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(54) **Drowning prevention system**

(57) Drowning prevention system of the type of those which emit an alarm signal when they detect that a user is submerged in water for a long time. It is specially designed to be used in swimming pools with people who do not know how to swim or can not swim. It comprises at least an radio emitting unit (1) positioned in a safety harness (2) that is placed in the user's head. It comprises an emitter registration unit (3) that controls the activation of the emitting units (1) and comprises an antenna that receives the signals of the emitting units (1) and a CPU unit (4) that processes them sending an alarm signal in case of not detecting signal from an emitting unit (1) for a predetermined time. There is a communications unit (5) that collects and sends information about registrations and cancellations of the emitting units (1) and system incidences.

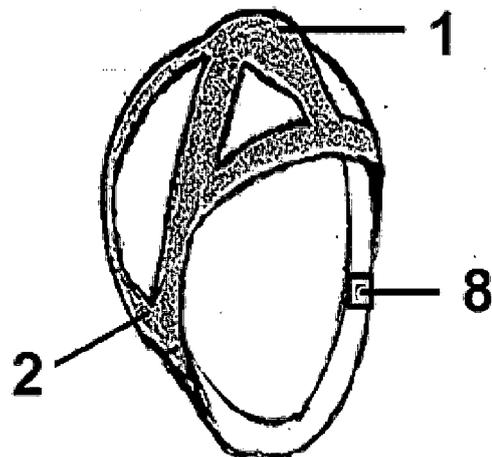


FIG. 1

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Description

[0001] The present invention describes a drowning prevention system specially intended to be used in public pools for the surveillance of children, elderly, disabled persons and people who do not know how to swim or can not swim.

State of the prior art

[0002] The practice of aquatic activities by non-swimmer persons or with difficulties for the practice of swimming involves its permanence in shallow bathing areas or the use of bathing aids such as inflatable armbands, life preservers, rubber rings, or the like.

[0003] The non-existence or loss of these bathing aids may lead to an emergency situation in the above-mentioned persons that, along with an excess of time before receiving help from lifesavers or people nearby, it can result in a fatal outcome.

[0004] Sometimes, the children swimming instructor spends more time counting the children than making their knowledge and skills reach to students, which has a negative impact in the quality of teaching and the stress of the monitor. Sports centers managers are forced to form small groups of students, especially in cases in which children are younger and they have therefore less swimming abilities. As the number of students increases in the groups, the dilemma is always of whether to increase an existing group, with the risks that entails from the point of view of safety.

[0005] The current result of this dilemma is usually the opening of a waiting list until the moment where there are a sufficient number of petitioners that allows to start a new group with security guarantees. The expansion of the group of students in a safe way could result in the elimination or reduction of waits for obtaining a service so essential to the preservation of life as is the obtaining of swimming abilities. The same problems arise in groups such as the elderly or disabled persons.

[0006] The current drowning prevention devices have significant disadvantages that require the development of a new prevention system that is simple, economical, and effective. Some of the drowning prevention systems known have at least an element floating on water, resulting in risk of accidents or vandalism. Other systems make necessary the installation of cameras or other fixed items in the pool so it is necessary to empty the pool for both the installation of cameras and its maintenance, and this implies high costs and disruption in customer service. This happens for example in the system described in document US5907281.

[0007] There are also known from the state of the art systems based on floating systems that generate an alarm when a wave occurs, when there is an echo or when movements are produced on the surface of the water. These systems are useful to prevent drowning by detecting persons, presumably not authorized, which en-

ter the swimming pool or a bath area when there is no monitoring, but these systems cannot be used when the pool is being used since they would emit continuously alarm signals.

5 **[0008]** There are other systems which are based on a series of ultrasonic transducers that monitor the type of movement of the swimmer, assuming a drowning based on suspicious movements; others that are based on radars to scan the pool, detecting bodies without movement, assuming that they can be potential victims of
10 drowning; other systems detect immobile bodies inside in the pool by using sonar technology from the pool floor; there are systems that incorporate a device carrying the swimmer and that triggers an alarm when he/she goes beyond a certain depth during a certain time as in the document EP1492069, generating an alarm and activating a float in some cases as in the system described in the patent EP1950720; there is a microphone system to detect sounds from the heartbeat and breath and identify
15 the possibility of drowning based on the absence or presence of these sounds.

