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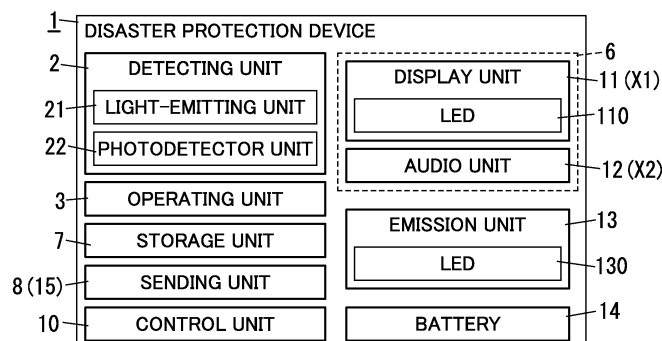
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(54) **DISASTER-PREPAREDNESS DEVICE, CONTROL METHOD AND PROGRAM**

(57) An object of the present disclosure is to suppress replacement from being forgotten by a user. A disaster protection device (1) is configured to perform alert operation relating to disaster protection. The disaster protection device (1) includes an auxiliary alert unit (X1), an operating unit (3), and a main alert unit (X2). The auxiliary alert unit (X1) is configured to, when the disaster protection device (1) reaches a time for replacement, execute an auxiliary alert relating to the replacement. The oper-

ating unit (3) is configured to receive an operation. The main alert unit (X2) is configured to, when the operating unit (3) receives the operation while the auxiliary alert unit (X1) executes the auxiliary alert, execute a main alert relating to the replacement. The auxiliary alert unit (X1) is configured to, when a prescribed condition is satisfied after the main alert is started, execute the auxiliary alert at least one more time.

FIG. 1



Description

Technical Field

[0001] The present disclosure generally relates to disaster protection devices, control methods, and programs, and specifically, to a disaster protection device configured to perform alert operation relating to disaster protection, a method and program for controlling such a disaster protection device.

Background Art

[0002] Patent Literature 1 discloses a known fire alarm. The fire alarm includes a fire detector and an alarm unit. The fire detector is configured to: determine whether or not a temperature exceeds a fire threshold; determine that a fire is present when the temperature exceeds the fire threshold; and detect an outbreak of the fire. The alarm unit is configured to, upon detection of the breakout of the fire, light an indicator as a fire alarm and emit a sound alarm to the outbreak of the fire. The fire alarm further includes: a replacement detector configured to detect that a replacement time is reached; and an alarm unit configured to, upon detection that the replacement time is reached, emit a replacement alarm.

Citation List

Patent Literature

[0003] Patent Literature 1: JP 2016-192117 A

Summary of Invention

[0004] Incidentally, even when the fire alarm (a disaster protection device) alerts a user to that a replacement time (time for replacement) is reached, the user may not be ready to immediately replace the disaster protection device depending on user's circumstances. The user may forget to replace the disaster protection device a while after the time for replacement is alerted, and as a result, the disaster protection device which should be replaced may remain installed.

[0005] In view of the foregoing, an object of the present disclosure is to provide a disaster protection device whose replacement is suppressed from being forgotten by a user, a control method, and a program.

[0006] A disaster protection device according to one aspect of the present disclosure is configured to perform alert operation relating to disaster protection. The disaster protection device includes an auxiliary alert unit, an operating unit, and a main alert unit. The auxiliary alert unit is configured to, when the disaster protection device reaches a time for replacement, execute an auxiliary alert relating to the replacement. The operating unit is configured to receive an operation. The main alert unit is configured to, when the operating unit receives the operation

while the auxiliary alert unit executes the auxiliary alert, execute a main alert relating to the replacement. The auxiliary alert unit is configured to, when a prescribed condition is satisfied after the main alert is started, execute the auxiliary alert at least one more time.

[0007] A control method according to one aspect of the present disclosure is a control method of a disaster protection device configured to perform alert operation relating to disaster protection. The control method includes an auxiliary alert step, a main alert step, and a re-alerting step. The auxiliary alert step includes, when a time for replacement of the disaster protection device is reached, executing an auxiliary alert relating to the replacement. The main alert step includes, when an operating unit of the disaster protection device receives an operation while the auxiliary alert is executed, executing a main alert relating to the replacement. The re-alerting step includes, when a prescribed condition is satisfied after the main alert is started, executing the auxiliary alert at least one more time.

[0008] A program according to still another aspect of the present disclosure is designed to cause a computer system to carry out the control method described above.

Brief Description of Drawings

[0009]

FIG. 1 is a block diagram illustrating a disaster protection device according to an embodiment;

FIG. 2 is a view illustrating an overall configuration of a disaster protection system including a plurality of the disaster protection devices;

FIG. 3 is an external view illustrating the disaster protection device;

FIG. 4 is a front view illustrating the disaster protection device;

FIG. 5 is a view illustrating how the disaster protection device works when installed in a bedroom;

FIG. 6A is a view illustrating an auxiliary alert by the disaster protection device;

FIG. 6B is a view illustrating an operation test of the disaster protection device;

FIGS. 7A to 7C are views each illustrating re-execution of the auxiliary alert by the disaster protection device; and

FIGS. 8A and 8B are views each illustrating re-execution of a main alert by the disaster protection device.

Description of Embodiments

(1) Schema

[0010] The drawings to be referred to in the following description of the embodiment are all schematic representations. That is to say, the ratio of the dimensions (including thicknesses) of respective constituent ele-

ments illustrated on the drawings does not always reflect their actual dimensional ratio.

[0011] A disaster protection device 1 according to the present embodiment is configured to perform alert operation relating to disaster prevention. In this embodiment, the disaster protection device 1 is assumed to be, for example, a disaster protection device that performs alert operation relating to a fire. That is, the disaster protection device 1 may be implemented as a fire alarm that emits an alarm sound or any other type of sound at the outbreak of the fire. However, in the disaster protection device 1, an event about which the alarm sound should be emitted is not limited to a fire but may be gas leakage, generation of carbon monoxide (CO) due to unburning, or the like.

[0012] As shown in FIG. 5, the disaster protection device 1 is installed in a structural component C1 (i.e., a building component such as a ceiling or a wall). As illustrated in FIG. 1, the disaster protection device 1 includes an auxiliary alert unit X1, an operating unit 3, and a main alert unit X2. As shown in FIG. 1, the disaster protection device 1 includes a photoelectric sensor (as a detecting unit 2) for detecting smoke as a built-in component thereof. Alternatively, the detecting unit 2 may also be a fixed temperature sensor for detecting heat. Optionally, the detecting unit 2 may also be provided separately from the disaster protection device 1. In that case, the disaster protection device 1 may be provided with information about the fire by communicating with another disaster protection device (a fire alarm) including the detecting unit 2.

[0013] As illustrated in FIG. 2, the disaster protection device 1 may be installed on a surface (such as a ceiling surface or wall surface) of a structural component C1 such as a resident's room, a bedroom, stairs, or a hallway in a dwelling house 200. The dwelling house may be a single-family dwelling house or a multi-family dwelling house (condominium). Alternatively, the disaster protection device 1 may also be installed (on the ceiling surface or wall surface) in a non-residential structural component C1, instead of those dwelling houses. Examples of such non-dwelling structural components include office buildings, theaters, movie theaters, public halls, amusement facilities, complex facilities, restaurants, department stores, schools, hotels, inns, hospitals, nursing homes for the elderly, kindergartens, libraries, museums, art museums, underground shopping malls, railway stations, and airports.

[0014] In this embodiment, the auxiliary alert unit X1 is configured to, when a time for replacement of the disaster protection device 1 is reached, execute an auxiliary alert relating to the replacement. It is determined, when about 10 years have elapsed since installation (turning on) of the disaster protection device 1, that the "time for replacement" is reached. When 10 years have elapsed, the disaster protection device 1 may no longer be able to sense or alert a fire due to life expiration of an electronic component in an interior of the disaster protection device 1, exhaustion of a battery of the disaster protection device

1, and the like, and therefore, replacement of the disaster protection device 1 is recommended based on 10 years as a reference.

[0015] The operating unit 3 receives an operation given by a user (e.g., a resident 300 in FIG. 5). The main alert unit X2 is configured to, when the operating unit 3 receives the operation while the auxiliary alert unit X1 executes the auxiliary alert, execute a main alert relating to the replacement. In the following description, it is assumed that the auxiliary alert unit X1 includes a display unit 11 which executes an auxiliary alert by display. Moreover, it is assumed that the main alert unit X2 includes an audio unit 12 configured to execute a main alert by emitting a sound. That is, the auxiliary alert is emitted as light, and the main alert is emitted as a sound.

[0016] The auxiliary alert unit X1 is configured to, when a prescribed condition is satisfied after the main alert is started, execute the auxiliary alert at least one more time. With this configuration, the auxiliary alert is executed at least one more time when the prescribed condition is satisfied, and therefore, this configuration suppresses the replacement from being forgotten by a user.

(2) Details

(2.1) Overall Configuration

[0017] An overall configuration of the disaster protection device 1 and a disaster protection system 100 according to the present embodiment will be explained in detail below. In this embodiment, the disaster protection device 1 is, for example, a battery-type fire alarm. However, this is only an example of the present disclosure and should not be construed as limiting. Alternatively, the disaster protection device 1 may also be implemented as a fire alarm which is electrically connected to an external power supply (such as a commercial power grid) and which is operated by converting AC power (with an effective voltage of 100 V, for example) supplied from the external power supply into a direct current.

[0018] The disaster protection system 100 includes a plurality of (in the example shown in the figures, five) disaster protection devices 1 as illustrated in FIG. 2. The plurality of disaster protection devices 1 are so-called interconnect-type disaster protection devices. Each of the plurality of disaster protection devices 1 is configured to emit an alarm sound in interconnection with the other disaster protection device(s) 1 (together with the other disaster protection device(s) 1) no matter which of the plurality of disaster protection devices 1 detects the fire. The disaster protection device 1 (an interconnection origin) located at a fire source emits an alarm sound saying, for example, "Pew, Pew, Fire". Meanwhile, the other disaster protection device(s) 1 (an interconnection destination) emits an alarm sound which enables the fire source to be located. Of the plurality of disaster protection devices 1, any one disaster protection device desirably functions as a master, and the other remaining disaster

protection device(s) 1 desirably functions as a slave. The disaster protection device 1 which is the master desirably stores identification information on the other disaster protection device(s) 1 which is the slave.

[0019] Each disaster protection device 1 is, whether it is the master or the slave, set in advance by a builder or a user (e.g., the resident 300) such that an alarm sound suitable to its installation location is emitted from the other disaster protection device(s) 1. Each disaster protection device 1 stores voice warning messages of a plurality of types of alarm sounds in advance. For example, when a disaster protection device 1 is installed in a living room, and the disaster protection device 1 detects a fire, the disaster protection device 1 located at the source of the fire emits an alarm sound saying "Pew, pew, fire". Moreover, the disaster protection device 1 located at the source of the fire transmits an alarm signal to the disaster protection device 1 functioning as the master and the disaster protection device(s) 1 functioning as the slave. The alarm signal includes information on the types of the voice warning messages corresponding to the outbreak of the fire and the installation site of the disaster protection device 1. The disaster protection device(s) 1 at a location other than the source of the fire emits an alarm sound saying "Pew, pew, fire in the living room" based on the alarm signal that the disaster protection device(s) 1 has received.

[0020] In the example to be described below, each of the plurality of disaster protection devices 1 is supposed to be installed on a ceiling surface (which is an exemplary surface of the structural component C1) of each room or stairs in the dwelling house 200 as shown in FIG. 2. Thus, the arrangement and operation of respective constituent elements of the disaster protection device 1 in upward, downward, rightward, and leftward directions will be described as being defined by the up, down, right, and left arrows shown in FIG. 3. Note that the arrows indicating these directions are just shown there as an assistant to description and are insubstantial ones. It should also be noted that these directions do not define the direction in which the disaster protection device 1 should be used.

