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Myers

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[54] **TILT RESPONSIVE SWITCH WITH BALL CONTACT ACTUATING STRUCTURE**

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[52] **U.S. Cl.**.....**200/61.52,** 200/61.45 R, 200/61.48, 200/61.51, 200/DIG. 29

[51] **Int. Cl.**.....**H01h 35/14**

[58] **Field of Search**.....200/61.11, 61.45 R, 200/61.52, 61.53, DIG. 29, 166 BB, 166 BE, 11 K

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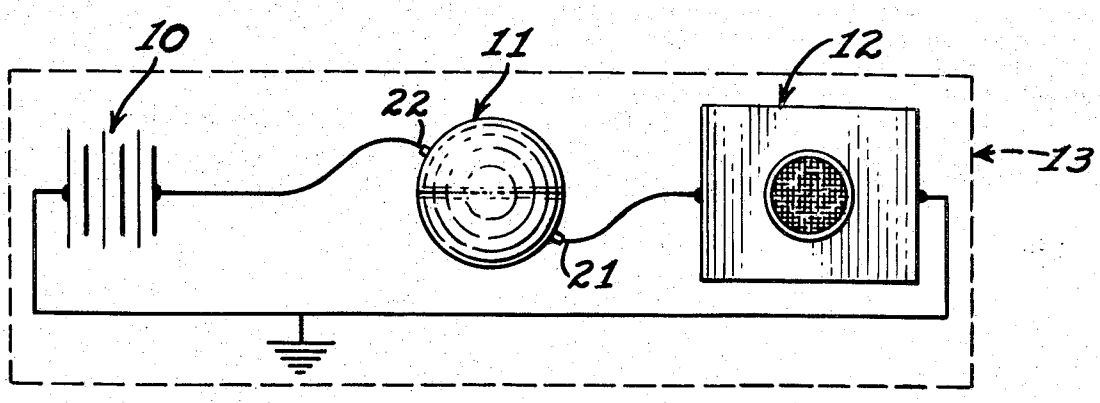
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Primary Examiner—J. R. Scott
Attorney—Warren F. B. Lindsley

[57] **ABSTRACT**

A pair of hollow concentrically arranged containers having conductive inner surfaces separated by electrical insulating material and having a small conductive ball positioned in a hole in the inner container making contact with the conductive surfaces of both containers when the containers are tilted away from a level position.

8 Claims, 5 Drawing Figures



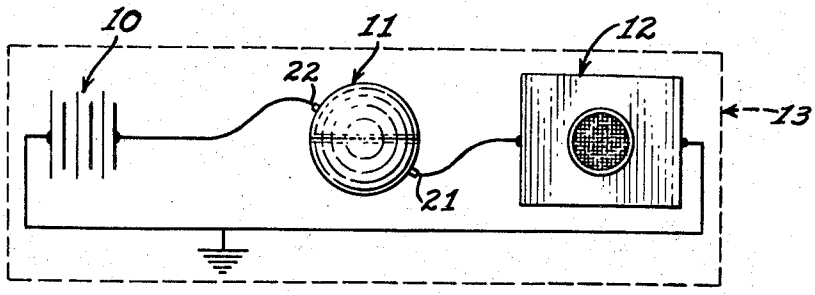


FIG. 1

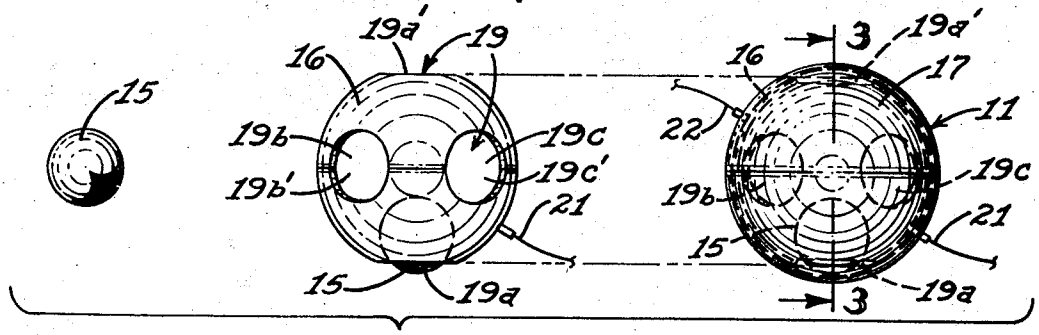
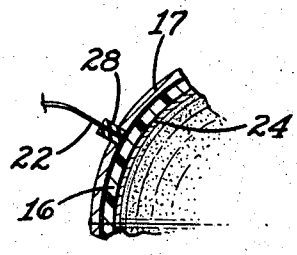


