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(54) Title: EMERGENCY EVACUATION APPARATUS

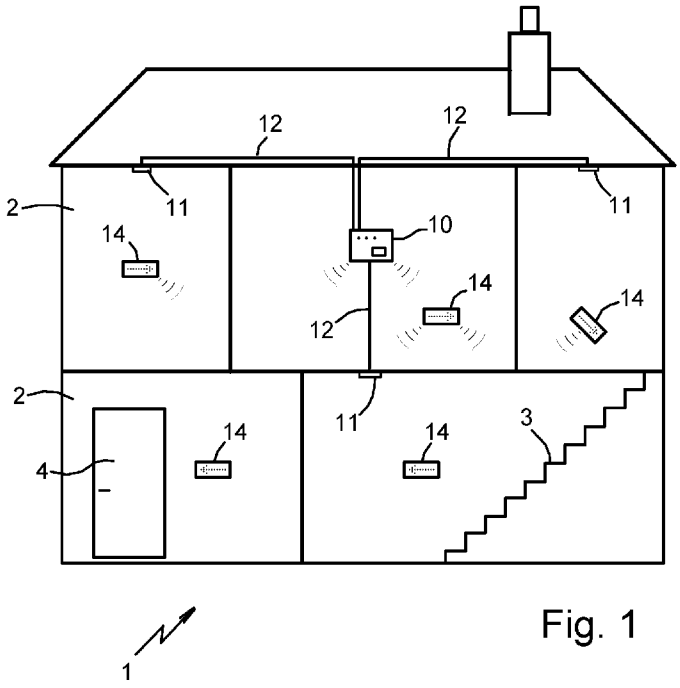


Fig. 1

(57) Abstract: The apparatus includes detectors (11) which are responsive to a potentially hazardous condition, such as smoke or heat. The detectors are connected by wires (12) to a control unit (10) which sends out a wireless activation signal upon receipt of an alarm signal from a detector. Indicator units (14) configured to be activated by the activation signal are installed at various locations to direct persons to an emergency exit. Each indicator unit is mounted on a vertical surface below eye level and includes a housing with a power source and an array of discrete light emitting elements. An electronic controller energizes the light emitting elements in a sequence which provides a moving vector display to direct persons towards an emergency exit. The indicator units are configured as RF repeaters and send out further activation signals to other indicator units within range.

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EMERGENCY EVACUATION APPARATUS

TECHNICAL FIELD OF THE INVENTION

This invention relates to emergency evacuation apparatus to assist people to evacuate in the event of a hazardous situation such as a fire.

BACKGROUND

It is well known that the majority of deaths and serious injuries that occur in building fires are due to the effects of smoke and fumes rather than the fire itself. When a fire happens people are usually taken by surprise and they are generally confused and disorientated which reduces their capacity to quickly and safely evacuate a building even if they are familiar with the layout. This is even worse in the case of fires which occur at night when the occupants may be woken suddenly, and the effects of the fire might cause a power failure which plunges the building into darkness.

Existing fire alarms may be linked in to an intruder system. Generally, smoke or heat detectors are placed in strategic places

around the building. They are commonly mounted on a ceiling and connected by hidden wiring to a central alarm unit. When one of the detectors is triggered the alarm unit activates one or more sirens to alert the occupants.

In commercial buildings safety standards require the installation of illuminated signs with a directional indicator to show the best route out of the building - see **GB 479 928** for example. As with most emergency lighting, these illuminated signs are normally installed high up above door level. Since hot air rises, smoke tends to be at its densest near the ceiling where impaired visibility in a smoke-filled area makes it difficult or impossible to see emergency signs clearly.

US 3 969 720 describes an emergency alarm and evacuation system for directing persons to an emergency exit. The system includes an alarm, a plurality of indicator units arranged in a line toward the emergency exit, and an operating unit coupled to the alarm and being operable in response to an output signal from the alarm to successively energize the indicator units in the direction of the exit. The indicator units each have a light and a buzzer so as to generate both an audible and visual indication. One problem with such a system is that, even if one of the indicator units is visible in a smoke-filled area the next indicator unit might be totally obscured. The audible indication does little to solve the problem if the occupants are hard of hearing, and ambient noise levels also tend to be elevated in an emergency situation.

