Feb. 28, 1939. J. F. JOY 2,148,472

ELECTRICAL CONTROLLING APPARATUS

Filed Aug. 12, 1935

Fig. 1.

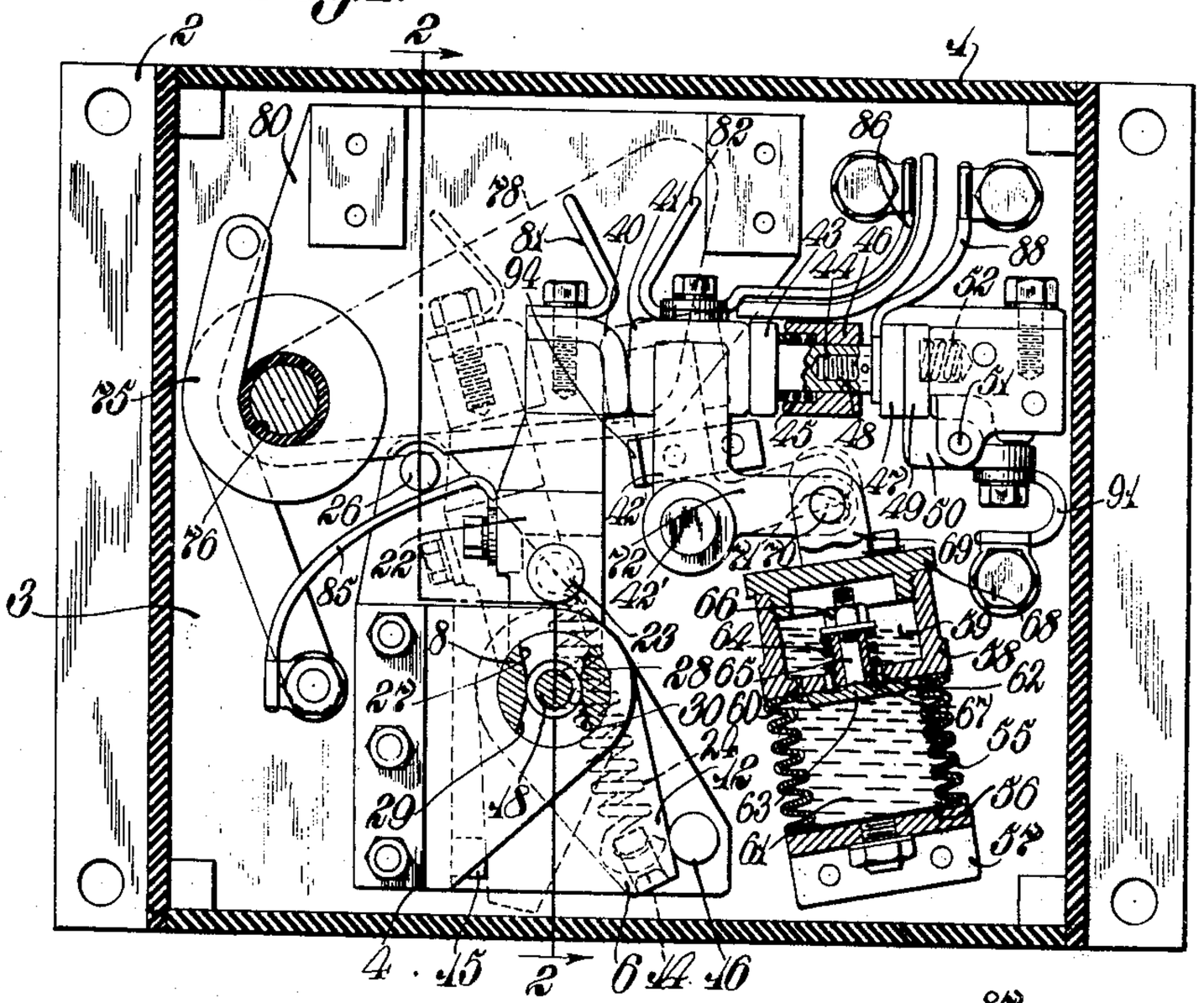


Fig. 2.

