No. 745,347. PATENTED DEC. 1, 1903.

E. M. HEWLETT.

AUTOMATIC CIRCUIT BREAKER.

APPLICATION FILED APR. 5, 1900.

NO MODEL. 2 SHEETS—SHEET 1.

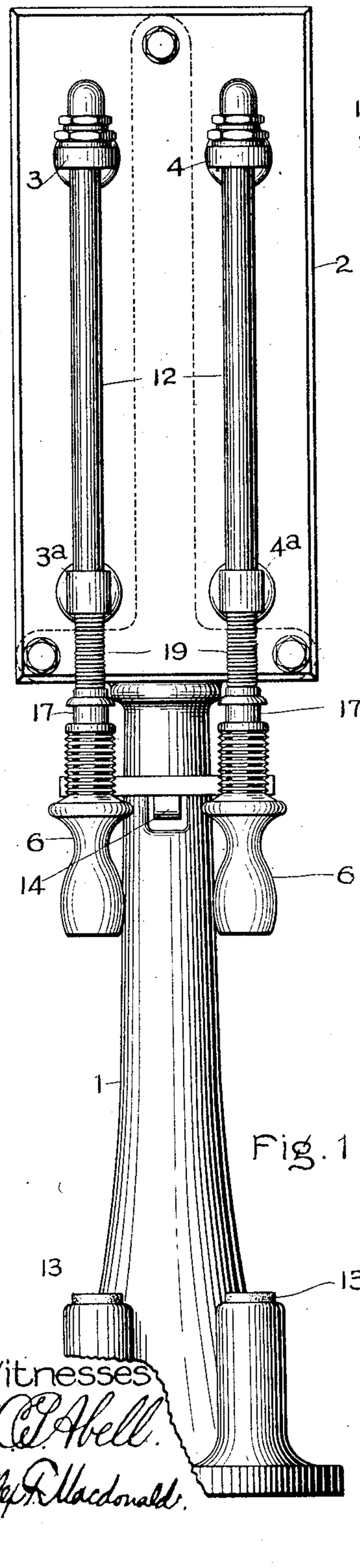


Fig. 1.

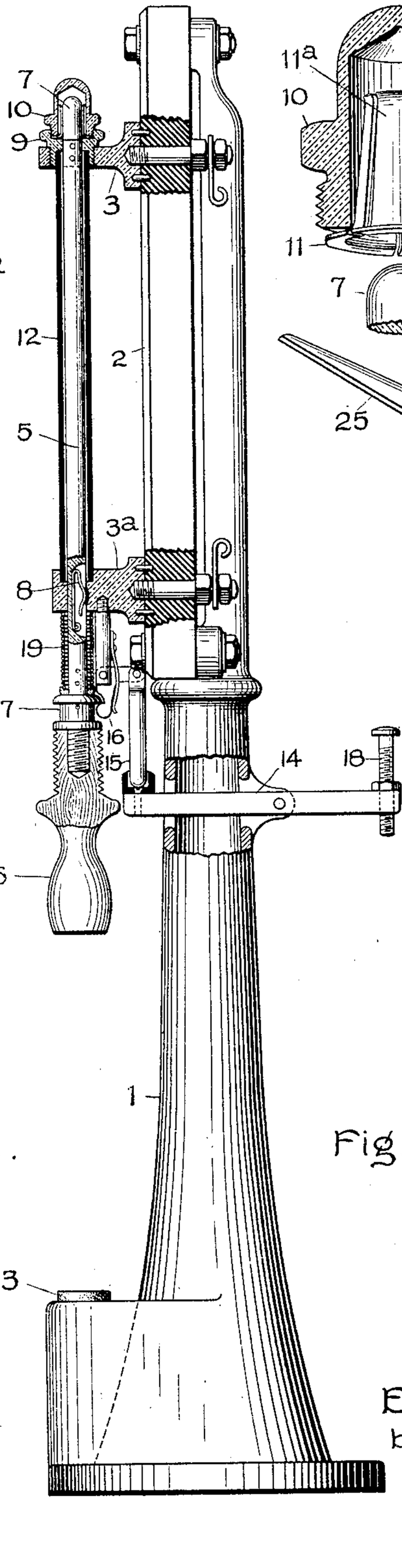
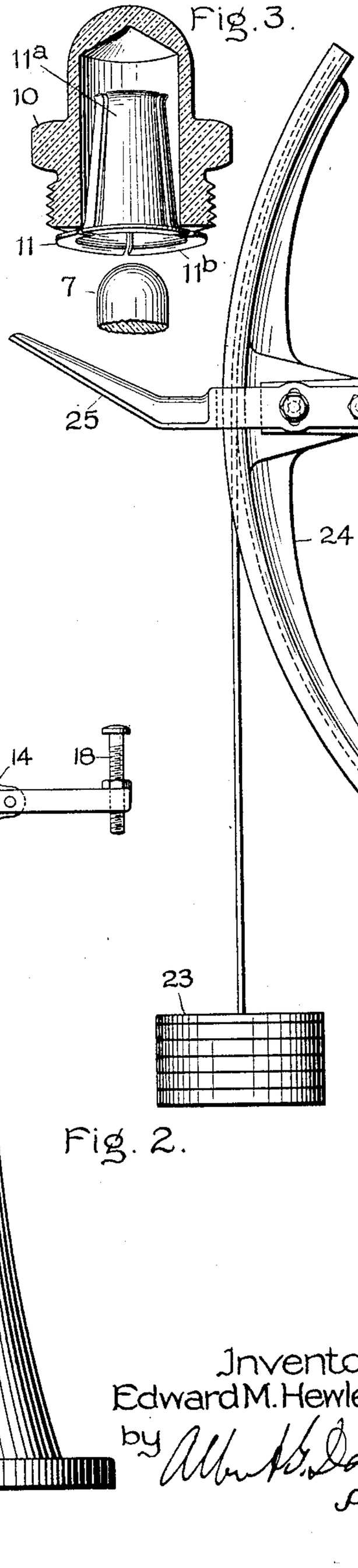


