

April 28, 1925.

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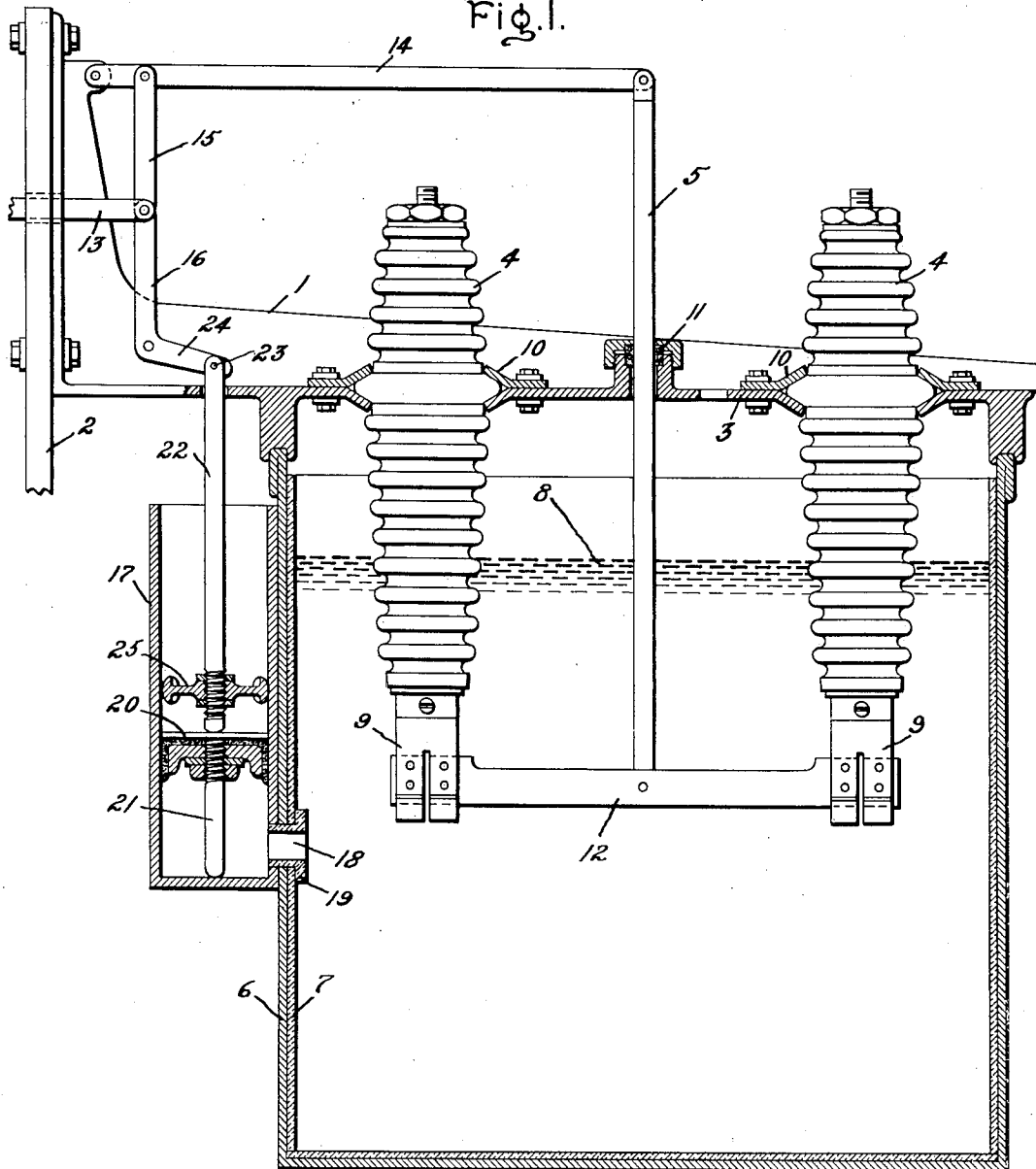
J. D. HILLIARD

ELECTRIC SWITCH

Filed Nov. 20, 1922

2 Sheets-Sheet 1

Fig. 1.



