United States Patent

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[33] **Italy**
[31] **15036A/69**

[54] **BREAKING CHAMBER FOR SELF-BLASTING COMPRESSED GAS ELECTRIC CIRCUIT BREAKERS**
4 Claims, 3 Drawing Figs.

[52] **U.S. Cl.** ..... **200/148 G**
[51] **Int. Cl.** **H01h 33/86**
[50] **Field of Search** ..... 200/148 A, 150 G

[56] **References Cited**

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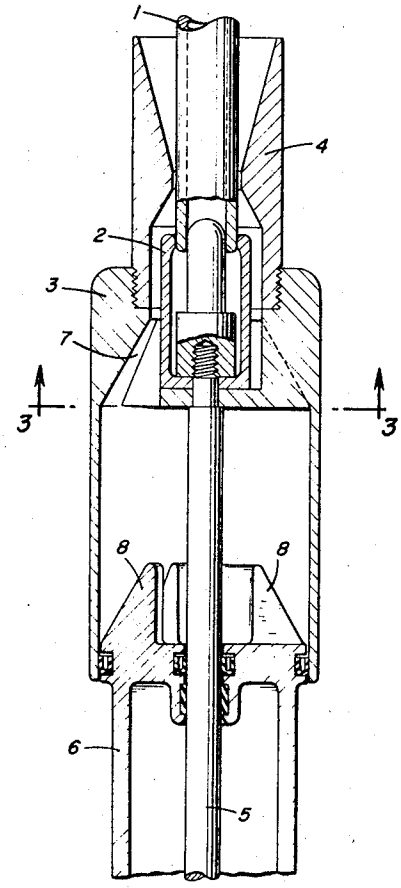
ABSTRACT: An improved self-blasting compressed gas electric circuit breaker having a cylindrical member axially slidable on a fixed piston and forming a breaking chamber therebetween. The chamber contains the breaking gas and further comprises a plurality of recesses formed in one end of the cylindrical member with a like number of projections formed on the fixed piston complementary to the recesses. The recesses and projections preferably have a substantially truncated cone shape with a wide base. When a projection enters into a recess, the residual volume of the latter is reduced to a minimum upon the opening of the contacts. The recesses directly communicate with the cylindrical cavity defined between the known orifice structure and the fingers of the tulip-shaped movable contact and serve to break up the undesirable whirling motion of the gas heretofore formed in the known circuit breakers of this type.



