May 27, 1947. R. S. BENNETT 2,421,236

ELECTRIC CIRCUIT INTERRUPTER

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Fig. 1.

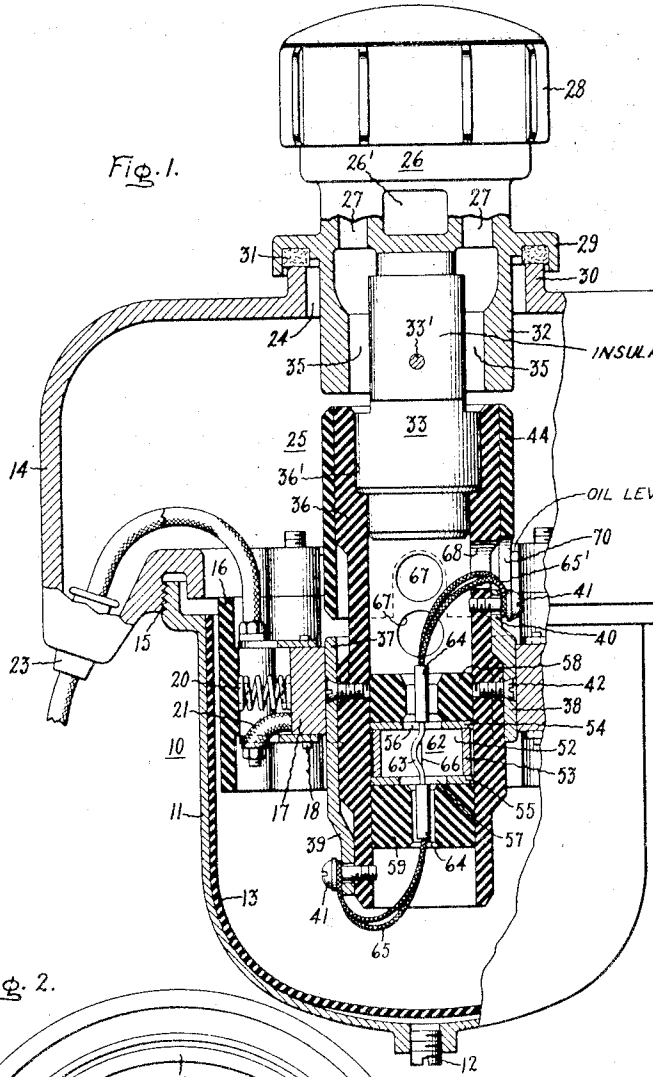


Fig. 2.

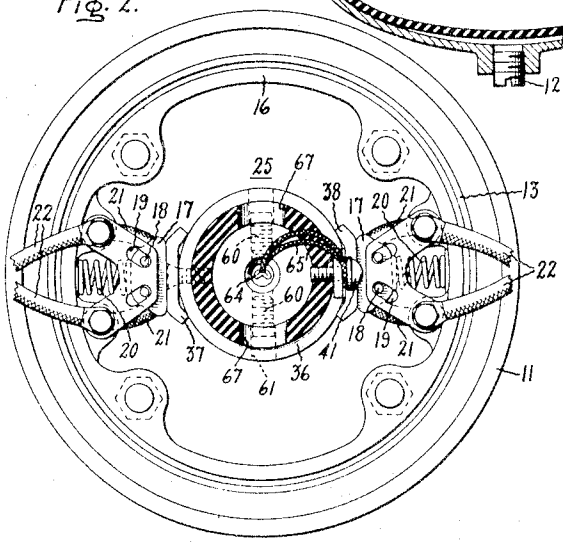
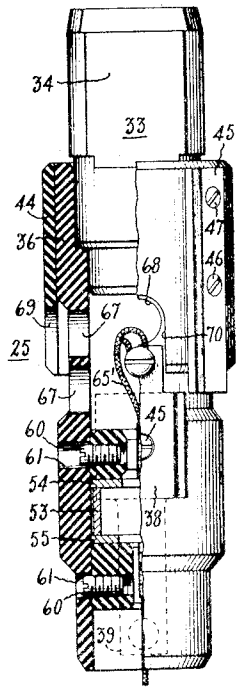


Fig. 3.



