

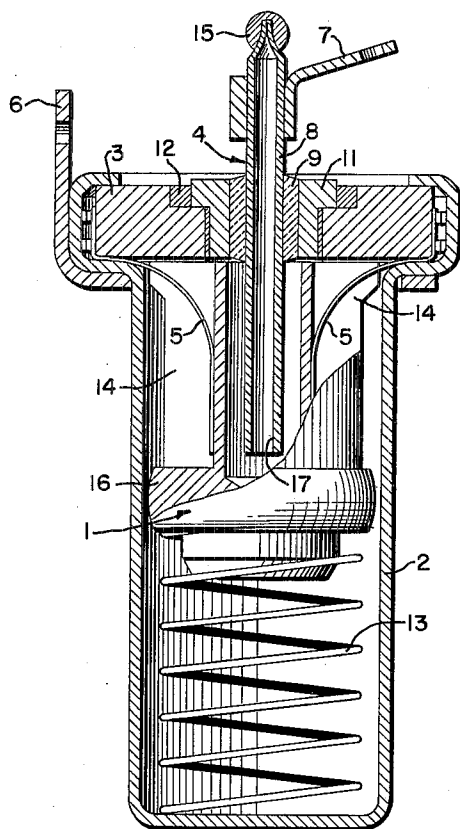
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P. J. McCABE ET AL

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HYDRAULIC SECONDARY SAFETY SWITCH

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INVENTORS

P. J. McCABE

R. S. MARCH

BY

G. J. Taylor
J. E. Hodges
ATTORNEYS

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HYDRAULIC SECONDARY SAFETY SWITCH

Philip J. McCabe, Vienna, Va., and Robert S. March, Sunnyvale, Calif., assignors, by direct and mesne assignments, to the United States of America as represented by the Secretary of the Navy

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9 Claims. (Cl. 200—82)

This invention relates to an electrical switch, and more particularly to an acceleration-time responsive hydraulic electrical switch for maintaining a rocket fuze firing circuit normally inoperative until acted upon by an acceleration greater than a prescribed minimum acceleration, and for a time such that the integral of acceleration vs. time exceeds a prescribed minimum dictated by controllable features of the design.

An object of the invention is to provide a new and improved hydraulic electrical switch responsive to acceleration-time.

Another object of the instant invention is the provision of a secondary safety switch that will provide electrical safety during rough handling including drops from any height less than the design-prescribed minimum value onto any impact surface whatsoever.

A more specific object of the invention is the provision of a switch having a central rod member contactable by a pair of leaf spring contacts in response to a predetermined integral of acceleration vs. time.

A further object of the invention is the elimination of an insulating member or members to retain the aforementioned leaf spring contacts in the open circuit position.

Another object is the provision of positive locking or clamping of the electrical contacts after acceleration to insure the continuance of the electrical conductive path through the switch.

Other objects and many of the attendant advantages of this invention will be readily appreciated as the same becomes better understood by reference to the following detailed description when considered in connection with the accompanying drawing wherein:

The sole figure is a longitudinal sectional view of the new switch.

Referring now to the drawing, reference numeral 1 denotes a piston mass, with a carefully machined flange 16, which is held in the position shown by spring 13. The piston is contained within a hermetically-sealed housing comprising cylindrical casing 2, annular member 3 and a standard commercially available feed-through terminal 4. The piston is contained in the hermetically-sealed casing containing silicone fluid of one centistoke viscosity. The clearance between the flange and the inside diameter of the casing acts as an annular orifice which meters the flow of fluid as the piston is driven rearwardly. The feed-through terminal is used as the center terminal of the switch, and as the filling tube for the housing as will hereinafter become more apparent.

Affixed between the casing 2 and annular member 3 on opposite sides of the housing is a pair of leaf spring electrical contacts 5. Connected to the casing 2, in electrical contact therewith, is a ground terminal tab 6. The other terminal tab 7 of the switch is affixed to the tube portion 8 of the feed-through terminal 4. In addition to the terminal tab 7 and tube 8, the feed-through terminal is comprised of an insulating glass sleeve 9 and a metal collar 11. The tube is bonded to the glass sleeve and the sleeve is bonded to the metal collar. The feed

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through terminal is sealed into the unit by soldering, at 12, the metal collar 11 to the annular member 3. The switch is filled with a hydraulic fluid, preferably silicone fluid of one centistoke viscosity, through the upper end of tube 8 which is then sealed at 15 by crimping and soldering the tube. It is to be understood that other suitable fluids may also be employed.

The piston 1 has a pair of milled slots 14 into which the spring contacts 5 project. A cylindrical opening 17 in the center of the piston allows clearance around the tube 8 thereby providing an open circuit. Upon set-back in rocket (or other similar devices) firing, the piston is moved to the opposite end of the casing 2 moving against the force of the fluid in casing 2 and spring 13 which thereby allows the spring contacts 5 to engage the tube 8 and complete an electrical circuit. The circuit thus completed is from terminal tab 6 through the casing to spring contacts 5, tube 8 and hence to terminal tab 7.

