

March 3, 1959

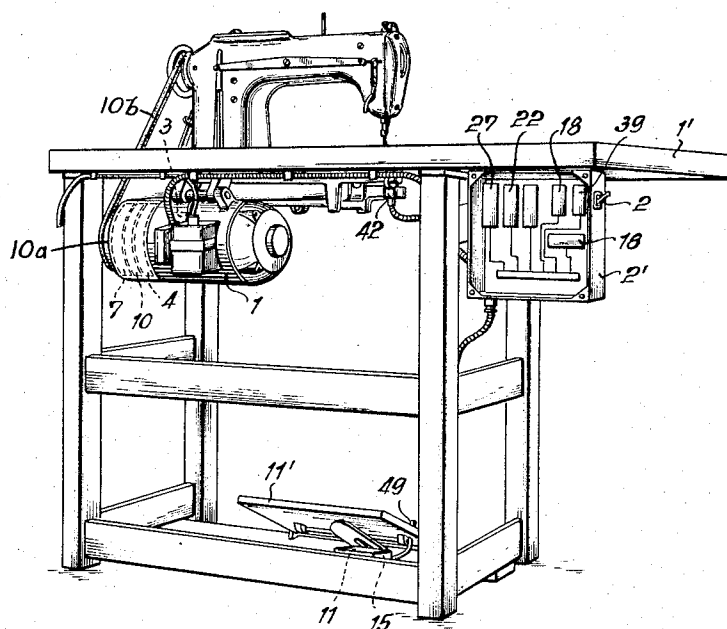
K. WINZ
ARRANGEMENTS FOR STOPPING ELECTRICALLY
OPERATED SEWING OR OTHER MACHINES

2,876,407

Filed July 29, 1954

3 Sheets-Sheet 1

FIG. 1



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March 3, 1959

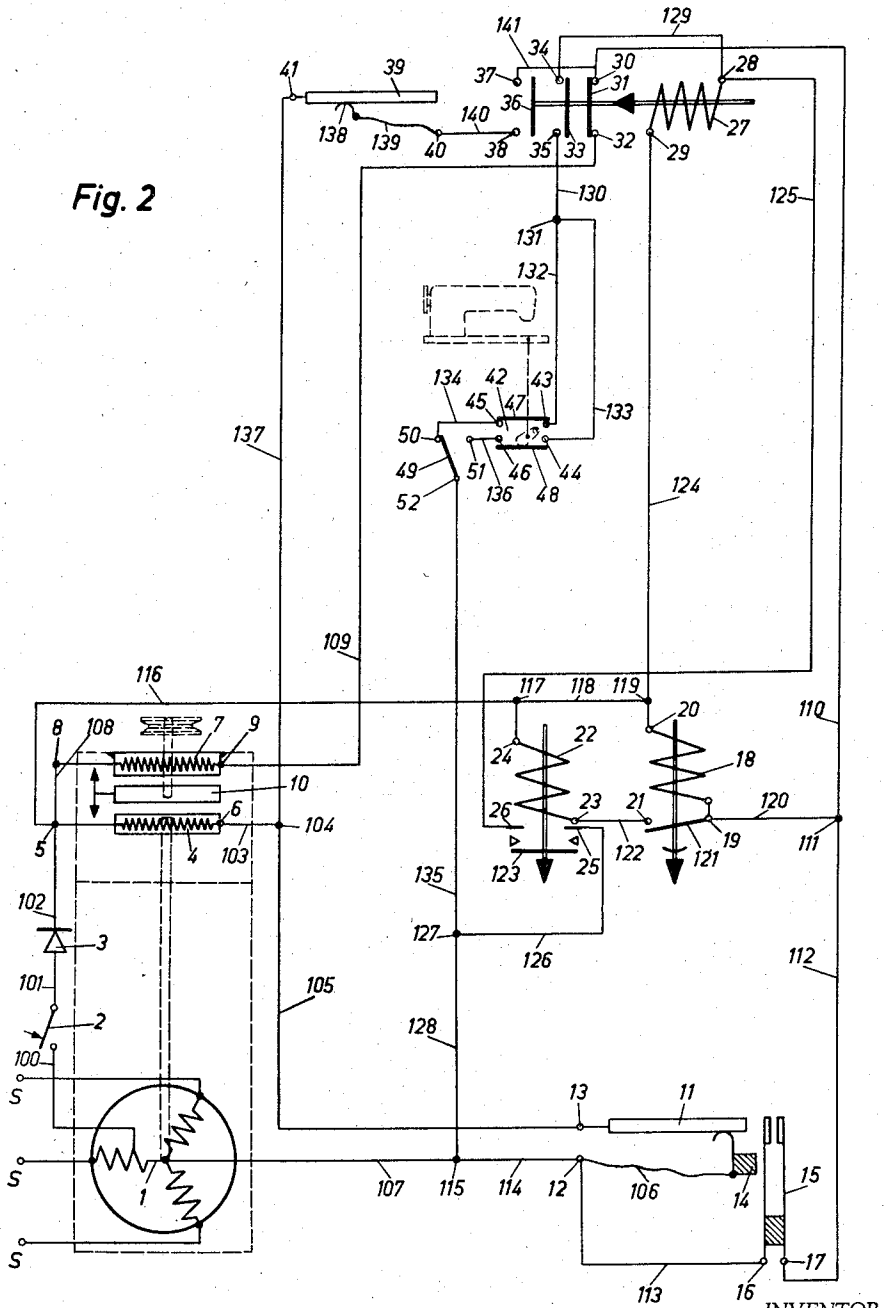
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Fig. 2



