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(71) Applicant: **Carrier Corporation**
Palm Beach Gardens, FL 33418 (US)

(72) Inventor: **MOIX OLIVÉ, Pere**
Barclona 08950 (ES)

(74) Representative: **Dehns**
St. Bride's House
10 Salisbury Square
London EC4Y 8JD (GB)

(54) **SELF-CLEANING ASPIRATING SMOKE DETECTOR**

(57) An aspirating smoke detector system 1 comprises a network of pipes 4 connected to a central smoke detection unit 3, which includes a smoke sensor and a pump 6. The pump 6 is configured to selectively draw air through the network of pipes 4 in a first direction towards the smoke sensor during a normal mode of operation, and to blow air through the network of pipes 4 in a second, opposite direction during a cleaning mode of operation. The cleaning mode of operation may comprise reversing a direction of rotation of the pump 6, or may comprise changing how the pump 6 is connected to the network of pipes 4.

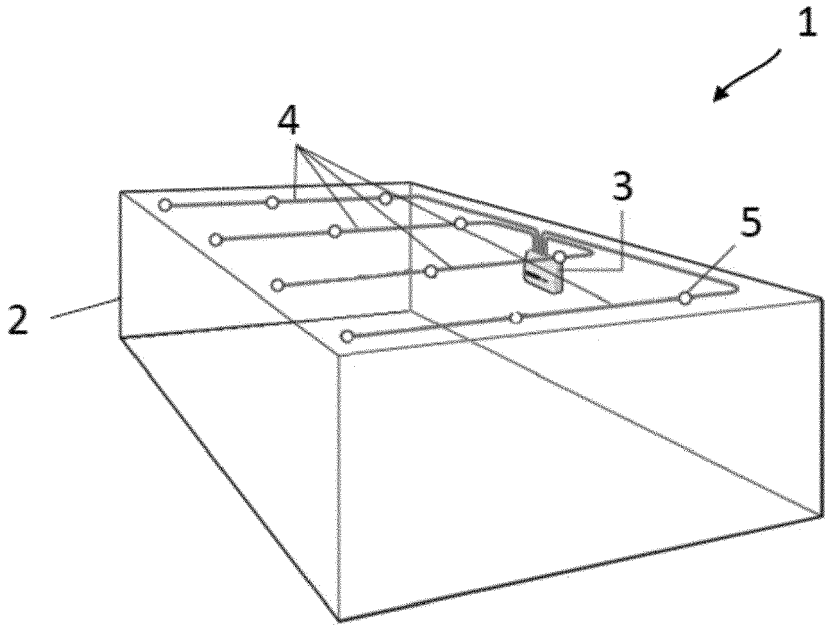

Fig. 1

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Description

[0001] The present disclosure relates to a self-cleaning aspirating smoke detector system.

[0002] An aspirating smoke detector system is a system used in active fire protection, comprising a central detection unit which draws air through a network of pipes to detect smoke in multiple locations around a building. The central detection unit includes a nephelometer that detects the presence of smoke particles suspended in air by examining light scattered from a laser beam passing through a sensor chamber. Aspirating smoke detector systems are typically much more sensitive than spot-type smoke detectors.

[0003] Over time, fouling such as dust and other pollutants can accumulate in the pipes. This can contaminate the air samples, resulting in false alarms, or can reduced flow rate through the network of pipes meaning that incomplete air samples are received by the central detection unit. Aspirating smoke detector systems are typically configured to monitor for the presence of fouling, and will trigger an alert if excessive fouling is detected.

[0004] When fouling is detected, it is necessary to clean the network of pipes. This typically comprises a maintenance worker disconnecting a section of the network of pipes and connecting a vacuum or compressor to that section in order to remove the accumulated fouling. In simpler aspirating systems, the section of the network of pipes may need to be mechanically disconnected. In other systems, valves may be included within the network of pipes to isolate a section of piping and to allow air to be supplied or vented via a separate port.

[0005] A need exists for an improved aspirating smoke detector system.

[0006] Viewed from a first aspect, the present disclosure provides an aspirating smoke detector system comprising a smoke sensor, a network of pipes for supplying air to the smoke sensor, and a pump configured to draw the air through the network of pipes in a first direction towards the smoke sensor during the normal mode of operation, wherein the system is configured to selective operate in a cleaning mode of operation in which the pump blows air in a second, opposite direction through at least part of the network of pipes.

