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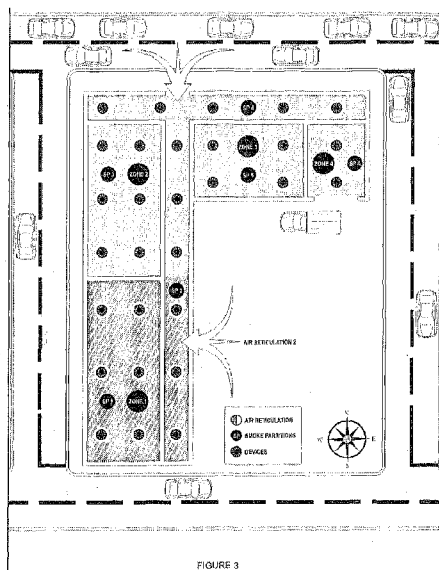


FIGURE 3

(57) Abstract: A fire detecting system is disclosed in which the building being protected is divided into smoke compartments SP1, SP2 etc. The compartments have fire detectors in them and there is walling which retains products of combustion in the compartments. The system determines the normal level of particle contamination in each compartment using the average of the outputs of the detectors in the compartment. A pre-alarm threshold is set at a predetermined level of particle contamination above a predetermined normal level and the average of the detector outputs of one compartment is compared with the average of the detector outputs of another compartment. The pre-alarm threshold level is adjusted up or down in the event that the particle contamination in the compartments are commensurate with one another but different to the predetermined normal particle contamination level established.

FIRE DETECTING SYSTEM

FIELD OF THE INVENTION

THIS INVENTION relates to a fire detecting system.

BACKGROUND TO THE INVENTION

Current fire detecting systems comprise a control panel and a plurality of detectors distributed throughout the building being protected. Each detector includes a casing with terminals for connecting it into the wiring loop which includes the panel. The detectors have therein sensors of various types such as heat sensors, smoke particle sensors and carbon monoxide sensors.

The panel polls the detectors in turn and obtains status information from them from which the logic of the control panel makes a decision on whether or not to institute an alarm condition. A balance must be struck between having a detecting system which is too sensitive and raises false alarms, and one that is too insensitive and does not react quickly enough to a genuine fire threat.

It is known that detectors "age" over a period of time and their sensitivity changes due to, for example, the deposition of dust particles onto the sensors. The threshold at which the output from a sensor will cause the panel to institute an alarm condition is consequently adjusted over time to prevent false alarms.

Fires are of various types and the products of combustion from different types of fire vary. Detectors comprising heat sensors and carbon monoxide sensors and optical sensors set for detection at different incident angles can distinguish between partial combustion, smouldering material, the burning of PVC insulation, fast burning spirit

fires, burning polyurethane and burning wood.

The output from sensors of these types is processed by a conventional fire detection algorithm and the algorithm's logic determines whether the data being received exceeds any of the thresholds set and that an alarm condition should be established.

The present invention has as its main object to provide a fire detecting system which is less prone to establishing false alarm conditions than current fire detection systems.

A further object of the present invention is to provide a fire detecting system which establishes a pre-alarm condition on input data which is below that required to establish an alarm condition but is sufficiently abnormal to require a notification signal being generated.

BRIEF DESCRIPTION OF THE INVENTION

According to the present invention there is provided a fire detecting system in which:

the building being protected comprises first and second smoke compartments having fire detectors in them and having walling which retains products of combustion in those compartments;

the system determines the normal level of particle contamination in each compartment using the average of the outputs of the detectors in the compartment;

a pre-alarm threshold is set at a predetermined level of particle contamination above the predetermined normal;

the average of the detector outputs of each compartment is compared with the average of the detector outputs of the other compartment; and

the pre-alarm threshold level is adjusted up or down in the event that the particle contamination in the compartments are commensurate with one another but different to the predetermined normal particle contamination established.

In the event that the compartments show different levels of particle contamination a pre-alarm condition is established.

Preferably a pre-alarm condition is only established after the different levels of particle contamination have lasted for a predetermined time.

Said fire detectors can include unique identification chips which can be scanned to enable the identities of the detectors to be determined. The detectors can also include memories on which the dates of installation of the detectors are stored.

Said memories can additionally have the service histories of the detectors stored on them.