As the acceleration decreases the spring 13 forces the piston toward its original position, and the spring contacts 5 and tube 8 are enclosed by the center hole of the piston. This further secures the electrical connection and upon impact of the projectile the piston exerts an additional clamping action on the spring contacts.

In addition to the fact that no insulation is required to retain the spring contacts in their open position, the electrical conduction of the circuit is also improved by the tight contact of the spring contacts and tube. The piston and return spring form no part of the circuit since the contacts are secured to the case and make contact with the terminal tube 8 directly.

By way of example only and not as a limitation, the piston is preferably made of brass, the casing of copper, the annular member of steel, and the leaf-type spring contacts of beryllium copper. The entire unit is hermetically sealed, the joints being diffusion sealed and not mere mechanical bonds.

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 safety switch comprising a hermetically sealed casing, a terminal insulated from said casing and projecting into and out of said casing, a piston within said casing, said piston having a cup-shaped recess therein for normally surrounding the portion of said terminal projecting into said casing to maintain said switch open, spring contact means within said casing normally pressing against said piston and adapted to contact said terminal upon sufficient movement of said piston from a first position.

2. A switch as in claim 1 wherein said piston has a pair of slots and said spring contact means comprises a pair of leaf-type spring contacts each affixed at one end thereof to opposite sides of said casing, respectively, and the other ends of which are adapted to engage said slots when said piston is in said first position and to engage said terminal when said piston is in a second position thereby completing an electrical circuit from said casing through said spring contacts to said terminal.

3. A switch as in claim 2 wherein a first terminal tab is affixed to said casing and a second terminal tab is affixed to the outwardly projecting portion of said terminal, each of said tabs being provided for electrical connection to said switch.

4. A switch as in claim 2 wherein said piston is urged into said first position by a spring member thereby to

retain said spring contacts from contact with said terminal.

5. A switch as defined in claim 4 wherein upon application of an acceleration to the entire assembly for a sufficient time said piston moves from said first position to said second position whereby said spring contacts engage said terminal, and upon deceleration said piston clamps said spring contacts against said terminal.

6. A switch as in claim 5 wherein said chamber is filled with hydraulic fluid.

7. A hydraulic safety switch comprising: a hermetically sealed chamber comprising, a cylindrical casing closed at one end and open at the other, an annular member sealed into said open end and an insulated terminal tube means sealed within the opening defined by said annular member and mounted coaxially therewith, the tube of said insulated terminal tube means projecting into and out from said chamber; a pair of leaf spring contacts each affixed at one end between the junction of said casing and said annular member on opposite sides of the periphery of the annular member; a piston mounted for longitudinal movement within said casing, said piston having a flange machined thereon for providing a carefully controlled flow of hydraulic fluid within said casing, a cylindrical opening in one end of said piston and coaxial therewith, and a pair of slots in said piston in alignment with and for engagement of said spring contacts; hydraulic fluid within said casing; and a spring member between the face of said piston and the closed end of said casing for urging said piston into a first position thereby restraining said spring contacts into a first open circuit position preventing their engagement with said tube, whereby, upon application of a set-back acceleration said piston moves against the force of the hydraulic fluid and said spring member from said first position to a second position thereby allowing said spring contacts to conductively contact said tube completing an electrical circuit, and upon removal of said acceleration said piston moves toward said first position and the cylindrical opening therein locks said spring contact against said tube.

8. An acceleration responsive safety switch comprising a first contact, a second contact for making an electrical contact with said first contact, a hermetically sealed

casing, said second contact electrically connected to and having at least one resilient member extending within said casing, said first contact located at one end of and extending into said casing, said first contact being electrically isolated from said casing, a spring biased piston located in said casing and having an area slightly less than said casing, said piston having a cup-shaped recess at one end thereof for housing said first contact member, said resilient member pressing against said piston, said piston normally keeping the second contact from making an electrical connection with said first contact, oil completely filling the safety switch and surrounding said piston whereby upon being subjected to a predetermined acceleration force for a period of time the spring biased piston moves from its position between said first and second contact to allow the second contact on said resilient member to make an electrical connection between said first contact and said second contact.

9. An acceleration responsive switch comprising a hermetically sealed casing, terminal means insulated from and extending into said casing for providing one electrical contact of the switch, spring contact means providing a second electrical contact of the switch, said spring contact means being electrically connected to said casing for making contact between said terminal means and said casing, a spring biased piston means normally in a first position for keeping said spring contact means from making electrical contact with said terminal means, said piston means being movable to a second position by an acceleration force, said spring contact means moving into contact with said terminal means when said piston means moves to said second position, said piston means being moved into clamping engagement with said spring contact means and terminal means when said acceleration force is sufficiently reduced.

References Cited in the file of this patent

UNITED STATES PATENTS

2,056,494	Tucker et al. -----	Oct. 6, 1936
2,156,751	Collins -----	May 2, 1939
2,251,648	Wayman -----	Aug. 5, 1941
2,785,319	Simpson et al. -----	Mar. 12, 1957
2,921,999	Ziegler -----	Jan. 19, 1960