WO 2012 069 782 A1 discloses an emergency guidance display comprising three or more light points arranged in a line and a control means, in which the control means illuminates said light points sequentially from one end of the line to the other in a first mode of operation and sequentially in the opposite direction in a second mode of operation, in which said light points comprise two groups, and in which the control means illuminates the light points of each group sequentially along said line in opposite directions in a third mode of operation.

SUMMARY OF THE INVENTION

When viewed from one aspect the present invention provides an emergency evacuation installation having a detector (11) responsive to a potentially hazardous condition to generate an alarm signal.

When viewed from another aspect the present invention provides an emergency evacuation installation having a control unit (10) configured to send out an activation signal in response to the alarm signal.

When viewed from another aspect the present invention provides an emergency evacuation installation having a plurality of indicator units (14) installed at various locations remote from the detector to direct persons to an emergency exit, each indicator unit having a plurality of discrete light emitting elements (26)

arranged to provide a vector display to direct persons towards an emergency exit.

When viewed from another aspect the present invention provides an emergency evacuation installation having indicator units (14) mounted below eye level.

When viewed from another aspect the present invention provides an emergency evacuation installation having indicator units (14) which are not hard wired to the detector (11).

When viewed from another aspect the present invention provides an emergency evacuation installation having a control unit (10) configured to send out a wireless activation signal in response to the alarm signal.

When viewed from another aspect the present invention provides an emergency evacuation installation having indicator units (14) configured to be activated in response to a wireless activation signal.

When viewed from another aspect the present invention provides an emergency evacuation installation having indicator units (14) which include a housing (20), a power source (21) within the housing for powering the indicator unit, and an electronic controller (22) to energize the light emitting elements (26).

When viewed from another aspect the present invention provides

an emergency evacuation installation having indicator units (14) configured as RF repeaters, each having a receiver (23) to receive a wireless activation signal, and a transmitter (24) to send out a further activation signal to other indicator units within range.

When viewed from another aspect the present invention provides an emergency evacuation installation having indicator units (14) configured such that upon the receipt of a wireless activation signal by the receiver (23), whether received directly from the control unit (10) or from another indicator unit (14) within range, the electronic controller (22) energizes the light emitting elements (26).

BRIEF DESCRIPTION OF THE DRAWINGS

The following description and the accompanying drawings referred to therein are included by way of non-limiting example in order to illustrate how the invention may be put into practice. In the drawings:

Figure 1 is a schematic diagram showing a building in which emergency evacuation apparatus has been installed;

Figure 2 is a schematic block diagram of one of the indicator units included in the emergency evacuation apparatus;

Figure 3 is a general external view of one embodiment of the indicator units;

Figure 4 is a general rear view of the indicator unit; and

Figures 5 to 7 are general external views showing three further embodiments of the indicator units.

DETAILED DESCRIPTION OF THE DRAWINGS

Referring firstly to **Fig. 1**, a building 1 is divided internally into a number of rooms and corridors 2, which may be on several floors. The building could be a domestic dwelling with just a few rooms on one or two floors, or it could be a block of flats, or a commercial establishment such as a multi-storey office block, theatre or cinema, for example. In the building shown, which is a typical two storey dwelling, the only way to exit quickly and safely from the upper floor is via a single staircase 3. Similarly the best way to vacate the ground floor may be via an external exit door 4.

An emergency evacuation apparatus installed in the building includes a master control unit 10. The control unit can be installed in any convenient position, which in this case is on the upper floor of the building. The control unit is typically connected to the main power supply for the building but may include internal backup batteries so that the control unit is still functional in the event of a

power failure. A number of smoke or heat detectors 11 are installed at various strategic locations around the building, as determined by the installer. These detectors are generally mounted on a ceiling where they are best placed to detect smoke or a rapid temperature rise. The detectors will normally be hard-wired to the control unit 10 via wiring 12 which can be routed out of sight within the walls and ceilings of the building.

A number of indicator units 14 are mounted at various locations within the building to direct persons towards an emergency exit. In the case of first floor spaces the indicator units are arranged to direct people towards the staircase 3, but on the ground floor the indicator units direct people towards the exit door 4.