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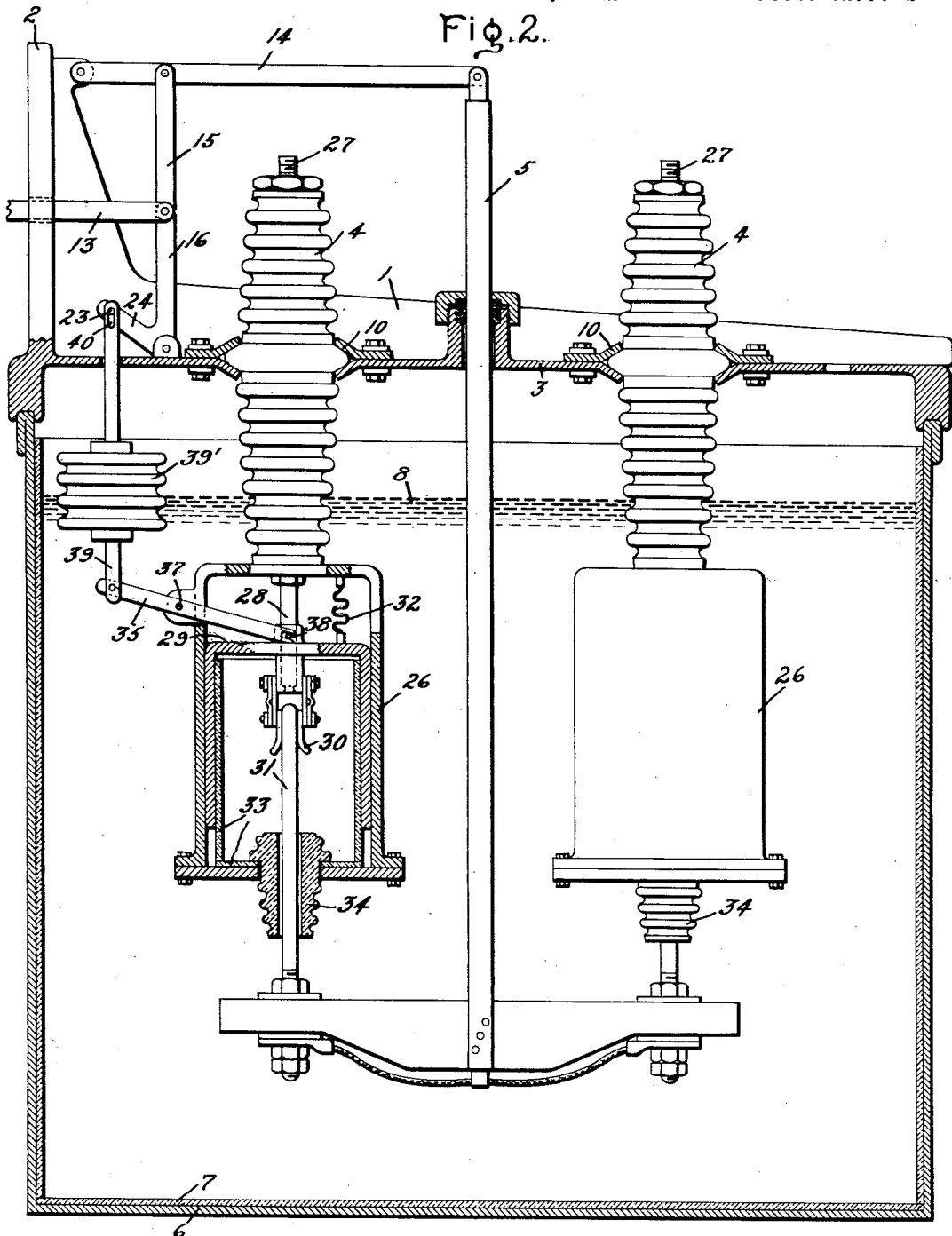
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2 Sheets-Sheet 2



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UNITED STATES PATENT OFFICE.