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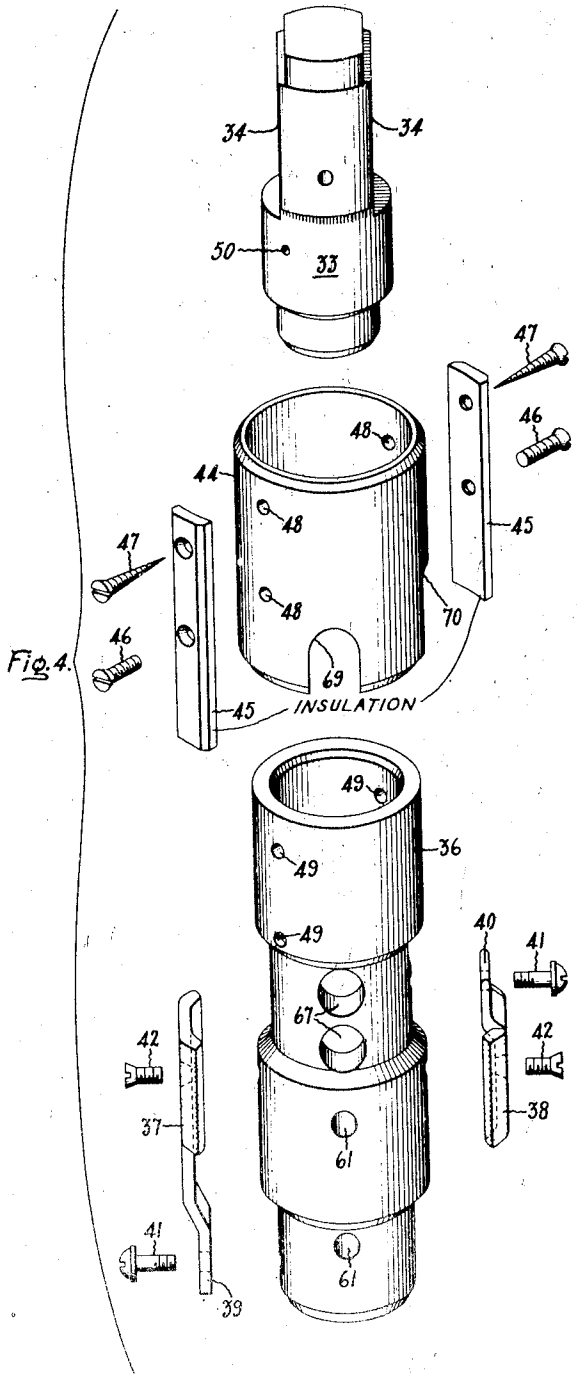


Fig. 4.

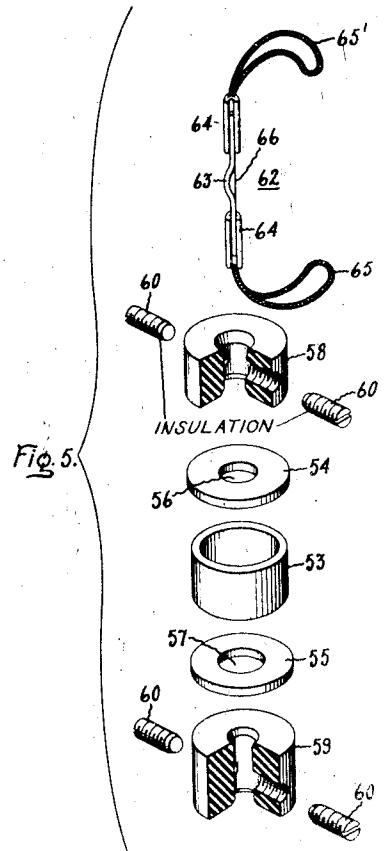
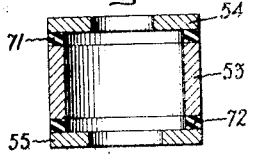


Fig. 5.

Fig. 6.



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UNITED STATES PATENT OFFICE

2,421,236

ELECTRIC CIRCUIT INTERRUPTER

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10 Claims. (Cl. 200—120)

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My invention relates to electric circuit interrupters and more particularly to circuit interrupters of the fluid blast type wherein pressure is utilized to effect a blast of arc-extinguishing or insulating liquid through a break in the circuit to be interrupted. Specifically, my invention is an improvement on U. S. Letters Patent 2,049,318, Prince, granted July 28, 1936, and assigned to the same assignee as the present application.

