March 22, 1949. W. M. LEEDS 2,465,240

CIRCUIT INTERRUPTER

Filed Aug 31, 1944 3 Sheets-Sheet 1

Fig. 1.

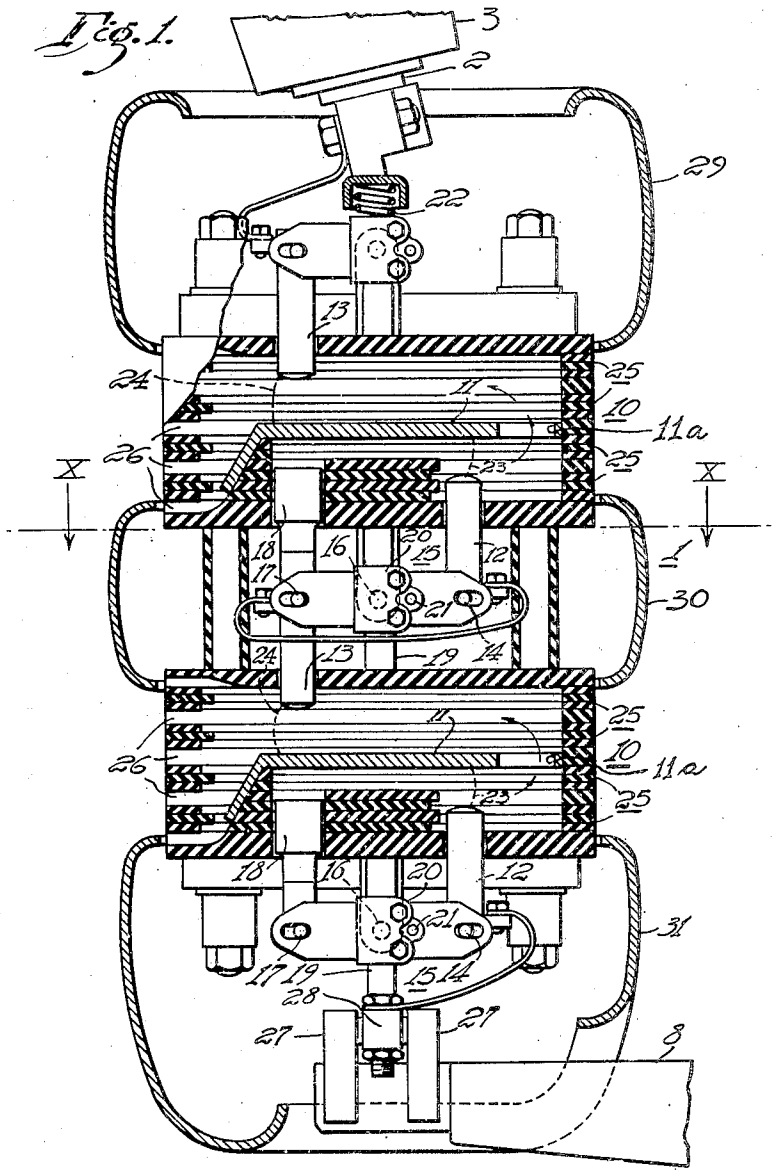
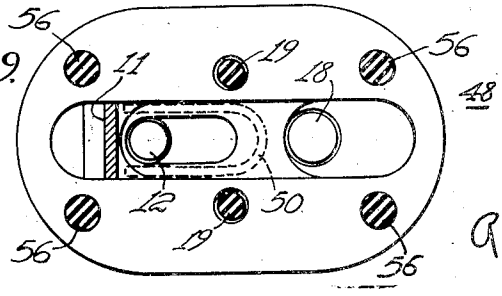


Fig. 9.



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CIRCUIT INTERRUPTER

Filed Aug. 31, 1944 3 Sheets-Sheet 2

Fig. 2.

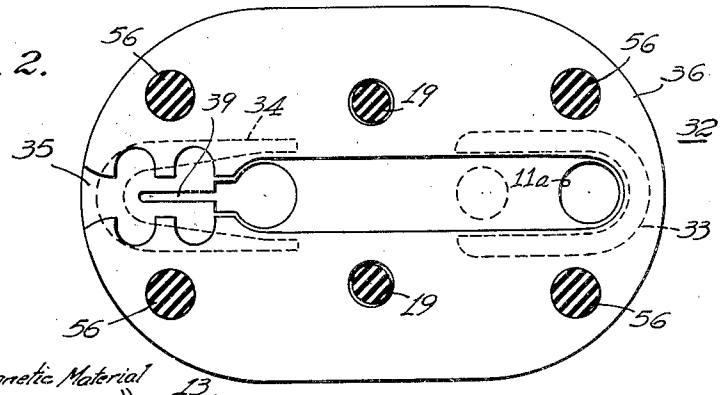


Fig. 3

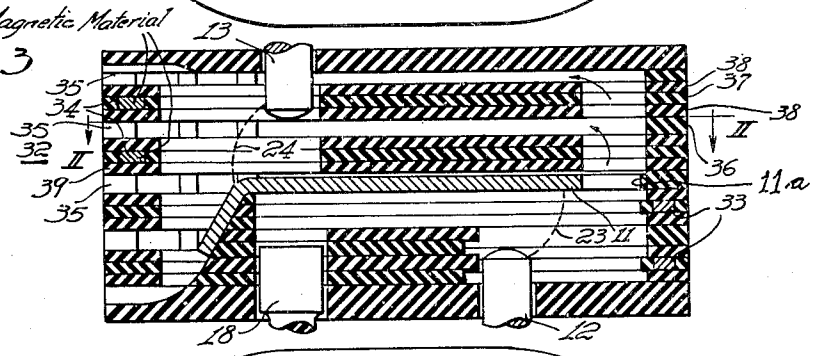


Fig. 4.

