June 9, 1942. H. BEIERSDORF ET AL 2,285,643

ARC CHUTE FOR ELECTRIC CIRCUIT BREAKERS

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Fig. 1.

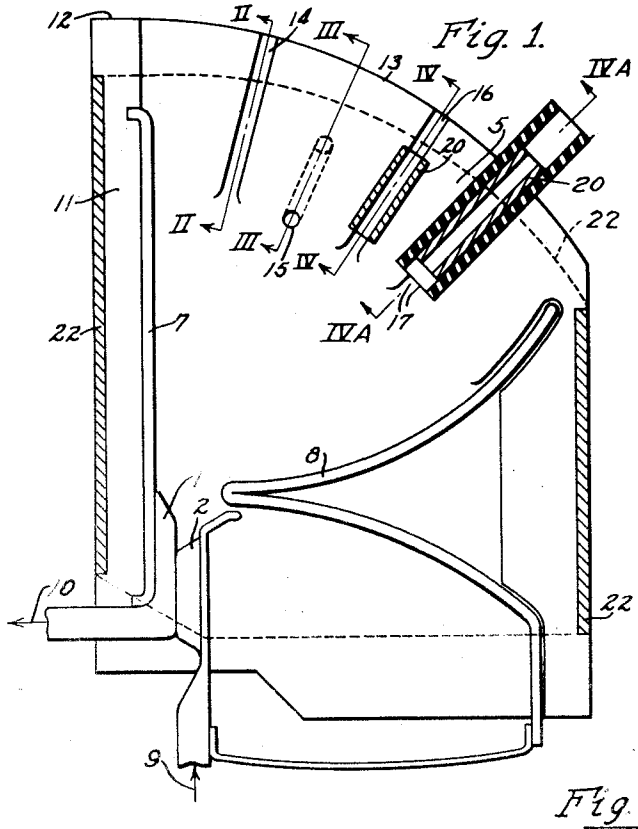



Fig. 2.

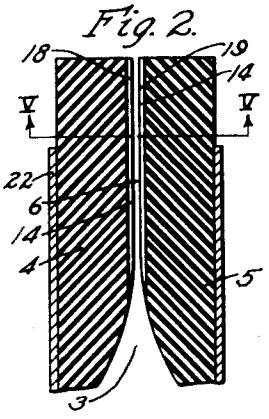



Fig. 5.

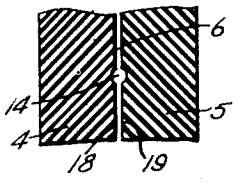



Fig. 6.

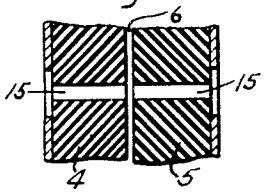



Fig. 4A.

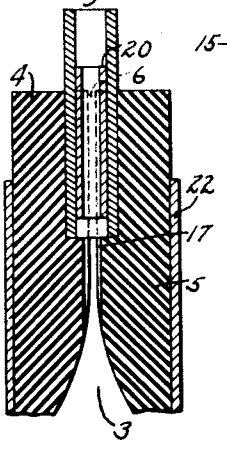



Fig. 3.

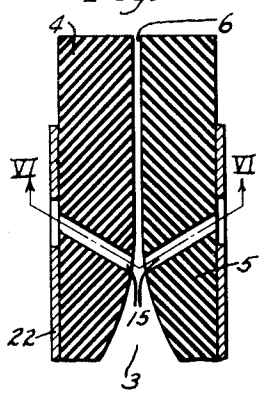



Fig. 4.

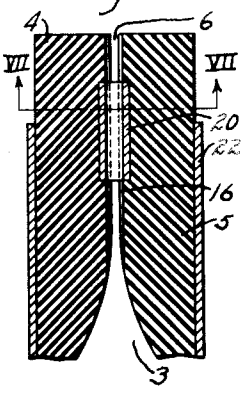
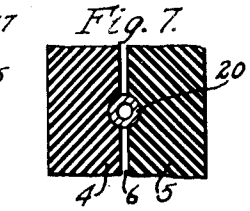



Fig. 7.

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ARC CHUTE FOR ELECTRIC CIRCUIT BREAKERS

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Fig. 8.

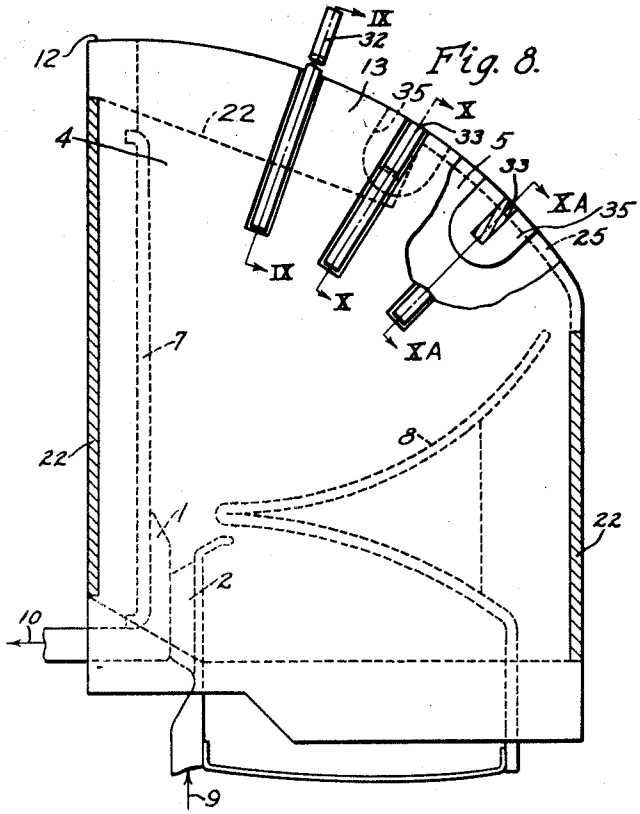



Fig. 9.

