

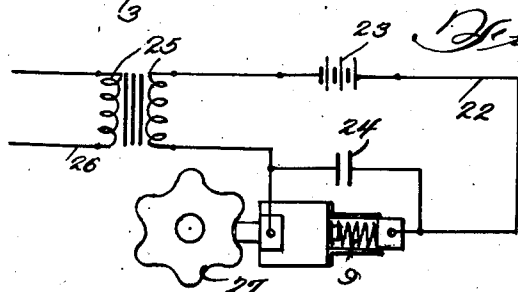
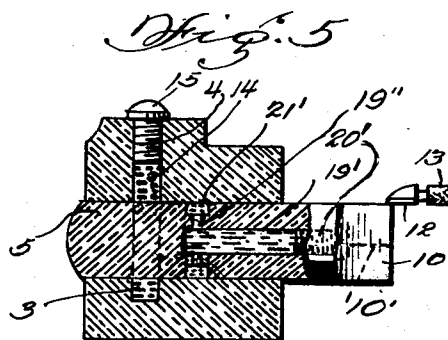
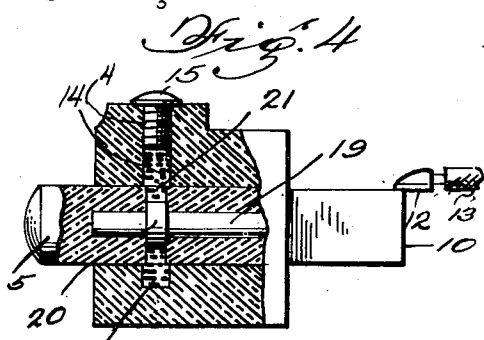
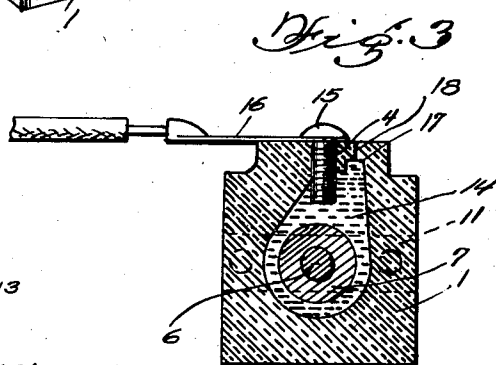
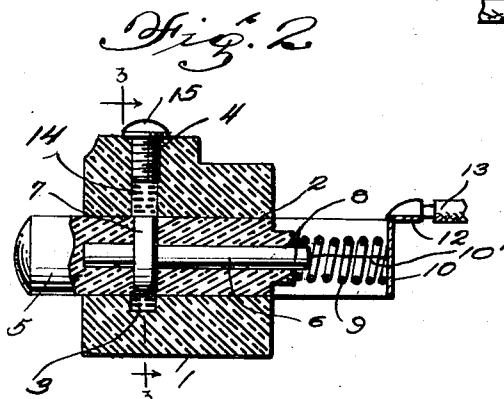
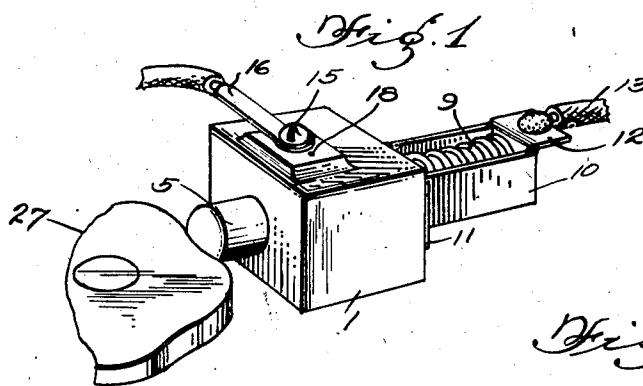
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N. SISSENWINE ET AL

2,606,256

MERCURY SWITCH

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INVENTORS
NORMAN SISSENWINE
AND JACK RATZKIN
BY

W. J. Eccleston.

ATTORNEY

UNITED STATES PATENT OFFICE

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MERCURY SWITCH

Norman Sissenwine, Takoma Park, and Jack
Ratzkin, Greenbelt, Md.

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5 Claims. (Cl. 200—32)

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The invention described herein, if patented, may be manufactured and used by or for the Government for governmental purposes, without the payment to us of any royalty thereon.

This application is a continuation-in-part of our copending application Serial No. 78,204, filed February 24, 1949, now abandoned, for a Mercury Switch.