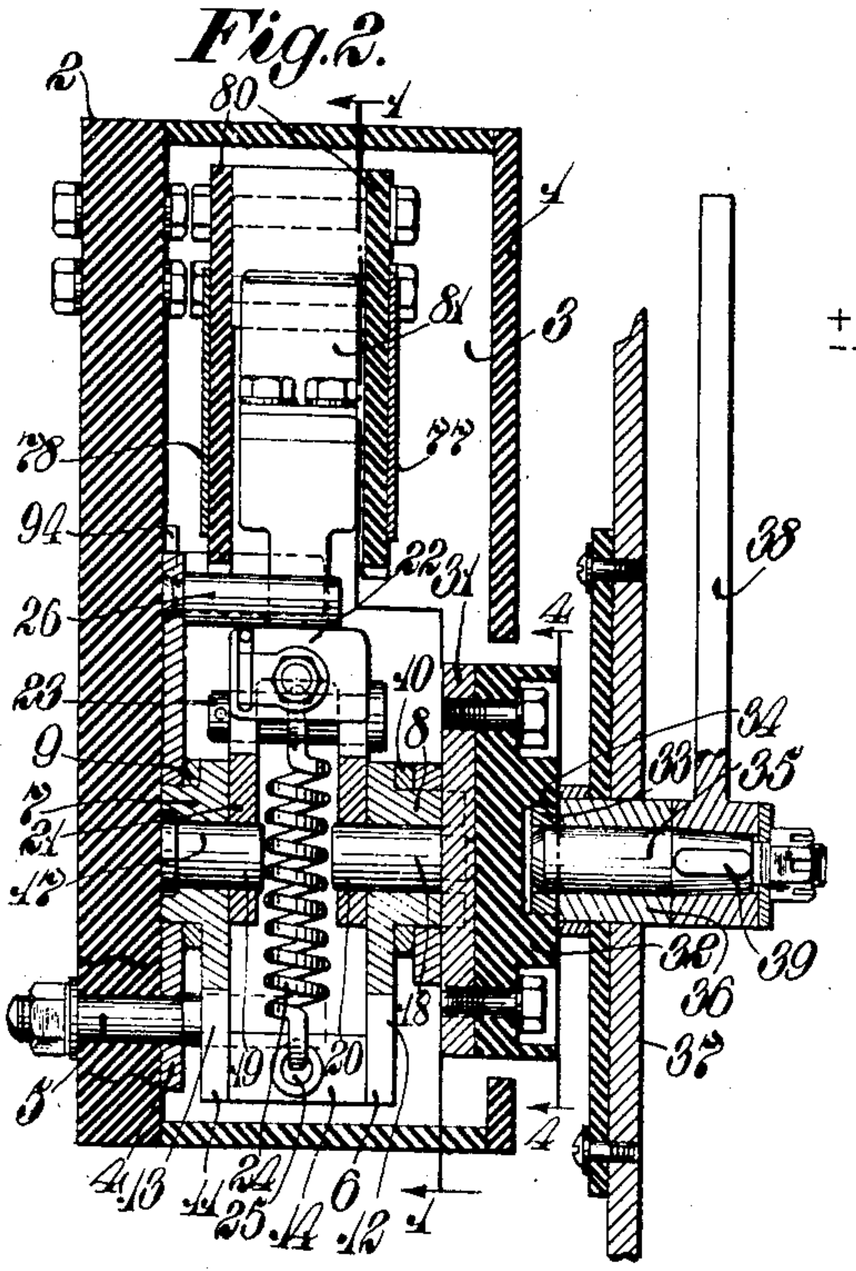


Fig. 3.