In that event that a detector 11 is triggered by a potentially hazardous condition, e.g. the presence of smoke, the detector sends an alarm signal to the master control unit 10 via wiring 12. Upon receipt of an alarm signal from any of the detectors the control unit sends out a wireless RF activation signal to the indicator units 14.

Unlike the detectors 11, the indicator units 14 are not hard wired to the master control unit 10. Referring to **Fig. 2**, each indicator unit 14 includes a housing 20 which contains a battery 21 to provide power for the indicator unit. The housing also contains an electronic controller or microcontroller 22 which is connected to an internal radio receiver 23 and an internal radio transmitter 24. The microcontroller 22 also has an output bus 25 which is

connected to an array of discrete light emitting diodes (LEDs) 26. The radio receivers 23 are configured to receive the activation signals sent out by the control unit 10 and inform the microcontroller 22 when the signal has been received. The microcontroller then responds by energizing the LEDs 26 as described below. In addition, the microcontroller simultaneously causes the transmitter 24 to commence sending out wireless activation signals which can be received by other indicator units within RF communication distance. In this way it is ensured that all or the indicator units are activated almost simultaneously even if they are out of range of the master control unit 10.

An embodiment of one of the indicator units 14 is shown in **Fig. 3**. It can be seen that the housing 20 is generally rectangular with opposite front and rear walls 30 and 32. The LEDs 26 have rectangular lenses and are mounted on the front wall 30 configured in the form of an arrow. In some embodiments the LEDs 26 may be energised concurrently to provide a static vector display directing persons towards the nearest emergency exit. However. in a preferred embodiment, when the microcontroller 22 powers the LEDs in response to the alarm signal they are sequentially energized one-by-one from the tail end of the arrow, on the right, ending with the LEDs at the tip of the arrow, on the left. Once a unit has been activated the energizing sequence of the LEDs is repeated over and over. The illuminated arrow thus provides a moving vector display to direct persons towards the emergency exit, i.e. the staircase 3 or the external door 4. The moving display is preferred because it is much more likely to

attract attention in an emergency situation than a static display. Furthermore, the life of the internal batteries is greatly extended so that the display continues to operate for a much longer period.

Referring to **Fig. 4**, the rear wall 32 has mounting means in the form of screw holes 34 and one or more adhesive pads 35, either of both of which can be used to fix the indicator unit to a vertical surface. The units can therefore be mounted at or below eye level where they are not as badly obscured by smoke as ceiling mounted devices. The indicator units can be fixed to or stuck onto the walls, skirting boards, floors, or by doorways etc, in positions determined by the installer to direct people out of the building by the best route.

The housing 20 may include a reset button 28, **Fig. 2**, to return the microcontroller to a standby condition. Upon receiving a reset command the microcontroller deactivates the LED display and turns off the transmitter 24 but continues to monitor for receipt of further activation signals by the receiver 23.

In other embodiments the indicator units may have round LEDs as in **Fig. 5**, with a static or moving display. When the display forms a moving vector a single row of LEDs can be arranged in a line, as in **Fig. 6** such that the LEDs "chase" in the exit direction. This reduces the number of LEDs required and avoids the need for simultaneous energisation of LEDs, thereby further conserving battery life. The housing could also be of other suitable shapes, e.g. circular as in **Fig. 7**.

Various other modifications are possible. For example, in some situations a single detector may be sufficient, and the detector could be configured to send an activation signal directly to nearby indicator units rather than going through a master control unit. Detectors could also be adapted to respond to other potentially hazardous conditions such as smoke, water, rollover (as in the case of a boat or vehicle) or shock, or any combination of these.

The indicator units can be mounted in any orientation with the indicator LEDs indicating left, right, up, down, or any angle in between. The indicator units can be mounted in any convenient location and are easily moved to take account of changes in the configuration of the building. Due to their RF repeater function, activating other indicator units within range, additional indicator units can be added without having to modify the fixed wiring within the building.

Whilst the above description places emphasis on the areas which are believed to be new and addresses specific problems which have been identified, it is intended that the features disclosed herein may be used in any combination which is capable of providing a new and useful advance in the art.