[0007] The aspirating smoke detector system is thus capable of providing a self-cleaning function by using its pump to blow air through the network of pipes. This reduces or even avoids the need for manual cleaning of the pipes, as well as the need for a separate blower or vacuum to be connected to the system.

[0008] The aspirating smoke detector system may be configured to initiate the cleaning mode of operation responsive to detection of possible fouling. Possible fouling may be detected by detection of contaminants in air received by the smoke sensor and/or by detection of a reduction in air flow through the network of pipes.

[0009] Additionally, or alternatively, the aspirating smoke detector system may be configured to initiate the cleaning mode of operation periodically, for example daily, weekly, monthly, or based upon any other periodic cycle.

[0010] Yet further additionally, or alternatively, the aspirating smoke detector system may be configured to initiate the cleaning mode of operation responsive to an action by an operation, such as a command to initiate the cleaning mode of operation.

[0011] In one embodiment, the system may be configured such that the pump operates in a first direction during a normal mode of operation and in a second, opposition direction during the cleaning mode of operation.

[0012] The pump is preferably driven by an electric motor, and the motor may be operable in a first direction and a second, opposite direction. Thus, the motor may drive the pump in the first direction during the normal mode of operation, and may drive the pump in the second, opposition direction during the cleaning mode of operation.

[0013] In another embodiment, the system may comprise a valve arrangement to alternately connect an outlet of the pump to an outlet of the system and to the network of pipes. The outlet of the pump may be connected to the outlet of the system during the normal mode of operation, and the outlet of the pump may be connected to the network of pipes during the cleaning mode of operation.

[0014] The pump may comprise a centrifugal blower. However, any pump suitable for use with an aspirating smoke detector system may be used.

[0015] The system may be configured such that the pump moves air through the smoke sensor during the normal mode of operation. The system may be configured such that the pump does not move air through the smoke sensor during the cleaning mode of operation.The network of pipes preferably comprises at least one pipe, which may comprise one or more branches. Optionally, the network of pipe may comprise a plurality of pipes. The system may be configured to selectively isolate one or more of the plurality of pipes from a central unit comprising the smoke sensor and the pump. The system may be configured to selectively isolate one or more of the plurality of pipes from the central unit during either one or both of the normal mode of operation and the cleaning mode of operation.

[0016] The one or more pipes preferably each comprise a plurality of sampling holes exposed to a protected environment. The protected environment may comprise one or more rooms of a building.

[0017] The smoke sensor may comprise a nephelometer.

[0018] The system preferably comprises an alert module. The alert module may be configured to trigger an alert responsive to the detection of possible fouling. The alert module may be configured to trigger an alert responsive to detection of smoke.

[0019] The system may be installed within a building. Thus, in a preferred embodiment, the present disclosure also provides a building comprising a protected environ-

ment, and an aspirating smoke detector system as described above, wherein the network of pipes extends through the protected environment for supplying air from the protected environment to the smoke sensor.

[0020] Viewed from a second aspect, the present disclosure provides a method of operating an aspirating smoke detector system, comprising: when operating in a normal mode of operation, using a pump to draw air through the network of pipes in a first direction towards a smoke sensor; and when operating in a cleaning mode of operation, using the pump to blow air in a second, opposite direction through at least part of the network of pipes.

[0021] The aspirating smoke detector system may be an aspirating smoke detector system as described above, and may include any of the optional features described thereof.

[0022] The method may comprise initiating the cleaning mode of operation responsive to detection of possible fouling. The method may comprise detecting fouling, for example by detection of contaminants in air received by the smoke sensor and/or by detection of a reduction in air flow through the network of pipes.

[0023] The method may comprise initiating the cleaning mode of operation periodically, for example daily, weekly, monthly, or based upon any other periodic cycle.

[0024] The method may comprise initiating the cleaning mode of operation responsive to an action by an operation, such as a command to initiate the cleaning mode of operation.

[0025] In the normal mode of operation, the pump may operate in a first direction, and in the cleaning mode of operation, the pump may operate a second, opposition direction.

[0026] The pump is preferably driven by an electric motor, and the motor may be operate in a first direction and a second, opposite direction. Thus, the motor may drive the pump in the first direction during the normal mode of operation, and may drive the pump in the second, opposition direction during the cleaning mode of operation.