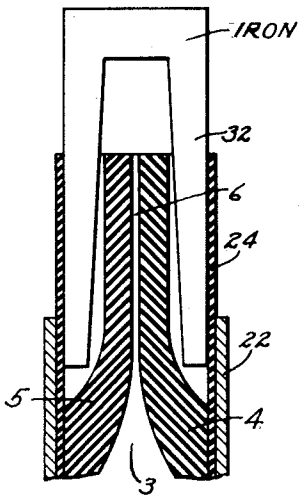



Fig. 10.

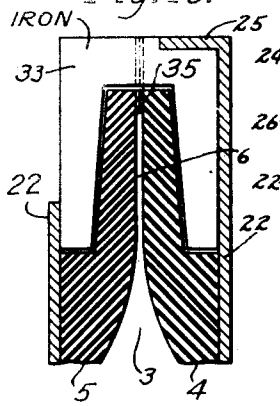



Fig. 11.

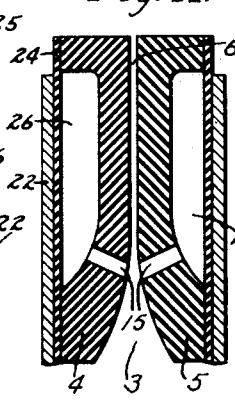



Fig. 12.

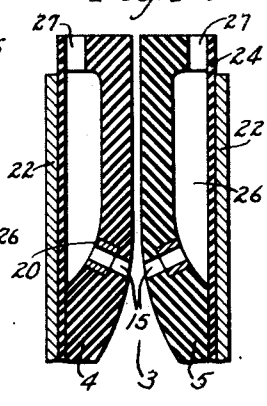
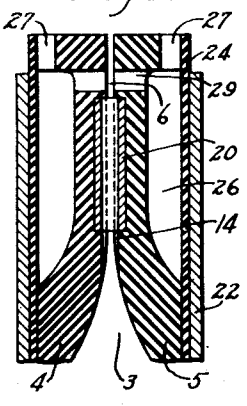



Fig. 13.

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ARC CHUTE FOR ELECTRIC CIRCUIT BREAKERS

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Fig. 14.

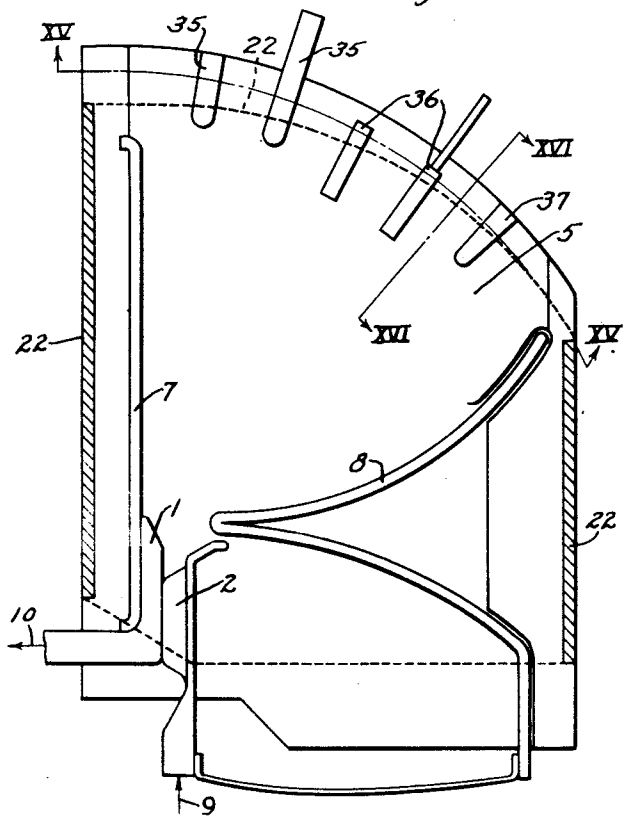



Fig. 16.

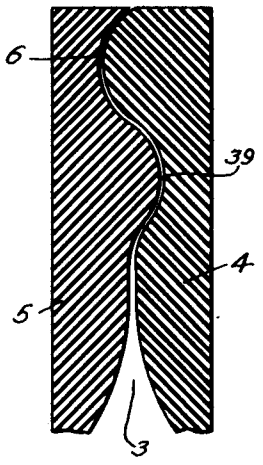
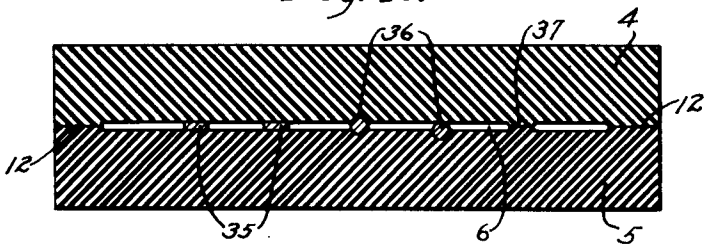



Fig. 15.

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ARC CHUTE FOR ELECTRIC CIRCUIT BREAKERS

