Nov. 16, 1926. 1,607,582

W. R. WALKER

METHOD OF MAKING ELECTRIC SWITCHES

Filed Nov. 10, 1923

Fig. 1

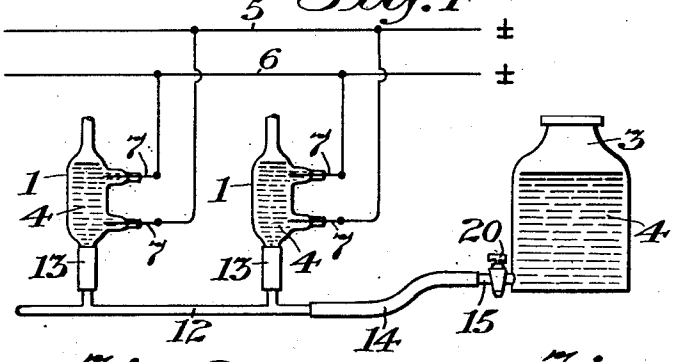


Fig. 2

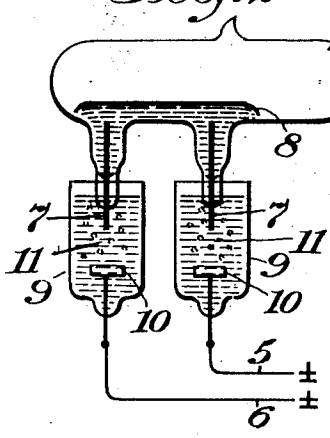


Fig. 4

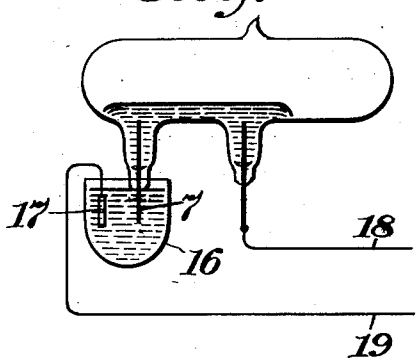


Fig. 3

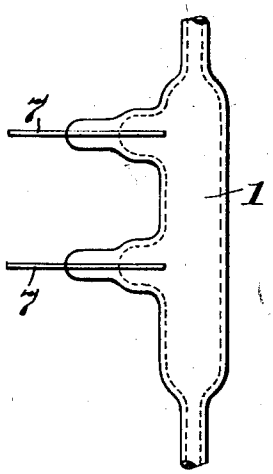
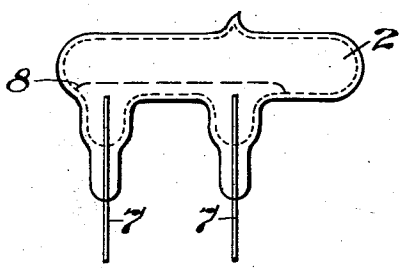


Fig. 5



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UNITED STATES PATENT OFFICE.

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METHOD OF MAKING ELECTRIC SWITCHES.

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The present invention relates to mercury electric switches and the like and a method in the making of them. It relates particularly to the sealing in of metal electrode terminals in such switches and the preparation of such terminals for actual use and operation.

In the sealing in of electrode terminals in the walls of switches, lamps, and other electrical apparatus and the like, the heat necessary for the fusion of such walls which are usually of glass causes the oxidation of the metal of the terminals. And the removal of this coating of oxide from the sealed-in terminal has heretofore been done with considerable difficulty, if at all, and has contributed materially to the cost of production of such apparatus. For practical application methods heretofore used have been highly unsatisfactory in that they entailed either prohibitive cost or produced results of a very low grade.

An object of this invention is to provide a method for the thorough cleaning of such electrodes and to prepare their surfaces for good electrical contact for use with mercury, for contact with solid metal conductors, and for the soldering to them of external leads.

The description of this invention and the drawings of apparatus which are used to carry out this method will for purpose of illustration refer to the production of electric switches of the mercury pool type and to the method of cleaning both the inside and the outside ends of the terminals of such switches.

In the drawing in which like numerals refer to like parts throughout:

Fig. 1 is a schematic diagram showing apparatus and electrical connections for practicing the method of producing and cleaning the inner ends of mercury switch terminals.

Fig. 2 is a schematic diagram showing apparatus and electrical connections for practicing the method of producing and cleaning the outer ends of mercury switch terminals.

Fig. 3 is a view of the body of a mercury switch in the form in its process of manufacture in which the inner ends of its terminals are cleaned by my method and apparatus.

