No. 815,824. PATENTED MAR. 20, 1906.

E. M. HEWLETT.

HIGH POTENTIAL SWITCH OR CIRCUIT BREAKER.

APPLICATION FILED FEB. 7, 1900. RENEWED NOV. 3, 1904.

3 SHEETS—SHEET 1.

Fig. 1.

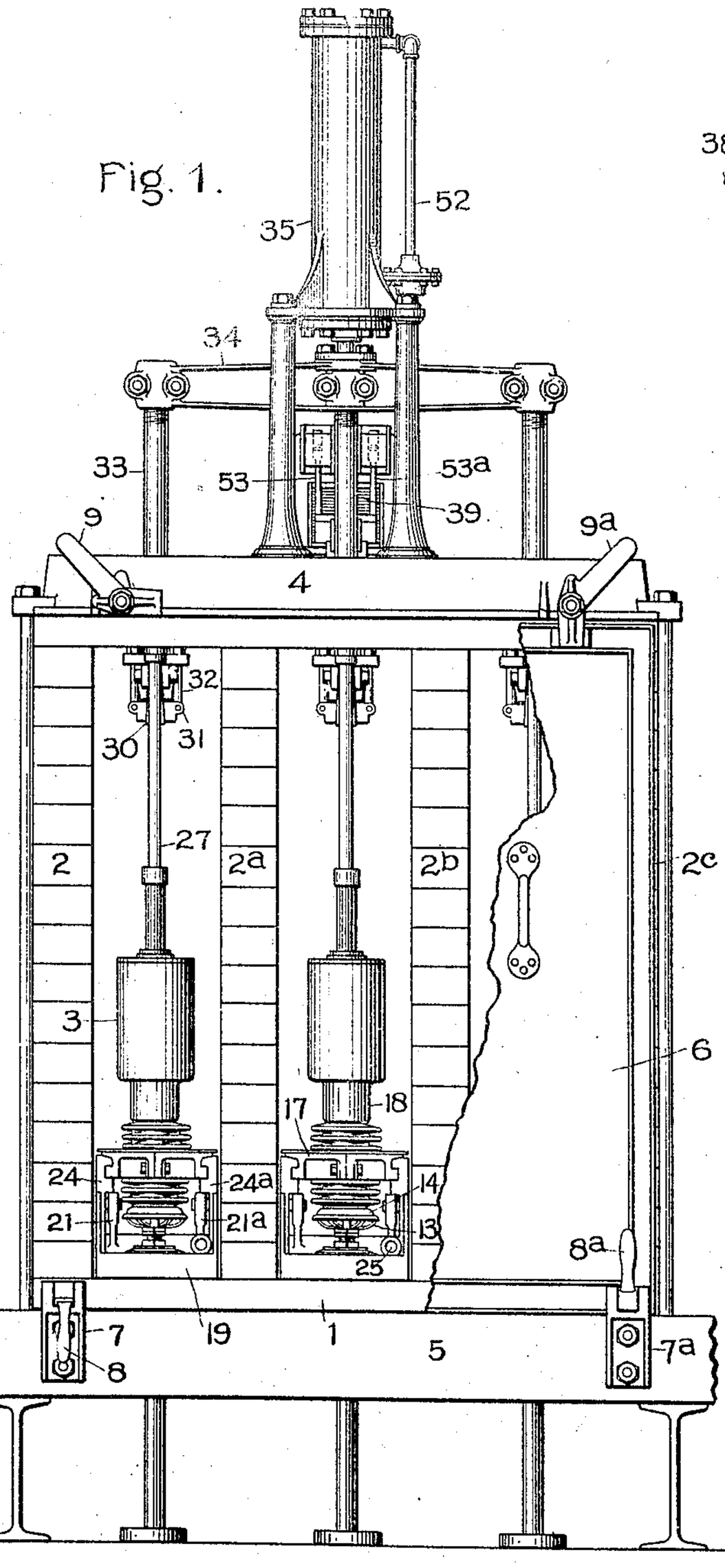
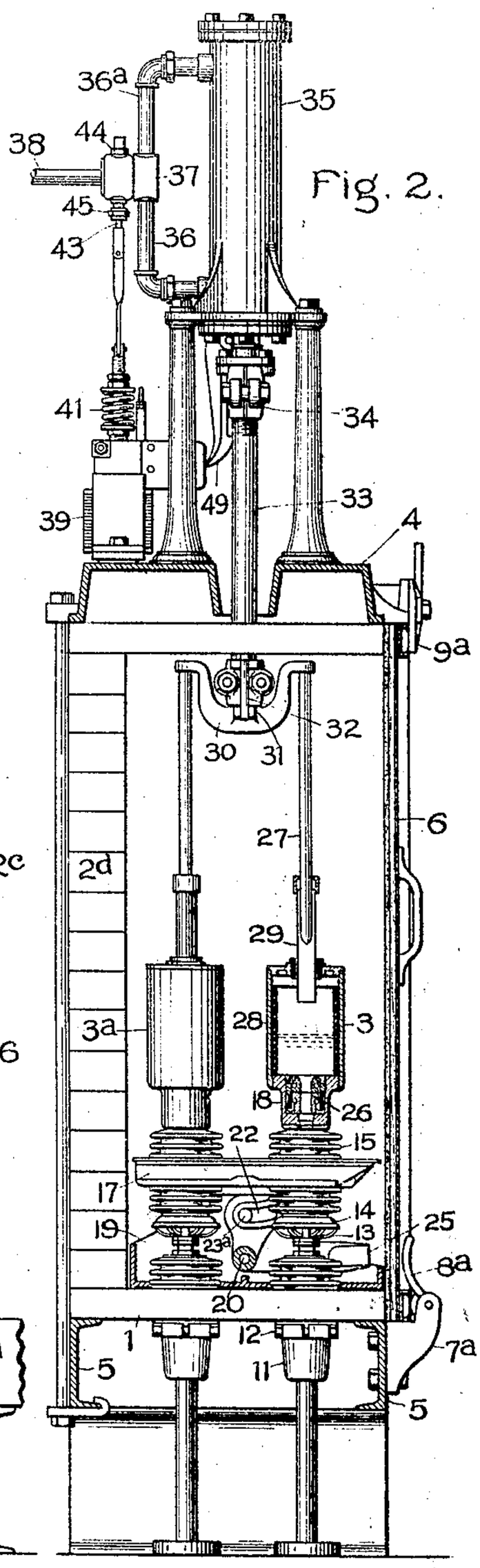


