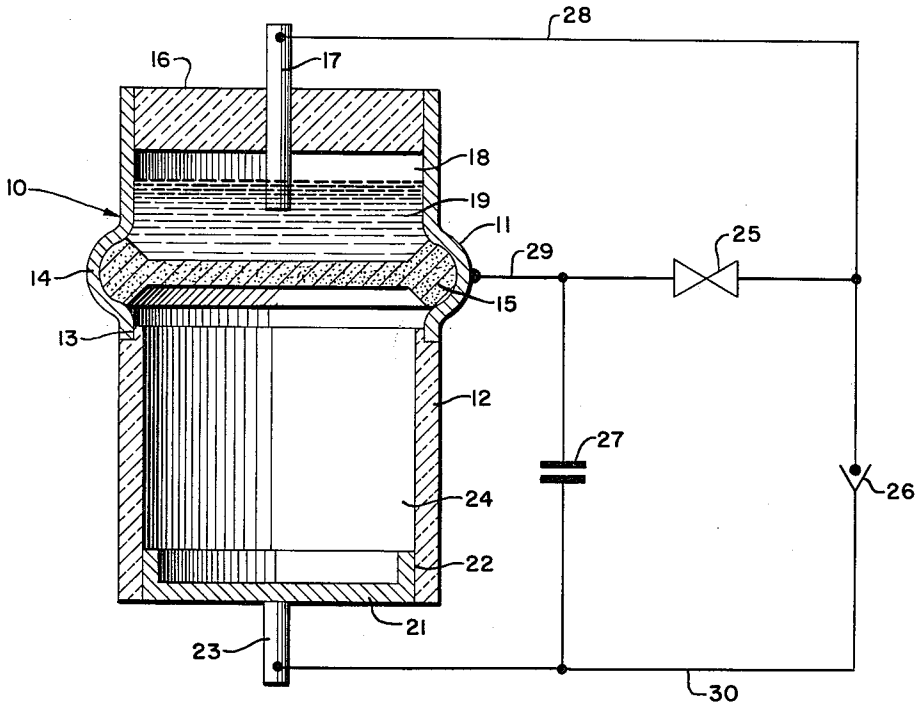
Nov. 14, 1961 H. E. RUEHLEMANN 3,008,416

MERCURY SWITCH GENERATOR FOR ELECTRIC FUZES

Filed Feb. 25, 1955



INVENTOR
H. E. RUEHLEMANN

BY

ATTORNEYS

United States Patent Office 3,008,416 Patented Nov. 14, 1961

3,008,416

MERCURY SWITCH GENERATOR FOR ELECTRIC FUZES

Herbert E. Ruehlemann, Fullerton, Pa., assignor to the United States of America as represented by the Secretary of the Navy

Filed Feb. 25, 1955, Ser. No. 490,713
8 Claims. (Cl. 102—70.2)
(Granted under Title 35, U.S. Code (1952), sec. 266)

The invention described herein may be manufactured and used by or for the Government of the United States of America for governmental purposes without the payment of any royalties thereon or therefor.

The present invention relates to an electrostatic generator and more particularly to a spin operated electrostatic generator of the type which employs a globule of mercury and in which the mercury performs a dual function of actuating switching contacts to interrupt a normally closed circuit and concurrently therewith activating an open circuit as the mercury is forced through a porous diaphragm by centrifugal force from one container to another container, and in which the mercury develops an electrical potential between one of the switch contacts and the generator terminal during the flow of the mercury between the containers.

In devices of this general character hereinbefore devised, it has been the usual practice to employ a substance such as mercury for generating an electrostatic charge as the mercury passes through a porous barrier and in certain other devices, mercury has been employed to open or close selectively switching contacts. In each of such devices, however, the mercury performs but a single function and therefore at least two such devices would be required, each of the devices containing a quantity of mercury which functions independently and separately from the mercury in the other device.

The present invention possesses all of the advantages of the foregoing devices and none of the foregoing disadvantages. In accordance with a preferred embodiment of the invention only a single globule of mercury is employed. This globule of mercury is normally retained within a chamber until forced therefrom through a porous diaphragm into a second chamber by centrifugal force applied to the envelope of which the chambers are formed. By providing a pair of electrodes respectively in communication with the two chambers and a conducting portion of the first chamber in normal contact with the mercury, the device performs the function of a single pole switch in addition to generating an electrostatic potential as the mercury is forced into the second container, as will hereinafter appear more clearly as the description proceeds.

