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ACCELERATED BREAK CIRCUIT INTERRUPTER

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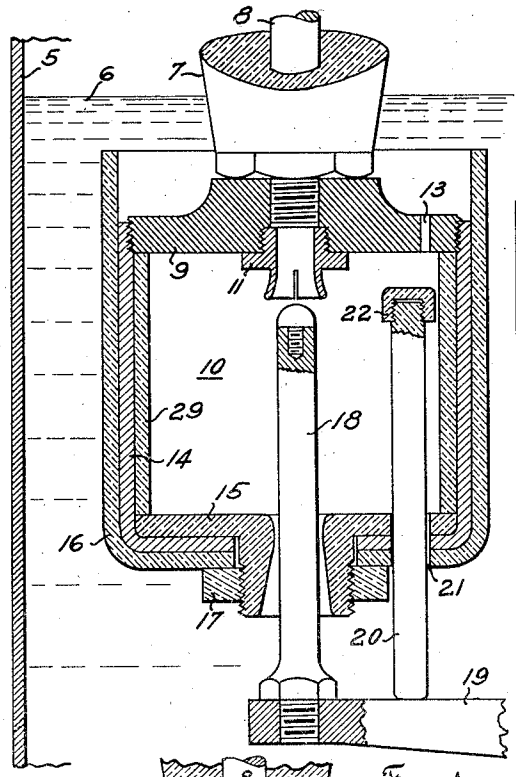


Fig. 1

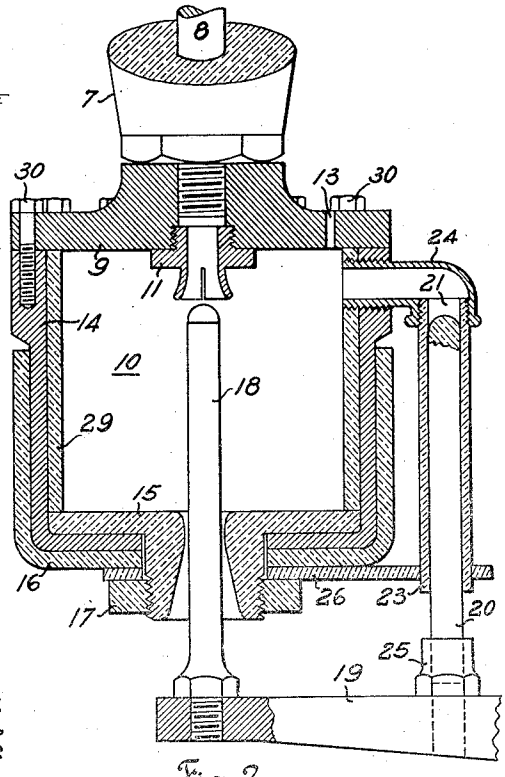


Fig. 2

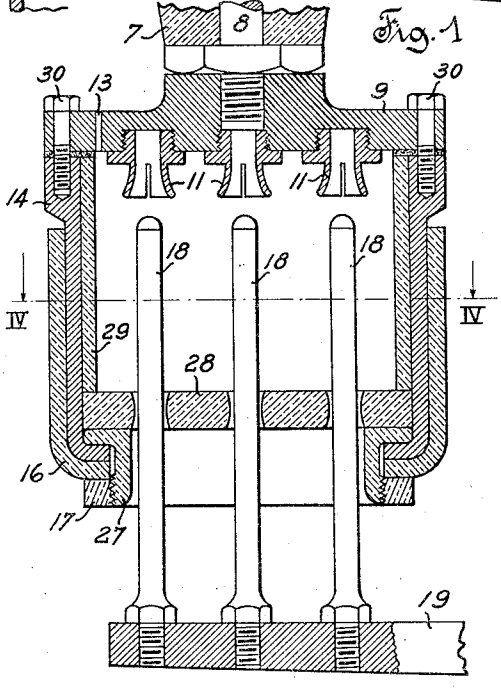


Fig. 3

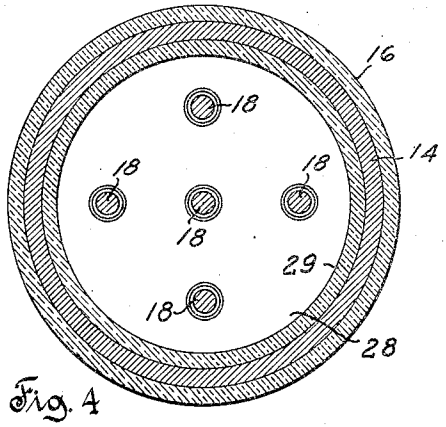


Fig. 4

Inventor
J. D. Hilliard
by
Attorney

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ACCELERATED BREAK CIRCUIT INTERRUPTER

John D. Hilliard, Glens Falls, N. Y.

