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[54] SWIMMING POOL ALARM SYSTEM

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[51] **Int. Cl.**.....**G08b 13/16**

[58] **Field of Search** .....340/261, 244 R, 244 C, 340/258 R; 200/190; 73/304 R

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[57] **ABSTRACT**

A swimming pool alarm system for instantly providing an audible or other alarm in response to a person or other object falling into the water. According to the invention, the alarm is adapted to be energized and held in the energized state by electronic switching means that switches from its "off" to its "on" condition in response to a trigger pulse from normally open sensor conductor means which is closable by a momentary splash of water thereon. Such sensor conductor means substantially completely circumscribes the pool closely spaced above the normal water level thereof, whereby the splash or wave motion from an object falling into the pool any place about the periphery thereof will momentarily close the sensor conductor means and thereby turn the switching circuit means "on" to actuate the alarm.

14 Claims, 4 Drawing Figures

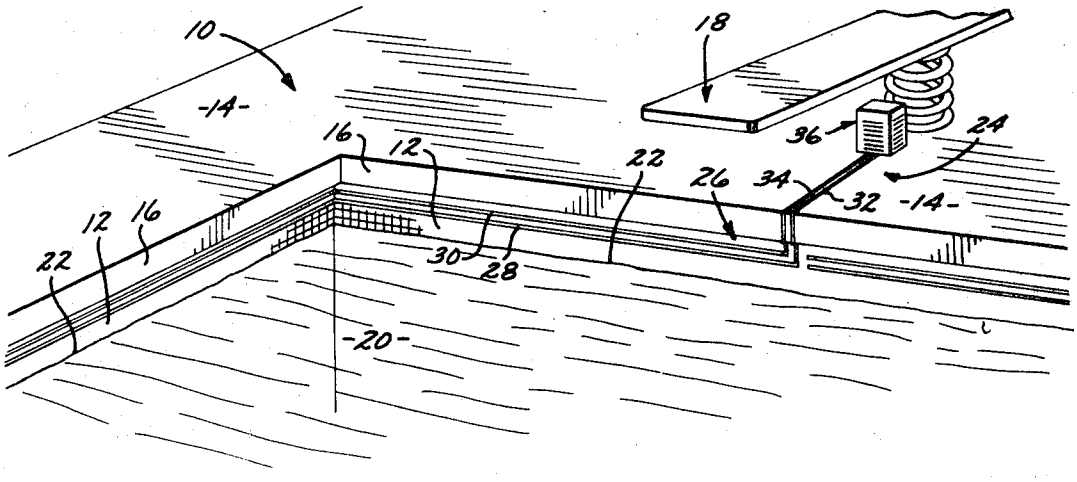


FIG. 1

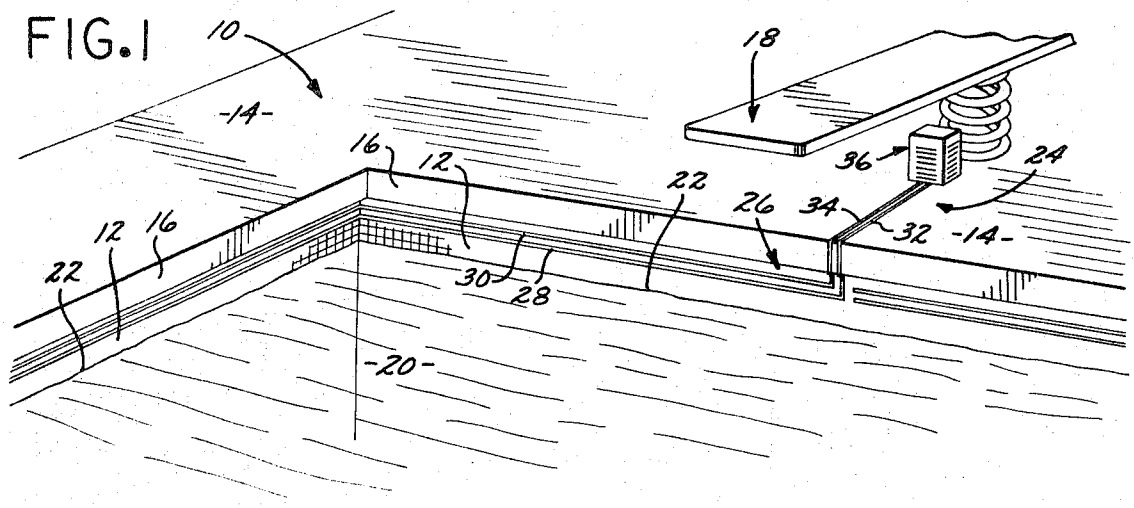


FIG. 2

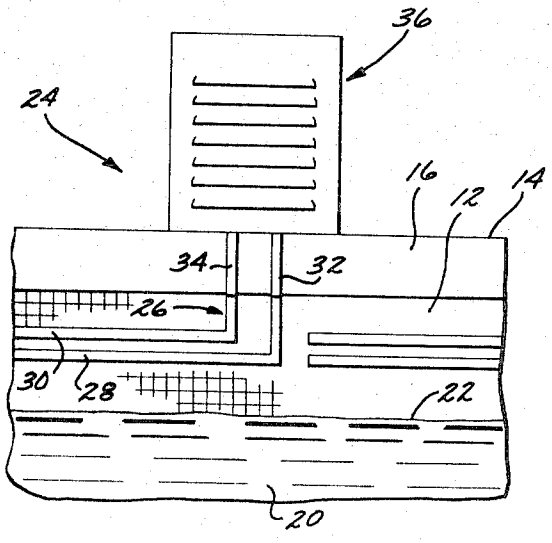
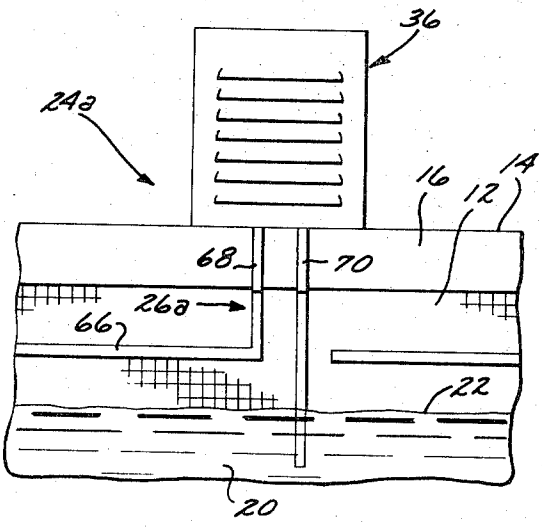