It is an object of my invention to provide a new and improved fluid blast circuit interrupting means.

It is another object of my invention to provide a fuse cut out type of circuit interrupting device operating on the oil blast principle in which two arcs in series are produced substantially simultaneously so that the oil blast produced may become effective before the current and pressure have increased to dangerously high values.

Still another object of my invention is to provide a fuse cut out type of circuit interrupting device operating on the oil blast principle in which two arcs in series are produced substantially simultaneously upon the blowing of a single fusible element.

Further objects and advantages of my invention will become apparent as the following description proceeds and the features of novelty which characterize my invention will be pointed out with particularity in the claims annexed to and forming a part of this specification.

For a better understanding of my invention reference may be had to the accompanying drawings in which Fig. 1 is an elevational view, partly in section, of a circuit interrupting device embodying my invention; Fig. 2 is a top view, partly in section, of the circuit interrupter of Fig. 1 with the cover of the casing removed; Fig. 3 is a side elevational view, partly in section, of a portion of the fuse carrier of Fig. 1; Figs. 4 and 5 are exploded perspective views of the portion of the fuse carrier shown in Fig. 3, and Fig. 6 illustrates a modification of my invention.

Although my invention may have application generally in connection with fluid blast circuit interrupters, I have chosen to illustrate it specifically as applied to the well known form of oil-filled fuse cut out disclosed in United States Patents 1,195,790, 1,203,316, and 1,248,090.

As shown in the drawings the oil fuse cutout embodying my invention and generally indicated at 10 comprises a cyindrical container or tank 11, preferably formed of steel so as to be sufficiently strong to withstand the pressures generated therein under certain conditions. Tank 11 is provided with a drain plug 12 in the lower portion thereof. The interior of tank 11 is preferably provided with a liner 13 of suitable insulating material. A suitable cover 14 preferably formed of cast iron is threadedly attached to tank 11 as indicated at 15.

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Bolted or otherwise suitably fastened to the cover 14 of oil fuse cutout 10 is a suitable ring 16 of insulating material which depends from the cover so as to be almost wholly contained in casing 11. The insulating ring 16 supports flat stationary contacts 17. As best indicated in Fig. 2, these flat stationary contacts 17 are self-aligning by virtue of the pin and slot connections indicated at 18 and 19 respectively. Furthermore, each of these contacts is spring biased by means of a helical spring 20 tending to push flat contacts 17 toward the center of insulating ring 16. Two contacts 17 are provided which are mounted diametrically opposite one another with respect to cylindrical tank 11 and each of these contacts is connected by suitable conductors 21 and 22 with an external electrical circuit through suitable entrance bushings 23, as shown in Fig. 1. Tank 11 is filled with a suitable dielectric, such as oil for example, to the level indicated in Fig. 1.

The portion of the oil-filled cutout 10 described thus far may be substantially identical with the cutout disclosed in Patent 1,248,090 referred to above and forms no part of my present invention. Consequently, it has only been briefly described since a detailed description thereof is available in the above mentioned United States Letters Patent.

The cover 14 of oil fuse cutout 10 is provided with a central opening 24 through which is inserted a fuse carrier generally indicated at 25. This fuse carrier comprises a metal cap 26 having ventilating or breathing openings 27 therein. A rectangular opening 26' is provided so that any handy lever may be inserted to assist in turning the fuse carrier. The top of this cap is provided with a hood 28. Cap 26 is provided with an annular flange 29 to suitably seat on an upturned flange 30 surrounding the opening 24 in cover 14. A suitable gasket 31 may be interposed between flanges 29 and 30 for sealing purposes. Cap 26 also includes a depending flange 32 extending into the opening 24 of cover 14. A suitable plug such as 33, preferably formed of a treated wood, is provided with an upper portion of cylindrical form which fits snugly into an opening or recess in depending flange 32 of cap

28 and is pinned thereto by a suitable pin or rivet 33'. This portion of wood plug 33 inserted in the lower portion of cap 26 is provided with two flat sides such as 34 to provide breathing or venting passageways 35 from within the casing of cutout 10 to the exterior through the vent openings 27. As is disclosed in the above mentioned Patent 1,195,790 the cover 14 and the cap 26 are provided with suitable locking means so that flanges 29 and 30 may be maintained in sealing engagement with one another through gasket 31 when the fuse carrier 25 is in the position indicated in Fig. 1. This locking means is not shown in the drawing.

