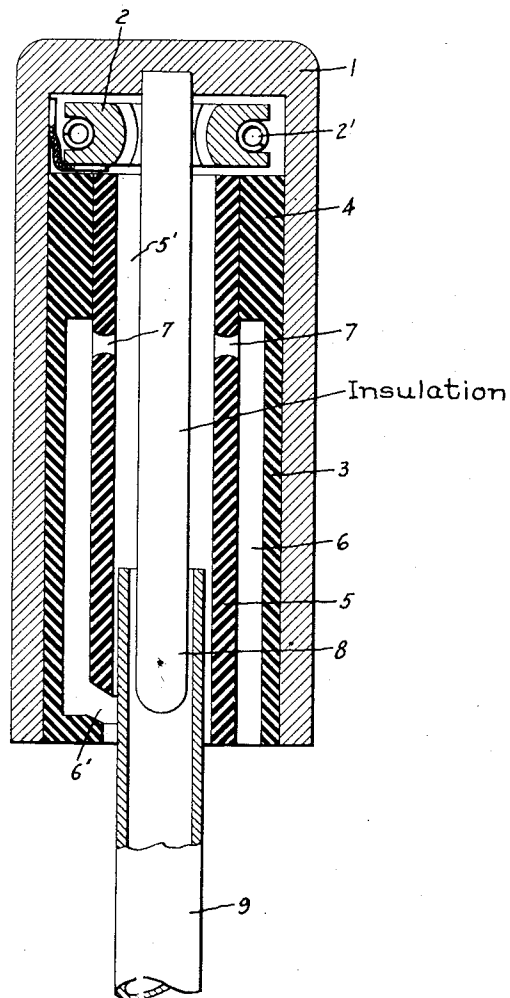


Sept. 20, 1938.

F. PETERMICHL
ELECTRIC CIRCUIT INTERRUPTER

2,131,000

Filed June 3, 1937



Inventor:
Franz Petermichl,
by *Harry E. Dunham*
His Attorney.

UNITED STATES PATENT OFFICE

2,131,000

ELECTRIC CIRCUIT INTERRUPTER

Franz Petermichl, Berlin-Charlottenburg, Germany, assignor to General Electric Company, a corporation of New York

Application June 3, 1937, Serial No. 146,253
In Germany June 25, 1936

6 Claims. (Cl. 200-149)

This invention relates to electric circuit interrupters, more particularly to circuit breakers of the gas expulsion type wherein automatic generation of an arc-extinguishing gas is effected within a pressure confining chamber in accordance with the circuit opening operation.

Circuit breakers of the aforesaid type have been proposed wherein the arc formed upon opening of the circuit is closely confined within an insulating tube defining a pressure-confining or arc chamber, the walls of which are composed of a material adapted to yield an arc-extinguishing gas when subjected to the heat of the arc. The arc pressure within the tube increases until one end of the tube is opened in accordance with predetermined separation of the switch contacts, at which time a blast of gas from the arc chamber is directed through the arc. In such an arrangement, the length of the insulating tube must be such that sufficient gas pressure is built up for the interruption of comparatively small currents. However, a switch chamber of this size is considerably longer than that required for the interruption of comparatively heavy load currents which can be interrupted after a short separation of the contacts due to the high arc pressure generated within the chamber.

The principal object of this invention is the provision of an improved circuit interrupter of the aforesaid type which is efficient and positive in operation throughout the rated current interrupting range, simple, compact and rugged in construction and designed so as efficiently to utilize the arc chamber pressure throughout the complete interrupting range.

My invention will be more fully set forth in the following description referring to the accompanying drawing, 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.

Referring to the drawing the single figure thereof is an elevational view partly in section of a circuit breaker of the gas expulsion type embodying the present invention.

The gas expulsion type circuit breaker illustrated comprises relatively movable contacts separable within a casting 1 forming a switch housing. The fixed contact structure comprises a segment or socket type contact 2 of well-known form normally biased toward contact engagement by a garter spring 2'. The fixed contact 2 is suitably mounted at one end of the casing 1 which is closed.