FIG. 2



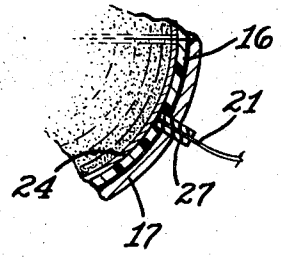


FIG. 4

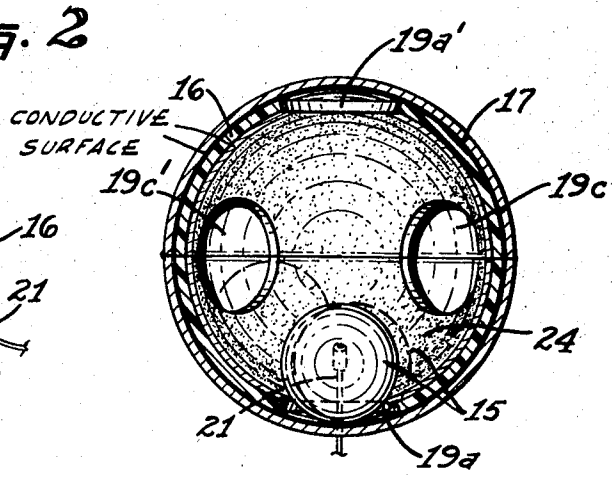


FIG. 3

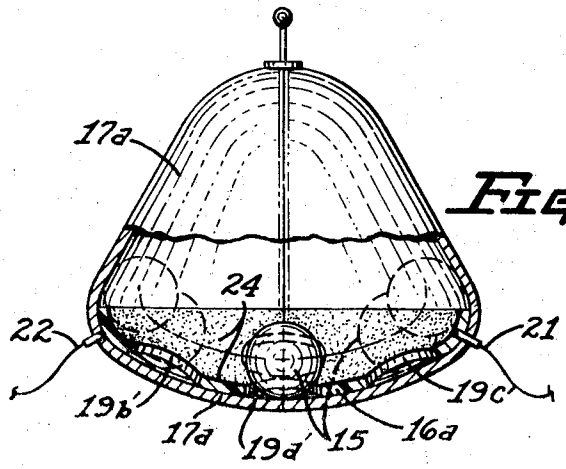


FIG. 5

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TILT RESPONSIVE SWITCH WITH BALL CONTACT ACTUATING STRUCTURE

BACKGROUND OF THE INVENTION

This invention relates to electrical switches and more particularly to electrical switches which are open when retained in a level position and closed when tilted away from a level position.

Valuable articles such as television sets, radios, coin-operated vending machines, appliances and articles of furniture in homes, hotels, motels and other public places are often removed or tampered with when left unattended. Warning devices may be connected to such articles to provide an alarm signal when these articles are moved. Prior art warning devices are often large and bulky and may not be suitable for use in smaller articles. Some of the prior art switches used with the warning devices operate the device when tilted in one direction but will not operate when moved or tilted in another direction. Other prior art switches are complicated and expensive.

SUMMARY OF THE INVENTION

The present invention alleviates the disadvantages of the prior art by providing a switch having only one moving part. The switch is open when retained in a level position and is closed when tilted in any direction away from the level position.

It is, therefore, an object of this invention to provide a new and improved electrical switch which closes whenever the switch is tilted.

Another object of this invention is to provide an electrical switch which closes when the switch is tilted in any direction.

A further object of this invention is to provide an electrical switch which closes when the switch is tilted over a wide range of angles.

