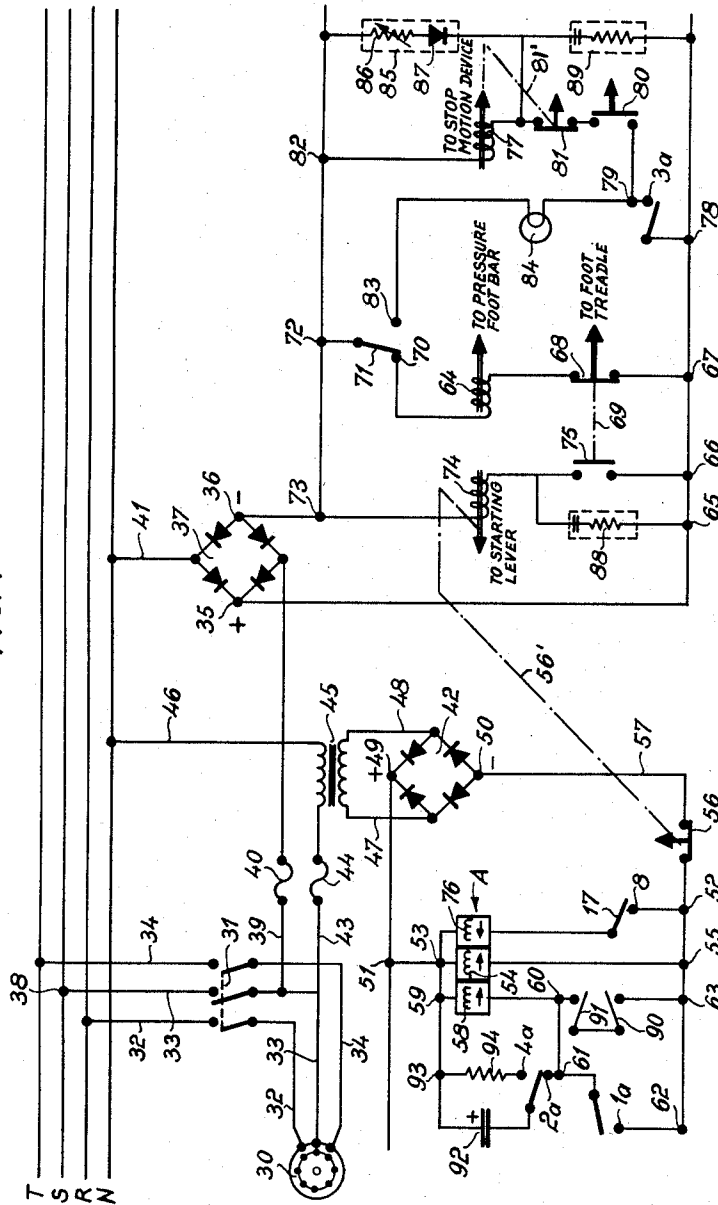
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FIG. 4



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ELECTRICAL CONTROL SYSTEM FOR SEWING AND THE LIKE MACHINES

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Claims priority, application Germany May 22, 1957

11 Claims. (Cl. 112—219)

The present invention relates to electrical control systems, more particularly to a control system for sewing and the like machines, to produce a warning signal and/or to initiate the stoppage of the machine upon breakage or failure of the thread during operation.

An object of the invention is the provision of a thread-controlled safety device for lock-stitch sewing machines operative upon breakage of the lower or bobbin thread in either the forward or reverse stitching direction of the machine.

Another object of the invention is the provision of a thread-controlled stop-motion device for sewing machines operative substantially instantly upon breakage or failure of the lower thread in either the forward or reverse stitching direction of the machine, in such a manner as to involve a minimum of idle or unbound stitches prior to the final stoppage of the machine by the stop-motion mechanism.

Yet another object of the invention is the provision of a control system responsive to both lower and upper thread breakage or failure and adapted to operate a single control device, such as a stop-motion mechanism, warning signal etc. with a minimum of time delay and operating parts being required.