Fig. 2.



Witnesses:

Louis C. Abell.

Benjamin B. Hull.

Inventor:
Edward M. Hewlett
by Allen H. Dann
Atty.

No. 815,824. PATENTED MAR. 20, 1906.

E. M. HEWLETT.

HIGH POTENTIAL SWITCH OR CIRCUIT BREAKER.

APPLICATION FILED FEB. 7, 1900. RENEWED NOV. 3, 1904.

3 SHEETS—SHEET 2.

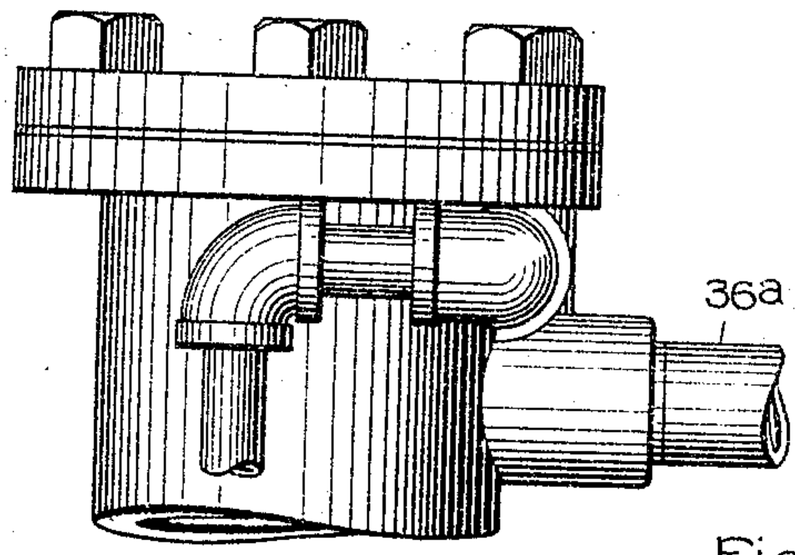


Fig. 3.

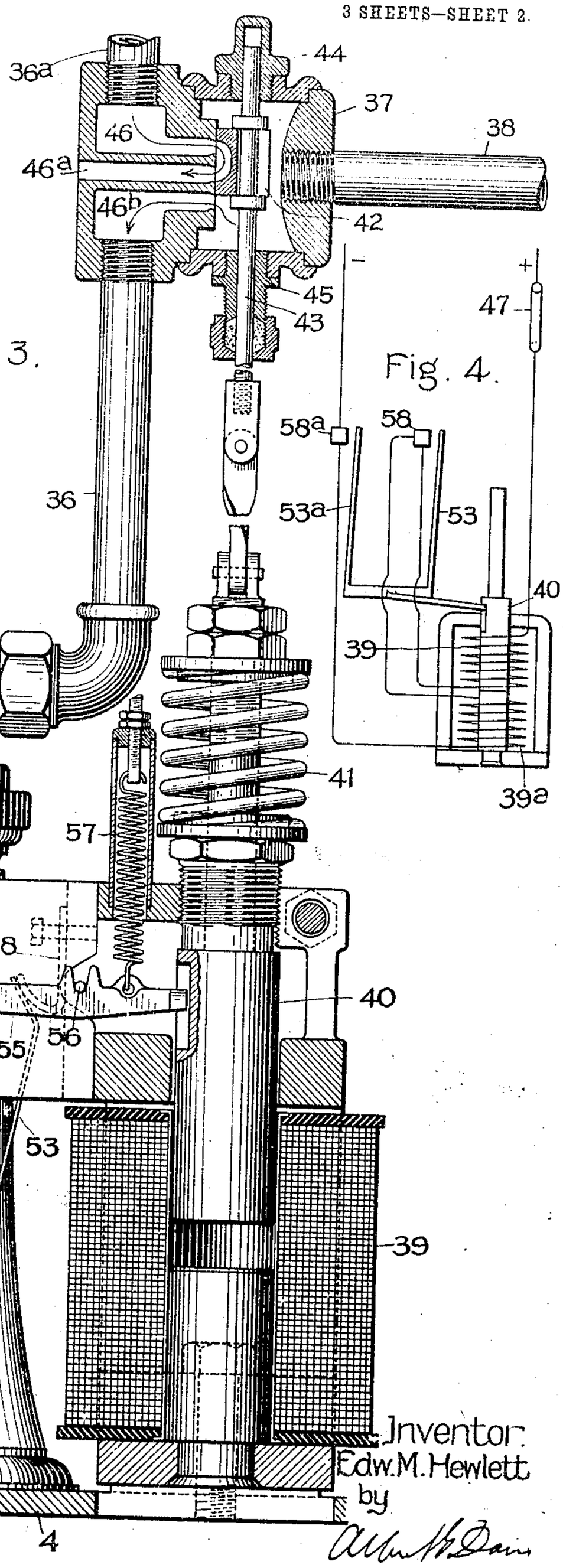


Fig. 4.

