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E. R. CARICHOFF
MAGNETIC BLOW-OUT DEVICE

Filed Nov. 2, 1920

Fig. 1.

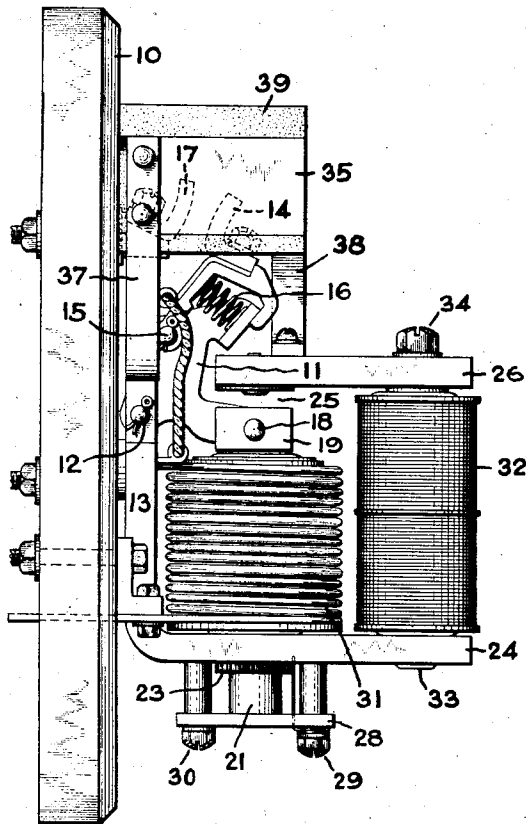
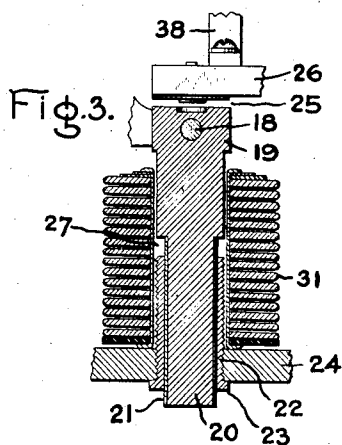
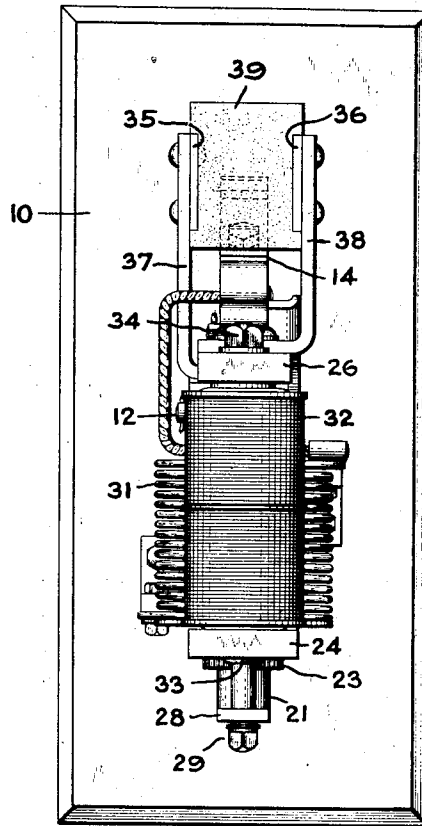


Fig. 2.



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UNITED STATES PATENT OFFICE.

EUGENE R. CARICHOFF, OF SCHENECTADY, NEW YORK, ASSIGNOR TO GENERAL ELECTRIC COMPANY, A CORPORATION OF NEW YORK.

MAGNETIC BLOW-OUT DEVICE.

Application filed November 2, 1920. Serial No. 421,212.

To all whom it may concern:

Be it known that I, EUGENE R. CARICHOFF, a citizen of the United States, residing at Schenectady, county of Schenectady, State of New York, have invented certain new and useful Improvements in Magnetic Blow-Out Devices, of which the following is a specification.