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8 Claims. (Cl. 200—150)

This invention relates in general to circuit breakers and more particularly to circuit breakers of the pressure pot type having means for accelerating the interruption of the current by utilizing the pressure generated within the pressure pot to increase the contact separating speed and by providing the pressure pot with a plurality of small discharge throats.

The major factor which determines the interrupting capacity of a circuit breaker is the amount of gas generated during circuit interruption. In general, the amount of gas generated is proportional to the kv-a interrupted and the arcing time. The arcing time may be reduced by increasing the speed of separation of the contacts.

It is known that the pressure generated by an arc within the pressure pot of a circuit breaker will act upon the movable contact rod and this principle has been utilized in British Patent No. 147,456, April 28, 1921, however, if the movable contact rod is fixedly secured to the contact operating arm, to avoid the use of pigtail conductors, the movable contact must be of large diameter in order to obtain an appreciable increase in contact speed. An increase in the diameter of the contact rod necessarily increases the size of the throat opening through which the contact rod passes. It is known that pressure pots having large throat openings are less efficient in extinguishing an arc than pressure pots having smaller throat openings.

It is therefore an object of the present invention to improve the operation of a circuit breaker of the pressure pot type by providing one or more auxiliary plungers which extend into the pressure pot and are acted upon by the pressure generated within the pressure pot to increase the separating speed of the movable contacts.

Another object of the invention is to provide a circuit breaker of the pressure pot type with one or more auxiliary contact accelerating plungers in order that the discharge opening or openings through which the arc is drawn may be of efficient size.

A further object of the invention is to provide a circuit breaker of the pressure pot type with a plurality of small movable contact rods cooperating with small discharge openings so that the arc which is drawn by certain of these contacts may be readily extinguished in the discharge openings and the other contact rods may be utilized to accelerate the interrupting movement of the circuit breaker.

A still further object of the invention is to provide a circuit breaker of the pressure pot type with a plurality of parallel connected movable contacts withdrawable through a plurality of discharge orifices to break contact with a plurality of parallel connected stationary contacts within the pressure pot.

These and other objects and advantages are attained by this invention, various novel features of which will be apparent from the description and drawing herein, and will be more particularly pointed out in the claims.

Various illustrative examples of the application of this invention are shown in the accompanying drawing in which:

Fig. 1 is a vertical section view of a circuit breaker having mechanism associated with the pressure pot thereof embodying the present invention;

Fig. 2 is a vertical section view of a modified form of a circuit breaker pressure pot mechanism embodying the present invention;

Fig. 3 is a vertical section view of another form of circuit breaker embodying the present invention; and

Fig. 4 is a horizontal section view of Fig. 3 taken along the line IV—IV.

Referring now to Fig. 1, 5 is a circuit breaker tank which contains a body of arc extinguishing liquid 6. An insulating bushing 7 is supported from the housing (not shown) of a circuit breaker and has a conductor rod 8 extending therethrough. The upper wall 9 of a pressure pot 10 is secured to bushing 7 by any suitable known means such as conductor 8. A stationary contact 11, here shown as of the "tulip" type, is secured to wall member 9. Bleeder openings 13 are provided in the wall member 9. A shell member 14 is suitably secured to wall member 9 and is provided with an aperture in the bottom thereof through which throat bushing 15 of insulating material projects. An insulating tube 29 within shell member 14 serves to insulate the interior of the pressure pot. Insulating shell member 16 surrounds shell 14 and is held in place by suitable means such as insulating nut member 17. A movable contact rod 18 normally extends through the throat opening of bushing 15 into engagement with stationary contact 11 and is fixedly secured to contact actuating member 19 which is operated by any suitable known mechanism which is not shown for the sake of simplicity.

An auxiliary plunger member 20, preferably of insulating material, extends through an opening 21 in the pressure pot 10 and is preferably provided at one end with a cap member 22, noting

that the other end thereof abuts against contact actuating member 19.