[0027] The method may comprise connecting an outlet of the pump to the outlet of the system during the normal mode of operation, and may comprise connecting the outlet of the pump to the network of pipes during the cleaning mode of operation.

[0028] The method may comprise moving the air through the smoke sensor during the normal mode of operation. The method may not move air through the smoke sensor during the cleaning mode of operation.

[0029] The network of pipes may comprise a plurality of pipes. The method may comprise, in the cleaning mode of operation, selectively isolating one or more pipe of the plurality of pipes and blowing the air only through one or more non-isolated pipe of the plurality of pipes.

[0030] A preferred embodiment of the present disclosure will now be described in greater detail, by way of example only and with reference to the drawings, in which:

Figure 1 shows a schematic illustration of an aspirating smoke detector system;

Figure 2 shows a central detection of the system during in a normal mode of operation; and

Figure 3 shows the central detection unit during a cleaning mode of operation.

[0031] Figure 1 shows an aspirating smoke detector system 1 configured to detect smoke within a protected environment 2. The illustrated protected environment 2 is shown as a single room, but it will be appreciated that the aspirating smoke detector system 1 may be readily employed to detect smoke across multiple rooms.

[0032] The aspirating smoke detector system 1 comprises a central detection unit 3 which is configured to receive air samples via a network of piping 4 that extends across the protected environment. In the illustrated embodiment, the network of piping 4 comprises a plurality of pipes disposed along a ceiling of the protected volume 2. The illustrated example includes four discrete pipes that each connect directly to the central detection unit 3, but in other embodiments the network of piping 4 may include more or fewer pipes, and one or more of the pipes may include branches.

[0033] The network of piping 4 comprises a plurality of sampling holes 5 located in the pipes of the network of piping 4 for collecting air samples from the protected volume 2.

[0034] The central detection unit 3 is configured to apply a reduced pressure to one or more pipes of the network of piping 4 so as to draw air through the sampling holes and along the respective pipes to the central detection unit 3. Where multiple pipes connect to the central detection unit 3, as in the illustrated embodiment, the aspirating smoke detector system 1 may comprise valves to selective draw air along the pipes. For example, the aspirating smoke detector system 1 may periodically draw air through each one of the pipes individually.

[0035] The central detection unit 3 comprises a sample analyser having a smoke sensor (not shown), such as a nephelometer. The sample analyser is configured to process air samples received from the network of piping 2 in order to detect at least the presence of smoke. Typically, the sample analyser will provided details regarding the quantity and/or composition of detected smoke.

[0036] The central detection unit 3 includes an alert module that is configured to monitor data output by the sample analyser and to trigger an alert based on the data. Typically, the alert module will be able to trigger different types of alert based on respective criteria. For example, an initial alert may be raised when low levels of smoke are detected, which may alert an appropriate member staff to investigate a potential fire risk, and a general alert may be raised when higher levels of smoke are detected, which may instruct occupants of the building to evacuate the building. Figures 2 and 3 show part of the central

detection unit 3 of the aspirating smoke detector system 1.

[0037] The central detection unit 3 comprises a pump 6 connected to an inlet conduit 7. The inlet conduit 7 is in turn connected to the network of piping 4 so as to receive the air samples and to supply the air samples to the sample analyser before the air is exhausted via an outlet conduit 8. The pump 6 in this embodiment is a centrifugal blower driven by an electric motor.

[0038] During a normal mode of operation, as illustrated in Figure 2, the pump 6 is driven in a first direction (clockwise in the figures), which causes the pump 6 to draw air through the network of piping 4 into the sample analyser.

[0039] The central detection unit 3 comprises monitoring software that monitors for indicators of potential fouling of the network of piping 4. Such indicators may include a reduce air flow rate, indicative of blockage of a pipe, or the presence of non-smoke particulate matter such as dust or other pollution. Upon detection of potential fouling, the central detection unit 3 initiates a cleaning mode of operation.

[0040] During the cleaning mode of operation, as illustrated in Figure 3, the pump 6 is driven in a second direction (counter clockwise in the figures) opposite to the first direction, which causes the pump 6 to blow air into the network of piping 4, i.e. air drawn in through the outlet conduit 8. This flow of air dislodges accumulated fouling and causes the fouling to be carried out of the network of piping 4 via the sampling holes 5.

[0041] Optionally, the central detection unit 3 may be configured to bypass the sample analyser when operating in the cleaning mode of operation, so as to avoid any risk of damaging the components thereof. Thus, the air may flow directly from the outlet conduit 8, through the pump 6 and out of the inlet conduit 7 into the network of piping 4.

