Aug. 4, 1942. H. L. RAWLINS 2,292,088

CIRCUIT INTERRUPTING DEVICE

Filed June 8, 1938 2 Sheets-Sheet 1

Fig. 1.

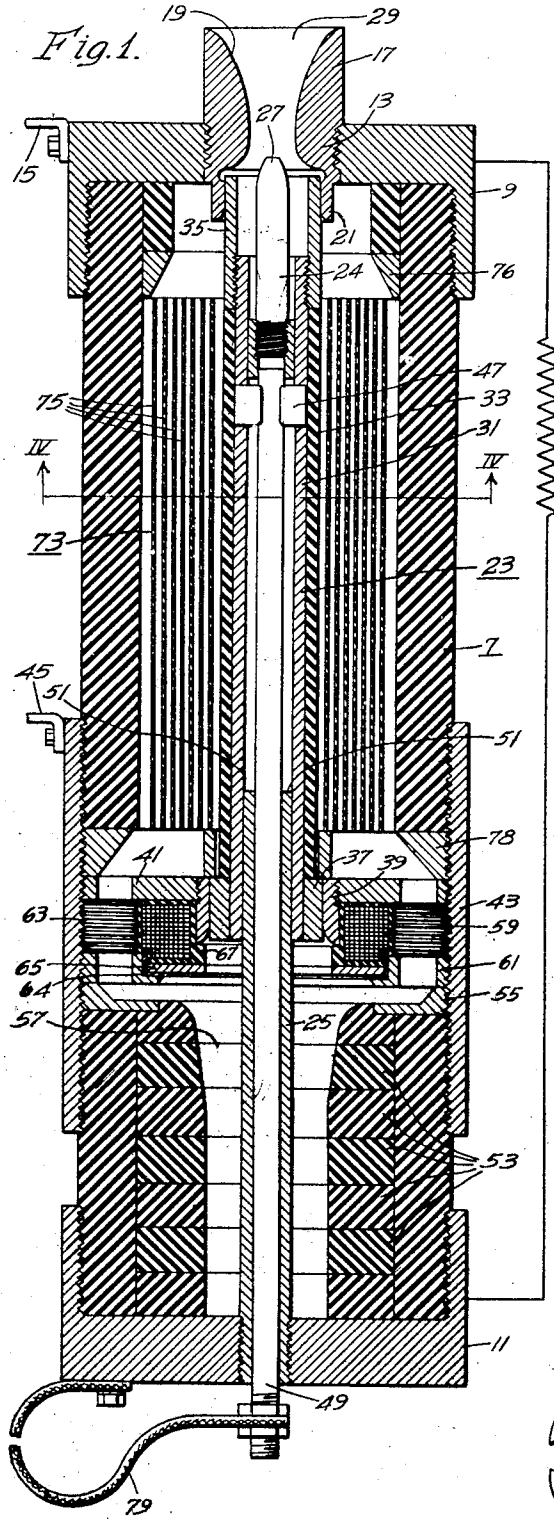
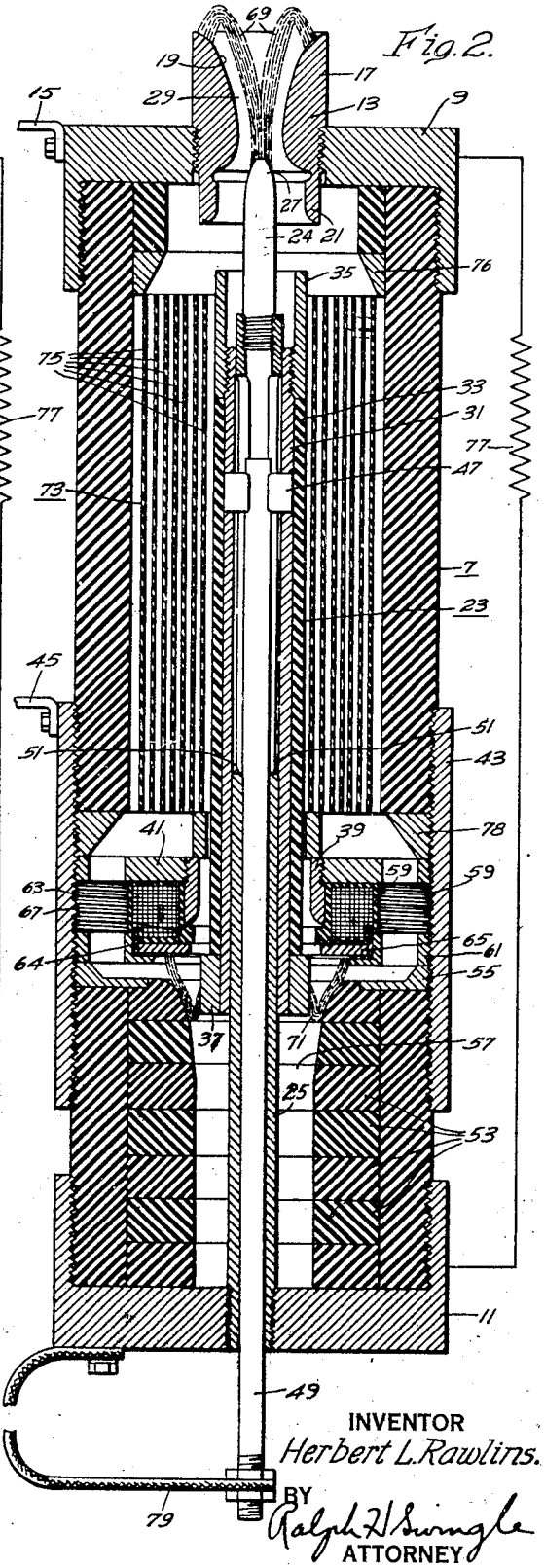


