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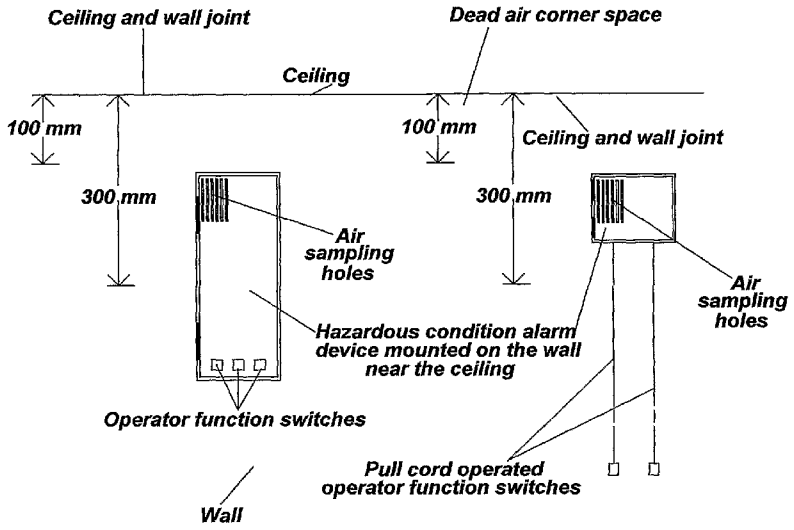
(54) **Title:** METHOD OF FACILITATING ACCESS TO OPERATOR FUNCTIONS OF HAZARDOUS CONDITION ALARM DEVICES



(57) **Abstract:** A method of facilitating access by an operator for the purpose of carrying out one or more operator functions of a hazardous condition alarm device mounted on or near the ceiling, the method including: lowering the height above the floor at which the operator functions can be carried out.

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METHOD OF FACILITATING ACCESS TO OPERATOR FUNCTIONS OF HAZARDOUS CONDITION ALARM DEVICES

Introduction

This invention relates to hazardous condition alarm devices mounted on or near the ceiling as used in buildings, caravans, motor homes and boats to provide a warning when a hazardous condition such as that associated with the presence of fire, poisonous gas or combustible gas is detected, and to a method of facilitating access to operator functions of these alarm devices.

A number of terms and expressions are used herein and their meanings in relation to hazardous condition alarm devices of this invention are given below.

Alarm device: a hazardous condition alarm device.

Alarm device silencing facility: the silencing facility of a hazardous condition alarm device is useful for deactivating the audible and/or visual warning provided by the alarm device when a hazardous condition is detected or in the event of a false or nuisance alarm. The silencing function of a hazardous condition alarm device is usually activated by operating a momentary action normally open alarm device silence switch.

Alarm device test facility: the test facility of a hazardous condition alarm device allows the manual testing of the detector and warning functions of the alarm device. The test function of a hazardous condition alarm device is usually activated by operating a momentary action normally open alarm device test switch.

Alarm mode: condition of an alarm device when a hazardous condition has been detected. The alarm mode is characterised by the emission of a warning, audible and/or visual, to alert occupants of the hazardous condition.

Dual supply alarm device: a hazardous condition alarm device operating from two power sources, namely a primary power supply such as mains electricity supply and a standby

battery power supply for powering the alarm device when the primary power supply is not available or has failed. Dual supply alarm devices are generally more reliable when compared to single supply alarm devices since the loss of one power supply, for example mains primary power supply as a result of an electrical fault, does not result in the hazardous condition alarm device becoming inoperative. However, dual supply alarm devices are generally more expensive when compared to single supply alarm devices.

Facilitate: make easier or less difficult.

Extension: in relation to a hazardous condition alarm device of this invention, the word extension is to be taken to mean an increase in the physical dimensions of the hazardous condition alarm device such as an increase in length or height of the device.

Hazardous condition: the presence of smoke, heat, carbon monoxide, poisonous gas or combustible gas.

Hazardous condition alarm device: a smoke, heat, carbon monoxide, poisonous or combustible gas detector incorporating an audible and/or visual device to warn occupants when a hazardous condition is detected.

Hazardous condition alarm system: a system comprising of one or more hazardous condition alarm devices, a common single power supply source or a common dual power supply source, and a common control panel/box.

Low battery alarm: a brief warning, usually in the form of a single chirp, emitted to warn of a low battery condition when the battery of a hazardous condition alarm device is automatically tested in self-test mode.

Low battery pre-alarm: a brief warning, usually in the form of a single chirp, emitted to warn of an impending low battery condition when the battery of a hazardous condition alarm device is automatically tested in self-test mode. The low battery pre-alarm warning is provided when the battery of a hazardous condition alarm device has depleted to a level that is close, but slightly higher than that required to generate a low battery alarm.

The low battery pre-alarm facility of hazardous condition alarm devices is operable in an active mode in which the low battery pre-alarm warning is emitted when the required level of battery depletion is reached, and a bypass mode in which the low battery pre-alarm facility is deactivated and any low battery pre-alarm warning is silenced. The two modes of operation of the low battery pre-alarm facility are selectable by operating a two position active/bypass switch.

Operator: person carrying out the operator functions of a hazardous condition alarm device. The operator is usually a building occupant.

Operator function: a function carried out by building occupants and operators including testing the functionality of a hazardous condition alarm device, silencing the warning provided by an alarm device when a hazardous condition is detected or when there is a false or nuisance alarm, bypassing the low battery pre-alarm facility of a hazardous condition alarm device when a warning of an impending low battery condition is provided, or replacing and installing the battery of a hazardous condition alarm device when a low battery condition exists and a low battery alarm is provided.

Operator function switch: a switch used for the purpose of carrying out an operator function of a hazardous condition alarm device.

Pendant: hanging or suspended.

Primary power supply: power supply supplying power to a hazardous condition alarm device at all times except during periods when the primary power supply is not available or has failed.

Quiescent mode: normal silent operating condition of a hazardous condition alarm device when the alarm device is not in alarm mode or self-test mode.

Self-test mode: brief and periodic automatic testing of the battery of a hazardous condition alarm device to determine its condition. In this mode, and if the battery is found to be

low or defective, a brief warning, usually in the form of a single chirp, is emitted to warn of the low or defective battery condition.

Single supply alarm device: a hazardous condition alarm device operating from only one power source such as a battery power source or mains electricity power supply. Single supply alarm devices are less expensive when compared to dual supply alarm devices. Furthermore, battery operated single supply alarm devices such as battery operated smoke alarms are generally of very low cost.

Smoke alarm: a hazardous condition alarm device that is responsive to the presence of smoke.

Standby battery power supply: battery power supply supplying power to a hazardous condition alarm device only when the primary power supply is not available or has failed.

Background

Hazardous condition alarm devices are used extensively in boats, caravans, motor homes, dwellings, motels, hotels, hostels, hospitals, old people's homes and other commercial premises to detect hazardous conditions such as a fire or the presence of poisonous or combustible gases, and to warn occupants when a hazardous condition is detected. With many types of hazardous condition alarm devices, for example alarm devices responsive to natural gas, carbon monoxide, heat and smoke, it is essential to locate the alarm devices on or near the ceiling to ensure the fastest response when a hazardous condition exists. For this reason, manufacturers of hazardous condition alarm devices responsive to natural gas, carbon monoxide, heat and smoke recommend that these alarm devices are installed on or near the ceiling generally in accordance with **Fig.1**. Thus, according to the same manufacturers recommendations, particular care is required during alarm device installation so as not to locate the alarm devices on the ceiling any closer than 100 mm from the wall and ceiling joint, in the dead air corner space extending 100 mm vertically and horizontally from the wall and ceiling joint where natural gas, carbon monoxide, smoke or heat may not reach, or on the wall any lower than 300 mm below the wall and ceiling joint.

Because hazardous condition alarm devices are important life safety devices, they usually have provisions for enabling one or more operator functions to be carried out so as to ensure that the alarm devices continue to operate reliably over their design life, to minimise the inconvenience to occupants of false or nuisance alarms or to enhance the use and performance of the alarm devices. The importance and usefulness of the operator functions of hazardous condition alarm devices are as follows:

Battery replacement and installation

The brief low battery alarm warning, emitted by a hazardous condition alarm device to warn of a low battery condition when the battery is automatically tested in self-test mode, serves as a prompt for occupants to replace the battery of the alarm device. Irrespective of whether the hazardous condition alarm device operates from a single battery supply or a dual power supply that includes a standby battery, timely replacement of the battery of the hazardous condition alarm device by occupants when a low battery alarm is provided is essential to ensure that the reliability of the alarm device is not compromised and that the level of safety afforded by the alarm device is maintained.

Testing of hazardous condition alarm device

The manual testing of a hazardous condition alarm device allows the person carrying out the test to determine whether the detecting and warning functions of the alarm device are operating as intended. Therefore, regular testing of the hazardous condition alarm device by occupants is essential to ensure that the reliability of the alarm device is not compromised and that the level of safety afforded by the alarm device is maintained.

False or nuisance alarm silencing

It is well known that in many environments where hazardous condition alarm devices are installed the alarm devices are subjected to high rates of false or nuisance alarms as a result of non-hazardous activities generating products to which the alarm devices are responsive. A typical example of this problem is the response of smoke alarms installed in dwellings to smoke from burning toast, aerosols from cooking activities, steam and other non-threatening products

present in domestic environments. A high incidence of false or nuisance alarms can discourage building occupants from using hazardous condition alarm devices to protect themselves, or for those who have been subjected to such incidents, the unsafe practice of disabling alarm devices by disconnecting them from their power supply sources is common and often results in occupants being left exposed and at risk.

Therefore, by silencing the warning provided by hazardous condition alarm devices for a short period of time during which occupants can intervene and clear the source of any false or nuisance alarm, the silencing function of hazardous condition alarm devices is an important feature for the effective management of false or nuisance alarms by occupants. Thus, the silencing facility of hazardous condition alarm devices has a positive impact on life safety of occupants as it reduces the likelihood of alarm devices being disabled, and that of prospective users of alarm devices refraining from using such devices for their protection, as a result of the high incidence of false or nuisance alarms.

Low battery pre-alarm bypassing

An active low battery pre-alarm facility of a hazardous condition alarm device provides occupants with a warning of an impending low battery condition so that, if a battery is not immediately available when the low battery pre-alarm is emitted, the low battery pre-alarm facility can be bypassed to silence the warning. Thus, occupants receive prior warning, several hours or days in advance, of an impending low battery condition. During this time, occupants can procure themselves of a new battery to replace the one in use without having to resort to the unsafe practices of battery removal and disconnection/turning off of the power sources supplying the hazardous condition alarm device, or suffer the inconvenience of an ongoing audible warning being emitted.

Access by occupants for carrying out operator functions

Although the above mentioned operator functions are essential for the proper operation of hazardous condition alarm devices and/or are important to life safety, current alarm device designs incorporating operator function switches and batteries have the disadvantage that access to these switches and batteries can be difficult when the alarm devices are mounted on or near

the ceiling as recommended by manufacturers to ensure fast alarm device response. This problem arises from the fact that for a large proportion of building occupants who are not tall, the height above the floor at which occupants can carry out the operator functions of hazardous condition alarm devices, mounted on or near the ceiling, is excessive resulting in the operator functions being inaccessible and inoperable by those occupants. In many cases, the problem of the lack of access for carrying out operator functions results in building occupants becoming frustrated and simply disabling alarm devices by disconnecting them from their power supply sources leaving them exposed and at risk. In other cases, building occupants resort to climbing on items of furniture, as a proper ladder is not always available, to operate operator function switches or replace batteries of hazardous condition alarm devices and they do so at considerable risk of injury to themselves.

