

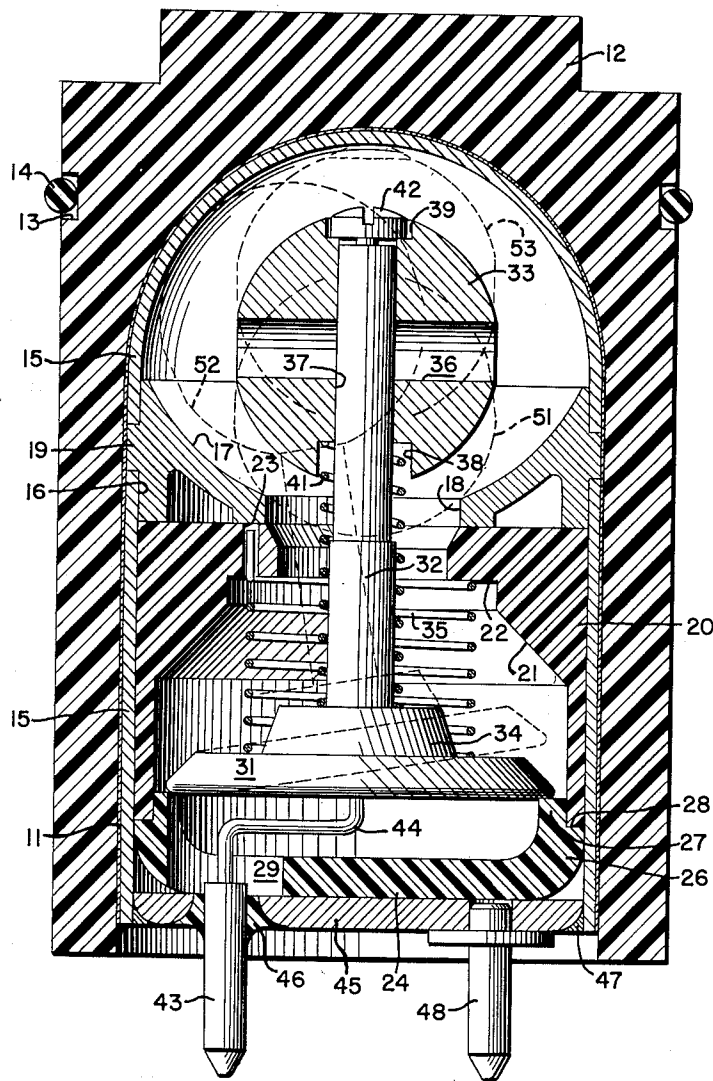
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H. ROVIN

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OMNIDIRECTIONAL INERTIA ACTUATED SWITCH

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INVENTOR.
HERMAN ROVIN

BY *W. R. Gould*
W. O. Jesenberry
W. O. Hodges ATTYS.

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OMNIDIRECTIONAL INERTIA ACTUATED SWITCH

Herman Rovin, Green Acres, Valley Stream, N.Y., assignor, by mesne assignments, to the United States of America as represented by the Secretary of the Navy
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This invention relates to an inertia operated switch of the type sensitive to shock or impact regardless of the direction of such shock or impact and which is particularly suitable for use in the exploder unit in torpedo heads.

An object of the present invention is to provide a switch of the type actuated by a shock or impact received from any direction and having a movable contact.

Another object of the invention is to provide a switch having a normally open spring biased movable contact which will be actuated to a closed position by an impact in any direction of predetermined force.

A further object of the present invention is to provide an inertia operated switch having a ball mounted for sliding movement on a movable pedestal, both ball and pedestal being held against movement by springs.

A still further object of the present invention is to provide an inertia operated switch having a spring biased contact movable to a closed position which will be actuated by a shock or, if coupled with a moving object upon impact with a relatively stationary object, when the shock or impact is in any direction relative to the movable contact.

A still further object of the invention is to provide an inertia operated switch having a movable contact consisting of a ball, spring biased against movement, and substantially surrounding said ball with a surface contact concentric with the ball when the ball is in normal out-of-contact position.

A still further object of the present invention is to provide an inertia operated switch having a spring biased movable ball contact surrounded by a stationary hollow spherical contact such that the mass of the movable ball and the resiliency of the springs is so selected that the switch and its exploder may be safely handled, while assuring actuation under a relative heavy shock or impact when in use.

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 FIGURE is a vertical section of the switch with movement of the movable contact to several positions being shown in dashed outlines.

