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(54) ALARM DEVICE FOR USERS OF CLIMBING CENTERS AND SYSTEM COMPRISING SAID DEVICE

(57) The present invention relates to an alarm device (D) for users of climbing centers, comprising a height sensor, user warning means (1) and a processor to which the height sensor and user warning means (1) are connected and comprising a portable housing (2) in which the height sensor and user warning means (1) are integrated. It also relates to a system (S) for climbing centers, comprising a harness (AR) intended to be worn by the climber, the harness having a ventral ring (AM), the safety device (D) attached to the harness (AR), a safety rope (CA) attached to the climbing center, the rope being fitted with a carabiner (M) intended to be anchored to the ventral ring (AM) of the harness (AR), and a pin (5) attached to the safety carabiner (CA) and intended to be inserted into the device (D).

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Description

TECHNICAL SECTOR

[0001] The present invention relates to an alarm device for users of climbing centers to reduce accidents in climbing centers.

BACKGROUND

[0002] Climbing, with the exception of solo climbing, requires the correct use of safety equipment to make it a safe sport. The number of manoeuvres that take place between the climber and the safety elements during the course of his or her sporting life is in the thousands, and carelessness can have fatal consequences.

[0003] A warning system for use on a climbing center and an automatic safety device for securing a climber is known. This known system provides the warning system with a warning that a climber is not protected by the automatic belay device.

[0004] The prior art warning system includes a sensor positioned to detect that a lower end of the climbing rope is secured to the climbing center and the climber is not connected to the selftethering system indicating a dangerous situation, and a height sensor to detect when the climber has reached a selected height on the climbing center.

[0005] A processor receives signals from the sensors and compares the signals to determine if the climber has reached the selected height with the lower end of the climbing center still secured to the wall and, if so, triggers a warning alarm.

[0006] This type of solution, described in WO 2008/097508, is a costly and complex system that is difficult to use.

DESCRIPTION OF THE INVENTION

[0007] To overcome the drawbacks of the prior art, the present invention proposes a climbing center user alarm device, comprising a height sensor, user warning means and a processor to which the height sensor and user warning means are connected, comprising a portable housing in which the height sensor and user warning means are integrated.

[0008] In some embodiments, the processor is configured to send an alarm signal to the user warning means in response to a signal provided by the height sensor.

[0009] In some embodiments, the means of alarming the user warning means are:

- an LED connected to the processor, the processor being preferably configured to command the LED to emit bursts of light; and/or
- a loudspeaker connected to the processor, the processor being preferably configured to command the loudspeaker to output sound bursts; and/or
- a vibrator connected to the processor.

[0010] In some embodiments, the device comprises transmission means connected to the processor so that it can remotely send messages.

[0011] In some embodiments, the device is configured to:

- periodically take a reading of the atmospheric pressure using the altitude sensor;
- transform this reading to a height value $h_{current}$;
- compare the current height value $h_{current}$ with a previously recorded minimum height value h_{min} in order to obtain with each measurement the height variation Δh; and

  - If $\Delta h < 0$: replace the minimum height value register h_{min} by the height value of the current reading $h_{min} = h_{current}$;
  - $0 \leq \Delta h < h_{max}$: no action to be taken;
  - $\Delta h \geq h_{max}$: to proceed to the emission of an alarm signal.

[0012] Therefore, the device is equipped with a self-calibration system that allows it to adapt to absolute pressure conditions, and to be able to take relative height measurements.

[0013] In some embodiments, the device comprises a lever, button or switch movable between two configurations, a first and a second, the lever, button or switch being connected to the processor.

[0014] In this way, the device is provided with a means for the user to transmit state information. That is, if the user decides that the lever is in one of the configurations, it will be transmitting one state, and if it decides that it is in the other configuration, it will be transmitting that it is in another state. This is particularly useful, as each of the configurations can be associated with a state of the climber's belay system. In a more basic version, the user would perform a verification of the correct attachment of the harness with the safety carabiner of the self-belay system and set the lever to the second configuration, so that the device would go into an unattended state, as it would assume that the user has verified that the user has met the safety conditions. However, in other embodiments, the device can be provided with further security features linked to the lever, as shown below.

[0015] In some embodiments, the device comprises a spring or elastic element that tends to bring the lever, button or switch to the first configuration. That is, the lever will have means for being brought into a guarded state by default.

