May 5, 1931. W. R. WALKER 1,803,986

ELECTRIC LIQUID FLOW SWITCH

Filed Oct. 18, 1929

Fig. 1

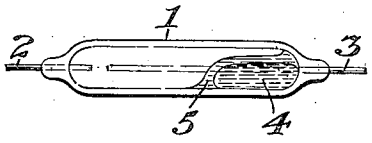


Fig. 2

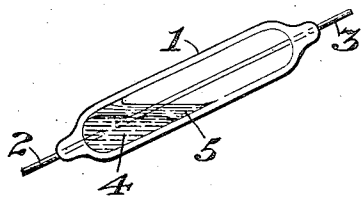


Fig. 3

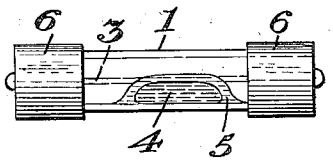


Fig. 4

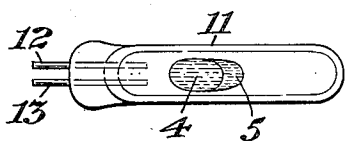
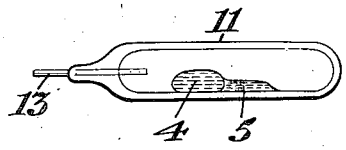


Fig. 5



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1,803,986

UNITED STATES PATENT OFFICE

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ELECTRIC LIQUID FLOW SWITCH

Application filed October 18, 1929. Serial No. 400,688.

The present invention relates to electric switches of the liquid flow type, and particularly to mercury switches of small size.

The particular object of the invention is to provide a switch of this type which will be reliable under commercial operating conditions. Other objects and advantages will be obvious from the following specification.

The invention comprises a new and novel combination of materials and parts to form a product having the general characteristics and the several original features of utility hereinafter set forth and claimed.

Mercury switches as commonly constructed rely upon the movement of a mercury body in an envelope to make and break an electrical circuit. In most cases it is desirable to have the mercury respond to slight movements of the envelope. Under certain conditions, as when the size of the envelope is decreased, the mercury movement becomes increasingly sluggish, so that special means have to be availed of to maintain the desired freedom of mercury movement. For example, the use of a fluid such as guaiacol, alcohol, benzol, or the like in the container with the mercury seems to decrease the adhesion of the mercury to the walls of the container, permitting free movement of the mercury globule even through very small passages. While the addition of this fluid eliminates the sluggishness it also introduces a new problem, in that it has been found to have a very undesirable effect on the mercury, since the latter, when agitated in its presence, has a marked tendency to break up into small globules which do not readily coalesce, and as a result the operation of such a switch is very uncertain.

Applicant has found that this difficulty may be readily overcome by dissolving in the mercury a trace, say of the order of one part in a thousand by weight, of nickel, platinum, or palladium. Iron, cobalt, osmium and other members of the eighth group of elements, copper, lead, tin and other similar metals, have also been found to be suitable for this purpose in somewhat varying degree. Mercury modified in this manner has been found to give highly satisfactory results when enclosed in the usual manner in glass, quartz, or other vitreous envelopes into which are sealed in-leads of nickel, iron, tungsten, platinum, dumet, or other suitable material, and in the presence of alcohol, guaiacol or other similar liquid. When so modified by the nickel or other metal the mercury loses the tendency to break up into small globules which it would otherwise have in the presence of the other fluid, any globules thereof which are formed readily coalescing.

For the purpose of illustration two types of mercury switches embodying my invention are shown in the accompanying drawings, in which

Fig. 1 is an elevational view of a mercury switch in an open circuit position,

Fig. 2 is an elevational view of the switch of Fig. 1 in a circuit closing position,

Fig. 3 is an elevational view of the same switch with terminal caps attached thereto to adapt it for mounting in spring clips,

Fig. 4 is a plan view of a somewhat similar switch having both inleads sealed into one end thereof, and

Fig. 5 is an elevational view of the same switch.

In these drawings, with particular reference to Figs. 1 to 3 a tubular envelope 1 of glass or other suitable vitreous material, of say ¼ inch diameter, has sealed into one end thereof an inlead 2, while into the opposite end there is sealed an inlead 3, said inleads being of dumet, iron, tungsten, nickel, platinum or other suitable metal, dumet being preferred, however, in those cases where the envelope 1 is constructed of lead glass because of its relatively low cost. Said inleads 2 and 3 extend toward each other and have a short gap between the ends thereof near one end of the envelope 1. Within said envelope 1 is a quantity of mercury 4 which is sufficient to close the circuit between said inleads 2 and 3 when said envelope is in the position shown in Fig. 2. Since the small diameter of the envelope 1 tends to prevent the free movement of the mercury 4 therein a few drops 5 of alcohol, guaiacol, benzol, or other similar fluid which will reduce the adhesion of said mercury to the wall of said envelope are also

enclosed therein. Where the switch is to be subjected to low ambient temperatures alcohol is preferred for this purpose because of its low viscosity at such temperatures. Dissolved in the mercury 4 is a trace, of say one part in a thousand, of a metal such as nickel. Palladium, platinum, iron, cobalt, or other metal of the eighth group in the Periodic table, copper, lead, tin or other similar metal may be used instead of nickel, where desired. This dissolved metal has the effect of promoting coalescence of any mercury globules formed during operation of the switch, entirely overcoming the tendency toward maintenance thereof resulting from the use of the alcohol or similar fluid in contact with the mercury.

