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(54) **CENTRAL DETECTION UNIT FOR AN ASPIRATING DETECTION SYSTEM**

(57) A central detection unit for an aspirating detection system, a kit for assembling a central detection unit for an aspirating detection system and a method of assembling a central detection unit for an aspirating detection system are described.

The central detection unit 2 comprises: a plurality of modular sensor units 3; and a controller 4 for receiving an input from each of the plurality of modular sensor units.

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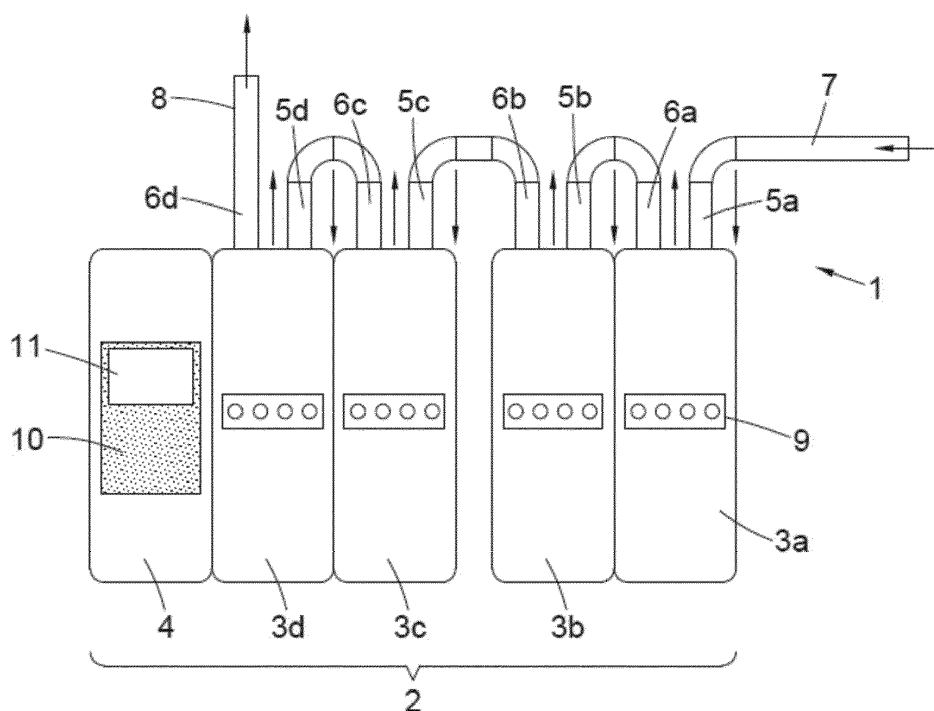


Fig. 1

Description

[0001] The present invention relates to a central detection unit for an aspirating detection system, a kit for assembling a central detection unit for an aspirating detection system and a method of assembling a central detection unit for an aspirating detection system.

[0002] Aspirating detection systems are generally aspirating smoke detectors, i.e. aspirating detection systems employed for smoke detection in buildings or locations where point smoke detectors may not provide sufficient detection of smoke. Aspirating smoke detectors may detect smoke at a centralised detection location. The centralised detection location may be regarded as a centralised detection unit. Aspirating smoke detectors typically draw air from various sampling locations through a network of pipes, the sample air then being analysed to determine if any smoke is present. Accordingly it is understood that an aspirating smoke detector generally comprises a centralised detection location, and a network of pipes through which air is aspirated to the centralised detection location. Once smoke is detected the aspirating smoke detector generates an alarm, indicating that the sampled environment is compromised. By using a centralised detection location, aspirating smoke detectors may sample large areas (e.g. entire and/or multiple floors and rooms of buildings or other structures) with high efficiency and/or accuracy.

[0003] It is desirable to provide a central detection unit for an aspirating detection system that provides greater flexibility. This may permit a decrease in installation, maintenance and/or monitoring costs for a building.

[0004] Viewed from a first aspect, the invention provides a central detection unit for an aspirating detection system. The central detection unit comprises: a plurality of modular sensor units; and a controller for receiving an input from each of the plurality of modular sensor units.