It is also desirable for each memory to have stored information thereon denoting the type of detector, and for the fire panel to which the detectors are connected to be able to distinguish between detectors of different types from the information stored in the memories of the detectors.

BRIEF DESCRIPTION OF THE DRAWINGS

For a better understanding of the present invention, and to show how the same may be

carried into effect, reference will now be made, by way of example, to the accompanying drawings in which:-

Figure 1 is a diagrammatic section through a fire detector;

Figure 2 is a diagrammatic representation of a fire detecting loop;

Figure 3 is a plan view one floor of a building; and

Figure 4 diagrammatically represents normal, pre-alarm and alarm thresholds.

DETAILED DESCRIPTION OF THE DRAWINGS

The fire detector shown in Figure 1 is designated 10 and comprises a casing 12 which is releasably secured to a fixed base 14. The casing 12 has an internal chamber 16. Slits 18 in the casing 12 permit the products of combustion to flow into the chamber 16.

The term "fire detector" as used herein encompasses all types of detectors that are sensitive to the products of combustion.

Within the casing there is a carbon monoxide sensor 20, a heat (thermal) sensor 22, a first optical sensor 24 and a second optical sensor 26. The sensors 24, 26 have different light scatter view angles.

There is also a light source 28, such as a light emitting diode, in the casing. The beam from the light source reflects to the sensors 24, 26 off any particles in the chamber 16. The different outputs of the sensors 24, 26 enables the difference between, for

example, water mist and smoke particles to be determined by the fuzzy logic of the algorithm used.

The casing 12 also has therein a unique identification chip 30. Any commercially available chip can be used and an example of a suitable chip is that known as a MAC MI.

The final component within the casing 12 is a microprocessor 32.

The chip 30 can be read by a suitable scanner which enables stolen detectors to be positively identified. The memory of the microprocessor 32 stores information such as the date on which the fire detecting system was commissioned and thus when the detector went into use. It can also carry service information showing that the specified regular servicing schedules have been adhered to. The history of the detector from first installation to decommissioning can consequently be logged in the chip. This enables the total time for which the detector has been in service to be determined and for the time that has elapsed since the last service also to be determined. It is also possible to use that part of the logged information that identifies the type of detector to determine if it has been placed at an incorrect point on the loop which includes the detectors and the fire panel, as is described below. For example, if after service one type of detector is placed on the loop where another type of detector should be, this will be detected by the panel.

Any detector can be positively identified by scanning it and reading the information on the chip.

The base 14 includes terminals 34 and 36 which permit it to be connected into the loop wiring designated 38. The two wires 40 and 42 constituting the wiring 38 provide power to the detectors and also data communication between the detectors and the panel 44

shown in Figure 2.

To enable the present invention readily to be understood, reference will now be made to Figure 3 which illustrates a building on a site with streets on all four sides.

The building has six areas which are referred to herein as "smoke compartments". These areas are designated SP1 to SP6 and are separated from one another by walls, which may be permanent or constituted by the usual removable dry walls which divide the space within a building into offices. An attribute of such walls is that they form smoke barriers so that smoke in one smoke compartment does not readily leak into adjacent smoke compartments. Consequently all the detectors in one smoke compartment will normally be subjected to the same products of combustion in the event of there being burning material in that compartment. However, the detectors of adjacent compartments will generally not be subjected to products of combustion until a wall is breached opening the way for smoke to flow between smoke compartments.

The number of particles in the atmosphere varies with time. Factors influencing this include traffic density and weather conditions. During peak traffic hours morning and evening the level of pollution caused by vehicles is high. In the middle of the night when there is little or no traffic the level of pollution is low. Falling rain tends to take particles out of the air and contribute to a lower level of pollution even at peak traffic hours.

In use of the system according to the present invention two or more smoke compartments operate in conjunction with one another. It will be assumed for the purposes of the description that two smoke compartments chosen by the commissioning engineers are used in conjunction with one another.

In Figure 4 the horizontal line designated "normal" refers to the average output of the sensors in a smoke compartment when subjected to the pollution level which is usual

for the environment in which the detectors have been placed. As will be described, a change in average output to the threshold level indicated as "pre-alarm" is a change to the level at which the output of the detectors is sufficiently far from normal to make it desirable to alert the building management of a possible event. This threshold level is adjusted over time as is described below.

