

Dec. 18, 1923.

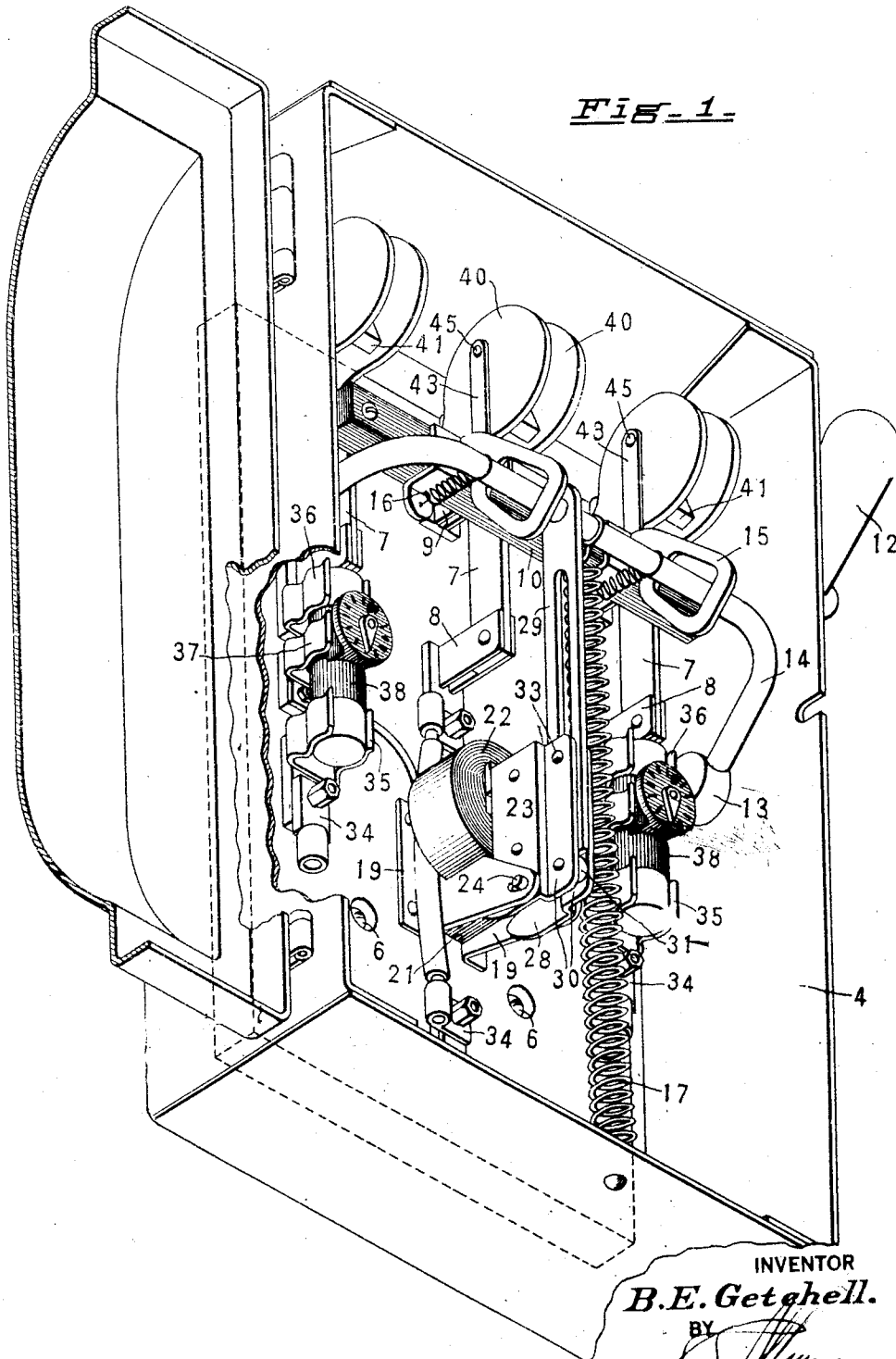
1,477,871

B. E. GETCHELL
MOTOR STARTING SWITCH

Filed June 27, 1922

2 Sheets-Sheet 1

FIG. 1.