While most conventional sewing machines are designed for both forward and reverse stitching, the reversal of the stitching direction is of prime importance for button-hole and barring stitch sewing machines provided with means to effect a stoppage of the machine upon completion of a predetermined sewing operation or cycle, such as a cam, lever or the like stop-motion mechanism well known in connection with button-hole and similar group-stitch sewing machines.

Furthermore, in the case of a thread failure, it is desirable to stop the machine instantly, to reduce the number of idle or unbound stitches to an absolute minimum. This is of special importance in the case of modern rapid sewers, since the available operating or switching time is extremely limited. As an example, if the thread breaks shortly before the completion of an operating cycle, such as during the sewing of the first stitches of the second set of barring stitches of a button-hole, the operative has to take great care to prevent operation of the button-hole cutting knife at the termination of the operating cycle, since this would make it necessary to re-sew the hole cut by the knife, to return the needle to the breakage point of the thread and to repeat the sewing operation.

It is well known to utilize the slack or inclined position assumed by the upper thread upon failure to interlock with the lower or bobbin thread as a means to operate an electrical contact device mounted adjacent to the needle for the purpose of initiating the stoppage of the machine. A disadvantage of known stop-motion devices of this type is the fact that they are operative only in a single, i.e. the forward, stitching direction so that no stoppage of the machine will occur in case of thread failure in the opposite or reverse stitching direction.

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On the other hand, it is necessary in many cases, such as in sewing button-holes or the like, that the thread-controlled automatic stop-motion device operate in both stitching directions, since the zig-zag side stitches of a button-hole are normally sewn in different directions. Further considering the fact that the length of the stitches in sewing a button-hole is extremely small, being of the order of 0.3 mm., it can be readily seen that the machine must be stopped practically instantly upon breakage of the lower thread in order to reduce to an absolute minimum the number of idle or unbound stitches. For this reason, it is necessary to mount the control device as closely as practically possible to the needle and work, to ensure both optimum response sensitivity and a minimum of time delay or response time of the automatic stop-motion mechanism.

According to the improvements of the present invention, a continuous monitoring of the lower thread and stoppage of the machine upon thread failure is effected by the provision of a control member or sensing device, preferably in the form of a spring-urged lever or the like, having a pair of fingers or prongs extending to points at opposite sides of the needle in respect to the stitching direction, in such a manner as to cause engagement of either of said prongs by the slack formed by upper thread upon failure of the lower thread in either stitching direction of the machine. More particularly, upon the occurrence of a thread failure, the control member is deflected by the slack assumed by the upper thread in either the forward or reverse stitching direction, as will become more apparent from the following description, whereby to operate a single electrical contact device controlling the stop-motion mechanism or other output device. With a control device of this type, care must be taken to prevent obstruction of or interference with the needle or auxiliary devices located in the vicinity, such as a button-hole cutting knife, upper thread cutter etc.

The importance of a thread-controlled stop-motion device responsive to lower thread failure of a button-hole sewing machine will become further apparent from the fact that, in many instances, the button-hole in order to improve its appearance is sewn with increased upper thread tension, to result in what is known as a raised button-hole. In this case, the lower thread is drawn all the way through the work or sewing material, whereby the total length of the lower thread required for a given sewing operation will be a multiple of the length of the upper thread. This increased lower thread consumption, in turn, requires a more frequent change of the lower thread bobbin. Although there is a greater danger of failure or breakage of the upper thread, which may be controlled or monitored by means of a known upper thread control or stop-motion device as described, for instance, in the co-pending patent application Serial No. 598,872, filed July 19, 1956, now Patent No. 2,868,151 dated January 13, 1959 entitled Thread Controlled Automatic Stop Device for Sewing Machines, by Karl Winz, one of the joint applicants of the present application, on account of the greater alternating load imposed upon the upper thread, the more frequent condition in practice will be the exhaustion of the lower thread, wherefore the necessity of a sensitive automatic stop-motion device operative instantly upon lower thread failure in either stitching direction of the machine and involving a minimum of time delay or response time in controlling the stop-motion mechanism of the machine.