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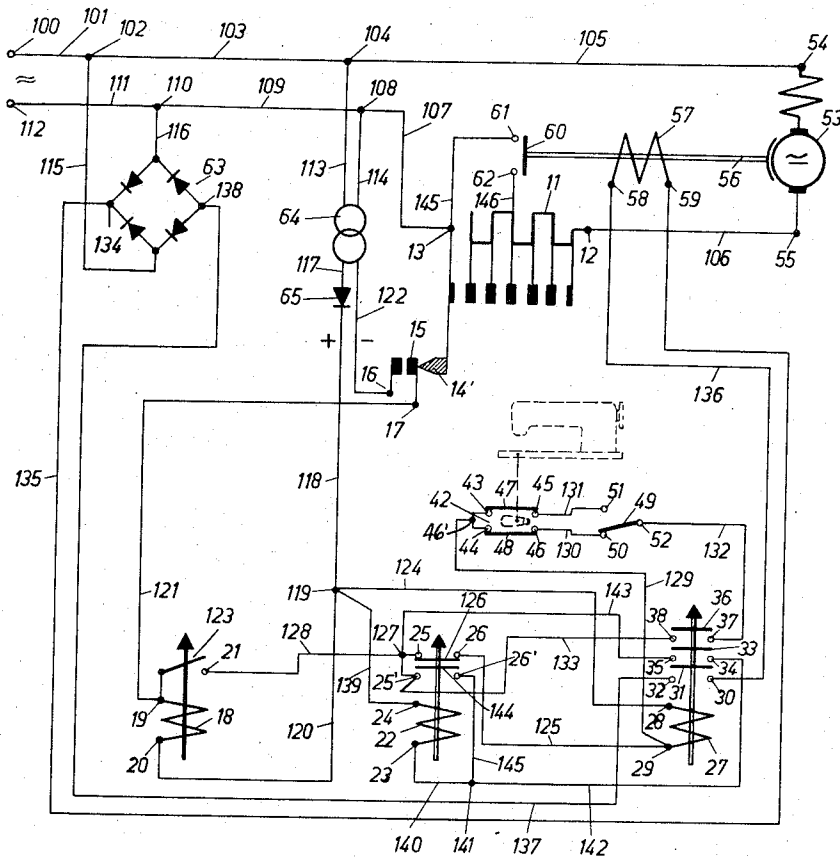
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Fig. 3



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2,876,407

ARRANGEMENTS FOR STOPPING ELECTRICALLY OPERATED SEWING OR OTHER MACHINES

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Application July 29, 1954, Serial No. 446,517

Claims priority, application Germany August 3, 1953

3 Claims. (Cl. 318—269)

The present invention relates to an arrangement on electrically driven sewing or other machines for stopping the needle rod or other element thereof in pre-determined positions.

The invention primarily consists of a relay arrangement energised in the off-position of a regulator or the starter for the electric driving motor from a switch associated therewith and which is supplied with current and operates in conjunction with a control switch influenced directly or indirectly by the needle rod or other positively moved part of the sewing or the like machine, mainly by mechanical means. The switching parts of the said control switch are at the same time connected with the positively moved parts of the sewing or the like machine in such a manner that their position corresponds with a pre-determined position of the stitch making tool or other element of the machine.

In order to ensure a regular switching sequence it is desirable to take measures which delay the demand of the relay arrangement and allow the switching operation of the latter to become effective when the electric drive of the sewing or other machine has either completely or nearly come to a standstill. This may, for example be accomplished by designing the control relay as a time delay relay. For the same purpose an additional switching element with a retarded action, such as for example a supplementary relay, may be provided.

It has further been found expedient to insert the control switch in series with a switching element, designed in such a manner that pre-selection of different possible switch positions may be achieved, the particular pre-selected switching position corresponding, at any time with the desired definite stopping position for the stitch making tool or other element of the machine.

An object of the invention is also to provide improvements in the relay arrangements which take into account the particular electrical drive of the sewing or other machine. As a rule the drive of a sewing machine is effected either by means of a motor driving through a clutch or by means of a motor which drives the machine directly. With the first type of drive a coupling disc is adapted to be driven by a magnetic engaging disc fixed on the shaft of the drive motor and is adapted to be braked by an immovable magnetic braking disc located on its opposite side.

With such drives the present invention provides for the control of the coil of the magnetic engaging disc. The coil of the magnetic brake disc is then included in another circuit which, with the aid of the relay arrangement can be interrupted. In such cases it has furthermore been proved advantageous to provide regulatable resistance between the coils of the magnetic engaging disc and the said relay arrangement which permits the said coil to receive controlled current.

When the sewing or other machine is driven by means of a directly coupled motor which in known manner is fitted with a mechanical operating brake, it is preferable to place the relay arrangement of the present invention

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in the circuit of the releasing magnet for the brake. In such case it is advantageous to use a switch arrangement which supplies the motor with increased current when the brake is released by shunting a part of the resistance connected in series with the motor.

