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(54) **An alarm controller**

(57) A controller (1) for a smoke, heat, and carbon monoxide alarm system automatically assigns one of a plurality of commands to a common user action button (10) press, according to circumstances. It assigns a test command if all of the alarm devices are in standby, a locate command if any of the alarm devices are alarming,

and a hush command if its last command was a locate command. The processor activates output indicators to provide alarm condition information to a user, and there is a dedicated indicator (21-23) for each sensed condition. The processor controls the indicators (24-27) to inform the user of the command which would be assigned to a next button (10) press.

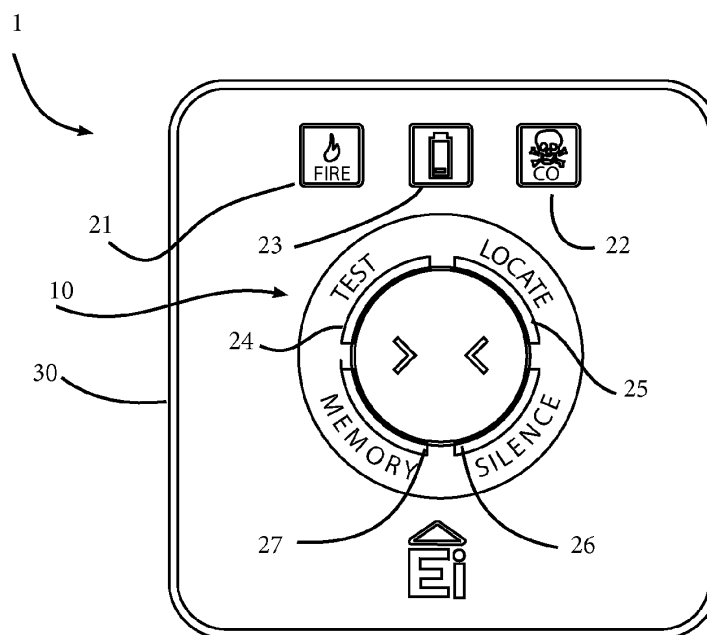


Fig.2(a)

Description

INTRODUCTION

Field of the Invention

[0001] The invention relates to a controller for sensing alarm devices for detecting environmental conditions such as smoke, heat, or toxic gas.

[0002] EP1906371 describes such a controller which multiplexes signals onto interconnect ("I/C") device wires. The user interface has two buttons, one for test/hush, the other for locate functionality.

[0003] A problem with use of such alarm devices is that many users do not take the time to familiarise themselves with the instruction manuals. Hence if an event occurs such as alarm activation due to normal cooking or a back-up battery failure, some users do not take the appropriate action. For example they may not know how to locate which alarm device of the group has sounded for a non-emergency reason such as excess smoke arising from cooking. This can sometimes give rise to a situation where alarm devices are un-necessarily disabled, which can be dangerous.

[0004] The invention is directed towards providing enhanced control of groups of alarm devices.

SUMMARY OF THE INVENTION

[0005] According to the invention, there is provided a controller for an alarm system having sensing devices for sensing an environmental condition, the controller comprising:

a housing,
an interface for communicating with alarm devices,
a processor,
a user interface, and
wherein the processor is adapted to automatically assign one of a plurality of commands to a common user action at the user interface, according to circumstances, and to implement a corresponding action in response.

[0006] By automatically allocating a command the controller removes need for the user to fully understand what is involved in dealing with operation of an alarm system for a variety of conditions such as smoke and/or fire and/or toxic gas.

[0007] The commands may for example be alarm device test and/or locate and/or silence, and/or memory of past activity. For example, the processor may be adapted to automatically allocate a command and corresponding action as follows:

assign a test command to the user action if all of the alarm devices are in standby;
assign a locate command to the user action if any of

the alarm devices are alarming, in which the processor de-activates sound emitters in all devices except those directly sensing an alarm condition; and assign a hush (or "silence") command to the user action if its last command was a locate command.

[0008] In one embodiment, the user interface includes a button and the user action is pressing of the button.

[0009] In one embodiment, the controller further comprises output indicators and the processor is programmed to activate said output indicators to provide alarm condition information to a user, and wherein there is a dedicated indicator for each sensed condition.

[0010] In one embodiment, the processor is adapted to control said indicators to inform the user of the command which would be assigned to a next user action.

[0011] Preferably, there is a dedicated light emitter for each command.

[0012] In one embodiment, the light emitters are physically arranged in a logical time-based sequence for alarm system operation.

[0013] In one embodiment, the user interface includes a button for the user action and the indicators are arranged in a logical sequence in a clockwise direction around the button.

[0014] In one embodiment, each light emitter comprises a segment of a plurality of LEDs of different colours, and the processor is adapted to activate a specific colour in the relevant segment to indicate a status for the command including current performance of the command or completion of the command.

[0015] In one embodiment, the logical sequence is device test, alarming device locate, and alarming device silencing.

[0016] In one embodiment, there is a memory segment in a next sequential order after silencing command segment, for a memory command to provide information about historical alarm device condition sensing.

[0017] In one embodiment, the controller is adapted to interface with smoke, heat, and/or CO sensing alarm devices.

[0018] Preferably, the controller further comprises a technician diagnostics switch for diagnostics operation, and the processor is adapted to activate a common colour across all segments to provide servicing technician feedback.

[0019] In one embodiment, the controller comprises a servicing technician diagnostics switch, operation of which causes the processor to implement diagnostics operations, in which the processor is adapted to respond to operation of the diagnostics switch by indicating which device historically alarmed during a preceding period, and in which the processor is programmed to assign a different command to a next user action if the diagnostics switch has been operated.

[0020] In one embodiment, the diagnostics switch is located at the rear of the controller housing.

[0021] In one embodiment, the controller housing is

portable and the controller further comprises a wall-mounted cradle, and a tamper-proof latch for engaging the controller housing.

[0022] In another aspect, the invention provides an alarm system comprising a plurality of alarm devices and a controller as defined above in any embodiment, wherein said alarm devices are adapted to communicate with the controller.

DETAILED DESCRIPTION OF THE INVENTION

Brief Description of the Drawings

[0023] The invention will be more clearly understood from the following description of some embodiments thereof, given by way of example only with reference to the accompanying drawings in which:-

Fig. 1 is a circuit diagram of an alarm system with a controller connected by wiring to the sensing alarm devices;

Fig. 2(a) shows physical appearance of the controller, Fig. 2(b) shows a mounting bracket, and Figs. 2(c) and 2(d) show parts of the rear of the controller including switches for use by technicians;

Fig. 3 shows connection of the controller to a group including different types of alarm device;

Fig. 4 is a circuit diagram of an alternative battery-powered controller with capability for RF communication with the alarm devices;

Fig. 5 is a diagram showing wireless communication of the controller of Fig. 4 with a group of devices; and

Figs. 6 and 7 are flow diagrams illustrating processor operation.

