No. 851,420. PATENTED APR. 23, 1907.

R. B. HEWITT & J. G. NOLEN.

ELECTROTHERMAL SWITCH.

APPLICATION FILED JUNE 5, 1903.

Fig. 1.

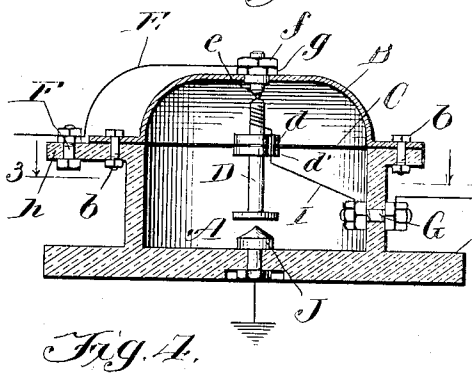


Fig. 2.

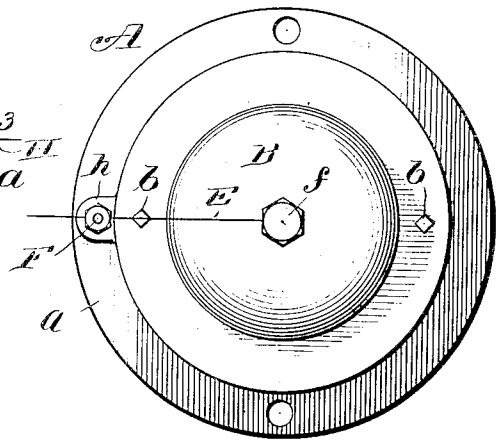


Fig. 4.

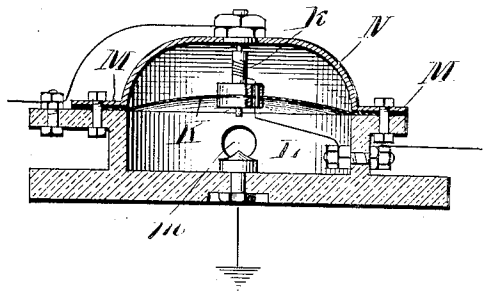


Fig. 3.

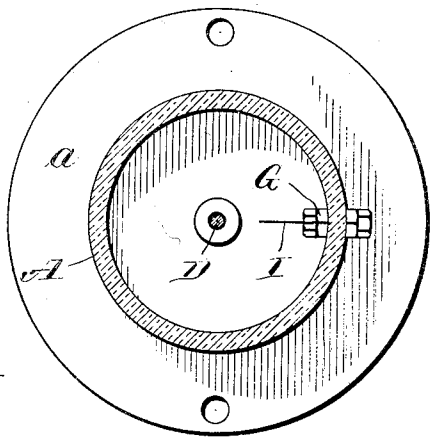


Fig. 5.

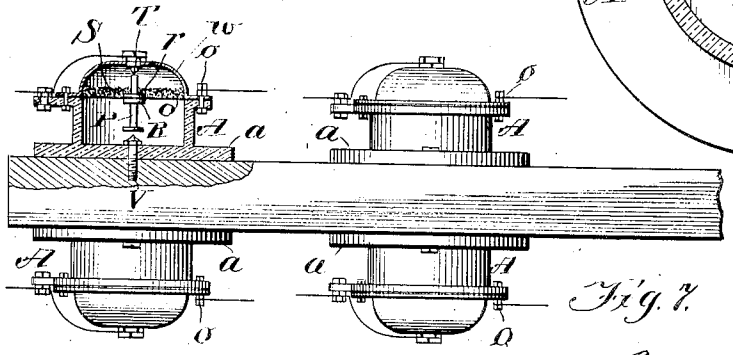


Fig. 8.

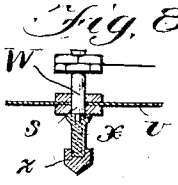


Fig. 7.

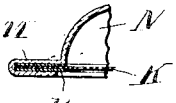
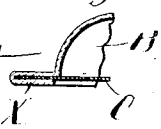


Fig. 6.



Witnesses:

H. S. Gaither

D. R. Greene

Inventors

Richard B. Hewitt and

James G. Nolen

by Frank D. Thomasson

Attorney.

UNITED STATES PATENT OFFICE.

RICHARD B. HEWITT AND JAMES G. NOLEN, OF CHICAGO, ILLINOIS; SAID NOLEN ASSIGNOR TO FRANK B. COOK, OF CHICAGO, ILLINOIS.

ELECTROTHERMAL SWITCH.

No. 851,420. Specification of Letters Patent. Patented April 23, 1907.

Application filed June 5, 1903. Serial No. 160,182.

To all whom it may concern:

Be it known that we, RICHARD B. HEWITT and JAMES G. NOLEN, both citizens of the United States, and residents of Chicago, in the county of Cook and State of Illinois, have invented certain new and useful Improvements in Electrothermal Switches, of which the following is a full, clear, and exact description.