A still further object of this invention is to provide an electrical switch which closes when the switch is tilted over a wide range of angles in any direction.

A still further object of this invention is to provide apparatus which developes an alarm signal when the apparatus is moved.

A still further object of this invention is to provide apparatus which developes an alarm signal when the apparatus is tilted.

The foregoing objects are achieved in the present invention by providing a small compact switch which is open when retained in a level position and which closes when tilted in any direction. The switch and a small alarm device can be enclosed in many machines and appliances.

Other objects and advantages of this invention will become apparent from the following description when taken in connection with the accompanying drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a diagram of an alarm system using the present invention;

FIG. 2 illustrates in exploded relationships the components used in the disclosed switch;

FIG. 3 is a cross-sectional view of the components shown in assembled position taken on line 3 — 3 of FIG. 2;

FIG. 4 is an enlarged cross-sectional view of a portion of the switch shown in FIG. 3 illustration the electrical connections of the two concentrical electrical components:

FIG. 5 illustrates a modification of the present invention.

DESCRIPTION OF THE PREFERRED EMBODIMENT

FIG. 1 shows an alarm system using the switch of the present invention. This system includes a battery or source of electric current **10**, a tilt-actuated switch **11**, and an alarm device **12**. The alarm system can be housed in or encapsulated in a container **13** and the container mounted in an appliance or other article for protection thereof against theft.

When container **13** is mounted in a horizontal or level position, as shown in FIG. **1**, switch **11** is in a level, open circuit position and alarm device **12** is inactivated, i.e. not actuated. If the container and switch are tilted, switch **11** closes and the alarm device is actuated.

The tilt-actuated switch shown in FIGS. **2**, **3** and **4** includes a ball **15** made of or coated with an electrical conductive material, an inner sphere **16** and a concentrically arranged outer sphere **17**. The inner sphere **16** has a plurality of spacedly arranged holes **19** which may be six in number identified more specifically as **19***a*, **19***a'*, **19***b*, **19***b'*, **19***c* and **19***c'* which are approximately the same diameter as ball **15**. These holes may be arranged in any suitable pattern but are shown in FIG. **2** and **3** at each end of the vertical diameter of the spherical configuration of the switch and at spaced intervals around the horizontal center line of the sphere. A pair of terminals **21** and **22** are connected to spheres **16** and **17**, respectively. Sphere **16** is shown as being formed of an electrical insulating material having a conductive inner surface **24**. The entire outer sphere **17** may be made of electrical conductive material or the sphere may be made of a nonconductive material and coated on its inside surface with a conductive material. The inner sphere **16** also may be a sphere made of conductive material having a nonconductive outside surface or an insulative material may be positioned between the two spheres.

When the switch is in the level position shown in FIG. **3**, ball **15** is positioned near the center of hole **19***a* so that the ball touches only the inner surface of outer sphere **17**. When the switch is tilted the ball **15** makes contact with the surface of the inner sphere **16** and with the inner surface of outer sphere **17** by rolling against the edges of hole **19***a* formed in inner sphere **16**.

When the switch is tilted further the ball may move out of hole **19***a* into one of the other holes, such as **19***b* or **19***c* where it may make contact with both the outer sphere **17** and the inner surface of inner sphere **16**.

FIG. **4** shows a method of electrically connecting terminals **21** and **22** to the conductive surfaces of spheres **16** and **17**. Terminal **21** is insulated from outer sphere **17** by insulating material **27** and terminal **22** provided with an insulating material **28** is electrically connected to the inner surface of sphere **17**.

FIG. **5** illustrates a modification of the structure shown in FIGS. **1–4** wherein switch **11** comprises a hollow pear or bell shaped container **17***a* made of or inter-

nally coated with an electrical conductive material. Although a pear or bell-shaped container is shown, this container may be made in a wide variety of other suitable shapes. A plate of conductive material **16***a* is separated from the hollow container **17***a* by electrical insulating coating or material **24**. Plate **16***a* may be made of a solid piece of conductive material or it may be a conductive coating on insulating material. The bottom of the hollow container is concave toward the inside of the container so ball **15** rolls into its position shown along the bottom of the vertical axis of the device when the container is in its level or untilted position. The insulating material **24** and plate **16***a* are formed in the same shape as the bottom of container **17***a* and are provided with holes extending therethrough in the same manner as holes **19** of FIGS. **1–4**. When container **17***a* is in its level position, ball **15** makes electrical contact only with container **17***a*. When the switch is tilted slightly ball **15** makes contact with both container **17***a* and plate **16**a at the side of hole **19***a'*. When the switch is tilted slightly further the ball may move into one of the other holes **19***b'* or **19***c'* and make contact with both container **17***a* and plate **16***a*.

