Feb. 17, 1953 R. L. BROWN 2,629,036

CIRCUIT BREAKER

Filed March 16, 1950 2 SHEETS—SHEET 1

FIG. 1

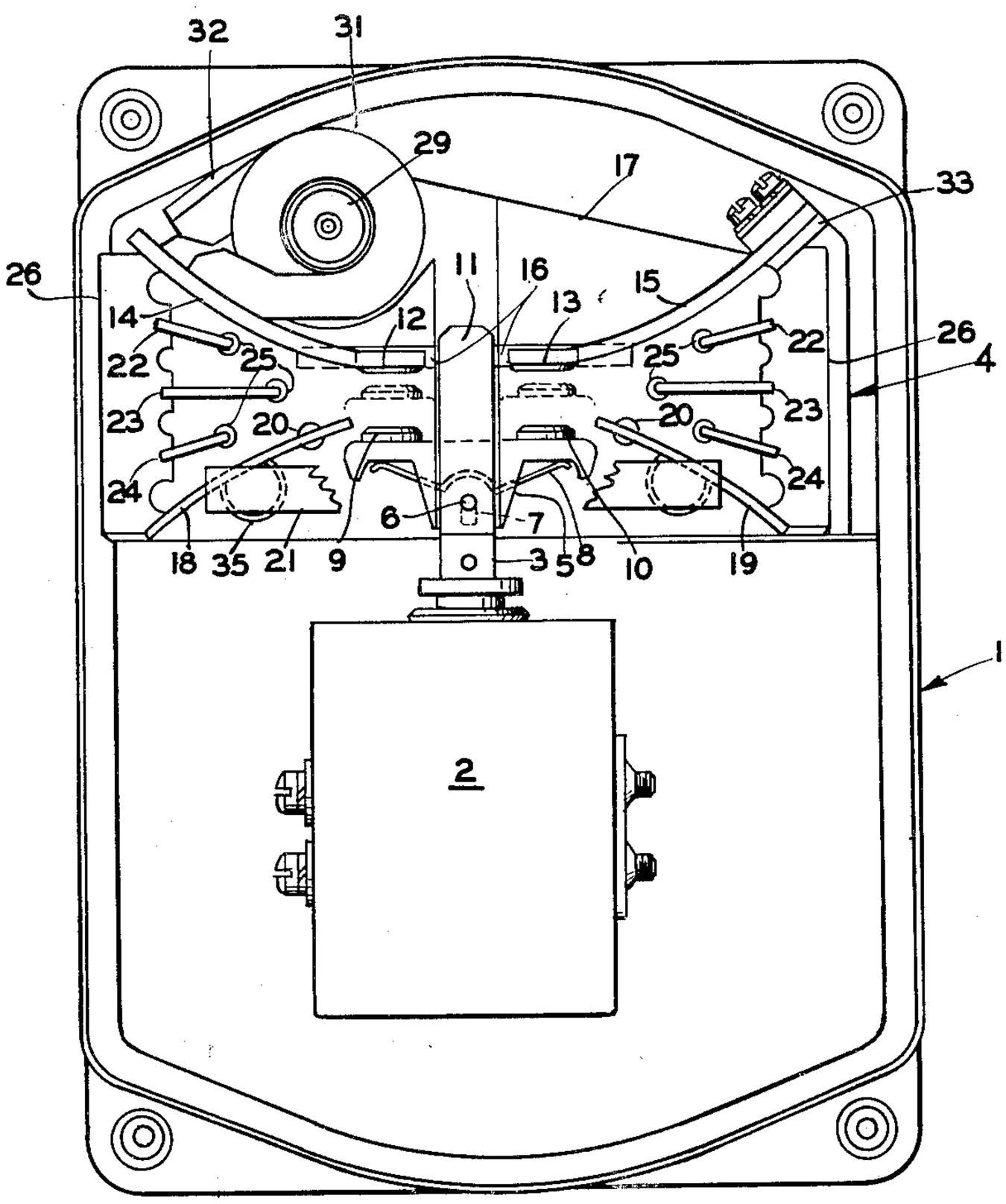

