G. A. BURNHAM.

ELECTRIC SWITCH.

APPLICATION FILED JUNE 17, 1911.

1,015,613.

Patented Jan. 23, 1912.

4 SHEETS—SHEET 1.

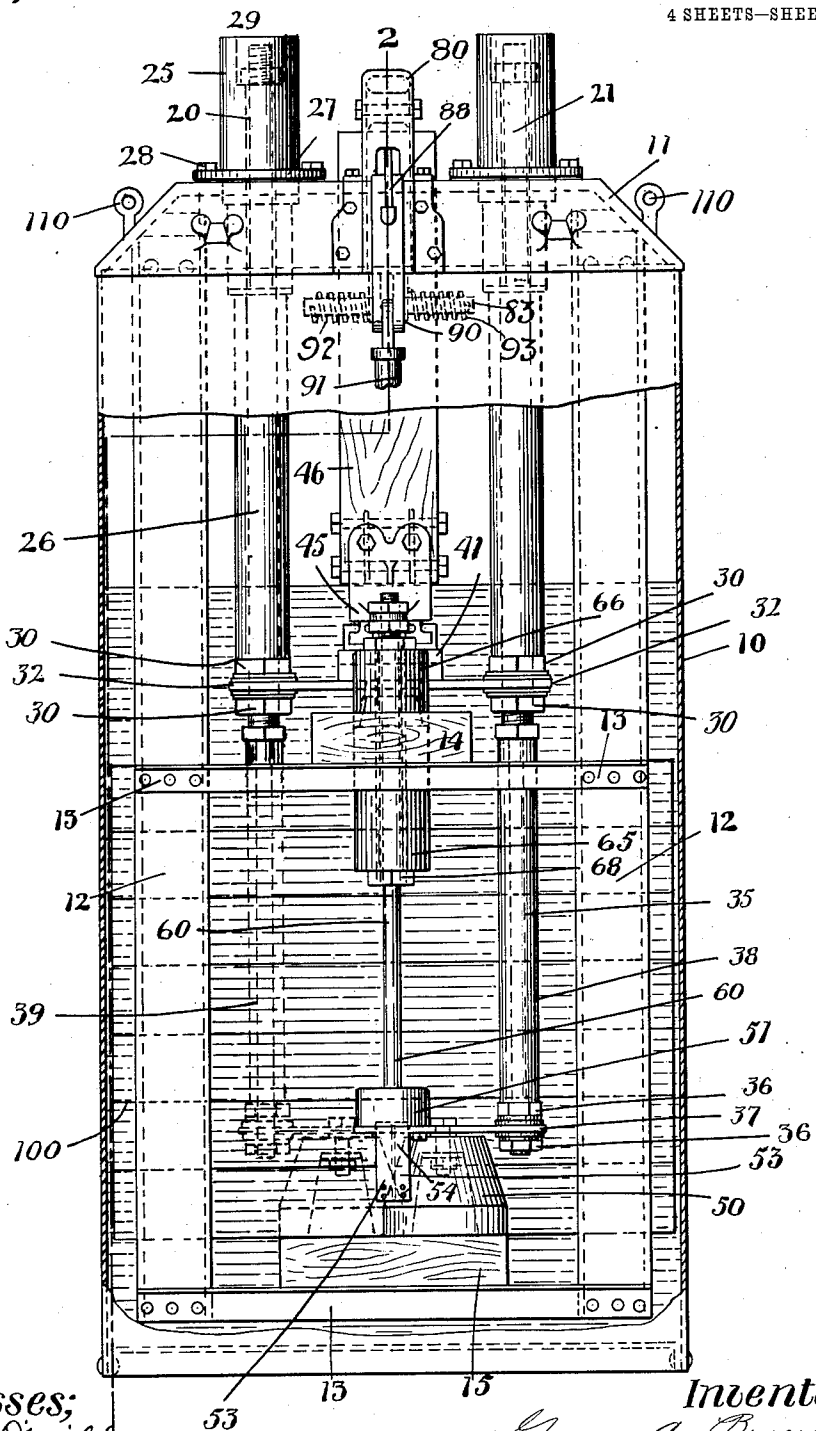

Fig. 1

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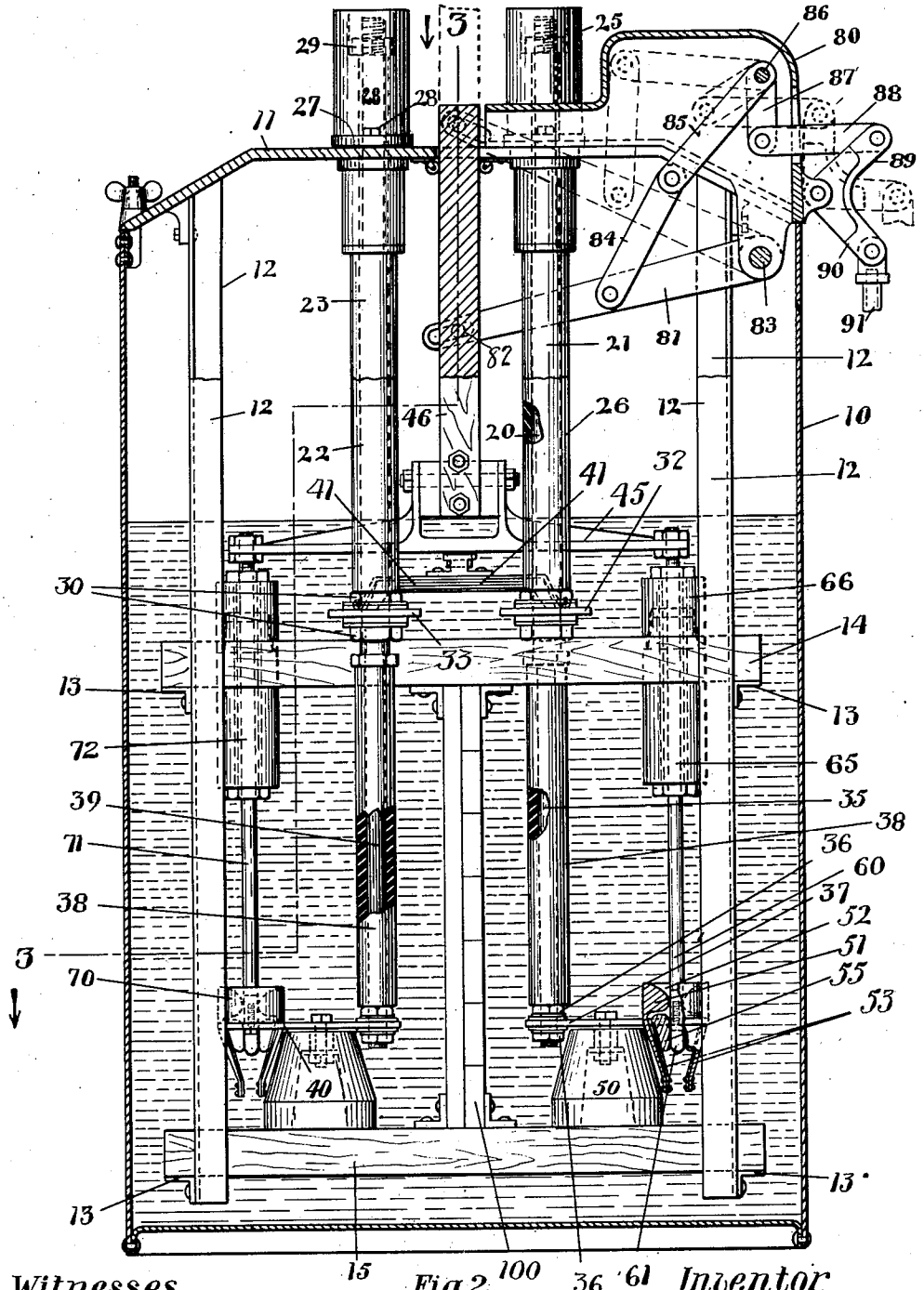