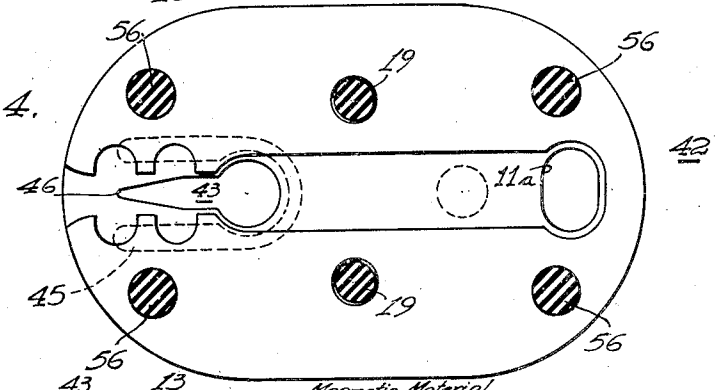
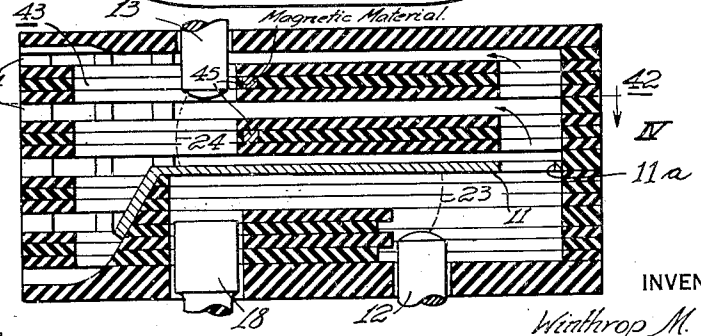


Fig. 5.



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CIRCUIT INTERRUPTER

Filed Aug. 31, 1944 3 Sheets-Sheet 3

Fig. 6.

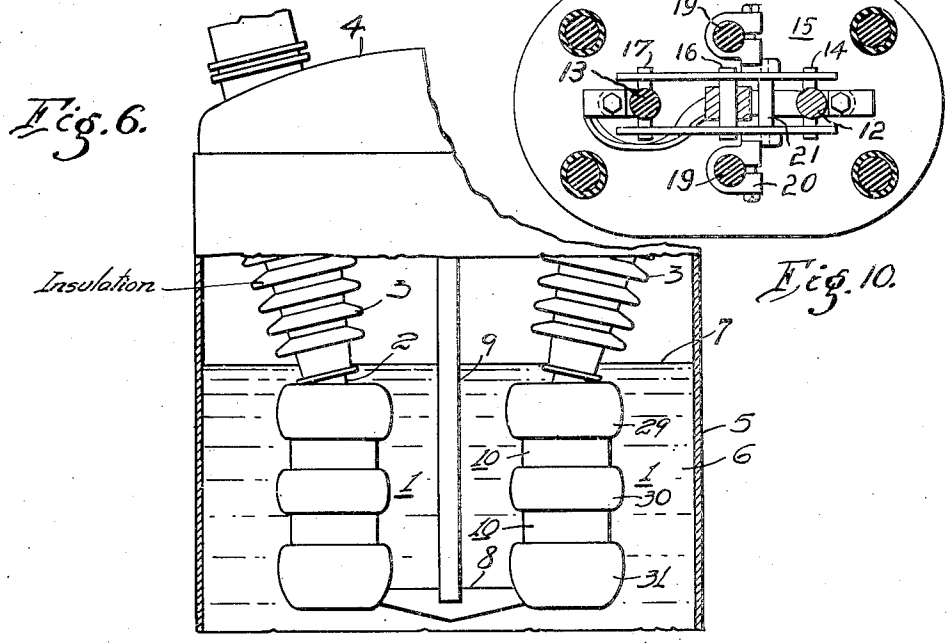


Fig. 10.

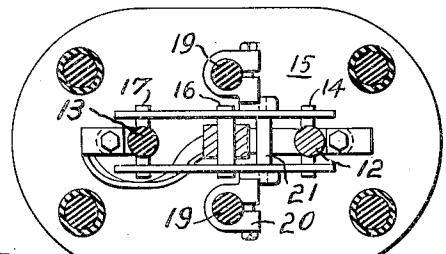


Fig. 7.

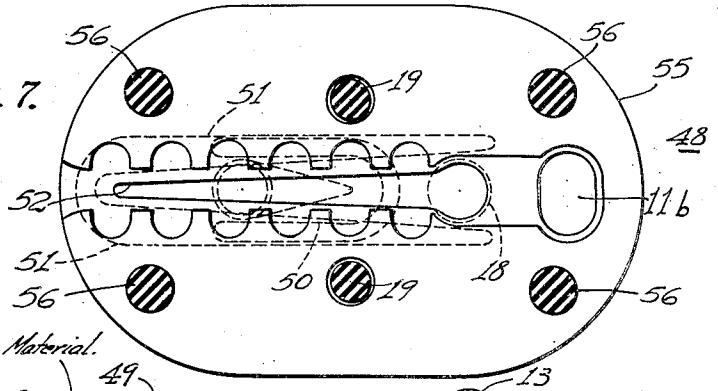
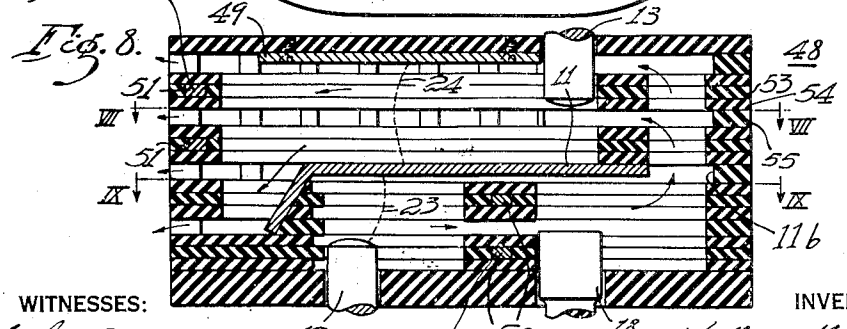


Fig. 8.



