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2,465,218

CIRCUIT INTERRUPTER

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Fig. 2.

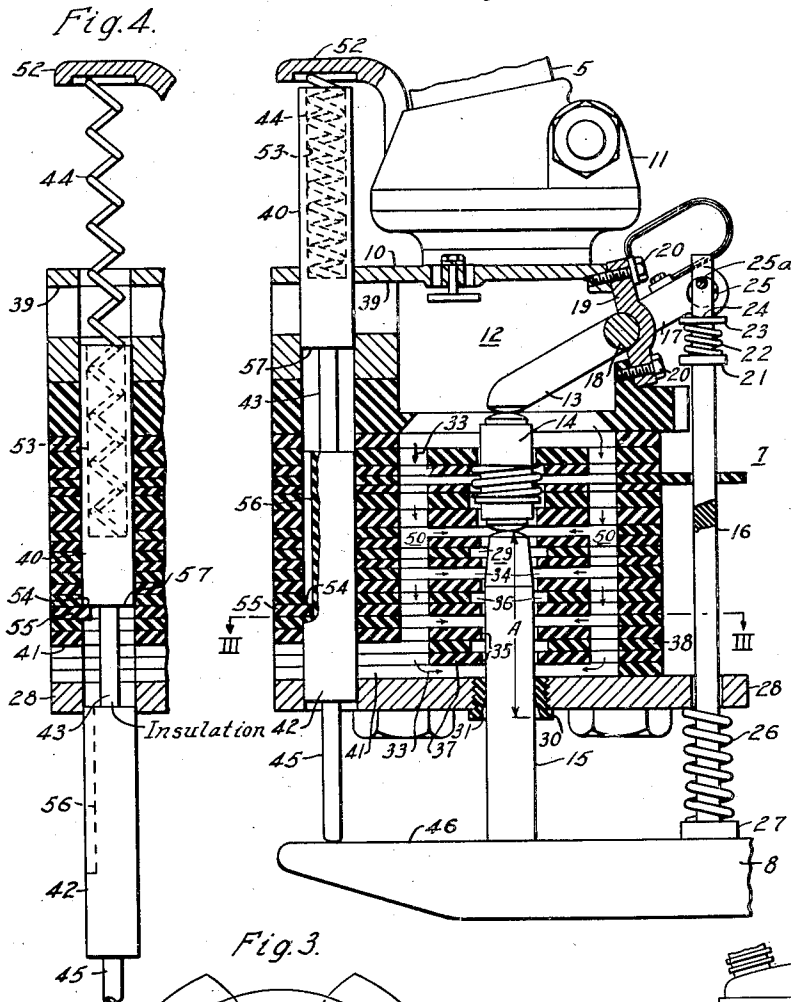
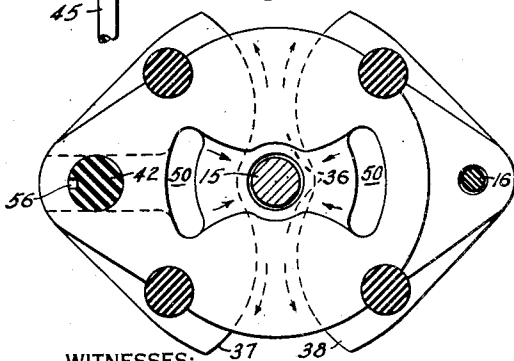


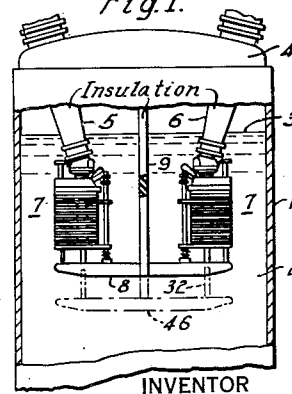
Fig. 3.



WITNESSES:

N. F. Sussner.
W. R. Crout

Fig. 1.



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CIRCUIT INTERRUPTER

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9 Claims. (Cl. 200—150)

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This invention relates to circuit interrupters, in general, and more particularly to arc extinguishing structures therefor.

