July 18, 1933. T. E. MURRAY 1,918,711

CIRCUIT BREAKER

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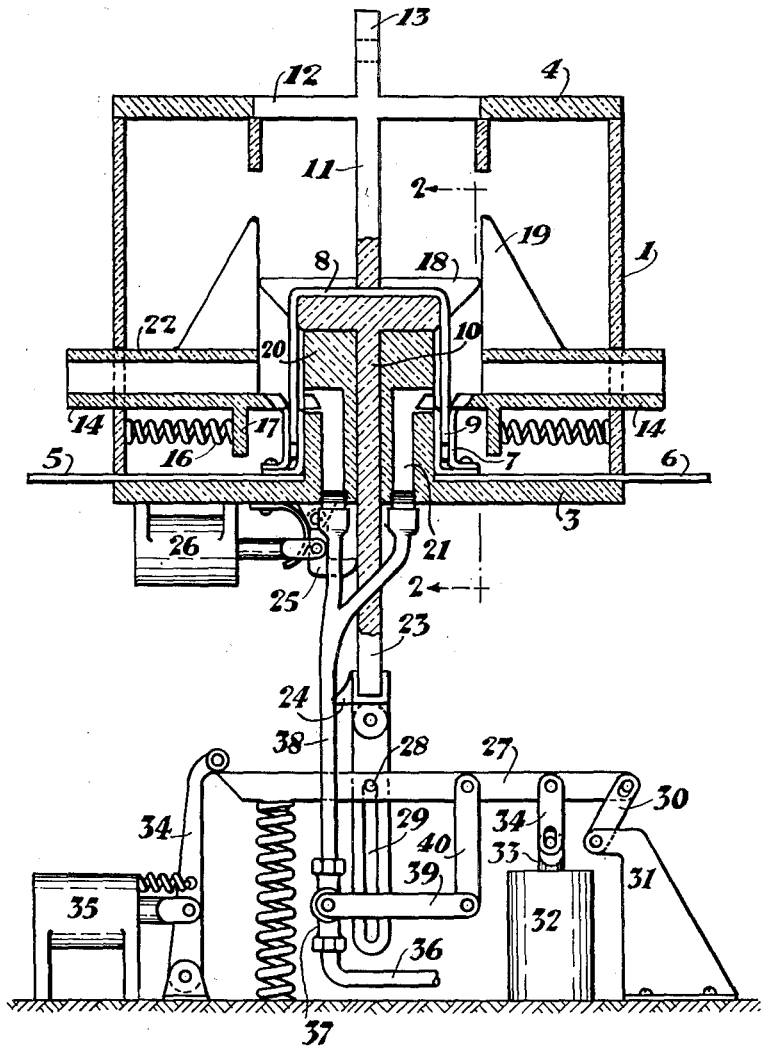
Fig. 1



