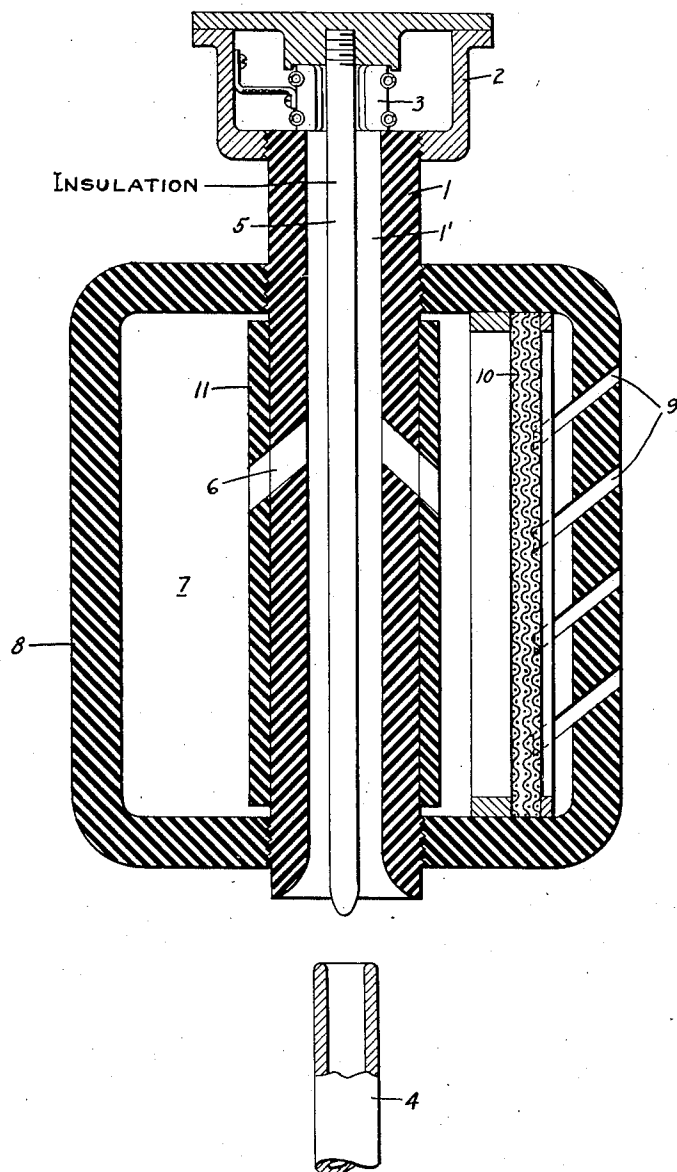


March 28, 1939.

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ELECTRIC CIRCUIT BREAKER  
Filed May 4, 1938

2,152,497



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## UNITED STATES PATENT OFFICE

2,152,497

## ELECTRIC CIRCUIT BREAKER

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Application May 4, 1938, Serial No. 205,955  
In Germany July 29, 1937

4 Claims. (Cl. 200-149)

My invention relates to electric circuit breakers, more particularly to those of the gas expulsion type wherein an arc-extinguishing gas is produced from insulating arc-confining structure by the arc heat.

The principal object of my invention is the provision of an improved circuit breaker of the aforesaid type that has high interrupting capacity and that can be safely used for station operation in high capacity power circuits.

In one form of gas expulsion circuit breaker heretofore proposed, an insulating tube closed at one end is provided with relatively movable contacts adapted to draw an arc within the tube upon opening of the circuit. The gas generated within the tube by the arc heat is expelled through the open end of the tube for distinguishing the arc. In an improved form of this breaker, the tube is provided with vents intermediate the ends thereof for permitting expulsion of gas when the arc is drawn to a predetermined length. This feature is particularly applicable in the case of high or short circuit current interruptions since in such cases a comparatively short arc is sufficient to generate high gas pressures. Although circuit breakers as above described are generally satisfactory as to interrupting ability, they are unsuited for station operation wherein closely spaced high voltage apparatus might be affected by the highly heated expelled arc gases. Also, the emission of flame in case of short circuit interruptions might be very dangerous to station operatives.

In accordance with my invention the arc-confining structure is provided with an exhaust chamber having gas-cooling and venting means for receiving only the exhaust gases from the intermediate or high pressure vent above referred to. The open extremity of the arc-confining structure communicates directly with the atmosphere since it has been found that the large current interruptions take place substantially at the intermediate vent, and in the case of low current arcs that are drawn substantially throughout the length of the arc-confining structure, the attendant noise and gas emission are negligible.

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 gas expulsion electric circuit breaker in the open circuit position thereof embodying the present invention.

