

Sept. 5, 1933.

R. C. DICKINSON

1,925,865

CIRCUIT BREAKER

Filed Nov. 6, 1928

5 Sheets-Sheet 1

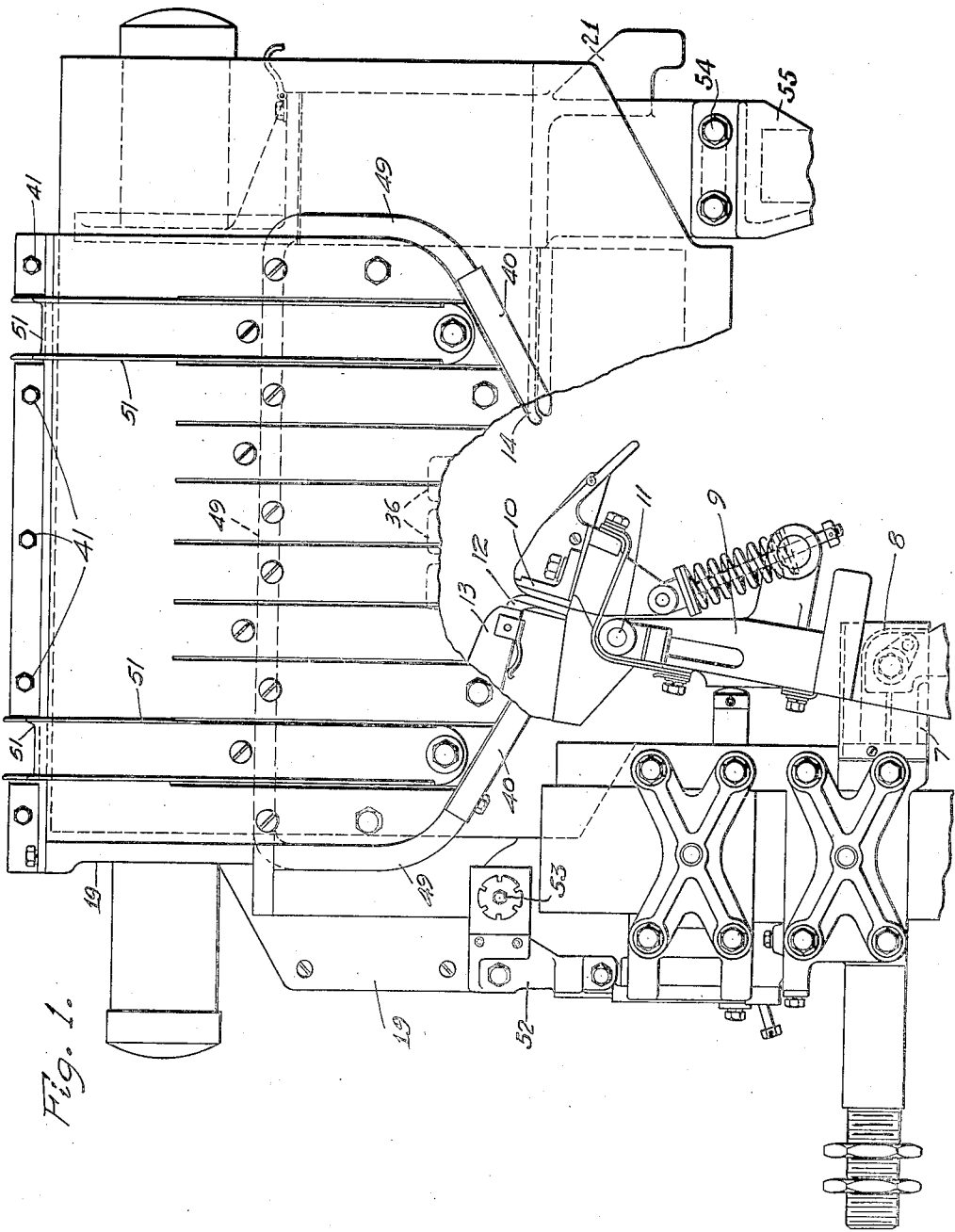


Fig. 1.

