April 2, 1935. O. JENSEN ET AL 1,996,112

DETACHABLE ARC CONTROLLING STRUCTURE

Filed Jan. 18, 1932 3 Sheets-Sheet 1

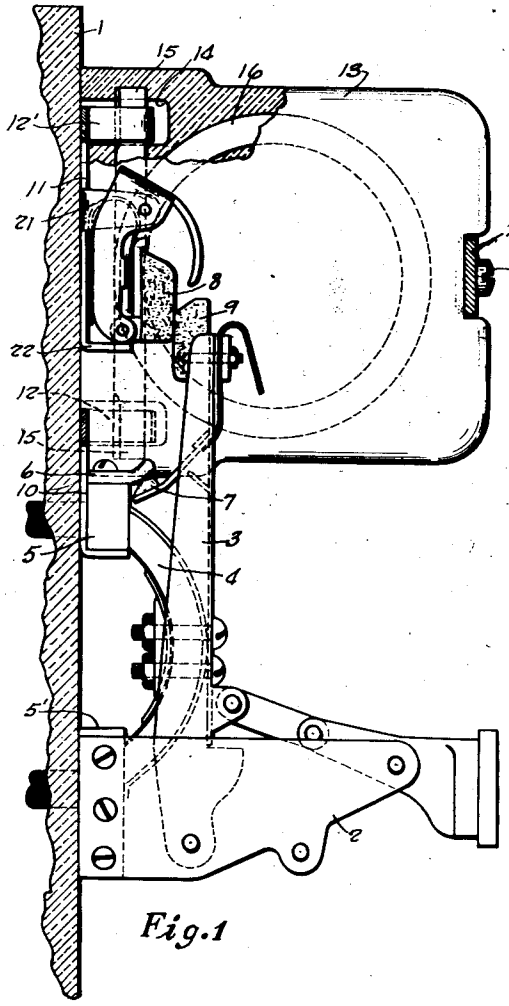


Fig. 1

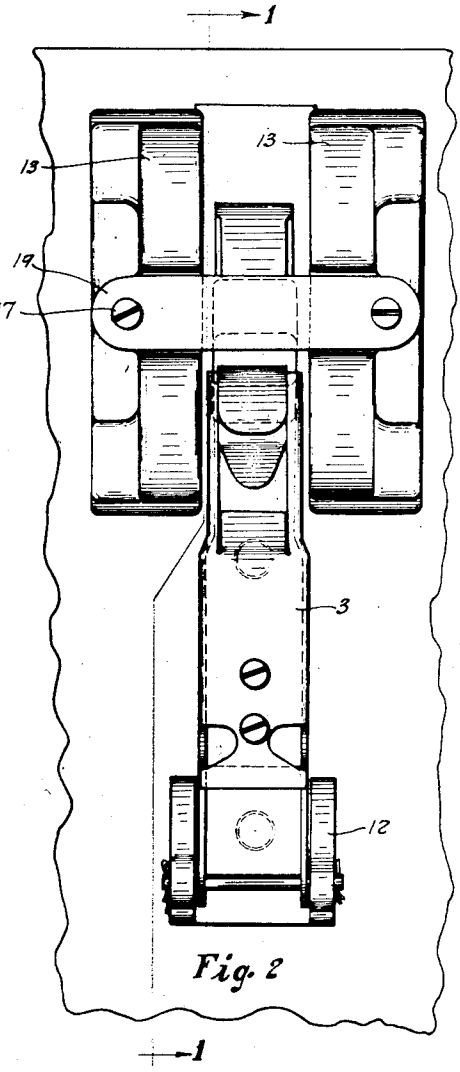


Fig. 2

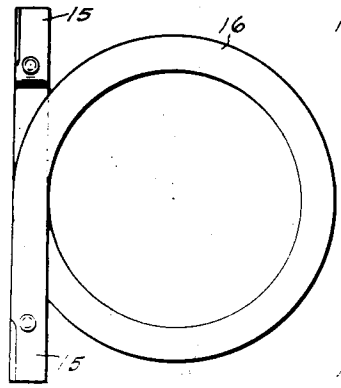


Fig. 6

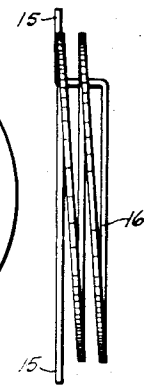


Fig. 6-a

INVENTORS
Otto Jensen and
Knute Haleck
Cornelius D. Ethret
BY their ATTORNEY

April 2, 1935. O. JENSEN ET AL 1,996,112

DETACHABLE ARC CONTROLLING STRUCTURE

Filed Jan. 18, 1932 3 Sheets-Sheet 2

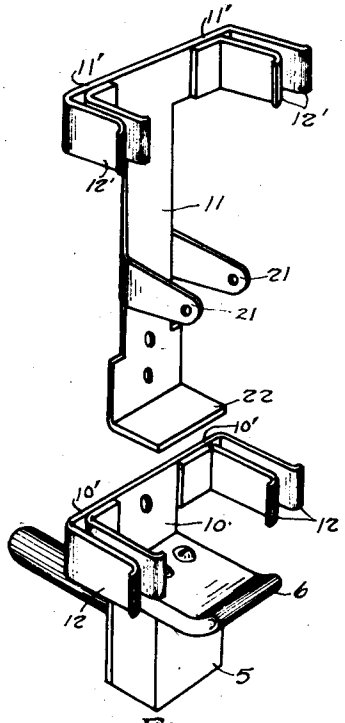


Fig. 3

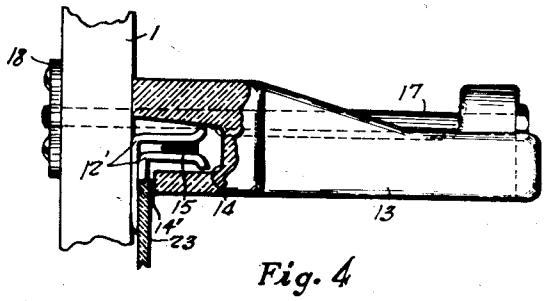


Fig. 4

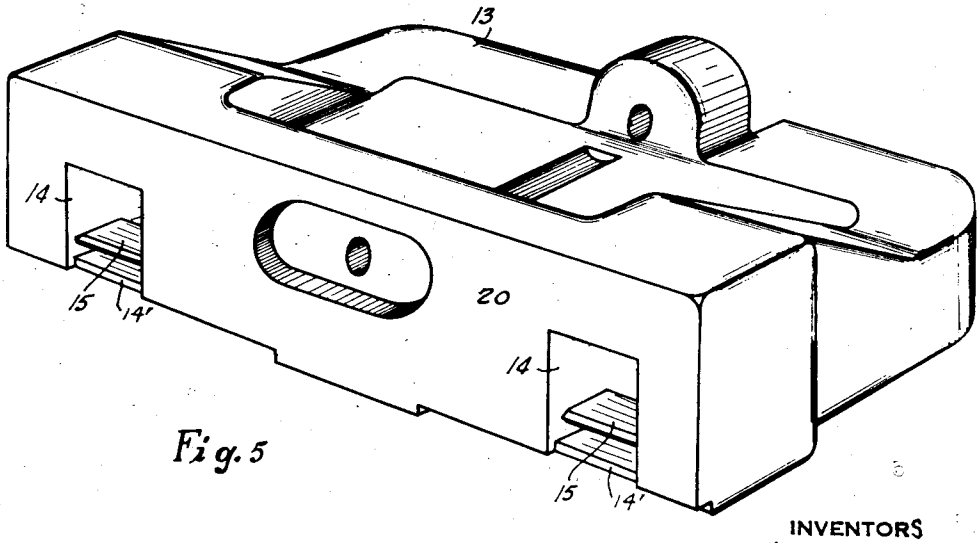


Fig. 5

INVENTORS
Otto Jensen and
BY Knute Halek
Cornelius L. Colvet
their ATTORNEY

April 2, 1935. O. JENSEN ET AL 1,996,112

DETACHABLE ARC CONTROLLING STRUCTURE

Filed Jan. 18, 1932 3 Sheets-Sheet 3

