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(54) **Intelligent fire extinguishing**

(57) Fire extinguishing equipment comprises:
a sensor for detecting a region of raised temperature in a volume, the sensor having a field of view;
a nozzle for ejecting a fire-extinguishing substance therefrom at a sprayable region;

processing means in communication with the sensor and the nozzle;
wherein the processing means is adapted to cause the nozzle to eject the fire-extinguishing substance only when the sensor detects a region of raised temperature that substantially coincides with the sprayable region.

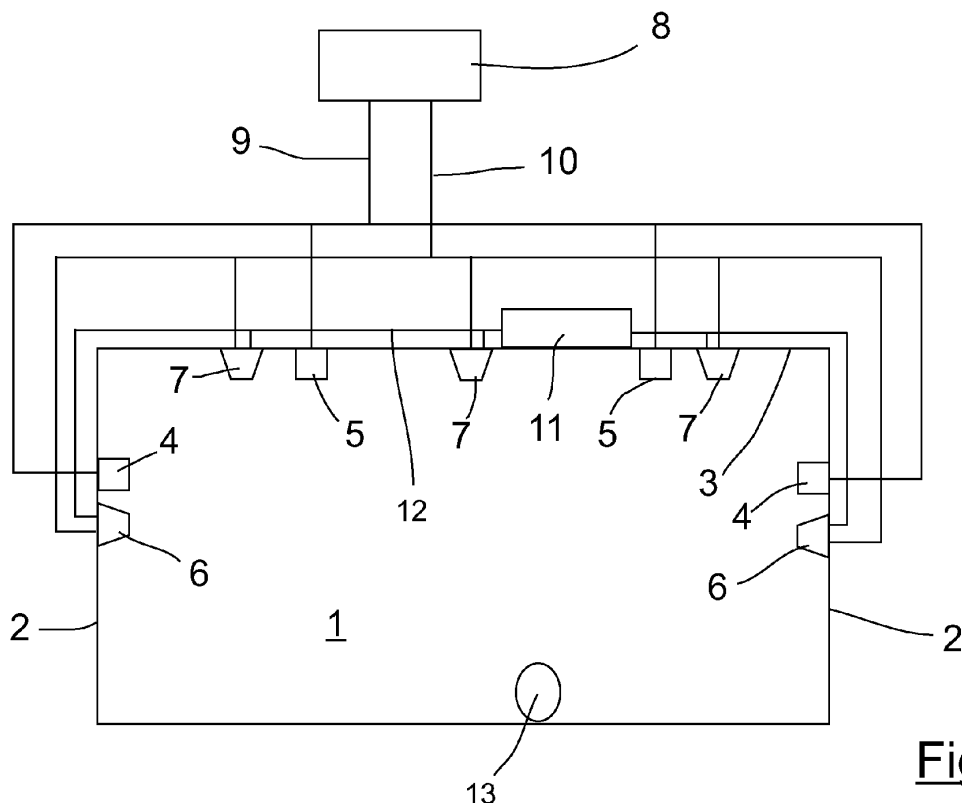


Fig. 1

Description

[0001] This invention relates to fire extinguishing equipment.

[0002] Currently, a preferred fire extinguishing system is to use installed sprinkler systems. These comprise a fire detection means which detects the presence of a fire in a location, for example by smoke detection, or detection of an area of raised temperature. Once a fire has been so detected, an activation signal is produced, which acts to turn on a number of sprinklers at the location, the sprinklers expelling a quantity of water to the location. Known sprinklers typically include a number of shower-head type nozzles, which jettison water substantially evenly over respective areas. While this may be effective at extinguishing the fire, such a sprinkler system will douse or flood an area without discrimination, which may result in the loss of much expensive or valuable equipment, for example computers, files or the like.

[0003] It is an aim of the present invention to overcome these problems. This aim is achieved by intelligently activating fire extinguishing equipment so that a fire-extinguishing substance is aimed at the fire, rather than indiscriminately.

[0004] In accordance with the present invention there is provided fire extinguishing equipment comprising:

a sensor for detecting a region of raised temperature in a volume, the sensor having a field of view;
a nozzle for ejecting a fire-extinguishing substance therefrom at a sprayable region; processing means in communication with the sensor and the nozzle;
wherein the processing means is adapted to cause the nozzle to eject the fire-extinguishing substance only when the sensor detects a region of raised temperature that substantially coincides with the sprayable region.

[0005] As is known in the art, passive infrared (PIR) sensors are electronic devices comprising pyroelectric sensor material that are responsive to thermal infrared radiation emitted from objects within the sensor's field of view. Since the infrared radiation emitted by an object is temperature dependent, the PIR sensor output can be used both to identify areas of high temperature within the field of view, and to measure the temperature of objects within that field of view (as long as the sensor is suitably calibrated).

