No. 730,704. PATENTED JUNE 9, 1903.

R. H. READ.

CIRCUIT BREAKER FOR ELECTRIC CIRCUITS.

APPLICATION FILED FEB. 24, 1902.

NO MODEL. 2 SHEETS—SHEET 1.

Fig. 1.

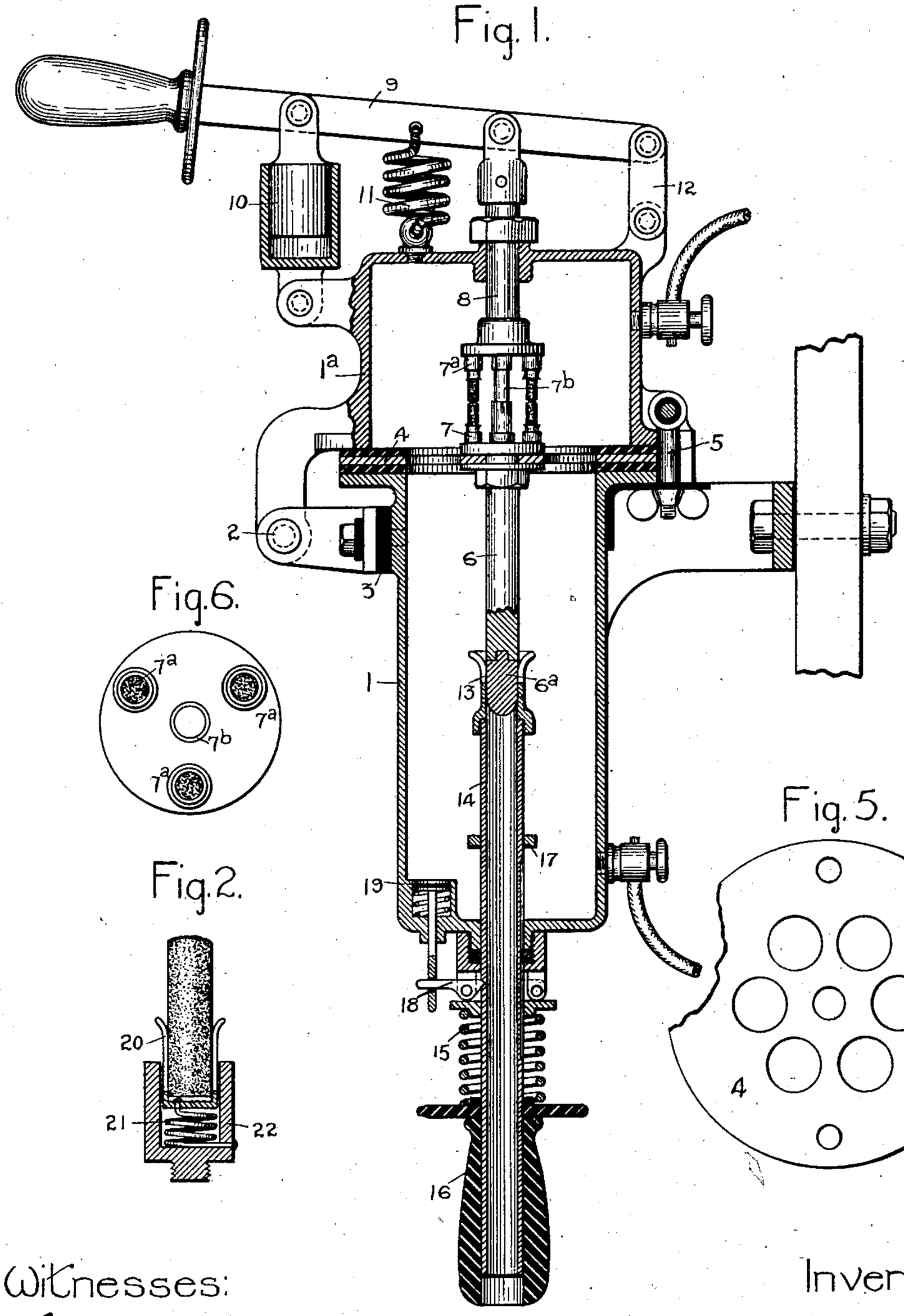

Fig. 6.

Fig. 2.

Fig. 5.

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THE NORRIS PETERS CO., PHOTO-LITHO., WASHINGTON, D. C.

