H. P. BALL.

OIL SWITCH.

APPLICATION FILED JAN. 19, 1905.

945,671.

Patented Jan. 4, 1910.

2 SHEETS—SHEET 1.

Fig. 3.

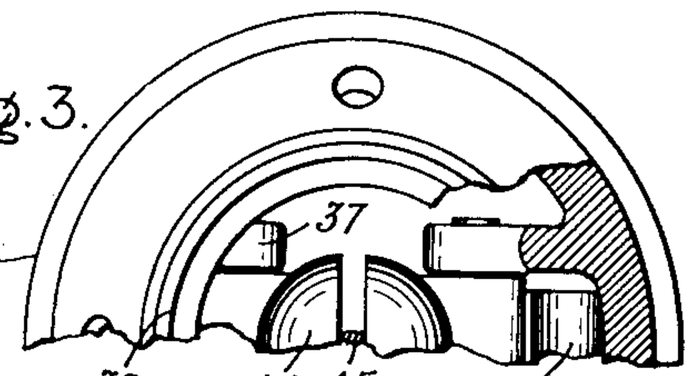


Fig. 2.

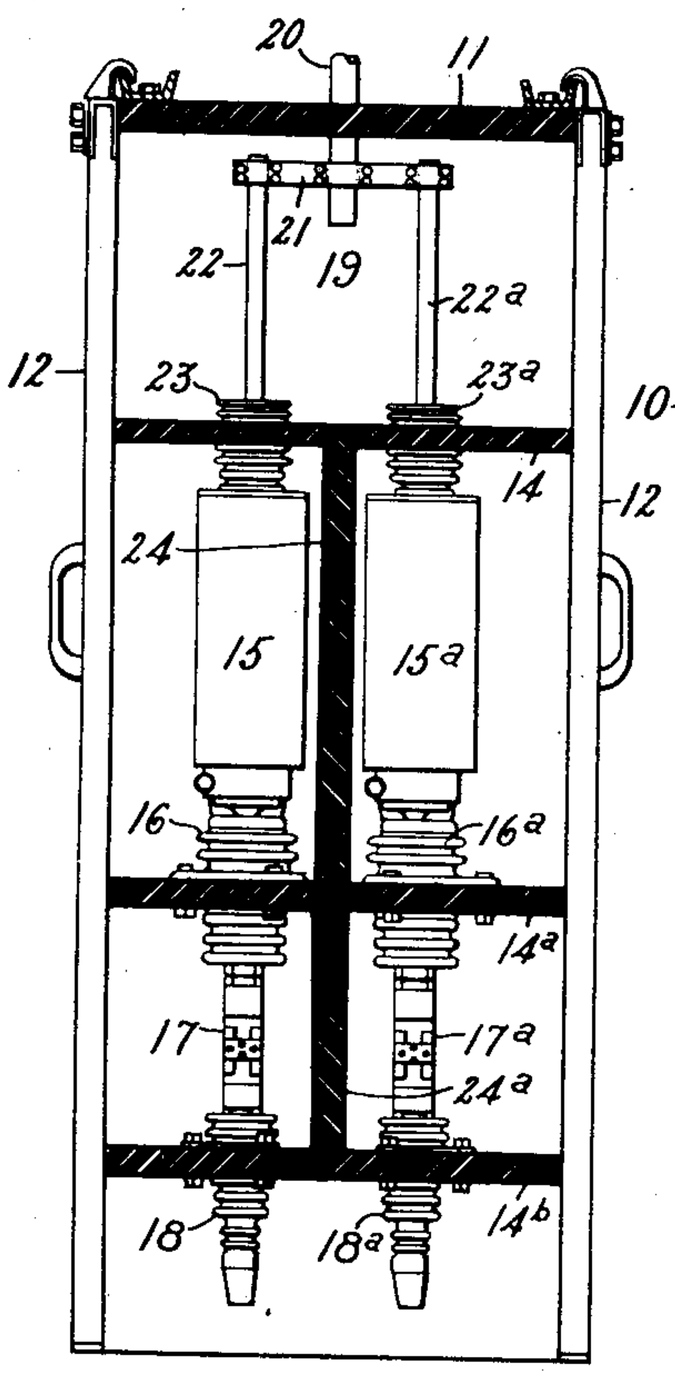


Fig. 1.