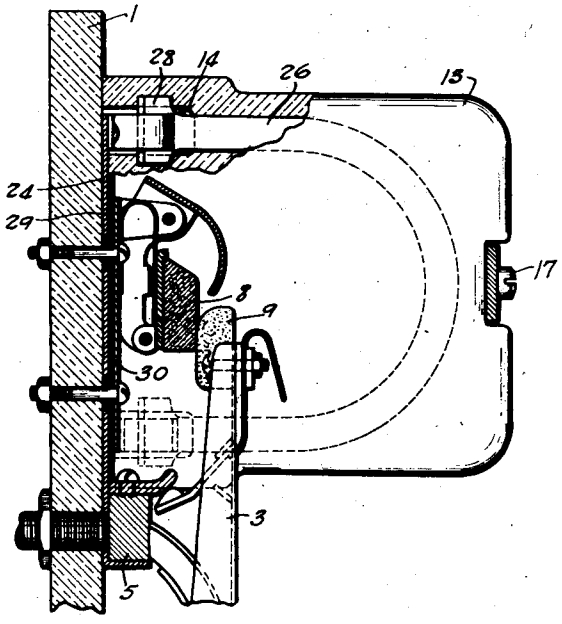


Fig. 7

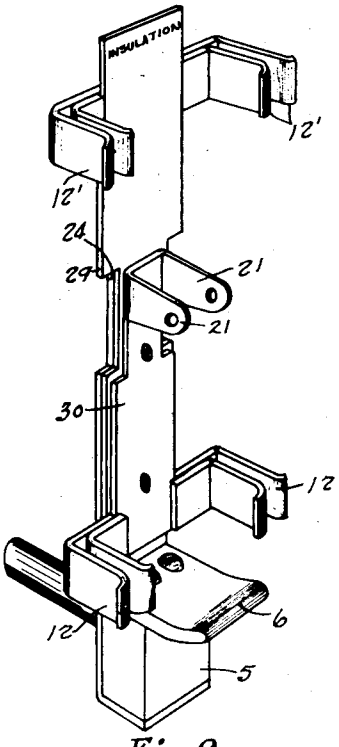


Fig. 9

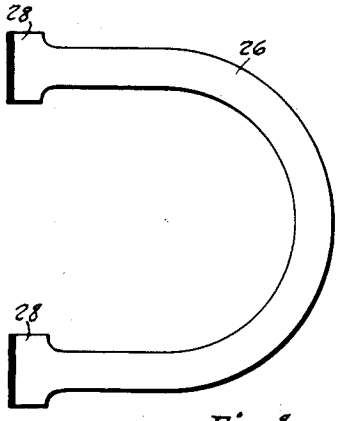


Fig. 8

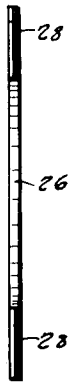


Fig. 8-a

INVENTORS
Otto Jensen and
Knute Walck
BY Cornelius D. Ebert
their ATTORNEY.

Patented Apr. 2, 1935 1,996,112

UNITED STATES PATENT OFFICE

1,996,112

DETACHABLE ARC CONTROLLING STRUCTURE

Otto Jensen and Knute Falck, Philadelphia, Pa., assignors to I-T-E Circuit Breaker Company, Philadelphia, Pa., a corporation of New Jersey

Application January 18, 1932, Serial No. 587,190

10 Claims. (Cl. 200—147)

Our invention relates to electric switching mechanisms, and more particularly to removable arc controlling structure for switches and automatic circuit breakers.

In accordance with the invention, in switching mechanisms having a magnetic arc-controlling coil, for example, a blow-out coil, and arc barrier structure for extinguishing or confining the arc across the switch contacts at the time of opening the switch, the blow-out coil is secured to the barrier, for example, enclosed therein, to comprise therewith a unitary structure, the coil having contact portions or terminals, preferably in predetermined positions with respect to each other, adapted detachably to engage complementary fixed contacts or clips, so that the blow-out coil and barrier structure may readily be removed as a unit, to afford free access to the contacts and parts of the switch or circuit breaker for inspection, repair or replacement purposes. Preferably, and as shown, the barrier-coil unit is removable from the front of the switch panel, access to the rear of the panel being unnecessary for this purpose.

