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L. H. NELSON ET AL

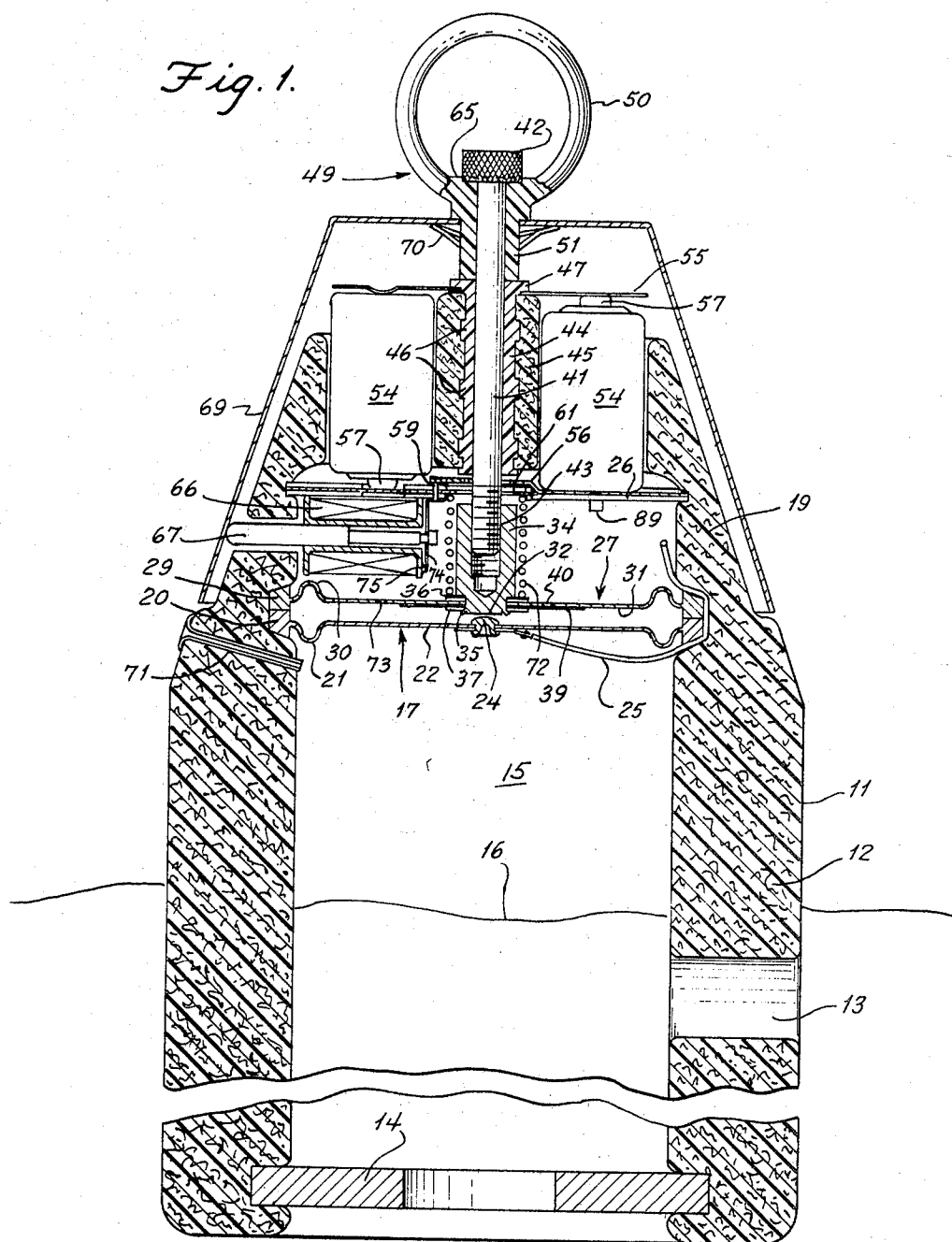
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POOL ALARM

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Fig. 1.