Fig. 2

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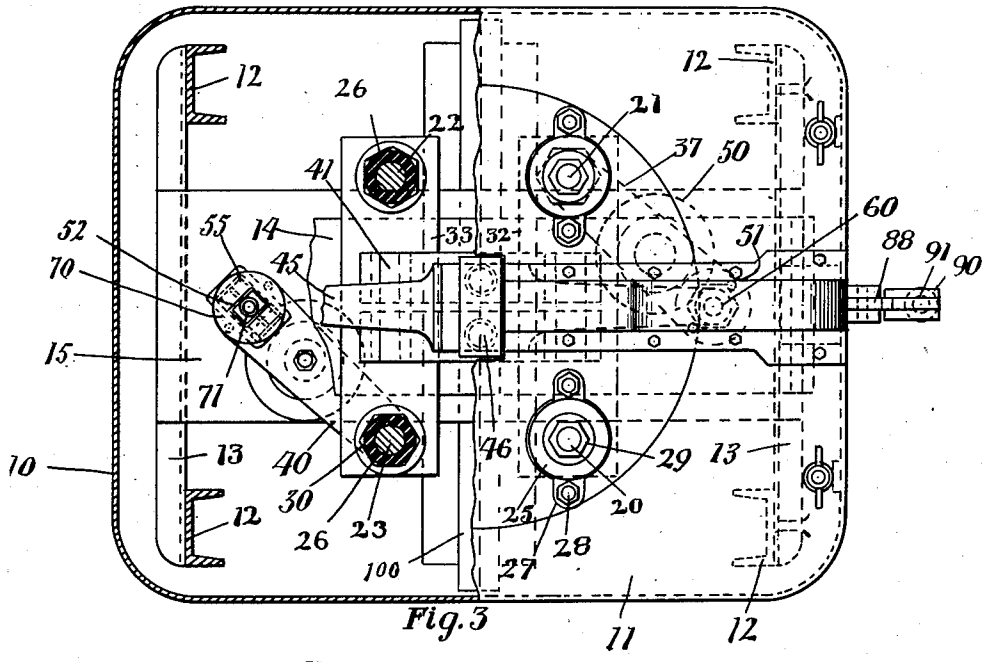

Fig. 3

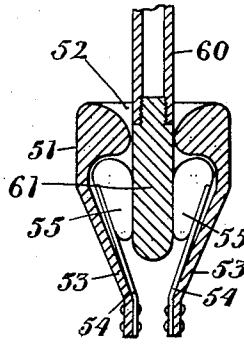

Fig. 4

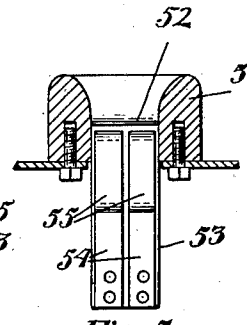

Fig. 5

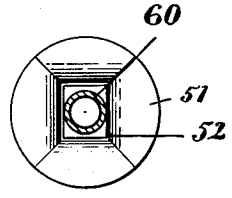

Fig. 6

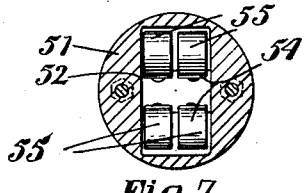

Fig. 7

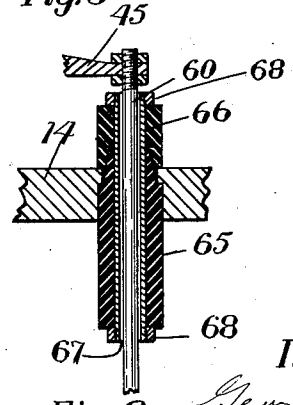

Fig. 8

Witnesses

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4 SHEETS—SHEET 4.