[0042] In various embodiments, during the cleaning mode of operation, the pump 6 may be driven at maximum power. Additionally, during the cleaning mode of operation, one or more sections of the network of piping 4 may be isolated from the pump 6 so as to increase the flow rate of air through non-isolated sections. For example, in the illustrated embodiment, the system 1 may close valves to isolate three of the pipes of the network of pipes 4 from the pump 6, such that the full flow rate is directed along the remaining, non-isolated pipe. After that pipe has been cleaned, that pipe is then isolated and another pipe is connected to the pump 6 to be cleaned. This process is repeated until the entire network of piping 4 has been cleaned.

[0043] By using the pump 6 of the central detection unit 3, the aspirating smoke detector system is capable of performing self-cleaning of the network of pipes without the need for manual intervention or a separate cleaning apparatus being connected.

[0044] Whilst the described embodiment operates the pump 6 in reverse, a similar effect can be achieved by utilising a valve arrangement to switch the connections between an inlet and an outlet of the pump 6, and the inlet conduit 7 and the outlet conduit 8. For example, during the normal mode of operation, the inlet of the pump 6 would be connected to the inlet conduit 7 and the outlet of the pump 6 would be connected to the outlet conduit 8, and in the cleaning mode of operation, the inlet of the pump 6 would be connected to the outlet conduit 8 and the outlet of the pump 6 would be connected to the inlet conduit 7.

Claims

1. An aspirating smoke detector system comprising a smoke sensor, a network of pipes for supplying air to the smoke sensor, and a pump configured to draw the air through the network of pipes in a first direction towards the smoke sensor during a normal mode of operation, wherein the system is configured to selective operate in a cleaning mode of operation in which the pump blows air in a second, opposite direction through at least part of the network of pipes.

2. A system according to claim 1, wherein the system is configured to initiate the cleaning mode of operation responsive to detection of possible fouling.

3. A system according to claim 1 or 2, wherein the system is configured to initiate the cleaning mode of operation periodically.

4. A system according to any preceding claim, wherein the system is configured to operate the pump in a first direction during the normal mode of operation and in a second, opposition direction during the cleaning mode of operation.

5. A system according to any of claims 1 to 3, wherein the system may comprise a valve arrangement configured to alternately connect an outlet of the pump to an outlet of the system during a normal mode of operation, and connect the outlet of the pump to the network of pipes during the cleaning mode of operation.

6. A system according to any preceding claim, wherein the network of pipes comprise a plurality of pipes, and wherein the system is configured to selectively isolate one or more of the plurality of pipes from a central unit comprising the smoke sensor and the pump.

7. A building comprising a protected environment and an aspirating smoke detector system according to any preceding claim, wherein the network of pipes extends through the protected environment for supplying air from the protected environment to the

smoke sensor.

8. A method of operating an aspirating smoke detector system, comprising:

when operating in a normal mode of operation, using a pump to draw air through the network of pipes in a first direction towards a smoke sensor; and
when operating in a cleaning mode of operation, using the pump to blow air in a second, opposite direction through at least part of the network of pipes.

9. A method according to claim 8, comprising:
initiating the cleaning mode of operation responsive to detection of possible fouling.

10. A method according to claim 8 or 9, comprising:
initiating the cleaning mode of operation periodically.

11. A method according to any of claims 8 to 10, wherein the pump operates in a first direction during the normal mode of operation, and operates in a second, opposition direction during the cleaning mode of operation.

12. A method according to any of claims 8 to 10, wherein an outlet of the pump is connected to an outlet of the system during the normal mode of operation, and wherein the outlet of the pump is connected to the network of pipes during the cleaning mode of operation.

13. A method according to any of claims 8 to 11, wherein the network of pipes comprises a plurality of pipes, the method further comprising:
in the cleaning mode of operation, selectively isolating one or more pipe of the plurality of pipes and blowing the air only through one or more non-isolated pipe of the plurality of pipes.

