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3,038,151

WAVE-ACTUATED SIGNAL

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FIG. 1.

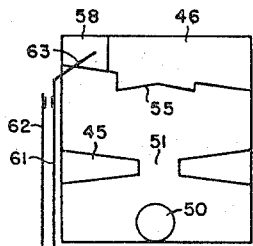
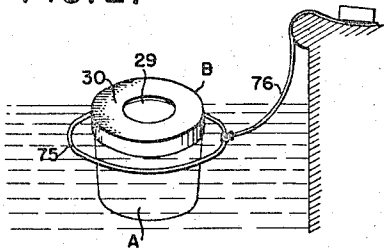


FIG. 4.

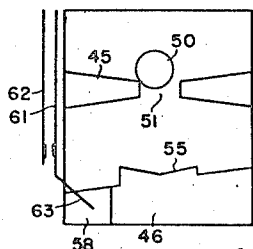


FIG. 5.

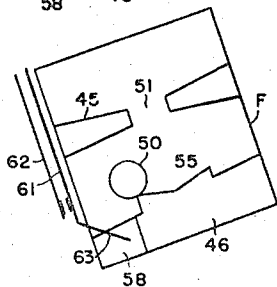


FIG. 6.

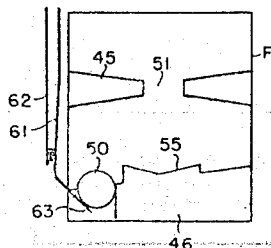


FIG. 7.

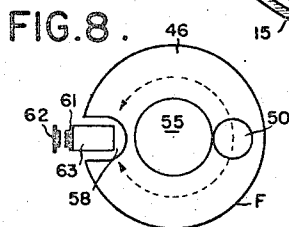


FIG. 8.

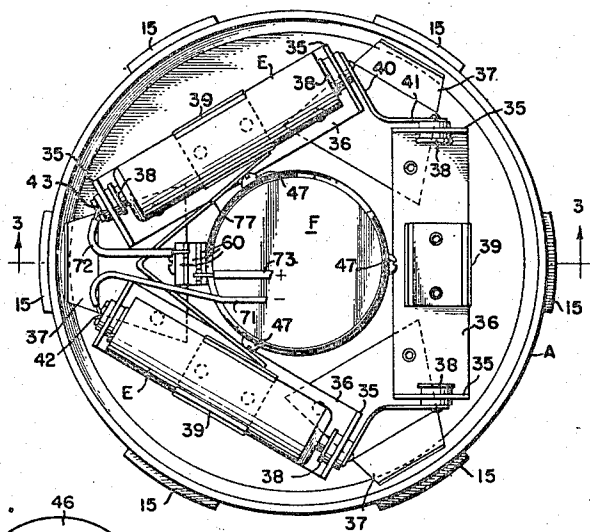
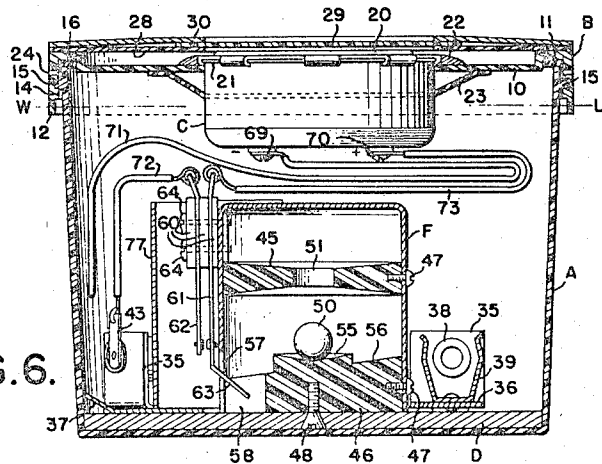


FIG. 2.

FIG. 3.