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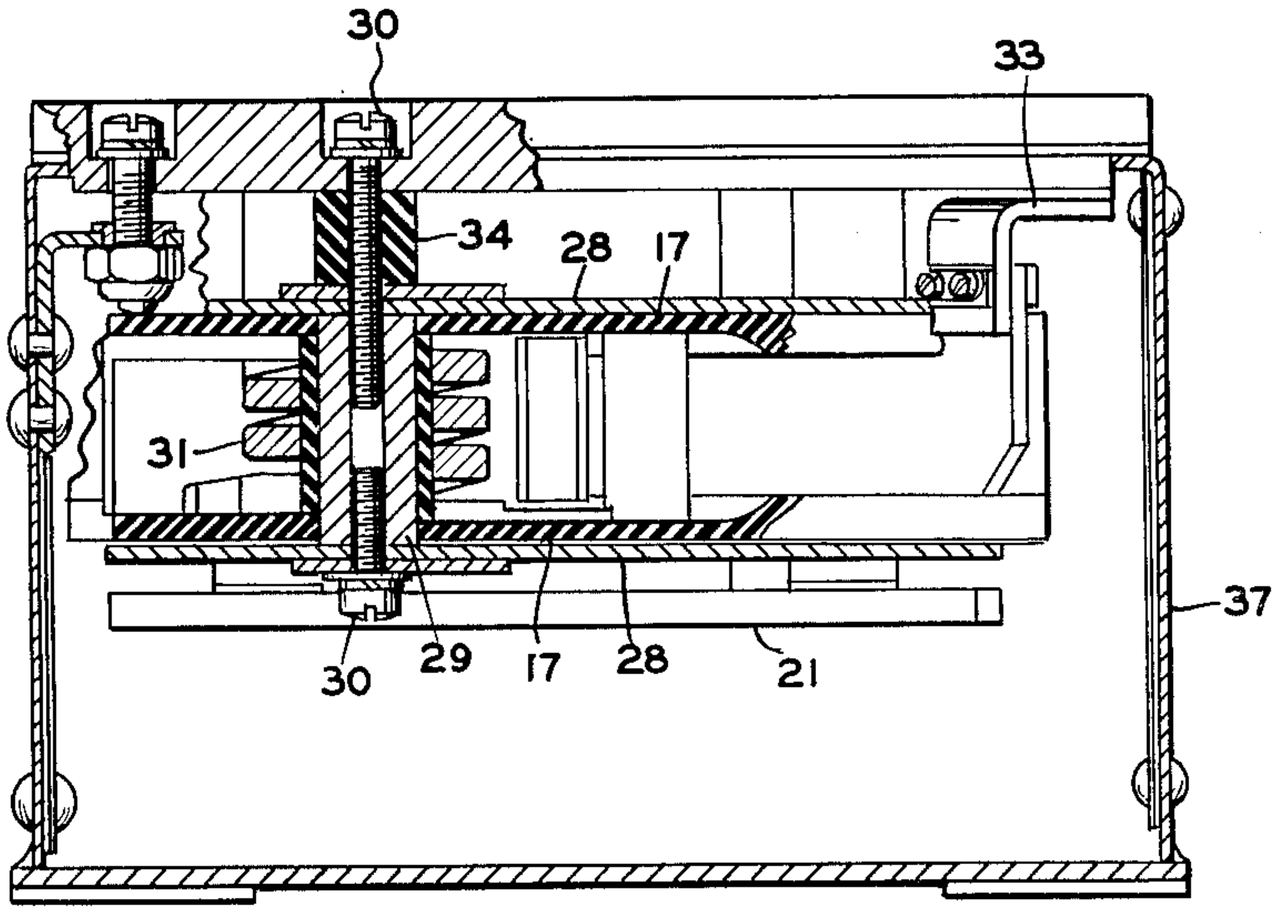
FIG. 2