Fig. 4 shows apparatus for plating the external terminal or lead-in wire of the switch.

Fig. 5 shows a completed mercury switch having interior and exterior terminals or lead-in wires cleaned and its external terminals plated.

For cleaning and deoxidizing the electrodes or those parts thereof projecting from the wall of the switch electric current is employed to produce electrolytic action at the surfaces of the metal. For this purpose the metal part is immersed in an electrolytic solution suitably connected to a source of electric current and which completes the electric circuit through the metal part or parts. The solution may be an alkali solution of either sodium hydroxide, potassium hydroxide, or any other suitable electrolyte solution which may be prepared from chemicals readily obtained on the market, but I prefer to use a solution of sodium hydroxide. This solution, at low voltages, will sustain electrolytic action which will deoxidize the metal of the terminals in a short space of time. The current may be either alternating or direct but I use alternating current and the drawing and description of my invention will be directed mainly to the use of alternating current and apparatus therefor, it being apparent however that this apparatus may be used with direct current. However, by having the two, or more, electrodes immersed in the alkali solution at the same time and by having them in the same electric circuit I am able to clean all the electrodes of a switch simultaneously.

For cleaning the electrodes I use method and apparatus described as follows:

The manifold 12, is connected to the bottle 3 by means of the rubber tubing 14 and the spout 15 of the bottle, in which is the valve 20 (see Fig.1). To the manifold is connected by means of the short lengths of rubber tubing 13 the body walls 1 of mercury switches 4 into the walls of which the terminals 7, 7, have been sealed. The switch bodies 1, 1, and the bottle 3 are filled with a caustic soda solution and the level of the bottle placed so that the liquid in the body 1 is well above the upper terminal 7. To the several terminals 7 of each of the switch bodies are connected leads from the supply mains 5 and 6 of the supply

of alternating current. As shown in Figure 1 one lead of this main is connected to one tungsten terminal of the switch, and the other to the other tungsten terminal thereof, the switch being of the two electrode type. Current is then passed through the mains and consequently through the electrolyte in the switches and the terminals of said switches, the electrolytic action set up in the solution deoxidizing and cleaning the ends of the tungsten terminals immersed in the solution. By the use of alternating current instead of direct current I secure the cleaning of both terminals simultaneously, whereas with direct current it is necessary to reverse the polarity of a given pair of terminals to secure the cleaning of each terminal.

After sufficient electrolytic action has taken place to completely deoxidize and clean the terminals the bottle 3 is lowered to thereby permit the caustic solution to flow from the interior of the switch bodies 1. These bodies then are detached from the manifold 13, and thoroughly rinsed out to remove the electrolyte and then dried. The ends of the switch body are then sealed, and the switch tubulated, connected to an exhaust pump to evacuate the tube, the tube next being supplied with the desired quantity of mercury, a suitable gas being introduced if desired, and the tube sealed off.

As shown in Figure 2 the terminals of the switch are immersed in caustic solution which is held in cups 9. The electrical terminals 10 of said cups are connected to the mains 5 and 6 of an alternating current supply, and current passed through the solution 10, the terminals 7 and the mercury 8 of the switch. By means of the electrolytic action produced in the solution 10 the outside ends of the tungsten terminals 7 are deoxidized and cleaned. After such cleaning the terminal ends are washed to remove the electrolyte and one of them immersed in a cup 16, similar to 9, containing an electrode 17, and a solution for nickel plating. The plating electrode and the other terminal of the switch are then connected to a source of direct current 18 and 19, and the immersed electrode plated with a coating of nickel. After this the switch terminals are reversed and the second terminal is plated (see Fig. 4).

In the event that a metal which does not lend itself to soft soldering, such as tungsten, is used as the terminals 7, 7, the coating thereof with nickel permits of the ready attachment to the exterior portion of the terminal of wires by soft soldering methods now common in the art, thus making a device of this type available to the trade equipped with the ordinary apparatus for joining electrical conductors and doing away with the necessity of maintaining and carrying on expensive hard soldering, brazing and welding apparatus and methods for this purpose. The plated coating may be of other material than nickel, such for instance as cobalt, copper, silver, gold or any suitable metal which lends itself to soft soldering.

While I have described my invention in connection with the production of a new and efficient type of switch with tungsten terminals and having properties not present in the devices heretofore known, it is to be understood that my invention is not limited to this particular device but is useful in the production of devices generally and particularly electrical ones where terminals of any suitable metal are desired free from deleterious oxide or other material on the terminals.