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WAVE-ACTUATED SIGNAL

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16 Claims. (Cl. 340-261)

This invention relates to a free-floating, self-contained signal device adapted for operation only when laterally displaced or rocked from the vertical (or horizontal, depending on one's viewpoint). When used in a swimming pool, for instance, such a signal device will be laterally accelerated and/or rocked to an off-vertical position by the wave action set in motion when the body of the water is disturbed, as when a person has entered therein. The alarm signal, be it visual or audible, is thereupon operated to apprise those in the vicinity of this invasion of the pool so that action, remedial or otherwise, may promptly be taken. The device to be herein disclosed in detail, as an example of this invention in a preferred form, is one that is especially designed for use in swimming pools which are often dangerous to small children or non-swimmers who may enter therein.

The main objectives of our invention are to provide a free-floating signal of the kind described which will be inexpensive to produce and maintain ready for use; which will be certain and effective in operation when laterally accelerated or tilted through a predetermined distance to an off-vertical position in response to the action of waves created by disturbance of the water, such as follows entry or movement of a body therein; which may be confined by a tether while floating in the water without impairment of its free rocking motion, so as to remain always in a localized area; which may be rendered inoperative by lifting and inverting the device, as when removed from the water for standing at the pool side or elsewhere; and which is otherwise adapted to fully meet all special conditions encountered in use of the signal device, by providing a warning to those in the vicinity that the pool is then occupied by a person, animal or moving object whose presence therein might otherwise be unsuspected.

These and other objects and advantages of our invention will be apparent from the description to follow where reference is made to the accompanying drawing which illustrates a preferred embodiment of the signal device in the manner following:

FIGURE 1 is a sectional-perspective view of the present wave-actuated signal device shown floating operatively in a pool wherein it is tethered for free movement; FIGURE 2 is a top plan view of the container cup wherein are fixedly positioned the power and control units; FIGURE 3 is a view in vertical section through the container, taken on line 3-3 of FIGURE 2, the container cap which carries the signal mechanism being added to the view in an operative position upon the upper open end of the cup; and FIGURES 4-8 are diagrammatic views of the switch control mechanism showing several positions which the ball element of the switch occupies during a normal operating cycle.

The present device comprises a power and control unit plus a signal mechanism, both enclosed within a container of plastic or the like. Such a container is here shown as a cup A to the upper open end of which is removably fitted a closure cap B having a top portion in the form of an annulus 10. The peripheral portion of the cap annulus is upwardly turned to provide a rim 11 from which depends a flange 12 which lies to the outside of the cup in slightly spaced relation thereto. Extending inwardly from this flange is a plurality of circumferentially spaced helical ribs 14 providing, in effect, interrupted threads

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adapted for interengagement with cooperating interrupted ribs 15 on the exterior of the cup A at a point adjacent its top, thereby to provide means for tightly locking the cap to the cup in any one of several different rotative positions thereupon. To assure that the connection so provided will be watertight, a resilient gasket 16 is fitted into the downwardly facing circular channel formed between the rim 11 and the flange 12 at a point directly opposite the top edge of the cup A for compressive engagement therewith.

Within the annular cap B is a large round hole, slightly off-center, fully occupied by the cylindrical casing C of a suitable signal mechanism. For such a mechanism which is audible, we may employ a conventional horn or buzzer having a relatively loud sound capacity. An outwardly turned flange 21 on the casing C is adapted to rest upon the adjacent marginal portion of the cap annulus 10, thereby to support the casing in place. A suitable sealing compound 22 is spread around and under this flange to prevent ingress of water therebetween. A resilient locking ring 23 fits tightly around the signal casing C to the underside of the cap annulus 10, and engages with the casing to cooperate with the overlapping flange 21 in securing the said casing fixedly and closely to the cap B. One or more small vent holes 24 may be formed through the cap flange 12 at a point above the water line W-L of the container, when floated in a pool, and close to the top edge of the cup A so as to be in communication with the narrow space between the cup and the surrounding flange 12 of the cap. The purpose of such vent holes is to assure an equalization of air pressures on opposite sides of the cup flange whereby to obviate any tendency for water to be drawn into the interior of the container in response to a minus pressure therein, such as might result from the sun's heat followed by a temperature drop overnight.