[0024] Referring to Figs. 1 and 2 an alarm group controller 1 comprises a micro-controller IC 2, a power supply 3, power mains terminals 5(a) and an interconnect terminal 5(b). The controller 1 has a generally rectangular housing 30 and is releasably mounted on a wall mounting cradle 20. As shown in Fig. 2(d), at the back of the controller 1 there is a break-away tab 15 to allow operation of a latch 16 in the cradle to ensure that the controller may not be easily tampered with after installation. A spring-loaded latch 16 on the mounting cradle 20 engages with the recess behind the tab 15 in the rear of the controller 1, preventing the controller 1 from being slid off, unless released by a screwdriver or similar.

[0025] There is a single spring-loaded user button 10 in the front of the controller 1. A single common user action of pressing the button 10 is interpreted by the processor 2 as an appropriate one of a number of commands or modes, as described in more detail below. Also, for

use by installation and servicing technicians, there is a diagnostics sliding switch 11(a) at the back of the housing 30, along with a power switch 11(b), and a house code switch 11(c). The switches 11(a), (b), and (c) are primarily for use by servicing technicians, for example for initial house coding and for later servicing.

[0026] The circuit also includes transistors 12 and 13 connected to the micro-controller 2 for interconnect-driven Test/Hush and Locate operations respectively. A voltage level detector 14 is also connected to the micro-controller 2.

[0027] The micro-controller 2 controls LEDs behind printed icons for each of various indications, as follows:

- 21, fire (red),
- 22, CO (red),
- 23, low battery status (amber),

[0028] Also, there are four segments of LEDs arranged in sequence around the button 10 in a logical sequence, and the segment order is:

- 24, Test (red, green or blue),
- 25, Locate (red, green or blue),
- 26, Silence (red, green or blue), and
- 27, Memory (red, green or blue).

[0029] As shown in Fig. 2(a) the LED segments 24-27 are arranged in discrete groups around the button 10, and the general sequence is clockwise.

[0030] Individual LED control is achieved by the fact that the LEDs are on a bus 28 connected to different output pins on the micro controller 2.

[0031] Fig. 3 shows the controller 1 connected to smoke alarms 40, heat alarms 41, and CO alarms 42 by an interconnect wire link.

[0032] Referring to Fig. 4 an alternative controller 50 has a micro-controller 51, a single user switch 52, a house code switch 53 on the rear and, a diagnostics switch 54 also on the rear. There is also a sliding power switch 11(b) on the rear. At the output side there is an RF transceiver 55 for wireless communication with the alarm devices in the wireless group. There are LEDs 60 behind icons on the controller front face for the same indications as for the LEDs of the controller 1:

- 61, fire,
- 62, CO, and
- 63, low battery.

[0033] Also, there are LED segments as follows in a similar arrangement as for the controller 1:

- 64, Test,
- 65, Locate,
- 66, Silence, and
- 67, Memory.

[0034] Fig. 5 shows the controller 50 controlling a wireless group of RF smoke alarms 70, RF heat alarms 71, and RF CO alarms 72. A transceiver base 73 is also shown in Fig. 5 which is used for interfacing mains powered alarms to the RF system.

[0035] The micro-controllers 2 and 51 are programmed to automatically control the alarm group in a comprehensive manner, even though the main user interface has only one user action, namely a button 10 press. It uses timing and context of user pressing the single button (10 or 52) to automatically assign a relevant command to a button press, in order to implement an action. In summary, the processor programmed to assign one of a plurality of commands to a user button press, according to circumstances, and to implement a corresponding action in response. Also, it generates feedback for the user using the LEDs. In other embodiments a sound emitter may additionally be used. In this way, the micro-controller 2 drives the device group operation and user interfacing. This reduces the requirement for the user to understand operation of the system.

[0036] The manner in which the processor 2 automatically assigns commands to button presses is illustrated in Figs. 6 and 7, as described in more detail below.

[0037] The user can operate the controller 1 in the correct manner, without having read instructions or labelling on the switch. The problem of the user pressing the wrong button is overcome by only having one button, and the processor automatically determines a correct action for a button press means according to the context.

[0038] In the normal standby situation, which is the vast majority of the time, a button press is understood as a Test instruction. It is recommended that all the alarms are tested regularly with this.

[0039] If there is a sensed alarm condition such as fire or toxic gas (for example CO) leak, button press is understood as a "Locate" instruction. Pressing the button 10 automatically turns off the sounders in all the alarm devices except the one sensing fire (or toxic gas). This encourages the user to go to the device that is still sounding to investigate.

[0040] Then, after about 2 minutes the button is automatically set to act as a "Hush" or "Silence" button allowing the resident to silence the alarm.

[0041] Therefore, the processor 2 automatically forces a correct sequence of actions without relying on user knowledge of the system. In addition, to further guide the resident in the correct use of the system, when the devices are sounding, the LEDs 21-23 are activated so that an icon is lit to indicate "Fire" or "CO" and the button flashes indicating "Locate" to draw attention to the control button and encouraging the user to press it.

[0042] After about 2 minutes (to give time for the user to investigate and also preventing instant silencing of all the alarms) the segment 26 flashes indicating "Hush".

[0043] As illustrated, the controller can be configured to operate with RF signalling or to operate with hardwired systems. Figs. 4 and 5 show an RF system. Figs. 1 to 3

show how mains powered alarms with an RF transceiver base can be controlled.

Additional Diagnostics with RF Systems

[0044] The controller can have a very useful additional memory feature to help with troubleshooting the system. For example if a system, which could have from 2 to over 30 alarm devices connected, goes into alarm during the night for a short period and then stops, it can be very difficult to establish which unit initiated the alarm. By pressing the "hidden" Mode switch 11(a) on the rear with a screwdriver, the controller 1 can be put into diagnostic mode. Now, when the main button 10 is pressed, only the alarm which went off during the night will sound for a short period. This is a great help to the person troubleshooting the system as it can identify faulty alarms, badly sited alarms (e.g. near bathrooms or kitchens), alarms near strong EMC sources etc. The switch 11(a) is typically used by servicing personnel, but may alternatively be used by a user who acquaints himself with the instructions.

[0045] The controller is portable to facilitate this, as it may be easily lifted from the cradle. The controller can be taken out of the Diagnostic mode by re-pressing the hidden switch 11(a) or letting it time-out after about 30 minutes.

[0046] The memory feature in the alarms can be reset by pressing the button 10 when it is in the standby (i.e. Test) mode. Alternatively it can be held until a reset communication is sent manually (generated by holding say the diagnostic switch and the main button down together). It could also be let reset automatically after say 24 to 48 hours.