[0021] As illustrated in FIG. 1, each disaster protection device 1 further includes a control unit 10, and, for example, an emission unit 13, a battery 14, and a housing 4 (see FIG. 3) in addition to the display unit 11 (the auxiliary alert unit XI), the audio unit 12 (the main alert unit X2), the detecting unit 2, and the operating unit 3. The display unit 11 and the audio unit 12 are included in an alert unit 6. The disaster protection device 1 further includes a storage unit 7.

[0022] Moreover, each disaster protection device 1 further includes a communicator 8 (a sending unit 15) for communication with the other disaster protection device(s) 1. The communicator 8 is a communication interface for wireless (or wired) interconnection of emission of an alarm sound and an operation test (described later) in a disaster protection system 100.

(2.2) Housing

[0023] The housing 4 houses the control unit 10, the display unit 11, the audio unit 12, the emission unit 13, the battery 14, the detecting unit 2, the storage unit 7, the communications unit 8, and a circuit board (not shown) on which the control unit 10 and other circuit components that form various other circuits are assembled together. Although not shown, as used herein, the various other circuits include, for example, an audio circuit, a first lighting circuit, a second lighting circuit, and a power supply circuit as will be described later.

[0024] The housing 4 is made of a synthetic resin and may be made of flame-retardant ABS resin, for example. The housing 4 is formed in the shape of a generally compressed cylinder. The housing 4 includes, on the upper surface thereof, a mounting portion, with which the housing 4 is mounted on one surface (installation surface) of the structural component C1.

[0025] As illustrated in FIG. 3, the housing 4 has a peripheral wall 400 in which holes 401 are formed to let smoke flow into a labyrinth provided inside the housing 4. The housing 4 includes a partition wall that partitions the interior space thereof into upper and lower parts. The labyrinth and the detecting unit 2 are provided in the upper, first space and the control unit 10, the display unit 11, the audio unit 12, the emission unit 13, the battery 14, the storage unit 7, the communications unit 8, the circuit board, and other components are provided in the lower, second space.

[0026] As shown in FIGS. 3 and 4, the front surface 402 (e.g., the lower surface in FIG. 3) of the housing 4 has a slit 9, which is recessed upward. The slit 9 is formed in the shape of a circular ring with a predetermined groove width, which extends along the outer periphery of the housing 4. As illustrated in FIG. 4, the slit 9 has a sound hole H1 and a window hole H2 respectively provided through a first region 91 and a second region 92 of its inner surface 90. The sound hole H1 is a hole to let the alarm sound, emitted from the audio unit 12, come out of the housing 4, and faces the audio unit 12 in the housing 4. Note that the sound hole H1 may be omitted (i.e., no sound holes H1 may be provided). Meanwhile, the window hole H2 is a hole to let the light, emitted from the emission unit 13, come out of the housing 4, and faces the emission unit 13 in the housing 4. In the following description, the light emitted from the emission unit 13 will be hereinafter referred to as "illuminating light". Note that the light emitted from the emission unit 13 has lower intensity than illuminating light emitted from a general light fixture and may be bright enough to indicate an evacuation route.

[0027] The housing 4 further supports, on the front surface 402 thereof, the operating unit 3 such that the lower surface of the operating unit 3 is exposed on the outer surface of the housing 4. The operating unit 3 accepts an operating command entered externally. The operating unit 3 is configured to be pushed upward by the user with

one of his or her fingers, for example. The operating unit 3 is a disk member with a light-transmitting property. The operating unit 3 is arranged to face the display unit (an indicating lamp) 11 housed inside the housing 4. In addition, the operating unit 3 is configured to press down a push button switch (not shown) housed inside the housing 4 when subjected to a push operation.

(2.3) Alert Unit

[0028] As described above, the alert unit 6 includes the display unit 11 and the audio unit 12. The alert unit 6 has a function of alerting a person to the presence of an external event. The "presence of an external event" in the present disclosure is, for example, the presence of an event which is a target of disaster protection in the disaster protection device 1, that is, an outbreak of a fire. The alert unit 6 further has a function of alerting a person to the presence of an internal event other than the external event that is the target of the disaster protection in the disaster protection device 1. The "presence of an internal event" in the present disclosure includes the presence of an event which may occur in the disaster protection device 1 itself and includes, for example, that a time for replacement (a replacement time) of the disaster protection device 1 is reached. The "presence of an internal event" further includes a failure (e.g., a failure in a circuit component or breakage of an electrical wire) in the disaster protection device 1, the occurrence of battery exhaustion (a state where residual capacity of the battery 14 is small), and the occurrence of a communication error between the disaster protection devices 1. The battery 14 may be a lithium-ion battery, for example.

[0029] The audio unit 12 has a function of alerting a person to the presence of the internal event and a function of alerting a person to the presence of a fire. The audio unit 12 emits a sound (sonic wave). When the control unit 10 determines that a fire should be present, the audio unit 12 emits an alarm sound to alert a person to the presence of the fire.

[0030] The audio unit 12 may be implemented as a loudspeaker that transduces an electrical signal into a sound. The loudspeaker includes a diaphragm and emits an alarm sound by mechanically vibrating the diaphragm in accordance with the electrical signal. The loudspeaker is formed in the shape of a circular disk in a front view. The audio unit 12 emits an alarm sound (such as a beep) under the control of the control unit 10. The audio unit 12 suitably emits an alarm sound, of which the loudness (i.e., the sound pressure level) is variable. For example, the alarm sound may include a sweep sound that is swept from a low-frequency sound to a high-frequency sound. Optionally, the alarm sound may be accompanied with a voice warning message such as "Fire! Fire!" In this embodiment, the alarm sound is supposed to be made up of the sweep sound and the voice warning message continuous with the sweep sound.

[0031] On the circuit board, circuit components that

form an acoustic circuit, for example, may be assembled together. The acoustic circuit includes a low-pass filter and an amplifier, for example. On receiving a pulse width modulation (PWM) signal corresponding to the alarm sound and generated by the control unit 10 at the outbreak of a fire, the acoustic circuit makes the low-pass filter transform the PWM signal into an audio signal with a sinusoidal waveform, makes the amplifier amplify the audio signal, and then makes the audio unit 12 output the amplified signal as an alarm sound.

[0032] When the control unit 10 determines that any internal event is present, the audio unit 12 emits a sound to alert a person to the presence of the internal event. This sound is hereinafter also referred to as an "alert sound" to distinguish this sound from the alarm sound at the outbreak of a fire. Examples of the alert sound relating to the time for replacement of the disaster protection device 1 include, for example, a voice warning message, for example, "It is time for replacement of the alarm". Examples of an alert sound relating to a failure include a voice warning message, for example, "A failure is caused in 'XX'". Examples of an alert sound relating to battery exhaustion include a voice warning message, for example, "Battery is exhausted". The alert sound is emitted at a volume of about 60% to 70% of the volume of the alarm sound.

[0033] The audio unit 12 also emits the alarm sound and the alert sound tentatively even when subjected to an operation check test. The operation check test may be carried out by either pushing the operating unit 3 or pulling a pull string (not shown) extended from the housing 4.

[0034] Note that, when the operating unit 3 externally receives an operation input during alarming (during emission of the alarm sound), the audio unit 12 stops emitting the alarm sound.

[0035] The display unit (the indicating lamp) 11 has a function of alerting a person to the presence of the internal events and a function of alerting a person to the presence of a fire. The display unit 11 includes, as a light source, a red light-emitting diode (LED) 110 mounted on the circuit board. The display unit 11 is OFF normally (i.e., while monitoring to see if there is any fire present) but starts flashing (or solidly lighting) when the control unit 10 determines that a fire should be present. The flashing for alerting a person to the presence of the fire is hereinafter also referred to as an "actuation flashing". The actuation flashing stops under the control of the control unit 10 when the emission of the alarm sound stops.

[0036] On the circuit board, mounted are circuit components of the first lighting circuit for flashing the LED 110 of the display unit 11. The first lighting circuit flashes the LED 110 with the DC power discharged from the battery 14 under the control of the control unit 10. If the disaster protection device 1 is electrically connected to a commercial power grid, then the first lighting circuit flashes the LED 110 by converting the AC power supplied from the power grid into a DC current.

[0037] The light emitted from the display unit 11 is transmitted through the operating unit 3 with light transmitting property to come out of the housing 4. The resident 300 is allowed to learn, by seeing the operating unit 3 flashing in red, that the disaster protection device 1 is now in operation (i.e., detecting a fire).

[0038] Incidentally, the display unit 11 is included in the auxiliary alert unit X1 in the present disclosure. When an internal event is present, the auxiliary alert unit X1 executes an auxiliary alert relating to the internal event under the control of the control unit 10. In this embodiment, the auxiliary alert unit X1 is configured to, when the time for replacement of the disaster protection device 1 is reached, execute displaying of an auxiliary alert relating to the replacement. In other words, when the control unit 10 determines that the time for replacement of the disaster protection device 1 is reached, the display unit 11 flashes to alert a person to that the time for replacement is reached. The flashing in this case is hereinafter also referred to as "alert flashing". The display unit 11 may perform the alert flashing also when a failure or battery exhaustion occurs in addition to when the time for replacement is reached. Note that in order to distinguish between the alert flashing and the actuation flashing, a flashing cycle is different between the alert flashing and the actuation flashing.

[0039] The operation check test of the display unit 11 may be carried out by either pushing the operating unit 3 or pulling a pull string just like the audio unit 12.

[0040] In contrast, the audio unit 12 is included in the main alert unit X2 in the present disclosure. The main alert unit X2 is configured to, when the operating unit 3 receives the operation while the auxiliary alert unit X1 executes the auxiliary alert, execute a main alert relating to the replacement under the control of the control unit 10. In other words, the audio unit 12 emits a voice warning message saying, for example, "It is time for replacement of the alarm" when the operating unit 3 is pushed while the display unit 11 executes the auxiliary alert (the alert flashing). At this time, based on pushing the operating unit 3 as a trigger, the operation test is started in the disaster protection device 1 that receives the operation and the other disaster protection device(s) 1 in an interconnected manner. The voice warning message is emitted in the operation test. When the operating unit 3 is pushed again while the main alert is executed (while the voice warning message is emitted), the audio unit 12 stops the main alert under the control of the control unit 10.

(2.4) Emission Unit

[0041] The emission unit 13 emits illuminating light that irradiates the surrounding region R1 (see FIG. 5; mainly the floor surface) at the outbreak of a fire under the control of the control unit 10. The emission unit 13 includes, as a light source, a single or a plurality of illuminating white light-emitting diodes (LEDs) 130 mounted on the circuit

board (see FIG. 1). The emission unit 13 is OFF normally and starts solidly lighting (i.e., starts emitting the illuminating light) when the control unit 10 determines that a fire should be present. Thus, as illustrated in FIG. 5, for example, also when a fire breaks out in a midnight time zone in which the resident 300 is sleeping, the resident 300 can evacuate by immediately viewing an evacuation pathway by using the illumination light of the emission unit 13 without giving an ON operation to the wall switch to turn ON the lighting fixture.

