

Aug. 30, 1966

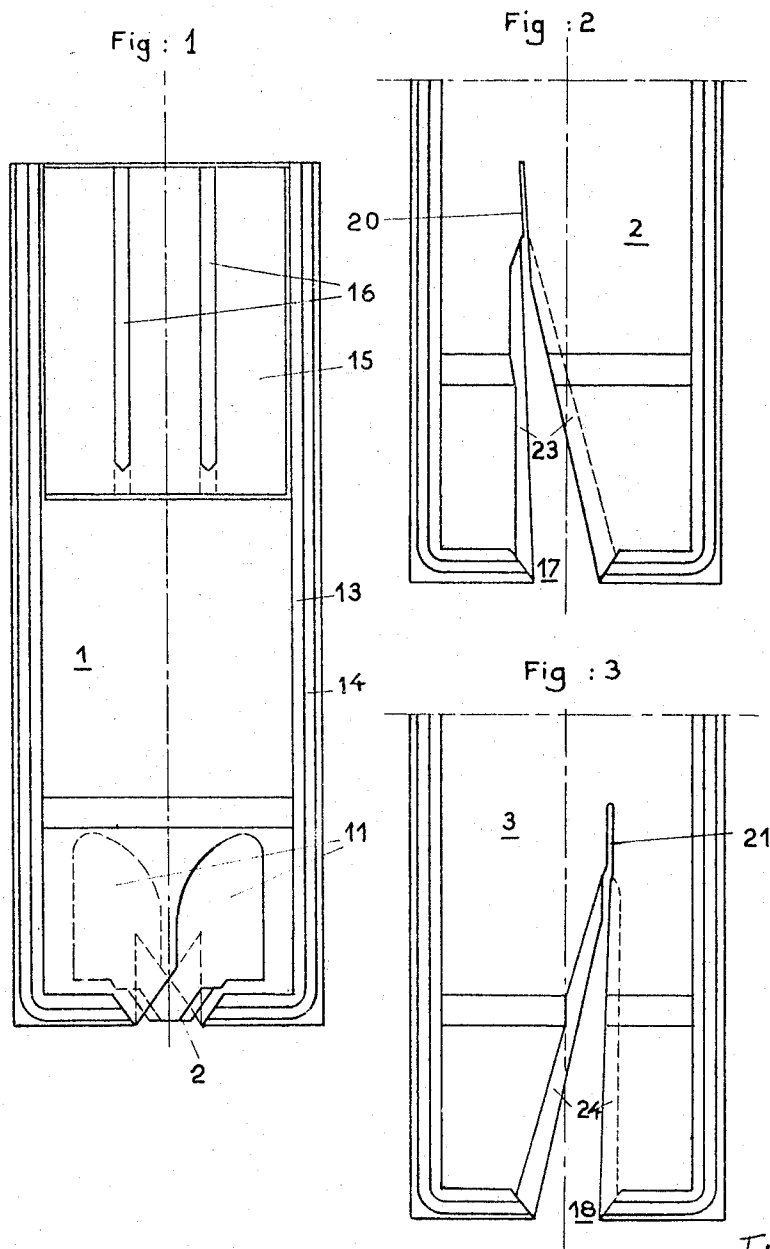
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EXTINGUISHING DEVICE FOR ELECTRICAL ARCS