[0009] Systems allowing the detection of physiological changes in the swimmer such as the pulse, the chest expansion and contraction, or the blood oxygen levels
20 such as for example the document US6111510 are also known. Some systems are also based on cameras that analyze movements of bodies at the bottom of the pool as an indicator of possible drowning. In some systems are used cameras to analyze images and draw conclusions from them related to the behavior of the swimmers to identify possible drowning and other systems comprise devices carried by the swimmer that detect drowning situations based on changes in the movements of the swimmer. Finally there are systems which include devices with
25 an alarm button such as the patent US2004/0095248 that sent an alarm signal when the button is pressed.

[0010] None of these patents has created products that have been widely adopted by the sector, due to, in some cases, its complexity, and in others, to their high cost,
30 low reliability, interfere with the provision of the service or to be susceptible to vandalism and intentional false alarms.

[0011] It is also known the patent WO-2004/086327 describing a system that provides the accurate location and depth to which the swimmer is found in the pool and warns of strange movements of the swimmer comparing them with a pre-set movement pattern. The system described herein requires the installation of several antennas both inside and outside the pool to perceive the signal emitted by the swimmer-carried device at all times, detecting when the signal is attenuated. The swimmer-carried device repeats the signals received from an external emitter. The biggest problem from the use of this system is that if a swimmer floats face down, as occurs in many
35 cases, he/she drowns but is not fully submerged and the signal received by the antennas are still being received fully so this is not detected as an alarm situation. Another problem with this system is that it uses a plurality of dif-

ferent frequencies so that the management of the system is quite complex and has to be configured individually to the specific measure based on the size and depth of each pool.

[0012] Hence, to date there is not known any drowning prevention system that can be used in public or private pools but of public use in which users are people who do not know to swim or can not swim. In addition this system must be economic so that its installation and maintenance compensates the managers of pools.

Explanation of the invention

[0013] Drowning is defined as death due to asphyxia by submersion in water or other liquid. A near-drowning situation represents an episode of immersion of sufficient severity to require medical care and able to cause irreversible brain damage. Around 360 thousand people die by drowning each year worldwide, of which 21,000 occur within the territory of the European Union.

[0014] Drowning is the second cause of damage or unintentional death among children under 14 years, after traffic accidents. Studies show that, at least, 10% of children under 5 years have lived a situation of high risk of drowning. In the majority of cases, children in difficulties was unable to emit assistance sounds because he/she was already unconscious and in drowning process.

[0015] A lifeguard, although he/she is in warning provision, can only control exhaustively a part of a swimming pool and even in that part, a person can be immersed under the surface without being detected by the lifeguard. Once a person is under the surface, it is difficult that a lifeguard can detect him/her at a glance and the problem is intensified if we take into account that drowning and especially drowning of children occur, in most cases, quickly and quietly, in a matter of seconds.

[0016] The classic image of a victim screaming and paddling for help is relatively rare, being much more frequent the image of someone immobile floating in the water or silently disappearing beneath the surface.

[0017] The main object of this invention is the preservation of human life through the reduction or elimination of drowning in swimming areas, using a relatively simple and inexpensive apparatus that allows parents, caregivers, lifeguards or potential rescuers, to be aware of a dangerous situation, before a fatal outcome may take place.

[0018] The drowning prevention system of the present invention allows improving the safety of bathers in a pool. It is specially intended to be used with children, elderly, disabled persons and people who can not swim, and to be installed in public or private pools for public use in which a single lifeguard must monitor to many people at the same time.

[0019] The system includes a safety harness, which are belts surrounding the swimmer's head, on his/her swim cap, and that accommodates an emitting unit which is completely watertight, battery-operated and compris-

ing a radio emitter. To avoid the children can remove the safety harness without the pool safety manager being aware of it, said safety harness has a plastic safety lock.