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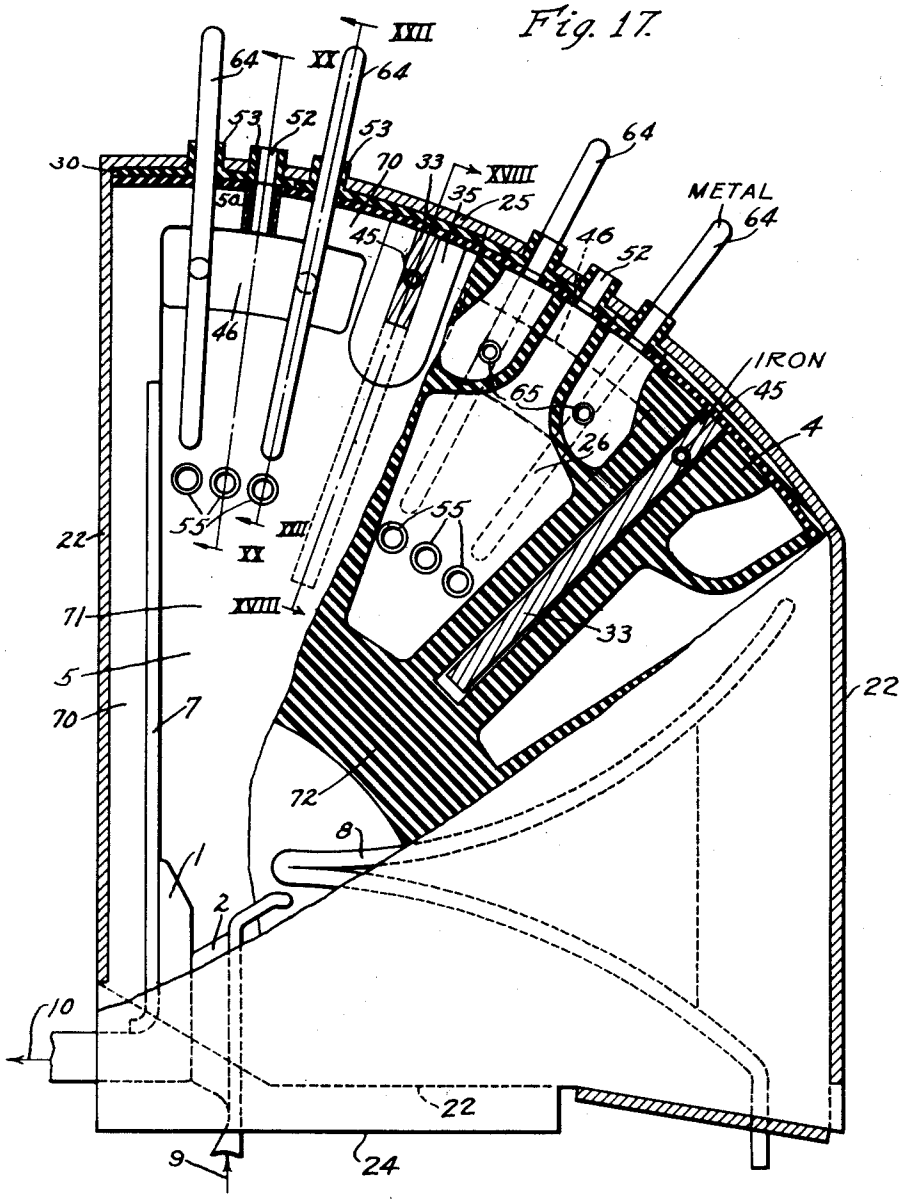
Fig. 17.

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ARC CHUTE FOR ELECTRIC CIRCUIT BREAKERS

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Fig. 18.

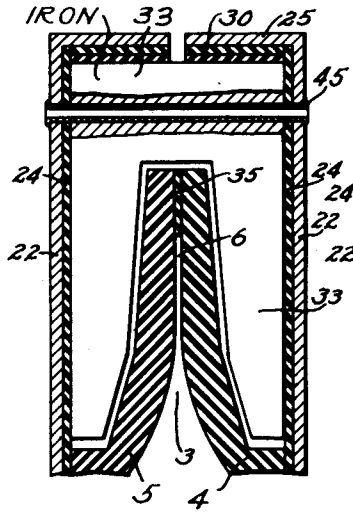



Fig. 19.

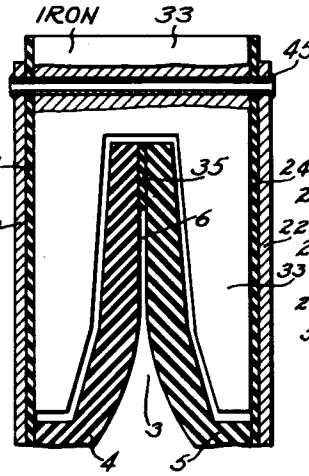



Fig. 20.

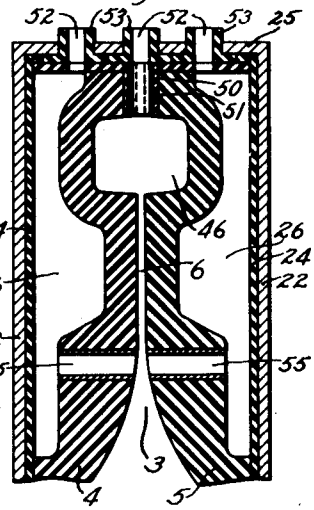



Fig. 21.

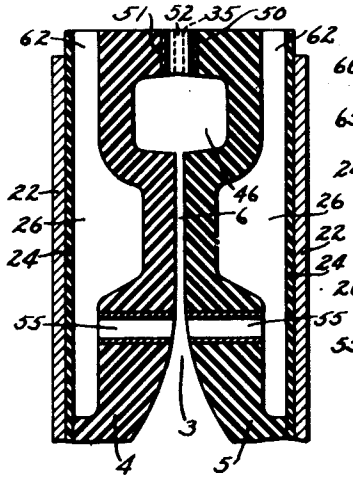



Fig. 22.

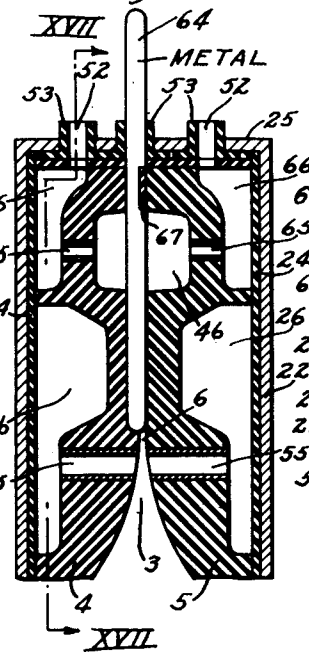
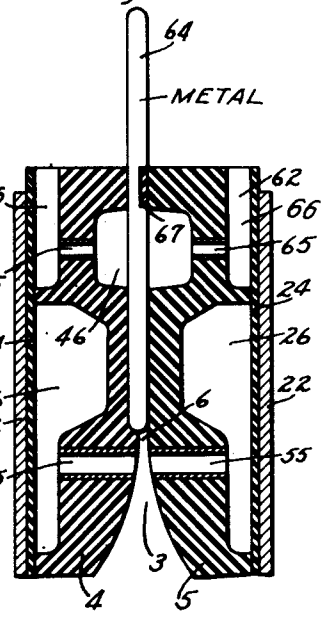



Fig. 23.

