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CONTROL APPARATUS

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Fig. 1.

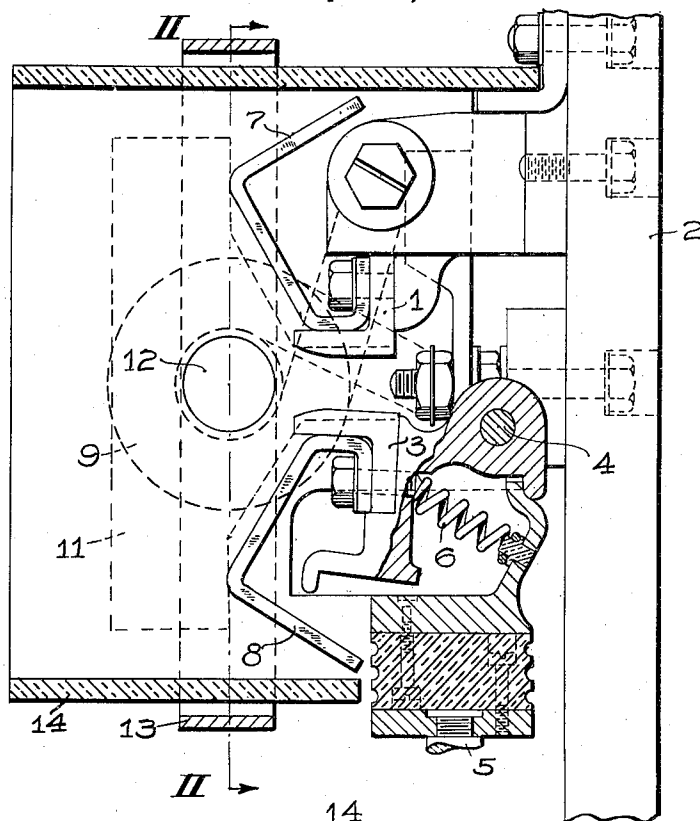
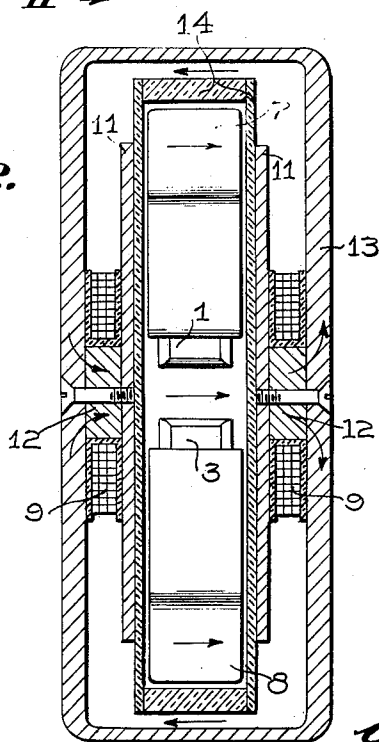


Fig. 2.



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CONTROL APPARATUS.

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This invention relates to devices adapted to rupture electric arcs occurring between two points, such, for example, as contact members of a unit-switch controller or other controller for electric motors.

The object of my invention is to provide a blow-out magnet of improved character which will confine the paths of arcs within definite limits.

Considerable difficulty has been experienced in the design of magnetic switches or contactors in providing an arc box or chute of suitable dimensions and in preventing burning of the chute on account of contact with the arc. In certain applications, it is very desirable to reduce the overall height of the contactors. It is usual to locate the blow-out coil above the switch contacts.

I propose to divide the blow-out coil into two sections, for convenience, and locate them adjacent to the outer sides of the respective arcing horns. The arc chute is then reduced in height to a minimum sufficient to accommodate the pole pieces of a blow-out magnet of well-known construction.

A band of magnetic material, which is clamped to the pole pieces, entirely encompasses the blow-out magnet. For convenience, I use each blow-out-coil section as a spacer between the band and the pole pieces. With the common arrangement of switch contacts which operate in a vertical plane, this band is arranged substantially in a vertical position and the upper and the lower ends of the band are of constricted sectional area to permit of leakage of magnetic lines of force which are opposite in direction to the lines of force induced by the blow-out magnet.

