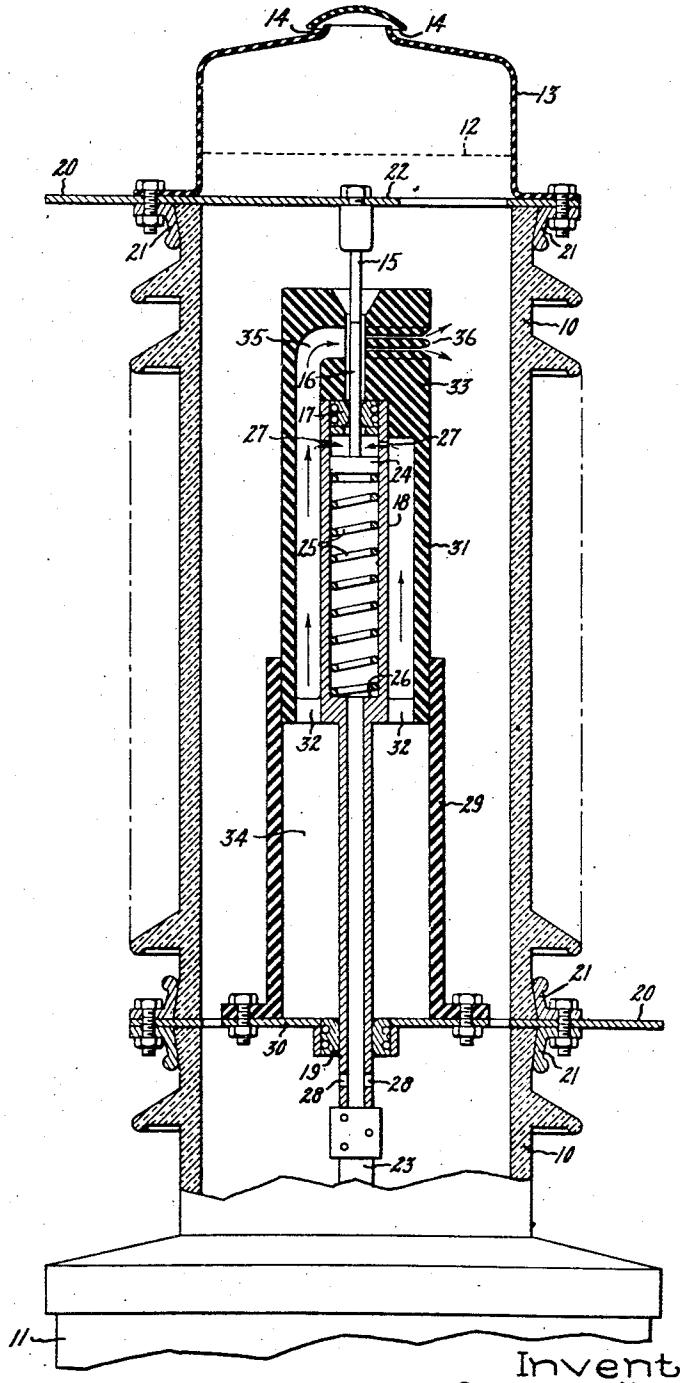
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ELECTRIC CIRCUIT BREAKER

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ELECTRIC CIRCUIT BREAKER

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This invention relates to electric circuit breakers, and more particularly to circuit breakers of the fluid blast type.

It is an object of this invention to provide a circuit breaker of the above type which provides for rapid separating movement of the switch contacts and which is characterized in its operation by substantial freedom from restriking of the arc after it has once been extinguished.

It is another object of the invention to provide a simple and compact construction which provides for a more effective use of the arc-extinguishing fluid as a pressure medium for actuating the movable contact of a circuit breaker.

Further objects and advantages of the present invention will become apparent as the following description proceeds, reference being had to the accompanying drawing in which the single figure is an elevational view in section of a circuit breaker embodying the invention.

In the particular arrangement illustrated in the drawing the invention is shown embodied in an oil circuit breaker of the cross-blast type. It will be apparent as the following description proceeds that many features of the invention are not limited to such a circuit breaker and are capable of general application.

Referring to the drawing, the circuit breaker comprises a cylindrical housing which may be made up of a plurality of hollow insulating bushings 10, secured together in any suitable way and mounted on a base 11 which houses a suitable switch-operating mechanism (not shown). The cylindrical housing contains a quantity of suitable insulating fluid, such as oil, the level of which is indicated by the dotted line 12. The upper end of the switch housing is closed by a cap member 13 which is provided at the top with suitable vent openings 14 to provide for the escape of gases liberated during the circuit-interrupting operation of the switch.