Our invention relates to electric switches, and has for its object the automatically switching of the current passing therethrough, when the resistance to the circuit, after it leaves the switch, would have a tendency to endanger the connections or devices in the circuit. This we accomplish by simple and economical means, comprising hermetically sealed elements forming part of a normally closed circuit, substantially as hereinafter fully described, and as particularly pointed out in the claims.

In the drawings, Figure 1 is a vertical central sectional view of our improved switch. Fig. 2 is a plan view of the same. Fig. 3 is a horizontal section therethrough, taken on dotted line 3—3, Fig. 1. Fig. 4 is a vertical central section of a modification of said switch. Fig. 5 is a side view of a group or battery of said switches, showing one, which embodies yet another modification, in vertical central section. Figs. 6 and 7 are detail views showing in section different methods of securing the edges of the diaphragms of the switches to the cover of the box. Fig. 8 is a detail view showing in longitudinal section, a modified form of one of the electrodes of the switch.

Referring to the drawings, A represents a box of suitable insulating material, one end of which is provided with a circumferential flange *a*, by means of which it may be screwed or otherwise secured to its support. The edges of the mouth of this box are flanged outwards, and secured to these flanged edges, preferably, by means of bolts *b*, are the corresponding flanged edges of the cap or cover B, which is made dome-shape, or is otherwise constructed to provide an interior chamber, which is separated from the chamber enclosed within the box by a diaphragm C. This diaphragm C is made of isinglass or other suitable insulating material, and its edges are securely clamped between the flanged edges of the cover and box, as shown in Fig. 1 of the drawings. If desired, however, the edges of the diaphragm might be seamed in the edges of the cap B, before the latter are secured to the edges of the box, as shown at X, in Fig. 6 of the drawings. Extending centrally through this diaphragm is a metal spindle D, the exterior of which is covered with a suitable insulation, and which is secured in position to said diaphragm by nuts or washers *d*, *d'*, located thereon both above and below the diaphragm. This spindle is of a suitable length, and is so disposed that the part above the diaphragm extends nearly to the top of the box, and its exposed terminal is normally in touch with the contact *e*. This contact *e* comprises a short bolt, which extends up through suitable insulation in the top of the cover, in alignment with spindle D, and has nuts *f*, and *g*, on its upper screw-threaded end, that adapt it to serve as a binding-post for the negative wire E of the circuit. Wire E may extend direct from contact *e* to the means for utilizing the current carried thereby. I prefer, however, to run it to a suitable binding-post F, secured to a lug *h* projecting from the flanged edge of the mouth of the box, and have the main wire of the circuit extend from there.

At a desirable point below the diaphragm a double end binding-post G is passed through the side-walls of box A, to the outer end of which the positive end of the main-wire H is secured, and to the inner end of which, a short wire I is connected that extends to and through an insulated opening in the washers *d*, *d'*, into the chamber above the diaphragm, and is coiled around the portion of spindle D in said chamber, and has its contiguous end soldered in the upper exposed metal end of the spindle, substantially as shown in the drawings.

When constructed as above-described, any resistance to the current in wire E, causes the portion of the wire-coil I in the cap above the diaphragm, to heat the spindle, which thus heats the air in the chamber and causes it to expand and to force the diaphragm downwards. When the latter moves downwards, the upper end of the spindle disconnects from contact *e*, and its lower end moves downward and comes in contact with the head of a post J, secured in the closed end of the box in alignment therewith, and switches the current through said post and the electrical connections thereof.

In Fig. 4 we show a modification of our im-

proved switch, in which the diaphragm K is made of metal, and has a part thereof, separating the interior chambers of the box and the cover, concavo-convex, and so arranged that the convex side, normally, enters the chamber enclosed within the cover. The construction of the spindle *k*, used in connection with this modified form of diaphragm, is substantially the same as that illustrated in Fig. 1 of the drawings, except that the portion of the spindle below the diaphragm is considerably shortened. This is due to the fact that the movement of a concavo-convex diaphragm is considerably greater than that of a diaphragm, such as described in Fig. 1, and, in order to permit of this increased movement the shortening of the spindle is necessary. The operation of the switch shown in Fig. 4 is the same as that shown in Fig. 1, with the exception that when the diaphragm is at the limit of its lower movement it will not automatically return to the position shown in the drawings. It is necessary, therefore, to provide the walls of the cup L with a finger-opening *m*, through which the finger is inserted, to press the diaphragm upwards, and restore it to its original position. If desired, the edges of the diaphragm K may be enclosed within the folds of insulating material *n* and seamed within the flanged edges M of the cap or cover N, substantially as shown in Fig. 7 of the drawings.

In Fig. 5 of the drawings we show a cross-section of another modification of our invention. In this switch the diaphragm O is similar to that shown in Fig. 1 of the drawings, and a binding-post *o* is made of one of the bolts used for clamping the flanged edges of the cover and the box together. The spindle P is the same as that shown in Fig. 1, excepting it is not enclosed in insulating material, and it is secured in and insulated from the diaphragm by the washers *r*, R. A layer of granular graphite or carbon S of sufficient thickness is placed upon the diaphragm, and is of such depth or thickness that it forms an electrical connection between the spindle P and the outer shell *w*, and when there is resistance in the circuit, this granular graphite or carbon becomes heated sufficiently to expand the air in the chamber above the diaphragm, and throw the spindle out of engagement with the negative contact T, which is insulated from the shell *w*, and into contact with the post V.