High speed reclosing oil circuit breakers encounter difficulties where the first and second interruptions occur within 20 or less cycles of each other. Conventional interruptions are handicapped inasmuch as the second interruption must confront contaminated gases and fluid remaining from the first interruption. My improved interrupter is designed to improve the aforementioned situation by affording the gases remaining after the first interruption an enhanced opportunity to escape from the arc extinguishing structure and to be replaced by fresh oil from the tank, thus setting up the same conditions in the interrupter as existed before the first interruption.

The principal object of my invention is to provide an improved arc extinguishing structure suitable for rapid reclosing operations in which means are provided to permit rapid circulation of fluid through the interrupter in the open circuit position thereof, so that contaminated fluid will not be present within the interrupter for the second opening operation.

Another object is to provide an improved arc extinguishing unit of the type utilizing pressure and interrupting chambers in which port openings are provided controlled by valve means to permit ready circulation of fluid through the chambers in the open circuit position of the interrupter.

Another object is to provide an improved arc extinguishing structure in which contact means is cooperable to establish an arc and in which port openings are provided to eliminate contaminated fluid in the open circuit position of the interrupter.

Further objects and advantages will readily become apparent upon a reading of the following specification, taken in conjunction with the drawing, in which:

Figure 1 is a side elevational view, partially in section, of a circuit interrupter embodying my invention and shown in the closed circuit position;

Fig. 2 is an enlarged vertical sectional view through the left hand arc extinguishing unit of Fig. 1, the contacts being shown in the closed circuit position;

Fig. 3 is a sectional view taken along the line III—III of Fig. 2; and

Fig. 4 is a fragmentary view similar to Fig. 2 but showing the valve means in the freely open position.

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Referring to the drawing, and more particularly to Fig. 1 thereof, the reference numeral 1 designates a tank in which a suitable arc extinguishing fluid 2, in this instance circuit breaker oil, fills the tank 1 to the level 3. Depending from the cover 4 of the tank 1 are two insulating bushings 5, 6 at the lower ends of which are rigidly secured identical arc extinguishing units, generally designated by the reference numeral 7. The two units 7 are electrically connected together in the closed circuit position of the interrupter, as shown in Fig. 1, by a conducting crossbar or operating bar 8 reciprocally operated in a vertical direction by an insulating operating rod 9, the latter being actuated by suitable mechanism, not shown.

Referring to Fig. 2, which shows more clearly the internal construction of the extinguishing unit 7, it will be observed that I have provided a top dome casting 10 which is an integral part of a contact foot 11, the latter being threadedly secured and clamped to the lower end of the terminal stud which extends interiorly through the terminal bushing 5. The top dome casting 10 defines a pressure-generating chamber generally designated by the reference numeral 12, in which a pivotally mounted pressure-generating contact 13 cooperates with an intermediate contact 14 to establish a pressure-generating arc. Cooperable with the intermediate contact 14 is a lower movable contact 15 secured to the end of the crossbar 8 and actuated thereby. An operating rod 16 extends longitudinally exteriorly of the unit 7 and is pivotally connected by a lost motion connection to the externally disposed actuating arms 17 of the pivotally mounted pressure-generating contact 13, only one of which is shown in Fig. 2. The pressure contact 13 is pivotally mounted at 18 and is secured in place by a clamp plate 19 secured by bolts 20 to the housing or dome casting 10. A flange 21 is integrally formed with the operating rod 16 and serves as a lower seat for a compression spring 22, the upper end of which is seated against a washer 23 slidable upon the rod 16 and making engagement with the lower ends 24 of the actuating arms 17. The arms 17 have apertures 25 provided therein through which extends the pivot pin 25a, the latter being affixed to the upper end of the rod 16.

