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BALL SHAPED FLOAT SWITCH ADAPTED TO BE MOUNTED ON A FLAT SURFACE

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Fig. 1.

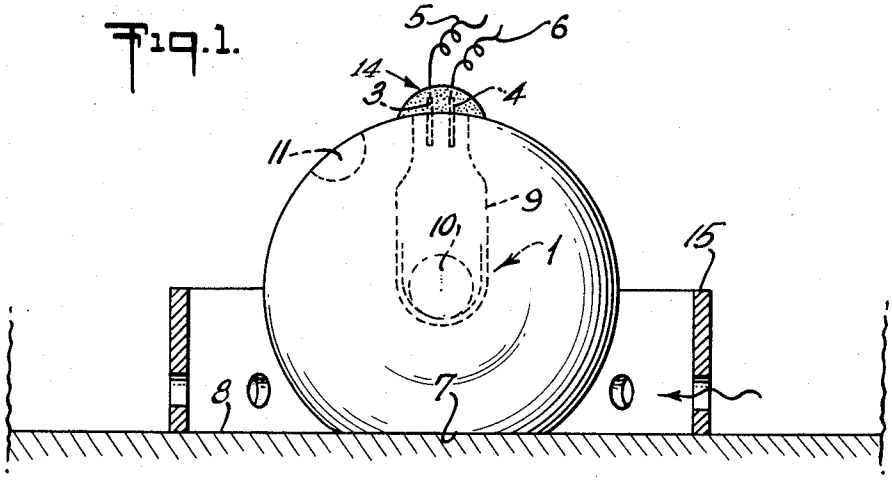


Fig. 2.

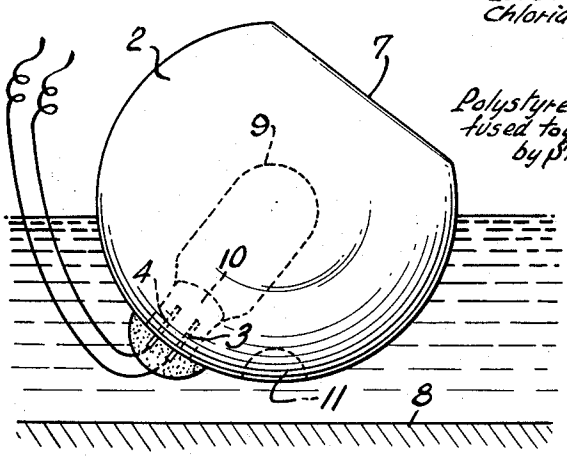


Fig. 3.

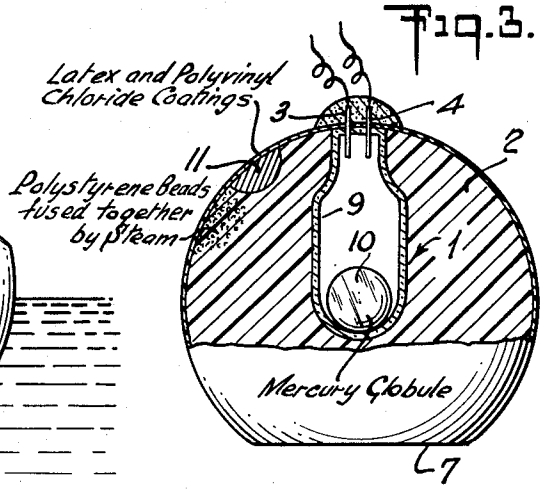
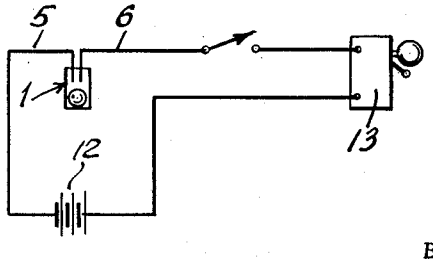


Fig. 4.