Overlying the top face of the cap B is an annular disc 28 of styrene or the like, having an off-center hole of approximately the same diameter and position as that in the cap annulus 10. This disc may be supported upon spaced circular seats afforded by the cover rim 11 and the flange 21 of the casing C. Carried by the disc 28 coaxially of its off-center hole is a smaller disc 29 of vinyl or the like whose peripheral portion overlies the supporting disc 28 sufficiently for an adhesive connection therewith. And topping this annular disc 28 and peripheral portion of the circular disc 29 is an exposed annular disc 30 of a water-resistant material such as a polyester plastic, the off-center hole in this disc being coaxial with that of the disc 28. Some such assembly of annular discs, together with a supported circular disc, is suitably united and secured, adhesively or otherwise, to the top face of the cap B whereby to (1) protect the casing C from ingress of water while (2) minimizing resistance to free emission of sound waves from within the casing C through to the exterior of the alarm device at its topmost point.

The power and control unit, as here shown, is mounted upon the top face of a circular base plate D slightly smaller than the inside diameter of the cup A at its bottom where the base plate is fixedly secured. This plate which serves as a ballast for the floating container may be as heavy as required for purposes of stability. Affixed to this base plate in symmetrical tangential arrangement about a common circle at distances of 120° apart, we have shown a plurality of conventional elongated holders, three in number, each affording a seat for a dry battery E. In FIGURE 2 the holder at the right is shown as empty for clarity of illustration. Each holder comprises a thin metallic strip having end walls 35 upstanding from the ends of a base 36 which is secured by rivets or otherwise to the base plate D. The base plate unit is fixedly secured

within the cup A adjacent its bottom by any suitable means, that shown being three thin locking wafers each affixed to the base plate D; one edge portion 37 of each wafer is upwardly inclined to provide a resilient tongue which projects slightly beyond the base plate periphery for yielding engagement with the inner face of the walls of the cup A when the base plate assembly is fitted in place therewithin.

Extending through each end wall 35 of the battery holders and insulated therefrom is a pin carrying at its inner end a contact button 38 in position to be engaged by the end terminal of an elongated dry battery E when fitted into place within a spring clip 39 upstanding from the holder base 36 to which it is affixed at a point immediately of its ends. At the outer end of each pin is a terminal fitting, there being six altogether for the three batteries which are series-connected. These fittings 40 and 41 are interconnected at proximate ends of adjacent batteries except only one pair—the juxtaposed terminal fittings 42 and 43 at opposite ends of the circuit through the three series-connected batteries when occupying positions in the holders therefor. The terminal fittings 42 and 43 are in electrical connection with the alarm casing C and with a control switch presently to be described. This assembly of series-connected batteries on the base plate D constitutes a power pack and will be so referred to hereinafter.

The center space inwardly of the batteries E is occupied by an upstanding cup-shaped shell F closed at the top. Within this shell is secured an annular disc 45 at an upper elevation and a closure disc 46 at its bottom. Both discs are desirably produced from a suitable plastic material. They may be fixedly secured within the shell F in a predetermined spaced relation, as by means of radially disposed screws 47 entered thereto from the exterior of the shell. A flat-headed screw 48 entered axially into the closure disc 46 from the base plate D into whose bottom face it is countersunk, affords a convenient and effective means of securing the shell F fixedly to the base plate D.

Between the closed top of the shell and the upper annular disc 45 is a space amply sufficient to accommodate a ball 50 of steel or the like. The center hole 51 in this disc is also sized to guide such a ball, when passing there-through, into a fall which will proceed axially of the shell. Upper and lower faces of this disc are also pitched inwardly toward each other to induce a gravity movement of the ball toward the center hole whenever the container is positioned with its axis vertically disposed, whether inverted (FIGURE 4), or upright (FIGURES 3 and 5).

The closure disc 46 is spaced below the annular disc 45 a distance sufficient to provide a chamber wherein the ball may freely move around. This disc carries an upwardly facing shallow seat 55 in the form of an inverted cone having its center coaxial with that of the hole 51 thereabove. The seat top face is inclined downwardly at a pitch very slightly greater than that of the opposite faces of the associated annular disc 45 for a reason that will shortly appear. The seat 55 upstands from a surrounding base 56 in the form of an annular plane forming a runway which slopes downwardly toward an opening 57 through the circular wall of the shell F, extending upwardly from its bottom to an elevation about oppositely of the seat. The closure disc 46 is also notched at a point oppositely of the shell wall opening 57 to register therewith and provide within itself a pocket 58 which is disposed at the end of the runway at its lowest point. This pocket is of a size to receive the ball 50 if and when it becomes displaced in any direction from off the seat 55 for gravity-induced free rolling upon the sloping runway 56 to its point of lowest elevation. FIGURE 8 illustrates diagrammatically the circular runway 56 around which the ball 50 is free to roll from a point of highest elevation to the pocket 58 through either of two paths indicated by the dotted lines.

