(No Model.) 2 Sheets—Sheet 1.

E. M. HEWLETT.

ELECTRICALLY CONTROLLED SWITCH.

No. 603,786. Patented May 10, 1898.

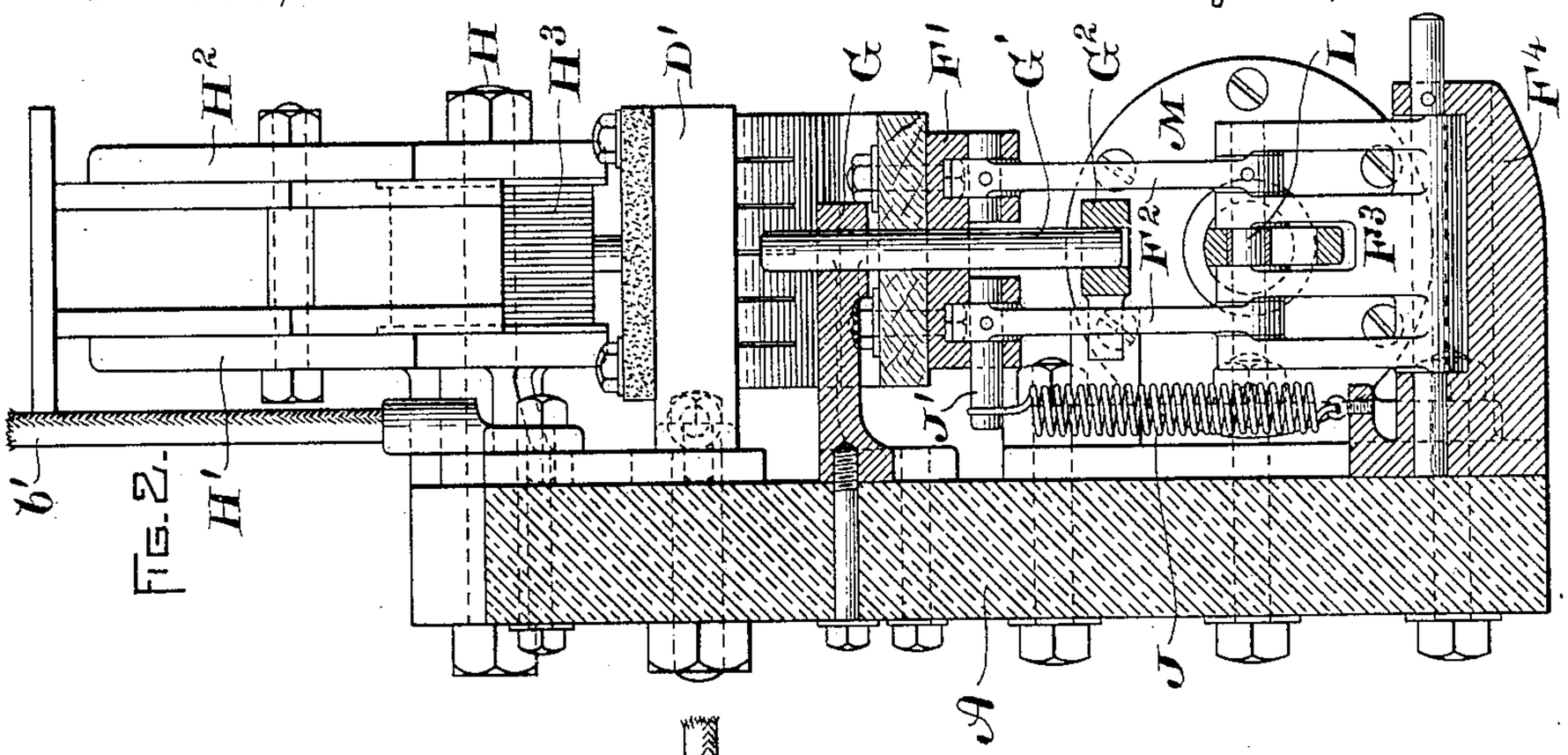

FIG. 2.