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NO MODEL. 2 SHEETS—SHEET 2.

Fig. 3.

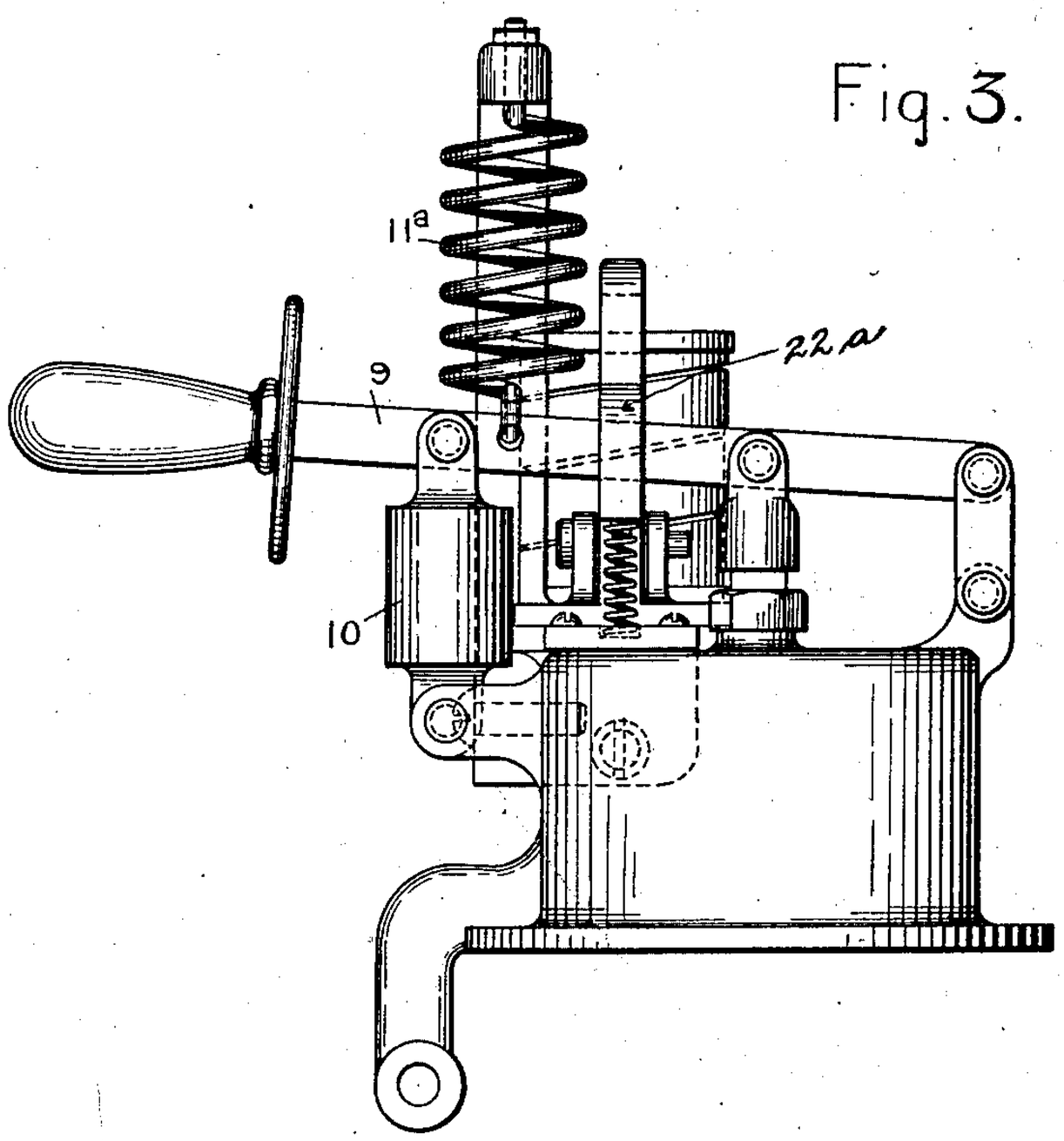
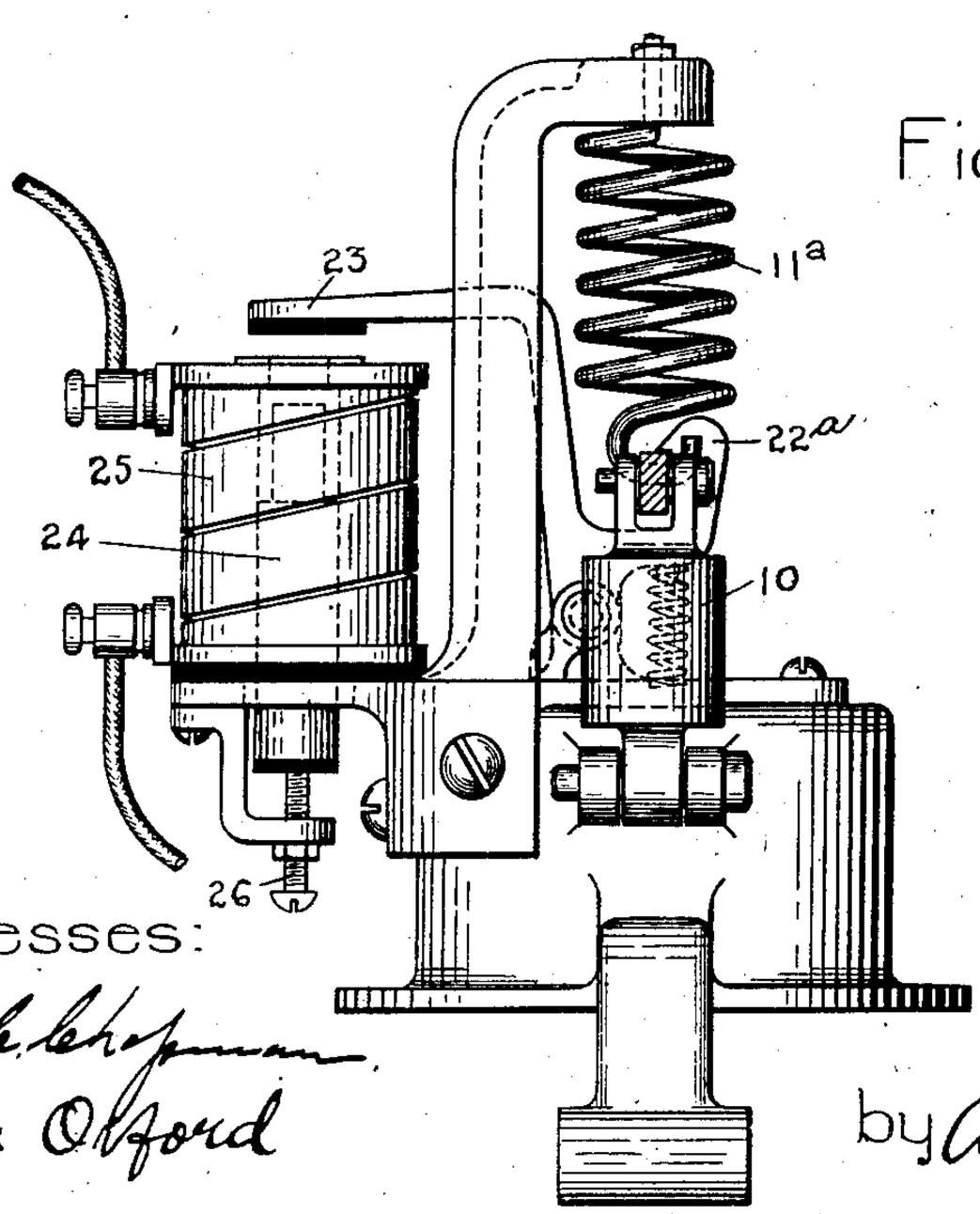