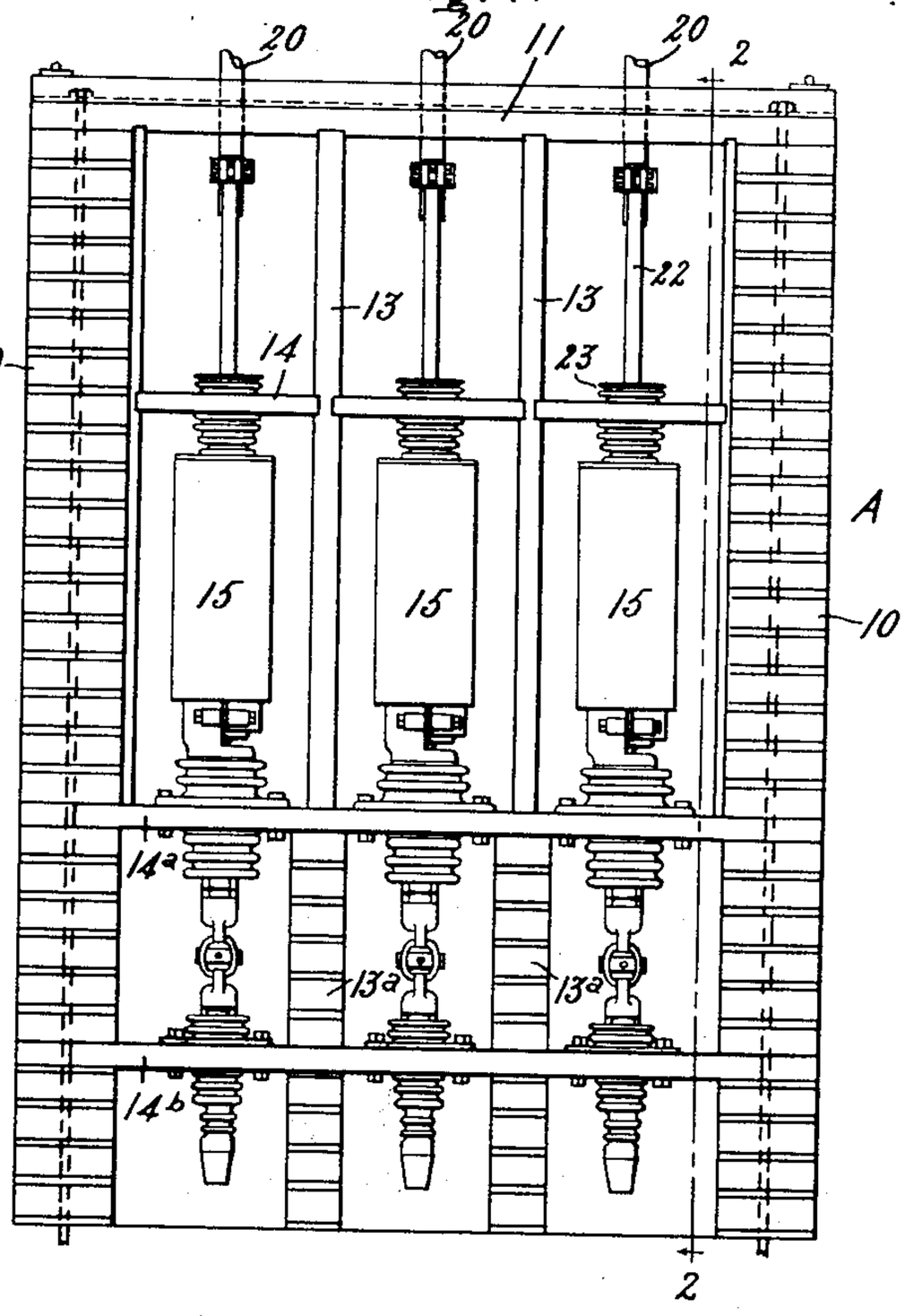
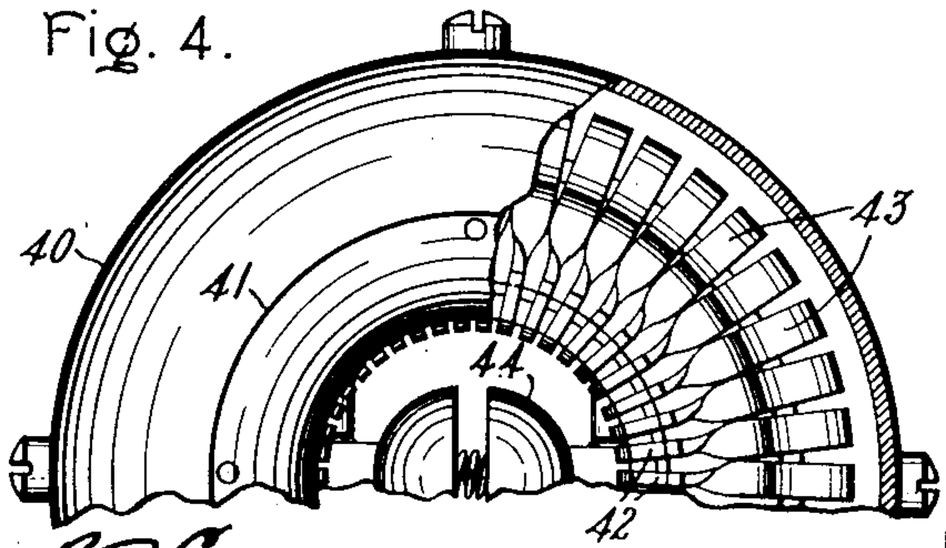