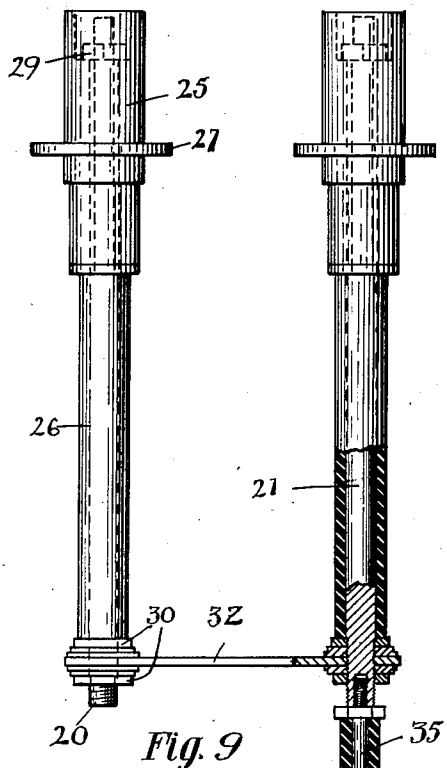

Fig. 9

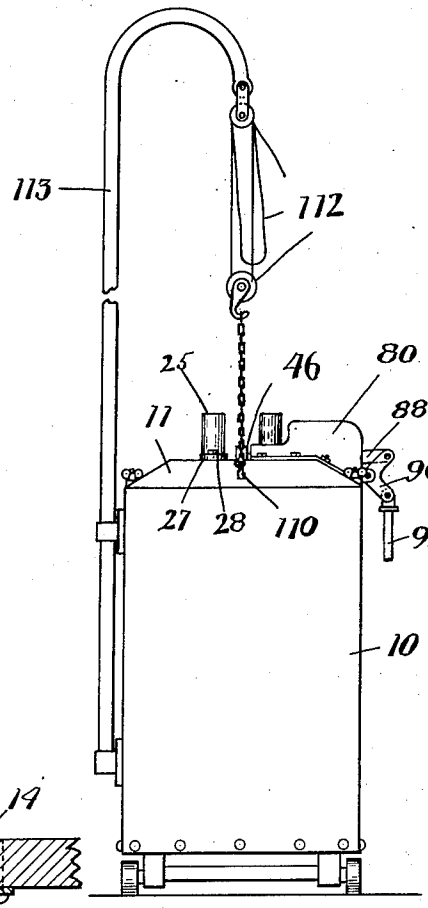

Fig. 11

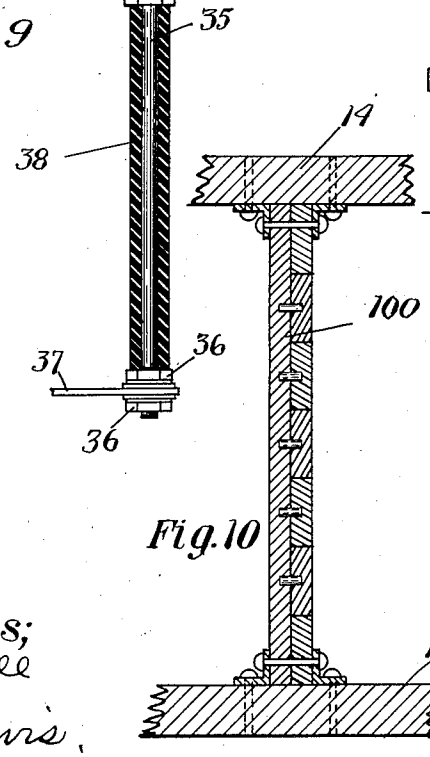

Fig. 10

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UNITED STATES PATENT OFFICE.

GEORGE A. BURNHAM, OF SAUGUS, MASSACHUSETTS, ASSIGNOR TO S. B. CONDIT, JR., OF BOSTON, MASSACHUSETTS.

ELECTRIC SWITCH.