One of the objects of the present invention is to provide a new and improved electrostatic generator having means for performing a switching function as the electrostatic charge is generated.

Another object is to provide a single pole spin operated mercury switch in which new and improved means are provided for collecting a static charge generated by the mercury as the switch operates in response to centrifugal force applied thereto.

A still further object is a new and improved device for energizing and rendering effective the firing circuit of a spin type missile during the flight of the missile.

Still other objects, advantages and improvements will be apparent from the following description taken in connection with the accompanying drawing on which is shown the invention according to a preferred embodiment thereof.

Referring now to the drawing for a more complete understanding of the invention, there is shown thereon a

spin operated mercury switch and electrostatic generator indicated generally by the numeral 10, the switch comprising an envelope, generally circular in shape and formed of a metallic portion 11 bonded to a cylindrical glass portion 12 as at 13 and disposed coaxially therewith. The metallic portion 11 has formed therein an annular protuberance 14 within which is disposed a porous sintered diaphragm 15 composed of any suitable metal such, for example, as stainless steel to which the envelope is sealed at the portion 14 thereof. A glass seal 16 having an electrode 17 therein is employed to seal the end of the metallic portion of the envelope thereby providing a chamber 18 within which is disposed a copious quantity of mercury 19.

The other end of the envelope is enclosed by a cap or charge collector 21 sealed thereto as at 22 substantially as shown. The cap is composed of any metal suitable for the purpose and is provided with a terminal 23 for establishing an external electrical connection thereto. The cap 21 and glass portion of the envelope comprise means forming a chamber 24 into which the mercury is forced by centrifugal force as it passes through the diaphragm 15.

The device of the present invention is suitable for many useful purposes, such, for example, for use with the circuit illustrated for firing an electroresponsive detonator 25 upon actuation of the impact switch 26 after the condenser 27 has been charged by the device. The electrode 17 is connected by conductor 28 to the detonator 25 and to the impact switch 26. The metallic portion 11 of the envelope is connected by the conductor 29 to the detonator 25 and to the condenser 27 and the terminal 23 is connected to the other plate of the condenser 27 and to the impact switch 26 by the conductor 30.

The operation of the device will now be described. Let it be assumed, by way of example, that the mercury switch and electrostatic generator 10 is mounted within a spin type missile in such a manner that the mercury will be forced from chamber 18 through porous diaphragm 15 into chamber 24 by centrifugal force during the flight of the missile and that chamber 18 is initially provided with a copious quantity of mercury.

It will be noted that with the mercury in chamber 18 as illustrated, the detonator 25 is normally shorted by the mercury. As mercury is forced through the porous diaphragm 15 by centrifugal force from chamber 18 into chamber 24 an electrostatic charge is developed thereby. This charge is collected on the charge collector 21 and applied to condenser 27. When sufficient mercury has passed through porous diaphragm 15 to interrupt the circuit between the metallic portion 11 of the envelope and electrode 17, the short is removed from the detonator 25, the flow of droplets of mercury into chamber 24 and engaging cap 21 causing an electrostatic charge to be developed sufficient to charge condenser 27. When this occurs, the missile is armed. As the missile strikes a target, impact switch 26 is closed thereby closing a firing circuit from the charged condenser to the detonator and firing the detonator.

By employing a porous diaphragm in the manner disclosed herein, the flow of mercury from chamber 18 to chamber 24 is retarded and the switch, therefore, is made slow-acting whereby the missile is not armed until a predetermined time has elapsed since it was launched in flight. Furthermore, by retarding the flow of mercury between the chambers in the manner shown, the switch is made non-responsive to shocks or sudden jolts and thereby rendered safe in handling and during transportation. Premature arming and firing are thus prevented.

Whereas the invention has been described in detail with respect to arming and firing means for a spin type projectile in which the electrical energy required for operating the detonator is generated by a sustained appli-

cation of centrifugal force applied to the mercuric element of the device during flight, it is not so limited as it may be advantageously employed for various other purposes and in other combinations with circuit components other than those illustrated in which a switching function concurrently with the generation of an electrostatic potential is advantageous.

Obviously many modifications and variations of the present invention are possible in the light of the above teachings. It is therefore to be understood that within the scope of the appended claims the invention may be practiced otherwise than as specifically described.