Fig. 4.



WITNESSES:

Benjamin B. Hall

Helen Alford

INVENTOR:
HENRY P. BALL

BY Albert G. Davis

ATT'Y.

H. P. BALL.

OIL SWITCH.

APPLICATION FILED JAN. 19, 1905.

945,671.

Patented Jan. 4, 1910.

2 SHEETS—SHEET 2.

Fig. 5.

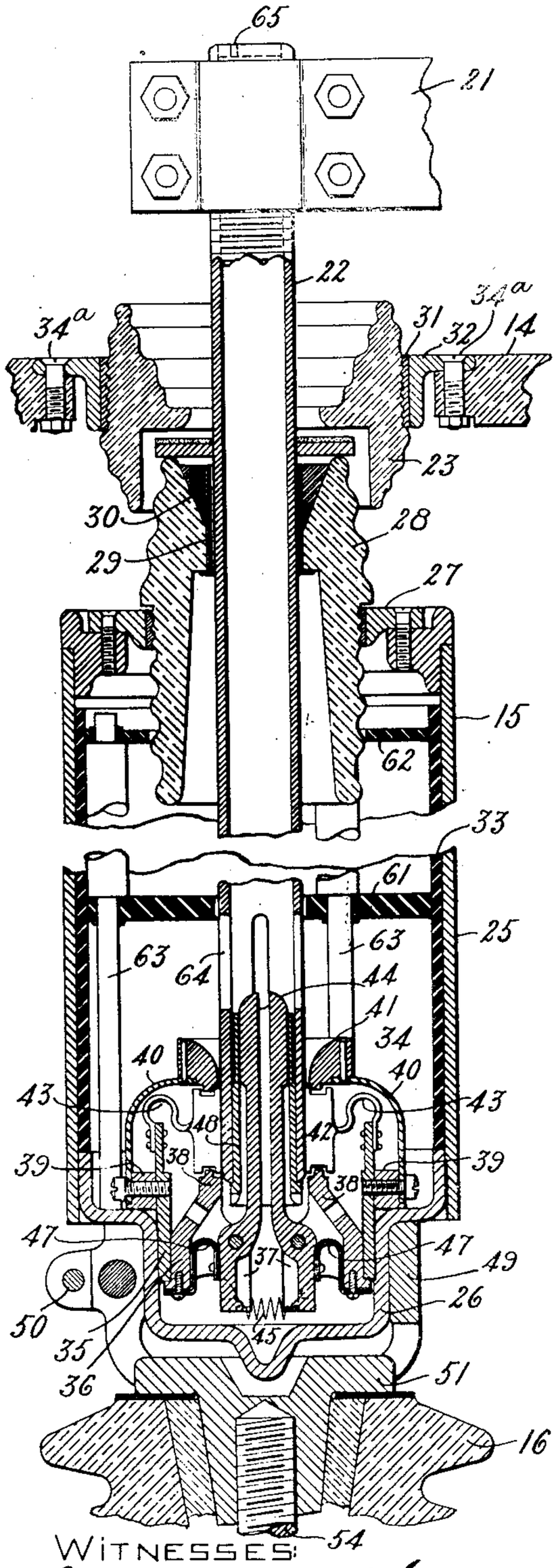
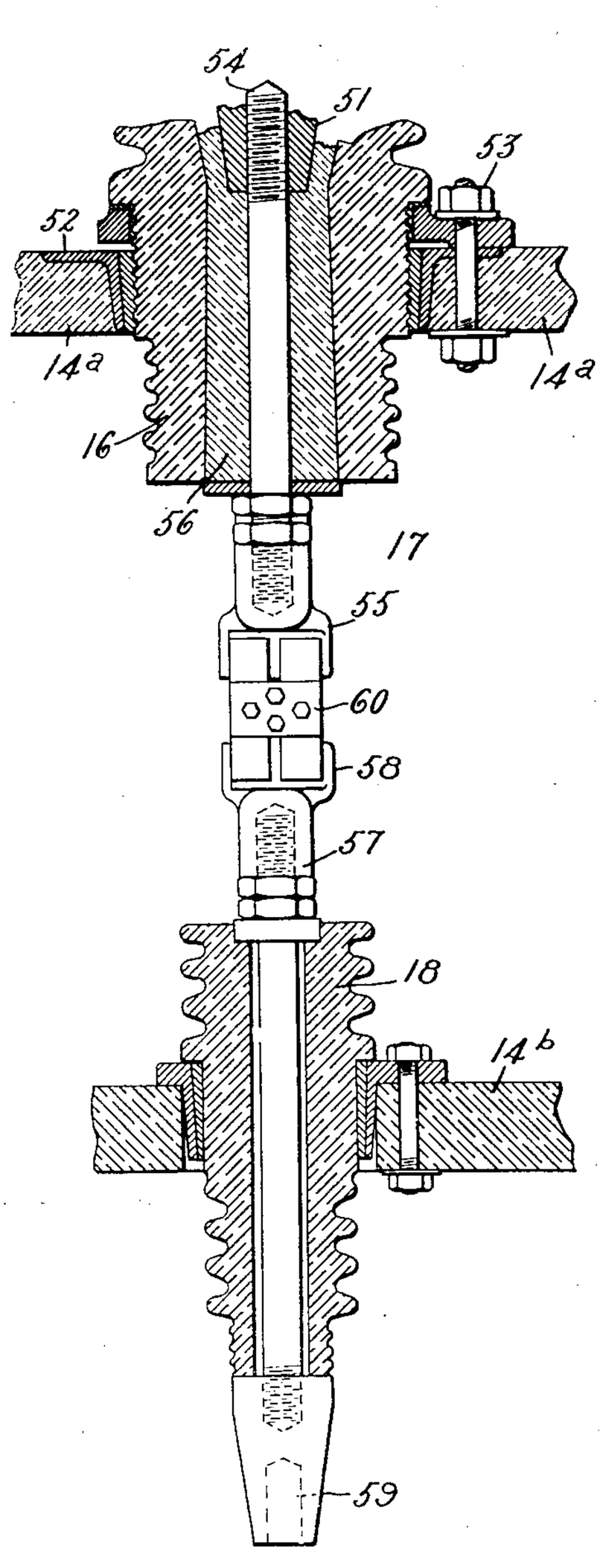


Fig. 6.



WITNESSES:

Benjamin B. Hull

Helen Alford

INVENTOR:
HENRY P. BALL

BY Albert G. Davis
ATT'Y.

UNITED STATES PATENT OFFICE.

HENRY PRICE BALL, OF NEW YORK, N. Y., ASSIGNOR TO GENERAL ELECTRIC COMPANY, A CORPORATION OF NEW YORK.

OIL-SWITCH.

945,671. Specification of Letters Patent. Patented Jan. 4, 1910.