According to a preferred embodiment of the invention, the foregoing object is achieved essentially by the provision of a control member or lever mounted upon an extension of the pressure foot of the machine about an axis parallel to the stitching direction and having a pair of prongs or fingers extending at right angle to the stitch-

ing direction to points close to and spaced from opposite sides of the needle, said member being adapted to operate an electrical contact device initiating the stop-motion operation upon engagement of either of said prongs by the slack assumed by the upper thread upon its failure to interlock with the lower thread. In this manner, operation of the stop-motion device responsive to lower thread failure is ensured in either stitching direction of the machine, substantially without obstruction or interference with the operation of the needle and other operating parts of the machine.

Advantageously, the operating lever has a bent or angular shape with one of the lever arms being provided with a pair of prongs or fingers and with the cooperating lever arm carrying an electrical contact, said lever being rotatably mounted at its apex upon a support connected to the pressure foot of the machine about an axis parallel to the stitching direction. In this manner, there is obtained a relatively large operating path for the electrical contacts in response to a relatively small deflection of the lever by the slack assumed by the upper thread upon failure to interlock with the lower thread. This, in turn, results in a minimum of idle or unbound stitches between the instants of lower thread breakage and the final stoppage of the machine by the automatic stop-motion means. Further considering the fact that a minimum normal contact pressure is required, in order to prevent "fluttering" of the electrical contacts due to mechanical vibration of the machine or other causes, the advantages of the invention in achieving maximum operating safety and efficiency of the automatic stop-motion device will become further evident.

While the mechanical design of the control device according to the invention insures a minimum of delay or response time of the stop-motion mechanism, it will be further evident that any additional delay caused by the associated electrical devices or circuit, such as relays, etc., must be avoided in the interest of all-over maximum efficiency and reliability of the control system. In other words, any auxiliary electrical devices liable to introduce an additional delay should be avoided wherever possible, especially in the case of rapid button-hole sewers or the like machines, as will be readily understood.

Sewing machines equipped with a thread-controlled stop-motion device advantageously are also provided with automatic stop-motion means responsive to upper or needle thread breakage, or failure such as described, for instance, in the above-mentioned co-pending application. In such a case, there would be two relays controlling a single stop-motion device, that is, one relay controlled by failure of the lower thread and a further relay controlled by failure of the upper thread, respectively. In a system of this type, it has been found that additional electrical control or blocking devices and the like may be necessary which are liable to introduce additional delay in the operation of the stop-motion mechanism.

The use of separately operated relays may also result in an undue increase of the total response or operating time to an extent as to increase the number of idle stitches beyond the practical minimum, especially in the case of machines requiring a repeated operation of the actuating lever or the like stop-motion control member, quite aside from the increased costs involved. Moreover, since it is customary to operate the contact associated with the upper thread in closed-circuit mode or operation and to operate the contact associated with the lower thread in open-circuit mode or operation, further difficulties are experienced in the operation of a single output or stop-motion device by either control circuit, to effect the stoppage of a sewing machine or to effect any other operation of control.

Accordingly, a further object of the invention is the provision of a simplified and efficient control device to enable the operation of a single output device by either

of a pair of control circuits operated in the closed-circuit and open-circuit mode of operation, respectively.

The latter object is achieved principally according to the invention by the provision of a single polarized control relay having a pair of differential windings energized by the currents of the open-circuit and of the closed-circuit relays or contact devices, respectively, said relay having a further winding being continuously energized and related to said differential windings in the manner described hereafter. Such an arrangement has the advantage, in addition to reducing the number of operating parts, of increasing the operating safety by further reducing the total response time of the system to a safe minimum required for practical and reliable operation of the stop-motion device of a sewing and the like machine.

The invention, as to its further objects as well as novel aspects, will be better understood from the following detailed description, taken in reference to the accompanying drawings forming part of this specification and in which:

Fig. 1 is a perspective front view showing the head of a button-hole sewing machine equipped with a lower thread control device constructed in accordance with the principles of the invention, the machine being shown in the rest or non-operative position of the control device;

Fig. 2 is a perspective side view of Fig. 1, showing the position of the needle thread and control device upon the occurrence of a lower thread failure during the operation of the machine;

Fig. 3 is a fragmentary perspective view more clearly illustrating the control device in the operative position; and

Fig. 4 is a circuit diagram of an improved control system according to the invention responsive to either lower or upper thread failure of a sewing machine and operative in controlling a single control device, such as a warning signal or stop-motion mechanism.

