A. E. BERDON.

ELECTRIC CONTROLLER.

APPLICATION FILED DEC. 18, 1912.

1,067,580. Patented July 15, 1913.

Fig. 1.

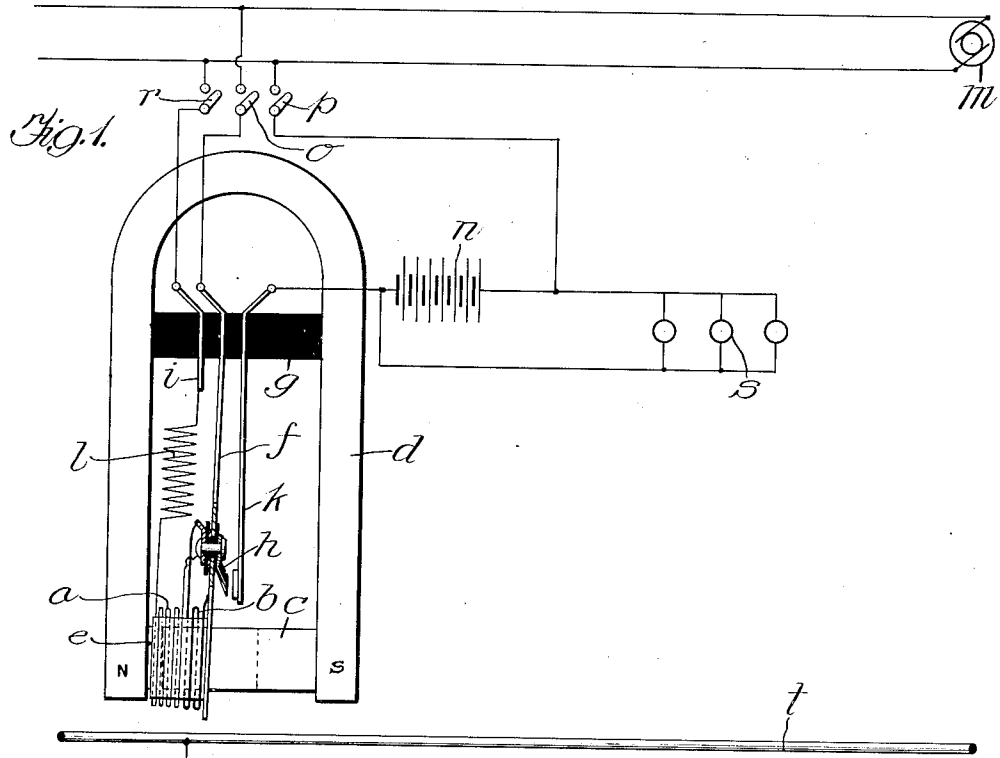


Fig. 2.

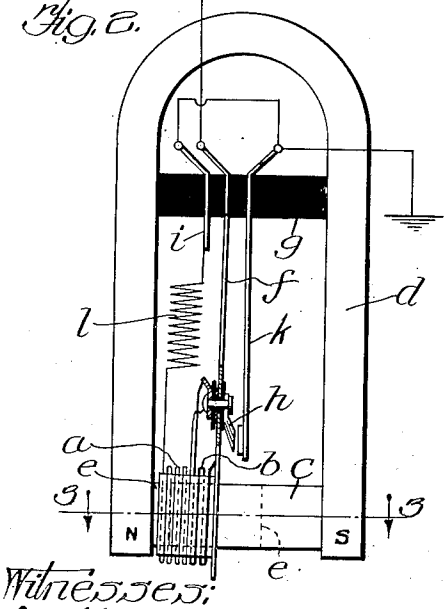
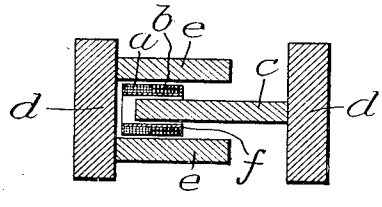


Fig. 3.



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UNITED STATES PATENT OFFICE.

ALBERT E. BERDON, OF LA FAYETTE, INDIANA.

ELECTRIC CONTROLLER.

1,067,580. Specification of Letters Patent. Patented July 15, 1913.

Application filed December 18, 1912. Serial No. 737,508.

To all whom it may concern:

Be it known that I, ALBERT E. BERDON, a citizen of the United States, residing at La Fayette, in the county of Tippecanoe and State of Indiana, have invented a certain new and useful Improvement in Electric Controllers, of which the following is a full, clear, concise, and exact description, reference being had to the accompanying drawings, forming a part of this specification.

My invention relates to electric controllers and, specifically considered, is a species of the controller disclosed in my prior application for United States Letters Patent, Serial No. 570,239, filed July 5, 1910.