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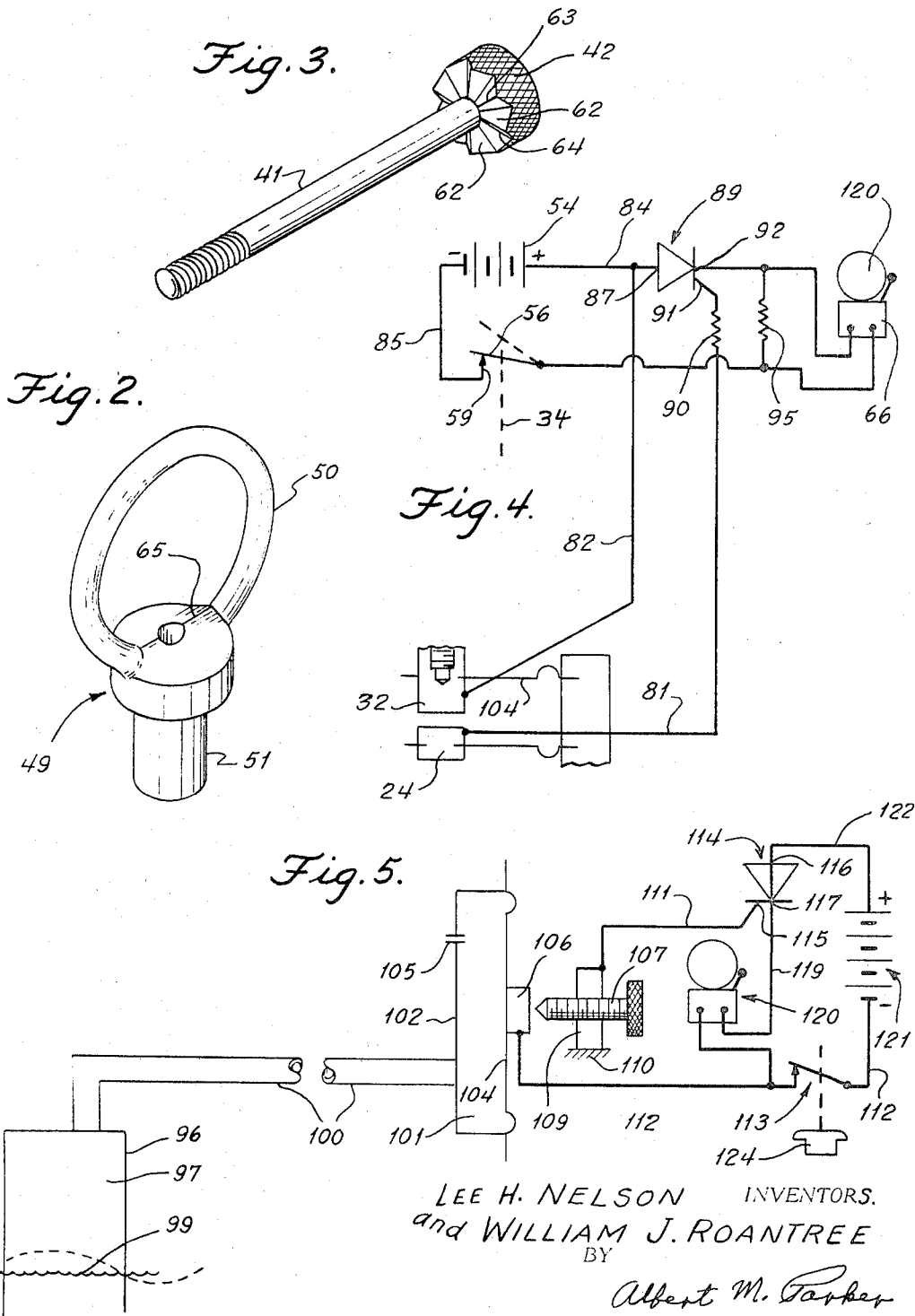
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POOL ALARM

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11 Claims

ABSTRACT OF THE DISCLOSURE

A self-contained alarm device floats freely on the surface of a pool. When the liquid in the pool is disturbed a flexible diaphragm responds to pneumatic pressure produced in a chamber containing air by wave motion to actuate a signalling device when continues to operate until it is turned off.

This invention relates to a device for detecting disturbances in a pool of liquid, and may be advantageously employed as a safety device in swimming pools and the like.