Like reference characters denote like parts in the different view of the drawings.

Referring more particularly to Figs. 1 to 3, there is shown the head 1 of a conventional button-hole sewing machine including a pressure foot 2 to which is secured by means of a screw 3 a support or bracket 4 having a curved horizontal extension 5 which terminates in a vertical arm or bar 7 arranged parallel to the needle bar 6 carrying the needle in a manner well known and shown in the drawing. The arm 7 is provided with a bore having mounted therein an electrical contact element 8 insulated from said arm. Further rotatably mounted upon the lower end of the arm 7 about an axis 10 parallel to the stitching direction is a bent or angular control lever 9 having two lever arms 11 and 12. The arm 11 terminates in a pair of parallel fingers or prongs 13 and 14 extending at right angle to the stitching or work feeding direction to points close to the opposite sides of the needle carried by the needle bar 6. The lever arm 12 extends from the axis 10 along one side of the arm 7 and terminates in a bent portion 16 to which is secured a further contact 17 cooperating with the contact 8 insulatingly mounted upon the bar 7. Further secured to the lower part of the arm 7 is a biasing or return spring 18 having its resilient end portion bent around a lateral face of the lever arm 12, whereby to urge the latter into a position to normally cause engagement between the contacts 8 and 17, as shown in Fig. 1.

Contact 8 may be connected to one terminal of an operating current source through an insulated conductor 20, the cooperating terminal of the source being advantageously connected to contact 17 through the metal parts of the machine, to close the electrical circuit by engagement or closing of the contacts 8 and 17 by the control lever 9.

In operation, the upper thread 22 is normally interlocked with the lower thread at the point of entry of the needle into the work 21, while the control lever 9

is urged by the spring 18 into the closed position of contacts 8 and 17, as described and shown in Fig. 1.

In case of exhaustion or breakage of the lower thread, the stitch formation or interlock between the upper and lower thread is interrupted, while the work feed continues to operate, resulting in the upper thread 22 assuming a slanting or oblique position, hereinafter referred to as the slack of the thread, after the occurrence of a number of idle or unbound stitches, as shown more clearly in Fig. 2 of the drawings. As a result, the thread 22 engages either of the prongs or fingers 13 or 14, depending upon the stitching direction. As the distance between the latest point of interlock between the threads and the point of entry of the needle into the work 21 increases more and more, the slack of the upper thread finally assumes a length sufficient to cause the lever 9 to rotate about its axis 10 and to separate or open the contacts 8 and 17 and the electrical circuit associated therewith. This in turn, may serve to initiate the operation of a stop-motion device or mechanism, in a manner well known in connection with automatic stop-motion devices for sewing machines.

Damage to the needle by the operation of the lever 9 is substantially prevented due to the fact that the axis 10 of both the fingers 13 and 14 is parallel to the stitching or work feed direction, thus eliminating an approach of any of the fingers 13 and 14 towards the needle. The return spring 18 may be designed in such a manner as to prevent an excessive force on the lever 9 liable to cause breakage of the thread 22. On the other hand, the design and/or adjustment should be such as to prevent "flutter" of the contacts caused by vibration of the machine and liable to result in undesirable or premature stoppage thereof.

After restoring the lower thread tension or exchanging of the thread bobbin, the lever 9 returns to its normal position, whereby to close the contacts 8 and 17 and associated control circuit. In order to enable safe operation of the upper thread cutting knife 23 at the end of a sewing operation or cycle without damage to the lever 9, the finger 14 is provided with a bent portion 15 being engaged by the cutter 23 during its operation, whereby to operate the lever 9 and to open the controls 8 and 17 for the purpose as will be further described hereafter.

Instead of operating the contacts 8 and 17 in normally closed-circuit mode of operation, as shown and described, the operation may be in accordance with the open-circuit mode by a proper construction and mounting of the contacts, as will be readily understood by those skilled in the art.

