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V. GROSSE

2,231,576

ELECTRIC CIRCUIT INTERRUPTER

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Fig. 1.

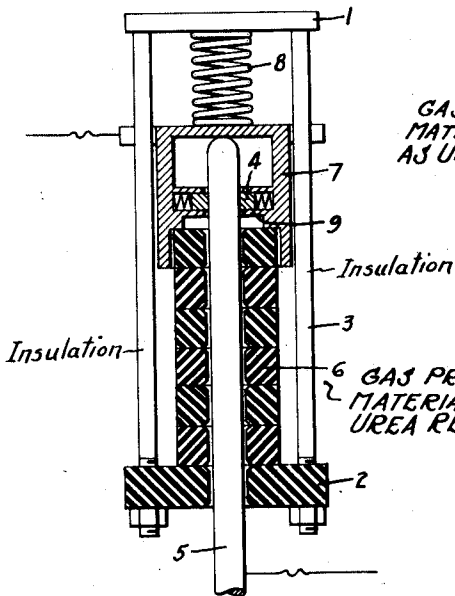


Fig. 2.

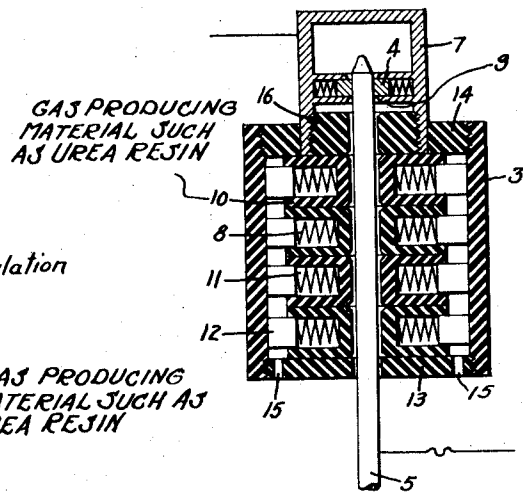


Fig. 4.

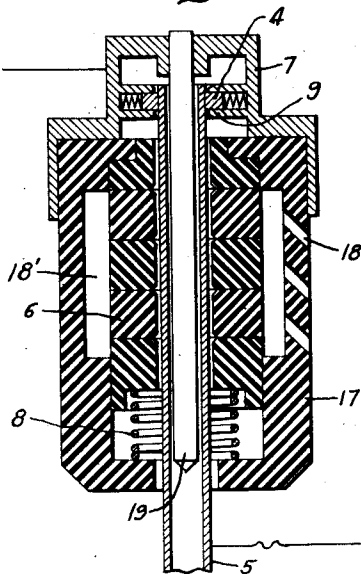
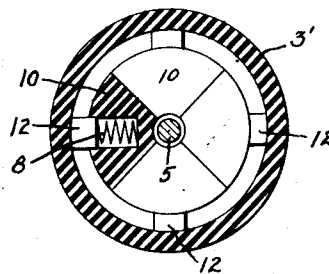


Fig. 3.



Inventor:
Vitaly Grosse,
by *Harry E. Dunkley*
His Attorney.

UNITED STATES PATENT OFFICE

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ELECTRIC CIRCUIT INTERRUPTER

Vitaly Grosse, Berlin-Lichterfelde, Germany, assignor to General Electric Company, a corporation of New York

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5 Claims. (Cl. 200-149)

My invention relates to electric circuit interrupters, more particularly to those of the gas generating type wherein an arc extinguishing gas is formed by the action of the arc heat on adjacent arc confining structure.

In circuit interrupters of this type, it has been proposed to use an insulating tube forming a sleeve-like arc chamber that is vented intermediate its ends for the purpose of facilitating arc interruption throughout a wide range of current values. In such an arrangement, however, arc interruption in the case of comparatively weak currents is often delayed until the arc is drawn throughout the length of the tube. This is due to the fact that the building up of sufficient extinguishing pressure is delayed by reason of the intermediate vents.