[0047] The following describes aspects of operation of the controller 1 in more detail. In several of the following scenarios references to the "user" will typically in practice be a technician. Also, the drawing references for the controller 1 are used, however, it equally applies to the controller 50.

System Diagnostics Mode

[0048] A system diagnostic mode will facilitate the following special tests:

- Two minute "Long Test". This is an alternative to the walk round test.
- Alarm identification test. Identify any alarm that been previously activated.

[0049] To enter the system diagnostic mode a small screwdriver is used to press and release the Mode switch 11(a) on the back of the controller 1. All segments 24-27 will flash green to indicate that the diagnostic mode has been activated.

Two Minute - Long Test

[0050] On entering the system diagnostic mode the Test segment 24 will flash green inviting the user to press the button. When the button is pressed the segment will turn blue and all the alarm devices in the system will sound for 2 minutes. This will allow the user to walk around the house and verify that each individual alarm device is sounding. During the test the user may notice a Test segment 24 flash blue periodically indicating that a refresh signal is being transmitted. The test will automatically cease after two minutes or if the button is pressed again. All the segments 24-27 will flash green to indicate the test has been completed. The user must wait 2 minutes before performing any additional tests.

Alarm Identification Test

[0051] If an alarm memory has been set the Test and Memory segments 24 and 27 will flash green alternatively after entering the system diagnostics mode. While the Memory segment 27 is illuminated the user presses the button 10 until the Memory segment 27 turns blue. This will then locate the alarm device that was previously activated and cause it to sound for a number of seconds (depending on the number of devices in the system). Pressing the button again will cause it to sound again. This allows the user to walk around the house until he has found the activated alarm device. The controller 1 will automatically exit the alarm identification test after 2 minutes or if the Mode switch 11(a) is operated again. All segments 24-27 will turn green for a brief period as the controller 1 exits the Diagnostic mode.

Erase Alarm Memory

[0052] Press and hold the Mode switch 11(a) on the back of the controller 1. The green segments will light up. When these segments start flashing, release the button. The memory identification is now cleared.

Installation

[0053] The user installs the controller mounting plate 20 at an accessible point on the wall 1.4 +/- 0.2 m from floor level. The choice depends on aspects such as whether a disabled person will use it, security, and choice of a location where it will not be accidentally or otherwise operated. The user turns on the system by sliding the power switch 11(b) to the on position and checking the power up LED sequence.

Power up sequence

[0054]

- Fire, Battery & CO indicators 21, 22, and 23 flash
- Each individual segment 24-27 lights up red

- Each individual segment 24-27 lights blue
- Each individual segment 24-27 lights green

After the power-up sequence all lights will go off to indicate standby mode.

House Coding

[0055] It is essential to house code the alarm controller 1 to all of the devices in the system to ensure that they will not communicate with nearby systems. Failure to house code the system may also result in a system malfunction. All the alarm devices must be house coded in situ to ensure that they will all communicate with each other; it also includes a margin for RF signal degradation for additional reliability.

[0056] The user presses and holds the House Code button (H CODE) 11(c) on the back of the controller 1 until all segments 24-27 light up blue, then releases it. The segments will flash rapidly for a moment on entering house code. The user house codes all other devices in the system similarly.

[0057] The user returns to the alarm controller 1 and checks that all segments 24-27 (ring) are flashing blue. The number of flashes should equal the number of alarm devices in the system. A system with three smoke alarm devices, one CO alarm device, and one alarm controller will result in 5 blue flashes. It may take up to 10 minutes before all 5 flashes are seen.

[0058] The flash pattern will repeat every 5 to 10 seconds while the alarm controller remains in house code. The user walks around the house to verify that all the other devices are giving the correct amount of flashes.

[0059] To complete the commissioning, the system must exit house code mode. The devices will automatically exit house code after 30 minutes. Once coded, the system will not communicate with any other devices outside the house coded group. To manually exit house code the user presses the house code (H CODE) button on the back of the controller. When all the segments light up blue, the user releases the button. This controller 1 will then send an exit house code signal to all the other devices to exit house code. After a short period the blue light will turn off and the controller 1 will return to standby mode (normal). Depending on the number of devices in the system this period could vary from 5 to 20 seconds.

[0060] If the user chooses to make the controller 1 tamper-proof she/he removes a "pip" (plastic post) using a pliers or similar tool.

[0061] After sliding the controller 1 onto the mounting base 20 on the wall, the user checks that the system is working by pressing the button 10 until the Test segment 24 lights blue. This indicates a system test signal has been activated. All the alarm devices in the system will sound for a short period and then stop.

Reset the House Code

[0062] Sometimes, in order to resolve an RF communication problem, e.g. alarms have to be relocated, it may be necessary to reset and house code all devices in the system again. To reset the controller the user presses and holds the house code button 11(c). All segments 24-27 will flash blue briefly and then go solid. After 5 seconds approx. the segments will start flashing blue. At this point release the house code button. The controller has now been reset.

Testing the alarm system

[0063] Frequent testing of the system is advised to ensure its continued and safe operation. Guidelines and best practices for testing are after the system is installed, once weekly thereafter, after prolonged absence from the dwelling (e.g. after holiday period), and after repair or servicing of any of the systems elements or household electrical works.

[0064] The user presses and holds the button 10 on the controller until the Test segment 24 lights up blue. The user releases the button when all the alarms in the system are sounding. The alarms will stop sounding after a period and the Test segment 24 will flash blue to indicate the test has been completed. If the Memory segment 27 lights up blue instead of the Test segment 24 it means that a CO or Fire alarm was previously activated.

Walk Around Test (optional)

[0065] The user removes the controller 1 from its cradle 20. If the controller 1 has been tamper-proofed the user needs to release the latch 16 with a screwdriver. With the controller in his/her hand he/she presses and holds the button 10, and walks around the house and verifies that each alarm device is sounding. When testing is complete he/she releases the button and replaces the controller 1 in its cradle 20.

[0066] When the alarm system sounds, if the source of the alarm is not obvious the user should go to the controller 1 and check to see which indicator is illuminated, Fire 21 or CO 22. If the CO indicator 22 is flashing, he/she should open doors and windows while evacuating the premises.

Locate the Source Alarm(s)

[0067] If the Fire indicator 21 is lighting and there is no obvious fire, the user presses the button 10. The Locate 25 segment will change from red to blue. After a 10 to 40 seconds period, all the devices in the system will stop sounding except the source alarm device(s).

[0068] If satisfied that there is no fire but the alarm device is still continuing to alarm the user may now silence the system. He/she waits until the Silence segment 26 is flashing red and then presses the button 10. The Si-

lence segment 26 will turn blue, after a delay the alarm devices(s) will stop sounding and all segments 24-27 on the controller 10 will flash green momentarily to indicate that the controller 10 is back in standby.