The invention is more particularly described with reference to the accompanying diagrammatic drawings, by way of example, in which:

Fig. 1 is a perspective view of a sewing machine fitted with the control arrangement.

Fig. 2 is a circuit diagram suitable for adoption when a coupling motor is used to drive the sewing machine.

Fig. 3 is a circuit diagram of a suitable arrangement when using a directly coupled motor for driving the sewing machine.

Fig. 1 shows a driving motor 1 of the usual type which is fixed underneath the sewing machine table 1'. On the drive side of the motor there is provided in known manner a clutch which consists of a coupling disc 10, placed between an electrically operated magnetic disc 4 arranged on the shaft of the motor for rotation therewith and a stationary magnetic disc 7. The coupling disc 10 is rotatable and is connected with the driving pulley 10a of the machine around which passes the usual driving belt 10b while the magnetic disc 4 functions as an engaging medium.

When the electric circuit of the engaging magnetic disc 4 is closed by the actuation of a switch device 14 (Fig. 2), then disc 4 will cause rotation of the coupling disc 10 along with it and set the disc 10 in motion. When however, by the corresponding movement of a switch 15, the circuit of the magnetic braking disc 7 is closed, said disc 7 attracts the coupling disc 10 and by a braking effort thereon, brings it to a standstill.

A switchbox 2', fixed beneath the sewing machine table 1' accommodates in addition to other switching gear a switch 2 which is at the same time constructed as an automatic cut-out. This switch serves as a control for the whole switching arrangement. In the housing of the electric motor 1 a rectifier 3 is placed which as Figure 2 shows supplies the switching arrangement with the required direct current.

The rectifier 3 draws current from the stator coil of the motor 1. The stator coil thereby acts as an auto-transformer.

The arrangement of relays in both examples of circuits illustrated in the drawings consists of three relays, which are housed in the switchbox 2'.

The electric current to the switchgear in the switchbox may be supplied in known manner by means of contact media, not shown for example through knifeshaped contact strips which may be inserted between springy or springloaded contact elements.

As shown in the circuit diagram of Fig. 2, there is provided a stator winding for the motor 1 which is arranged in Y (star) connection, and the three ends of the coils of which are connected in a conventional manner to a network SSS. The switching arrangement for the motor may consist, for instance, of a three-pole switch (not shown).

During the operation of the sewing machine, the motor 1 is running all the time. The operator will connect the sewing machine to the motor 1 or disconnect it therefrom by means of the magnetic clutch arrangement referred to in the foregoing. The principle of such a clutch arrangement is well-known, as evidenced by the German patent to Rotter, No. 53,879/1890. To drive the sewing machine, the operator will cause the magnetic disc 4 to be energized so that the disc 4 will turn the coupling disc 10 to run the sewing machine. The energizing circuit for the magnetic revolving disc 4 is as follows:

(I) Electric circuit for energizing the magnetic revolving disc 4 (Fig. 2)

A lead 100 taps one of the windings or coils of the stator of the motor 1. The switch 2 is in series with the lead 100; as previously mentioned, the switch 2 may be constructed as an automatic cut-off safety switch. A lead 101 connects the switch 2 with the rectifier 3, and another lead 102 connects the rectifier 3 with a brush terminal 5. Between the brush terminal 5 and another brush 6, the current is carried by the magnetic disc 4. A lead 103 connects the brush 6 with a terminal 104, and a lead 105 connects the terminal 104 with a terminal 13 of a regulator 11. A sliding contact 14 engages the regulator 11, and a lead 106 interconnects the sliding contact 14 with a terminal 12. A lead 114 connects the terminal 12 with a terminal 115, and a lead 107 connects the terminal 115 with the neutral point of the Y-connection of the stator winding of the motor 1, thereby completing the energizing circuit for the magnetic disc 4.

By moving the sliding contact 14 along the regulator 11, there can be regulated the current supplied to the magnetic disc 4, so that thereby there can be controlled whether the sewing machine is driven fast or slow. If the energization of the magnetic disc 4 is reduced below a permissible minimum, by movement of the sliding contact 14 towards the right, the maximum resistance of the regulator 11 (near the position shown in Fig. 2), the disc 4 will practically become de-energized. In this position (slightly to the right of the position shown in Fig. 2), the sliding contact 14 will close the switch 15. Closure of the switch 15 causes energization of the stationary magnetic brake disc 7, in the following circuit:

(II) Electric circuit for energizing magnetic brake disc 7 (Fig. 2)

The brush terminal 5 is connected to a tap-off point of the stator winding of the motor 1, as previously described in the circuit (I) for the magnetic disc 4. A lead 108 connects the brush terminal 5 with a brush terminal 8. Between the brush terminal 8 and a brush 9, the current is carried by the brake disc 7. A lead 109 connects the brush 9 with a contact 32 of a control relay 27. A movable contact 31 of the relay 27 (in the position of the relay 27 shown in Fig. 2) interconnects the contact 32 with an opposite contact 30. Two leads 110 and 112 in series connect the contact 30 with one terminal 17 of the switch 15, and a lead 113 connects the other terminal 16 of the switch 15 with the previously mentioned terminal 12 of the regulator 11, the leads 114 and 107 completing the circuit of the neutral point of the stator winding of the motor 1.

