Aug. 19, 1941. C. E. POLLARD 2,253,135

MERCURY SWITCH

Filed Oct. 19, 1940

FIG. 1

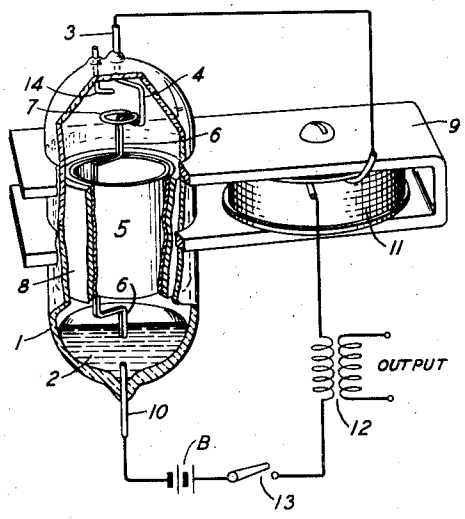
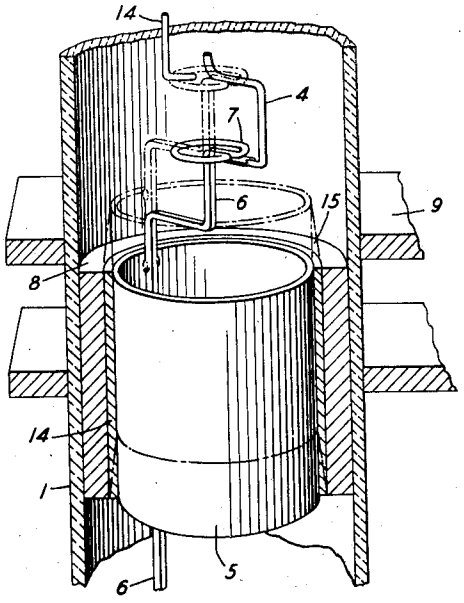


FIG. 2



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MERCURY SWITCH

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Application October 19, 1940, Serial No. 362,306

2 Claims. (Cl. 200—111)

This invention relates to so-called mercury switches and more particularly to magnetically operated mercury contact interrupters.

An object of the invention is to provide an interrupter of the mercury contact type to periodically open and close a circuit at a predetermined frequency rate.

In a copending application, in the name of the present applicant, Serial No. 362,305, filed October 19, 1940, an interrupter of this type is disclosed in which a magnetic armature is vertically suspended by means of a coiled spring from the top of a sealed vessel having a pool of mercury in the bottom with which a contact element, attached to the armature, normally makes contact and which contact is broken when the armature is raised by an external magnetic field. When used as a self-interrupting device, the frequency with which the contact is opened and closed can be predetermined by properly choosing the mass of the armature and the stiffness of the spring.

The feature of the present invention differs from the foregoing described arrangement in that the armature, without coiled spring support, is slidably positioned within a stationary metallic guiding sleeve, the inner diameter of which is only slightly greater than the outer diameter of the armature and in so treating both armature and sleeve that upon contact with mercury, the opposing surfaces will become "wetted" and a film of mercury formed in the space therebetween, which film, due to its surface tension, tends to center the armature within the sleeve. A capillary conductor, comprising two closely positioned parallel wires, is attached to and carried by the armature, dips into the pool of mercury at the bottom and is carried up through to a point above the armature where it makes a normally closed contact to a sealed-in terminal member. This contact wire, in addition to forming a connection between the mercury pool and the upper contact, also acts as a wick to supply, by capillary action, mercury to the contact and to the space between the armature and sleeve.

When the armature is raised out of the guiding sleeve, by an external magnetic force, the surface of the mercury film surrounding the armature is stretched and serves as a retractile force to return the armature to its normal or mid-position within the sleeve when the force is removed.

The natural period of vertical vibration of the armature, and consequent frequency of contact interruptions, can be predetermined by a proper choice of the mass of the armature and dimensions of the surrounding mercury film.

The invention will be understood from the following description when read in connection with the accompanying drawing:

Fig. 1 of which shows a mercury contact interrupter constructed in accordance with the invention and showing one method of use; and,

Fig. 2 is an enlarged portion of the interrupter device showing the armature slidably positioned within a guiding sleeve and lubricated with mercury, together with a capillary conductor and the upper contacts thereof.

