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Endo

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[54] **LIQUID CONTACT TILT INERTIAL SWITCH WITH MOVABLE METALLIC CONDUCTIVE MEANS RESPONSIVE TO ACCELERATION AND DECELERATION FORCES**

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[51] **Int. Cl.** **H01h 35/02,** H01h 29/10

[58] **Field of Search** .. 200/61.45 R, 61.45 M, 61.47, 200/61.52, 187, 188, 220, 221, 223, 228, 229, 235, 236

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[57] **ABSTRACT**

Upper and lower chambers are connected by a restricted passageway and contain three electrical contacts and a conductive fluid respectively. A ball disposed in the upper chamber and biased by a magnet to close the passageway connects one contact with another when the vehicle undergoes excessive deceleration or when it is tilted on its side. Fluid flows from the lower into the upper chamber to connect the one contact with the third when the vehicle is inverted.

1 Claim, 4 Drawing Figures

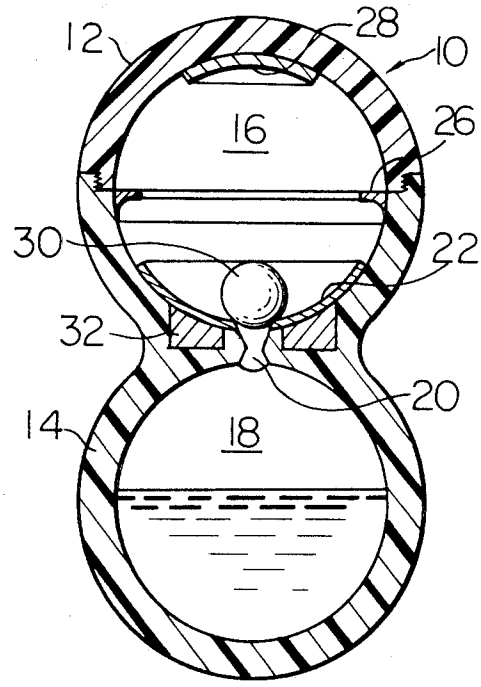


Fig. 1

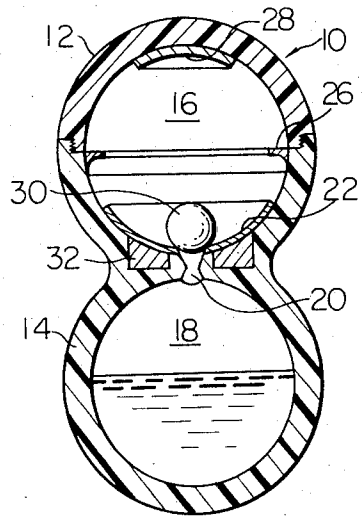


Fig. 2

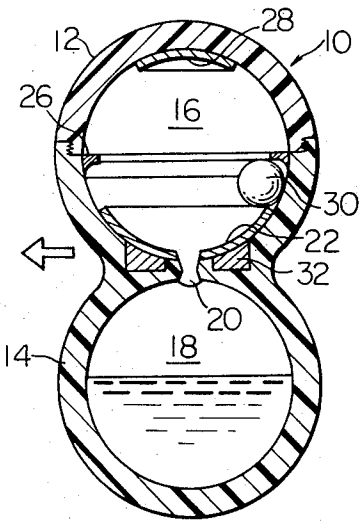
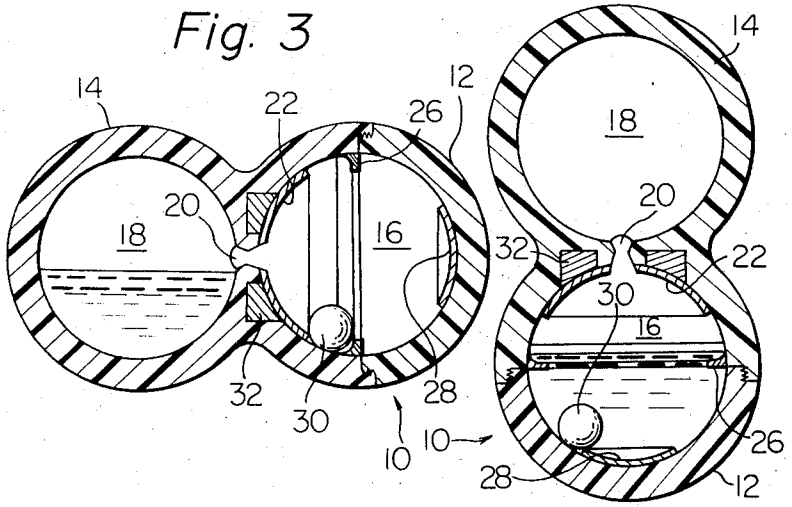


Fig. 4

Fig. 3



LIQUID CONTACT TILT INERTIAL SWITCH WITH MOVABLE METALLIC CONDUCTIVE MEANS RESPONSIVE TO ACCELERATION AND DECELERATION FORCES

The present invention relates to an accident detecting switch for a vehicle.