CLAIMS

1. An emergency evacuation installation:

- a detector (11) responsive to a potentially hazardous condition to generate an alarm signal;
- a control unit (10) configured to send out an activation signal in response to the alarm signal;
- a plurality of indicator units (14) installed at various locations remote from the detector to direct persons to an emergency exit, each indicator unit having a plurality of discrete light emitting elements (26) arranged to provide a vector display to direct persons towards an emergency exit;

characterised in that

- the indicator units (14) are mounted below eye level;
- the indicator units (14) are not hard wired to the detector (11);
- the control unit (10) is configured to send out a wireless activation signal in response to the alarm signal;
- each of said indicator units (14) is configured to be activated in response to a wireless activation signal;
- each of the indicator units (14) includes a housing (20), a power source (21) within the housing for powering the indicator unit, and an electronic controller (22) to energize the light emitting elements (26);
- the indicator units (14) are configured as RF repeaters, each having a receiver (23) to receive a wireless activation signal, and a transmitter (24) to send out a further activation signal to other indicator units within range; and

- each indicator unit (14) is configured such that upon the receipt of a wireless activation signal by the receiver (23), whether received directly from the control unit (10) or from another indicator unit (14) within range, the electronic controller (22) energizes the light emitting elements (26).

2. Emergency evacuation apparatus according to Claim 1 in which the electronic controller (22) is arranged to energize the light emitting elements (26) in a sequence which provides a moving vector display.

3. Emergency evacuation apparatus according to Claim 1 in which the housing (20) has opposite front and rear walls (30, 32) with the light emitting elements (26) on the front wall and the rear wall has mounting means (35) which fixes the indicator unit to a vertical surface below eye level.

4. Emergency evacuation apparatus according to Claim 1 in which the detector (11) is connected by wires (12) to a separate control unit (10) which is configured to send out a wireless activation signal upon receipt of an alarm signal from the detector.

5. Emergency evacuation apparatus according to Claim 4 in which a plurality of such detectors (11) are connected by wires (12) to the control unit (10).