Referring to the drawing, 1 is a glass tube containing a pool of mercury 2. A terminal 3 is sealed into the top of the tube 1 which terminal extends within the tube and terminates in a hook-shaped contact member 4. A cylindrical armature 5 of magnetic material, such as iron or steel, is suspended within the tube from the contact member 4 by means of a capillary wire member 6 terminating at its upper extremity in a circular or ring-shaped head 7. If desired, a second hook-shaped terminal 14 may be sealed in the top of the tube to make contact with the ring-shaped head 7 when the armature 5 is raised thus forming a so-called make contact. The capillary member 6 consists of two closely spaced parallel wires fastened to the inside of the armature in any convenient manner such as by welding, which member extends below the armature a sufficient distance to make contact with the mercury at all times. Closely surrounding the armature 5 and acting as a guide therefor is a non-magnetic metallic sleeve 8, fixed with respect to the wall of the tube 1, in which the armature is free to slide. Due to the capillary action of the two closely spaced parallel wires forming the member 6, mercury from the pool 2 is drawn upward and wets the contacts 4 and 7 and also supplies mercury to the armature 5 which wets its outer surface whereby a film of mercury is formed thereon. This film of mercury also wets the inner surface of the sleeve 8 thereby joining these two members by film 14 having elastic properties due to surface tension which substantially centers the armature within the sleeve. It will be understood that the sleeve 8 is formed from metal which is readily "wet" by mercury, and that the opposing surfaces of the sleeve and armature are smooth and free from contaminating films in order that substantially complete wetness results when mercury is brought into contact therewith.

The tube 1 is located in the magnetic field of

an electromagnet 9 in such a position that the armature 5 partially, but not completely, closes the magnetic circuit. A terminal 10 is sealed in the bottom of the tube and makes contact with the mercury therein. The circuit of the interrupter extends from battery B, terminal 10, mercury 2, capillary member 6, contacts 7, 4, terminal 3, winding 11 of electromagnet, primary winding of output transformer 12 and switch 13.

When switch 13 is closed, the electromagnet is energized in the circuit previously traced thereby raising the armature and breaking the contact between the circular head 7 of the member 6, and the contact member 4, whereupon the circuit of the electromagnet is broken and the armature restores thereby remaking the contact between 7 and 4 and causing the preceding cycle to be repeated at the natural period of the armature which can be predetermined by a proper choice of the armature mass and the dimensions of the mercury film between the outer surface of the armature and its guiding sleeve, it being noted that the force of the magnetic field created by the electromagnet is opposed by the surface tension of the film of mercury surrounding the armature which film stretches as shown at 15 when the armature is raised and serves as a retractile force to quickly restore the armature to its normal position when the magnetic force is removed.

The periodic interruption of the energizing circuit of the device causes an alternating current to flow in the secondary or output winding of transformer 12 which current can be employed wherever a substantially constant frequency alternating source is required, i. e., for operating synchronous clock motors, telephone ringers, etc.

What is claimed is:

1. The combination in a mercury contact interrupter of a closed vertical envelope having a pool of mercury in the bottom thereof, a cylindrical armature of magnetic material vertically movable therein, a movable terminal comprising two closely positioned parallel sections of wire secured to said armature with its lower end immersed in said mercury pool and its upper end terminating above said armature in a relatively large circular head whose plane is at right angles to the axis of the armature, a stationary contact member above said armature and forming a contact-making surface for said circular head, said parallel wires forming a capillary channel for causing mercury to be transferred from said pool to said contact surface and the surface of said armature, a sealed-in terminal in contact with said mercury and a corresponding sealed-in terminal connected to said stationary contact, electromagnetic means for moving said armature, and a metal-guiding sleeve closely surrounding said armature, said armature and sleeve being treated in such a manner that mercury supplied to said armature will form a closely adhering film between the outer surface thereof and the opposing surface of the sleeve tending to hold said armature in a predetermined position within the sleeve.

2. In a mercury contact switch, a closed vertical envelope containing a pool of mercury in the bottom thereof and having a cylindrical armature of magnetic material vertically movable therein, a stationary non-magnetic metal-guiding sleeve closely surrounding said armature, and means for supplying mercury from said pool to the outer surface of said armature, said armature and guiding sleeve being treated in such a manner that mercury supplied thereto will wet the opposing surfaces to form an elastic closely adhering film therebetween tending to hold the armature in a definite position within the sleeve.

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