Fuse carrier 25 further includes supporting means for the movable contacts to be described hereinafter comprising a generally cylindrical member 36 of insulating material having an annular recess 36' provided in the upper portion thereof to accommodate wood plug 33. Suitably fastened to the lower portion of movable contact supporting means 36 are movable contacts 37 and 38. Movable contact 37 has a downwardly extending portion 39 while contact 38 has an upwardly extending portion 40, both of which are suitably fastened to contact supporting member 36 by fuse link attachment screws 41. Flat headed screws 42 extend through movable contacts 37 and 38 into member 36, thereby firmly supporting the contacts 37 and 38 on member 36. These contacts are somewhat concave in form with respect to the portion thereof engaging member 36 and are adapted to make electrical contact with flat contacts 17. The circuit at contacts 37 and 17 and contacts 39 and 17 is made and broken by rotating fuse carrier 25 in a manner clearly described in the above mentioned United States Letters Patent.

Surrounding the upper portion of movable contact support 36 is a guide supporting cylinder 44 formed of insulating material which in turn supports insulating guides 45 best shown in Figs. 3 and 4. Insulating guides 45 are attached to guide supporting member 44 by means of screws or other suitable supporting means 46 and 47. These screws are sufficiently long to also threadedly engage not only the openings 48 in cylinder 44 but also the openings 49 in the upper part of movable contact supporting member 36. Furthermore, the screws 47 are long enough to engage the openings 50 in wood plug 33 indicated in Fig. 4, thereby making the fuse carrier 25 in effect a unitary structure. The insulating guide members 45 which are preferably formed of insulating material are adapted to engage cooperating slots (not shown) in the cover member 14 adjacent opening 24 to insure that fuse carrier 25 is inserted only in a predetermined manner with the contacts 37 and 38 thereof rotated to a position out of line with stationary contacts 17. After the fuse carrier 25 is fully inserted the guide members 45 are substantially free of the cooperating slots (not shown) in cover member 14 so that fuse carrier 25 may be rotated and contacts 37 and 38 may then engage stationary flat contacts 17. At the same time the locking means referred to above and disclosed in the above mentioned United States Letters Patent 1,195,790 comes into play to lock fuse carrier 25 in position so that flanges 29 and 30 are in sealing engagement with the gasket 31 therebetween.

In order to provide a fuse arrangement embodying the oil blast principle in which two arcs are produced substantially instantaneously and in series with each other upon the blowing of a single fusible element, I have provided within contact supporting member 36 a metallic pressure chamber or reservoir 52 which comprises a cylindrical member 53 and end members 54 and 55 each having an opening such as 56 and 57, respectively, therein. The metallic chamber 52 comprising members 53, 54 and 55 is supported within cylindrical member 36 by annular insulating supporting means 58 and 59 which are fastened by suitable insulating screws 60 to member 36 provided with cooperating openings 61. A fuse link is provided generally indicated at 62 comprising a fusible element 63 having suitable terminals 64 at either end thereof connected to flexible cable loops 65 and 65'. Flexible cable loops 65 and 65' are adapted to be slipped over fuse links supporting screws 41 to support the fuse link 62 in the position shown in Fig. 1. Loop 65 is made less flexible than loop 65' as one means for controlling the length of the arc and thereby to generate more gas and thus to provide greater pressure in the one portion than in the other so as to aid in directing the blast in the desired direction. By making cable 65' less flexible than cable 65 the lower arc is permitted to grow longer faster than the upper arc and hence produce an upwardly directed oil blast. If desired, a suitable strain wire 66 may be connected in parallel with fusible element 63 between terminals 64.

