W. B. CROSSLAND.

ELECTRIC SWITCH FOR INCANDESCENT LAMP CIRCUITS.

APPLICATION FILED AUG. 9, 1909.

960,626.

Patented June 7, 1910.

3 SHEETS—SHEET 1.

Fig. 1.

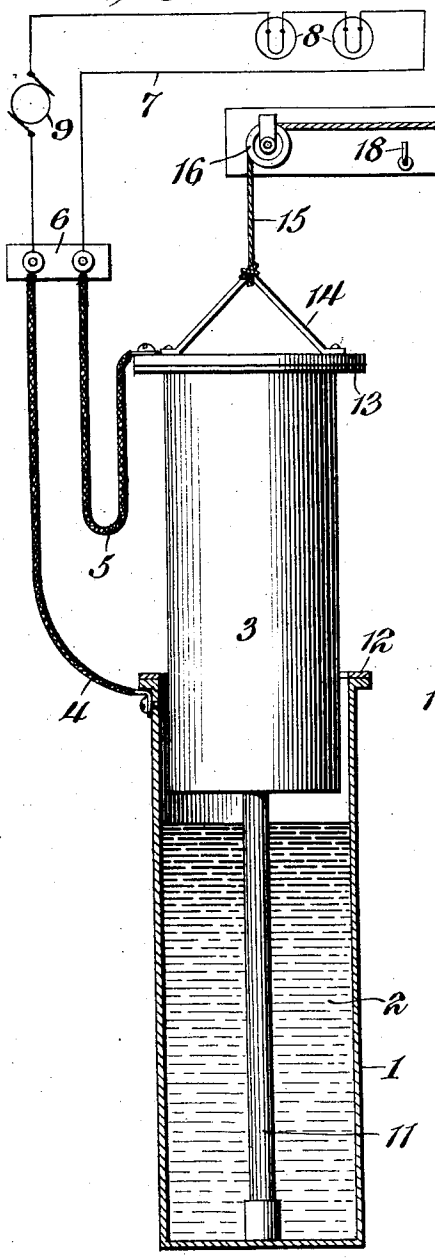
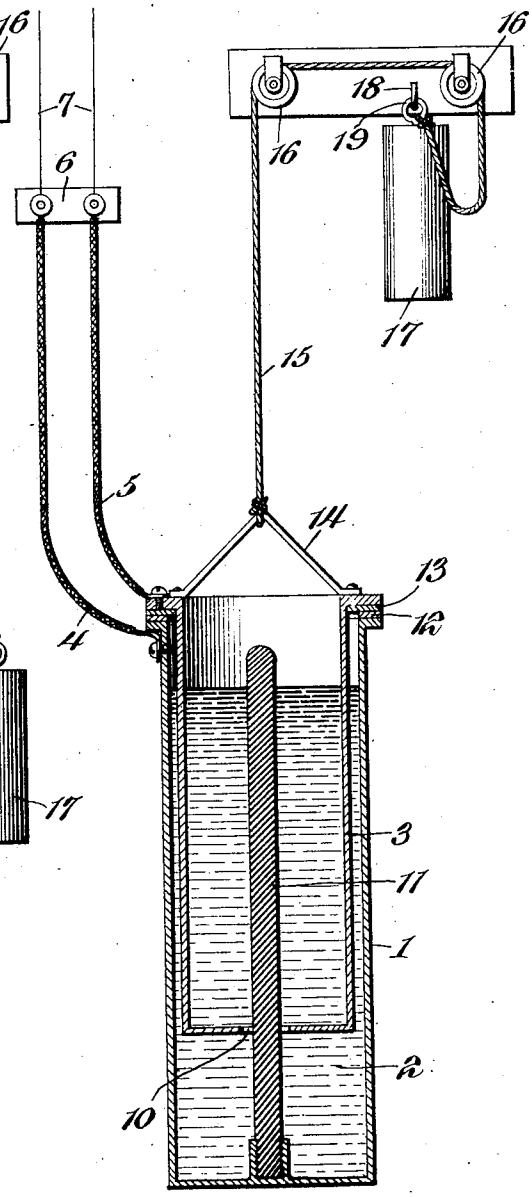


Fig. 2.



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Witnesses

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3 SHEETS—SHEET 2.