An electric circuit through the switch is completed in the closed circuit position thereof through a stationary contact 15, a movable contact 16, wiping contact 17, a hollow conducting rod 18 and a wiping contact 19. Lead-in conductors 20 are brought into the housing at longitudinally spaced points and connected to the fixed contact 15 and wiping contact 19, respectively. Suitable sealing rings 21 are provided at the ends of the insulating bushings to secure them together and seal the housing to form a fluidtight receptacle. The fixed contact 15 is supported near the upper end of the housing and concentrically therewith by any suitable means such as a spider 22 which may be formed as an integral part of the associated lead-in conductor. The conducting rod 18 and the movable contact 16 form a two-part movable contact structure which is connected to an operating mechanism (not shown) by an insulating rod 23 coupled to the end of the conducting rod and extending into the switch-operating mechanism housing.

The movable contact 16 is in the form of a rod having a piston 24 on the inner end thereof lying within the hollow rod 18 which forms a cylinder in which the piston 24 is adapted to reciprocate. The contact 16 forms a continuation of the rod 18 and is normally biased to extended relationship with respect thereto by a helical compression spring 25 which is housed within the hollow rod between the piston 24 and a shoulder 26. The electrical circuit between the contact 16 and rod 18 is made through the wiping contact 17 which is mounted in the upper end of the rod. Ports 27 formed in the wall of the hollow rod 18 permit fluid to act upon the upper face of the piston 24 to move it relative to the rod against the bias of the helical spring 25. Ports 28 in the lower end of the rod permit the escape of fluid from the lower side of the piston 24.

In accordance with the present invention a compact and novel arrangement is provided for exerting a pressure on the arc-extinguishing fluid in proximity to the piston 24 and in the region of separation of the contacts to actuate the movable contact 16 and direct a fluid blast across the arc drawn between the contacts. A cylinder 29 of insulating material is mounted on a supporting spider 30 which extends across the switch housing. The spider also forms a support for the wiping contact 19 and may, as illustrated, be formed as an integral part of the lead-in conductor associated therewith. The cylinder extends upwardly into the housing and cooperates with a hollow piston 31 also of insulating material which is carried by and is movable in unison with the hollow rod 18. The piston 31 is secured to the rod by a spider 32 which extends across the lower end of the piston and by a block of insulating material 33 which partially surrounds the upper end of the rod. The block is preferably formed as an integral part of the piston 31. The interior of the piston 31 and cylinder 30 form a compression chamber 34 which communicates with the interior of the conducting rod through the ports 27 and with the

surrounding housing through a blast passage 35 which extends across the path of the movable contact and is provided at its outer end with arc-splitting baffles 36 of insulating material. The movable contact closes the blast passage 34 in the closed circuit position of the circuit breaker.

In the closed circuit position of the circuit breaker described above, the parts are in the relative positions shown in the drawing and a circuit is completed between the lead-in conductors 20 through the relatively movable contacts 15 and 16 as previously described. Upon the occurrence of abnormal conditions the operating mechanism of the switch (not shown) is moved to exert a downward pull on the hollow conducting rod 18. At this moment the compression chamber 34 is substantially closed since the movable contact 17 extends across the blast passage and cuts off communication between the interior of the piston 31 and the remainder of the switch housing. The pressure caused by the downward pull on the conducting rod forces fluid into the interior of the rod through the ports 27 and forces the piston 24 and the movable contact 16 downwardly. As the liquid passes into the interior of the rod the insulating piston 31 also moves downwardly so that the movable contact itself is subjected to two movements which are additive, that is, the movement of the hollow rod relative to the fixed contact and the movement of the movable contact relative to the hollow rod. This feature provides for fast opening movement at the start of the circuit-interrupting operation and insures that the distance between the fixed and movable contacts required to prevent restriking is obtained in a very short time. The movable contact is proportioned relative to the upper end of the piston 31 of insulating material so that it is withdrawn from the blast passage at substantially the time that the fixed and movable contacts have separated sufficiently to prevent restriking. At this time the blast of fluid acts upon the arc drawn between the contacts during separation and forces it into the passage 35 where it is lengthened and finally interrupted. The downward movement of the piston 31 maintains pressure on the piston 24 even after the blast passage is opened by the withdrawal of the movable contact 16. When the downward movement of the hollow rod is completed and with the blast passage open the movable contact 16 will immediately start its closing movement under the influence of the compression spring 25. In order to open the circuit permanently before closing movement of the contact 16 is initiated, a disconnecting switch may be provided and operated in timed relation with the opening movement of the circuit breaker contact. The disconnecting switch may be incorporated in the same housing with the circuit breaker contacts, or furnished as a separate unit which is either mechanically or electrically connected to operate in timed relation with the circuit breaker contacts.

From the preceding description it is apparent that the present construction provides an arrangement for rapidly operating the movable contact of an electric circuit breaker by a mechanism which subjects the movable contact to two movements which are additive and in a direction away from the fixed contact. The fluid which operates the movable contact 16 by acting on the piston 24 is put under pressure by the piston 31. Because of the proximity of the pistons only a small body of fluid need be moved by the piston 31 to cause movement of the contact 16 and consequently the system is characterized by small inertia forces and correspondingly rapid accelerations.