1,015,613. Specification of Letters Patent. Patented Jan. 23, 1912.

Application filed June 17, 1911. Serial No. 633,698.

To all whom it may concern:

Be it known that I, GEORGE A. BURNHAM, a citizen of the United States, residing at Saugus, in the county of Essex and State of Massachusetts, have invented an Improvement in Electric Switches, of which the following is a specification.

This invention relates to electric-switches for circuits carrying high power currents; and the invention is embodied in a switch of the oil type having main and auxiliary switches.

Ordinarily the main switches are made of full current-carrying capacity, and are designed and intended to carry the current, and the auxiliary switches are made of partial current-carrying capacity, and are designed and intended to serve as the circuit-breaking switches, and the movable members of said main and auxiliary switches are operated to break the circuit successively, the movable switch-members disengaging the stationary main switch-members in advance of the movable switch-members disengaging the stationary auxiliary switch-members. By and during the operation of each movable switch-member the oil surrounding it is disturbed, sometimes violently, and when arranged near together and operated one in advance of the other, the operation of the second member occurs while the oil near it is being disturbed by the first member, and the efficiency of the oil as a means to reduce the arc and to dissipate the heat energy of the products thereof is diminished; the contention being that for the highest efficiency the oil about the movable switch-members should be quiet at the moment said members are operated to break the circuit.

The essential object of this invention is to provide for widely separating the submerged switches from each other, so that there is surrounding each a large body of oil which will be quiet at the moment it is operated. In the present embodiment of my invention the main switches are arranged near the top of the body of oil which is contained in the oil-receptacle, and the auxiliary switches are arranged near the bottom of said body of oil, so that there is a large body of oil between them, and the oil surrounding each is not disturbed by the operation of the other. Furthermore, owing to the fact that the main switches are normally shunted by the auxiliary switches, and are first operated, the arcs are formed upon disengagement of the members of the auxiliary switches, and by arranging said auxiliary switches near the bottom of the body of oil the heat energy of the gases produced by the arcs is, for the most part, dissipated in the oil before reaching the expansion chamber which is provided at the top of the body of oil. Furthermore, in the present embodiment of my invention the main and auxiliary switches are arranged in different vertical planes, as well as in different horizontal planes, to more fully insure the carrying out of the ideas above stated.

It is very desirable that all of the operating parts shall be arranged upon and supported by the cover of the oil-receptacle, and, hence, in the present embodiment of my invention terminal-bars are provided, which extend through the cover, to which the stationary main and auxiliary switch-members are connected, said bars being of suitable length to support the stationary main switch-members below but near the top of the body of oil, and to support the stationary auxiliary switch-members near the bottom of the body of oil, and said terminal-bars are insulated throughout their length or substantially so.

In the present embodiment of my invention the movable-members of the main switches are resilient and both members of the auxiliary switches are non-resilient. The movable-members of said auxiliary switches comprise longitudinally movable rods which will not mechanically disturb the oil surrounding them, and the stationary-members thereof comprise rings having holes through them to receive said rods and having pressure-devices which act to move the rods in a lateral direction into firm engagement with one side wall of the hole through the rings.

While herein the operating parts are all connected with the cover of the oil-receptacle, the actuating-mechanism for the movable-members of the switches is entirely separated by a cap, which is detachably connected with said cover, and which is disposed above an elongated slot in said cover, so that said mechanism may be separately removed in assembled condition, if desired. A partition wall, of special construction is

arranged between the auxiliary switches, which extends from side to side of the oil-receptacle or thereabout. In view of the fact that all of the operating parts are connected with the cover of the oil-receptacle, it is possible to make repairs without entirely removing said operating parts, by lifting the cover more or less, and herein means are provided for thus lifting the cover which also admits of the cover being entirely removed.