Fig. 4.



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No. 730,704. Patented June 9, 1903.

UNITED STATES PATENT OFFICE.

ROBERT H. READ, OF SCHENECTADY, NEW YORK, ASSIGNOR TO GENERAL ELECTRIC COMPANY, A CORPORATION OF NEW YORK.

CIRCUIT-BREAKER FOR ELECTRIC CIRCUITS.

SPECIFICATION forming part of Letters Patent No. 730,704, dated June 9, 1903.

Application filed February 24, 1902. Serial No. 95,156. (No model.)

To all whom it may concern:

Be it known that I, ROBERT H. READ, a citizen of the United States, residing at Schenectady, county of Schenectady, State of New York, have invented certain new and useful Improvements in Switches or Circuit-Breakers for Electric Circuits, of which the following is a specification.

The object of this invention is to provide a device for rupturing currents, and particularly those of high potential and large current value, with greater certainty and less damage to the contacts and by a smaller and cheaper instrument than has been heretofore provided for that purpose. In prior applications filed by me I described means of the same general character in which the arc at the opening or separating points of contact was extinguished by movement of an insulating fluid which forced the arc into and through a tubular opening. My present invention is specially directed to rendering a device of this character self-contained, so that the pressure necessary to determine the movement of the insulating fluid may be generated within the device itself. To this end I provide the device with means for effecting a double break, the preliminary movement of the operating handle or mechanism separating carbon or similar contacts and drawing an arc by which pressure is stored in the inclosing chamber and forces an insulating fluid in a direction to extinguish the arc at the separating metallic contacts, the separating motion of which occurs at a later period, when the stored pressure is sufficient to safely extinguish the arc.

I prefer to operate with air as an insulating fluid, and both breaks may occur within the same chamber, an automatic release device for the tubular electrode being provided in which the metal contacts are separated only after a sufficient pressure has been stored by the burning arc to release the movable terminal and extinguish the arc by forcing the volatile matter down into the tube.

The invention is applicable to any type of switch or circuit-breaker in which an opening of a circuit carrying currents of high potential and large amperage, either or both, becomes necessary, and the device may be hand-operated or provided with an automatic trip, so as to respond to definite load conditions.

One essential feature of the present improvements is supplying pressure by an arc drawn by separating contacts, and another involves an auxiliary arc drawn for the purpose of storing pressure to put out the arc at the main break.

The invention therefore comprises a switch or circuit-breaker provided with a casing and means for drawing an arc and storing pressure to drive the arc of circuit rupture through a tubular electrode. It comprises also a switch or circuit-breaker having a plurality of breaks and means for drawing an arc at a part of these breaks preliminary to the final rupture of the circuit, said arc being utilized to store pressure to force an insulating fluid to extinguish all the arcs.

It embodies other features more specific, the novelty of which will be hereinafter more fully described, and definitely indicated in the appended claims.

In the accompanying drawings, Figure 1 is a cross-section of a hand-operated type of switch or circuit-breaker embodying my improvements. Fig. 2 is a detail of the elastic seat for one of the carbon break-points. Figs. 3 and 4 are side elevations from different points of view at right angles to each other of the top part of the device. Fig. 5 is a plan view of a spider for supporting one of the electrodes, and Fig. 6 shows the contacts at the carbon break.

Referring first to Fig. 1, 1 1^a represent a sectional casing, the two parts of which are well insulated from each other and which houses the operative parts of the switch or circuit-breaker. The upper portion is arranged to swing on a hinge or pivot 2 to admit of access to the parts supported within the casing. A supporting-bracket for the pivot may be mounted on the lower section of the casing, but should be particularly well insulated therefrom, as indicated at the point 3. Between the two sections is supported a well-insulated metal spider 4, bored or cast so as to permit free communication between the upper and lower sections of the chamber inclosed by the sectional casing. In order to

make the joint air-tight, a layer of asbestos or similar soft substance may be used at the joint. The parts are locked together by one or more swing-bolts 5, pivoted to the upper section of the casing and adapted to be swung into and out of a slot, so as to lock the two parts together, as indicated in Fig. 1. The parts of the bolt which contact with the lower section must of course be well insulated. The spider 4 supports a fixed metallic electrode 6, the upper part of which is provided with an annular head containing a plurality of sockets 7, in which are elastically supported a group of short carbon pencils, also a central metal socket to form a metal shunt for the carbons when closed. Coöperating with these pencils is another group 7^a 7^b, mounted on a head carried by a rod 8, moving snugly through the upper part of the casing and pivotally connected with an operating-lever 9. A dash-pot 10, pivoted to the lever and to the upper part of the casing, slows the movement of the lever, so as to enforce in operation a slow drawing of the arc at the carbon contacts. A boss on the casing and carbon-carrier limits the length of the arc that may be drawn and prevents flashing across to the lower casing. A spring 11 returns the handle to its normal position when released. The fixed end of the lever is connected by a link 12 with a lug on the upper member of the casing. The fixed electrode 6 carries a removable arcing tip 6^a, of brass or similar material, and coöperating with this is a tubular electrode 14. A number of saw-cuts are made in the upper end of the tip 13, so as to permit an elastic connection between the fixed electrode 6 and the tubular electrode 14. The movement of the latter is controlled by a helical spring 15, one end of which abuts against the end of the casing and the other end against a fiber or other insulating-disk on the end of the insulating-handle 16. A stuffing-box may be provided to make the movable electrode air-tight, though in most cases where currents of considerable volume are handled such provision will be unnecessary, since the pressure rises so rapidly that a small leakage does not greatly affect it. A stop 17 limits the downward movement of the movable electrode. By pushing upward on the latter the spring 15 is compressed and the electrodes 6 and 14 are brought into good solid contact, being latched in this position against the tension of the spring 15 by a detent 18, which may be tripped by a spring-controlled plunger 19, responsive to air-pressure within the casing.

