May 23, 1950 J. S. GARVIN 2,508,508

MERCURY CONTACT FOR ELECTRICAL SWITCHES

Filed Aug. 10, 1946

FIG. 1

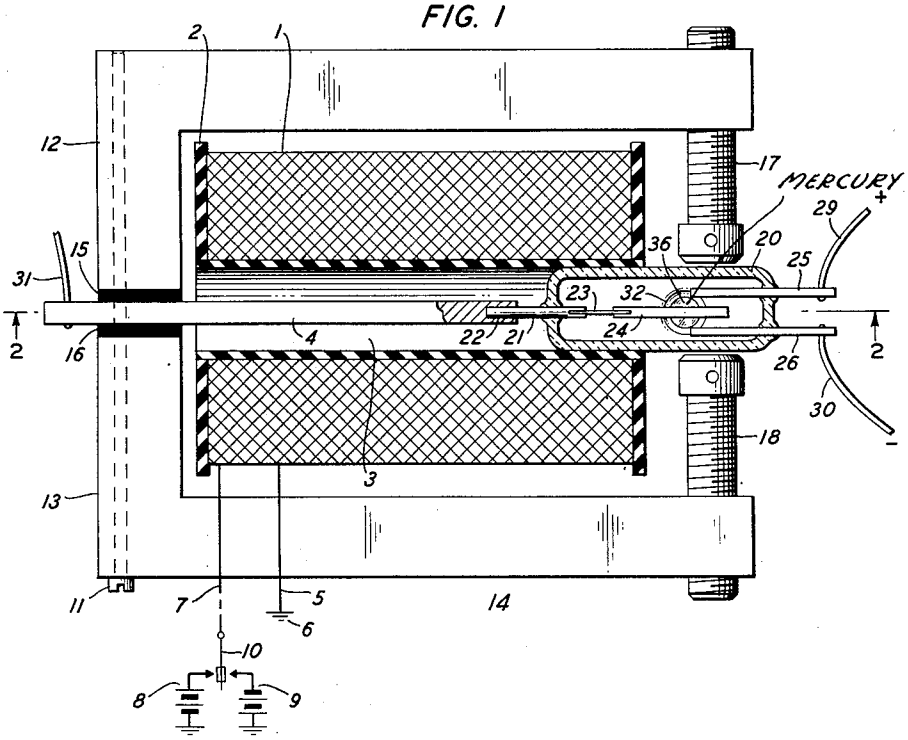
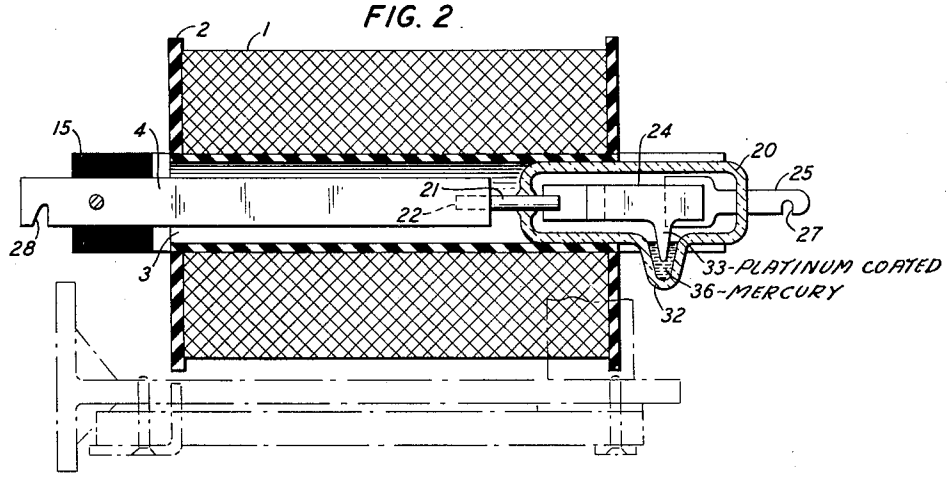


FIG. 2



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MERCURY CONTACT FOR ELECTRICAL SWITCHES

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3 Claims. (Cl. 200—112)

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This invention relates to magnetic relays and more particularly to magnetic relays having mercury contacts.

An object of this invention is the improvement of magnetic relays. A more particular object of the invention is the improvement of magnetic relays having mercury contacts.