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Patented Mar. 22, 1949 2,465,240

UNITED STATES PATENT OFFICE

2,465,240

CIRCUIT INTERRUPTER

Winthrop M. Leeds, Forest Hills, Pa., assignor to Westinghouse Electric Corporation, East Pittsburgh, Pa., a corporation of Pennsylvania

Application August 31, 1944, Serial No. 552,133

22 Claims. (Cl. 200—150)

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This invention relates to circuit interrupters in general and, more particularly, to circuit interrupters of the liquid-break type.

In United States patent application filed August 15, 1944, Serial No. 549,576, by Winthrop M. Leeds and James M. Cumming, and assigned to the assignee of the instant invention, there is disclosed a novel circuit-interrupting structure in which rotatable actuating means are employed to effect simultaneous operation of the contact structures in a plurality of serially related superimposed arc-extinguishing units.

A general object of my invention is to provide an improved circuit interrupter which will more effectively interrupt the electrical circuit therethrough than has been achieved heretofore.

Another object is to provide an improved circuit interrupter comprising a plurality of arc-extinguishing units and to employ an improved operating arrangement for establishing two serially related arcs within each arc-extinguishing unit. Preferably one of the arcs is a pressure-generating arc and the other arc is an interrupting arc so that fluid may flow from the pressure-generating arc toward the interrupting arc to facilitate the latter's extinction.

Another object is to provide an improved circuit interrupter of the foregoing type in which piston means are associated with the movable contact means to assist in the interruption of low currents.

Another object is to provide an improved circuit interrupter in which the contact structure is such that there are no overlapping electrical potentials, thus reducing the hazard of insulation breakdown within the interrupter.

Another object is to provide an improved circuit interrupter comprising a plurality of arc-extinguishing units, in each of which stationary contact means are disposed within the unit with which two movable contacts movable toward each other come into engagement.

Another object is to provide an improved circuit interrupter of the foregoing type in which piston means associated with the contacts are employed to facilitate low current interruption.

Another object is to provide an improved circuit interrupter comprising an improved arc-extinguishing unit within which is positoned a stationary conducting plate. Preferably two movable contacts strike the plate in the closed circuit position of the interrupter and rotatable actuating means are employed for effecting the operation of each of the movable contacts. In a preferred arrangement, both of the rotatable

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actuating means are simultaneously operated by longitudinal movement of an operating rod extending externally of the several arc-extinguishing units.

In the usual type of two break circuit interrupter in which oil under pressure from the pressure-generating break is sent downwardly along the sides of the intermediate contact toward the interrupting break to effect the extinction of the interrupting arc, the vertical length along the sides of the relatively long intermediate contact is relied upon to prevent gas contamination of the oil forced into the interrupting arc. Such a vertical construction is shown, for example, in U. S. Patent 2,406,469 issued August 27, 1946, to Leon R. Ludwig, Winthrop M. Leeds and Benjamin P. Baker, and assigned to the assignee of the instant application.

The vertical height of such a construction as set forth in the above-mentioned patent does not readily lend itself to repeatable unit construction for higher voltage application because of the considerable vertical height required for a plurality of such units disposed in spaced superimposed relation and arranged for simultaneous operation.

It is, therefore, a further object of my invention to provide an improved arc extinguishing unit construction in which a relatively flat plate-like intermediate contact is utilized to diminsh vertical height, and to obtain the requisite length of oil travel by having an opening in partition means disposed adjacent the intermediate plate at a considerable distance laterally from both the contacts which engage the intermediate contact. This will provide the desired length of oil passage by such a U-shaped passage construction around the partition means, and yet the vertical height of such a relatively flat unit lends itself to repeatable unit construction for the higher voltage applications.

Still another object is to improve such a construction as set forth in the preceding paragraph by having a non-alignment of the contacts when engaging the intermediate plate contact with the opening through the partition means off laterally to one side of both contacts. Preferably a piston is employed to facilitate low current interruption.

Another object is to provide an improved operating mechanism for such a relatively flat repeatable unit construction in which the movable contacts are not aligned when in engagement with the plate type intermediate contact.

Further objects and advantages will readily become apparent upon a reading of the following

specification taken in conjunction with the drawings, in which:

Figure 1 is a vertical sectional view of an arc-extinguishing assemblage embodying my invention and shown in the partially open circuit position;

Fig. 2 is a sectional view taken along the line II–II of Fig. 3 of a modified type unit construction;

Fig. 3 is a vertical sectional view through the modified type of arc-extinguishing unit embodying my invention;

Fig. 4 is a sectional view taken along the line IV–IV of Fig. 5 of a still further modified type unit construction;

Fig. 5 is a vertical sectional view through the modified type of arc-extinguishing unit embodying my invention;

Fig. 6 is an elevational view of two of the arc-extinguishing assemblages shown in Fig. 1 immersed in a liquid contained within a tank structure, the parts being shown in the closed circuit position;

Fig. 7 is a sectional view taken along the line VII—VII of Fig. 8 of another modified type unit construction;

Fig. 8 is a vertical sectional view through the modified type of arc-extinguishing unit embodying my invention;

Fig. 9 is a sectional view on a reduced scale taken along the line IX—IX of Fig. 8; and

Fig. 10 is a sectional view taken along the line X—X of Fig. 1.