Figure 1 is an end elevation of an electric switch embodying this invention, the oil-receptacle being broken away. Fig. 2 is a vertical section of the switch shown in Fig. 1 taken on the dotted line 2—2, Fig. 1. Fig. 3 is a plan view and partial section taken on the dotted line 3—3, Fig. 2. Figs. 4, 5, 6 and 7 are enlarged views of one of the auxiliary switches. Fig. 8 is a sectional view of the insulating guide for the plunger of the auxiliary switch. Fig. 9 is a separate view of two of the terminal-bars. Fig. 10 is a detail of the insulating partition wall which is arranged in the oil-receptacle. Fig. 11 is a side elevation of the electric switch, having means for lifting the cover and operating parts attached thereto more or less.

10 represents a receptacle of suitable size and dimensions to receive the operating parts of the switch and to contain oil in which the operating parts of the switch are submerged, the oil partially filling the receptacle, as indicated in Fig. 1, so as to leave an expansion chamber above the oil at the top part of the receptacle.

11 is the cover of the receptacle which is detachably connected thereto by any suitable means. This cover is of a very substantial construction, in order that it may support all the operating parts of the switch. On the under side of the cover 11 a frame is secured which supports the operating parts, consisting essentially of vertical channel-iron bars 12, four in number, attached at their upper ends to the cover, horizontal cross-bars 13 connected at their ends to the bars 12, and two flat horizontal boards or plates 14 and 15, of wood, supported upon said cross-bars. A double-break switch is here shown, and two pairs of terminal-bars are employed which extend down through the cover and are connected with the stationary main and auxiliary switch-members, but my invention is applicable to a single-break switch and if desired but one pair of terminal-bars need be employed. One terminal-bar of each pair is short, but long enough to extend below the surface of the body of oil, and the other terminal-bar is formed with an extension, making it long enough to extend nearly to the bottom of the body of oil, and said short and long terminal-bars support the stationary main switch-members near the top of the body of oil and the stationary auxiliary switch-members near the bottom of the body of oil.

The short terminal-bar 20 is screw-threaded at its upper and lower ends and its upper end portion extends through a collar 25 and tube 26, both of insulating material, and arranged one in continuation of the other. The collar 25 extends through a hole in the cover, and has perforated ears 27, arranged above the cover, which receive screws 28 by which the collar is attached to the cover. The upper threaded end of the bar is designed to receive the terminal of a circuit-wire, but may receive upon it, as here shown, a nut 29, which rests in a socket formed in the upper end of the collar. The lower threaded end of the bar receives upon it a pair of nuts 30, and one end of a plate 32, which is arranged between said nuts; and the lower end of the tube 26, engages one of said nuts and is held between said nut and the collar 25. The plate 32 serves as one of the stationary main switch-members. The other short terminal-bar 22, is similarly constructed and insulated and supports at its lower end one end of another plate 33, which latter serves as the other stationary main switch-member. The long terminal-bar comprises a short bar 21 constructed like the aforesaid short terminal-bars and similarly insulated, and having nuts at its lower end between which is arranged and supported the other end of said stationary main switch-member 32; and an extension bar 35, the upper end of which is screw-threaded and enters a screw-threaded socket formed in the lower end of said short bar, thereby connecting them together. The lower end of the extension bar 35 is threaded and receives upon it a pair of nuts 36, and one end of a conducting plate 37, which is held in place by said nuts. The extension bar is incased in a tube 38 of insulating material. The other long terminal-bar is similarly constructed and insulated, comprising the short bar 23, having an extension bar 39, and supporting the other end of the stationary main switch-member 33, and one end of a conducting plate 40, which is held in place by said nuts.

The movable main switch-members, two being here shown, are designed to bridge the stationary main switch-members 32 and 33, and, each may consist of a laminated bar or brush 41, with a resilient strip superposed thereon, the ends of said brush and strip engaging said plates 32 and 33. Said members 41 are connected loosely by suitable means to a cross-bar 45, which is fixedly attached to the lower end of an upright bar 46, which extends up through a hole in the cover 11, permitting up and down movements thereof for the purpose of

moving the movable main switch-members into and out of engagement with the stationary main switch-members.