FIG. 3



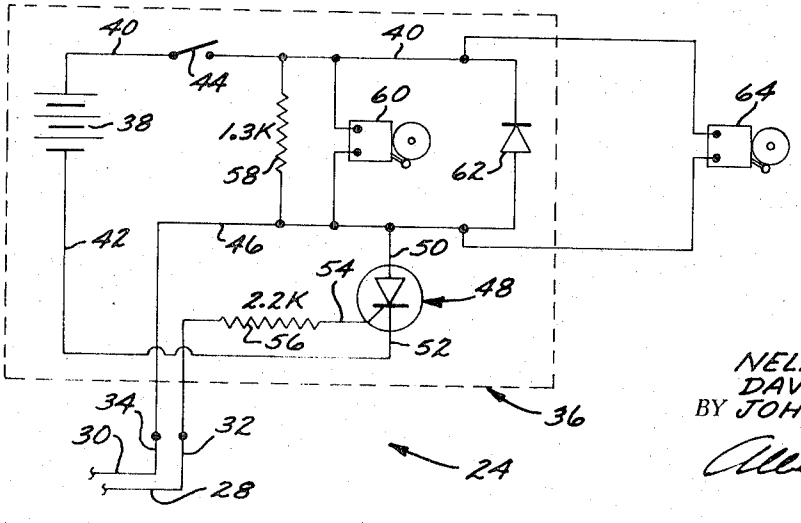


FIG. 4

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SWIMMING POOL ALARM SYSTEM

BACKGROUND OF THE INVENTION

Most swimming pool safety measures are in the nature of physical barriers such as fences, gates and the like, and sometimes pool covers. Such conventional protective measures are very expensive, yet they do not provide positive assurance against accidental drownings resulting from a child or other non-swimmer falling into the water from the side of the pool or from some apparatus associated with the pool such as a diving board, slide or the like. In fact, fences and gates often serve as an attractive nuisance for children to climb over. Additionally, such conventional physical barriers are generally troublesome to operate, with the result that gates are frequently left unlocked, and pool covers are often left in the open position when the pool is unattended.

Another problem in connection with such conventional physical barrier type swimming pool safety measures is that in the event they for some reason fail to stop a child or other non-swimmer from accidentally falling into the water, they do not provide any warning of the occurrence; in fact, such physical barriers provide an obstruction to visual observation of the pool and dampen sounds emanating from the pool so as to compound such an accident once it has occurred.

A still further problem in connection with such physical barrier safety measures applied to swimming pools is that while they may be regularly closed and locked when the pool is unattended for a substantial period of time, as for example overnight or while the proprietor is away for the weekend, nevertheless such barriers are generally left open and unlocked for extended periods of time during the day or evening when people may be using the pool for only part of the time, and perhaps going into and out of an adjacent house or other structure for meals, to use lavatory facilities, or the like. Several minutes of such non-attendance of the pool provide sufficient time for an accidental drowning to occur.

SUMMARY OF THE INVENTION

In view of these and other problems in the art, it is a general object of the present invention to provide a novel swimming pool alarm system usable either alone or to supplement existing swimming pool safety measures of the physical barrier type that will instantly and reliably provide an audible or other alarm in response to a person or other object falling into the water of the swimming pool.

Another object of the invention is to provide a swimming pool alarm system of the character described, wherein one or more alarm devices are adapted to be energized and held in the energized state by electronic switching means that switches from an armed but non-conducting or "off" state to a conducting or "on" state in response to a trigger pulse from normally open sensor conductor means which is closable by a momentary splash of water thereon.

Another object of the invention is to provide a swimming pool alarm system of the character described wherein the sensor that provides the gating pulse to the electronic switching means for keying on the alarm comprises conductor means disposed along the wall of the pool closely spaced above the normal water level and substantially completely circumscribing the pool, such conductor means providing a normally open electrical circuit to said switching means that is adapted to be momentarily closed or shorted by disturbed water of the swimming pool splashing or surging thereagainst to provide a trigger pulse to said switching means for turning on the alarm. Provision of said sensor conductor means around substantially the entire perimeter of the pool and closely spaced above the normal water level thereof assures that the splash or wave motion from the object falling into the pool at any location about the periphery thereof will actuate the alarm system. According to one form of the invention, a pair of spaced, generally parallel sensor conductors extend around the periphery of the pool, being adhesively bonded or otherwise attached to the tile or other wall material of the pool just above the normal water level, so that a disturbance of the water adjacent the side of the pool at any point around the periphery will cause the water as a conducting medium to bridge the parallel sensor conductors to close the circuit and energize the alarm. According to another form of the invention, only a single sensor conductor extends peripherally about the wall of the pool closely spaced above the normal water level, while the second conductor is simply exposed to the water in the pool at any desired point below the surface thereof.

The electronic switching circuit employed in the swimming pool alarm system of the present invention can be armed to make the system operative during periods of disuse of the pool, or disarmed to make the system inoperative during periods of use of the pool, by simply manipulating an electrical switch. The system preferably utilizes a relatively low voltage battery as its source of electrical energy to avoid any danger of shocks and so that the system will not be vulnerable to commercial power failures. A presently preferred semiconductor switching circuit according to the invention draws so little current in its armed but "off" or non-conducting condition that a conventional 6 volt type "F" lantern battery will last for many months under ordinary use of the system, so that the battery can generally be replaced seasonally.