The problems associated with difficult access to operator function switches and batteries of hazardous condition alarm devices installed on or near the ceiling are made worse if the building occupant is a person with a disability, for example somebody who is wheelchair bound, or if the occupant is an elderly person, is frail, or is under the influence of alcohol, drugs or medication when balance may be a problem.

It is to be noted that, in recognition of the above described accessibility problems associated with operator function switches and batteries of hazardous condition alarm devices, some manufacturers offer solutions that, whilst solving the accessibility problems previously identified, the solutions are themselves problematic and disadvantageous in many ways. These solutions are as follows:

- A type of hazardous condition alarm device, namely a smoke alarm marketed under the brand name of FireAngel, is designed for installation into a light socket of a normal mains powered switched electrical light circuit. The hazardous condition alarm device is designed in such a way that regular alarm device testing is carried out by turning power on and off to the alarm device once by operating the switch controlling the light circuit. Similarly, turning power on and off to the hazardous condition alarm device twice activates the silencing facility of the alarm device. The FireAngel design also

incorporates a rechargeable standby power source which is kept charged whenever mains power to the smoke alarm is switched on.

Although the FireAngel design provides access to the silencing and manual testing operator functions of the smoke alarm, the design is problematic as it allows the operator silencing and testing functions to be performed only when mains electricity supply is available. Furthermore, for safety reasons many codes and standards around the world do not allow smoke alarms to be installed on switched electrical circuits as it is possible for these circuits to remain de-energised for very long periods. The disadvantage with the FireAngel design is that during these long periods when the electrical circuit is de-energised the backup power source may completely be depleted to result in the smoke alarm becoming inoperative.

Another disadvantage of the FireAngel smoke alarm design is that, when installed in a light socket, the smoke alarm and the light bulb are co-located. This arrangement is not in accordance with most installation standards and manufacturer's recommendations that require smoke alarms to be kept away from light fittings as the heat released by light bulbs can interfere with the movement of smoke and the performance of the smoke alarm. A further disadvantage of the FireAngel design is that the smoke alarms must always be operated from mains supply and low cost single supply battery operated smoke alarms of this design are not possible.

- Some manufacturers of hazardous condition alarm devices offer remote alarm device testing and silencing switches that are connected to the alarm devices by electrical wiring. Thus, these switches can be mounted at a convenient height on a wall and the alarm device testing and silencing operator functions can then be carried out from the installed switch locations.

  The disadvantage of remote mounted operator function switches of hazardous condition alarm devices is that it is not always possible to install wiring to wall mounted switches in existing buildings due to access problems. Even where it is possible to install wiring in walls of existing buildings, and in new buildings, wiring to wall mounted remote

operator function switches is more often than not a specialised task requiring the services of a wiring specialist. Therefore, the installation of the remote wall mounted operator function switches is disadvantageous in that it is often expensive to carry out.

A further disadvantage of remotely wired operator function switches is that the hazardous condition alarm devices are no longer self-contained which, in at least the case of single supply battery operated hazardous condition alarm devices, would discourage installation by the vast majority of potential users of such alarm devices who are do-it-yourself type installers.

- The remote control of the operator functions of hazardous condition alarm devices is now being offered by some manufacturers so as to overcome the accessibility problems associated with the testing and silencing of alarm devices by building occupants. Thus, one manufacturer offers smoke alarms incorporating a photoelectric cell, and a light from a torch directed at the photoelectric cell is used as a signal for initiating alarm device testing. In smoke alarms of another brand, the alarm devices include infrared receiver circuits that are activated by a hand held infrared transmitter to remotely silence and test the alarm devices.

  A disadvantage of remote control operator functions of hazardous condition alarm devices is that reliance is placed on an additional piece of powered equipment, the torch or the infrared transmitter, for carrying out the important functions of alarm device silencing and testing, equipment that may not be available when required if it is misplaced or lost. Another disadvantage of remote control operator functions of hazardous condition alarm devices is that the required torch or infrared transmitter is powered by batteries whose condition are not normally monitored, and therefore there is a real risk that the torch or transmitter fails to operate when required due to flat or missing batteries. A further disadvantage of the remote control operator functions of hazardous condition alarm devices is that, in a building where a number of alarm devices may be installed, generally only one torch or infrared transmitter will be available. With such an arrangement, and in the event of a false or nuisance alarm that requires the silencing of one particular alarm device, the torch or transmitter may be

quite remote from the alarm device to be silenced and therefore inconvenient long delays before silencing are possible.

Summary of the Invention

This invention, in one aspect, resides broadly in a method of facilitating access by an operator for the purpose of carrying out one or more operator functions of a hazardous condition alarm device mounted on or near the ceiling, said operator functions consisting of operating an alarm device test switch, operating an alarm device silence switch, operating an alarm device low battery pre-alarm active/bypass switch, or replacing an alarm device battery, the method including:

lowering the height above the floor at which the operator functions of the hazardous condition alarm device can be carried out.

It will be appreciated that, for various reasons, any one hazardous condition alarm device of this invention may not have all the above mentioned operator functions. Some of these reasons are listed below.

- Although the hazardous condition alarm device test function is usually found in all alarm devices as it is a compulsory requirement of many relevant codes and standards, the other operator functions associated with alarm device silencing and the low battery pre-alarm activation and bypassing, although very useful, are optional functions that may or may not be provided in hazardous condition alarm devices of this invention.

- Some hazardous condition alarm devices of this invention may have long-life batteries that are designed to last the full life of the alarm device and therefore battery replacement by the operator is not necessary.

- Some hazardous condition alarm devices of this invention may form part of a central hazardous condition alarm system in which the battery power supply is common to all the system's alarm devices. In such cases, the system's alarm devices do not usually have batteries as these would normally be located remotely as part of the system's

central control panel/box. Therefore, battery replacement is usually not a required operator function of alarm devices forming part of a hazardous condition alarm system incorporating hazardous condition alarm devices of this invention.

- Some single supply hazardous condition alarm devices of this invention may not require batteries for their operation. An example of such an alarm device is one that does not have a battery backup supply and operates from mains power supply only. Therefore, battery replacement is not a required operator function of these single supply alarm devices of this invention.

The lowering of the height above the floor at which the operator functions of hazardous condition alarm devices of this invention can be carried out can be effected by various means to achieve the desired result. In one preferred embodiment of the invention, the hazardous condition alarm device incorporates several operator function switches including an alarm device test switch, an alarm device silence switch, and an alarm device low battery pre-alarm active/bypass switch, and the height above the floor at which the operator function switches are located and operable is lowered by using operator function switches that are pull cord operated.

In another preferred embodiment of the invention, the hazardous condition alarm device incorporates a battery and several operator function switches including an alarm device test switch, an alarm device silence switch, and an alarm device low battery pre-alarm active/bypass switch, and the height above the floor at which the operator function switches are located and operable and that at which the battery can be accessed is lowered by:

extending the hazardous condition alarm device such that, when the alarm device is mounted on or near the ceiling, the extension is towards the floor, and

locating the operator function switches and the battery of the hazardous condition alarm device in the extended section of the hazardous condition alarm device to reduce the height above the floor at which the battery can be accessed and that at which the operator function switches are located and operable.

It must be realised that the extension of the hazardous condition alarm device can take various forms. Thus, the extension can be an integral part of the hazardous condition alarm device, or the extension can be a separate base or plate cooperatively mounted with the hazardous condition alarm device to allow wiring and connections to any one or more operator function switches and/or alarm device battery located in the extension. In the latter case, once the hazardous condition alarm device and the base or plate are cooperatively mounted in a final installed position, the alarm device and the base or plate become indistinguishable and the hazardous condition alarm device is to be taken to be the complete installed extended assembly.

In yet another preferred embodiment of the invention, the hazardous condition alarm device incorporates a battery and several operator function switches including an alarm device test switch, an alarm device silence switch, and an alarm device low battery pre-alarm active/bypass switch, and the height above the floor at which the operator function switches are located and operable and that at which the battery can be accessed is lowered by:

constructing the alarm device so as to have an upper hazardous condition sensing section, for mounting at or near the ceiling, and a lower alarm device section;

locating the operator function switches and the battery of the hazardous condition alarm device in the lower alarm device section to reduce the height above the floor at which the battery can be accessed and that at which the operator function switches are located and operable.

It is to be realised that the lower control section of the hazardous condition alarm device can take various forms without departing from the scope and intent of this invention, namely:

- the lower control section of the hazardous condition alarm device may be of the pendant type, the lower control section being suspended unattached at the end of a cable which is used for electrically connecting it to the upper sensing section of the hazardous condition alarm device;

- the upper sensing section and the lower control section of the hazardous condition alarm device may be wall mounted with the cable connecting the two sections exposed and visible;

- the upper sensing section and the lower control section of the hazardous condition alarm device may be wall mounted with the cable connecting the two sections being concealed behind a cover plate or in a piece of ducting.

In another aspect the invention resides broadly in a hazardous condition alarm device including:

(a) any one or more of the following:

a battery;

an alarm device test switch;

an alarm device silence switch;

an alarm device active/bypass, and

(b) height lowering means for lowering the height above the floor at which the battery can be accessed and that at which the operator function switches are located and operable, and wherein:

(c) said height lowering means includes:

(i) means for extending said hazardous condition alarm device such that, when the alarm device is mounted on or near the ceiling, the extension is towards the floor, and

(ii) means for locating the battery and the operator function switches of the hazardous condition alarm device in the extension of the alarm device to reduce the height above the floor at which the battery can be accessed and that at which the operator function switches are located and operable.

In another aspect the invention resides broadly in a hazardous condition alarm device including:

(a) any one or more of the following:

a battery;

an alarm device test switch;

an alarm device silence switch;

an alarm device active/bypass, and

(b) height lowering means for lowering the height above the floor at which the battery can be accessed and that at which the operator function switches are located and operable, and wherein:

(c) said height lowering means includes:

(i) means for providing an upper hazardous condition sensing section of the alarm device for mounting on or near the ceiling;

(ii) means for providing a lower alarm device section;

(iii) electrical connecting means for providing electrical connections between the upper hazardous condition sensing section and the lower alarm device section, and

(iv) means for locating the battery and the operator function switches of the hazardous condition alarm device in the lower alarm device section to reduce the height above the floor at which the battery can be accessed and that at which the operator function switches are located and operable.

In another aspect the invention resides broadly in a hazardous condition alarm device that is suitable for mounting on or near the ceiling and including any one or more operator

function switches such as an alarm device test switch, an alarm device silence switch, an alarm device active/bypass, and wherein the operator function switches are pull cord operated.

In yet another aspect the invention resides broadly in a hazardous condition alarm device including:

(a) an upper hazardous condition sensing section suitable for mounting on or near the ceiling;

(b) a lower alarm device section that includes any one or more of the following:

a battery;

an alarm device test switch;

an alarm device silence switch;

an alarm device active/bypass, and

(b) electrical connections for connecting the upper hazardous condition sensing section and the lower alarm device section.

The lower section of the alarm device can be of the pendant type or the lower section may be fixed to an element of building structure such as a wall.

Preferred Embodiments of the Invention

The method and the hazardous condition alarm devices of this invention are best explained by referring to the following preferred embodiments. However, the preferred embodiments described in the following subsections of this specification, and illustrated by the accompanying drawings, are merely illustrative of how the invention might be put into effect and are not to be understood to be limiting on the invention. For example, all preferred embodiments described relate to hazardous condition alarm devices that are single supply battery operated smoke alarms although the method of this invention applies equally to dual

supply smoke alarms and to other hazardous condition alarm devices sensing hazardous products other than smoke. Furthermore, although the preferred embodiments may require several operator functions to be carried out, it is to be understood that other practical examples of hazardous condition alarm devices of this invention may only require one or only some, but not all, of the operator functions to be carried out.