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2 Sheets-Sheet 1



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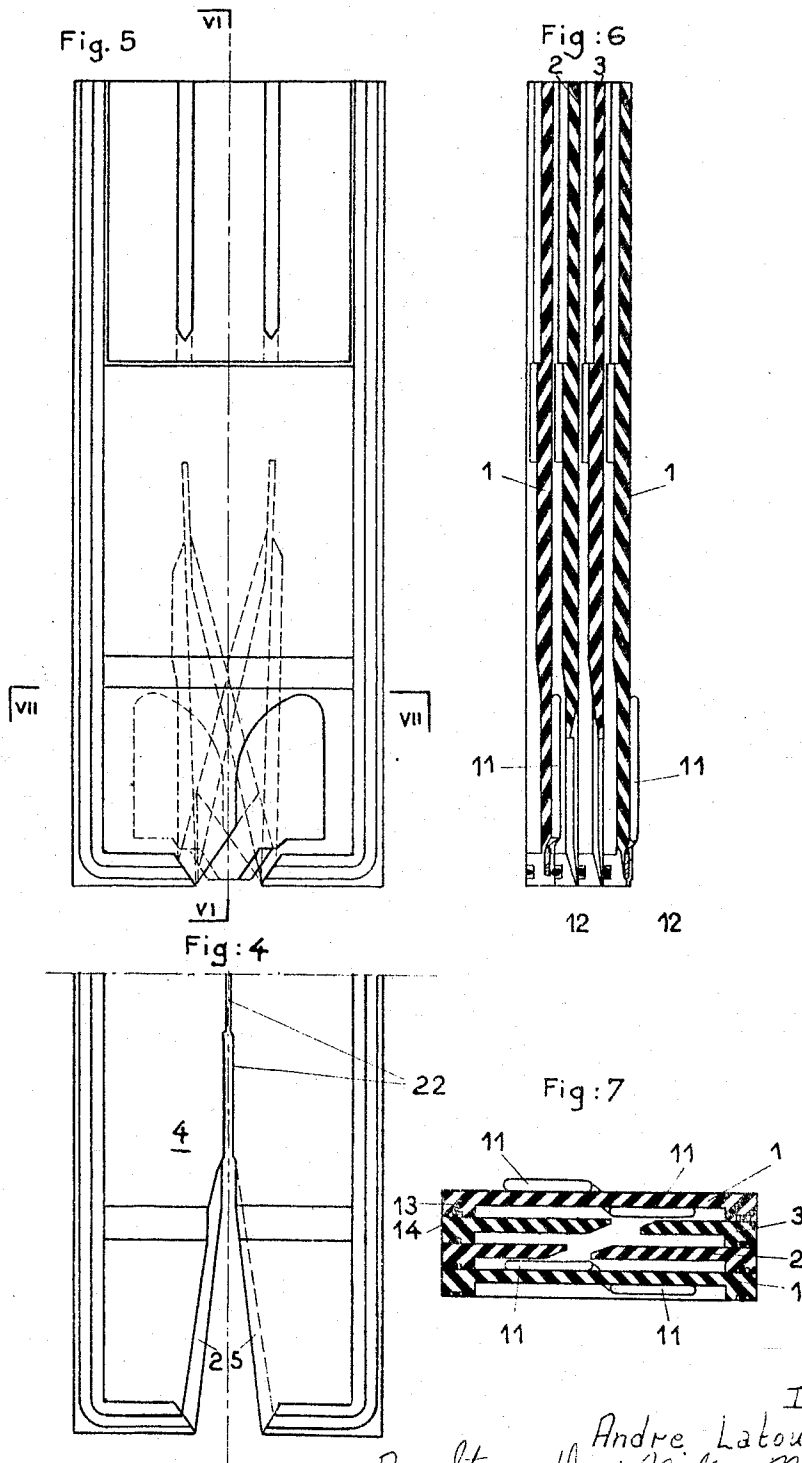
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1

3,270,171 EXTINGUISHING DEVICE FOR ELECTRICAL ARCS

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Filed Mar. 22, 1965, Ser. No. 441,819

Claims priority, application France, July 1, 1960,

4,265, Patent 1,269,359

5 Claims. (Cl. 200—144)

This is a continuation-in-part of my now pending application filed July 3, 1961, Serial Number 121,434, now abandoned.

This invention relates to extinguishing devices for electrical arcs drawn between separable contact members located in an arc formation chamber of an electrical circuit breaker, and more particularly to extinguishing devices of this type having an arc extinguishing chamber which comprises a set of at least two parallel plates of insulating material spaced apart from one another and disposed transversely of the direction of separation of the contacts or the initial direction of the arc.

The spaced parallel plates of insulating material define narrow arc separating or extinguishing chambers and are furnished with open-ended conductive members which are generally V or U-shaped and whose legs or wings embrace or straddle the individual insulating plates each furnished plate having a vertical axis of symmetry. Conductive members of this general type and configuration are disclosed in my U.S. Patent No. 2,707,739. The web portion of the V or U-shaped conductive member straddles the side or edge of an insulating plate while the legs or wings of the conductive member extend along the faces of the insulating plates in a substantially parallel arrangement. The opposed parallel wings of each conductive member are slightly offset or diverging relative to each other. Conductive members or paths are thus provided on the faces of the insulating plates which attract and conduct the arc drawn between the insulating plates in such a manner as to turn the arc to form expanding curved or looped configurations within the narrow spaces between the insulating plates. The initial arc in contact with the conductive members is thus subdivided into a number of partial arcs which enter the extinguishing chambers where they are extended and developed into loops of substantially oblong form. The partial arc are effectively cooled upon coming in contact with the adjacent parallel plates of insulating material and are thereby extinguished.

