United States Patent

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[73] Assignee C.B. Associates Limited
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[33] Great Britain
[31] 18,722/68

[54] **INERTIA SWITCH RESPONSIVE TO HIGH AND LOW LEVEL SHOCKS**
8 Claims, 6 Drawing Figs.

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[51] Int. Cl. H01h 35/14
[50] Field of Search ..... 200/61.45; 52(ball), 61.52; 340/261, 262

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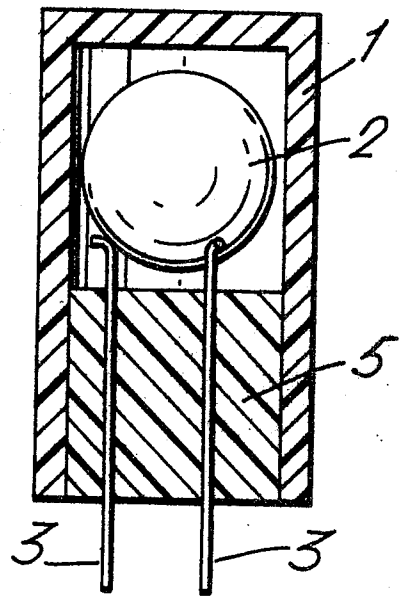
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Assistant Examiner—M. Ginsburg
Attorney—Woodhams, Blanchard and Flynn

ABSTRACT: The invention concerns an inertia switch in the form of a sphere supported normally on a seat formed by three pins, two of which form electrical contacts. Upon dislodgement of the sphere upon a vibration of the switch a circuit between two of the contacts is broken whereby to actuate a device, such as a burglar alarm, controlled by the switch. The construction offers a simple and inexpensive yet extremely sensitive switch.



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SHEET 1 OF 2

Fig. 1a.

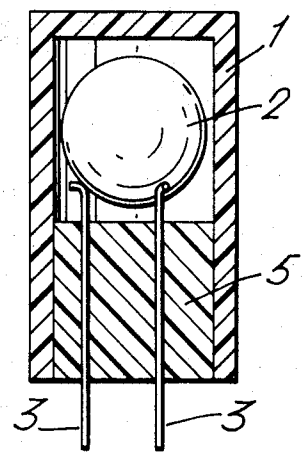


Fig. 1b.

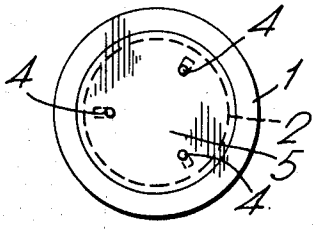


Fig. 2a.

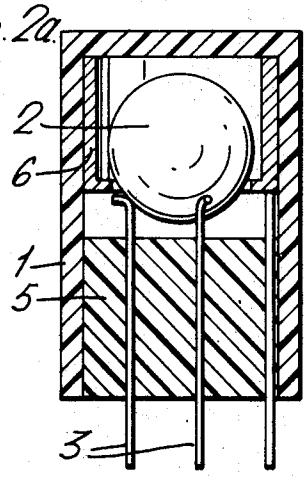
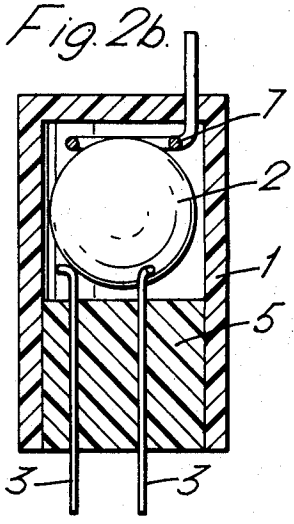


Fig. 2b.



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Fig. 3a.