Fig.1 is a typical section of a protected room showing the ceiling to wall dead air corner space extending 100 mm vertically and horizontally from the ceiling and wall joint, and in which manufacturers recommend that hazardous condition alarm devices not be installed. **Fig.1** also identifies areas along the ceiling and wall where manufacturers recommend that hazardous condition alarm devices be installed to ensure the best possible alarm device response when a hazardous condition exists.

First Preferred Embodiment

The first preferred embodiment overcomes the accessibility problems associated with the operation of hazardous condition alarm device operator function switches by persons with a permanent disability, such as those who are wheelchair bound. However, the difficulties overcome by the first preferred embodiment of this invention would equally benefit other persons who are not tall, the elderly and those who are frail or are under the influence of alcohol, drugs or medication when balance may be a problem.

The first preferred embodiment is as depicted by **Fig.2** and **Fig.3** which provide a side view and a front view respectively of a single supply battery operated smoke alarm **SA** mounted within the recommended portion of the wall extending from 100 mm to 300 mm below the ceiling and wall joint. The smoke alarm **SA** incorporates an alarm device test switch and an alarm device silence/hush switch that are operable using the pull cord **PC** of each of the alarm device operator function switches. Each pull cord **PC** has a small weight **W** at its end to ensure that each pull cord hangs taught for improved visual appearance. Referring to **Fig.3**, it can be seen that the smoke alarm **SA** has a front hinged cover **HC** having openings **O** to allow air and smoke to reach the sensor of the smoke alarm mounted on the printed circuit board of the alarm

device. The hinged cover **HC** of the smoke alarm **SA** is connected to the smoke alarm casing **C** through hinges **H**.

Further construction details of the smoke alarm **SA** of the first preferred embodiment are as per **Fig.4** which provides a front view of the smoke alarm with the front hinged cover **HC** in open position. Thus, it can be seen that in the first preferred embodiment the smoke alarm printed circuit board **CB** and the smoke alarm battery **B**, held in battery holder **BH**, are mounted on the inner face of the hinged cover **HC** connected to the smoke alarm casing **C** by hinges **H**. The smoke alarm casing **C** is fixed to the wall by mounting screws **MS** and contains pull cord switches **PCS1** and **PCS2** for silencing and testing the smoke alarm respectively. Pull cord switches **PCS1** and **PCS2** are connected to pull cords **PC** and weights **W** in the usual way, the pull cords **PC** hanging down below the smoke alarm casing **C** through openings in the lower part of the casing **C**. **Fig.4** also shows cables **CA** for electrically connecting the pull cord switches **PCS1** and **PCS2** and battery **B** to the smoke alarm printed circuit board **CB**.

Since the pull cords **PC** of the smoke alarm **SA** depicted by **Fig.2**, **Fig.3** and **Fig.4** extend below the wall mounted smoke alarm **SA**, the pull required on the pull cords to operate the smoke alarm test and silence/hush switches can be applied at a height above the floor that is less than that above the floor at which the smoke alarm **SA** is mounted. Thus, the provision of pull cord operated smoke alarm test and silence/hush switches lowers the height above the floor at which these operator function switches of the smoke alarm **SA** are located and operable.

A variation of the first preferred embodiment of this invention is as shown in **Fig.5** and **Fig.6** which are side and front views respectively of a ceiling mounted smoke alarm **SA** incorporating pull cords **PC** and weights **W** associated with the smoke alarm test and silence/hush switches. **Fig.5** and **Fig.6** show the smoke alarm **SA** installed on the ceiling in a location that is more than 100 mm from the ceiling wall joint as recommended by manufacturers. The testing and silencing operator functions of the ceiling mounted smoke alarm **SA** are carried out in a manner identical to that previously described for the first preferred embodiment.

Second Preferred Embodiment

The second preferred embodiment overcomes the accessibility problems associated with the operation of hazardous condition alarm device operator function switches and battery replacement by persons who are not tall, the elderly and those who are frail or are under the influence of alcohol, drugs or medication when balance may be a problem.

The second preferred embodiment is as depicted by **Fig.7**, **Fig.8** and **Fig.9** which provide a front view, a side view and a second front view with hinged cover open respectively of a hazardous condition alarm device that is a single supply battery operated smoke alarm. According to **Fig.7**, the smoke alarm **SA** is mounted on the recommended portion of the wall extending from 100 mm to 300 mm below the ceiling and wall joint. The smoke alarm **SA** incorporates an alarm device test switch **TS**, an alarm device silence/hush switch **SS** and a low battery pre-alarm active/bypass switch **LBPS** that are all grouped in the lower section of the front hinged cover **HC** of the smoke alarm **SA**. The upper section of smoke alarm **SA** includes openings **O** to allow air and smoke to reach the sensor of the smoke alarm **SA** mounted on the printed circuit board of the alarm device. The hinged cover **HC** of the smoke alarm **SA** is connected to the smoke alarm casing **C** through hinges **H**.

Fig.8 provides a side view of the smoke alarm **SA** mounted on the wall so that the smoke sensor of the alarm device, located within the upper section of the smoke alarm **SA**, is mounted on the portion of the wall extending from 100 mm to 300 mm below the ceiling and wall joint as recommended by manufacturers. **Fig.8** also shows the operator function switches **OFS** protruding through the lower section of smoke alarm **SA**.

Further construction details of the smoke alarm **SA** of the second preferred embodiment are as per **Fig.9** which provides a front view of the smoke alarm **SA** with the front hinged cover **HC** in open position. Thus, it can be seen that in the second preferred embodiment of the invention the smoke alarm main printed circuit board **CB1** incorporating the smoke alarm sensor and the operator function switches printed circuit board **CB2** are mounted on the upper and lower sections respectively of the inner face of the hinged cover **HC** connected to the smoke alarm casing **C** by hinges **H. Fig.9** also shows the smoke alarm battery **B** and battery

holders **BH** for holding the smoke alarm battery **B** and a spare battery, when available and located in spare battery space **SBS**, all contained within the lower section of the smoke alarm casing **C**. The arrangement of **Fig.9** shows the casing **C** of the smoke alarm **SA** fixed to the wall by mounting screws **MS** and cables **CA** for electrically connecting the operator function switches printed circuit board **CB2** and the smoke alarm battery **B** to the smoke alarm main printed circuit board **CB1**.

It can be seen from the previous description of **Fig.7** through to **Fig.9** that the lower section of the smoke alarm **SA** of the second preferred embodiment is in fact an extension of the smoke alarm so that, when the smoke alarm **SA** is in its installed position on the wall, the extension is towards the floor. Thus, locating the operator function switches within the lower extended portion of the smoke alarm **SA** ensures that the height above the floor at which the switches are located and operable is lowered. Similarly, locating the smoke alarm battery **B** and the spare battery, when available, in the accessible part of the lower extended portion of the smoke alarm **SA** reduces the height above the floor at which the batteries can be accessed when battery replacement is required.

A variation of the second preferred embodiment of this invention is as shown in **Fig.10**, **Fig.11** and **Fig.12** which are front, side and rear views respectively of a smoke alarm assembly mounted on the wall. **Fig.10** shows a smoke alarm assembly comprising of a plate **P**, a conventional smoke alarm **SA** incorporating air/smoke sampling openings **O**, a smoke alarm test switch **TS**, a low battery pre-alarm active/bypass switch **LBPS** and a smoke alarm silence/hush switch **SS**. The conventional smoke alarm **SA** is located on the upper section of the plate **P** so that when the smoke alarm assembly is in its final installed position on the wall, the smoke alarm is located on the recommended portion of the wall extending from 100 mm to 300 mm below the ceiling and wall joint. A second set of operator function switches to include a smoke alarm test switch **TS**, a low battery pre-alarm active/bypass switch **LBPS** and a smoke alarm silence/hush switch **SS** is located in the lower section of the plate **P** so that the switches protrude through the plate **P**. **Fig.10** also shows mounting screws **MS** that are used to mount the smoke alarm assembly on the wall.

Fig.11 shows a side view of the variation of the second preferred embodiment of this invention wherein the plate **P** of the smoke alarm assembly is spaced from the wall, when installed, using spacers **S**. According to **Fig.11**, the space between the plate **P** and the wall is used to accommodate a printed circuit board **CB** on which the operator function switches **OFS** are mounted. The smoke alarm battery **B** is held in place by a battery holder **BH** and cables **C1** and **C2**, also located in the space between the plate **P** of the smoke alarm assembly and the wall, are used to electrically connect the smoke alarm **SA** and the smoke alarm battery **B** to the operator function switches printed circuit board **CB**. The smoke alarm battery **B** and the spare battery, if available, can both be accessed by an operator through the open sides of the space between plate **P** of the smoke alarm assembly and the wall.

Fig.12 is a rear view of the smoke alarm assembly showing the four sets of screw holes **SH** and spacers **S** used for mounting and spacing the plate **P** from the wall. **Fig.12** shows the outline of the smoke alarm **SA** on the front upper section of the face of plate **P**, cable entry **CE** to allow electrical connection of the smoke alarm **SA** to the operator function switches printed circuit board **CB**, located in the lower section of the smoke alarm plate **P**, via cable **C1**. **Fig.12** also shows the smoke alarm battery **B** held in position by a battery holder **BH** which also has provision for holding a spare battery, if available, in the spare battery space **SBS**. Cable **C2** is used to electrically connect the smoke alarm battery **B** to the operator function switches printed circuit board **CB** which, together with battery holder **BH**, are fixed to the plate **P** of the smoke alarm assembly by screw sets **S1** and **S2** respectively.

It can be seen from the previous description of **Fig.10** through to **Fig.12** that the lower section of the smoke alarm **SA** of the variation of the second preferred embodiment is in fact an extension of the smoke alarm **SA** so that, when the smoke alarm assembly is in its installed position, it serves as an extension of the smoke alarm **SA** towards the floor. Thus, locating the operator function switches within the lower extended portion of smoke alarm assembly ensures that the height above the floor at which the switches are located and operable is lowered. Similarly, locating the smoke alarm battery **B** and the spare battery, when available, in the accessible part of the lower extended portion of smoke alarm assembly reduces the height above the floor at which the batteries can be accessed.

Third Preferred Embodiment

The third preferred embodiment overcomes the accessibility problems associated with the operation of hazardous condition alarm device operator function switches and battery replacement by persons who are not tall, the elderly and those who are frail or are under the influence of alcohol, drugs or medication when balance may be a problem.

The third preferred embodiment is as depicted by **Fig.13** which provides a front view of a single supply battery operated smoke alarm **SA** mounted on the recommended portion of the wall extending from 100 mm to 300 mm below the ceiling and wall joint. A pendant type control section **CS** is suspended unattached below the smoke alarm **SA** to which it is electrically connected by cable **CA**. The control section **CS** incorporates a smoke alarm test switch **TS**, an alarm device silence/hush switch **SS**, an alarm device low battery pre-alarm active/bypass switch **LBPS** and a smoke alarm battery contained in a battery compartment **BC** fitted with a removable cover **RC**. Thus the described arrangement of the third preferred embodiment of the invention comprises of an upper hazardous condition sensing section **SA** and a lower alarm device control section **CS** to house the smoke alarm battery and operator function switches, the upper and lower sections of the alarm device being electrically connected by cable **CA**.

It can be seen from the previous description of **Fig.13** that locating the operator function switches and the battery of the smoke alarm in the lower pendant type control section of the alarm device reduces the height above the floor at which the battery can be accessed and that at which the operator function switches are located and operable.

A number of variations of the third embodiment are possible without departing from the scope and intent of this invention. Thus, the lower control section of the smoke alarm assembly can be wall mounted, instead of being suspended unattached, with the cable **CA** remaining exposed. Alternatively, a cover **C** in the form of a plate or a piece of ducting may be used to join the smoke alarm **SA** and the control section **CS** so as to conceal cable **CA** as shown in **Fig.14**.