Referring to the drawing, the switch comprises a housing 12 formed of a plastic or other suitable non-conductive material with all working parts completely within the housing. The housing is centrally bored or otherwise formed to receive the working parts of the switch and has an annular outer groove 13 in which an O-ring 14 is mounted to seal the housing in an exploder unit (not shown) within which the housing is disposed, means (not shown) being provided for locking the switch unit in the exploder.

The central bore is substantially lined with a stationary brass gold-plated contact shell 15 which is divided into an upper semi-spherical portion and a cylindrical lower portion. Both portions of the shell are attached firmly to the housing by a cementing material 11. The upper spherical portion is spaced from and connected to the lower cylindrical portion by an annular collar composed of electroconducting material and having a substantially

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cylindrical outer surface 16 and a substantially semi-spherical inner surface 17. The internal opening 18 in the collar is too small to permit passage of the movable contact therethrough as will be hereinafter more fully described. The outer cylindrical surface 16 has extending therefrom an annular rib or collar 19 which abuts the edge of the upper semi-spherical portion and the edge of the lower cylindrical portion of the gold plated shell forming the stationary contact. The edges about the rib while the inner surfaces of both portions of the shell are in contact with the outer cylindrical surface 16 of the collar to provide a good electrical contact between the two sections of the shell and the collar so that a substantially hollow spherical stationary contact surface is located in the closed end of the housing.

Housed within the bore and in contact with the lower portion of the shell 15 as well as in contact with the collar is a sleeve 20 formed of insulating material. The sleeve is bored or otherwise formed to form a conical seat 21 and a flat annular spring seat 22. A small vertical hole 23 opening onto the flat spring seat 22 is formed in the insulating sleeve to receive the end of a spring. The insulating sleeve is abutted by an insulating cap 24.

The cap 24 has side walls 26 and an annular rim 27 forming an annular seat 28 for the edge of the sleeve 20. The cap is also provided with a hole 29 so that electrical connections may be made to the movable contact. The rim 27 of the cap supports a pedestal 31.

The pedestal 31 is formed with an integral central frusto-conical base 34 from which base extends an upright post 32. The post 32 has slidably mounted thereon a ball 33 which is normally held centrally of the hollow spherical contact. A coil spring 35 seated on the pedestal and over the base 34 is held under compression by engagement with the flat annular spring seat 22 formed in the sleeve 20. This arrangement holds the pedestal and its supported ball contact in a yieldable upright position.

The movable ball 33 is bored on a diametric line at 36 and 37. The hole 36 is formed to facilitate the fabrication of the ball and has no part in the mechanism of the switch, while the bore 37 receives the post 32 and is enlarged at each end as shown at 38 and 39 to receive respectively the end of a coil spring 41 and a ball retaining screw 42 which is threaded into the post and preferably secured thereto by a cement. The ball may slide longitudinally of the post 32 and is normally held against such movement by the coil spring 41, one end of which is seated in the enlarged bore 38 of the ball 33, and the other end rests on the frusto-conical base 34.

The ball, post and pedestal form the movable contact and are connected to an insulated contact prong 43 by a flexible wire 44. The contact prong is held, by insulation 46, from contact with a plate 45 which serves as a closing plate for the housing being soldered at 47 along its edge to the shell 15. A contact prong 48 extends from the plate 45 to serve as a ground connection for the shell 15. The prongs make connection with complementary contacts within the exploder when the switch unit is inserted therein.

The switch is used to explode torpedoes and is sensitive to impact from any direction when the impact is sufficient to overcome the strength of the springs 35 or 41. These springs are selected so that an impact such as received by a torpedo hitting an object will relatively move the ball along the post as shown in dotted lines 51 or move the entire contact structure, that is, tilt the pedestal, post and ball, as shown in dashed outlines 52 or move the pedestal, post and ball upwards (referring to the drawing) as shown by dashed line 53. In the position shown at 51 the impact is from the bottom

section of the drawing and acts to compress the spring 41 bringing the shell collar 17 into contact with the ball. A side impact would result in a contact between the shell and pedestal set-up in a position as indicated by dashed line 52 while an impact from a location (at the top of the drawing) will move the switch to the position as shown at 53. Any of these positions shown in dashed lines, or any other position making contact throughout the entire spherical surface which the movable contact will assume, as the result of an impact from any direction will initiate the explosion. The device thus is an omnidirectional inertia switch.