Referring to the drawings, and more particularly to Figs. 1 and 6 thereof, the reference numeral 1 generally designates an arc-extinguishing assemblage supported by a terminal stud 2 extending through an insulating bushing 3 which is supported from the cover 4 of a tank 5 in which a suitable arc-extinguishing fluid 6, in this instance oil, is filled to the level 7. A movable conducting bridging member 8, reciprocally operated by an insulating operating rod 9, serves to electrically connect the arc-extinguishing assemblage 1 with a second identical arc-extinguishing assemblage 1 supported in like manner from the cover 4.

Referring more particularly to Fig. 1, it will be observed that the arc-extinguishing assemblage 1 comprises a plurality of, in this instance two, arc-extinguishing units generally designated by the reference numeral 10 which are positioned in spaced relation by suitable means well known in the art. Disposed intermediate the ends of each unit 10 are stationary contact means and apertured partition means comprising a stationary conducting plate 11 which makes engagement in the closed circuit position with movable contact means, in this instance comprising a first or lower movable contact 12 and a second or upper movable contact 13. The contacts 12, 13 are not aligned when in engagement with the plate 11. The lower movable contacts 12 are pivotally supported at 14 to the right-hand end of a lever means generally designated by the reference numeral 15 and pivotally operable about a stationary pivot 16 intermediate the ends thereof. At the left-hand end of the lever means 15 pivotally supported thereto at 17 is a piston member 18. It will be noted that the second or upper movable contact 13 associated with the lower arc-extinguishing unit 10 moves with the piston member 18 associated with the upper arc-extinguishing unit 10.

The lever means 15 is rotated by vertical reciprocating motion of two insulating operating rods 19 (see Fig. 3) to which are clamped brackets 20, the brackets 20 having pins 21 extending therethrough. The pins 21 also extend through the lever means 15 at an offcenter location so that upward or closing movement of the operating rods 19 causes a counterclockwise rotation of the lever means 15 to thereby effect an engagement between the movable contacts 12, 13 and the stationary plate 11.

During the opening operation the bridging member 8 moves downwardly to permit the accelerating compression springs 22 to force the operating rods 19 downwardly thereby causing a clockwise rotation of the lever means 15 about the pivots 16 to cause a separation between the movable contacts 12, 13 and the stationary plate 11 within each arc-extinguishing unit 10.

The separation between the movable contact 12 and the stationary plate 11 establishes a pressure-generating arc 23 which serves to drive oil in the direction indicated by the arrows through an opening 11a in the plate 11 and toward the interrupting arc 24 drawn between the movable contact 13 and the stationary plate 11. Splitter members, generally designated by the reference numeral 25, may be employed to more readily effect the extinction of the interrupting arc 24 as it moves in the direction of the vents 26.

It will be observed that with the construction shown gas contamination of the oil forced into the interrupting arc 24 is avoided by the position of the opening 11a in the partition means 11, which gives a relatively long U-shaped oil flow passage between the arcs 23, 24. In many prior constructions where the contacts are aligned, the length of the intermediate contact is considerable and consequently the vertical height of prior art unit constructions prohibited their superimposed use for higher voltage applications.

In my improved unit 10 it will be noticed that the structure is relatively flat because of the use of the flat plate 11 and the location of the opening 11a to give a U-shaped oil flow passage. Consequently I may employ two or more such units in spaced superimposed relation and still have very little height used up for the entire assemblage 1.

Also, the non-alignment of the contacts 12, 13 cooperates with the particular lever means 15 employed and results in a considerable lateral distance between the arcs 23, 24. This has the advantage, as indicated before, in providing a sufficiently long oil flow passage between the two arcs to prevent gas contamination of oil forced into the interrupting gap. This lateral distance is enhanced in the construction shown by positioning the opening 11a off laterally to one side of both contacts 12, 13 to thereby obtain an increased length of U-shaped oil flow passage between the arcs 23, 24.

Further, the non-alignment of the contacts 12, 13 cooperating with the particular lever operating means 15 shown permits the use of the pistons 18 in alignment with the contacts 13 at the other end of the lever means 15 from the contacts 12.

During the interruption of low currents when the pressure generated at the pressure-generating arc 23 is relatively low, the piston action afforded by the upward moving piston member 18 will create the requisite flow required for interruption of the interrupting arc 24. After interruption of the interrupting arc 24 has occurred, and after the operating rods 19 have reached their lowermost position, the conducting bridging

member 8 separates from the disconnect fingers 27, associated with a cross-member 28 interconnecting the two operating rods 19, to provide an isolating gap into the circuit. Electrostatic shields 29, 30 and 31 may be employed to minimize corona formation.

It will be noted that each unit 10 is a duplicate of the next unit, thus making this interrupter very adaptable to application at different voltages by using a proportional number of units 10. It will also be noted that a distinct advantage of this design is that the series-connected arcs, 23, 24 are also in series in space, that is, there are no overlapping electrical potentials, thereby reducing the hazard of insulation breakdown. Furthermore, considerable mechanical speed of contact separation is obtained by connecting the operating rods 19 to the lever means 15 at a shorter radius offcenter than the moving contacts 12, 13. As a result, different ratios of speed of the pressure break to the interrupting break are easily obtainable. I have found that a 1:2 ratio gives very good test results. The piston members 18 for low current interruption may be added without appreciable complication of the operating mechanism.

By making the area of the low current piston 18 equal approximately to the sum of the areas of moving contacts 12 and 13, the pressure developed by the arcs will exert forces on the operating linkage which are approximately balanced.

Figs. 2 and 3 show a modified type of arc-extinguishing unit generally designated by the reference numeral 32 which may be used in place of the arc-extinguishing units 10 of Fig. 1. It will be noted that U-shaped inserts 33 composed of a suitable magnetic material, in this instance iron, are employed in the lower portion of the unit 32 to effect a lateral movement of the pressure-generating arc 23. Also in the upper portion of the unit 32 U-shaped magnetic inserts 34 may also be used to bias the interrupting arc 24 toward vents 35 provided in insulating plates 36 having a configuration more clearly shown in Fig. 2. The magnetic inserts 34 are positioned in insulating plates 37 between adjacent insulating plates 38 of the same shape. The plates 37, 38 provide a restricted slot 39 (Fig. 2) into which the interrupting arc 24 may be biased by the inserts 34 only during relatively low instantaneous values of arcing current, that is, near a current zero. The oil flow from the pressure arc 23 toward the interrupting arc 24 is as indicated by the arrows.