I claim:

1. A method of facilitating access by an operator for the purpose of carrying out one or more operator functions of a hazardous condition alarm device mounted on or near the ceiling, the method including:

lowering the height above the floor at which the operator functions can be carried out.

2. A method as claimed in claim **1** wherein the hazardous condition alarm device incorporates one or more operator function switches such as an alarm device test switch, an alarm device silence switch or an alarm device low battery pre-alarm active/bypass switch, and the height above the floor at which the operator function switches are located and operable is lowered by using operator function switches that are pull cord operated.

3. A method as claimed in claim **1** wherein the hazardous condition alarm device incorporates a battery and the height above the floor at which the battery can be accessed for replacement by an operator is lowered by:

extending the hazardous condition alarm device such that, when the alarm device is mounted on or near the ceiling, the extension is towards the floor, and

locating the battery in the said extension of the alarm device to reduce the height above the floor at which the battery can be accessed.

4. A method as claimed in claim **1** wherein the hazardous condition alarm device incorporates one or more operator function switches such as an alarm device test switch, an alarm device silence switch or an alarm device low battery pre-alarm active/bypass switch, and the height above the floor at which the operator function switches are located and operable is lowered by:

extending the hazardous condition alarm device such that, when the alarm device is mounted on or near the ceiling, the extension is towards the floor, and

locating the operator function switches in said extension of the alarm device to reduce the height above the floor at which the operator function switches are located and operable.

5. A method as claimed in claim **1** wherein the hazardous condition alarm device incorporates a battery, and the height above the floor at which the battery can be accessed for replacement by an operator is lowered by:

constructing the alarm device so as to have an upper hazardous condition sensing section, for mounting on or near the ceiling, and a lower alarm device section;

providing electrical connections between said upper and lower alarm device sections of the hazardous condition alarm device, and

locating said battery in the lower alarm device section to reduce the height above the floor at which the battery can be accessed.

6. A method as claimed in claim **1** wherein the hazardous condition alarm device incorporates one or more operator function switches such as an alarm device test switch, an alarm device silence switch or an alarm device low battery pre-alarm active/bypass switch, and the height above the floor at which the operator function switches are located and operable is lowered by:

constructing the alarm device so as to have an upper hazardous condition sensing section for mounting on or near the ceiling, and a lower alarm device section;

providing electrical connections, between said upper and lower alarm device sections, and

locating said operator function switches in the lower alarm device section to reduce the height above the floor at which the operator function switches are located and operable.

7. A method as claimed in claim **5** wherein said lower alarm device section is of the pendant type, and electrical connection means are used for suspending said lower alarm device section under said upper hazardous condition sensing section of the hazardous condition alarm device.

8. A method as claimed in claim **5** wherein said lower alarm device section is fixed to an element of building structure such as a wall.

9. A method as claimed in claim **6** wherein said lower alarm device section is of the pendant type, and electrical connection means are used for suspending said lower alarm device section under said upper hazardous condition sensing section of the hazardous condition alarm device.

10. A method as claimed in claim **6** wherein said lower alarm device section is fixed to an element of building structure such as a wall.

11. A hazardous condition alarm device including:

a battery, and

height lowering means for lowering the height above the floor at which the battery can be accessed for replacement by an operator when the alarm device is mounted on or near the ceiling.

12. A hazardous condition alarm device as claimed in claim **11** wherein said height lowering means includes:

means for extending said hazardous condition alarm device such that, when the alarm device is mounted on or near the ceiling, the extension is towards the floor, and

means for locating said battery in said extension of the alarm device to reduce the height above the floor at which the battery can be accessed.

13. A hazardous condition alarm device as claimed in claim **11** wherein said height lowering means includes:

means for providing an upper hazardous condition sensing section of said alarm device for mounting on or near the ceiling;

means for providing a lower section of said alarm device;

electrical connecting means for providing electrical connections between the upper hazardous condition sensing section and the lower section of said alarm device, and

means for locating said battery in the lower section of the alarm device to reduce the height above the floor at which the battery can be accessed.

14. A hazardous condition alarm device as claimed in claim **13** wherein said lower section of said alarm device is of the pendant type and said electrical connection means are used for suspending the lower alarm device section under the upper hazardous condition sensing section of said hazardous condition alarm device.

15. A hazardous condition alarm device as claimed in claim **13** wherein said lower alarm device section is fixed to an element of building structure such as a wall.

16. A hazardous condition alarm device including:

one or more operator function switches, and

height lowering means for lowering the height above the floor at which said operator function switches are located and operable when the alarm device is mounted on or near the ceiling.

17. A hazardous condition alarm device as claimed in claim **16** wherein said height lowering means includes:

means for extending said hazardous condition alarm device such that, when the alarm device is mounted on or near the ceiling, the extension is towards the floor, and

means for locating said operator function switches in said extension of the alarm device to reduce the height above the floor at which the operator function switches are located and operable.

18. A hazardous condition alarm device as claimed in claim **16** wherein said height lowering means includes:

means for providing an upper hazardous condition sensing section of said alarm device for mounting on or near the ceiling;

means for providing a lower section of said alarm device,

electrical connecting means for providing electrical connections between the upper hazardous condition sensing section and the lower section of said alarm device, and

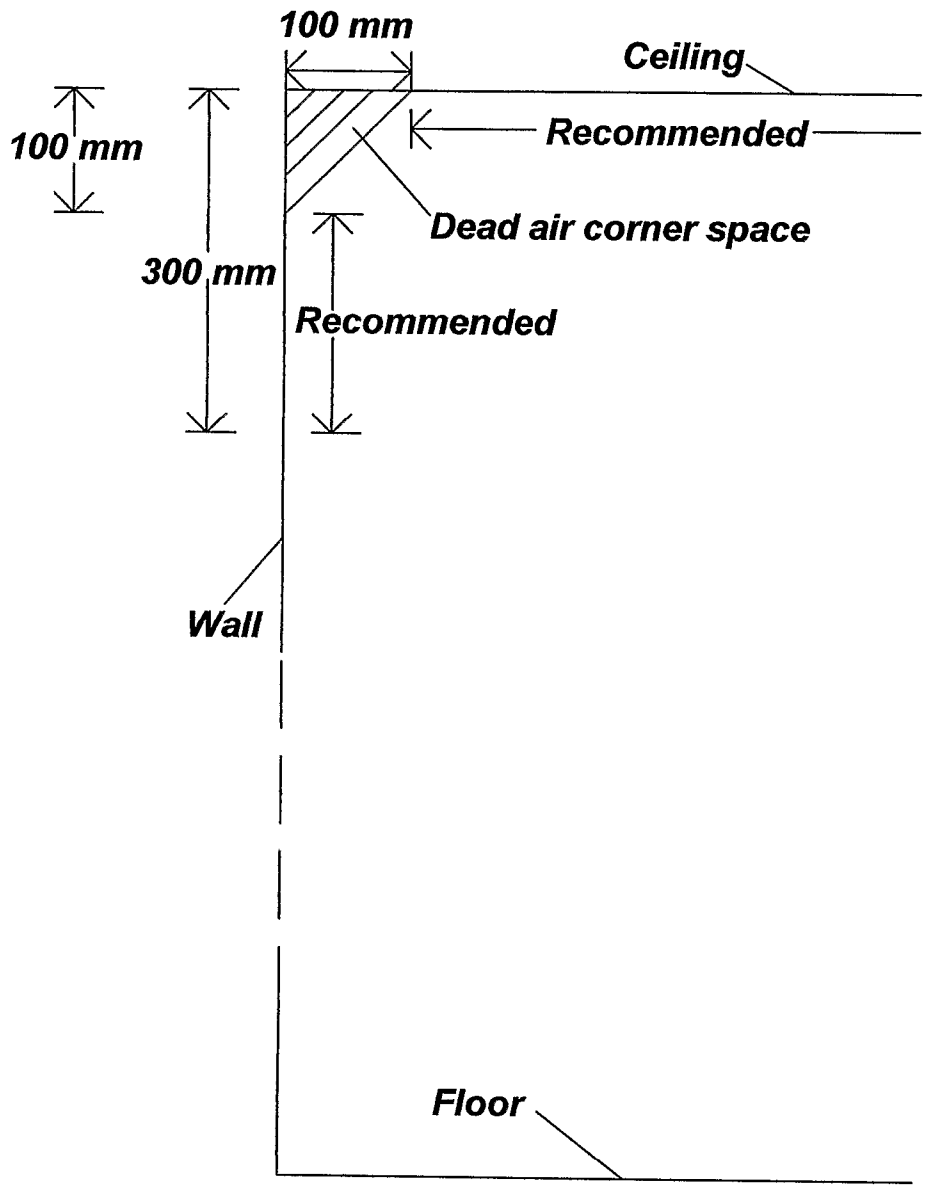
means for locating said operator function switches in the lower section of the alarm device to reduce the height above the floor at which the operator function switches are located and operable.

19. A hazardous condition alarm device as claimed in claim **18** wherein said lower section of said alarm device is of the pendant type and said electrical connection means are used for suspending the lower alarm device section under the upper hazardous condition sensing section of said hazardous condition alarm device.

20. A hazardous condition alarm device as claimed in claim **18** wherein said lower alarm device section is fixed to an element of building structure such as a wall.

21. A hazardous condition alarm device that is suitable for mounting on or near the ceiling and including one or more operator function switches that are pull cord operated.

22. A hazardous condition alarm device that is suitable for mounting on or near the ceiling and including one or more operator function switches that are of the pendant type.



Note: Manufacturers recommend that hazardous condition alarm devices that are responsive to natural gas, carbon monoxide, heat or smoke are installed on the ceiling no closer than 100 mm from the ceiling and wall joint, or on the wall between 100 mm and 300 mm below the ceiling and wall joint.