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CIRCUIT BREAKER

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Fig. 2

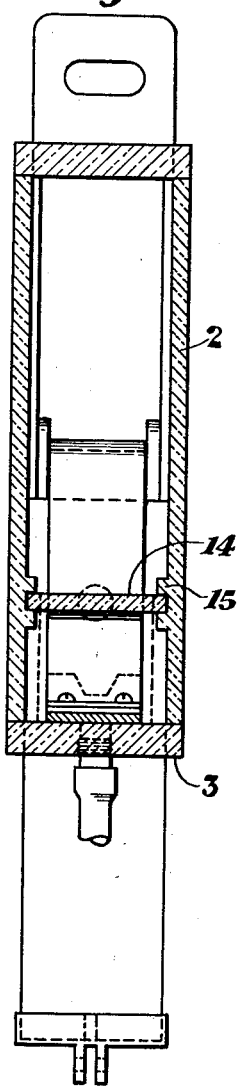
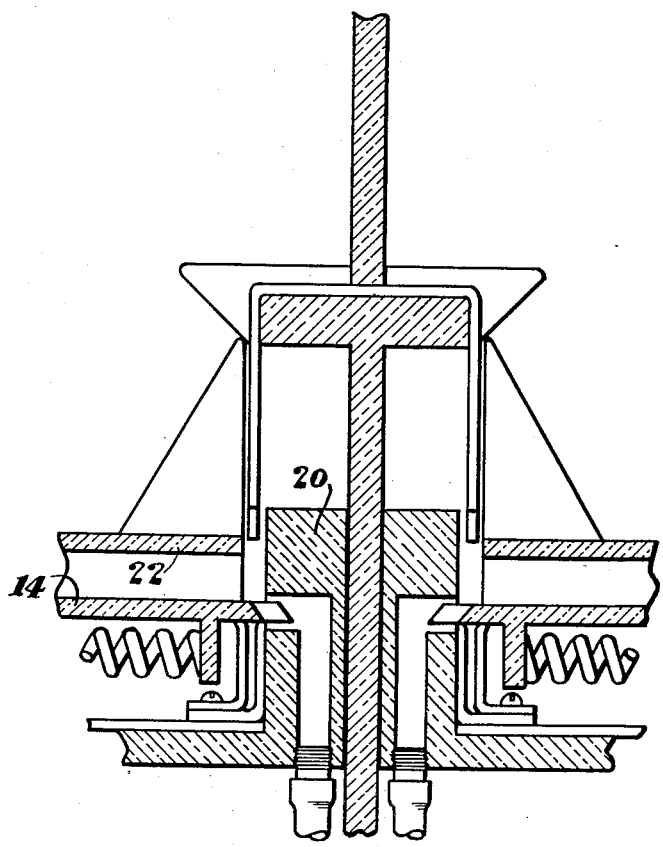


Fig. 3



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CIRCUIT BREAKER

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Fig. 4

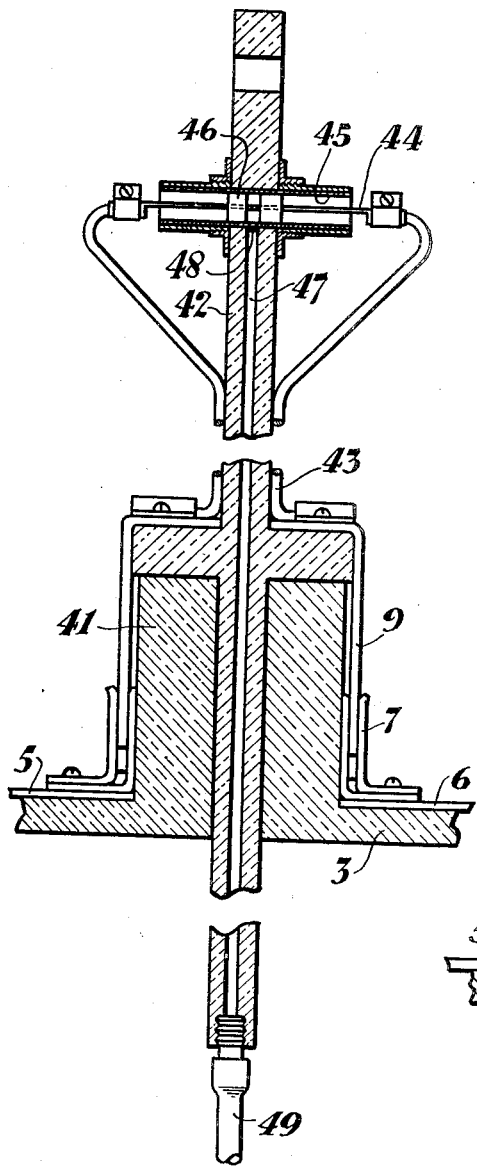
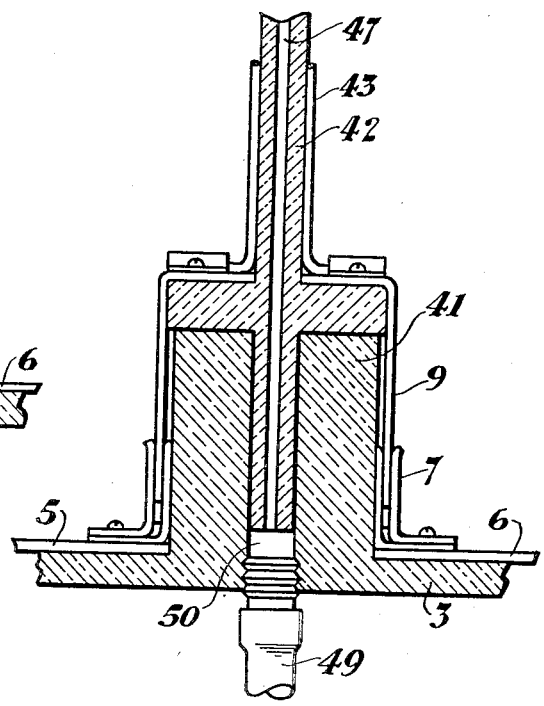