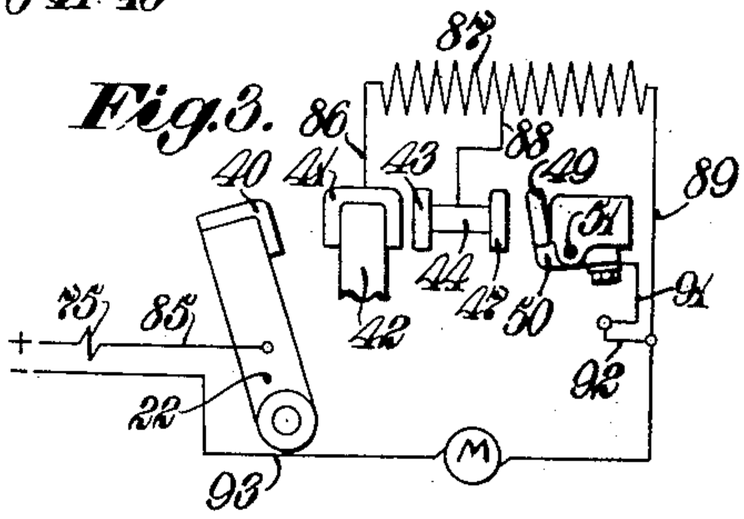
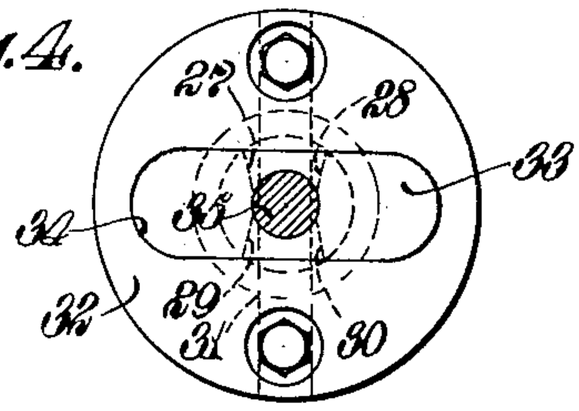


Fig. 4.



Inventor:
Joseph F. Joy.
by Louis A. Watson.
Atty.

Patented Feb. 28, 1939 2,148,472

UNITED STATES PATENT OFFICE

2,148,472

ELECTRICAL CONTROLLING APPARATUS

Joseph F. Joy, Claremont, N. H., assignor to Sullivan Machinery Company, a corporation of Massachusetts

Application August 12, 1935, Serial No. 35,828

18 Claims. (Cl. 200—34)

My invention relates to electrical controlling apparatus, and more particularly to the type of electrical controlling apparatus which is effective to connect a motor to a power line through a resistance and then cut out the resistance automatically so that the motor will be directly on the line when operating at normal speed.

An object of my invention is to provide an improved controlling apparatus. Another object of my invention is to provide an improved controlling apparatus of the type which first connects a motor through a resistance to a power line and thereafter automatically cuts out the resistance. A further object of my invention is to provide an improved controlling apparatus having improved means for effecting the automatic cutting out of an initial resistance from a motor circuit. Still another object of my invention is to provide an improved time delay means for a resistance-cut-out controller. Yet another object of my invention is to provide an improved apparatus for effecting the elimination in steps of an initial resistance from a motor circuit and providing improved means whereby the timing of the steps may be effected. Still another object of my invention is to provide an improved resistance-eliminating contactor device, in which appropriate time delay in the elimination of the resistance may be secured, but in which the breaking of circuits shall be localized at a point where minimum danger will result. Other objects and advantages of the invention will hereinafter more fully appear.

In the accompanying drawing, in which for purposes of illustration one embodiment which the invention may assume in practice has been shown—

Fig. 1 is a sectional view through a controlling apparatus on a plane corresponding generally to the line 1—1 of Fig. 2.

Fig. 2 is a section on a plane corresponding to the line 2—2 of Fig. 1.