Thus, when the switch 15 is closed by impact of the sliding contact 14, the brake disc 7 will be energized and will cause braking of the coupling disc 10 and thereby of the sewing machine. At the same time, there will be energized a time delay relay 18 in the following circuit:

(III) Electric circuit for energizing the time delay relay 18

A lead 116 connects the brush terminal 5 with a terminal 117 of an auxiliary relay 22, and a lead 118 interconnects the terminal 117 with a terminal 119 of the relay 18. From the terminal 119 the current is conducted to a terminal 20, and from there through the coil or winding of the relay 18 to a terminal 19. A lead 120 connects the terminal 19 with a terminal 111 which is interconnected between the leads 110 and 112 of the previously described circuit (II) of the magnetic brake disc 7, the lead 112, the switch 15, and the leads 113, 114 and 107 completing the circuit to the neutral point of the stator winding of the motor 1. The relay 18 operates a movable contact 121 for opening and closing the electric connection between the contact 19 and an opposite contact 21.

The relay 18 acts under a time delay, so that when the aforescribed circuit (III) is closed, the relay 18 will close the movable contact 121 only after the lapse of a predetermined time interval. The contact 121 is normally open, and is closed only after said time interval when the relay 18 has been energized. The closure of the contact 121 will establish the connection between the terminals 19 and 21 and close the circuit for an auxiliary relay 22 as follows:

(IV) Electric circuit for energizing the auxiliary relay 22

Current will flow from the terminal 117 (to which point it is carried as previously described by the leads 100, 101, 102 and 116) to a terminal 24, and from there through the windings of the relay 22 to a terminal 23. A lead 122 interconnects the terminals 23 and 21, and the contact 121 when the relay 18 is closed interconnects the terminals 21 and 19. The connection between the terminal 19 and the stator windings of the motor 1 complete the circuit comprising the previously described elements including the leads 120, 112, the switch 15, and the leads 113, 114 and 107.

The auxiliary relay 22 is so arranged that its armature will be operated only once upon energization of its coil. The armature of the relay 22 carries a movable contact 123. When the relay 22 is energized, the movable contact 123 will bridge the space between two terminals 25 and 26 and will thereby close the circuit of the control relay 27, as follows:

(V) Initial energizing electric circuit for the control relay 27

The connection between the stator winding of the motor 1 and the terminal 119 of the relay 18 is as previously described, and includes the leads 100, 101, 102, the terminal 5 and the leads 116 and 118. A lead 124 connects the terminal 119 with a terminal 29 and the coil or winding of the relay 27 connects the terminal 29 with a second terminal 28. A lead 125 connects the terminal 28 with the terminal 26 of the auxiliary relay 22. When the auxiliary relay 22 is energized, the movable contact 123 connects the terminal 26 with the terminal 25. A lead 126 connects the terminal 25 with a terminal 127, and a lead 128 connects the terminal 127 with an intermediate terminal 115 that is disposed between the leads 114 and 107. The lead 107 completes the circuit.

When the control relay 27 is energized by this circuit (V), its armature will be moved to the left in (Fig. 2, as indicated by the arrow depicted on the armature). Thereby there will be moved to the left the movable contacts 31, 33 and 36 that are carried by the armature of the relay 27. Normally, the armature is in a rightward rest position (illustrated in Fig. 2), so that the movable contact 31 normally is positioned across the terminals 31 and 32 of the circuit (II) of the brake disc 7. When the relay 27 is energized, however, the contacts 31, 33 and 36 will be moved to the left and will in the following sequence cause the following operations:

Firstly, there will be opened by the contact 31 the connection between the terminals 31 and 32, thereby de-energizing the circuit (II) of the brake disc 7.

Secondly, the movable contact 33 will bridge two opposite terminals 34 and 35.

Thirdly, and last in point of sequence, the movable contact 36 will bridge the gap between two opposite terminals 37 and 38.

When the movable contact 33 of the relay 27 closes the space between the terminals 34 and 35, it establishes a holding circuit for the relay as follows:

(VI) Electric holding circuit for the control relay 27

One of the stator windings of the motor 1 is connected to the terminal 119 of the relay 18 as previously described, by the leads 100, 101, 102, 116 and 118. The

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lead 124 connects the terminal 119 with the terminal 29 of the relay 27, and the coil of the relay 27 interconnects the terminals 28 and 29. A lead 129 connects the terminal 28 with the terminal 34. The movable contact 33, when the relay 27 is energized, establishes the connection between the terminals 34 and 35. A lead 130 connects the terminal 35 with a terminal 131. A lead 132 connects the terminal 131 with a terminal 43. A movable first main contact 47 of a control switch 42 is shown in Fig. 2 interconnecting the terminal 43 with an opposite terminal 45. A lead 134 connects the terminal 45 with the terminal 50 of a movable selector switch 49 that in Fig. 2 is shown temporarily disposed between the terminal 50 and a terminal 52 to establish connection therebetween. The selector switch 49 may be moved to make instead connection between the terminal 52 and a terminal 51 opposite relative to the terminal 50. A lead 135 interconnects the terminal 52 with the terminal 127, and the leads 128 and 127 complete the holding circuit to the center of the stator winding of the motor 1.