Figure 1 is a side view, partially in section and partially in elevation, of apparatus embodying my invention.

Fig. 2 is a front view, partially in section, of apparatus illustrated in Fig. 1.

Referring particularly to Fig. 1, a contactor comprises a stationary contact member 1 that is supported on an insulating base 2 and a movable contact member 3 that is pivotally mounted on a shaft 4 and actuated upon the vertical movement of a plunger 5 connected thereto. Suitable contact pressure is maintained by means of a compression spring 6. Arcing horns 7 and 8 are mounted on the stationary and the movable contact members 1 and 3, respectively. A blow-

out coil 9, comprising two sections, has one of its terminals bolted to the insulating base 2 and its other terminal connected to the stationary contact member 1. Pole pieces 11 are attached to core members 12 on which the sections of the blow-out coil are mounted. A band of magnetic material 13 surrounds the blow-out magnet and is fastened to the outer ends of the magnet core members 12. An arc chute 14 supports the pole pieces 11 and provides insulation for both pole pieces and the band 13.

The contact members 1 and 3 are engaged upon the vertical movement of plunger 5, which may be actuated by suitable means, and contact member 3 operates with a rolling motion to compress the spring 6. Upon the release of plunger 5 and the consequent separation of contact members 1 and 3 to interrupt the circuit traversing these contact members, the current which also traverses blow-out coil 9 induces a magnetic field in a well known manner. Current is carried across the air gap between contact members 1 and 3, and the arc incident thereto is acted upon in a manner similar to that of an armature conductor of an electric motor in its magnetic field. The arc is carried out in a path of bow-shape, with its ends extending around the arcing horns 7 and 8.

Referring now to Fig. 2, for a predetermined direction of current through the blow-out coil 9, the magnetic lines of force are directed between the pole pieces 11 in a direction indicated by the arrows at the extreme upper and lower edges of the pole pieces. Also, the lines of magnetic force traversing the core members 12 extend through the band 13 and, on account of the restricted cross-sectional areas at the ends of this band, there will be a leakage of the lines of magnetic force traversing the air gap at the upper and lower portions of the blow-out magnet which are opposite in direction to the lines of force between the pole pieces. There is a neutral point between the fields traversed by these oppositely directed lines of force.

The bow-shape path of the arc, the ends of which extend along the arcing horns 7 and 8 in a well known manner under the influence of the field induced between the pole pieces 11, as it approaches the end of the arcing horn, is opposed by the field in-

duced by the band 13. The lines of force in the latter field are opposite in direction to those in the field impelling the arc. As a result, the path of the arc will be directed
 5 along the neutral zone between the oppositely directed fields and away from the arcing horns. The arc is, therefore, also restricted in its vertical movement by the reversed field and will not be blown against
 10 the upper or lower ends of the arc chute.

Thus, the energization of the magnet coils 9 induces an arc-rupturing field about the contact members 1 and 3 and arc horns 7 and 8 which functions to force an arc
 15 drawn between the contact members outward along the arc horns. The band 13 of magnetic material serves to concentrate the external lines of magnetic force to provide a strong magnetic field opposite in direc-
 20 tion to the arc-rupturing field. Consequently, a neutral zone is established between the two magnetic fields.

Since the ends of the band are constricted, there is a great leakage of magnetic flux between the sides of the band near their extremities, thus building up a mag-
 25 netic field inside the band, thereby locating the neutral zone at a distance from the ends of the band 13 and near the points where the arc horns extend beyond the pole pieces
 30 11. Hence, it will be readily understood that the points at which the arcs are forced to leave the arc horns may be located as desired.

The advantages of equipment of the character described will be at once evident to those familiar with the art. The principles of a single blow-out magnet are well known, but I have succeeded in limiting
 40 the path of an electric arc by setting up a magnetic field which opposes the force directing the arc in such a manner as to assist in blowing the arc free from the live portions of the switch mechanism and also
 45 eliminate burning of the arc chute. As the arrangement of parts illustrated is a matter of convenience and not, to any great extent, a matter of necessity, I do not wish to be limited to the exact arrangement
 50 shown.