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2 Sheets-Sheet 2

FIG. 2.

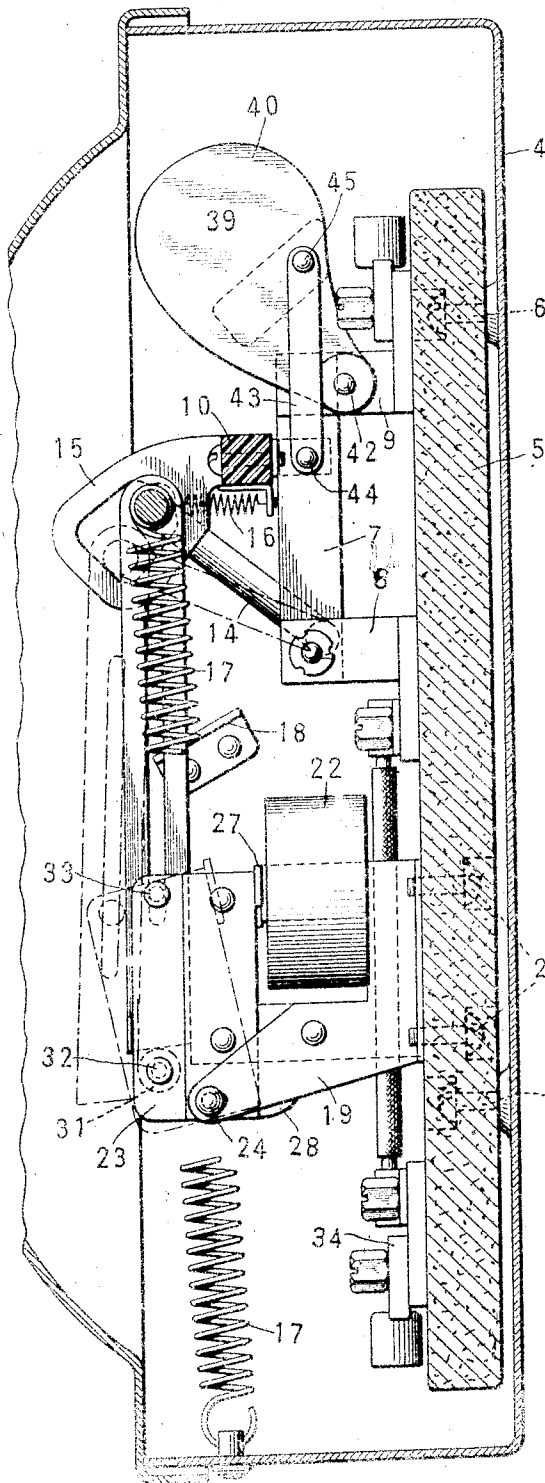
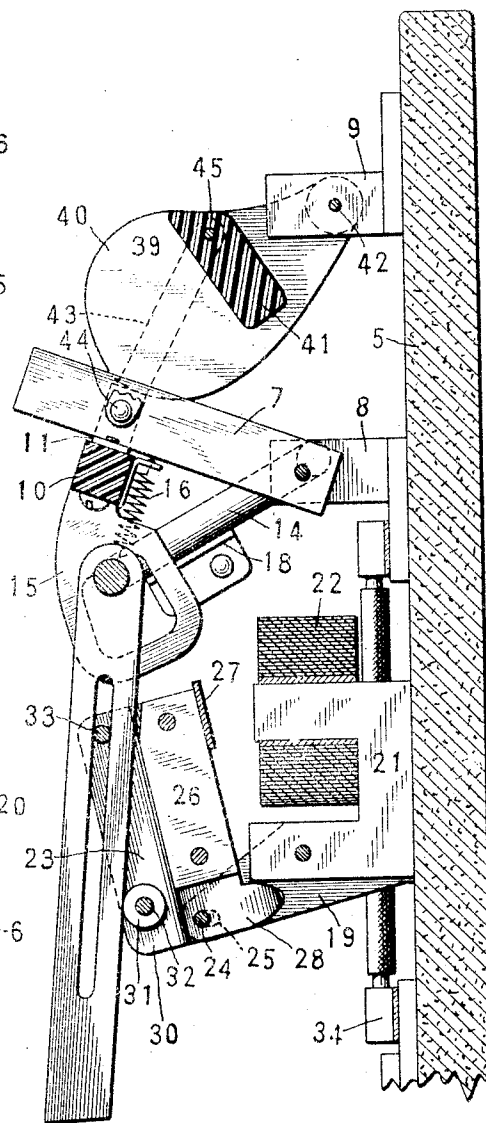


FIG. 3.