Witnesses:

Louise Abell

B. B. Hines

Inventor:
Edw. M. Hewlett
by
Allen H. Davis
Atty

No. 815,824. PATENTED MAR. 20, 1906.

E. M. HEWLETT.

HIGH POTENTIAL SWITCH OR CIRCUIT BREAKER.

APPLICATION FILED FEB. 7, 1900. RENEWED NOV. 3, 1904.

3 SHEETS—SHEET 3.

Fig. 6.

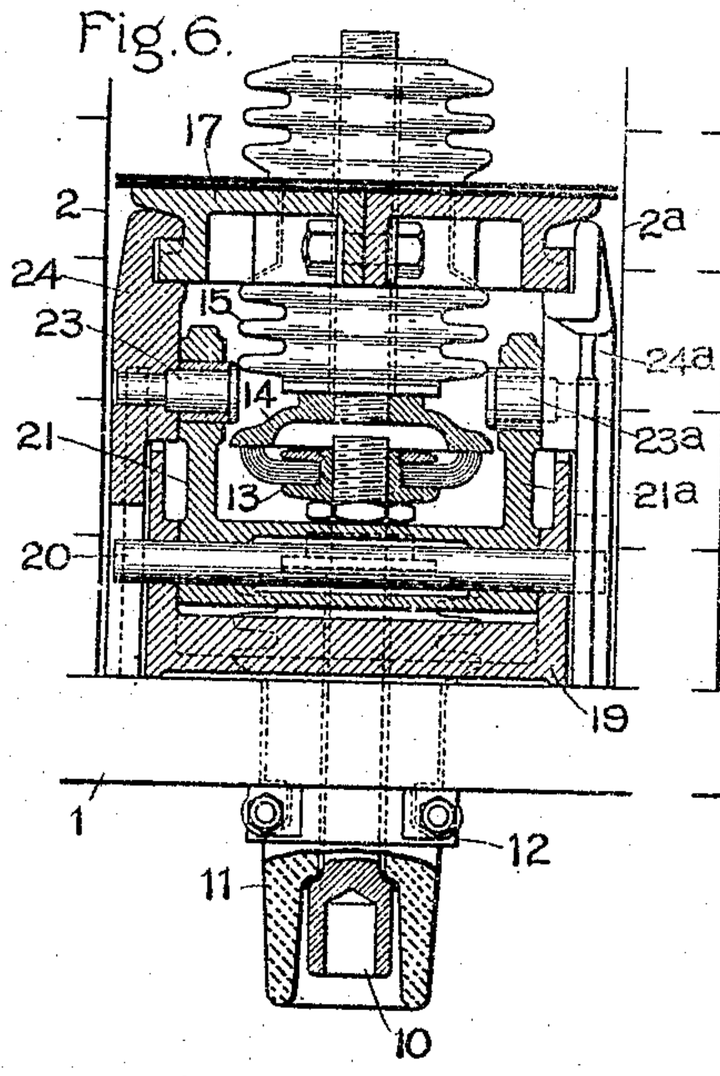
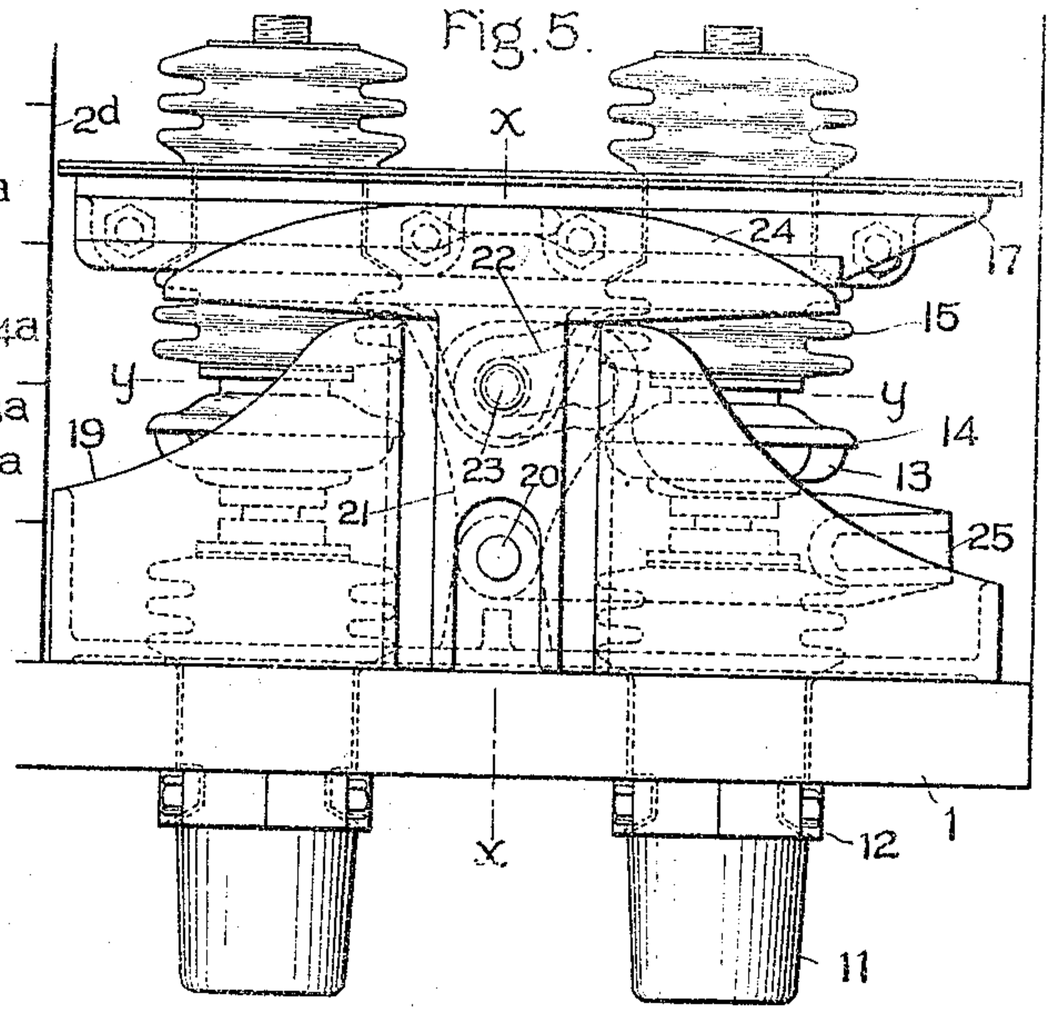