Further objects and advantages of the present invention will appear during the course of the following part of the specification, wherein the details of construction and mode of operation of a presently preferred embodiment are described with reference to the accompanying drawings, in which:

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a fragmentary perspective view illustrating one form of the present invention operatively associated with a swimming pool.

FIG. 2 is an enlarged fragmentary elevational view of the alarm system shown in FIG. 1.

FIG. 3 is a fragmentary elevational view similar to FIG. 2 but illustrating another form of the invention.

FIG. 4 is a wiring diagram illustrating a presently preferred circuit arrangement employed with the present invention.

DETAILED DESCRIPTION

Referring to the drawing, and at first particularly to FIGS. 1 and 2 thereof, one form of the invention is il-

lustrated in these figures operatively disposed in combination with a swimming pool generally designated **10**. The swimming pool **10** includes a generally vertical peripheral wall **12** which may be rectangular or otherwise configured in horizontal section, and within which the water of the pool is confined. According to conventional construction the pool is surrounded by a deck **14**, the deck **14** that is illustrated in the drawing being of a modern cantilever type having an edge **16** which projects somewhat over the wall **12**. A diving board **18** is shown mounted on the deck **14**, and it is to be understood that other conventional apparatus (not shown) such as a slide, stairs for entering and leaving the water, or the like may be associated with the swimming pool **10** without interfering with the installation or operation of the present invention.

The body of water contained in the swimming pool **10** is generally designated **20**, and its normal water level around the wall **12** is designated **22**.

The swimming pool alarm system shown in FIGS. **1** and **2** is generally designated **24**, and this includes sensor means **26** supported on the wall **12** above the normal water level **22** and substantially completely circumscribing the pool so as to be sensitive to a surge or splash of water at any point around the entire periphery of the pool. In the form of the invention shown in FIGS. **1** and **2**, this sensor means **26** includes a pair of elongated, parallel electrical conductors **28** and **30** that are bonded to the wall **12** of the pool, the conductors **28** and **30** being electrically connected through respective connections **32** and **34** to an alarm unit **36**. The parallel conductors **28** and **30** are preferably substantially uniformly spaced throughout their extent about the pool, and in the form shown in FIGS. **1** and **2** they extend from their respective connections **32** and **34** around to free ends that are located just short of the connection **32**, such free ends being disposed close enough to the connection ends that any splash or surge of the body **20** of water in this region will bridge the parallel conductors **28** and **30** either proximate the connections **32** and **34** or proximate the free ends of the parallel conductors.

Alternatively, if desired, the free end of the lower conductor **28** may be joined to the connected end of conductor **28** so as to form a closed loop of the conductor **28**; while the free end of the upper conductor **30** may extend either over or under the connection **32** in electrically insulated relationship thereto and be connected to the connected end of the conductor **30** so as to form a closed loop of the conductor **30** (such closed loop construction not being shown).

Although the present invention is not limited to any particular dimensions for the spacing of the sensor conductors **28** and **30**, in an experimental example of the present invention reliable and sensitive pulsing of the alarm unit **36** has been achieved with the lower conductor **28** spaced approximately 1½ inches above the normal water level **22** of the pool, and the upper conductor **30** spaced approximately one-half inch above the lower conductor **28**. The presently preferred range of the spacing of the lower conductor **28** above the normal water level **22** is between about 1 inch and 3 inches. If such spacing is less than about 1 inch, the system tends to become too sensitive to small disturbances in the body **20** of water in the pool; while if the spacing of the lower conductor **28** above the water level **22** is more than about 3 inches, the sensitivity of the alarm system tends to fall below a desired minimum sensitivity for positively assuring energization of the alarm in response to an object falling into the pool.

The conductors **28** and **30** may be made of any electrically conducting material that is generally resistant to the corrosive effects of the swimming pool water; i.e., any material that will remain generally surface conducting so that in the operative state of the alarm system a splash of water covering the two conductors **28** and **30** at any point around the pool will provide an electrical short or connection between the conductors **28** and **30**. One satisfactory type of material for the conductors **28** and **30** is lead foil tape, between about one-fourth inch and one-half inch in width. A satisfactory form of such lead foil tape is No. 420 "Scotch" brand tape manufactured by 3M Company of Saint Paul, Minnesota, which has a water-resistant, pressure-sensitive adhesive on one side thereof. Such tape can simply be pressure-bonded to the tile or other surface material of the swimming pool wall **12**.