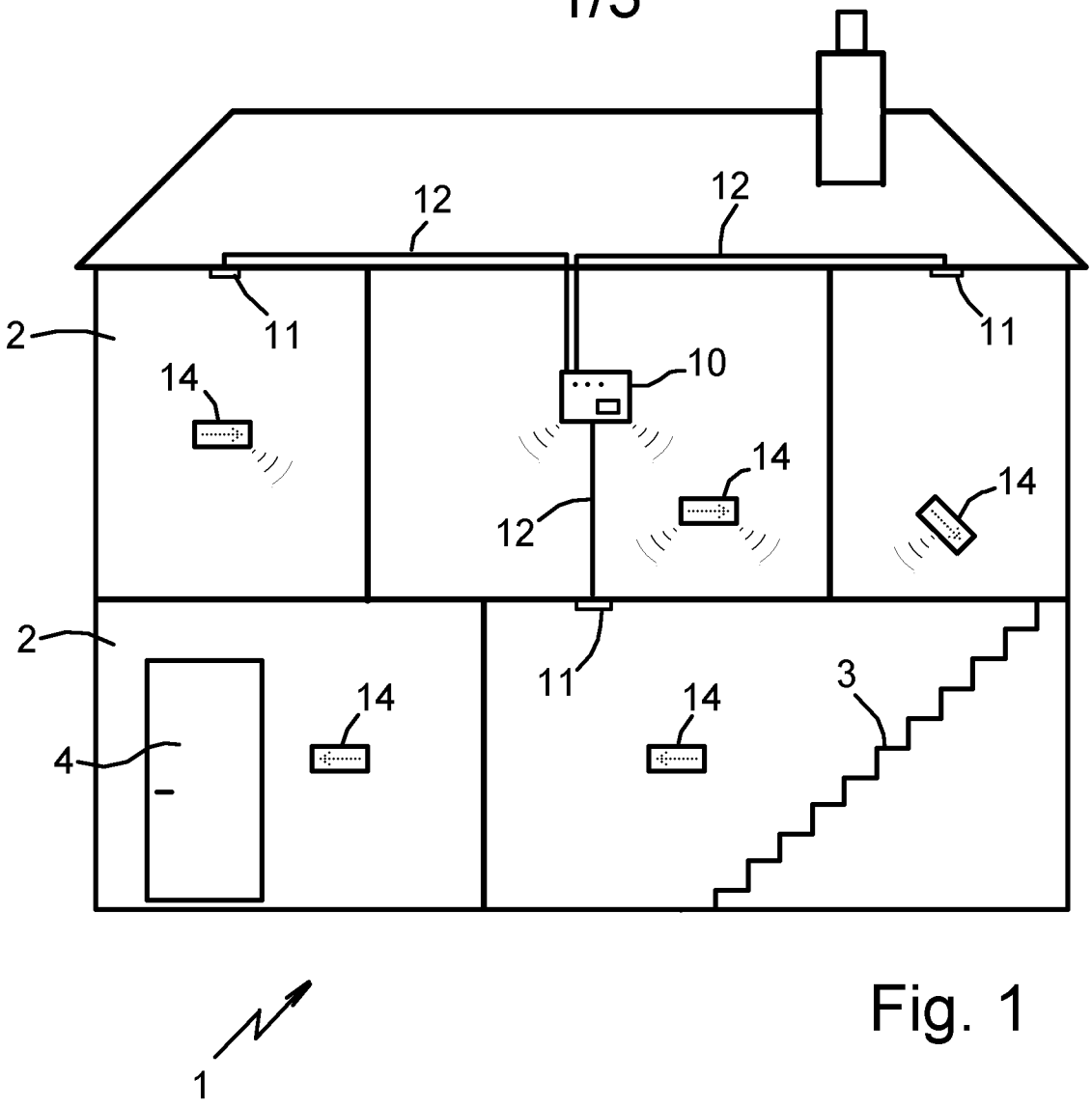

12
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1

Fig. 1

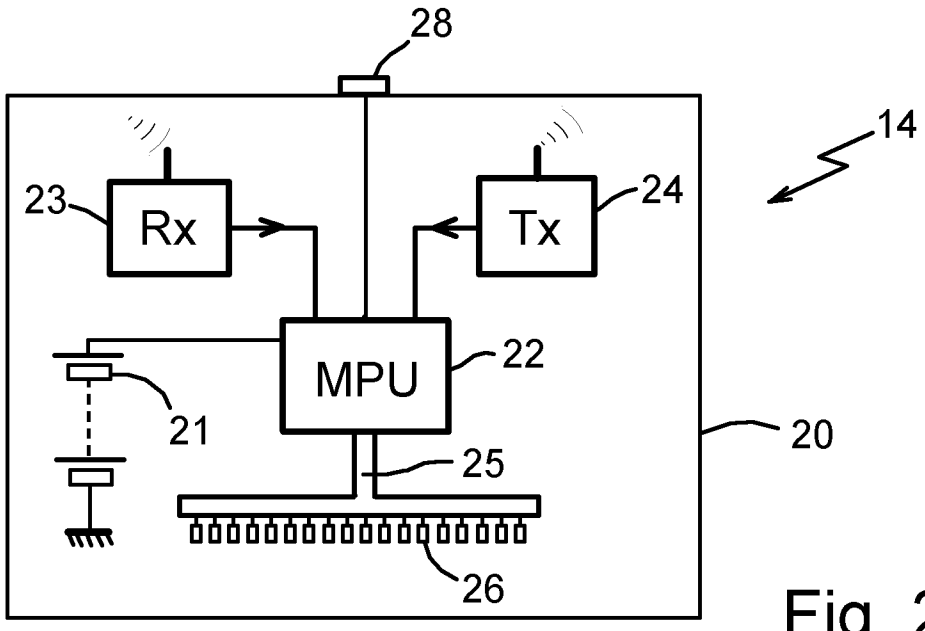

28
14
23
Rx
Tx
24
MPU
22
21
20
25
26

Fig. 2

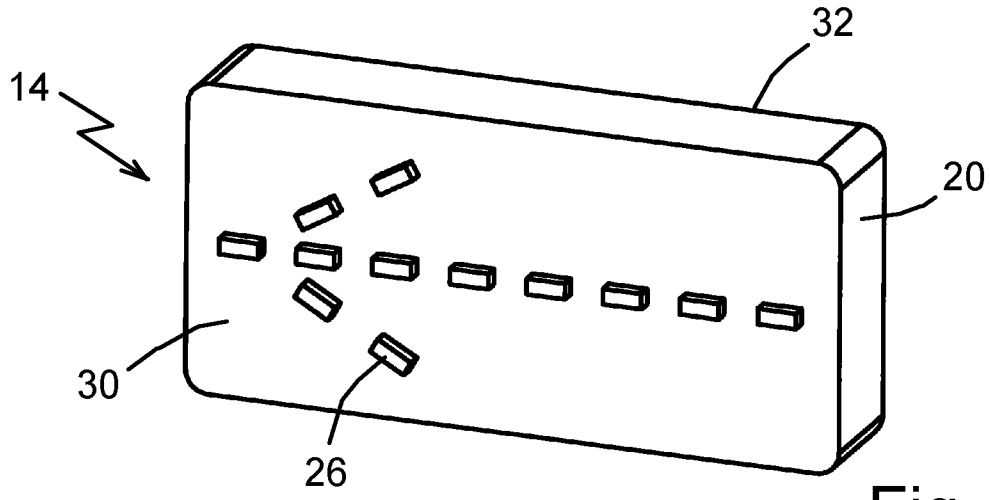


Fig. 3

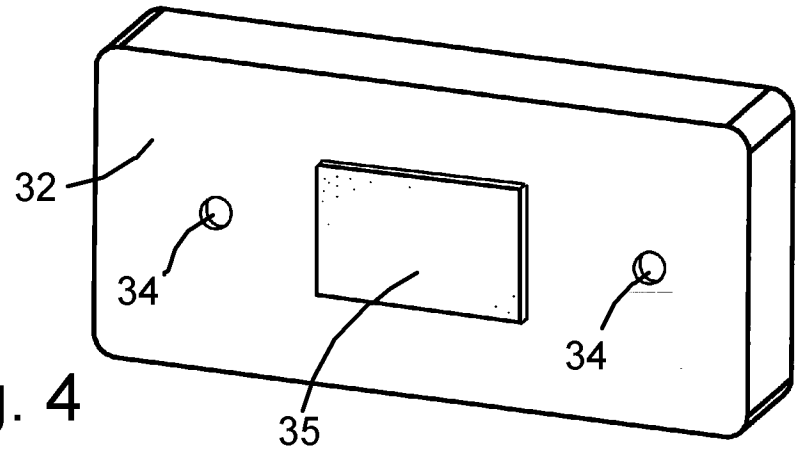


Fig. 4

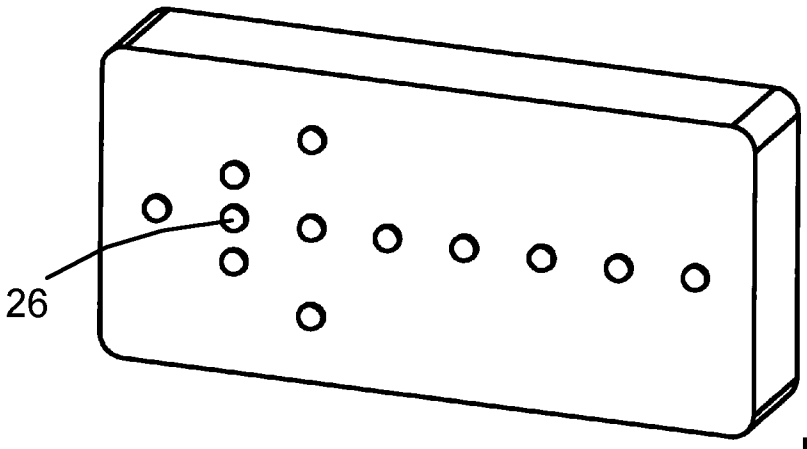


Fig. 5

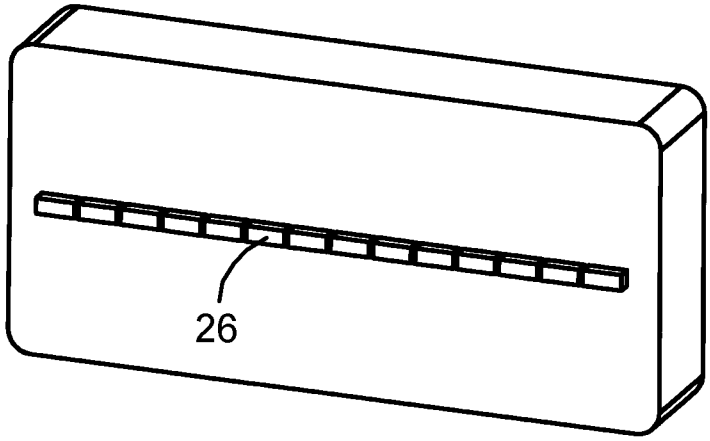


Fig. 6

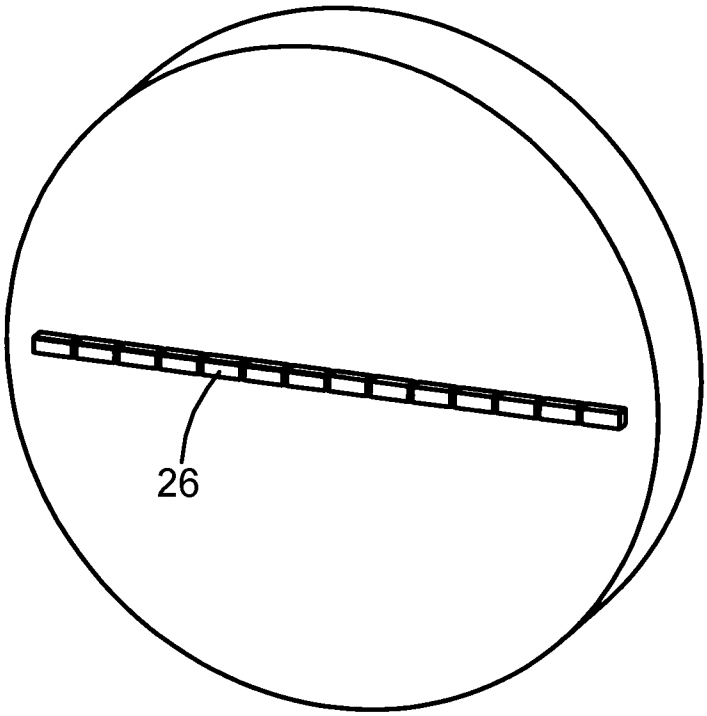


Fig. 7

INTERNATIONAL SEARCH REPORT

International application No
PCT/GB2018/050903

A. CLASSIFICATION OF SUBJECT MATTER
INV. G08B7/06
ADD.

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
G08B

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)
EPO-Internal, WPI Data