Fig. 2.

Fig. 3.



Witnesses
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NO MODEL. 2 SHEETS—SHEET 2.

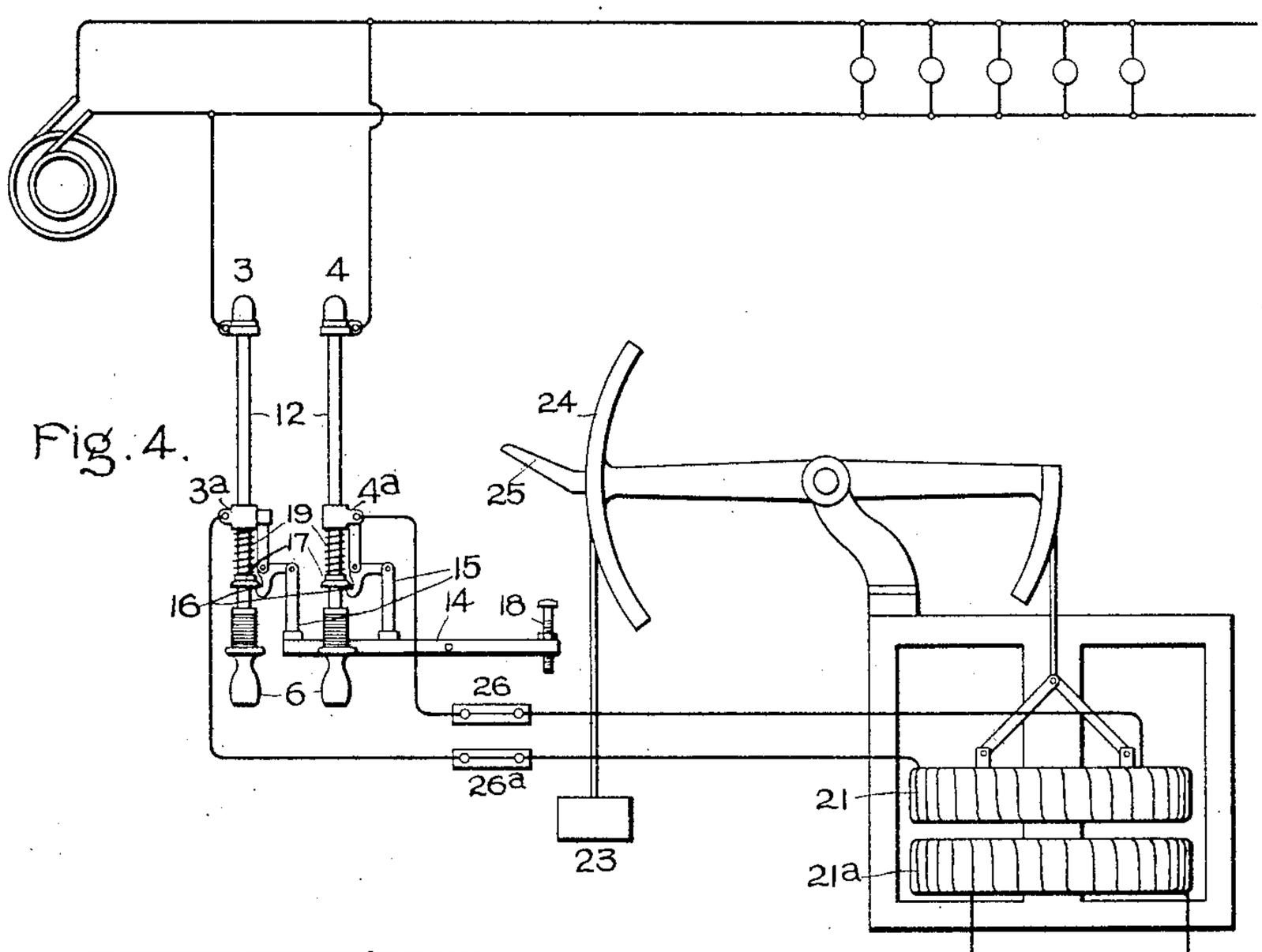

Fig. 4.

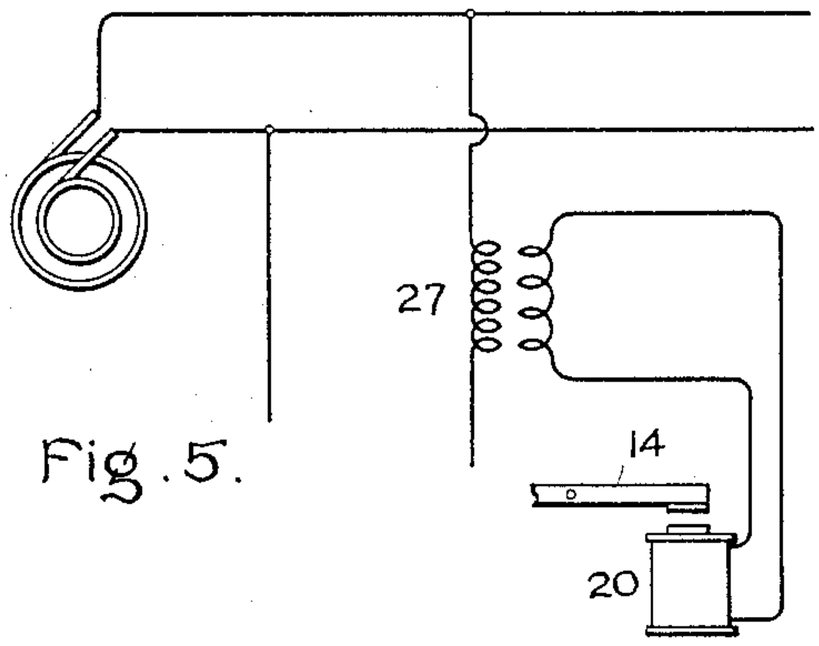

Fig. 5.

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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.

AUTOMATIC CIRCUIT-BREAKER.

SPECIFICATION forming part of Letters Patent No. 745,347, dated December 1, 1903.

Application filed April 5, 1900. Serial No. 11,626. (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 Automatic Circuit-Breakers, of which the following is a specification.

This invention relates to circuit-breakers for opening circuits carrying currents of high potential, the object being to automatically interrupt the circuit upon the attainment of a predetermined limiting-current by producing a long quick break.

The invention is particularly designed for service in connection with alternating circuits feeding constant-current transformers. As will hereinafter be understood, however, it may be applied generally to any circuits, direct or alternating.

In carrying out my invention I provide one or more gravitative switch-plugs coöperating with circuit-terminals mounted upon a fixed support and adapted to slip through the lower terminal and form a good connection with a socket on the upper terminal, a spring being strained in effecting the connection before a detent latches the plug in place. A trip is provided for releasing the detent, thereby permitting the spring to rebound, and disconnecting the plug, which drops by gravity and produces a long quick break, by which the arc is extinguished. In order to avoid damage or injury by the arc or spattering of molten metal and to assist the rapidity of movement of the plug, a tubular inclosure is provided, surrounding the plug through a sufficient range of movement to insure safety. A preferable construction in accomplishing this end is to mount the tube so as to extend between and form a joint with the respective terminals, the tube of course being of insulating material. The trip may be actuated in any suitable way, as by an electromagnetic, thermal, or other device responsive to the condition of the circuit controlled.

In regulating constant-current systems, for which the invention is well adapted, I provide a mechanical trip actuated by the movable element of the constant-current transformer, the coöperating portions of this trip and the detent device being adjustable to vary the delicacy of release or the range over which the same may be effected. I provide also an improved cup-contact for the plug, by which its resiliency may be rendered comparatively uniform and an effective contact may be made for a long term of service and by which also a renewal of the contact may be easily effected when necessary.