Fig. 3.

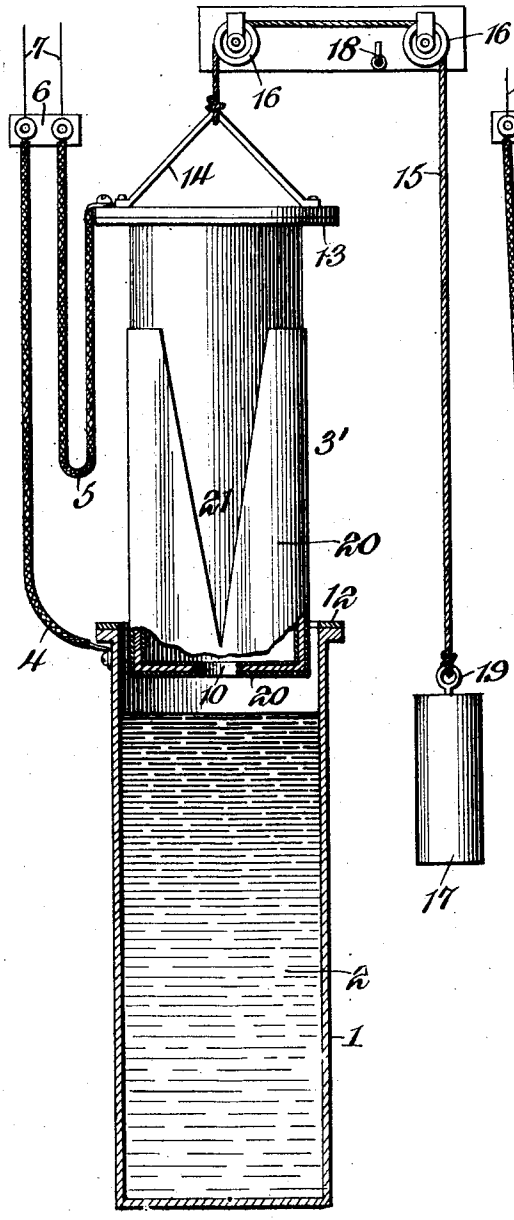
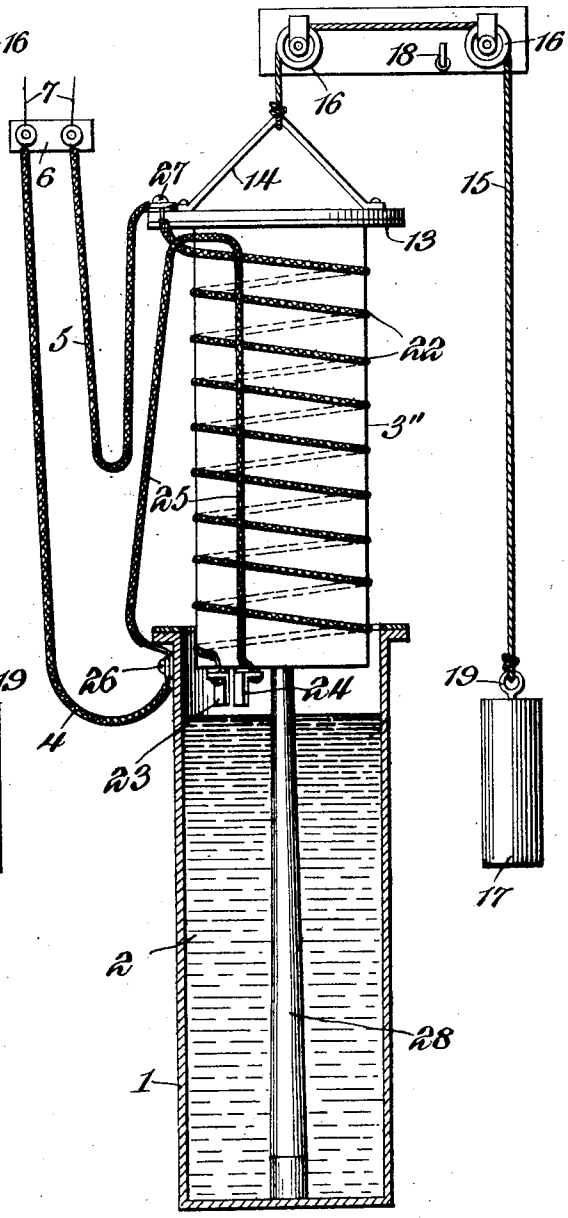


Fig. 4.