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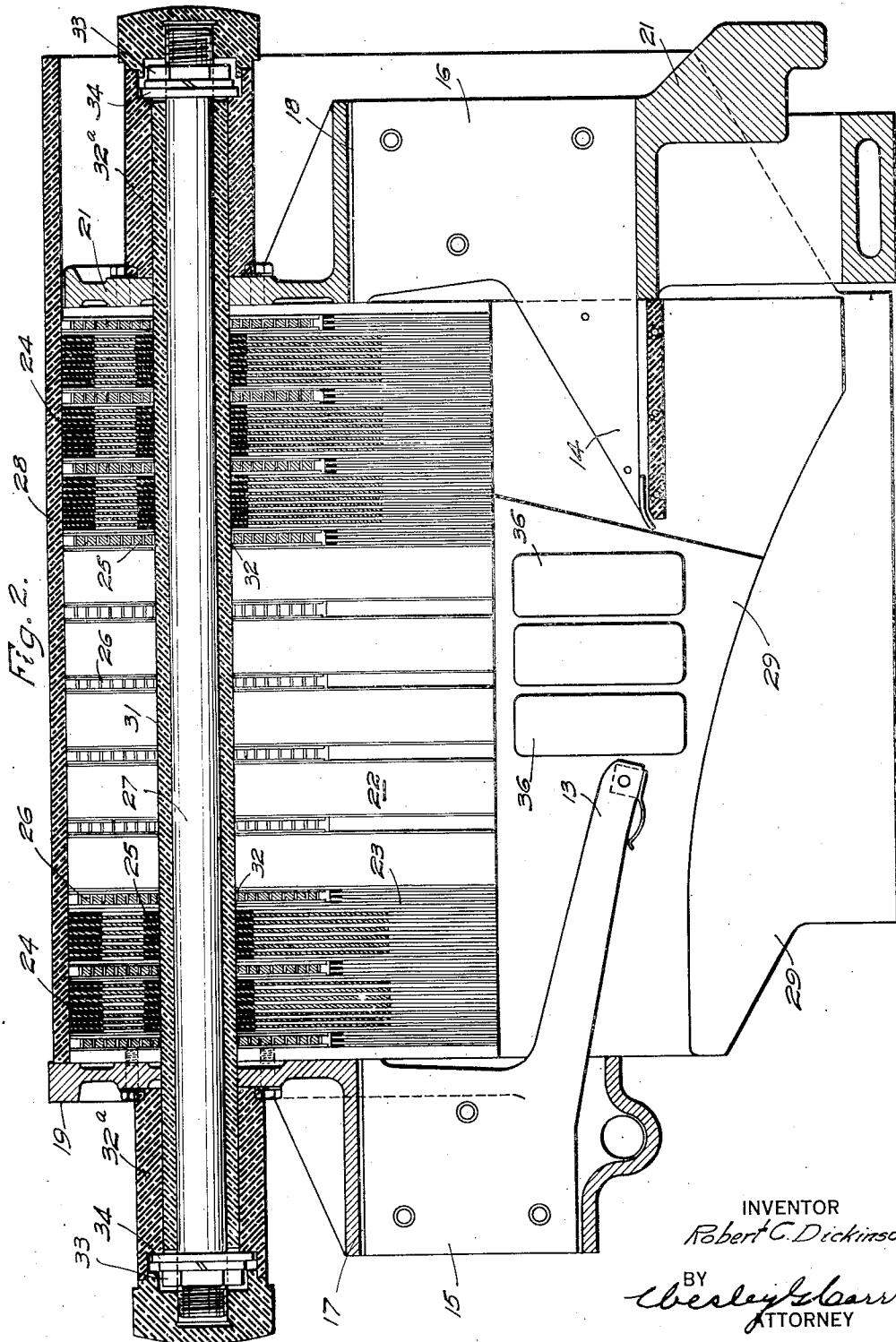
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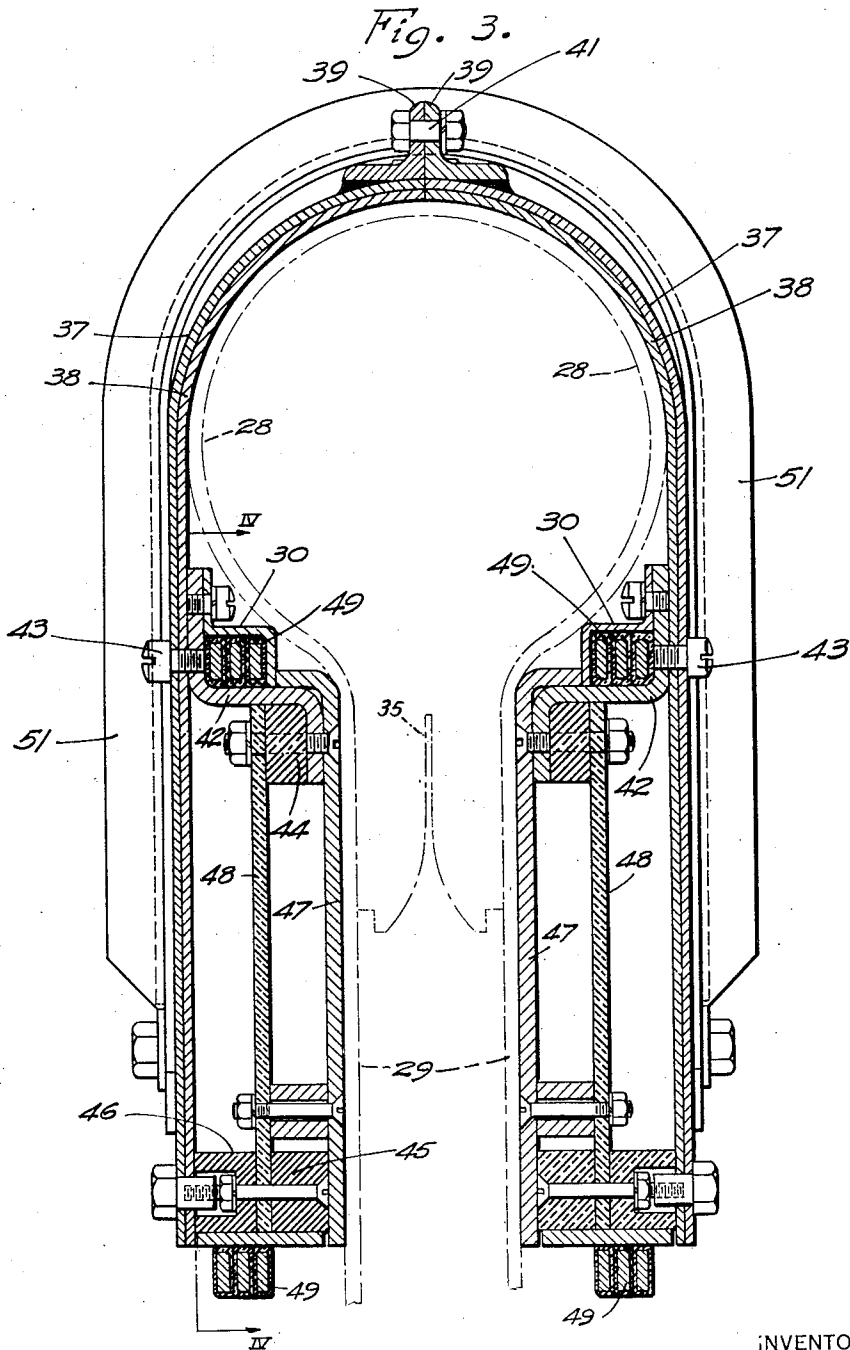
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CIRCUIT BREAKER