The present invention is well adapted for use in circuit breakers of the reclosing type because it insures a high operating speed. In such a construction it is necessary to arrange the disconnecting switch in such a manner that it will operate only after the desired number of reclosures have occurred.

While the invention has been shown and described in connection with an oil circuit breaker of the cross-blast type, it is apparent to those skilled in the art that many of the features of the invention are applicable to breakers employing other arc-extinguishing fluids which are directed in different relation to the arc, and it is intended in the appended claims to cover all modifications falling within the true spirit and scope of the invention.

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

1. An electric circuit breaker comprising a housing having a body of insulating fluid therein, a fixed contact and a movable contact mounted in said housing and separable to form an electric arc, said movable contact comprising two relatively movable parts one of which is connected to a switch-operating mechanism and the other of which engages said fixed contact in the closed circuit position of said circuit breaker, and means movable by said one part when moved toward open circuit position to force a portion of said fluid against a surface of the other part of said movable contact to cause relative movement therebetween in a direction to increase the speed of separation of said fixed and movable contacts.

2. An electric circuit breaker comprising a fixed contact, an operating member having a contact portion movably mounted thereon and normally biased to extended relation therewith in the closed circuit position of said breaker, said contacts being separable to draw an electric arc, and means operable by movement of said member in a direction away from said fixed contact to move said contact portion relative to said member in the direction of movement of said member whereby the speed of separation of said fixed and movable contacts is increased.

3. An electric circuit breaker comprising a housing having a body of insulating fluid therein, a fixed contact and a movable contact mounted in said housing and separable to form an electric arc, said movable contact comprising two relatively movable parts one of which is connected to a switch-operating mechanism and the other of which engages said fixed contact in the closed circuit position of said circuit breaker, a piston secured to said one part and a cylinder cooperating therewith to form a compression chamber, said piston being movable with said one part of said movable contact and effective to force said liquid against a surface of the other part of said movable contact to move said parts relative to each other in response to opening movement of said one part to increase the speed of separation of the fixed and movable contacts.

4. An electric circuit breaker comprising a housing having a body of fluid contained therein, a fixed contact, a movable contact structure including a hollow conducting rod having a contact portion movably mounted thereon, said con-

tact portion having a piston connected therewith lying within the walls of said hollow rod and biased to extended relationship therewith, a second piston secured to said movable contact structure, said hollow rod being connected to the operating mechanism of said switch and movable away from said fixed contact during the circuit-interrupting operation of said breaker, the movement of said hollow rod being effective to actuate said second piston to force a portion of said fluid into said hollow rod to move the contact portion thereof relative to said rod in a direction to increase the speed of separation of said contacts.

5. An electric circuit breaker comprising a housing having a body of fluid contained therein, a fixed contact, a movable contact structure including a hollow conducting rod having a contact portion movably mounted thereon, said contact portion having a piston connected therewith lying within the walls of said hollow rod and biased to extended relationship therewith, a second piston secured to said movable contact structure and shaped to define a blast passage communicating with the fluid in said housing, said hollow rod being connected to the operating mechanism of said switch and movable away from said fixed contact during the circuit-interrupting operation of said breaker, the movement of said hollow rod being effective to actuate said second piston and force a portion of said fluid into said hollow rod to move the contact portion thereof relative to said rod and to force a blast of fluid through the arc formed by separation of said contacts.

6. An electric circuit breaker of the fluid blast type comprising a housing containing a quantity of arc-extinguishing fluid, a fixed contact and a movable contact separable therefrom to form an electric arc, said movable contact comprising a two-part conducting rod, a hollow piston secured to one part of said movable contact and shaped to define a fluid blast passage extending across the path of opening movement of said movable contact, a cylinder in said housing cooperating with said piston to form a compression chamber, said piston being effective upon opening movement of said one part of the movable contact to force said fluid against a surface on the other part of said contact to move it relative to said one part in a direction to increase the speed of separation of said fixed and movable contacts and to force a blast of arc-extinguishing fluid through said blast passage.

7. An electric circuit breaker of the fluid blast type comprising a housing containing a quantity of arc-extinguishing fluid, a fixed contact, an elongated operating member having a hollow cylindrical portion, a movable contact extending from said operating member and having a piston portion lying within the hollow portion thereof and normally biased toward engagement with said fixed contact, a hollow piston secured to said operating member and a cylinder cooperating therewith to form a compression chamber surrounding said operating member, said piston being shaped to define a blast passage leading to the exterior of said compression chamber and crossing the path of opening movement of said movable contact whereby movement of said operating member toward open circuit position of said breaker and the resultant movement of said hollow piston is effective to increase the pressure in said compression chamber to move said movable contact relative to the operating member and to force an arc-extinguishing jet through said blast passage.

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