The provision of magnetic means for effecting the lateral movement of the pressure-generating arc 23 increases the pressure formed thereat. The concept of laterally moving the pressure-generating arc by magnetic means is disclosed and claimed in United States patent application Serial No. 471,847, filed January 9, 1943, by Benjamin P. Baker, now Patent No. 2,412,857, granted December 17, 1946, and assigned to the assignee of the instant application. Also the magnetically biasing of the interrupting arc 24 toward the vents 35 coupled with the oil flow from the pressure-generating arc 23 rapidly effects the extinction of the interrupting arc 24.

Figs. 4 and 5 show another modified type of arc extinguishing unit generally designated by the reference numeral 42. In this embodiment of my invention the interrupting arc 24 is drawn in a widened slot 43, but is biased to the right away from the vents 44 by U-shaped inserts 45

composed of magnetic material and being positioned as shown more clearly in Fig. 4. The provision of the inserts 45 biases the interrupting arc 24 away from the vents 44 only during relatively high instantaneous values of arcing current, but near a current zero the biasing force decreases to permit oil flow from the pressure-generating arc 23 to carry the interrupting arc 24 into the restriction adjacent the vents 44 to effect its extinction at an early current zero.

Figs. 7 through 9 show another embodiment of my invention. A modified type of arc-extinguishing unit generally designated by the reference numeral 48 is provided at the upper end of which is employed an arcing horn 49 thus permitting extensive lateral movement of the interrupting arc 24 to the left. U-shaped magnetic inserts 50 are employed to effect a lateral movement of the pressure-generating arc 23 to increase the pressure formed thereat. U-shaped inserts 51 composed of a suitable magnetic material are provided to bias the interrupting arc 24 toward the left along the arcing horn 49 and plate 11 into a tapering restriction 52 provided by groups of plates, each group including an insulating plate 53 containing the magnetic insert 51 and two adjacently disposed insulating guard plates 54 of the same shape. Insulating vent plates 55 having a configuration more clearly shown in Fig. 7 are provided with oil pockets along the arc slot and openings to permit the oil to vent out of the unit 48. An opening 11b is provided adjacent the partition means 11 disposed intermediate the ends of the unit 48. The long slot provided for arc motion permits the magnetic field to keep the arc moving up to the boundary of the advancing gas bubble where the turbulent deionizing action is a maximum. This assures arc interruption at the first current zero after the arc moves off contact 13 onto the arcing horn 49.

In the several embodiments of my invention, insulating tie rods 56 may be employed to hold the several plates fixedly in position, and preferably the operating rods 19 extend through the arc-extinguishing units.

From the foregoing description it will be apparent that I have provided an improved interrupter comprising a plurality of arc-extinguishing units in spaced relation without overlapping electrical potentials, in each of which a pressure-generating arc is established to drive oil toward an interrupting arc, the oil flow being supplemented by a piston for low current interruption. Preferably I employ magnetic means to effect a lateral movement of one or both of the arcs drawn in each arc-extinguishing unit to accelerate and intensify the interrupting action.

It will also be apparent from the foregoing description of several embodiments of my invention that I have provided an improved relatively flat arc extinguishing unit construction readily adaptable for higher voltage applications without using much vertical space. The construction is such that a relatively great distance is provided between the arcs 23, 24 by having the contacts 12, 13 disposed laterally apart. This nonalignment of the movable contacts 12, 13 cooperates with the operating mechanism disclosed including the rotatabe lever means 15, and permits the employment of a U-shaped oil flow passage passing through the partition means 11 and interconnecting the arcs 23, 24 in such manner as to prevent gas contamination of the oil sent

toward the interrupting arc 24 to effect the latter's extinction.

It will furthermore be observed that by the provision of the non-alignment of the movable contacts 12, 13 with the rotatable lever means 15 employed to effect their operation, advantage may be taken of one end of the lever means to cause actuation of the piston members 18, which by their position, do not interfere with motion of their adjacent laterally disposed companion movable contact members 12.

Also the simultaneous separation of the contacts 12, 13 from the intermediate plates 11 causes simultaneous drawing of the pressure-generating arcs 23 and the interrupting arcs 24. Thus the assemblage 1 is high speed in operation and may be used for high speed breaker application.

It will be apparent to those skilled in the art that various interrupting structures may be employed for effecting extinction of the interrupting arc 24. However, I do not desire my invention to be confined to the particular plate interrupting structures herein set forth, as certain broad structural positioning features of my invention together with the operating mechanism cooperating therewith are of wide scope and application.

Although I have shown and described specific structures, it is to be clearly understood that the same were merely for purposes 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, two arc-extinguishing units, stationary contact means disposed in each unit intermediate the ends thereof, lever means disposed between the two units, means pivotally mounting the lever means intermediate the ends thereof, means for rotating the lever means during the opening and closing operations, a movable contact linked to each end of the lever means, the two movable contacts being movable in opposite directions and into engagement with one side of the stationary contact means disposed in the two units, and means for establishing a serially related arc on the other side of the stationary contact means in at least one of the units.

2. In a circuit interrupter, a first and a second arc-extinguishing unit, stationary contact means disposed in each unit intermediate the ends thereof, lever means disposed between the two units, means pivotally mounting the lever means intermediate the ends thereof, means for rotating the lever means during the opening and closing operations, a first contact linked to one end of the lever means and movable into the first unit into engagement with the stationary contact means disposed therein, a second contact linked to the other end of the lever means and movable into the second unit into engagement with the stationary contact means positioned therein, means including the stationary contact means for establishing a second serially related arc in one of the two units, and a piston member forming an extension of the second contact and movable during the opening operation into the first unit to assist during low current interruption.