Fire Memory

[0069] The fire memory feature enables the identification of an alarm event that has previously been activated, e.g. one that false alarmed when the house was not occupied. After the alarm device deactivates, the Fire indicator 21 will flash alternatively with the Memory segment 27 (red) for 2 minutes and then stop. To check the memory he/she presses the button 10, and the Memory segment 27 will light blue and the source alarm will sound briefly. To recheck the memory he/she presses and holds the button 10 briefly while the Fire indicator 21 is still flashing. This can be repeated as long as the Fire indicator 21 is flashing. If the button 10 is not pressed within 20 seconds the Fire indicator 21 stops flashing, the alarms stop sounding and the memory is erased.

CO Memory

[0070] The CO memory feature enables the identification of a CO Alarm that has previously been activated, e.g. a CO incident while the house was not occupied. After the system deactivates, the CO indicator will flash alternatively with the Memory segment 27 (red) for 2 minutes and then stop. For the next 24 hours they will flash alternatively once a minute. To check the memory the user presses the button 10, the Memory segment 27 will light blue and the source alarm device will sound briefly. To recheck the memory the user presses and holds the button 10 briefly while the CO indicator is flashing. This can be repeated as long as the CO memory is flashing. If the button 10 is not pressed within 10 seconds the CO indicator stops flashing, the alarm devices stop sounding and the memory is erased.

[0071] The invention is not limited to the embodiments described but may be varied in construction and detail. For example the user button may be virtual using known touch screen technology. Indeed, the term "button" in this specification may also be interpreted to mean any type of single user action user input device, such as a flick switch which is toggled up and down. Also, the commands that are automatically determined by context of the common user action may be different from those described.

Claims

1. A controller (1) for an alarm system having sensing devices for sensing an environmental condition, the controller comprising:

a housing (30),

an interface (5(b), 55)) for communicating with alarm devices (40-42),
 a processor (2, 51),
 a user interface (10, 21-27), and
 wherein the processor is adapted to automatically assign one of a plurality of commands to a common user action (10) at the user interface, according to circumstances, and to implement a corresponding action in response, in which:

the processor (2, 51) assigns a test command to the user action if all of the alarm devices are in standby;
 the processor (2, 51) assigns a locate command to the user action if any of the alarm devices are alarming, in which the processor de-activates sound emitters in all devices except those directly sensing an alarm condition; and
 the processor (2, 51) assigns a hush command to the user action if its last command was a locate command.

2. A controller as claimed in claim 1, wherein the user interface includes a button (10) and the user action is pressing of the button.
3. A controller for an alarm system as claimed in any preceding claim, wherein the controller (1) further comprises output indicators (21-23, 24-27) and the processor is programmed to activate said output indicators to provide alarm condition information to a user, and wherein there is a dedicated indicator (21-23) for each sensed condition.
4. A controller for an alarm system as claimed in claim 3, wherein the processor is adapted to control said indicators (24-27) to inform the user of the command which would be assigned to a next user action.
5. A controller as claimed in claim 4, wherein there is a dedicated light emitter (24-27) for each command.
6. A controller as claimed in claim 5, wherein the light emitters (24-27) are physically arranged in a logical time-based sequence for alarm system operation.
7. A controller as claimed in claim 6, wherein the user interface includes a button (10) for the user action and the indicators (24-27) are arranged in a logical sequence in a clockwise direction around the button.
8. A controller as claimed in any of claims 5 to 7, wherein each light emitter (24-27) comprises a segment of a plurality of LEDs of different colours, and the processor (2) is adapted to activate a specific colour in the relevant segment to indicate a status for the command including current performance of the com-

mand or completion of the command.

9. A controller as claimed in any of claims 6 to 8, wherein the logical sequence is device test (24), alarming device locate (25), and alarming device silencing (26).
10. A controller as claimed in claim 9, wherein there is a memory segment (27) in a next sequential order after silencing command segment, for a memory command to provide information about historical alarm device condition sensing.
11. A controller as claimed in any preceding claim, wherein the controller is adapted to interface with smoke, heat, and/or CO sensing alarm devices (40-42).
12. A controller as claimed in any of claims 8 to 11, wherein the controller further comprises a technician diagnostics switch (11(a)) for diagnostics operation, and the processor is adapted to activate a common colour across all segments (24-27) to provide servicing technician feedback.
13. A controller for an alarm system as claimed in any preceding claim, wherein the controller comprises a servicing technician diagnostics switch (11(a)), operation of which causes the processor to implement diagnostics operations, in which the processor (2) is adapted to respond to operation of the diagnostics switch by indicating which device historically alarmed during a preceding period, and in which the processor is programmed to assign a different command to a next user action if the diagnostics switch has been operated.
14. A controller for an alarm system as claimed in claims 12 or 13, wherein the diagnostics switch (11(a)) is located at the rear of the controller housing (30).
15. A controller as claimed in any preceding claim, wherein the controller housing (30) is portable and the controller further comprises a wall-mounted cradle (20), and a tamper-proof latch (16) for engaging the controller housing.
16. An alarm system comprising a plurality of alarm devices (40-42) and a controller (1) as claimed in any preceding claim, wherein said alarm devices are adapted to communicate with the controller.