Fig. 1

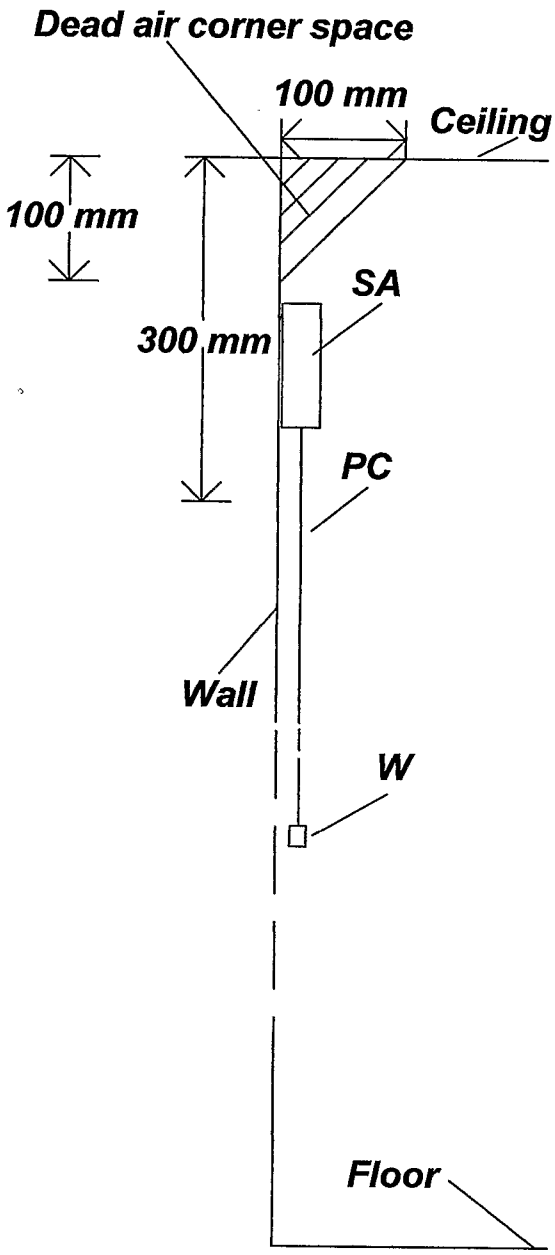

Dead air corner space
100 mm
Ceiling
100 mm
SA
300 mm
PC
Wall
W
Floor

Fig. 2

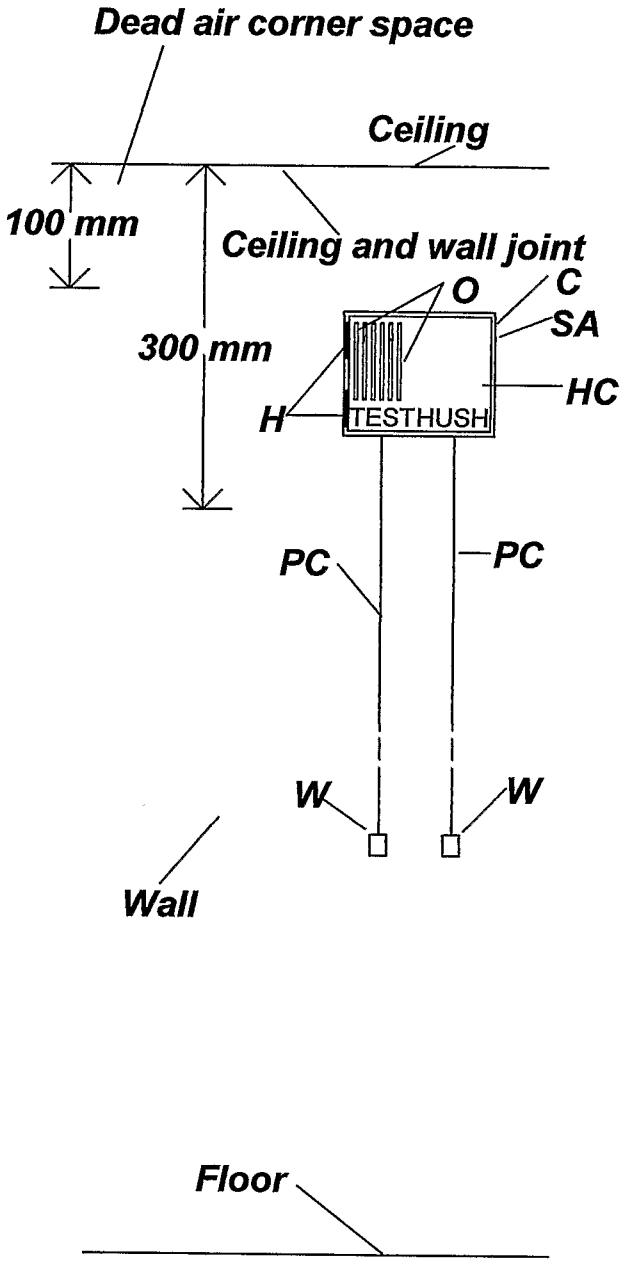

Dead air corner space
Ceiling
100 mm
Ceiling and wall joint
O
C
SA
300 mm
HC
H
TESTHUSH
PC
PC
W
W
Wall
Floor

Fig. 3

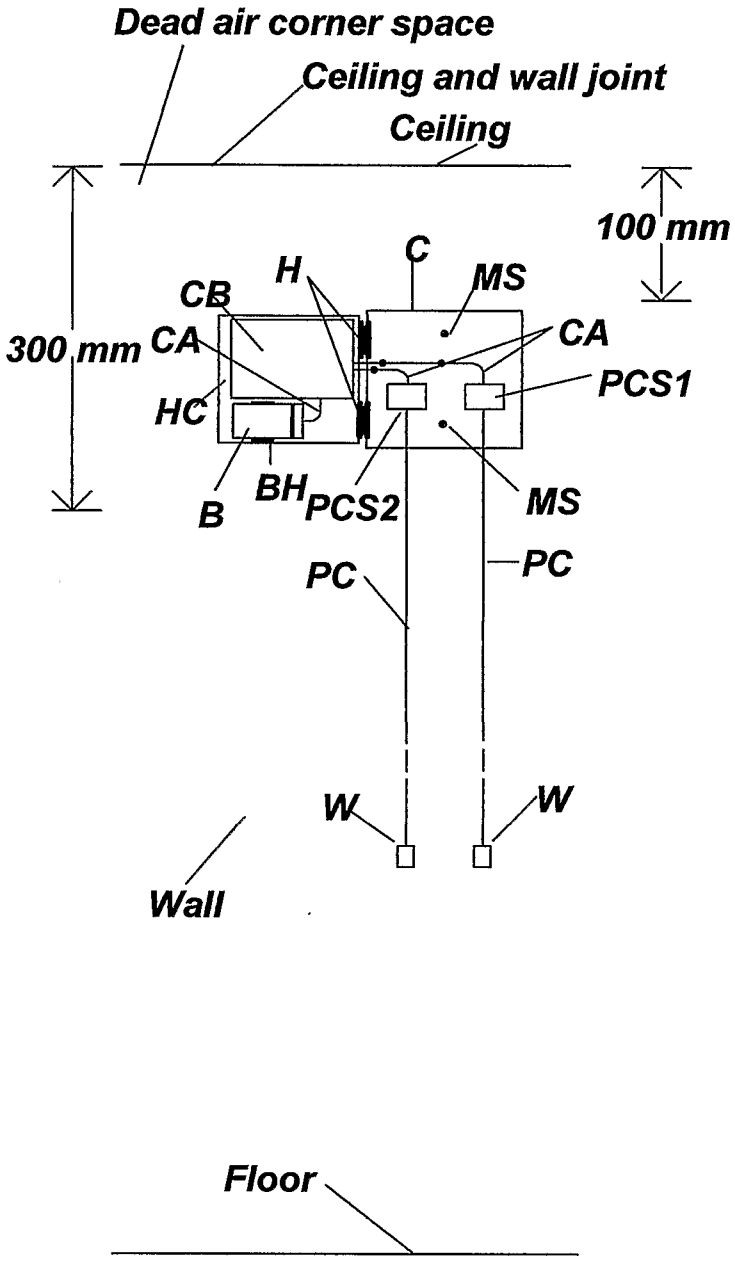

Dead air corner space
Ceiling and wall joint
Ceiling
100 mm
300 mm
C
H
MS
CB
CA
CA
PCS1
HC
B
BH
PCS2
MS
PC
PC
W
W
Wall
Floor

Fig. 4

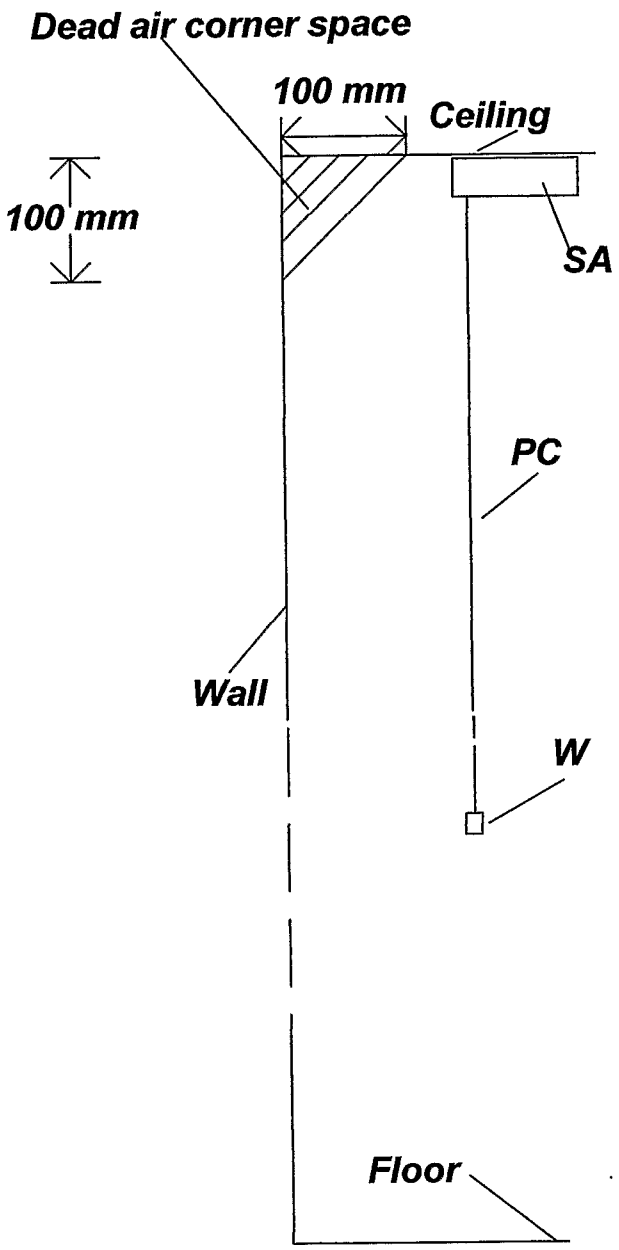


Fig. 5

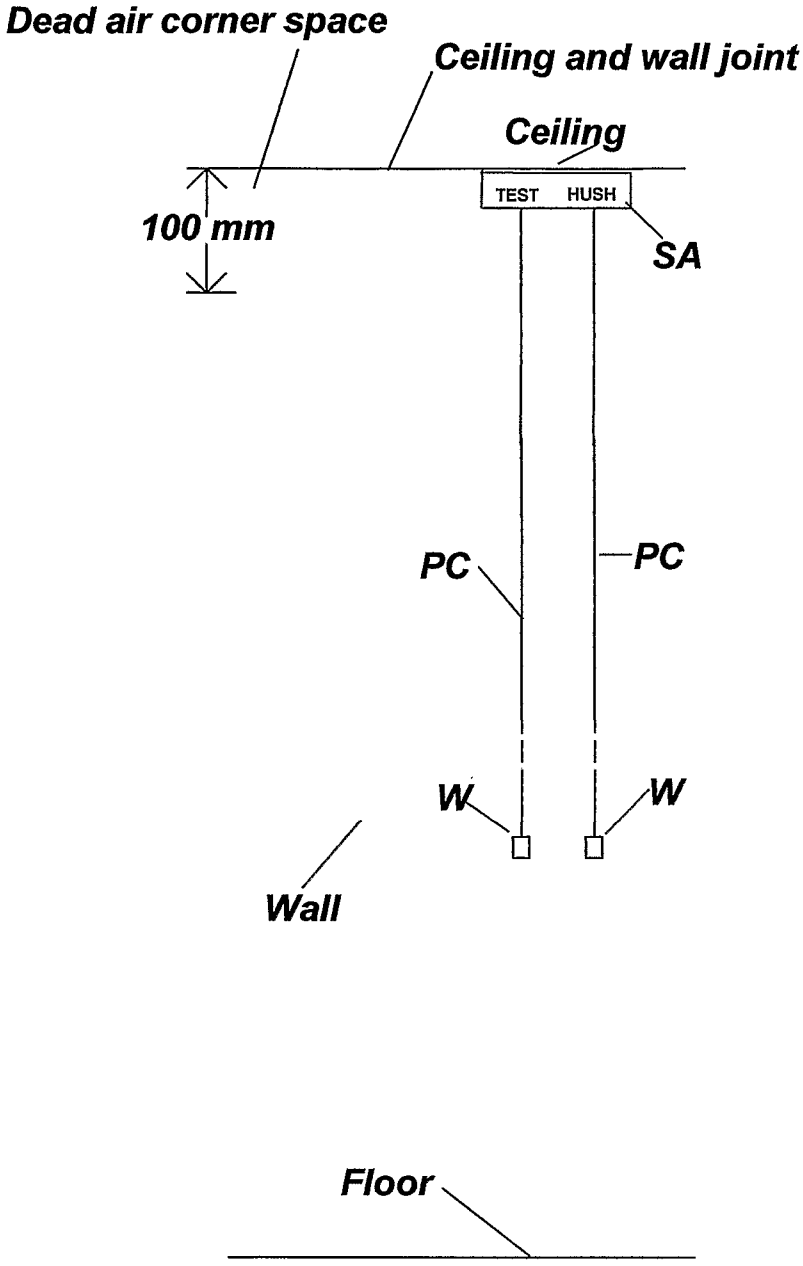

Dead air corner space
Ceiling and wall joint
Ceiling
TEST HUSH
100 mm
SA
PC
PC
W
W
Wall
Floor

