Jan. 7, 1941. J. D. HILLIARD 2,228,231

CIRCUIT INTERRUPTER

Filed Feb. 17, 1938 2 Sheets-Sheet 1

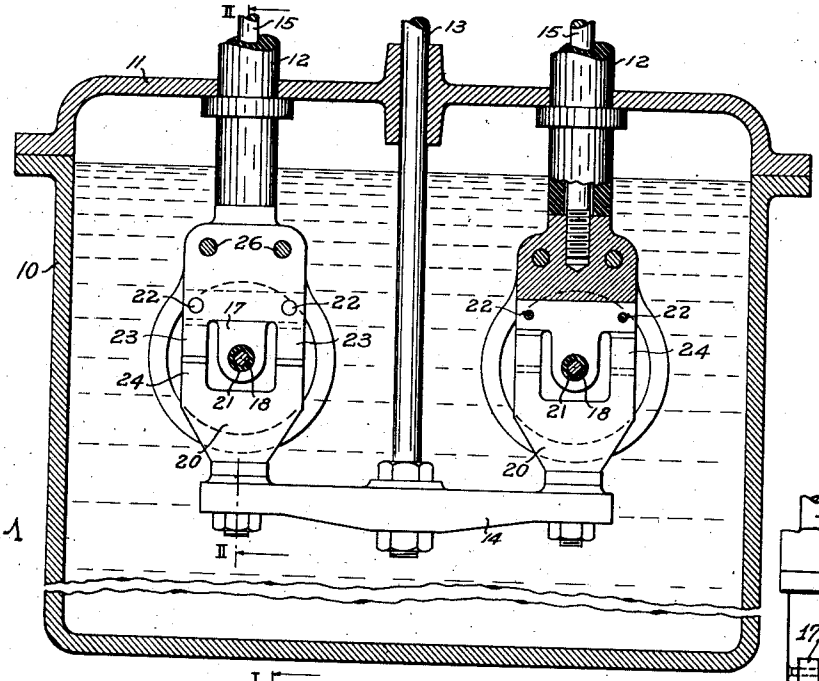


Fig. 1

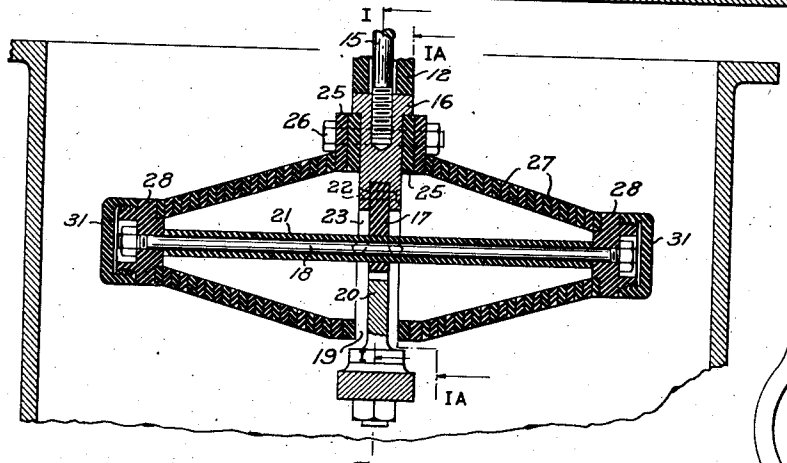


Fig. 2

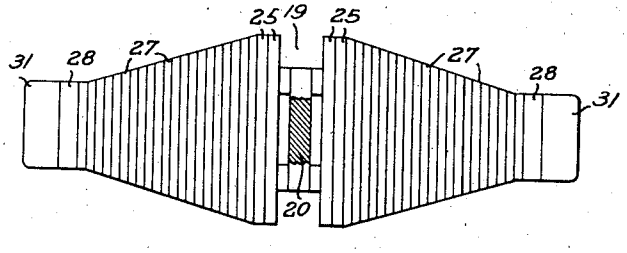


Fig. 3

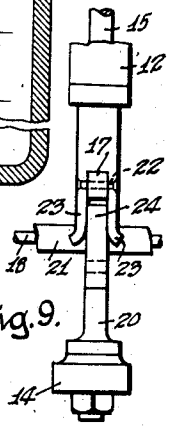


Fig. 9.