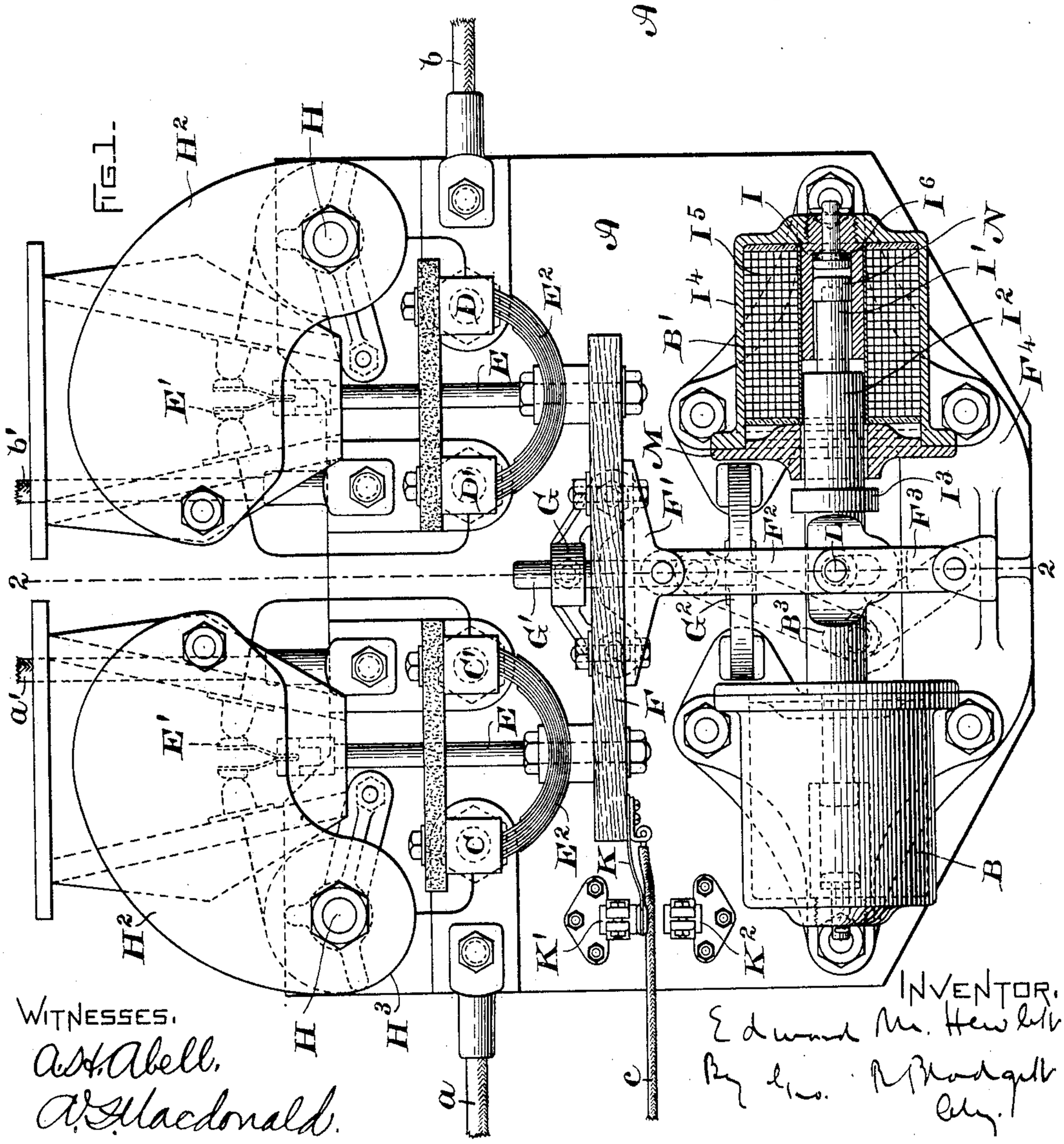

FIG. 1.

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(No Model.) 2 Sheets—Sheet 2.