Although the alarm device of the present invention is capable of use to advantage in the detection of disturbances in various bodies of liquid, the embodiments of the device disclosed herein will be described in connection with their use in swimming pools. Small swimming pools, such as the so-called backyard pool are frequently unattended. Such pools, even though fenced, thus are serious hazards, particularly to small children who may climb the fence and accidentally fall into the pool. The alarm device of the present invention detects waves formed on the surface of the water in a pool resulting from objects falling or otherwise being introduced into the water in the pool. The alarm device incorporates a signalling mechanism such as a bell which is energized when the alarm device is subjected to such wave. Preferably the signalling mechanism is so made and so powered that it continues to operate until it is turned off. The alarm device in each of the disclosed embodiments is simple and economical to manufacture and is easily installed. Thus for a modest additional outlay a householder having a backyard swimming pool may markedly decrease the hazards which formerly attended its use.

It is accordingly among the objects of the invention to provide a novel alarm device which detects a disturbance in a pool of liquid.

A further object of the invention lies in the provision of a novel alarm device which produces a signal upon the formation of a surface wave in a pool of liquid, as by the falling of an object or otherwise inserting it into the pool of liquid.

Yet another object of the invention lies in the provision of a novel alarm device of the type indicated which is self-contained and floats freely upon the surface of a pool of liquid.

A still further object of the invention lies in the provision of a pool alarm which is economically made and installed and possesses a long operating life.

The above and further objects and novel features of the invention will more fully appear from the following description when the same is read in connection with the accompanying drawings. It is to be expressly understood, however, that the drawings are for the purpose of illustration only, and are not intended as a definition of the limits of the invention.

In the drawings, wherein like reference characters refer to like parts throughout the several views:

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FIG. 1 is a fragmentary view in vertical axial section through a first embodiment of pool alarm in accordance with the invention, the lower portion of the sidewall of the body of the alarm device being foreshortened for economy of space in illustration, certain of the parts being shown in elevation;

FIG. 2 is a view in perspective of the lifting ring device employed in the alarm of FIG. 1;

FIG. 3 is a view in perspective of the elongated stem which forms a portion of the mounting means for the adjustable contact of the alarm device of FIG. 1;

FIG. 4 is a diagram of the signalling circuit employed in conjunction with the embodiment of FIG. 1; and

FIG. 5 is a schematic view of a second pool alarm device in accordance with the invention.

As will be evident from the above, two embodiments of alarm device in accordance with the invention are shown and described herein. The first embodiment is shown in FIGS. 1-3, inclusive, and the second is shown in FIG. 5. The alarm device of the first embodiment is of the freely floating, self-contained type. The alarm device of FIG. 5 is adapted to be installed as a permanent part of a pool, the signalling portion of the system being mounted remote from the pool.

Turning now to the drawings, the first illustrative embodiment of alarm device shown in FIG. 1 is generally designated by the reference character 10. Device 10 is made generally in the shape of a nun buoy, having a body 11 with a cylindrical sleeve-like lower end 12 and a frusto-conical upper end 19. The body 11 may be made, for example, of foamed polystyrene so that the device 10 will float on the surface of a pool of liquid as shown. The body 11 may be made in halves divided along a vertical axial plane, such halves being secured together as by an adhesive after the various other parts of the alarm device have been assembled therein. For the purpose of maintaining the alarm 10 in upright position, an annular weight 14 is secured to the lower end of the body 11. The body 11 when floating upon a pool of liquid such as water is thus provided with a space 15 which is filled with air and is held essentially trapped within body 11 above the surface 16 of the water which extends partially upwardly within the body and somewhat above an opening 13 through the lower sidewall of body 11 through which liquid may pass in order that the body 11 may partially submerge in the liquid. When an object falls into the water of the pool, there is created a disturbance in the form of a surface wave which travels through the water in the pool and into the portion thereof within the lower end of portion 12 of the body 11. The air trapped within space 15 of the device 10 is thus subjected to increased pressure as a result of such wave and, acting upon the mechanism now to be described, actuates an audible signal device.