Fig. 3 is a diagrammatic view showing electrical connections, and

Fig. 4 is a detail sectional view on a plane corresponding to the line 4—4 of Fig. 2.

Referring to the drawing it will be noted that a box 1 in which the controlling apparatus is housed is supported upon a suitable plate 2 of insulating material. The box 1 provides a chamber 3 in which the controlling apparatus is housed. Upon a suitable bearings-providing support 4 bolted at 5 to the plate 2 there is pivotally mounted a yoke 6 having hollow bearing portions 7 and 8 rotatably supported in bearings 9 and 10 formed within the member 4. The yoke 6 comprises, in addition to the bearing portions 7 and 8, a yoke portion proper 11 including side arms 12 and 13 and a cross member 14. The range of oscillation of the yoke is controlled by stop means 15 and 16. The portions 7 and 8 of the yoke structure support alined pin devices 17 and 18, which at their adjacent ends provide pivots 19 and 20 for the forked end 21 of a contact-carrying member 22. A pin 23 extends between the arms of the forked end 21, and a spring 24 of suitable strength extends from the pin 23 and hooks into an opening 25 in the cross member 14. A suitable stop 26 is provided to limit movement in circuit-breaking direction of the arm 22, and its opposite movement is controlled by the contact arrangement later described. It will be evident that the mechanism so far described, except for the fact that no operating means has yet been explained, constitutes an ordinary snap throw or trigger mechanism.

The bearing portion 8 of the yoke member 6 is provided at its outer end with a transverse slot having pairs of bounding surfaces 27, 28 and 29, 30 respectively, and adapted to cooperate with a bar 31 mounted upon a rotatable insulating body 32 which is supported by an elongated element 33 received in a correspondingly shaped recess 34 in the body 32 and carried by an operating shaft 35. The operating shaft is suitably journaled in a bearing 36 carried by the cover 37 of the box 1, and the shaft 35 may be oscillated by a manually movable lever 38 keyed, as at 39, to the shaft 35. It will be evident that with the surfaces 27, 28 and 29, 30 at appropriate angles and in appropriate angular relation to the contactor-carrying arm 22, the operator by moving the lever 38 will be able to move the cross member 14 and spring connection 25 in such manner relative to the axial line of the pins 17, 18 as to cause snap actuation of the arm 22 in opposite directions, the arm remaining motionless until the snap action is initiated.

The arm 22 carries a primary circuit-making and breaking contact 40, which is adapted to cooperate with another contact member 41 which is herein made bodily movable for a purpose which will shortly be made apparent. Contact 41 is carried upon one arm of a bell crank lever 42 pivoted at 42' relative to the plate 2. Contact member 41 is U-shaped, and accordingly has a portion engageable with the contact 40, and also another portion adapted to cooperate with a second and relatively movable contact element 43 supported for sliding movement by a slidably mounted pin 44 normally thrust toward the contact element 41 by a spring 45, the pin 44 being slidable in a guide mounting 46 carried by the plate 2. At its other end the pin 44 carries a further contact 47 suitably supported for replacement by the socket arrangement shown at 48. Contact 47 is adapted to engage contact element 49 supported upon a bell crank lever 50 pivoted at 51 upon a suitable contact mounting and thrust toward the contactor 47 by a spring 52.