My invention relates to improvements in electromagnetic switches, and in particular to magnetic blow-out devices for disrupting the arcs formed between the switch contacts.

The customary magnetic blow-out device is provided with a blow-out coil which is in series with the switch contacts or one which is included in the circuit of the arc after the contacts separate. One of the objects of my invention is to eliminate this separate blow-out coil, thereby simplifying the switch construction and also reducing the cost of manufacture. My invention has a particular application in electromagnetic switches provided with an operating or controlling magnetic structure through which a magnetic flux passes during the opening of the switch and also after the switch contacts have opened. In carrying my invention into effect, I connect my blow-out device across the points on the magnetic structure of the switch between which there is a difference of magnetic potential. A particular application of my invention is found in electromagnetic switches of the series lock-out type which are provided with a magnetic structure which is energized during the opening of the switch and also after the switch has opened. Such switches are customarily provided with two air gaps in the magnetic circuit, one a "closing" gap and the other a "holding-out" gap, and in carrying my invention into effect in a switch of this character I connect two magnetic members to the magnetic structure so as to provide a shunt path for the magnetic flux around the "closing" gap, the flux through this shunt path passing across the space in which the contacts separate so as to disrupt any arcs formed between the contacts.

For a better understanding of my invention, reference is had to the accompanying drawings, in which I have shown my invention embodied in concrete form for purposes of illustration, and in which Fig. 1 shows a side view of a series coil electro-magnetic switch of the lockout type having

a shunt controlling coil and a magnetic blow-out device connected across the "closing" gap in the magnetic circuit; Fig. 2 is a plan view of the same; and Fig. 3 is a detail for the purpose of showing the "closing" and "holding-out" gaps in the magnetic circuit of the switch.

For purposes of illustrating my invention and with the object of giving others an easy understanding of the same, I have shown my invention embodied in an electromagnetic switch of the series lock-out type, described and claimed in a co-pending application in which I am a joint applicant with Benjamin W. Jones. This joint application is assigned to the same assignee as this application, and the serial number thereof is 421,290, filed November 2, 1920.

Referring to the drawings, the switch mechanism is mounted on a base 10 of slate or other suitable insulating material, and the movable switch member 11 in the form of a bell crank lever is pivoted at 12 to the member 13 which is a part of the magnetic structure of the switch. The wiping contact finger 14 is pivotally mounted on the bell crank switch member 11 at 15, and a spring 16 is provided for the purpose of resiliently mounting the contact 14 so that the contact 14 will make a wiping engagement with the stationary contact 17 in closing, and when the contactor is closed there will be a spring pressure between the contacts. The bell crank 11 is pivotally connected at 18 to a plunger 19 which constitutes the movable member of the magnetic structure of the switch. This plunger 19 is constructed substantially as shown in Fig. 3 with a lower portion 20 of reduced cross-sectional area. A sleeve 21 of brass or other non-magnetic material surrounds the lower end 20 of reduced cross-section for the purpose of preventing the plunger from sticking to the adjustable sleeve 22 of magnetic material which surrounds the end 20 and the sleeve 21. This adjustable sleeve 22 is preferably in the form of a hollow cylindrical externally threaded screw, and the sleeve is provided with a knurled head 23, by means of which the sleeve may be adjusted in position with respect to the plunger 19 and the lower supporting member 24 of magnetic material. A "closing" air gap 25 is provided between the upper and enlarged end of the plunger 19 and the upper member 26 of the

magnetic structure of the switch. A "holding-open" air gap 27 (Fig. 3) is provided between the upper portion of the plunger 19 and the adjustable sleeve 22 of magnetic material. The lower end 20 of the plunger 19, which is of reduced cross-section, is adapted to rest on the support 28 which is held in position by the two bolts 29 and 30. This support 28 arrests the opening movement of the switch and provides a means whereby the "closing" air gap 25 may be adjusted if desired. The plunger 19 will rest on this support if the switch windings are deenergized, or if the series winding 31 which surrounds a portion of the plunger 19 and completely surrounds the "holding-open" gap 27 is energized above the calibrating point, or in case the direction of current in the series winding 31 is reversed with respect to the shunt winding 32.