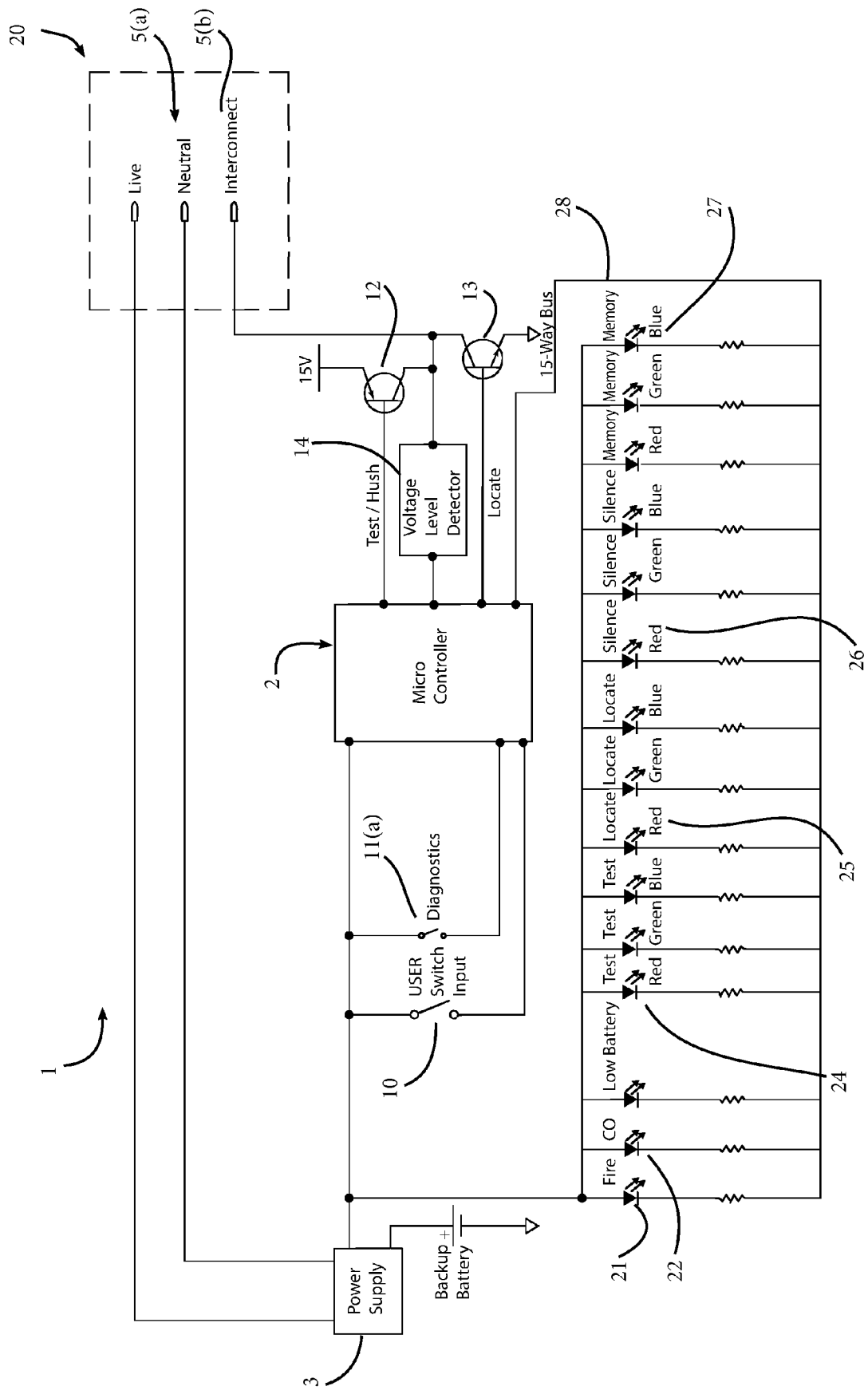


Fig.1

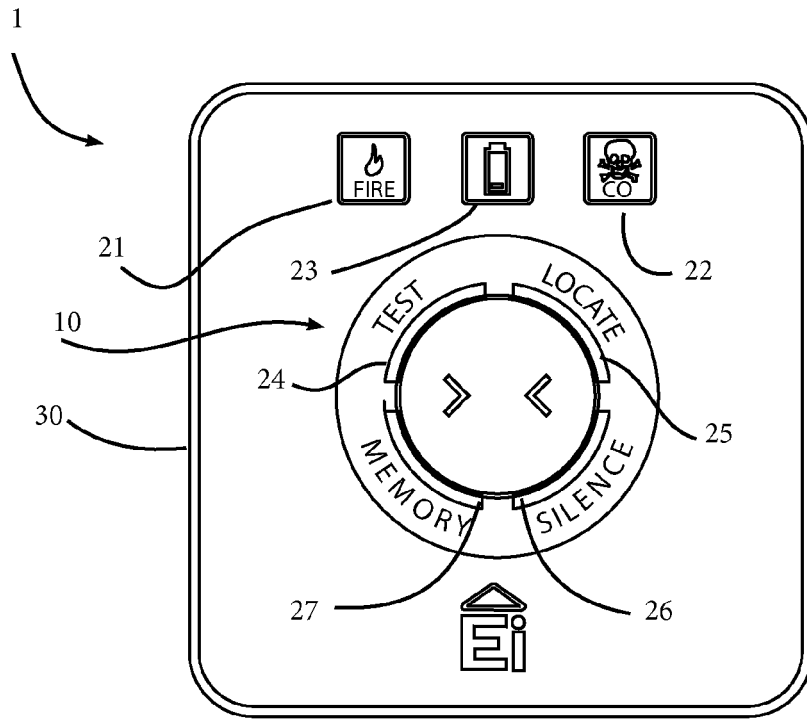


Fig.2(a)

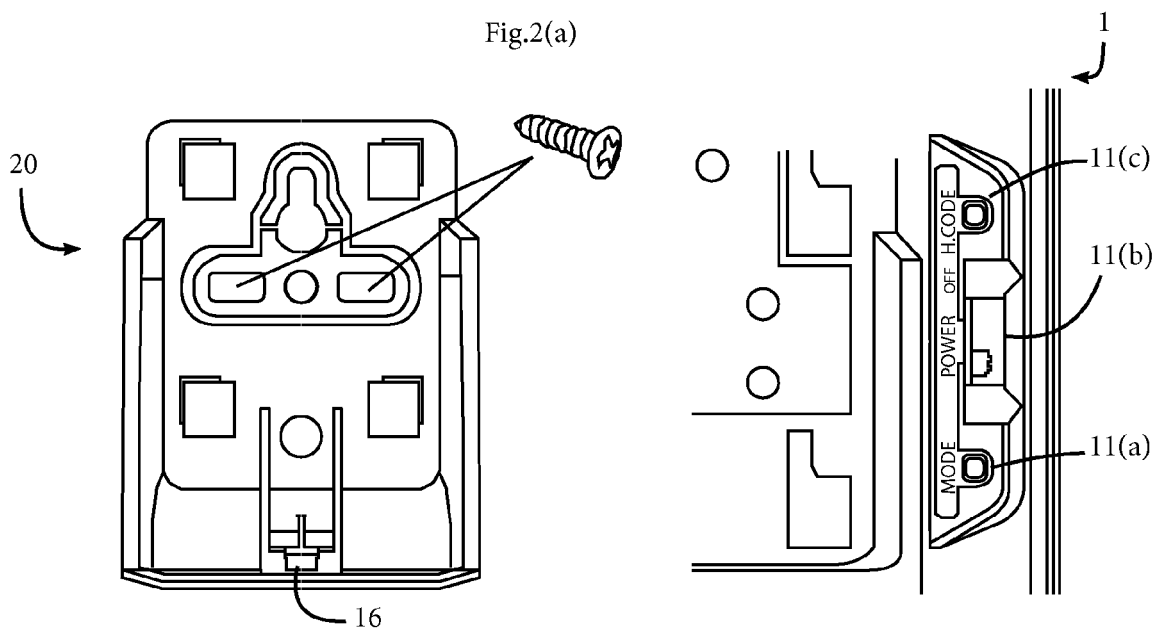


Fig.2(b)

Fig.2(c)