It will be observed that since, when the same is thrown in a circuit-establishing direction by the spring 24, the contactor element 40 will be maintained under a powerful thrust toward the right in Fig. 1, it will not only engage the contactor element 41, but cause the latter to engage the contactor element 43 and move the latter bodily to the right in Fig. 1 in such manner that the contactor element 47 will engage the contactor element 49 and thereby establish a continuous metallic circuit of low resistance from 40 to 49. To effect any desired time delay between engagement of contact 41 with contact 43 and any further desired time delay between engagement of contact 47 with contact 49, suitable means is provided. Herein this takes the form of a dash-pot device having retarded movement in one direction and a relatively slightly retarded movement in the other. The particular nature of the movement of the dash-pot may be subject to considerable variation, dependent upon the results desired, as will shortly be explained. This dash-pot mechanism comprises a suitable flexible diaphragm element 55 having a sealed connection at 56 at its lower end on a stationary mounting 57 carried by the plate 2. At its free end the diaphragm member 55 is secured in fluid-tight relation to a chamber member 58 whose interior 59 is constantly connected through one or more small passages 60 with the interior 61 of the flexible diaphragm member 55 and intermittently connectible, through a series of large openings 62 under the control of a spring-seated valve 63 having a seating spring 64 of suitable strength, with said chamber 61. A threaded portion 65 carrying an adjustable nut 66 extends through an opening 67 in the wall of the member 58 adjacent the chamber 61 and provides guidance for the valve member 63 and an adjustment of the pressure of the spring 64. The member 58 has a removable head 68 having ears 69 carrying a pin 70 which is engaged by a somewhat elongated opening 71 in the other arm 72 of the bell crank lever 42. The interior of the chamber 61 will be filled with oil when the diaphragm 55 is in its maximum expanded condition.

Suitable means for extinguishing the arc created between the contacts 40 and 41 upon separation of the latter may be provided, and such a provision is here shown in the form of a blow-out coil 75 having a core 76 therein suitably connected to generally triangular pole pieces 77 and 78 mounted at opposite sides of an arc chute 80 of appropriate construction. Diverging metallic fingers 81 and 82 respectively are carried by the contact devices 40 and 41 to aid in breaking the arc and to conduct the latter away from the contacts.

Referring to Fig. 3, the circuit relations will be readily understood. One side of the power line indicated by + will be connected through the blow-out coil 75 and a conductor 85 to the contact-carrying arm 22. Contact device 41 will be connected by a conductor 86 to one end of the multi-part resistance 87. A conductor 88 will connect, at a point perhaps midway between the ends of the resistance 87, with the contacts 43 and 47, which, being carried and electrically connected by the conducting pin 44 may be viewed from different aspects both as separate contacts, and also as a single contact element having different contact surfaces. The other end of the resistance 87 will be connected by conductor 89 to one side of the motor M, and a flexible connection 91 and another suitable conductor 92 will connect the contactor 49 with the conductor 89. The opposite side of the motor will be connected by a conductor 93 to the other side of the line, indicated by —.

The mode of operation of the invention will be clearly understood from the description given. When it is desired to start the motor M, the operator will grasp the lever 38, and through swinging of the shaft 35, the member 32 and the yoke 6 will cause the yoke 6 to pass from the dotted line position shown in Fig. 1 to the full line position shown in that figure. Beyond the position in which the axis of the yoke is in alinement with the axis of the arm 22, the movement of the arm 22 will not be dependent upon the force exerted by the operator upon lever 38, but will take place with a sharp snap action. This will close the circuit between contact 40 and contact 41, and connect the motor through the resistance 87 to the power lines, and will apply to contact 41 a substantial pressure due to the tension of the spring 24. Bell crank 42 will therefore be pressed in a clockwise direction, but its rate of movement will be controlled by the rate at which liquid can pass from the chamber 61 through the opening 60 into the space 59. After the lapse of the time which is required to permit sufficient collapse of the diaphragm 55 to enable contact 41 to engage contact 43, a circuit will be created which will shunt the first half of the resistance 87, and upon further pressing of contacts 40, 41 and 43, and, with the latter, contact 47, toward the right in Fig. 1, movement, whose time will be controlled by the dash-pot device described, will take place sufficient to allow contact 47 to engage contact 49 and shunt the entire resistance 87, and the motor will then be upon the line. When it is desired to stop the motor, the operator will move the lever 38 in the opposite direction, and contact 40 will be thrown open with a sharp snap action after the yoke 6 has been moved beyond a vertical position with reference to Fig. 1. The retarding action of the dash-pot device will be relatively slight as the contact 41 tends to move away from the contact 43, but it will be sufficient to insure the breaking of the circuit between the contacts 40 and 41, where the arc will be caused to move along the elements 81 and 82 and blown out. The resilience of the daiphragm member 55, reinforced if desired by appropriate spring means, will cause contact 41 to leave contact 43, and contact 47 will thereupon be caused by the spring 45 to leave engagement with contact 49. If desired, means may be provided, in addition to the diaphragm 55, for limiting the motion of the contact element 41 in a counterclockwise direction, as for example stop 94.