Referring to the circuit diagram shown by Fig. 4, both the three-phase driving motor 30 of the sewing machine and the control device are shown energized from a three-phase power network comprising the conductors R, S, T, and neutral line N. The control system may be placed in operative or working condition by closing a main switch 31, to energize the motor 30 through leads 32, 33 and 34 and to provide D.C. operating voltage for the starting, presser foot control and stop-motion devices of the machine at the output terminals 35 and 36 of a rectifier 37, shown in the form of a rectifier bridge and comprising selenium or the like contact rectifier units connected to the power supply through a circuit traced as follows:

(I) Line conductor S, terminal 38, lead 33, switch 31, lead 39, fuse 40, rectifier 37, lead 41 and line conductor N.

A further rectifier 42 to provide operating voltage for the control relay is connected to the power supply network through a circuit traced as follows:

(II) Line conductor S, terminal 38, lead 33, switch 31, lead 43, fuse 44, primary of transformer 45, lead 46, secondary of transformer 45, lead 47, rectifier 42 and lead 48.

Terminals 49 and 50 of the rectifier 42 provide a D.C.

voltage for energizing the differential relay A having three windings 54, 58, and 76 and controlling the stop-motion device upon failure of either the upper or lower thread of the machine, in a manner to be described in greater detail presently.

During operation of the upper thread cutter 23, Figs. 1 and 2, the contacts 8 and 17 of the control device are opened as described above, whereby to operate the relay A by closing of the following control circuit:

(III) Rectifier terminal 49, terminal 51, terminal 53, relay winding 54, terminal 55, terminal 52, control switch 56, and rectifier terminal 50.

The control switch 56 is mechanically coupled with the starting magnet or solenoid 74 of the sewing machine, as indicated by the dot-dash line 56', in such a manner as to open the switch 56 during the excitation of the solenoid 74.

Upon energization of the relay A, as described, its contacts 1a, 3a, and 4a are closed and the contact 2a opened, whereby to establish a holding circuit through the further relay winding 58 traced as follows:

(IV) Rectifier terminal 49, terminal 51, terminal 53, terminal 59, relay winding 58, terminal 60, terminal 61, contact 1a, terminal 62, terminal 63, terminal 55, terminal 52, control switch 56, and rectifier terminal 50.

The windings 54 and 58 of the relay A are connected or wound to produce magnetic field components in the relay magnet in the same direction, as indicated by the arrows in the drawing.

At the same time, the lifting magnet 64 operating the pressure foot bar 2 is energized by the rectifier 37 through a circuit traced as follows:

(V) Rectifier terminal 35, terminal 65, terminal 66, terminal 67, contact 68 of foot switch 69, lifting magnet 64, contact 70, roller contact 71, terminal 72, terminal 73 and rectifier terminal 36.

The roller contact 71 has a position as shown in the drawing during the rest or inoperative condition of the machine, and may be operated by a cam or the like mounted upon the machine and opening contact 71 and closing a contact 83, while the machine is in operation. Upon energization of the lifting magnet 64, the pressure foot bar 2 is raised, whereby to enable the insertion and adjustment of the work 21.

In order to start the sewing operation, the foot switch 69 is at first operated to an intermediate position, whereby to interrupt circuit V and to deenergize the lifting magnet 64. The results in a lowering of the pressure foot bar 2 upon the work 21. By again closing the circuit V by release of the foot switch, the pressure foot may be raised again to enable readjustments of the work, in a manner well understood. In order to start the machine, the foot switch 69 is now operated to its final or end position, whereby to energize the starting magnet or solenoid 74 through a circuit being traced as follows:

(VI) Rectifier terminal 35, terminal 65, terminal 66, contact 75 of the foot switch 69, starting magnet 74, terminal 73, and rectifier terminal 36.

As a result, the sewing machine is coupled with the driving motor 30 in a known manner, to initiate an automatic button-hole sewing cycle or operation. At the same time, the control switch 56 is operated during the time period of response of the starting magnet or solenoid 74. This, in turn, results in the interruption of circuits III and IV and deenergization of relay windings 54 and 58. Upon expiration of the brief response period of the starting magnet 74, after release of the foot switch or treadle 69 by the operator, the control switch 56 is re-closed, as shown in the drawing. In the meantime, the contacts 8 and 17 of the lower thread control device are closed after the upper-thread cutter 23 has been retracted. An exciting circuit is now established through the third relay winding 76 as traced in the following:

(VII) Rectifier terminal 49, terminal 51, terminal 53,

relay winding 76, contacts 17—8, terminal 52, control switch 56 and rectifier terminal 50.