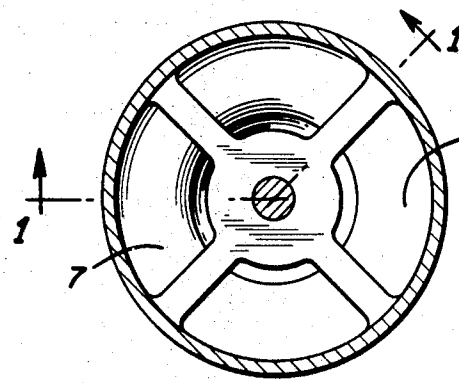


FIG. 3

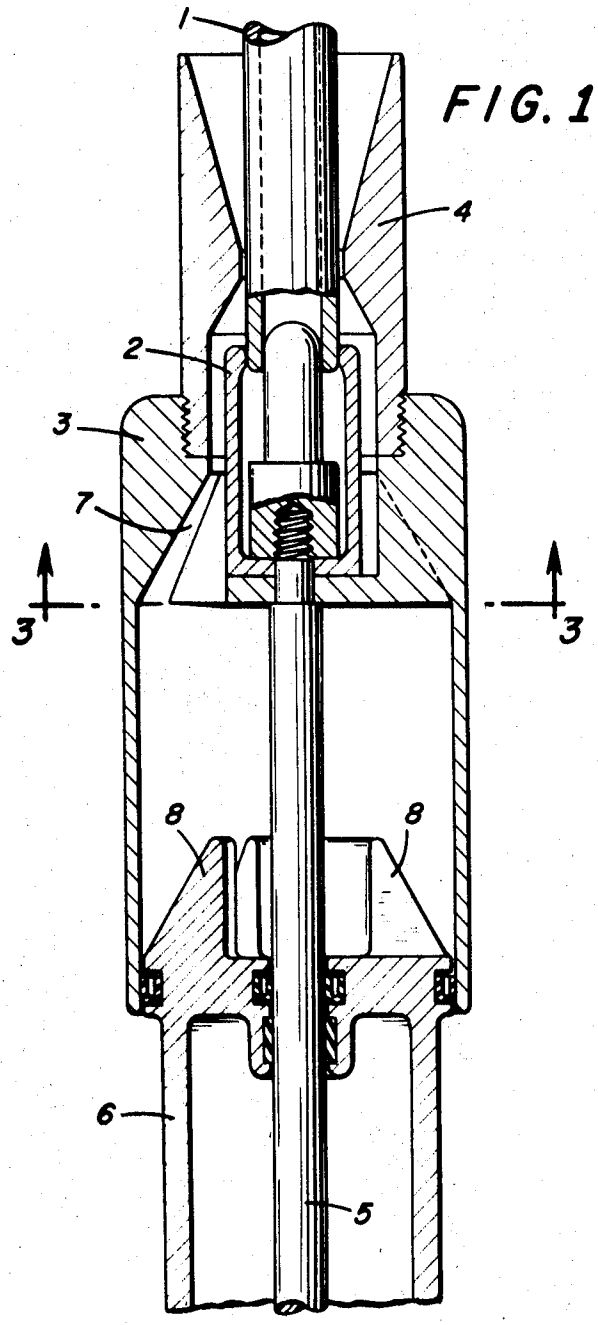
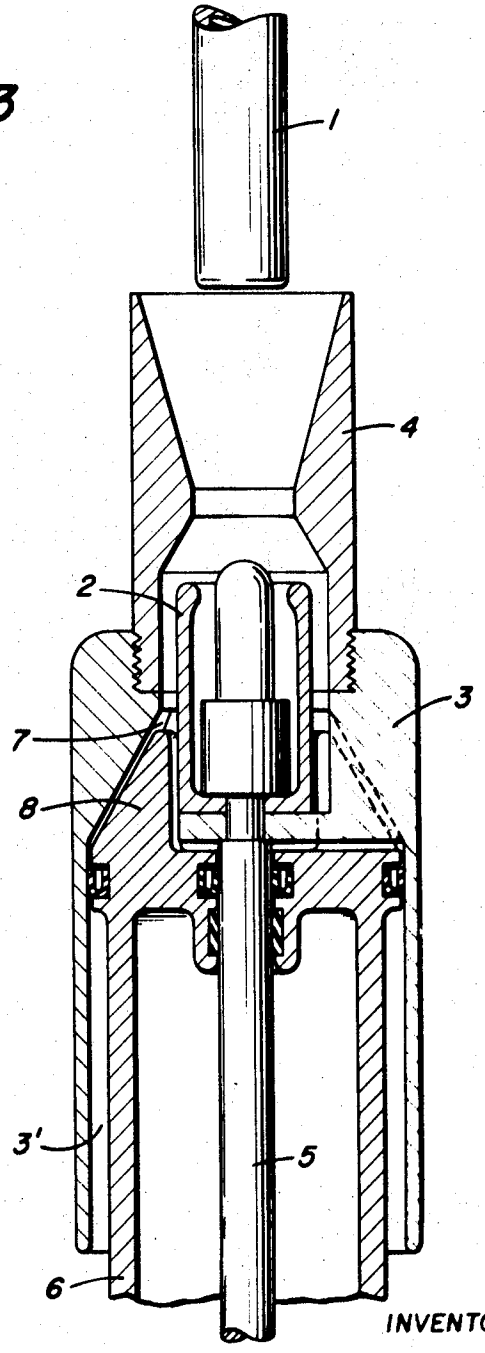


FIG. 1

FIG. 2



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BREAKING CHAMBER FOR SELF-BLASTING COMPRESSED GAS ELECTRIC CIRCUIT BREAKERS

The present invention relates to an improvement in the quenching means of the breaking chambers for self-blasting compressed gas circuit breakers, which improvement adapts said breakers for improved breading capacity especially when very high currents are involved.

It is well known that self-blasting compressed gas circuit breakers generally include a fixed contact and a moving contact preferably of a tulip shape. The moving contact is fixedly connected to the bottom of a cylindrical member containing compressed gas and to an orifice structure or nozzle wherein the arc quenching takes place as a consequence of the axial gas blast proceeding from said cylindrical chamber.

This cylindrical member is mounted to slide axially on a fixed piston thereby varying the volume of the chamber therein. The operational principle of the circuit breakers lies, as is known, in the quick arc breaking carried out by a gas blast generated by the relative displacement of the contacts themselves. Such arc breaking becomes more effective and quicker as the axial gas blast becomes more rapid, i.e. the more limited are the whirling motions of the gas in the passages leading from the chamber to the nozzle. These whirling motions or eddy currents that have always developed in the known circuit breakers are undesirable since they result in losses of gas flow which can often be of appreciable importance.

It is an object of this invention to provide a compressed gas chamber in a gas blast circuit breaker which remarkably increases the breaking capacity of the breaker, particularly when very high currents are involved.

Another object of the present invention is to provide an improved compressed gas chamber having higher duty capacities without altering the circuit breaker characteristics, which are necessary for a correct operation when very high currents are to be broken.

These and further objects, which can be more clearly appreciated with the help of the following detailed description, are in practice obtained through the provision of a compressed gas chamber for a self-blasting compressed gas electric circuit breaker having the moving contact fixed to the bottom of a cylindrical member having a chamber filled with the quenching compressed gas and which is slidably mounted on a piston fixed to a support base. The compressed gas chamber according to the present invention is provided with a plurality of openings or recesses formed in one end of the cylindrical member. The openings or recesses preferably have substantially the shape of a truncated cone with the wide base thereof directed inwardly towards the chamber. A corresponding plurality of projections are provided on the upper surface of the fixed piston and are shaped complementary to the recesses. The projections, upon opening of the circuit breaker contacts, extend into the respective recesses and reduce the residual volume thereof to the minimum at the end of the opening stroke of the contacts. The substantially truncated cone-shaped recesses are in direct communication with a cylindrical cavity formed between the known orifice structure of the arc suppression nozzle and the fingers of the tulip-shaped movable contact.