Between the terminals 131 and 52 there is provided a branch parallel to that of the leads 132 and 134. The branch circuit includes a lead 133 that interconnects the terminal 131 with a terminal 44. A second movable main contact 48 of the control switch 42 is operable to establish a connection between the terminal 44 and an opposite terminal 46. A lead 136 connects the terminal 46 with the terminal 51 and, as previously mentioned, the selector switch 49 may be moved to provide a connection between the terminals 51 and 52.

In Fig. 2, the contact 47 of the switch 42 is shown in closed position and the selector switch 49 completing that branch, while the contact 48 is shown in open position and the selector switch 49 disconnects that branch. The control switch 42 including its movable contacts 47 and 48 is in positive connection with a cyclically moving element of the sewing machine (such as with the needle bar or the transporting shaft, for instance as shown in my co-pending application Serial No. 534,366, filed September 14, 1955, now Patent No. 2,838,019). During each complete cycle of such element, both of the main contacts 47 and 48 will be opened and closed.

Both parallel branches of the above described circuit part for the control switch 42 are in series with the selector switch 49. The selector switch 49 may be set by the operator either between the terminals 52 and 50 to be in series with the parallel branch of the contact 47 (as shown in Fig. 2) or may be set between the terminals 52 and 51 to be in series with the branch of the contact 48, instead. The position of the selector switch 49 determines the stop position of the sewing machine element such as the needle bar or the like.

Shortly after the movable contact 33 connects the terminals 34 and 35, thereby closing the holding circuit (VI) for the control relay 27, there will again be closed a circuit for energizing the revolving magnetic disc 4 bridging with the contact 36 of the relay 27 the terminals 37 and 38, as follows:

(VII) *Electric operating circuit for energizing the magnetic disc 4*

A portion of the circuit runs from a tap on a winding of the stator of the motor 1 to the brush 6, as previously described including the leads 100, 101, and 102, the brush terminal 5, and the disc 4. The lead 103 connects the brush 6 with a terminal 104 that is disposed on the lead 105. The remaining circuit part is in parallel with the previously disclosed part of the lead 105, the regulator 11, and the leads 106, 114 and 107, as follows: A lead 137 connects the terminal 104 with a terminal 41 of the resistor 39. A sliding contact 138 is adjustably positionable along the resistor 39 for tapping. A flexible lead 139 connects the sliding contact 138 with a

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terminal 40. A lead 140 interconnects the terminals 40 and 38. When the relay 27 is energized, the movable contact 36 of the relay 27 bridges the gap between the terminals 38 and 37. A lead 141 interconnects the terminals 37 and 30. The circuit portion is completed by the leads 110 and 112, the switch 15, and the leads 113, 114 and 107 to the neutral point of the windings of the stator 1.

By varying the position of the sliding contact 138 on the resistor 39 there can be varied the degree of energization of the revolving magnetic disc 4. Normally, the operator will maintain that energization sufficiently large in order to assure revolving of the coupling disc 10. The sewing machine will run with a speed corresponding to the degree of energization of the magnetic disc 4 until that one of the two contacts 47 and 48, of the control switch 49, is opened which is in series with the selector switch 49 as the latter has been pre-set by the operator. In that instant, the holding circuit (VI) of the control relay 27 is interrupted, and the armature of the relay 27 is retracted (into the position shown in Fig. 2) including the movable contacts 31, 33 and 36 thereof. During this retraction, the movable contact 36 will first interrupt the operating circuit (VII) for the magnetic disc 4 thereby causing de-energization of the disc 4; secondly, the contact 33 will open the holding circuit (VI) of the relay 27 which has previously been interrupted; and lastly the contact 31 will re-establish the circuit of the magnetic brake disc 7 (II), whereby the brake disc 7 will brake the sewing machine by braking the coupling disc 10.

If it is desired to start the sewing machine again, the operator will move the sliding contact 14 of the regulator 11 to the left (Fig. 2) to reactivate the circuit for energizing the magnetic disc 4 (I). By this leftward movement of the sliding contact 14, there will be opened the switch 15, interrupting the circuit for the brake disc 7 (II).

The purpose of the time delay relay 18 is to delay the energization of the control relay 27 until the sewing machine has been braked to a stop or nearly to a stop and the time interval of delay between the energizing of the relays 18 and 27 must be so chosen as to be sufficient for that purpose. The auxiliary relay 22 will respond only once upon energization, and thereafter will again return its armature to the rest position, and during the return of the armature will interrupt the circuit for the energizing of the relay 27 (V), so that the relay 27 cannot respond more than once, and the relay 27 will then depend on its holding circuit (VI) for continued energization until the holding circuit is interrupted. The time delay relay 18 will be retracted when the switch 15 is opened. As shown schematically in Fig. 2, the control switch 42 with its contacts 47 and 48 is operated by an element of the sewing machine in a known manner.