Another satisfactory material for the conductors **28** and **30** is stainless steel wire, as for example No. 20AWG stainless, which can be bonded to the wall **12** by any suitable water-resistant adhesive, as for example by means of an epoxy or other water insoluble cement.

If desired, one of the conductors **28** and **30** may be composed of lead foil tape and the other of stainless steel wire. Similarly, either or both of the conductors **28** and **30** may be composed of any other suitable conductive material within the scope of the invention, and may be secured to the wall **12** by any suitable bonding means.

Some conventional swimming pool wall materials such as tile or fiberglass are good electrical insulators, and accordingly if the wall **12** is of such insulation material, it is not necessary to insulate the conductors **28** and **30** relative to the wall. However, if the wall **12** were of an electrical conducting character, then a layer of insulation material would be provided between the conductors **28** and **30** and the wall **12** so that the conductors **28** and **30** would not be bridged by the wall itself, but only by a splash or surge of water thereon.

The alarm unit **36** is preferably contained in a suitable housing which is louvered or otherwise apertured to allow the alarm noise to project therefrom. The unit **36** may be placed at any convenient location outside of the wet area of the pool. FIG. **1** illustrates the unit **36** disposed underneath the diving board **18**, which is a particularly convenient place therefor because it is close to the sensor means **26** and also affords good protection for the alarm unit **36** and the connection leads **32** and **34**.

Referring now particularly to FIG. **4** of the drawing, the presently preferred circuit arrangement for energizing the alarm pursuant to a splash or surge of water against the sensor conductors is an SCR switching network arranged to conduct or switch "on" when the SCR gate sees a positive potential. The circuit is energized by a suitable dry cell battery **38**, as for example a 6 volt type "F" lantern battery. The circuit includes positive and negative conductors **40** and **42**, respectively, that are connected to the battery **38**, the positive

conductor 40 having a switch 44 therein that arms the circuit in its closed position and disarms the circuit in its open position.

The SCR is designated 48, and includes an anode terminal 50, a cathode terminal 52 and a gating terminal 54. The sensor conductor connection 34 is electrically connected to the anode terminal 50 of the SCR through a conductor 46; while the sensor conductor connection 32 is electrically connected to the SCR gating terminal 54 through a resistor 56. The SCR cathode terminal 52 is connected to the negative conductor 42.

A resistor 58, alarm bell 60, and a diode 62 are all connected in parallel between the positive conductor 40 and the conductor 46. The alarm bell 60 is preferably disposed within the alarm unit 36, and if desired a second alarm bell 64 may also be connected between the conductors 40 and 46, but may be positioned at a location that is remote from the swimming pool, as for example in an adjacent house.

Satisfactory values for the resistors 56 and 58 are 2.2 kilohms and 1.3 kilohms, respectively. A satisfactory SCR 48 is Radio Shack SCR No. 276–1067, 6 amps, 200 volts. A satisfactory diode 62 is a 1N547 diode. Satisfactory bells 60 and 64 are Edwards Catalog No. 740 bells. Such particular values and designations for circuit components are given by way of example only, and not of limitation.

With the switch 44 in its open position as illustrated in FIG. 4, the circuit is disarmed and completely inoperative so that the swimming pool can be used without the alarm inadvertently being actuated. All that is required to arm the circuit and thereby make it responsive to an object falling into the water at any point around the perimeter of the pool is to close the switch 44.

With switch 44 closed, positive voltage from the battery 38 is provided through conductor 40 to one side of resistor 58, one side of the coil in each of the alarm bells 60 and 64, and the cathode of diode 62. In the normal armed but "off" condition of the circuit, the bell coils do not have a completed circuit to the negative conductor 42, or ground, through the SCR 48, so the bells are unenergized. At this time, the positive voltage on conductor 40 is passed through resistor 58 to conductor 46 and thence through connection 34 to the upper sensor conductor 30, so that the upper sensor conductor 30 has this positive voltage thereon throughout its length.