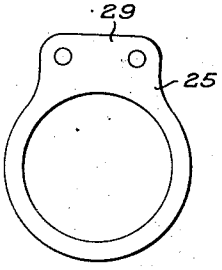


Fig. 4

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CIRCUIT INTERRUPTER

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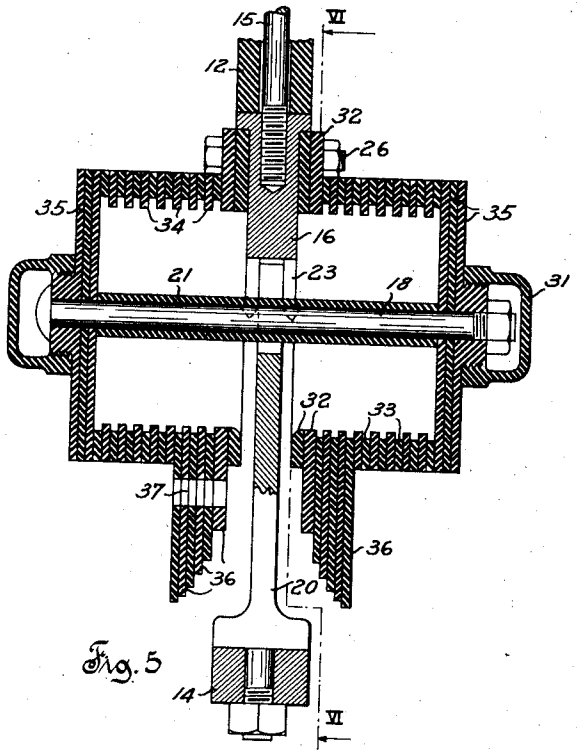


Fig. 5

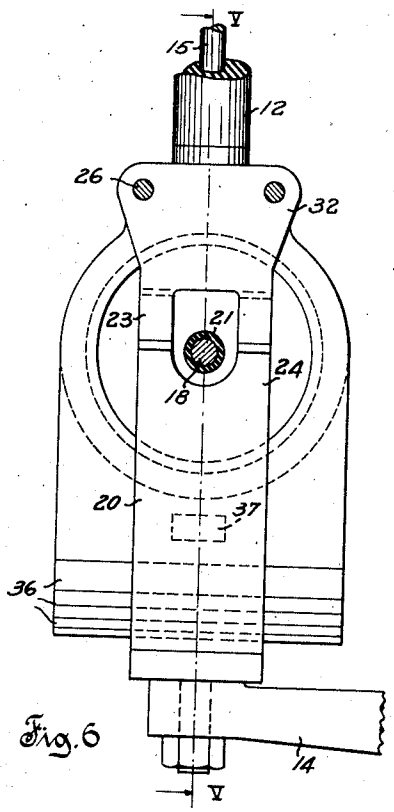


Fig. 6

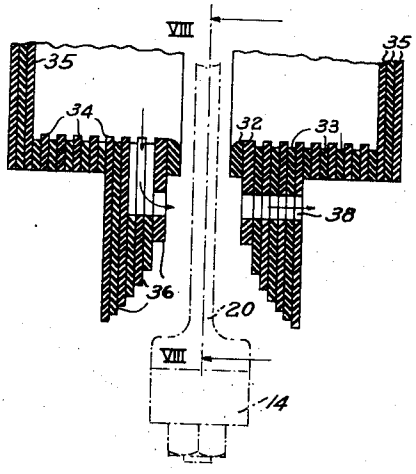


Fig. 7

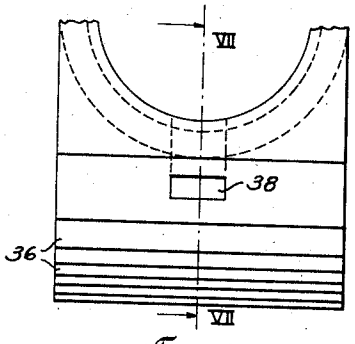


Fig. 8

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UNITED STATES PATENT OFFICE

2,228,231

CIRCUIT INTERRUPTER

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Application February 17, 1938, Serial No. 190,898

9 Claims. (Cl. 200—150)

This invention relates in general to circuit breakers of the type wherein cooperating contacts draw an arc in oil or some similar arc extinguishing and insulating fluid and relates particularly to a novel construction for circuit breakers of the above type which is very simple, rugged and easy of manufacture, but yet is very efficient in extinguishing the arc and interrupting the circuit.