[0042] Each LED 130 may be implemented as a package LED in which at least one LED chip is mounted at the center of the mounting surface of a flat plate mounting board. The LED chip is suitably a blue light-emitting diode that radiates a blue ray out of the light-emitting surface thereof, for example. In addition, the mounting surface of the board including the LED chip is coated with an encapsulation resin to which a fluorescent material is added to convert the wavelength of the blue ray emitted from the LED chip. The LED 130 is configured to emit the white illuminating light from the light-emitting surface thereof when a DC voltage is applied between the anode electrode and cathode electrode thereof. The color of the illuminating light does not have to be white but may also be any other color. Nevertheless, the color of the illuminating light is suitably different from the color of the light emitted from the display unit 11.

[0043] A circuit component included in a second lighting circuit for flashing the LEDs 130 of the emission unit 13 is mounted on the circuit board. The second lighting circuit turns the LEDs 130 ON with the DC power discharged from the battery 14 under the control of the control unit 10. If the disaster protection device 1 is electrically connected to a commercial power grid, then the second lighting circuit turns the LEDs 130 ON by converting the AC power supplied from the power grid into a DC current.

[0044] Light (the illumination light) emitted from the emission unit 13 is transmitted through a slit 9 formed in a window hole H2 to the outside of the housing 4 and radiates the surrounding region R1. The emission unit 13 also emits light tentatively even when subjected to an operation check test. The operation check test of the emission unit 13 may be carried out by either pushing the operating unit 3 or pulling a pull string just like the audio unit 12.

(2.5) Detecting Unit

[0045] The detecting unit 2 detects information about a fire (external event), about which an alarm sound should be emitted. In this embodiment, the detecting unit 2 may be implemented as, for example, a photoelectric sensor for detecting smoke. Therefore, the information includes information about smoke, for example. As shown in FIG. 1, the detecting unit 2 includes a light-emitting unit 21 such as an LED and a photodetector unit 22 such as a photodiode, for example. The light-emitting

unit 21 and the photodetector unit 22 are arranged in the labyrinth of the housing 4 such that the photosensitive plane of the photodetector unit 22 is off the optical axis of the light emitted from the light-emitting unit 21. In the event of the outbreak of a fire, smoke may flow into the labyrinth through the holes 401 provided through the peripheral wall 400 of the housing 4.

[0046] If there is no smoke in the labyrinth of the housing 4, then the light emitted from the light-emitting unit 21 hardly reaches the photosensitive plane of the photodetector unit 22. On the other hand, if there is any smoke in the labyrinth of the housing 4, then the light emitted from the light-emitting unit 21 is scattered by the smoke, thus causing some of the scattered light to reach the photosensitive plane of the photodetector unit 22. That is to say, the detecting unit 2 makes the photodetector unit 22 receive the light emitted from the light-emitting unit 21 which has been scattered by the smoke.

[0047] The detecting unit 2 is electrically connected to the control unit 10. The detecting unit 2 transmits an electrical signal (detection signal), indicating a voltage level corresponding to the quantity of the light received by the photodetector unit 22, to the control unit 10. In response, the control unit 10 determines, by converting the quantity of light represented by the detection signal received from the detecting unit 2 into the concentration of smoke, whether or not any fire is present. Alternatively, the detecting unit 2 may convert the quantity of the light received by the photodetector unit 22 into a smoke concentration and then transmit a detection signal indicating a voltage level corresponding to the smoke concentration to the control unit 10. Still alternatively, the detecting unit 2 may determine, based on the quantity of the light received at the photodetector unit 22, that a fire (smoke) should be present and then transmit a detection signal, including information about the outbreak of the fire, to the control unit 10.

(2.6) Control Unit

[0048] The control unit 10 may be implemented as, for example, a microcontroller including, as major constituent elements, a central processing unit (CPU) and a memory. That is to say, the control unit 10 is implemented as a computer including a CPU and a memory. The computer performs the function of the control unit 10 by making the CPU execute a program stored in the memory. In this embodiment, the program is stored in advance in the memory. However, this is only an example and should not be construed as limiting. The program may also be downloaded via a telecommunications line such as the Internet or distributed after having been stored in a non-transitory storage medium such as a memory card.

[0049] The control unit 10 controls the display unit 11, the first lighting circuit, the audio unit 12, the acoustic circuit, the emission unit 13, the second lighting circuit, the detecting unit 2, the storage unit 7, the communications unit 8, and other units. In addition, the control unit

10 also controls a power supply circuit for generating, based on the DC power supplied from the battery 14, operating power for various types of circuits. The storage unit 7 is a data rewritable memory and is preferably a non-volatile memory. The storage unit 7 may be a memory of the control unit 10 itself.

[0050] The control unit 10 is configured to determine, on receiving a detection signal from the detecting unit 2, whether or not any fire is present. Specifically, the control unit 10 monitors the level of the detection signal received from the detecting unit 2 to determine whether or not the signal level included in the detection signal has exceeded a threshold value.

[0051] The control unit 10 stores the threshold value in the storage unit 7. The control unit 10 may determine, at regular time intervals, whether or not the smoke concentration has exceeded the threshold value, and may determine, when finding the smoke concentration greater than the threshold value at least once, that a fire should be present. The regular time interval may be 5 seconds, for example. Alternatively, the control unit 10 may count the number of times the smoke concentration has exceeded the threshold value consecutively, and may determine, on finding the number of times reaching a predetermined number of times, that a fire should be present. Naturally, the control unit 10 may directly determine, on receiving a detection signal including information about the outbreak of a fire from the detecting unit 2, that a fire should be present.

[0052] On determining, based on the smoke concentration, that a fire should be present, the control unit 10 makes the audio unit 12 start emitting an alarm sound. Specifically, the control unit 10 generates a PWM signal corresponding to a sweep sound, of which the frequency changes linearly with the passage of time, and outputs the PWM signal to the acoustic circuit. The PWM signal is converted by the acoustic circuit into an audio signal so that a sweep sound (as an alarm sound) is emitted from the audio unit 12. In addition, the control unit 10 also generates, based on message data stored in the storage unit 7, a PWM signal corresponding to the voice warning message and outputs the PWM signal to the acoustic circuit. The PWM signal is converted by the acoustic circuit into an audio signal so that a voice warning message (with an alarm sound) is emitted from the audio unit 12.

[0053] Moreover, on determining that a fire is present, the control unit 10 transmits a control signal for flashing the display unit 11 to the first lighting circuit, and a control signal for solidly lighting the emission unit 13 to the second lighting circuit. On receiving the control signal from the control unit 10, the first lighting circuit causes the display unit 11 to perform the actuation flashing. On receiving the control signal from the control unit 10, the second lighting circuit solidly lights the emission unit 13 with a certain level of brightness.

[0054] The control unit 10 also continues determining the smoke concentration even while the fire alarm is being sounded (i.e., while an alarm sound is being emitted).

When finding the smoke concentration equal to or less than a reference value while the fire alarm is being sounded, the control unit 10 stops generating the PWM signal to instruct the audio unit 12 to stop emitting the alarm sound. In addition, the control unit 10 also transmits a stop signal to the first lighting circuit and the second lighting circuit to stop emitting light from the display unit 11 and the emission unit 13. On determining that the fire (smoke) should be no longer present, the control unit 10 automatically stops emitting the alarm sound, stops emitting the illuminating light, and stops flashing the display unit 11.

[0055] In addition, on detecting that the push button switch is turned ON in the housing 4 through a push operation performed on the operating unit 3 while the fire alarm is being sounded, the control unit 10 stops emitting the alarm sound. If the resident 300 determines that the alarm should be being sounded by the disaster protection device 1 by mistake, then he or she may give the push operation to the operating unit 3 to stop emission of the alarm sound. Emitting the alarm sound may also be stopped by the resident 300 pulling the pull string.

[0056] On the other hand, when the push button switch is turned ON in the housing 4 by a push operation given to the operating unit 3 while the fire alarm is not being sounded, the control unit 10 carries out a predetermined type of test to check the operation. The operation check test includes, for example, a sound emission test on the audio unit 12, a light emission test on the emission unit 13, and a flashing light test on the display unit 11. The operation check test may also be performed by pulling the pull string.

[0057] The control unit 10 is further configured to determine whether or not an internal event (e.g., replacement, a failure, battery exhaustion) is present. The determination as to the presence or absence of the internal event will be described in detail below.

[0058] The control unit 10 monitors used hours by its built-in timer. The used hours correspond to, for example, hours for which a power supply is ON and the disaster protection device 1 is in an operating state. The control unit 10 adds up and stores the used hours in the storage unit 7. When the total of the used hours amounts to 10 years, the control unit 10 determines that it is time for replacement of the disaster protection device 1 in which the control unit 10 is included, and the control unit 10 causes the auxiliary alert unit X1 (the display unit 11) to execute the auxiliary alert (auxiliary alert step). That is, the display unit 11 starts performing the alert flashing.

[0059] FIG. 6A is a view illustrating how the auxiliary alert (the alert flashing) is executed. In the example shown in the figure, a time period A3 corresponds one cycle. The time period A3 is, for example, 5 minutes. The display unit 11 repeats operation of being ON for a time period A1 and is then being OFF for a time period A2. The time period A1 is, for example, 0.1 second, and the time period A2 is, for example, 1.9 seconds. Then, after the display unit 11 is turned ON for the fourth time, the

display unit 11 remains OFF for the remaining time, and after the time period A3 has elapsed, the display unit 11 repeats lighting for the time period A1 four times. Note that this alert flashing is a mere example and should not be considered as limiting.

[0060] Reaching the time for replacement is lower in emergency level than the battery exhaustion and the failure, and replacement of the disaster protection device 1 depends on the availability of the resident 300. Therefore, the control unit 10 does not cause the main alert unit X2 (the audio unit 12) to emit the main alert, that is, a voice warning message that notifies of the replacement immediately after the determination. Then, when the resident 300 gives a first push operation to the operating unit 3 while the auxiliary alert is executed, that is, while the alert flashing is performed, the main alert is executed (main alert step). As described above, notifying that the time for replacement is reached in the order of the auxiliary alert (light) and the main alert (sound) prompts the resident 300 to replace the disaster protection device without inconvenience.

[0061] When the resident 300 gives a push operation again (a second push operation) to the operating unit 3 while the main alert is executed, the control unit 10 stops emitting the voice warning message from the audio unit 12. That is, the main alert being executed can be stopped in accordance with the availability of the resident 300, which improves convenience. Moreover, electric power consumed by continuous execution of the main alert can be reduced.

[0062] Note that the control unit 10 continuously executes the auxiliary alert after the control unit 10 causes the auxiliary alert unit X1 (the display unit 11) to start the auxiliary alert until the main alert is started (until the first pushing operation is given to the operating unit 3). Thus, the possibility that the resident 300 notices the auxiliary alert is improved, and the replacement is further suppressed from being forgotten by the resident 300.

[0063] The control unit 10 monitors a current flowing from the audio circuit to the audio unit 12 in addition to the used hours monitored, and, for example, when the current value of the current is an unusual value (e.g., zero or a value close to zero), the control unit 10 determines that a wire is broken. Moreover, when the voltage value of a prescribed electric path of at least one circuit of a various types of circuits is an unusual value, the control unit 10 determines that a failure is present in the at least one circuit. Moreover, the control unit 10 may monitor the temperature of each of the various types of circuits, and when unusual heat generation is found, the control unit 10 may determine that a failure is present. When the control unit 10 determines that the failure is present, the control unit 10 causes the alert unit 6 to execute an alert. Executing the alert concerning the failure may be performed in the order of the auxiliary alert and the main alert in a similar manner to the above-described notification of the replacement, or the auxiliary alert may be omitted, and only the main alert may be performed.

Note that when an electric wire between an acoustic circuit and the audio unit 12 is broken, executing the alert by the audio unit 12 is impossible, and therefore, the alert concerning the failure is issued from only the display unit 11.