When the signal from any detector reaches the level designated "Alarm", a full alarm condition is established with the normal consequences of fire doors closing, air conditioning being shut down, audible and visual alarms being activated and an automatic call being made to firefighters.

If it is assumed that there are peak traffic conditions and that there have been warm, still atmospheric conditions for a period of time, pollution levels will be high. As each detector is polled in turn by the panel, it returns an output indicative of the generally high level of pollution. A possible result is that the pre-alarm level will be reached when, in fact, what is being sensed is a general rise in pollution levels not associated with the products of combustion of a fire.

In accordance with the present invention the pre-alarm level is adjusted in these circumstances. Specifically when the first detector in a smoke compartment returns a signal which is such as to establish a pre-alarm condition, the algorithm of the panel calculates the average of the outputs of all the other detectors in that smoke compartment. It also establishes the average of the outputs of all the detectors in the co-operating smoke compartment.

If the detectors in the co-operating smoke compartment are also detecting a commensurate increase in levels, indicative of it being a rise in general pollution levels, and not of a fire, then the threshold at which a pre-alarm condition is established is raised to a level commensurate with the new "normal" conditions which then prevail.

Conversely, if the average signal indicating pollution levels in both smoke compartments falls then the sensitivity level can be adjusted downwards. When the conditions existing in the two smoke compartments are deemed to be normal, even if the pollution level is changing, the pre-alarm level is adjusted so that the measurement of an abnormal condition commences not from the "clean air" air level but from the level of what, at that time, is the normal atmospheric condition.

It will be understood from the above that adjustment of the pre-alarm threshold occurs with changing conditions and that the threshold can be changed every few minutes if varying conditions demand it. The pre-alarm threshold thus tracks the general atmospheric conditions.

If the average output of the detectors in one smoke compartment is above the average output of the detectors in the other compartment, this is an indication of a combustion event in said one smoke compartment. In such circumstances the pre-alarm threshold is not adjusted and it is preferred that this difference exist for a predetermined period of time before a pre-alarm condition is established. This eliminates the possibility that there is a time lag between the general change in pollution level in one compartment affecting the general pollution level in the other compartment. If the condition pertains for, say, 5 to 15 minutes then it is safe to assume that conditions in one smoke compartment differ from those in the other compartment, and that the conditions are not going to equalize.

The full alarm level is not altered with the pre-alarm level and remains fixed at the predetermined level.

In the diagrammatic representation of Figure 4, smoke compartment SP6 would not be used in cooperation with any other smoke compartment. The reason for this is that a truck at the loading bay which constitutes compartment SP6 could rapidly raise pollution

levels. This condition could exist for long enough to cause comparison with the average of a "clean" smoke zone to result in a pre-alarm condition.

CLAIMS:

1. According to the present invention there is provided a fire detecting system in which:

the building being protected comprises first and second smoke compartments having fire detectors in them and having walling which retains products of combustion in those compartments;

the system determines the normal level of particle contamination in each compartment using the average of the outputs of the detectors in the compartment;

a pre-alarm threshold is set at a predetermined level of particle contamination above a predetermined normal level;

the average of the detector outputs of each compartment is compared with the average of the detector outputs of the other compartment; and

the pre-alarm threshold level is adjusted up or down in the event that the particle contamination in the compartments are commensurate with one another but different to the predetermined normal particle contamination established.

2. A system as claimed in claim 1, wherein, in the event that the compartments show different levels of particle contamination, a pre-alarm condition is established.

3. A system as claimed in claim 1 or 2, wherein a pre-alarm condition is only established after the different levels of particle contamination have lasted for a predetermined period of time.

4. A system as claimed in any preceding claim, wherein said fire detectors include unique identification chips which can be scanned to enable the identities of the detectors to be determined.
5. A system as claimed in any one of claims 1 to 4, wherein the detectors include memories on which the dates of installation of the detectors are stored.
6. A system as claimed in any one of claims 1 to 4, wherein said fire detectors include memories on which the service histories of the detectors are stored.
7. A system as claimed in any one of claims 1 to 4, wherein said fire detectors include memories on which is stored information denoting the type of detector, and wherein there is a fire panel to which the detectors are connected and which can distinguish between detectors of different types from the information stored in the memories of the detectors.