[0016] In some embodiments, the device comprises means of locking the lever, button or switch in the second configuration. Thus, the climber, once he has checked that the attachment of the harness to the safety carabiner of the self-belay system is correct, can lock the lever in the second configuration, so that it is no longer in a guard-

ed state and allows him to start the ascent without raising alarms. These locking means are preferably attached to the carabiner or lanyard at a short distance from the carabiner, e.g. by means of a chain, cord, or short length of webbing. In this way, you can only insert the locking means if the carabiner is properly attached to the harness.

[0017] In some embodiments, the locking means comprises an orifice and pin assembly, such that when the pin is inserted into the orifice, the lever, button or switch is locked in the second configuration.

[0018] In some embodiments, the pin comprises a shank, a distal slot for temporarily holding the pin in the bore, a disc in a shape complementary to the mouth of the bore, and a retaining ring attached to the disc.

[0019] In some embodiments:

- the first of the configurations corresponds to a surveillance state, in which the device can emit a signal upon detection of a predetermined maximum height (h_{max});
- the second of the configurations corresponds to an unattended state, in which the processor does not watch and enters a dormant state to avoid battery consumption.

[0020] In some embodiments, the processor is configured to issue an alarm signal in the event of a malfunction or low battery level.

[0021] In some embodiments, the device comprises means for attaching the device to the user.

[0022] Finally, in some embodiments, the means of attachment consists of a buckle.

[0023] The invention also relates to a climbing center system comprising:

- a harness intended to be worn by the climber, the harness having a ventral ring;
- a device according to any of the variants of the invention attached to the harness;
- a lanyard attached to the climbing center, the lanyard being fitted with a safety carabiner intended to be anchored to the ventral ring of the harness;
- A pin attached to the safety carabiner and intended to be inserted into the device.

[0024] Additional advantages and features of the invention will become apparent from the following detailed description and will be pointed out particularly in the appended claims.

BRIEF DESCRIPTION OF THE DRAWINGS

[0025] To complement the description and in order to aid a better understanding of the features of the invention, in accordance with some examples of practical embodiments of the invention, there is attached as an integral part of the description, a set of figures in which, by way of illustration and not limitation, the following has been depicted:

Figure 1 is a perspective view of the device according to the invention in which the lever is in the first configuration.

Figure 2 is a rear perspective view showing the attachment buckle, e.g. to the belt.

Figure 3 shows the lever locking pin in perspective.

Figure 4 shows the device in a configuration where the user is pressing the lever to its second setting and the user is about to insert the pin.

Figure 5 is a view from the underside of the device.

Figure 6 is a front view of the device in its first configuration.

Figure 7 is a front view of the device in its second configuration.

Figure 8 is a side elevation of the device in its second configuration, i.e. with the pin inserted.

Figures 9.1 and 9.2 show the schematic of the system according to the invention.

DESCRIPTION OF A PREFERRED EMBODIMENT OF THE INVENTION

[0026] In the description of possible preferred embodiments of the invention it is necessary to give numerous details in order to promote a better understanding of the invention. However, it will be apparent to the person skilled in the art that the invention can be implemented without these specific details. On the other hand, well-known features have not been described in detail in order to avoid unnecessarily complicating the description.

[0027] The invention consists of a device D intended to be attached to the user, preferably attached to the climber's harness.

[0028] The device D constantly monitors the variation in height in order to monitor if a safety threshold is exceeded. If this programmed threshold is exceeded and the climber has not informed the device of the correct climber-safety linkage, the device goes into alarm.

[0029] The D device is designed to act as a substitute for the climbing partner when climbing is not done in pairs (climber-belayer). In other words, it is a device that is not global for a group of users, like the existing ones, but is physically associated with each climber and monitors each climber individually.

[0030] As a rule, climber and belayer, just before the start of the climb, check with each other that the partner is adequately prepared for the climb to be safe. In the

case of individual practice, the device D of the invention acts as the absent partner, and as indicated above, if the climber does not communicate to it that the preparation is adequate, it remains in a state of 'vigilance' and if the height variation exceeds a safety threshold (h_{max}), it goes into a state of alarm.

[0031] For this purpose, as shown in the figures, the climbing center user alarm device D of the invention comprises a height sensor, user warning means 1 and a processor to which the height sensor and user warning means 1 are connected.

[0032] In addition, the device comprises a portable housing 2 in which the height sensor and user warning means 1 are integrated. The device also comprises, as shown in figure 2, means of attachment 3 of the device to the user, which in the illustrated embodiment is a buckle 3, although more reliable attachment systems can of course be used.

[0033] The processor is configured to send an alarm signal to user notification means 1 in response to a signal provided by the height sensor. These user notification means 1 are:

- an LED connected to the processor, the processor being preferably configured to command the LED to emit bursts of light; and/or
- a loudspeaker connected to the processor, the processor being preferably configured to command the loudspeaker to output sound bursts; and/or
- a vibrator connected to the processor.