So-called accident detecting switches of the prior art are utilized to cut off the whole electric system and/or fuel supply system of a vehicle to prevent burning or exploding of the vehicle during the collision. A typical accident detecting switche generally comprises a deceleration switch mounted along the longitudinal axis of the vehicle to respond to an applied deceleration in one direction or within a given angular range. However, with this type of accident detecting switch it is impossible to discriminate upset of the vehicle from lateral turning of the vehicle. Thus, initiation of proper safety devices has been difficult with prior art accident detecting switches.

It is accordingly an object of the present invention to provide an accident detecting switch for a vehicle which is capable of discriminating upset of the vehicle from lateral turning of the vehicle.

Other objects, features and advantages of the present invention will be apparent from the following description taken in conjunction with the accompanying drawing, in which:

FIG. **1** is a cross sectional view of an embodiment of an accident detecting switch according to the present invention;

FIG. **2** is a cross sectional view of the switch when decelerated in a horizontal or lateral direction;

FIG. **3** is a cross sectional view of the switch when the vehicle is turned on its side; and

FIG. **4** is a cross sectional view of the switch when the vehicle is upset.

Referring to the accompanying drawing, there is shown an accident detecting switch **10** according to the present invention, which includes first and second electrically non-conductive casings **12** and **14** respectively which are connected together by suitable means, and define therein first and second chambers **16** and **18** respectively connected by a restricted passageway **20.** The chamber **18** normally contains an electrically conductive fluid such as mercury which flows into the chamber **16** when the vehicle is tilted or upset. In the present embodiment, the chambers **16** and **18** are spherical.

A first curved contact **22** is suitably fixed to the inner wall of the chamber **16** of the casing **14** about the opening of the passageway **20.** An annular contact **26** is fixed to the inner wall of the chamber **16.** A second curved contact **28** is fixed to the inner wall of the chamber **16** opposite to the contact **22.** An electrically conductive ball **30** is movable within the chamber **16** but is normally biased by a magnet **32** to the position illustrated in FIG. **1** to block the passageway **20.** Preferably, the contact **22** is formed with a tapered profile around the passageway **20** for properly positioning the ball **30.** The magnet **32** is in contact with the contact **22** and surrounds the passageway **20** as shown.

The contacts **26** and **28** are disposed in different parallel planes, such that the ball **30** cannot bridge the space therebetween. The contacts **22** and **26** are spaced apart such that the ball **30** will bridge the space therebetween when the vehicle is subjected to an acceleration greater than a predetermined absolute magnitude (see FIG. **2**).

The conductive liquid normally disposed in the chamber **18** has a volume less than half that of the chamber **18** so that the liquid will not enter the passageway **20** if the vehicle is tilted on its side (see FIG. **3**), but it will flow into the chamber **16** and bridge the space between the contacts **26** and **28** upon upset of the vehicle (see FIG. **4**). The ball **30** will connect the contacts **22** and **26** if the vehicle is tilted within a predetermined range from its upright position.

In case of a vehicle collision whereby the vehicle is accelerated or decelerated greater than the predetermined magnitude as shown in FIG. **2,** the inertia of the ball **30** will cause it to move out of the influence of the magnetic field of the magnet **32** to connect the contacts **22** and **26.** In case of a vehicle accident whereby the vehicle is tilted, the impact resulting will cause the ball **30** to move out of the influence of magnetic field to connect the contacts **22** and **26,** but the liquid is still disposed in the chamber **18** and will not flow into the chamber **16.** In both cases the contacts **22** and **26** are connected temporarily. The contact **26** may be connected to ground and the contact **22** to a circuit including a latching relay so that an electrical signal is produced at an output terminal thereof when the contacts **22** and **24** are connected.

In case of a vehicle accident whereby the vehicle is upset beyond the predetermined angular range as shown in FIG. **4,** the impact resulting will cause the ball **30** to move out of the influence of the magnetic field to open the passageway **20.** Thus, due to the gravity, the conductive fluid will flow into the chamber **16** through the restricted passageway **20** and fill the space between the contacts **26** and **28** to connect them. The contact **28** may be connected to an electric circuit so that another electric signal, upon upset of the vehicle, is produced at an output terminal thereof.

It will now be appreciated from the foregoing description that these two electric signals can be used for actuation of proper safety device initiation means corresponding to the respective accident conditions. The signal produced by contact of the contacts **22** and **26** may be used as an initiation signal for cutting off the ignition circuit, application of the brakes and inflation of an air bag mounted in the vehicle. The other signal may be used as an initiation signal for cutting off the ignition circuit and the fuel supply system mounted in the vehicle.

What is claimed is:

1. An accident detecting switch for a vehicle comprising: an electrically conductive ball; a normally vertical dielectric casing having an upper chamber and a lower reservoir joined by a restricted passageway, said upper chamber including said movable spherical contact member; a first electrical contact having an aperture at the bottom thereof communicating with the passageway; a second electrical contact; said first and second electrical contacts being disposed in said upper chamber in a spaced relationship; a magnet to attract said ball to said aperture to block said passageway and to maintain said ball separated from said second electrical contact; said ball being movable against the action of said magnet into contact with said first and second electrical contacts when an applied acceleration in any direction within a given plane exceeds a predetermined magnitude; a third electrical contact disposed in said upper chamber; and an electrically conductive fluid disposed in said lower reservoir, said fluid being adapted to flow into said upper chamber and into contact with said second and third electrical contacts upon the upset of said dielectric casing with said passageway opened.

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