[0006] Advantageously, such fire extinguishing equipment may find application within the hydrocarbon extraction industry, and as such may be installed at oil platforms, installation portable buildings (e.g. "Portakabin" RTM) and suchlike.

[0007] The invention may be used either as a replacement or as a back-up to existing sprinkler systems.

[0008] The invention will now be described with reference to the accompanying drawings, in which:

Fig. 1 schematically shows a cross-section of a room with fire extinguishing equipment in accordance with an embodiment of the present invention installed therein.

[0009] An embodiment of the invention is schematically shown in Fig. 1, where fire extinguishing equipment in accordance with the present invention is installed in a room 1 having walls 2 and a ceiling 3, in order to monitor and extinguish fires within the room volume.

[0010] In the installation shown, a plurality of passive infrared (PIR) sensors 4, 5 are located on the walls 2 and ceiling 3 respectively. In addition, a plurality of directional nozzles 6, 7 are located on the walls 2 and ceiling 3 respectively. In the embodiment shown, nozzles 6, 7 are connected via a pipe system 12 to a reservoir 11 containing a fire-extinguishing substance, e.g. water, installed in ceiling 3, to receive a water supply therefrom in use. Of course, Fig. 1 shows a cross-sectional, and therefore two-dimensional, view of room 1. In practice, the sensors 4, 5 and nozzles 6, 7 would typically be distributed approximately regularly about the extent of the room 1. The nozzles and sensors are provided with power supplies (not shown), for example batteries located at each nozzle / sensor or from an external power source.

[0011] Sensors 4, 5 are connected to a processing means, e.g. a computer 8, via network 9. Nozzles 6, 7 are also connected to processing means 8, via network 10. Processing means 8 stores information relating to the "sprayable region" of each nozzle 6, 7, in other words, the region which could be sprayed with water if that nozzle were activated.

[0012] Sensors 4, 5 may operate in a variety of modes. For example, they may be set to trigger when an area with a temperature exceeding a threshold value is detected within their field of view. In this case, the sensors must be calibrated before use. Alternatively, the sensors may be arranged to trigger if an region of raised temperature relative to its surroundings is detected within their field of view.

Basic Operation

[0013] In normal operation, no regions of raised temperature are detected by sensors 4, 5, and the equipment may remain dormant.

[0014] However, if a region 11 of raised temperature is present, such as might be produced by a fire for example, any sensors 4, 5 whose field of view includes that area 11 are triggered, and output signals are sent via network 9 to processing means 8. These signals include a component identifying the particular sensor outputting the signal.

[0015] The processing means 8 is adapted to process the signals received via network 9. In particular, the processing means 8 identifies the sensors which have sent the signals from the identification components of the signals. The processing means 8 then correlates the

identified sensors to determine an approximate location of the region of raised temperature.

[0016] The processing means 8 then matches the determined location of the region of raised temperature with the sprayable areas of nozzles 6, 7, and sends activation signals to the matched nozzles via network 10. For example, if processing means 8 determines that two nozzles have respective sprayable regions that match the region of raised temperature, then it sends activation signals to those two nozzles via network 10, thus causing those two nozzles to activate and spray water at the respective sprayable regions. Since the sprayable regions and the region of raised temperature should coincide due to the matching process performed by the processing means 8, the region of raised temperature will receive a spray of water from the activated nozzles.

[0017] Sensors 4, 5 may continue to check the status of the region of raised temperature. If they determine that the temperature within this region has fallen to a level which is considered "safe", then the change in their output signals will communicate this to processing means 8. Accordingly, processing means 8 may then send a "cease" command to nozzles 6, 7 to stop the flow of water there-through.

Specific embodiments

[0018]

i) In a first specific embodiment, at least one sensor 4, 5 has a relatively narrow field of view, in other words receiving infrared radiation from a relatively small solid angle. In this case, a relatively large number of sensors is required in order to ensure that the entirety of room 1 is monitored by the sensors. On the other hand, processing of the received signals is relatively simple, and if a sensor is triggered, the position of the region of raised temperature may be relatively accurately determined.

ii) In a second specific embodiment, at least one sensor 4, 5 has a relatively wide field of view, in other words receiving infrared radiation from a relatively wide solid angle. In this case, a relatively small number of sensors is required in order to ensure that the entirety of room 1 is monitored by the sensors.

iii) In a third specific embodiment, at least one sensor 4, 5 comprises a number of sensor arrays, each of which has an associated field of view, and is capable of outputting an output signal independently. In this case, each sensor array is equivalent to an individual sensor, and the output from each array may be processed in a similar manner as for sensor outputs described above.