Upon circuit interrupting movement of contact actuating member 19, an arc will be drawn between movable contact 18 and stationary contact 11 within pressure pot 10 which is normally filled with arc extinguishing liquid. The heat of said arc will dissociate a portion of this liquid and thereby generate pressure which will operate on the plunger member 20 to increase the downward speed thereof. Inasmuch as the combined cross-sectional area of contact 18 and plunger 20 is subjected to the pressure within pressure pot 10, contact 18 will be moved downwardly at high speed thus minimizing the amount of gas generated within pressure pot 10 and thus enabling the orifice in throat bushing 15 to be made sufficiently small that a highly effective blast of arc extinguishing liquid is projected in the path of the arc upon the movement of contact 18 through the throat bushing. It is to be understood that plunger 20 may be secured to contact actuating member 19 in the manner shown in Fig. 2 if desired, and hole 21 may have an insulating bushing.

Fig. 2 is substantially the same as Fig. 1 except that the auxiliary plunger 20 is secured to contact actuating member 19 by means of member 25 and is slidable in a tube 23 of insulating material which is in communication with the interior of pressure pot 10 by way of nipple member 24 which with member 23 forms an auxiliary passageway 21. In Fig. 2 a bracket member 26 is interposed between thread nut member 17 and shield member 16 in order to hold tube member 23 firmly in position.

The operation of Fig. 2 is substantially the same as that described in connection with Fig. 1 except that, as shown in Fig. 2, auxiliary plunger member 20 may be completely withdrawable from tube member 23. Upon withdrawal of plunger rod 20 from tube member 23, the accelerating action thereof will cease, however, it is to be understood that the length of plunger rod 20 may be shorter or longer than as shown in Fig. 2 in order that the duration of this action may be controlled.

In Fig. 3 a plurality of stationary contacts 11 are secured to the upper plate member 9 which serves to connect these contacts in parallel. As here shown, contacts 11 are of the "tulip" type, however, other known types of contacts may be used, such as spring biased butt contacts. A throat bushing member 27 is secured to shell member 14 by means of nut member 17 which also serves to hold insulating shield 16 in place. A bottom plate member 28 of insulation with a plurality of discharge orifices therein is here shown as resting on member 27 and is held in place by inner shield member 29 which is biased downwardly by the clamping action of bolts 30. A plurality of movable contacts 18 are secured to contact actuating member 19 and are thus connected in parallel. Although five movable contacts have been shown, it is to be understood that the number of contacts may be increased or decreased, noting that a symmetrical arrangement should be maintained in order that the forces acting on the movable contacts due to the pressure within pressure pot 10 will not cause actuating member 19 to tilt or move out of alinement.

Contact actuating member 19 is operated by any suitable known operating mechanism (not shown) which usually comprises a spring capable of moving contacts 18 to their lowermost position in a predetermined time. By reason of the fact that the combined cross-sectional area of contact rods 18 is preferably greater than the cross-sectional area of a single contact would be in a conventional pressure pot breaker, the pressure action on contacts 18 will considerably augment the downward speed of these contacts thus reducing the arcing time of the breaker. A single contact rod having the same cross-sectional area as the total cross-sectional area of contact rods 18 would require a throat discharge opening so large that efficient throat action could not be secured, that is, the velocity and turbulence of the discharge of arc extinguishing fluid through the throat would not be sufficient to rapidly extinguish the arc.

Upon downward movement of contacts 18 one or more arcs will be drawn through the discharge orifices in plate member 28 and inasmuch as these orifices are only slightly larger than the relatively small contact rods 18 a highly efficient blast action is obtained as well as an increase in the downward speed of the contacts 18 due to the pressure action thereon. In service the renewable tips on contact rods 18 will be gradually burned away, however, the longest contact rods, that is, the last ones to break contact, will take the greatest amount of burning so that the contact rods will automatically maintain substantially the same length. It is thus apparent that a circuit breaker such as above described will require less inspection and less renewal of contacts.

The use of the present invention permits the throat orifice area to be designed entirely on the basis of efficiency of throat action, and not dependent upon the movable contact size which will give proper opening speed due to the piston action. Such design permits the throat to be made sufficiently small so that the arc therein is confined in a region of great turbulence, cooling and deionization, whereas if the throat is designed large enough to permit movement therethrough of a moving contact large enough to provide the desired contact separating speed due to the piston action, it does not provide the necessary confinement of the arc so that the throat action due to turbulence, cooling and deionization is sufficiently efficient. With the throat size that which provides the most efficient throat action, the increased speed is obtained by the added piston members which are operatively independent of the throat size.