Upon the occurrence of predetermined current conditions fusible element 63 will melt and an arc will occur between terminals 64. However, due to the proximity of the walls of reservoir chamber 52 to arcs, one to member 54 and the other to member 55, will occur substantially simultaneously. Since the opening in member 58 is larger and shorter than the opening in member 59, the lower arc will tend to produce greater pressure and thus an oil blast from the reservoir chamber 52, which blast is forced through the upper arc to extinguish the same. Also, the opening 56 in member 54 is smaller than the opening 57 in member 55 so that the lower arc will be longer and tend to produce greater pressure. Suitable openings 67 are provided in member 36 to permit free escape of the oil blast to the upper oil level, whereas the blasting of fluid from the lower end of the lower opening 57 is restricted by the greater head of oil as provided by the vertical arrangement at openings 56 and 57 and reservoir chamber 52 on the vertically inserted fuse carrier 25. Where necessary, a further restriction of the blast from the lower end of opening 57 can be provided by the addition of suitable baffles or the like. Similarly, member 36 is provided with an opening 68 through which the flexible cable 65 may extend to engage electrically the contact 38. In order that guide supporting cylinder 44 will not interfere with the operation of oil blast openings 67 or opening 68 it is provided with recesses 69 and 70. It should be understood that my invention is not limited to the specific means or combination of means for directing the fluid blast and the direction of said blast as herein described, since other means for accomplishing this will suggest themselves to those skilled in the art.

From the above description it will be obvious that the length of the fusible element 63 and the length of the pressure chamber 52 may be so adjusted that when the fusible element ruptures the arc will tend to jump at once from upper fusible terminal 64 to the edge of pressure chamber 52 surrounding opening 56 and from the edge

of pressure chamber 52 surrounding opening 57 to the lower fuse terminal 64. There will thus be created two arcs in series which are formed substantially simultaneously so that the oil blast principle may be satisfactorily employed without dangerous pressures being reached before the oil blast may become effective. The two arcs in series are disposed so that the pressure generated by the lower arc will blast the fluid in pressure chamber 52 through the upper arc to extinguish it and thereby interrupt the circuit through fuse cutout 10.

I have found it desirable to construct the metallic chamber or oil reservoir comprising members 53, 54 and 55 of steel since steel affords appreciable resistance to current flow, thereby tending to limit the current below the values which might otherwise be attained. This is desirable and helpful in extinguishing the arc.

In view of the detailed description included above, the operation of the fuse cutout operating on the oil blast principle embodying my invention will be obvious and no further discussion will be included here. It will be observed that the fuse carrier 25 embodying my invention may replace the fuse carrier of prior art fuses of the type similar to cutout 10.

The metallic chamber or oil reservoir comprising members 53, 54, and 55 may be constructed to have short gaps between the respective members so as to produce short arcs at an advantageous position within the oil reservoir to produce a blast of fluid through both of the other arcs. In Fig. 6 I have illustrated the metallic pressure chamber of Figs. 1 and 5 with the parts thereof separated by insulating washers 71 and 72 which may be constructed of fiber or the like. In this way the oil in the reservoir may be used to the greatest possible extent.

While I have shown and described a particular embodiment of my invention, it will be obvious to those skilled in the art that various changes and modifications may be made without departing from my invention in its broader aspects and I therefore aim in the appended claims to cover all such changes and modifications as fall within the true spirit and scope of my invention.

What I claim as new and desire to secure by Letters Patent of the United States is:

1. In an electric circuit interrupting device of the fluid blast type, an arc chamber of conducting material containing an arc-extinguishing liquid, means defining a pair of openings one at each end of said arc chamber, and a fuse link including a fusible element having a single rupturable section extending through said openings so that said fusible element is in said arc chamber immersed in said liquid, said fusible element being so arranged that upon rupture of said fusible element two arcs in series are produced substantially simultaneously between said fuse link and said first mentioned means with one of said arcs producing a fluid blast to extinguish said other arc.

2. In an electric circuit interrupting device of the fluid blast type, a fuse carrier, an arc chamber of conducting material supported on said carrier, means defining a pair of openings one at each end of said arc chamber, a fuse link including a fusible element supported by said carrier and extending through said openings with said fusible element in said arc chamber, said fusible element and said arc chamber being so arranged that upon rupture of said fusible element two arcs in series are produced substantially simultaneously between said fuse link and said chamber, and an arc-extinguishing liquid contained in said chamber adapted to be blasted by one of said arcs through said other arc to extinguish the same and interrupt the circuit through said device.