[0005] The provision of a plurality of modular sensor units, each of which provides an input to be received by the controller, allows custom-built/bespoke aspirating detection systems to be provided. The unit may be capable of being modified to allow the sensing and/or detecting a number of combinations of different conditions and/or parameters, as required.

[0006] The modular sensor units may each comprise one or more respective sensors and/or other sensing devices.

[0007] By modular it may be meant that each sensor unit is a separate discrete module. The modular sensor units may be interchangeable. Hence the sensor units may be interchanged as required as a result of their modularity.

[0008] The present invention may provide an aspirating detection system comprising a network of one or more sampling pipes and the central detection unit.

[0009] Typically in a building when it is desired to detect conditions in addition to the presence of smoke, multiple systems (including systems other than aspirating sys-

tems) are employed to detect different gas properties as well as for fire detection purposes. These may include, but are not limited to, gas leak detection and carbon monoxide detection, as well as for the detection of other industrial substances. As such multiple piping systems, multiple detection units, multiple control panels and/or multiple alarms, may be installed within a building or location where it is desired to monitor an environment. Similarly multiple detection units may also be installed at separate locations, and/or on separate platforms. As a result the installation, maintenance and monitoring of multiple detecting systems within a building or location may be expensive and time consuming.

[0010] The central detection unit for an aspirating detection system of the present invention that comprises a plurality of modular sensor units may be used to detect multiple conditions/parameters with a single detection system and/or a single network of one or more pipes. This may make the detecting and monitoring of multiple conditions possible using a single detection system.

[0011] The central detection unit/aspirating detection system may be for detecting and/or monitoring one or more conditions in a building. The central detection unit may be for detecting smoke and/or conditions other than the presence of smoke. The central detection unit may be for detecting conditions other than the presence of fire.

[0012] The central detection unit may be regarded as a modular central detection unit.

[0013] The aspirating detection system may be regarded as a modular aspirating detection system.

[0014] The aspirating detection system may comprise a single network of one or more pipes, a single controller and a plurality of modular sensor units. The modular sensor units may each be connected to the single network of pipe(s) and/or the single controller.

[0015] The plurality of modular sensor units may be interchangeable. Because the sensor units are modular they may be interchanged easily according to the building requirements and/or owner or occupant requirements. This may be performed without having to change the network of pipes and central controller. This means that a bespoke system may easily be provided. Also, the units may be easily replaced and repaired such that maintenance is facilitated. Thus the system may be easily maintained, repaired, or modified after its installation to maintain its performance.

[0016] The provision of a controller in the central detection unit may centralise the detecting of the aspirating detection system.

[0017] The modular sensor units may be connected to the controller, e.g. a single/centralised controller. As a result the output from all of the sensor units may be collated at a single output point. This may facilitate monitoring of the building.

[0018] The sensor units may also each be controlled by the single controller.

[0019] The invention may provide a customisable central detection unit/aspirating detection system which may

reduce manufacturing and installation costs, may be easier to maintain, and may be easier to modify, due to its modularity.

[0020] The central detection unit with a plurality of sensor units may allow the monitoring of a number of conditions on a single platform.

[0021] The provision of a central detection unit/an aspirating detection system based on a common modular platform may provide all-in-one monitoring of different conditions, e.g. different substances such as gases and/or smoke. This may negate the need to provide multiple systems, which may result in a more compact aspirating detection system.

[0022] Each modular sensor unit may comprise an information panel. The information panel may comprise a number of buttons, lights or other visual indicators. The information panel may be for indicating the operation, status and/or performance of the modular sensor unit. For example, the information panel may be for indicating whether the sensor unit is on, connected to the controller and/or whether there are any faults with the sensor unit itself.

[0023] The modular sensor units may each comprise substantially the same general construction and/or structure.

[0024] The modular sensor units may each have the same shape and/or size and/or the inlets and/or outlets may be in the same relative positions for each sensor unit. The housing for each modular sensor unit may be the same.

[0025] For example, each sensor unit may have the same (e.g. substantially the same) external dimensions. Each sensor unit may have a sample input and/or output location that are located relative to each other the same as the sample inputs and outputs of each other modular sensor unit. The sensor units may be interchanged with one another without modification to the other sensor units and/or other parts of the system such as the controller and/or pipes. Thus the modular sensor units may be regarded as interchangeable sensor units. The modular sensor units may be interchanged for one another without changes to their hardware, software, structure, design and/or structure, or other general properties which they may comprise. The same is understood to apply to the term 'modularity' used herein.