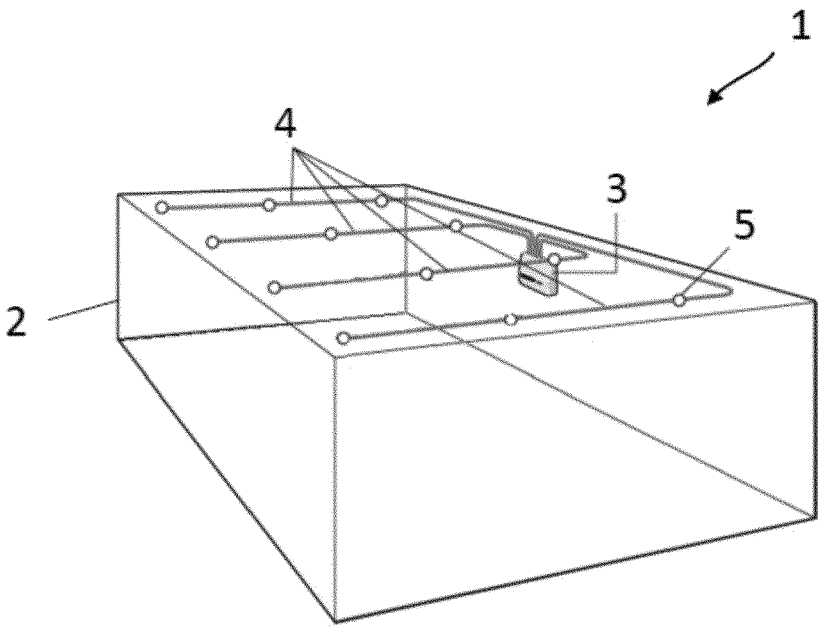

Fig. 1

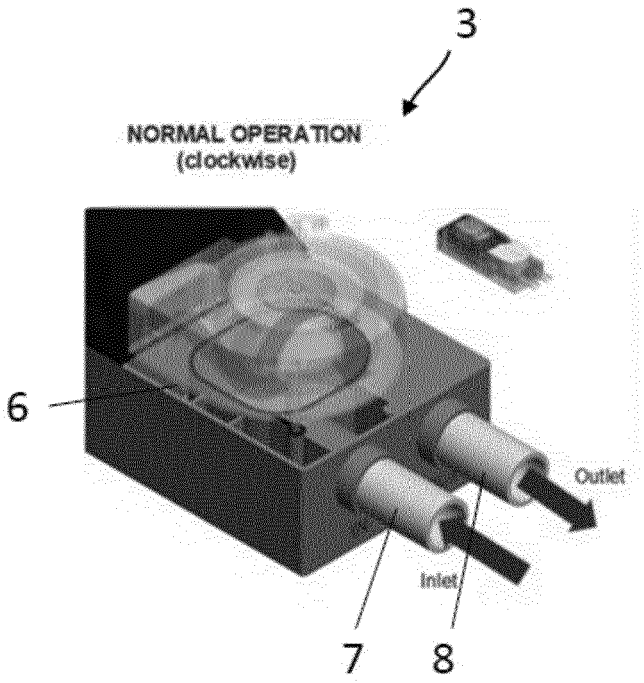

Fig. 2

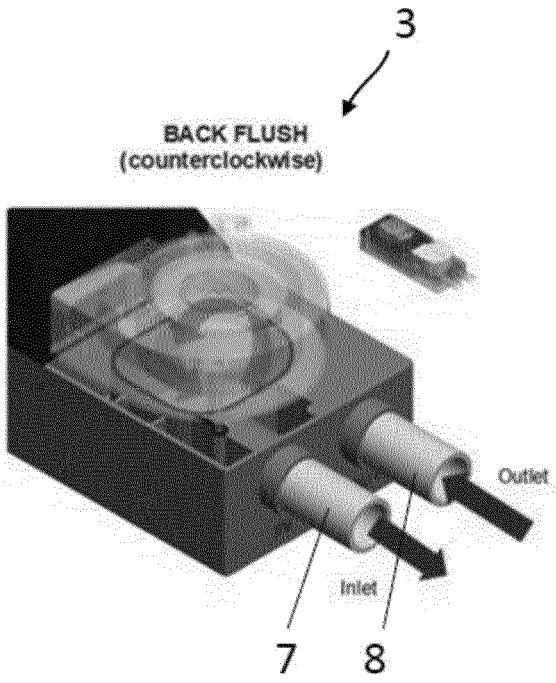

Fig. 3

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EUROPEAN SEARCH REPORT

Application Number
EP 20 38 2245

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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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The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
Munich	11 September 2020	Heß, Rüdiger

CATEGORY OF CITED DOCUMENTS

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