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3 SHEETS—SHEET 3.

Fig. 5.

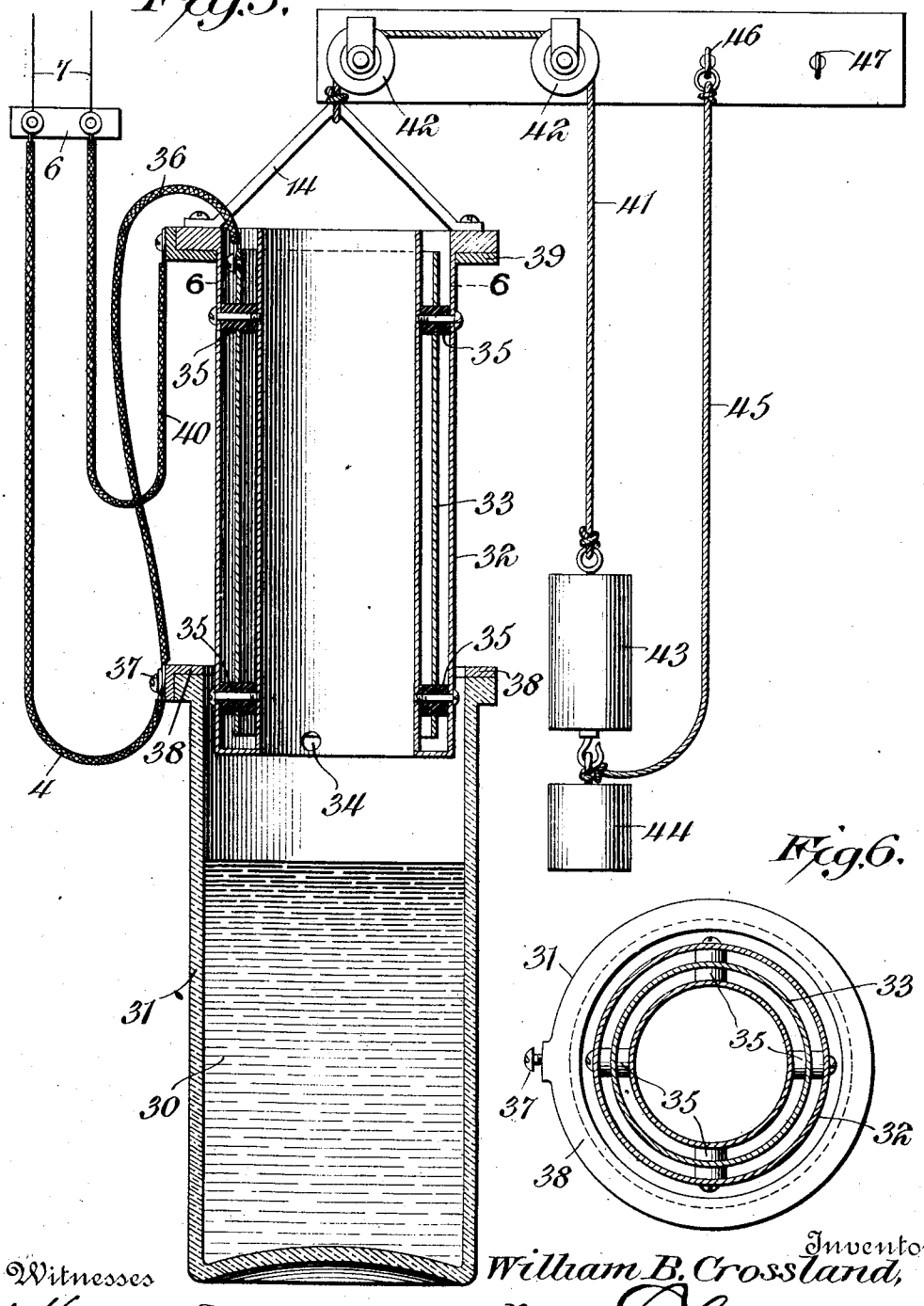

Fig. 6.

