No. 728,797. PATENTED MAY 19, 1903.

E. M. HEWLETT.

CIRCUIT BREAKER OR SWITCH FOR HIGH POTENTIALS.

APPLICATION FILED FEB. 11, 1899. RENEWED APR. 3, 1902.

NO MODEL. 2 SHEETS—SHEET 1.

FIG. 1.

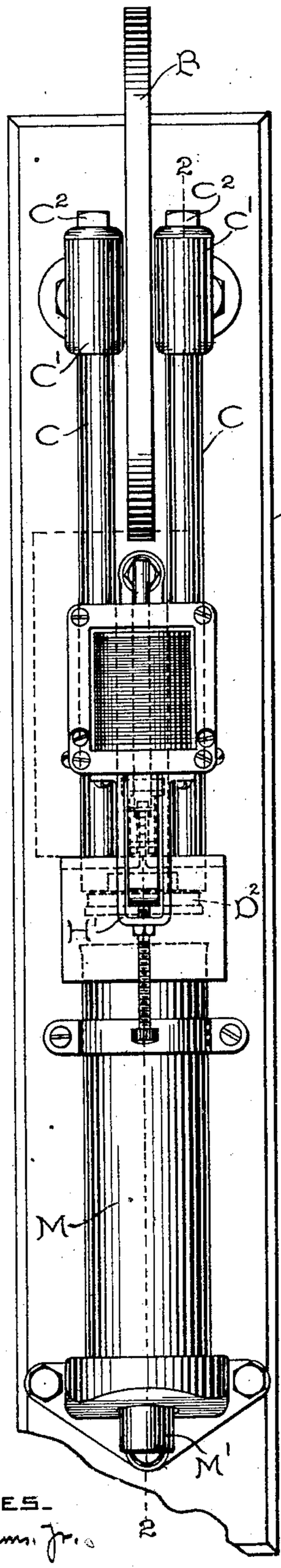
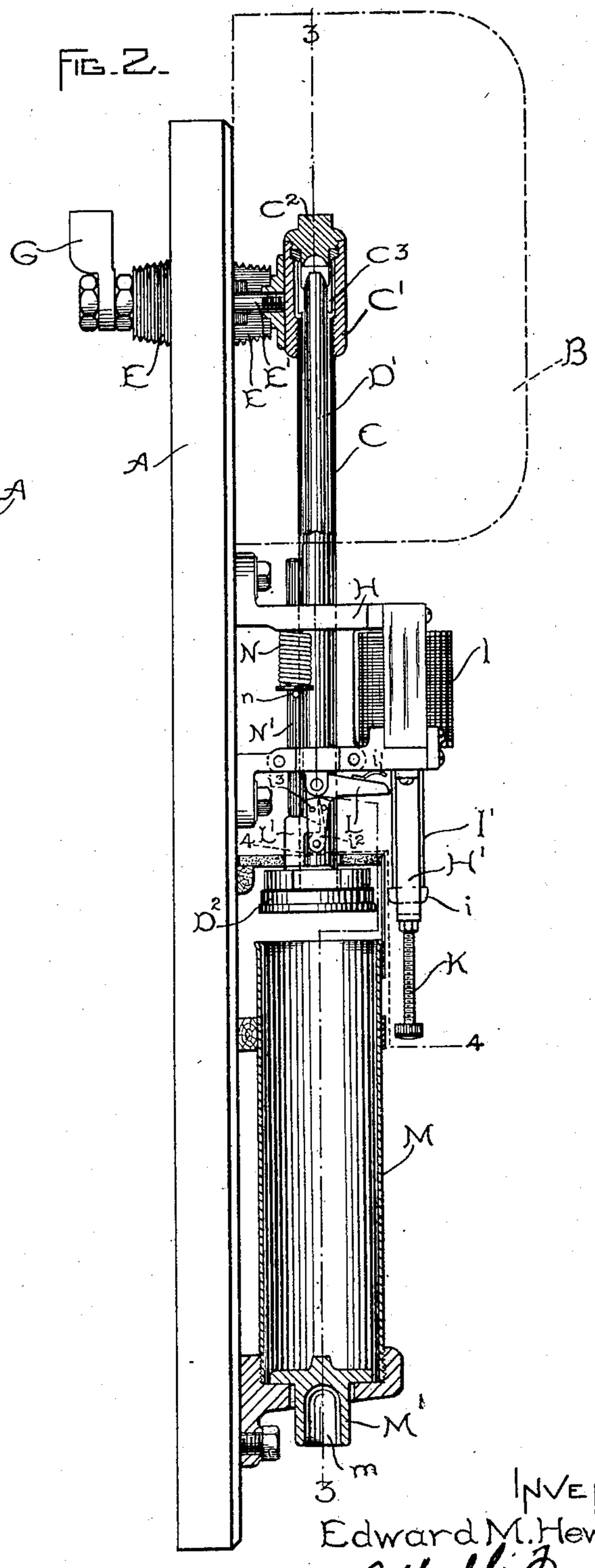