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Patented June 9, 1942 2,285,643

# UNITED STATES PATENT OFFICE

2,285,643

## ARC CHUTE FOR ELECTRIC CIRCUIT BREAKERS

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Application January 29, 1941, Serial No. 376,412
In Germany August 28, 1939

28 Claims. (Cl. 200—147)

This invention relates to an arc chute in which is provided a space surrounding the contacts and a narrow communicating slot adjacent thereto which is limited by two walls formed by two plates, and into which slot the arc is forced. The narrow slot has a widened entrance portion for the reception of the arc, said widened entrance portion tapering down to the narrow slot width within the arc chute. Such an arc chute which provides an intense cooling of the arc column is improved according to the invention to a further extent. In this connection the invention is based on the following facts.

To attain favorable blow-out conditions it is desirable to cause the arc to burn over its entire length in the narrow slot of the arc chute. In this case the blow-out conditions are the more favorable, with the cooling more intense and prolonged, the narrower the slot width and the greater the slot depth of the arc chute.

The limits for the slot width and the slot depth have depended in the hitherto known arc chute upon the difficulties with which the arc is introduced into the chute slot. Owing to the arrangement of narrow and deep slots the gases leave the arc chute with a relatively small speed. A rise in pressure results. In the case of too high a resulting pressure within the narrow slot, the pressure also increases in the widened entrance portion of the slot to such an extent that the arc column is prevented by the pressure from entering the narrow slot in the absence of very strong magnetic blow-out fields. The use of a strong magnetic blow-out field causes, however, a great increase in the traveling speed of the arc column after the arc has entered the blow-out slot. In this case the traveling speed of the arc column assumes such values that the full heat absorptive power of the arc chute is not utilized. Greater slot depths must therefore be employed than those employed in the case of low magnetic fields for interrupting the same current.

When using weaker magnetic blow-out fields, the depth of the slot may be less. However, in this case a reduction of the pressure of the gases in the arc chute is necessary. This may be brought about by widening the chute slot to the detriment of the intensity of the extinction power of the slot, or by the provision of a wider entrance portion with less tapering thereof.

It follows that either the full heat absorptive power of the slot walls cannot be utilized or an entrance portion of large surface area must be provided which hardly takes part in the extinction of the arc. This means that the chutes are overdimensioned.

According to the invention the above drawbacks may be removed. This may be accomplished according to the invention by the fact that pressure relief channels end in the widened entrance portion, particularly for relieving the counter-pressure. These channels may either be made in the form of hollow recesses within the ceramic material of the arc chute, or they may consist of tubes with the walls thereof consisting wholly or partly of metal. The use of metal has the advantage that the relief channels may have relatively large cross-sections, from which an escape of the arc is, nevertheless, prevented.

According to the invention metal fittings, for instance U-shaped magnetized metal clips are arranged on the chute to increase the magnetic rising of the arc when entering the blow-out slot, the limbs of the clips being secured in the chute walls in such a manner that they are as close as possible to the slot but are at the same time protected by the chute walls against the influence of the arc.

In the accompanying drawings are shown some embodiments of the invention.

Fig. 1 shows an arc chute of the narrow slot type with various pressure relief channels according to the invention terminating in the widened entrance portion, with one wall of the arc chute removed.

Figs. 2 to 4A show various forms of safety means for providing against the escape of the arc from the pressure relief channels. Fig. 2 is a sectional view of a portion of the chute taken on the line II—II of Fig. 1; Fig. 3 is a sectional view of a portion of the chute taken on the line III—III of Fig. 1; Fig. 4 is a sectional view of a portion of the chute taken on the line IV—IV of Fig. 1; and Fig. 4A is a sectional view taken on the line IVA—IVA of Fig. 1.

Fig. 5 is a sectional view of a portion of the arc chute taken on the line V—V of Fig. 2.

Fig. 6 is a sectional view of the arc chute taken on the line VI—VI of Fig. 3.

Fig. 7 is a sectional view of the arc chute taken on the line VII—VII of Fig. 4.

Fig. 8 shows a modified arc chute, in which the front iron plate and front insulating plate are removed.

Fig. 9 is a sectional view of the arc chute taken along the line IX—IX of Fig. 8.

Fig. 10, on the left, is a sectional view of the chute in Fig. 8 taken on the line X—X and on

the right a sectional view taken on the line XA—XA of Fig. 8.

Figs. 11 to 13 are sectional views of a modified type of arc chute, not shown, in which are shown various expansion chambers and pressure relief channels.

Fig. 14 is a modified arc chute showing various arc damping means.

Fig. 15 is a sectional view taken along the line XV—XV of Fig. 14.

Fig. 16 is a sectional view taken on the line XVI—XVI of Fig. 14.

Fig. 17 is a modified arc chute, partly in section, which shows different forms of expansion chambers, with part of the front chute wall, insulating plate and front iron sheet plate removed.

Fig. 18 is a sectional view of the arc chute on the line XVIII—XVIII of Fig. 17 with the front chute wall, insulating plate and iron plate added.

Fig. 19 is a sectional view of an arc chute, not shown, which is designed in a similar manner as the arc chute of Fig. 18.

Fig. 20 is a sectional view of the arc chute on the line XX—XX of Fig. 17 with the front chute wall, insulating plate and front iron plate added.

Fig. 21 is a sectional view of an arc chute, not shown, differing slightly from that shown in Fig. 20.

Fig. 22 is a sectional view of the arc chute taken on the line XXII—XXII of Fig. 17 with the front chute wall, insulating plate and front iron plate added, and

Fig. 23 is a sectional view of an arc chute, not shown, which differs slightly from that shown in Fig. 22.

In Fig. 1, 1 and 2 denote the two contacts, one of which is stationary and the other may be rotatable about a pivot (not shown), for instance, by a rod. The contacts are shown in the closed circuit position and they are disposed between the chute walls 4 and 5.

The chute walls consist as will be seen, for instance, from Figs. 2 to 7 each of a layer of ceramic material, fibre or other refractory insulating material. However, other materials (amino-compounds) may be employed for the chute walls, which materials develop gases under the action of the arc. The chute walls 4 and 5 are formed to provide an enlarged space adjacent the contacts 1 and 2, that is in the zone in which the arc is struck. The chute walls 4 and 5 together form a widened entrance portion 3 which narrows down to the narrow extinction slot 6 between the walls 4 and 5, which narrow extinction slot may have a width of about 1 to 1.5 mm. which is practically constant throughout the entire blow-out zone.