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5 Sheets-Sheet 3



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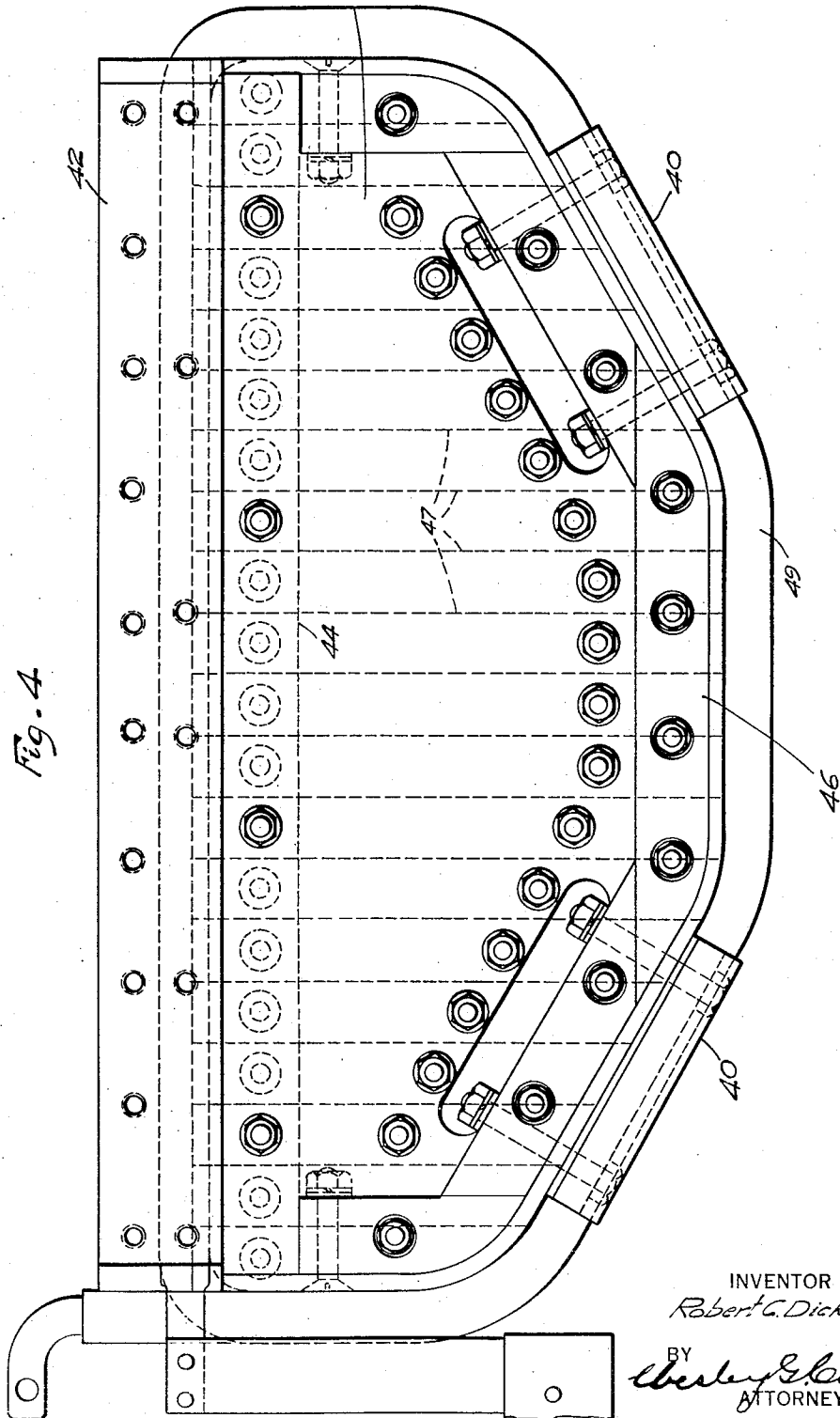
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CIRCUIT BREAKER

