United States Patent

[11] **3,549,841**

[72] Inventors **James R. McCloud**
Burbank;
Lorne D. McConnell, Sierra Madre, Calif.

[21] Appl. No. **680,848**
[22] Filed **Nov. 6, 1967**
[45] Patented **Dec. 22, 1970**

[73] Assignee **I-T-E Imperial Corporation**
Philadelphia, Pa.
a corporation of Delaware. by mesne assignments

[54] **RESISTOR SWITCH FOR AIR BLAST CIRCUIT BREAKER**
3 Claims, 2 Drawing Figs.

[52] **U.S. Cl.** **200/148,** 200/144, 200/146

[51] **Int. Cl.** **H01h 33/16,** H01h 33/82

[50] **Field of Search** 200/148, 144APRI, 146

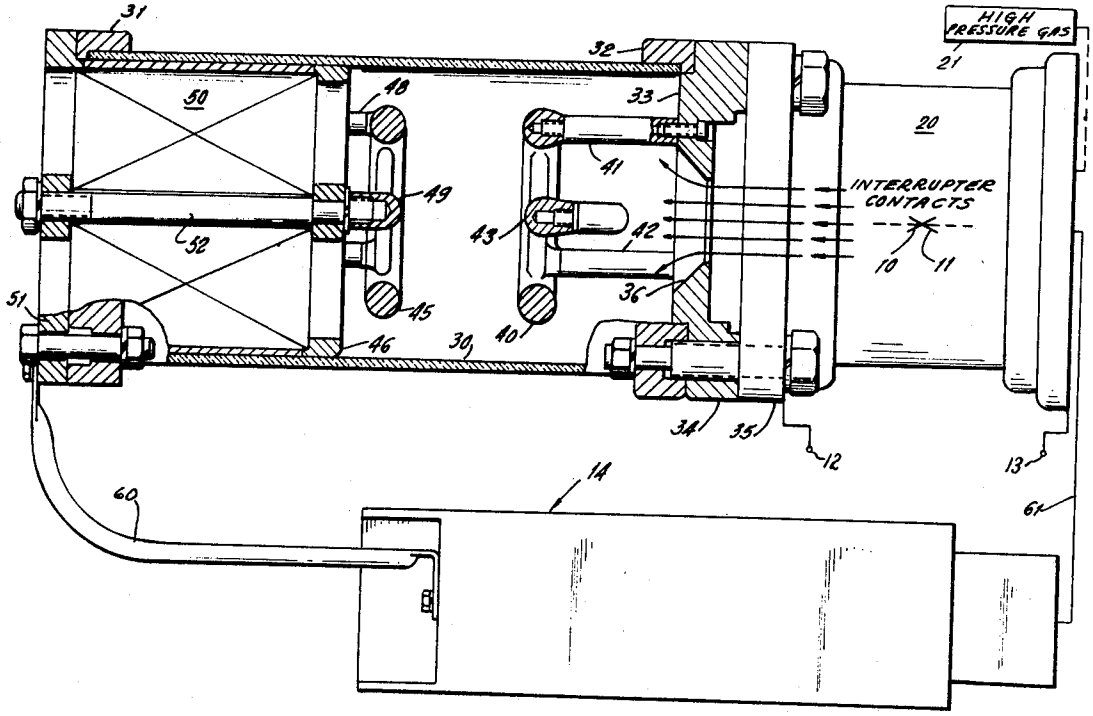
[56] **References Cited**

UNITED STATES PATENTS

1,961,475	6/1934	Clerc	200/148
2,541,792	2/1951	Thommen	200/148

Primary Examiner—Robert S. Macon
Attorney—Ostrolenk, Faber, Gerb and Soffen

ABSTRACT: A series connected arc gap and resistor are connected in parallel with the interrupter contacts of a gas blast circuit breaker. The arc gap is positioned downstream of the interrupter contacts and consists of spaced, toroidally-shaped contacts.