E. M. HEWLETT.

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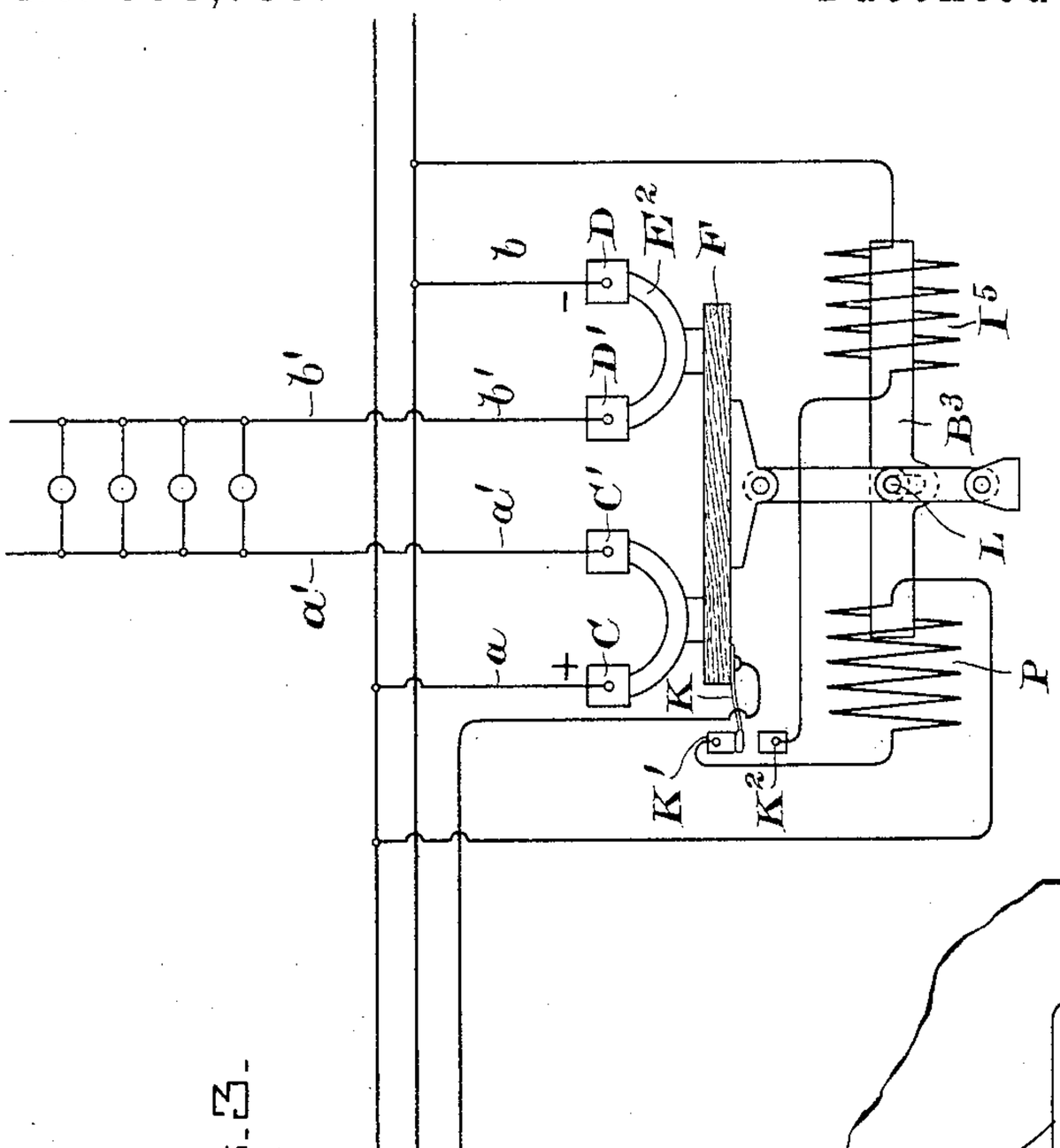


FIG. 3.