The barrier-coil unit preferably, although not necessarily, comprises a blow-out coil molded or imbedded in refractory insulating material comprising, for example, asbestos and the like with suitable binder, which is pressed and hardened to the desired shape to form a flame resistant barrier, the imbedded coil mechanically reenforcing the barrier to provide a rigid unitary structure.

The invention resides in the features of construction, combination, and arrangement hereinafter described and claimed.

To describe the invention, and for illustration of some of the various forms it may take, reference is had to the accompanying drawings, in which:

Fig. 1 is a side elevational view of a circuit breaker having two removable barriers in accordance with the invention, and looking along the line 1—1 of Fig. 2.

Fig. 2 is a front elevation of the circuit breaker, with both barriers in position.

Fig. 3 is a detail of panel terminal clips for the barriers.

Fig. 4 is a view, partly in section, looking down upon one of the barriers in operating position.

Fig. 5 is a perspective view of one of the barriers removed from the circuit breaker.

Figs. 6 and 6a are side and end views, respectively, of the blow-out coil encased in the barrier of Fig. 1.

Fig. 7 shows a removable barrier embodying a modified form of blow-out coil.

Figs. 8 and 8a are side and end views, respectively, of the blow-out coil employed in Fig. 7.

Fig. 9 is a detail of the panel terminal clips of Fig. 7.

The maintenance of switch gear for controlling circuits carrying current for power, lighting, and other purposes, presents a problem of increasing importance as the service becomes more severe and the requirements more exacting. Modern supply lines have a large capacity, so that the short circuit currents may rise to enormous values, and since each switch or circuit breaker must be able to clear its own circuit under such abnormal conditions, this, combined with increased frequency of operation, and exacting size and price conditions, make it essential to use all material at the highest duty and capacity consistent with good engineering practice.

These conditions impose the requirement of rugged simplicity and easy replacement of parts damaged in service. The most rapid deterioration is in the arcing area, and the inspection, replacement or repair of arcing tips must be made as easy as possible.

The embodiment of the invention illustrated involves an inductive blow-out coil enclosed or embedded in a barrier of moldable arc-resistant material, with electrical contact portions or terminals in recesses in the base of the barrier, and which may readily be removed as a unit to give free access to the switch gear. Suitable means are provided for securing the barrier to the circuit breaker panel, and for removing it from the front of the panel. This also enables barriers to be readily renewed, and increases the space available for cleaning or changing the main and arcing contacts of the circuit breaker.

Referring now particularly to Figs. 1, 2 and 3, a supporting panel 1 of insulation, for example, slate, has a bracket 2 secured thereto for supporting switch mechanism comprising an arm 3 carrying a main brush or bridge member 4 adapted to engage main contact terminals 5 and 5' to control an external circuit connected thereto by means of studs passing through to the back of the panel. The usual further appurtenances, such as electro-magnetic closing and tripping mechanism common in the art, is not shown. The secondary or auxiliary contact system comprises a shunt contact 6 secured to the upper part of terminal block 5, a movable shunt contact 7 carried by arm 3, a relatively fixed arcing contact 8 of carbon or other suitable material, and

a movable arcing contact 9 carried by arm 3.

The main contact terminal 5 is connected to a metal bracket piece 10 having laterally extending arms terminating in switch clips or terminals 12, and the arcing contact support piece 11 also has switch clips or terminals 12'. The terminals 12 and 12' fit into apertures or recesses 14 in the barriers 13 disposed on each side of the arcing contact system, as shown in Fig. 2, the terminals engaging extensions, contact portions or terminals 15, of a blow-out coil 16, encased in each barrier. This particular arrangement permits the base of the barrier units 13 to lie flush against the supporting panel 1, providing a particularly rigid structure and minimizing space requirements.