The novel features of my invention will be more particularly described hereinafter and will be definitely pointed out in the claims appended to this specification.

In the drawings which illustrate the invention, Figure 1 is a side elevation of a two-pole automatic circuit-breaker embodying my improvements. Fig. 2 is an elevation on a plane at right angles to that indicated in Fig. 1, parts being shown in section to better illustrate the construction. Fig. 3 is a detail view of an improved form of socket-contact. Fig. 4 is a diagram showing the coöperation of an organization embodying my improved circuit-breaker with a constant-alternating-current transformer, and Fig. 5 is a diagram of an overload-releasing device for an alternating system of a general character.

Referring first to the construction as seen in Figs. 1, 2, and 3, 1 represents a pillar which forms a support for the circuit-breaker and which may be made in the form of a hollow casting provided with a base, by which it may be bolted to a bracket or other support. On the upper part of this post is mounted a board 2, of insulating fireproof material, such as slate or marble, and which carries the terminals 3 3^a 4 4^a of a double-pole circuit-breaker. The terminals may be secured to the board in any approved manner. 5 is a conducting-plug provided with an insulating-handle 6 and a brass arcing tip 7. The lower terminal is bored, so as to permit insertion of the plug, a spring-pressed contact 8 being mounted in a recess in the plug in such relation that when the latter is inserted, so as to bridge the terminals, the spring will engage one wall of the lower terminal, thus forcing the plug into good contact with the terminal. On the upper terminal is mounted an elastic socket adapted to form a good contact with the arcing tip 7 of the plug. The terminal is

bushed with a socket 9, provided with a thread by which it may be screwed into firm engagement, and into the cupped upper face of this socket screws an inverted cup 10. (Shown in enlarged view in Fig. 3.) Between the engaging faces or edges of the cup are placed a plurality of springs. (Shown in detail in Fig. 3 at 11 11^a 11^b.) These may be formed of as many pieces as desired, each piece being shaped so that it will be provided at the bottom with a flat flange adapted to rest against the flat seat in the socket 9 and be clamped firmly in position when the cup 10 is screwed home. Thus there is provided a plurality of yielding fingers which may be shaped in a press so as to form when the parts are assembled a cup-contact, the free prongs of which lean in toward a common center and are curved in cross-section, which adds to their stiffness and prevents their becoming limp or losing their temper when heated. The contact parts are so arranged as to form an easy fit with the arcing tip 7 at or near the base, so that when the latter is pushed up a hard contact is effected. The terminals are connected by an insulating-tube 12, which confines the arc when the circuit is opened and also assists the rapidity of arc rupture by an expulsive action of the heated air and gases which tend to fill the chamber. On a projection from the bottom of the supporting-pillar is mounted a cushion 13, which receives the blow of impact when the plug drops in opening the circuit. Pivoted on a bracket of the post is a lever 14, carrying an insulated stud 15, which controls a releasing and latching detent 16, which is spring-actuated and tends to throw the detent into the path of a collar 17 on the plug. The free end of the lever carries an adjusting-screw 18, coöperating with a tripping device depending for its operation upon the condition of the controlled circuit. Around the plug is a helical spring 19, shown in its compressed condition in Figs. 1 and 2 and which by its rebound when the lever 14 is shifted and the detent 16 released acts to start the plug and withdraw the arcing tip from the socket on the upper terminal and also to give it an accelerated motion in opening the circuit. The plug is then driven rapidly, under the combined effect of gravity and the confined gases in tube 12, until it is arrested by the cushion 13, producing a long break, which safely extinguishes the arc. The electrically-controlled device coöperating with the lever 14 may be a simple magnet, such as indicated in Fig. 5 at 20, adjusted to operate upon a predeterminate fluctuation of load in the circuit, or it may be a constant-current transformer, such as shown diagrammatically in Fig. 4. I have shown a particular type of transformer in which are two coils in the primary and secondary circuit, respectively, and movable relatively to one another, so as to assume a closer or more remote inductive relation as the number of arc-lamps in circuit varies. In the condition of maximum load the coils 21 21^a, primary and secondary, respectively, are in close inductive relation and feeding a constant-current circuit—as 22, for example—containing a group of arc-lamps. The movable coil 21 is partially counterbalanced by a weight 23, flexibly supported from an arc-shaped arm 24, attached to one end of a lever, the other end of which carries the coil. Upon a decrease of load—as, for example, by cutting out one or more arc-lamps—the increased strength of current causes a strengthening of the repulsive effort on the movable coil, thereby separating the two coils and cutting down the potential to a point where current will be of the same strength as before the translating device was cut out. On the end of the lever carrying the counterbalance is a projection 25, in the path of movement of which is placed the adjusting-screw 18 on the end of the release-lever of the circuit-breaker. Fuses 26 26^a may be placed in the primary circuit to guard against accidents. By adjusting the screw 18 or the projection 25 the range of the circuit-breaker may be varied, so as to cut out the transformer at a definite minimum load. These transformers are commonly designed so as to furnish a constant current through a wide range of load. For example, in a twenty-five-lamp transformer the current may be kept constant from about seven lamps upward, and when less than this number is included in the circuit the transformer should be cut out.