One group of carbon contacts should be spring-seated, so as to permit of an elastic engagement. An effective mode of securing this result is indicated in Fig. 2, where the carbon pencil or stick is clamped by a socket 20, having slit or elastic jaws or prongs between which the carbon may be gripped. This elastic socket may be connected by a coil-spring 21 with a brass cup 22, which may be screwed to one of the supporting parts. I preferably provide three of these break-points, arranged at the corners of an equilateral triangle, a central metal plug-and-socket contact (indicated at 7^b) being mounted on the two metal heads and adapted to form a good short circuit for the carbons when the parts are in position as in Fig. 1, but parting contact before the carbons to permit the arc to be drawn on the latter, as will be understood by those familiar with circuit-breakers. Thus when the handle 9 is depressed the carbons and metal shunt are brought together, the former elastically, and close the circuit through the upper part of the switch. The circuit may be finally closed by raising the handle 16 until the metal electrodes are firmly socketed, in which position the spring will be latched and the circuit held closed. The metal shunt-contacts around the carbon increase its carrying capacity and prevent heating.

In opening the circuit the lever 9 is raised against the tension of the spring 11, a slow movement being enforced by the dash-pot. The metal shunt opens without arc and then the carbons part and an arc is immediately drawn at the carbon-points and the heat gradually stores pressure, in fact almost instantaneously does so, the pressure rising until a predetermined value has been attained, when the piston 19 is driven downward against its control-spring and the tubular electrode 14 is tripped, the spring 15 causing a quick downward movement of the tubular electrode. The stored pressure forces a current of air or a combination of air and residual products of combustion at the arc radially in all directions across the arc drawn between the electrodes 6 and 14 and crowds all of the arc vapor down through the tube 14. The action is very rapid and causes instantaneous extinguishment of the arc.

The apparatus might easily be arranged, of course, to make both abutting electrodes tubular, as in my companion applications Serial Nos. 54,122, 66,460, and 69,893.

When the arc is extinguished at the metal terminals, it will of course be evident that the carbon arc simultaneously goes out. Thus it will be seen that a carbon arc is drawn, storing pressure, and this pressure is utilized to break the arc formed at another point in the circuit. I preferably arrange these arcs in series, though they might be arranged in other ways.

In Figs. 3 and 4 is shown an automatic trip instead of the hand-operated device just described. In this case the lever 9 is acted on by an upwardly-pulling spring 11^a and is latched in the closed position by a spring-pressed detent 22^a, an arm of which, as indicated at 23, lies over a trip-core 24 within the field of the trip-coil 25. A set-screw 26 permits adjustment of the core to vary the calibration of the trip-coil. In operation the circuit will be automatically opened at a

point determined by the calibration of the trip-coil. When the current reaches the predetermined value, the core 24 is lifted and with a rapidly-accelerating movement is raised upwardly within the coil. Striking the arm 23, it unlatches the handle and permits the spring 11ª to raise the handle 9, an operation which is necessarily slow by reason of the dash-pot 10. An arc is thus drawn between the carbon contacts and the pressure stored for automatic release of the movable metal tube in the manner just described in connection with Fig. 1. The upper part of the casing is preferably made of larger diameter than the lower to provide considerable storage capacity for air. The size of the casing should be in all cases calculated, so as to maintain a movement of a considerable body of air through the tube 14 when it is tripped, since otherwise the decline of pressure will be very rapid and the arc may not under all conditions be extinguished.

When it becomes desirable to inspect the condition of the carbon contacts, the lock bolt or bolts 5 may be swung upwardly and the upper part of the casing tilted upside down, when the carbons may be renewed and any other necessary repairs made.