Fig. 5.



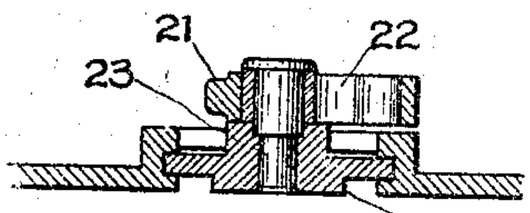


Fig. 7.

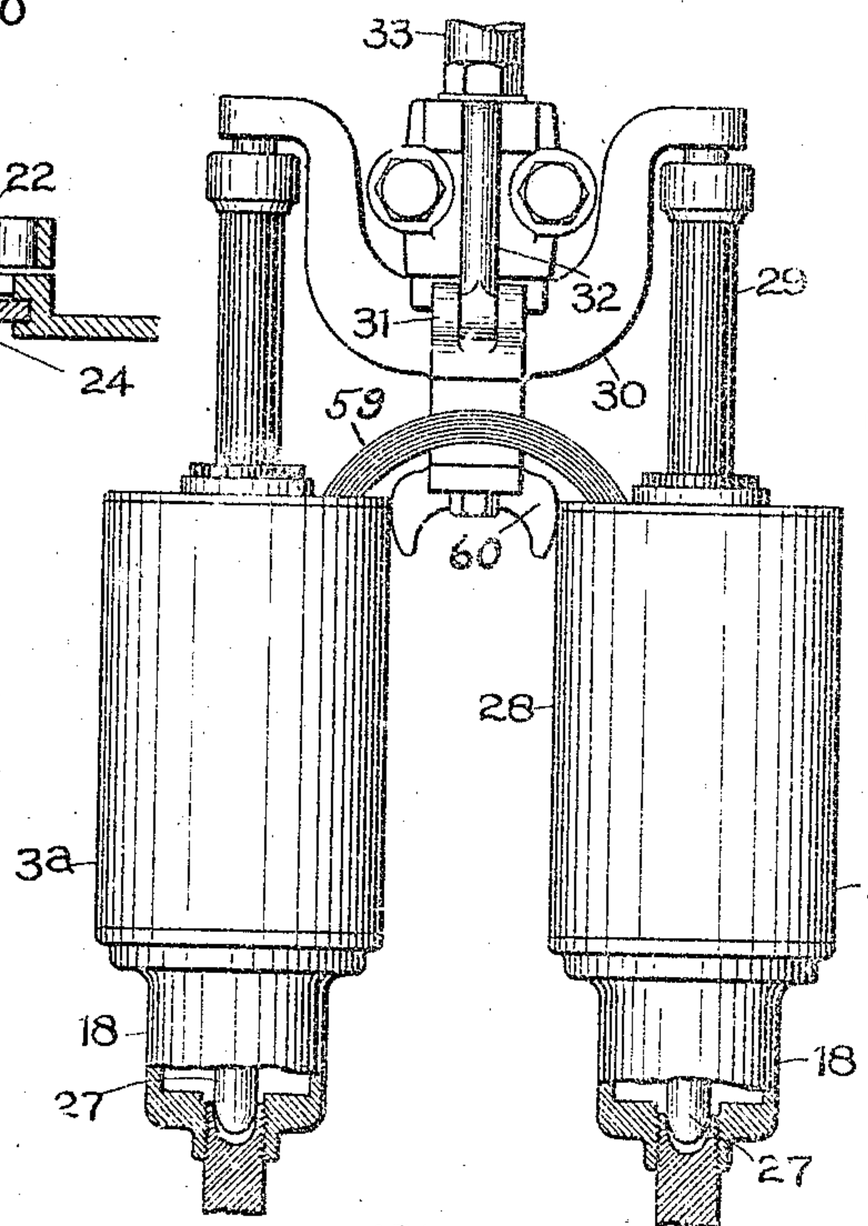


Fig. 8.

