May 19, 1942. H. V. NYE 2,283,874

CIRCUIT BREAKER

Filed April 12, 1935

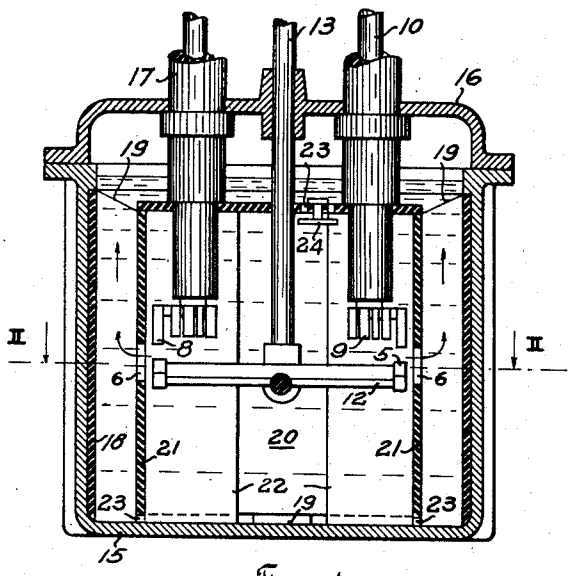


Fig. 1

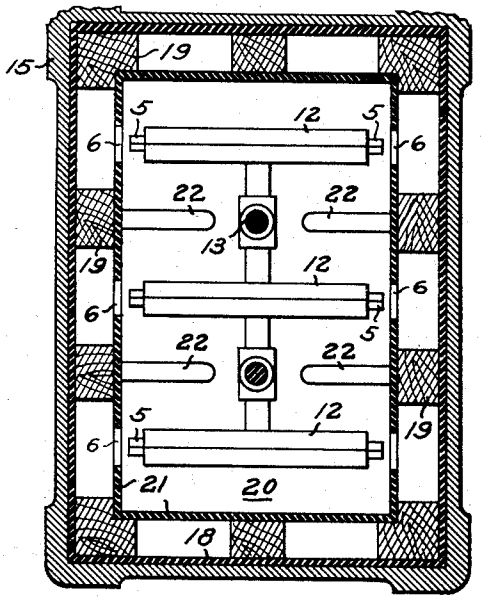


Fig. 2

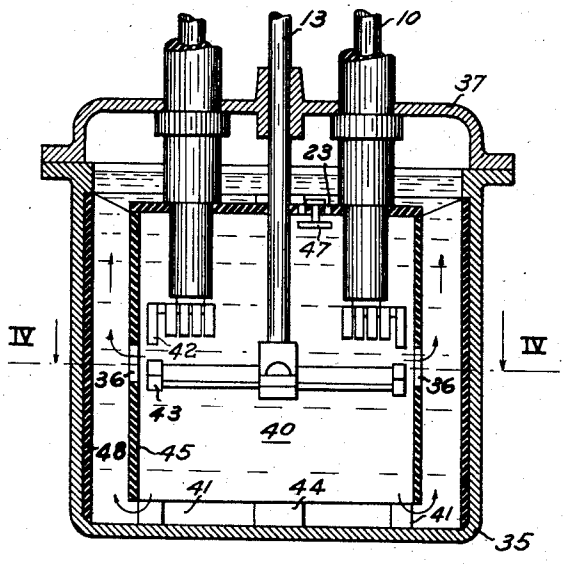


Fig. 3

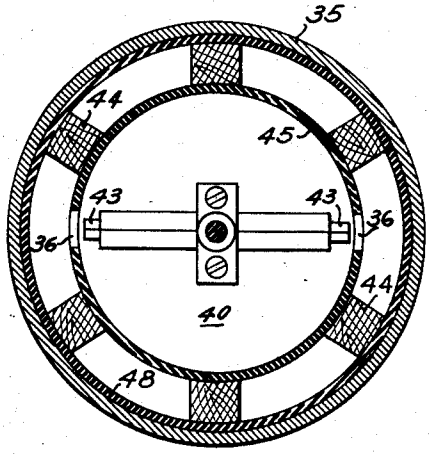


Fig. 4

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CIRCUIT BREAKER

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7 Claims. (Cl. 200—150)

This invention relates in general to circuit breakers and more particularly to circuit breakers of the fluid break type wherein the arc formed during interruption of the circuit is extinguishing in oil or some similar insulating and arc extinguishing fluid.