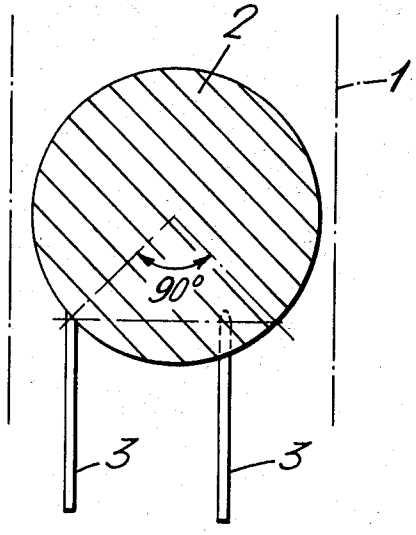
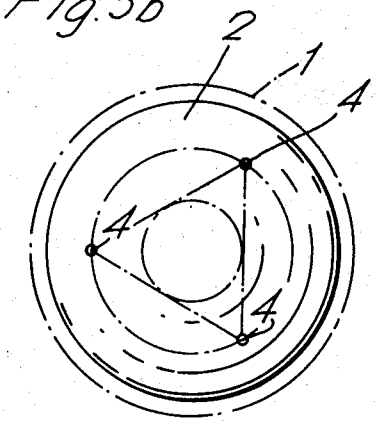


Fig. 3b



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INERTIA SWITCH RESPONSIVE TO HIGH AND LOW LEVEL SHOCKS

The present invention relates to inertia activated switches and in particular to an inertia-activated switch suitable for use as a burglar alarm switch.

It is known that extreme sensitivity to vibrations is exhibited by normally closed inertia switches set for low threshold values. It is also evident from practical experience that such inertia switches possess the property of mode conversion whereby whatever axis is excited by vibration, the vibration becomes reorientated along the sensitive direction(s) of the switch. The degree of mode conversion is dependent on the disposition, construction and relationship of the contact members.

According to the present invention an inertia switch comprises an electrically conductive sphere supported normally on a seat formed by three pins or legs, two of the pins or legs forming electrical contacts such that upon dislodgement of the sphere off its seat upon vibration of the switch the circuit between the two contacts is momentarily broken.

Preferably, a third contact is provided which is contacted by the sphere upon its dislodgement to complete a circuit between the third contact and one of the first two mentioned contacts.

The third contact may be provided by the switch housing. Preferably the third contact is formed by a sleeve or ring located adjacent the sphere within the housing.

The invention will be described further, by way of example, with reference to the accompanying drawings in which:

FIGS. 1*a* and 1 1*b* are sectional elevation and plan views respectively of a first embodiment of a switch according to the invention;

FIG. 2*a* is a sectional elevation of a second embodiment of a switch according to the invention;

FIG. 2*a* is a sectional elevation of a second embodiment of a switch according to the invention;

FIG. 2*b* is a sectional elevation of a third embodiment of a switch according to the invention; and

FIGS. 3*a* and 3*b* shows respectively in elevation and plan the geometrical conditions underlying the disposition of the elements of a switch.

In the construction illustrated in FIGS. 1*a* and 1*b* a switch comprises a retaining cylinder 1 of insulating material, a conducting metallic ball 2 and wires or pins 3 having curved end portions providing convex surfaces which function as contact terminals 4 for the ball 2, the wires 3 being supported in a nonconducting moulding 5 formed of insulating material. The wires or pins 3 may be plated, for example with gold, to provide good electrical contact.

The three wires 3 form a seat for the ball with any two of the wires being coupled to a circuit incorporating, for example, an alarm system. Upon dislodgement of the ball from its seat upon vibration of the switch the circuit is momentarily broken to actuate the alarm system. In an alternative construction one of the three wires may be replaced by a nonconducting support member.

The retaining cylinder 1 may be formed from an electrically conducting material to provide a further contact for the switch. Upon dislodgement, the circuit incorporating two of the three wires is broken as before and the ball upon contacting the cylinder completes a circuit between the cylinder and one of the wires.

In the embodiment illustrated in FIG. 2*a* this further contact is formed as a cylindrical sleeve 6 having an inwardly directed flange at the lower end thereof. Alternatively, the flange may be located at the upper end of the sleeve 6 or the interior of the sleeve may be tapered from one end thereof to the other. In the embodiment illustrated in FIG. 2*b* the further contact is formed as a ring 7. In FIGS. 2*a* and 2*b* the cylinder is formed from an insulating material.