The conducting plate 37, which is connected with the extension bar 35, rests upon and is attached to a block 50, of insulating material, which is supported upon the frame, and the outer or free end bears the stationary auxiliary switch-member. Said switch-member comprises a ring or block 51, of conducting material, having a quadrangular hole 52 through it, or a hole made other than round, and it has a bell-mouthed or tapering entrance to said hole, from above, and said ring rests upon the plate 37, above a hole therein, and is secured to said plate by screws or otherwise. Said ring has a pair of downwardly extended arms 53, 53, arranged at opposite sides of the hole, which project down through the hole in the plate 37, and said arms have attached to them, on their adjacent faces and at their lower ends, flat springs 54, there being two such springs attached to each arm and arranged side by side, and said springs bear at their upper ends small blocks 55, the adjacent faces of which are made flat and their upper ends rounded to form a tapering entrance to the space between the two pairs of blocks from above.

The auxiliary switch-member is made as a rod or plunger 60, of small diameter, so that it will not act to mechanically disturb the oil surrounding it when moved, and, as here shown, said rod 60 has connected with it, at its lower end, a piece 61, quadrangular in cross-section, or otherwise shaped to loosely fit the hole in the stationary member. Said rod extends through and is guided by an insulating bushing secured to the board 14, and its upper end is connected with one end of the cross-bar 45, so that it will be moved vertically by said cross-bar. When the cross-bar is in its lowermost position, as shown in Fig. 2, the end-piece 61 will occupy a position in the hole in the ring and between the two pairs of blocks 55. The oil is not disturbed mechanically by a movement of the plunger-rod until permitted to flow beneath the end thereof, at which time it acts to reduce the arc, and not being disturbed mechanically at such time is in the best possible condition to perform its function. The bushing through which the plunger-rod extends is composed of two parts 65 and 66, the part 65 extending up through a shouldered hole in the board 14, and having a frusto-conical end portion, and the part 66 having a socket in its under side to receive said end portion, and bearing at its lower end upon the board 14. A metallic tube 67 is placed within the two-part insulating bushing, which is made longer than the bushing and projects therefrom at each end, and its ends are threaded to receive upon it nuts 68 by which the two parts of the bushing and the tube are secured together and also held in fixed relation to the board 14. The plunger-rod slides freely in said bushing. By arranging the auxiliary switch-members near the bottom of the body of oil which, is herein permitted, by the employment of the long terminal-bars, the heat energy of the products of the arc formed upon disengagement of the members thereof will be sufficiently dissipated by the oil, so that the expansion chamber which is provided at the top of the body of oil will adequately take care of the gases which rise from the oil. There is connected with the conducting-plate 40, a similarly constructed stationary auxiliary switch-member 70, with which coöperates a similarly constructed plunger-rod 71, which extends through a bushing 72, connected with the board 14, and is connected to the end of the cross-bar 45, opposite the plunger-rod 60. The invention, however, is not limited to the employment of main and auxiliary switches of any particular construction, the forms here shown being for the purpose of illustrating one embodiment of my invention.

The actuating-mechanism for the switch is entirely supported by a cap 80, secured to the cover 11, above an elongated hole therein. Said actuating-mechanism involves an arm 81, slotted at its outer end to engage a laterally extended pin 82 on the upright bar 46, a pivot-shaft 83, to which said arm is connected, toggle-levers 84, 85, loosely connected to said arm 81, at one end and secured to a pivot-shaft 86, at the other end, an arm 87 secured to said pivot-shaft 86, a link 88 connecting said arm 87 with one arm 89 of a bell-crank lever, the other arm 90 of said bell-crank lever being loosely connected to a rod 91, which is connected with suitable tripping-mechanism, by which the mechanism is released, springs 92, 93, which encircle the end portions of the pivot-shaft 83, which are connected at one end with the shaft and at the other end to the support for the shaft, and which, when permitted, act to turn the shaft in one direction and lift the arm 81. The full and dotted line positions shown in Fig. 2, represent the two positions of the actuating-mechanism.