In my U.S. Patent No. 2,750,476 I have disclosed, as an improvement to the device hereinabove described, an embodiment in which, between two plates with conductive elements, according to my said patent 2,707,739 an unfurnished plate is disposed, said unfurnished plate having generally the same configuration as the furnished plates, and having a notch extending from the lower edge of said unfurnished plate towards the upper part thereof, with the object to divide the loop formed by the arc and extending normally between two furnished plates, into two half-loops, each half-loop extending between one of the furnished plates and the unfurnished plate, and these two half-loops joining each other through the notch of said unfurnished plate without practically extending the length of the arc in the horizontal projection. Thus is provided, for each half-loop, a separate

2

plate for development and expansion, and a double cross-sectional area for the escape of the hot gases, without any increase of the narrow clearances through which the loops are to expand and thus without any adverse effect on the cooling and extinguishing capacity of the apparatus.

The present invention may be considered as an improvement of said last described improvement, both Patents 2,707,739 and 2,750,476 being included herewith by way of reference and has for its object to retain all the advantages thereof, and furthermore to secure a supplementary advantage in lengthening the divisional arc drawn between two successive furnished plates, thus allowing the employment of the device for heavier currents relative to the device described in my said Patent 2,750,476.

With said supplementary object in view, at least two unfurnished plates are disposed between two successive furnished plates, said unfurnished plate being of the type in which the notch is offset relatively to the vertical axis of symmetry of the plate, and the two unfurnished plates being disposed between the two successive furnished plates in such a manner that the notches of the unfurnished plates are not seen on the same side of the vertical plane of symmetry of the set of plates containing the axis of symmetry of the plates.

If more than two unfurnished plates are provided between two furnished plates, the notches of the unfurnished plates are to be disposed alternatively on one side and on the other side of said vertical plane of symmetry.

It will be easily understood that if L is the horizontal dimension of the plate, the length of the arc, seen in horizontal projection, is L with the previous device described in my Patent 2,750,476 with or without unfurnished plates.

On the contrary, according to the present invention and supposing, by way of example, that the apex of the notch of an unfurnished plate is at a distance $L/6$ from the vertical axis of symmetry, it will be easily understood (see FIGS. 5 and 6) that the divisional arc, seen in horizontal projection, will have a length of

$$L + 2L/3$$

as a minimum and that said length, after expansion, may reach $3L$.

As in said Patent 2,750,476 the notches of the unfurnished plates may be prolonged by a thin slot extending upwards, such an improvement is highly beneficial for the extinction of the arc but it must be clear that said improvement has nothing to do with the lengthening of the arc which is only a consequence of the combination of the alternatively offset arrangement of the notches of the unfurnished plates and of the electrodynamic forces developed between the furnished plates.

On another point of view, the lengthening of the arc according to the invention has another advantage in the sense that the cooling surface for a divisional arc between two furnished plates is considerably increased.

According to an additional feature of the present invention the notched portions of the insulating plates are provided with chamfered edges in order to facilitate the penetration of the initial arcs into the extinguishing chambers.

These and other objects and features of the invention will become apparent upon reading the specific description of the invention in connection with the accompany-

3

ing drawing which forms part of the specification and which illustrates by way of example only an embodiment of the invention. In the drawings:

FIG. 1 shows on a reduced scale and diagrammatically a front view of elevation of an insulating plate provided with conductive members known per se in the prior art and utilized in the combination according to the present invention.

FIG. 2 is a front view of an embodiment showing the lower part of a notched spacer plate known per se in the prior art and utilized in combination according to the present invention.

FIG. 3 is a second embodiment showing the lower part of a notched spacer plate known per se in the prior art and utilized in combination according to the present invention.

FIG. 4 is a third embodiment showing the lower part of a notched insulating plate known per se in the prior art and utilized in combination according to the present invention.

FIG. 5 shows a stack of four successive insulating plates according to the invention, but the furnished plates only being represented by their straddling conductors traced in discontinuous dashes.

FIG. 6 is a cross-section along line VI—VI of FIG. 5 the furnished plates being fully represented.

FIG. 7 is a cross-section along line VII—VII of FIG. 5 but supposing two unfurnished plates according to FIGS. 2 and 3 are sandwiched between two furnished plates.

Referring now to the various figures of the attached drawing, numeral 1 designates an insulating support plate for a conductive member 11. Numerals 2, 3 and 4 designate insulating plates which do not carry a conductive member. Insulating plate 1 supports a substantially U-shaped conductive member 11, the connecting web portion of which straddles the edge or side of the insulating plate while the legs or wings of the conductive member each extend parallel to each other along the opposite faces of the plate and diverge from each other transversely of the plate.

