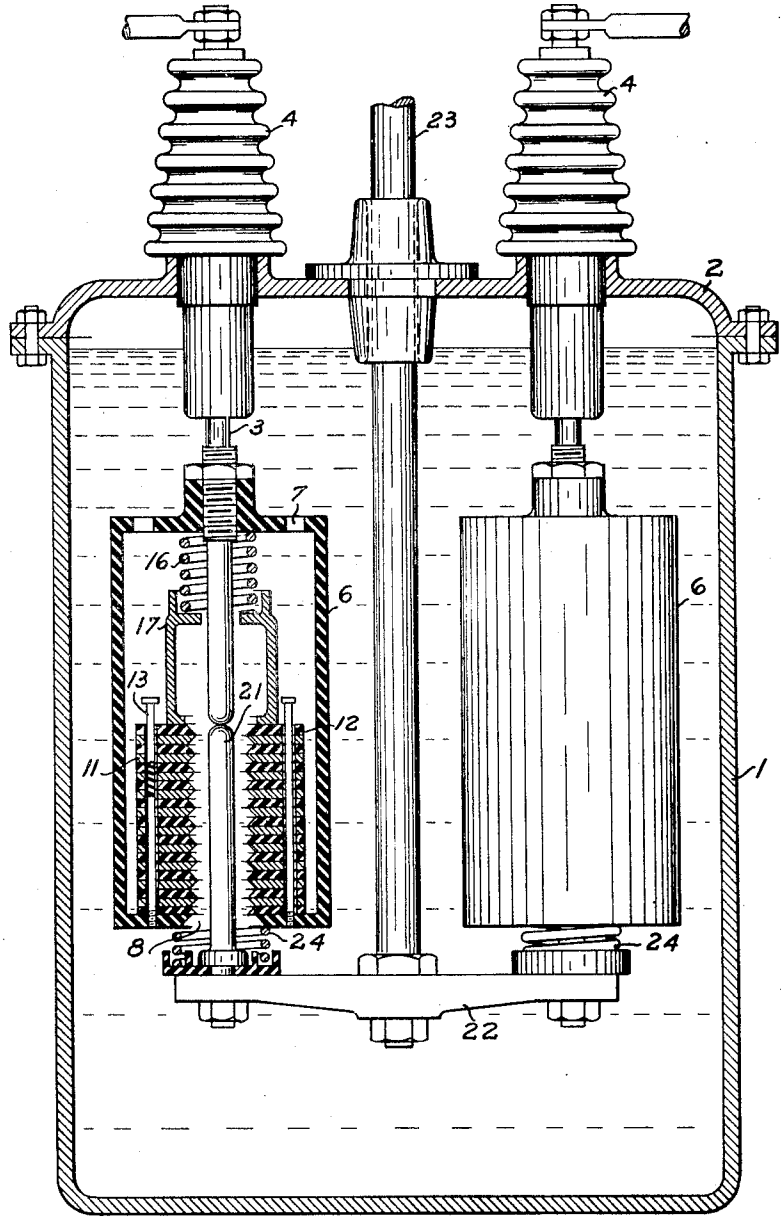
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CIRCUIT BREAKER

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CIRCUIT BREAKER

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This invention relates to improvements in electric circuit breakers and particularly to circuit breakers in which the circuit is interrupted by the separation of contacts beneath the surface of a fluid.

When an electric circuit is interrupted by the separation of the contacts of a switch in a body of a fluid, such as oil, separation of the contacts produces an arc therebetween which acts to heat the fluid and to produce vapors therefrom. Such vapors expand with substantially explosive rapidity and are generally of such character as to be explosive when mixed with air. It is accordingly necessary, for the rapid and safe interruption of a circuit, that the vapors be cooled as rapidly as possible and also that the vapors be conducted away from the vicinity of the arc as rapidly as possible, in such manner as to be thoroughly intermingled with the fluid.

It is, therefore, among the objects of the present invention to provide an electric circuit breaker in which the contacts are separated in a liquid within means for cooling the vapors formed from the liquid upon separation of the contacts.