Fig. 5



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CIRCUIT BREAKER

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Fig. 6

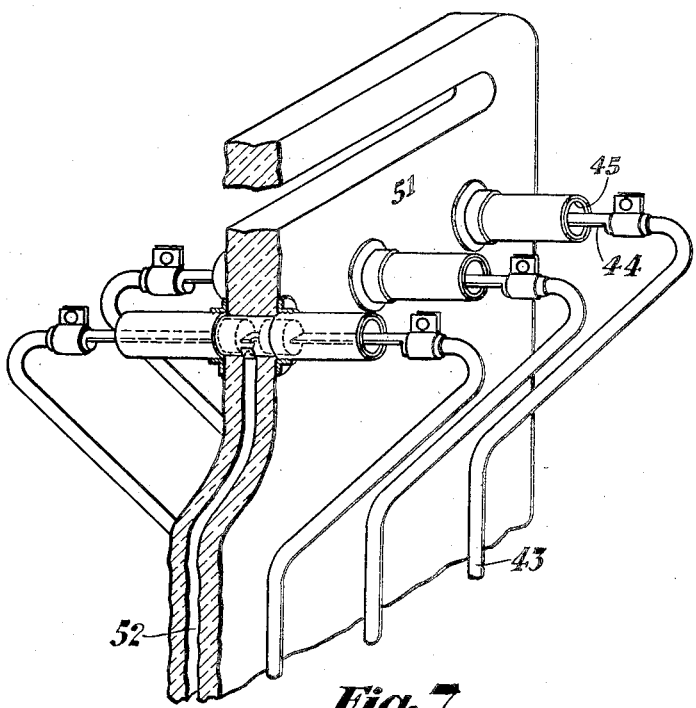
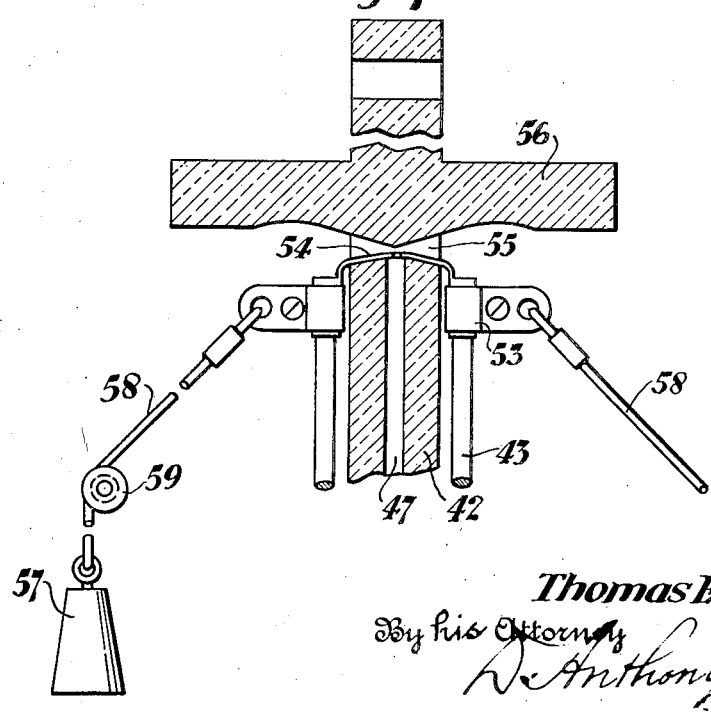