With some of the above metals this effect may be produced with a concentration of only one part in a million. As shown in Fig. 3 the completed switch has metal caps 6 placed on either end thereof to which the inleads 2 and 3 are connected, so that the switch may be mounted in spring clips such as have been commonly used for electrical fuses.

With reference to Figs. 4 and 5 the inleads 12 and 13 are fused into a common seal at one end of the tubular envelope 11, thus adapting the switch to a different type of mounting. In all other respects the switch of Figs. 4 and 5 is identical with that of Figs. 1 and 2.

It has been found that switches so constructed are extremely reliable in operation, and that the internal resistance thereof is constant throughout their useful life. Such switches are especially useful for interrupting electrical circuits of low voltage.

While I have described my invention in connection with switches using alcohol, benzol, guaiacol or like substance, it will be readily understood that it is equally useful when any other substance is present in such devices which tends to maintain the mercury in a globular condition.

I claim:

1. In a mercury switch, mercury, a substance which tends to promote the maintenance of globules of said mercury, and a substance which promotes coalescence of said globules dissolved in said mercury and counteracting the effect of said first named substance.

2. In a mercury switch, mercury, a substance which tends to promote the maintenance of globules of said mercury, and a metal dissolved in said mercury which promotes coalescence of said globules.

3. In a mercury switch, mercury, a substance which tends to promote the maintenance of globules of said mercury, and a metal of the eighth group dissolved in said mercury.

4. In a mercury switch, mercury, a substance which tends to promote the maintenance of globules of said mercury, and nickel dissolved in said mercury in sufficient quantity to cause said globules to readily coalesce.

5. In a mercury switch, mercury, a substance which tends to promote the maintenance of globules of said mercury, and 0.1% of nickel dissolved in said mercury.

6. In a mercury switch, mercury, a substance such as alcohol in contact therewith, and a substance dissolved in said mercury which promotes coalescence of globules of said mercury.

7. In a mercury switch, mercury, a substance such as alcohol in contact therewith, and a metal dissolved in said mercury which promotes coalescence of globules of said mercury.

8. In a mercury switch, mercury, a substance such as alcohol in contact therewith, and a metal of the eighth group dissolved in said mercury.

9. In a mercury switch, mercury, a substance such as alcohol in contact therewith, and nickel dissolved in said mercury in sufficient quantity to cause globules of said mercury to readily coalesce.

10. In a mercury switch of the seal vitreous envelope type, mercury, a substance such as alcohol in contact therewith, and 0.1% of nickel dissolved in said mercury.

10. In a mercury switch of the sealed vitreous envelope type, mercury, a substance such as alcohol in contact therewith, and 0.1% of envelope having a smaller cross-section than that permitting free movement of said mercury, a fluid in said envelope to effect free movement of said mercury, and means comprising a metal dissolved in said mercury to promote coalescence of globules thereof.

12. In a mercury switch, in combination, a sealed envelope having inleads sealed therein, a mercury globule in said envelope, said envelope having a smaller cross-section than that permitting free movement of said mercury, a small quantity of alcohol in said envelope, and a metal of the eighth group dissolved in said mercury.

13. In a mercury switch, in combination, a sealed envelope having inleads sealed therein, a mercury globule in said envelope, said envelope having a smaller cross-section than that permitting free movement of said mercury, a small quantity of alcohol in said envelope, and nickel dissolved in said mercury.

Signed at Hoboken in the county of Hudson and State of New Jersey this 17th day of October A. D. 1929.

WARREN R. WALKER.

CERTIFICATE OF CORRECTION.

Patent No. 1,803,986. May 5, 1931.

WARREN R. WALKER.

It is hereby certified that error appears in the printed specification of the above numbered patent requiring correction as follows: Page 2, line 91, first claim 10, for "seal" read sealed; and lines 95, 96 and 97, strike out "10. In a mercury switch of the sealed vitreous envelope type, mercury, a substance such as alcohol in contact therewith, and 0.1% of" and insert instead 11. In a mercury switch, in combination, a sealed envelope having inleads sealed therein, a mercury globule in said envelope, said; and that the said Letters Patent should be read with these corrections therein that the same may conform to the record of the case in the Patent Office.

Signed and sealed this 25th day of September, A. D. 1934.

(Seal)

Leslie Frazer
Acting Commissioner of Patents.