[0020] The system comprises an emitter registration unit comprising a magnet and a CPU unit. The magnet allows the activation of the emitting unit before the entry of the user in the water. CPU unit receives and processes all the signals of emitting units, and is responsible for generating the necessary alarm signals. The user emitting unit is deactivated when it comes out of the water and is approaching the emitter registration unit to cancel it by the magnet of said emitter registration unit. In the emitter registration unit there is also a communications unit which is responsible for collecting and sending the registration, cancellation, and incident information to the computer system. The system comprises an antenna placed on the pool, which receives the signal from the harness emitters, it sent them to the CPU and is placed high enough so that the user may not deactivate the emitting unit when he/she passes through the vicinity of the registration unit.

[0021] For the management of the drowning system this includes a software to display on a screen the system status, allowing the administrator knowing the status of the alarms, consulting records and assigning per screen portable emitting units to different types of alarms. Moreover, it allows the access to this data from any computer connected to the internet.

[0022] The antenna is the receiver unit that is placed in a place and at a height inaccessible to an unauthorized person. This receiver unit is responsible for receiving radio signals generated by the emitting units and has visual and audible elements with which sends a alert signal at the moment in which detects that one of the emitting units ceases to send the signal for a certain pre-set time associated with a possible situation of drowning.

[0023] In a preferred embodiment of the invention the system also comprises a secondary alarm unit, pointing to the exit of the locker-rooms. This secondary alarm is in the system to avoid the eventuality that the person wearing the safety harness leaves the pool and enters the locker-room with this device. This secondary alarm signal is especially intended for cases in which persons who carry the safety harness are children. The system comprises antennas and local alarm devices, with less presence and intensity than those previously described, in the exit towards the locker-rooms to warn to the pool guard of this anomalous without it can be confused with an alarm by drowning in the pool.

[0024] This system can also be installed on a beach, river, lake, etc., in which case the antennas are installed in sea pontoons. It is useful for example in situations where children are in 'summer schools' and taken them to the beach for some activities, which are usually carried out on the shore.

[0025] Throughout the description and claims, the word 'comprises' and its variations are not intended to exclude other technical features, additives, components

or steps. For those skilled in the art, other objects, advantages and characteristics of the invention will emerge in part from the description and in part from the practice of the invention. The following examples and drawings are provided by way of illustration, and are not intended to be limiting of the present invention. Furthermore, the present invention covers all the possible combinations of particular and preferred embodiments herein indicated.

Brief description of the drawings

[0026]

FIG. 1 shows the safety harness of the system of the invention with the emitting unit in an embodiment in which has a safety lock.

FIG. 2 shows the user who carries the emitting unit and the relationship between the user registration unit.

FIG. 3 shows the part of the secondary alarm system that indicates when the user leaves the swimming pool enclosure with the safety harness on.

References:

[0027] 1: Emitting unit; 2: Safety harness; 3: Emitter registration unit; 4: CPU unit; 5: Communications unit; 6: Secondary alarm; 7: Antennas; 8: Safety lock; 9: Audible and visual signal

Detailed explanation of the embodiments

[0028] The drowning prevention system of the type of those which emit an alarm signal when they detect that a user is submerged in water for a long time comprising at least an radio emitting unit (1) positioned in a safety harness (2) that is placed on the user's head. The system also comprises an emitter registration unit (3) that controls the activation of the emitting units (1) and has a CPU unit (4) that receives and processes the signals of the emitting units (1), emitting an audible and visual alarm signal (9) when the emitter signal is not detected from the emitting unit (1) and this occurs when the emitter is submerged. A communications unit (5) that collects and sends information about registrations and cancellations of the emitting units (1) and system incidences is also part of system of the invention.

[0029] The safety harness (2) is formed by belts surrounding the swimmer's head, as shown in the figure 1, on the user's swim cap. In the safety harness (2) is accommodated the emitting unit (1) which is completely watertight, battery-operated and comprising a radio emitter. To avoid the children can remove the safety harness without the pool safety manager being aware of it, said safety harness (2) has, in a embodiment of the invention,

a safety lock (8).