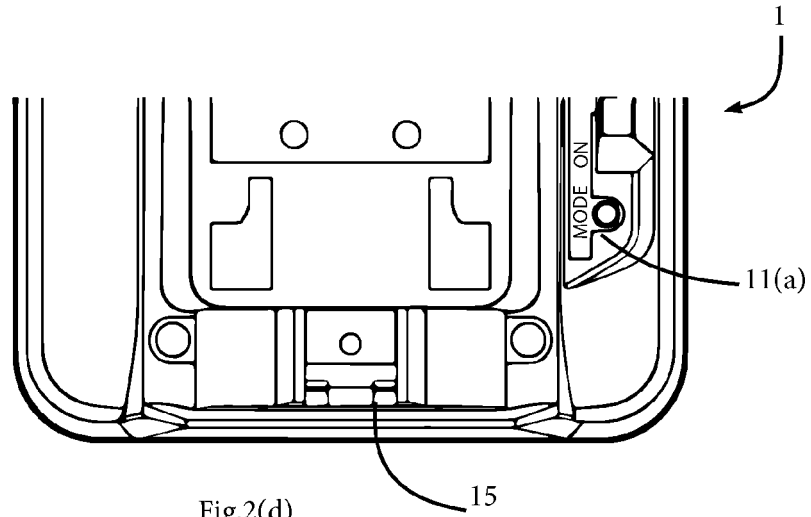


Fig.2(d)