Prior art circuit breakers of the cross blast type utilize two oil-immersing series-connected pairs of separable contacts enclosed in a single enclosure vented with a single opening positioned adjacent one pair of contacts so as to direct a cross blast of oil from the remote pair of contacts across the pair of contacts adjacent the vent. This interaction of one art upon another in a single enclosure involved intermixture of the highly conductive arc gases with the oil to be used for arc extinguishment, thus diminishing its value as a dielectric.

The present invention has for its general object the avoidance of the above disadvantages of a cross blast circuit breaker by freely and immediately venting the electrically conductive arc gases at each arcing region. By providing similar or identical ports similarly positioned relative to the separable arcing contacts, these conductive gases and metallic vapors are immediately vented equally from each arcing region, thereby maintaining the oil between these arcing regions as a barrier definitely assuring isolation of one arcing region from the other. Such isolation of the arcing regions prevents intermixing of the highly conductive gases with the oil that is utilized for extinguishing the arc, so that high dielectric oil will remain a mechanical barrier between the pairs of contacts and the arcs will be drawn into intimate contact with this high dielectric oil.

It is an object of this invention to provide an improved circuit breaker of the above type wherein the arc is extinguished and the circuit is interrupted in an improved and efficient manner.

It is also an object of this invention to provide a circuit breaker of the above type with a substantially closed chamber surrounding the arcing contacts which chamber has similar or identical expulsion ports immediately adjacent each pair of arcing contacts.

It is also an object of this invention to provide a circuit breaker of the expulsion port type with a means for limiting the effect of impact of the oil or other insulating and arc extinguishing fluid.

It is a further object of this invention to provide in a circuit breaker of the expulsion port type an improved method of and means for driving a solid stream of cool oil or other insulating and arc extinguishing fluid, unmixed with gases generated by the arc, across the arc stream after the arc has been expelled through the port thereby aiding in deionizing the arc gases and effecting improved circuit interruption.

It is also an object of this invention to provide a circuit breaker structure wherein openings adjacent the arcing contacts are of such size and shape as to hold the length of arc to a minimum by limiting the spread of the arc loop.

It is a further object of this invention to provide a circuit breaker structure wherein a blast of cool arc extinguishing fluid unmixed with gas is forced across the arc loop externally of the port opening and at an angle to the movement of the loop thereby aiding in interrupting the circuit.

Objects and advantages other than those above set forth will be apparent from the following description when read in connection with the accompanying drawing in which:

Fig. 1 is a vertical sectional view taken through the tank of a circuit breaker embodying the present invention;

Fig. 2 is a horizontal sectional view of the circuit breaker of Fig. 1 taken along the line II—II;

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

Fig. 4 is a horizontal sectional view of the circuit breaker of Fig. 3 taken along the line IV—IV.

Figs. 1 and 2 of the drawing illustrate a circuit breaker of the expulsion port type wherein the tank 15 contains oil or other insulating and arc extinguishing fluid and has a cover 16 which supports the conventional bushing, contact and operating member structure. Enclosing the contacts is a substantially closed chamber 20 preferably made of insulating material. Immediately adjacent the arcing contacts 5 and 8 are similar expulsion ports 6 which are the only openings in the chamber 20 except for bleed holes 23 at the top and bottom of this chamber which allow refilling with arc extinguishing fluid. The opening 23 in the top of the chamber has a valve 24 closing the hole during circuit interruption. The walls 21 of the chamber 20 are spaced from the walls of the tank 15 by spacer members of any suitable material of which wood is an example. The tank 15 has an insulating lining 18 which with the side walls 21 of the chamber 20 and the spacer members

19 forms ducts for the passage of the arc gases from the arcing region to the air space above the arc extinguishing fluid. Partitions 22 are utilized to segregate the phases of the circuit breaker by preventing arcing from the contacts of one phase to the contacts of another phase. As shown in the drawing, the serially connected pairs of arcing contacts 5 and 8 are similar in construction and arrangement and draw arcs simultaneously when operated.