In circuit breakers of the above type where a so-called pressure pot is utilized, many and various attempts have been made to utilize insulating material for such pressure pots. When these insulating chambers are formed of a solid mass of insulating material which may be of a plastic molded construction or may be of a rolled up sheet which has been pressed into shape, it has been found that, due to the pressure or due to the molding process, flaws have very often appeared in the finished product which have caused fracture of the pressure chamber upon operation of the circuit breaker.

To avoid the above disadvantages, pressure pots have been made of rings of laminated insulating material. In order to clamp the laminated rings of insulation into the desired shape of chamber, a plurality of bolts, spaced at various intervals around the laminated rings and extending therethrough, have been used. Such construction has necessitated each individual ring being wide enough so that the bolts could extend therethrough. Unless a great many bolts were used, the clamping action thereof was not evenly distributed around the periphery of the rings. As these stay bolts were usually utilized also to support the pressure chamber from the bushing construction, it necessitated mounting the pressure chamber with the laminations running at right angles to the bushing, usually a horizontal direction. In order to provide a throat opening and to provide an opening for the movable contact to enter the pressure chamber, channels through the chamber wall were of necessity at right angles to the line of the laminations.

It is therefore an object of the present invention to provide in a circuit breaker a pressure chamber built up of laminated insulating rings which lie in the plane of movement of the moving contact members.

It is a further object of this invention to provide a pressure chamber construction of laminated insulating rings in which such rings are held in position by a single stay bolt member.

It is a further object of this invention to provide in a pressure chamber construction of the above type utilizing rings of insulating material, a throat construction which is simply and easily made by varying the shape of the insulating rings.

It is also an object of the present invention to provide a pressure pot construction utilizing laminated rings of insulation, wherein a clamping member for the rings extends through substantially the center of the arcing chamber.

Objects and advantages other than those above set forth will be apparent from the following description, when read in connection with the accompanying drawings, in which:

Fig. 1 is a sectional elevational view taken partly on the line I—I and partly on the line IA—IA of Fig. 2, showing a circuit breaker embodying the present invention;

Fig. 2 is a side elevation sectional view of the pressure chamber of the circuit breaker shown in Fig. 1 taken on the line II—II;

Fig. 3 is a bottom view of the pressure chamber of Figs. 1 and 2 with the movable contact partly cut away so as to more clearly show the throat construction;

Fig. 4 is a detailed view of one of the laminated rings utilized in the circuit breaker of Figs. 1 and 2;

Fig. 5 is a sectional view of a modified form of the present invention, taken on the line V—V of Fig. 6;

Fig. 6 is an end elevation view of the pressure chamber shown in Fig. 5, taken on the line VI—VI;

Fig. 7 is a section view of a modified form of the circuit breaker shown in Fig. 5 and is taken on the line VII—VII of Fig. 8; and

Fig. 8 is an end elevation view of the circuit breaker shown in Fig. 7, taken on the line VIII—VIII;

Fig. 9 is a detail end view of the contact structure of Fig. 1 with the casing and pressure chamber removed.

In the circuit breaker shown in Fig. 1, the tank 10 contains oil or a similar insulating and arc extinguishing fluid. The cover 11 supports the current conducting studs 15, which in turn support the fixed contact and pressure pot construction. The studs 15 are insulated from the tank by bushing 12.

The pressure chamber is constructed of rings of insulating material held in pressure chamber forming position by means of the single stay bolt 18. The center ring 25, shown in detail in Fig. 4, has extensions 28 thereon which are utilized to support the pressure chamber from the fixed contact member 16 which is supported by the

studs 15. The pressure chamber may be supported on the member 16 by bolts 26 passing through the extension 29.

A series of rings 27 form the walls of the pressure chamber which is closed at the end by plate 28 against which the nut and the stay bolt 18 are tightened to hold the pressure chamber rings in position. The caps 31 of insulating material are fastened to the plate 28 to insulate the ends of the stay bolt.