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UNITED STATES PATENT OFFICE.

WILLIAM BLACKNELL CROSSLAND, OF DE SOTO, MISSOURI.

ELECTRIC SWITCH FOR INCANDESCENT-LAMP CIRCUITS.

960,626. Specification of Letters Patent. Patented June 7, 1910.

Application filed August 9, 1909. Serial No. 511,994.

To all whom it may concern:

Be it known that I, WILLIAM B. CROSSLAND, a citizen of the United States, residing at De Soto, in the county of Jefferson and State of Missouri, have invented a new and useful Electric Switch for Incandescent-Lamp Circuits, of which the following is a specification.

This invention relates to an electric switch of that type which, after being set in motion, with automatically cut resistance into or out of circuit so as to gradually bring the current up to normal voltage or gradually reduce it to zero.

The principal object of the present invention is the provision of a novel switch of this type which is especially adapted for incandescent lamp circuits whereby the full voltage of the lighting circuit cannot be suddenly impressed upon the lamps but, on the contrary, the voltage is gradually brought up to normal to thereby permit the filaments of the lamps to more or less slowly heat, with the result that the life of the filament and the brilliancy thereof is maintained to the greatest possible extent.

In the operation of tungsten incandescent lamp circuits, I have noticed the overshot in the lamps, and found, upon investigation, that the filament, when cold, is of very low resistance and the sudden throwing on of the normal one hundred and ten volts causes a very sudden jerk or movement of the filament, due to the sudden expansion, incident to the heating effect of the current. The filaments, if imperfect, cannot stand many of these violent jerks and soon become broken, and even with perfect filaments, the life and brilliancy are greatly reduced after a short term of service. Therefore, by a switch as herein proposed, the current is gradually increased in voltage in bringing the lamp circuit into service, and consequently the jerking movement or vibration of the filaments is avoided. The voltage is also gradually reduced from normal to zero when cutting the lamp circuit out of service, which has the effect to prolong the life and maintain the brilliancy of the lamp.

With such and other objects in view, as will appear as the description proceeds, the invention comprises the various novel features of construction and arrangement of parts which will be more fully described hereinafter and set forth with particularity in the claims appended hereto.

In the accompanying drawings, which illustrate certain embodiments of the invention, Figure 1 is a vertical section of the switch with parts in elevation and showing the same in open circuit position. Fig. 2 is a vertical section showing the parts in closed circuit position. Figs. 3 and 4 are sectional views of different modified forms of the switch. Fig. 5 is a vertical section of a further modified construction. Fig. 6 is a horizontal section on line 6—6, Fig. 5.

Similar reference characters are employed to designate corresponding parts throughout the views.

In carrying out the invention, I employ two telescoping receptacles which form terminals between which current is conducted by a body of liquid contained in the outer receptacle and the inner receptacle is arranged to be gradually submerged by the entrance of the liquid through an opening in the bottom, whereby a larger area of the inner vessel is exposed to the liquid during the submerging movement to increase the conductivity and allow more current to flow through the switch, the principle of the switch being similar to an ordinary water rheostat but specifically different therefrom in construction.

In the first form of the invention shown in Figs. 1 and 2, 1 designates an outer metallic vessel which is open at its top and contains a body of liquid 2 such as water, and movable vertically in this vessel 1 is an inner metallic vessel 3 which can be gradually sunken in or raised out of the body of water 2. The metallic vessels are connected, respectively, with conductors 4 and 5, the latter of which is flexible so as to permit the inner vessel to rise and fall. These conductors are connected by a terminal block 6 with a lighting circuit 7 having tungsten or other lamps 8 and a source of current 9. Thus, as the inner cylinder is submerged, the current flowing through the circuit can be gradually brought from zero to maximum voltage without the injurious effects following from the full voltage being suddenly thrown on the lamp circuit, according to the common method now in