Fig. 6

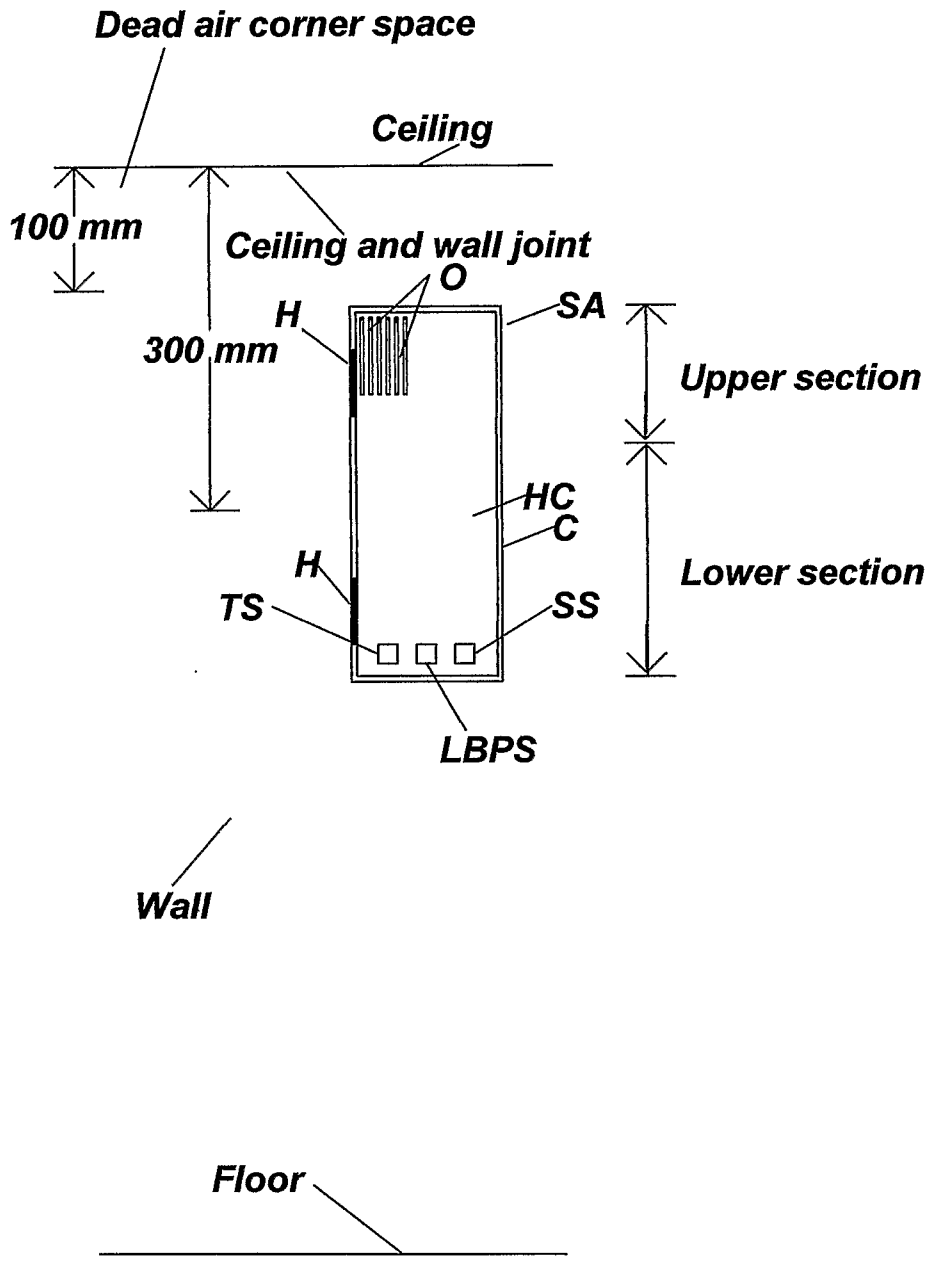

Dead air corner space
Ceiling
100 mm
Ceiling and wall joint
O
H
SA
300 mm
Upper section
HC
C
H
Lower section
TS
SS
LBPS
Wall
Floor

Fig. 7

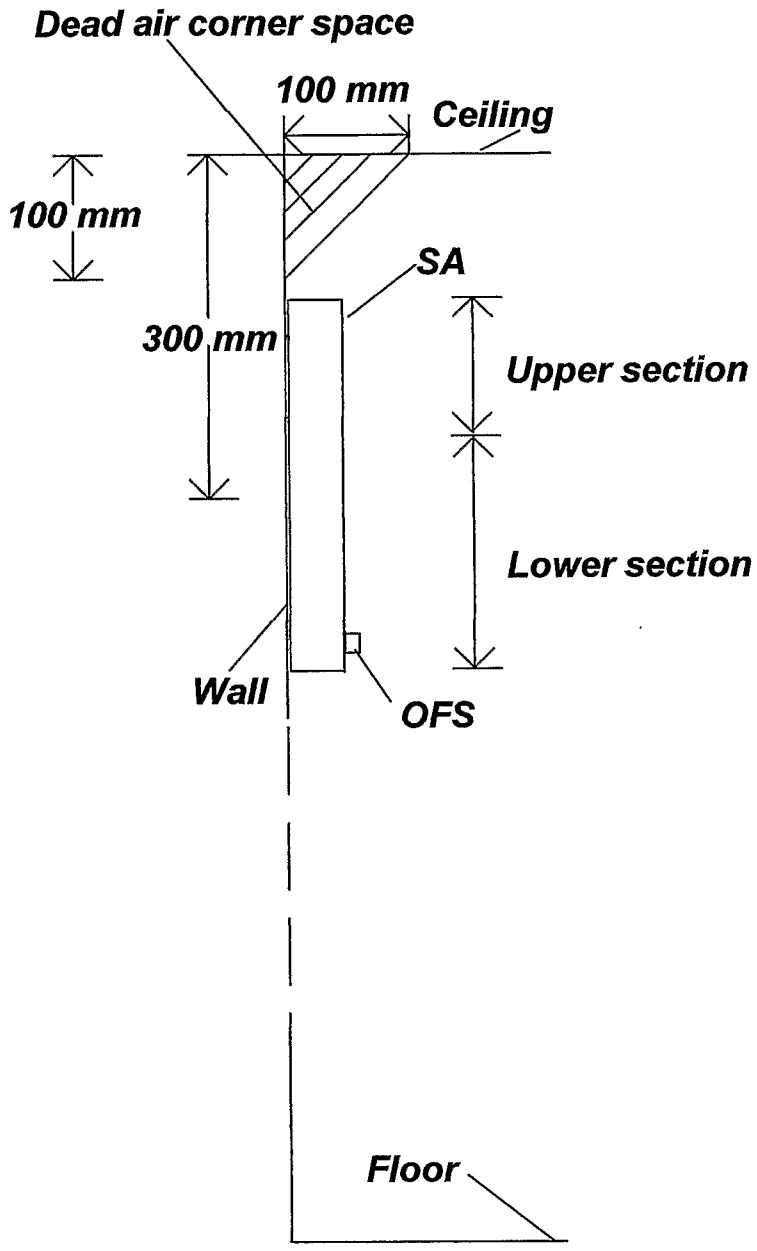

Dead air corner space
100 mm
Ceiling
100 mm
SA
300 mm
Upper section
Lower section
Wall
OFS
Floor

Fig. 8

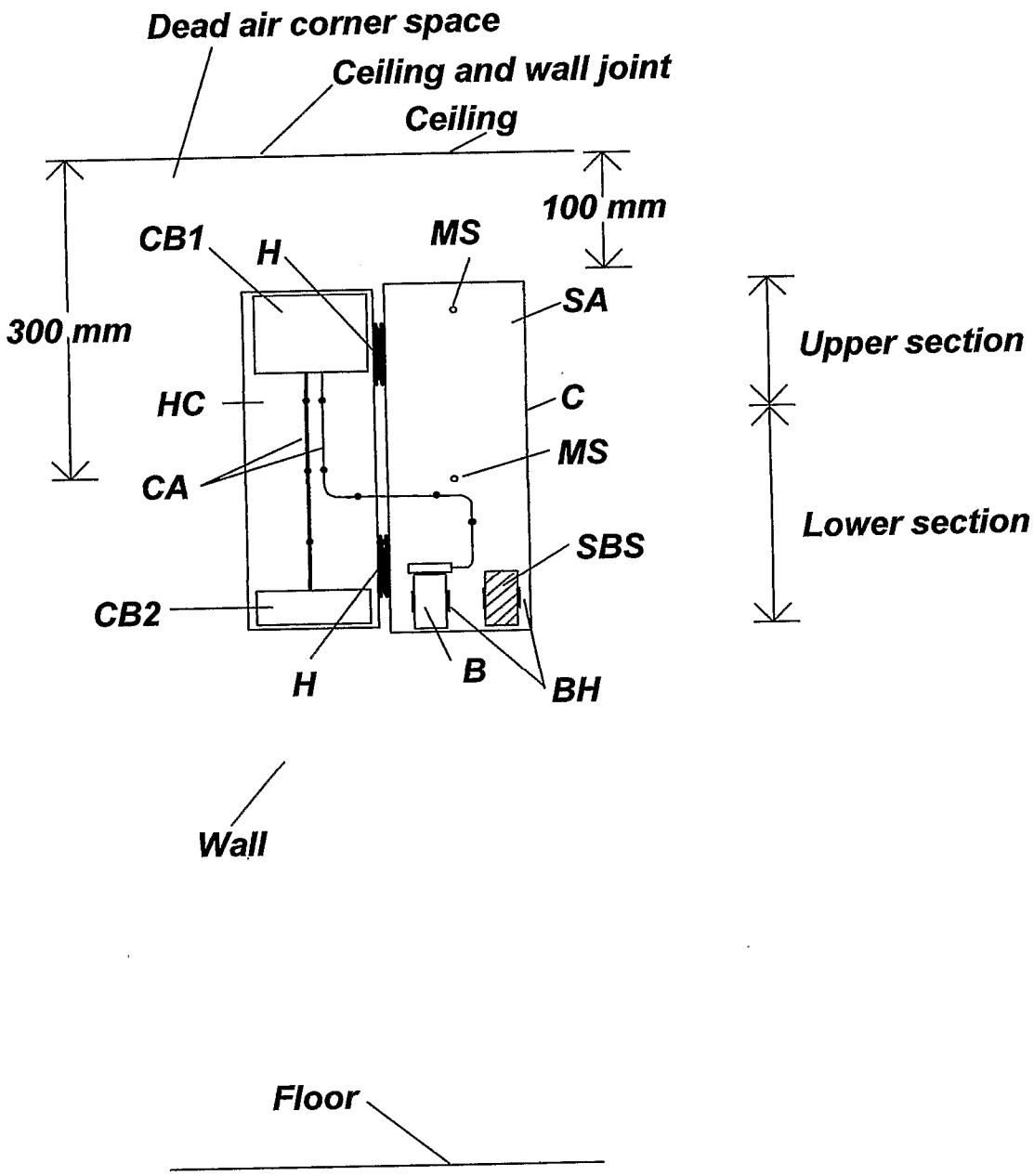

Dead air corner space
Ceiling and wall joint
Ceiling
100 mm
300 mm
CB1
H
MS
SA
Upper section
HC
C
MS
CA
Lower section
SBS
CB2
H
B
BH
Wall
Floor