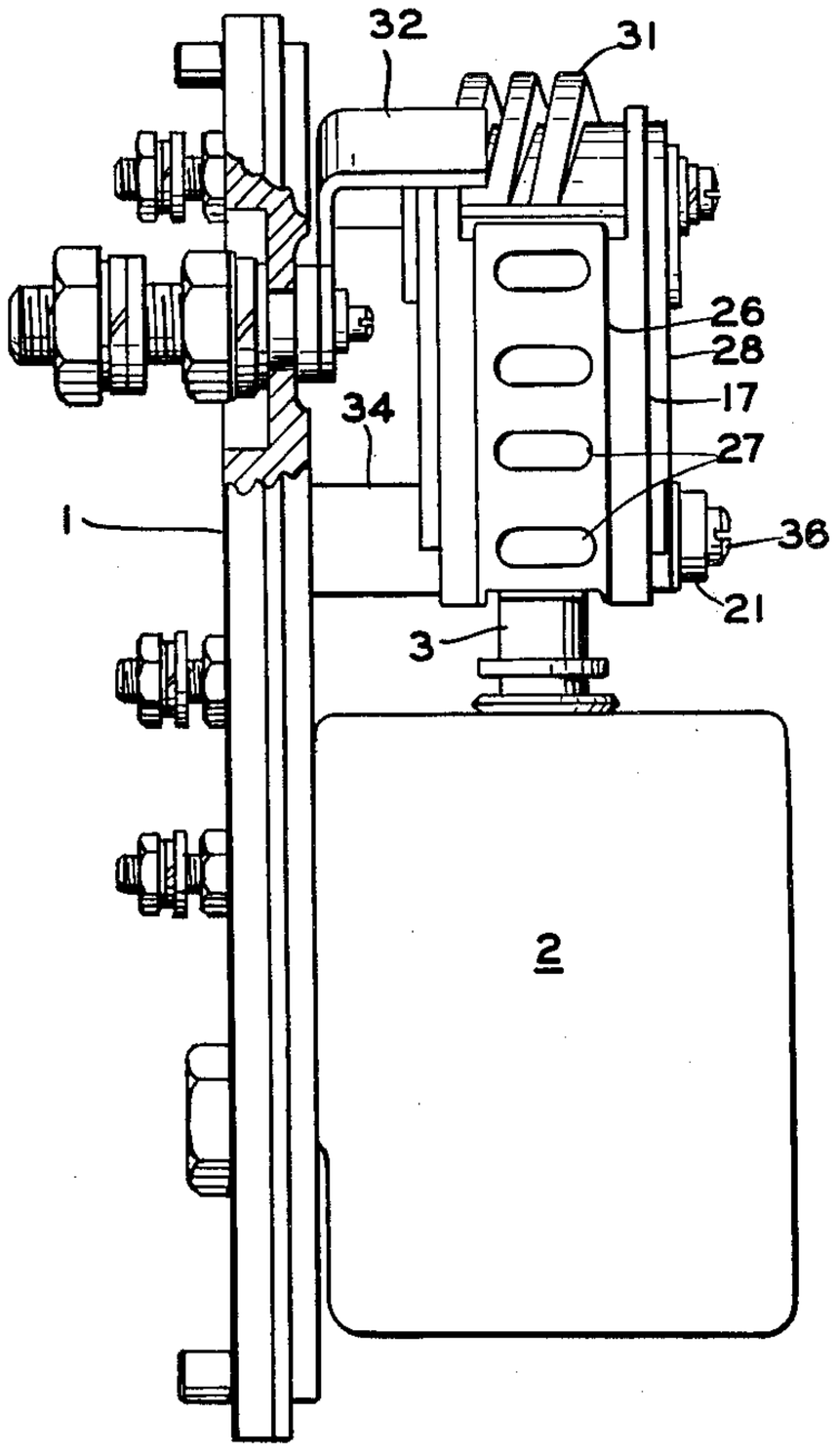


FIG. 3

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CIRCUIT BREAKER

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6 Claims. (Cl. 200—147)

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The present invention relates to direct current circuit interruption and more particularly to means for extinguishing arcs therein.