In order to provide a further support for the stay bolt 18, an insulating support 17 is carried by the fixed contact member 16 and may be suitably fastened thereto as by the bolts 22. The stay bolt 18 is insulated from the arcing chamber by the insulating tube 21, which tube fits snugly in the supporting member 17. If the bolt 18 is sufficiently insulated it may be supported directly by the fixed contact 16. The fixed contact member 16 has two extending fingers 23 thereon cooperating with similar fingers 24 on the moving contact 20. The bridging member 14 connects the moving contacts 20 in series and is operated by the rod 13 from a suitable operating mechanism, not shown.

By utilizing this construction of making the pressure chamber of laminations which lie in a plane parallel to the plane of movement of the moving contacts 20, provision of the single stay bolt member for holding the laminations in position is very simple. Also, this construction permits a simple method of providing a throat 19 extending in the plane of contact movement in substantially all directions from the breaking contacts. The provision of such a throat vent aids in the efficient extinguishing of the arc and also provides a pressure chamber in which venting by auxiliary means when breaking currents of great magnitude is unnecessary. The throat 19 as seen from Figs. 1, 2 and 3 is formed merely by the absence of laminations at the mid-section of the pot, that is, the pot is formed in two sections, each formed by members 25, 27 and 28, which sections are positioned in spaced relation on the fixed contact 16 to form the throat 19. The throat extends radially in the plane of the laminations in all directions except toward the bushing 12 which avoids burning thereof by the hot arc products.

The circuit breakers of Figs. 5, 6, 7 and 8 are modifications of the circuit breakers shown in Figs. 1, 2 and 3. The pressure chambers of these circuit breakers are supported in a casing in a manner similar to those previously shown. The pressure chamber shown in Fig. 5 has center laminations 32 supporting the pressure chamber on the fixed contact member 16. This chamber is made up of two sets or sections of laminations of which the laminations 33 are narrower than the laminations 34, thus providing an irregular surface in the pressure chamber. This irregular surface prevents the oil from being blown out of the pressure chamber upon drawing of the arc. Sufficient oil will therefore be maintained therein during interruption to provide deionization and arc extinguishing.

The central laminations of the pressure chamber are extended to form a simple throat passage. These extensions 36 extend farther from the bolt 18 as the throat progresses away from the moving contact member and provide a stepped diverging throat. This step construction restricts and limits the flow of oil from out of the pressure chamber. A shunt vent 37 is provided in the circuit breaker shown in Figs. 5 and 6 to aid in the extinguishing of the arc by permitting the ionized gas to rapidly vent from the arcing region. In the modification shown in Figs. 7 and 8, a passage is provided which permits oil from the pressure chamber to be forced across the arc at right angles thereto and also provides the shunt vent 38.

In constructing the pressure chamber of the present invention, the rings are stamped out of insulating material in the shapes desired.

The rings may then be stacked in configurations similar to one-half of the pressure chamber shown in Figs. 2 or 5. The halves may then be positioned on the member 16 by bolts 26 and maintained in pressure forming relation by the stay bolt 18.

Before positioning, the rings may be impregnated with, or have applied thereto, Bakelite or its equivalent. The Bakelite may be utilized merely as a temporary binder for holding the rings in stacked formation until put under compression by the bolt 18. The stacks may, after Bakelite impregnation, be held in a mold while heat and pressure are applied and in such case the rigidity and strength thereof are greatly increased. In either case the two stacks of rings forming a pressure chamber are prevented from being blown apart during excessive arc pressures by the stay bolt 18. Thus the single bolt 18 forms a simple means for maintaining the pressure chamber forming elements in pressure chamber forming relation.

In the construction shown in Figs. 5, 6, 7 and 8, no supporting member for the stay bolt such as 17 in Figs. 1 and 2 is shown, however, such support may be added if desired. In any of the pressure chambers of the above construction, it may be necessary to provide bleed holes in the top of the pot to prevent air pockets and to aid in refilling the pot with insulating fluid after an operation of the circuit breaker.

In the above pressure chambers, it is a very simple manufacturing matter to change the shape of the pressure chamber or the size and shape of the throat opening and the extent thereof. As shown above, the only outlet from the pressure chamber is the throat opening and this may embrace substantially the whole circumference of the chamber or as much thereof as may be required. By making the throat narrow at the bottom and wide at the top, both ample pressure relief and high interrupting efficiency are obtained.