Spanning the upper end of the spacing 15 within the body 11 is a first, imperforate, lower flexible diaphragm 17 which may be made, for example, of a relatively thin sheet of plastic material such as polyvinyl chloride. The diaphragm 17 is attached and sealed to the body 11 as by a thickened rim 20 on the diaphragm. Diaphragm 17 is preferably provided with an annular pleat 21 adjacent its periphery so as to facilitate distortion of the diaphragm. The inner central portion 22 of the diaphragm lies substantially in a plane as shown in FIG. 1 when in relaxed condition. Mounted centrally on the diaphragm 17 is a first lower contact 24 which in the embodiment shown is in the form of a metal rivet provided with a lower metal washer. A flexible wire 25 extends from such washer of contact 24 to a circuit board 26 containing a printed circuit (not shown) for the signalling system of the device. The circuit of the signalling system is shown in FIG. 4,

which will be described hereinafter. A silicon controlled rectifier 89, which forms an element of the circuit of FIG. 4, is shown mounted upon the circuit board 26.

Mounted somewhat above the diaphragm 17 and parallel thereto is a second generally similar diaphragm 27. Diaphragm 27 is attached and sealed to the body 11 of the device by a thickened rim 29 thereon, and is provided with an annular pleat 30 adjacent its periphery. The rims 20, 29 of the diaphragms may have such dimensions as to be snugly retained together in an annular groove in the body 11, as shown. Preferably the confronting surfaces of the rims 20 and 29 of the diaphragms are sealed together by a suitable adhesive. The main central portion 31 of the diaphragm 27 is flat when in relaxed condition and with the exception of the check valve opening 40 therethrough and of the small hole 73, to be described, is imperforate. Secured to diaphragm 27 centrally thereof is an upper contact 32. Contact 32 is formed by the lower end of a metal coupling sleeve 34. The lower end of sleeve 34 extends in that order through an upper metal washer 36, the inner edge portion of the diaphragm 27 at a central hole therethrough, a thin flexible plastic washer 39, and a lower metal washer 37. The lower end of sleeve 34 is staked over the lower washer 37, as shown. The flexible washer 39, which may be made, for example, of polyvinyl chloride, underlies the aforesaid hole 40 in the diaphragm 27 and functions as a check valve so as to admit air into the space between the diaphragms 17 and 27 when the upper diaphragm is raised to remove the upper contact 32 from engagement with the lower contact 24 in the manner to be described. The upper diaphragm is provided with a small hole 73 therethrough to provide for the slow escape of air from between the diaphragms after the alarm device, held by lifting device 49, is lowered into the water and the diaphragm with contact 32 sink to the position shown in FIG. 1.

As shown in FIG. 1, an elongated central stem member 41 having an enlarged head 42 extends centrally downwardly from the upper end of the alarm device, the lower end of the stem 41 being threaded and being received at 43 in the threaded bore of the coupling sleeve 34. Intermediate its length the stem member 41 is slidably received in a vertical guide sleeve 44 which is affixed to the central portion 45 of the body 11. Flanges 46 and 47 on the guide sleeve 44 retain the sleeve securely in place. The device 10 is provided with a lifting means generally designated 49 which includes a ring 50, device 49 having a depending sleeve 51 through which the upper end of the stem 41 extends. It will thus be apparent that when the device 10 is picked up by the lifting ring 50 the weight of the alarm device is borne by the stem 41 and in turn by the contact 32 and the upper metal washer 36 of the contact assembly. A coil compression spring 72 extends between the washer 36 at its bottom and the lower surface of the circuit board 26 at its top. Spring 72 thus backs up the diaphragm 27 in supporting the weight of the device 10; the spring 72 is also employed to connect the upper contact 32 to the portion of the signalling circuit contained on circuit board 26.

The alarm device 10 is powered by a battery made up of a plurality of cells 54 (two shown), the cells being mounted reversely and having the upper poles thereof connected by a spring metal disc 55. The lower central pole 57 of the left-hand cell connects with a portion of the printed circuit on board 26. A spring metal strip 56 which engages the case of the right-hand cell extends to the left (FIG. 1) and is provided with a hole for the passage therethrough of the lower end of stem 41. The left-hand end of strip 56 normally engages a contact 59 which is disposed on the circuit board 26. The circuit board is provided with a central opening 61 within which the upper end of sleeve 34 may pass freely. When the alarm device 10 is raised by the lifting means 49, the stem 41 and thus the sleeve 34 secured thereto rise sufficiently for the upper end of the sleeve to engage the left-

hand end of the strip 56 thus to break the circuit through the strip and the contact 59. As will appear with the description of the circuit shown in FIG. 4, which is employed with the device of FIG. 1, the means 56, 59 constitute a normally closed interrupt switch by means of which the signalling device is shut off once it has been energized.