[0030] Furthermore, the system of the invention comprises in a preferred embodiment a secondary alarm unit (6) of exit of the swimming pool enclosure and which is connected with antennas (7) detecting the pass of an emitting unit (1) through the exit of the enclosure and emitting a secondary alarm signal. This secondary alarm system is designed in order to avoid in case of a user leaves the pool enclosure that the drowning alarm is triggered when the user is no longer in the enclosure. In this way the lifeguard will detect with a secondary alarm when a user wants to leave the enclosure with the safety harness (2) still placed so that he/she can go to disable the corresponding emitter element (1) and remove the safety harness (2) to the user which wears it. As the system has different signs to indicate the drowning and for the exit of a user of the enclosure there is no danger of confusing the signals and creating unnecessary panic situations triggering an alarm by someone who is not even in the water.

[0031] CPU unit (4) is associated with a web page to which sends information and having restricted access, wherein the status of the alarms is displayed, the records are consulted and emitting units (1) are assigned to different types of alarm.

[0032] The activation and deactivation of the emitting units (1) is by a magnet located in the emitter registration unit (3). In addition, in a preferred embodiment of the invention the system can be managed via the Internet.

[0033] When a user wants to start the session of bath, he/she brought close the corresponding emitting unit (1) to the emitter register unit (3) in such a way that the corresponding emitting unit (1) is activated. When the emitting unit has already been activated the user puts on the safety harness (2) and can now start the bath.

[0034] The emitter unit incorporates a communication protocol via radio in a multipoint mode, to avoid interferences with the typical noises of the pool environments and which allows optimizing the battery consumption.

[0035] Once the emitting unit (1) has been activated in the emitter registration unit (3) is continually emitting a signal that is received by the CPU unit (4) through the antenna. When the user who wears the safety harness (2) with the emitting unit (1) is submerged in the water or takes a dip, the emitting unit (1) emits signal but said signal does not reach the antenna and therefore neither the antenna nor the CPU unit (4) receive the signal. At the time that this change in the signal is detected, the system checks the duration of this lack of signal by the emitting unit (1) of the user to see if it exceeds or not a default time, previously chosen by the lifeguard of the pool or by the owners of the drowning prevention system. If the duration of the change in the signal does not exceed the predetermined time as dangerous situation the alarm signal is not generated, but if it exceeds said default time then the visual and audible alarm signals are activated.

[0036] The system of the present invention improves the safety of the pool, either for the swimming area or

the bath area. Also the use of this system allows increasing the number of users in a pool so the managers of pools can manage them with greater efficiency and operability.

[0037] In a particular embodiment, the emitting unit (1) has a microcontroller with very low consumption including a radio transceiver configured to work in a band of 868 MHz and a custom software which configures the microcontroller to send coded data frames, with the number of module, state of the battery, C.R.C. (cyclic redundancy code) and other data of interest, with certain power and cadence. Likewise, the emitting unit (1) has a lithium battery to power the assembly, a radio antenna and a magnetic sensor that allows activating or deactivating the microcontroller through a magnet. When the microcontroller is inactive stops emitting frames, and goes into the 'very low consumption' mode (less than one millionth of ampere). If it is activated by the magnet, sends few frames of initialization and identification to the base, and then enters the working mode, carrying out the task described above. The whole is mounted on a miniature printed circuit board, for the subsequent encapsulation, thus ensuring the tightness.

[0038] In a particular embodiment, the CPU unit (4), which is the manager of the whole installation, incorporates a powerful microcontroller, an LCD display of 4 lines x 20 characters, with four keys, which acts as a man-machine interface and an LED diode array numbered '01' to '40', serving to inform the user of the different status of the emitting units ('inactive', 'in service' ('active'), 'alarm'), identifying each one of them by the bright number of front panel. It also includes a alarm acknowledgement pushbutton, and a powerful magnet that serves to activate or deactivate the emitting units. The controller used in this embodiment has two communications ports. One of them is used to interconnect with the receiver units (1), and the other to communicate with the outside (computer, internet, etc.).