Application filed January 19, 1905. Serial No. 241,758.

To all whom it may concern:

Be it known that I, HENRY PRICE BALL, a citizen of the United States, residing at New York, county of New York, State of New York, have invented certain new and useful Improvements in Oil-Switches, of which the following is a specification.

The present invention relates to electric switches and more particularly to switches of the oil break type in which the circuit is broken under oil contained in suitable inclosures surrounding the rupture points of the contacts. In constructing switches of this type it is the common practice to provide a supporting structure of insulating and fire-proof material, such as brick or concrete, having a plurality of cells in which the oil pots are arranged, and to mount the operating mechanism of the switch on the exterior of this structure. Each circuit passing through the switch passes through two oil pots each of which contains a contact which is directly connected to the line, and with these a movable bridging contact coöperates to make and break the circuit. The bridging contact is rigidly connected to an actuating rod which extends through the cell structure into operative connection with the switch operating mechanism. When such switches are designed for large current capacity, additional bridging and coöperating contacts which break in air are employed and the contacts which separate under oil are used to make the secondary and final break. With such switch construction the oil pots and their contacts for each leg of the circuit may be readily separated by the insulating partitions of the cell structure, and such has been the practice heretofore, but, due to the presence of the primary bridging contact, it has been impossible to separate the individual oil pots of each leg by such insulating partitions.

One feature of the present invention consists in a switch structure of the above type in which each oil pot is completely inclosed in a fire proof insulating cell.

Another feature of the invention consists in a novel construction of switch contacts by which both the primary and secondary breaks are made in the oil pot under the insulating liquid.

The present invention also comprises a novel oil pot construction by which the arc is effectively extinguished upon the separation of the contacts. According to this feature of the invention the oil pot is divided into two compartments, one of which at least contains the insulating liquid within which the break in the circuit is made. The pot is preferably so divided by means of a baffle-plate having a central opening through which the movable contact is adapted to reciprocate. This movable contact preferably consists of a tube which is provided with lateral openings which lie below the level of the baffle-plate when the switch is closed, but are adapted to pass above it before the final break occurs between the contacts upon opening the switch. This tubular contact provides a communicating passage between the compartments of the oil pot and when the final break takes place the drawing of the arc in the lower filled compartment produces an enormous pressure which forces the oil up through the tubular contact and out through its lateral opening into the upper compartment. In this way the arc is torn apart and readily ruptured with a minimum of movement. It is also common in switches of this type to provide the fixed contacts in the oil pots with connections which may be broken when it is desired to repair or inspect the oil pots. These connections are located ordinarily directly beneath their respective oil pots. An additional feature of the present invention is an improved switch structure in which better insulation between these adjacent connections is obtained and thereby the likelihood of injury due to an arc forming between them is minimized. Specifically this is accomplished by locating each construction in a separate insulating fire-proof cell thus isolating each connection in the same way that the oil pots are isolated.

The different features of the invention will be more fully and clearly understood upon reference to the following description taken in connection with the accompanying drawings in which I have illustrated my invention in its preferred form, and the novel features of the invention will be particularly pointed out in the appended claims.

In said drawings, Figure 1 is a side elevation of a three-phase switch constructed in accordance with the present invention, the closing doors of the cell structure being

omitted for clearness; Fig. 2 is a sectional view of the same viewed at right angles to Fig. 1, illustrating the oil pots and their connections in elevation, the section being taken on a plane indicated by the line 2 2 of Fig. 1; Figs. 3 and 4 are details of the fixed contacts located in the oil pots; and Figs. 5 and 6 are central sections taken respectively through the oil pot and its contacts and through the terminal connections.