[0026] The modular sensor units may be interchanged for one another without changes to the hardware, software, structure, design and/or other general properties of the other parts of the detection system such as the controller and/or network of pipes (i.e. sampling pipes).

[0027] The central detection unit may comprise one or more dummy sensor units. These dummy sensor units may not comprise any sensors. The dummy sensor units may provide for a continuation of the flow path for the sampled air. For example, the dummy sensor may be a housing which is the same as the housing for the other sensor units but just with internal pipes for connecting the inlet to the outlet. The dummy sensor units may each

comprise substantially the same general construction and/or structure as the modular sensor units comprising sensors.

[0028] The one or more dummy sensor units (if present) may each have the same shape and/or size and/or the inlets and/or outlets may be in the same relative positions as the modular sensor units with sensors.

[0029] For a central detection unit with a dummy sensor unit, if it is desired for an additional condition to be sensed, the dummy unit may be interchanged for a modular sensor unit with a sensor for detecting that condition.

[0030] The system may be a "plug-and-play" type system allowing modular sensor units to be simply plugged in without any other modifications to the system. This may be possible if the software of the controller is already programmed so that the controller can receive a process input from a suite of available modular sensor units.

[0031] Each of the plurality of modular sensor units may be configured to detect different conditions and/or parameters to the other modular sensor units. Accordingly, each of the plurality of modular sensor units may comprise one or more sensors for detecting one or more different conditions and/or parameters.

[0032] The present invention may provide a central detection unit for an aspirating detection system, wherein the central detection unit comprises a plurality of sensors (which may each be provided by a separate modular sensor unit) for detecting a plurality of different conditions and/or parameters. These conditions may be conditions other than the presence of smoke particles.

[0033] Each of the plurality of modular sensor units may be connected to one another in series. That is, being an aspirating detection system, an intake of aspirating air may be configured to (i.e. in use) flow sequentially through each of the plurality of modular sensor units.

[0034] Each of the plurality of modular sensor units may comprise an inlet and an outlet. The plurality of modular sensor units may be connected to each other in series via the inlet and outlet of each of the plurality of modular sensor units. The inlet of one of the plurality of modular sensor units may be connected to the outlet of an upstream and adjacent modular sensor unit. Additionally or alternatively, the outlet of one of the plurality of modular sensor units may be connected to the inlet of a downstream and adjacent modular sensor unit.

[0035] The inlet of an upstream modular sensor unit may be connected to an intake portion of the aspirating system and/or central detection unit. The intake portion of the aspirating system and/or central detection unit may receive air from a network of one or more pipes. Additionally and/or alternatively, the outlet of a downstream modular sensor unit may be connected to an exhaust of the aspirating detection system and/or central detection unit.

[0036] The most upstream modular sensor unit of the plurality of modular sensor units may be regarded as the first modular sensor unit. The first modular sensor unit may be configured to receive the aspirated air of the as-

pirating detection system via its inlet, before passing it on to any adjacent, downstream modular sensor unit(s). Given that the upstream modular sensor unit is that of an aspirating detection system, the intake portion of the aspirating detection system may be a network of one or more pipes. The network of pipes may be preinstalled and/or part of a previous aspirating detection system.

[0037] The most downstream modular sensor unit of the plurality of modular sensor units may be regarded as the last modular sensor unit. The last modular sensor unit may exhaust the aspirated air from the central detection unit/aspirating detection system via its outlet. The last modular sensor unit may be configured to receive aspirated air from any adjacent and upstream modular detection unit.

[0038] Connecting the plurality of modular sensor units to one another as discussed may facilitate the installation and/or removal of the one or more of the plurality of modular sensor units from the central detection unit.. Connecting the plurality of modular sensor units in series may ease the maintenance and installation of the central detection unit/aspirating detection system. Additionally and/or alternatively, requiring that each of the plurality of modular sensor units is connected in a similar manner may simplify the manufacture of the modular sensor units and may simplify the installation and customisability of the aspirating detecting system, owing to the modular one-size-fits-all approach of the system. Simplification of these processes may result in reduced costs and time taken to perform these processes.