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UNITED STATES PATENT OFFICE.

BENJAMIN E. GETCHELL, OF PLAINVILLE, CONNECTICUT, ASSIGNOR TO THE TRUMBULL ELECTRIC MANUFACTURING COMPANY, OF PLAINVILLE, CONNECTICUT, A CORPORATION OF CONNECTICUT.

MOTOR-STARTING SWITCH.

Application filed June 27, 1922. Serial No. 571,310.

To all whom it may concern:

Be it known that I, BENJAMIN E. GETCHELL, a citizen of the United States of America, residing at Plainville, Connecticut, have invented a new and useful Motor-Starting Switch, of which the following is a specification.

This invention relates to switches which may be opened and closed by hand, but is more particularly directed to switches for controlling motor circuits, and which release automatically upon undue variations in the load, thereby protecting the motors.

An important object of the invention is to provide a simple, rugged switch mechanism arranged to be closed by hand, and to be opened either by hand or automatically in response to certain changes in the load or line voltage.

A further object is to provide such a switch having powerful means constantly urging the movable contacts to open circuit position while but a small amount of energy is required to hold the contacts in closed position when the load is normal.

A further object of the invention is to provide in a switch of the foregoing type a holding magnet and contact opening mechanism which operate with a minimum of wear to give a quick break of the switch contacts.

Other objects of the invention will become apparent as the description progresses.

In carrying out the invention there are provided a contact operating member, means such as a spring to actuate said member to open the switch, a toggle joint or member having one part connected to the operating member, and an electromagnet connected in the load circuit having an armature connected to the other part of the toggle to hold the two parts in locking alignment to maintain the switch closed when the magnet is normally energized.

One embodiment of the invention is illustrated in the accompanying drawings in which:

Fig. 1 is a perspective view with certain

parts broken away of a switch and its operating means.

Fig. 2 is a central longitudinal section of the switch with the contacts closed, and

Fig. 3 is a similar section taken on a slightly different plane showing the contacts open.

A casing 4 of any desired type houses the entire switch which is supported on an insulating base 5 secured to the casing as by the screws 6. The circuit closing members may comprise any desired number of blades or movable contacts 7, each pivoted on a post 8 for engagement with a stationary contact such as spring clip 9, three sets of contacts being shown in the drawings. An insulating cross-bar 10 is connected as by angle pieces 11 to the blades 7. An operating handle 12 is journaled at one end 13 in one side of the casing 4. A crank shaped contact operating member 14 has one end secured for rotation with the end 13 of the handle, while its other end is journaled in the opposite wall 6 of the casing. Operating member 14 may be connected to bar 10 by any suitable linkage, but when an automatic quick break of the switch contacts is desired, crank 14 passes through a number of links 15 carried by bar 10. When this construction is employed, a tension spring 16 is provided near each link to connect the bar and crank. A spring 17 stretched between operating crank 14 and a fixed point such as the bottom wall of casing 4 constantly urges the crank and thus the movable contacts 7 into open circuit position, and normally holds the crank against a stop 18 secured to the left hand wall of the casing, with the switch parts in the position shown in Fig. 3.

To hold the switch in closed position while the load current is normal, a magnet and toggle joint are provided. The magnet comprises angle plates 19 secured to base 5 in spaced relation as by screws 20. Riveted between plates 19 is a U-shaped core 21 for instance of laminated iron, about the upper leg of which is coiled the winding 22 of the magnet. Plates 19 extend downwardly and

outwardly clear of the core 21 to provide a support for an armature. The armature comprises two frame pieces 23 pivoted at their lower ends on a pin 24 which is preferably freely movable in slots 25 in the extensions of plates 19. Secured between frame pieces 23 as by the rivets shown is an armature formed for instance of laminated iron sheets 26 arranged to fit snugly against the ends of core 21 when the armature is attracted. A copper separator 27 may be carried at the upper end of the armature to prevent its sticking to the core when deenergized, in which case the lower leg of the core is longer by the thickness of the separator 27 than the upper leg, as best seen in Fig. 3. In any case the slots 25 permit sufficient play of pin 24 to allow the armature to adapt itself to the core, and secure a strong magnetic attraction with a small current flow in the winding 22. Frame plates 23 have ears 28 which bear against core 21 to limit opening movement of the armature.