[0034] The device is configured to:

- periodically take a reading of the atmospheric pressure using the altitude sensor;
- transform this reading to a height value $h_{current}$;
- compare the current height value $h_{current}$ with a previously recorded minimum height value h_{min} in order to obtain with each measurement the height variation Δh; and

    - If $\Delta h < 0$: replace the minimum height value register h_{min} by the height value of the current reading $h_{min} = h_{current}$;
    - $0 \leq \Delta h < h_{max}$: no action to be taken;
    - $\Delta h \geq h_{max}$: to proceed to the emission of an alarm signal.

[0035] As can be seen in the figures, the device comprises a lever 4, button or switch movable between two configurations, a first and a second, the lever 4, button or switch being connected to the processor. The lever comprises a spring or elastic element (not shown) which tends to bring the lever 4, button or switch to the first configuration.

- the first of these configurations corresponds to a surveillance state, in which the device can emit a signal upon detection of a predetermined maximum height (h_{max});
- the second of these configurations corresponds to an unattended state, in which the processor does not watch and enters a dormant state to avoid battery consumption.

[0036] Preferably, the device comprises means of locking the lever 4, button or switch in the second configuration. As can be seen for example in Figures 3 or 4 the locking means comprise a hole 6 and pin 5 assembly, so that when the pin 5 is inserted into the hole 6, the lever 4, button or switch is locked in the second configuration.

[0037] The pin 5 comprises a shank 51, a distal groove 52 for temporarily holding the pin 5 in the bore 6, a disc 53 complementary to the mouth of the bore 6 and a retaining ring 54 attached to the disc 53.

[0038] The device works as follows. As can be seen in Figure 9, the device D is (firmly) attached to the climber's harness AR. The lever, in the absence of action on it, will be in the first configuration, i.e. the one shown in Figure 1. In this first configuration, as mentioned above, the device is in a guarded state, since it is not aware that the safety measures consisting of attaching the safety carabiner M (attached to the lanyard CA) to the belay ring AM of the harness AR have been taken. Once the user has attached the karabiner M to the ventral ring AM, the user can insert the pin 5 into the hole 6 of the device D, so that the lever 4 will be in its second configuration, i.e. non-monitoring or dormant. In other words, by inserting pin 5 into hole 6, the user will have communicated to the device, and specifically to the processor, that he/she is now in minimum safety conditions to start climbing.

[0039] It is envisaged that in the event that the device enters an alarm state because the user has not informed the device that escalation is to be initiated, the procedure for exiting the alarm state to return to the watchful state is to momentarily hold the lever in the down position.

[0040] In addition, the following optional functions are foreseen:

In order to improve the reliability of the behaviour of inventive user devices D (user device to be distinguished hereafter), a networked system can be chosen. For this purpose the device may have the ability to communicate. This communication capability opens the possibility to create a system by adding to the number of existing 'user devices' the 'referrer device' and one or more 'personnel devices':

Reference device: The 'user device' D in its most basic state is intended to be able to work autonomously or more reliably, working in a network. This is explained by its principle of operation: when a variation in atmospheric pressure occurs, its origin must be distinguished: climatic or altitude. The former is generally much slower than the latter, so discernment is usually straightforward. In the rare case of a sudden climatic variation resulting in a sudden change in pressure, this distinction is no longer possible and the device is logically designed so that in

case of doubt, the alarm state is activated, even though it may be a false alarm.

[0041] To address this type of uncertainty, the device, as indicated above, may have a communication capability. This capability would allow it to communicate periodically with a "reference device" that would be incorporated into the system and would be placed at a fixed position. This device would be responsible for monitoring and communicating to the user devices the atmospheric variations of climatic origin ($\Delta h = 0$). This would make the compensation more realistic and the height variation more reliable.

[0042] **Staff device**: In case user devices have the ability to communicate, a new type of device can be incorporated into the system: the venue security staff could have 'staff devices' which would be receivers of messages from user D-devices in order to be informed of possible security incidents in the venue.

[0043] The user D-devices, apart from being able to receive messages from the reference device and broadcast messages to the staff devices, are prepared to communicate via *gateway* with a server in order to manage the alarm messages according to how the climbing center managers want to manage them. Therefore, in a scenario with music or ambient noise loud enough for the user not to hear the sound bursts (*buzzer*) that alert him. With the possibility of computer processing of the messages received, it would be up to those responsible for the climbing center how to extend the alarm support (general alarm sound in the room, sending messages, etc.).