As will be seen from Figs. 1, 8, 14 and 17, arc horns 7 and 8 project into the arc chute. The upper horn 7 consists of a straight flat bar made, for instance, of copper whose upper end is bent at right angles and which is embedded in the insulating support plate 11 or in the rear wall of the chute. The opposite arc horn 8 consists of two limbs, the upper end of the upper limb along which the arc travels is embedded in the insulating chamber. In order that the arc terminal is transferred in a proper manner from the movable contact 2 to the arc horn 8 the movable contact is so designed and arranged that it directly slides along the lower part of the horn 8. Figs. 1, 8, 14 and 17 show by arrows 9 and 10 the direction of the current. In Figs. 1 and 8, 12 denotes the vertical portion of the chute with an intermediate layer therein to close the slot 6 and 13 the horizontal portion of the chute without an intermediate layer so that the slot 6 can communicate with the atmosphere. The thickness of the intermediate layer may be equal to the slot width as will hereinafter be described.

As will be apparent from Figs. 1 to 7 pressure relief channels 14, 15, 16 and 17 respectively extend according to the invention from the widened entrance portion 3 to the outside atmosphere, so that the high back-pressure of the arc gases within the slot 6 and entrance portion 3 is reduced sufficiently to permit an easy forcing of the arc into the narrow slot 6. For the sake of simplicity different designed pressure relief channels are shown in the arc chute of Fig. 1. In practice pressure relief channels designed in the same manner may be provided in one and the same arc chute.

As will be seen from Figs. 2 and 5 (sectional view II—II of Fig. 1) the pressure relief channels 14 may be obtained by providing recesses in the walls 4 and 5 of the narrow slot 6. However, the pressure relief channels may be designed in the form of bores 15 extending obliquely in the lateral walls of the chute as will be apparent from Figs. 3 and 6 (sectional view on the line III—III of Fig. 1).

As shown in Figs. 4 and 7 safety tubes 20 may be provided according to the invention in the pressure relief channel 16. Such safety tubes 20 serve to reduce the high traveling speed of the arc after entering the slot 6 so as to prevent the arc and the heated conducting arc gases from escaping from the arc chute. The safety tubes 20 are preferably made of metal so that part of the arc in the slot 6 is short-circuited. To facilitate the fastening of the tubes 20 and to prevent flashovers, each metallic tube may be surrounded with an insulating jacket. However, the safety tube may be made of insulating material and its interior wall coated over its whole length or a portion thereof with an electrically conducting metallic layer, the layer being applied thereto by the spraying method or in any other suitable manner. The insulating jacket on the metallic safety tube may project beyond one or both ends of the metallic tube as will be seen from Fig. 4A. In this manner flashovers between the adjacent metallic safety tubes or between the safety tubes and the current carrying parts of the breaker are prevented. This form of the invention is shown in Fig. 4A.

As will be seen from Figs. 1, 2 to 4A, 6, 8 to 14 and 17 to 23 metallic magnetized fittings 22, for instance, U-shaped metallic clips consisting of iron, iron alloys or the like, are arranged on the arc chute to increase the magnetic force for causing the arc to move in the upward direction when entering the blow-out slot 6. The limbs of the iron fittings 22 are embedded in the chute walls 4 and 5 in such a manner as to be as close as possible to the arc slot 6 and are protected at the same time against the influence of the arc by the chute walls. In this manner the magnetic driving force is considerably increased as compared to the use of blow-out magnet coils which may be dispensed with in the arc chute according to the invention.

As shown in Figs. 8, 9 and 10 the arc chute besides the iron fittings 22 may also be provided with U-shaped magnetized clips 32 and 33. In this case the clips 32 and 33 are preferably em-

bedded in the insulating material of the chute in such a manner that they are not under the influence of the arc. In this case, the clip 32 as will be seen from Fig. 9 may project out from the chute walls 4 and 5 and be held firmly in position between the walls of the recesses formed in the chute walls 4, 5 and the insulating plate inserts 24 of Bakelite, bakelized paper, fibre, laminated insulating material (linax) or the like. As shown in Fig. 10 the clips 33 may also be embedded in the recesses formed in the chute walls 4, 5 and they are surrounded exteriorly by iron fittings 22. In this case, the iron fittings 22 are preferably provided with a lateral extension 25 which encloses the top of the chute and lies exteriorly of the iron clip 33, and which may contain slots to communicate with the narrow slot 6. Such a form is shown in Fig. 8 at the upper right-hand half of the chamber broken away as well as in the right-hand portion of Fig. 10. U-shaped insulating plates 35 may be used to protect clips 33 from the arc. By designing the iron fitting 22 in such a manner the intensity of the blow-out field is increased to a considerable extent. The iron clips 33 may be formed of two identical halves and the two halves may be firmly held together in the recesses formed in the insulating walls 4, 5 of the chute by the iron fitting 22 in a manner similar to that shown in the right hand portion of Fig. 10.

As shown in Fig. 11 the pressure relief channels 15 may extend from the widened entrance portion 3 to the closed expansion chambers 26 provided in the interior of the chute. The closed expansion chambers may be thus obtained by cutting out a part of the outer parts of the chute walls and by covering the empty spaces thus obtained by means of insulating inserts 24 of Bakelite, fibre, linax or the like. Owing to the arrangement of the expansion chambers 26, the counter-pressure is reduced and at the same time the arc gases are prevented from escaping to the outside atmosphere. Flash-overs are also prevented from occurring between the arc and the live parts of the breaker.

As shown in Figs. 12 and 13 the design may be carried out in such a manner that the expansion chambers 26 are in communication with the outside atmosphere through the channels 27. In the form of the invention as shown in Fig. 12 metallic safety tubes 20 may be provided in the inclined channels 15, which tubes prevent the arc from reaching the expansion chambers 26.

Instead of the above arrangement, the safety tubes 20 may be arranged in the pressure relief channels 14 extending along the arc slot 6, and the channels 29 may be provided in the upper ends of the chute walls, for instance, perpendicularly to the direction of the safety tube 20.