The armature acts as one part of a toggle joint, the other part consisting of a longitudinally slotted bar 29 journaled at its upper end near the mid-point of crank 14 while its lower portion slides between margins 30 of plates 23 which are inwardly bent to guide it as seen in Fig. 1. A roller 31 is mounted on a pin 32 carried between the lower ends of margins 30 of armature plates 23. This roller carries the thrust exerted on bar 29 by the spring 17 so long as the switch is closed and bar 29 is in locking alignment with the armature. A pin 33 passes through the slot in bar 29 and through the upper ends of armature plates 23 to hold the bar in alignment with the armature when the latter is attracted, and serves to retract the armature when the magnet deenergizes and the lower end of bar 29 slides free of roller 31. Since spring 17 exerts no lifting force on bar 29, the lower edge of the bar is preferably given a slight bevel, as best seen in Fig. 3, so that the downward pressure of the bar on roller 32 tends to lift the bar free of the roller and retract the armature. Such bevel is however not essential to operation of the toggle joint, since the thrust of bar 29 produces a couple which acts on pins 32 and 24 tending to retract the armature, and thus to lift bar 29 by means of pin 33 and the pressure of the upper ends of sheets 26 on the bar.

In a switch of the type described which is adapted to be used for example with a three phase power line or a three wire two phase line, the line wires are connected to the spring clips 9 by the usual terminals shown. Motor terminals 34 are secured to the base 5 near the bottom of the casing, the two outer terminals having spring clips 35

while the middle terminal 34 is connected direct to its post 8 as by the insulated wire shown. Outer posts 8 have spring clips 34 in alignment with clips 35, while between each of these pairs are clips 37 independently secured to the insulating base 5. Magnet winding 22 is connected between clips 37. A relay 38 held by each set of clips 35, 36, 37 normally serves to interconnect the clips, but is arranged upon the continuance of an overload condition for a predetermined time interval (which is short enough to prevent damage to the motor) to disconnect clips 37 from the line circuits.

Thus upon closure of the switch by operation of the handle 12, the contact of the switch 7 with jaw post 9 completes the circuit through winding 22 in shunt with the motor to energize the magnet and thus draw the bar 29 and armature 23 into alignment and lock the toggle joint members against the action of spring 17, and the switch remains closed. Should an undervoltage condition arise, the current in winding 22 would become too weak to hold the armature attracted, and spring 17 would open the switch. Similarly if an overload condition arises, relays 38 will interrupt the circuit of winding 22 before the motor has become overheated, and the switch will be opened.

Whether the switch is opened by hand or by the spring 17 upon deenergization of the magnet, the operating crank 14 moves as far as the outer end of links 15 without disturbing the blades 7 (as shown in broken lines in Fig. 2) and thus puts springs 16 under considerable tension. When upon further movement of the crank the blades are withdrawn from clips 9, the springs 16 suddenly contract to cause a very quick break between the contacts by snapping cross bar 10 towards the crank until the latter abuts the inner end of the links in the position shown in Fig. 3. The blades at the instant of opening therefore have a velocity towards the crank caused by springs 16, while the crank has a velocity towards its stop 18 caused by spring 17, as a result of which the blades leave their spring clips 9 at a speed equal to the sum of the two velocities mentioned, and thereby minimize arcing and consequent wear.

To still further decrease arcing between the contacts, and to positively prevent any arc to the walls of the casing, there may be provided arc snuffers 39 of insulating composition. Each snuffer 39 comprises two plates 40 united by a cross strip 41 and pivoted to a clip 9 as at 42. The snuffers are actuated by rods 43 pivoted to blades 7 at 44 and to the out side of plates 40 as at 45. It will thus be apparent that when the switch is closed, snuffing piece 41 will have one edge close to blade 7, and as the blade moves out

of engagement with its clip 9, piece 41 will immediately be interposed between blade and clip to snuff the arc, while plates 40 at all times prevent arcing between clips 9 and the casing 4.