It will be evident from the foregoing description that I have provided a very simple and effective arrangement for the serial cutting-out of resistance, that by appropriate control of port areas it will be possible to provide for the necessary speeding-up of any motor between the successive eliminations of resistance, that the principles of this device in which a two-step resistance cut-out is disclosed may be extended to other constructions in which resistance is eliminated in three or more steps, that reliance upon electrical devices for the cutting-out of resistance with the danger of unsatisfactory operation when low voltage is encountered is avoided, and that the whole device is simple, rugged and virtually free from possibility of derangement..

While I have in this application specifically described one form which my invention may

assume in practice, it will be understood that this form of the same is shown for purposes of illustration, and that the invention may be modified and embodied in various other forms without departing from its spirit or the scope of the appended claims.

What I claim as new and desire to secure by Letters Patent is:

1. In an electrical controlling apparatus, a snap-actuated contact, a movably supported contact engageable by said snap-actuated contact to close a circuit, a third contact engageable in circuit establishing relation by said movably supported contact after a predetermined movement of the latter, and means yieldably resisting movement of said movably supported contact towards said third contact.

2. In an electrical controlling apparatus, a snap-actuated contact, a movably supported contact engageable and movable by said snap-actuated contact on circuit closing movement of the latter, a third contact engageable in circuit establishing relation by said movably supported contact after a predetermined movement of the latter, and time delay means precluding engagement of said third contact by said movably supported contact for a predetermined time after engagement of the latter by said snap-actuated contact.

3. In an electrical controlling apparatus, a snap-actuated, primary-circuit-establishing contact, a movably supported contact engageable in circuit establishing relation by said snap-actuated contact, a third contact engageable in circuit establishing relation by said movably supported contact after a predetermined movement of the latter, and dash-pot means for retarding movement of said movably supported contact towards circuit establishing relation with said third contact.

4. In an electrical controlling apparatus, a snap-actuated contact, a movably supported contact engageable in circuit establishing relation by said snap-actuated contact, a third contact engageable in circuit establishing relation by said movably supported contact after a predetermined movement of the latter, and means for continuously urging said second contact towards said snap-actuated contact and for providing a retardation of its movement towards said third contact including dash-pot means for retarding movement of said movably supported contact towards circuit establishing relation with said third contact and permitting relatively unretarded movement in an opposite direction.

5. In an electrical controlling apparatus, a snap-actuated, primary-circuit-establishing contact, a plurality of movably supported contacts each normally spaced from the other and one of which is engageable by said snap-actuated contact in circuit establishing relation on predetermined actuation of the latter, a further contact engageable in circuit establishing relation by a different one of said plurality of relatively movable contacts after predetermined movement of said last-mentioned contact, and means for retarding the movement of said contact engageable by said snap-actuated contact to effect successive contact engagements after predetermined time intervals.

6. In an electrical controlling apparatus, a snap-actuated contact, a plurality of movably supported contacts each normally spaced from the other and one of which is engageable by said snap-actuated contact in circuit establishing relation on predetermined actuation of the latter, and movable by the latter, a further contact engageable in circuit establishing relation by a different one of said plurality of relatively movable contacts after predetermined movement of said last-mentioned contact, and dash-pot means for retarding the movement of said contact engageable by said snap-actuated contact to effect successive contact engagements after predetermined time intervals.