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5 Sheets-Sheet 4



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CIRCUIT BREAKER

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5 Sheets-Sheet 5

Fig. 5.

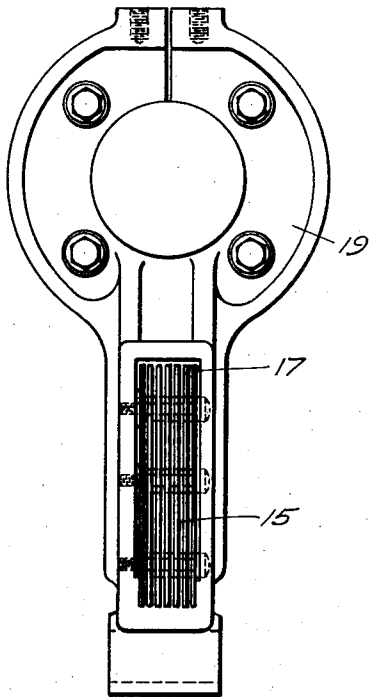
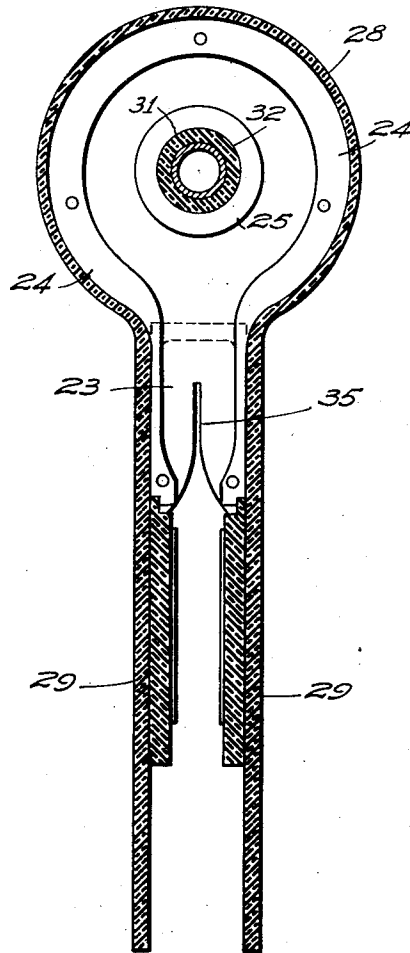


Fig. 6.



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1,925,865

CIRCUIT BREAKER

Robert C. Dickinson, Wilkinsburg, Pa., assignor
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Company, a corporation of Pennsylvania

Application November 6, 1928. Serial No. 317,617

20 Claims. (Cl. 200—147)

My invention relates to circuit breakers and particularly to circuit breakers of the deionization type such as is disclosed in the copending application of Benjamin P. Baker, Serial No. 187,987, filed April 30, 1927, and assigned to the Westinghouse Electric & Manufacturing Company.

An object of my invention is to provide a circuit breaker of the deionization type wherein a grid structure is provided for receiving and extinguishing the arc incident to separation of the circuit breaker contacts and wherein a blowout device is provided for causing the arc to move into the grid structure which comprises a pair of blowout coils that are mounted upon the pole pieces of the blowout magnet.

Another object of my invention is to provide a circuit breaker having the above noted characteristics wherein the blowout magnet is of U-shape and substantially surrounds, and is supported by, the grid structure, thus providing a secure anchorage for the blowout coils which are usually subjected to severe mechanical stresses caused by inductive reactions.

A further object of my invention is to provide a circuit breaker of the deionization type with a grid structure wherein the grid structure is maintained in assembled relation by end plates that are securely clamped in position by a tie bolt extending through a centrally disposed insulating bushing, the tie bolt serving as a central magnetic member about which the arc revolves.

A further object of my invention is to provide a circuit breaker of the deionization type wherein the end plates for retaining the grid structure are provided with arc chutes or openings having spaced gas-cooling metal grids for permitting relatively free expansion of the air within the arc chutes and grid structures and preventing excessively heated gases from issuing from the arc chutes.