The improvements of the present invention more particularly allow for an increase in the compression ratio of the circuit breaker, namely, an increase in the ratio between the maximum volume of the gas-containing cylinder (the dead spaces as far as the cross section of the proper nozzle included) and the corresponding residual minimum volume at the end position of the opening stroke of the circuit breaker.

The means for accomplishing the foregoing objects and other advantages, which will be apparent to those skilled in the art, are set forth in the following specification and claims and are illustrated in the accompanying drawings dealing with a basic embodiment of the present invention. Reference is made now to the drawings in which:

FIG. 1 is a schematic longitudinal section of a portion of a self-blasting circuit breaker with the contacts closed;

FIG. 2 is a schematic longitudinal section, similar to FIG. 1, with the contacts in the open position; and

FIG. 3 is a schematic transverse cross section taken along line 3—3 of FIG. 1 and showing the bottom of the cylindrical member.

The circuit breaker of the present invention comprises a compressed gas circuit breaker having a fixed contact 1 and a movable contact 2, which is of the type having a tulip shape and is connected to the bottom of a hollow cylindrical member 3. A chamber 3' is formed within the member and contains the compressed gas. The member 3 is driven by a control rod 5 to axially slide on a piston-shaped body 6. An arc suppression nozzle 4 (or like orificed structure) is connected to the upper end of the cylindrical member in communication with the chamber.

The inventive circuit breaker is adapted to remarkably improve the performance of a gas-blast circuit breaker in its ability to interrupt very high currents. This is accomplished by forming a plurality of recesses 7, which are preferably at least four in number and are uniformly and evenly spaced on the closed end of the cylindrical member 3. These recesses are preferably substantially shaped in the form of truncated cones having a wide base directed toward the chamber 3'. The recesses 7 are actually sections of a slanted cone-shaped body having a cone generatrix, which is perpendicular to the base plane, coaxial with the body formed by the fingers of movable contact 2.

The present invention also provides a plurality of projections 8, shaped complementary to the recesses 7 and being of a like number, protruding from the head of the fixed piston 6. These projections are of such shape and dimensions that when the circuit breaker contacts are open, as shown in FIG. 2, the projections almost completely fill the recesses. Thus, the insertion of the projections into the recesses reduces the volume of the recesses to a minimum.

The best results are obtained in practice by increasing the base of recesses 7 as much as possible and by reducing their conicalness. This shape substantially eliminates the whirling or eddy current motion of the gases while reducing the flow losses to a minimum.

As shown in FIG. 3, the recesses are preferably four in number and their bases have the shape of a circular sector with the widest possible area compatible with the end of the member 3.

The present invention may be embodied in other specific forms without departing from the spirit or essential characteristics thereof. The present embodiment is therefore to be considered in all respects as illustrative and not restrictive, the scope of the invention being indicated by the appended claims rather than the foregoing description, and all changes which come within the meaning and range of equivalency of the claims are therefore to be embraced therein.

What is claimed is:

1. A self-blasting compressed gas electric circuit breaker comprising a fixed contact, a tulip-shaped movable contact, an orificed member surrounding said movable contact, a cylindrical member having therein a compressed gas chamber, a fixed piston, said cylindrical member being axially slidably mounted on said fixed piston, a plurality of recesses formed in one end of the cylindrical chamber, and a like plurality of projections fixed to said piston and directed towards said recesses, said projections and recesses having complementary shapes, said projections being received in said recesses to reduce the residual volume thereof to an absolute minimum at the end of the opening stroke of said contacts, said recesses providing direct communication between the chamber and the orificed structure around the fingers of the tulip-shaped movable contact.

2. An electric circuit breaker according to claim 1 wherein said recesses and said projections have the shape of a slanting truncated cone with a wide base, the generatrix of said cone, perpendicular to a base plane, being coaxial with the fingers of the tulip-shaped movable contact.

3. An electric circuit breaker according to claim 1 in which the base section of said recesses is circular-shaped and the sum of said base sections is as high as possible and yet compatible with the inner dimensions of the chamber wherein said gas is contained.

4. A self-blasting compressed gas circuit breaker comprising a fixed contact, a tulip-shaped movable contact, a hollow cylindrical member fixedly connected to and movable with said movable contact, an orifice member extending from said cylindrical member past said movable contact to enclose said contacts in the contacts closed position, a fixed piston, said cylindrical member being axially movably mounted on said

fixed piston forming a chamber therebetween, a plurality of recesses formed in said cylindrical member at the end opposite said fixed piston, said recesses providing direct communication between said chamber and said orifice member, a like plurality of projections formed on said piston and directed toward said recesses, said projections being complementary in shape to said recesses and extending therein, in a contact open position, to substantially fill the entire volume thereof whereby swirling of the gas in said chamber is reduced to a minimum upon opening of said contacts.