To the right of the series coil 31 and located between the members 24 and 26 of magnetic material is the shunt control coil 32. This shunt control coil is mounted on a core 33 of magnetic material and is clamped between the members 24 and 26 by means of the bolt 34.

The magnetic structure of the operating electromagnet of this switch is energized at all times while the switch is in operation, and I make use of the magnetic flux of this operating magnet to extinguish the arcs formed between switch contacts 14 and 17 when the switch is opened. The "closing" gap 25 is closed when the switch is closed, but there is a drop of magnetic potential across this gap at all times while the switch is opening and when the switch is opened because of the flux set up by the shunt coil 32. In carrying my invention into effect, I connect my improved magnetic blow-out device in shunt to this "closing" gap, the strip 37 of magnetic material being magnetically connected with the lower member 24, and the strip 38 of magnetic material being connected to the upper member 26 of the magnetic structure of the switch. Connected to the upper ends of the strips 37 and 38 are the plates 35 and 36 of magnetic material which are disposed parallel to the plane of movement of the switch contacts, and which are adapted to support the arc chute 39 of refractory material in such a position that the arcs formed between the switch contacts will be caused to proceed upwardly from the contacts through the arc chute.

The operation of my invention is as follows: Assume that the switch is in the open position. If the winding 31 is energized by current in excess of a predetermined value, the switch is magnetically held in the open position, by reason of the fact that the reduced cross-section portion 20 of the plunger 19 will be magnetically saturated

and an increased flux will cross the "holding-out" gap 27 and exert a force which will oppose the pull exerted by the flux across the "closing" gap 25 to such an extent that the switch will remain in the open position. In case the current drops to the predetermined value, the switch will be closed by reason of the fact that the pull at the "closing" gap 25 predominates. The shunt winding 32 is energized at all times while the switch is in operation to set up a flux in the magnetic structure which has no tendency to hold the switch open, but which nevertheless exerts a force which will close the switch in case the current in the series coil 31 is at any value less than the previously mentioned predetermined value. This value is ordinarily termed the "calibrating" value or "lock-out" value.

If after the switch is closed, the current in the series coil 31 is reversed due, for instance, to what is termed a "pump back," the switch will automatically open at a certain value of the reverse current. This is due to the fact that the flux set up by the shunt coil 32 is opposing the flux set up by the series coil 31, and for the further reason that the series coil is setting up a pronounced force across the "holding-open" gap 27. The switch will therefore automatically open, and while it is opening there will be a drop of magnetic potential across the "closing" gap 25. By reason of the fact that the magnetic blow-out device is arranged in shunt to this "closing" gap, the magnetic flux set up by the shunt coil will be caused to proceed through a path comprising the strip 37, across the switch contacts 14 and 17 at right angles to their plane of movement, and through the strip 38. This flux, which is effective as a magnetic blow-out, will be effective even after the switch is open, and the arcs formed between the switch contacts are quickly disrupted and forced to proceed upwardly from the switch contacts through the arc chute 39.

In accordance with the provisions of the patent statutes, I have described the principle of operation of my invention, together with the apparatus which I now consider to represent the best embodiment thereof, but I desire to have it understood that the apparatus shown is only illustrative and that the invention can be carried out by other means.

What I claim as new and desire to secure by Letters Patent of the United States, is:

1. An electromagnetic switch comprising an operating electromagnet having a magnetic structure with an air gap across which there is a difference of magnetic potential while the switch is opening, a pair of relatively movable switch contacts, and a pair of magnetic members each of which has one

end connected to the magnetic structure and the other end disposed adjacent the switch contacts, forming a path for the magnetic flux of the magnetic structure shunting the said air gap through which the magnetic flux of the electromagnet is caused to pass at right angles to the plane of movement of the switch contacts.

2. An electromagnetic switch comprising an operating electromagnet having a magnetic structure with an air gap across which there is a difference of magnetic potential while the switch is opening and after it is opened, a pair of switch contacts operated by the said electromagnet to and from the closed position, and a magnetic blowout device adjacent the said contacts shunting the said gap in the magnetic structure.