FIG. 2.



WITNESSES-
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NO MODEL. 2 SHEETS—SHEET 2.

FIG. 3.

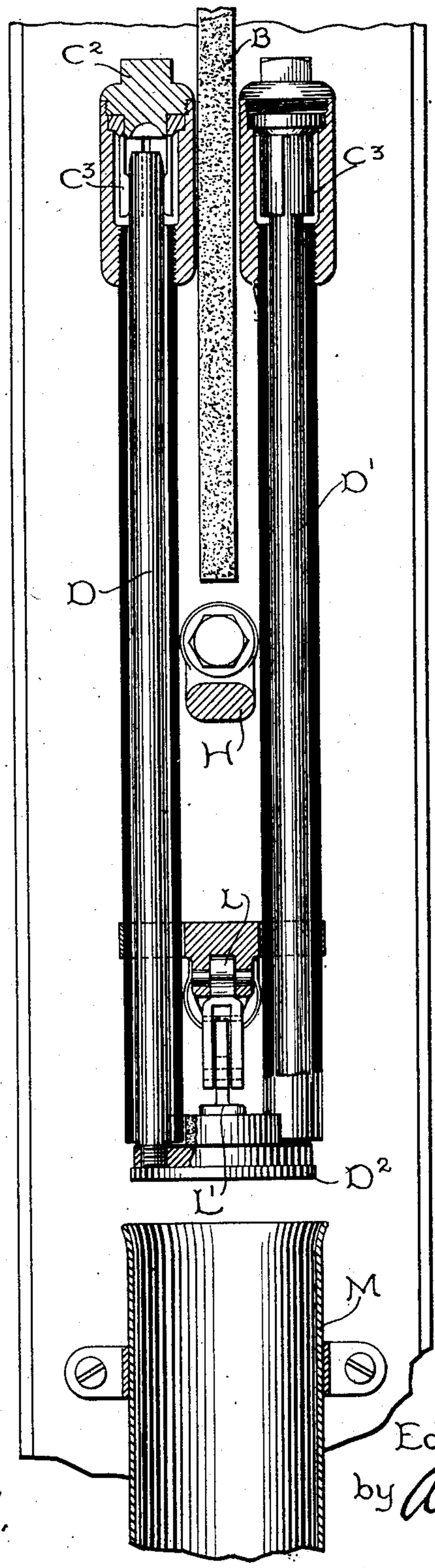
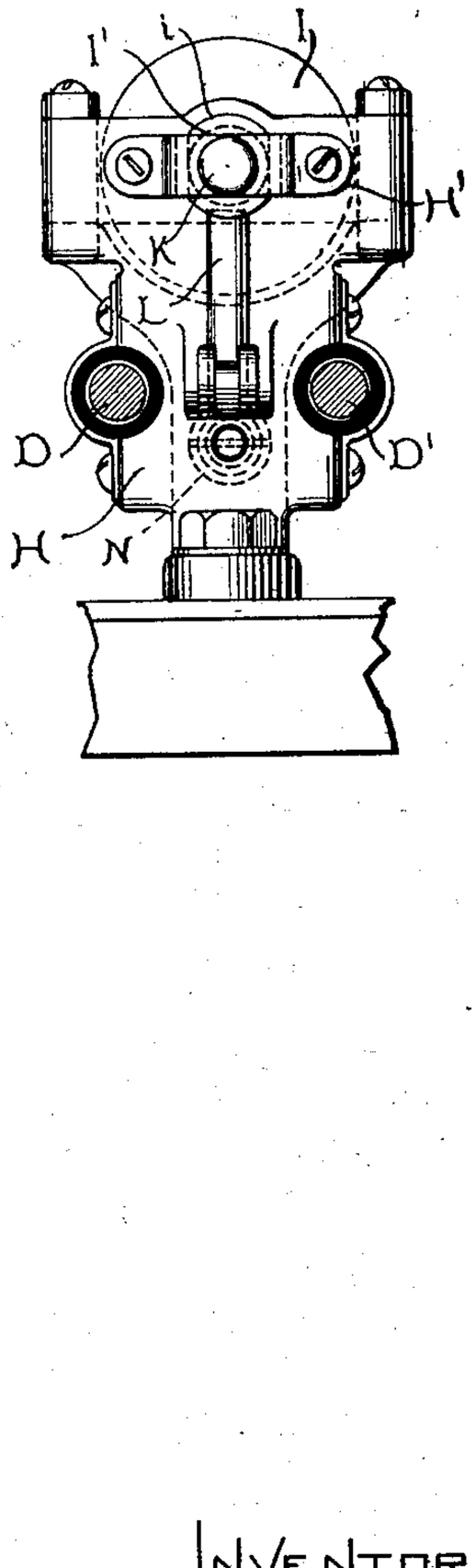