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BALL SHAPED FLOAT SWITCH ADAPTED TO BE MOUNTED ON A FLAT SURFACE

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The invention described herein may be manufactured and used by or for the Government of the United States of America for governmental purposes without the payment of any royalties thereon or therefor.

This invention relates to a switch for inclusion in an electric circuit of a signal to indicate the substantial rise of water in an enclosure, such as in the hull of a ship or compartment thereof.

When ships are "put in moth balls" or inactivated for long periods of time, care must be taken that leakage of water into the hulls of such ships or compartments thereof does not become serious. While caretakers make periodic visits to such stored ships, it is desirable to provide for signalling to caretakers substantial leakage in a ship hull or compartment thereof between such periodic visits.

An object of this invention is to provide an improved and simple switch for controlling a utilization circuit, which will be automatically operated into desired circuit controlling condition by water or other liquid rising around it, to cause operation of said circuit, and which is so exceptionally simple, dependable, durable, compact and inexpensive that it is practical to distribute them widely in places where leakage may occur.

Another object of the invention is to provide a simple, dependable, compact and inexpensive switch which may be operated into a desired circuit controlling condition by water or other liquid rising about it to a desired extent.

Other objects and advantages will appear from the following description of an example of the invention and the novel features will be particularly pointed out in connection with the appended claims.

In the accompanying drawing:

FIG. 1 is a side elevation of a switch constructed in accordance with this invention as constrained against undesired displacement on the surface on which it may rest, in normally open position;

FIG. 2 is a side elevation of the same after it has been operated into a circuit closing condition by water rising around it:

FIG. 3 is a sectional elevation of the switch in its normal open circuit position; and

FIG. 4 is a diagram of a typical, simple alarm circuit in which such a switch may be included.

In the illustrated embodiment of the invention, a mercury switch **1** is provided within a body **2** of a material that floats readily in water, with its contacts or electrodes **3** and **4** extending exteriorly of the body **2** and there connected to flexible, insulated wires **5** and **6**. In this example, the body **2** is approximately spherical or somewhat ball-shaped, except that it has a segment removed or omitted to provide a flat base **7** for seating on a horizontal flat surface **8** on which the ball or sphere is normally supported in use. The switch **1** is preferably disposed directly above this flat face **7** with the contacts **3** and **4** uppermost but extending into the interior of a closed glass casing **9** of the switch. A globule of mercury **10** is disposed within and only partially fills the chamber of the hermetically sealed casing **9**, so as to be out of contact with at least one of the contacts **3** and **4** when the ball or body **2** rests on its flat face **7**. When the ball is tilted or rolled from this position in which its flat face had rested on surface **8**, the globule of mercury **10** will roll within the casing **9** and make contact or engagement with the inner ends of the contacts **3** and **4** to complete an electric circuit between wires **5** and **6**.