When the switch shown in FIG. **5** comprising container **17***a* and plate **16**a is tilted further, ball **15** makes contact with the edge of plate **16***a* and with container **17***a*. The switch may be tilted more than 90° away from the level position shown in FIG. **5** and the ball will still make contact with both container **17***a* and plate **16***a* through the edges of holes formed in plate **16***a* and insulative material **24***a* at other positions in the switch.

Although FIG. **1** illustrates the switch in close association with battery **10** and alarm device **12**, it should be recognized that either the battery or alarm may be mounted at a distance from the switch. Thus, the switch may be solely mounted in the protected article while the alarm is positioned at a remote spot. The alarm may be a light, bell or any other suitable alerting device indicating the movement of the protected article.

While the principles of the invention have now been made clear in illustrative embodiments, there will be many obvious modifications of the structure, proportions, materials and components possible without departing from those principles. The appended claims are intended to cover any such modifications.

What is claimed is:

1. An electrical switch comprising:

first and second concentrically arranged hollow containers having similar shapes juxtapositioned in close proximity to each other;

the inner surfaces of said containers being of electrical conductive material;

electrical insulating material mounted between the juxtapositioned surfaces of said containers;

at least one hole arranged to extend through the inside container and the insulating material mounted between said containers;

said hole being arranged in said inner container at its lower most point; and

a ball having an electrical conductive outer surface, said ball being positioned inside the inner container and assuming a point of rest near the center of said hole when the switch is in a level position;

said ball making electrical contact with only the inner surface of the outer container when said switch is in a level position;

said ball rolling to one side of said hole and electrically interconnecting the conductive surfaces of said first and said second containers when said switch is tilted from a level position.

2. The electrical switch of claim **1** in further combination with:

a pair of electrical terminals;

one of said terminals being electrically connecting to the conductive surface of said first container and the other of said terminals being electrically connecting to the conductive surface of said second container.

3. The electrical switch set forth in claim **1** wherein the hole in said inner container has a minimum distance across it of substantially the same length as the diameter of said ball, said ball making electrical contact with the conductive surfaces of said first and said second containers when said ball rolls against the side of said hole.

4. The electrical switch set forth in claim **1** wherein a plurality of holes are spacedly arranged to extend through the inside container and the insulating material mounted therebetween;

one of said holes being arranged in the lower most point of said inner container;

said holes in said inner container having a diameter substantially of the same diameter as the diameter of said ball, said ball making electrical contact with the conductive surfaces of said first and second containers when said ball rolls against the sides of any of said holes.

5. The electrical switch set forth in claim **1** wherein:

said concentrically arranged first and second hollow containers comprise spheres, each of said spheres being made of electrical conductive material;

said electrical insulating material being mounted on the juxtapositioned surfaces of one of said spheres.

6. The electrical switch set forth in claim **5** in further combination with:

first and second electrical terminals, each of said terminals electrically connected to a different one of said first and second spheres.

7. The electrical switch set forth in claim **5** wherein the inner sphere has a plurality of holes therein, the minimum distance across each of said holes being substantially the same as the diameter of said ball, said ball making contact with said first and said second spheres when said ball rolls against the side of any one of said holes.

8. The electrical switch set forth in claim **1** wherein:

the outer container is of a bell shape configuration made of electrical conductive material and having an inner concave surface;

the inner container comprises a conductive plate formed substantually in the same shape as the bottom of the outer container;

an electrical insulating material mounted between said plate and the concave surface of the outer container; and

said hole extending through said plate and said electrical insulating material.

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