In interrupting direct current electrical circuits, especially at high altitudes and voltages above 30 volts, considerable difficulty is encountered with arcing currents. These arcing currents, unless extinguished quickly will seriously damage the switch contacts and other parts with which they come into contact.

According to the present invention the arcs are forced out by magnetic action along a pair of arc horns and are driven into deion plates. Thus, the arc drop is finally made so great that the applied voltage can no longer maintain the arcs and the current flow is interrupted.

An object of the invention is to provide an improved contactor.

Another object of the invention is to provide improved means for extinguishing arcs.

Another object of the invention is to provide an improved contactor for operation at high altitudes.

Another object is to provide an improved contact making and breaking arrangement.

Another object is to provide an improved magnetic arc blowout arrangement.

The above and other objects and features of the invention will appear more fully hereinafter from a consideration of the following description taken in connection with the accompanying drawings wherein one embodiment of the invention is illustrated by way of example.

In the drawing:

Figure 1 is a partial cutaway front view of a contactor embodying the invention.

Figure 2 is an end view of the contactor of Figure 1.

Figure 3 is a side view of the contactor of Figure 1.

Referring now to the drawings, wherein like parts have been given the same reference numbers in the several figures, there is shown a base plate 1, upon which is mounted operating mechanism 2. The operating mechanism 2 may be a solenoid, hand-operated or other suitable form of actuating mechanisms which are known to the art and a detailed description has been omitted as it forms no part of the invention.

A contact actuating rod 3 operatively connected to the operating mechanism 2 extends into an arc chamber 4. The rod 3 carries a bridge contact member 5 secured thereto by a pin 6 and slotted hole 7. A spring 8 biases the bridge member 5 outward from the rod 3. Contacts 9 and 10 are carried and electrically connected by the

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bridge member 5. An insulating barrier 11 is inserted between the contacts 9 and 10 and secured to the actuating rod 3.

The contacts 9 and 10 when actuated to the closed circuit position engage contacts 12 and 13 respectively. The contacts 12 and 13 are attached to one end of respective flared arc horns 14 and 15. The arc horns 14 and 15 are secured in position by suitable slots 16 in a pair of plates 17. The plates 17 are of a refractory insulating material and form the sides of the arc chamber 4.

A second pair of flared arc horns 18 and 19 are secured in position by suitable slots 20 in the plates 17 and are tied together electrically by a copper bar 21. In the flared-out area between the pairs of arc horns are deion plates 22, 23 and 24 of electrical conducting material. The deion plates are secured in position and electrically isolated by suitable slots 25 in the plates 17 and grids 26 of refractory insulating material which form the ends for the arc chamber 4. The grids 26 have suitable openings 27 to permit the escape of gases from the arc chamber 4.

On the outside of the insulating plates 17 are a pair of soft iron plates 28. External to the two arc cavities formed by the aforenoted arrangement is an iron core 29 connecting the iron plates 28 together by means of bolts 30. A three turn series coil 31 is wrapped around the core 29. One end of the coil 31 is connected to the arc horn 14 carrying the contact 12. The other end of the coil 31 is connected to input conductor 32. The arc horn 15 carrying the contact 13 is connected to output conductor 33.

The arc chamber 4 is mounted on the base 1 by insulated spacers 34, post 35 and screws 36 and by the screws 30 and iron core 29. A suitable cover 37 may be attached to the base 1 in any suitable manner.

In operation when the contacts 9 and 10 are in the closed position, the current path is from the input conductor 32, coil 31, arc horn 14, contact 12, contact 9, bridge 5, contact 10, contact 13, arc horn 15 and output conductor 33. Any current flowing through the unit (either while the contacts are closed or while an arc persists when the contacts are opening) causes the coil 31 to set up a flux in the core 29 that is substantially proportional to the value of the current. This flux is carried along the iron plates 28 and then passes through the air across from one plate to the other. Thus a magnetic field is set up in the arc chamber 4 adjacent to the bridge 5 that is perpendicular to an arc that may form on the parting contacts.