Fig. 9

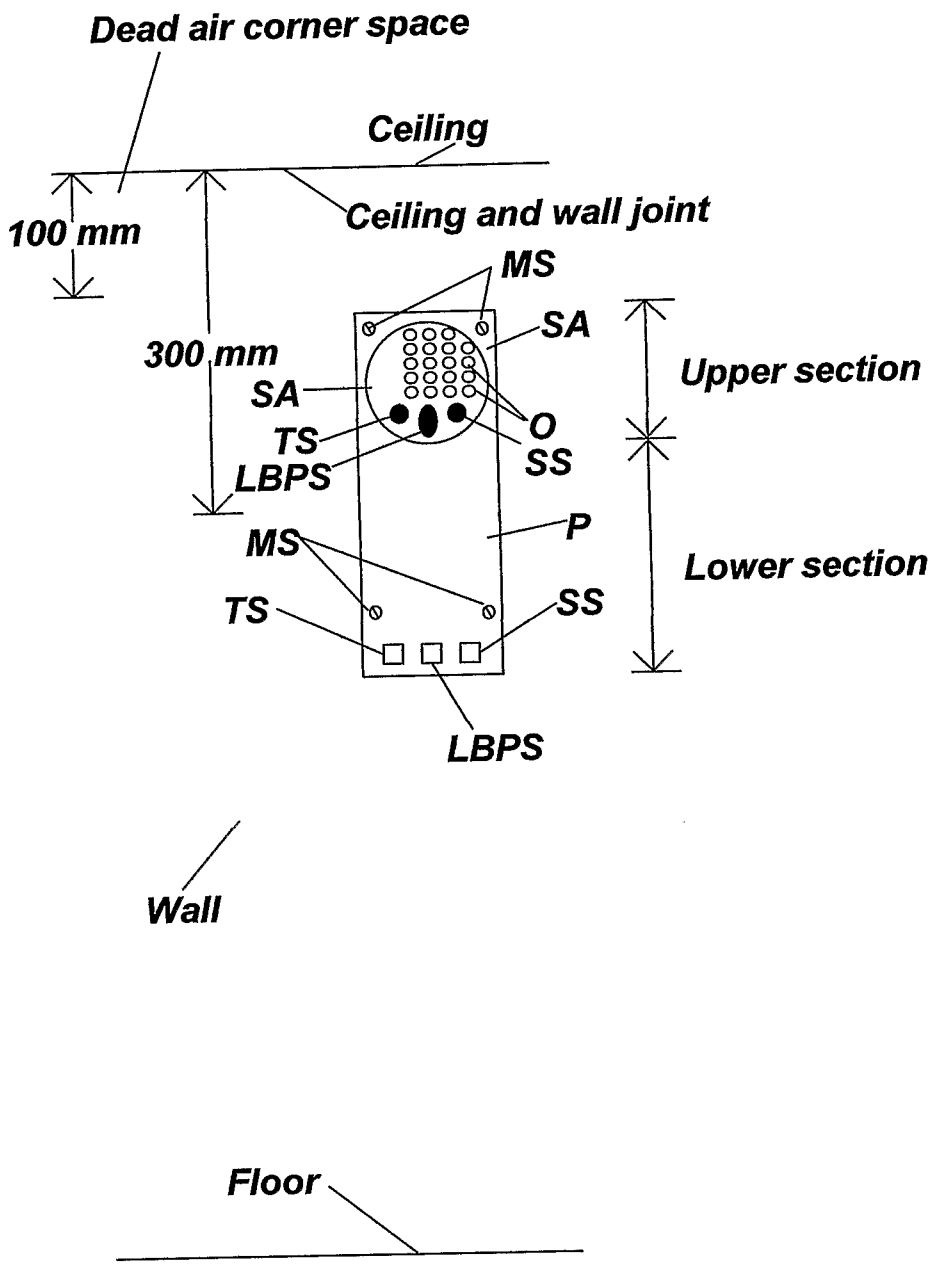

Dead air corner space
Ceiling
Ceiling and wall joint
100 mm
300 mm
MS
SA
SA
TS
LBPS
O
SS
P
MS
TS
SS
LBPS
Upper section
Lower section
Wall
Floor

Fig. 10

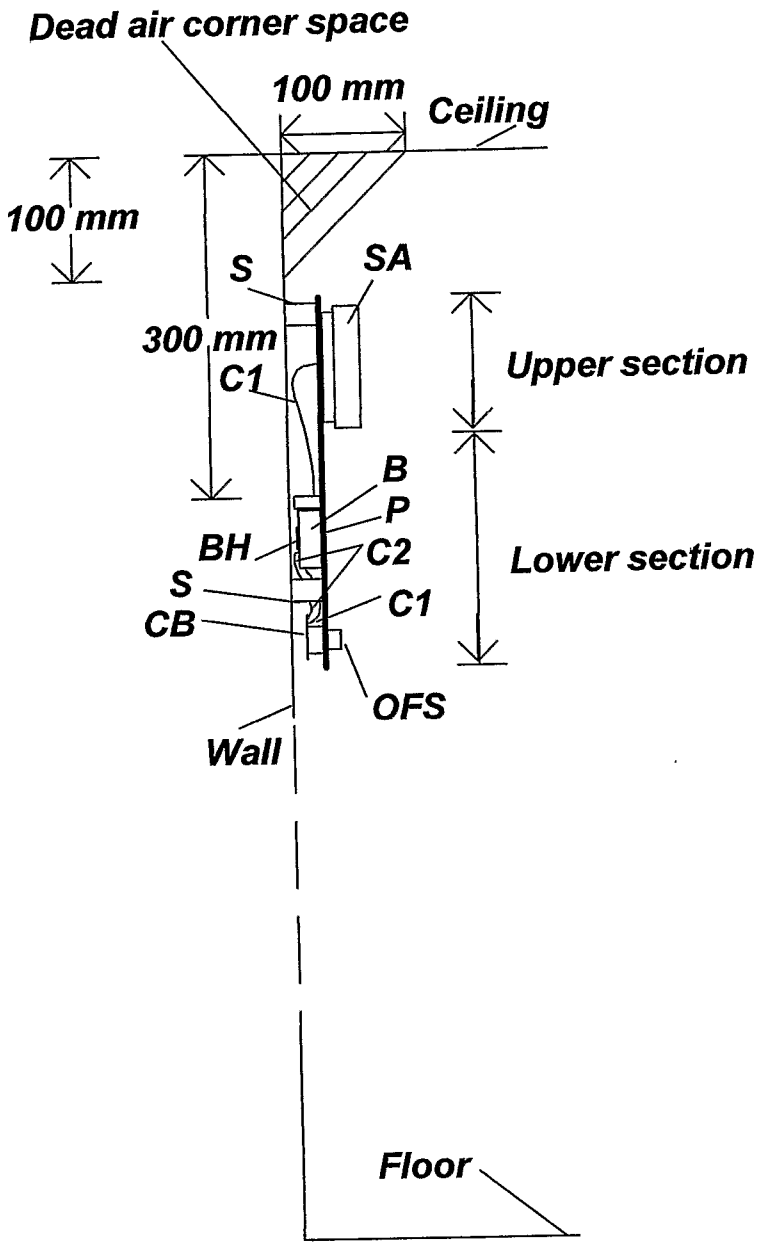

Dead air corner space
100 mm
Ceiling
100 mm
S
SA
300 mm
C1
Upper section
B
P
BH
C2
Lower section
S
C1
CB
OFS
Wall
Floor

Fig. 11

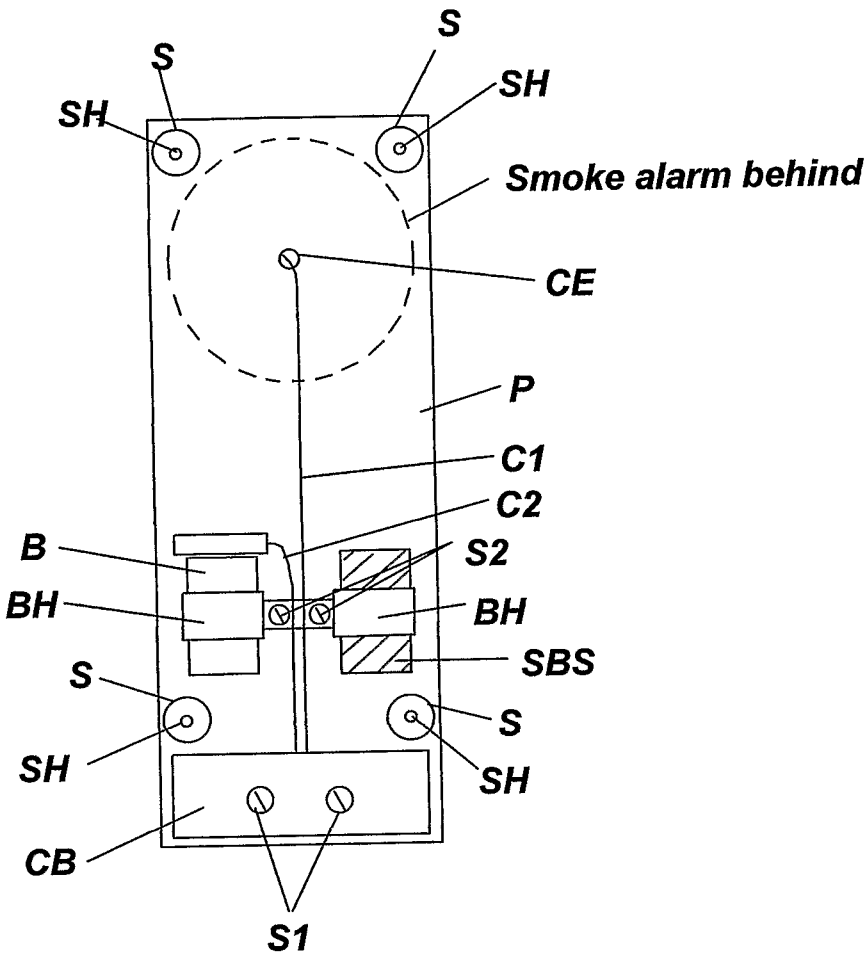


Fig. 12

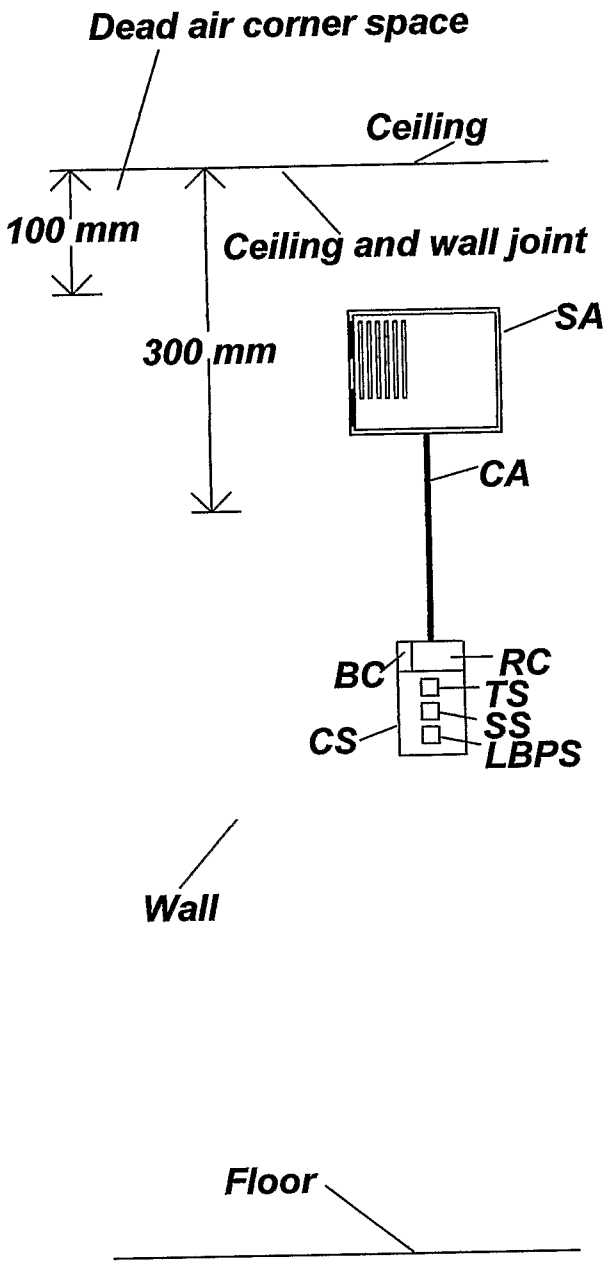

Dead air corner space
Ceiling
100 mm
Ceiling and wall joint
300 mm
SA
CA
BC
RC
TS
SS
CS
LBPS
Wall
Floor