At the same time, circuit III is reclosed. However, since the ampere-turns of the windings 54 and 76 are equal and their magnetic fields opposing one another, response of the relay A is prevented.

Upon completion of the button-hole sewing operation, the machine is automatically stopped by a suitable stop-motion means (cam, lever etc.) associated with conventional group-stitch sewing machines. If during the sewing operation a failure occurs of the lower thread, due to exhaustion of the thread bobbin or to thread breakage, the contacts 8 and 17 will be opened in the manner described, whereby to interrupt circuit VII of the winding 76. Since now the magnetic field of winding 54 is no longer cancelled or compensated by the field of winding 76, relay A responds, an additional relay holding circuit being again established by the energization of winding 58 through circuit VI.

As a result, contact 3a of relay A closes a circuit energizing the stop-motion magnet 77 of the machine and traced as follows:

(VIII) Rectifier terminal 35, terminal 65, terminal 66, terminal 67, terminal 78, contact 3a, terminal 79, control switch 80, interrupter switch 81, stop-motion magnet 77, terminal 82, terminal 72, terminal 73 and rectifier terminal 36.

Control switch 80 is closed during operation and opened during the rest position of the machine. Furthermore, the roller contact 71 engages the contact 83 upon starting of the machine, as pointed out, whereby to energize a pilot lamp 84 by closing a circuit through contact 3a traced as follows:

(IX) Rectifier terminal 35, terminal 65, terminal 66, terminal 67, terminal 78, contact 3a, terminal 79, pilot lamp 84, contact 83, roller contact 71, terminal 72, terminal 73 and rectifier terminal 36.

The stop-motion magnet 77 attracts its armature and, as a result reduces the speed of the machine by operation of the stop-motion lever or the like. The stop-motion means may be of any suitable type known, such as a normally locked switch connected in one of the supply leads of the motor 30 and being unlocked by the armature of magnet 77 as shown, for instance, by U.S. Patent 1,742,953. In the case of machines requiring only a single operation to effect the stoppage thereof, the stop-motion magnet may serve to effect the complete stoppage upon energization in the manner described. If, however, two consecutive operations are required to effect stopping of the machine, the interrupter switch 81 being operated simultaneously with the response of the stop-motion magnet 77, serves to interrupt and reclose the exciting circuit VIII. More specifically, upon operation of the armature of the stop-motion magnet 77, the interrupter switch 81 is opened and reclosed upon release of said armature, as indicated schematically by the dot-dash line 81), whereby to operate the stopping lever or the like for a second time, to effect complete or final stoppage of the machine. At this time, the control switch 80 is opened, resulting in interruption of the circuit VIII.

The time delay circuit 85 connected across the winding of the magnet 77 and including a preferably adjustable resistor 86 and rectifier 87 serves to delay the operation of the stop-motion magnet 77. More particularly, this circuit causes a delay of the release of the armature of the magnet 77 in that, at the instant of opening of the contact 81, the inductive or kickback voltage generated in the winding 77 is impressed upon the rectifier 87 and resistance 86, thus retarding the collapse of the magnetic field and, in turn, the release of the magnet armature. By-passing of the normal exciting current of the winding 77 is prevented by the rectifier 87. Items 88 and 89 represent quenching circuits, to reduce sparking or arcing between the switch contacts, in a manner well known and understood.

After repair or readjustment of the thread, the starting magnet is re-energized by operation of the foot switch 69, whereby to re-establish the circuit VI resulting in a repetition of the operating steps described hereinbefore.

Upon breakage of the upper thread, contact 90 of the upper thread control device is closed, whereby the synchronous switch or contact 91 operated in a known manner by the machine causes a series of brief periodic charging currents applied to a capacitor 92 through a circuit traced as follows:

(X) Rectifier terminal 49, terminal 51, terminal 53, terminal 59, terminal 93, capacitor 92, contact 2a, terminal 61, terminal 60, synchronous contact 91, contact 90 of the upper thread control, terminal 63, terminal 55, terminal 52, control switch 56, and rectifier terminal 50.