Fig. 2.



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Fig. 3.

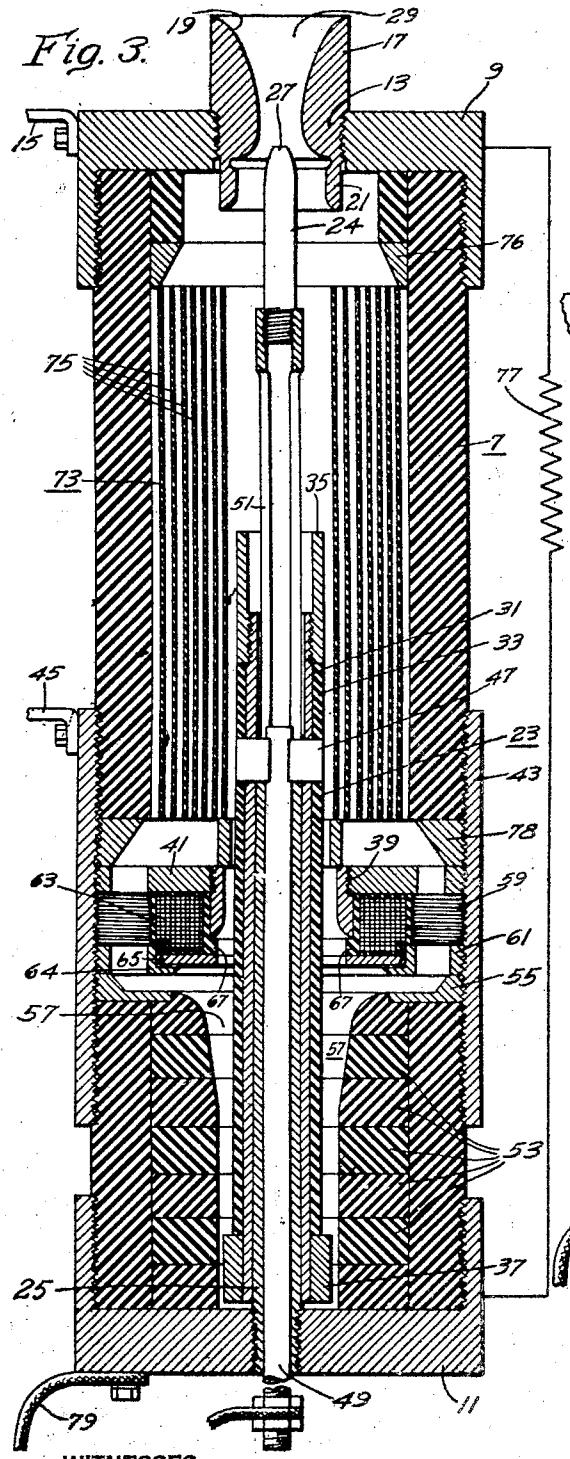


Fig. 4.