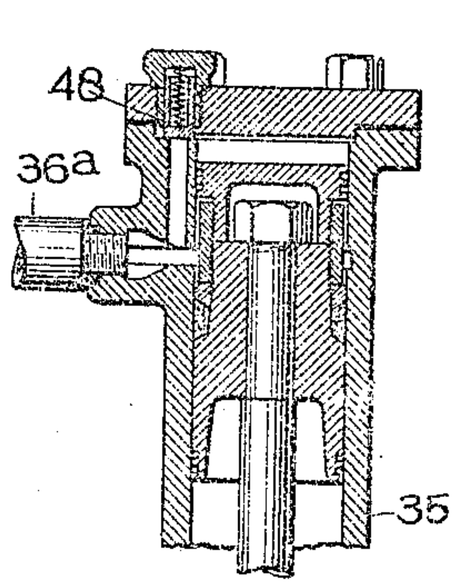


Fig. 9.

Witnesses:

Lewis E. Abell.

Benjamin B. Hull.

Inventor:
Edward M. Hewlett
by Albert G. Davis
Atty.

UNITED STATES PATENT OFFICE.

EDWARD M. HEWLETT, OF SCHENECTADY, NEW YORK, ASSIGNOR TO GENERAL ELECTRIC COMPANY, A CORPORATION OF NEW YORK.

HIGH-POTENTIAL SWITCH OR CIRCUIT-BREAKER.

No. 815,824. Specification of Letters Patent. Patented March 20, 1906.

Application filed February 7, 1900. Renewed November 3, 1904. Serial No. 231,204.

To all whom it may concern:

Be it known that I, EDWARD M. HEWLETT, a citizen of the United States, residing at Schenectady, county of Schenectady, State of New York, have invented certain new and useful Improvements in High-Potential Switches or Circuit-Breakers, of which the following is a specification.

The object of this invention is to provide a switch or circuit-breaker which may be employed for the rupture or closure of circuits of extraordinary potential and large amperage, the particular aim being to provide a switch to handle such currents which shall be compact in construction and safe and effective in operation.

In carrying out my invention I inclose the rupture-points of the switch in a closed oil-chamber surrounded by fireproof walls, the movable contacts being operated by a motor adapted to give a long break and controllable at a distance from the switch. The fixed and movable contacts are so mounted that they may be disconnected from the circuit-leads, and thereby rendered dead to insure the safety of operators in repairing or adjusting the apparatus.

My improvements involve structural features of the governing mechanism which controls the operation of the device and also features of mounting the several parts. The generic features are the same as disclosed in the application filed in the name of Edwin W. Rice, Jr., on or about December 30, 1899, Serial No. 742,124, my invention residing in improvements on the switch therein described and claimed.

The novel features will be more fully indicated hereinafter and will be definitely set forth in the claims.

In the accompanying drawings, Figure 1 is a side elevation with the front cover partly broken away of a switch or circuit-breaker embodying my improvements. Fig. 2 is a sectional view on a plane at right angles to that indicated in Fig. 1. Fig. 3 is an elevation, partly in section, of a fluid-pressure motor for operating the device. Fig. 4 is a diagram of the motor-controlling circuits. Fig. 5 is a detail view of the mounting for the fixed terminal. Fig. 6 is a sectional view of said mounting on a plane indicated by the line X X of Fig. 5. Fig. 7 is a sectional detail on a plane indicated by the line *y y* of Fig. 5 of a lifting device for the fixed terminal. Fig. 8 is a detail view showing an auxiliary contact between the fixed terminals, and Fig. 9 is a detail of the controlling-motor.

Referring first to Figs. 1 and 2, 1 represents an insulating base or support for the frame in which the oil-chambers are housed. This may be formed of a slab of slate or marble or other fireproof insulating material and may be mounted upon a frame of channel-iron supported on **I**-beams, as illustrated. Through this insulating-support pass the circuit-leads. The apparatus shown in the drawings represents a double-break triphase switch suitable for high-potential triphase alternating currents. Upon the support 1 are built masonry walls of brick, as indicated at 2 2^a 2^b 2^c 2^d, forming on all sides except the front a masonry inclosure for the oil-chambers 3 3^a, &c. On top of these masonry walls is placed a slab of insulating fireproof material upon which rests a cast-iron cap 4, bolted to the channel-irons 5, which form a supporting-frame for the switch. On the front side of the chambers formed by the masonry wall is placed a removable insulated door or cover 6, (see Fig. 2,) resting on brackets 7 7^a at the bottom and clamped in position by clamps 8 8^a at the bottom and corresponding buttons 9 9^a at the top. Each circuit-lead terminates in a plug which is secured in good conductive relation to a socket 10, (see Fig. 6,) formed on the end of a copper bolt extending through a porcelain insulator 11, enlarged above the slate-support and clamped firmly in its seat by a split washer 12. The upper end of the copper terminal is threaded, and a flexible terminal is screwed over this thread, said terminal being formed of a number of curved bundles of laminæ of phosphor-bronze or copper riveted together and mounted in a nut 13, on the upper part of which is a plate which may be screwed firmly into engagement with the arms of the brush, as indicated in Fig. 6. The bundle of plates is sufficiently elastic to establish a good contact and to yield slightly when pressed into engagement with the face of a coöperating cup-shaped portion 14 of each fixed terminal contact of the switch. The cup-shaped part 14 is likewise screwed to the end of a copper stem passing through an insulator of porcelain 15, constricted at its middle portion and secured to a two-part