The type of blow-out coil illustrated is formed of a copper bar of any desired number of turns, Figs. 6 and 6a. The adjacent parts of the coil are insulated from each other, as by an enamel coating, or wrapping of insulation, and the coils are then placed in a mold and surrounded by a refractory insulating material which is pressed and hardened to the desired shape. This forms a rigid, flame-resistant barrier containing an inductive coil, with or without iron in the circuit, for producing a magnetic field suitably to act on the arc occurring between the shunt contacts 8 and 9 when the main switch or circuit breaker opens. The coil also provides a reinforcing structure for increasing the mechanical strength of the barrier. Similarly, the barrier secures the two ends or terminals 15 of the blow-out coil in fixed spaced relation with respect to each other for engagement with their complementary terminals 12, 12', and, as seen in Fig. 1, the ends of the blow-out coil also extend on opposite sides of the recesses to provide a firm anchorage for the coil ends.

Each of these barriers is held against the panel by a single bolt 17 which is threaded into a nut plate 18 (Fig. 4) secured to the back of the breaker panel. A bar 19 of insulating material connects the two bolts across the front, tying the two barriers together and providing a mutual support. The width of the barrier base 20, Fig. 5, ensures a solid support, and the engagement of the coil ends 15 with the panel clips 12, 12' makes rotation impossible. The recessed portions 14 of each barrier surround and enclose the terminals 12, 12' when the barrier is in operative position, and the terminals are thereby protected from arcing occurring between the arcing contacts 8 and 9.

The panel terminals for this barrier are illustrated in Fig. 3, which shows in perspective view the arrangement of these parts. The upper main terminal 5 and secondary or shunt terminal 6 are shown assembled to the clip plate 10 having laterally extending arms 10' terminating in blow-out coil terminals 12. A clip plate 11, which carries an arcing terminal support 21, has corresponding laterally extending arms 11' terminating in contacts 12' for connection to the upper ends of the respective blow-out coils. The plate 11 serves as a bridging member connecting the blow-out coils.

A detailed view of the barrier mounting and contact means is shown in Fig. 4. This is a section in plan of the recessed portion 14, showing the manner in which the clips 12 or 12' engage the coil ends or terminals 15. The coil ends are beveled to facilitate their entrance into the clips. These contacts carry the current flowing through the arcing contacts, and during opening and closing movements of the circuit breaker, and particularly during short circuit or other abnormal conditions, the two clip portions, 12, 12' of each contact are drawn toward each other during heavy current surges, because of the attraction between adjacent conductors in which current is flowing in the same direction. This maintains high contact pressure ensuring continuous circuit and low contact resistance. The upper clip parts 12' are covered by a sheet or plate of insulation 23 to prevent an arc jumping to the body portion of 11 and burning the metal. Each of the openings 14 has a recessed portion 14' through which the arms 10', 11' and/or insulation 23 extend.

A perspective view of one of the barriers is shown in Fig. 5. This drawing indicates a form which the barrier may take when designed for strength and lightness. A broad base portion 20 is provided to give lateral stability, while the outer portions may comprise a webbed structure, the latter being reinforced by the blow-out coil.

A modified form of the barrier is shown in Fig. 7. A half turn of copper 26 terminates in T shaped ends or terminals 28 (Figs. 8 and 8a) within the recesses 14, the ends of the T heads being embedded in the barrier at opposite sides of the recess to firmly anchor the terminal portions.

The connection of this barrier-coil unit to a circuit breaker is necessarily different from that previously described, as it is essential to have current flow around the loop in a given direction, clockwise as viewed in Fig. 7, to force any arc upward. This requires an arrangement of connections, such as shown in Fig. 9. The terminal 5 and auxiliary terminal 6 are shown secured to a connection plate 24 which is carried up to the contact clips 12' entering the recess 14 and engaging the coil ends or terminals 28 of the barrier-coil unit. Mounted on the connection plate is an insulating member 29 over which is secured the connection plate 30 having arms 21 for pivotally supporting the arcing contact 8, the plate having laterally extending arms terminating in lower contact clips 12. This results in a reversal of connections and causes current to flow in the proper direction to blow the arc upwardly. The barrier-coil unit is detachably secured to the panel in the same manner as in the other modification.

While the blow-out coil is embedded in molded insulating material in the forms illustrated, it will be understood that the coil may also be enclosed or embedded in sheets or boards of asbestos, transite, or other suitable barrier material, in such manner as to comprise therewith a unitary structure having substantially the advantages of the present invention.