[0044] In short, this device improves safety without being part of the safety package; in the same way that a vehicle detects the presence of a passenger and alerts the user that he/she is not wearing a seatbelt when the vehicle is in motion, the device acts in the same way when it detects a height and does not receive a signal from the user confirming that he/she is properly secured.

[0045] In view of this description and figures, the person skilled in the art will understand that the invention has been described according to some preferred embodiments thereof, but that multiple variations may be introduced in said preferred embodiments, without departing from the subject matter of the invention as claimed.

[0046] In this text, the term "comprises" and its derivations (such as "understanding", etc.) should not be understood in an exclusive sense. That is, these terms should not be interpreted as excluding the possibility that what is being described and defined may include further elements, stages, etc.

Claims

1. -Alarm device (D) for users of climbing centers, comprising a height sensor, user warning means (1) and a processor to which the height sensor and user warning means (1) are connected, **characterised in that it** comprises a portable housing (2) in which the height sensor and user warning means (1) are integrated.

2. -Device (D) according to claim 1, wherein the processor is configured to send an alarm signal to the user warning means (1) in response to a signal provided by the height sensor.

3. -Device (D) according to any of the preceding claims, wherein the user warning means (1) are:

   - an LED connected to the processor, the processor being preferably configured to command the LED to emit bursts of light; and/or
   - a loudspeaker or buzzer connected to the processor, the processor being preferably configured to command the loudspeaker to emit bursts of sound; and/or
   - a vibrator connected to the processor.

4. -Device (D) according to any one of the preceding claims, comprising transmission means connected to the processor so that it can remotely send messages.

5. -Device (D) according to any of the previous claims, which is configured for:

   - periodically take a reading of the atmospheric pressure by means of the altitude sensor;
   - transform this reading to a height value ($h_{current}$);
   - compare the height value ($h_{current}$) with a previously recorded minimum height value (h_{min}) in order to obtain for each measurement the height variation (Δh); and

     • If $\Delta h < 0$: replace the minimum height value register (h_{min}) by the height value of the current reading ($h_{min} = h_{current}$);
     • $0 \leq \Delta h < h_{max}$: no action to be taken;
     • $\Delta h \geq h_{max}$: to proceed to the emission of an alarm signal.

6. -Device according to any of the preceding claims, comprising a lever (4), button or switch that can be moved between two configurations, a first and a second, the lever (4), button or switch being connected to the processor.

7. -Device according to claim 6, comprising a spring or elastic element that tends to bring the lever (4), button or switch to the first configuration.

8. -Device according to claim 8, comprising means for locking the lever (4), button or switch in the second configuration.

9. -Device according to claim 9, wherein the locking means comprises a hole (6) and pin (5) assembly, such that when the pin (5) is inserted into the hole (6), the lever (4), button or switch is locked in the second configuration.

10. -Device according to claim 10, wherein the pin (5) comprises a shank (51), a distal groove (52) for temporarily holding the pin (5) in the hole (6), a disc (53) complementary to the mouth of the hole (6) and a retaining ring (54) attached to the disc (53).

11. -Device according to claim 6 or any claim dependent upon claim 6 wherein:

- the first of the configurations corresponds to a surveillance state, in which the device can emit a signal upon detection of a predetermined maximum height (h_{max});
- the second of the configurations corresponds to an unattended state, in which the processor does not watch and enters a dormant state to avoid battery consumption.

12. Device according to any one of the preceding claims, wherein the processor is configured to output an alarm signal in the event of a malfunction or low battery level.

13. -Device (D) according to any of the previous claims, comprising means of attachment (3) of the device to the user.

14. -Device (D) according to claim 13, wherein the means of attachment (3) consists of a buckle (3).

15. -System (S) for climbing centers, comprising:

- a harness (AR) intended to be worn by the climber, the harness having a ventral ring (AM);
- a device (D) according to any one of claims 1 to 14 attached to the harness (AR);
- a safety rope (CA) attached to the climbing center, the rope being fitted with a carabiner (M) intended to be anchored to the ventral ring (AM) of the harness (AR);
- A pin (5) attached to the safety carabiner (CA) and intended to be inserted into the device (D).