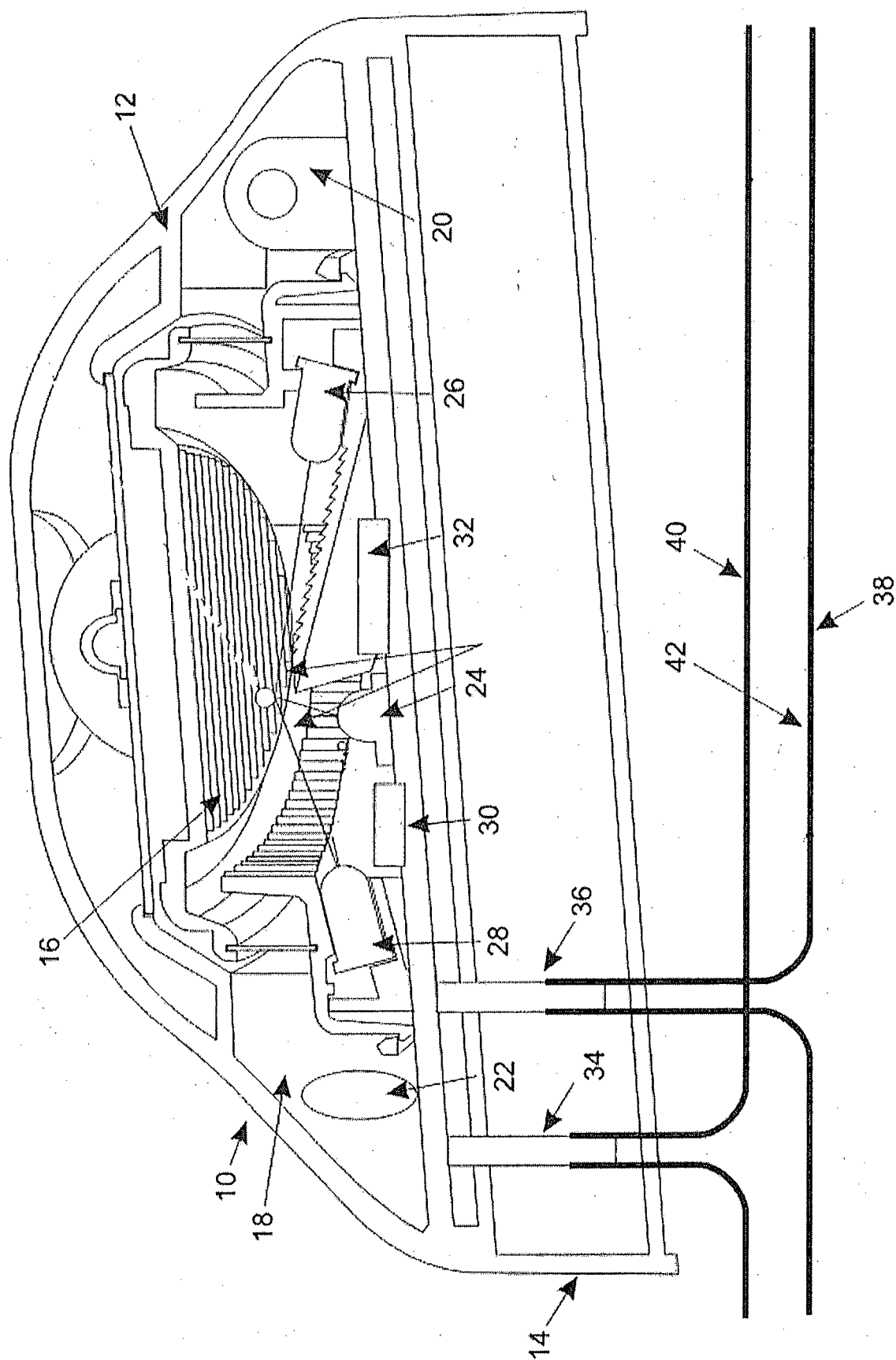


FIGURE 1

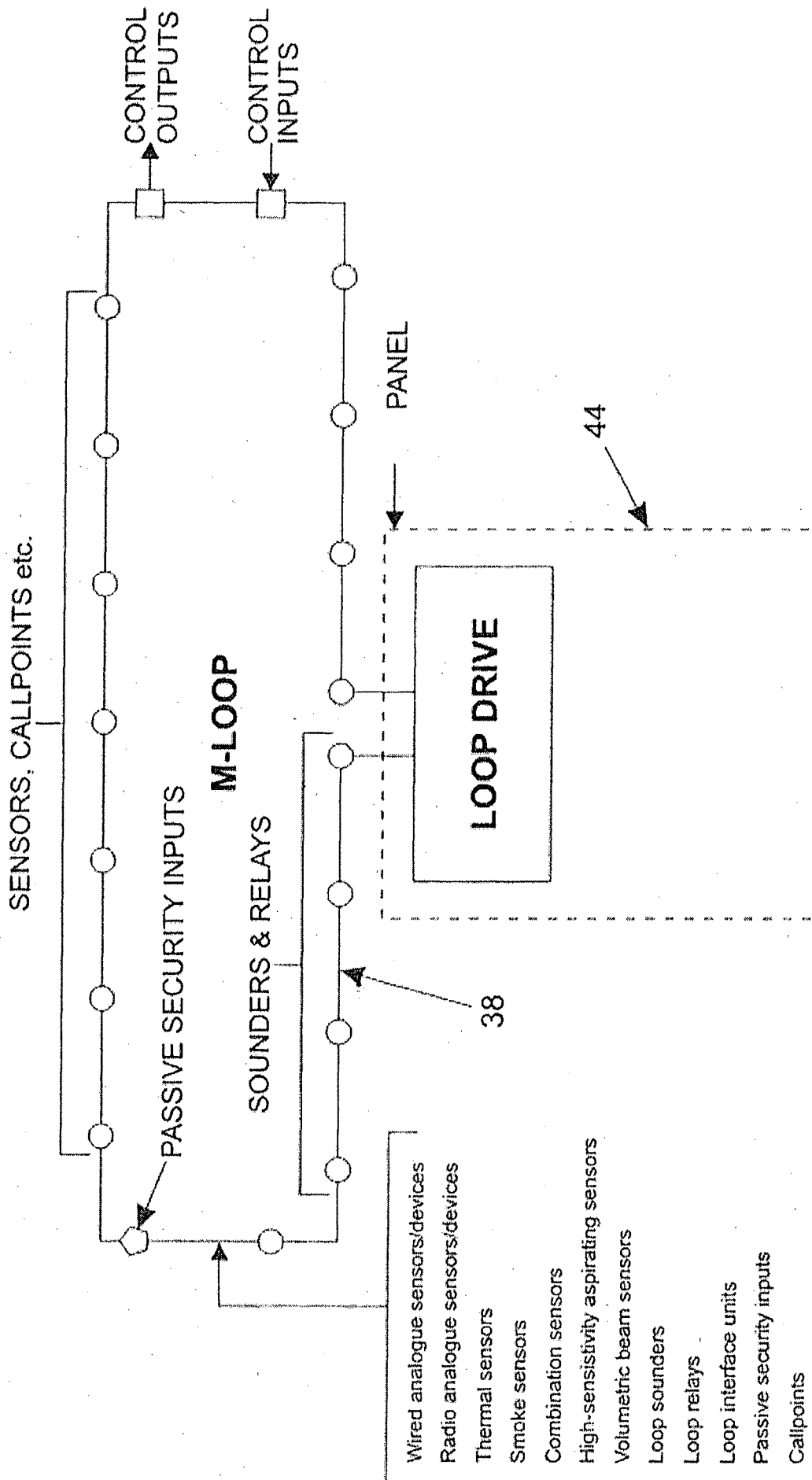


FIGURE 2

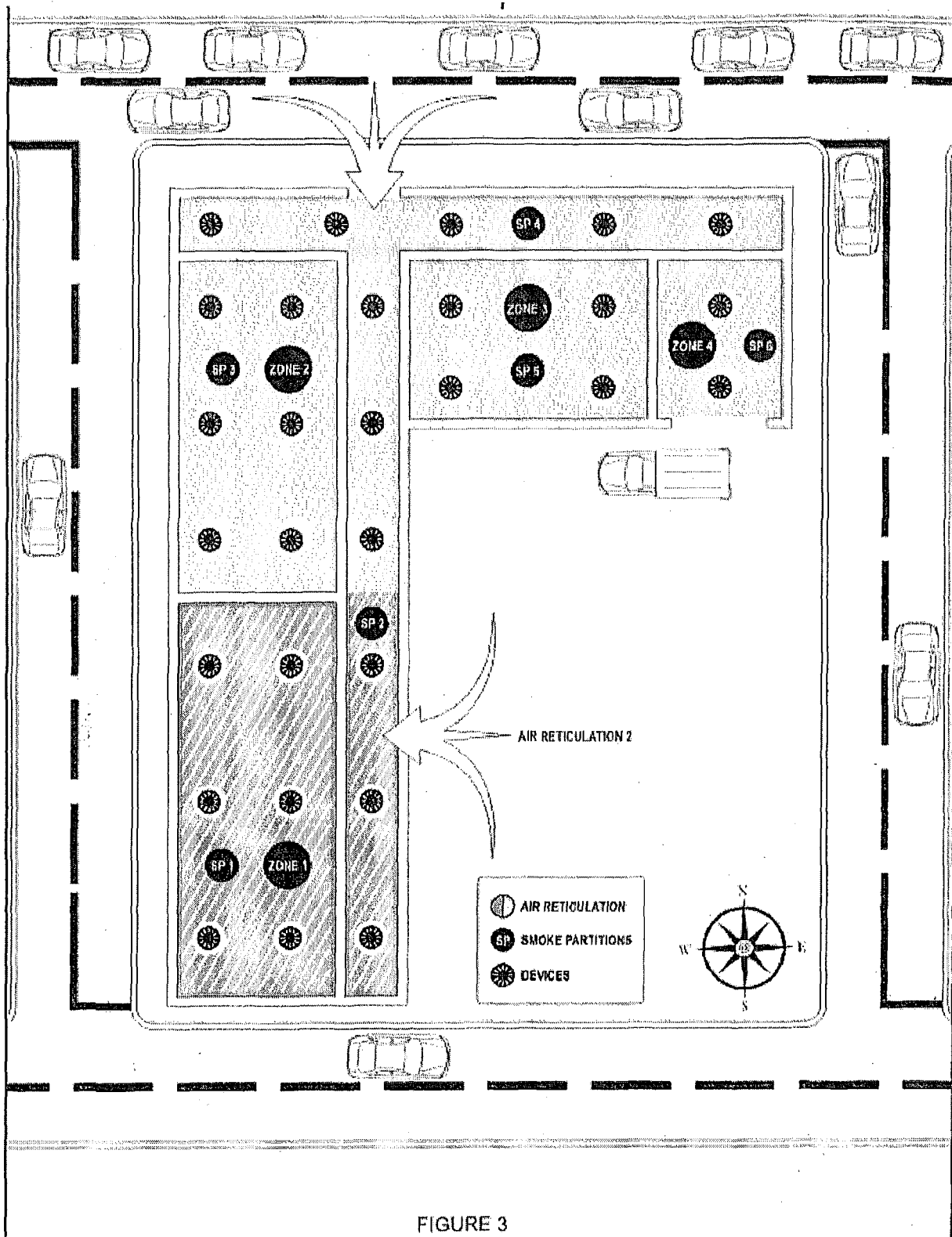


FIGURE 3

ALARM THRESHOLDS

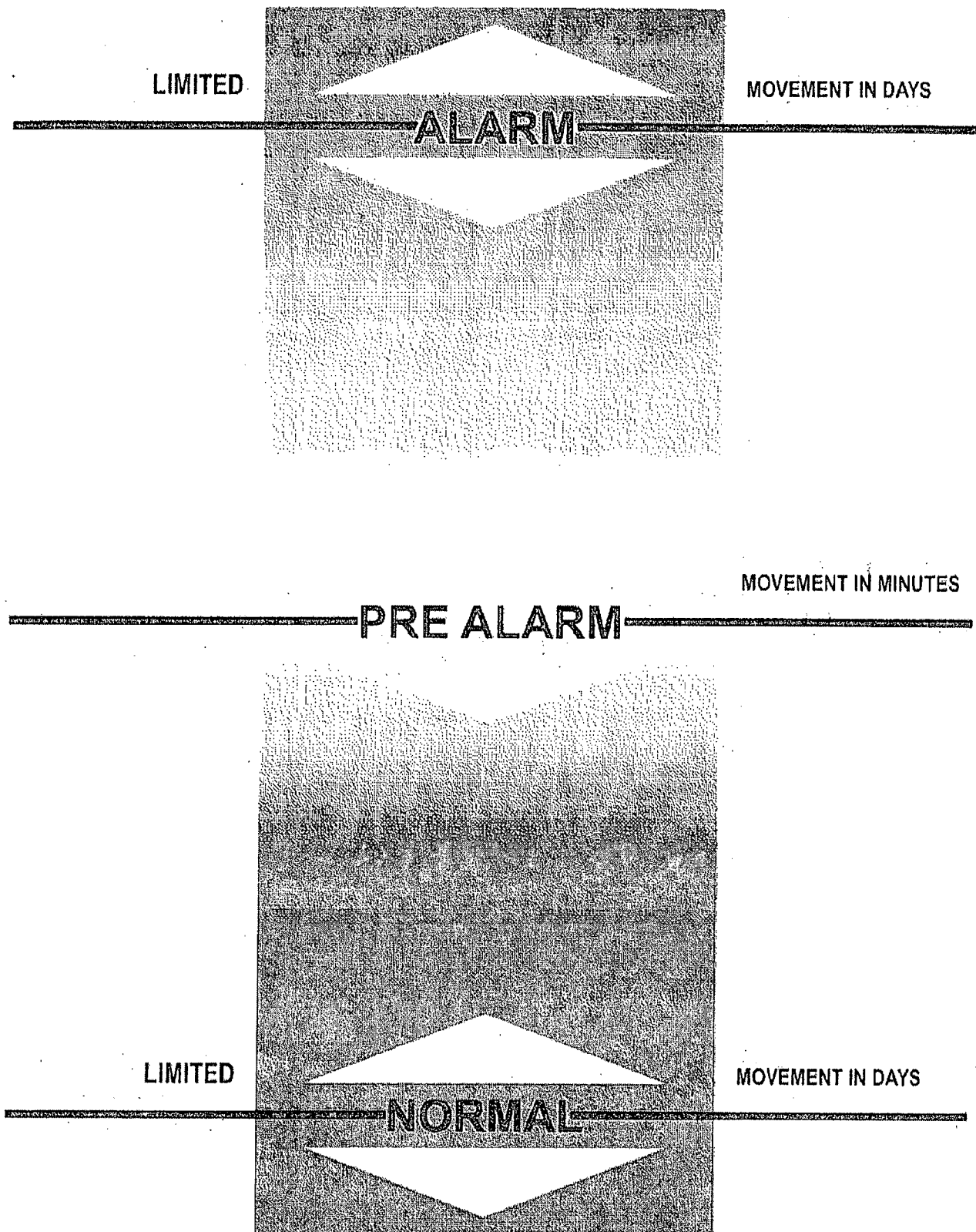


FIGURE 4

INTERNATIONAL SEARCH REPORT

International application No.

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A. CLASSIFICATION OF SUBJECT MATTER IPC: G08B 17/10 (2006.01); G08B 29/26 (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) A62C, G08B Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched		
Electronic data base consulted during the international search (name of data base and, where practicable, search terms used) EPODOC, WPI, TXTDE, TXTEN		
C. DOCUMENTS CONSIDERED TO BE RELEVANT		
Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 2004090335 A1 (PFEFFERSEDER ET AL.) 13 May 2004 (13.05.2004) Abstract; Figures 1, 3; Description of figures; Claims 1-2, 4-8, 10;	1-7
X	US 5369397 A (WONG) 29 November 1994 (29.11.1994) Abstract; Figures 1, 3-4; Description of figures; Claims 1-2, 6, 9;	1-7
A	US 2008061996 A1 (BEHLE ET AL.) 13 March 2008 (13.03.2008) Abstract; Figure 1; Description of figure; Claims 9-12, 14;	1-7
☐ Further documents are listed in the continuation of Box C. ☒ See patent family annex.		
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INTERNATIONAL SEARCH REPORT
Information on patent family members

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