casting 17, the two halves of which are bolted together around the constricted neck of the two insulators, which are placed side by side to form a double-pole break, as shown in Fig. 5. The copper stem extending through the insulator 15 terminates in a metallic socket 18, which forms the bottom of the oil-chamber and which also forms the fixed terminal of the switch or circuit-breaker. The two insulators 11 and 15 are capable of relative movement when it is desired to adjust or repair the parts of the switch in order to render the lower fixed contact of the switch dead, and they may be separated by means of an organization which I will now describe. This comprises a casting 19, in the opposite walls of which is supported a stud 20, forming a bearing for a crank having two arms, as indicated at 21 21ª, and provided with an inclined slot 22 (see Fig. 5) near its free edge through which pass studs 23 23ª, fixed in two plates 24 24ª, the upper ends of which hook into a yoke or split nut 17, which embraces the pair of movable insulators. The plates 24 24ª move in guides at the sides. The position of the cranks 21 21ª is controlled by a long wooden handle adapted to be inserted into a socket 25, (see Fig. 1,) by which they may be rocked on the pin 20, thereby lifting or lowering the plates 24 24ª and closing or opening contact between the brush-arms 13 and the contact 14. Thus when it becomes for any reason necessary to detach any part of the switch to repair it or to examine its condition a handle may be inserted in the socket 25 and the contact-faces 14 of the companion double-pole contacts raised out of engagement with the brushes 13, thereby entirely disconnecting the lower terminals of the switch from the circuit and permitting the insulator 15 and its connected parts to be withdrawn from the cell in which it is inclosed. This of course also necessitates the detachment of the upper or movable terminal of the switch, which may be also easily effected, as will presently be described. The socket 18, which forms the lower switch-terminal, is hollow and contains a yielding cup-contact, (indicated at 26 in Fig. 2,) it being so arranged that it may yield laterally, so as to accommodate the entrance of the movable plug-contact 27. On the plug-terminal 18 is mounted a cylinder 28, provided with a cap at the top forming a seat for a tube of insulating material 29, in which moves the upper contact 27 of the switch. The oil-chamber is preferably lined with an insulating material.

In the type of switch shown in the drawings there is, as already noted, a double-pole break for each leg of the circuit, two oil-chambers 3 3ª being placed side by side on the companion insulators, as indicated in Fig. 2, in a cell common to both. The two movable plug-terminals are connected at the top by a good conducting-yoke 30. (Shown in enlarged view in Fig. 8.) This yoke is provided at its bottom with ears 31, on each side in which are journaled bolts 32, adapted to be thrown into a slot in the top of a head secured to the end of a rod 33. With this organization it will be evident that by loosening the nuts on the bolts 32 they may be swung outwardly, disconnecting the yoke 30 from the rod 33 and permitting both contacts of the switch or circuit-breaker to be withdrawn from its fireproof cell when the lower contact is disconnected, as hereinbefore described. The rods 33, of which there is one for each leg of the circuit, are connected at the top by a cross-head 34, rigidly secured to the motor-piston.

I have shown in the drawings a motor operated by compressed air, 35 representing the cylinder, and 36 36ª the induction and eduction pipes, connecting through a valve-chamber 37 with the pipe 38, leading to a reservoir of compressed air. The details of its mode of construction will be more clearly understood from an inspection of Figs. 3, 4, and 9. Its operation is governed by a control-circuit extending to a point distant from the apparatus, so as to insure safety to the operator in manipulating it. This control-circuit includes an electromagnet 39, provided with a movable core 40, normally retracted by a coil-spring 41, and is linked to a slide-valve 42 in the valve-chamber of the motor. The valve is held in its seat by a rod 43, mounted to slide in nuts 44 45, screwed into the valve-casing. The valve controls three ports 46 46ª 46ᵇ, 46ª being an exhaust-port and the other two ports leading to the ends of the cylinder. With this organization when the control-switch 47 is closed the electromagnet 39 is excited, the core 40 drawn down, and the valve shifted, so as to admit air-pressure from the supply-pipe to the upper end of the cylinder, thereby quickly shifting the movable contacts into engagement with the fixed contacts of the switch. In order to provide a cushion for the end of the stroke, the induction-ports at the cylinder are placed between its ends, as indicated in Fig. 9, so that they are covered by the movement of the piston before it reaches the end of its stroke, thereby leaving a small body of air in the end of the cylinder, which acts as a cushion and brings the parts to rest after their sudden movement without jarring the apparatus, and in order to provide for driving the piston in the opposite direction a leak-opening 48, controlled by a spring-actuated valve, is provided between the induction-pipe and the end of the cylinder through which the air feeds until the main induction-port is uncovered. When the switch is opened, I provide a latch 49, (see Fig. 3,) adapted to hook over the edge of the cross-head when the piston is raised to its upper limit and prevent the movable element of the switch from