The operation of the embodiment of Fig. 2 is as follows:

To start the sewing machine, the operator will move the sliding contact 14 of the regulator 11 to the left (Fig. 2), reducing thereby the resistance of the energizing circuit (I) until the sewing machine will have attained a predetermined rotary speed. By increasing the energization of the magnetic disc 4, the slippage between the magnetic disc 4 and the coupling disc 10 will be decreased until there is synchronous operation between these discs. The sewing machine is then ready for use, and will run in this manner until it is desired to stop it.

In order to arrest the sewing machine with the needle bar at a selectively predetermined position, the operator will move the sliding contact 14 along the regulator 11 to the right (Fig. 2) until the resulting slippage occurring between the magnetic disc 4 and the coupling disc 10 is so large that the coupling disc 10 will come to a standstill. Subsequently the brake disc 7 will be energized in an electric circuit (II), so that thereby the sew-

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ing machine is positively arrested. During this operational step, the retarding relay 18, the auxiliary relay 22, and the control relay 27 will operate in succession, to de-energize the brake disc 7 thereby interrupting the brake effect between the clutch disc 10 and the brake disc 7. At the same time, the control relay 27 will close again the energizing circuit (VII) for the magnetic disc 4.

Since the circuit for the magnetic disc 4 includes the regulatable resistor 39, and therefore the voltage available for the circuit is smaller than under normal circumstances, the slippage between the magnetic disc 4 and the clutch disc 10 will be increased, so that the sewing machine will run at reduced speed. If during that operational phase either the contact 47 (or the contact 48) of the switch 42, which is controlled automatically by the sewing machine, is opened, the control relay 27 will be de-energized, the magnetic disc 4 will likewise be de-energized and the brake disc 7 will again be energized. Accordingly, the sewing machine will be arrested in a predetermined position of the needle bar, since the switch 42 is controlled by parts of the sewing machine positively driven by the sewing machine itself.

The diagram of Fig. 3 utilizes a directly coupled motor 53 for driving the sewing machine. The motor 53 may be a series wound motor or a shunt motor. The energizing circuit for the motor 53 is as follows:

(VIII) *Electric circuit for energizing the motor 53 (Fig. 3)*

An alternating current network is tapped at the terminals 100 and 112 thereof. A lead 101 connects the terminal 100 with a terminal 102. A lead 103 connects the terminal 102 with a terminal 104. A lead 105 connects the terminal 104 with a motor terminal 54. The winding and brushes of the motor 53 carry the current from the terminal 54 to a motor terminal 55. A lead 106 connects the motor terminal 55 with a terminal 12 of a starter 11' that extends between the terminal 12 and a second starter terminal 13. A lead 107 connects the terminal 13 with a terminal 108. A lead 109 connects the terminal 108 with a terminal 110; and a lead 111 interconnects the terminals 110 and 112, thereby completing the circuit for the motor 53.

The starter 11' may be designed as a carbon pressure regulatable resistor or a variable coil resistor. By varying the resistance of the starter 11', the rotatable speed of the motor 53 may be varied. The primary winding of a transformer 64 is connected to the terminals 104 and 108 by means of leads 113 and 114, respectively. The secondary winding of the transformer 64 supplies the electric energy for the relays 18, 22 and 27, and for the switches 15, 42 and 49, which are similar to the corresponding parts of, correspondingly numbered in, the previously described embodiment of Fig. 2.

The motor 53 is provided with a mechanically acting brake 56, which is subject to the action of a relief magnet 57 for electrically relieving the motor 53 from the braking action of the brake 56 when the magnet 57 is energized. Electric energy is delivered to the magnet 57 through connecting terminals 58 and 59 thereof. A rectifier 63 is connected to the terminals 102 and 110 by means of leads 115 and 116, respectively. The rectifier 63 serves to supply the electric energy necessary for the magnet 57 to de-activate the brake 56. Normally, the brake 56 acts to brake the motor 53, and the braking action is interrupted when the brake 56 is de-activated by energization of the magnet 57.

The starter 11' has an operating lever 14' which is movable between positions in one of which (shown in Fig. 3) it acts to close the switch 15 and to interrupt the circuit (VIII) of the motor 53, so that the motor 53 will be braked by the brake 56. Closing of the switch 15 by the lever 14' completes the circuit for the time delay relay 18 as follows:

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(IX) *Electric circuit for the time delay relay 18 (Fig. 3)*

A lead 117 connects the secondary winding of the transformer 64 with a rectifier 65. A lead 118 connects the rectifier 65 with a terminal 119. A lead 120 connects the terminal 119 with a terminal 20 of the winding of the time delay relay 18, the winding terminating at a second terminal 19. A lead 121 connects the terminal 19 with a first terminal of the switch 15, and a lead 122 completes the circuit between the second terminal 16 of the switch 15 and the secondary winding of the transformer 64.

Similar to the embodiment of Fig. 2, the relay 18 has a delayed action so that upon energization it operates only after the lapse of a predetermined time interval, to close after that interval the movable contact 123 that is carried by the armature of the relay 18. Closure of the contact 123 interconnects the terminal 19 with a terminal 21 to complete the circuit for the control relay 27 as follows:

(X) *Electric circuit for the control relay 27 (Fig. 3)*

As previously mentioned, the leads 117 and 118 connect the terminal 119 with the secondary winding of the transformer 64. A lead 124 connects the terminal 119 with a terminal 28 of the coil or winding of the relay 27, said coil terminating at another terminal 29. A lead 125 connects the terminal 29 with a terminal 26. A movable contact 126 that is carried by the armature of the auxiliary relay 22 interconnects the terminal 26 (in the position shown in Fig. 3) with an opposite terminal 25 that is connected to a terminal point 127. A lead 128 interconnects the terminal point 127 with the terminal 21. The movable contact 123 of the time delay relay 18, the lead 121, the switch 15, and the lead 122 complete the circuit for the relay 27.