Provided on or in the body **2** is a weight **11** such as of metal, for example lead, disposed eccentrically of the ball or body **2** and to one side of the switch so that it is angularly less than 180 degrees from the center of the flat face **7**. The flexible, insulated wires **5** and **6** are slack or loose so that the body **2** can roll or tilt, and they are connected in series with a battery **12** and any suitable audible or visual signal **13**, which signal may be both visual and audible if desired. The ball or body **2** may advantageously be formed of foamed polystyrene, or of polystyrene beads fused together in a mold, as by the use of steam, with the switch incorporated in the ball before the fusing. After the fusing of the beads of polystyrene some sealing wax **14** may be applied around the outer ends of the contacts or switch elements **3** and **4** of the switch and the wires **5** and **6** soldered or otherwise secured to the switch elements **3** and **4**. The wax should cover the exposed outer ends of contacts **3** and **4** and the connections. As one example, the body or ball **2** may have a height from the flat face **7** of about 3¼ inches, a flat face with a diameter of about 2½ inches and a lateral width or diameter of about 4 inches. The styrene is of the foamed type, such as foamed beads that are fused together in the somewhat spherical cavity of a mold (not shown). A latex or polyvinyl chloride protective skin coating is preferably applied over the body **2** when it is completed to make it entirely water tight or sealed against penetration by water. This outer protective coating, the insulation on wires **5** and **6**, and the wax **14**, will be of materials inert to the liquid expected in the enclosure in which the alarm device is to be placed in use. The relative arrangement of switch **1** and the metal **11** may be varied from that shown, so long as the metal is of sufficient weight to roll the ball, when the ball is floated and is free to roll, to an extent sufficient to change the position of the globule of mercury in its casing **9** and connect or move away from one or both of the switch contacts. The switch may be positioned or mounted to be inverted by a surrounding liquid from that shown, so that the circuit between wires **5** and **6** will be closed when the body **2** is resting on its flat face, and opened when the body **2** rolls to shift the mercury out of contact with at least one of the switch contacts **3** and **4**. The alarm circuit would then be held inactive by an open circuit through the switch. While the ball shape, with flat supporting face, for the body **2** is preferred, the shape may be otherwise and the body **2** mounted to tilt and operate the switch when water or other liquid rises around the body **2** to a depth that will float the body **2** and tilt it, or enable it to tilt, and operate the switch.

In use on a ship, the completed device is placed on the bottom of a tank or compartment, with its flat face resting on the bottom of the tank. The wires **5** and **6** are connected in an alarm circuit, of which the circuit of FIG. 4 is typical. If water enters this tank, due to leakage, when it rises around the body **2** sufficient to float

it, the weight 11 will rock or tilt the body 2 from the FIG. 1 position to the FIG. 2 position and the switch 1 will activate the alarm or signal. The latex coating is preferably first applied to the surface of finished body 2 and after this latex coating is dry, the polyvinyl chloride coating is applied over the latex coating such as by dipping the body 2 in the polyvinyl chloride. The device may be suspended by wires 5 and 6 and when water reaches and surrounds the body 2, the water will float the ball or body 2 upwardly to provide slack in wires 5 and 6 and enable the body 2 to roll into the position shown in FIG. 2 where it activates the alarm.

It will be observed that without the weight 11, the switch, which is disposed at the opposite side of the center of the ball from the flat area 7, will, when the ball is floated, cause rolling or inverting of the ball to cause the mercury switch to close. The rolling or pitching of a ship in which this device is placed will cause the ball to roll out of dead center position where it is floated by liquid rising around it, but the use of weight 11 makes the operation of the switch through rolling of the ball or body 2, more rapid and positive.

When the switch is placed in a ship compartment, and the ship is subject to some pitch and rolling, it may be advisable to encircle the body 2 with a low fence 15 with apertures 16. The fence is considerably larger than the body 2 so that when floated the body 2 can tilt or roll freely under the action of weight 11 and operate the switch, yet it limits sidewise displacement or premature movement of body 2 on the surface 8 on which it rests, so that it will not be prematurely tilted or rolled by the motion of the ship into a position in which the alarm is activated, or into a position in which so much slack in wires 5 and 6 is taken up that these wires then prevent tilting or rolling of the body 2 in a manner to activate the switch. The normal position of the body 2 is shown in FIG. 1, and the activated position, when floated by water, is shown in FIG. 2.

While the switch of this invention has been described in connection with its advantageous use in ships or tanks thereof to signal an alarm when the tank leaks, it will also be understood that the switch has various other uses. For example, a plurality of such switches may be arranged at different levels in any tank, and the flexible circuit wires from each switch connected to an individual signal circuit, so that each switch will control an individual signal. The condition of the signals will indicate when the different liquid levels in the tank are obtained, so that the extent to which the tank is filled will be apparent by mere observation of the signals.