A normally open switch which is affixed to the outer face of the shell F comprises a plurality of insulating

leaves 60 mounting between them the upper end portions of two elongated spring blades 61 and 62 both extending in parallel relation vertically of the shell at a point adjacent the opening 57 therein. The inner blade 61 in its lower free end portion 63 is inwardly bent to enter through the shell opening 57 and lie partly within the pocket 58 in a position where it will be wedgingly engaged by the ball 50 when entering the pocket (FIGURE 7). The two blades are equipped with confronting contact points which may be interengaged whenever the inner blade 61 is swung outwardly in response to light pressure arising from wedging engagement of the ball 50 with its angled free end portion 63. Since both blades are somewhat resilient, such an outward deflection of the inner blade, and possibly also of the outer blade but for a lesser distance, may freely take place through the requisite distance to assure interengagement of their contact points, thereby to complete an electrical circuit therebetween. The several elements comprised in the switch—the insulating leaves and conductor blades—may be operatively held together and to the shell F by one or more screws 64 (see FIGURE 3).

Terminals for the electrically operated signal, here shown as screws 69 and 70, are carried on the bottom of the casing C. To the terminal 69 is attached a conductor wire 71 in connection with the terminal fitting 42 at one end of the series-connected battery line. The terminal fitting 43 at the other end of this battery line is connected by a conductor wire 72 with the outer blade 62 of the control switch, and a conductor wire 73 leading from the inner blade of this switch connects with the other horn terminal 70. This circuit is simple in the extreme, yet amply adequate for all purposes of this invention.

As will now be pointed out, the wave-actuated signal herein disclosed is adapted for operation in a pool wherein, during periods of inactivity, the water is relatively quiet and still. The container in which all the mechanism is self-contained is designed for relatively stable floating. With most of the container body submerged, the water line W-L will be slightly above the bottom edge of the cap flange 12 (FIGURE 3). In water that is perfectly quiet, the axis of the container should be very close to vertical. Should the container float off-vertical, correction may readily be made by removing the screw cap B and then replacing it in a different rotative position of which several are available. By providing an excess of length in the conductor wires 71 and 73 leading from the casing C, intermediate portions of these wires may be shifted to various positions circularly within the cup A in response to different adjustments of the cap B, thereby tending to correct for any imbalance resulting in off-verticality of the floating container.

Stability of the device, when floating on the water, should be such that rocking movements to a predetermined critical point will take place only in response to one kind of wave motion. This critical point is reached when the ball 50, at rest upon its seat 55, is displaced therefrom due to (1) lateral acceleration of the container or (2) rocking movement thereof to a sufficiently off-vertical position. Either or both of these motions, which for convenience herein we shall term "rocking movements," may be induced by wave action of the kind we are here concerned with. For instance, the seat 55 may be designed to retain the ball in place so long as off-verticality does not exceed 6°. The extent of rocking movement due to wave action is dependent upon a number of closely related factors, including size and shape of the floating container, its balance and stability, and the frequency and amplitude of the waves exerting their force upon the container.