7. In an electrical controlling apparatus, a snap-actuated contact, a plurality of jointly movably supported contacts each normally spaced from the other and one of which is engageable by said snap-actuated contact in circuit establishing relation on predetermined actuation of the latter, a further contact engageable in circuit establishing relation by a different one of said plurality of relatively movable contacts after predetermined movement of said last-mentioned contact, and dash-pot means for retarding the movement of said contact engageable by said snap-actuated contact to effect successive contact engagements after predetermined time intervals but permitting rapid contact disengagement.

8. In an electrical controlling apparatus, a pivotally supported contact having a dash-pot associated therewith for retarding the movement thereof in circuit establishing direction, a bodily movable contact engageable in circuit establishing relation by said first-mentioned contact after predetermined movement of the latter in circuit establishing direction and thereafter movable bodily with said first-mentioned contact, a third contact engageable in circuit establishing relation after predetermined bodily movement of said bodily movable contact, and an operator-controllable contact for engaging in circuit establishing relation and exerting a movement-effecting pressure on said first-mentioned contact.

9. In an electrical controlling apparatus, a pivotally supported contact, motion delaying means associated therewith for retarding the movement thereof in circuit establishing direction, a bodily movable contact engageable in circuit establishing relation by said first-mentioned contact after predetermined movement of the latter in circuit establishing relation and thereafter movable bodily with said first-mentioned contact, a third contact engageable in circuit establishing relation after predetermined bodily movement of said bodily movable contact, and an operator-controllable contact for engaging in circuit establishing relation and exerting a yielding, movement-effecting pressure on said first-mentioned contact.

10. In an electrical controlling apparatus, a pivotally mounted contact, a second pivotally mounted contact engageable by said first-mentioned contact after a predetermined movement of the latter in circuit establishing direction, a third contact, slidably supported, and engageable by said second-mentioned contact after predetermined movement of the latter in circuit establishing direction, a fourth contact carried by said third-mentioned contact, and a fifth contact engageable by said fourth-mentioned contact after predetermined movement of the latter in circuit establishing direction, means associated with the second-mentioned contact for retarding movement thereof and thereby effecting delayed engagements between said second and third-mentioned contacts and said fourth and fifth-mentioned contacts, and means for actuating said first-mentioned contact.

11. In an electrical controlling apparatus, a pivotally mounted, primary-circuit-establishing contact, a second pivotally mounted contact engageable by said first-mentioned contact after a predetermined movement of the latter in circuit establishing direction, a third contact, slidably supported, and engageable by said second-mentioned contact after predetermined movement of the latter in circuit establishing direction, a fourth contact carried by said third-mentioned contact, and a fifth contact engageable by said fourth-mentioned contact after predetermined movement of the latter in circuit establishing direction, a dash-pot associated with the second-mentioned contact for retarding movement thereof and thereby effecting delayed engagements between said second and third-mentioned contacts and said fourth and fifth-mentioned contacts, and means for actuating said first-mentioned contact.

12. In an electrical controlling apparatus for use in connecting a motor to power lines through a resistance and then cutting out the resistance in steps, a contact for connection to a motor, jointly bodily movable electrically connected contacts one of which is engageable with the first mentioned contact, bodily movable contact means engageable with the other of said second-mentioned contacts, means for connecting one end of a resistance to said first mentioned contact, means for connecting the other end of the same resistance to said contact means, means for connecting an intermediate point in the resistance continuously to each of the second mentioned contacts, a main line contact engageable with said contact means to close a circuit including the resistance and connectible to a power line, and actuating means for said main line contact and, through the latter, for said jointly movable contacts.