This invention relates to mercury switches and while illustrated in connection with a multiple cam and primary circuit, such as commonly used in ignition systems of internal combustion engines, is capable of general use.

An object of the invention resides in the provision of a switch which will eliminate the possibility of pitting and corrosion such as cause frequent replacement when tungsten breaker points are used.

Another object of the invention consists in providing a switch such that the timing is automatically maintained and changes in temperature have no deleterious effects.

A further object of the invention resides in the provision of a switch in which the contacts are inclosed and so arranged as to eliminate the possibility of arcing.

Another object of the invention consists in providing a switch in which the make or break is caused by contacting or separating two charges of mercury.

A still further object of the invention consists in providing an improved ignition system for internal combustion engines.

Other objects and advantages of the invention will be apparent from the following description when taken in connection with the accompanying drawings, in which,

Figure 1 is a perspective view of the switch associated with a multiple operating cam.

Figure 2 is a longitudinal sectional view through the switch.

Figure 3 is a transverse sectional view taken on line 3—3 of Figure 2; and

Figure 4 is a vertical sectional view through a slightly modified construction of a switch in closed position.

Figure 5 is a similar view showing a still further modified form of switch; and

Figure 6 is a plan view of one of the switches placed in an otherwise conventional ignition circuit.

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Referring to the drawings in greater detail, and particularly to Figures 1 to 3 inclusive, the numeral 1 indicates a block of insulating material, preferably formed of glass or similar material which will not be wetted by mercury. This block of material forms the body of the switch and is provided with a longitudinally extending bore 2, with which communicates a transversely extending annular recess or pocket 3, more clearly shown in Figure 3 wherein one portion of the pocket is shown as extending to a point adjacent the upper wall of the body member 1 and provided with a filling opening 4.

Slidably mounted with the bore 2 is a plunger 5 formed of fiber or other insulating material and having a metal conductor 6 embedded therein and extending axially thereof. The conductor 6 has welded thereto or integrally formed therewith intermediate its ends, a metal disc 7 having a diameter corresponding to the diameter of the fiber member 5, and being exposed at the periphery thereof. The metal conductor 6 extends beyond the end of the plunger 5, as indicated by the numeral 8, and is surrounded by one end of a coil spring 9, which engages the plunger 5 at one end and is seated upon the inner face of a bracket 10 at its other end. This bracket is of general U-shape construction and is provided with outwardly-turned flanges 11 by means of which it may be secured to the body or stationary portion 1 of the switch. The bracket 10 is also provided with a flange 12 which may be soldered or otherwise electrically connected with one terminal 13, of the primary circuit in which the switch is mounted. A cat whisker 14 connected to the end of conductor 6, and to the bracket 10, serves to insure a flow of electric current through the circuit when the switch is closed.

Disposed within the annular pocket 3, formed in the body member 1, is a charge of mercury 15, and the filling opening 4, through which the pocket is charged with mercury may be closed by a screw 16, which also forms an anchor for the other terminal 16 of the primary circuit. An air space 17, is provided above the surface of the mercury for expansion purposes, and a vent 18 is also provided. This charge of mercury of course, as clearly shown in Figures 2 and 3, forms an electrical connection between terminal 16 and the disk 7, when the latter is in the po-

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sition indicated in these figures. The current will then flow through rod 6, cat whisker 10', and bracket 10 to the other terminal 13, of the primary circuit. It will be noted that when the disk or contact 7, is moved to the right (Figure 2), against the pressure of spring 9, beyond the charge of mercury 14, the circuit will be broken.

The mercury switch shown in Figure 4 is substantially the same as that described above, except that the metal conductor 19 which corresponds to the conductor 6 of the previously described form is provided with a metal disk 20, which is of lesser diameter than the disk 7, of Figures 1 to 3 inclusive, and is therefore of less diameter than the plunger 5. Consequently, in this modified construction, an annular pocket 21 is formed in the plunger and this pocket is filled with mercury, as clearly indicated in these two figures. This construction of switch has all of the advantages of that shown in Figures 1 to 3, but has the additional advantage that it presents less resistance due to the molecular cohesion of the two bodies of mercury. Also, there is no wear on the contacting elements, and there is no coefficient of thermal expansion to be contended with in a construction wherein the contacts are formed of two bodies of mercury.