The sleeve 6 or the ring 7 may be axially displaceable within the retaining cylinder whereby to adjust the sensitivity of the switch. The sensitivity of the switch is determined by the relative position of the cylindrical sleeve, or ring, in relation to the ball 2. Alternatively, or in addition, the moulding 5 carrying the wires 3 may be axially displaceable within the cylinder so as to adjust the position of the ball seat.

It will be understood that in operation a normally closed circuit is provided by the ball 2 and two of the wires 3; on disturbance of the ball 2 the normally closed circuit is broken and the ball 2 contacts the cylindrical sleeve 6 or the ring 7 to complete a circuit therebetween and one of the wires 3.

As will be seen from FIGS. 3*a* and 3*b* in order for the switch to return to the closed position the clearance between the ball 2 and the retaining cylinder 1 or cylindrical sleeve 6 or the ring 7 must be significantly less than the radius of the inscribed circle formed by joining the terminals 4 of the contact members of the normally closed switch.

The switch is intended to be mounted with its axis substantially vertical and in general it is inadvisable for any two contacts to subtend an angle on the ball of more than 90°.

In the case illustrated in FIGS. 3*a* and 3*b* the contacts lie on a circle (on the ball's surface) which defines a cone of total angle 90° at the center of the ball. In this case the angle subtended by any two contacts at the center of the ball is approximately 75°. It is not, however, necessary to restrict the geometry to any special angular conditions. Reduction of the pitch circle diameter of the contacts in relation to the ball diameter causes increase of sensitivity. A particular advantage of the construction is that fairly large equal pressures are exerted on each contact due to gravity. Hence the normal static contact pressure is not defined by the G-setting.

In any one switch configuration (ratio of pitch circle diameter to ball diameter), it is possible to increase sensitivity by tilting the axis away from the vertical, over an angle which is restricted by the geometrical conditions illustrated in FIG. 3.

Since a primary application for an inertia switch according to the invention is for intruder alarm systems in which there are transient interruptions of direct current passing through the switch when the switch is subjected to low level transient shocks, the duration of which may be extremely short. This speed of response clearly enables the switch to respond to low level vibrations over a very wide frequency range. The transient interruptions of direct current passing through the switch (or through a series of them) are recognized by standard electronic circuits and, as these circuits control alarm systems it is likely that tampering will occur. For this reason a nonmagnetic ball is preferred though not essential. An externally placed magnet cannot then be used to increase the holding force between the ball and the contacts. However, in certain applications it might be desirable to form the ball from a magnetic material and to locate a cooperating magnet in the moulding 5. The magnet can be axially adjustable whereby to vary and adjust the retaining force on the ball.

I claim:

1. An inertia switch comprising a housing, three legs in the housing forming a tripod support, a curved portion of each leg having convex and concave surfaces, an electrically conductive sphere normally seated on the convex surfaces of the curved portions of the legs within the housing, and electrical contacts formed by two of said legs, a circuit between the contacts being momentarily broken upon dislodgement of the sphere upon vibration of the switch.

2. An inertial inertia switch including a housing, a sphere within the housing, a support seat for the sphere, said support seat comprising convex surfaces of curved portions of three legs disposed in tripod fashion, electrical contacts formed by the convex surfaces of two of said legs and normally closed by the sphere, at least one of said support seat and sphere being gold plated to provide improved electrical contact therebetween, and a third contact cooperable with the sphere upon dislodgement of the sphere from its support seat upon vibration of the switch.

3. An inertia switch according to claim 2 in which the third contact comprises a cylindrical sleeve within the housing and an inwardly directed flange at one end of said sleeve.

4. An inertia switch according to claim 3 in which the sleeve is axially displaceable within the housing.

5. An inertia switch according to claim 2 in which the third contact comprises a ring positioned above the sphere and of a diameter less than the diameter of the sphere.

6. An inertia switch according to claim 5 in which the ring is axially displaceable within the housing.

7. An inertia switch according to claim 1, in which the sphere is of ferromagnetic material and a magnet is mounted in the housing to releasably maintain the sphere seated on said convex surfaces.

8. An inertia switch according to claim 1, in which at least one of said tripod support and sphere is gold-plated to provide improved electrical contact therebetween.