JOHN D. HILLIARD, OF SCHENECTADY, NEW YORK, ASSIGNOR TO GENERAL ELECTRIC COMPANY, A CORPORATION OF NEW YORK.

ELECTRIC SWITCH.

Application filed November 20, 1922. Serial No. 601,956.

To all whom it may concern:

Be it known that I, JOHN D. HILLIARD, 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 Electric Switches, of which the following is a specification.

My invention relates to electric switches, and especially to means for accelerating the opening of such switches, and for preventing their accidental closure by pressure generated within the switch tank upon separation of the switch contacts.

My invention is particularly useful in connection with switches operated under high pressure by an operating rod movable inwardly through the tank wall to separate the switch contacts. In the operation of such switches, difficulty has been encountered by reason of piston action of the operating rod tending to force it outwardly and thus to accidentally close the contacts immediately after they have opened.

It is, therefore, a principal object of my invention to provide an improved means for utilizing the internal pressure of the switch to hold the switch open until the arc incident to separation of the contacts has been extinguished and normal pressure within the tank has been restored.

It is a further object to provide means by which the pressure within the switch tank below the oil line may be utilized to accelerate the opening movement of the switch.

Other objects and advantages will appear as my invention is considered in connection with the accompanying drawings in which Fig. 1 illustrates my invention as applied to a single pole switch, and in which Fig. 2 shows it as applied to a modified form of switch.

Referring now to Fig. 1, there is shown a supporting frame 1, attached to the support 2, and forming a part of the tank cover 3 which is provided with apertures for receiving the insulating bushings 4 and the contact operating rod 5. The tank 6 is provided with an insulating lining 7 and is adapted to contain an insulating liquid 8. The bushings 4 are designed to support the stationary electrodes 9 and are held in

place by the clamping rings 10. The contact operating rod 5 which enters the tank 6 through a packed bushing 11 is adapted to support a movable bridging contact 12 which engages the stationary contact members 9 to operate the switch.

The operating means (not shown but which may be of any suitable type, such as that shown in Letters Patent No. 942,491 to Emmet & Hewlett, dated December 7, 1909 for example) is connected to the link 13, motion being transmitted to the operating rod 14 through the toggle 15—16 and the operating lever 14.

A cylinder 17 is attached to the tank 6, registering apertures in each being provided to form a communicating passage 18 which is protected by an insulating bushing 19. A hydraulically packed piston 20 is adapted to operate in the cylinder 17 its downward movement being limited by the stud 21. A rod 22 is pivoted at 23 to one end of the bell crank lever 24 and is guided in the piston casing by the spider 25.

Fig. 2 shows a switch of the explosion chamber type, the frame, tank and operating mechanism of which is similar to that shown in Fig. 1. An explosion chamber casing 26 is attached to the stationary contact stud 27 an extension of which forms a guide 28 for a piston 29 adapted to move inside the explosion chamber casing 26. The piston is adapted to support contact fingers 30 which engage in the closed position of the switch shown with a movable contact stud 31. Electrical connection between the explosion chamber casing 26 and the piston 29 is maintained by a flexible lead 32. The inner side walls of the piston and the bottom of the explosion chamber casing are protected by an insulating lining 33. The movable contact stud enters the explosion chamber through the insulating bushing 34.

A rocker arm 35 is pivoted to the explosion chamber 26 at 37 and is actuated by the pin 38 in the piston 29, transmitting motion of the piston 29 to a connecting member 39 which may be made in the form of a rod of insulating material or of metal rods connected to an insulator 39'. The connecting member 39 is adapted to engage a pin 23 in the bell crank 24 to complete the

connection between the piston 29 and the operating means. A slot 40 is provided in the connecting member 39 for permitting separation of the contacts 30 and 31 without the exertion of force between the bell crank 24 and the connecting member 39.