When this circuit for the control relay 27 is closed by the operation of the relay 18, the relay 27 will be energized and will close with its movable contact 36 the following holding circuit for the relay 27:

(XI) *Electric holding circuit for the relay 27 (Fig. 3)*

As previously described, the terminal 119 is connected to the secondary winding of the transformer 64 by means of the leads 117 and 118 which are in series with the rectifier 65. The lead 124 connects the terminals 119 and 28, and the winding of the relay 27 completes the connection to the terminal 29. A lead 129 connects the terminal 29 with a terminal 46' of the control switch 42. Like in the previous embodiment of Fig. 2, there are two circuit branches for the control switch 42, either branch terminating in the selector switch 49, depending on the position to which the switch 49 has been set by the operator. In the position of the switch 49 set as shown in Fig. 3, the energized branch circuit includes the switch contact 48 which bridges the terminals 44 and 46, a lead 130 which ends in a terminal 50, and the selector switch 49 in the position set (Fig. 3) which connects the terminal 50 with a terminal 52.

If the selector switch 49 is moved into the opposite position (not shown in Fig. 3), the connection between the terminals 46' and 52 will be the terminal 43, the contact 47, the terminal 45, a lead 131, the terminal 51, the switch 49 and the terminal 52.

A lead 132 connects the terminal 52 with the terminal 37, and the contact 36 of the relay 27 in this position (not shown in Fig. 3) of energization of the relay 27 bridges the gap between the contacts 37 and 38. A lead 133 connects the terminal 38 with a terminal 25' that is disposed adjacent a contact 144 carried by the armature of the auxiliary relay 22. The terminal 25' is inter-connected to the terminal 127. The lead 128 connects the terminal 25' with the terminal 21, and the contact 123, the lead 121, the switch 15, and the lead 122 complete the circuit terminating in the secondary winding of the transformer 64.

When the control relay 27 is operated, its contact 31 will bridge the gap between the terminals 30 and 32, thereby closing the circuit for the magnet 57 to disengage the brake 56 from the motor 53, as follows:

(XII) *Electric circuit for the brake relief magnet 57* (Fig. 3)

A lead 135 connects a terminal 134 of the rectifier 63 with the terminal 59 of the magnet 57. A lead 136 connects the other terminal 58 of the magnet 57 with the terminal 30 of the relay 27. The movable contact 31 of the relay 27 interconnects the terminals 30 and 32, and a lead 137 connects the terminal 32 with a terminal 138 of the rectifier 63.

The auxiliary relay 22 is energized by a circuit that is completed by the movable contact 33 of the control relay 27, as follows:

(XIII) *Electric circuit for the auxiliary relay 22* (Fig. 3)

As previously described, the terminal 119 is interconnected to the secondary winding of the transformer 64 by the leads 117 and 118 in series with the rectifier 65. A lead 139 connects the terminal 119 with a terminal of the winding of the auxiliary relay 22 that terminates in another terminal 23. A lead 140 connects the terminal 23 with a terminal 141, and a lead 142 connects the terminal 141 with the terminal 34 near the relay 27. The movable contact 33 of the relay 27 will, when the relay 27 is energized, bridge the gap between the terminal 34 and a terminal 35 opposite thereto. A lead 143 connects the terminal 35 with the terminal 127, and the lead 128, the contact 123 of the relay 18, the lead 121, the switch 15 and the lead 122 complete the circuit.

The auxiliary relay 22, when thus energized, interrupts with its contact 126 the circuit (X) for the control relay 27, and its contact 144 bridges the gap between the terminal 25' and a terminal 26', thereby completing a holding circuit as follows:

(XIV) *Electric holding circuit for the auxiliary relay 22* (Fig. 3)

As previously described, the terminal 141 is connected to the secondary winding of the transformer 64, by means of elements including the leads 117, 118, 139 and 140. A lead 145 interconnects the terminals 141 and 26'. The movable contact 144 will, when the auxiliary relay 22 is energized interconnect the terminal 26' with the terminal 25. The terminal 127 is connected to the terminal 25' and the circuit is completed to the secondary winding of the transformer 64 by means of the previously described elements which include the lead 128, the contact 123, the lead 121, the switch 15, and the lead 122.

There is provided a switch 60 for the brake 56 which will be closed following the disengagement of the brake 56 upon energization of the circuit (XII) for the electromagnet 57. Closing of the switch 60 will close a circuit for reactivating the motor 53 as follows:

(XV) *Electric circuit for reactivation of the motor 53*

As previously described, the terminal 12 of the starter 11' is interconnected to the network terminal 100 by means of elements including the lead 106, the winding of the motor 53, and the leads 105, 103 and 101. A lead 146 connects a part of the starter 11' which is connected to the terminal 12 to a terminal 62 of the switch 60. In Fig. 3, the switch 60 is shown open. When it is closed, owing to the energization of the winding of the magnet 57, the gap between the terminal 62 and an opposite terminal 61 is closed. A lead 145 connects the terminal 61 to the terminal 13, and as previously described, the terminal 13 is connected to the network terminal 112 by means of the leads 107, 109 and 111.