The mercury switch shown in Figure 5 is substantially identical with that shown in Figure 4, except that in lieu of the metal conductor 19, a tubular cavity 19' is provided in the plunger 5, and has extending therefrom a plurality of radial passages 19'' communicating with the annular channel 21'. The tubular cavity, radial passages and annular channel are filled with mercury, and the mercury in the annular channel serves as a contact in cooperating with the mercury in the annular pocket 3. After the mercury is placed in the cavity 19' etc., the same may be sealed by a screw plug 20'. The cat whisker 10' serves to conduct the current from the plug 20' to the bracket 10.

With this particular construction of switch in which the column of mercury is substituted for the solid metal conductor 19, danger of injury to the plug 5, by reason of unequal expansion of the parts due to temperature changes, is eliminated.

The mercury switches as described above, and as heretofore indicated, are mounted in primary circuits generally indicated by the numeral 22, and provided with a storage battery 23, condenser 24, and an induction coil 25, which latter is associated with a secondary circuit 26 in which the distributor and spark plugs of an internal combustion engine may be connected. The plunger 5, is intermittently reciprocated to open and closed position by a rotatably mounted multiple cam 27, provided with 6 lobes in the present instance for use in a 6-cylinder internal combustion engine, the plunger being held in operative contact with the cam by means of the spring 9. In this connection, it is to be noted that when the plunger 5 is in engagement with the dwell portions of the rotary cam 27, the contact disk 7 or mercury 21 is in contact with the mercury charge 14, and when the high portions or lobes of the cam engage the plunger, the latter is moved to the right (Figure 2) so as to break the primary circuit and induce a high potential in the secondary circuit 26.

This particular construction of an annular contact such as the metal disk 7, cooperating with the annularly arranged charge of mercury, or a plurality of mercury contacts, has many advan-

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tages, not only in an ignition device such as illustrated herein, but also in electrical switches generally. Changes in temperature will have no effect on the operation of the switch because the charge of mercury fills the contact space at all times; also the contacts are entirely inclosed and thus eliminate arcing. Moreover, accurate timing is automatically maintained at all times because the switch is caused to open at the exact instant that the left hand edge of the disk 7 or the mercury rings 21 or 21' leave the right hand edge of the annular charge 3 of mercury. Furthermore, by means of this arrangement the use of breaker points and the resultant pitting, disarrangement of timing, and replacement of the points, are avoided. Additionally, the switches shown in Figures 4 and 5, by reason of the contact being formed of two charges of mercury, will provide lessened resistance for the reason mentioned above, and will obviate any possibility of wear on the contacts, since the mercury charges are automatically maintained at full capacity. Also there can be no possibility of binding between the movable parts, inasmuch as the contacting elements are formed of pockets of liquid metal.

The term "mercury" employed herein and in the claims to designate the liquid conductor is to be construed as including any electrical conductor which is liquid at normal temperatures.

In accordance with the patent statutes, we have described what we now deem to be the preferred form of construction, but since various minor changes may be made in structural details without departing from the spirit of the invention, it is intended that all such variations be included within the scope of the appended claims.

We claim:

1. In a mercury switch a stationary portion, a reciprocable portion associated therewith, one of said portions provided with an annular mercury-receiving pocket, an annular metal contact connected with the other portion for contacting the mercury in said pocket, and electrical conductors connected with said pocket and said annular contact respectively.

2. A mercury switch comprising a stationary portion of insulating material provided with a bore opening into an annular mercury-receiving pocket, a plunger formed of insulating material reciprocably mounted in the bore, said plunger provided with a longitudinal mercury-receiving cavity and an external annular groove communicating therewith.

3. A mercury switch comprising a stationary portion of insulating material provided with a bore opening into an annular mercury-receiving pocket, a plunger formed of insulating material reciprocably mounted in the bore, said plunger provided with a longitudinal mercury-receiving cavity, and an external annular groove communicating therewith, and electrical conductors associated with said pocket and said cavity.

4. A mercury switch comprising a stationary portion of insulating material provided with a bore opening into an annular mercury-receiving pocket, said stationary portion provided with an air space and a venting passage connecting said pocket with the atmosphere, a plunger formed of insulating material reciprocably mounted in the bore, and an annular contact carried by the plunger for coaction with the mercury in said pocket, and a conductor disposed axially of the plunger and connected with said annular contact.

5. A mercury switch comprising a stationary

portion of insulating material provided with a bore opening into an annular mercury-receiving pocket, a plunger formed of insulating material reciprocally mounted in the bore, an annular contact on said plunger for coaction with the mercury in said pocket, and a conductor mounted axially of the plunger and connected to said annular contact.

NORMAN SISENWINNE.
JACK RATZKIN.

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