13. In an electrical controlling apparatus for use in connecting a motor to power lines through a resistance and then cutting out the resistance in steps, a contact for connection to a motor, jointly bodily movable electrically connected contacts one of which is engageable with the first mentioned contact, bodily movable contact means engageable with the other of said second-mentioned contacts, means for connecting one end of a resistance to said first mentioned contact, means for connecting the other end of the same resistance to said contact means, means for connecting an intermediate point in the resistance continuously to both of the second mentioned contacts, a main line contact engageable with said contact means and connectible to a power line, arc blow out means for said main line contact arranged adjacent the same, and actuating means for said main line contact operative to move the same into contact with said contact means and through the latter to move the first specifically mentioned one of said jointly movable contacts into contact with said first mentioned contact.

14. In an electrical controlling apparatus, a blow-out coil having elongated pole pieces arranged at its opposite ends in parallelism with each other, a contact arranged adjacent the outer ends of said pole pieces, a pivotally movable contact swingable in the space between said blow-out coil and said first-mentioned contact, snap-actuated means for said last-mentioned contact, and means connected to each of said contacts extending parallel to said elongated pole pieces and away from the faces of said contacts to conduct the arc away from said contacts.

15. In an electrical controlling apparatus, a snap-actuated contact, a plurality of movably supported contacts each normally spaced from the other and all deriving closing movement from said snap-actuated contact, one of said movably supported contacts engageable by said snap-actuated contact in circuit establishing relation on predetermined actuation of the latter, and means for retarding the movement of said contact engageable by said snap-actuated contact to effect successive contact engagements after predetermined time intervals.

16. In an electrical controlling apparatus, a snap-actuated, primary-circuit-establishing contact, a plurality of movably supported contacts each normally spaced from the other and one of which is engageable in circuit-establishing relation and movable by said snap-actuated contact on predetermined actuation of the latter, a different one of said plurality of movably supported contacts engageable and movable by the first of said movably supported contacts, a further contact engageable by said last mentioned contact after predetermined movement of the latter, and means for retarding the movement of said contact engageable by said snap-actuated contact to effect successive contact engagements between said second and third and said fourth mentioned contacts after predetermined time intervals.

17. In an electrical controlling apparatus, a pivotally mounted contact, a second pivotally mounted contact engageable by said first-mentioned contact after a predetermined movement of the latter in a circuit establishing direction, a third contact slidably supported and engageable by said second-mentioned contact after predetermined movement of the latter in a circuit establishing direction, and a fourth movably supported contact engageable by said third-mentioned contact after predetermined movement of the latter in circuit establishing direction, means associated with said second pivotally mounted contact for retarding movement thereof in circuit establishing direction but permitting substantially free movement in circuit breaking direction, means associated with said third and fourth contacts yieldably resisting movement of said contacts in the direction of their movement upon circuit establishment and continuously urging said contacts in the opposite direction, and means for actuating said first mentioned contact with a snap action in either circuit closing or circuit opening direction.

18. In an electrical controlling apparatus, a snap-actuated contact, a plurality of movably supported contacts each normally spaced from the other and all deriving closing movement from said snap-actuated contact, one of said movably supported contacts engageable by said snap-actuated contact in circuit-establishing relation on predetermined actuation of the latter, means for retarding movement of said contact engageable by said snap-actuated contact to effect successive contact engagements after predetermined time intervals, and means associated with each of said movably supported contacts for continuously urging said contacts in a direction opposite that in which they are movable by said snap-actuated contact.

JOSEPH F. JOY.

CERTIFICATE OF CORRECTION.

Patent No. 2,148,472. February 28, 1939.

JOSEPH F. JOY.

It is hereby certified that error appears in the printed specification of the above numbered patent requiring correction as follows: Page 4, second column, line 31, claim 16, for the words "said fourth" read said third and fourth; and that the said Letters Patent should be read with this correction therein that the same may conform to the record of the case in the Patent Office.

Signed and sealed this 23rd day of May, A.D. 1939.

Henry Van Arsdale

(Seal) Acting Commissioner of Patents.