May 23, 1939. L. S. HOBSON 2,159,830

ELECTRIC CIRCUIT BREAKER

Original Filed May 10, 1934

Fig. 1.

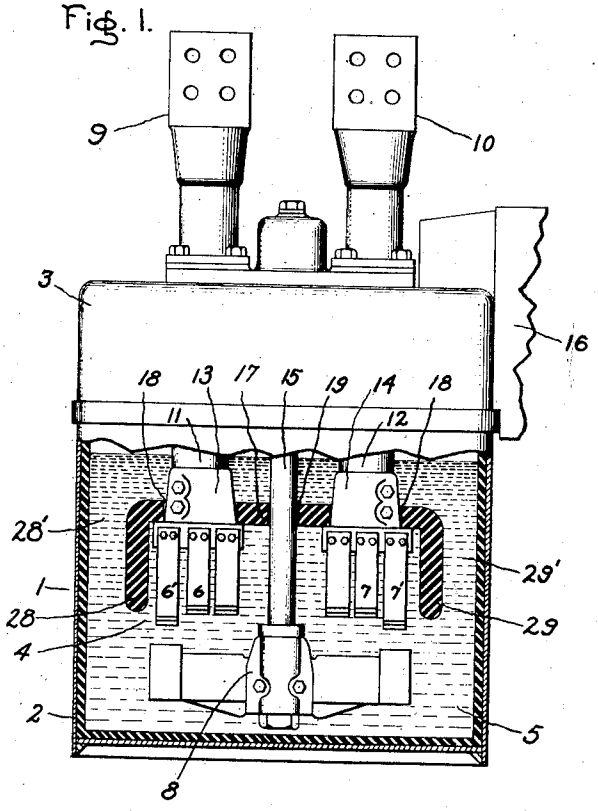
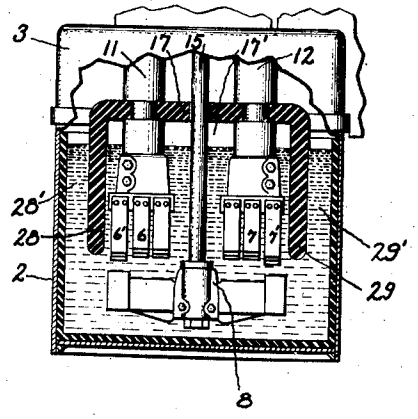


Fig. 2.



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ELECTRIC CIRCUIT BREAKER

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Original application May 10, 1934, Serial No. 724,864. Divided and this application November 16, 1938, Serial No. 240,782

5 Claims. (Cl. 200—150)

My invention relates to electric circuit breakers of the fluid-break type wherein relatively movable contact structure is immersed in arc-extinguishing or insulating liquid, as oil, and has for its principal object the provision of an improved circuit breaker of the aforesaid type which shall have appreciably increased interrupting capacity, and be efficient in operation and simple, compact and rugged in construction.

Oil circuit breakers of the well-known plain-break type wherein a contact bridging member is lowered within an oil-containing switch casing or tank to interrupt the circuit are more or less fortuitous in operation and cannot with any degree of certainty be relied upon consistently to interrupt large power currents under similar load conditions. This is due to the fact that the generation of gas by action of the arc on the oil results in conducting gas bubbles of appreciable volume at the "breaks" or points of contact separation tending to support arcing unless broken up sufficiently by oil turbulence in the switch. The switch casing, which is but partially filled with oil, does not have a confining or restraining effect on the body of oil through which the bridging member descends with the result that the sudden generation of pressure upon opening of the circuit throws a large volume of oil upwardly into the air space of the switch casing. The region adjacent the separating contacts is, therefore, but partly filled with oil at the time when an insulating liquid is most needed.

The bridging member may, therefore, be lowered varying distances in opening the circuit under similar load conditions before the insulating medium between the contacts has sufficient dielectric strength to interrupt the circuit at a current zero. Furthermore, if the circuit is not cleared when the bridging member reaches its lower limit of travel, failure of the breaker and a dangerous explosion and oil fire may result.

In accordance with my invention, the interrupting capacity of the circuit breaker is increased and greater reliability is obtained by improved baffle structure having a confining effect on the body of insulating liquid into which the movable contact structure is projected upon opening of the circuit, said baffle however being arranged so as to direct away from the contact structure the immediate escape of gas formed at each of the breaks.

My invention will be more fully set forth in the following description referring to the accompanying drawing, and the feature of novelty which characterize my invention will be pointed out with particularity in the claims annexed to and forming a part of this specification.

This application is a division of my copending application Serial No. 724,864, filed May 10, 1934, for Electric circuit breakers.

Referring more particularly to the drawing, Fig. 1 is an elevational view, partly in section, of an oil circuit breaker embodying my invention, and Fig. 2 is a similar view showing a modified form thereof.