FIG. 4.



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UNITED STATES PATENT OFFICE.

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

CIRCUIT-BREAKER OR SWITCH FOR HIGH POTENTIALS.

SPECIFICATION forming part of Letters Patent No. 728,797, dated May 19, 1903.

Application filed February 11, 1899. Renewed April 3, 1902. Serial No. 101,235. (No model.)

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 Circuit-Breakers or Switches for High Potentials, (Case No. 820,) of which the following is a specification.

My present invention has relation to the interruption of high-potential circuits. This has been attended with great difficulty on account of the persistent arcs which are formed where such circuits carry current of any considerable amplitude. Ordinary circuit-breaking devices which are operative and useful at potentials such as are commonly employed are readily spanned by the arcs on high-potential circuits and may be easily destroyed. If the devices usually employed are applied to high-potential circuits, the switches become of such great size in order to get the necessary extent of motion and length of opening as to become uncommercial and impracticable.

To obviate the difficulties attendant upon old constructions, I have devised the present invention. While to some extent this utilizes principles which are known in the art, it does so in a different way from any construction with which I am familiar and has distinctive features which enable it to perform its functions with certainty. In carrying out the invention I provide the contacts at which the circuit is to be broken with a long range of movement in a tubular space, preferably of small cross-section, and insure a rapid separation of the contacts when the circuit is opened. The lengthening of the arc formed at the points of separation increases the resistance of the gap rapidly, and this combined with the rapid separation extinguishes the arc. At the same time it is of moderate cost and is capable of almost indefinite application to circuits of any potential.

The construction consists in general of a bridge the parts of which are inclosed within tubes of insulation, and contacts are provided within the tubes, they being stationary. When the bridge is removed, the arc springing from one contact to another heats the air and expels the bridge with considerable force, so that the arc is ruptured. The movable contact being free to obey the rapidly-increasing air-pressure rapidly accelerates in speed, being, in fact, shot along the tube until the arc is ruptured, when its motion is dampened and finally arrested by a dash-pot.

My invention comprises a circuit-breaker in which the arc is drawn at the rupturing-contacts in a closed chamber, which permits the accumulation of air-pressure due to the heat of the arc and permits it to control the expulsion of the movable contact and give it a rapidly-accelerating movement until the rupture is established.

There are details of construction which also are of my invention; but its use and operation will be pointed out after the description, in connection with which they will be more readily understood.