settling and making an accidental contact. When the switch is to be closed, the latch is pressed open by a pin 50, controlled by a diaphragm of rubber or other elastic material 51 in open communication, through pipes 52, with the upper end of the cylinder, so that when the pressure is applied to close the switch the diaphragm 51 is depressed and the latch 49 is withdrawn from the cross-head. The control-circuit being closed and the operation of the switch effected, it is desirable to cut down the strength of the control-current to prevent heating and waste of energy. I effect this by cutting into the control-circuit an auxiliary magnet-coil or resistance 39ª. By reason of the air-pressure on the slide-valve considerabe force is necessary in order to move it, and the magnet must therefore be wound for a very strong pull, and the sudden thrust given to its core will damage the operative parts which cut in the auxiliary section of the magnet unless special provision is made to counteract it. An effective remedy is provided by the organization shown in Fig. 3 and consists of two insulated contact-springs 53 53ª, mounted upon a standard on the cap-plate 4 and connected by a link 54 with a lever 55, held up against a stud 56 on the magnet-frame by an adjustable coil-spring 57. The end of this lever projects into a slot formed in the upper part of the core 40, the end wall of which it engages when the core has moved a sufficient distance. When under rapid movement, the core engages the end of the lever, and the latter is depressed, taking the fulcrum from the pin 56, which ordinarily acts as a fulcrum, and making a fulcrum of the end of the spring. Two fixed contacts 58 58ª, mounted on the magnet-frame, coöperate with the springs 53 53ª when the circuit is closed. Thus when the switch 47 is first thrown the upper coil only of the magnet 39, as shown in the diagram in Fig. 4, is in circuit, current passing to the fixed contact 58, then across the springs 53 53ª to the terminal 58ª. The core 40 is then drawn down, opening the contact at 53 53ª, thereby putting the circuit in the condition indicated in Fig. 4 and cutting in the auxiliary coil 39ª, cutting down the current strength and holding the valve in the position to which it was thrown. This movement shifts the slide-valve, so as to cover the ports 46ª 46ᵇ. Pressure is thereby introduced to the upper end of the cylinder and the switch closed. For heavy currents I employ a shunt-contact 59, of copper or phosphor-bronze laminæ, to short-circuit the rod-contacts when the switch is closed, being mounted (see Fig. 8) to bridge the top of the oil-pots after the circuit has been closed by the rods. To prevent distortion of alinement of the pots, a wedge or spacer 60 may be used to hold the pots in alinement. Both the laminated contact and spacer may be mounted on the yoke 30. On opening the control-switch 47 the magnet is deënergized, spring 41 pushes back the slide-valve, putting the upper part of the cylinder in connection with the exhaust 46ª and applying pressure below the piston. After being opened the latch 49 prevents accidental closure of the switch.

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

1. A high-potential switch, comprising an insulating-support, a fireproof cell inclosing the terminals, a cap mounted on the top of the cell, and a motor to operate the switch mounted on the cap.

2. A high-potential switch, comprising an insulating-support, a fireproof cell inclosing double-pole terminals and a bridging contact for said terminals, a cap mounted on top of the cell, and a motor to operate the switch mounted on the cap.

3. A high-potential switch having fixed and movable contacts, terminals therefor, and means for mechanically withdrawing said contacts from their terminals to render said contacts dead.

4. A high-potential switch having multipolar terminal contacts, and means for disengaging the active or engaging portion of the contacts from the terminals to render them dead.

5. A high-potential switch having a fixed terminal mounted on an insulating-base, a detachable contact-tip for the fixed terminal, a movable contact-piece mechanically connected to the tip but insulated therefrom, a coöperating movable contact, and means for rendering both said movable contact and movable contact-piece dead and removing them from the other parts of the switch.

6. A high-potential switch provided with a fixed terminal mounted on an insulating-support, a movable contact-piece for said terminal, mounted on an independent insulator, and means for separating the two insulators.

7. A high-potential switch provided with double-pole fixed terminals mounted on an insulating-support, coöperating double-pole contact-pieces normally forming terminal extensions mounted on a frame common to both and insulated therefrom, and means for shifting the frame to separate the contact-pieces from the circuit-terminals.

8. A high-potential switch provided with a fixed terminal mounted on an insulating-support, a removable contact-piece for said terminal, mounted on an independent insulator, and a lever mounted on a fixed part of the switch for separating the two insulators.

9. A high-potential switch provided with a fixed hollow insulator, a terminal supported therein, and a coöperating movable insulator containing a detachable contact-piece for said terminal.

10. A high-potential switch provided with

a fixed terminal supported by an insulator, a coöperating movable contact-piece for said terminal mounted on an independent insulator, and a laminated yielding contact at the joint.

11. A high-potential switch provided with an insulated fixed terminal, a movable contact-piece on an independent insulating-support forming an extension of said terminal when the circuit is closed, and a plurality of laminated contact-arms to effect good contact at the joint.

12. A fixed contact-terminal for a switch, comprising a hollow insulator secured in a supporting-frame between its ends, a metal rod having its lower end housed within the insulator and its upper end connected with a contact above the insulator.