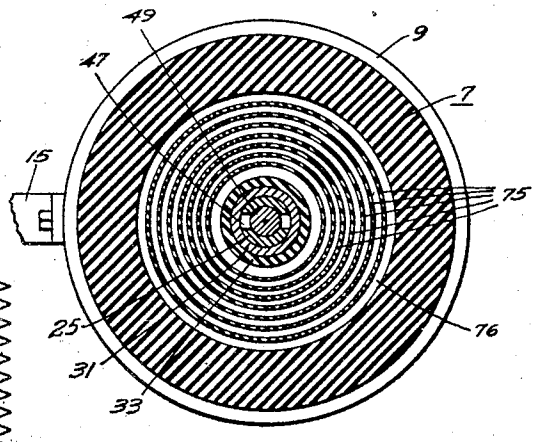
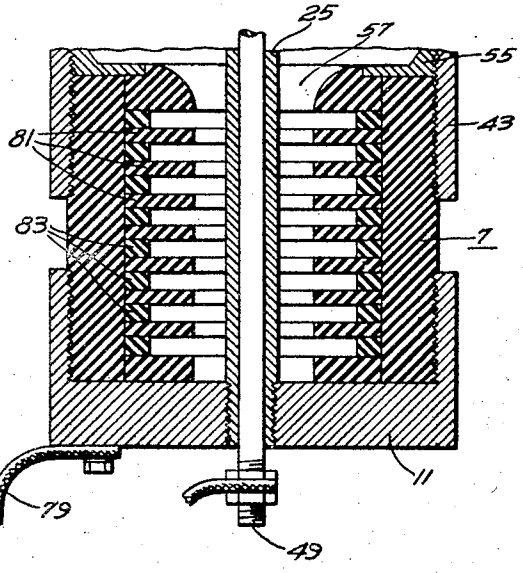


Fig. 5.



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UNITED STATES PATENT OFFICE

2,292,088

CIRCUIT INTERRUPTING DEVICE

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Application June 8, 1938, Serial No. 212,438

15 Claims. (Cl. 200—149)

The invention relates to circuit interrupting devices of the fluid blast type in which interruption of the circuit is effected by a blast of arc extinguishing fluid through the arc drawn during circuit interruption.

An object of the invention is the provision of a circuit interrupting device wherein means are provided for drawing an arc and causing a fluid under pressure to be passed through a cooling medium prior to being blasted through the arc.

Another object of the invention is the provision of a circuit interrupting device embodying means for drawing a plurality of arcs in series one of which acts to produce a fluid under pressure which is passed through a cooling medium to increase its dielectric strength prior to being blasted through the other arc.

Another object of the invention is the provision of a circuit interrupting device embodying means for drawing a plurality of arcs in series one of which causes the generation of a gas under pressure during circuit interruption which is cooled and then blasted through the other arc to extinguish the same and interrupt the circuit.

Another object of the invention is the provision of a circuit interrupting device embodying an arc extinguishing structure having a nozzle and a pressure chamber communicating with the nozzle through a cooling means, and means for drawing a plurality of arcs in series one in the throat of the nozzle and another in the pressure chamber.

Another object of the invention is the provision of a circuit interrupting device as previously described in which the arc in the pressure chamber is restricted in an annular slot defined by walls of a solid material which evolves a gas when heated by the arc.

Another object of the invention is the provision of a circuit interrupter as previously described in which the annular slot is tapered so that its walls will be acted on by arcs of varying current magnitude to generate an amount of gas proportional to the current magnitude of the arc.

Another object of the invention is the provision of a circuit interrupting device as described above in which the cooling means has a multiplicity of interstices or passages forming a large cooling surface area, and is of a material which liberates an additional quantity of gas when passed over by the hot gases generated in the pressure chamber.

The novel features that are considered characteristic of the invention are set forth in particular in the appended claims. The invention itself, however, both as to structure and operation, together with additional objects and advantages thereof, will best be understood from the following detailed description of a preferred embodiment thereof when read in conjunction with the accompanying drawings in which:

Figure 1 is a sectional view of a circuit interrupting device constructed in accordance with the invention, the device being shown in the closed circuit position,

Fig. 2 is a sectional view similar to Fig. 1 showing the device during the initial portion of the circuit opening operation,

Fig. 3 is a sectional view similar to Figs. 1 and 2 showing the interrupter in the full open position.

Fig. 4 is a transverse sectional view of the device taken substantially along the line IV—IV of Fig. 1 and looking in the direction of the arrows; and,

Fig. 5 is a fragmentary sectional view of a modified form of arc extinguishing means.

Referring to the drawings, the reference numeral 7 designates generally a two-part casing of insulating material on the ends of which are threaded a pair of metal caps 9 and 11. The cap 9 forms one terminal of the interrupting device and has a central opening in which is threaded an annular electrode 13. The cap 9 is also provided with a terminal lug 15 for connecting the cap and electrode 13 to an external electrical circuit.

The electrode 13 forms a nozzle or jet which communicates with the interior of the casing and through which the arc extinguishing gases generated within the casing are expelled as will be hereinafter described. The electrode 13 has an arcing tip portion 17 which extends outside of the cap, the throat of which is flared outwardly as indicated at 19. The electrode 13 is also provided with an annular contact portion 21 which extends inside of the casing and is adapted to be engaged by a movable contact carried by a movable switch member indicated generally at 23.