The rod 16 is biased downwardly in the circuit opening direction by means of a compression spring 26, the latter being seated upon a flange 27 integrally formed with the rod 16. The upper end of the compression spring 26 seats against

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the bottom metallic plate 23 of the unit 7. From the foregoing description it will be apparent that downward movement of the rod 16 will initially merely cause downward movement of the pin 23a within the apertures 25 formed in the external actuating arms 17, the washer 23 biasing the contacts 13 and 14 into engagement. However, when the pin 23a strikes the lower ends of the apertures 25, it will cause positive clockwise rotation of the pivotally mounted pressure-generating contact 13 upwardly away from the intermediate contact 14 to establish a pressure-generating arc within the pressure-generating chamber 12.

Substantially simultaneously with the separation of the contacts 13, 14, separation takes place between the upper end of the lower movable contact 15 and the lower end of the intermediate contact 14 to establish an interrupting arc within the interrupting chamber, generally designated by the reference numeral 29, and formed by the superpositioning of a plurality of suitably configured insulating plates. An insulating bushing 30 is provided in the plate 23 to guide the lower contact 15, which is completely withdrawn from the contact opening 31 in the fully open circuit position of the interrupter, as shown by the dotted lines 32 of Fig. 1.

The interrupting chamber 29 is more fully set forth and described in U. S. patent application, filed November 11, 1942, Serial No. 465,244 by Leon R. Ludwig, Winthrop M. Leeds and Benjamin P. Baker, now U. S. Patent 2,406,469, issued August 27, 1946, and assigned to the assignee of the instant application. This application also claims the pivotal connection between the operating rod 16 and the pressure contact 13.

For the purpose of explaining my invention, it is merely necessary to state that fluid, in this instance oil, under pressure from the pressure arc within the pressure chamber 12, flows downwardly as indicated by the arrows 33 to flow radially inwardly toward the interrupting arc drawn between the contacts 14, 15 through a plurality, in this instance four, pairs of inlet passages 34 to engage the interrupting arc. After engaging the interrupting arc, the oil flows through orifices 35 longitudinally of the interrupting arc to exhaust out of the unit 7 through oppositely directed exhaust passages 36, shown more clearly by the dotted lines of Fig. 3. The exhaust passages 36 are formed by the cooperation of a pair of vent plates 37, 38 positioned on the same level.

To facilitate circulation of the oil through the interrupter in the fully open circuit position thereof, I have provided a first port opening 39 disposed adjacent to the pressure-generating chamber 12 at the upper end of the unit 7. The first port opening 39 is controlled by a first cylindrical valve member 40. I also provide a second port opening 41 disposed adjacent the interrupting chamber 29 at the lower end of the unit 7 which is controlled by a second cylindrical valve member 42. Preferably, I interconnect the first and second valve members 40, 42 by an insulating rod 43, and I provide biasing means such as a compression spring 44 to bias both valve members 40, 42 downwardly to thereby tend to cause opening of the first and second port openings 39, 41.

The spring 44 seats at its upper end against a bracket 52 integrally formed with the contact foot 11. The lower end of the compression spring seats within a hollow portion 53 formed within the upper end of the cylindrical valve 40. A pro-

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jection 54 formed by a plate 55 extends within a groove 56 of valve 42 and provides a stop for the downward opening travel of the valve means when it strikes the lower end 57 of valve 40. Actuating means for the valve means includes a valve rod 45 affixed to the lower end of the valve member 42 and making abutting engagement with a projection 46 of the crossbar 8.

I have provided improved flushing means by providing the large port openings 39, 41 in both the top and bottom of the unit 7 after interruption has occurred. The considerable pressure remaining in the pressure chamber 12 at the time when the port opening 39 is permitted to open blows contaminated oil out of the pressure chamber 12 through the port opening 39 and facilitates the replacement of fresh oil into the pressure chamber 12. When the interrupter is reclosed, these port openings 39, 41 are respectively sealed off by the valve pistons 40, 42 mounted on the actuating means or rod 45 which is engaged by the breaker crossbar 8 and biased toward the open position by the compression spring 44. The rod 45 remains in abutting engagement with the crossbar 8 during the opening operation by virtue of compression spring 44 until the stop 54 is struck by upper valve member 40. The open position of the valve members 40, 42 is shown by Fig. 4. It is preferable, and the illustrated construction is such, that the port openings 39, 41 are not opened until the movable contact 15 withdraws from the contact opening 31. This provides the desired pressure within the unit 7 during the interruption process.