In accordance with the present invention, the extinguishing chamber is normally closed during formation of the arc except in the case of predetermined arc pressure when venting passages are automatically formed laterally of the arc chamber. Therefore, in the case of weak currents, an adequate extinguishing pressure is assured by reason of the confined arc gases under pressure, and in the case of large or short circuit currents, venting passages are automatically formed regardless of the arc length for immediately venting the arc chamber. More specifically the chamber is preferably composed of a plurality of individual segments of gas yielding material normally biased to arc confining position arranged for relative movement so as to form said venting passages and also to increase the effective gas yielding surface of said material.

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, Fig. 1 is an elevational view, partly in section, of an electric circuit breaker embodying my invention; Fig. 2 is a similar view showing another form my invention may assume; Fig. 3 is a plan view, partly in section, of the circuit breaker shown by Fig. 2, and Fig. 4 is an elevational view, partly in section, of a modified form of the breaker shown by Fig. 1.

The circuit breaker shown by Fig. 1 comprises a supporting frame for the relatively movable contacts and arc chamber comprising a pair of fixed end plates 1 and 2 spaced by insulating

supporting rods 3. The arc forming means, such as the separable contacts 4 and 5, can be of any suitable type, such as the fixed segmental contact 4 and coacting movable contact rod 5 arranged to make plug and socket contact engagement as shown. Upon separation of the contacts, the arc is drawn along a generally rectilinear path within a closely confining sleeve-like arc chamber formed in the present instance by a plurality of segments or disk-like insulating members 6. The members 6 are stacked in superposed relation between the insulating end plate 2 and the contact carrier 7 which is of piston-like construction and guided for reciprocal movement by the frame rods 3. A spring 8 biases the contact carrier 7 and the segments 6 in compression with respect to the end plate 2.

The disk-like members 6, which are preferably composed of a material, such as urea resin, adapted to yield an arc extinguishing gas when subjected to the arc heat, are provided with aligned central openings, as is the end plate 2, for receiving in closely confining relation the rod contact 5.

Accordingly as the contacts separate to form an arc at the contact flange 9, the arc pressure when sufficiently great overcomes the bias of spring 8 to cause relative axial movement between the contact carrier 7 and the individual segments 6 so as to form passages for laterally and radially venting the arc chamber. As the segments 6 are separated by the momentary high arc pressure, the heated arc gases in flowing between the segments make contact with additional gas yielding surfaces so that the amount of arc extinguishing gas is appreciably increased. This increase in the amount of the arc extinguishing gas is particularly important at this time, since the segments are separated to the greatest extent in the case of heavy or short circuit currents. Furthermore, the spring pressure can be adjusted so that a strong expulsive action takes place as the segments 6 separate to an extent depending on the arc pressure. In the case of weak currents, the spring 8 maintains the segments in pressure confining relation to the arc so that sufficient extinguishing pressure is rapidly built up.

In the arrangement shown by Fig. 2, the segments 10, instead of being relatively movable longitudinally or axially of the arc path, are individually movable in radial directions with respect thereto. As illustrated, the segments are individually biased into pressure confining relation by springs 8 that are seated within recesses

11 in the segments and within fixed guide pins 12. As shown by Fig. 3, the segments 10 are of sector shape, four segments being shown by way of example for each of the stacked disk-like structures, indicated in Fig. 2. An apparent advantage of this arrangement wherein the segments move radially lies in its compact axial dimension.

It will, therefore, be apparent that localized arc pressure within the sleeve-like chamber can bias at that point one or more segments outwardly in a radial direction against the spring tension at 8 to form gas venting passages. As in the previous instance the gas is vented outwardly in a radial direction and, in the case of heavy arc currents, the additional gas yielding surface exposed by relative movement of the segments 10 produces additional arc extinguishing gas under influence of the arc heat. Where the segments are mounted for relative radial movement, the axial bias should be such that excessive friction is precluded.

For the purpose of housing the main arc chamber and associated biased springs, the fixed contact carrier 7 has mounted in depending relation thereon, a housing 3' comprising insulating end plates 13 and 14 for the cylindrical housing 3'. The housing 3' is concentrically spaced with respect to the arc chamber so as to form an annular gas passage which can be vented through the lower end plate 13 by openings 15. If desired, a disk-like member 16 also composed of a suitable gas yielding material can be positioned in the contact carrier 7 immediately beyond the point of initial separation of the contacts so as to insure an immediate supply of arc extinguishing gas.