As shown more particularly in FIGS. 2 and 3, the device 10 is provided with means whereby the normal spacing between the contacts 24 and 32, and thus the sensitivity of the alarm device, may be adjusted. Thus the head 42 of the stem means 41 is provided on its under surface with a plurality of angularly disposed flat surface portions 62, the junctions between surfaces 62 being alternately valleys 64 and peaks 63. The under surface of the head 42 rests upon a sharpened diametrically extending edge at the upper surface of the base portion of lifting means 49. Such edge portion 65 and the valleys 64 thus constitute inter-engaging detents which hold the stem member 41 in angularly adjusted position. Thus by turning the stem member 41 in the appropriate direction the total effective length of the stem member and the sleeve 34 may be increased or decreased whereby to decrease and increase, respectively, the normal spacing between the contacts 24 and 32.

The signalling device which is shown somewhat schematically at 66 is generally similar to the ordinary door bell wherein the circuit powering the alarm device is periodically opened and closed. The alarm device 66 is provided with a striker 67 which when the device is energized reciprocates so as periodically to strike bell 69 which is formed as the outer housing member of the upper end portion of device 10. The bell 69 is spaced from the upper portion 19 of the body 11 and is mounted upon the stem 51 of the lifting device 49 and is retained thereon by a press-on spring washer 70.

The alarm device 10 is provided with an orifice 71 through the body 11 above the water line 16 as shown. Such orifice 71 provides for the slow leakage of air through the sidewall of the body thus to equalize the level of the water within and outside of the body 12 of the alarm device. Thus the initial adjusted distance between the contacts 24 and 32 remains the same despite temperature changes and any slow sinking of the alarm device in the water due to any slight waterlogging of the body 11 that may occur.

The circuit shown in FIG. 4 includes a wire 84 which connects the positive terminal of the battery 54 to the anode 87 of the silicon controlled rectifier 89. A wire 85 connected to the negative terminal of the battery 54 has interposed therein the interrupt switch 56, 59, wire 85 then continuing to one of the terminals of the electrical alarm device 66. Device 66 periodically interrupts the current delivered thereto by means of a resilient metal strip 74 (FIG. 1), affixed to the inner end of striker 67, and a fixed contact 75. The cathode 92 of the silicon controlled rectifier 89 is connected to the other terminal of the alarm device 66. A wire 81 from contact 24 leads through an interposed resistor 90 to the gate 91 of the rectifier 89. Resistor 90 limits the current delivered to the gate 91 and thus preserves the rectifier 89 from damage. A wire 82 leads from contact 32 to the wire 84, as shown.

It will be apparent that upon the closing of the contacts 24 and 32, a current pulse is delivered to the gate 91 of the rectifier 89. The rectifier then becomes conductive between the anode and the cathode thereof and remains so as long as current between the anode and cathode is uninterrupted. Because the alarm device 66 periodically interrupts its supply circuit, the circuit of FIG. 4 is provided with a second resistor 95 connected in parallel with the alarm device 66 thereby constantly to maintain a flow of current between the anode and the cathode of the rectifier 89 at all times during operation of the alarm device. Upon the lifting of the alarm device 10 by the lifting

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means 49, however, the switch 56, 59 is opened, thereby again rendering the rectifier 89 non-conductive and shutting off the alarm device 66.

FIG. 5 shows a second embodiment of alarm device in accordance with the invention, such device being adapted as a permanently installed accessory for a swimming pool. Such figure shows somewhat schematically a sensing chamber 96 which may be installed at any convenient location in the pool, the chamber 96 being in the form of an open bottomed vessel partially submerged in the water so that the surface 99 of the water is located intermediate the depth of the vessel and the vessel has a substantial space 97 filled with air above the water. The space 97 is connected through a tube 100 which extends to the operating end circuit device shown at the right in the figure which may be part of a unit mounted remote from the chamber 96. Such unit includes an essentially closed chamber 102 having a space 101 therewithin communicating with the space 97 in the chamber 96. The chamber 101 is spanned by a flexible diaphragm 104 which is deflected when a shock wave is detected by the sensing chamber 96 and is transmitted through the air in space 97 to the tube 100 to the air in space 101 and thence to the diaphragm. The chamber 102 is provided with a narrow orifice 105 which generally corresponds to the orifice 73 in FIG. 1, such orifice allowing for the equalization of the pressure within and without the chamber 102 under normal non-operating conditions of the system.