A hollow tube 25 of conducting material extends centrally within the casing 7 and has one end threaded in a central opening provided in the cap 11. A fixed electrode 24 is threaded in the opposite or upper end of the fixed conducting tube and this electrode has a rounded nose 27 which projects partially into the throat 29 of the nozzle or electrode 13.

The movable switch member 23 comprises a

tubular sleeve 31 of conducting material around the outer surface of which is mounted a sleeve 33 of an insulating material such as horn fibre which evolves an arc extinguishing gas when subjected to the heat of an arc. The upper end of the conducting sleeve 31 has a ring shaped movable contact 35 threaded thereon which is movable by the switch member 23 into and out of engagement with the contact portion 21 of the electrode 13 to close and open the circuit through the interrupting device. The lower end of the conducting sleeve 31 carries a second movable ring shaped contact 37 which is engageable with a stationary annular contact 39 carried by the casing 7. The stationary contact 39 is carried by a spider member 41 which is threaded in an outer terminal sleeve 43 which forms the opposite terminal of the interrupting device. The terminal sleeve 43 connects the upper and lower sections of the insulating casing 7 together by threadedly engaging the opposed ends of the two sections. A terminal lug 45 is bolted to the terminal sleeve 43, which together with the terminal lug 15, serves to connect the interrupting device in series in the external electrical circuit.

The movable switch member 23 comprising the two movable contacts 35 and 37 which are electrically connected by the tubular conducting sleeve 31, is mounted for sliding movement on the fixed conducting tube 25, and is connected by a key 47 of conducting material with an operating rod 49 also of conducting material. The operating rod 49 is mounted for sliding movement within the fixed conducting tube 25 and the tube 25 is provided with a pair of elongated slots 51 for accommodating the key 47 and for permitting movement of the switch member by the operating rod 49.

The stationary contacts 21 and 39 and the cooperating movable contacts 35 and 37 form two pairs of separable contacts which are connected in series in the circuit through the device by means of the conducting sleeve 31. The two movable contacts 35 and 37 are simultaneously movable to open and to closed circuit position by the axial movement of the switch member 23 and operating rod 49.

In the closed circuit position of the switch member 23, the movable contacts 35 and 37 engage their cooperating stationary contacts 21 and 39, respectively, and the circuit through the device extends from the upper terminal cap 9 through the stationary contact portion 21, movable contact 35, conducting sleeve 31, movable contact 37, stationary contact 39, and the spider 41 to the opposite terminal sleeve 43.

To open the circuit interrupter the operating rod 49 is moved downwardly by any suitable operating mechanism to cause the switch member 23 carrying the movable contacts 35 and 37 to move to the open circuit position out of engagement and away from the cooperating stationary contacts 21 and 39. Thus in the open circuit position two airgaps in series are introduced in the circuit through the device. The full open position of the interrupter is illustrated in Fig. 3 of the drawings.

In order to extinguish the arcs drawn between the pairs of separable contacts, there is provided in the lower section of the casing 7 a stack of annular plates 53 composed of an insulating material, such as horn fibre which evolves an arc extinguishing gas when subjected to the heat or contact of an arc. The plates 53 are held in position in the lower section of the casing 7 by means of a ring 55 which clamps the plates together against the cap 11 to form a solid gas-generating structure. The plates 53 are shaped to provide a tapered annular slot 57 in which the arc drawn between the movable contact 37 and the stationary contact 39 plays, one wall of the slot being formed by the inner surfaces of the plates 53 and the opposite wall being formed by the fibre insulating sleeve 33 of the switch member when the switch member is moved downwardly.

The purpose of the tapered shape of the slot 57 is to adapt the device for interrupting currents of varying magnitude over a considerable range. By providing a tapered annular slot, arcs of varying current magnitude are caused to intimately engage the walls of the annular slot. Current arcs of large magnitude will engage the enlarged upper end of the annular slot and current arcs of small magnitude will engage the walls of the lower or narrow portion of the slot.