PATENTED DEC 22 1970

3,549,841

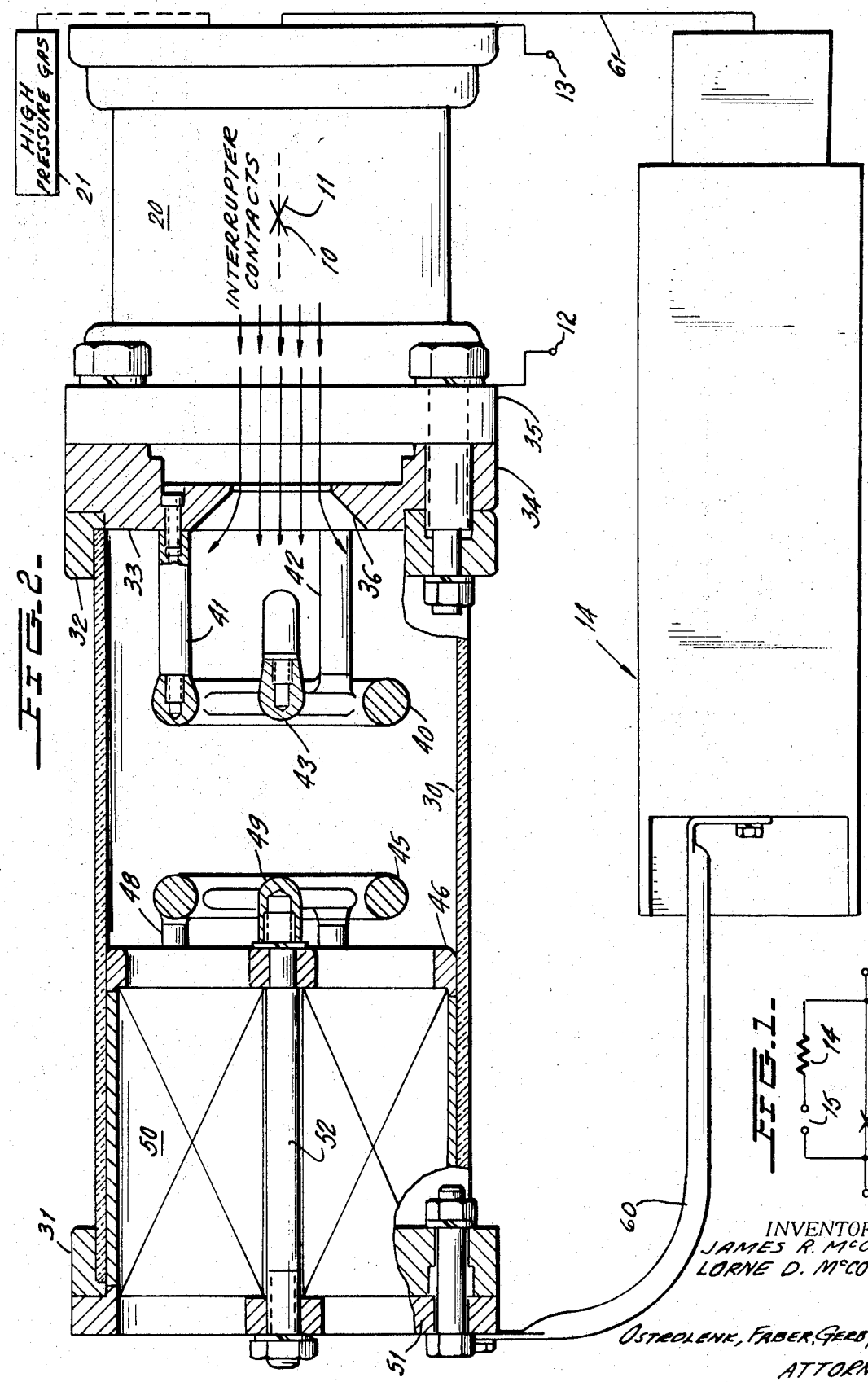


FIG. 2.

FIG. 1.

INVENTORS
JAMES R. McCLOUD
LORNE D. McCONNELL

OSTROLENK, FABER, GERB & SOFFEN
ATTORNEYS

RESISTOR SWITCH FOR AIR BLAST CIRCUIT BREAKER

This invention relates to gas or air blast interrupters, and more particularly relates to a novel arrangement for switching a resistor in parallel with the interrupter contacts during circuit interruption.