use. The inner cylinder is so constructed as to slowly submerge to effect a gradual cutting out of the resistance. For this purpose, the bottom of the inner vessel has an opening 10, as clearly shown in Fig. 2, through which the water 2 enters the receptacle and allows the latter to sink, the upper end of the vessel being open to allow the air displaced by the entering water to escape. The opening is of restricted area as compared with the cubical contents of the inner cylinder, so that water will enter slowly to effect gradual diminution in the buoyancy of the cylinder. The dead weight of the inner cylinder is constant at all times, and hence as the buoyancy decreases, the cylinder will gradually submerge more and more. By properly adjusting the size of the opening, the time required for the submerging of the inner vessel can be varied as desired, according to the requirements. In order to prevent contact of the inner with the outer vessel during the opening and closing of the switch, a guide rod 11 is fixed in the outer cylinder in the axial or center line thereof and this guide rod passes through the inlet opening 10 to thereby prevent lateral movement of the inner vessel to such an extent as to prevent short-circuiting by direct contact between the vessels. The two vessels are provided at their upper ends with contact rings 12 and 13 which engage when the switch is completely closed so that current will not have to pass through the water. The inner vessel has a bail 14 to which is connected a suspending cable 15 that passes over guide pulleys 16 and is equipped with a weight 17. This weight is slightly heavier than the inner vessel, so that it will gradually raise the latter out of the water during the opening movement of the switch. The switch is held open by the weight 17, and when it is desired to close the switch, the pull of the weight is removed from the movable element of the switch by placing the weight on a hook 18, the weight having an eye 19 for receiving the hook. When the weight is thus hooked up, the movable element is adapted to fall and lowers into the liquid at a rate depending upon the rate of the flow of the water into the movable element through the opening thereof, until the element reaches closed circuit position, as shown in Fig. 2. It will thus be seen that the effective submerging weight of the movable element as compared with its dead weight, gradually increases in accordance with the increasing buoyancy and hence causes the closing of the switch, while the pull of the weight 17, when exerted on the cord or cable 16, opens the switch. This pull cannot raise the element suddenly out of the water because the counterbalance weight is so proportioned to the combined weight of the inner cylinder and the water that is held therein, that it can exert only a gradual pull on the inner cylinder, and this pull exerted by the counterbalance weight uniformly increases because the water in the inner cylinder becomes less and less, and hence the total weight uniformly diminishes. It will thus be seen that the inner cylinder constitutes, in a unitary structure, a resistance element or conductor of current and a device for retarding the movement in both directions, so that the switch can be neither suddenly opened nor closed. When it is desired to close the lamp circuit, which is open when the switch is in the position shown in Fig. 1, it is merely necessary to place the weight 17 on the hook 18. The inner vessel 3 at the same time moves downwardly in the vessel 1 until it encounters the water, when its movement is retarded. As soon as the contact with the water is made, a weak current passes through the circuit, but not sufficient to cause excessive expansion or vibration of the lamp filaments. The inner vessel continues to descend as the water enters through the opening 10 thereof, whereby a greater surface contact is produced between the said vessel and water to thereby gradually increase the flow of current. When the descending movement of the vessel 3 ceases, the contact rings 12 and 13 will be in engagement as shown in Fig. 2, so that current of normal voltage will pass through the lighting circuit. In this manner, the filaments are allowed to gradually heat and glow until the normal brilliancy is attained. When the circuit is to be opened, the weight is removed from the hook 18 and allowed to hang by the cord 25, whereby a tension is exerted on the latter to raise the inner vessel out of the water. This tension, however, is not much greater than the resistance offered by the inner vessel and water, so that the upward movement of the latter is gradual, with the result that the conductivity is more and more decreased until finally the circuit is opened by the inner vessel leaving the water. Of course, during this upward movement of the inner vessel, the water therein flows out through the opening or port 10.

In the construction shown in Fig. 3, the movable element 3′ of the switch is provided with a coating of porcelain, enamel or other non-conducting material 20 which is so applied as to leave a V-shaped portion 21 of the metal vessel 3′ exposed to contact with the water contained in the outer vessel 1. The vertex of this V-shaped portion is at the bottom, so as to make initial contact with the water, and as the inner vessel descends, more and more area is exposed to the water and greater conductivity is provided. This arrangement provides for a finer gradation

in the cutting out of the resistance from the circuit. The enamel 21 prevents short-circuiting of the switch by accidental contact between the two vessels, and the guide rod 11 in the first form of the invention can be dispensed with.