The oil circuit breaker illustrated in Fig. 1 comprises a switch casing 1 formed by an oil-containing tank 2 and a cover member or dome 3, and relatively movable contact structure 4 disposed within the casing and immersed in the oil or insulating liquid 5. The contact structure may be of the well-known blade-and-finger type, the stationary contacts 6 and 7 comprising spring mounted finger contact members arranged to be spread apart and interconnected, as illustrated, by the conducting bridging member 8. The stationary contacts 6 and 7 are connected to and supported at the lower ends of the lead-in conductors 9 and 10 which extend into the switch casing through the cover 3. The lead-in conductors 9 and 10 are supported by insulating bushings 11 and 12, respectively, and are suitably mechanically and electrically connected to the stationary contacts as by clamping means 13 and 14, respectively.

Opening and closing of the circuit are effected by reciprocal vertical movement of the bridging member 8 which is connected to a lift-rod 15 in turn operatively connected to suitable actuating means (not shown) as at 16. The oil circuit breaker structure so far described is conventional and opening of the circuit is effected simply by lowering the bridging member 8 within the oil body so that two breaks in series are formed between opposite ends of the bridging member and the arcing contact fingers 6' and 7'.

For the purpose of producing a restraining or confining effect on the oil body between the stationary contacts 6 and 7, into which the bridging member 8 is projected during the circuit opening operation, insulating baffle structure is employed. The baffle also is arranged to provide immediate and direct escape of gas formed at both the contact breaks. In the present instance, I have illustrated a plate-like insulating baffle 17 horizontally disposed beneath the surface of the oil 5 and immediately above the stationary contacts 6 and 7 in juxtaposition thereto. The insulating baffle 17 is suitably composed of an impregnated laminated structure which is mechanically strong

and of good insulating characteristics. With the exception of apertures 18 and 19 through which the lead-in conductor studs and lift rod 15 extend respectively, the baffle 17 between its outer edges is continuous between the stationary contacts and, although not illustrated, can fit closely against the end walls of the switch tank 2. By way of example, but without limitation thereto, a polyphase circuit breaker is preferred, the contact structure of the individual phases being similarly arranged beneath the baffle to operate simultaneously.

The baffle 17 at opposite edges is spaced from the side walls of the tank 2 to provide a venting passage immediately adjacent and opposite the breaks of each individual phase. As illustrated, the opposite edges of the baffle form with the tank walls a slot-like or rectangular passage between the upper and lower chambers defined by the baffle so as to afford direct and immediate escape of gas formed at the contact breaks. The continuous portion of the baffle prevents the main body of oil around the contact structure from being thrown into the air space of the switch casing. Accordingly, the bridging member in operation is lowered through a substantially uniform oil body instead of through a mixture of oil and gas as in the operation of the conventional plain-break oil circuit breaker.

The immediate lateral escape of gas from the breaks at the opposite sides of the switch casing without appreciably disturbing the main oil body, therefore, not only eliminates a factor tending to cause prolonged arcing but also insures comparatively rapid interruption of the circuit by reason of the uniform oil body about the bridging member when the arc current passes through zero.

For the purpose of preventing expulsion of too great a quantity of oil beneath the baffle and also more effectively directing the escape of gas for arc interruption, the insulating baffle 17 is provided with depending insulating structure comprising flanges 28 and 29 terminating adjacent the outer tips of the arcing contacts 6' and 7'. The flanges 28 and 29 are spaced, as illustrated, a suitable distance with respect to the side walls of the casing 2 so as to form rectangular chimney-like passages 28' and 29' for immediate and direct escape of the gas bubbles. It will be apparent that the cross-sectional area of the passages 28' and 29' may be varied to suit the operating requirements of the breaker. The present arrangement has the effect of bringing the baffle 17 to a level adjacent the tips of the arcing contacts so that free gas venting is effected and a minimum amount of gas is present around the stationary contact structure upon opening of the circuit.

As previously described, the elimination and decrease in volume of the gas adjacent the separating contacts is highly desirable in order to increase the effectiveness of the insulating oil. In the present arrangement the main part of the oil body intermediate the lower tips of the stationary contacts is not subject to displacement by the gas pressure; and the gas itself, under pressure, tends to expand directly into the exhaust passages 28' and 29'.

Fig. 2 illustrates an arrangement wherein an air or gas cushion is used generally for the purpose of absorbing in part and utilizing arc energy in the case of heavy overload and short circuit currents. Excess energy initially absorbed can subsequently be utilized to expel oil through the arc path. In this case the insulating baffle 17 is suitably positioned a short distance above the oil level so that an air space 17' of the desired proportions is provided. For the purpose of defining the gas cushion and restraining the oil through which the bridge 8 is lowered, the baffle 17 is provided as in the previous case with depending flanges 28 and 29 which extend across the switch tank 2 so as to form with the sides thereof chimney-like passages 28' and 29' for the direct and immediate escape of gas from the breaks at 6' and 7'.