Although only a few embodiments of the present invention have been illustrated and described, it is to be understood that modifications and changes therein may be made by those skilled in the art without departing from the spirit of the invention or from the scope of the following claims.

It is claimed and desired to secure by Letters Patent:

1. In a circuit breaker, the combination of a pressure pot having a contact passageway and a second passageway therein, a stationary contact mounted within said pressure pot, a movable contact substantially closing said contact passageway and extending therethrough for engagement with said stationary contact, a movable contact carrying member operable to disengage said movable contact from said stationary contact to draw a pressure generating arc within said pot, and means utilizing said pressure for accelerating the disengaging movement of said movable contact comprising an auxiliary member operable in said second passageway independently of the cross sectional area of said contact passageway.

2. In a circuit breaker, the combination of a pressure pot having a discharge passageway therein, the cross sectional area of said passageway being sufficiently small to provide efficient throat action of said circuit breaker during interruption, a fixed contact mounted within said pressure pot, a movable contact member withdrawable through said discharge passageway to break contact with said fixed contact and thereby draw a pressure generating arc in said pressure pot, and means for accelerating the speed of said moving contact comprising piston means within said pressure pot.

3. In a circuit breaker, the combination of a pressure pot immersed in an arc extinguishing liquid and having a discharge orifice of a size providing substantial throat efficiency, a fixed contact mounted within said pressure pot, a contact actuating member, a movable contact secured to said actuating member and withdrawable through said orifice to draw a pressure generating arc within said pressure pot, said pressure pot having another orifice therethrough, a piston device slidable through said another orifice into engagement with said contact actuating member and operable to increase the contact separating speed of said contact actuating member in response to the pressure generated within said pressure pot.

4. In a circuit breaker, the combination of a pressure pot immersed in an arc extinguishing liquid and having a discharge orifice, a fixed contact mounted within said pressure pot, a contact actuating member, a movable contact secured to said actuating member and withdrawable through said pressure pot and said orifice and cooperable with said fixed contact to draw a pressure generating arc within said pressure pot, said pressure pot having another discharge orifice therethrough, another movable contact provided with a closed end and slidable through said another orifice and secured to said contact actuating member, said another contact member being operable to increase the contact separating speed of said contact actuating member in response to the pressure generated within said pressure pot.

5. In a circuit breaker, the combination of a pressure pot having a plurality of discharge passageways therein, a plurality of stationary contacts mounted within said pressure pot in alinement with said passageways, a plurality of movable contacts normally closing said passageways and extending therethrough into engagement with said stationary contacts respectively, a contact actuating member operable to withdraw said movable contacts from said pressure pot through said discharge passageways to cause at least one pressure generating arc within said pressure pot, said movable contacts also serving as pistons to increase the contact separating speed of said contact actuating member in response to the pressure generated within said pressure pot.

6. In a circuit breaker, the combination of a pressure pot having a plurality of discharge passageways therein, a plurality of stationary contacts multiply connected and mounted within said pressure pot in alinement with said passageways, a plurality of movable contacts normally closing said passageways and extending therethrough into engagement with said stationary contacts respectively, a contact actuating member connecting said movable contacts in multiple and operable to simultaneously withdraw said movable contacts through said discharge passageways to draw at least one arc within said pressure pot and through at least one of said discharge passageways.

7. In a circuit breaker, the combination of a pressure pot immersed in an arc extinguishing liquid, said pressure pot having one wall of insulating material with a plurality of holes therein and an opposite wall of conductive material, a plurality of stationary contacts mounted on said conductive wall in alinement with said holes respectively, a contact actuating member, a plurality of movable contacts provided with substantially closed ends and mounted on said actuating member and arranged for simultaneous withdrawal through said holes to draw a plurality of arcs in parallel through said holes, whereby the arc extinguishing liquid within said pressure pot is caused to blast in the path of said arcs.

8. An oil circuit breaker of the type comprising a pressure chamber, a stationary contact mounted in said chamber, a discharge orifice in said chamber in alinement with said stationary contact, a contact movable through said orifice and cooperating with said stationary contact to draw a pressure generating arc, and means for accelerating the operating speed of said movable contact, said means comprising additional discharge orifices of an area less than the area of said first said discharge orifice, said means further comprising additional moving contact members operating through said additional discharge orifices.

JOHN D. HILLIARD.