iv) In the embodiments described above, the sensors are fixed at a predetermined location and orientation

with respect to the room. In a fourth specific embodiment, at least one sensor 4, 5 may be movable, rather than fixed. In particular, each such sensor may be swivelled about a fixed point, i.e. changing at least one of the azimuth and elevation, under the action of one or more motors, so that the sensor may have an increased field of view. The movable sensor may be arranged to swivel continuously about a predefined locus for example. Alternatively, the sensor may be arranged to move in response to a command from an operator. Other set-ups are also possible, for example for the sensor to stay fixed at an area which is considered at most risk of fire, but intermittently moved to check other, lower risk, areas. With this embodiment, it is required that the triggered output from the sensor to the processing means 8 includes not only identification information, but also information relating to the orientation of the sensor, so that the processing means 8 may determine the field of view of the sensor at that time. In the extreme case, only one sensor is provided, but which may monitor the entirety of the room by virtue of its range of movement. In this case, the sensor output need not include identification information.

v) In a fifth specific embodiment, at least one of the nozzles 6, 7 is fixed at a predetermined location and orientation with respect to the room. When a region of raised temperature is located, the processing means 8 sends activation commands to only those nozzles whose sprayable regions coincide with the region of raised temperature.

vi) In a sixth specific embodiment, at least one of the nozzles 6, 7 is movable with respect to the room. In particular, each such nozzle may be swivelled about a fixed point, i.e. changing at least one of the azimuth and elevation, under the action of one or more motors, so that the location of the sprayable region of the nozzle may be varied. When a region of raised temperature is located, the processing means 8 sends a movement command to those nozzles whose range of sprayable regions coincide with the region of raised temperature in order to move the nozzles to the correct orientation, as well as an activation command to activate the spraying of water from the nozzle. With this embodiment, it is possible that all nozzles could be controlled in order that the sprayable region coincides with the region of raised temperature. In the extreme case, only one nozzle is used, but which has a large possible associated sprayable region, preferably being able to spray substantially the entirety of the room, by virtue of its range of movement.

vii) In a seventh specific embodiment, at least one additional PIR sensor may be incorporated into a nozzle in order to help refine the location of the region

of raised temperature. This additional sensor would preferably have a narrower field of view than the main sensors 4, 5, so as to locate the region more accurately. Output signals from the additional sensor would be sent to processing means 8 via network 9. Again, these signals would include identification information, and the sensor's field of view would be known to the processing means 8.

viii) In an eighth specific embodiment, at least one sensor is housed within an integral unit with an associated nozzle. This embodiment reduces the number of components that require fitting to the room. Preferably, the sensor and nozzle within each unit are substantially aligned, such that the sensor's field of view and the nozzle's sprayable region substantially coincide. With this arrangement, the processing load on processing means 8 is reduced, since it is clear that if a sensor detects a region of raised temperature, the associated nozzle should be activated.

[0019] In any of the above embodiments, the region of raised temperature may be more accurately located by combining information received from sensors. For example, if a number of sensors are triggered to produce output signals, then it is apparent that the region of raised temperature must lie within the volume where the fields of view overlap or coincide. This calculation may be performed by the processing means 8. Alternatively, the various combinations may be predetermined, and the processing means may effect a look-up to determine the location of the region of raised temperature. For example, when setting up the equipment, it may be determined that if signals are received from a particular three sensors, then the region of raised temperature will be within a certain known volume of the room.

[0020] The above-described embodiments are exemplary only, and other possibilities and alternatives within the scope of the invention will be apparent to those skilled in the art. For example, while Fig. 1 shows hard-wiring between the processing means 8 and sensors and nozzles, a wireless configuration, for example using Wi-fi (RTM), Bluetooth (RTM) or the like.

[0021] Although the above described embodiments shows the use of water for use with the nozzles, other fire-extinguishing materials could be used, for example foam, halogens, carbon dioxide etc.

[0022] The sprayable region of each nozzle may be adjustable. For example, the processing means could cause a nozzle to eject the fire-extinguishing substance at a particular velocity, in order to maximise the amount of substance that reaches the region of raised temperature.

Claims

1. Fire extinguishing equipment comprising:

a sensor for detecting a region of raised temperature in a volume, the sensor having a field of view;
a nozzle for ejecting a fire-extinguishing substance therefrom at a sprayable region;
processing means in communication with the sensor and the nozzle;
wherein the processing means is adapted to cause the nozzle to eject the fire-extinguishing substance only when the sensor detects a region of raised temperature that substantially coincides with the sprayable region.

2. Equipment according to claim 1, wherein the sensor is operable to output a signal to the processing means when it detects a region of raised temperature within its field of view.