The form and arrangement of the parts may be widely varied without departing from the spirit of my invention, it being broadly new, so far as I am aware, to effect by a preliminary movement an arc by which pressure is stored to rupture a circuit. It is not absolutely essential that the preliminary arc should be in the same circuit as the tubular electrode. Its principal function being to supply heat, it might be in an auxiliary or independent circuit, the trip-coil which controls its operation, of course, being in the circuit containing the tubular contact.

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

1. A switch or circuit-breaker comprising a plurality of break-points part of the same effecting a storage of pressure by the arc when the electrodes are separated to extinguish the arc at the remainder, a chamber in which said pressure is stored, and means for parting the electrodes at said break-points.

2. A switch or circuit-breaker comprising a plurality of break-points connected in series at which arcs may be drawn, and means for storing pressure at one break-point to extinguish the arcs and thus break the circuit at all of said points.

3. A switch or circuit-breaker provided with separable contacts and a casing around the same for storing pressure due to the arc, auxiliary contacts in series with the former, and means for directing the stored pressure to extinguish the arc at the auxiliary contacts thereby opening the circuit.

4. A switch or circuit-breaker provided with separable contacts, means for heating an insulating fluid by the arc formed on circuit rupture, an auxiliary pair of contacts, and means for directing the blast due to expansion to extinguish the arc at the auxiliary contacts.

5. A switch or circuit-breaker comprising a plurality of break-points in series relation, means for storing energy from the arc formed at part of the same, and a chamber for directing a blast of insulating fluid by such stored energy to extinguish the arc at all of said break-points.

6. A switch or circuit-breaker comprising a tubular contact, a casing inclosing the same, a coöperating contact, means for drawing an arc, and means for storing pressure around the tubular contact due to the heat of said arc, whereby the current is broken at the tubular contact.

7. A switch or circuit-breaker comprising a plurality of breaks, means for first opening one and developing an arc, a chamber to store pressure due to the heat, and means for directing said pressure to extinguish the arc when the final break is made.

8. A switch or circuit-breaker comprising a plurality of breaks in series relation, one containing a tubular contact, an inclosing casing, means for drawing an arc at one break, and an inclosure for directing the pressure due to the arc heat to the inclosure for the tubular contact.

9. A switch or circuit-breaker comprising a plurality of breaks, a substantially air-tight inclosure, a tubular electrode, and means for drawing an arc at one break to store pressure and then opening the circuit at the tubular electrode.

10. A switch or circuit-breaker comprising a closed casing, a pair of carbon contacts within the same, a tubular electrode in circuit with the carbons, and means for opening the circuit first on the carbons and then on the tube.

11. A switch or circuit-breaker comprising a closed casing, relatively movable electrodes, at least one of which is tubular, means for drawing an arc to store pressure in the casing, and means for separating the electrodes while pressure is thus stored.

12. A switch or circuit-breaker comprising a closed casing, relatively movable electrodes, at least one of which is tubular, means for drawing an arc to store pressure, and a pressure-release for one of the electrodes.

13. A switch or circuit-breaker comprising a closed casing, relatively movable electrodes at least one of which is tubular, means for drawing an arc to store pressure, an automatic trip to start the arc, and automatically-responsive devices for separating the movable electrodes whereby the circuit is broken at the tubular electrode.

14. A switch or circuit-breaker comprising a closed casing, separable electrodes, at least one of which is tubular, a pair of carbon contacts, means for enforcing a slow separation

of the same, and an automatic release for the movable electrodes when the proper pressure has been raised in the casing.

15. A switch or circuit-breaker provided with a pair of carbon contacts and a pair of metal contacts, an inclosing casing, means for drawing an arc first at the carbons, and then at the metal contacts, and a hinged cover for permitting access to the parts within the casing.

16. A switch or circuit-breaker comprising carbon contacts, a tubular electrode, a contact coöperating with the latter, a spring-closed lever for separating the carbons and drawing an arc, an inclosing casing for storing pressure due to the arc to extinguish the arc formed at the tubular electrode, and a limiting device for the carbon arc length.

In witness whereof I have hereunto set my hand this 20th day of February, 1902.

ROBERT H. READ.

Witnesses:

ALEX. F. MACDONALD,

HARRY H. TILDEN.