13. A high-potential switch provided with a hollow insulator, a fixed terminal extending through the insulator, a movable contact-piece for the terminal supported in an independent insulator, a yoke on the movable insulator, and a crank for raising the yoke, said crank being adapted for disconnection from the yoke.

14. A high-potential switch comprising double-pole fixed terminals, a movable bridge to engage the same in an oil-bath, and a shunt-contact outside of the oil, of greater current-carrying capacity, adapted to open before the oil-submerged contact.

15. A multipolar high-potential switch comprising a plurality of fireproof insulated cells for different poles, and a removable door for the cells.

16. A high-potential switch, comprising multipolar fixed terminals, a movable bridging contact, all inclosed in a fireproof cell, an operating connection extending through the cell-cover, and means for rendering the contacts dead and permitting withdrawal from the cell.

17. A high-potential switch, comprising a plurality of pairs of separable contacts, a small oil-chamber around each pair of contacts, fireproof insulated cells separating different poles, and a fluid-pressure motor for joining or separating the contacts.

18. A high-potential switch, comprising separable contacts, a fluid-pressure motor controlling their junction or separation, a valve for reversing the motor, and an electromagnet in a control-circuit leading away from the switch for controlling the valve.

19. A high-potential switch, comprising separable contacts, a fluid-pressure motor controlling their junction or separation, a valve for controlling the motor, an electromagnet controlling the valve, a control-circuit for the magnet, and a resistance cut into the control-circuit after the valve has operated.

20. A high-potential switch, comprising separable contacts, a fluid-pressure motor controlling their junction or separation, a valve controlling the fluid-pressure, an electromagnet to operate the valve, a resistance cut into the control-circuit by the operation of the switch, and a lever controlling the resistance having two movable fulcrums, one being yielding to reduce damage from impact.

21. A high-potential switch, comprising separable contacts, a fluid-pressure motor controlling their junction or separation, a valve controlling the fluid-pressure, an electromagnet to operate the valve, a resistance cut into the control-circuit by the operation of the magnet, a lever controlling a normal short circuit for the resistance having one end in line for engagement by the magnet-armature, the other end linked to the short-circuiting contact, and two fulcrums, one rigid and separable, and the other elastic and permanently connected to the lever.

22. A high-potential switch comprising separable contacts, a fluid-pressure piston controlling their junction or separation, a latch to hold the switch open, and a release device governed by the application of fluid-pressure to operate the latch.

23. A high-potential switch comprising fixed and movable contacts, a fireproof cell inclosing said contacts, and a motor for operating the switch mounted on the exterior of said cell.

24. A high-potential switch having a fixed pole mounted on an insulating-base, a removable contact therefor, means for disconnecting the removable contact, without dismounting the same, to render it dead, and a coöperating movable pole to make and break the circuit.

25. A high-potential switch having a fixed pole mounted on an insulating-base, a movable contact therefor, a detachable movable pole, and means for disconnecting the contact of the fixed pole to render dead the coöperating switch-contacts.

26. A high-potential switch comprising separable contacts, a fluid-pressure piston controlling their junction and separation, and pneumatically-controlled means for holding the switch open when pressure tending to open the switch is removed from said piston.

27. A high-potential switch comprising fixed contacts submerged in oil, one or more coöperating vertically-movable bridging contacts, a fluid-pressure piston for actuating said bridging contacts, and pneumatically-released means for holding the switch open when pressure tending to open the switch is removed from said piston.

28. A high-potential switch comprising fixed contacts submerged in oil, one or more coöperating vertically-movable bridging contacts, a fluid-pressure piston for actuating said contacts, and mechanical means for holding the switch open when pressure tend-

ing to open the switch is removed from said piston, said means being rendered inoperative when fluid-pressure is admitted to the piston to close the switch.

29. A high-potential switch comprising fixed contacts submerged in oil, coöperating movable contacts, a horizontal supporting member to which said movable contacts are connected, means for preventing the formation of an arc between the fixed contacts, an operating-cylinder located above said member, a piston in said cylinder operatively connected to said member, and pneumatically-controlled means for engaging said member to hold the switch in its open position.

30. A high-potential switch comprising fixed contacts submerged in oil, coöperating movable contacts, a horizontal supporting member to which said movable contacts are connected, a separate oil-chamber for each of said contacts, an operating-cylinder located above said chambers, a piston in said cylinder operatively connected to said member, and pneumatically-controlled means for engaging said member to hold the switch in its open position.

31. A high-potential switch comprising fixed contacts submerged in oil, coöperating movable contacts, a horizontal member to which said movable contacts are connected, means for preventing the formation of an arc between the fixed contacts, an operating-cylinder located above said member, a piston in said cylinder operatively connected to said member, and latching means located adjacent to said cylinder and operative to engage said member to hold the switch in open position.

32. A high-potential switch, comprising fixed contacts submerged in oil, coöperating movable contacts, a horizontal supporting member to which said movable contacts are connected, means for preventing the formation of an arc between the fixed contacts, an operating-cylinder located above said member, a piston in said cylinder operatively connected to said member, and a mechanical means for holding the switch open rendered ineffective when fluid-pressure is admitted to the piston to close the switch.

In witness whereof I have hereunto set my hand this 5th day of February, 1900.

EDWARD M. HEWLETT.

Witnesses:

BENJAMIN B. HULL,

MABEL E. JACOBSON.