The cell structure A in which the switch contacts are mounted is composed of wholly fire-proof insulating material and in the present instance comprises end walls 10 of brick, a roof or cover 11 of slate, interior partitions also of slate, and removable doors 12 by which access may be had to the interior of the structure. Vertical insulating partitions 13 13ª divide the interior of the structure into three parts, one per phase, and horizontal partitions 14, 14ª, 14ᵇ divide each of these compartments into four cells arranged in a vertical tier. These different cells contain the different switch parts. The second row of cells, viz: that between the horizontal partitions 14 and 14ª, is occupied by the oil pots 15 and 15ª in which the terminal contacts of the switch are located. These oil pots are arranged so that the partitions 13 13ª separate the contacts carrying currents of different phases. The oil-pots are mounted on suitable insulators 16 16ª carried by the horizontal partition 14ª and are electrically connected therethrough to the line terminals with the interposed detachable connections 17 17ª located in the cells below the partition 14ª. The line terminals are supported by and extend through similar insulators 18 18ª carried by the horizontal partition 14ᵇ, while the partitions 14 support insulators 23 23ª which hold the upper ends of the oil pots in place. The cells just beneath the top slab 11 are occupied by the bridging contacts 19 which are supported at the lower ends of wooden rods 20 which are adapted to be reciprocated by any suitable means to move the contacts 19 into and out of engagement with the terminal contacts in the oil pots. Each contact 19 comprises a horizontal member 21, and two tubular contacts 22 22ª mechanically and electrically connected therewith. The horizontal member 21 is secured at its center to the rod 20 and the tubular contacts extend within the oil pots and as they are reciprocated make and break the circuit with the contacts therein. Obviously any desired mechanism may be employed for reciprocating the rods 20, or, if desired, they may be operated by hand. Patent No. 755,771, granted March 29, 1904, to Edward M. Hewlett; Patent No. 760,601, granted May 24, 1904, to the applicant, and others show mechanism for producing this quick break reciprocating movement, and since the same is unnecessary to a proper understanding of the present invention no such means has been illustrated or described.

In addition to the partitions previously referred to within the cell structure A, vertical partitions 24 and 24ª are also provided. The vertical partitions 13 13ª separate the contacts and switch parts carrying differently phased currents, and the vertical partitions 24 and 24ª separate the oil pots 15 15ª of each phase and their respective connections 17 17ª. Thus it will be seen that in this construction each oil pot is completely inclosed by refractory insulating walls with an air space intervening between the interior of the pot and said walls, and that the same is also true of the connections 17 and 17ª.

In Figs. 5 and 6 one of the oil pots and its connections, as for example the oil pot 15 and its connection 17, are illustrated in section. Since the pots 15 and 15ª and connections 17 and 17ª are identical a description of one will suffice. The pot 15 comprises an inclosing casing 25, which is preferably cylindrical in form, provided with a lower cup-shaped head 26 and an upper head 27 having an aperture in which a porcelain or glass insulator 28 is secured in any suitable manner, preferably by the use of lead or other similar metal. The insulator 28 serves as a guide for the movable tubular contact 22 and also by telescoping within the lower end of the insulator 23 mounted on the slate slab 14 prevents the pot from being laterally displaced. The upper end of the insulator 28 is provided with a metal thimble 29 which loosely fits the exterior of contact 22 and provides a smooth guiding surface for the latter. This thimble may be leaded in place as indicated at 30. The insulator 23 is also leaded at 31 to a metal ring 32 which is firmly held by bolts 34ª to the supporting slab 14. The oil pot 15 is lined on its interior with a cylinder of indurated fiber or other non-conducting material 33.

From the construction thus far described it will be seen that the oil pot 15, which is composed of metal and consequently conducting material, is well insulated from the tubular contact 22. On the other hand, the fixed contact within the oil pot which is seated within the cup-shaped head 26, is in contact and consequently in conductive relation to the oil pot. This contact which may be designated generally 34, comprises a ring 35 which fits snugly into the cup-shaped head 26. This ring has secured to its lower end a casting 36 provided with inwardly extending lugs 37 and a guiding ring 38 provided with an upwardly extending rib. To the exterior of the ring 35 is connected a ring 39 which limits the downward movement of the ring 35 in the cupped seat formed by the head 26 and supports a protecting shield 40