These and other objects that will be made apparent throughout the further description of my invention are attained by means of the switch mechanism hereinafter described and illustrated in the accompanying drawings wherein

Figure 1 is a side elevational view of a circuit breaker embodying features of my invention.

Fig. 2 is a longitudinal section through a portion of the circuit breaker apparatus illustrated in Fig. 1.

Fig. 3 is a transverse section through the magnetic blowout device embodying features of my invention.

Fig. 4 is a side elevational view of the portion of the electro-magnetic blowout mechanism.

Fig. 5 is an end elevational view of an end plate and

Fig. 6 is a transverse section through a portion 60 of the grid structure shown in Fig. 2.

Referring to the drawings and particularly to Fig. 1 wherein a portion of a circuit breaker of the deionization type is illustrated, the apparatus comprises a stationary circuit-breaker contact 7 that is engaged by a movable main contact 8 part of which is shown, and which is adapted to be moved into and out of engagement with the contact 7 in the usual manner employed in circuit breakers of this character. The main contact 70 8 is provided with an extension 9 which carries an auxiliary arcing contact 10 that is pivoted at 11 upon the extension 9 in such manner that a rocking motion is imparted to the contact 10 when it engages and is disengaged from a stationary 75 auxiliary contact 12.

It will be understood that the current is actually interrupted by the separation of the auxiliary contacts 10 and 12 which draw an arc between them as they are separated.

Referring to Figs. 1 and 2, contacts 10 and 12 are disposed in the immediate vicinity of a pair of arc horns 13 and 14, the specific construction of which will be hereinafter described.

When the arc is drawn between the contacts 85 10 and 12, it is immediately transferred to the arc horns 13 and 14 which, it will be understood, are connected to opposite poles of the circuit. The arcing horns are integral parts of a plurality of metal gas-cooling plates 15 and 90 16, respectively, that are mounted in openings 17 and 18 in the end plates 19 and 21, between which the grid structure 22 is securely clamped.

The grid structure illustrated is substantially like that disclosed in the copending application of Benjamin P. Baker, Serial No. 187,987, filed April 30, 1927, and assigned to the Westinghouse Electric & Manufacturing Company, and comprises a plurality of metal plates 23 that are spaced apart by insulating plates 24 and annular 100 discs 25, as illustrated in Figs. 2 and 6. Flat coils 26, which conduct line current during the period in which the circuit breaker is being opened, are distributed throughout the length of the grid structure, as indicated in Fig. 2, the coils 105 being provided for the purpose of creating flux lines that tend to cause the arc to revolve about the central tie bolt 27 of magnetic material, in a manner disclosed in the above noted copending application, Serial No. 187,987.

As indicated in Figs. 2 and 6, the grid structure is substantially surrounded by an insulating jacket 28 having side wall portions 29 disposed in spaced parallel relation and which serve to constitute the central portion of the arc chute and between which the contacts 10 and 12 operate.

The entire grid-structure and blowout-coil assembly is retained in assembled position by means of the tie bolt 27 which is surrounded by an insulating bushing 31 extending through openings 32 in the grids 23 and washers 25. Insulating bushings 32a surround the projecting ends of the bushing 31 and are clamped in the positions shown in Fig. 2 by means of threaded nuts 33 upon the ends of the tie bolt 27 which engage washers 34 within the bushing 32a.

When the arc bridges the arc horns 13 and 14, it travels toward the outer ends thereof and eventually enters the slots 35 in the grids 23, the entrance into the grids being facilitated by convection air currents and magnetic flux lines of two blowout coils to be hereinafter described.

In order to protect the insulating side walls 29 against excessive burning by the arc, arc-resisting inserts 36 are secured to the side walls, as indicated in Fig. 2, in the vicinity between the arcing horns 13 and 14. Expanding gases incident to the arc may readily escape through openings 17 and 18 in the end plates and between the metal cooling grids 15 and 16.

The magnetic blowout device for causing the arc to move into the grid structure comprises an iron magnet core of U-shape, such as is illustrated in Figs. 3 and 4. The magnet is made in two separable parts, each comprising a pair of sheet-iron plates 37 and 38, the sections being joined by means of angle bars 39 and bolts 41 extending therethrough. The plates 37 and 38 substantially surround the grid structure which serves to support the plates. The plates 37 and 38 are provided with pole pieces which extend substantially the entire length of the grid structure and comprise iron straps 42 of Z-shape that are attached to plates 37 and 38 by screws 43. The pole piece is oblong in shape and the marginal edges thereof comprise heavy bars of iron 44, 45 and 46 disposed in the manner illustrated in Figs. 3 and 4 and supported by iron straps 47. The pole pieces are hollow and reinforced by insulating plates 48.