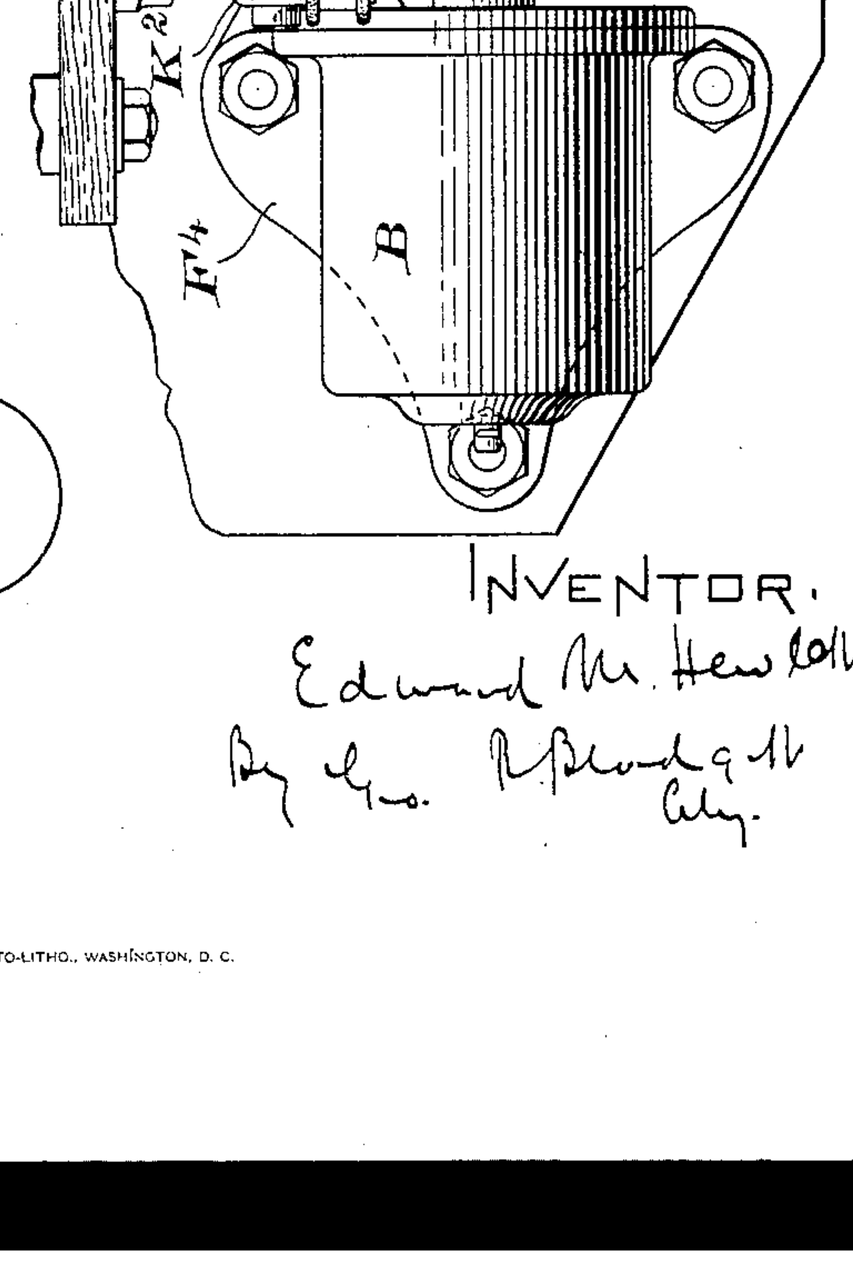
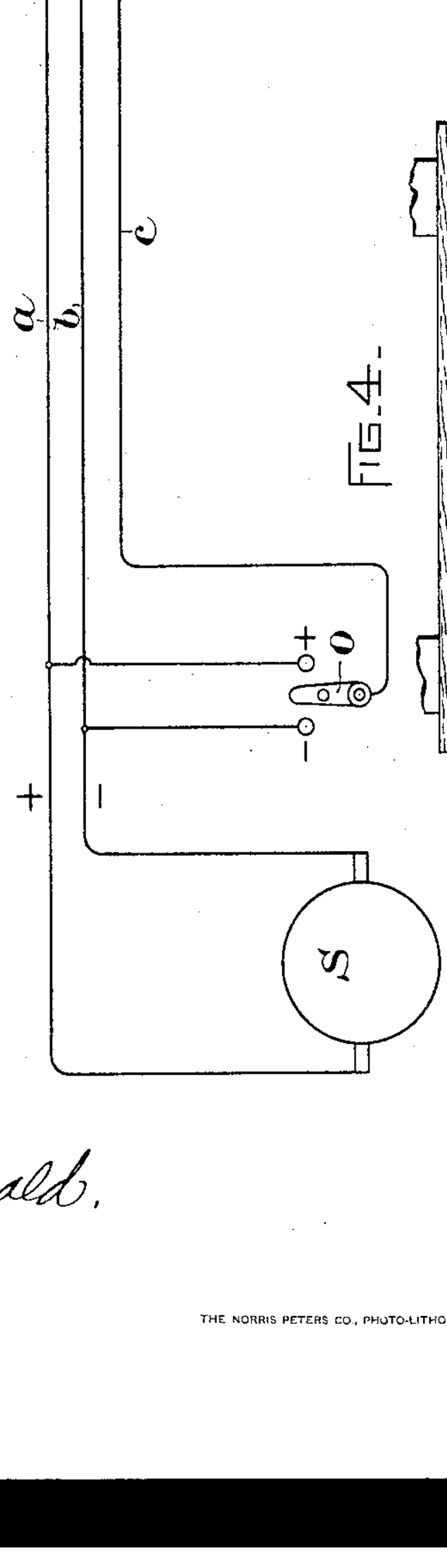