My invention may be generally described as comprising an electric current controlling device and an electric circuit controlled thereby, said controller including a magnet of unchanging polarity; a movable pressure coil coöperating with said magnet whereby movement of the coil is effected upon sufficient energization of the coil; a movable current coil also coöperating with said magnet, the current and pressure coils being relatively substantially fixed, a resilient support or device for the coils and operating to restore the coils when sufficiently deënergized, and switching mechanism subject to the movement of said coils and operated upon by the pressure coil in coöperation with the magnet to alter said electric circuit at a predetermined minimum value of electromotive force impressed on said pressure coil and operated upon by the current coil in cooperation with the magnet to maintain the change in the circuit effected by the pressure coil.

I will explain my invention fully by reference to the accompanying drawing showing the preferred embodiment thereof and illustrating two of many applications to which the invention may be put.

In the drawing Figure 1 illustrates a storage battery charging circuit in connection with which the device is used; Fig. 2 shows the device as it may be employed to prevent appreciable current from flowing from ground to underground piping; and Fig. 3 is a sectional view on line 3 3 of Fig. 2, certain pole pieces being broken away in Fig. 1 and Fig. 2 for clearness.

Like parts are indicated by similar characters of reference throughout the figures.

The high resistance pressure coil *a* and the comparatively low resistance current coil *b* are fixed with respect to each other and are in the form of solenoid coils whose bores are placed in alinement and surround a permanent magnet soft iron pole piece *c* secured at one end to one side of a permanent magnet *d* and free of attachment at its other end. Soft iron pole pieces *e* are secured to the other side of the magnet and overlap pole piece *c*, suitable air spaces intervening between the pole piece *c* and the pole pieces *e* in which the coils *a* and *b* are free to move while surrounding the pole piece *c*. The coils *a* and *b* are mounted in fixed relation to each other upon the free lower end of a movable support in the form of a leaf spring *f* whose upper end is anchored within a support *g* of insulating material. The spring support *f* is itself, preferably, one terminal of the current coil, the other terminal of the current coil residing in a brush contact *h* mounted upon the spring *f* near its lower end, but insulated from direct electrical connection with said spring. The current coil contact terminal *h* also constitutes one terminal of the pressure coil *a*, the other terminal of the pressure coil residing in a short strip of metal *i* embedded in the insulating support *g*. When the controller is in operation the pressure coil is constantly in circuit by way of the current coil, while the current coil is adapted for inclusion in circuit by way of the contact provided upon the lower free end of a contact spring *k* whose upper end is held in the mounting block *g*.

I will now refer more particularly to Fig. 1 which shows the use of the device in connection with a storage battery charging circuit. The direct current generator *m* is adapted for inclusion in circuit with the storage battery *n* by the switch members *o* and *p* at which time the switch member *r* is also closed so as to include the pressure coil *a* in bridge of the generator mains and thereby occasion the closure of the charging circuit at *h*, the charging circuit being traced from the upper pole of the generator *m* through the switch portion *o*, the spring support *f*, the current coil *b*, the contact *h*, the contact spring *k*, the battery *n*, the switch part *p*, to the lower terminal of the generator *m*. The load for the battery (which may be also supplied with current from the generator *m* when operating) is indicated at *s*. When the generator is thrown into circuit with the battery and its load, the pressure coil *a* is included in bridge

of the charging circuit and in parallel with the battery and the load *s*, the initial path containing the pressure coil being traced from the upper side of the generator circuit through the switch part *o*, the spring *f*, the current coil *b*, the pressure coil *a*, the resistance *l*, the terminal *i*, the switch part *r*, to the lower side of the generator circuit. The bridge resistance *l* is so adjusted, or the strength of the spring *f* supporting the coils *a* and *b* is so adjusted that voltage equal to the average voltage of the battery to be charged is capable of effecting movement of the coils until the charging circuit is established at *h*, movement of the coil *a* to the right (carrying with it coil *b*) being due to the coöperation of the permanent magnet, the coils in their movement being accompanied by the flexure of the spring *f* that permits the establishment of the charging circuit at *h*. Any increase of voltage impressed upon the mains will cause current to flow through the battery *m* in such direction as to charge it, the pressure at the contact *h* being in proportion to the strength of the current because of the series coil *b*. A reduction of voltage impressed on the mains will first reduce the pressure at contact *h* to zero and then permit the charging circuit to open at *h* due to the resiliency of the supporting spring *f*. A reversed current cannot exist because of the polarized action due to permanent magnet, a reverse current tending to cause wider separation of contacts at *h* and while the permanent magnet is preferably of the ordinary permanent magnet horseshoe formation, I do not limit myself to a magnet lacking an energizing winding. Likewise reversed potential will prevent circuit from being closed. While the charging circuit is closed the switch *r* may be opened without stopping the charging operation until the current reduces to such a value that the ampere turns of the series coil *b* alone will not be sufficient to maintain the contact at *h*, whereupon the charging circuit will open at *h* and remain open until switch *r* be again closed.