After the capacitor 92 has been fully charged, winding 58 of the relay A is energized through a circuit as follows:

(XI) Capacitor 92, contact 2a, terminal 61, terminal 60, winding 58, terminal 59 and terminal 93.

As a result, relay A responds and is maintained in its attracted position by a circuit according to IV, since the magnetic field of winding 58 balances the field of winding 76. Accordingly, contact 3a closes the energizing circuit VIII of the stop-motion magnet 77 with the ensuing operating steps being substantially the same as described hereinabove.

From the foregoing, it is seen that the sewing machine will be stopped temporarily upon the occurrence of an upper thread failure. After response of the relay A, capacitor 92 is discharged through a resistance 94 and contact 4a.

If a control device for the upper thread is used, of the type described in the above mentioned copending application, that is, where the synchronous switch or contact 91 is omitted, a D.C. current results through the relay winding 58 upon thread failure, in turn, causing operation of the relay and of the stop-motion device, in substantially the same manner as described hereinbefore. In this case, the capacitor 92 and discharge resistor 94 may also be dispensed with.

In the foregoing, the invention has been described with reference to a specific illustrative device and circuit. It will be evident, however, that variations and modifications, as well as the substitution of equivalent elements and devices for those shown and described herein, may be made without departing from the broader scope and spirit 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 sewing machine having upper and lower stitch-forming means and a needle, to produce a series of lock stitches in a work piece in both a forward and reverse stitching direction; a control device comprising a lever rotatable about an axis parallel to the stitching direction, said lever having a pair of parallel fingers extending therefrom at right angle to the stitching direction to points adjacent to and spaced from opposite sides of said needle, biasing means normally urging said lever to a position of said fingers adjoining the work, whereby to rock said lever upon engagement of either said fingers by the upper thread upon failure to interlock with the lower thread in both the forward and reverse stitching directions, respectively, and electrical contact means controlled by said lever.

2. In a sewing machine having a work presser foot, lower and upper stitch-forming means and a needle, to produce a series of lock stitches in a work piece in both a forward and reverse stitching direction; a control device comprising an extension of said presser foot positioned laterally of said needle in respect to the stitching direction, a lever rotatably mounted upon said exten-

sion about an axis parallel to the stitch-direction, said lever having a pair of parallel fingers extending therefrom at right angle to the stitching direction to points adjacent to and spaced from the opposite sides of said needle, biasing means urging said lever to a position of said fingers adjoining the work, whereby to rock said lever upon engagement of either said fingers by the upper thread upon failure to interlock with the lower thread in both the forward and reverse stitching directions, respectively, and electrical contact means controlled by said lever.

3. In a sewing machine having a work presser foot, lower and upper stitch-forming means and a needle to produce a series of lock stitches in a work piece in both the forward and reverse stitching direction; a control device comprising a support positioned parallel to and laterally of said needle in respect to the stitching direction, an angular lever having a first and second lever arm and rotatably mounted upon said support at its apex about an axis parallel to the stitching direction, said first arm terminating in a pair of parallel fingers extending at right angle to the stitching direction to points adjacent to and spaced from opposite sides of said needle, biasing means normally urging said second arm against a face of said support, whereby to rock said lever upon engagement of either said fingers by the upper thread upon failure thereof to interlock with the lower thread in both the forward and reverse stitching directions, respectively, thereby to disengage said second arm from said support, and cooperating electrical contact means upon said support and second arm, respectively.

4. In a sewing machine having a work presser foot, lower and upper stitch-forming means and a needle to produce a series of lock stitches in both the forward and reverse stitching direction; a control device comprising a curved horizontal extension of said presser foot terminating in a vertical bar parallel to and laterally of said needle in respect to the stitching direction, a lever rotatably mounted upon said bar about an axis parallel to the stitching direction, one end of said lever terminating in a pair of parallel fingers extending therefrom at right angle to the stitching direction to points spaced from and adjacent to opposite sides of said needle, biasing means to urge said lever to a position of said prongs adjoining the work, whereby to rock said lever upon engagement of either said fingers by the upper thread upon failure to interlock with the lower thread in both forward and reverse stitching directions respectively, and electrical contact means arranged for control by said lever.