[0039] In this particular embodiment, the whole is mounted in a watertight surface box with a power supply 230 Vac/24 Vdc, supplying a stabilized voltage to all the elements and which allows its installation near the use areas. A software developed for the application, installed on the micro-controller is responsible for controlling the different peripherals (display, keyboard, matrix, serial ports, etc.) and analyzing the frames sent by the emitting units, accurately controlling the cadence of these and its structure. Depending on the type of frame, the controller manages the automatic Cancellations and Registrations received from the emitter registration unit (3), when the emitting unit (1) of a user is 'active' or 'inactive', controlling the time between frames, to determine if an alarm condition occurs.

[0040] In addition, in this concrete embodiment, although the CPU unit (4) is prepared to operate fully autonomously, incorporates a communication protocol with a series of commands which sent by the communications port available, allow the connection with the outside, to

a computer or the internet, an application installed on a local or remote computer, can enable or disable the emitting units, and consult its status, allowing a statistical control of the operation.

[0041] The CPU unit (4) comprises the receiving unit, which as the emitting unit (1), incorporates a radio transceiver in the same band, and a micro-controller with a custom software, which stores the data frames received without errors, to forward them to the CPU unit (4) when it is required. This structure allows facilities with one or more receiver units (1), depending on the coverage and size of the enclosure.

[0042] In the event that a user, carrier of an emitting unit (1) enters a prohibited area, there is an anti-theft system that detects such access to a prohibited area and activates a small built-in siren when this happens. It incorporates a receiver tuned to the same radio band as emitting units, with the suitable antenna, to avoid false alarms, and a micro-controller that checks the consistency of the data received, activating the siren when the identification is positive. A concrete embodiment, said anti-theft unit is mounted in a surface box with a 230 VAC power supply for connecting directly to the mains.

Claims

1. Drowning prevention system of the type of those which emit an alarm signal when they detect that a user is submerged in water for a long time comprising at least an radio emitting unit (1) positioned in a safety harness (2) that is placed around the user's head, it also comprises an emitter registration unit (3) that controls the activation of the emitting units (1) and the system has an antenna that receives the signals of the emitting units (1) and a CPU unit (4) that processes said signals emitting an audible and visual alarm signal (9) in case of detecting an unusual signal from an emitting unit (1) and also has a communications unit (5) that collects and sends information about registrations and cancellations of the emitting units (1) and system incidences.
2. System according to claim 1 comprising a secondary alarm unit (6) of exit of the swimming pool enclosure and connected with antennas (7) that detect the pass of an emitting unit (1) through the exit of the enclosure and emit a secondary alarm signal.
3. System according to any one of the preceding claims wherein the safety harness (2) has a safety lock (8).
4. System according to any one of the preceding claims wherein the CPU unit (4) is associated with a second communications unit showing the information on a web page wherein the status of the alarms is shown, the records are consulted, emitting units (1) are assigned and the default time to raise the alarm signal

is defined.

- 5. System according to any one of the preceding claims that is managed via the internet.

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- 6. System according to any one of the preceding claims wherein the activation and deactivation of the emitting units (1) is by a magnet located in the emitter registration unit (3).

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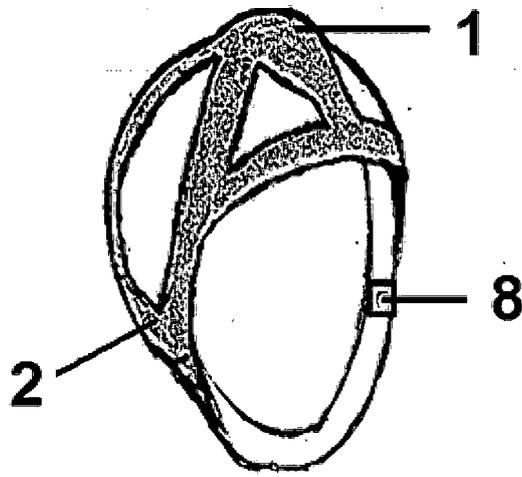