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	WO 2010/105825 A1 (BRADLEY VINCENT [IE]; MAGEE JOHN [GB]) 23 September 2010 (2010-09-23) abstract; figures 1,2 page 1, line 18 - page 3, line 18 page 5, line 18 - line 20 page 6, line 11 - line 25	1-5
Y	US 2017/140619 A1 (RUSSO LINDA [US] ET AL) 18 May 2017 (2017-05-18) abstract; figures 1,6 paragraph [0032] paragraph [0073] - paragraph [0074]	1,3-5
Y	GB 2 516 073 A (LITE4LIFE LTD [GB]) 14 January 2015 (2015-01-14) page 2, line 3 - line 23 page 2, line 33 - page 3, line end	1-5

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[X] Further documents are listed in the continuation of Box C.

[X] See patent family annex.

* Special categories of cited documents :

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"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
12 December 2018	02/01/2019

Name and mailing address of the ISA/	Authorized officer
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INTERNATIONAL SEARCH REPORT

International application No
PCT/GB2018/050903

C(Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	US 7 800 511 B1 (HUTCHISON JAMES R [US] ET AL) 21 September 2010 (2010-09-21) abstract; figures 1,2	1-5

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INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No
PCT/GB2018/050903

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
WO 2010105825 A1	23-09-2010	NONE	
US 2017140619 A1	18-05-2017	NONE	
GB 2516073 A	14-01-2015	NONE	
US 7800511 B1	21-09-2010	NONE	