FIG. 4.



WITNESSES.

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UNITED STATES PATENT OFFICE.

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

ELECTRICALLY-CONTROLLED SWITCH.

SPECIFICATION forming part of Letters Patent No. 603,786, dated May 10, 1898.

Application filed January 23, 1897. Serial No. 620,311. (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, in the county of Schenectady, State of New York, have invented certain new and useful Improvements in Electrically-Controlled Switches, (Case No. 422,) of which the following is a specification.

The present invention relates to electrically-controlled switches which are employed for establishing or interrupting the circuit connections of a system of distribution or electrical apparatus located at a distance from the point of control.

The present apparatus has been designed more particularly for use with a system of underground feeders where it is desirable at certain times to establish or interrupt the circuit of some or all of the branch feeders located at a distance from the main source of supply; but the invention is not limited to this, for it can readily be applied to any system requiring a switch electrically controlled from a distance.

The present invention has for one of its objects to dispense with the motor and gearing usually employed for this purpose and to substitute therefor a simple means of operating the switch positively in both directions, at the same time insuring a quick break at the time the circuit is interrupted.

The invention further has for its object to arrange the circuits of the magnet-coils in such a manner that they may be included in circuit with the source of supply by a switch located at the power-house and an extra wire extending from the source of supply to the feeder-switch, the wire and magnets being out of circuit, except when employed in operating the switch.

The invention furthermore has for its object to provide an improved magnet capable of working over a long range with a substantially equal pull throughout.

The magnet comprises a movable core having two parts differing in their cross-section. In the energizing-coil is placed a hollow core, within which the smaller portion of the core is located at all times. This insures a good magnetic circuit, but one of limited area and one in which the lines of force are crowded. As the core is drawn inward the larger portion reaches a point where the lines of force may pass directly from it to the hollow core, thus increasing the area of the magnetic circuit and slightly increasing the pull. By experiment I have found that it is possible to so construct the core and to limit its inward movement that a strong pull is obtained at the start, which is not greatly increased as the core moves into the energizing-coil.

The invention further relates to details of construction hereinafter more fully described and claimed.

In the accompanying drawings attached to and made part of this specification I have shown an embodiment of my invention, in which—

Figure 1 is a plan view of the switch and operating mechanism; Fig. 2, a sectional view on the line 2 2 of Fig. 1; Fig. 3, a diagram of the circuit connections, and Fig. 4 a modification.

The insulating-base A, to which the parts of the switch are secured, is preferably mounted in a horizontal position within a suitable inclosing case, which protects it from dirt and moisture. The leading-in or main-circuit wires *a* and *b* are provided with terminals and secured to the bases of contacts C and D. *a'* and *b'* indicate the outgoing or branch feed-wires, and are provided with suitable terminals, secured to the base of the contacts C' and D'. Mounted on the insulating-support F are two laminated copper connectors E^2. These are adapted to close the circuit between the contacts C C' and D D'. The support F is also provided with rods E, in electrical connection with the contacts E^2, which carry at their upper ends bifurcated connectors E'. The moving and stationary contacts, each of which, when in the position shown, completes a shunt-circuit around the corresponding main-switch terminals through a blow-out magnet H^3 and stationary contacts, (not lettered,) bear such a relation to each other that the circuit is first interrupted at E^2 and then at E'. As soon as the circuit at E^2 is interrupted the coil H^3 of the blow-out magnet becomes energized, which blows out any arc formed at the contact E'. The blow-out magnet consists of two plates H' H^2, be-

tween which is located the coil I^3 and an arc-restraining chute. These are secured together and to the insulating-base A by bolts H.