3. An electric circuit interrupter of the fluid blast type comprising an arc chamber containing an arc-extinguishing liquid, and a fusible element having a single rupturable section immersed and arranged to rupture in said liquid in said chamber, said chamber and said fusible element being so arranged that upon rupture of said fusible element two arcs in series are produced substantially simultaneously, and means for at least partially confining the escape of the fluid blast caused by one of said arcs to produce a fluid blast to extinguish said other arc.

4. An electric circuit interrupter of the fluid blast type comprising an arc chamber containing an arc-extinguishing liquid, and a fusible element immersed and arranged to rupture in said liquid in said chamber, said chamber and said fusible element being so arranged that upon rupture of said fusible element two arcs in series are produced substantially simultaneously, and means for increasing the arc gas pressure created by one of said arcs to provide a fluid blast to extinguish said other arc.

5. An electric circuit interrupter of the fluid blast type comprising an arc chamber containing a relatively large quantity of arc extinguishing liquid in a reservoir portion of said chamber, said reservoir portion of said chamber being lined with electrically conductive material, and a single circuit opening means immersed and arranged to draw an arc in said liquid in said chamber, said electrically conductive lining and said circuit opening means being so arranged that upon the drawing of the arc, two arcs in series are produced substantially simultaneously with one of said arcs producing a fluid blast from the reservoir portion of said chamber to extinguish said other arc.

6. An electric circuit interrupter of the fluid blast type comprising an arc chamber containing an arc extinguishing liquid, an electrically conducting member in said chamber, and a single circuit opening means immersed and arranged during a circuit opening operation to produce an arc in said liquid in said chamber, said electrically conducting member and said circuit opening means being so arranged that upon the production of said arc, two arcs in series are produced substantially simultaneously with one of said arcs producing a fluid blast to extinguish said other arc.

7. An electric circuit interrupter of the fluid blast type comprising an arc chamber containing an arc-extinguishing liquid, said arc chamber comprising means defining two relatively small openings with an enlarged liquid containing reservoir therebetween, and a circuit opening means immersed and arranged to draw an arc in said liquid in said chamber, said chamber and said circuit opening means being so arranged that upon the drawing of the arc, two arcs in series are produced substantially simultaneously in said two small openings of said chamber with one of said arcs producing a fluid blast from said reservoir to extinguish said other arc.

8. An electric circuit interrupter of the fluid blast type comprising an arc chamber containing an arc extinguishing liquid, said arc chamber comprising means defining two relatively

small openings with an enlarged liquid containing reservoir there between, said openings differing dimensionally from each other, and a circuit opening means immersed and arranged to draw an arc in said liquid in said chamber, said chamber and said circuit openng means being so arranged that upon the drawing of the arc, two arcs in series are produced substantially simultaneously in said two small openings of said chamber with one of said arcs producing a fluid blast from said reservoir to extinguish said other arc.

9. An electric circuit interrupter of the fluid blast type comprising an arc chamber containing an arc extinguishing liquid, said arc chamber comprising means defining two relatively small openings with an enlarged liquid containing reservoir therebetween, a circuit opening means immersed and arranged to draw an arc in said liquid in said chamber, said chamber and said circuit opening means being so arranged that upon the drawing of the arc, two arcs in series are produced substantially simultaneously in said two small openings of said chamber, and means for producing a differential in the relative pressures generated in one of said two openings with respect to the other of said openings thereby producing a fluid blast from said reservoir through said other opening to extinguish the arc therein.

10. In an electric circuit interrupting device of the fluid blast type, a casing, a circuit opening means, a vertically removable carrier for said circuit opening means mounted in said casing, a cylindrical arc chamber supported in said carrier, an arc extinguishing liquid in said casing and in said chamber, and means defining a pair of vertically spaced openings one at each end of said chamber so the head of said liquid above the lower of said openings is greater than above the other of said openings, said circuit opening means being immersed and arranged to produce an arc in said liquid in said chamber, said chamber and said circuit opening means being so arranged in said carrier that upon the production of said arc two arcs in series are produced substantially simultaneously in said two openings with the arc in said lower opening producing a fluid blast through said upper opening to extinguish said other arc in said upper opening.

RALPH S. BENNETT.

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The following references are of record in the file of this patent:

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