3. Equipment according to claim 2, wherein the processing means locates the region of raised temperature based on the field of view of the sensor when the signal is output.

4. Equipment according to either of claims 1 and 2, comprising a plurality of sensors.

5. Equipment according to claim 4, wherein the processing means locates the region of raised temperature based on the respective field of view of each sensor when said sensors output respective said signals.

5. Equipment according to any preceding claim, wherein the sensor is movable relative to the volume.

6. Equipment according to any preceding claim, comprising a plurality of nozzles.

7. Equipment according to any preceding claim, wherein the nozzle is movable relative to the volume.

8. Equipment according to any preceding claim, wherein the nozzle comprises an additional sensor for detecting the region of raised temperature.

9. Equipment according to any preceding claim, wherein the sensor comprises a passive infrared sensor.

10. Fire-extinguishing equipment substantially as herein described with reference to the accompanying figure.

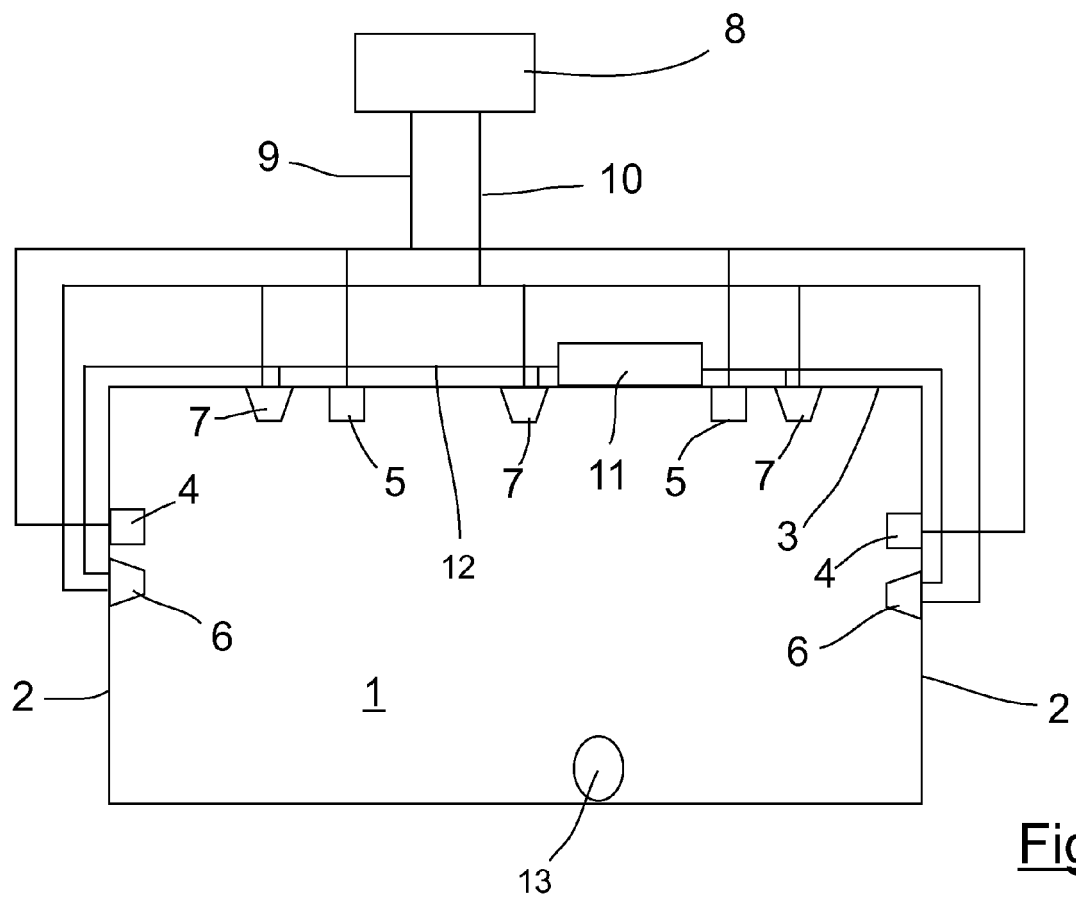


Fig. 1



EUROPEAN SEARCH REPORT

Application Number
EP 10 16 7901

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Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
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			TECHNICAL FIELDS SEARCHED (IPC)
			G08B
The present search report has been drawn up for all claims			
Place of search The Hague		Date of completion of the search 14 October 2010	Examiner Tanguy Michotte
CATEGORY OF CITED DOCUMENTS X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons & : member of the same patent family, corresponding document			

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**ANNEX TO THE EUROPEAN SEARCH REPORT
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EP 10 16 7901

This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report.
The members are as contained in the European Patent Office EDP file on
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