It will be apparent that in the open circuit position of the interrupter, as shown by the dotted lines 32 of Fig. 1 and in Fig. 4, the provision of two port openings 39, 41 will permit circulation of fresh oil into the unit 7 and upwardly through the vertical flow passages 50 toward the pressure chamber 12 and out through the upper port opening 39. This facilitates circulation of fresh oil into the unit 7 in the open circuit position thereof and washes out contaminated liquid to thereby provide fresh oil of high dielectric strength for the next circuit opening operation.

From the foregoing description, it will be apparent that I have provided an improved circuit interrupter especially adapted for rapid reclosing operations by eliminating the contaminated liquid within the extinguisher in the open circuit position thereof.

Although I have shown and described a specific structure, it is to be clearly understood that the same was merely for the purpose of illustration and that changes and modifications may readily be made therein by those skilled in the art without departing from the spirit and scope of the appended claims.

I claim as my invention:

1. In a circuit interrupter of the liquid break type, a substantially enclosed arc extinguishing unit immersed in the liquid, contact means including a movable contact for establishing at least one arc within the unit, an opening in the wall of the unit, means for moving the movable contact out of the unit through the opening in the fully open circuit position of the interrupter, a relatively large first opening in the wall of the unit adjacent one end thereof, a relatively large second opening in the wall of the unit adjacent the other end thereof, relatively free passage means connecting the said first and second openings, and valve means closed in the closed position

of the interrupter and responsive to the initial opening movement of the movable contact for opening the first and second openings only after withdrawal of the movable contact through the first-mentioned opening to permit circulation of fluid through the unit.

2. In a circuit interrupter of the liquid break type, a substantially enclosed arc extinguishing unit, means for establishing a pressure-generating arc and an interrupting arc within the unit, a relatively large first opening in the wall of the unit disposed adjacent to the pressure-generating arc, a relatively large second opening in the wall of the unit disposed adjacent to the interrupting arc, and valve means closing the said openings in the closed position of the interrupter and opening the first and second openings in the fully open circuit position of the interrupter.

3. In a circuit interrupter of the liquid blast type, means at least partially of insulating material defining an arc extinguishing unit, means defining a confined pressure-generating chamber disposed at one end of the unit, means defining an interrupting chamber disposed adjacent the other end of the unit, an opening in the unit disposed adjacent the said other end of the unit, means for establishing a pressure-generating arc within the pressure-generating chamber, means including a movable contact movable out of the said opening for establishing an interrupting arc within the interrupting chamber, a relatively large first port opening in the wall of the unit adjacent the pressure-generating chamber, a relatively large second port opening in the wall of the unit adjacent the interrupting chamber, and valve means closing the said port openings in the closed position of the interrupter and responsive to the initial movement of the movable contact for opening the first and second port openings in the fully open circuit position of the interrupter.

4. In a circuit interrupter of the liquid break type, an arc extinguishing unit having two port openings in the walls thereof disposed adjacent opposite ends of the unit, an opening in the wall of the unit, contact means including a movable contact for establishing an arc within the unit, a crossbar secured to the movable contact to cause the actuation thereof out of the unit through the said opening, the crossbar having a projection thereon, valve means including a valve rod for opening the two port openings in the open circuit position of the interrupter, and the projection of the crossbar controlling the initial movement of the valve rod during the opening operation.

5. In a circuit interrupter of the liquid break type, means defining an arc extinguishing unit, a pressure chamber and an interrupting chamber within the unit, an exhaust passage leading out of the interrupting chamber to the region exterior of the unit, a contact opening in the wall of the unit, contact means including a movable contact movable out of the contact opening for establishing an interrupting arc within the interrupting chamber, means for establishing a pressure-generating arc within the pressure chamber, passage means interconnecting the two chambers, relatively large first and second port openings in the walls of the unit disposed respectively adjacent the pressure and interrupting chambers, and valve means closing the port openings in the closed position of the interrupter and controlling the opening of the two port openings in response to opening movement of the movable contact.