I claim—

1. In the manufacture of switches comprising a glass wall, terminal electrodes sealed therethrough and mercury therein, a method of cleaning and deoxidizing said terminal electrodes which comprises filling an open ended switch body having the electrodes sealed through the walls thereof with a caustic solution, and passing an electric current through said electrodes and caustic solution, to cleanse and deoxidize said electrodes, removing said caustic solution, drying the interior of the switch, and supplying with the desired quantity of mercury and sealing the said open ends of the switch wall.

2. In the manufacture of electric switches having glass walls, electrodes sealed through said wall, and mercury therein, a method of cleansing and deoxidizing said electrodes which comprises supplying the switch body at that step in its manufacture in which it has its ends open and the electrodes sealed through the walls thereof, with a caustic solution to a level above said electrode terminals to afford electric contact between said terminals and to completely cover the surfaces thereof, passing an alternating current through said electrodes and said caustic solution to cleanse and deoxidize the surfaces of said electrodes, removing said caustic solution, drying the interior of the switch, adding the desired amount of mercury, sealing off said open ends of the switch wall inserting the outer ends of said electrode terminals in separate cups containing caustic solution while the switch is in such a position that the mercury therein electrically connects the terminals thereof, and passing an electric current through said caustic solution, said terminals, and said mercury to cleanse and deoxidize the surfaces of said outer ends of the terminals, removing and drying the caustic solution from said terminals.

3. In the manufacture of electric switches having glass walls, electrodes sealed through said wall, and mercury therein, a method of

cleansing and deoxidizing said electrodes which comprises supplying the switch body at that step in its manufacture in which it has its ends open and the electrodes sealed through the walls thereof, with a caustic solution to a level above said electrode terminals to afford electric contact between said terminals, passing an alternating current through said electrodes and said caustic solution to cleanse and deoxidize the surfaces of said electrodes, removing said caustic solution, drying the interior of the switch, adding the desired amount of mercury, sealing off said open ends of the switch wall completely immersing the outer ends of said electrode terminals in separate cups containing caustic solution while the switch is in such a position that the mercury therein electrically connects, the terminals thereof, passing an electric current through said caustic solution, said terminals, and said mercury to cleanse and deoxidize said outer ends of the terminals, removing and drying the caustic solution from said terminals, and then electro-plating said outer ends of the terminal electrodes with a metal to which solder is readily applied.

4. In apparatus for producing electrolytic action at the interior terminals of a mercury switch, in combination, a source of electric current supply, a vertically movable reservoir containing caustic solution, a manifold flexibly connecting the container of said supply and said manifold, taps along said manifold, means on said taps for connecting open ended bodies of glass switches thereto and means for raising and lowering the level of said solution in said container above and below the level of the electrodes of said switch, and leads for connecting said current supply to the electrodes of said switch.

5. In the manufacture of electric devices comprising an insulating wall and terminals joined thereto, the method of cleaning said terminals which consists in immersing the terminals in an electrolyte and causing said terminals to act as electrodes of an electric circuit through the electrolyte.

6. A wall of insulating material and a conductor sealed thereto electrolytically freed of deleterious material.

7. A mercury switch having a sealed vitreous envelope and a conducting liquid therein, and having sealed through the walls thereof terminals which have been cleaned interiorly electrolytically.

8. A mercury switch having a sealed vitreous envelope and a conducting liquid therein, and having sealed through the walls thereof terminals which have been cleaned interiorly and exteriorly electrolytically.

9. A mercury switch having a sealed vitreous envelope and a conducting liquid therein, and having sealed through the walls thereof terminals which have been cleaned interiorly and exteriorly electrolytically and having their exterior portions nickeled.

10. A mercury switch having a sealed vitreous envelope and a conducting liquid therein, and having sealed through the walls thereof terminals which have been cleaned interiorly and exteriorly electrolytically and having their exterior portions electroplated.

11. A mercury switch having a sealed vitreous envelope and a conducting liquid therein, and having sealed through the walls thereof terminals which have been cleaned interiorly and exteriorly electrolytically and having their exterior portions electroplated with nickel.

12. A mercury switch having a sealed vitreous envelope and a conducting liquid therein, and having sealed through the walls thereof, terminals which have been cleaned interiorly and exteriorly electrolytically and having their exterior covered with a coating of solder adherent material.

13. A mercury switch having a sealed vitreous envelope and a conducting liquid therein, and having sealed through the walls thereof tungsten terminals which have been cleaned interiorly and exteriorly electrolytically and having their exterior covered with a coating of solder adherent material.

Signed at Hoboken in the county of Hudson and State of New Jersey this 9th day of November, A. D. 1923.

WARREN R. WALKER.