In order to ensure a more complete and uniform engagement of the arc with the walls of the annular tapered slot 57 there is provided an electromagnet 59 which is carried by the spider 41 and an additional spider 61. The electromagnet 59 has a winding 63 which is adapted to be connected in series in the circuit of the two arcs by means of an electrode 65 arranged in the path of the arc drawn between the movable contact 37 and the stationary contact 39 and insulated from the stationary contact by a sleeve 67. The electrode 65 is also insulated from the spider 61 by an insulating ring 64. One terminal of the winding 63 is connected to the fixed electrode 65 and the opposite terminal thereof is electrically connected to the spider 41 and through the same to the terminal sleeve 43. As soon as the movable contact 37 passes the electrode 65 in its downward opening movement, the arc drawn between the movable contact 37 and the stationary contact 39 is transferred from the stationary contact 39 to the fixed electrode 65 so that at this point the coil 63 of the magnet 59 is connected in series circuit with the arc and is traversed by the current flowing through the interrupting device. The electromagnet 59 when energized serves to rotate the arc drawn between the movable contact 37 and the fixed electrode 65 around the annular tapered slot so that it is caused to intimately engage a large portion of the surface of the walls of the slot.

The annular slot 57 forms a pressure chamber which communicates with the nozzle formed by the electrode 13 through openings in the spiders 41 and 61 around the electromagnet 59.

The pressure developed by the arc in the annular slot 57 causes the gases evolved by the action of the arc on the walls of the slot 57 to be blasted through the openings in the spiders 41 and 61 around the electromagnet 59 and out through the nozzle 13 to extinguish the arc drawn in the nozzle.

As soon as the movable contacts 35 and 37 have separated a predetermined distance from their cooperating stationary contacts 21 and 39, respectively, during a circuit opening operation of the device, the arc extinguishing gases generated under pressure in the annular slot 57 are blasted up through the casing and through the arc drawn between the contacts 21 and 35 and out through the nozzle 13. This initial blast of gas blows the arc drawn between the contacts 21 and 35 upwardly in the throat of the nozzle

so that its terminal which was on the movable contact 35 is transferred to the fixed electrode 24. The other terminal of the arc which was on the contact 21 being driven up through the throat of the electrode 13 to the arcing tip portion 19, so that the arc is looped up somewhat in the manner so indicated at 69 in Fig. 2, having one of its terminals on the arcing tip portion 19 and its other terminal on the nose 27 of the fixed electrode 24. At this point the current flows through the interrupting device as follows: from the terminal cap 9 through the arcing tip portion 19 of the electrode 13, through the arc 69, fixed electrode 24, through the fixed conducting tube 25 and the conducting sleeve 31, movable contact 37, through another arc 71 to the fixed electrode 65 through the winding 63 of the electromagnet 59 and spider 41 to the opposite terminal sleeve 43 of the device. The position of the parts at this stage of the opening operation are illustrated in Fig. 2.

The gases generated in the annular slot 57 are at a very high temperature and for this reason are not well suited for interrupting an arc efficiently, although they are capable of interrupting lower voltages. In order to cool and deionize the gases there is interposed between the pressure chamber or annular slot 57 and the nozzle 13 a cooling means indicated generally at 73. The cooling means 73 comprises a plurality of concentrically disposed tubes 75 composed of insulating material such as horn fibre which evolves an arc extinguishing material when heated. The tubes 75 are mounted within in the casing 7 by means of a pair of spiders 76 and 78. The tubes 75 provide a large cooling surface area along which the hot gases generated in the annular slot 57 are passed prior to their being blasted out through the nozzle 13. The heat of vaporization of the hot gases, in passing over the cooling surface of the cooling means is absorbed by the tubes 75 so that the gases are cooled and deionized to increase their dielectric or arc extinguishing strength before being blasted through the nozzle 13. The heat of the hot gases absorbed by the tubes 75 liberates an additional quantity of gas from the material of the tubes which is at a low enough temperature to materially assist in extinguishing the arc drawn in the throat of the nozzle.

The ability of a gas blast type circuit interrupter to interrupt a circuit is largely dependent upon the rate of rise of the recovery voltage. The higher the rate of rise of the recovery voltage the more difficult the circuit is to interrupt. In order to reduce the rise of recovery voltage and thus increase the circuit interrupting ability of the device, there may be provided a resistance 77 which is connected at one end to the terminal cap 9 and at its other end to the metal cap 11, so as to be shunted across the arc 69 in the throat of the nozzle for electrode 13. The resistance 77 is connected to the electrode 13 by the conducting material of the terminal cap 9 and to the fixed electrode 24 through the cap 11, a flexible shunt conductor 79, operating rod 49 and the fixed conducting tube 25. The resistance very greatly increases the effectiveness of the gas blast through the nozzle in extinguishing the arc between the annular electrode 13 and the fixed electrode 24. The residual current which flows through the resistance 77 in series with the arc 71 following extinction of the arc in the nozzle is readily interrupted in the annular slot 57.