Depending on the degree of resistance to which the starter 11' has been set, the motor 53 will continue to turn at reduced rotatable speed until, as previously dis-

closed, one of the contacts 47 or 48 which is in series with the selector switch 49 is opened, thus interrupting the holding circuit (XI) of the control relay 27. Thereupon, the relay 27 will be de-energized and the movable contact 36 of its armature will interrupt the connection between the terminals 37 and 38, thereby discontinuing the holding circuit (XI) of the relay 27 which has previously been interrupted. At the same time the contact 31 will interrupt the circuit (XII) of the magnet 57, thereby permitting the brake 56 to return into its active braking position and the motor 53 will be braked.

In order to start the motor 53 again, the operator will move the lever 14' of the starter 11' to the right (in Fig. 3) to reestablish the motor circuit (VIII). By this rightward movement, the switch 15 will be opened and there will be interrupted the circuit for the other relays, so that all of the relays will be de-energized.

The operation of the embodiment of Fig. 3 is as follows:

To energize the motor 53, the operator will move the lever 14' of the starter 11' to the right (Fig. 3), to close the motor circuit (VIII). The rotary speed of the motor 53 will depend on the resistance of the starter 11' in the circuit.

In order to arrest the machine, on the other hand, the operator will move the lever 14' to the left (Fig. 3) so that the increase of the resistance within the circuit will reduce the rotary speed of the motor 53 until finally the circuit is interrupted. At this instant the motor 53 will be braked mechanically by the brake 56. At the same time, the lever 14' will close the switch 15, thereby energizing the electric circuit for the time delay relay (IX). After the passage of the retarding period for the relay, the brake 56 will be released electromechanically, and the motor 53 will again, by means of the switch 60, be connected to the network terminals 100 and 112. In this position, however, a portion of the starter 11' resistance is within the energizing circuit (XV) so that the rotary speed of the motor 53 is reduced. The switch 42 which is controlled mechanically from the sewing machine, will open alternatively for each full turn of the sewing machine shaft one of the contacts 47 or 48. As soon as the contact 48, which is in series with the switch 49, is opened, the holding circuit of the control relay 27 will be interrupted (in a manner similar to the afore described embodiment of Fig. 2) and the magnet 57 of the brake 56 will be de-energized so that the motor 53 is arrested.

After a new work piece has been inserted, the operator can initiate the next full cycle in the same way as described in the foregoing.

The invention is not confined to the use of any definite number of relays. Although in the two arrangements shown by way of example the problem of the relays has also been solved with the aid of three relays, it is within the frame of the invention to effect the switching operations by less than three, and even one alone. This is particularly so when smaller demands are imposed on the sensitiveness and exactness of the switching operations. Such single relay would then assume the functions of the control, retarding and impulse-imparting auxiliary relays employed in the illustrated examples.

Although the invention is described with particular reference to the stopping of sewing machine parts it will be appreciated that it is equally applicable for use with other electrically driven machines, and that in addition the particular arrangements described and illustrated herein are merely for the purpose of exemplifying the invention.

Having thus described the invention, what I claim as new and desire to be secured by Letters Patent, is as follows:

1. A control system, for use in connection with a sewing machine having a cyclically moving element, said control system being operable to stop the sewing machine

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in a predetermined of a plurality of certain positions of said element in said cycle and comprising an electric control circuit including a plurality of parallel branches one for each position of said element and having in each branch a contact movable by said element in one of said certain positions and including a selector switch positionable in series with each parallel branch, drive means and brake means for said sewing machine, an electric drive circuit operable to energize said drive means and including a variable regulator settable to control the degree of energization of said drive means and thereby the rotational speed of the sewing machine, an electric brake circuit operable to energize said brake means, said control circuit including a switch normally open, said regulator including means operable to close said switch when the drive means is energized by said regulator at low voltage and to open the switch when the drive means is energized at other voltages, and electric relay means energizable by said control circuit, said relay means being operable when energized for rendering effective said control circuit and said drive circuit and, respectively, when de-energized for interrupting said drive circuit and rendering effective said brake means.

2. A control system as claimed in claim 1, said drive means including a continuously rotating electrically magnetizable disc and a coupling disc journaled adjacent said

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magnetizable disc and in driving connection with said sewing machine, said magnetizable disc being operable when energized to engage said coupling disc to rotate it, said brake means including a stationary brake disc magnetizable by electric energization to brake said coupling disc, said relay means being operable when energized to energize said magnetizable disc for driving said coupling disc, and said relay means being operable when de-energized for de-energizing said magnetizable disc and for energizing said brake disc to brake said coupling disc.

3. A control system as claimed in claim 1, said drive means including a directly coupled motor driving said sewing machine, said brake means including a mechanical brake normally positioned to brake said motor, said brake circuit including an electro-magnet operable for disengaging the brake from the motor.

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