Fig. 7



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CIRCUIT BREAKER

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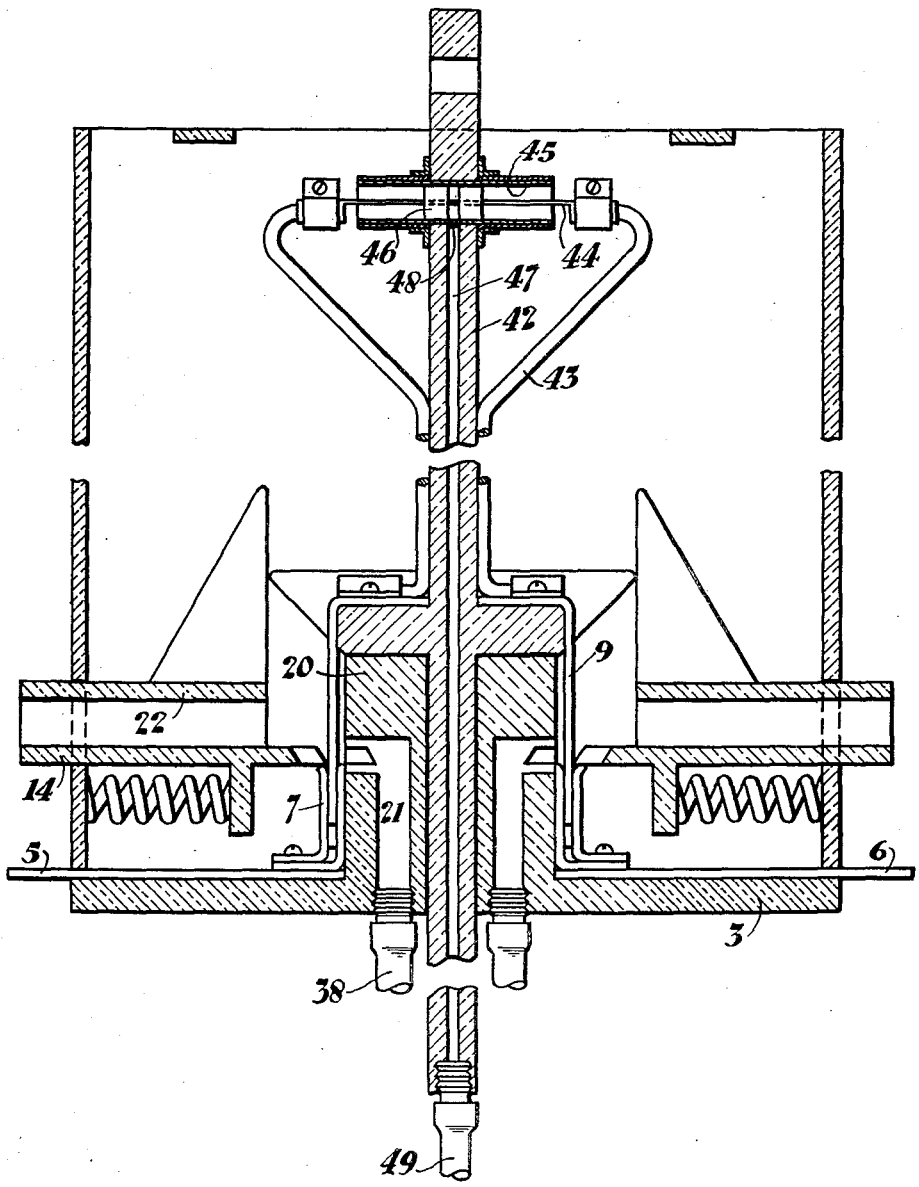
Fig. 8