What is claimed as new and desired to be secured by Letters Patent of the United States is:

1. A spin operated electrostatic generator of the character disclosed comprising an electrical conducting envelope of circular configuration having an electrode disposed therein, means supporting said electrode in sealed relation to one end of said envelope and insulated therefrom, a second cylindrical envelope composed of insulating material secured at one end thereof to the first-named envelope coaxially therewith, a charge collector composed of electrical conducting material sealing the other end of said insulated envelope, a porous diaphragm disposed transversely within the other end portion of said conducting envelope thereby forming a chamber within which a quantity of mercury is disposed sufficient to normally engage said electrode, said second envelope forming a second chamber between the diaphragm and said charge collector whereby the conducting envelope is normally electrically connected to the electrode by the mercury and an electrostatic charge is developed between the metallic envelope and the charge collector as droplets of mercury are forced through the diaphragm by centrifugal force continuously applied thereto.

2. A mercury switch static generator of the character disclosed comprising a circular envelope composed of electrical conducting material and a second envelope composed of insulating material secured thereto in coaxial relation, a porous metal diaphragm disposed transversely to the axis of said envelopes and secured in sealed relation to the conducting envelope in close spaced adjacency to the end of the nonconducting envelope, a glass seal in the other end of said conducting envelope having an electrode therein thereby forming a chamber within which a quantity of mercury is disposed sufficient to establish an electrical connection between the electrode and the electrical conducting envelope, and a conducting cap sealed to the other end of the non-conducting envelope for collecting a charge thereon as the mercury is forced in droplets through the diaphragm by centrifugal force as the droplets of mercury come into electrical conduct with the cap.

3. A mercury switch generator for an electric fuze comprising a cylindrical envelope having an electrical conducting portion and an insulating portion along the length thereof, a porous metal baffle member arranged transversely within the envelope adjacent the intersection of the conducting and non-conducting portions thereof, an insulating seal closing the other end of said conducting portion of the envelope and forming a chamber therein, a quantity of mercury within said chamber, an electrode carried by said seal for establishing an electrical connection through the mercury with said conducting portion of the envelope, a charge collecting cap sealed to the outer end of the non-conducting portion of said envelope and having means for establishing an electrical circuit connection thereto, an electroresponsive detonator connected across said electrode and conducting portion of the envelope and normally shunted by said mercury, a condenser connected between said conducting portion of the envelope and said cap, and an impact switch connected between said electrode and cap whereby the short is removed from the detonator and the condenser is charged by a flow of mercury through the diaphragm as centrifugal force is applied thereto and the impact switch is rendered effective to fire the detonator by the charge on said condenser upon closure of the switch.

4. A spin operated mercury switch of the character disclosed comprising an envelope, means for sealing said envelope, a porous baffle disposed transversely of said envelope thereby to form two chambers, a quantity of mercury within the first of said chambers, an electrode in contact with said mercury, that portion of the envelope forming said first chamber being electroconductive thereby providing a switching mechanism normally closed by said mercury, and a charge collecting device within the second chamber and insulated from said electroconductive portion for collecting a static charge as droplets of mercury flow through said baffle in response to a sustained force caused by said spin.

5. A spin actuatable mercury electrostatic generator for arming the fuze of a projectile and comprising an elongated sealed envelope having one portion thereof electrically conducting and the other portion non-conducting, a porous diaphragm arranged transversely within said envelope and carried thereby forming two chambers associated with said conducting and non-conducting portions respectively, a quantity of mercury normally disposed within said conducting chamber, an electrode arranged within said conducting chamber adjacent but not in contact with said diaphragm whereby the conducting portion of the envelope and electrode are normally shorted by the mercury, and a charge collector on the other end of the non-conducting envelope and disposed with the chamber formed thereby for collecting an electrostatic charge thereon as droplets of mercury are forced through the diaphragm by a sustained force applied thereto by the spin of the projectile.

6. A claim according to claim 5 including an initially ineffective electroresponsive detonator connected across said electrode and said conducting portion of the casing and being rendered effective as the mercury is forced through the diaphragm.

7. A claim according to claim 6 including a normally ineffective condenser of sufficient capacity to fire said detonator connected across said conducting portion of the casing and said charge collector whereby the condenser is charged and rendered effective as the mercury is forced through the diaphragm and engages the charge collector.

8. A claim according to claim 7 in which a normally open firing switch is connected across said electrode and charge collector thereby to fire the detonator from the charged condenser as the switch is closed.

References Cited in the file of this patent

UNITED STATES PATENTS

2,414,836 Rickmeyer ---------- Jan. 28, 1947