The accompanying drawings show an embodiment of the invention. In these Figure 1 is a front elevation of the circuit-breaker. Fig. 2 is a side elevation, partly in section, upon the line 2 2 of Fig. 1. Fig. 3 is an enlarged view, partly in section, with parts omitted for clearness, of a section taken upon the line 3 3 of Fig. 2. Fig. 4 is a plan view of the device inverted, with parts in section, taken from the line 4 4 of Fig. 2.

A is the usual base of non-combustible insulating material, such as slate, and B is the interposed septum of refractory insulating material.

C C are the tubes of insulation. At the head of each of these tubes is a terminal C′, provided with interior flexible contacts C^3, between which an end of the bridge B is inserted, as shown best in Fig. 2. A nut C^2 closes the top of the tube, making a practically air-tight chamber. A bolt E′ connects the terminal C′ to the lead G on the back of the board, insulators E E being provided where required. Another view of the same parts is shown in Fig. 3, where the construction of the bridge is more clearly indicated. It consists, as will be seen in this figure, of the two rods (which of course are of good conducting material, such as copper) D D′, connected by the metallic piston D^2, which coacts with the dash-pot M (see Fig. 2) to check the motion of the bridge after the cir-

cuit is ruptured. The dash-pot is preferably pneumatic, as this gives the increasing retardation which is desirable in my construction. It is provided with a bottom M′, which acts as a valve, permitting the ready closure of the circuit. The bottom or plug M′ has a hole *m*, in which a stick or other non-conducting bar may be inserted to close the circuit, this being readily effected by pressing up the plug M′, carrying with it the piston D^2 and forcing the rods D D′ into engagement with the upper terminals.

In Figs. 2 and 4 the tripping device is illustrated. This consists of the magnetic frame H, from which projects a yoke H′. A core I′, having a boss *i*, reciprocates within the series coil I, a screw K being provided by which the calibration is effected. A bell-crank lever L, with a spring *i*′ and a pawl i^2 reciprocating between stops i^3, engages with a pawl L′, which is fast to the piston D^2. A spring N, coiled around a rod N′, operates upon a pin *n*, fixed in the rod. The pawl L′, which is rigid with the piston D^2, abuts against the end of the rod N′, so that when the latter is pushed up in resetting the circuit-breaker the pin engages with the collar of the spring N and forces it up. As already explained, the spring may be of only sufficient power to positively overcome the friction upon the bridge of the terminals C^3.

The operation of the device will be readily apparent, but may be briefly described as follows: When the current in the coil I exceeds the determined value for which the device is set to act by adjusting the screw K, the plunger I′ is drawn up forcibly and strikes the bell-crank L, withdrawing it from the pawl L′ and releasing the latter. The spring N then opens the circuit. As the arc springs from the flexible contacts to the bridge the air in the closed terminal C′ becomes enormously heated and enlarged in volume, blowing open the circuit with considerable force, which is taken up by the dash-pot M. Of course all these actions, though here successively described, are practically instantaneous. I have found the device compact and efficient in its operation, avoiding almost entirely the difficulties incident to opening high-potential circuits.

It is quite manifest that the same arrangement here described could be utilized as a switch for manual operation, if desired. In that case instead of using a current-measuring device the latch can be tripped by hand, and as the parts are then left free to move the resulting rupture of the circuit will be effected with certainty. Furthermore, it is manifest that without invention and still within the scope of the claims appended changes may be made in the construction, whether the switch be adapted to automatic operation or not. A thermal device could be used in place of the current-measuring coil in ways too well understood to require description, and various other changes might easily be made.

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

1. In a switch, the combination of a fixed contact, a movable contact, a tube inclosing the latter throughout a long range of movement, said tube having imperforate walls throughout its length, and means for effecting a rapid separation of contacts.

2. In a switch, a fixed terminal, a movable terminal mounted on a long rod, an air-chamber of small volume around the point of contact of the terminals, and an insulating-tube imperforate throughout its length in which the rod moves through one end of the tube.