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Patented July 18, 1933 1,918,711

UNITED STATES PATENT OFFICE

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CIRCUIT BREAKER

Application filed October 5, 1928. Serial No. 310,507.

In my prior Patent #1,833,173 issued Nov. 24, 1931, on an application filed July 10, 1928, and my application No. 296,881, filed Aug. 2, 1928, I have described circuit breaking apparatus including switches and fuses for breaking the circuit particularly in lines carrying high voltages. The present invention provides improvements designed for extinguishing arcs formed in the separation of the contacts or in the blowing of the fuses of such circuit breakers and of other apparatus of the same character.

The accompanying drawings illustrate embodiments of the invention.

Fig. 1 is a longitudinal vertical section of a circuit breaker without a fuse, partly in elevation;

Fig. 2 is a cross-section on the line 2—2 of Fig. 1;

Fig. 3 is a section similar to Fig. 1, showing the parts in a different position;

Fig. 4 is a section similar to Fig. 1 showing the improvement applied with a fuse;

Fig. 5 is a similar view of a modification;

Fig. 6 is a perspective view of a group arrangement of fuses;

Fig. 7 is a vertical section illustrating a different type of fuse;

Fig. 8 is a section showing a combination of the arrangements of Figs. 1 and 4.

Referring to Figs. 1 and 2, the mechanism is carried in a box or casing having end walls 1, side walls 2, a bottom 3 and a cover 4 through which is a central opening hereinafter referred to. The conductors 5 and 6 pass through the end walls and are mounted on the bottom with upwardly extending switch blades 7. A conducting bridge 8 has end terminals 9 adapted to enter between the blades 7 or to be lifted out of contact with the latter. The bridge 8 is mounted on a transverse slide 10 which extends down through the bottom of the box and has an upward portion 11 with flanges 12 which serve to close the central opening in the cover, above which is a handle 13. The carrier thus forms an insulating partition or barrier entirely across the box between the terminals 7 of the line conductors.

When the carrier is raised to break the circuit, sliding barriers 14 are arranged to move across the gap between the terminals 7 and 9 so as to prevent the establishment or maintenance of a conductive arc between the separated terminals. These slides are held at their side edges in guides 15 (Fig. 2) on the side walls of the box. They are pressed forward by springs 16 engaging lugs 17 on their under sides.

The carrier 10 has a pair of cam projections 18 engaging projections 19 on top of the slides and holding the slides back until the carrier is raised sufficiently to pass the cams 18 above the projections 19; whereupon the slides will spring into the gap. When the carrier is lowered the cams 18 engage the tops of the projections 19 and force the slides back to permit the entry of the ends 9 of the conductive bridge into the switch blades 7.

Within the two legs of the conductive bridge there is also an upward transverse projection 20 through the centre of which the carrier 10 slides. The projection 20 is fixed on the bottom 3 of the box and has air passages 21 through it leading from openings in the bottom of the box to lateral openings just at the top of the switch blades 7. These passages are for blasts of air which are to be applied at the proper moment to blow out any arc which tends to form between the switch terminals as they are separated.

The sliding barriers 14 carry tubes 22 which extend through the end walls 1 to points outside of the box so as to remove the hot air and the conductive vapor from the proximity of the parts within. When the slides 14 move inward as in Fig. 3, the end of the tube bears against the partition 20. The barrier 14 is just short of the back of the passage 21. The end of the sliding barrier is also specially shaped, being notched to co-operate with specially shaped terminals, as described in the aforesaid Patent No. 1,833,173, so that it leaves room for the passing of the air blast from the passages 21 into the tubes 22 and thus outside of the box.