The fundamental principle of operation of this expulsion port breaker is that of drawing arcs in a closed chamber containing oil or other similar insulating and arc extinguishing fluid with the only points of egress for the gases formed by the arcs being openings or ports located immediately adjacent to the points of arcing. Under these conditions as soon as an arc is struck, gas is formed which is immediately vented equally through the ports at high velocity. This immediate equal venting of the highly conductive arc gases prevents intermixing thereof with the oil to be utilized for arc extinguishing. This equal venting maintains the oil as a mechanical barrier isolating each arcing region from the interaction of one arc on the other.

The venting of the gases at high velocity results in a blast action. This blast action expels the hot arc gases and possibly the arc loop itself through the port and causes turbulence at the point of arcing which disrupts the arc stream and shuts off the conducting path during the zero point of the current wave. Although it is definitely known that the bubbles of incandescent gases formed around the arcs blast themselves out of the chamber 20 through the ports 6, it is not definitely known whether or not the arcs themselves are actually looped through the ports, or if so how far such loop extends. However, the arcs themselves are driven at least sufficiently near to the ports 6 so that they are in the region of greatest turbulence and so that the conducting gases surrounding the arcs can be blasted out of the arcing regions and freely vented to the space above the oil level. The electromagnetic action of the circuit loop opposite the port also aids in driving the arc toward or through the port. Inasmuch as the ports 6 are relatively narrow in the direction of arc length, the spread of the arc loop is limited thus holding the length of the arc to a minimum. However, due to the fact that the arc stream is quickly expelled from the region of the arcing contacts, it is cooled by the relatively cool fluid outside of the chamber and by the free venting of the hot gases from the arcing region. The expansion of the arc gases after passing out through the expulsion port further cools the arc region. Due to the above features, aided by the turbulence caused by the gases, the arc is sufficiently cooled and deionized so that after a zero current it is unable to re-strike.

In the form shown in Figs. 1 and 2, downward movement of the operating rod 13 first causes separation of the current carrying contacts 9 from member 12 and further downward movement causes separation of the arcing contacts 5 and 8. As more and more of the operating rod 13 enters the closed chamber 20, a so-called "impulse" action is obtained, that is, a piston action which starts movement of oil through the ports 6 toward the space above the oil level. Any such movement of the oil aids the expulsion port action which immediately follows.

The form of the invention shown in Figs. 3 and 4 is that of the expulsion port breaker of Figs. 1 and 2 with an added feature which limits oil impact and further aids circuit interruption.

In the larger sizes of circuit breakers of this type each phase of the circuit breaker is placed as shown in a separate tank 35 which is shown as cylindrical in shape. The tank has an insulating lining 48 and spacer members 44 which spaces the chamber 40 from the tank wall. Expulsion ports 36 are provided immediately adjacent the arcing contacts 42 and 43 which function similarly to those described in connection with the circuit breaker shown in Figs. 1 and 2. The chamber 40 however had additional openings 41 at the bottom thereof and immediately below the ports 36. These additional openings 41 in conjunction with the lining 48, the chamber wall 45 and the spacer members 44 form ducts for the passage of a slug of cool fluid across the loop of the arc after it has been expelled to or through the ports 36. This cool fluid aids in cooling the arc and extinguishing it thereby interrupting the circuit.

The openings 41 also aid in limiting the effect of oil impact. Oil impact is the action of a solid slug of oil striking the underside of the top of the circuit breaker at a high velocity and is very objectionable as serious stresses are imparted by it to the circuit breaker structure which tends to lift the circuit breaker from the floor. The impact further acts on the operating mechanism tending to reclose the circuit breaker. These openings 41 which may be only small openings under the expulsion ports 36 or which may be enlarged laterally as much as 360 degrees as shown in Fig. 3. The lateral spread of these openings rather than an increase in vertical height greatly limits the effect of oil impact and equalizes the stresses in the breaker caused thereby throughout the breaker structure.

Although but a few embodiments of the present invention have 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. An electric circuit breaker of the fluid-break type comprising a casing partly filled with an insulating liquid, relatively movable contact structure immersed in said liquid including a pair of stationary contacts having arcing portions and a movable bridging member arranged to form simultaneously two similar breaks in series, and an insulating baffle disposed beneath the level of said liquid, said baffle being substantially continuous between said stationary contacts so as to have a confining effect on the oil body beneath the same and terminating at the arcing portions of said contacts for forming with each of the corresponding side walls of said casing similar pressure relief passages immediately opposite said stationary contacts for the direct escape of gas formed at said breaks upon opening of the circuit.