The use of resistors in parallel with interrupter contacts is well known. In order to connect the resistor in the circuit, it is well known to place an arc gap in series with the parallel connected resistor through dielectric breakdown to a probe-type electrode inserted in the area of the arc stream of the main arc during interruption. The design embodies an insulation bushing mounting this electrode in a metal housing approximately midway between the main breaker contacts and the downstream arcing horn or electrode. Thus, the gap has an element directly in the path of the main power arc.

During the interruption of capacitive current, a voltage charge is left on one terminal of the circuit breaker, while the other terminal follows the sinusoidal applied voltage. This can result in voltages equal to up to three times the maximum phase voltage appearing across the open breaker. This voltage would, in the construction described above, appear between the resistor probe and the metal housing, between the resistor probe and the main arcing horn, and across the insulating bushing which mounts the probe.

The shape, physical size and nonuniform field form presented by this combination of components proved capable of withstanding 60 cycle voltages of the order of 40 to 45 k.v. RMS. This would allow for application to service voltage of the order of only 25 k.v. (three phase line-to-line).

The present invention provides a novel resistor switch applicable to service voltages of up to 38 k.v. (three phase line-to-line). This requires a withstand a capability across switch components of approximately 66 k.v. maximum 60 cycle RMS. $\left[\frac{38KV}{\sqrt{3}}\times 3\right]$

In accordance with the present invention, a novel arrangement is provided of an arc gap contained in an insulation chamber. The arc gap is formed of identical toroidal electrodes axially spaced from one another and coaxial with the direction of flow of blast air or gas coming from the interrupter structure. The toroidal electrodes are spaced so that they can withstand in excess of 66 k.v. in clean air, with arcing occurring upon the passage of ionized gas between them from the flow of gas during interruption of the arc between the interrupter contacts to switch in the resistor. After the arc is interrupted between the main contacts of the interrupter, the arc between the toroidal electrodes continues and carries the low resistor current. However, the toroids are properly spaced, so that this small current will be interrupted at its first natural current zero.

Accordingly, a primary object of this invention is to provide a resistor switching device for gas blast interrupters which has increased voltage capability.

Another object of this invention is to provide an improved resistor switch in which the resistor switch gap is remote from the main power arc.

These and other objects of this invention will become apparent from the following description when taken in connection with the drawings in which:

FIG. 1 shows a schematic circuit diagram of a resistor and its arc gap switch and the interrupter contacts.

FIG. 2 is a partial cross-sectional view of the novel arc gap and its resistor physically located with respect to a conventional gas blast interrupter.

Referring first to FIG. 1, there is schematically shown a pair of gas blast interrupter contacts 10 and 11 connected between main terminals 12 and 13. A resistor 14, connected in series with arc gap 15 is connected in parallel with interrupter contacts 10 and 11. In accordance with the present invention, during interruption by separation of contacts 10 and 11, arc gap 15 is caused to arc over so that resistor 14 is connected across the arc drawn between contacts 10 and 11. After interruption of the main power arc, resistor current flows between terminals 12 and 13, this current being interrupted in gap 15 at the first natural current zero.

FIG. 2 shows the physical relation of the components of FIG. 1. Referring to FIG. 2, the interrupter is shown as a cylindrical housing 20 which is of any standard type and which contains the interrupter contacts 10 and 11. Interrupter 20 is mounted in any suitable manner and is provided with any suitable operating mechanism. This arrangement could be of the type shown in copending application Ser. No. 680,778, filed Nov. 6, 1967, entitled ADJUSTABLE CONTACT NOZZLE AND RETRACTABLE ARCING CHAMBER FOR GAS BLAST CIRCUIT BREAKERS, and assigned to the assignee of the present invention. A compressed gas source 21 suitably cooperates with interrupter 20 to insure a flow of gas through contacts 10 and 11 during interruption which flows within the cylinder and in the direction shown and out of the left-hand end of the interrupter 20.