The adjustment described permits the conditions to be altered to accommodate the organization to different systems and can be set so as to cut out the transformer at a required minimum load.

In Fig. 5 the control-magnet 20 is placed in the secondary circuit in inductive relation to a primary coil 27, controlling the local service, and upon a predetermined variation of load the circuit-breaker may be tripped.

I prefer to employ two independent plug connectors, one for each side of the circuit, as seen in Fig. 4, thus securing all the advantages of a double-pole break and in addition preventing damage to the circuit by closure under dangerous conditions. It will be evident that in closing the circuit after one plug has been latched in position when the other is inserted, thereby closing the circuit, the transformer of Fig. 4 or the magnet 20 of Fig. 5 will trip the plunger and immediately open the circuit. This follows from the arrangement of the latches as shown, in which both are operated by a movement of the trip-lever 14. Consequently if the operator has one plug in his grasp and closes a circuit during or at an instant when an overload occurs both latches will be operated, and the other plug will be free to open the circuit.

While I have shown my invention as adapt-

ed for use with alternating systems and while I have described a double-pole type of circuit-breaker, the invention is not in any sense limited in these particulars and may be applied to any kind of service within the scope of the subjoined claims.

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

1. A circuit-breaker comprising fixed circuit-terminals, a straight gravitating plug connector, an automatic release device, and an insulated tubular inclosure for the connector connecting the terminals, forming a closed chamber when the plug is inserted.

2. A circuit-breaker comprising fixed circuit-terminals connected by an insulating-tube, a retractile plug connector inserted through one terminal and adapted to move freely through the same, automatic means for disconnecting the plug, and a fixed stop to arrest the plug after a long range of free movement.

3. A circuit-breaker comprising a plug connector and a cup-contact coöperating therewith, comprising a group of independent springs clamped together to form a socket for the plug.

4. A circuit-breaker comprising a plug connector and a cup-contact formed of a group of independent concave springs clamped together to form a socket for the plug.

5. A circuit-breaker comprising fixed circuit-terminals vertically superposed and connected by an insulating-tube, a connecting-conductor to bridge the same, a cup-contact on the upper terminal, a releasing device, and a cushioned stop to arrest the movement of the plug after a determinate range of movement.

6. An automatic circuit-breaker comprising a plurality of pairs of fixed terminals, the members of each pair being vertically superposed and connected by an insulating-tube, plug connectors for each pair movable within the tube, connections of the several pairs with a single circuit for forming a multiple-pole contact, and means for withdrawing the several plug connectors simultaneously.

7. An automatic circuit-breaker comprising a plurality of pairs of fixed terminals, the members of each pair being vertically superposed and connected by an insulating-tube, retractile plug connectors for each pair, connections of the several terminals with a single circuit, and an electrically-operated release device common to the several plug connectors.

8. An automatic circuit-breaker comprising a plurality of fixed terminals connected by an insulating-tube, a retractile plug connector having a long range of movement, passing through one terminal and engaging a companion terminal, a release device, and an electrically-operated trip responsive to predetermined current in the circuit supplied through the circuit-breaker.

9. An automatic circuit-breaker comprising a plurality of fixed terminals, an insulating-tube connecting them, a retractile plug connector having a long range of movement movable within the tube, and free to accelerate throughout said range, a detent for the connector, a release-lever, a tripping device responsive to current conditions in the circuit supplied through the circuit-breaker, and an adjustable stop to vary the circuit condition at which the trip shall act.

10. An automatic circuit-breaker comprising two independent retractile plug connectors, one for each side of a circuit, an insulating-tube inclosing each connector, and a releasing device responding to a predetermined current condition in the circuit adapted to release either plug connector when the other is inserted, if the predetermined condition obtains.

In witness whereof I have hereunto set my hand this 4th day of April, 1900.

EDWARD M. HEWLETT.

Witnesses:

BENJAMIN B. HULL,

MABEL E. JACOBSON.