[0064] Moreover, the control unit 10 monitors the battery voltage of the battery 14. The control unit 10 stores characteristic data including the battery voltage and the capacity of the battery 14 associated with each other in the storage unit 7, and when a residual capacity corresponding to the battery voltage monitored is less than 10% of the capacity, the control unit 10 determines that the battery is exhausted. When the control unit 10 determines that the battery is exhausted, the control unit 10 causes the alert unit 6 to execute an alert. Executing the alert regarding the battery exhaustion may be performed in the order of the auxiliary alert and the main alert in a similar manner to the above-described notification of the replacement, or the auxiliary alert may be omitted, and only the main alert may be performed.

[0065] The control unit 10 may determine the presence or absence of these internal events at a predetermined period. The determination as to at least some of the internal events may be performed, for example, once a day at 0:00.

[0066] Note that regarding the voice warning message that alerts a person to the presence of the internal event, the control unit 10 generates the PWM signal based on the message data stored in the storage unit 7 and emits the corresponding voice warning message via the audio circuit from the audio unit 12.

(2.7) Re-Execution of Auxiliary Alert

[0067] The auxiliary alert unit X1 of each of the disaster protection devices 1 in the present embodiment is configured to, when a prescribed condition is satisfied after the main alert is started, execute the auxiliary alert at least one more time. In other words, when the control unit 10 determines that a prescribed condition is satisfied after the main alert is started, the control unit 10 causes the auxiliary alert unit X1 (the display unit 11) to execute the auxiliary alert at least one more time (re-alerting step).

[0068] In this embodiment, the "prescribed condition" is that a predetermined time T1 elapses since a time point tx (see FIG. 7A). The time point tx is, for example, a starting time point t1 of the main alert (a time point at which the first pushing operation is given to the operating unit 3) (see FIG. 7A). The predetermined time T1 is, for example, four weeks, but is not particularly limited to this example. In the case of FIG. 7A, a second auxiliary alert is executed at a time point t3.

[0069] The time point tx may be an end time point t2 of the main alert (a time point at which the second pushing operation is given to the operating unit 3) (see FIG. 7B). In the case of FIG. 7B, the second auxiliary alert is executed at a time point t4.

[0070] Alternatively, the time point tx may be a starting

time point t0 of the auxiliary alert (see FIG. 7C). In the case of FIG. 7C, the second auxiliary alert is executed at a time point t5. In the example shown in FIG. 7C, the first pushing operation is not given to the operating unit 3 even after a lapse of the predetermined time T1, the control unit 10 desirably resets counting of the predetermined time T1 and causes the auxiliary alert to be continued.

[0071] As described above, in the present embodiment, when the prescribed condition is satisfied, the auxiliary alert is executed at least one more time (at least two times in total, three times including the main alert), and therefore, replacement is suppressed from being forgotten by the resident 300.

[0072] Moreover, the auxiliary alert is executed by (lighting) display, and the main alert is executed by emitting a sound, and therefore, it is possible to make the resident 300 recognize the difference between the auxiliary alert and the main alert as compared to a case where both the auxiliary alert and the main alert are executed by display or are executed by emitting a sound. In addition, the possibility that discomfort is provided to the resident 300 can be reduced as compared to a case where the auxiliary alert is executed by emitting a sound. Moreover, as compared to a case where the main alert is executed by display, the possibility that the resident 300 notices the alert can be increased. In particular, the main alert is performed by a sound immediately after an operation is given, thereby reducing cases where the resident 300 fails to hear the main alert by a sound.

[0073] Note that, the auxiliary alert unit X1 may be configured to, when a prescribed condition is satisfied after the main alert is started, repeatedly execute the auxiliary alert. In sum, each disaster protection device 1 may continue the operation, that is, the auxiliary alert, the main alert, the lapse of the predetermined time T1, the auxiliary alert, the main alert, the lapse of the predetermined time T1, the auxiliary alert Causing the auxiliary alert to be repeatedly executed further suppresses the replacement from being forgotten by the resident 300.

[0074] By the way, not only the auxiliary alert but also the main alert may be re-executed. For example, as illustrated in FIG. 8A, when the operating unit 3 receives an operation after a prescribed time period T2 has elapsed since a specific time point tz (time a point t6), the control unit 10 may cause the main alert unit X2 (the audio unit 12) to re-execute the main alert. In FIG. 8A, the specific time point tz corresponds to a time point at which the operating unit 3 receives the first operation while the auxiliary alert is executed, that is, the starting time point t1 of the first main alert. However, the specific time point tz may be, as illustrated in FIG. 8B, a time point at which the operating unit 3 receives the second operation while the first main alert is executed, that is, the end time point t2 of the first main alert.

[0075] The prescribed time period T2 (e.g., 1 day) is preferably shorter than the predetermined time T1 (e.g., four weeks) but is not particularly limited to this example.

The prescribed time period T2 may be the same as the predetermined time T1 or may be longer than the predetermined time T1.

[0076] Moreover, when the operating unit 3 receives an operation after the prescribed time period T2 has elapsed since the specific time point t_z , and if an event with a higher priority than the replacement is present at the time point, the control unit 10 may cause the main alert unit X2 to execute an alert concerning information regarding the event with the higher priority. Examples of the event with the higher priority than the replacement include a failure and battery exhaustion. Naturally, while a fire alarm is emitted, the highest priority is given to the fire alarm.

[0077] In this case, re-execution of the main alert or execution of the alert concerning information regarding an event with a higher priority degree can be performed according to the availability of the resident 300, and therefore, convenience is improved.

(2.8) Operation Test and Interconnection Function

[0078] In the present embodiment, when the first pushing operation is given to the operating unit 3 with respect to the disaster protection device 1 which is performing the auxiliary alert, the disaster protection device 1 does not immediately execute the main alert, that is, does not emit a voice warning message notifying a user of the replacement but starts a prescribed operation test at first. It has described that the plurality of disaster protection devices 1 are so-called interconnect-type disaster protection devices and emit alarm sounds in an interconnected manner. In addition to this, the disaster protection devices 1 perform the operation test in an interconnected manner. That is, when the operating unit 3 receives an operation while the auxiliary alert is executed, the operation test starts an operation test of not only the disaster protection device 1 that receives the operation but also the other disaster protection devices 1 (the interconnection destinations) of the disaster protection device 1 (the interconnection origin) (interconnection step).

[0079] An operation test with the auxiliary alert as a starting point and operation relating to the interconnect function in the disaster protection system 100 will be described below with reference to FIG. 6B. Note that as described above, execution itself of the operation test does not have to be during the execution of the auxiliary alert but is possible by performing the specific operation (giving an operation to the operating unit 3, a pulling string, or the like) when the disaster protection device 1 is in a standby state.

[0080] The operation test includes a test relating to at least the replacement (checking time for replacement). In the present embodiment, the operation test includes, for example, checking the time for replacement of the disaster protection device 1, an emission test of illumination light of the emission unit 13, an emission test of an alarm sound from the audio unit 12, a lighting test of

the display unit (the indicating lamp) 11, checking the capacity of the battery 14, checking the presence or absence of a failure in each types of circuits, and the like. Moreover, the operation test may include a communication test between a plurality of disaster protection devices 1. For example, a disaster protection device 1 which is the master executes checking a radio wave intensity such as whether or not a plurality of disaster protection devices 1 which are slaves are all in a communicable area.

[0081] In this embodiment, it is assumed that a replacement time of 10 years is reached in one disaster protection device 1 which is a slave of the plurality of disaster protection devices 1 included in the disaster protection system 100. In this case, the one disaster protection device 1 starts the auxiliary alert (see FIG. 6A). It is assumed that the resident 300 who notices the auxiliary alert gives the first pushing operation at a time point t_{10} in FIG. 6B to the operating unit 3 of the one disaster protection device 1 executing the auxiliary alert.

[0082] In this case, the one disaster protection device 1, which receives the pushing operation, emits a voice warning message saying, for example, "Bleep, testing" from the audio unit 12. Thereafter, the one disaster protection device 1 starts the test operation at a time point t_{11} .

[0083] In this embodiment, the one disaster protection device 1, which receives the pushing operation, serves as the interconnection origin, and in a period from the time point t_{10} to t_{11} , the one disaster protection device 1 sends from the communicator 8 (the sending unit 15) the test signal (a interconnection signal) that instructs the disaster protection device 1 which is the master or the disaster protection device(s) which is the slave to start the operation test. When the disaster protection device(s) 1 which is the slave receives the test signal from the interconnection origin, the disaster protection device(s) 1 directly starts the operation test. Moreover, when the disaster protection device 1 which is the master receives the test signal from the interconnection origin, the disaster protection device 1 transmits, a test signal that instructs the disaster protection device(s) 1 which is the slave in the disaster protection system 100 to start the operation test.

[0084] More specifically, each of the disaster protection device 1 which is the master and the disaster protection device(s) 1 which is the slave in the disaster protection system 100 checks the presence or absence of a signal such as the test signal and the alarm signal when an actual fire is detected, in a standby state, by a non-interconnection intermittent reception method. That is, in the present embodiment, each disaster protection device 1 which is of a wireless type and in which the battery 14 is built adopts an intermittent reception method to reduce power consumption by the battery 14. The disaster protection device 1 which is the interconnection origin performs multicast transmission to the disaster protection devices 1 which is the master or the other disaster protection device(s) 1 which is the slave by repeatedly trans-

mitting the test signal (the alarm signal when a fire is detected) a plurality of number of times (e.g., three times). When the disaster protection device(s) 1 which is the slave receives the test signal, the disaster protection device 1 starts the operation test. When the disaster protection device 1 which is the master receives the test signal, the disaster protection device 1 starts transmission of a periodic beacon to the slave(s), thereby starting the operation test in the slave(s) without fail. Hereafter, the disaster protection device 1 which is the master and the disaster protection device(s) 1 which is the slave communicate with each other in time sharing multiple access method until the operation test ends.

[0085] In the example shown in FIG. 6B, it is assumed that at the time point t11, all the disaster protection devices 1 in the disaster protection system 100 start the operation test substantially at the same time. In this embodiment, the disaster protection device 1 which is the interconnection origin continues, as illustrated in FIG. 6B, the auxiliary alert until the time point t11 and stops the auxiliary alert at the time point t11. Note that the auxiliary alert does not have to be stopped at the time point t11 but may be stopped at the time point t10 at which the first pushing operation is given.

[0086] At the time point t11, each disaster protection device 1 issues, from the audio unit 12, an alert concerning a test result relating to the operation test together with a beep sound "Bleep, bleep, bleep, bleep". Since the time for replacement of the one disaster protection device 1 which is the interconnection origin is reached, as shown in the figure, the one disaster protection device 1 directly emits a voice warning message (main alert) saying "Bleep, bleep, bleep, bleep". It is time for replacement of the alarm". That is, the time point t11 corresponds to the starting time point t1 of the main alert in FIG. 7A, that is, "a prescribed time point tx". When in the other disaster protection device(s) 1 which is the interconnection destination, for example, a small residual capacity of the battery 14 is confirmed, the other disaster protection device(s) 1 emits a voice warning message saying that "Bleep, bleep, bleep, bleep, the battery is exhausted".

[0087] When the operation test finds the presence of an event such as a failure or battery exhaustion other than that the time for replacement is reached, each disaster protection device 1 may alert only an event with the highest priority as a test result or may sequentially alert all the test results. Since the operation test is premised on the auxiliary alert, at least the time for replacement of the one disaster protection device 1 which is the interconnection origin is reached. However, none of time for replacement, battery exhaustion, a failure, and the like is present in the other disaster protection device(s) 1, a voice warning message saying "Bleep, normal" is emitted. These voice warning messages are repeatedly emitted at an interval of 4 seconds until the operation test is terminated.