3. In a circuit interrupter, two arc-extinguishing units, stationary contact means disposed in each unit intermediate the ends thereof, lever means disposed between the two units, a movable contact linked to each end of the lever means, the two movable contacts being movable in opposite directions and into engagement with the stationary contact means disposed in the two units, means for pivotally mounting the lever means intermediate the ends thereof, means including the stationary contact means in each unit for establishing a second serially related arc in each unit, and an operating rod extending longitudinally of the units and pivotally connected to the lever means to cause the rotation thereof.

4. In a circuit interrupter, a first and a second arc-extinguishing unit, stationary contact means disposed in each unit intermediate the ends thereof, lever means disposed between the two units, means for rotating the lever means during the opening and closing operations, a first contact linked to one end of the lever means and movable into the first unit into engagement with the stationary contact means disposed therein, a second contact linked to the other end of the lever means and movable into the second unit into engagement with the stationary contact means positioned therein, a piston member forming an extension of the second contact and movable during the opening operation into the first unit to assist during low current interruption, means for pivotally mounting the lever means intermediate the ends thereof, means including the stationary contact means in each unit for establishing a second serially related arc in each unit, and an operating rod extending longitudinally of the units and pivotally connected to the lever means to cause the rotation thereof.

5. In a circuit interrupter, a first and a second arc-extinguishing unit, stationary contact means disposed in each unit intermediate the ends thereof, lever means disposed between the two units, means pivotally mounting the lever means intermediate the ends thereof, means for rotating the lever means during the opening and closing operations, a movable contact linked to each end of the lever means, the two movable contacts being movable in opposite directions and into engagement with the stationary contact means disposed in the two units, second lever means positioned on the other side of the second unit, and a movable contact linked to one end of the second lever means and movable during the closing operation into engagement with the stationary contact means disposed in the second unit.

6. In a circuit interrupter, a first and a second arc-extinguishing unit, stationary contact means disposed in each unit intermediate the ends thereof, lever means disposed between the two units, means for rotating the lever means during the opening and closing operations, a movable contact linked to each end of the lever means, the two movable contacts being movable in opposite directions and into engagement with the stationary contact means disposed in the two units, second lever means positioned on the other side of the second unit, a movable contact linked to one end of the second lever means and movable during the closing operation into engagement with the stationary contact means disposed in the second unit, means pivotally mounting both lever means intermediate the ends thereof, and an operating rod extending longitudinally of the units and pivotally connected to both lever means to cause the rotation thereof.

7. In a circuit interrupter, a first and a second arc extinguishing unit, stationary contact means disposed in each unit intermediate the

ends thereof, lever means disposed between the two units, means for rotating the lever means during the opening and closing operations, a movable contact linked to each end of the lever means, the two movable contacts being movable in opposite directions and into engagement with the stationary contact means disposed in the two units, second lever means positioned on the other side of the second unit, a movable contact linked to one end of the second lever means and movable during the closing operation into engagement with the stationary contact means disposed in the second unit, means pivotally mounting the first and second lever means intermediate the ends thereof, and a piston member linked to the other end of the second lever means and movable into the second unit during the opening operation.

8. In a circuit interrupter, a first and a second arc-extinguishing unit, stationary contact means disposed in each unit intermediate the ends thereof, lever means disposed between the two units, means for rotating the lever means during the opening and closing operations, a movable contact linked to each end of the lever means, the two movable contacts being movable in opposite directions and into engagement with the stationary contact means disposed in the two units, second lever means positioned on the other side of the second unit, a movable contact linked to one end of the second lever means and movable during the closing operation into engagement with the stationary contact means disposed in the second unit, means pivotally mounting both lever means intermediate the ends thereof, an operating rod extending longitudinally of the units and pivotally connected to both lever means to cause the rotation thereof, and a piston member linked to the other end of the second lever means and movable into the second unit during the opening operation.

9. In a circuit interrupter, a first and a second arc-extinguishing unit, stationary contact means disposed in each unit intermediate the ends thereof, lever means disposed between the two units, means pivotally mounting the lever means intermediate the ends thereof, means for rotating the lever means during the opening and closing operations, a first contact linked to one end of the lever means and movable into the first unit into engagement with the stationary contact means disposed therein, a second contact linked to the other end of the lever means and movable into the second unit into engagement with the stationary contact means positioned therein, a piston member forming an extension of the second contact and movable during the opening operation into the first unit to assist during low current interruption, second lever means disposed on the other side of the second unit, and a first contact linked to one end of the second lever means and movable into engagement with the stationary contact means disposed in the second unit.

10. In a circuit interrupter, a first and a second arc-extinguishing unit, stationary contact means disposed in each unit intermediate the ends thereof, lever means disposed between the two units, means for rotating the lever means during the opening and closing operations, a first contact linked to one end of the lever means and movable into the first unit into engagement with the stationary contact means disposed therein, a second contact linked to the other end of the lever means and movable into the second unit into engagement with the stationary contact means positioned therein, a piston member forming an extension of the second contact and movable during the opening operation into the first unit to assist during low current interruption, second lever means disposed on the other side of the second unit, a first contact linked to one end of the second lever means and movable into engagement with the stationary contact means disposed in the second unit, means pivotally mounting the two lever means intermediate the ends thereof, and an operating rod extending longitudinally of the units and pivotally connected to the two lever means to cause the rotation thereof.