Fig. 13

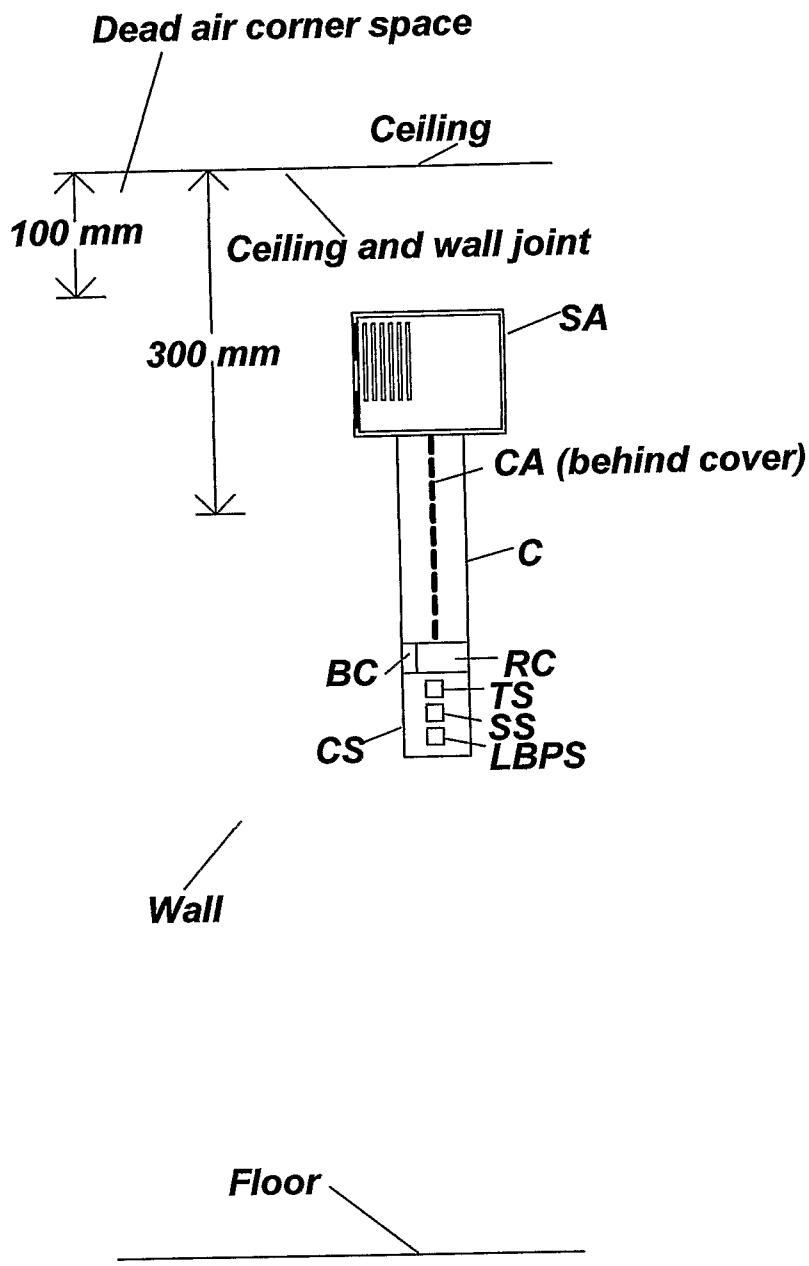

Dead air corner space
Ceiling
100 mm
Ceiling and wall joint
300 mm
SA
CA (behind cover)
C
BC
RC
TS
SS
CS
LBPS
Wall
Floor

Fig. 14

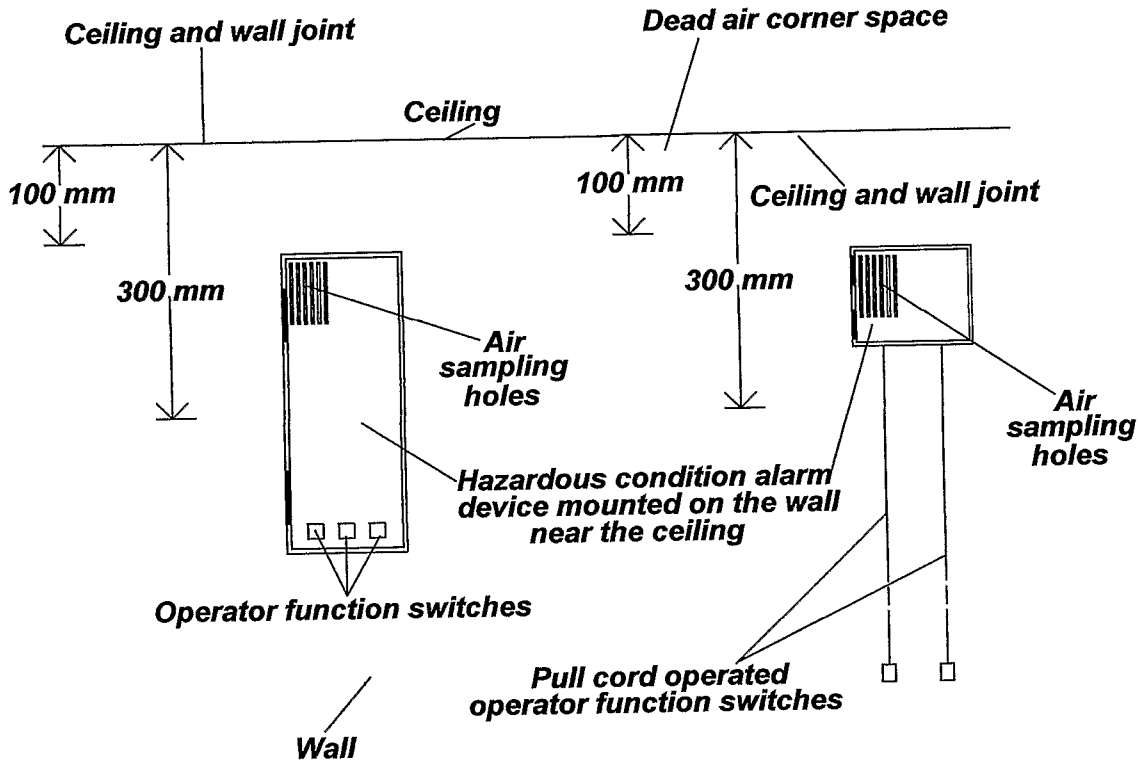

Ceiling and wall joint
Dead air corner space
Ceiling
100 mm
100 mm
Ceiling and wall joint
300 mm
300 mm
Air sampling holes
Air sampling holes
Hazardous condition alarm device mounted on the wall near the ceiling
Operator function switches
Pull cord operated operator function switches
Wall

Fig. 15

INTERNATIONAL SEARCH REPORT

International application No.
PCT/AU2006/000906

A. CLASSIFICATION OF SUBJECT MATTER

Int. Cl.

G08B 17/10 (2006.01)

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)

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

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)
dwpi (alarm, smoke detector, fire detector, gas detector, ceiling, extending, extension, reachable, accessible, control panel, keypad, battery, pull cord)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 2004/0032335 A1 (PARRISH) 19 February 2004 The whole document	1, 3-6, 8,10-13, 15-18, 20
X	WO 1986 /005908 A1 (RASHLEGER) 9 October 1986 The whole document	1, 3-6, 8,10-13, 15-18, 20
X	GB 2396965 A (KENNEDY) 7 July 2004 The whole document	1, 2, 21, 22
X	GB 2318670 A (HORSMAN et al.) 29 April 1998 The whole document	1, 2, 21, 22

[X] Further documents are listed in the continuation of Box C [X] See patent family annex

* Special categories of cited documents:

"A" document defining the general state of the art which is not considered to be of particular relevance

"E" earlier application or patent but published on or after the international filing date

"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)

"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

"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

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

"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	Date of mailing of the international search report
09 August 2006	17 AUG 2006
Name and mailing address of the ISA/AU AUSTRALIAN PATENT OFFICE PO BOX 200, WODEN ACT 2606, AUSTRALIA E-mail address: pct@ipaustralia.gov.au Facsimile No. (02) 6285 3929	Authorized officer **J. LAW** Telephone No : (02) 6283 2179

INTERNATIONAL SEARCH REPORT

International application No.
PCT/AU2006/000906

C (Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 2005/0083205 A1 (DEACY) 21 April 2005 The whole document	1, 4, 6, 10, 16, 17, 18, 20
X	US 2002/0024436 A1 (SUZUKI et al.) 28 February 2002 The whole document	1, 4, 6, 10, 16, 17, 18, 20
X	US 2002/0024435 A1 (SUZUKI et al.) 28 February 2002 The whole document	1, 4, 6, 10, 16, 17, 18, 20
X	US 4788530 A (BERNIER) 29 November 1988 The whole document	1, 4, 6, 10, 16, 17, 18, 20
X	EP 122433 A1 (NOHMI BOSAL KOGYO CO. LTD.) 24 October 1984 The whole document	1, 4, 6, 10, 16, 17, 18, 20
X	GB 2405735 A (DUNWELL) 9 March 2005 The whole document	1, 11
X	US 5149038 A (VANCLEVE) 22 September 1992 The whole document	1, 11
X	US 2004/0207551 A1 (VINING) 21 October 2004 The whole document	1
X	US 2002/0126016 A1 (SIPP) 12 September 2002 The whole document	1

INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No.
PCT/AU2006/000906

This Annex lists the known "A" publication level patent family members relating to the patent documents cited in the above-mentioned international search report. The Australian Patent Office is in no way liable for these particulars which are merely given for the purpose of information.

Patent Document Cited in Search Report		Patent Family Member					
US	2004032335						
WO	1986/005908	EP	0217865				
GB	2396965						
GB	2318670						
US	2005083205	US	6940410				
US	2002024436	EP	1187081	JP	2002074568	US	6577233
US	2002024435	EP	1182630	JP	2002064887	JP	2002083385
		US	6693529				
US	4788530						
EP	0122433	JP	59173898				
GB	2405735						
US	5149038						
US	2004207551						
US	2002126016						

Due to data integration issues this family listing may not include 10 digit Australian applications filed since May 2001.

END OF ANNEX