[0088] Moreover, at the time point t11, each disaster

protection device 1 performs a lighting test by the display unit (the indicating lamp) 11 concurrently with the alert concerning the test result. The display unit 11 periodically repeats lighting for 0.5 second and being off for 0.5 second.

[0089] Moreover, at the time point t11, each disaster protection device 1 performs an emission test of illumination light from the emission unit 13 concurrently with the alert concerning the test result. That is, the emission unit 13 of each disaster protection device 1 starts emitting illumination light based on reception of the first pushing operation by the operating unit 3 as a trigger in the disaster protection device 1 which is the interconnection origin. The emission unit 13 is continuously lit.

[0090] As described above, in the present embodiment, an auxiliary alert, that is, that the time for replacement of a disaster protection device 1 is reached can be used as a starting point to perform the operation test of the other plurality of disaster protection devices 1. Thus, even if the resident 300 does not know a timing at which the operation test should be conducted, the possibility that the operation test is conducted is increased by the auxiliary alert. Moreover, it is no longer necessary to perform the operation test on the plurality of disaster protection devices 1 one by one, and thus, convenience relating to the operation test is improved.

[0091] The above-described operation test (e.g., the alert concerning the test result, the lighting test of the display unit 11, and the emission test of illumination light of the emission unit 13) ends when the second pushing operation is given to the operating unit 3. That is, the disaster protection device 1 which is the interconnection origin stops the main alert when the operating unit 3 executing the main alert receives an operation again, and in addition, the disaster protection device 1 causes the other disaster protection devices 1 executing the alert concerning test results to stop executing the alert concerning the test results. Therefore, the operation given to the operating unit 3 in the disaster protection device 1 can be used as the starting point to cause the other disaster protection devices 1 to stop executing the alert concerning the test results. Moreover, alerts which are being executed and which relate to the test results can be stopped all together in accordance with the availability of the resident 300, and therefore, convenience is improved. Moreover, electric power consumed by continuous execution of the alerts concerning the test results can be reduced.

[0092] In a similar manner, the emission unit 13 of each disaster protection device 1 stops emitting illumination light based on reception of the pushing operation again as a trigger by the operating unit 3 in the disaster protection device 1 which is the interconnection origin while emitting the illumination light. Thus, the main alert and the illumination light can be interconnected with each other.

[0093] FIG. 6B shows an example in which the resident 300 gives a pushing operation to the operating unit 3 at

the time point t12. If, for example, no pushing operation is given to the operating unit 3 for one minute at the longest from the time point t11, the operation test automatically ends. Note that the interconnection of the operation test is, in the above description, stopped by using, as the starting point, a pushing operation given to the operating unit 3 of the disaster protection device 1 which has executed the auxiliary alert, but the interconnection may be stopped by using, as the starting point, a pushing operation given to the operating unit 3 of another disaster protection device 1. In sum, disaster protection devices 1 to which the first pushing operation and the second pushing operation are directed may be different.

[0094] Then, at the time point t13 at which the predetermined time T1 has elapsed since the time point t11 at which the main alert is started, the disaster protection device 1 which is the interconnection origin re-executes the auxiliary alert. Also in the case of the second and following auxiliary alerts, when a pushing operation is given to the operating unit 3, the operation test is re-executed in each disaster protection device 1.

(3) Variations

[0095] Note that the embodiment described above is only one of various embodiments of the present disclosure and should not be construed as limiting. Rather, the embodiment described above may be readily modified in various manners depending on a design choice or any other factor without departing from the scope of the present disclosure. Also, the functions of the disaster protection device 1 according to the exemplary embodiment described above may also be implemented as a method for controlling the disaster protection device 1, a computer program, or a non-transitory storage medium that stores the computer program thereon.

[0096] Next, variations of the exemplary embodiment will be enumerated one after another. Note that the variations to be described below may be adopted in combination as appropriate. In the following description, the exemplary embodiment will be referred to as a "basic example".

[0097] The control unit 10 of the disaster protection device 1 includes a computer system. In that case, the computer system may include, as principal hardware components, a processor and a memory. The functions of the control unit 10 of the disaster protection device 1 according to the present disclosure may be performed by making the processor execute a program stored in the memory of the computer system. The program may be stored in advance in the memory of the computer system. Alternatively, the program may also be downloaded through a telecommunications line or be distributed after having been recorded in some non-transitory storage medium such as a memory card, an optical disc, or a hard disk drive, any of which is readable for the computer system. The processor of the computer system may be made up of a single or a plurality of electronic circuits

including a semiconductor integrated circuit (IC) or a large-scale integrated circuit (LSI). As used herein, the "integrated circuit" such as an IC or an LSI is called by a different name depending on the degree of integration thereof. Examples of the integrated circuits include a system LSI, a very large-scale integrated circuit (VLSI), and an ultra-large-scale integrated circuit (ULSI). Optionally, a field-programmable gate array (FPGA) to be programmed after an LSI has been fabricated or a reconfigurable logic device allowing the connections or circuit sections inside of an LSI to be reconfigured may also be adopted as the processor. Those electronic circuits may be either integrated together on a single chip or distributed on multiple chips, whichever is appropriate. The plurality of chips may be collected in one device or may be distributed in a plurality of devices. As mentioned herein, the computer system includes a microcontroller including one or more processors and one or more memories. Thus, the microcontroller may also be implemented as a single or a plurality of electronic circuits including a semiconductor integrated circuit or a large-scale integrated circuit.

[0098] Also, in the embodiment described above, the plurality of constituent elements (or the functions) of the disaster protection device 1 are integrated together in a single housing. However, this is only an example and should not be construed as limiting. Alternatively, those constituent elements (or functions) of the disaster protection device 1 may be distributed in multiple different housings. Still alternatively, at least some functions of the disaster protection device 1 may be implemented as a cloud computing system as well. Conversely, the plurality of functions of the disaster protection device 1 may be integrated together in a single housing as in the basic example.

[0099] In the basic example, the disaster protection device 1 is an interconnect-type fire alarm and includes the communicator 8 for communication with the other fire alarm(s) but may be a single-type fire alarm. In sum, the communicator 8 is not an essential configuration element in the disaster protection device 1.

[0100] In the basic example, the auxiliary alert is continuously executed after the control unit 10 causes the auxiliary alert unit X1 (the display unit 11) to start the auxiliary alert until the main alert is started (until the pushing operation is given to the operating unit 3). However, the auxiliary alert unit X1 may stop the auxiliary alert when a prescribed time period has elapsed without the operation being received by the operating unit 3 since the auxiliary alert unit X1 started the auxiliary alert. In this case, the possibility that discomfort is provided to the resident 300 can be reduced as compared to a case where the execution of the auxiliary alert is maintained as in the basic example. Moreover, electric power consumed by continuous execution of the auxiliary alert can be reduced.

[0101] Note that the auxiliary alert unit X1 preferably restarts the auxiliary alert when a specific time period

has further elapsed since the time point at which the auxiliary alert unit X1 stops the auxiliary alert in accordance with the lapse of the prescribed time period. Restarting the auxiliary alert reduces the possibility that discomfort is provided to the resident 300 while the replacement is further suppressed from being forgotten by the resident 300.

[0102] In the basic example, the auxiliary alert is performed by display, and the main alert is performed by emitting a sound, but this should not be construed as limiting. For example, both the auxiliary alert and the main alert may be emission of sounds, and in this case, the sounds may differ in volume, or the contents of the voice warning message thus emitted may differ between the auxiliary alert and the main alert.

[0103] In the basic example, the disaster protection device 1 includes the emission unit 13 configured to emit illumination light. However, the emission unit 13 is not an essential configuration element in the disaster protection device 1. The disaster protection device 1 does not have to include the emission unit 13.

[0104] In the basic example, the display unit 11 serves as both the indicating lamp (the actuation flashing) and the auxiliary alert (the alert flashing), but the indicating lamp may be provided as a component separated from the display unit 11. Moreover, the light of the display unit 11 is configured to be viewed through the operating unit 3 which is light transmitting. However, the operating unit 3 may be a non-transparent member, and in this case, the light of the display unit 11 may be output to the outside of the housing 4 through a pore or a light transmitting cover located at a side different from the location of the operating unit 3.

[0105] In the basic example, a configuration in which the operation test follows the auxiliary alert is described, but in addition to this configuration, even when the auxiliary alert is absent, the operation test may be started when an operation is given to the operating unit 3 while the disaster protection device 1 is in the standby state. Also in this case, the disaster protection device 1 serves as the interconnection origin, and the operation test may be started in the other disaster protection device(s) 1.

[0106] In the basic example, the disaster protection device 1 itself that receives an operation also performs the operation test but does not have to perform the operation test. That is, after the disaster protection device 1 receives an operation, the disaster protection device 1 may directly emit only a voice warning message, which is the main alert, saying, for example, "It is time for replacement of the alarm".

(4) Advantages

[0107] As described above, a disaster protection device (1) of a first aspect is configured to perform alert operation relating to disaster protection. The disaster protection device (1) includes an auxiliary alert unit (X1), an operating unit (3), and a main alert unit (X2). The auxiliary

alert unit (X1) is configured to, when the disaster protection device (1) reaches a time for replacement, execute an auxiliary alert relating to the replacement. The operating unit (3) is configured to receive an operation. The main alert unit (X2) is configured to, when the operating unit (3) receives the operation while the auxiliary alert unit (X1) executes the auxiliary alert, execute a main alert relating to the replacement. The auxiliary alert unit (X1) is configured to, when a prescribed condition is satisfied after the main alert is started, execute the auxiliary alert at least one more time. With the first aspect, the auxiliary alert is executed at least one more time when the prescribed condition is satisfied, and therefore, this aspect suppresses the replacement from being forgotten by a user.

[0108] In a disaster protection device 1 (1) of a second aspect referring to the first aspect, the auxiliary alert unit (X1) preferably includes a display unit (11) configured to execute the auxiliary alert by display. The main alert unit (X2) preferably includes an audio unit (12) configured to execute the main alert by emitting a sound. With the second aspect, a user is made recognize a difference between the auxiliary alert and the main alert.

[0109] In a disaster protection device (1) of a third aspect referring to the first or second aspect, the main alert unit (X2) is preferably configured to, when the operating unit (3) receives the operation again while the main alert is executed, stop the main alert. With the third aspect, the main alert being executed can be stopped in accordance with the availability of a user, and therefore, convenience is improved. Moreover, electric power consumed by continuous execution of the main alert can be reduced.

[0110] In a disaster protection device (1) according to a fourth aspect referring to any one of the first to third aspects, the prescribed condition is preferably that a predetermined time (T1) elapses from a time point (tx). The time point (tx) is preferably a starting time point (t1, t11) of the main alert, an end time point (t2) of the main alert, or a starting time point (t0) of the auxiliary alert. With the fourth aspect, replacement is suppressed from being forgotten by a user.

[0111] A disaster protection device (1) according to a fifth aspect referring to any one of the first to fourth aspects preferably further including an emission unit (13) configured to emit illumination light radiating a surrounding region (R1). The emission unit (13) is preferably configured to start emitting the illumination light based on reception of the operation by the operating unit (3) as a trigger. The emission unit (13) is preferably configured to stop emitting the illumination light based on reception, of the operation by the operating unit (3) again as a trigger while the illumination light is emitted. With the fifth aspect, a disaster protection device (1) configured to emit illumination light is provided, and in addition, interconnection of the main alert and the illumination light is realized.