As will be seen from Figs. 14 and 15 restraining bodies 35 and 36 may be arranged in the narrow blow-out slot 6 in such a manner as to cause an additional damming up of the gases after the arc has entered the blow-out slot 6. Such bodies may be, for instance, in the form of flat pieces 35 of metal or refractory insulating plates, or rods 36 of metal or insulating material dimensioned in accordance with the slot width. The rods 36 are arranged in the depressions provided in the two chute walls 4, 5 or in the depressions provided in one chute wall so that they completely fill up the entire slot width. However, the damming up of the gases may be also brought about by providing on the chute walls 4, 5 bosses 37 which contact one another and are, for instance, finely grounded.

The additional damming up of the gases may also be brought about by causing the arc slot 6 as shown in Fig. 16 to extend in a zig-zag manner as indicated at 39.

Another embodiment of the invention consists in arranging the expansion chamber 26 (see Fig. 17) for the escaping gases in such a manner that it is in communication with the outside atmosphere through additional blow-out gaps or pressure relief channels 52 (see also Figs. 20 and 22). In Figs. 17 to 23, 4 and 5 denote the chute walls 22 the outer iron fitting, 35 the insulating spacers between the chute walls 4 and 5 to protect the clip 33 from the arc consisting of refractory insulating material, for instance, of fibre etc., 24 and 36 insulating inserts, for instance, of fibre, Bakelite, linax, rubber or the like and 33 (see Figs. 18, 19) the magnetized clips. As will be seen from Figs. 17, 18 and 19 the iron fitting 22, the insulating inserts 24 and the magnetized clips 33 may be held together by means of a single hollow rivet 45. In Fig. 17, 70 denotes the surface ground portion of the chute wall 5 which closes the slot 6 similar to 12 in Fig. 15, 71 the arcing surface of chute wall 5 forming one side of the slot 6, and 72 a cross-section substantially on line XVII—XVII of Fig. 22 showing the outer surface of chute wall 4.

As shown in Figs. 20 and 21 (sectional view taken on the line XX—XX of Fig. 17) an expansion chamber 46, which is in communication with the widened entrance portion 3 through the blow-out slot 6 and with the outside atmosphere through the pressure relief channel 52, may be provided besides the expansion chambers 26 for the relief of the pressure formed in entrance portion 3 in one and the same arc chute. In this case, as shown in Fig. 20 safety tubes 50 of insulating material with inner metallic coatings may be employed, the safety tubes 50 being arranged in the half cylinder-shaped grooves 51 provided in the insulating chute walls 4 and 5. In Fig. 20, 53 denotes the insulating bushings extending through the lateral extensions 25 of the iron fittings 22.

In Figs. 20 and 21, 55 denotes pressure relief channels (bores in the ceramic chute walls 4 and 5) which may be metallized on the interior or provided with inner metallic bushings. In the form of the invention shown in Fig. 21 the expansion chambers 26 communicate directly with the outside atmosphere through channels 62, i. e., without the use of bushings 53.

The form of the invention shown in Fig. 22 corresponds to that shown in Fig. 20 except that a damping rod 64 of metal is provided in a groove formed in one of the chute walls. The rod 64 is grooved to receive a member 67 of refractory insulating material. The member 67 secures the rod 64 from falling out.

To relieve the expansion chamber 46 further expansion chambers 66 are provided in the embodiment shown in Fig. 22 which communicate with the outside atmosphere through pressure relief channels 52. The expansion chamber 46 communicates with the expansion chamber 66 through pressure relief bores 65 provided with metallic inserts or whose inner walls are metallized.

The construction according to Fig. 23 differs from that shown in Fig. 22 in that the horizontal lateral extensions 25 of the iron fittings are omitted so that the auxiliary expansion chambers

66 are directly in communication with the outside atmosphere, i. e., without the use of pressure relief channels.

The arc chute is particularly adapted to be used in air of atmospheric pressure. However, it may also be employed in air of lower or higher pressure as well as in other gases of different pressures which are used to facilitate arc extinction, so that a further increase in the interrupting capacity may be obtained. It is also possible to employ the individual features of our invention in other arc chutes, for instance in arc chutes which do not have a widened entrance portion.

What is claimed is:

1. In a circuit interrupter, means for establishing an arc, a relatively narrow extinction slot having a relatively widened entrance portion adjacent said arc, means for causing the arc to pass through said widened entrance portion and into said narrow extinction slot to effect the extinguishment thereof, and means adjacent said widened entrance portion for relieving the pressure within said narrow extinction slot to facilitate the entry of the arc therein.

2. In a circuit interrupter, means for insulating material, means for establishing an arc, a relatively narrow extinction slot having a relatively widened entrance portion adjacent said arc, said narrow extinction slot and said widened entrance portion being formed by said means of insulating material, means for causing the arc to pass through said widened entrance portion and into said narrow extinction slot to effect the extinguishment thereof, and means comprising one or more vents adjacent the juncture between said widened entrance portion and said narrow extinction slot for relieving the pressure within said narrow extinction slot to facilitate the entry of the arc therein.

3. In a circuit interrupter, means for establishing an arc, a relatively narrow extinction slot having a relatively widened entrance portion adjacent said arc, means for causing the arc to pass through said widened entrance portion and into said narrow extinction slot to effect the extinction thereof, means intermediate the ends of said narrow extinction slot for relieving the pressure within said narrow extinction slot to facilitate the entry of the arc therein, and safety means associated with said pressure relieving means to prevent the escape of the arc through said pressure relieving means, said safety means consisting at least in part of conducting metal.

4. In a circuit interrupter, means of insulating material, means for establishing an arc, a relatively narrow extinction slot having a relatively widened entrance portion adjacent said arc, said narrow extinction slot and said widened entrance portion being formed by said means of insulating material, said insulating material evolving an arc extinguishing fluid upon being contacted by an arc, means for causing the arc to pass through said widened entrance portion and into said narrow extinction slot to effect the extinction thereof, and means adjacent the juncture between said widened entrance portion and said narrow extinction slot for relieving the pressure within said narrow extinction slot to facilitate the entry of the arc therein.