Blowout coils 49 are mounted on the enlarged hollow portions of the pole pieces, as indicated in Figs. 3 and 4, and, since relatively heavy currents pass through them in series, relatively large mechanical stresses are set up tending to displace the coils. The magnet core is, therefore, provided with channel bars 51, as indicated in Figs. 1 and 3, which materially stiffen the entire core structure and prevent lateral movement of the pole pieces. The coils are securely held in position by clamp members 30, and 40, (Figs. 3 and 4). The blowout coils 49 are each of substantially the same length as the stack of plates 23 and have a straight portion 59 which extends along the whole length of the stack of plates within the U-shaped magnetic plates 37 and 38.

It is thus seen that the magnetic plates 37 and 38, together with the pole pieces, surround and form an enclosure for the stack of arc extinguishing plates. When the coils 49 are energized, lines of magnetic flux are set up in the sheets 37 and 38 along the whole length of the arc in planes substantially perpendicular to the axis of the stack of plates and to the arc.

The flux lines produced by current passing through the coils 49 cause the arc to move upwardly into the grid structure where it is caused to rapidly revolve about the tie bolt 27 and between the grids of the grid structure. This rotation of the arc is caused by the coils 26 which set up a radial field in the spaces between the annular portion of the plates. Since the tie bolt 27 is of magnetic material and passes through the center of the radial field coils, it acts as a pole piece for these coils and distributes the flux along the length of the stack. A return path for the flux is provided outside of the annular portion of the plates 23 by the magnetic plates 37 and 38 as is indicated diagrammatically by the arrows 58 in Fig. 2. The plates 37 and 38, therefore, function to provide an iron path both for the magnetic field lying in planes perpendicular to the arc due to the blow-in coils 49 and for the magnetic field parallel to the arc due to the radial field coils 26. When the alternating-current cycle passes through zero, the arc is immediately extinguished because of the cooling and deionizing effect of the grids, as set forth in the above noted copending application Serial No. 187,987.

In order to render the contacts 10 and 12 accessible for inspection and repair, the complete grid and blow-out coil assembly is pivotally mounted upon the support 52 by means of a pivot bolt 53 that extends through openings in the support 52 and the end plate 19. The grid-and-coil assembly is releasably retained in operative position by bolts 54 (Fig. 1) which connect the end plate 21 to a fixed support 55. To inspect the contacts 10 and 12 the grid-and-coil assembly is rotated counter-clockwise sufficiently to expose the contacts.

While I have illustrated only one embodiment of my invention, it will be apparent to those skilled in the art that various changes, modifications, substitutions, additions and omissions may be made in the apparatus illustrated without departing from the spirit and scope of my invention as set forth in the appended claims.

I claim as my invention:

1. An arc-extinguishing device for circuit breakers comprising a grid structure having a plurality of spaced grids and end plates for retaining the grids in assembled position provided with ventilating chutes having a plurality of cooling grids.

2. In an arc-extinguishing structure, means for deionizing the arc having a body portion in which the arc is extinguished and an entrance portion, means for moving the arc into said deionizing means comprising magnetic means having a wide portion surrounding said body portion in which the arc is extinguished and a narrowed portion at said entrance portion.

3. In an arc-extinguishing structure, means for deionizing the arc having an annular arc path, and magnetic means having a wide portion surrounding said annular path and a narrow portion for providing a magnetic field for moving the arc toward said annular path.

4. In an arc-extinguishing structure, a plurality of deionizing members, means for causing a radial field for rotating the arc among said deionizing members, and magnetic means of U-shape surrounding said deionizing members and having a wide portion adjacent said radial field to minimize distortion thereof and a narrow portion to provide a strong magnetic field for moving the arc into said radial field.

5. In a circuit interrupter, means for causing

an arc, a pair of side wall members forming a chute for said arc, a pair of arc horns positioned in said chute, each of said arc horns comprising a plurality of separate sheets of metal having corresponding edge portions positioned side by side to form the surface on which the arc plays, and open spaces between said sheets to permit flow of gas in said chute through said arc horns.

6. In a circuit interrupter, the operation of which produces an arc, an arc horn, a deionizing structure having an end plate provided with a ventilating opening located near one end of said arc horn, said arc horn comprising a plurality of spaced metal sheets having portions extending into said opening to cool and deionize the gases escaping therefrom.

7. In a circuit interrupter, a stack of deionizing sheets having aligned slots therein forming a groove, a pair of end plates between which said deionizing sheets are secured and having ventilating openings therein at the ends of said groove, and cooling and deionizing means in said openings.

8. In a circuit interrupter, means for causing an arc, a plurality of spaced sheets of non-magnetic conducting material for extinguishing said arc, and means of magnetic material providing magnetic flux paths having a generally U-shape lying in planes substantially perpendicular to the arc, and the closed ends of said generally U-shaped flux paths lying adjacent the side of said spaced sheets opposite to said means for causing the arc.

9. In a circuit interrupter, means for causing an arc, a plurality of spaced sheets of non-magnetic conducting material for extinguishing said arc, and means of magnetic material providing magnetic flux paths having a generally U-shape lying in planes substantially perpendicular to the arc along substantially the whole length of the arc, and means of conducting material forming a loop having a length along said plurality of plates at least almost as long as the arc for energizing said means of magnetic material to move the arc into said sheets.