Referring to Fig. 4, the movable element 3'' is provided with a winding of insulated wire 22 wrapped around the outside thereof and which has its lower end connected with a fixed terminal piece 23 that is spaced from another fixed terminal piece 24 which, like the other, is secured to the bottom of the vessel 3''. The terminal piece 24 is connected with the flexible conductor 25 which has its outer end connected with the binding post 26 for the wire 4. This flexible conductor 25 is of sufficient length to permit the inner vessel to descend into the outer vessel without interference. The wire 22 has its upper end connected with the binding post 27 to which the wire 5 is attached. This resistance is cut into circuit prior to the metallic vessel 3'' because the terminal pieces 23 are nearest the water. Hence, as the inner vessel 3'' descends, the water between the terminal pieces 23 and 24 will form a bridging conductor and the initial flow of current will take place through the resistance wire 22. As the vessel descends into contact with the water, current will flow through the vessel also, and when the switch is finally closed, the wire and vessel will be short-circuited, because of the current passing through the contact rings 12 and 13. By the use of the resistance coil 22, the range of the switch can be increased. The vessel 3'' is constructed with a bottom opening for admitting water and for receiving the guide rod 28 secured within the outer casing 1.

In Figs. 5 and 6, which show a construction that in some cases might be the preferred form of the invention, the current-conducting liquid 30 is arranged in a jar 31 which is preferably of glass so that the liquid can be observed to note the evaporation from time to time, and thus enable the attendant to replenish the liquid as needed for maintaining the normal level. The submergible metallic vessel 32, which forms one element of the switch, carries the other element 33. The vessel 32 is constructed of inner and outer cylindrical shells forming an annular chamber which is closed at the bottom except for one or more ports 34 through which the liquid enters for gradually sinking the vessel. The element 33 is insulated from the shells of the vessel 32 in any suitable manner, as for instance, by blocks of insulation 35. The inner element is connected by a flexible conductor 36 with the binding post 37 on a contact ring 38 supported on the jar 31. The vessel 32 is in electrical connection with a contact ring 39 to which a flexible conductor 40 is connected. These conductors 36 and 40 are connected with opposite sides of an electric circuit and current passes from one element of the switch to the other through the liquid when the vessel is submerged therein. By lowering the vessel 32 into the liquid, the vessel gradually sinks by reason of the liquid entering the port 34, and as soon as the liquid contacts with both elements, a weak current flows through the circuit and this current becomes stronger and stronger, as more and more surface of the element is exposed to the liquid. When the vessel is fully submerged, the ring 39 will engage the ring 38 and thereby short-circuit the liquid and elements. The vessel is suspended by a cord 41 guided on pulleys 42 and provided with a counterbalancing weight 43. This weight is insufficient to raise the vessel out of the jar 31, and in order to do this, a supplemental weight 44 is attached to the weight 43. This weight 44 is suspended by a cord 45 from a hook 46. When it is desired to open the switch, the weight 44 is suspended on the weight 43 so that both will be sufficient to gradually lift the vessel 32 out of the jar 31. When the switch is closed, the weight 44 is, of course, detached and can hang on its own cord or be suspended on the hook 47.

From the foregoing description, taken in connection with the accompanying drawings, the advantages of the construction and of the method of operation will be readily apparent to those skilled in the art to which the invention appertains, and while I have described the principle of operation of the invention, together with the apparatus which I now consider to be the best embodiment thereof, I desire to have it understood that the apparatus shown is merely illustrative, and that such changes may be made when desired as are within the scope of the claims appended hereto.

Having thus described the invention, what I claim as new, and desire to secure by Letters Patent, is:—

1. In a switch of the class described, a combined current resistance and device for retarding the opening and closing movement of the switch, such resistance and device consisting of a hollow structure having a restricted opening through which liquid passes into or out of the structure during the closing or opening of the switch.

2. In a switch of the class described, the combination of a circuit, with a resistance-varying device connected therewith, said device including a receptacle adapted to hold liquid, and an element movable into and out of the liquid for gradually decreasing or increasing the resistance of the circuit, said element comprising a buoyant structure adapted to take up the liquid for gradually

decreasing the buoyancy and cause submerging of the structure.

3. In a variable resistance switch, the combination of a vessel adapted to hold a current-conducting liquid, a combined movable switch element and retarding device comprising a hollow structure open at its top and having a restricted opening in its bottom to permit liquid to pass into and out of the structure as the same moves into and out of the vessel, and a device for gradually lifting the structure out of the vessel while the liquid passes out of the structure into the vessel through the said opening.