The pressure-confining or arc chamber is

formed in the present instance by an insulating structure 3 formed as a cylinder having thickened portion 4 adjacent the contact 2. Fitted within the portion 4 is an insulating cylinder or tube 5 which extends from the contact 2 to the open end of the casing 1 and forms with the structure 3 an annular intermediate chamber 6. The chamber 6 is in communication with the inner arc chamber 5' formed by the tube 5 through pressure exhaust ports 7, the chamber 6 exhausting at the other end to atmosphere.

The arc chamber in the present instance is of annular cross-section, a centrally positioned insulating bolt 8 being in alignment with the center of the movable tubular contact 9. The insulating bolt 8 is fixed at one end with respect to the casing 1 and has a cross-sectional area approaching that of the inner cross-sectional area of the tubular contact 9 so that the tubular contact, which has a fairly close fit with respect to the insulating tube 5, has a confining effect on the arc pressure generated within the annular chamber 5'.

In the closed circuit position contact 9 is elevated so as to be engaged by the contact 2 in plug and socket fashion. The circuit is opened by lowering the rod 9 at which time an arc is formed in the restricted annular chamber 5'. For the purpose of generating an adequate amount of arc-extinguishing gas the insulating tube 5, and preferably also the insulating cylinder 3, are composed of a material adapted to yield an arc-extinguishing gas when subjected to the heat of the arc such as fiber, for example.

The arc chamber exhaust port 7 is spaced a predetermined distance from the fixed contact 2 corresponding to the length of tube 5 required for interruption of comparatively heavy load currents. In other words, the tube 5 need not extend beyond the exhaust port 7 in order effectively to interrupt large load currents by reason of the high arc pressure generated by the intense heat of the arc. When the contact 9 uncovers the exhaust port or ports 7 during the opening movement, the sudden pressure release causes a high velocity blast and the arc is interrupted coincident with the flow of gas into the intermediate exhaust chamber 6. The gas is then exhausted to atmosphere.

In the case of comparatively low currents insufficient pressure is generated within a short separation of the contacts as defined by the ports 7, and it is generally necessary to lengthen the arc so that more heat is available for building up an adequate gas pressure for such interruptions.

The additional length of the tube 5 serves to increase the efficiency of the gas blast for low current interruptions by reason of the pressure-confining effect of the intermediate chamber 6 at low arc chamber pressure. In other words, the interrupting operation which takes place very rapidly is not adversely affected by the exhaust ports 7 since the stationary air in the jacket-like space 6 has a certain counter-resistance, which in the case of low arc pressures in the main chamber is sufficient to permit building up of adequate gas pressure to cause interruption of low current arcs when the contact 9 leaves the lower end of the tube 5.

In the case of intermediate currents the exhaust chamber 6 can be provided with exhaust openings as at 6' for directing the arc-extinguishing gas into the path of the arc at the exhaust end of the switch tube. In this case it is preferable that the insulating cylinder 3 also be composed of gas-yielding material so that the hot arc gases passing into the chamber 6 from the ports 7 act on the intermediate chamber walls further to generate additional gas which is directed through the exhaust passage 6' into the arc path. In the case of low currents, this generation of gas within the chamber 6 serves to increase the counter-pressure with respect to the arc chamber pressure, thereby increasing the effectiveness of the gas generated within the tube 5.

The exhaust ports 7 can, if desired, be located within a different range for automatically regulating the chamber pressure in the interruption of large currents. For example, the ports 7 may be arranged in spaced rows or along a helical path with respect to the longitudinal axis of the tube 5.

It should be understood that my invention is not limited to specific details of construction and arrangement thereof herein illustrated, and that changes and modifications may occur to one skilled in the art without departing from the spirit of my invention.