It will also be understood that instead of having a switch operate a signal, the signal may be replaced by a relay whose other circuit controls a motor that drives a pump, whose intake leads to the bottom of the tank, so as to empty the tank when the switch is operated. Thus, the switch when used to control a pump, together with the pump, may act as an automatic sump pump. The signal and pump control may both be used, such as, for example, with the signal connected in parallel across the pump circuit. Where the flexible wires 5 and 6 normally are taut enough to keep the switch device in generally upright position, whenever the level of liquid around the device rises enough to tilt the body, the device will tilt and activate the switch. When the liquid falls again, the device will descend and these wires will return the device to its former upright position, thus acting as an automatic reset for another cycle of operation. Such switch devices when connected to control pumps may also be used in submarines and ballast tanks of other vessels to control liquid levels therein.

It will be understood that various other changes in the uses, details, materials and arrangements of parts, which have been herein described and illustrated in order to explain the nature of the invention, may be made by those skilled in the art within the principle and scope of the invention, as expressed in the appended claims.

We claim:

1. A switch for inclusion in an electric circuit with a signal to indicate the presence of a predetermined depth of water over a horizontal surface, which comprises:

an approximately ball-shaped waterproof body having a flat base means for seating the body stably in an upright position on the horizontal surface,

said ball-shaped body having weight and displacement relationship for readily floating in water,

said ball-shaped body including an elongate closed casing of electrically non-conducting material mounted therein approximately normal to the center of the base thereof,

a pair of electrical contacts extending into that end of said casing remote from the base and terminating in exposed spaced relation to one another in that end of said casing,

an electrically conducting liquid enclosed in and only partially filling said casing and normally spaced from said contacts when the flat base of said body seats on a horizontal surface,

a pair of flexible circuit wires extending into said body and connected to said contacts respectively,

said body further including a weight member of substantially greater density than the average density of said body and whose maximum linear dimension is a minor fraction of the radius of the body, said weight being located in said body eccentric to a diametral line perpendicular to the center of the flat base and in the vicinity of the portion of the body remote from the flat base, to positively and rapidly rock said body to an approximately base upward position when said body is buoyed by said predetermined depth of water;

whereby when water rises to said predetermined depth around said body while its base is seated on a flat horizontal surface, said weight will rock the floating body into an approximately base upward orientation to cause said conducting liquid to move into engagement with both of said contacts.

2. The switch according to claim 1, and a fence means encircling said body with sufficient looseness and clearance for preventing objectionable sliding, rolling and tilting of said body on the surface on which it rests when said surface is tilted.

3. The switch according to claim 1, wherein the portion of said body that includes the casing, the contacts, the wires, and the weight is composed of polystyrene beads fused together.

4. A switch for inclusion in an electric circuit with means to indicate the presence of a substantial depth of water in an enclosure having an approximately horizontal surface, which comprises:

(a) a free body of a material which readily floats in water and has means for seating the body stably upright on said horizontal surface in said enclosure, and

(b) a switch fixed to said body for automatically closing in one orientation and for automatically opening in a different orientation, circuit wires leading from said switch and body for inclusion in a utilization indicating circuit, said switch being in one of said orientations when said body is upright,

(c) said body and switch, having their combined center of gravity located relative to said seating means for turning the body and switch from said one orientation to the other orientation when the body and switch are floated by water of sufficient depth around them.

5. In a device of the type for indicating the presence of water of substantial depth in an enclosure having an approximately horizontal surface, and employing a utilization electric circuit for such indication, that improve-

ment therein which comprises the combination with said circuit of:

(a) a free body of a material which readily floats in water and has means for seating the body stably upright on said horizontal surface in said enclosure, and

(b) a switch fixed to said body for automatically closing in one orientation and for automatically opening in another orientation, circuit wires leading from the switch, and connected to said utilization circuit,

(c) said body and switch having their combined center of gravity located relative to said seating means for tipping the body and switch from the upright position on the seating means and from said one

orientation respectively to said another orientation when the body and switch are floated by water around them.

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