The diaphragm 104 carries centrally thereof a first contact 106, such contact cooperating with a confronting adjustable contact 107 mounted in a support 109 disposed on an insulating base 110. A wire 111 extends from contact 107 to the gate 115 of a silicon controlled rectifier 114. A further wire 112 extends from the movable contact 106 through a normally closed interrupt switch 113 to the negative terminal of a battery 121. The positive terminal of the battery is connected by a wire 122 to the anode 116 of the rectifier 114. The cathode 117 of the rectifier is connected to the solenoid 120 of an alarm bell by a wire 119. In this instance it is assumed that the bell 120 is of the type wherein the circuit thereto remains uninterrupted when the bell is in operation. Consequently, it is not necessary to provide in the circuit a resistor in parallel with the coil of the bell as is the case of the resistor 95 in the circuit of FIG. 4.

As with the previously described embodiment the alarm system is adjusted to the desired degree of sensitivity by suitable adjustment of the adjustable contact. As with the first embodiment, the alarm bell 120 of the system of FIG. 5 remains in operation once the contacts 106 and 107 have momentarily engaged until the circuit in which the anode and cathode of the rectifier 114 are included is broken. Thus the switch 113 is provided with a control button 124 which may be depressed in order momentarily to break such circuit, thereby to return the rectifier to non-conducting condition.

What is claimed is:

1. A pool alarm comprising an open bottomed sensing chamber adapted to be partially immersed in a pool of liquid with the upper portion of the chamber above the surface of the liquid and containing a body of gas trapped therewithin above the liquid in the bottom of the chamber, the upper portion of the chamber being essentially closed by means including a flexible diaphragm, a signalling system, and means operated by distortion of the diaphragm, upon its reception of the force from a wave in the liquid, for operating the signalling system.

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2. A pool alarm as claimed in claim 1, wherein the signalling system is electric and has a signal initiating circuit, and wherein the means for operating the signalling system includes a switch operated by the diaphragm for selectively energizing the signal initiating circuit.

3. A pool alarm as claimed in claim 2, wherein the switch has a pair of contacts, the contacts are interposed in the signal initiating circuit, and one of said contacts is mounted to move with the diaphragm upon distortion of the latter.

4. A pool alarm as claimed in claim 3, comprising a further circuit, and a relay and a signalling device connected in said second circuit, so that the relay selectively energizes the signalling device, the relay being so constructed and arranged as to remain conductive to operate the signalling device, when once turned on, until the further circuit is broken, and wherein the signal initiating circuit operates the relay.

5. A pool alarm as claimed in claim 4, wherein the relay is a silicon controlled rectifier having an anode, a cathode, and a gate, the signal initiating circuit is connected to the gate, and the further circuit contains a current source and is connected to the anode and the cathode.

6. A pool alarm as claimed in claim 5, comprising means for selectively opening the further circuit whereby to disable the signalling device.

7. A pool alarm as claimed in claim 1, wherein the sensing chamber is fixedly positioned with respect to the pool of liquid, the diaphragm and the switch operated thereby are disposed remote from the sensing chamber, and comprising conduit means having one end connected to the upper end of the sensing chamber and a further chamber spanned by the diaphragm connected to the other end of the conduit means, said upper end of the sensing chamber, the conduit means, and the further chamber being essentially closed.

8. A pool alarm as claimed in claim 1, wherein the diaphragm spans and closes the upper end of the sensing chamber.

9. A pool alarm as claimed in claim 1, wherein the alarm is self-contained and is adapted to float freely on the pool of liquid, the sensing chamber being bouyant and including means to maintain it partially immersed in the liquid and in upright position therein.

10. A pool alarm as claimed in claim 9, wherein the signalling system and the means for operating it are so constructed and arranged that once energized the system remains operative until disabled, and means for disabling the signalling system.

11. A pool alarm as claimed in claim 10, comprising means on the alarm which may be engaged to lift the alarm from the water, and means connecting the lifting means with the means for disabling the signalling system so that the lifting of the alarm disables the signalling system.

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