The insulating flanges 28 and 29 preferably terminate approximately at the outer lower edges of the arcing contacts 6' and 7' as in Fig. 1. The air cushion at 17' is confined beneath the baffle structure and is so proportioned with respect to the interrupting capacity and operating requirements of the breaker that no oil-throw takes place. The energy stored in the air cushion during circuit interruption is effective, as above stated, to aid interruption of arcing at a current zero and to force out gas through the passages 28' and 29'.

It should be understood that my invention is not limited to specific details of construction and arrangement thereof herein illustrated, and that changes and modifications may occur to one skilled in the art without departing from the spirit of my 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 casing containing an arc-extinguishing liquid, a pair of lead-in conductor studs extending within said casing, stationary arcing contacts mounted at the lower ends of said studs and immersed in said liquid, a movable bridging member coacting with said stationary contacts, and a horizontally disposed plate-like insulating baffle mounted at the lower ends of said studs and above said stationary contacts to form upper and lower chambers in said casing, said baffle at opposite edges being spaced from the adjacent side walls of said casing to form a slot-like passage at each of said edges between said chambers for venting arc gases at said stationary contacts, said baffle having depending flange-like insulating structure at said opposite edges terminating approximately at a level defined by the lower edges of said stationary arcing contacts so that there is but a liquid-filled space between said bridging member and the adjacent side walls during opening movement of said member.

2. An electric circuit breaker comprising a casing containing an arc-extinguishing liquid, a pair of lead-in conductor studs extending within said casing, stationary arcing contacts mounted at the lower ends of said studs and immersed in said liquid, a movable bridging member coacting with said stationary contacts, and a horizontally disposed plate-like insulating baffle mounted at the lower ends of said studs and above said stationary contacts, said baffle approximately corresponding in width to the spacing between said arcing contacts so as to be spaced from opposite side walls of said casing, insulating flanges depending from the edges of said baffle opposite said side walls and terminating approximately at the outer lower edges of said stationary arcing contacts so that there is but a liquid-filled space between said bridging member and the adjacent side walls during opening movement of said member, said insulating flanges thereby defining with said side

walls relief passages for the arc pressure generated beneath said baffle.

3. An electric circuit breaker comprising a casing containing an arc-extinguishing liquid, a pair of lead-in conductor studs extending within said casing, stationary arcing contacts mounted at the lower ends of said studs and immersed in said liquid, a movable bridging member co-acting with said stationary contacts, and a horizontally disposed plate-like insulating baffle mounted at the lower end of said studs and above said stationary contacts, said baffle being generally of rectangular shape and engaging opposite end walls and spaced substantially equal distances from opposite side walls of said casing opposite said stationary contacts thereby forming rectangular shape lateral passages at the sides of the casing adjacent said contacts, said baffle at said lateral passages having a depending insulating flange-like structure at each edge terminating substantially at the level defined by the outer lower edges of said stationary arcing contacts, so that there is but a liquid-filled space between said bridging member and the adjacent side walls during opening movement of said member.

4. An electric circuit breaker comprising a casing containing oil, a pair of lead-in conductor studs extending within said casing, stationary arcing contacts mounted at the lower ends of said studs and immersed in said oil, said stationary contacts being spaced substantially equal distances from opposite side walls of said casing, a movable bridging member coacting with said stationary contacts, and a horizontally disposed plate-like insulating baffle corresponding approximately in width to the spacing between said arcing contacts mounted at the lower ends of said studs and beneath the level of said oil so as to be above and in juxtaposition to said stationary arcing contacts, said baffle having at opposite edges depending insulating structure defining narrow strip-like flanges terminating approximately at the outer lower edges of said stationary arcing contacts so as to form lateral slot-like passages along the adjacent side walls of said casing for venting arc gases generated at said arcing contacts beneath said baffle.

5. An electric circuit breaker of the fluid-break type comprising a casing partly filled with an arc-extinguishing liquid, relatively movable contact structure immersed in said liquid including a pair of stationary contacts and a movable bridging member arranged to form two breaks in series, and an insulating baffle including a horizontally disposed plate-like portion above the level of said liquid, said baffle having oppositely disposed depending walls each spaced with respect to the side walls of said casing to form passages opposite both of said breaks for directing immediate escape of the gas formed at said contacts upon opening of the circuit, said insulating baffle thereby forming a substantially confined gas cushion above the level of said liquid and between said stationary contacts for aiding high current interruption.

LELAND S. HOBSON.