[0112] In a disaster protection device (1) according to a sixth aspect referring to any one of the first to fifth as-

pects, the main alert unit (X2) is preferably configured to, when the operating unit (3) receives the operation after a lapse of a prescribed time period (T2) since a specific time point (tz), execute the main alert. Alternatively, the main alert unit (X2) is preferably configured to, when the operating unit (3) receives the operation after the lapse of a prescribed time period (T2) since the specific time point (tz), execute an alert concerning information regarding an event with a higher priority than the replacement. The specific time point (tz) is preferably a time point at which the operating unit (3) receives the operation while the auxiliary alert is executed or while the main alert is executed. With the sixth aspect, re-execution of the main alert or execution an alert regarding information on an event with a higher priority degree can be performed according to the availability of a user, and therefore, convenience is improved.

[0113] In a disaster protection device (1) according to a seventh aspect referring to any one of the first to sixth aspects, the auxiliary alert unit (X1) is preferably configured to continuously execute the auxiliary alert from when the auxiliary alert is started until the main alert is started. With the seventh aspect, the possibility that a user notices the auxiliary alert is improved, and the replacement is further suppressed from being forgotten by the user.

[0114] In a disaster protection device (1) of an eighth aspect referring to any one of the first to sixth aspects, the auxiliary alert unit (X1) is preferably configured to stop the auxiliary alert when a prescribed time period elapses without the operation being received by the operating unit (3) since the auxiliary alert unit (X1) starts the auxiliary alert. With the eighth aspect, the possibility that discomfort is provided to a user can be reduced as compared to a case where the execution of the auxiliary alert is maintained. Moreover, electric power consumed by continuous execution of the auxiliary alert can be reduced.

[0115] In a disaster protection device 1 (1) of a ninth aspect referring to the eighth aspect, the auxiliary alert unit (X1) is preferably configured to restart the auxiliary alert when a specific time period further elapses since a time point at which the auxiliary alert unit (X1) stops the auxiliary alert in accordance with a lapse of the prescribed time period. With the ninth aspect, the possibility that discomfort is provided to a user is reduced while replacement is further suppressed from being forgotten by the user.

[0116] In a disaster protection device (1) according to a tenth aspect referring to any one of the first to ninth aspects, when the operating unit (3) receives the operation while the auxiliary alert is executed, the disaster protection device (1) preferably configured to cause one or more other disaster protection devices (1) to start an operation test. The operation test includes a test relating to at least the replacement. With the tenth aspect, based on the auxiliary alert by the disaster protection device (1) as a starting point, a plurality of disaster protection devices (1) can be caused to perform the operation test.

[0117] In a disaster protection device (1) of an eleventh aspect referring to the tenth aspect, the disaster protection device (1) is preferably configured to, when the operating unit (3) receives the operation again while the main alert is executed, stop the main alert. Further, the disaster protection device (1) is preferably configured to cause the one or more other disaster protection devices (1) to stop executing an alert concerning a test result relating to the operation test. With the eleventh aspect, the one or more other disaster protection devices (1) can be caused to stop execution of the alert concerning the test results by using, as the starting point, the operation given to the operating unit (3) in the disaster protection device (1).

[0118] A control method of a twelfth aspect is a control method of a disaster protection device (1) configured to perform alert operation relating to disaster protection. The control method includes an auxiliary alert step, a main alert step, and a re-alerting step. The auxiliary alert step includes, when a time for replacement of the disaster protection device (1) is reached, executing an auxiliary alert relating to the replacement. The main alert step includes, when an operating unit (3) of the disaster protection device (1) receives an operation while the auxiliary alert is executed, executing a main alert relating to the replacement. The re-alerting step includes, when a prescribed condition is satisfied after the main alert is started, executing the auxiliary alert at least one more time. The twelfth aspect provides a control method configured to suppress replacement from being forgotten by a user.

[0119] A program of a thirteenth aspect is designed to cause a computer system to carry out the control method of the twelfth aspect. The thirteenth aspect provides a function configured to suppress replacement from being forgotten by a user. Optionally, a non-transitory computer-readable medium may store the program. In that case, when the program is executed by a computer system, the computer system may carry out the control method of the twelfth aspect.

[0120] The configurations of the second to eleventh aspects are not essential for the disaster protection device (1) and may be omitted accordingly.

Reference Signs List

[0121]

1	DISASTER PROTECTION DEVICE
X1	AUXILIARY ALERT UNIT
X2	MAIN ALERT UNIT
3	OPERATING UNIT
11	DISPLAY UNIT
12	AUDIO UNIT
13	EMISSION UNIT
R1	SURROUNDING REGION
TX	A TIME POINT
tz	SPECIFIC TIME POINT
t0	STARTING TIME POINT OF AUXILIARY

ALERT
 t1, t11 STARTING TIME POINT OF MAIN ALERT
 t2 END TIME POINT OF MAIN ALERT
 T1 PREDETERMINED TIME
 T2 PRESCRIBED TIME PERIOD

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Claims

1. A disaster protection device configured to perform alert operation relating to disaster protection, the disaster protection device comprising:

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an auxiliary alert unit configured to, when the disaster protection device reaches a time for replacement, execute an auxiliary alert relating to the replacement;

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an operating unit configured to receive an operation; and

a main alert unit configured to, when the operating unit receives the operation while the auxiliary alert unit executes the auxiliary alert, execute a main alert relating to the replacement, the auxiliary alert unit being configured to, when a prescribed condition is satisfied after the main alert is started, execute the auxiliary alert at least one more time.

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2. The disaster protection device of claim 1, wherein the auxiliary alert unit includes a display unit configured to execute the auxiliary alert by display, and the main alert unit includes an audio unit configured to execute the main alert by emitting a sound.

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3. The disaster protection device of claim 1 or 2, wherein the main alert unit is configured to, when the operating unit receives the operation again while the main alert is executed, stop the main alert.

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4. The disaster protection device of any one of claims 1 to 3, wherein the prescribed condition is that a predetermined time elapses from a time point, and the time point is a starting time point of the main alert, an end time point of the main alert, or a starting time point of the auxiliary alert.

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5. The disaster protection device of any one of claims 1 to 4, further comprising:

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an emission unit configured to emit illumination light radiating a surrounding region, wherein the emission unit is configured to

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start emitting the illumination light based on reception of the operation by the operating unit as a trigger, and

stop emitting the illumination light based on reception of the operation by the operating unit again as a trigger while emitting the illumination light.

6. The disaster protection device of any one of claims 1 to 5, wherein

the main alert unit is configured to when the operating unit receives the operation after a lapse of a prescribed time period since a specific time point, execute the main alert or an alert concerning information regarding an event with a higher priority than the replacement, and

the specific time point is a time point at which the operating unit receives the operation while the auxiliary alert is executed or while the main alert is executed.

7. The disaster protection device of any one of claims 1 to 6, wherein

the auxiliary alert unit is configured to continuously execute the auxiliary alert from when the auxiliary alert is started until the main alert is started.

8. The disaster protection device of any one of claims 1 to 6, wherein

the auxiliary alert unit is configured to stop the auxiliary alert when a prescribed time period elapses without the operation being received by the operating unit since the auxiliary alert unit starts the auxiliary alert.

9. The disaster protection device of claim 8, wherein the auxiliary alert unit is configured to restart the auxiliary alert when a specific time period further elapses since a time point at which the auxiliary alert unit stops the auxiliary alert in accordance with a lapse of the prescribed time period.

10. The disaster protection device of any one of claims 1 to 9, wherein

the disaster protection device is configured to, when the operating unit receives the operation while the auxiliary alert is executed, cause one or more other disaster protection devices to start an operation test including a test relating to at least the replacement.

11. The disaster protection device of claim 10, wherein the disaster protection device is configured to, when the operating unit receives the operation again while the main alert is executed, stop the main alert and is further configured to cause the one or more other disaster protection devices to stop executing an alert concerning a test result relating to the operation test.

12. A control method of a disaster protection device configured to perform alert operation relating to disaster protection, the control method comprising:

an auxiliary alert step of, when a time for replacement of the disaster protection device is reached, executing an auxiliary alert relating to the replacement;

a main alert step of, when an operating unit of the disaster protection device receives an operation while the auxiliary alert is executed, executing a main alert relating to the replacement; and

a re-alerting step of, when a prescribed condition is satisfied after the main alert is started, executing the auxiliary alert at least one more time.