FIG. 1

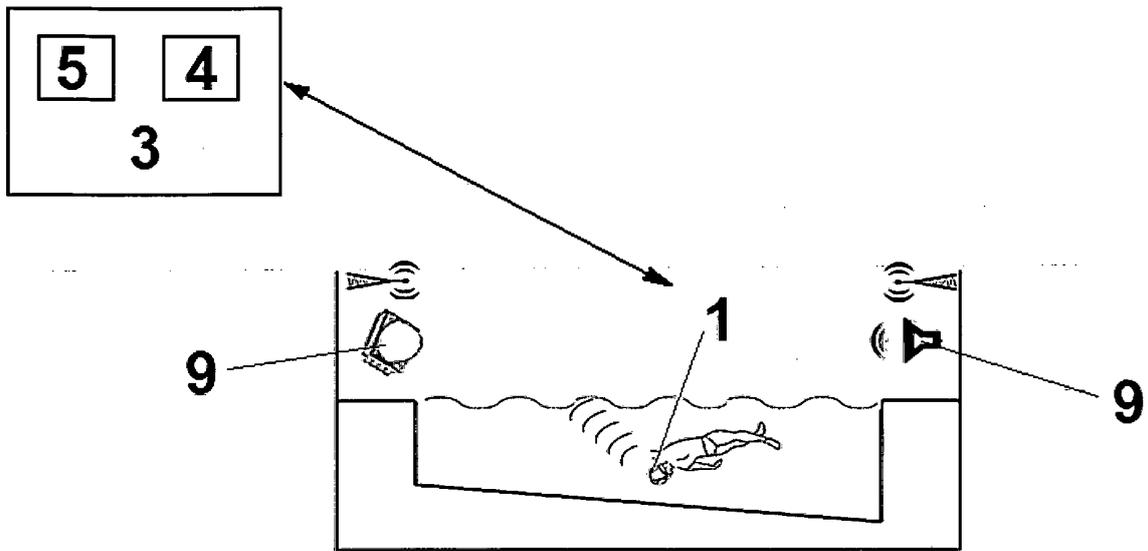


FIG. 2

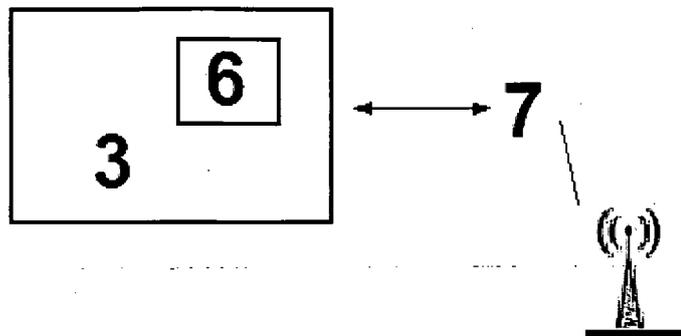


FIG. 3



EUROPEAN SEARCH REPORT

Application Number
EP 13 38 2309

DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
X	US 2007/132578 A1 (POWELL M J) 14 June 2007 (2007-06-14) * figures 2,3 * * sentence 2, paragraph 81 * * paragraph [0094] * * sentence 3, paragraph 112 * * sentences 2-4, paragraph 137 * * sentences 1,2, paragraph 147 * * paragraph [0188] * * sentence 1, paragraph 205 * * paragraph [0199] * -----	1-6	INV. G08B21/08
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The present search report has been drawn up for all claims			
Place of search Munich		Date of completion of the search 11 November 2013	Examiner Plathner, B
CATEGORY OF CITED DOCUMENTS X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document		T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons & : member of the same patent family, corresponding document	

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**ANNEX TO THE EUROPEAN SEARCH REPORT
ON EUROPEAN PATENT APPLICATION NO.**

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For more details about this annex : see Official Journal of the European Patent Office, No. 12/82

REFERENCES CITED IN THE DESCRIPTION

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