[0039] The modular sensor units may alternatively be connected in parallel. The aspirating detection system may comprise a manifold. The manifold may be for directing air from the network of pipes to the modular sensor units.

[0040] The central detection unit may be configured so that one or more of the modular sensor units can be disconnected, e.g. removed and/or interchanged, without affecting the other modular sensor units.

[0041] The central detection unit/system may comprise interconnecting pipes for connecting between the modular sensor units (and dummy sensor units, if present). The interconnecting pipes may be in fixed positions to allow the sensor units to be interchanged easily. The interconnecting pipes may be flexible.

[0042] The inlet of each modular sensor unit may be regarded as upstream of its outlet, whilst the outlet may be regarded as downstream of its inlet, as in most systems where there is a flow. As it will be readily appreciated for an aspirating detection system, the flow is a fluid flow. The fluid flow is preferably in a gaseous phase. The fluid may be sampled air from the building, i.e. air drawn in through the network of one or more pipes.

[0043] Upstream may be regarded as the direction in which a fluid, such as air, is initially aspirated into the central detection unit/aspirating detection system, whilst downstream may be regarded as the direction in which the fluid, such as air, is finally exhausted from the central

detection unit/aspirating detection system.

[0044] The connecting of each of the plurality of modular sensor units, as described herein, may be regarded as connecting the modular sensor units such that an aspirated fluid may flow through the plurality of modular sensor units, e.g. in series. The plurality of modular sensor units may be in flow communication with one another. The plurality of modular sensor units may be in flow communication with one another in series.

[0045] The aspiration detection system may be configured to aspirate air from a surrounding environment. To aspirate air from the surrounding environment, an aspirator (i.e. air moving device), such as one or more pumps and/or one or more fans may be provided, each configured to aspirate air. The one or more pumps and/or one or more fans may be provided downstream or upstream of the plurality of modular sensor units. Additionally and/or alternatively, the one or more pumps and/or one or more fans may be provided within one or more of the plurality of modular sensor units (and optionally dummy sensor units, if present) as required.

[0046] One or more or each of the one or more of the plurality of modular sensor units (and optionally dummy sensor units, if present) may be provided with an aspirator, e.g. a pump and/or a fan. The aspirator of each unit may be switched on or off as required. In a system with a plurality of aspirators (e.g. an aspirator in each sensor unit or dummy sensor unit), each aspirator may be independently operable and/or controllable.

[0047] By providing one or more independently operable and/or controllable aspirators within one or more of the plurality of modular sensor units (and optionally dummy sensor units, if present) the total air flow speed within the aspiration detection system may be adjusted, e.g. optimised. For example, each of the one or more aspirators (e.g. fans and/or pumps) may each generate a static pressure. The total pressure generated by the aspiration detection system for aspirating air may be regarded as the sum of the static pressures of each of the aspirators. As such the pressure generated and/or the total air flow speed may be adjusted by interchanging the modular and/or dummy sensor units and/or by controlling, e.g. powering on or off, the aspirators as required. This may be used to achieve a desired airflow rather than using bigger or unnecessary aspirators (e.g. fans and/or pumps). This may allow a balance between maximising the energy efficiency of the system whilst achieving a desired coverage area and/or sample transit time of the system.

[0048] For example, if the aspirating detection system has a relatively short network of one or more pipes (e.g. in a prison cell), the system may be operated with only one aspirator on. Any other aspirators in the system may be off. If the aspirating detection system has a relatively long network of one or more pipes (e.g. in a shopping centre/mall or an airport), the system may be operated with many, or all of the aspirators on, as required.

[0049] The aspirating detection system and/or central

detection unit may comprise a single aspirator for directing sampled air through all of the sensor units.

[0050] The plurality of modular sensor units may sample the same intake of aspirated air independently of one another. That is, the plurality of modular sensor units may sample the same intake of aspirated air without affecting the properties of the sample. As the modular sensor units may be provided in series, the sample or air aspirated by the system may pass through each of the plurality of modular sensor units. As the outlet of one modular sensor unit may act as the inlet of another, all air aspirated may be passed through each sensor. Accordingly, the sensing of the one or more conditions and/or parameters by the one or more sensors and/or other sensing devices of the each of the plurality of modular sensor units may not impact the sensing and/or measuring performed by the other modular sensor units.