The springs 8 also can be graduated with respect to biasing force along the arc path so as to facilitate interruption of a wide range of currents. In such a case the springs at the end of the arc path are weaker so that low arc currents can be more effectively interrupted by the explosive action of the gas. High arc currents are interrupted at shorter arc lengths in the manner above described. It will be apparent that in some cases it may be desirable to have some of the segments fixed.

In the modification shown by Fig. 4, the gas yielding members 6 of the arc chamber are biased together as in the case of Fig. 1 by a spring 8 that is seated between the lower wall of a housing 17 and the lower segment of the arc chamber structure. The contact carrier 7, as in the case of Fig. 2, has mounted thereon in depending relation a cylindrical housing 17 that is provided in the present instance with laterally disposed venting passages 18 communicating with the annular gas passage 18' into which gas from the arc chamber is expelled when the segments 6 are separated by arc pressure. The wall structure of the housing 17 can also be composed of a gas-yielding material, at least where it is subjected to the heated arc gases.

In the present instance the contact structure is slightly modified, the movable rod contact 5 being of tubular form for receiving a fixed insulating pin 19 composed of gas yielding material secured to the contact carrier 7. The arc is thereby confined within a restricted annular passage, both walls of which are composed of gas yielding material.

A practical advantage of a circuit interrupter constructed in accordance with the present invention, is that of easy and inexpensive main-

tenance, particularly in the case of heavy duty operation. In view of the fact that the gas yielding material necessarily deteriorates under the influence of arcing, replacement of such material may be necessary from time to time. In the case of a tubular switch chamber, complete replacement thereof may be necessary even though the material damaged due to arcing is quite localized, for example, at a point two or three inches from the initial point of arcing. However, in the present case, the segments that are composed of gas yielding material can be individually replaced as required so that the replacement factor is greatly minimized.

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 generating type comprising relatively movable contacts separable to draw an arc along a generally rectilinear path, a sleeve-like arc chamber closely confining said arc comprising a plurality of individual sector-like segments adapted to yield an arc extinguishing gas under influence of the arc heat normally in said arc confining position, said segments being relatively movable to form venting passages therebetween for said chamber, and spring means for biasing said segments radially with respect to said arc so as normally to oppose the arc pressure in said chamber within predetermined limits.

2. An electric circuit breaker of the gas generating type comprising relatively movable contacts separable to draw an arc along a generally rectilinear path, a plurality of individual insulating members positioned along said rectilinear path and normally surrounding the same in radial relation to form a sleeve-like arc chamber, said members being composed at least in part of a gas-yielding material for aiding arc interruption, and spring means for biasing at least some of said members radially toward a confining position with respect to said arc, said spring means being related to a predetermined arc pressure for permitting individual relative movement of said members to increase the effective gas-yielding surface and to form venting passages for the arc gases.

3. An electric air circuit breaker comprising relatively movable contacts separable to draw an arc along a generally rectilinear path, a closely confining sleeve-like arc chamber therefor comprising a plurality of insulating sector-like segments positioned in superposed relation along said path, said segments being relatively movable laterally in radial directions with respect to said path so as to form gas venting passages therebetween for said chamber, and spring means for individually biasing said segments radially toward the arc confining position whereby selective movement of said segments in response to predetermined arc pressure is provided.

4. An electric circuit breaker comprising relatively movable contacts separable to draw an arc along a generally rectilinear path, a plurality of disk-like structures in stacked relation arranged to form a sleeve-like arc chamber, at least some of said disk-like structures comprising a plurality of individual segments relatively movable in radial directions with respect to the arc path

to form arc venting passages for said chamber, and spring means for biasing at least some of said segments radially to confine said arc, said spring means permitting individual movement of one or more of said segments independently of adjacent segments.

5. An electric circuit breaker comprising relatively movable contacts separable to draw an arc along a generally rectilinear path, a plurality of individual insulating members positioned along said rectilinear path and normally surrounding

the same to form a closely confining arc chamber, and spring means for individually biasing at least some of said members laterally toward an arc confining position, said spring means being graduated as to biasing force so that the insulating members most remote from the point of initial arc formation can separate under reduced arc pressure to form venting passages for said chamber.

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