In a swimming pool, for example, the build-up of waves due to wind movement over the water will ordinarily be but little; yet, when the water is disturbed, as by a body falling into or moving within the water, the resulting wave action extends to a point further below its

surface to produce a wave whose amplitude and frequency are different. Such differences may conveniently be expressed by the formulas (1) $D > 2l$ and (2) $D < L/2$, where D is the diameter of the floating container, l is the length (crest to crest) of small wind-induced waves, and L is the length (crest to crest) of waves created by a massive body falling into or entering the water suddenly. Waves on the surface of a pool, produced normally by a wind blowing across its surface, are of high frequency, i.e., they are close together, and in order that a small self-contained signal device, such as the one herein disclosed, may not undergo rocking movements to or past the critical point as a result of the force exerted by such waves, the diameter of the container should be at least twice the length of such waves, and preferably more. By contrast, waves produced by disturbance of water due to entry of a body therein or movement therethrough, are of greater length, or low frequency. So that the container may be assured of rocking to or past the critical point, when acted upon by waves so produced, the container diameter should preferably be not more than one-half the distance between the crests of such waves. This factor of diameter, while not the only one to be considered in this connection, is nevertheless of primary importance in endowing the present signal device with the capacity for selectivity by which to confine its operations to conditions where water is disturbed, through entry of a body therein or movement therethrough, sufficiently to create a succession of waves having the prescribed characteristics above set forth.

When not in use, the device is preferably removed from the water. If it be then inverted, the ball will roll out of the pocket 58 to the position shown in FIGURE 4 where it lies in the chamber between the annular disc 45 and the end wall of the shell F. Should the container be rested on its side, the ball will still remain in that same end chamber where it is ineffective to close the switch. To bring the ball to operative position, however, the container is uprighted so that the ball may roll toward and through the center hole 51 (FIGURE 5) to drop axially onto its seat 55 (FIGURE 3). Because the sides of this seat are inclined more steeply than is the pitch of the top face of the annular disc 45, the ball, when dropped therefrom onto the seat therebelow, will normally remain there indefinitely in a cocked position so long as the container is not moved either laterally rather suddenly, or rocked to an off-vertical position beyond the critical point.

With the ball in cocked position, the container may be placed in the water where its drifting movements should preferably be limited to a restricted area well removed from any inlet or outlet. In so confining the container, it is important also that its freedom to move in response to wave action be not impaired or affected. We accomplish this objective by use of a tether 75 in the form of a loop somewhat greater in diameter than that of the cap B of the container. This loop is preferably made from a length of plastic material of tubular cross section having its two ends united and sealed and with just sufficient buoyancy for floating. Its specific gravity need be but very little less than that of water, and its mass (weight) is desirably low. A short flexible cord 76 attached at one end to the loop is secured near its other end by a small weight which may be rested on the coping surrounding the pool, thereby affording an ample anchorage for the tether. The loop which is free to float within the area determined by the length of the cord, surrounds the container in spaced relation thereto free of interference therewith. Should the container, while undergoing rocking movement, make contact with the loop at any point, the latter may, if frictionally urged to do so, move therewith either into or out of the water, with no measurable resistance to the container in so doing. Operability of the signal device is thereby assured while preventing drifting thereof to points where

specially existing conditions might otherwise interfere with its proper functioning.

When the ball 50 is displaced from its seat (FIGURE 6), it will drop off onto the surrounding base, i.e., the runway, which is an inclined plane sloping toward a point of lowest elevation where the pocket 58 is located. Here the ball comes to rest (FIGURE 7), rolling down into wedging engagement with the inner switch blade 61 which is thereupon deflected outwardly toward the outer blade 62 to complete an electrical circuit therewith. In this position the ball remains confined to assure a closed condition of the switch with continuing operation of the signal device for an indefinite period. Only when (1) the power pack has become exhausted or (2) a nearby person at the scene has lifted the container from the water and turned it upside down will the ball drop out of its confining pocket to permit return of the resilient switch blade 61 to its normal open position. Protection to the switch, particularly to its blades, is amply afforded by a V-shaped shield 77 of insulating material, such as plastic, which is fitted in place in surrounding relation to the switch.