6. In a circuit interrupter of the liquid break

type, an arc extinguishing unit immersed in an arc extinguishing liquid, means defining a pressure-generating chamber disposed at one end of the unit, means defining an interrupting chamber disposed at the other end of the unit, a first port opening disposed in the wall of the unit adjacent the pressure-generating chamber, a second port opening disposed in the wall of the unit adjacent the interrupting chamber, means for establishing a pressure-generating arc within the pressure-generating chamber, contact means including a movable contact movable out of the unit during the opening operation for establishing an interrupting arc within the interrupting chamber, valve means for controlling the opening of the first and second port openings, actuating means for the valve means responsive to the initial motion of the contact means, means biasing the valve means to the open position, and the actuating means maintaining the valve means closed in the closed circuit position of the interrupter against the biasing action exerted by the biasing means.

7. In a circuit interrupter of the liquid break type, an arc extinguishing unit immersed in an arc extinguishing liquid, means defining a pressure-generating chamber disposed at one end of the unit, means defining an interrupting chamber disposed at the other end of the unit, a first port opening disposed in the wall of the unit adjacent the pressure-generating chamber, a second port opening disposed in the wall of the unit adjacent the interrupting chamber, means for establishing a pressure-generating arc within the pressure-generating chamber, a contact opening provided in the wall of the unit adjacent the interrupting chamber, contact means including a movable contact movable out of the unit through the contact opening during the opening operation for establishing an interrupting arc within the interrupting chamber, valve means for controlling the opening of the first and second port openings, actuating means for the valve means responsive to the initial motion of the contact means for delaying the opening of the first and second port openings until the movable contact has withdrawn from the unit through the contact opening, means biasing the valve means to the open position, and the actuating means maintaining the valve means closed in the closed circuit position of the interrupter against the biasing action exerted by the biasing means.

8. In a circuit interrupter of the liquid break type, an arc extinguishing unit immersed in an arc extinguishing liquid, means defining a pressure-generating chamber disposed at one end of the unit, means defining an interrupting chamber disposed at the other end of the unit, a first port opening disposed in the wall of the unit adjacent the pressure-generating chamber, a second port opening disposed in the wall of the unit adjacent the interrupting chamber, means for establishing a pressure-generating arc within the pressure-generating chamber, a contact opening provided in the wall of the unit adjacent the interrupting chamber, an operating bar, contact means including a movable contact secured to the operating bar for establishing an interrupting arc within the interrupting chamber, the operating bar withdrawing the movable contact out of the contact opening in the fully open circuit position of the interrupter, valve means for controlling the opening of the first and second port openings, means biasing the valve means to the open position, actuating means for the valve

means including a valve rod making abutting engagement with a portion of the operating bar, and the operating bar maintaining the valve means closed in the closed circuit position of the interrupter against the biasing action exerted by the biasing means.

9. In a circuit interrupter of the liquid break type, an arc extinguishing unit immersed in an arc extinguishing liquid, means defining a pressure-generating chamber disposed at one end of the unit, means defining an interrupting chamber disposed at the other end of the unit, a first port opening disposed in the wall of the unit adjacent the pressure-generating chamber, a second port opening disposed in the wall of the unit adjacent the interrupting chamber, means for establishing a pressure-generating arc within the pressure-generating chamber, a contact opening provided in the wall of the unit adjacent the interrupting chamber, an operating bar, contact means including a movable contact secured to the operating bar for establishing an interrupting arc within the interrupting chamber, the operating bar withdrawing the movable contact out of the contact opening in the fully open circuit position of the interrupter, valve means for con-

trolling the opening of the first and second port openings, means biasing the valve means to the open position, actuating means for the valve means including a valve rod making abutting engagement with a portion of the operating bar, the operating bar maintaining the valve means closed in the closed circuit position of the interrupter against the biasing action exerted by the biasing means, and the arrangement being such that the valve means does not open the two port openings until the movable contact has withdrawn from the contact opening during the opening operation of the interrupter.

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