5. In a sewing machine having a work presser foot, lower and upper stitch-forming means and a needle to produce a series of lock stitches in a work piece in both forward and reverse stitching direction; a control device comprising a curved horizontal extension of said presser foot terminating in a vertical bar parallel to and spaced laterally from said needle in respect to the stitching direction, a lever having a first and a second lever arm and being rotatably mounted upon said bar about an axis parallel to the stitching direction, said first lever arm terminating in a pair of parallel fingers extending at right angle to the stitching direction to points adjacent to opposite sides of said needle, resilient means normally urging said lever to a position of engagement of said second arm with said bar, normally closed cooperating electrical contact means upon said second lever arm and bar respectively, whereby to rock said lever and to open said contact means upon engagement of either said fingers by the slack assumed by the upper thread upon failure to interlock with the lower thread in both forward and reverse stitching directions, respectively.

6. In a sewing machine having a presser foot, lower and upper stitch-forming means and a needle to produce a series of lock stitches in a work piece in both the for-

ward and reverse stitching direction; a control device comprising a curved horizontal extension of said presser foot terminating in a vertical bar parallel to and spaced laterally from said needle in respect to the stitching direction, an angular lever having a first and a second lever arm and being rotatably mounted upon said bar about an axis parallel to the stitching direction, said first lever arm terminating in a pair of parallel fingers extending at right angle to the stitching direction to points spaced from and adjacent to opposite sides of said needle, biasing means to normally urge said first lever arm to a position of said fingers adjoining the work and of said second arm engaging said bar, normally closed electrical contact means upon said second arm and bar respectively, whereby to rock said lever and to open said contact means upon engagement of either said fingers by the slack assumed by the upper thread upon failure to interlock with the lower thread in both the forward and reverse stitching directions, respectively.

7. A control system for a lock-stitch sewing machine comprising a first electrical control circuit including switch means actuatable in response to lower thread failure of said machine, a second electrical control circuit including switch means actuatable in response to upper thread failure of said machine, one of said switch means being arranged for open-circuit operation and the other switch means being arranged for closed-circuit operation, a common controlled device, and means to operate said device by either said circuits including an electromagnetic relay having an output circuit controlling said device, a first control winding of said relay connected in said first circuit, a second control winding of said relay connected in said second circuit, a third winding for said relay, and current supply means for said circuits and said third relay winding to produce substantially equal and opposite magnetic flux components by said first and second relay windings.

8. A control system as claimed in claim 7, said third relay winding arranged to produce a magnetic flux equal to and having a direction in line with the flux produced by the relay winding connected in said open-circuit operated control circuit.

9. A control system for a lock-stitch sewing machine comprising a first electrical control circuit including closed-circuit operated switch means actuatable in response to lower thread failure of said machine, a second electrical control circuit including open-circuit operated switch means actuatable in response to upper thread failure of said machine, a common controlled device, and means to operate said device by either said circuits comprising an electromagnetic relay having an output circuit controlling said device, a first control winding of said relay connected in said first circuit, a second control winding connected in said second circuit, a third winding of said relay, and current supply means for said circuits and said third relay winding, to produce substantially equal and opposite magnetic flux components by said first and second relay windings and to produce a flux by said third winding equal to and in the direction of the flux produced by said second relay winding.

10. In a control system as claimed in claim 9, wherein said controlled device is comprised of a motion-stoppage means, to automatically stop said machine upon either lower or upper thread failure.

11. An electrical control system comprising a first electrical control circuit including closed-circuit operated switch means, a second electrical control circuit including open-circuit operated switch means, a common controlled device, and means to operate said device by either said circuits comprising an electromagnetic relay having an output circuit controlling said device, a first control winding of said relay connected in said first circuit, a second control winding of said relay connected in said second circuit, a third control winding of said relay, and current supply means for said circuits and said third relay wind-

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ing, to produce substantially equal and opposite magnetic flux components by said first and second relay windings and to cause a flux by said third winding equal to and in the direction of the flux produced by said second relay winding.

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