3. A switch member composed of a long rod of substantially the same cross-section for a considerable portion of its length, and a tube of insulating material in which the rod loosely fits, said tube having imperforate walls through its length and closed at the ends, the rod moving through one end.

4. In a switch, the combination of relatively movable coöperating contacts, pressure accumulating and retaining walls inclosing one of the contacts throughout a long range of movement, and means for effecting a rapid separation of said contacts.

5. In a switch, the combination of relatively movable coöperating contacts, an operating-rod for one of the contacts, a pressure-retaining chamber about the points of engagement of said contacts, and pressure-retaining walls extending from said chamber and closely surrounding said rod through a considerable range of movement of the rod.

6. In a switch, the combination of a fixed contact, a coöperating contact having a rod of substantially uniform cross-section, and a pressure accumulating and retaining chamber having walls closely surrounding said rod throughout a considerable range of movement of said rod relative to said fixed contact.

7. A high-potential circuit-breaker, comprising a closed chamber surrounding a movable contact, and a guide for insuring linear movement of said contact, whereby the gaseous arc products on circuit-rupture expel the contact with an accelerating movement.

8. A high-potential circuit-breaker, comprising a closed chamber surrounding a movable contact, means for insuring a linear movement of said contact, and means for retarding the movement after the arc is ruptured.

9. A high-potential circuit-breaker comprising a chamber surrounding a contact free to take accelerated movement when the circuit is opened, said chamber being adapted to store pressure due to the arc and to assist the acceleration, means for insuring a linear movement of said contact, and a dash-pot connected to the contact and adapted to retard its movement after the circuit is ruptured.

10. In a circuit-breaker for high potentials, the combination of closed chambers containing terminals, tubes extending from the chambers, and a U-shaped bridge inclosed in the tubes and making contact with the terminals in the chambers, with a current-measuring device and a trip actuated thereby for releasing the movable terminal, said terminal being free to take an accelerating motion.

11. In a circuit-breaker for high potentials, the combination of the closed terminals containing flexible contacts and disposed adjacent to one another upon a suitable base, an insulating-septum between the terminals, tubes of insulating material extending from them, a pair of copper rods and a block connecting them forming a U-shaped bridge, with a dash-pot registering with the block, and a current-measuring coil and trip.

12. In an electric switch, the combination of a closed chamber containing a circuit-terminal, a tube extending from the chamber and a movable terminal inclosed in the tube extending into the chamber and making a circuit with the fixed terminal, said movable terminal being free to take an accelerated motion under gaseous pressure due to the arc.

13. In an electric switch, the combination of the closed chambers with contact-terminals contained therein, tubes of insulating material extending from the terminals, and a U-shaped bridge composed of a pair of copper rods joined at their outer ends extending within the tubes and completing the circuit at the contacts in the closed chambers, said bridge being free to take accelerated motion under gaseous pressure due to the arc.

14. The combination with a circuit-breaker, of a piston connected to the circuit-opening contact, a closed chamber around said contact and an aerial dash-pot to cushion the piston after a determined range of free movement; whereby the opening of the circuit is not primarily retarded, but the shock of the switch movement is taken up.

15. The combination with the U-shaped bridge, of the piston D^2 and the dash-pot M, having a movable bottom acting as a valve, by means of which the bridge may be restored to position.

16. The combination with the bridge of the circuit-breaker, of the piston D^2 and dash-pot M, with the movable bottom M′ having a recess *m*, for the purpose set forth.

17. The combination with the U-shaped bridge, of the guide-rod and spring, the piston, and the pawl or detent rigid with the piston and abutting against the guide-rod to reset the switch.

18. The combination of the U-shaped bridge inclosed within tubes of insulating material, with the guide-rod, spring and current-measuring coil and the trip, the ends of the bridge completing the circuit within closed chambers containing flexible contacts, the spring adapted to overcome the friction of the contacts when the circuit-breaker is tripped and the bridge is expelled from the tubes by the expansion of the air in the terminals.

In witness whereof I have hereunto set my hand this 10th day of February, 1899.

EDWARD M. HEWLETT.

Witnesses:
B. B. HULL,
EDWARD WILLIAMS, Jr.