which terminates at its upper end in a guiding ring 41 provided with a rib on its lower edge. Between the ribs on the lower edge of the ring 41 and on the upper edge of the ring 38 are located a plurality of contact segments 42 which are grooved at their upper and lower ends so as to loosely fit over the ribs on the rings 41 and 38 so that they may have a lateral movement. Each of these segments is formed integrally with a resilient connection 43 by which it is yieldingly supported upon the upper edge of the supporting ring 35. The opposing lugs 37 on the casting 36 pivotally support the two parts of a split plug 44 which extends upward through the contact ring formed by the segments 42 and beyond the upper guiding ring 41. The portions of this plug are forced apart at their upper ends by means of a spring 45 connecting their lower ends below their points of support and tending to draw said lower ends together. Suitable electrical connection is obtained between the plug 44 and the casting 36 by means of flexible connections 47, each composed of a bundle of laminæ of copper conducting strips. From this it will be seen that by reason of the independently actuated segments 42, good electrical contact is readily obtained. These segments engage the exterior of the tubular contact while the plug 44 passes into its interior. By means of these exterior and interior contacts a large contacting surface is obtained and the switch is enabled to carry a large amount of energy with a relatively small oil receptacle. In order to provide for ready renewal in case of injury due to arcing between the plug 44 and the tubular contact 22, the lower end of the latter is provided with a tubular tip 48 which extends within the tube 22 and slightly beyond its lower end. This tip is cut away on its outer surface near its upper end and is also split so that it may yield laterally when engaged by the plug 44 thus insuring good contact.

The oil pot 15 is held in position by means of a clamping ring 49 which embraces the exterior of the cup-shaped head 26 and is clamped in position by suitable bolts 50. This ring forms part of the terminal member 51 which rests upon the supporting insulator 16 carried by the horizontal partition 14^a of the cell structure. The insulator 16 is leaded to a ring 52 which is securely held by bolts 53 to the partition 14^a. The insulator 16 is provided with a tubular bore into which the lower end of the member 51 extends. This member is in threaded engagement with a terminal rod 54 which extends through and terminates just below the insulator 16 in a flattened head 55. When the members 51 and 54 are properly alined so as to bring the oil pot 15 in a vertical position, the space around them within the bore of the insulator 16 is filled with cement 56 which when set holds them securely in place. The insulator 18, which is carried by the horizontal partition 14^b, carries a terminal 57, similar to the terminal 54, and terminating in a head 58, similar to the head 55. The head 58 is located at one end of the terminal 57 in proximity to the head 55, and the opposite end of the terminal is provided with a socketed head 59 into which a circuit terminal may be soldered. The heads 55 and 58 are connected by a removable connector or coupling 60 made up of oppositely disposed brush contacts which engage the opposite sides of the heads 55 and 58. When the switch is open coupling 60 may be readily removed by simply withdrawing it from the heads 55 and 58 in order to disconnect the oil pots and the main switch contacts from the circuit for the purpose of repair or inspection.

It will be seen from the description thus far that the circuit for any one phase will be completed from the connecting head 59 at the lowermost part of the cell structure through the terminal 57, coupling 60, terminal 54, clamping ring 49, contact 34, tubular contact 22, connecting yoke 21 and thence through the tubular contact 22^a and a similar path through the oil pot 15^a and its connections 17^a.

In addition to the interior insulating lining 33 of the oil pot 15 a baffle-plate of insulating material 61 extends completely across the interior of the oil pot. This plate is provided with a central opening through which the tubular contact 22 passes. A similar plate 62 of insulating material is also located near the upper end of the oil pot and is apertured so as to fit around the lower end of the insulator 28. The plates 61 and 62 are held in position by wooden rods 63 which rest upon the bottom of the oil pot and to which these plates are connected. As the contacts 22 and 34 separate the final break is made between the tubular tip 48 and the end of the break contact 44. By reason of the baffle-plate 61 the pressure produced by the arc gases is confined in the lower portion of the oil pot which is divided into two compartments by this baffle-plate. The tubular contact is provided, however, with openings 64 which, when the switch is closed, communicate with the compartment below the baffle-plate 61. Before the final break takes place between the contacts 44 and 48 the openings 64 lie wholly above the baffle-plate so as to provide a communication between the two compartments of the oil pot. By reason of this construction when an arc is drawn the pressure of the oil which completely fills the lower compartment of the oil pot forces the oil up through the tube and out through the openings 64 into the upper compartment. This

has the effect of tearing apart the arc and quickly rupturing it. In order that the contacts may readily return to the closed position without compressing the air contained in the tubular contact 22, a small vent 65 is provided at the upper end of said contact.