Another object of the invention is the improvement of high speed relays of the polar type through the provision of such relays with mercury contacts.

Another object of the invention is to provide in a relay a readily replaceable mercury contact assembly.

As is well known in the art relay contact deterioration is one of the besetting difficulties of the communication industry and the most prevalent cause of circuit failure. Contact replacement and contact maintenance represent major items of expense. Many attempts have been made to obviate this difficulty and although some progress has been made, particularly in certain relay applications, the difficulty remains in considerable degree in other applications. One of the major sources of trouble caused by contact deterioration is in the high speed polar relay. In such relays as is well known the operation is required to be very fast. As a means of promoting fast operation, the contact separation is very small, ordinarily a few thousandths of an inch. Under such conditions, as should be quite apparent, contact deformation of very small magnitude, of such magnitude as would be permissible for many ordinary types of magnetic relays, would be quite intolerable.

The present invention is designed to minimize contact deterioration and increase the life of relay contacts and the intervals between required adjustment. This is achieved by means of the improved mercury contacting arrangement of the present invention.

It is particularly pointed out that while in the present preferred embodiment of the invention, described and illustrated herein, the mercury contacting arrangement is incorporated in a high speed polar relay, the invention may be incorporated in relays and switches of other types.

The invention may be understood from reference to the following description when read with reference to the associated drawing in which:

Fig. 1 is a plan view partly in section of a high speed polar relay in which the mercury contacting feature of the present invention is incorporated; and

Fig. 2 is a vertical section through line 2—2 of Fig. 1.

In its fundamental features of construction

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the specific relay disclosed in the present application may be similar to that disclosed in the patent to Cummings 1,624,476, granted April 12, 1927, or Curtis 1,680,667, granted August 14, 1928. The disclosures of these patents are incorporated herein by reference. The present invention may be applied to relays of the type disclosed in these patents as well as to relays of other types. It may be considered as an improvement upon relays of the type disclosed in those patents as well as upon other types of relays.

Refer now to Figs. 1 and 2 which show a magnetizing coil 1 wound on a spool 2, into the horizontal axial opening 3 of which a strip of magnetizable material 4 which may be of rectangular section projects. The coil 1 may have one or several windings, depending on the particular function or functions which the relay may be required to perform in a particular circuit. The relay coil 1 is illustrated as being connected by means of conductor 5 to ground 6 and by means of a line or other conductor 7, of any length, to a source of positive and negative battery 8 and 9 through a switching element 10, which may for instance be a relay armature or any other switching device. The switching device may for instance be actuated by an energizing winding on a relay not shown. The strip 4 is clamped near its left-hand end by means of screw 11, or any other suitable means, between opposed L-shaped magnetic members 12 and 13 of a U-shaped structure 14 of magnetizable material from which members strip 4 is separated by non-magnetizable shims 15 and 16. Near the right-hand ends of the L-shaped members 12 and 13 are adjustable screw pole-pieces 17 and 18 of magnetic material which form parts of the magnetic path and through which the magnetic flux flows. When the invention is incorporated in such a relay as is disclosed in Patent 1,680,667 mentioned in the foregoing, the relay will include a permanent magnet and supporting structure as disclosed therein.

A mercury contact switch assembly comprising an impervious container 20 preferably of glass fits snugly into the right-hand end of the axial opening 3. Through the left-hand end of the tube there projects a cylindrical bar 21 of magnetic material. The left-hand end of bar 21 is of such a diameter that it fits snugly into an axial recess 22 in the right-hand end of the rectangular magnetizable element or bar 4 as container 20 is pushed into the right-hand end of axial opening 3. The bar 21 is sealed in the left-hand end of container 20 at a linear section intermediate the ends of the bar and the right-hand end projects into the interior of the container. The

right-hand end of bar 21 is bifurcated to accommodate a thin flexible magnetizable element 23, the left-hand end of which is welded in the opening. The armature 24 of magnetizable material is provided also with a bifurcated left-hand end. The right-hand end of flexible element 23 projects into the opening between the bifurcations and is welded therein. Two spaced electrical contacts 25 and 26 project through the right-hand end of container 20, in which they are individually sealed, and into the interior of the container. They are each provided near their left-hand ends with enlarged surfaces. As may be seen in Fig. 1 the contacts are laterally spaced and positioned so that their opposed left-hand inner surfaces extend to the left of the right-hand end of armature 24 which is positioned between them. The right-hand end of each of contacts 25 and 26 and the left-hand end of member 4 is notched as at 27 and 28 to accommodate an individual conductor 29, 30 and 31 which may be connected to cooperating apparatus units in the circuit of which the present relay forms a part.