An important feature of our signal device is the arrangement and disposition of its power, control and signal components in a carefully balanced relationship within a substantially cylindrical container so as to assure verticality of its axis when floated in the water. Exact balancing at coequal distances from the container axis of the base plate-battery assembly imposes no difficulty. While the control switch and shield therefor are mounted off-center upon one side of the shell F, a counterbalance therefor, partial or complete, is provided by the increased mass of the closure disc 46 at its highest point which is diametrically opposite thereto. The arrangement and disposition of all components within the container is also such that the preponderance of weight—the base plate-battery assembly—is close to the bottom to assure stability. A facile adjustment to compensate for any remaining imbalance is provided for by the excess in wire length leading from the horn casing C to the switch and power pack, the arrangement being such that refitting of the cap to any one of several rotative positions will shift portions of the wire to new locations thereby redistributing to some extent the weight thereof within the container. In any repositioning of the cap, however, the off-center mounting of the horn casing C will tend to amplify this redistribution of the weight. This off-centering need be but slight—only a small fraction of an inch should suffice. By such means any one using the signal device will have no difficulty in making any needed compensatory adjustments which will ordinarily remain effective for an indefinite period of time to thereby assure operation of the signal in the intended manner.

We claim:

1. A self-contained, power-operated signal wholly enclosed within a free-floating, water-tight container ballasted for controlled rocking movements upon the wavy surface of a body of water comprising, in combination, a signal mechanism and a power pack therefor both mounted within the container, an electrical circuit interconnecting the power pack and signal mechanism also arranged within the container, and, fixedly mounted within the container in the electrical circuit, a normally-open switch having an associated position-controlled, gravity-operated element movable from an upper to a lower position for operation of the switch to a closed position in response to a wave-actuated rocking movement of the floating container to an off-level position sufficient for initiation of a gravity-induced movement of the position-controlled switch element to its lower position wherein it tends to remain indefinitely to maintain the switch in closed position.

2. A self-contained floating signal device according to claim 1 wherein the container is cup-shaped with its upper end open, and a cover is removably fitted to the open

end of the container to provide a water-tight closure therefor, the cover providing a mounting for the signal mechanism.

3. A self-contained floating signal device according to claim 1 wherein a ballasting means is fixedly carried within the container adjacent its bottom to assure normal floating of the latter in a predetermined position, the ballasting means furnishing a mounting for the power pack and switch.

4. A self-contained floating signal device according to claim 1 wherein the container is cup-shaped with one end open, a cover is fitted to the open end of the container to provide a water-tight closure therefor, the cover also providing a mounting for the signal mechanism, and ballasting means is carried fixedly at the closed end of the container to assure maintenance of the cover end thereof in a top position when floating in the water.

5. A self-contained floating signal device according to claim 1 wherein the container is cup-shaped with one end open, a cover is fitted to the open end of the container to provide a water-tight closure therefor, the cover providing a mounting for the signal mechanism, the power pack and switch is mounted within the container body below the cover, a plurality of coacting interrupted threads is provided on the cover and container permitting an operative interconnection between them in any selected of several rotative positions, one with respect to the other, and the electrical circuit extending away from the signal mechanism to the power pack and switch comprises a flexible wire having an excess of length for the distance spanned whereby intermediate portions of the wire may be shifted circularly of the container to re-position the weight of the wire according to the selected rotative position of the cover when applied to the container.

6. A self-contained, power-operated signal wholly enclosed within a free-floating, water-tight container in the form of a cup ballasted at its bottom end for controlled rocking movements upon the wavy surface of a body of water, comprising a closure cap for the open upper end of the container removably joined thereto by cooperating screw threads interrupted to permit connection of one with the other in any one of several selected rotative positions, of a power pack and control means fixedly mounted within the cup in substantially balanced relation about the axis thereof and at a low elevation therein to provide a ballast therefor, a signal mechanism carried by the cap eccentrically of its axis and, when the latter is disposed in the proper rotative position, serving to compensate for any imbalance in the container tending toward off-vertical axial floating thereof, and electrical conductors flexibly interconnecting the power pack, control means and signal mechanism for operation of the latter.

7. A self-contained wave-actuated floating signal device of the kind in which is combined an interconnected power pack, signal mechanism and control means therefor, all mounted within a floating container in the general form of a ballasted cup to the open upper end of which is removably fitted, in water-tight connection therewith, a cap having a peripheral flange downturned to overlie the upper end portion of the cup, exteriorly thereof and in slightly spaced relation thereto, the flange being extended down to terminate below the water line when the container is floated, cap end up, in a pool of water, and means providing a vent through the cap flange to the space interiorly thereof between itself and the cup and above the water line to maintain equalized air pressures on opposite sides thereof.