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

1. An electric circuit breaker of the gas expulsion type comprising relatively movable contacts and insulating means forming an elongated pressure-confining arc chamber within which separation of said contacts takes place, the walls of said chamber being in confining relation to the arc formed upon opening of the circuit and composed of a material adapted to yield an arc-extinguishing gas when subjected to said arc, said chamber having an intermediate pressure exhaust opening controlled by one of said contacts spaced a predetermined distance from the point of initial contact separation corresponding to the separation required for the interruption of comparatively large load currents, and means forming an exhaust chamber communicating by way of said exhaust opening with said arc chamber, said exhaust chamber being in concentric relation to and substantially surrounding said arc chamber.

2. An electric circuit breaker of the gas expulsion type comprising coacting fixed and movable contacts and an insulating sleeve having a comparatively close fit with respect to said movable contact and forming a pressure-confining chamber within which separation of said contacts takes place, the inner walls of said chamber being composed of a material adapted to yield an arc-extinguishing gas when subjected to the arc upon opening of the circuit, said insulating sleeve having a pressure exhaust opening controlled by said movable contact intermediate the ends

thereof and spaced a predetermined distance from the point of initial separation of said contacts corresponding to the separation required for interruption of comparatively large load currents, said chamber being otherwise pressure-confining between said exhaust opening and said point of initial separation, the length of the chamber beyond said exhaust opening corresponding to the additional separation required for interruption of comparatively small currents.

3. An electric circuit breaker of the gas expulsion type comprising relatively movable contacts, insulating means forming a pressure-confining chamber within which separation of said contacts takes place, said chamber having a length corresponding to the separation required for the interruption of small currents and having an exhaust opening controlled by one of said contacts spaced a predetermined distance from the point of initial separation of said contacts corresponding to the separation required for interruption of comparatively large currents, and an outer exhaust chamber concentrically disposed with respect to and communicating with said pressure-confining chamber through said exhaust opening, said outer chamber being restricted as to cross-sectional area so that low arc pressures in said chamber are not immediately relieved when said exhaust opening is uncovered during interruption of comparatively low currents.

4. An electric circuit breaker of the gas expulsion type comprising coacting fixed and movable contacts and insulating means forming a pressure-confining sleeve-like arc chamber and an intermediate chamber concentrically positioned with respect to said pressure chamber so as substantially to jacket the same, said pressure chamber having an exhaust port communicating with said intermediate chamber at a point spaced a predetermined distance from the point of initial separation of said contacts corresponding to the separation required for interruption of comparatively large load currents and said intermediate chamber in turn having an exhaust opening for directing gas into the path of said arc at a point beyond the aforesaid exhaust opening and exteriorly of said arc chamber.

5. An electric circuit breaker of the gas expulsion type comprising relatively movable contacts, an insulating casing forming a pressure-confining chamber within which separation of said contacts takes place, said chamber having a length corresponding to the separation required for the interruption of small currents and having an exhaust opening spaced a predetermined distance from the point of initial separation of said contacts corresponding to the separation required for interruption of comparatively large currents, and an intermediate exhaust chamber communicating with said pressure-confining chamber through said exhaust opening, the inner walls of said intermediate chamber being composed of a material adapted to yield an arc-extinguishing gas under the influence of heated arc gases from said pressure chamber, said intermediate chamber having an exhaust opening for directing the gases therefrom into the path of the arc exteriorly of said pressure chamber.

6. An electric circuit breaker of the gas expulsion type comprising relatively movable contacts, insulating means forming a pressure-confining chamber within which separation of said contacts takes place, said chamber having a length corresponding to the separation required for the interruption of small currents and having

2,131,000

3

an exhaust opening controlled by one of said contacts located at an intermediate point corresponding to the separation required for interruption of comparatively large currents, and an intermediate exhaust chamber communicating with said pressure chamber through said exhaust opening, the inner walls of said intermediate chamber

being composed of a material adapted to yield an arc-extinguishing gas under influence of heated arc gases from said pressure chamber so as to oppose low arc pressures in said chamber when said exhaust opening is uncovered during interruption of comparatively low currents. 5

FRANZ PETERMICHL.