11. In a circuit interrupter, a first and a second arc-extinguishing unit, stationary contact means disposed in each unit intermediate the ends thereof, lever means disposed between the two units, means for rotating the lever means during the opening and closing operations, a first contact linked to one end of the lever means and movable into the first unit into engagement with the stationary contact means disposed therein, a second contact linked to the other end of the lever means and movable into the second unit into engagement with the stationary contact means positioned therein, a piston member forming an extension of the second contact and movable during the opening operation into the first unit to assist during low current interruption, second lever means disposed on the other side of the second unit, means pivotally mounting the first and second lever means intermediate the ends thereof, a first contact linked to one end of the second lever means and movable into engagement with the stationary contact means disposed in the second unit, and a second piston member linked to the other end of the second lever means and movable into the second unit during the opening operation to assist during low current interruption.

12. In a circuit interrupter, a first and a second arc-extinguishing unit, stationary contact means disposed in each unit intermediate the ends thereof, lever means disposed between the two units, means for rotating the lever means during the opening and closing operations, a first contact linked to one end of the lever means and movable into the first unit into engagement with the stationary contact means disposed therein, a second contact linked to the other end of the lever means and movable into the second unit into engagement with the stationary contact means positioned therein, a piston member forming an extension of the second contact and movable during the opening operation into the first unit to assist during low current interruption, second lever means disposed on the other side of the second unit, a first contact linked to one end of the second lever means and movable into engagement with the stationary contact means disposed in the second unit, a second piston member linked to the other end of the second lever means and movable into the second unit during the opening operation to assist during low current interruption, means pivotally mounting the two lever means intermediate the ends thereof, and an operating rod extending longitudinally of the units and pivotally connected to the two lever means to cause the rotation thereof.

13. In a circuit interrupter, a substantially enclosed arc extinguishing unit, a conducting plate positioned intermediate the ends of the unit, the unit defining a pressure-generating chamber on one side of the plate and an interrupting cham-

ber on the other side of the plate, contact means including a pair of movable contacts simultaneously separable from the conducting plate to simultaneously establish a pressure-generating arc within the pressure-generating chamber and an interrupting arc within the interrupting chamber, the pair of contacts being non-aligned when in the closed circuit position, and a U-shaped fluid flow passage means interconnecting the two chambers so that fluid under pressure from the pressure-generating arc may flow under pressure through the passage means into the interrupting chamber to effect the extinction of the interrupting arc disposed therein.

14. In a circuit interrupter, a substantially enclosed arc extinguishing unit, a conducting plate positioned intermediate the ends of the unit, the unit defining a pressure-generating chamber on one side of the plate and an interrupting chamber on the other side of the plate, contact means including a pair of movable contacts simultaneously separable from the conducting plate to simultaneously establish a pressure-generating arc within the pressure-generating chamber and an interrupting arc within the interrupting chamber, the pair of contacts being non-aligned when in the closed circuit position, a pair of lever means disposed on opposite sides of the unit for operating the contact means, means pivotally mounting each of the lever means intermediate the ends thereof, each of the movable contacts being operatively connected adjacent one end of each lever means, passage means interconnecting the two chambers so that fluid under pressure from the pressure-generating arc may flow under pressure through the passage means into the interrupting chamber to effect the extinction of the interrupting arc disposed therein.

15. In a circuit interrupter, a substantially enclosed arc extinguishing unit, a conducting plate positioned intermediate the ends of the unit, the unit defining a pressure-generating chamber on one side of the plate and an interrupting chamber on the other side of the plate, contact means including a pair of movable contacts simultaneously separable from the conducting plate to simultaneously establish a pressure-generating arc within the pressure-generating chamber and an interrupting arc within the interrupting chamber, the pair of contacts being non-aligned when in the closed circuit position, a U-shaped fluid flow passage means interconnecting the two chambers so that fluid under pressure from the pressure-generating arc may flow under pressure through the passage means into the interrupting chamber to effect the extinction of the interrupting arc disposed therein, a piston chamber disposed closely adjacent to the path of movement of one of the movable contacts, and a piston member movable within the piston chamber to facilitate low current interruption.

16. In a circuit interrupter, a substantially enclosed arc extinguishing unit, a conducting plate positioned intermediate the ends of the unit, the unit defining a pressure-generating chamber on one side of the plate and an interrupting chamber on the other side of the plate, contact means including a pair of movable contacts simultaneously separable from the conducting plate to simultaneously establish a pressure-generating arc within the pressure-generating chamber and an interrupting arc within the interrupting chamber, the pair of contacts being non-aligned when in the closed circuit position, a pair of lever means disposed on opposite sides of the unit for operating the contact means, means pivotally mounting each of the lever means intermediate the ends thereof, each of the movable contacts being operatively connected adjacent one end of each lever means, passage means interconnecting the two chambers so that fluid under pressure from the pressure-generating arc may flow under pressure through the passage means into the interrupting chamber to effect the extinction of the interrupting arc disposed therein, a piston chamber disposed closely adjacent to the path of movement of one of the movable contacts, and a piston member movable within the piston chamber to facilitate low current interruption.

17. In a circuit interrupter of the liquid break type, a substantially enclosed arc extinguishing unit submerged within the liquid, operating means for the unit including a pair of lever means positioned on opposite sides of the unit, means pivotally mounting each of the lever means intermediate the ends thereof, a movable contact linked adjacent one end of each of the two lever means and movable within the unit, a conducting plate positioned intermediate the ends of the unit with which the two movable contacts make non-aligning engagement, the unit defining a pressure-generating chamber adjacent to the path of movement of one of the movable contacts, the unit defining an interrupting chamber adjacent to the path of movement of the other movable contact, and passage means interconnecting the two chambers so that liquid under pressure from the pressure-generating chamber may flow through the passage means and into the interrupting chamber to effect the extinction therein of the interrupting arc.