5. In a circuit interrupter, means for establishing an arc, a relatively narrow extinction slot having a relatively widened entrance portion adjacent said arc, means for causing the arc to pass through said widened entrance portion and into said narrow extinction slot to effect the extinction thereof, and means comprising tubes at least partly of metal adjacent said widened entrance portion for relieving the pressure within said narrow extinction slot to facilitate the entry of the arc therein.

6. In a circuit interrupter, means for establishing an arc, a relatively narrow extinction slot having a relatively widened entrance portion adjacent said arc, means for causing the arc to pass through said widened entrance portion and into said narrow extinction slot to effect the extinction thereof, and means comprising one or more vents extending within said narrow extinction slot and terminating at one end adjacent the juncture between said widened entrance portion and said narrow extinction slot to relieve the pressure within said narrow extinction slot and thus to facilitate the entry of the arc therein.

7. In a circuit interrupter, means for establishing an arc, a relatively narrow extinction slot having a relatively widened entrance portion adjacent said arc, means for causing the arc to pass through said widened entrance portion and into said narrow extinction slot to effect the extinguishment thereof, and means comprising one or more tubes at least partly of metal extending within said narrow extinction slot and terminating at one end adjacent the entrance to said narrow extinction slot to relieve the pressure within said narrow extinction slot and thus to facilitate the entry of the arc therein.

8. In a circuit interrupter, means for establishing an arc, an arc chute comprising two chute walls, said chute walls forming a relatively narrow extinction slot having a relatively widened entrance portion adjacent said arc, means for causing the arc to pass through said widened entrance portion and into said narrow extinction slot to effect the extinguishment thereof, means intermediate the ends of said narrow extinction slot for relieving the pressure within said narrow extinction slot to facilitate the entry of the arc therein, and one or more magnetized substantially U-shaped metallic clips, the legs of said clips being embedded in said chute walls near said narrow extinction slot to intensify the magnetic field therein and thus to assist the entry of the arc therein.

9. In a circuit interrupter, means for establishing an arc, an arc chute, one or more expansion chambers provided in the walls of said arc chute, a relatively narrow extinction slot having a relatively widened entrance portion adjacent said arc, means for causing the arc to pass through said widened entrance portion and into said narrow extinction slot to effect the extinguishment thereof, and means comprising one or more vents which lead from the region adjacent the entrance to said narrow extinction slot to one or more of said expansion chambers to relieve the pressure within said narrow extinction slot and thus to facilitate the entry of the arc therein.

10. In a circuit interrupter, means for establishing an arc, an arc chute, one or more expansion chambers provided in the walls of said arc chute, a relatively narrow extinction slot having a relatively widened entrance portion adjacent said arc, means for causing the arc to pass through said widened entrance portion and into said narrow extinction slot to effect the extinguishment thereof, and means for relieving the pressure within said narrow extinction slot comprising one or more vents which lead from

he region adjacent the juncture between said widened entrance portion and said narrow extinction slot to one or more of said expansion chambers, at least one of said expansion chambers venting to the atmosphere outside said chute, and safety means associated with said one or more vents consisting in part of metal for preventing the escape of the arc through said one or more vents.

11. In a circuit interrupter, means for establishing an arc, a relatively narrow extinction slot having a relatively widened entrance portion adjacent said arc, means for causing the arc to pass through said widened entrance portion and into said narrow extinction slot to effect the extinguishment thereof, means for relieving the pressure within said narrow extinction slot comprising one or more vents extending within said narrow extinction slot, one or more passages, and one or more expansion chambers communicating by one or more of said passages with at least one of said vents.

12. In a circuit interrupter, means for establishing an arc, an arc chute, one or more expansion chambers provided in the walls of said arc chute, a relatively narrow extinction slot having a relatively widened entrance portion adjacent said arc, means for causing the arc to pass through said widened entrance portion and into said narrow extinction slot to effect the extinguishment thereof, means for relieving the pressure within said narrow extinction slot and for facilitating the entry of the arc therein comprising a passage extending within said narrow extinction slot, one or more second passages, said first-mentioned passage leading from the region adjacent the juncture of said widened entrance portion with said narrow extinction slot and communicating at substantially right-angles through one or more of said second passages with one or more of said expansion chambers.

13. In a circuit interrupter, means for establishing an arc, a relatively narrow extinction slot having a relatively widened entrance portion adjacent said arc, a cross-section through said narrow extinction slot showing it to have a curved configuration, and means for causing the arc to pass through said widened entrance portion and into said narrow extinction slot to effect the extinguishment thereof.

14. In a circuit interrupter, means for establishing an arc, a relatively narrow extinction slot having a relatively widened entrance portion adjacent said arc, means for causing the arc to pass through said widened entrance portion and into said narrow extinction slot to effect the extinguishment thereof, means intermediate the ends of said narrow extinction slot for relieving the pressure within said narrow extinction slot to facilitate the entry of the arc therein, and means comprising one or more members disposed within said narrow extinction slot to increase the pressure therein and to prevent rapid motion of the arc therein.

15. In a circuit interrupter, means for establishing an arc, a relatively narrow extinction slot having a relatively widened entrance portion adjacent said arc, means for causing the arc to pass through said widened entrance portion and into said narrow extinction slot to effect the extinguishment thereof, and means comprising one or more elongated insulating members disposed within said narrow extinction slot to increase the pressure therein and to prevent rapid motion of the arc therein.

16. In a circuit interrupter, means for establishing an arc, a relatively narrow extinction slot having a relatively widened entrance portion adjacent said arc, means for causing the arc to pass through said widened entrance portion and into said narrow extinction slot to effect the extinguishment thereof, and one or more expansion chambers disposed within said narrow extinction slot to effect a reduction of the pressure therein.

17. In a circuit interrupter, means for establishing an arc, a relatively narrow extinction slot having a relatively widened entrance portion adjacent said arc, means for causing the arc to pass through said widened entrance portion and into said narrow extinction slot to effect the extinguishment thereof, one or more expansion chambers disposed within said narrow extinction slot, and means adjacent the juncture between said widened entrance portion and said narrow extinction slot for relieving the pressure within said narrow extinction slot to facilitate the entry of the arc therein.