The breaker may be actuated by hand or by various mechanisms. Fig. 1 illustrates a distant control mechanism, using solenoids. The lower end of the carrier 10 constitutes an extension 23 which carries a lug 24 adapted when raised to be caught by the spring latch 25. A solenoid 26 serves to withdraw the latch and drop the carrier to circuit closing position.

Attached to the link 27 is a link 34, the lower end of which is slotted and engaged by a pin on the upper end of the core 33 of a solenoid 32 which when energized pulls the core downward. The forward end of the link 27 is bevelled and when it swings downward, catches under a roller on the end of arm 34, the lower end of which is pivoted to a fixed support and the intermediate portion of which is connected to a core of solenoid 35 which when energized pulls the core and releases the latch.

Now when it is desired to open the switch, the solenoid 35 is energized; when this happens solenoid 35 pulls the core and releases the latch and a coil spring then throws the end of the link 27 upward to such a distance that the projection 24 snaps past the spring latch 25 which holds the switch open. Current is then applied to energize solenoid 32 and core 33 pulls the link 27 to the position of Fig. 1 so that the parts are ready for the closing of the switch. The closing of the switch is accomplished by releasing latch 25 by means of solenoid 26 disengaging the projection 24 which allows carrier 23 to drop to the position shown in Fig. 1, thereby closing the contacts.

A reservoir of air under pressure leads through a pipe 36 and a valve 37 to a rubber or other flexible hose connection 38 which leads to the lower ends of the passage 21 within the box.

The valve 37 has an operating arm 39 connected by a link 40 to the lifting link 27. When the carrier is lifted, therefore, the air valve is simultaneously opened and air under pressure is blown through the passages 21 across the space between the separated terminals and through the tubes 22 to the outside of the box.

A switch or circuit breaker of the same general type, but with the addition of a fuse, is illustrated in Fig. 4, the air blast, however, being applied to the fuse. In that case the switch illustrated is intended for use only after a fuse has blown and is to be replaced; but where the switch and the fuse are both intended to be used in the breaking of the circuit, an air blast may be applied to each of them. It is assumed that the structure of Fig. 4 is in a casing similar to that of Fig. 1.

The leads 5 and 6 with upright switch blades 7 are arranged on opposite sides of a stationary block or partition 41. The carrier 42 forms an insulating partition extending across the box, and the movable switch blades 9 are bridged at their upper ends by cables 43 connected at their upper ends to a fuse element 44 passing transversely through the carrier. The fuse has a tubular casing 45 open at opposite ends. Attached to the fusible strip are pistons 46, the reduced blowing point of the strip being located between the pistons. When the fuse blows, the gases generated expel the pistons forcibly and quickly out of the opposite ends of the tube, throwing the cable terminals as far apart as their length and the enclosing casing will permit.

For blowing out the arc which tends to form, the carrier 42 has a passage 47 within it leading to a hole in the casing 45 of the fuse which may be covered by an easily breakable piece of paper 48. The lower end of the carrier is connected to a flexible air hose 49 which leads air under compression to the passage 47. The air pressure may be applied constantly, or by an automatic valve as in Fig. 1.

The arrangement of Fig. 4 is specially designed for such uses as are described in the application of Thomas E. Murray, Jr., No. 257,861 filed February 29, 1928 in which the opening of a switch on the main line throws the current on to a parallel line containing the fuse, which then blows and breaks the circuit, thus permitting the use of a comparatively simple main switch on high tension lines. When such a fuse blows, the carrier will be lifted, disconnecting the cables at the terminals 7 and 9, and a new fuse will be inserted.