18. In a circuit interrupter of the liquid break type, a substantially enclosed arc extinguishing unit submerged within the liquid, operating means for the unit including a pair of lever means positioned on opposite sides of the unit, means pivotally mounting each of the lever means intermediate the ends thereof, a movable contact linked adjacent one end of each of the two lever means and movable within the unit, a conducting plate positioned intermediate the ends of the unit with which the two movable contacts make non-aligning engagement, the unit defining a pressure-generating chamber adjacent to the path of movement of one of the movable contacts, the unit defining an interrupting chamber adjacent to the path of movement of the other movable contact, passage means interconnecting the two chambers so that liquid under pressure from the pressure-generating chamber may flow through the passage means and into the interrupting chamber to effect the extinction therein of the interrupting arc, a piston chamber disposed adjacent the path of movement of one of the two movable contacts, and a piston member operatively linked adjacent the other end of one of the two lever means and movable within the piston chamber to facilitate low current interruption.

19. In a circuit interrupter of the liquid break type, a substantially enclosed arc extinguishing unit submerged within the liquid, operating means for the unit including a pair of lever means positioned on opposite sides of the unit, means pivotally mounting each of the lever means intermediate the ends thereof, a movable contact linked adjacent one end of each of the two lever means and movable within the unit, a conducting plate positioned intermediate the ends of the unit with which the two movable contacts make non-aligning engagement, the unit defining a pressure-gen-

erating chamber adjacent to the path of movement of one of the movable contacts, the unit defining an interrupting chamber adjacent to the path of movement of the other movable contact, passage means interconnecting the two chambers so that liquid under pressure from the pressure-generating chamber may flow through the passage means and into the interrupting chamber to effect the extinction therein of the interrupting arc, a piston chamber disposed adjacent the path of movement of the pressure-generating contact, and a piston member operatively linked adjacent the other end of one of the two lever means and movable within the piston chamber to facilitate low current interruption.

20. In a circuit interrupter, a substantially enclosed arc extinguishing unit, a conducting plate positioned intermediate the ends of the unit, the unit defining a pressure-generating chamber on one side of the plate and an interrupting chamber on the other side of the plate, contact means including a pair of movable contacts simultaneously separable from the conducting plate to simultaneously establish a pressure-generating arc within the pressure-generating chamber and an interrupting arc within the interrupting chamber, the pair of contacts being non-aligned when in the closed circuit position, a pair of lever means disposed on opposite sides of the unit for operating the contact means, means pivotally mounting each of the lever means intermediate the ends thereof, each of the movable contacts being operatively connected adjacent one end of each lever means, passage means interconnecting the two chambers so that fluid under pressure from the pressure-generating arc may flow under pressure through the passage means into the interrupting chamber to effect the extinction of the interrupting arc disposed therein, a piston chamber disposed closely adjacent to the path of movement of one of the movable contacts, a piston member movable within the piston chamber to facilitate low current interruption, and the piston member being operatively connected adjacent the other end of one of the two lever means.

21. In a circuit interrupter, a substantially enclosed arc extinguishing unit, a conducting plate positioned intermediate the ends of the unit, the unit defining a pressure-generating chamber on one side of the plate and an interrupting chamber on the other side of the plate, contact means including a pair of movable contacts simultaneously separable from the conducting plate to simultaneously establish a pressure-generating arc within the pressure-generating chamber and an interrupting arc within the interrupting chamber, the pair of contacts being non-aligned when in the closed circuit position, a pair of lever means disposed on opposite sides of the unit for operating the contact means, means pivotally mounting each of the lever means intermediate the ends thereof, each of the movable contacts being operatively connected adjacent one end of each lever means, passage means interconnecting the two chambers so that fluid under pressure from the pressure-generating arc may flow under pressure through the passage means into the interrupting chamber to effect the extinction of the interrupting arc disposed therein, a piston chamber disposed closely adjacent to the path of movement of the pressure-generating contact, and a piston member movable within the piston chamber to facilitate low circuit interruption.

22. In a circuit interrupter, a substantially enclosed arc extinguishing unit, a conducting plate positioned intermediate the ends of the unit, the unit defining a pressure-generating chamber on one side of the plate and an interrupting chamber on the other side of the plate, contact means including a pair of movable contacts simultaneously separable from the conducting plate to simultaneously establish a pressure-generating arc within the pressure-generating chamber and an interrupting arc within the interrupting chamber, the pair of contacts being non-aligned when in the closed circuit position, a pair of lever means disposed on opposite sides of the unit for operating the contact means, means pivotally mounting each of the lever means intermediate the ends thereof, each of the movable contacts being operatively connected adjacent one end of each lever means, passage means interconnecting the two chambers so that fluid under pressure from the pressure-generating arc may flow under pressure through the passage means into the interrupting chamber to effect the extinction of the interrupting arc disposed therein, a piston chamber disposed closely adjacent to the path of movement of the pressure-generating contact, a piston member movable within the piston chamber to facilitate low circuit interruption, and the piston member being operatively connected adjacent the other end of one of the two lever means.

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REFERENCES CITED

The following references are of record in the file of this patent:

UNITED STATES PATENTS

Number	Name	Date
1,081,119	Johnson	Dec. 9, 1913
1,645,905	Gregory et al.	Oct. 28, 1927
1,914,137	Leeds	June 13, 1933
1,991,901	Leeds	Feb. 19, 1935
2,039,054	Boden et al.	Apr. 28, 1936
2,147,497	Prince et al.	Feb. 14, 1939
2,155,263	Flurscheim	Apr. 18, 1939
2,192,772	MacNeill	Mar. 5, 1940
2,214,620	Leeds	Sept. 10, 1940
2,292,547	Sadler	Aug. 11, 1942
2,372,589	Leeds et al.	Mar. 27, 1945
2,394,046	Dickinson	Feb. 5, 1946

FOREIGN PATENTS

Number	Country	Date
486,050	Great Britain	May 30, 1938