The arc gap structure 15 of FIG. 2 is formed of an insulation tube 30 mounted between suitable end rings 31 and 32. The right-hand end of tube 30 is then covered with cover plate 33 which has a flange 34 bolted to a corresponding flange 35 (corresponding to terminal 12 of FIG. 1) of interruption cylinder 20. Plate 33 has an opening 36 therein which communicates with the open left-hand end of housing 20 so that high-pressure gas coming through contacts 10 and 11 will pass through opening 36 and axially along the interior of tube 30.

A first toroidal electrode 40 having an outside diameter of about 3 ½ inches and internal diameter of 2 inches, and made of suitable conductive material is supported from plate 33 as by support posts 41 and 42. An arcing electrode 43 is then carried from suitable spider extensions from toroidal electrode 40 and is positioned on the axis of tube 30. A second toroidal electrode 45 having a construction similar to toroid 40 is secured to internal spider plate 46 by posts 47 and 48. An arcing electrode 49 is supported from toroid 45 by suitable spider supports extending from the interior of toroid 45. Toroids 40 and 45 are spaced by about 2 ¼ inches between their adjacent surfaces.

Support plate 46 is held in position by arc cooler 50 which may be composed of concentric, radially spaced rings to cool the gas blast as it flows into the external atmosphere through the end support spider plate 51. Plate 51 is connected to arcing electrode 41 by conductive rod 52 extending through the center of cooler 50. Thus, toroids 40 and 45, and their central electrodes 43 and 49 are insulated from one another at a fixed distance.

The left-hand end resistor structure 14, which may be of any desired type, is then connected to plate 51 by conductive strap 60, while the right-hand end of resistor 14 is connected to the potential of contact 11 through a suitable connector 61 (corresponding to terminal 13 of FIG. 1) connected to an appropriate portion of interrupter housing 20, or the corresponding terminal of the circuit breaker.

In operation, and when interrupter contacts 10 and 11 open, a blast of gas from source 21 flows along the interior of housing 20, through contacts 10 and 11. The blast gas is ionized as it moves through contacts 10 and 11, and this gas continues to move through opening 36 and along the axis of arc gap 15, through toroidal electrodes 40 and 45, through cooler 50 to the external atmosphere. The ionized gas between electrodes 40 and 45 permits the striking of an arc therebetween which places resistor 14 in parallel with contacts 10 and 11. Once the power arc between contacts 10 and 11 is interrupted, current continues to flow through the resistor 14 and this current flows through the arc between the arc electrodes. The electrodes, however, are properly spaced so that the arc extinguishes at the first natural current zero.

Although this invention has been described with respect to its preferred embodiments, it should be understood that many variations and modifications will now be obvious to those skilled in the art, and it is preferred, therefore, that the scope of the invention be limited not by the specific disclosure herein, but only by the appended claims.

We claim:

1. In combination: a gas blast interrupter, a resistor and an arc gap; said gas blast interrupter comprising a pair of cooperating contacts and means for passing a gas blast through said cooperating contacts responsive to operation thereof and means for passing said gas blast out of said interrupter; said arc gap comprising a hollow insulation housing; first and second spaced electrodes insulated from one another mounted within said insulation housing and axially spaced from one another, by a fixed distance, along the axis of said housing; said hollow insulation housing having one end thereof adapted for receiving the flow of gas therethrough, and being connected to said means for passing said gas blast out of said interrupter whereby said gas blast moves axially through said insulation housing and between said first and second spaced electrodes; said resistor electrically connected in series with said first and second electrodes; said series connection electrically connected in parallel with said pair of cooperating contacts; said first and second electrodes each having identical toroidal shapes and facing one another; each of said toroidal shapes lying in spaced parallel planes perpendicular to the axis of said insulation housing and each of said toroidal electrodes have centrally disposed arcing electrodes secured thereto.

2. The combination as set forth in claim 1 wherein each of said toroidal electrodes have an external diameter of about 3 ½ inches and have their adjacent surfaces spaced from one another by about 2 ¼ inches.

3. The combination as set forth in claim 1 wherein each of said toroidal electrodes have centrally disposed arcing electrodes secured thereto.