Another object of the invention is to provide an electric circuit breaker in which the circuit is interrupted in a liquid and in which means are provided to dissipate the expansive forces of the vapors, formed from the liquid upon separation of the contacts, in such manner as to cause intermingling of the vapors with the liquid for the purpose of minimizing the danger of an explosion or of the explosive effects thereof.

Another obect of the invention is to provide an electric circuit breaker in which the circuit is interrupted in a liquid within a chamber substantially enclosing the contacts and provided with means to cool the vapors, formed from the liquid upon interruption of the circuit, before escape from the chamber to prevent ignition of such vapors.

Objects and advantages other than those above set forth will be apparent from the following description when read in connection with the accompanying drawing which is a vertical sectional view of a portion of an electric circuit breaker embodying the present invention.

Referring more particularly to the drawing by characters of reference, the reference number 1 designates a tank adapted to be closed by a cover 2 and to retain a quantity of a fluid, such as oil, as indicated therein. The cover 2 supports fixed contacts 3 extending through insulators 4, the contacts 3 forming one pole of a circuit breaker for interrupting a circuit not shown. The fixed contacts 3 have suspended therefrom, in any suitable manner, a casing 6 forming a chamber provided at the top and bottom thereof with apertures 7 and 8 respectively.

A stack of plates preferably of substantially annular form composed of electrically conductive material 11, such as a metal which is also highly heat-conductive, and electrically non-conductive material 12, arranged between the several conductive plates, is arranged to rest upon the bottom of the chamber formed by the casing 6 in such manner as to provide a passageway registering with the aperture 8. Copper is a suitable material for the conductive plates and the insulating plates may be made from a phenolic condensate, such as bakelite or from fiber. The plates are loosely retained in their stacked relation by studs or pins 13, preferably of insulating material as shown, extending upwardly through the stack from the inner surface of bottom wall of the casing 6 and are held by the pressure of helical springs 16 compressed between the inner surface of the top wall of the casing 6 and an intermediate or spacer member 17. The fixed contacts 3 extend through both the springs and the spacers into the plane of the upper layers of the stack of plates. The plates may also be retained against lateral movement by ribs formed on the interior surface of the casing 6, if desired, instead of by use of the studs 13, as shown.

The fixed contacts 3 are adapted to be bridged by movable contacts 21 supported upon a bridge 22 which is suspended within the tank 1, on an operating rod 23 extending through the tank cover 2. The contacts 21 extend through the apertures 8 in the bottom of the chambers 6 and through the passageways formed by the stacks of plates and are movable into and out of contact with the fixed contacts 3 upon movement of rod 23 by any of the preferred known means. Movement of contacts 21 into contact with fixed contacts 23 is cushioned by springs 24 to minimize the shock occurring at the contacts upon closing of the circuit.

When a circuit is to be interrupted by the circuit breaker, the contacts are separated by downward movement of the movable contacts 21. An arc is formed upon separation of the contacts which arc heats and thereby causes vaporization of the oil about the contacts within the casing 6. The movement of contact 21 being downward through the stack of plates, the vapors are formed within the apertures through the plates and expand in all directions. The upward expansion of the vapors raises the spacers 17 from the stacks

of plates against the compression of the springs 16 thus permitting the plates of the stacks to be separated. The lateral expansion of the vapors acting on the beveled edges of the plates causes separation of the plates thus permitting the hot vapors to pass therebetween in relatively thin sheets. The plates can also be made with alternately varying inside diameter. Heat is abstracted from the vapors by the plates and is transmitted to the insulating liquid within the chamber. Due to the thin sheet-like form of the gases flowing between the plates, the vapors are intimately mixed with the liquid oil and are at least partially condensed. The vapors are thus rapidly cooled and are dissipated throughout the oil in such manner as to prevent the collection of a sufficient quantity of such vapors to permit the occurrence of an explosion of destructive force. Such uncondensible gases as may be separated out of the vapors escape upwardly through the oil within the chamber and escape from the chamber through the apertures 7 in the top thereof. The expansive forces of the vapors are utilized in the separation of the plates and the danger of explosions thereof is further greatly reduced. The use of alternately arranged plates of conductive material and insulation divides the arcs between the contacts into series of a large number of small arcs which are very readily extinguished by virtue of the fact that these short arcs extend between adjacent conductive plates rather than through the central portion of the passageway and are thus acted upon by the gas and liquid which escape between the separated plates.