During circuit interruption the amount of gas generated by the arc in the annular slot 57 is proportional to the magnitude of the current flowing through the interrupter. In the case of heavy magnitude currents a large quantity of gas is generated so that the circuit will be interrupted when the separable contacts have been separated only a small part of their total distance of separation. In the case of lower currents a greater distance of separation of the contacts is required before a sufficient quantity of gas is generated to extinguish the arc, it being necessary for the arc to play in the restricted lower portion of the slot 57 to generate sufficient gas in the case of low magnitude currents. It will be understood, however, a smaller quantity of gas is required to extinguish low current arcs, therefore the device automatically operates to generate the required amount of gas in accordance with the magnitude of the current to be interrupted.

In some instances it may be desirable to provide for interrupting low values of current in the gas generating end of the device; that is, in the annular slot or pressure chamber. The construction illustrated is capable of interrupting low current arcs in the annular slot 57, but its effectiveness may be increased by substituting the modified form of arc extinguisher illustrated in Fig. 5. In the modification shown in Fig. 5 the gas generating structure consists of a plurality of spaced annular plates 81 of gas evolving material such as horn fibre or the like. The plates 81 are of smaller thickness than the plates 53 of the original embodiment of the invention and are spaced apart by suitable spacer rings 83 also of gas evolving insulating material. The remaining structure of the device is identical to that shown and described in connection with the original embodiment of the invention and its operation is substantially identical.

When an arc of low current magnitude is drawn in the slot 57 of the arc extinguishing structure illustrated in Fig. 5, the heat of the arc causes the material of the plates to evolve an arc extinguishing gas which is cooled in the spaces between the plates. The pressure developed by the arc causes the gases generated to be blasted through the arc to extinguish the same in a well known manner.

The cooling means 73 may take other forms than the specific structure shown and described. Any suitable form of cooling means may be used which has a multiplicity of passages or interstices to form a large cooling surface area for cooling the gases.

While the plates of the gas generating structure in both of the embodiments of the invention disclosed have been described as being composed of horn fibre, it is to be understood that any suitable material which evolves an arc extinguishing gas or vapor when acted on by an arc may be used in place thereof.

The operating means for moving the operating rod 49 may be similar to any of the various types of operating mechanism which are well known in the art. For example the operating rod may be biased to open circuit position by a suitable spring and releasably held in closed circuit position by a current responsive trip device such as a fusible element or a current responsive latch means. Provision may also be made for manually or electrically operating the rod 49 if desired.

The operation of the device is briefly as fol-

lows: To interrupt the circuit the operating rod 49 is moved downwardly to cause the movable contacts 35 and 37 carried by the switch member 23 to separate from the cooperating stationary contacts 21 and 39 and draw a plurality of arcs in series, one between the contacts 21 and 35 and another between the contacts 37 and 39. As soon as the movable contact 37 passes beyond the fixed electrode 65 the arc drawn between the contact 37 and the contact 39 leaves the contact 39 and transfers to the fixed electrode 65, causing energization of the electromagnet 59. The magnetic field produced by the electromagnet 59 causes the arc to be rotated in the annular slot 57 where it engages or heats the walls of the slot to generate a quantity of arc extinguishing gas. The pressure produced by the arc causes the gas to be blasted up through the tubes 75 of the cooling means 73 and through the arc drawn between the movable contact 35 and the stationary contact 21 and out through the nozzle opening. The initial blast of gas through the arc drawn between the contacts 21 and 35 moves the arc up into the throat 29 of the electrode 13 with one of its terminals on the arcing tip portion 19 of the electrode 13 and its other terminal on the fixed electrode 24. The blast of cooled arc extinguishing gas through the arc in the nozzle quickly extinguishes the same in a well known manner, and the resistance 77 effectively reduces the recovery voltage to prevent restriking of the arc in the nozzle. The arc drawn between the movable contact 37 and the electrode 65 which is connected in series with the resistance 77 following extinction of the arc in the nozzle is quickly extinguished in the annular slot 57 in a well known manner. To reclose the circuit interrupter the operating rod 49 is moved upwardly to cause the movable contacts 35 and 37 carried by the switch member 23 to move into engagement with their cooperating stationary contacts 21 and 39.

While the invention has been disclosed in accordance with the provisions of the patent statutes, it is to be understood that various changes in the structural details thereof may be made without departing from the spirit of the invention. It is desired therefore that the appended claims be given the broadest reasonable interpretation permissible in view of the prior art.