[0051] The sensor units may be for one or more of gas sensing, fire sensing, explosive detection and/or industrial leak detection.

[0052] The sensor units may each be for detecting different compounds.

[0053] The one or more sensor units may be configured to detect at least one of the following parameters/conditions: smoke (including different types of smoke), carbon monoxide, ammonia gas, hydrogen gas, chlorine gas, oxygen, methane gas, or sulphides. Accordingly, the aspirating detection system may be modified (i.e. by interchanging the modular sensor units) based on which conditions and/or parameters are desired to be detected. Additionally and/or alternatively, modular sensor units may be combined to detect certain substances and/or conditions based on a combination of the one or more sensors. For example, the combination of a plurality of modular sensor units comprising smoke, carbon monoxide and oxygen sensors could be used to detect fires. As another example, the combination of a plurality of modular sensor units comprising ammonia gas and hydrogen gas sensors could be used to detect explosives or potentially explosive substances, e.g. in airports and/or public transport hubs. In another example, the sensor units may comprise a methane sensor, a hydrogen gas sensor and/or an oxygen sensor, such that the central detection unit is configured to detect gas leaks. In yet another example, the central detection unit may comprise a plurality of smoke sensor units each comprising different laser diodes, such that the central detection unit may be configured to discriminate between different sources of smoke.

[0054] The controller is suitable for receiving an input (e.g. data) from each of the plurality of modular sensor units. The input from each of the plurality of modular sensor units may be one or more signals from each of the plurality of modular sensor units. The one or more signals from the modular sensor units may correspond to the detection of the one or more conditions and/or parameters by the one or more sensors. Accordingly, the input received by the controller may correspond to the sensing

of one or more conditions sensed by the modular sensor unit. The input received from each of the plurality of modular sensor units may correspond to a different condition. This is because each of the plurality of modular sensor units may be configured to sense a different condition.

[0055] The controller may be in electronic communication with the each of the plurality of modular sensor units. The electronic communication may be wired communication and/or wireless communication. The wireless communication may be performed by a number of protocols, including but not limited to infrared, WiFi, radio, Bluetooth or other known wireless forms of communication.

[0056] The controller may comprise a processor. The processor may be configured to generate an alarm signal when one or more conditions and/or parameters are detected by the one or more sensors. The processor may be configured to receive the input from each of the plurality of modular sensor units. The controller may be configured to process (e.g. using the processor) the input (e.g. data) from each of the plurality of modular sensor units and detect one or more conditions/parameters based on the received input.

[0057] The controller may be programmed so that it can process the input from a number of different sensor units. The controller may be arranged so that the software can be adjusted as required if the sensor units are interchanged and/or additional sensor units are added to the central detection unit. Alternatively, the controller may be programmed to process the input from different sensor units that are available to be used with that central detection unit. In this way, the sensor units may be chosen and/or interchanged without having to modify, e.g. reprogram, the controller.

[0058] The controller may be a control unit, i.e. a module that is discrete from the modular sensor units. The controller may be housed in a control panel unit. The control panel unit may comprise the controller, may comprise the processor, and/or may comprise one or more devices which facilitate the electronic communication of each of the plurality of modular sensor units with the controller. The control panel unit may comprise a screen or other visual indicator displaying current properties and/or a status of the controller. The control panel unit may comprise an aural or visual indicator with which the sensing and/or detection of one or more conditions may be indicated.

[0059] The system may comprise a single control panel for reporting the status of the plurality of sensor units. The single control panel may be used to display the status of the building with regard to a plurality of different conditions.

[0060] Viewed from a second aspect, the invention provides a kit for assembling a central detection unit of an aspirating detection system, wherein the central detection unit comprises: one or more modular sensor units and a controller for receiving an input from each of the one or more modular sensor units. The kit comprises:

the controller; and a plurality of modular sensor units from which the one or more modular sensor units can be selected.