According to the spirit of my invention it is quite important that the actuating-mechanism shall be entirely supported by the cap 80, so that upon removing said cap said mechanism is removed with it, but the construction of the mechanism itself may be changed, as required.

To more fully insure the separation of the auxiliary switches, a heavy vertical partition 100 is arranged between them, which extends from side to side of the oil-receptacle, and from the lower board 15 to the up-

per board 14. Said partition may be made double, and composed of strips of wood secured together, those on one side being arranged vertically and those on the other side being arranged horizontally, and the upper and lower ends of the partition may be held against displacement by corner irons secured to the boards 14 and 15.

The cover 11 has eyes 110 secured to it, adapted to be engaged by hooks connected with a block and tackle 112 suspended from a crane 113, adapted to be connected to brackets 114 on the side of the oil-receptacle, and by operating said block and tackle in the usual manner said cover and parts connected therewith may be lifted more or less, as desired, or may be entirely removed from the receptacle.

I claim:—

1. In an electric-switch, an oil-receptacle, stationary and movable main switch-members arranged below but near the top of the body of oil, stationary and movable auxiliary switch-members arranged near the bottom of the body of oil, and means to move the movable switch-members, substantially as described.

2. In an electric-switch, an oil-receptacle having a cover, a short and a long terminal bar extending through the cover of the receptacle and down into the body of oil, the short bar terminating a short distance below the top of the body of oil and the long bar terminating near the bottom of the body of oil, a stationary switch-member connected at one end to the lower end of said short terminal-bar and at the other end to an intermediate part of the long terminal-bar, and another stationary switch-member connected to the lower end of the long terminal-bar, switch-members movable into and out of engagement with said stationary switch-members, and means to move them, substantially as described.

3. In an electric-switch, an oil-receptacle, stationary switch-members, and a movable switch-member therefor, arranged near the top of the body of oil, stationary auxiliary switch-members, and movable switch-members therefor, arranged near the bottom of the body of oil, terminal-bars extending through the cover of the receptacle to which said stationary main switch-members are connected, two of said bars having downward extensions which terminate near the bottom of the body of oil, and conducting-plates connected to the lower ends of said extensions bearing the stationary auxiliary switch-members, substantially as described.

4. In an electric-switch, an oil-receptacle, stationary main switch-members, and a movable switch-member therefor, arranged near the top of the body of oil, stationary auxiliary switch-members and movable switch-members therefor, arranged near the bottom of the body of oil, terminal-bars extending through the cover of the receptacle to which said stationary main switch-members are connected, two of said bars having downward extensions which terminate near the bottom of the body of oil, conducting-plates connected to the lower ends of said extensions bearing the stationary auxiliary switch-members, and blocks supported on a frame connected with the cover to which said conducting-plates are attached, substantially as described.

5. In an electric-switch, an oil receptacle having a cover, a short and a long terminal bar extended through the cover and down into the body of oil and terminating, respectively, a short distance below the top and near the bottom of the body of oil, a stationary main switch-member and a stationary auxiliary switch-member supported by said terminal bars, one below but near the top, and the other near the bottom of the body of oil, and switch-members borne by a cross-head, movable into and out of engagement with said stationary switch-members, substantially as described.

6. In an electric-switch, an oil receptacle, a stationary main switch-member arranged below but near the top of the body of oil, a stationary auxiliary switch-member arranged near the bottom of the body of oil, a movable main switch-member arranged below but near the top of the body of oil to engage said stationary main switch-member, a support therefor, and a movable auxiliary switch-member comprising a rod, connected at its upper end to said support, which extends down into the body of oil to engage said stationary auxiliary switch-member, substantially as described.

In testimony whereof, I have signed my name to this specification, in the presence of two subscribing witnesses.

GEORGE A. BURNHAM.

Witnesses:
B. J. NOYES,
H. B. DAVIS.