In the alternative form shown in Fig. 5, the carrier 42 terminates within the block 41 and the air pipe 49 is mounted directly in the passage 50 in which the sliding carrier is guided within the block 41. This construction permits the complete removal of the carrier 42 without detaching the air pipe.

For certain cases a multiplicity of fuses, either in parallel or in series, are mounted on a carrier such as 51, Fig. 6. The passage 52 therein communicates with all of the three fuses shown. Otherwise the construction may be as in either Fig. 4 or Fig. 5.

According to Fig. 7 the main part of the carrier 42 is similar to that of Figs. 4 and 5, with a passage 47 therein for the air. The fuse, however, is somewhat different. The cables 43 at their upper ends are fastened by clamps 53 to a fuse strip 54 which has its breaking point at the center and overlies the end of the passage 47. The carrier itself is shaped to form a flaring transverse passage 55 between the lower part of the carrier and the flange 56 which forms part of the cover of the box. The fuse, therefore, is practically unenclosed. When the fuse blows there will be a repulsive force

between the two branches of the cable 43 which will tend to throw them apart. This may be assisted by springs or by weights 57 at the ends of cords 58 which are attached to the clamps 53 and pass over guide pulleys 59. Any tendency to form an arc between the burnt ends of the fuse or the ends of the cables will be overcome by the blast of air which enters through the passage 47 and blows violently in both directions through the passage 55.

Fig. 8 illustrates the application of the improvement to both the switch blades and the fuse. The carrier 42 with the fuse in its upper portion is similar to that of Fig. 4. The switch blades 7 and 9 overlie the ends of passages 21 in the block 20 which carry blasts of air which are discharged through the tubes 22 as in Fig. 1. The air hose 49 and 38 carry the air to the passages 47 and 21 respectively.

Various modifications in detail and in the arrangement of the parts may be made by those skilled in the art without departing from the invention as defined in the following claims.

I claim:

1. A circuit breaker comprising a casing, a fixed contact in said casing, a contact movable into and out of contact with said fixed contact, means for blowing a blast of air between said fixed and said movable contacts upon the separation of said contacts, and a barrier movable between said contacts upon their separation and having means to enclose said blast of air and conduct it outside of said casing.

2. A circuit breaker which comprises a pair of fixed contacts, a barrier between said contacts, said barrier having air passages with discharge outlets directed across the edges of said contacts, a slide slidable in said barrier, a contact on said slide to contact with and separate from said fixed contacts, and means actuated by the separation of said contacts to admit air to said passages.

3. A circuit breaker which comprises a casing, a pair of fixed contacts in said casing, a barrier between said contacts, said barrier having air passages with discharge outlets directed across the edges of said contacts, a slide slidable in said barrier, a contact on said slide to contact with and separate from said fixed contacts, means actuated by the separation of said contacts to admit air to said passages, and means movable towards said barrier to enclose said blast of air and conduct it outside said casing.

4. A circuit breaker which comprises a casing, a pair of fixed contacts in said casing, a barrier between said contacts, said barrier having air passages with discharge outlets directed across the edges of said contacts, a slide slidable in said barrier, a contact on said slide to contact with and separate from said fixed contacts, means actuated by the separation of said contacts to admit a blast of air to said passages, means movable towards said barrier to enclose said blast of air, and a fuse on said slide connected to said movable contact, and an air passage in said slide and closed by said fuse.

5. A circuit breaker which comprises a casing, a pair of fixed contacts in said casing, a barrier between said contacts, said barrier having air passages with discharge outlets directed across the edges of said contacts, a slide slidable in said barrier, a contact on said slide to contact with and separate from said fixed contacts, means actuated by the separation of said contacts to admit a blast of air to said passages, means movable towards said barrier to enclose said blast of air, a fuse on said slide connected to said movable contact, and an air passage in said slide and closed by said fuse, the air passage in said slide communicating with the air passages in said barrier.

THOMAS E. MURRAY.