Operation under load from the closed position of the switch shown in Fig. 1 is as follows: The link 13 is moved to the left, by any suitable operating means, to break the toggle 15-16 and permit downward movement of the operating rod 5 which disengages the movable electrode 12 from the contact fingers 9. Simultaneously with the downward movement of the operating rod 5, the rod 22 is raised parting contact with the piston 20. Upon separation of the switch contacts an arc is drawn in the liquid which vaporizes or disassociates a part of the liquid ambient, the arc stream thereby suddenly generating a pressure within the switch tank. This pressure is transmitted through the liquid to the piston 20 which is forced against the end of the rod 22 thereby serving to accelerate the opening movement of the switch, the movable contacts of which are cooperatively associated with the rod 22 through bell crank lever 24, the toggle 15-16, the operating lever 14 and the operating rod 5. Pressure will exist within the tank until the arc is ruptured and during this time reclosure of the switch due to piston action on the operating rod 5 will be prevented by reason of the force exerted on the toggle member 16 through the retarding rod 22.

After the arc has been ruptured, normal pressure in the tank will be restored by leakage and the switch may be reclosed, the piston 20 being returned to the position shown by downward movement of the rod 22.

Operation under load from the closed position of the switch shown in Fig. 2 is as follows: Manual or automatic tripping of the operating means permits the breaking of the toggle 15-16, the bell crank 24 moving in a counterclockwise direction. The operating rod 5 will fall to cause disengagement of the movable electrodes 31 from the contact fingers 30. An arc is drawn in the liquid which will cause the vaporization and dissociation of part of the liquid ambient the arc stream. A pressure will be suddenly generated in the liquid in the explosion chamber which will produce upward movement of the piston 29 and the contact fingers 30 to accelerate the relative movement between the contact fingers 30 and the movable contact 31. When the current to be interrupted is of sufficient magnitude the pressure will be generated quickly enough so the upward movement of the piston will cause the connecting member 39 to overtake the pin 23 in the bell crank

24 in its downward movement, thereby producing further acceleration of the movable contacts 31. In any case, however, pressure will be exerted upon the piston 29 until the arc has been extinguished so that reclosure of the contacts is thereby prevented.

My invention may be embodied in other forms than that shown and described, and I therefore do not wish to be restricted to the precise construction shown, but intend to cover by the appended claims changes and modifications within the scope of my invention.

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

1. A switching apparatus comprising a tank, electrodes separable within said tank to break a circuit, means for operating said electrodes, and a device responsive to pressure within said tank to prevent reclosure of said electrodes, said electrodes being movable independently of said device.

2. A switching apparatus comprising a tank, contacts separable within said tank to break a circuit whereby an arc is formed, means for operating said electrodes, and a device operated by pressure within said tank to assist in separating said electrodes and prevent their reclosure, said electrodes being movable independently of said device.

3. In a switching apparatus, a tank containing a liquid, electrodes separable within said liquid to break a circuit whereby an arc is formed and pressure is created within said tank, means for operating said electrodes, a device responsive to pressure within said tank to assist in separating said electrodes and prevent their reclosure, and a lost motion connection between said operating means and said device.

4. In a switching apparatus, a tank containing a liquid, electrodes separable within said liquid to break a circuit whereby an arc is formed and pressure is created within said tank, means for operating said electrodes, a receptacle in communication with said tank, and a piston within said receptacle responsive to pressure within said tank to assist in opening said electrodes and prevent their reclosure, said electrodes being movable independently of said piston.

5. In a switching apparatus, a tank containing a liquid, electrodes separable within said liquid to break a circuit whereby an arc is formed and pressure is created within said tank, means for operating said electrodes, a casing in communication with said tank beneath the surface of said liquid, a piston within said casing responsive to pressure within said tank to assist in opening said electrodes and prevent their reclosure, and a lost motion connection between said piston and said operating means whereby said electrodes may be operated independently of said piston.

6. In a switching apparatus, a tank containing an insulating liquid, electrodes relatively movable in said liquid to make and break a circuit, means for operating said electrodes, a cylinder having a piston therein and having a fluid connection with said tank below the level of the liquid therein

and means for transmitting a thrust from said piston to said operating means, said latter means permitting the operation of said contacts independently of said piston. 10

In witness whereof, I have hereunto set my hand this 17th day of November, 1922.

JOHN D. HILLIARD.