A well 32 is formed in the lower surface of container 20. A projection extending from the lower edge of armature 24 forming a wick 33, which may be plated with platinum, depends into the well which is filled with a conducting fluid such as mercury 36. Into the well there may be introduced, if desired, together with the mercury, any one or more of a number of other substances well known in the art which have the property of extending the useful life of the contact material resulting therefrom. The platinum plated wick draws up the conducting fluid by capillary attraction. The contacting surfaces at the right-hand end of armature 24 will thus be coated with a thin film of conducting fluid and as the armature engages its opposed contacts the contacts will be similarly wetted.

Since the life of mercury contacting elements arranged in accordance with the present invention will be found to be very long, for many applications wherein the contact service is not severe, it will not be necessary to arrange the mercury contact assembly so that it is removable. For such applications it is recommended that the left-hand end of bar 21 be welded to element 4 or that bar 21 be omitted and that the right-hand end of element 4 project directly into container 20 and that the left-hand end of flexible element 23 be welded directly to element 4.

As the coil 1 is alternately energized with current of opposite polarity the armature 24 will be actuated alternately to engage the opposed contacts. Contact will be made between the films with which the surfaces of armature 24 and contacts 25 and 26 are wetted. As a result of the making and breaking of the contacts a certain amount of the fluid will be vaporized. It will thereafter condense and fall to the bottom of the container which is so shaped that the condensed fluid will collect in the well. As a result of the capillary attraction the contacting film surfaces are self-renewing and clean-conducting films are constantly presented for engagement.

Attention is particularly called to the fact that the spacing between the armature 24 and the contacts 25 and 26 as shown on the drawing are each about .08 inch. This is for purpose of illustration only. In many applications this spacing may be only a few thousandths of an inch. The dimensions of the container, its wall thickness and the dimensions of the gaps in the magnetic paths, as shown in the drawing are all for purposes of illustration only.

The individually adjustable magnetic pole-pieces 17 and 18 make it possible to vary the gap between each pole-piece and the armature and thus equalize the response of the armature.

It is particularly pointed out that the mercury contact assembly may be applied to relays of types other than polar relays such as neutral relays of many varieties.

When arranged as a replaceable unit, the conducting wires 29 and 30 may be disconnected, the container 20 may be withdrawn manually and replaced by another container, which is thrust into the axial opening 3 and pressed inwardly until bar 21 fits snugly in the axial opening in the right-hand end of element 4.

What is claimed is:

1. In a magnetic relay, a magnetizable element, a recess therein, a readily replaceable mercury contact assembly, said assembly comprising an elongated horizontally disposed impervious container, electrical contacts in said container, means in said container for coating said contacts with a thin film of conducting fluid and means for readily mounting and demounting said container in and from operating relation in said relay to expedite the replacement of defective contacts, said means comprising a bar external to and integral with said container, said bar projectable into said recess and secured in said recess frictionally when pressed manually into said recess.

2. An electromagnetic relay, said relay having its longitudinal axis disposed horizontally, said relay comprising a magnetizable yoke, a magnetizing coil mounted in an opening in said yoke, a horizontally disposed axial opening in said coil, an elongated magnetizable element projecting into said opening, said element having one end secured in said yoke, a recess in the other end of said element, an elongated impervious container arranged for mounting in said axial opening so that the longitudinal axis of said container is disposed horizontally, a fixed electrode and an elongated armature both sealed in said container, said armature having one end connected to a rod, said rod projecting through an end of said container, said rod projecting into said recess and engaging frictionally in said recess, as said container is pressed into said axial opening, so that said container may be mounted and demounted with dispatch, said armature actuable to engage said electrode under control of said coil.

3. A relay in accordance with claim 2, said container having a well disposed in its lower longitudinal surface, an electrical conducting fluid in said well and means for raising said fluid by capillarity so as to afford fluid contacting between said armature and said electrode to minimize deterioration.

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The following references are of record in the file of this patent:

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