[0061] Each of the modular sensor units from which the one or more modular sensor units is selected may be for sensing a different parameter (as discussed above). Thus a bespoke central detection unit/aspirating system may be built from the kit. The bespoke aspirating detection system may have a network of one or more sampling pipes (which may be preinstalled in the building) and a controller. The central detection unit may be made bespoke by selecting the desired modular sensor units.

[0062] The plurality of modular sensor units from which the one or more modular sensor units can be selected may be referred to as a suite of modular sensor units.

[0063] The kit may comprise one or more dummy sensor units. These dummy sensor units may be as discussed above.

[0064] The may comprise one or more interconnecting pipes and/or manifolds for connecting the sensor units. These interconnecting pipes and/or manifolds may be as discussed above.

[0065] The central detection unit/aspirating detection system may be the central detection unit/aspirating detection system of the first aspect. One or more of the above features, including optional features may be provided by the kit for assembling a central detection unit of an aspirating detection system.

[0066] The kit may be for assembling an aspirating detection system comprising the central detection unit. In this case the kit may comprise a network of one or more sampling pipes for sampling air directed to the central detection unit.

[0067] The kit may be for retrofitting a preinstalled (i.e. pre-existing) aspirating detector system (e.g. a pre-installed aspirating smoke detector) to provide a modular aspirating detection system, e.g. the aspirating detection system of the first aspect. This may be achieved by replacing the central detection unit of the pre-existing aspirating detection system with the modular central detection unit. This modular central detection unit may be as described above and comprise one or more or all of the above described optional features.

[0068] The kit of the second aspect may have one or more or all of the features (including optional features) of the aspirating detection system/central detection unit of the first aspect and/or be capable of being used to assemble a central detection unit and/or aspirating detection system of the first aspect. Thus the above description may be equally applicable to the kit of the second aspect.

[0069] As is known in the state of the art, aspirating detection systems conventionally comprise a network of pipes. The network of pipes comprises a number of sampling points through which air is aspirated, before being monitored at a central monitoring location. Owing to the modular nature of the aspirating detection system and/or

central detection unit, the central detection unit may be connected to the existing network of pipes without additional pipes being installed in the existing pipe network. Advantageously, this may reduce installation costs and may minimise damage to the structure and/or the building in which the aspirating detection system is to be fitted. Further, the ability of the aspirating detection system to be retrofitted may mean that the central detection unit of an existing aspirating detection system may be modified and/or replaced by the modular central detection unit, such that a number of conditions and/or parameters may be sensed. The modularity of the central detection unit/aspirating detection system may reduce manufacture and installation costs associated with the kit, and/or during retrofitting of the aspirating detection system.

[0070] The kit may be configured to retrofit the aspirating detection system/central detection unit to an existing network of pipes. The inlet of the upstream modular sensor unit may therefore be connected to the existing network of pipes. The network of pipes may be the intake portion of the aspirating detection system/central detection unit. It is to be appreciated that, when only one of the plurality of modular sensor units is selected such that the central detection unit comprises one modular sensor unit, the one modular sensor unit is conceivably both the upstream and downstream modular sensor unit. The inlet of the one modular sensor unit may be connected to the intake portion. Similarly, the outlet of the one modular sensor unit may be connected to an exhaust of the central detection unit/aspirating detection system.

[0071] Viewed from a third aspect, the invention provides a method of assembling a central detection unit of an aspirating detection system. The method comprises: providing a controller; providing a plurality of modular sensor units; selecting one or more of the plurality of modular sensor units; and assembling the central detection unit from the controller and the one or more selected modular sensor units.

[0072] The method may be for assembling an aspirating detection unit/central detection unit of the first aspect. Thus the above described features, including one or more or all of the optional features may be provided by the method of the third aspect. Thus the above disclosure should be understood to be applicable to the method in addition to the system. The method may be for assembling the aspirating detection system. In this case the method may comprise connecting the central detection unit to a network of one or more sampling pipes.

[0073] The provision of a plurality of modular sensor units, each of which provides an input to be received by the controller, and the selection of one or more of the plurality of modular sensor units, allows custom-built aspirating detection systems to be provided.

[0074] Each central detection unit may be capable of sensing and/or detecting a number of combinations of different conditions and/or parameters as required.

[0075] The modular sensor units may each comprise respective sensors and/or other sensing devices.