On the lower portion of the base A is a casting F^4, to which are secured switch-operating magnets B B'. These magnets are provided with an outer iron casing I^4, which forms a part of the magnetic circuit, and have a common core B^3, to which are connected the toggle-levers F^2 and F^3. These levers are connected at their upper end to the casting F', which is secured to the insulating-piece F, and at the bottom are pivoted to the casting F^4. Mounted in the lugs G G^2, which are secured to the base A, is a rod G', which forms a guide for the insulating-piece F when moved up and down by means of the toggle. Secured to the pin J', which also forms a pivot for the arms F^2, is a spring J, which is secured at its lower end to a boss on the casting F^4. This spring assists the magnets to move the levers F^2 F^3 to either side of a dead-center position. Secured to the end of the magnet-casing I^4 by means of screws is a plate M, which forms a part of the magnetic circuit. The magnets are provided with hollow cores I, secured to the base by screw-threads and extending part way between the base and the plate M. The energizing-coil I^5 is wound and insulated upon a suitable spool, which is slipped into place before the plate M is mounted. In one end of the core I is mounted a buffer or stop comprising a metal disk carried by a pin and having a washer I^6, of rubber or leather, to lessen the hammer-blow when the head of the core I' strikes. The core B^3 is provided with portions I' I^2, which differ in their cross-section, that of I^2 being approximately twice as great as that of I'. To limit the inward movement of the core, a shoulder I^3 is formed on the core and is adapted to strike against the hub of the plate M. To adjust the inward movement of the core, a piece N is provided, which may or may not be of magnetic material. By proportioning the thickness of this piece the movement of the core B^3 may be limited as desired.

When the coil I^5 is energized and the core B^3 is in the extreme left-hand position, the magnetic flux passes from the plate M through a small portion of the larger core I^2, thence to the smaller core I', the hollow core I, the surrounding case I^4, and back to the plate M. With the core in this position the lines of force threading through the core I' are crowded; but the magnetic circuit being a good one a strong pull on the core is obtained. As the moving core is drawn into the hollow core I the pull increases up to a certain point, after which it falls off slightly until the core I^2 arrives at the position where the lines of force may pass directly therefrom to the core I. By this construction I provide a magnet having a strong pull at the start and one in which the pull is not materially increased as the core is drawn in. Mounted on the insulating-piece F is a spring-contact arm K, making contact with the contact K' when in the position shown and with the contact K^2 when the circuit between the mains a a' and b b' is interrupted and the core B^3 moved to the extreme left.

Referring now to Fig. 3, the operation of my feeder-switch will be explained.

The generator S is located at any convenient place, and extending therefrom are main-circuit wires a b, adapted to supply the branch feeders a' b' with current. A third wire c runs from the switch O at the station and is normally disconnected from the source of supply. The magnet-coil I^5 is connected at one end to the main b and at the other end to the contact K^2. The magnet-coil P is connected at one end to the main a and at the other end to the contact K'. As shown, the core B^3 is in the extreme right-hand position and the toggle has forced the insulating-piece F and contacts E^2 into a position where the circuit is closed between contacts C C' and D D' and the spring-contact K is in engagement with stationary contact K'. If it is desired to open the circuit of the branch feeders a' b', the switch O is moved into engagement with the negative terminal and the circuit is as follows: from the positive side of the generator S by wire a to the coil P, stationary contact K', moving contact K, to the wire c, switch O, and the negative side of the generator. This will energize the coil P and move the core B^3 to the left. The circuit is interrupted with a quick break.

If the circuit to the branch feeders is open and is to be closed, the switch O is moved to the positive contact and the circuit is from the positive side of the generator S to the switch O, wire c, contact K, fixed contact K^2, coil I^5 of the magnet, to the wire b, and the negative side of the generator. This will energize the coil I^5 and will close the circuit between C C' and D D'. As soon as the pivot L moves to the right of the center the spring J will hold the core in the right-hand position and the circuit of the coil I^5 may be opened at the switch O. It will be seen that as soon as the core B^3 is moved either to the right or left the contact K establishes a new connection suitable for again opening or closing the switch, as the case may be.