Although but one embodiment of the present invention has been illustrated and described, it will be apparent to those skilled in the art that various changes and modifications may be made therein without departing from the spirit of the invention or from the scope of the appended claims.

It is claimed and desired to secure by Letters Patent:

1. A circuit breaker comprising a tank containing a liquid, an explosion pot mounted within said casing and immersed in said liquid, a stationary contact arranged within said explosion pot, a movable contact normally in contacting engagement with said stationary contact, a stack of perforate plates arranged within said explosion pot so as to completely encircle said movable contact, and guiding means secured to said explosion pot for maintaining said plates radially spaced from said movable contact so as to define a discharge passageway between said movable contact and said perforate plates, and spring biased means for normally compressing said stack of perforate plates, said spring biased means being operable in response to pressures within said explosion pot greater than a predetermined value to permit said plates to separate and thereby form a plurality of transverse discharge passageways between said plates.

2. In an electric circuit breaker, a fixed contact, a cooperating movable contact disposed for connection with and disconnection from said fixed contact, a casing forming a chamber arranged about said contacts, and a fluid subject to vaporization responsive to movement of the said cooperating contact from connection with the said fixed contact contained within said chamber about said contacts, said fluid being vaporizable by the arc drawn between said contacts upon the disconnection thereof, and a plurality of plates arranged in stacked relation within said casing operative in such a manner that a plurality of vents are created between adjacent plates for the escape of vapor under pressure caused by the arc drawn by said contacts, to thereby reduce the temperature of the vapor, said stack comprising plates of electrically conductive material and plates of electrically non-conductive material arranged alternately.

3. In an electric circuit breaker comprising a casing containing a liquid vaporizable when subjected to an arc, a fixed contact, a cooperating movable contact disposed for connection with and disconnection from said fixed contact, the combination of a tubular insulating member forming an explosion chamber arranged about said contacts and completely immersed in said liquid, a plurality of plates of electrical conductive and non-conductive material arranged alternately in stacked relation within said tubular member separable upon occurrence of an increase in pressure within said member caused by an arc drawn between said contacts to reduce the temperature of the vapor created from said liquid upon occurrence of said arc and to divide said arc into a plurality of serially connected arcs.

4. In a circuit breaker having a tank containing a liquid volatilizable by an arc and cooperating fixed and movable contacts immersed in said liquid, the combination of a plurality of plates of insulating material and conductive material, each of said plates having a hole therethrough, and means for holding said plates in stacked relation with said insulating plates interlarded with said conductive plates so as to form a passageway through which said movable member may pass, said means permitting separation of said plates upon the formation of gas under pressure within said passageway caused by an arc drawn between said contacts.

5. In a circuit breaker having a tank containing a liquid volatilizable by an arc and cooperating fixed and movable contacts immersed in said liquid, the combination of a plurality of perforate plates of electrically conductive material, a plurality of perforate plates of electrically non-conductive material, means for mounting said first mentioned plates and said last mentioned plates in stacked interlarded relation so as to define a passageway for said movable contact, said means comprising a biasing device operable to oppose the separating movement of said plates caused by the gas pressure created within said passageway when an arc is drawn between said contacts.

6. In a circuit breaker having a tank containing a liquid volatilizable by an arc and cooperating fixed and movable contacts immersed in said liquid, the combination of a stack of interlarded metallic and insulating plates, said stack of plates having a passageway therethrough with continuous side walls, and means for mounting said stack of plates within said tank so that said movable contact extends substantially through said stack of plates when in engagement with said fixed contact and is symmetrically spaced from said side walls, said means comprising a biasing device normally biasing said plates into engagement with each other and operable, when an arc is drawn between said contacts and between adjacent metallic plates upon separation of said contacts, to permit the gas generated by said arc to separate said plates and thereby establish a plurality of annular vents for the escape of said gas.

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