While one embodiment of the invention as applied to a particular motor starting switch has been described in detail, it is to be understood that the invention is capable of many other embodiments as may be required in different applications, and that certain parts may be changed or dispensed with entirely without departing from the spirit of the invention as defined by the appended claims.

I claim:

1. In a switch, a fixed contact, a movable contact, a crank to actuate the movable contact, a magnet comprising an armature having a stop, a bar journaled on the crank and having an end portion abutting the armature stop when the contacts are closed, and means for forcing said end portion out of abutment with the stop to permit opening of the contacts.

2. In a switch, a fixed contact, a movable contact, means including a bar to control the movable contact, two guide plates for the bar, a stop between the guide plates, a pin and slot connection between the bar and guide plates, a support on which the guide plates are pivoted, a spring forcing the bar against the stop when the contacts are closed, an armature carried by the guide plates, the pressure of the bar on the stop tending to retract the armature to permit the bar to slide off the stop to open the contacts, and a magnet to attract the armature to prevent such sliding of the bar.

3. In a switch, two relatively movable contacts, a member to operate the contacts, a spring to open the contacts, a magnet having an armature, a stop carried by the armature and a bar slidably connected to the armature and secured to the contact operating member, said bar being arranged upon closing of the contacts to be moved into alignment with the stop to prevent opening of the contacts and said pin and slot connection maintaining said alignment while the magnet is energized.

4. In a switch, a fixed and a movable contact, an operating member for the movable contact, a relatively weak spring interconnecting said member and contact, and a relatively strong spring opposing the action of the weak spring and urging the operating member to open the contacts said strong spring being adapted to initiate opening movement of the operating member to stretch the weak spring before the contacts open whereby the movable contact is disengaged from the fixed contact by the simultaneous contraction of both springs, a bar

connected to the operating member, an armature arranged when attracted to hold the bar in position to prevent contact opening movement of the operating member, and an electromagnet to attract the armature.

5. In a switch a fixed and a movable contact, an operating member for the movable contact, a spring to actuate the operating member to open the contacts, a longitudinally slotted bar journaled on the operating member, two guide plates connected by a pin passing through the bar slot, an armature carried by said plates, a roller stop between said plates adapted to be engaged by said bar to prevent contact opening movement of said contacts when said armature is attracted, and a magnet to attract said armature.

6. In an electric switch, a contact blade, an operating crank having a lost motion connection therewith, a spring connecting said crank with said blade, another spring more powerful than the first tending to operate said crank, a jointed member connected to said crank adapted to oppose the action of said operating spring and hold said crank and switch blade in the closed circuit position, under certain circumstances, and an electromagnet for holding one part of said hinged member, the other part of said hinged member having a sliding engagement with the first mentioned part when the electro-magnet is deenergized.

7. In a switch, a movable contact, an operating member connected thereto, an electro-magnet, a pivoted armature therefor, an abutment carried by said armature, a bar connected to said operating member and having a hinged and sliding engagement with said armature and adapted to engage said abutment, and an operating spring holding said operating member under tension, said bar and armature holding the switch contact in the closed circuit position when said magnet is energized, said spring serving to disengage said bar from said abutment when the magnet is deenergized.

8. In an electric switch, an operating member, an electro-magnet, a pivoted armature for said magnet, an abutment carried by said armature, a bar connected to said operating member and having a sliding engagement with said armature and adapted to engage said abutment when in a closed circuit position, the moment arm of said abutment being materially shorter than the moment arm of said armature with respect to said magnet.

9. In a switch, fixed contacts, movable contacts, an operating member to actuate the movable contacts, a magnet including an armature having a stop, a bar connected with the operating member and having an abrupt end adapted to abut against the ar-

mature stop when the switch is in closed position and a spring for constantly urging the switch to open position, the said magnet being adapted to retain the armature stop in abutment with the abrupt end of said bar when the switch is in closed position.