I claim as my invention:

1. An arc-rupturing device comprising, in combination, a plurality of contact members disposed for relative movement, electro-
 55 magnetic means for developing a magnetic field cooperative to rupture an arc drawn between the contact members, and means for concentrating the external lines of magnetic force adjacent said arc-rupturing field to effect a restriction to the travel of an arc.
 60

2. An arc-rupturing device comprising, in combination, a plurality of contact members disposed for relative movement, elec-
 65 tro-magnetic means to develop a magnetic field cooperative to rupture an arc drawn

between the contact members, and means for concentrating the external lines of magnetic force to provide a magnetic field adjacent and opposite to the arc-rupturing field to effect a restriction to the travel of an arc. 70

3. An arc-rupturing device comprising, in combination, a plurality of contact members disposed for relative movement, a plurality of spaced magnets disposed on op-
 75 posite sides of said contact members to develop a magnetic field in one direction cooperative to rupture an arc drawn between the contact members and means for concentrating the external lines of magnetic force to provide a magnetic field in the op-
 80 posite direction to said arc-rupturing field, thereby to limit the travel of the arc.

4. An arc-rupturing device comprising, in combination, a plurality of contact members disposed for relative movement, a plu-
 85 rality of spaced magnets disposed on opposite sides of said contact members to develop a magnetic field in one direction cooperative to rupture an arc drawn between the contact members and a band of mag-
 90 netic material disposed to concentrate the external lines of magnetic force to provide an external magnetic field in the opposite direction to said arc-rupturing field, thereby to limit the travel of an arc. 95

5. An arc-rupturing device comprising, in combination, a plurality of contact members disposed for relative movement, a plu-
 100 rality of spaced magnets disposed on opposite sides of said contact members to develop a magnetic field in one direction cooperative to rupture an arc drawn between the contact members and a band of mag-
 105 netic material disposed to concentrate the external lines of magnetic force to provide a magnetic field encircling and in the opposite direction to the arc-rupturing field, said band being concentrated at predeter-
 110 mined points to develop an internal field at said predetermined points, thereby to restrict the travel of an arc. 115

6. An arc-rupturing device comprising, in combination, a plurality of contact members disposed for relative movement, a plurality of spaced magnets disposed on opposite
 115 sides of said contact members to develop a magnetic field in one direction cooperative to rupture an arc drawn between said contact members and a rectangular band of magnetic material disposed to concentrate
 120 the external lines of magnetic force, said band being of smaller cross-sectional area at the ends to develop a magnetic field inside the band and in opposition to the arc-rupturing field, thereby to limit the travel of
 125 an arc. 130

7. An arc-rupturing device comprising, in combination, a plurality of contact members disposed for relative movement, arc
 135 horns to receive arcs from the contact mem- 140

bers, a plurality of spaced magnets disposed on opposite sides of said contact members and arc horns to develop a magnetic field in one direction cooperative to rupture an arc drawn between said contact members, and a band of magnetic material disposed to concentrate the external lines of magnetic force to provide an external magnetic field in the opposite direction to said arc-rupturing field, thereby to provide a neutral zone near the ends of said arc horns to limit the travel of an arc.

8. An arc-rupturing device comprising, in combination, a plurality of contact members disposed for relative movement, arc horns to receive arcs from the contact mem-

bers, a plurality of spaced magnets disposed on opposite sides of said contact members and arc horns to develop a magnetic field in one direction cooperative to rupture an arc drawn between said contact members, pole pieces carried by said magnets, said arc horns extending beyond said pole pieces, and means for concentrating the external lines of magnetic force adjacent said arc-rupturing field to provide a neutral zone to effect a restriction of the travel of an arc along said arc horns.

In testimony whereof, I have hereunto subscribed my name this 14th day of September, 1921.

LYNN G. RILEY.