18. In a circuit interrupter, means for establishing an arc, a relatively narrow extinction slot having a relatively widened entrance portion adjacent said arc, means for causing the arc to pass through said widened entrance portion and into said narrow extinction slot to effect the extinguishment thereof, one or more expansion chambers disposed within said narrow extinction slot, one or more second expansion chambers, and means comprising one or more passages leading from adjacent the entrance of said narrow extinction slot to one or more of said second expansion chambers to relieve the pressure within said narrow extinction slot to facilitate the entry of the arc therein.

19. In a circuit interrupter, means for establishing an arc, a relatively narrow extinction slot having a relatively widened entrance portion adjacent said arc, means for causing the arc to pass through said widened entrance portion and into said narrow extinction slot to effect the extinguishment thereof, one or more expansion chambers disposed within said narrow extinction slot, and one or more elongated members disposed within said narrow extinction slot and extending at least part way across one or more of said expansion chambers, said expansion chambers reducing the pressure within said narrow extinction slot to facilitate the entry of the arc therein.

20. In a circuit interrupter, means for establishing an arc, a relatively narrow extinction slot having a relatively widened entrance portion adjacent said arc, means for causing the arc to pass through said widened entrance portion and into said narrow extinction slot to effect the extinguishment thereof, one or more expansion chambers disposed within said narrow extinction slot, one or more elongated members disposed within said narrow extinction slot and extending at least part way across one or more of said expansion chambers, and means intermediate the ends of said narrow extinction slot for relieving the pressure within said narrow extinction slot to facilitate the entry of the arc therein.

21. In a circuit interrupter, means for establishing an arc, a relatively narrow extinction slot having a relatively widened entrance portion adjacent said arc, means for causing the arc to pass through said widened entrance portion and into said narrow extinction slot to effect the ex-

tinguishment thereof, one or more expansion chambers disposed within said narrow extinction slot, one or more adjacently disposed expansion chambers communicating with said first-mentioned one or more expansion chambers, and one or more elongated members disposed within said narrow extinction slot and extending at least part way across one or more of said first-mentioned expansion chambers.

22. In a circuit interrupter, means for establishing an arc, a relatively narrow extinction slot having a relatively widened entrance portion adjacent said arc, means for causing the arc to pass through said widened entrance portion and into said narrow extinction slot to effect the extinguishment thereof, one or more expansion chambers disposed within said narrow extinction slot, one or more adjacently disposed second expansion chambers communicating with one or more of said first-mentioned expansion chambers, one or more elongated members disposed within said narrow extinction slot and extending at least part way across one or more of said first-mentioned expansion chambers, and means adjacent the juncture between said widened entrance portion and said narrow extinction slot for relieving the pressure within said narrow extinction slot to facilitate the entry of the arc therein.

23. In a circuit interrupter, means for establishing an arc, a relatively narrow extinction slot having a relatively widened entrance portion adjacent said arc, means for causing the arc to pass through said widened entrance portion and into said narrow extinction slot to effect the extinguishment thereof, one or more expansion chambers disposed within said narrow extinction slot, one or more adjacently disposed second expansion chambers communicating with one or more of said first-mentioned expansion chambers, one or more elongated members disposed within said narrow extinction slot and extending at least part way across one or more of said first-mentioned expansion chambers, and means comprising one or more venting tubes leading from adjacent the entrance to said narrow extinction slot to relieve the pressure within said narrow extinction slot and to facilitate the entry of the arc therein.

24. In a circuit interrupter, means for establishing an arc, a relatively narrow extinction slot having a relatively widened entrance portion adjacent said arc, means for causing the arc to pass through said widened entrance portion and into said narrow extinction slot to effect the extinguishment thereof, one or more expansion chambers disposed within said narrow extinction slot, one or more adjacently disposed second expansion chambers communicating with one or more of said first-mentioned expansion chambers, one or more elongated members disposed within said narrow extinction slot and extending at least part way across one or more of said first-mentioned expansion chambers, one or more adjacently disposed third expansion chambers, and means comprising one or more venting passages leading from the region adjacent the juncture between said widened entrance portion and said narrow extinction slot to one or more of said third-mentioned adjacently disposed expansion chambers to relieve the pressure within said narrow extinction slot and thus to facilitate the entry of the arc therein.

25. In a circuit interrupter, means for establishing an arc, an arc chute, one or more expansion chambers provided in the walls of said arc chute, a relatively narrow extinction slot having a relatively widened entrance portion adjacent said arc, means for causing the arc to pass through said widened entrance portion and into said narrow extinction slot to effect the extinguishment thereof, and means for relieving the pressure within said narrow extinction slot comprising one or more vents which lead from the region adjacent said widened entrance portion to one or more of said expansion chambers, at least one of said expansion chambers venting to the atmosphere outside said arc chute.

26. In a circuit interrupter, means for establishing an arc, an arc chute, a relatively narrow extinction slot having a relatively widened entrance portion adjacent said arc formed by the walls of said arc chute, means for causing the arc to pass through said widened entrance portion and into said narrow extinction slot to effect the extinguishment thereof, and means comprising one or more registering grooves on said chute walls forming said narrow extinction slot to create one or more vents terminating adjacent the juncture between said widened entrance portion and said narrow extinction slot to relieve the pressure within said narrow extinction slot and thus to facilitate the entry of the arc therein.

27. In a circuit interrupter, means for establishing an arc, an arc chute, a relatively narrow extinction slot having a relatively widened entrance portion adjacent said arc formed by the walls of said arc chute, means for causing the arc to pass through said widened entrance portion and into said narrow extinction slot to effect the extinguishment thereof, and means comprising one or more vents extending laterally from intermediate the ends of said narrow extinction slot through said chute walls to the atmosphere outside said arc chute.

28. In a circuit interrupter, means for establishing an arc, an arc chute, a relatively narrow extinction slot having a relatively widened entrance portion adjacent said arc, means for causing the arc to pass through said widened entrance portion and into said narrow extinction slot to effect the extinguishment thereof, one or more expansion chambers disposed within said narrow extinction slot, one or more pressure relief passages, at least one of said expansion chambers communicating to the atmosphere outside said arc chute through one or more of said pressure relief passages.

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