2. An electric circuit breaker of the fluid-break type comprising a casing partly filled with an insulating liquid, relatively movable contact structure immersed in said liquid including a pair of stationary contacts and a movable bridging member arranged to form simultaneously two similar breaks in series, and an insulating baffle disposed beneath the level of said liquid and immediately

above said stationary contacts, said baffle being substantially continuous between said stationary contacts so as to have a confining effect on the oil body beneath the same and provided with depending walls adjacent said breaks respectively, said depending walls each spaced with respect to the side walls of said casing to form similar passages at both breaks for directing immediate escape of gas formed at said contacts upon opening of the circuit.

3. An electric circuit breaker of the fluid-break type comprising a casing containing insulating liquid, a pair of contacts immersed in said liquid, a bridging member movable relative to said contacts and arranged to draw simultaneously an arc at each of said contacts in series therewith, an insulating baffle structure disposed beneath the level of said liquid including a plate-like portion above said contacts, said portion being substantially continuous between said contacts, said baffle structure including insulating side walls cooperable with said portion to have a confining effect on said liquid beneath said portion, and means for venting the gases formed at each of said arcs in a direction away from the other of said arcs, said means comprising identical apertures in said side walls immediately adjacent both of said contacts.

4. An electric circuit breaker of the fluid-break type comprising a casing containing insulating liquid, a pair of contacts immersed in said liquid, a bridging member movable relative to said contacts and arranged to draw simultaneously an arc at each of said contacts in series therewith, an insulating baffle structure disposed beneath the level of said liquid including a plate-like portion above said contacts, said portion being substantially continuous between said contacts, said baffle structure including insulating side walls cooperable with said portion to have a confining effect on said liquid beneath said portion, and means for minimizing the mixing of the gases formed at said arcs with said liquid positioned between said arcs, said means comprising identical expulsion ports in said baffle structure immediately adjacent each of said contacts.

5. An electric circuit breaker of the fluid-break type comprising a casing containing insulating liquid, a pair of contacts immersed in said liquid, a bridging member movable relative to said contacts and arranged to draw simultaneously an arc at each of said contacts in series therewith, an insulating baffle structure disposed beneath the level of said liquid including a plate-like portion above said contacts, said portion being substantially continuous between said contacts, said baffle structure including insulating side walls cooperable with said portion to have a confining effect on said liquid beneath said portion, and means for freely and immediately venting the gases formed by said arcs without mixture thereof with the liquid between said contacts, said means comprising identical expulsion ports immediately adjacent both of said contacts.

6. An electric circuit breaker of the fluid-break type comprising a casing containing insulating liquid, a pair of contacts immersed in said liquid, a bridging member movable relative to said contacts and arranged to draw an arc at each of said contacts in series therewith, an insulating baffle structure disposed beneath the level of said liquid including a plate-like portion above said contacts, said portion being substantially continuous between said contacts, said baffle structure including insulating side walls cooperable with said portion to have a confining effect on said liquid beneath said portion, means providing direct and immediate escape of arc products from the region adjacent each said arc comprising apertures in said baffle structure immediately adjacent each of said contacts, and means responsive to the drawing of said arcs for driving a stream of liquid unmixed with gases formed by said arcs across said apertures externally of said side walls.

7. An electric circuit breaker of the fluid-break type comprising a casing containing insulating liquid, a pair of contacts immersed in said liquid, a bridging member movable relative to said contacts and arranged to draw an arc at each of said contacts in series therewith, an insulating baffle structure disposed beneath the level of said liquid including a plate-like portion above said contacts, said portion being substantially continuous between said contacts, said baffle structure including insulating side walls cooperable with said portion to have a confining effect on said liquid beneath said portion, means providing direct and immediate escape of arc products from the region adjacent each said arc comprising apertures in said baffle structure immediately adjacent each of said contacts, and means responsive to the drawing of said arcs for driving a stream of liquid unmixed with gases formed by said arcs across said apertures externally of said side walls, said last said means comprising spacing said side walls from the bottom and sides of said casing.

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