[0076] The modular sensor units may be interchanged as required as a result of their modularity. Accordingly, the aspirating detection system may be easily maintained, repaired, or modified after its installation to maintain its performance.

[0077] The provision of a controller (e.g. a single controller) in the central detection unit may centralise the detecting requirements of the aspirating detection system. The modular sensor units may be controlled by a centralised controller. Thus the invention provides a customisable central detection unit/aspirating detection system which may reduce manufacturing and installation costs, may be easier to maintain, and may be easier to modify. This may be achieved due to the system/detection unit modularity.

[0078] The provision of an aspirating detection system based on a common modular platform may provide all-in-one monitoring of different gas properties. This may negate the need to provide multiple systems, which may result in a more compact aspirating detection system and/or more efficient, effective and/or easier monitoring of a building.

[0079] The modular sensor units may comprise substantially the same general construction and/or structure, such that they may be interchanged with one another without modification to each of the sensor units. Thus the modular sensor units may be regarded as interchangeable sensor units. As discussed above, the modular sensor units may each have the same shape and/or size and/or the inlets and/or outlets may be in the same relative positions.

[0080] The modular sensor units may be interchanged for one another without changes to their hardware, software, structure, design and/or structure, or other general properties which they may comprise.

[0081] The central detection unit may comprise one or more dummy sensor units. These dummy sensor units may not comprise any sensors. The dummy sensor units but may simply provide for a continuation of the flow path for the sampled air. For example, the dummy sensor may be a housing which is the same as the housing for the other sensor units but just with internal pipes for connecting the inlet to the outlet. The dummy sensor units may each comprise substantially the same general construction and/or structure as the modular sensor units comprising sensors.

[0082] The one or more dummy sensor units (if present) may each have the same shape and/or size and/or the inlets and/or outlets may be in the same relative positions as the modular sensor units with sensors.

[0083] For a central detection unit with a dummy sensor unit, if it is desired for an additional condition to be sensed, the dummy unit may be interchanged for a modular sensor unit with a sensor for detecting that condition.

[0084] The system may be a "plug-and-play" type system allowing modular sensor units to be simply plugged in without any other modifications to the system. This may be possible if the software of the controller is already

programmed so that the controller can receive a process input from a suite of available modular sensor units.

[0085] Each of the plurality of modular sensor units may be configured to detect different conditions and/or parameters to the other modular sensor units.

[0086] The modular sensor units may be interchanged for one another without changes to the hardware, software, structure, design and/or other general properties of the other parts of the system such as the controller and/or network of pipes (i.e. sampling pipes).

[0087] Each of the plurality of modular sensor units may comprise one or more sensors for detecting one or more different conditions and/or parameters.

[0088] Each of the plurality of modular sensor units, and thus each of the one or more modular sensor units selected, may comprise an inlet and an outlet.

[0089] The inlet of each modular sensor unit may be regarded as upstream of its outlet, whilst the outlet may be regarded as downstream of its inlet, as in most systems where there is a flow. As it will be readily appreciated for an aspirating detection system, the flow is a fluid flow. The fluid flow is preferably in a gaseous phase (e.g. sampled air from the building). Accordingly, upstream may be regarded as the direction in which a fluid, such as air, is initially aspirated into the central detection unit/aspirating detection system, whilst downstream may be regarded as the direction in which the fluid, such as air, is finally exhausted from the central detection unit/aspirating detection system.

[0090] The method may comprise connecting the inlet of an upstream modular sensor unit of the one or more modular sensor units to an intake portion of the central detection unit/aspirating detection system. Additionally and/or alternatively, the method may comprise connecting the outlet of a downstream modular sensor unit of the one or more modular sensor units to an exhaust. It is to be appreciated that, when only one of the plurality of modular sensor units is selected such that the central detection unit comprises one modular sensor unit, the one modular sensor unit may be simultaneously both the upstream and downstream modular sensor unit. Accordingly, the inlet of the one modular sensor unit may be connected to the intake portion. Similarly, the outlet of the one modular sensor unit may be connected to an exhaust of the central detection unit/aspirating detection system.