When water splashes or surges across the sensor conductors 28 and 30, positive voltage is instantly applied to sensor conductor 28 and thence through its connection 32 and resistor 56 to the gating terminal 54 of SCR 48. At this point resistors 58 and 56 act as current limiters for the gate circuit and protect the gate from an over-current pulse.

When the gating terminal 54 of SCR 48 thus receives the positive pulse as a result of the sensor conductors 28 and 30 being shorted by the water, SCR 48 switches to its conducting or "on" state, and the coils of the bells 60 and 64 now have a potential difference thereacross, thus causing the bells to draw current and produce their alarm sound. The diode 62 acts as an arc suppressant across the bell coils and protects the SCR 48 from receiving impulses from the rising and falling magnetic fields of the bell coils.

Once the SCR 48 is thus turned on by a splash or surge of water, it remains in its "on" or conducting state, and the bells continue to sound the alarm, as long as the switch 44 remains in its closed position. Thus, to turn off the alarm it is necessary to manually open the switch 44. Once switch 44 has been opened and the alarm shut off, and the SCR 48 has accordingly been returned to its non-conducting or "off" state, the switch 44 can then be closed again so as to arm the circuit, and the alarm will not be sounded again until another surge or splash of water closes the electrical connection between the sensor conductors 28 and 30. Accordingly, switch 44 serves both as an "on-off" switch as well as a reset switch.

In the operation of test apparatus according to the invention embodying the circuit arrangement illustrated in FIG. 4, measurements indicate that the transient trigger time is in the order of microseconds, the energization of the warning bell or bells is in the order of milliseconds, and the sensitivity is such as to require only on the order of about 0.3 volts from the sensor means 26.

With the resistor 56 in the gate circuit, the SCR 48 is protected against damage from a current reversal in the event that battery 38 should be connected the wrong way.

FIG. 3 illustrates a second form of the invention wherein the alarm system is generally designated 24a. This system is the same as that illustrated in FIGS. 1, 2 and 4, except for the sensor means 26a which in this form of the invention includes only a single peripheral conductor 66 that is disposed in closely spaced relationship above the water level 22, preferably about 1½ inches above the water level 22, and preferably within the range of from about 1 inch to about 3 inches above the water level 22. The single peripheral conductor 66 is connected to the alarm unit 36 through a connection 68. In this form of the invention, the other sensor conductor is a conductor 70 that extends directly down into the water 20. In the form illustrated in FIG. 3, the conductor 70 extends from the alarm unit 36 over the deck 14 and its edge 16 and then generally vertically downwardly along the wall 12 so as to be submerged in the water 20 below the normal water level 22 thereof. If desired, this direct sensor conductor 70 may extend into the water in the skimmer area of the pool, or the conductor 70 may extend underground and come out through the wall 12 at any desired underwater point.

Preferably, the connection 68 to the peripheral conductor 66 is electrically connected to the conductor 46 in the circuit of FIG. 4, with the direct conductor 70 being connected to the gating circuit, although such connections may be reversed if desired.

While the instant invention has been shown and described herein in what are conceived to be the most practical and preferred embodiments, it is recognized that departures may be made therefrom within the scope of the invention, which is therefore not to be limited to the details disclosed herein, but is to be accorded the full scope of the appended claims.

We claim:

1. A swimming pool alarm system which comprises normally unenergized alarm means, electric circuit means operatively connected to said alarm means and adapted to energize said alarm means in response to a

sensed signal, and sensor means electrically connected to said circuit means, at least a portion of said sensor means extending around substantially the entire perimeter of a swimming pool closely spaced above the normal water level thereof, said sensor means being operative to provide a sensed signal to said circuit means to energize said alarm means in response to the contacting of said portion of said sensor means by disturbed water of the pool at any point around the perimeter of the pool.