10. In a circuit interrupter, means for causing an arc, a plurality of spaced sheets of non-magnetic conducting material for extinguishing said arc, and means of magnetic material providing magnetic flux paths having a generally U-shape lying in planes substantially perpendicular to the arc along substantially the whole length of the arc, and the closed ends of said generally U-shaped flux paths lying adjacent the side of said spaced sheets opposite to said means for causing the arc, and means of conducting material forming a loop having a length along said plurality of plates at least almost as long as the arc for energizing said means of magnetic material to move the arc into said sheets.

11. In a circuit interrupter, means for causing an arc, a plurality of spaced sheets of non-magnetic conducting material for extinguishing said arc, and means of magnetic material extending along substantially the whole length of said arc for moving the arc into said sheets, and a conducting loop having a length not substantially less than the length of said arc for energizing said means of magnetic material.

12. In a circuit interrupter, means for causing an arc, a plurality of spaced sheets of non-magnetic conducting material for extinguishing said arc, and means of magnetic material providing magnetic flux paths having a generally U-shape

lying in planes substantially perpendicular to the arc along substantially the whole length of the arc, and a conducting loop having a substantially straight portion extending between the legs of said generally U-shaped flux paths along substantially the whole length of the arc.

13. In a circuit interrupter, means for causing an arc, a plurality of spaced sheets of non-magnetic conducting material for extinguishing said arc, and means of magnetic material providing magnetic flux paths having a generally U-shape lying in planes substantially perpendicular to the arc along substantially the whole length of the arc, and the closed ends of said generally U-shaped flux paths lying adjacent the side of said spaced sheets opposite to said means for causing the arc, and a conducting loop having a substantially straight portion extending between the legs of said generally U-shaped flux paths along substantially the whole length of the arc.

14. In a circuit interrupter, means for causing an arc, a plurality of spaced plates of non-magnetic conducting material having an annular path for the arc and means for moving the arc around said annular path, and magnetic means having a wide portion extending around said annular path and a narrow portion for moving the arc into said annular path, said magnetic means providing magnetic flux paths extending around said annular path and lying in planes substantially perpendicular to the arc along substantially the whole length of the arc.

15. In a circuit interrupter, means for causing an arc, a plurality of spaced plates of non-magnetic conducting material having an annular path for the arc and means for moving the arc around said annular path, and magnetic means having a wide portion extending around said annular path and a narrow portion for moving the arc into said annular path, said magnetic means providing magnetic flux paths having a generally U-shape lying in planes substantially perpendicular to the arc along substantially the whole length of the arc, and the closed ends of said generally U-shaped flux paths lying adjacent the side of said annular path opposite to said means for causing the arc.

16. In a circuit interrupter the combination of a fixed and a movable contact piece, a plurality of spaced plates arranged at right angles to the direction of movement of the movable contact, apertures in the plates through which the arc can play, a magnet pole passing through the plates and situated at one side of the said apertures in the plates, means of magnetic material arranged parallel with the magnet pole, and a magnet winding situated at one of the said magnet poles and said means of magnetic material.

17. In a circuit interrupter, means for causing an arc, a stack of spaced plates within which said arc plays, said stack of plates having an annular portion with an opening therethrough, a pole piece of magnetic material extending through said opening, means of magnetic material extending along said stack adjacent the outer edges of said annular portion of the plates, and a magnetizing winding between said pole piece and said means of magnetic material extending along the stack.

18. In a circuit interrupter, means for causing an arc, a stack of spaced plates within which said arc plays, said stack of plates having an annular portion with an opening therethrough, a pole piece of magnetic material extending

- through said opening, means of magnetic material extending along said stack adjacent the outer edges of said annular portion of the plates, said means of magnetic material providing magnetic flux paths along the stack substantially parallel to said pole piece of magnetic material and providing magnetic flux paths lying in planes substantially perpendicular to said pole piece of magnetic material.
19. In a circuit interrupter, means for causing an arc, a stack of spaced plates within which said arc plays, said stack of plates having an annular portion with an opening therethrough, a pole piece of magnetic material extending through said opening, means of magnetic material extending along said stack adjacent the outer edges of said annular portion of the plates, said means of magnetic material providing magnetic flux paths along the stack substantially parallel to said pole piece of magnetic material and providing magnetic flux paths lying in planes substantially perpendicular to said pole piece of magnetic material, a coil for causing magnetic flux along said stack of plates in said pole piece and said means of magnetic material and radially between the annular portions of said plates, and a winding for causing flux in said
- means of magnetic material to move the arc into said annular portions of the plates.
20. In a circuit interrupter, means for causing an arc, a stack of spaced plates within which said arc plays, said stack of plates having an annular portion with an opening therethrough, a pole piece of magnetic material extending through said opening, means of magnetic material extending along said stack adjacent the outer edges of said annular portion of the plates, said means of magnetic material providing magnetic flux paths along the stack substantially parallel to said pole piece of magnetic material and providing magnetic flux paths lying in planes substantially perpendicular to said pole piece of magnetic material, a coil for causing magnetic flux along said stack of plates in said pole piece and said means of magnetic material and radially between the annular portions of said plates, and a winding for causing flux in said
- means of magnetic material to move the arc into said annular portions of the plates, said winding having a substantially straight portion extending substantially parallel to the arc along substantially the whole length of said stack of plates.
- ROBERT C. DICKINSON.