8. In a self-contained floating signal device, the combination with a cup-shaped cylindrical container having an annular cover in water-tight connection therewith, of an electrically operated signal mechanism affixed to the inner face of the cover in position to transmit signal waves therethrough, a water-resistant sheet through which sound waves may be transmitted with relatively low

resistance carried by the cover spanning the opening thereof and in water-tight connection therewith, and a power pack and position-controlled gravity-operated switch both mounted within the container and in electrical connection with each other and with the signal mechanism for operation thereof consequent upon a predetermined minimum of rocking movement of the container in response to wave action of the water wherein the signal device is floated.

9. In combination with a portable self-contained floating signal device of the kind wherein an electrically operated signal, a power pack, and a gravity-operated switch are mounted within a ballasted buoyant water-tight container, a tether by which to confine drifting movements of the container to a restricted area comprising a buoyant loop adapted to float in surrounding relation to the container, the loop being somewhat larger than the floating container as measured at its water line whereby to have capacity for remaining spaced therefrom at all points to permit free movement of the container consequent upon wave action thereupon of the water wherein the signal device is floated, and flexible means connected to the loop and to a fixed object to confine movements of the loop to a predetermined area.

10. In combination with a portable self-contained floating signal device having its drifting movements restricted by a tether according to claim 9, the tether buoyancy being such as to render it slightly floatable and its mass being low to render its weight light whereby to facilitate movements thereof into or out of the water when frictionally urged in either direction by rocking movements of the container.

11. The combination with a bodily-movable, electrically-operated signal device wholly enclosed within a unitary package, comprising a signal mechanism in circuit with a power pack, of a normally open switch interposed in said circuit comprising a pair of contacts, one movable toward the other to complete the circuit therebetween, an upwardly facing circular seat at an upper elevation, a ball resting upon the seat but displaceable radially therefrom at any point peripherally thereof in response to momentary movement of the container from its normal upright position, and a sloping runway surrounding the seat at a lower elevation leading to a point adjacent a movable contact of the switch, the ball, when displaced from its seat, being gravity-impelled to roll downwardly along the runway and into engagement with the movable contact to advance the same toward the other contact to complete the electrical circuit therebetween.

12. A switch according to claim 11 wherein a shell encloses the seat and runway, an annulus is supported within the shell above the seat in spaced relation thereto and to the shell top thereabove, and the top face of the annulus is pitched downwardly toward its center hole, the latter being directly above the seat therebelow to guide the ball, when rolling downwardly through the hole, to a position of rest upon its seat.

13. A switch according to claim 11 wherein the runway is formed with a ball-receiving pocket at its point of lowest elevation adjacent the movable contact, the latter being extended partially into the pocket to receive wedging engagement from the ball when disposed therein.

14. A switch according to claim 11 wherein a shell encloses the seat and runway, an annulus is supported within the shell above the seat and runway in spaced relation thereto, the top face of the annulus being pitched downwardly toward its center hole but not so steeply as the inclination of the seat therebelow, the annulus hole being disposed directly above the seat to guide the ball, when rolling downwardly through the hole, to a position of rest upon its seat.

15. A switch according to claim 11 wherein a shell with covered top encloses the seat and runway in spaced relation thereto, opposite faces of the annulus being pitched inwardly toward each other to be separated a mini-

mum distance at the periphery of the center hole, the latter being directly above the seat therebelow to guide the ball, when rolling downwardly through the hole, to a position of rest upon its seat.

16. A self-contained wave-actuated floating signal device for use in swimming pools and the like wherein a ballasted water-tight cylindrical container mounts there-within a power pack, a position-controlled gravity-operated switch and a signal mechanism electrically interconnected thereto to be energized for operation when the switch is operated in response to a wave-actuated rocking movement of the container, the container having a diameter in relation to the lengths of (a) wind induced waves of $D > 2l$ and of (b) moving body-induced waves of $D < L/2$, where D is the diameter of the con-

tainer, l is the length of wind-induced waves, and L is the length of moving body-induced waves, for production of container rocking movements requisite for operation of the gravity switch and mechanism controlled thereby.

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