The circuit breaker illustrated by way of example comprises a tubular or sleeve-like insulating arc-confining structure 1 that is closed at one end, such as by a contact terminal housing 2, and open at the opposite end. The circuit-controlling means comprises suitable fixed contact structure 3, such as an annular segmental contact, disposed adjacent the closed end in the housing 2 and a coacting hollow rod contact 4 operable through the open end of the tube. There is also provided within the tube a centrally mounted insulating rod 5 that is aligned with the tubular contact 4 so as to form with the arc chamber walls an annular arc passage 1'. In the arrangement so far described separation of the contacts 3 and 4 by lowering of the contact 4 draws an arc within the annular passage 1' during which the arc heat generates high gas pressure within the confined passage.

The arc-confining tube 1 may be composed of a material such as hard fiber or an artificial resin, for example, for producing arc-extinguishing gas when subjected to the arc heat. The insulating rod 5 may also be similarly constituted.

For the purpose of interrupting high current arcs, the tube 1 is provided with intermediate vents 6 for permitting expulsion of gas from the arc chamber after the arc has been drawn to a predetermined length. The vents 6 may be radially disposed about the tube 1 if desired and communicate directly with an exhaust chamber 7 that is formed in the present instance by an annular insulating casing 8 in concentric surrounding relation to the tube 1 intermediate the ends thereof. The casing 8 is suitably secured to the tube such as by screw-threaded engagement and terminates short of the exhaust extremity of the tube which communicates as illustrated directly with the atmosphere.

The highly heated arc gases that are vented from the arc chamber at 6 are diffused and cooled in the annular chamber 7 and are finally vented laterally of the chamber at 9, preferably in a direction away from the movable contact 4. For the purpose of further cooling the arc gases and for precluding emission of flame from the breaker structure, suitable porous arc-cooling structure 10, such as wire gauze, is interposed between the arc chamber vents 6 and the exhaust chamber vents 9.

Accordingly, in the operation of my improved circuit breaker the interruption of high current

arcs is accomplished at short arc lengths, and the resulting highly heated arc gases are diffused and cooled before finally exhausting to atmosphere so that there is little danger of voltage breakdown at adjacent apparatus. Furthermore, there is little danger of flame emission. In the case of small current interruptions the exhaust extremity of the tube I can be uncovered by the movable contact without danger since the gas emission is comparatively slight. There is therefore provided an efficient and compact gas-cooling and flame suppressing arrangement that is used only where needed, viz., for high current interruptions. The breaker structure is thereby simplified and rendered more compact than in the case where cooling of the exhaust gases from the entire breaker tube is attempted. Furthermore, since short circuit or overload currents are generally interrupted well within the tube I, the possibility of flame ejection is greatly minimized or substantially precluded.

Since the switch tube I may be under considerable stress in case of high voltages, it may be advantageous to provide the portion of the tube within the arc chamber with a reinforcing tube or cylinder II composed of a suitable insulating material that does not carbonize under the influence of heat.

For the purpose of obtaining high mechanical strength of the switch tube, it can be constructed of two or more tubes, so that one tube only serves as the gas-producing material and may consist, for example, of carbamide resin and an outer tube constructed of hard fiber serves as a reinforcing tube. Hard fiber can be readily machined for mechanical attachment to the associated structure and, although it is subject to carbonization under influence of the arc heat, this disadvantage can be overcome by the protective casing II of suitable non-carbonizing material.

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, an insulating arc-confining structure within which separation of said contacts takes place, said structure being substantially closed at one end adjacent the point of initial contact separation

and open at the opposite end and also having an intermediate opening for venting said structure independently of said end opening, and a gas-cooling exhaust chamber in communication with said intermediate opening, said chamber substantially surrounding said arc-confining structure and being vented in a direction away from said end opening.

2. An electric circuit breaker of the gas expulsion type comprising an insulating tube, relatively movable contacts initially separable adjacent a closed end of said tube, and a laterally vented gas-cooling exhaust chamber concentrically disposed in surrounding relation to said tube, said tube having an intermediate opening directly communicating with said exhaust chamber for venting said tube when the arc is drawn within said tube to a predetermined length, said tube also extending entirely through said chamber and being open to atmosphere at its other end.

3. An electric circuit breaker of the gas expulsion type comprising an insulating tube, one end of which is substantially closed and the other end open, a fixed contact mounted adjacent the closed end of said tube, a coaxing movable contact operable through the open end of said tube, a gas-cooling exhaust chamber disposed in concentric surrounding relation to said tube intermediate the ends thereof, said tube having an intermediate opening communicating with said chamber for venting said tube when the arc drawn by said movable contact reaches a predetermined length, said chamber being laterally vented with respect to said tube.

4. An electric circuit breaker of the gas expulsion type comprising an insulating tube substantially closed at one end and open at the opposite end, a fixed contact mounted adjacent the closed end, a coaxing movable contact operable through the open end, a gas-cooling exhaust chamber disposed in concentric surrounding relation to said tube intermediate the ends thereof whereby the open end of said tube is vented directly to atmosphere exteriorly of said chamber, said tube having radially disposed vents directly communicating with said chamber for venting said tube after predetermined opening movement of said movable contact, said chamber being vented in a direction generally away from the open end of said tube, and gas-cooling structure disposed in said chamber between said radially disposed vents and chamber exhaust vents.

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