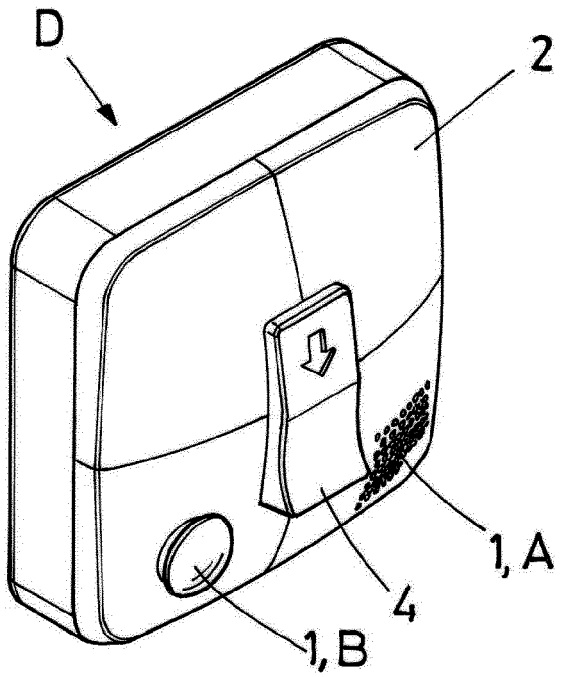

FIG.1

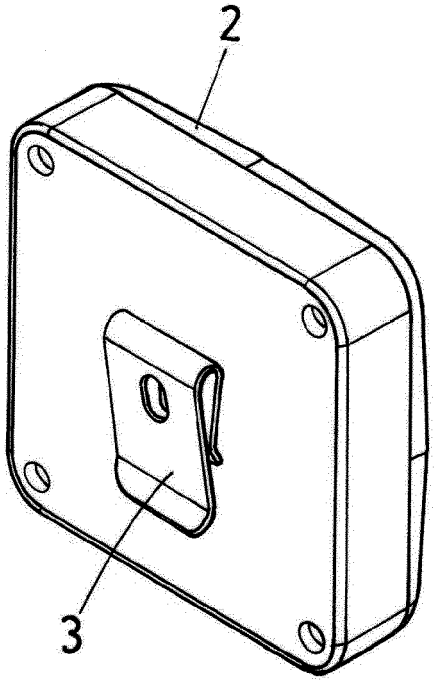

FIG.2

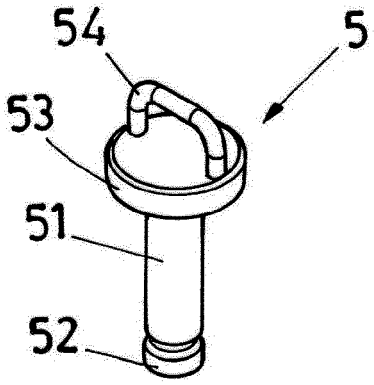

FIG.3

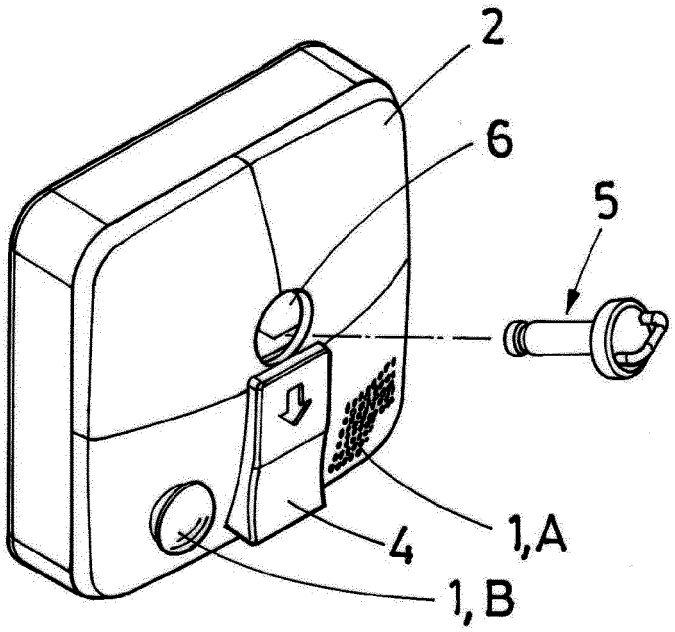

FIG.4

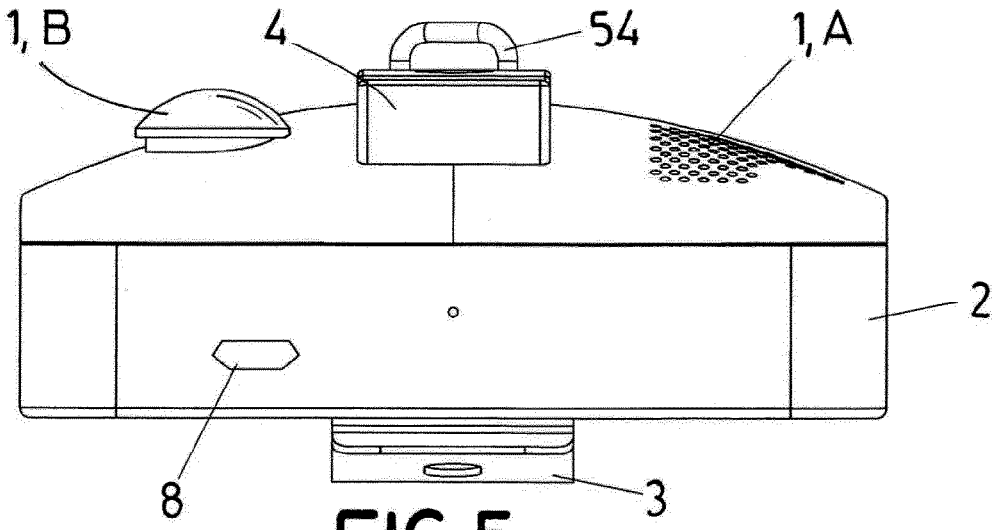

FIG.5

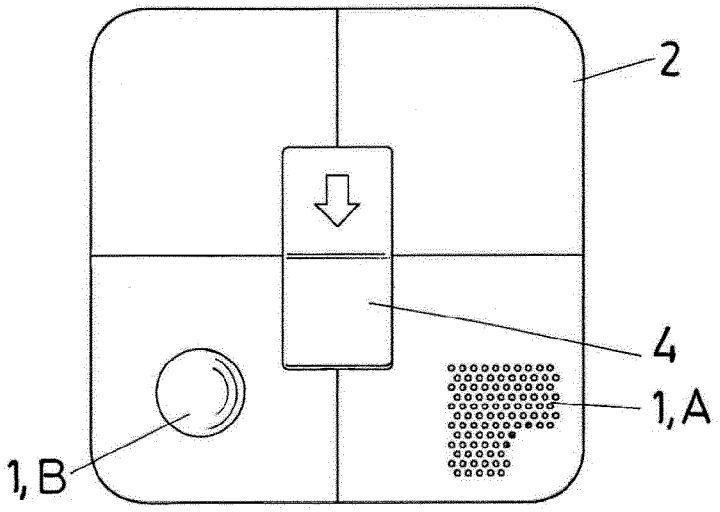

FIG.6

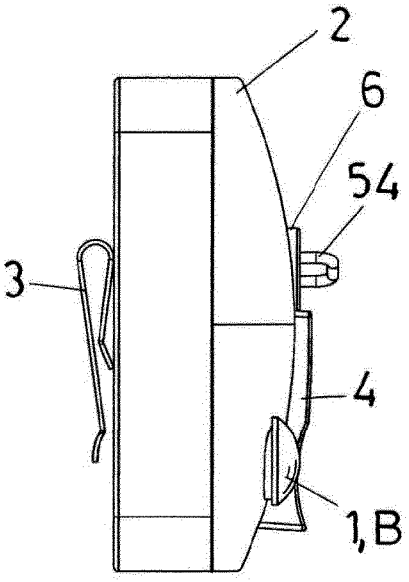

FIG.8

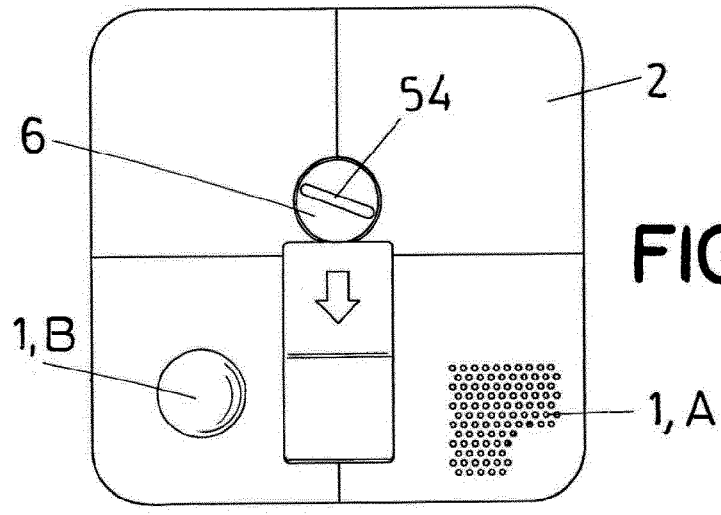

FIG.7

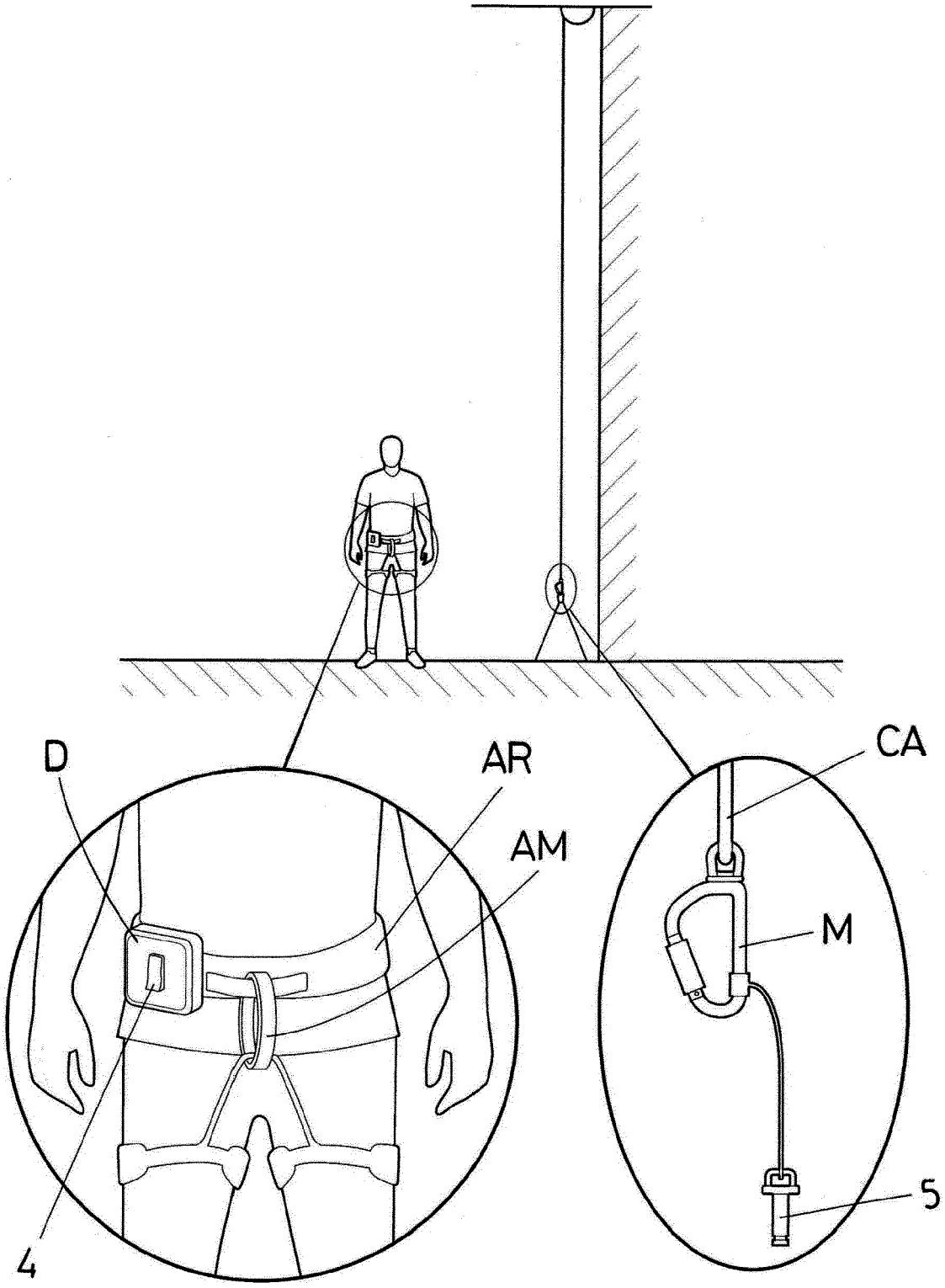

FIG.9.1