2. A swimming pool alarm system as defined in claim 1, wherein said circuit means comprises electronic switching means that is switched by said sensed signal from said sensor means from a normal generally non-conducting "off" condition to a conducting "on" condition.

3. A swimming pool alarm system as defined in claim 2, wherein said electronic switching means include SCR circuit component means.

4. A swimming pool alarm system as defined in claim 1, which includes a manually operable electrical switch in said circuit means that is selectively movable between an open position wherein said circuit means is disarmed and unresponsive to said sensor means, and a closed position wherein said circuit means is armed and responsive to said sensor means.

5. A swimming pool alarm system as defined in claim 4, wherein said circuit means comprises electronic switching means which, in said closed position of said manually operable switch, is normally in a generally non-conducting "off" condition but is adapted to be switched by said sensed signal from said sensor means to a conducting "on" condition in which it remains until said manually operable switch is moved to its said open position.

6. A swimming pool alarm system as defined in claim 1, wherein said sensor means comprises normally open electrical conductor means closable by contact therewith of disturbed water of the pool.

7. A swimming pool alarm system as defined in claim 1, wherein said alarm means comprises at least one audible alarm device.

8. A swimming pool alarm system as defined in claim 7, wherein said audible alarm device is located adjacent to the swimming pool.

9. A swimming pool alarm system as defined in claim 7, wherein said audible alarm device is located remote from the swimming pool.

10. A swimming pool alarm system which comprises normally unenergized alarm means, electric circuit means operatively connected to said alarm means and adapted to energize said alarm means in response to a sensed signal, and sensor means electrically connected to said circuit means, at least a portion of said sensor means extending around substantially the entire perimeter of a swimming pool closely spaced above the normal water level thereof, said sensor means being operative to provide a sensed signal to said circuit means to energize said alarm means in response to the contacting of said portion of said sensor means by disturbed water of the pool at any point around the perimeter of the pool, said sensor means comprising normally open electrical conductor means closable by contact therewith of disturbed water of the pool, and said sensor conductor means comprising a pair of generally parallel, generally uniformly spaced conductors extending around substantially the entire perimeter of a swimming pool spaced above the normal water level of the pool.

11. A swimming pool alarm system as defined in claim 10, wherein the lowermost of said pair of sensor conductors is spaced in the range of from about one inch to about three inches above the normal water level of the pool.

12. A swimming pool alarm system which comprises normally unenergized alarm means, electric circuit means operatively connected to said alarm means and adapted to energize said alarm means in response to a sensed signal, and sensor means electrically connected to said circuit means, at least a portion of said sensor means extending around substantially the entire perimeter of a swimming pool closely spaced above the normal water level thereof, said sensor means being operative to provide a sensed signal to said circuit means to energize said alarm means in response to the contacting of said portion of said sensor means by disturbed water of the pool at any point around the perimeter of the pool, said sensor means comprising normally open electrical conductor means closable by contact therewith of disturbed water of the pool, and said sensor conductor means comprising a first electrical conductor extending around substantially the entire perimeter of a swimming pool spaced above the normal water level of the pool, and a second electrical conductor extending into the pool with a portion thereof normally submerged below the normal water level of the pool.

13. A swimming pool alarm system as defined in claim 12, wherein said first electrical conductor is spaced in the range of from about one inch to about three inches above the normal water level of the pool.

14. A swimming pool alarm system which comprises normally unenergized alarm means, electric circuit means operatively connected to said alarm means and adapted to energize said alarm means in response to a sensed signal, and sensor means electrically connected to said circuit means, at least a portion of said sensor means extending around substantially the entire perimeter of a swimming pool closely spaced above the normal water level thereof, said sensor means being operative to provide a sensed signal to said circuit means to energize said alarm means in response to the contacting of said portion of said sensor means by disturbed water of the pool at any point around the perimeter of the pool, said sensor means comprising normally open electrical conductor means closable by contact therewith of disturbed water of the pool, and said conductor means at least in part comprising lead foil tape adhesively bonded to the side of a swimming pool.

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