Although but a few embodiments of the present invention have been illustrated and described, it will be apparent to those skilled in the art that various changes and modifications may be made therein without departing from the spirit of the invention or from the scope of the appended claims.

It is claimed and desired to secure by Letters Patent:

1. In combination, a casing containing arc extinguishing fluid, a current conducting member extending through said casing in insulated relation thereto, a fixed contact supported on said conducting member and electrically connected thereto, a pressure chamber surrounding said fixed contact and supported by said conducting member in said fluid, a contact movable in a given plane to cooperate with said fixed contact to draw a pressure generating arc in said chamber, said chamber comprising transversely apertured contiguous sheets of insulating material positioned in planes parallel to said given plane,

and means for maintaining said sheets of insulating material in pressure chamber forming relation comprising a clamping member extending through substantially the center of said pressure chamber.

2. In a circuit breaker provided with a pressure chamber adapted to be immersed in arc extinguishing fluid and provided with fixed and movable contacts adapted to cooperate to draw an arc in said chamber, means forming said pressure chamber comprising contiguous members of sheet insulation extending in a plane parallel to the plane of movement of said moving contact, certain of said members provided with extensions forming a throat passage for said movable contact member, each of said extensions extending a distance greater than the extension next nearest said moving contact.

3. In a circuit breaker provided with a pressure chamber adapted to be immersed in arc extinguishing fluid and provided with fixed and movable contacts adapted to cooperate to draw an arc in said chamber, means forming said pressure chamber comprising contiguous rings of sheet insulation extending in a plane parallel to the plane of movement of said moving contact, certain of said rings provided with extensions forming a throat passage for said movable contact member, each of said extensions extending a greater distance than the extension next nearest said moving contact, and an auxiliary passage through said extensions at an angle thereto.

4. In combination, a pressure chamber comprising transversely apertured members of insulating material, means maintaining said members in contiguous relation comprising a clamping member extending through said pressure chamber, a fixed contact in said pressure chamber, a movable contact cooperable with said fixed contact, and means including said fixed contact for supporting said clamping member.

5. In combination, a pressure chamber comprising transversely apertured members of sheet insulating material, a casing containing arc extinguishing fluid surrounding said pressure chamber, means maintaining said members in contiguous relation comprising a clamping member extending through said pressure chamber and insulated therefrom, a fixed contact in said pressure chamber, and a movable contact cooperable with said fixed contact to draw an arc in substantially the plane of some of said members of sheet insulating material.

6. In combination, a pressure chamber comprising transversely apertured members of sheet insulating material, a casing containing arc extinguishing fluid, means comprising a conducting member extending through said chamber for supporting the same in said fluid, a contact movable into and out of said chamber in substantially the plane of some of said members of sheet insulation to a position making and breaking a circuit including said conducting member, and means forming a throat passage for said contact comprising a slot in said chamber coextensive with said conducting member and extending substantially around the perimeter of said chamber.

7. A circuit breaker comprising a casing containing arc extinguishing fluid, a plurality of chamber sections each formed of a plurality of sheet insulation members, a conducting member supported in said fluid, means for supporting said sections adjacent said conducting member and spaced thereby to form a pressure chamber closed except for a slot coextensive with said conducting member and extending substantially around the perimeter of said chamber, and a contact movable through said slot.

8. In a circuit breaker, a casing containing arc extinguishing fluid, a conducting member supported from said casing in insulating relation thereto, means forming a pressure chamber immersed in said fluid and supported from said conducting member comprising apertured sheets of insulating material, and means for maintaining said apertured sheets in contiguous relation whereby said apertures are in substantial alinement to form said pressure chamber, said maintaining means comprising said conducting member and a clamping member extending through substantially the center of said apertures.

9. A circuit breaker comprising a casing containing arc extinguishing fluid, a plurality of chamber sections each formed of a plurality of sheet insulation members, a conducting member supported in said fluid, means for supporting said sections adjacent said conducting member and spaced thereby to form a pressure chamber closed except for a slot coextensive with said conductive member and extending substantially around the perimeter of said chamber, said supporting means comprising a clamping member extending through substantially the center of said chamber, and a contact movable through said slot to make and break a circuit including said conducting member.

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