In Fig. 2 I have illustrated a use of my device in connection with electrolysis troubles. The device permits the flow of current in one direction but prevents current from flowing in the reverse direction. In the circuit as shown current may flow from the pipe *t* to ground but not from ground to the pipe except the very small current that traverses the potential circuit of the breaker. In this instance the spring *f* is made very weak and the shunt of very high resistance to keep down this current flow to a negligible quantity.

While I have herein shown and particularly described the preferred embodiment of my invention, I do not wish to be limited to the precise details of construction shown as changes may readily be made without departing from the spirit of my invention, but

Having thus described my invention I claim as new and desire to secure by Letters Patent the following:—

1. An electric controller and an electric circuit controlled thereby, said controller including a magnet of unchanging polarity; a movable hollow pressure coil subject to the pressure of the controlled circuit and surrounding a pole of said magnet whereby said coil is moved by the coöperation of the magnetic fields produced by the magnet and coil when the coil is sufficiently energized; a movable hollow current coil receiving current from the controlled circuit and also surrounding the pole of the magnet that is surrounded by the pressure coil, the current and pressure coils being relatively substantially fixed; means for restoring the coils to normal position when sufficiently deenergized; and a switching device actuated upon the coöperation of the pressure coil and magnet to close said electric circuit at a predetermined minimum value of electromotive force impressed on the pressure coil, the current coil and magnet coöperating to operate upon said switch to maintain the circuit closed when the current coil is sufficiently energized.

2. An electric controller and an electric circuit controlled thereby, said controller including a magnet of unchanging polarity; a movable hollow pressure coil subject to the pressure of the controlled circuit and surrounding a pole of said magnet whereby said coil is moved by the coöperation of the magnetic fields produced by the magnet and coil when the coil is sufficiently energized; a movable hollow current coil receiving current from the controlled circuit and also surrounding the pole of the magnet that is surrounded by the pressure coil, the current and pressure coils being relatively substantially fixed; means for restoring the coils to normal position when sufficiently deënergized; and switching mechanism subject to the movement of said coils and operated upon by the pressure coil in coöperation with the magnet to alter said electric circuit at a predetermined minimum value of electromotive force impressed on said pressure coil and operated upon by the current coil in coöperation with the magnet to maintain the change in the circuit effected by the pressure coil.

3. An electric controller and an electric circuit controlled thereby, said controller including a magnet of unchanging polarity; a movable hollow pressure coil subject to the pressure of the controlled circuit and surrounding a pole of said magnet whereby said coil is moved by the coöperation of the magnetic fields produced by the magnet and coil when the coil is sufficiently energized;

a movable hollow current coil receiving current from the controlled circuit and also surrounding the pole of the magnet that is surrounded by the pressure coil, the current and pressure coils being relatively substantially fixed; a resilient support for the coils and operating to restore the coils when sufficiently deënergized; and a switching device actuated by the coöperation of the pressure coil and magnet to close said electric circuit at a predetermined minimum value of electromotive force impressed on the pressure coil, the current coil and magnet coöperating upon said switch to maintain the circuit closed when the current coil is sufficiently energized.

4. An electric controller and an electric circuit controlled thereby, said controller including a magnet of unchanging polarity; a movable hollow pressure coil subject to the pressure of the controlled circuit and surrounding a pole of said magnet whereby said coil is moved by the coöperation of the magnetic fields produced by the magnet and coil when the coil is sufficiently energized; a movable hollow current coil receiving current from the controlled circuit and also surrounding the pole of the magnet that is surrounded by the pressure coil, the current and pressure coils being relatively substantially fixed; a resilient support for the coils and operating to restore the coils when sufficiently deënergized; and switching mechanism subject to the movement of said coils and operated upon by the pressure coil in coöperation with the magnet to alter said electric circuit at a predetermined minimum value of electromotive force impressed on said pressure coil and operated upon by the current coil in coöperation with the magnet to maintain the change in the circuit effected by the pressure coil.

5. An electric controller and an electric circuit controlled thereby, said controller including a magnet of unchanging polarity; a movable pressure coil subject to the pressure of the controlled circuit and coöperating with said magnet whereby movement of the coil is effected upon sufficient energization of the coil; a movable current coil receiving current from the controlled circuit and also coöperating with said magnet to effect movement of this coil, the current and pressure coils being relatively substantially fixed; means for restoring the coils to normal position when sufficiently deënergized; and a switching device actuated upon the coöperation of the pressure coil and magnet to close said electric circuit at a predetermined minimum value of electromotive force impressed on the pressure coil, the current coil and magnet coöperating to operate upon said switch to maintain the circuit closed when the current coil is sufficiently energized.