It is obvious that many alterations and modifications may be made in the matter herein disclosed without departing from the spirit and scope of my invention. I therefore do not wish to be limited to the specific disclosure but aim to cover by the terms of the appended claims all such alterations and modifications.

What I claim as new and desire to secure by Letters Patent of the United States, is,

1. An electric switch contact comprising two annular guides, and a contact ring consisting of a plurality of laterally yielding contact segments interposed between said guides and annular channels in said contact ring engaged by said guides.

2. An electric switch contact comprising two annular guides, a contact ring consisting of a plurality of laterally yielding contact segments interposed between said guides and a central plug contact secured to the lower guide and extending upward through the contact ring beyond the upper guide.

3. An electric switch having a tubular contact, a tubular tip extending within said tubular contact and terminating at its inner end in a lateral yielding contact surface, and a coöperating contact having a yielding contact surface engaging the interior of said tip.

4. An electric switch having a tubular contact, a tubular tip extending within said tubular contact and beyond its end, and a cooperating contact comprising a central plug having yielding engaging surfaces to enter the tube and engage said tip.

5. An electric switch having a tubular contact, a tubular tip extending within said tubular contact and beyond its end, a cooperating contact comprising a central plug adapted to enter the tube and engage said tip, and an annular part adapted to engage the exterior of said tube.

6. An electric switch comprising a two-compartment inclosing chamber, a tubular contact forming a communicating passage between said compartments, and a coöperating contact arranged to break with said tubular contact in one of said compartments.

7. An electric switch comprising a two-compartment inclosing chamber, a movable tubular contact forming a communicating passage between said compartments, and a coöperating contact arranged to break therewith in one of said compartments.

8. An electric switch comprising a tubular contact and a coöperating contact separable under oil, a closed chamber for the oil, and an immovable apertured partition therein through which said tubular contact passes in drawing the arc.

9. An electric switch comprising a two-compartment inclosing chamber, an apertured wall between the compartments, a contact in one of the compartments, and a tubular contact coöperating therewith and extending through said apertured wall and forming a communicating passage between said compartments.

10. An electric switch comprising a two-compartment inclosing chamber one compartment containing insulating fluid, a movable tubular contact forming a communicating passage between said compartments, and a coöperating contact arranged to break with the tubular contact within said fluid.

11. An electric switch comprising a two-compartment oil-pot, a tubular contact forming a communicating passage between the compartments and separable from a cooperating contact in one of said compartments whereby the oil therein put under pressure by the arc-gases extinguishes the arc and flows from one compartment to the other.

12. An electric switch comprising a two-compartment oil-pot having a passage between said compartments, a tubular contact movable through the passage from one compartment to the other, a contact in one of said compartments coöperating with said tubular contact, and means for separating said contacts and drawing the tubular contact through the passage into the other compartment.

13. An electric switch comprising a closed chamber, a tubular contact and a coöperating contact separable therein, a plate or partition therein located above the break point and provided with an opening for the passage of the tubular contact, said tubular contact having openings in its sides located so as to lie below said partition when the switch is closed and to reach a position above said partition before the final break between the contacts occurs as the switch is opened.

14. In an electric switch, the combination with a stationary terminal permanently connected to the source of current, of a fixed contact immovably mounted vertically above said terminal, a disengageable connection between said fixed contact and said terminal, a movable contact coöperating with said fixed contact, an inclosure for said coöperating contacts, a horizontal insulating partition between said inclosure and said terminal.

15. In an electric switch, the combination with a stationary terminal permanently connected to a source of current, of an oil pot mounted above said terminal, coöperating contacts arranged to make and break the

circuit in said oil pot, a disengageable connection between said terminal and said oil pot, a cell for inclosing said oil pot and said terminal, and a horizontal insulating partition in said cell between said oil pot and said terminal.

16. An electric switch comprising a casing containing oil, a pressure retaining chamber therein, one wall of said chamber being provided with an aperture, a stationary contact located in said chamber and a tubular contact movable through said aperture to coöperate with the stationary contact.

In witness whereof I have hereunto set my hand this seventeenth day of January, 1905.

HENRY PRICE BALL.

Witnesses:
ANDREW A. LANAHAN,
THERESA MCKENNA.