4. In a variable resistance switch, the combination of a liquid-containing vessel, a conductor movable into and out of the liquid for varying the current flow through the circuit to which the switch is connected, said conductor constructed to automatically retard the submerging movement, and a weight which is inactive during the submerging movement of the conductor and is operatively connected with the latter to withdraw it from the liquid automatically to open the switch.

5. A variable resistance switch comprising a liquid-containing vessel, a chambered structure movable into and out of the liquid and having an opening to permit liquid to pass into and out of the chamber, contacts arranged to engage each other when the structure is submerged to its fullest extent to short-circuit the liquid in the vessel, and a weight adapted to exert a pull sufficiently greater than the combined weight of the structure and liquid therein as to gradually remove the structure from the liquid.

6. A switch of the class described, comprising vessels open at their tops and mounted for relative movement one within the other, the inner vessel having an opening for admitting liquid contained in the outer vessel during the submerging of the inner vessel, conductors connected with the vessels, and contacts arranged one on the inner vessel and one on the outer vessel to engage each other when the switch is closed to short-circuit the current from the vessel.

7. A variable resistance switch comprising a vessel containing a current-conducting liquid, a hollow vessel of greater specific gravity than the liquid and serving as a current resistance, said vessel having an opening for permitting liquid to enter therein at a predetermined rate for submerging the vessel, and a device brought into operation to open the switch and arranged to exert an upward pull on the inner vessel of such power as to effect a gradual withdrawal of the vessel from the liquid.

8. A variable resistance switch comprising a liquid-containing vessel, a chambered structure formed of metal to serve as a resistance and having a restricted opening in its bottom to permit liquid to pass into and out of the structure, said structure being of sufficient weight to sink as the liquid enters the same through the opening, and a weight operatively connected with the structure to gradually withdraw the same from the liquid and hold the switch open, and means for supporting the weight to relieve the pull thereof from the structure in the closing of the switch.

9. A variable resistance switch comprising a liquid-containing vessel, a resistance movable into and out of the vessel and having a buoyancy which automatically decreases as the resistance moves automatically into the vessel, and a device manually set into operation for exerting a pull of gradually increasing strength to solely withdraw the resistance from the liquid.

10. A variable resistance switch comprising a liquid-containing vessel, a chambered resistance movable into and out of the liquid and having an opening through which liquid passes into and out of the chamber, and a counterbalance device consisting of separate weights, one of which is less than the weight of the resistance and both of which are greater than the weight of the resistance and the water contained therein when the resistance is in closed circuit position for causing the counterbalancing device to withdraw the resistance from the liquid.

11. A switch of the class described comprising separate elements connected with the opposite sides of a circuit and adapted to be brought into conducting relation by a body of current-conducting liquid, one of the elements being in the form of a hollow vessel submergible in the liquid and having an initial buoyancy which automatically decreases whereby the submerging is retarded, and a device arranged to exert a pull of increasing strength on the hollow vessel to gradually open the switch.

12. A switch of the class described including a hollow metallic element submergible in a body of current-conducting liquid and having a restricted port through which the liquid enters or discharges for permitting the gradual sinking or raising of the element, and a circuit connected with the switch and through which a gradually increasing or decreasing current flows during the movement of the element.

13. A switch of the class described, including a hollow metallic element open at its top and having a permanently open port of restricted area compared with the cubical contents of the element in its bottom, a container for a current-conducting liquid in which the element gradually sinks as liquid enters the port, and means for connecting the switch with an electric circuit.

14. A switch of the class described, including a hollow metallic element open at its top and having a port in its bottom and constructed of inner and outer shells spaced from each other, a container for a current-conducting liquid in which the element gradually sinks as liquid enters the port, means for connecting the switch with an electric circuit, and contacts carried respectively by the said element and container and arranged to engage each other when the element has reached the limit of its submerging movement for short-circuiting the liquid.

In testimony, that I claim the foregoing as my own, I have hereto affixed my signature in the presence of two witnesses.

WILLIAM BLACKNELL CROSSLAND.

Witnesses:
ROBT. B. MUNROE,
FRANK L. LONG.