The aforenoted flux produces a force and result-

ant motion of the arc that is perpendicular to the flux and to itself. Furthermore, the flux direction has been so chosen as to cause each arc to be moved rapidly outward away from each other.

At the first instant of the contacts opening, arcs will be drawn between the contacts 9 and 12 and between the contacts 10 and 13. The current path will still be from one of the fixed contacts to one of the bridge contacts then along the bridge to the other bridge contact thence to the other fixed contact. As the contacts separate further, the two arcs will be driven off the ends of the of the bridge and forced to transfer to the two arc horns 18 and 19. The current now goes from the arc horn 14 to arc horn 18, then through the bus 21 to arc horn 19 and across the arc horn 15.

The arcs are next forced out along the respective arc horns and are driven into the deion plates 22, 23, 24 by the magnetic flux. The arc drop is thus finally made so great, due to long arc length, the cathode drop of each deion plate and the deionization action of all the relatively cool surfaces, that the applied voltage can no longer maintain the arcs and thus the current flow is interrupted.

The insulated grids 26 forming the ends of the arc chamber 4 add the final additional deionization that might be needed for exceeding heavy currents at high altitudes and also to lessen the chance of an arc flashing out the flared opening of the arc horns and transferring to the case of the unit. Also the openings 27 in the grid permit the escape of gases.

As an additional safety feature, the insulating barrier 11 prevents arcing from occurring between the fixed contacts 12 and 13 when small currents are interrupted at high altitudes. Upon arcs of small currents being drawn between the separating contacts, there will be little or no magnetic forces on them and thus instead of moving apart might combine to bridge the fixed gap between the contacts 12 and 13 with an uncontrollable arc.

Although only one embodiment of the invention has been illustrated and described, various changes in the form and relative arrangement of the parts, which will now appear to those skilled in the art, may be made without departing from the scope of the invention.

What is claimed is:

1. In a circuit interrupter, a pair of stationary contacts spaced apart from each other, movable contact means for bridging said contacts, a first pair of opposite extending outwardly flared arc horns, the inner ends of said arc horns engaging said stationary contacts, a second pair of oppositely extending outwardly flared arc horns positioned opposite from said first arc horns, the inner ends of said second arc horns being adjacent to said bridging means, means for connecting the outer ends of said second arc horns together electrically, and magnetic means including a coil in series with said contacts to bias an arc that may be formed between said contacts and said bridging means outward along said arc horns thereby to increase the arc length.

2. The combination as described in claim 1 and including an insulating barrier between said stationary contacts.

3. The combination as described in claim 1 and including a supporting structure for said arc horns comprising a pair of plates of refractory insulating material having slots therein for supporting said arc horns and forming an arc chamber.

4. The combination as described in claim 1 and including an arc chamber comprising a pair of side plates of refractory insulating material, and end grid plates of refractory insulating material having opening therein to permit the escape of gases.

5. In a contactor, a pair of symmetrical opposite extending outwardly flared arc horns having contact members on the inner ends thereof, said contact members being spaced apart, movable contact means for bridging said contact members, a second pair of symmetrical opposite extending flared arc horns positioned opposite from said first arc horns with the inner ends adjacent to said movable contact means, electrical conducting means for interconnecting said second pair of arc horns, deion plates positioned in the flared-out area between said pairs of arc horns, and means for producing a magnetic flux perpendicular to the arcs drawn between said contact means to drive said arcs outward along said arc horns into said deion plates.

6. In a circuit interrupter, a first pair of flared opposite extending arc horns having stationary contact members on the adjacent ends thereof, a pair of relatively movable contact members adapted for engaging said stationary contact members, electrical conducting means for connecting said movable contact members, a second pair of flared opposite extending arc horns positioned opposite of said first pair of arc horns, means for connecting said second arc horns in series, deion plates positioned in the flared area between said pairs of arc horns, and magnetic means for biasing an arc formed between said stationary and movable contacts outward along said arc horns into said deion plates.

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