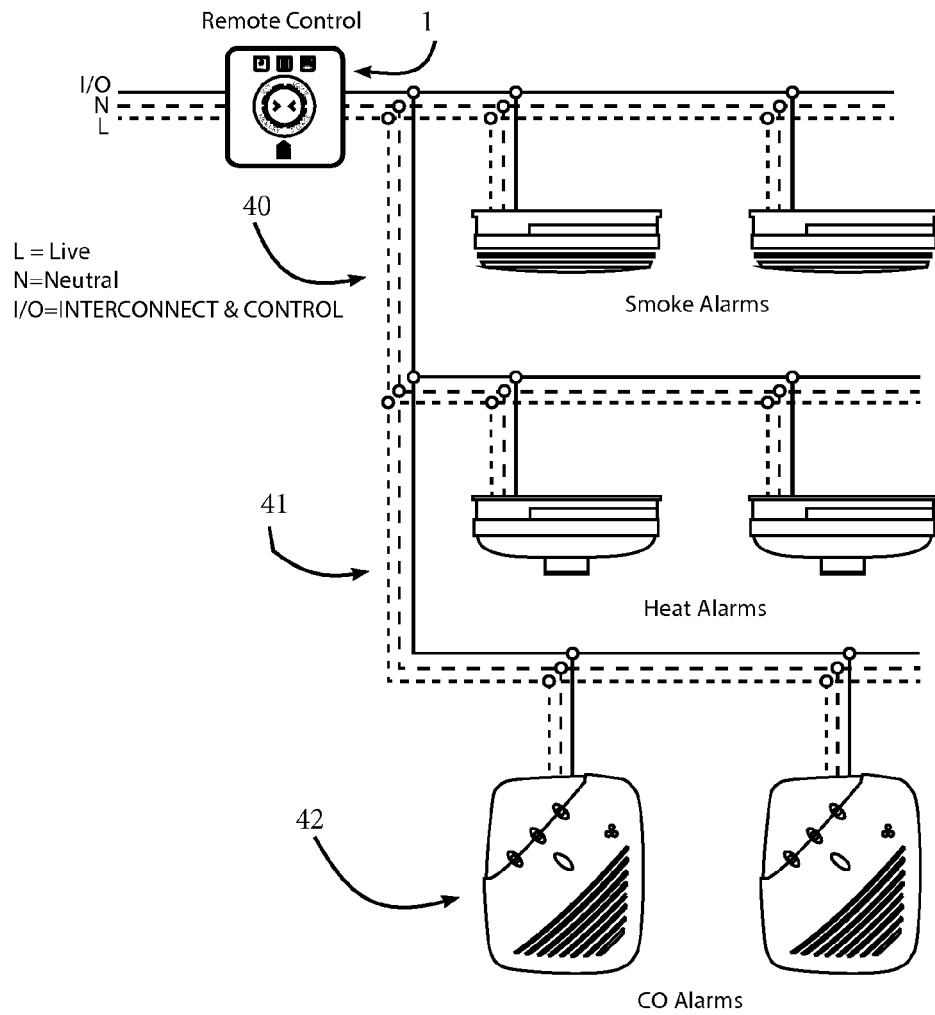


Fig.3

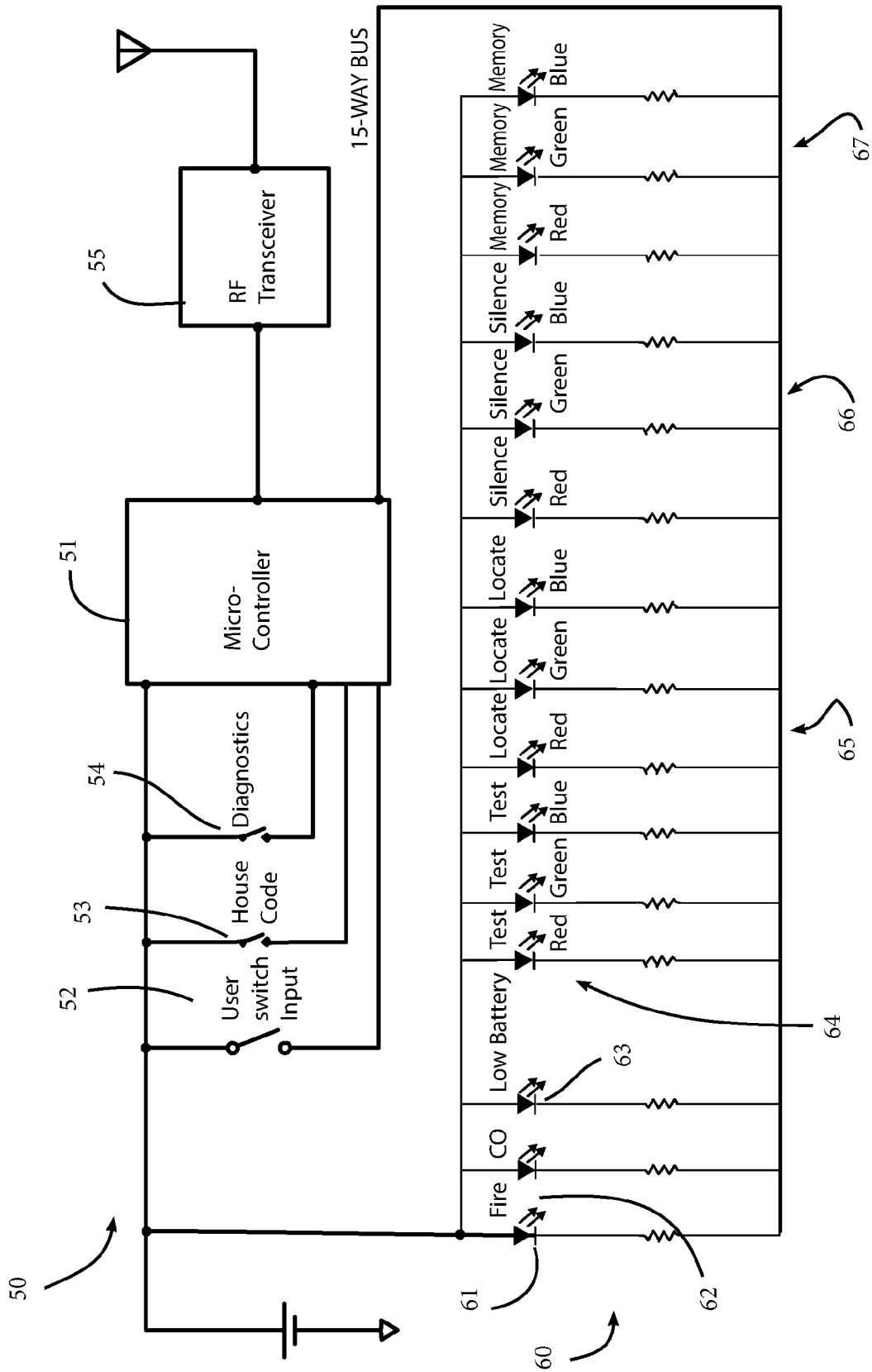


Fig.4

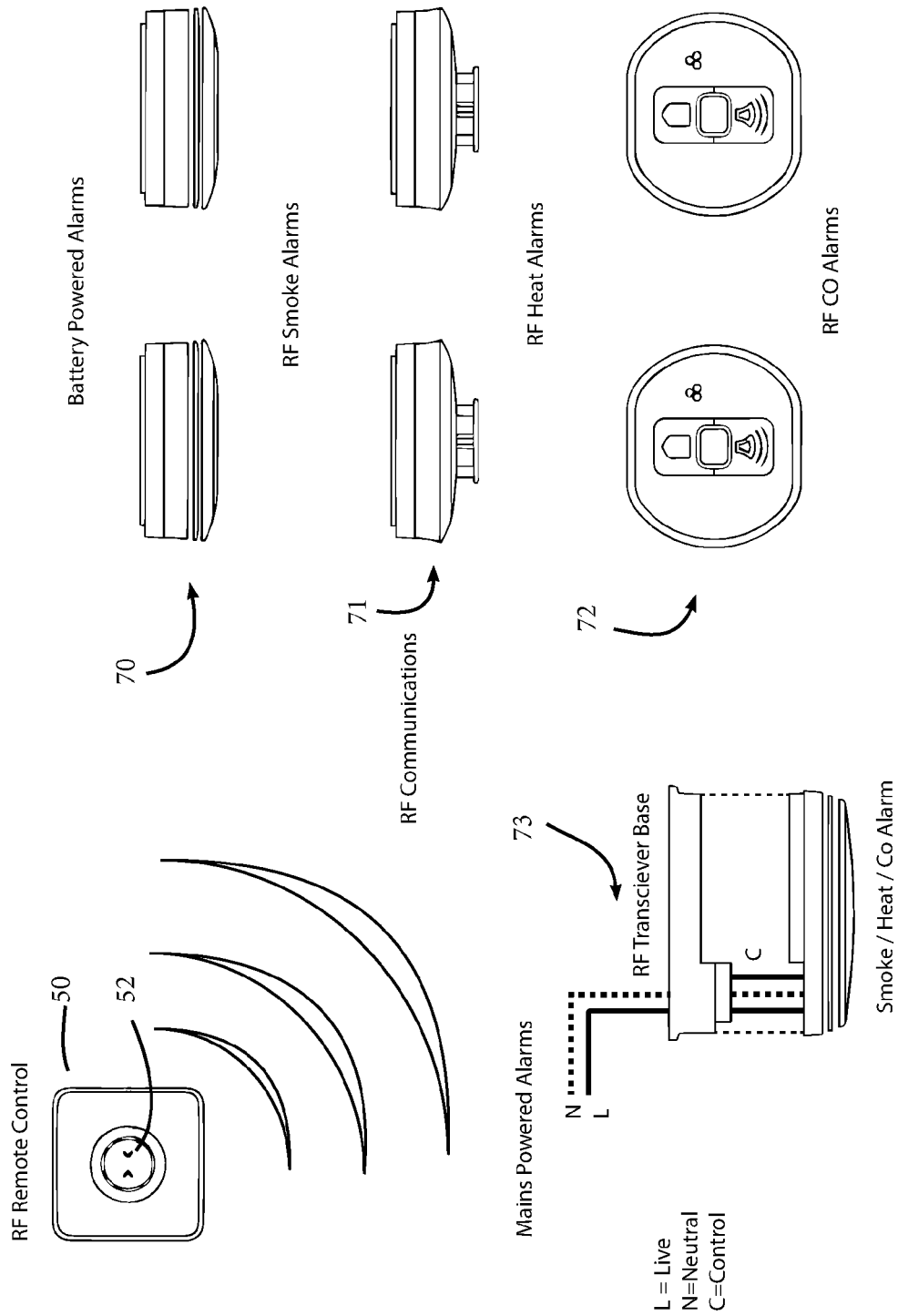


Fig.5