Instead of using the layer of graphite or carbon S shown in Fig. 5 of the drawings we can, if desired, use a spindle W, substantially as shown in Fig. 8 of the drawings. In this the part of the spindle *s* is within the chamber enclosed within the box, extends through and is secured in the diaphragm *v*, and has its upper end extend into a short carbon stick *x*, which is enclosed within the chamber surrounded by the cap or cover, and has a suitable metallic head *z*, which comes nearest and engages a contact of the negative wire of the circuit.

What we claim as new and desire to secure by Letters Patent is:—

1. An electric switch comprising a sealed chamber; a negative pole and a positive pole normally in contact and enclosed within said chamber; and electro-thermal means within said chamber, the increased temperature of which separate said poles, and exterior electrical connections for maintaining the continuity of the actuating electric circuit.

2. An electric switch comprising a sealed chamber; one side of which is flexible; a negative pole and a positive pole; which are normally in contact and one of which is secured in said flexible side and the other in the rigid wall thereof; and electro-thermal means within said chamber the increased temperature of which separate said poles, and exterior electrical connections for maintaining the continuity of the actuating electric circuit.

3. An electric switch comprising a sealed chamber; a negative pole and a positive pole, one of which is movable and which are normally in contact and are enclosed within said chamber, and electro-thermal means within said chamber the increase in temperature of which separate said poles, and exterior electrical connections for maintaining the continuity of the actuating electric circuit.

4. An electric switch comprising a sealed chamber; an automatically returnable flexible side therefor; a negative pole and a positive pole, which are normally in contact and one of which is secured in said flexible side and the other in the rigid wall thereof; and electro-thermal means within said chamber the increased temperature of which separate said poles, and exterior electrical connections for maintaining the continuity of the actuating electric circuit.

5. An electric switch comprising a sealed chamber; a vibratory switch member, one end of which is enclosed and terminates within said chamber, and the other extends and terminates outside of said chamber; opposite electrical contacts, one within and the other outside of said chamber, and electro-thermal devices within said chamber the increase in temperature of which moves said switch out of its normal contact with the contact within said chamber to that outside the same.

6. An electric switch comprising a suitable closed box; a flexible diaphragm dividing the same into two compartments one of which is hermetically sealed; a metallic spindle carried by said diaphragm, one end of which terminates in said sealed chamber and the other end in the other chamber; and electro-thermal devices in said sealed chamber through which a continuous electric current passes and which is electrically connected to

said spindle; and antipodal electrical contacts with one or the other of which said spindle is alternately in contact.

7. An electric switch comprising a suitable closed box; a flexible diaphragm dividing the same into two compartments one of which is hermetically sealed; a metallic spindle carried by said diaphragm, one end of which terminates in said sealed chamber and the other end in the other chamber; and a wire coil terminal extending into said sealed chamber through which a continuous electric current passes and which is electrically connected to said spindle; and antipodal electrical contacts with one or the other of which said spindle is alternately in contact.

8. An electric switch comprising a suitable box; a cover therefor; a flexible diaphragm the edges of which are secured between the edges of said box and cover, and make a sealed chamber in said cover; a metallic spindle one end of which extends centrally into said sealed chamber and has the portion therein insulated, and the other end of which extends into the chamber enclosed by the box; an electrical connection in the top of said box in alignment with said spindle with which said spindle is normally in contact; an electrical connection in the bottom of said box in alignment with the said spindle; and a coiled wire electric circuit terminal extending into said sealed chamber coiled around the insulated portion of the spindle, and having its pole electrically connected with the same.

9. An electric switch comprising a suitably constructed sealed chamber, one side of which is flexible; electro-thermal means connected in series with said chamber, the increased temperature of which moves the flexible side of said chamber and automatically switches and maintains the continuity of the actuating electric circuit.

10. An electro-thermal switch comprising a flexible metallic diaphragm, a casing enclosing said diaphragm, there being a confined body of air at one side of said diaphragm, a high resistance associated with said confined body of air, and circuit-controlling contacts mounted at opposite sides of and opened and closed by said diaphragm.

11. An electric switch comprising a suitably constructed sealed chamber, one side of which is flexible; electro-thermal means connected in series with said chamber, the increased temperature of which moves the flexible side of said chamber and automatically switches and maintains the continuity of the actuating electric circuit.

12. An eletro-thermal switch comprising a flexible metallic diaphragm, a confined body of air at one side of said diaphragm, a high resistance associated with said confined body of air, and circuit-controlling contacts mounted at opposite sides of and opened and closed by said diaphragm.

In testimony whereof we hereunto set our hands this 25th day of May, 1903.

RICHARD B. HEWITT.
JAMES G. NOLEN.

Witnesses:
FRANK D. THOMASON,
E. K. LUNDY.