The collar is formed with a central opening 18 to permit entrance of the post and ball into the hollow spherical cavity formed by the upper portion of the shell and the upper end of the collar. The ball 33 is, however, too large to pass through the hole 18 and in making contact with the collar takes the position shown by dashed line 51.

In the assembly the cylindrical portion of the shell together with the sleeve, spring 35 and pedestal are put together, the collar set in place, after which the ball is secured to the pedestal and the semi-spherical portion of the lining friction fitted over the collar, its edge abutting the rib 19. The inside of the housing is then coated with cement and the assembly slipped into place. The wire 44 is connected to pedestal 31 and insulated from metal closure plate 45. Plate 45 is then soldered to the shell 15 at 47 and the assembly is complete. Once the cement sets, the switch cannot be taken apart without damaging some of the parts. It is primarily designed for a single useful operation and must be of simple construction with foolproof operation. The terms upper and lower, as employed herein, may be defined as the upper and lower portions of the FIGURE shown on the drawing.

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 and desired to be secured by Letters Patent of the United States is:

1. An omnidirectional inertia operated switch comprising a plastic housing, means including a shell providing a substantially spherical hollow stationary electrical contact cemented to and forming a lining for said housing, a movable electrical inertial contact means insulated from said liner and within the housing, yieldable means for mounting said movable contact means in said housing and disengaged from said shell contact means whereby a single impact from any direction on said housing will move said movable contact means from an initial position of rest relative to said housing to close a circuit between said shell contact and said movable contact means.

2. An inertia operated switch according to claim 1 wherein the yieldable means comprises a pair of prestressed coil springs.

3. An inertia operated switch according to claim 2 wherein the movable electrical contact means comprises a pedestal, a post extending from said pedestal, and a ball slidably supported on said pedestal, and means on the post for limiting the degree of movement of the ball in one direction along the axis of the post, said ball being yieldably held against said movement limiting means by one of said springs.

4. An omnidirectional inertia operated switch for closing a circuit, comprising a relative stationary conductive substantially cylindrical shell having a closed hemispherical end and an open end, means within said shell forming a complementary substantially hemispherical annular contact in engagement therewith, an inertia responsive mov-

able contact member mounted within the shell intermediate said hemispherical end and said contact means and insulated therefrom, springs yieldably supporting said movable contact member in an initial position of rest and in spaced relation with said shell and contact means, said springs yielding selectively in response to the direction of movement of said movable contact member as a single impact force is applied to said switch from any direction, the movable contact member being brought from said position of rest into circuit closing position with respect to the stationary shell and contact means selectively in accordance with the direction of said force when said force is of a predetermined magnitude, and a housing of insulating material substantially covering and supporting said shell and contact means.

5. An inertia operated switch according to claim 4, including a collar connected to said shell and an insulating sleeve, said collar and said sleeve being within said shell to divide said shell into an upper hollow spherical compartment and a lower substantially cylindrical compartment, said movable contact member extending into both compartments.

6. An omnidirectional inertia operated switch according to claim 5 wherein the upper portion of the movable contact member housed within the hollow spherical compartment is an inertia responsive electroconductive ball placed to be substantially centered within the spherical compartment and normally disengaged therefrom.

7. An inertia operated switch according to claim 6 wherein the spring means supporting the movable contact member is yieldable in any direction sufficiently for the ball to move into engagement with the hollow spherical shell and contact means selectively in accordance with the direction of said force thereby to close a circuit therebetween.

8. An omnidirectional inertia operated normally open switch comprising a separable fixed hollow substantially spherical contact element having an aperture formed therein, an inertia responsive movable contact member comprising a spring biased rod disposed within the aperture and movable axially and angularly with respect thereto from an initial position of rest, stop means on said rod, a spherical inertia contact of greater diameter than the aperture disposed in spaced relation within the said fixed spherical contact and slideably carried by said rod, and means for yieldably urging said inertia contact against said stop means whereby the switch is effective to close the contacts thereof in response to a single impact force applied thereto from any direction.

9. An omnidirectional inertia operated switch according to claim 8 including a pedestal formed on an end portion of said rod and a fixed seat therefor, and a spring member yieldably urging the pedestal against the seat whereby the rod is movable axially and angularly to a switch closing position selectively in accordance with the direction of an impact force applied to the switch.

10. An omnidirectional inertia switch according to claim 9 wherein the means for yieldably urging the inertia contact against the stop is constructed and arranged to exert a force sufficiently in excess of the force of said spring member to prevent substantial sliding movement of the spherical inertia contact with respect to said rod as the rod moves axially from the position of rest thereof.

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