All the plates have a peripheral flange or reinforcing rib 13 provided with a groove 14 in which a suitable sealing member 30 is disposed. At the upper portion and on one side of the insulating plate flame arresters 15 are connected to the insulating plates. Ribs 16 which constitute spacer means for the adjacent plates are mounted on the flame arresters. Plates 2, 3 and 4 are respectively provided with cut-out portions or notches 17, 18 and 19 which extend from the lower edge upwardly and which terminate into a point which is extended preferably further upwardly by narrow slots substantially like saw cuts indicated respectively by numerals 20, 21 and 22. The edges of the notches are provided with chamfered portions 23, 24 and 25 which are provided on the two converging edges of each notch so that the chamfered portions are confronting or matching relation.

According to the invention two of the unfurnished plates are inserted between each two support plates furnished with the conductive members so that, in particular reference to FIG. 7, the two notched plates 2 and 3 which do not carry a conductive member are inserted between the two plates 1 each of which carries a conductive member 11.

The extinguishing device comprises thus a stack of insulating plates in the order 1-2-3-1-2-3-1 and so forth as seen in FIGS. 5, 6 and 7. In this arrangement the arc having its root or base on two successive conductive members rises into the notches of the unfurnished plates and guided by the chamfered portions 23, 24, and 25 is formed into portions respectively located in the subdivisual chambers defined by adjacent plates 1 and 2, 2 and 3 and 3 and 1, due to the displaced or offset arrangement of the apex of the notches. The upward movement of the arc portions is stopped by the slots 20 and 21 because the arc is not able to penetrate into these slots as long as the

4

current intensity remains substantial. The diameter of the arc column decreasing with the current intensity, allows the arc to penetrate into the slots. Consequently the arc comes in contact with supplementary cooling surfaces which achieve the deionization of the hot gases.

Thus, considering the chamber formed by two successive furnished chambers, which may be considered as a divisional chamber on the assembly forming the extinguishing device, such divisional chamber is divided, by means of the unfurnished plates, into three subdivisual chambers each containing an arc portion which extends into a loop by action of the electrodynamic forces, that is, a portion between the conductor of each furnished plate and the saw cut of the adjacent unfurnished plate and a third portion between the saw cuts of the unfurnished plates each of the three portions being extended in a loop by action of the electrodynamic forces.

It is understood that more than a plurality of sets, each set including two intermediate plates with offset notches carrying no conductive elements may be inserted between two plates which carry conductive elements, maintaining, however, the alternance of the successive notches respectively in the plane of symmetry of the device.

It will be observed that whenever a plate without conductive members is inserted between two plates which carry conductive members, not only the cooling surface is thereby increased, but also the possibilities of discharging the gases produced by the current interrupting operation are improved which results consequently in a decrease of the counter pressure.

According to a modification of the arrangement of the present invention, a third unfurnished plate shown in FIG. 4 of the drawings designated by reference numeral 4 may be inserted between unfurnished plates 2 and 3 of the above described arrangement. This intermediate plate 4 has a symmetrical triangular configuration relative to the longitudinal axis of the plate with the object to divide the portion of the loop between the unfurnished plates 2 and 3 into two half loops, but it is obvious that, if such a plate secures the advantage disclosed in my said Patent 2,750,476, it is practically inoperative relatively to the lengthening of the arc.

As shown more particularly in FIG. 5 of the drawing the notched portions of the two unfurnished plates have preferably a common base or starting width, the apex of the notches being offset relatively to the vertical axis of the plates, according to the invention.

What is claimed is:

1. An arc extinction chamber for extinguishing an electric arc drawn between two separable contacts, comprising a plurality of parallel plates of insulating material and having an axis of symmetry disposed transversely of the direction of separation of said contact members and each of said plates being furnished with an open-ended conductive element straddling the bottom part of the plates and extending along the faces of the corresponding plate in opposite directions relatively to said axis of symmetry, in which said plurality includes at least a set of two furnished plates, said set having a plane of symmetry containing said axis of symmetry of the plates and including at least two unfurnished plates disposed intermediate between two furnished plates, each of said unfurnished plates having a notched portion of substantially triangular configuration extending upwardly from the lower edge of said unfurnished plates, the apex of said triangular notches being displaced at a distance apart to each other and offset in opposite direction relatively to said plane of symmetry whereby an arc loop is formed between each said plate.

2. A device as set forth in claim 1 wherein said notched portions have a base aperture straddling said plane of symmetry.

3. A device as forth in claim 1 wherein at least a plate has a notched portion provided with a chamfered edge.

4. A device as set forth in claim 3 wherein the two

5

converging sides of the triangular notched portions of at least a plate are each provided with a chamfered edge, the two chamfered edges being disposed on opposite faces of the plate.

5. A device as set forth in claim 1 wherein the triangular notched portion of at least a plate is extended upwardly in a narrow slot substantially like a saw cut.

6

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