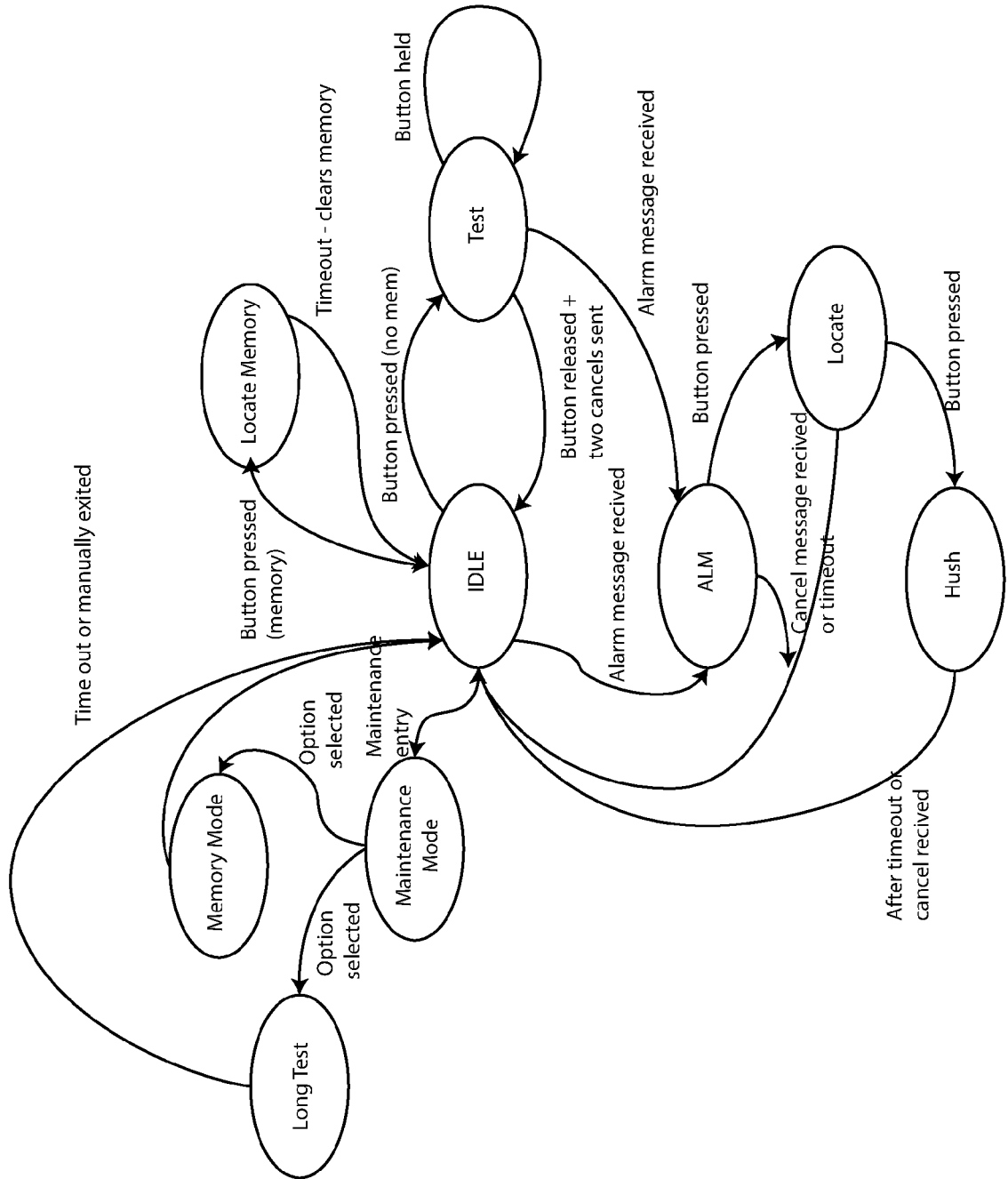


Fig.6

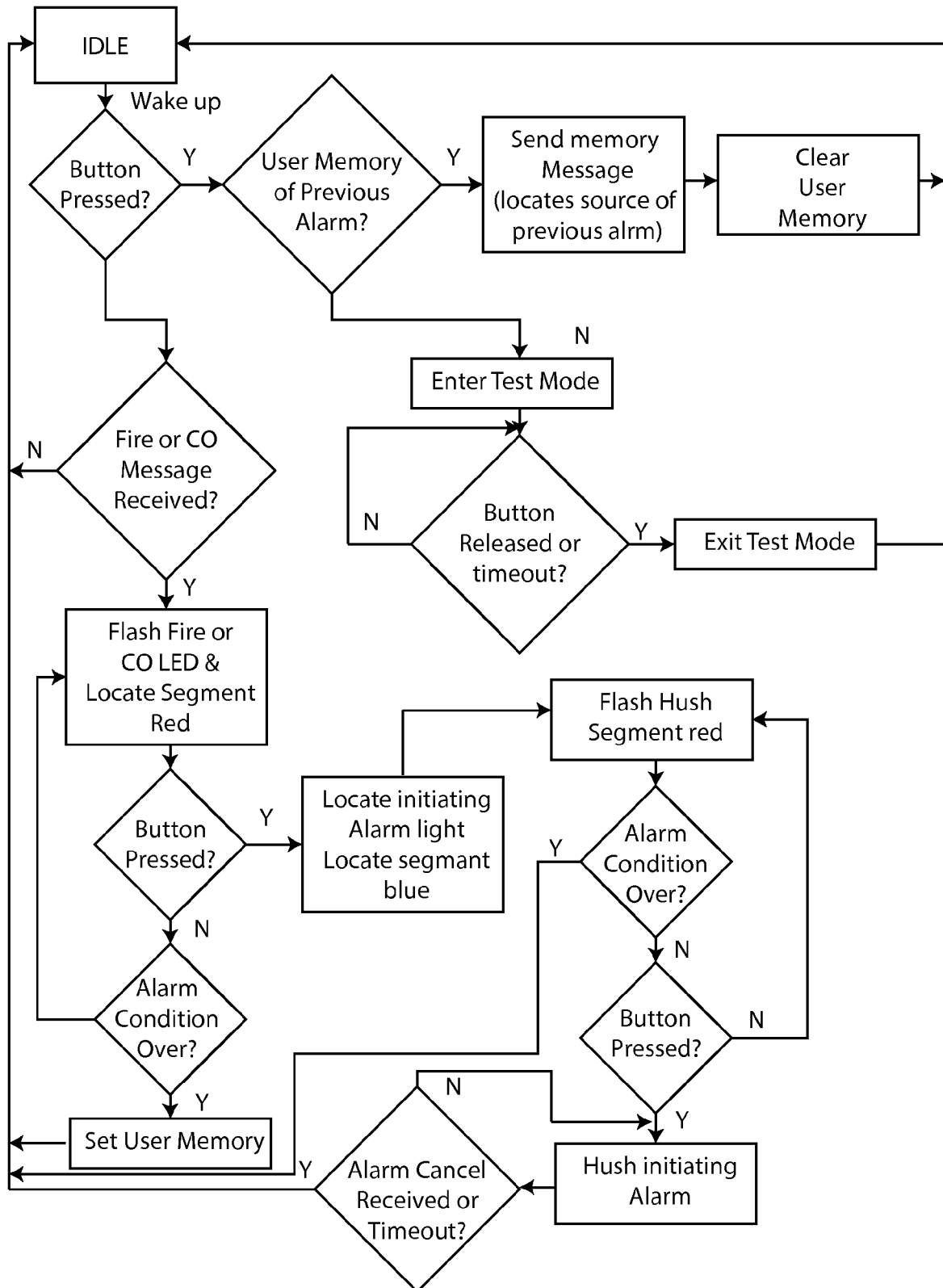


Fig.7

REFERENCES CITED IN THE DESCRIPTION

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