10. In a switch, fixed contacts, movable contacts, an operating member to actuate the movable contacts, a magnet including an armature having a stop, a bar connected to the operating member and having a substantially square end portion adapted to abut against the armature stop when the switch is in closed position and a spring for constantly urging the switch to open position, the said magnet being adapted to hold the armature stop and the square end of the said bar in abutting relation against the power of the spring when the switch is in closed position.

11. In a switch, fixed contacts, movable contacts, a crank member to actuate the movable contacts, a magnet, a pivoted armature for said magnet having a stop, a bar connected to said crank member and having a sliding engagement with said armature, said bar having an abrupt end portion adapted to abut against the armature stop when the switch is in closed position and a spring for constantly urging the switch to open position, the said magnet constituting a means for retaining the abrupt end of said bar in abutment with the said stop against the power of the spring when the switch is in closed position.

12. In a switch, fixed contacts, movable contacts, an operating member to actuate the movable contacts, a magnet including an armature having a stop, a bar journaled on the operating member and having operable engagement with the armature, the said bar having one of its ends adapted for engagement with the armature stop when the switch is in closed position and a spring means for constantly urging the switch to open position, the said magnet being adapted to hold the said bar in abutment with the said stop against the power of the spring when the switch is closed.

13. In a switch, fixed contacts, movable contacts, an operating crank for actuating the movable contacts, a magnet including an armature having a stop, a bar journaled on the operating crank and having one of its ends adapted to abut against the armature stop when the switch is in closed position, a spring constantly urging the crank to open the switch, the said magnet being adapted to retain the bar and armature stop in abutment against the tension of the spring when the switch is closed and the angular relation of said bar with said armature stop being such that the abutting engagement will be broken and the switch will be thrown open by the spring upon a reduction in volt-

age and the abutting engagement may be broken and the switch opened by the manual operation of the crank.

14. In a switch, fixed contacts, movable contacts, an operating crank for actuating the movable contacts, a magnet including an armature having a rotatable stop, a link operably connecting the said crank with the said armature, said link having one of its ends adapted for abutment against said armature stop when the switch is in closed position and a spring for throwing the switch to open position, the said magnet constituting a means for holding the abutment end of said link in engagement with said rotatable stop against the switch-opening force of the spring when the switch is in closed position.

15. In a switch including pertinent fixed and movable contacts, an operating crank for actuating the movable contacts, a magnet including an armature and a pivoted armature frame supporting said armature and a rotatable stop, a link member operably connecting said armature frame and said operating crank and having one of its ends adapted to be drawn into locking abutment with the said stop by the magnet when the switch is in closed position, means for constantly urging the switch to open position and manual means for disrupting the locking engagement of the link and stop to open the switch.

16. In a switch including pertinent fixed and movable contacts, a crank for operating the movable contacts, a movable member supporting a stop, a link operably connecting said crank and said member and having one of its ends adapted to abut against the said stop when the switch is in closed position, magnetic means for holding said link and said stop in locking abutment when the circuit is on, a spring for disrupting said locking engagement of the link and stop when the circuit is de-energized and for constantly urging the switch to open position and manual means for disrupting the locking engagement of said link and stop to open the switch.

17. In a switch, fixed contacts, movable contacts, a crank for actuating the movable contacts, a movable member, a stop supported by said member, a link operably connecting said crank with said member and having one of its ends adapted to abut against the said stop when the switch is in closed position with the normal circuit on, magnetic means for holding said link and stop in abutting relation when the normal circuit is on and for releasing said abutting relation when the circuit is de-energized, spring means for constantly urging the switch to off position and manual means for disrupting the abutting relation of the link and stop to open the switch.

18. In a switch, a loosely pivoted armature, a stop carried thereby, a link having a sliding engagement with said armature and adapted to engage said stop, a spring acting upon said link and a magnet acting upon said armature to hold the parts in closed circuit position.

19. In a switch, a magnet, an armature

pivoted at one end to swing toward and away from the magnet, a stop carried by said armature adjacent its pivot, a link having a sliding engagement with the opposite end of said armature and adapted to abut against said stop in the closed circuit position and means for actuating said link.

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