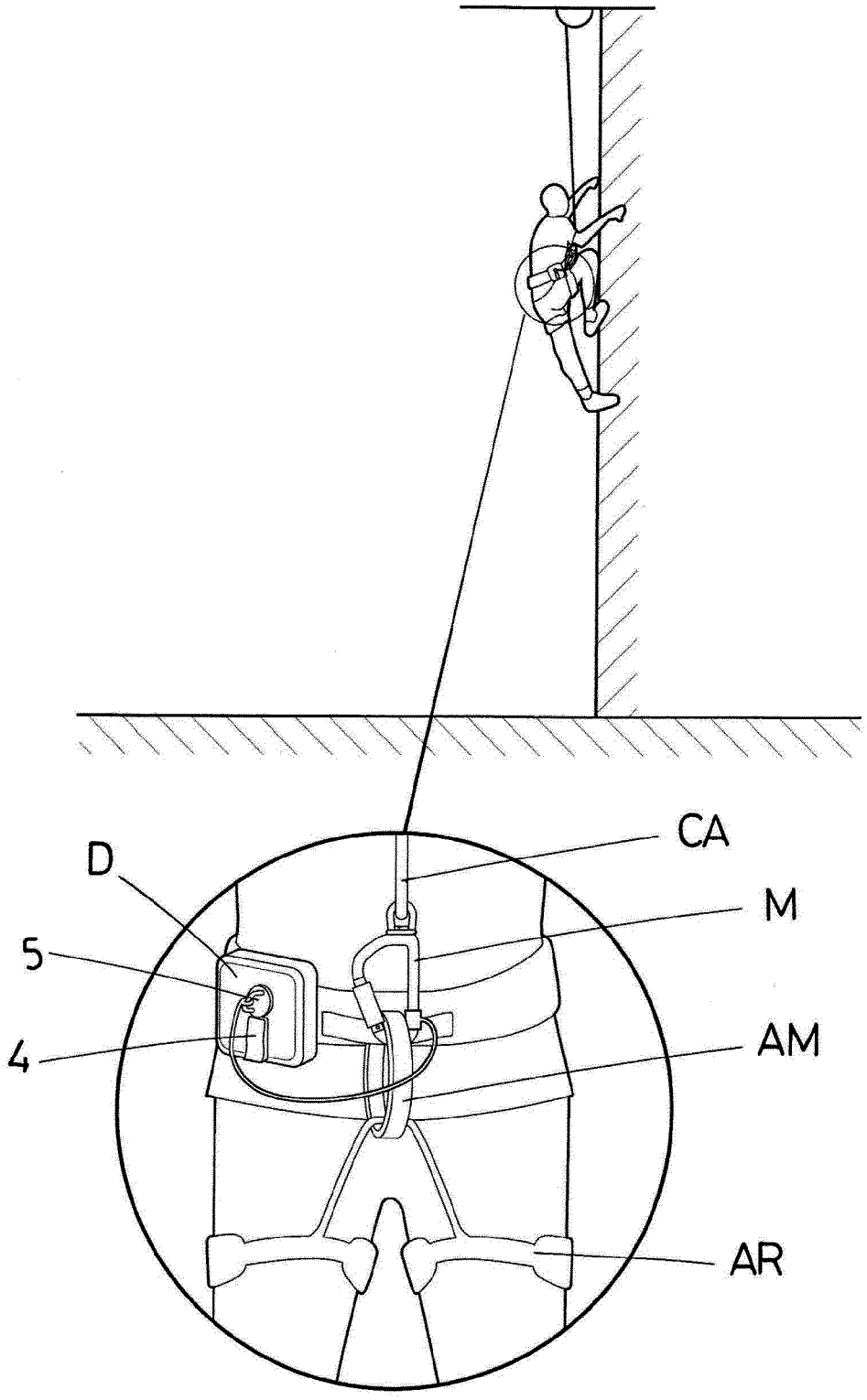

FIG.9.2

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EUROPEAN SEARCH REPORT

Application Number
EP 23 19 8619

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 A	CN 111 956 965 A (GUANGDONG POWER GRID CO ET AL.) 20 November 2020 (2020-11-20) * paragraph [0018] - paragraph [0025]; figures 1,2,3 * * paragraph [0018] * * * * paragraph [0044] - paragraph [0049] *	1-8, 11-15 9,10	INV. G08B21/02
X	CN 114 887 303 A (SHENXIAN POWER SUPPLY COMPANY STATE GRID SHANDONG ELECTRIC POWER COMPA) 12 August 2022 (2022-08-12) * the whole document *	1,2	
A	US 2008/185221 A1 (POSTMA NATHAN B [US]) 7 August 2008 (2008-08-07) * the whole document *	1-15	
			TECHNICAL FIELDS SEARCHED (IPC)
			G08B

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
Munich	6 February 2024	Kurzbauer, Werner

CATEGORY OF CITED DOCUMENTS

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06-02-2024

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
CN 111956965 A	20-11-2020	NONE	
CN 114887303 A	12-08-2022	NONE	
US 2008185221 A1	07-08-2008	US 2008185221 A1	07-08-2008
		WO 2008097508 A1	14-08-2008

EPO FORM P0459

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

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Patent documents cited in the description

- WO 2008097508 A **[0006]**