In Fig. 4 I have shown a modification in which the contact K is mounted on the pivot L', the latter also forming a pivot for the lever F^3. The stationary contacts K' K^2 are mounted on extensions from the casting F^4 and are provided with suitable insulation. Mounted on the back of the arm Q is a lug Q', (shown in dotted lines,) with which the screws R R' on the lever F^3 are adapted to engage when the core B^3 is moved from one position to the other. Mounted in the bottom of the arm Q is a spring-plunger Q^2, provided with a roller which works on the fixed cam-surface Q^3. The screws R R' are so arranged that the core B^3 can move a certain distance before they will engage with the lug Q'. This is to insure

the circuit between the contacts K and K′ or K and K^2 being maintained until the core has moved to nearly the end of its stroke in either direction, and the spring-plunger Q^2 engaging with the surfaces of the cam Q^3 insures the establishing of the circuit between the moving contact K and the stationary contacts K′ K^2 preparatory for further operation. By this arrangement the circuit between the moving and stationary contacts can be maintained as long as desired, and by varying the adjustment of the screws R R′ it may be varied to suit different conditions.

It is within the scope of my invention to provide a plurality of switches and branch mains and to control the operation of the switches either separately or simultaneously.

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

1. In a system of distribution, the combination of supply and branch mains, a single auxiliary main extending from the point of control, as for example, a supply or sub station, to a switch for opening and closing the circuit between the supply and branch mains, an electromagnetically-controlled switch, comprising a pair of electromagnets, each having a coil permanently connected to a supply-main at one end, and alternately connected to the auxiliary main by an automatic switch.

2. In a system of distribution, the combination of positive and negative circuit-mains, branch mains leading therefrom, a single auxiliary main, an electromagnetically-controlled switch for making and breaking the circuit of the branch mains, comprising a pair of magnets each having coils permanently connected to separated mains at one end, and so arranged that one coil is always open-circuited, an automatic switch for alternately connecting the coils to the auxiliary wire, and a manually-actuated switch for including the auxiliary main in circuit with either the positive or negative supply-main.

3. The combination of supply-mains, branch mains adapted to be connected to and disconnected from the supply-mains, two solenoid-magnets acting upon a core common to both, a toggle connected to the core, contacts actuated by the toggle for making and breaking the circuit between the supply and branch mains, and a switch in the circuit of the solenoids controlled by the toggle.

4. In a switch, the combination of fixed contacts, solenoid-magnets, a toggle acted upon by the magnet-core, contacts actuated by the toggle, and a spring acting on both sides of a dead-center and connected with the toggle.

5. In a switch, the combination of fixed contacts, solenoid-magnets, cores for the magnets, contacts actuated by the cores, a single auxiliary contact also actuated by the cores for controlling the circuit of both solenoid-coils, and means whereby a certain interval of time is allowed to elapse between the operation of the main and auxiliary contacts.

6. In a switch, the combination of stationary contacts, a plurality of moving contacts, solenoid-magnets, a core common to the magnets for actuating the toggle, a guide for the toggle, a spring acting on both sides of a dead-center to assist the core, an auxiliary contact also operated by the core, means permitting a certain amount of movement of the core independent of the auxiliary contact, and means for supplying current to the solenoid-coils for operating the switch.

7. In a switch, the combination of a solenoid, an iron casing surrounding it, a hollow core secured to one end of the casing, a plate secured to the opposite end of the casing, a core provided with parts differing in their cross-section, a shoulder on the core adapted to engage with the plate on the end of the casing, and a buffer for lessening the effect of the hammer-blow at the end of the movement of the core.

8. In a switch, the combination of a solenoid-magnet, a core, a toggle actuated thereby, an energizing-coil on the magnet, a contact connected with the coil, an arm actuated by the core, a contact carried by the arm, a cam for insuring a quick break between the moving and stationary contacts, and means permitting a predetermined amount of movement of the core independent of the arm.

9. In a solenoid-magnet, the combination of an inclosing casing and energizing-coil, a cylindrical straight-bored core, a removable cap having a central opening, the metal surrounding the opening having an increased cross-section to provide a good magnetic circuit, a cylindrical movable core comprising two parts differing in their cross-section, and a piece of non-magnetic material arranged to guide the movable core within the stationary hollow core and prevent them from sticking.

In witness whereof I have hereunto set my hand this 15th day of January, 1897.

EDWARD M. HEWLETT.

Witnesses:
B. B. HULL,
M. H. EMERSON.