I claim as my invention:

1. In a circuit interrupting device, an arc extinguishing structure having an orifice and a pressure chamber communicating with said orifice, means for establishing a plurality of arcs in series in said orifice and another in said pressure chamber, including spaced fixed electrodes in said orifice for one of said arcs and including separable contacts in said pressure chamber for another of said arcs, solid wall means for restricting the arc in said chamber and including means acted on by the arc in said chamber for liberating a fluid and developing pressure in said chamber, cooling means having a large number of passages communicating with the space defined by said wall means and providing a large surface area for cooling said fluid, the pressure developed in said chamber by large current arcs causing said fluid to pass through the arc in said chamber, along said passages where it is cooled, and then through said orifice arc to extinguish the same and whereby small current arcs may be extinguished by the flow of fluid therethrough in the space defined by said wall means.

2. In a circuit interrupting device, a casing having a nozzle and a pressure chamber communicating with said nozzle, means for establishing a plurality of arcs in series, including fixed spaced electrodes in said nozzle for one of said arcs and including separable contacts in said chamber for another of said arcs, said chamber having solid wall surfaces including a material which evolves an arc extinguishing gas when heated by the arc forming a restricted arc passage, cooling means interposed between the arc in said nozzle and the arc in said chamber, said cooling means heaving a large number of passages providing a large cooling surface area for cooling the gases, the pressure developed by the arc in said chamber causing the gases to pass through said arc passage, through the passages of said cooling means where it is cooled, and then through the arc in said nozzle for extinguishing the same.

3. In a circuit interrupting device, an arc extinguishing structure having a vent and a chamber communicating with said vent at all times, means for establishing a plurality of arcs in series including spaced fixed electrodes adjacent said vent for one of said arcs and including separable contacts in said chamber for another of said arcs, solid wall means defining a restricted arc passage for the arc in said chamber and including means acted on by the arc in said chamber for liberating a fluid, said arc passage having an opening, cooling means interposed between said vent and the opening of said arc passage, said cooling means having a multiplicity of passages providing a large surface area for absorbing heat, the pressure developed by the arc in said chamber causing said fluid to pass through said arc passage, said cooling means and then through the arc adjacent said vent to extinguish the same.

4. In a circuit interrupting device, a casing having an opening and a passage communicating with said opening, means for striking a plurality of arcs in series including spaced fixed electrodes adjacent said opening for one of said arcs and including separable contacts in said passage, for another of said arcs, solid wall means defining a restricted arc chamber for the arc in said passage, the heat of the arc in said passage developing a hot gas under pressure, said arc chamber having an opening, cooling means interposed between said passage and chamber openings having a large cooling surface area of a material which when acted on by the hot gas produced by the arc in said passage as it passes along said surface cools the gas and liberates an additional quantity of gas at a temperature below that of the hot gas, and means for causing the hot gas to pass along said cooling surface and together with the gas liberated from the cooling surface through said arc adjacent said passage opening to extinguish the same.

5. In a circuit interrupting device, a casing having an annular electrode forming a nozzle and a pressure chamber communicating with said nozzle, a fixed electrode projecting into the throat of said annular electrode and concentrically spaced therefrom, means for drawing a plurality of arcs in series one between the annular and fixed electrodes and another in said chamber, means in said pressure chamber acted on by the arc therein for developing a fluid under pressure, said fluid being blasted through the arc in said nozzle to extinguish the same.

6. In a circuit interrupting device, a casing

having a nozzle and a pressure chamber communicating with said nozzle, means for striking a plurality of arcs including spaced fixed electrodes in the throat of said nozzle for one of said arcs and including separable contacts in said pressure chamber for another of said arcs, means acted on by the arc in said chamber for causing a blast or fluid through the arc in said nozzle for extinguishing the same, a resistance shunting the arc in said nozzle and in series with the arc in said chamber to aid in the complete extinction of the arc in said nozzle, and said second-mentioned means including solid walls for restricting the arc and causing said fluid to flow therethrough for extinguishing the arc in said chamber to interrupt the resistance circuit.

7. In a circuit interrupting device, a casing having an annular electrode forming a nozzle and a pressure chamber communicating with said nozzle, a fixed electrode having a portion extending into the throat of said annular electrode and concentrically spaced therefrom, means for drawing a plurality of arcs one between said annular and fixed electrodes and another in said pressure chamber, means in said chamber acted on by said second arc for causing a blast of fluid through said arc in the nozzle to extinguish the same, a resistance shunting said annular and fixed electrodes and in series with the arc in said chamber for aiding in the complete extinction of said arc in said nozzle, and means for extinguishing said arc in said chamber for interrupting said resistance circuit.