It will further be understood that the blow-out coil terminal elements need not have the knife blade type of contact illustrated, but may comprise various other forms of contact structure known in the art and suitable for the purpose, and that the means for securing the barriers in place may comprise any suitable means other than that shown.

It is also to be understood that the term "blow-out coil" is used in a generic sense, and embraces a coil or other structure of any character for controlling arcing or flash-over, for example, for moving, lengthening, or changing the arc into a plurality of smaller arcs.

What we claim is:

1. In combination, a removable blow-out coil encased in a barrier of insulating material, the

barrier having recesses and the coil having terminals adapted to engage complementary contacts in the blow-out coil circuit, said terminals extending through said recesses and embedded in the material of the barrier on both sides of the recesses.

2. A panel, a blow-out coil and arc barrier assembly removable therefrom and comprising a blow-cut coil embedded in a barrier of molded arc resistant material, the base of the barrier being normally positioned flush with said panel and having openings therein and the coil having terminals positioned in said openings, and complementary contacts supported from said panel and detachably engaging said terminals within said openings for connecting the coil in circuit.

3. In combination, a supporting panel having circuit-controlling contact structure mounted thereon, fixed contacts on the face of said panel connected to the circuit controlled by said contact structure, an arc controlling coil encased in a member of refractory insulating material, recesses in said member, said arc controlling coil having contact portions extending into said recesses, and adapted to engage said fixed contacts, and means for removably and positively securing said member of refractory insulating material to the panel accessible from the front of the panel.

4. In combination, a supporting panel, circuit-controlling contact structure mounted on the face of said panel, fixed contacts on the face of said panel connected to the circuit controlled by said contact structure, a removable arc-controlling coil encased in a barrier of molded insulating material, said barrier having openings and the coil having terminals in said openings and adapted detachably to engage said contacts, the material of the barrier surrounding and enclosing said fixed contacts when the barrier is in operative position.

5. In combination, a circuit breaker having main and shunt contacts, conductive members respectively in circuit with said main and shunt contacts and having arms extending on either side of said shunt contacts, said arms having contacts in a blow-out coil circuit, and removable blow-out coils having terminals detachably engaging the contacts on said arms.

6. In combination, a circuit breaker having main and arcing contacts, conductive plate members respectively in circuit with said main and arcing contacts and having laterally extending arms on either side of said arcing contacts, said arms having contacts in a blow-out coil circuit, and removable blow-out coils disposed on either side of said arcing contacts and having terminals detachably engaging the contacts on said arms.

7. In combination with a circuit-controlling device, having a movable contact structure, individual blow-out units on opposite sides of the path of movement of said contact structure, each comprising an arc barrier and a blow-out element embedded therein, and a pair of stationary bridging members each including a pair of terminals detachably engaged by corresponding terminals of the blow-out elements of said individual units.

8. A circuit breaker comprising a panel, fixed and movable circuit-breaking contacts mounted on the face of said panel, auxiliary fixed contacts extending from said face of said panel to one side of said circuit-breaking contacts, and a removable blow-out unit comprising a barrier having a base flush with said panel and recesses therein to receive said auxiliary fixed contacts, and a coil enclosed in said barrier having terminals in said recess frictionally to engage said fixed contacts, said unit being removable by linear movement substantially normal to the face of said panel.

9. A circuit breaker comprising a panel having circuit-controlling contact structure mounted thereon, a pair of auxiliary contact structures supported from said panel and comprising a pair of elongated superimposed conductive strips insulated from each other, longitudinally spaced terminals individual to said auxiliary contact structures, and a blowout unit including a blow-out coil of substantially a half turn having terminals connected to the spaced terminals of said contact structure.

10. A circuit breaker comprising a panel having circuit controlling contact structure mounted thereon, a pair of auxiliary contact structures supported from said panel and comprising a pair of vertically-extending superimposed conductive strips insulated from each other, vertically-spaced terminals individual to said auxiliary contact structures, and a removable blowout unit comprising a barrier of arc-resistant material and a blowout coil molded therein of substantially a half turn, said coil having terminals for detachably engaging the terminals of said auxiliary contact structures.

OTTO JENSEN.
KNUTE FALCK.