13. A program designed to cause a computer system to execute the control method of claim 12.

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FIG. 1

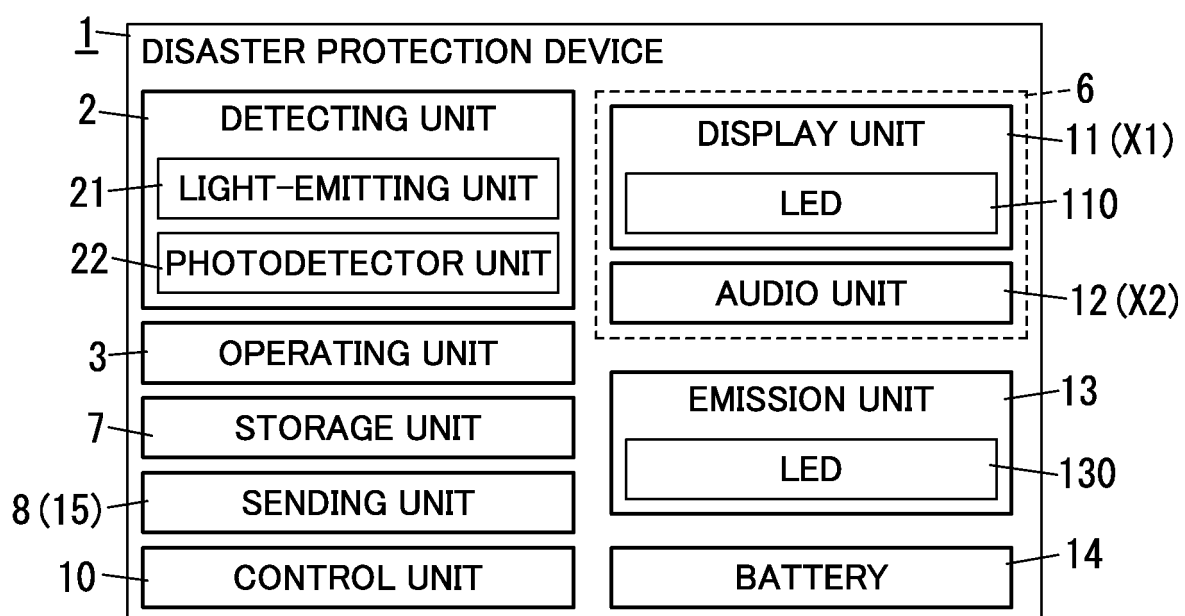


FIG. 2

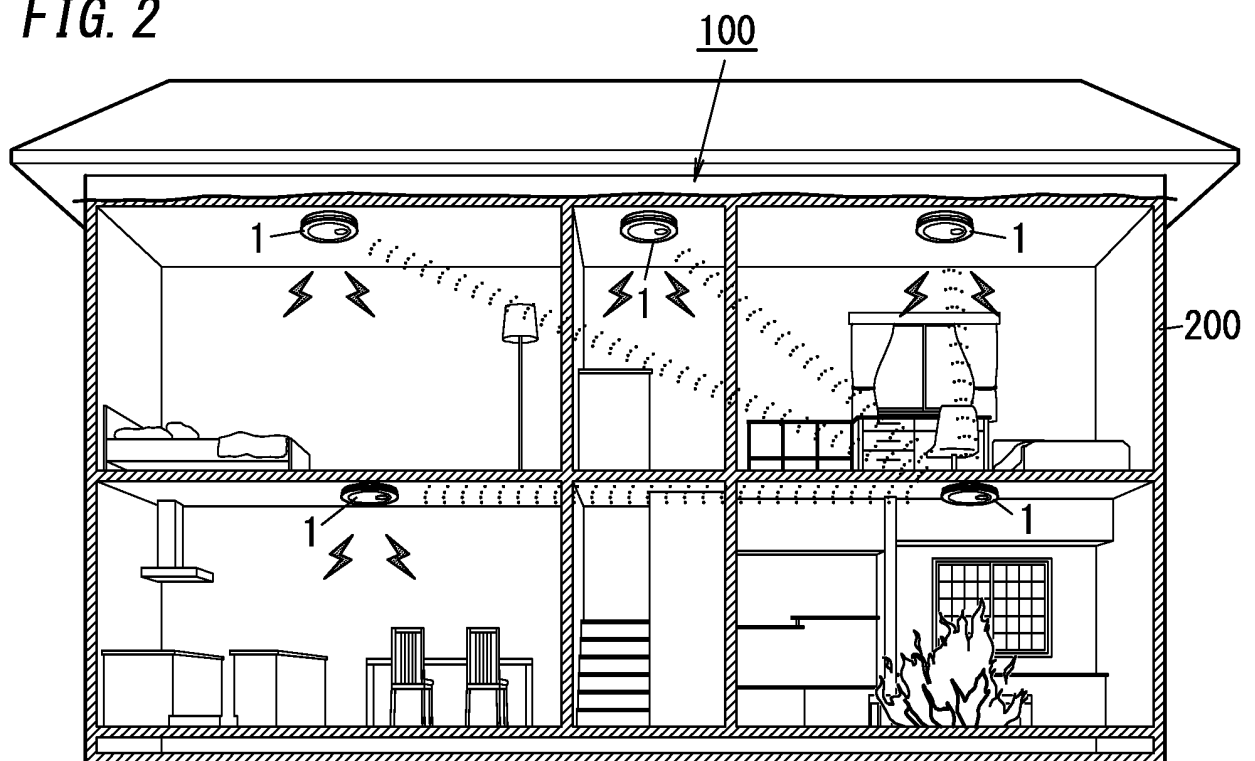


FIG. 3

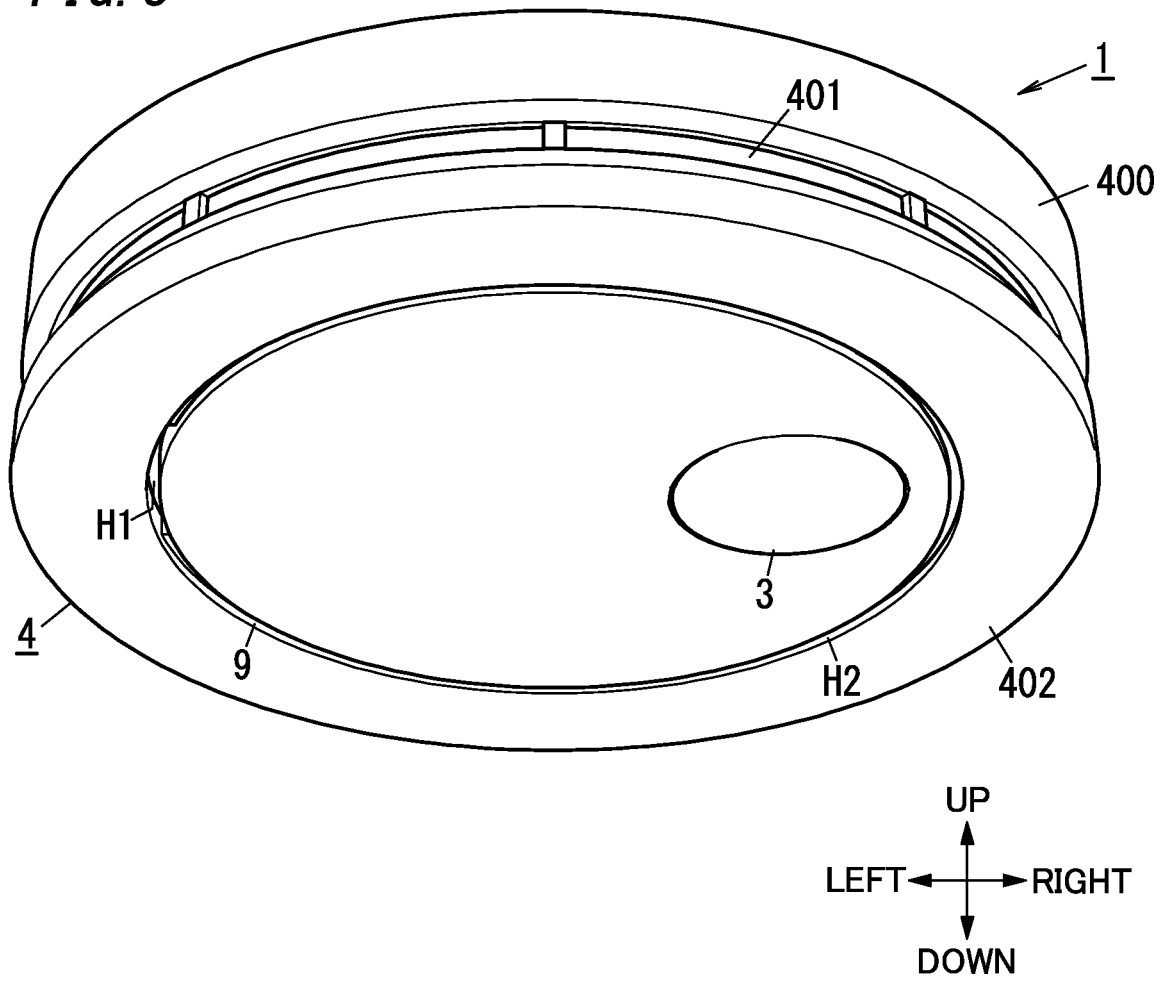


FIG. 4

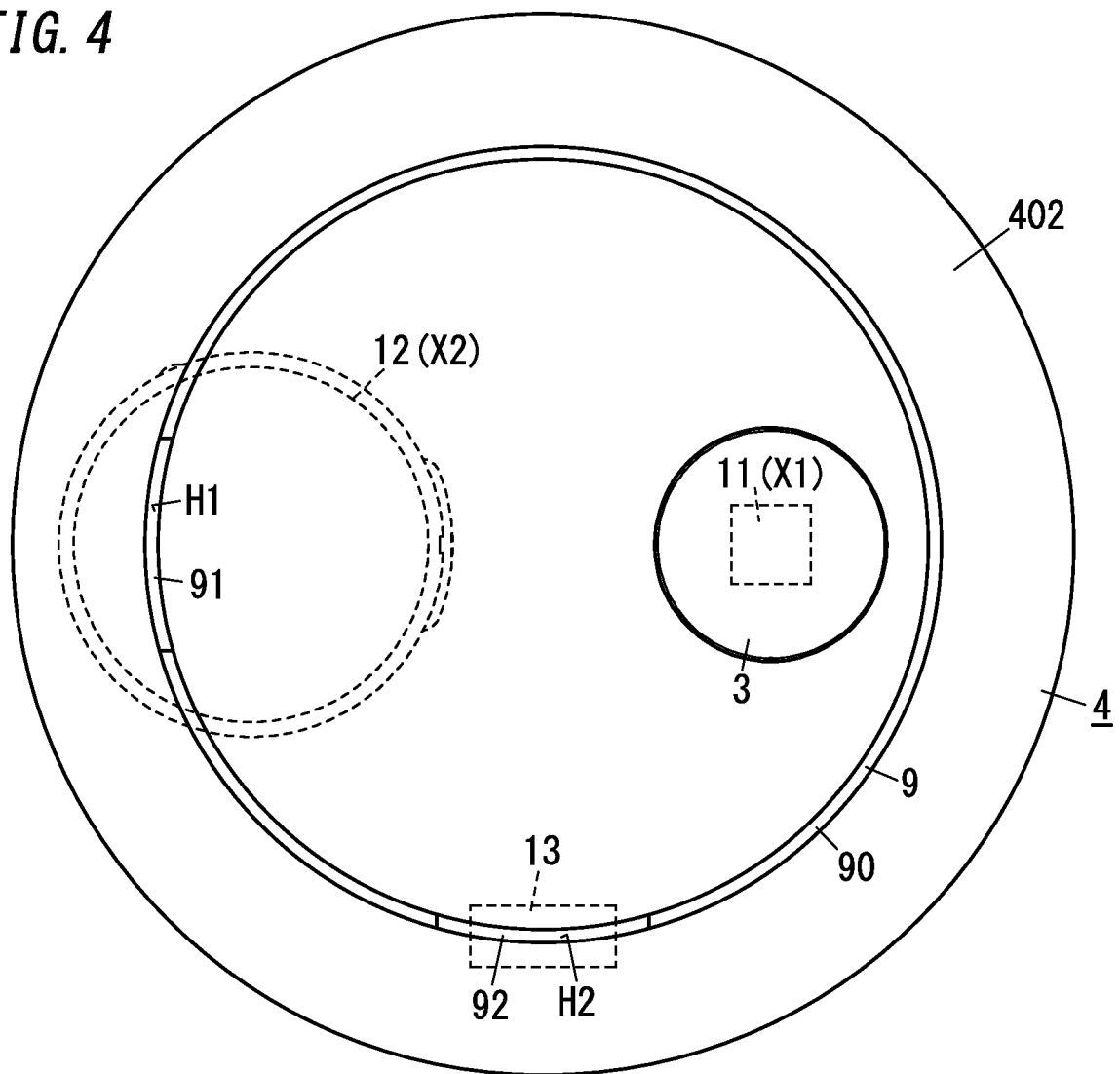


FIG. 5

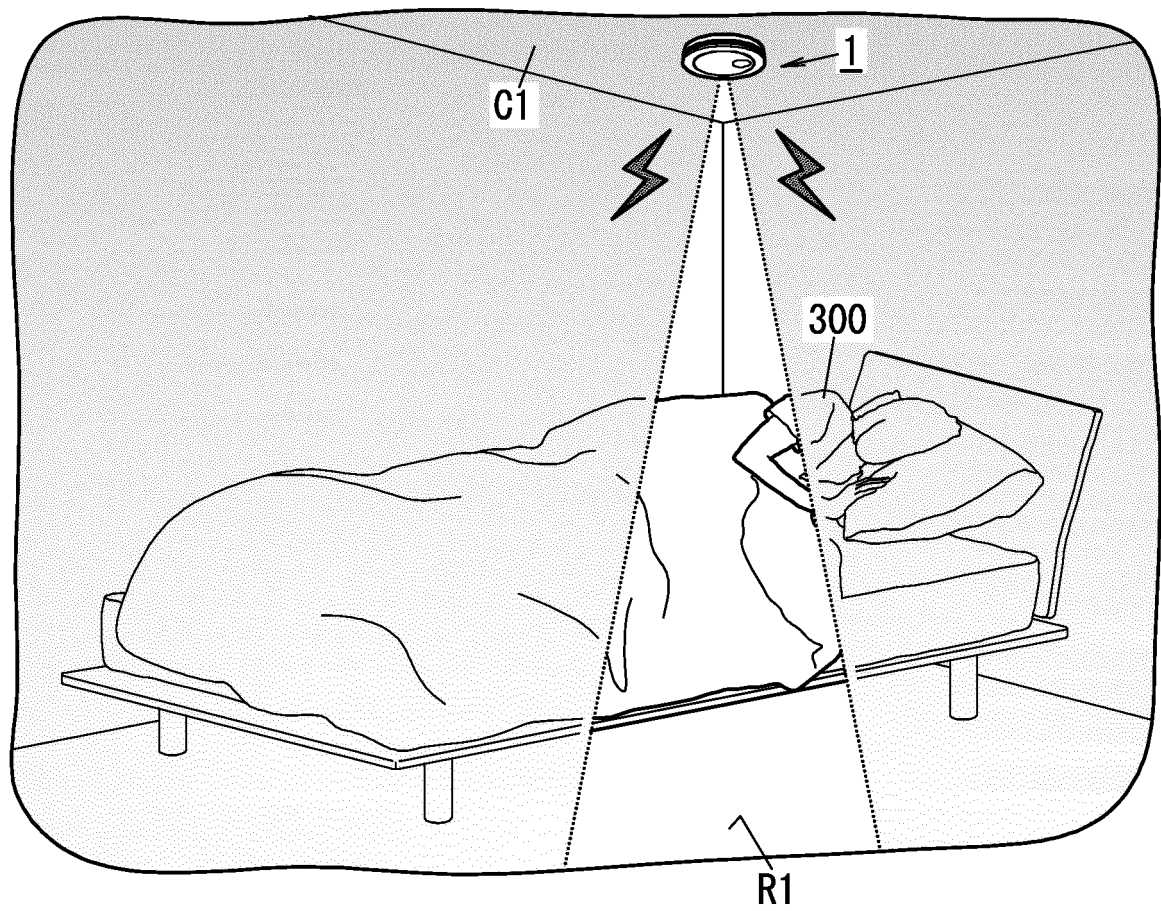


FIG. 6A

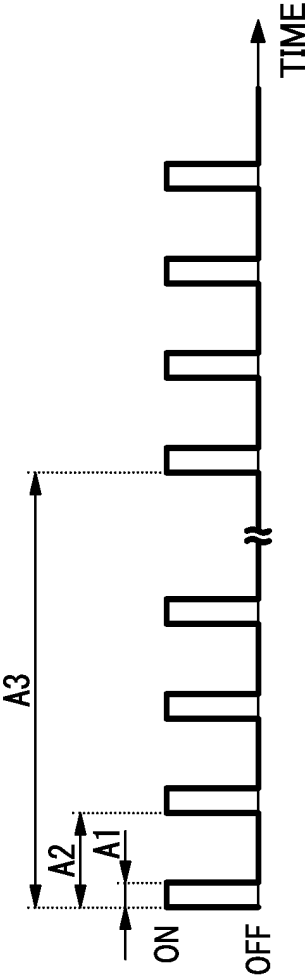


FIG. 6B

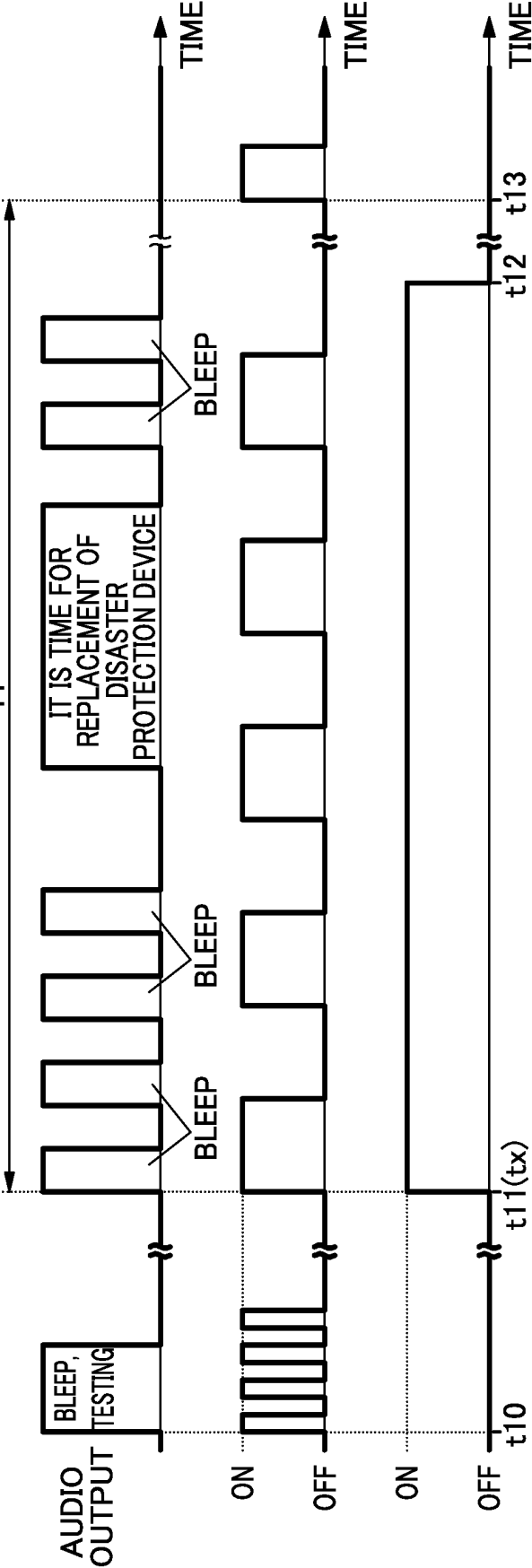


FIG. 7A

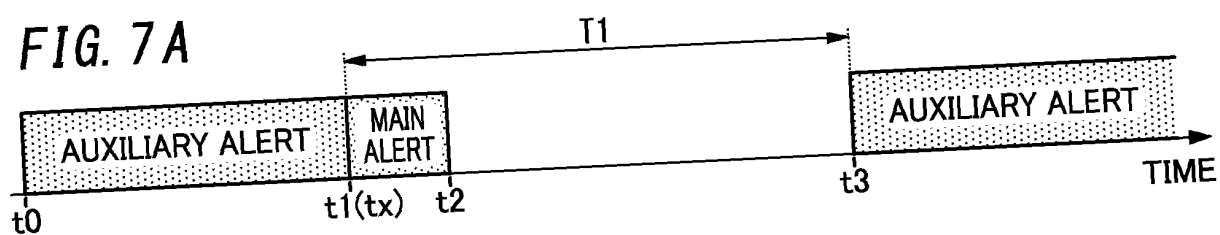


FIG. 7B

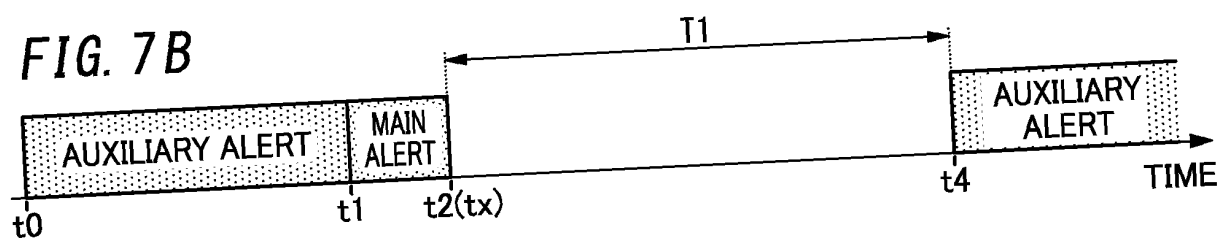


FIG. 7C

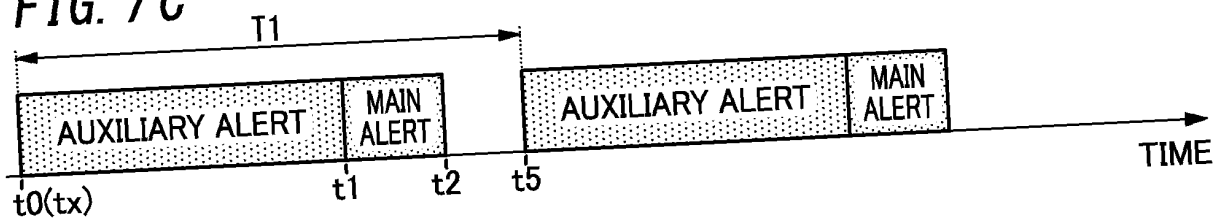


FIG. 8A

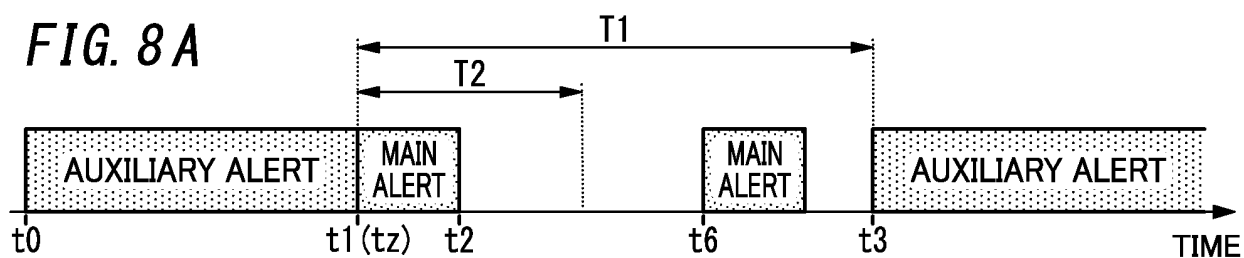
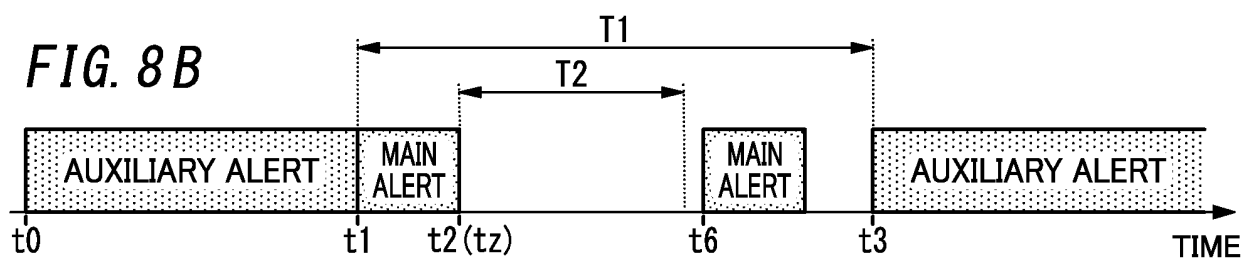


FIG. 8B



INTERNATIONAL SEARCH REPORT

International application No.

PCT/JP2019/027001

A. CLASSIFICATION OF SUBJECT MATTER

Int.Cl. G08B17/10 (2006.01) i, G08B23/00 (2006.01) i

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)

Int.Cl. G08B17/10, G08B23/00

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

Published examined utility model applications of Japan 1922-1996

Published unexamined utility model applications of Japan 1971-2019

Registered utility model specifications of Japan 1996-2019

Published registered utility model applications of Japan 1994-2019

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y A	JP 2014-139828 A (HOCHIKI CORP.) 31 July 2014, paragraphs [0051]-[0075] (Family: none)	1-4, 7-8, 12-13 5-6, 9-11
Y A	JP 2006-221458 A (YAZAKI CORPORATION) 24 August 2006, paragraphs [0019]-[0032] (Family: none)	1-4, 7-8, 12-13 5-6, 9-11
A	JP 2008-517376 A (RANCO INCORPORATED OF DELAWARE) 22 May 2008, entire text, all drawings & US 2006/0082452 A1 & GB 2434476 A & WO 2006/044360 A2 & CA 2583448 A1	1-13



Further documents are listed in the continuation of Box C.



See patent family annex.

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"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

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"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art

"&" document member of the same patent family

Date of the actual completion of the international search
03 September 2019 (03.09.2019)Date of mailing of the international search report
10 September 2019 (10.09.2019)Name and mailing address of the ISA/
Japan Patent Office
3-4-3, Kasumigaseki, Chiyoda-ku,
Tokyo 100-8915, Japan

Authorized officer

Telephone No.

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Patent documents cited in the description

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