8. In a circuit interrupting device, a casing having an annular electrode forming a nozzle and a pressure chamber communicating with said nozzle, a fixed electrode projecting into the throat of said annular electrode and spaced therefrom, means including a movable switch member for drawing one arc in said chamber adjacent said nozzle having one terminal on said annular electrode within said casing and its second terminal on said switch member and for drawing a second arc in series with said first arc in another portion of said chamber, means in said chamber acted on by said second arc for causing a blast of fluid through said first arc to cause its second terminal to be transferred to said fixed electrode and its other terminal to move out the throat of said nozzle to a point outside said casing, a resistance shunting said annular and fixed electrode and in series with said second arc for aiding in extinguishing the arc between said electrodes, and means associated with said second arc for extinguishing the same to interrupt the resistance circuit.

9. In a circuit interrupter, a casing having an annular electrode forming a nozzle and having a pressure chamber communicating with said nozzle, a fixed electrode in said casing projecting into the throat of said annular electrode and spaced therefrom, means for developing fluid pressure in said chamber, and means for causing an arc to play with one terminal on the annular electrode and its other terminal on said fixed electrode, the pressure developed in said chamber causing the fluid to be blasted through the arc and the nozzle to extinguish the arc.

10. In a circuit interrupter, means for drawing a plurality of arcs in series, including separable electrodes for one of said arcs, and spaced fixed electrodes for another of said arcs, solid means defining a restricted passage for said one arc including means acted on by said one arc for developing a hot gas under pressure, cooling means interposed between the arcs, said cooling means having a cooling surface of a material which when acted on by the hot gas produced by said one arc as the gas passes along said surface cools the gas and liberates an additional quantity of gas, an opening for said restricted passage located so that the gas escaping therefrom passes through said one arc, and means for causing the hot gas escaping from said restricted passage to pass along said cooling surface where it is cooled, and the cooled gas together with the gas liberated from the cooling surface to pass through said other arc to extinguish the same.

11. In a circuit interrupter, a tubular casing having an annular electrode at one end forming a nozzle, a fixed electrode disposed centrally in said casing and extending to a point adjacent the throat of said nozzle, said casing having a pressure chamber at the opposite end, means in said chamber for developing fluid pressure when an arc is drawn in said chamber, means for drawing two arcs one in said chamber and the other between the annular and fixed electrodes, cooling means comprising a plurality of concentrically disposed spaced tubes around said fixed electrode between the pressure chamber and the nozzle for cooling the fluid before it passes through the arc drawn between the annular and fixed electrode, the pressure developed causing the fluid to pass along the surface of the tubes where it is cooled and then through the arc between the annular and fixed electrodes and out the nozzle for extinguishing the last mentioned arc.

12. In a circuit interrupter, a casing having an annular electrode forming a nozzle and having a pressure chamber communicating with said nozzle, a fixed electrode in said casing projecting into the throat of said annular electrode and spaced therefrom, means for developing fluid pressure in said chamber, movable contact means for bridging said electrodes, and means for moving said contact means away from at least one of said electrodes for causing an arc to play with one terminal on the annular electrode and its other terminal on said fixed electrode, the pressure developed in said chamber causing the fluid to be blasted through the arc and the nozzle to extinguish the arc.

13. In a circuit interrupter, a casing having an annular electrode forming a nozzle and having a pressure chamber communicating with said nozzle, a fixed electrode in said casing projecting into the throat of said annular electrode and spaced therefrom, means for developing fluid pressure in said chamber, contact means adapted to bridge said electrodes and movably associated with said fixed electrode so as to be movable out of engagement with said annular electrode to strike an arc, the pressure developed in said chamber causing the fluid to be blasted through the arc and the nozzle to extinguish the arc and to aid in the transfer of one terminal of said arc from said contact means to said fixed electrode.

14. In a circuit interrupter, a casing having an annular electrode forming a nozzle and having a pressure chamber communicating with said nozzle, a fixed electrode in said casing projecting into the throat of said annular electrode and spaced therefrom, means for developing

fluid pressure in said chamber, contact means movably associated with said fixed electrode and adapted to engage an inner portion of said annular electrode so as to strike an arc when moved away from said annular electrode, the pressure developed in said chamber causing the fluid to be blasted through the arc and the nozzle to extinguish the arc and to aid in the transfer of one terminal of said arc from said contact means to said fixed electrode, and to move the other terminal of said arc outwardly through the opening of said nozzle.

15. In a circuit interrupting device, means for striking a pair of arcs in series including spaced fixed electrodes, and separable contacts for said arcs, respectively, solid wall means defining a restricted passage for said separable contact arc, said wall means having at least inner portions of a material capable of evolving an arc extinguishing gas when in proximity to an electric arc, fluid conducting means for conducting fluid from said restricted passage through the other of said arcs, resistance means shunting said other arc and in series with the arc in said restricted passage, whereby said other arc is extinguished by a gas blast action and the circuit interrupted in said restricted passage.

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