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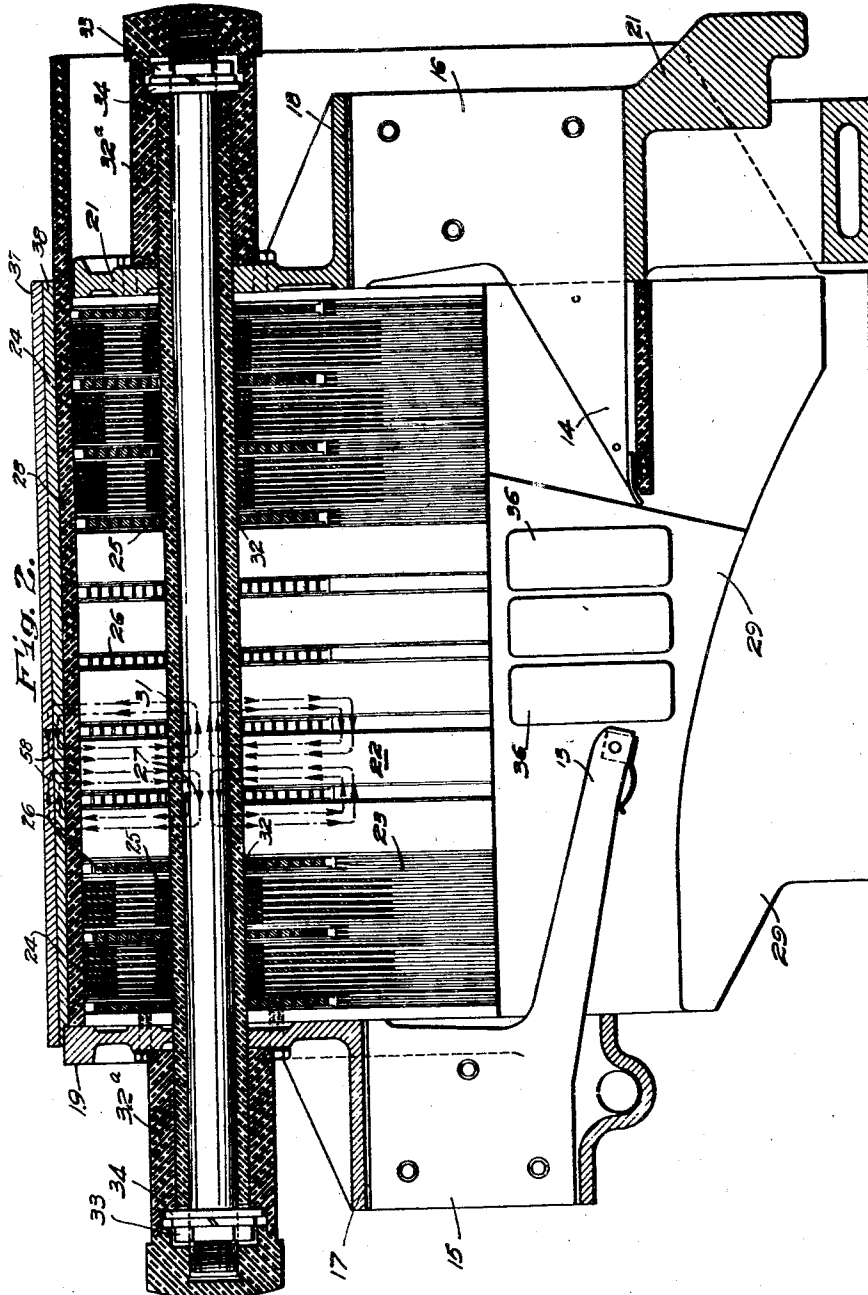
CERTIFICATE OF CORRECTION.

Patent No. 1,925,865.

September 5, 1933.

Robert C. Dickinson

It is hereby certified that error appears in the above numbered patent requiring correction as follows: In the drawings, Sheets 1 and 3, Figs. 1 and 3, for the upper straight horizontal portion of the blowout coil, for the reference numeral "49" read "59"; Sheet 4, Fig. 4, the dotted line indicating the upper straight horizontal portion of the blowout coil should be marked with the reference numeral "59"; Sheet 2, Fig. 2, should appear as shown below instead of as shown in the patent:



and that the said Letters Patent should be read with these corrections therein that the same may conform to the record of the case in the Patent Office.

Signed and sealed this 10th day of October, A. D. 1933.
F. M. Hopkins

(Seal)

Acting Commissioner of Patents.