3. The combination with an electromagnetic switch having relatively movable switch contacts and an operating electromagnet therefor having a magnetic structure through which a magnetic flux passes during the opening of the switch and after the switch is opened, of a magnetic blow-out device for disrupting the arcs formed between the switch contacts, comprising two members of magnetic material connected to points on the said magnetic structure between which there is a difference of magnetic potential.

4. The combination with an electromagnetic switch having relatively movable switch contacts and an operating electromagnet therefor having a magnetic structure through which a magnetic flux passes during the opening of the switch and after the switch is opened, of a magnetic blow-out device for disrupting the arcs formed between the switch contacts, comprising two members of magnetic material connected to points on the said magnetic structure between which there is a difference of magnetic potential, and an arc chute through which the arcs formed between the contacts are adapted to pass supported between the said members.

5. The combination with an electromagnetic switch having relatively movable switch contacts and an operating electromagnet therefor having a magnetic structure through which a magnetic flux passes during the opening of the switch and after the switch is opened, of a magnetic blow-out device for disrupting the arcs formed between the switch contacts, comprising a plurality of members of magnetic material connected to points on the said magnetic structure between which there is a difference of magnetic potential, and arranged to have corresponding ends of the members opposite each other adjacent the switch contacts so that the magnetic flux passing through the members passes at substantially

right angles to the plane of movement of the switch contacts.

6. The combination with an electromagnetic switch having relatively movable switch contacts and an operating electromagnet therefor having a magnetic structure through which a magnetic flux passes during the opening of the switch and after the switch is opened, of a magnetic blow-out device for disrupting the arcs formed between the said contacts comprising a plurality of members of magnetic material connected to points on the said magnetic structure between which there is a difference of magnetic potential, and arranged to have corresponding ends of the members opposite each other adjacent the switch contacts so that the magnetic flux passing through the members passes at substantially right angles to the plane of movement of the switch contacts, and an arc chute supported between the said ends of the members.

7. The combination in an electromagnetic switch of the lock-out type having a magnetic structure including a movable operating member arranged between two air gaps, one of which is a closing gap and the other of which is a holding-open gap, of a magnetic blow-out device for the switch contacts arranged in shunt to the closing gap.

8. The combination in an electromagnetic switch of the lock-out type having a magnetic structure, a variable current winding, an operating member arranged between a closing air gap and a holding-open air gap in the magnetic structure, a constant current winding on the magnetic structure for setting up a flux across the closing gap, and a magnetic blow-out device for the switch contacts energized by flux set up by the constant current winding.

9. The combination in an electromagnetic switch of a switch operating member, an operating electromagnet therefor having a variable current winding and a constant current winding normally supplementing the effect of the variable current winding, means whereby the said member is held in the open position when the current in the variable current winding is above a predetermined value and moves to the closed position when the current in the variable current winding drops to said value, and means whereby the arcs formed between the switch contacts when the switch opens are disrupted by the flux of the constant current winding.

10. The combination in an electromagnetic switch of the lock-out type having a magnetic structure with a variable current winding and a constant current winding disposed thereon, a magnetic movable element under the control of said windings, a pair of relatively movable cooperating

switch contacts magnetically held by the said magnetic element in the open position when the current in the variable current winding is above a predetermined value, 5 magnetically operated to the closed position when the current in the variable current winding drops to said value, and magnetically operated to the open position when the current in the variable current 10 winding reverses in direction, of a magnetic blow-out device comprising a plurality of members of magnetic material connected to the magnetic structure to be energized by

the said constant current winding and arranged to have corresponding ends thereof 15 adjacent the switch contacts so that the magnetic flux through the members is caused to be at substantially right angles to the plane of movement of the switch contacts when the said contacts open due to the 20 reversal of the current through the said variable current winding.

In witness whereof, I have hereunto set my hand this first day of November, 1920.

EUGENE R. CARICHOFF.