6. An electric controller and an electric circuit controlled thereby, said controller including a magnet of unchanging polarity; a movable pressure coil subject to the pressure of the controlled circuit and coöperating with said magnet whereby movement of the coil is effected upon sufficient energization of the coil; a movable current coil receiving current from the controlled circuit and also coöperating with said magnet to effect movement of this coil, the current and pressure coils being relatively substantially fixed; means for restoring the coils to normal position when sufficiently deënergized; and switching mechanism subject to the movement of said coils and operated upon by the pressure coil in coöperation with the magnet to alter said electric circuit at a predetermined minimum value of electromotive force impressed on said pressure coil and operated upon by the current coil in coöperation with the magnet to maintain the change in the circuit effected by the pressure coil.

7. An electric controller and an electric circuit controlled thereby, said controller including a magnet of unchanging polarity; a movable pressure coil subject to the pressure of the controlled circuit and coöperating with said magnet whereby movement of the coil is effected upon sufficient energization of the coil; a movable current coil receiving current from the controlled circuit and also coöperating with said magnet to effect movement of this coil, the current and pressure coils being relatively substantially fixed; a resilient support for the coils and operating to restore the coils when sufficiently deënergized; and a switching device actuated by the coöperation of the pressure coil and magnet to close said electric circuit at a predetermined minimum value of electromotive force impressed on the pressure coil, the current coil and magnet coöperating upon said switch to maintain the circuit closed when the current coil is sufficiently energized.

8. An electric controller and an electric circuit controlled thereby, said controller including a magnet of unchanging polarity; a movable pressure coil subject to the pressure of the controlled circuit and coöperating with said magnet whereby movement of the coil is effected upon sufficient energization of the coil; a movable current coil receiving current from the controlled circuit and also coöperating with said magnet to effect movement of this coil, the current and pressure coils being relatively substantially fixed; a resilient support for the coils and operating to restore the coils when sufficiently deënergized; and switching mechanism subject to the movement of said coils and operated upon by the pressure coil in coöperation with the magnet to alter said

electric circuit at a predetermined minimum value of electromotive force impressed on said pressure coil and operated upon by the current coil in coöperation with the magnet to maintain the change in the circuit effected by the pressure coil.

9. An electric controller and an electric circuit controlled thereby, said controller including a magnet of unchanging polarity; a movable hollow pressure coil subject to the pressure of the controlled circuit and surrounding a pole of said magnet whereby said coil is moved by the coöperation of the magnetic fields produced by the magnet and coil when the coil is sufficiently energized; a movable hollow current coil receiving current from the controlled circuit and also surrounding the pole of the magnet that is surrounded by the pressure coil, the current and pressure coils being relatively substantially fixed; means for restoring the coils to normal position when sufficiently deënergized; and a switching device for governing the electric circuit and in turn governed by said coils.

10. An electric controller and an electric circuit controlled thereby, said controller including a magnet of unchanging polarity; a movable pressure coil subject to the pressure of the controlled circuit and coöperating with said magnet whereby movement of the coil is effected upon sufficient energization of the coil; a movable current coil receiving current from the controlled circuit and also coöperating with said magnet to effect movement of the coil, the current and pressure coils being relatively substantially fixed; means for restoring the coils to normal position when sufficiently deënergized; and a switching device for governing the electric circuit and in turn governed by said coils.

11. An electric controller and an electric circuit controlled thereby, said controller including a magnet of unchanging polarity; a movable hollow pressure coil subject to the pressure of the controlled circuit and surrounding a pole of said magnet whereby said coil is moved by the coöperation of the magnetic fields produced by the magnet and coil when the coil is sufficiently energized; a movable hollow current coil receiving current from the controlled circuit and also surrounding the pole of the magnet that is surrounded by the pressure coil, the current and pressure coils being relatively substantially fixed; a resilient support for the coils and operating to restore the coils when sufficiently deënergized; and a switching device for governing the electric circuit and in turn governed by said coils.

12. An electric controller and an electric circuit controlled thereby, said controller including a magnet of unchanging polarity; a movable pressure coil subject to the pressure of the controlled circuit and coöperating with said magnet whereby movement of the coil is effected upon sufficient energization of the coil; a movable current coil receiving current from the controlled circuit and also coöperating with said magnet to effect movement of this coil, the current and pressure coils being relatively substantially fixed; a resilient support for the coils and operating to restore the coils when sufficiently deënergized; and a switching device for governing the electric circuit and in turn governed by said coils.

In witness whereof, I hereunto subscribe my name this seventh day of October A. D., 1912.

ALBERT E. BERDON.

Witnesses:
A. J. WEBER,
J. W. ESTERLINE.