[0091] The most upstream modular sensor unit of the one or more modular sensor units may be regarded as the first modular sensor unit. The first modular sensor unit may be configured to initially receive the aspirated air of the aspirating detection system via its inlet, before passing it on to any adjacent, downstream modular sensor unit. Given that the upstream modular sensor unit is that of an aspirating detection system, the intake portion of the aspirating detection system may be a network of one or more pipes. The network of pipes may be pre-installed and/or part of a previous aspirating detection system.

[0092] The method may involve connecting the inlet of the most upstream modular sensor unit to the intake portion of the aspirating detection system.

[0093] The most downstream modular sensor unit of the one or more modular sensor units may be regarded as the last modular sensor unit. The last modular sensor unit may exhaust the aspirated air from the aspirating detection system via its outlet. The last modular sensor unit may be configured to receive aspirated air from any adjacent and upstream modular detection unit. The method may involve connecting the outlet of the most downstream modular sensor unit to the exhaust of the central detection unit/aspirating detecting system.

[0094] Each of the plurality of modular sensor units may be configured to be connected to one another in series. An intake of aspirated air may be configured to flow sequentially through each of the plurality of modular sensor units. As will be appreciated, to be connected in series there must at least be two modular sensor units selected from the plurality of modular sensor units. Accordingly, the method may comprise selecting at least two or more (i.e. a plurality) of the plurality of modular sensor units. In this case the method may comprise the step of connecting each of the two or more modular sensor units to one another in series.

[0095] As discussed above, each of the plurality of modular sensor units may comprise an inlet and an outlet. Accordingly, the modular sensor units may be connected to each other in series via the inlet and outlet of each of the two or more modular sensor units. The method may comprise connecting each of the two or more modular sensor units to one another in series via the inlet and outlet of each of the two or more modular sensor units. Thus the method may comprise connecting the inlet of one of the two or more modular sensor units to the outlet of an upstream and adjacent modular sensor unit. Additionally and/or alternatively, the method may comprise connecting the outlet of one of the two or more modular sensor units to the inlet of a downstream and adjacent modular sensor unit.

[0096] Connecting the one, two, or more modular sensor units to one another as discussed may facilitate the installation and/or removal of the one, two, or more modular sensor units from the central detection unit when and where required.

[0097] Connecting the two or more modular sensor units in series may ease the maintenance and installation of the central detection unit/aspirating detection system.

[0098] The two or modular sensor units may be connected in parallel.

[0099] Requiring that each of the two or more modular sensor units is connected in a similar manner may simplify manufacture of the modular sensor units and may simplify the installation and customisability of the aspirating detecting system, owing to the modular one-size-fits-all approach of the central detection unit. Simplification of these processes may result in reduced costs and time taken to perform these processes.

[0100] The connecting of each of the one or more modular sensor units, as described herein, may be regarded as connecting the modular sensor units such that an aspirated fluid (e.g. aspirated air) may flow in through the one or more modular sensor units. The aspirated fluid may flow in series through the two or more modular sensor units. The two or more modular sensor units may be in flow communication with one another. The two or more modular sensor units may be in flow communication with one another in series.

[0101] The aspiration detection system may be configured to aspirate air from a surrounding environment. To aspirate air from the surrounding environment, an aspirator (i.e. air moving device), such as one or more pumps and/or one or more fans may be provided, each configured to aspirate air. Hence the method may comprise providing an aspirator, e.g. one or more pumps and/or fans, wherein the one or more pumps and/or fans are configured to aspirate air. The aspirator, e.g. one or more pumps and/or fans, may be provided downstream or upstream of the one or more modular sensor units. Additionally and/or alternatively, the aspirator, e.g. one or more pumps and/or fans, may be provided within one or more of the one or more modular sensor units (and optionally dummy sensor units, if present) as required.

[0102] One or more of each of the one or more modular sensor units (and optionally dummy sensor units) may be provided with an aspirator, e.g. a pump and/or a fan. The aspirator of each unit may be switched on or off as required. In a system with a plurality of aspirators (e.g. an aspirator in each sensor unit or dummy sensor unit), each aspirator may be independently operable and/or controllable.

[0103] By providing one or more independently operable and/or controllable aspirators within one or more of the plurality of modular sensor units (and optionally dummy sensor units, if present) the total air flow speed within the aspiration detection system may be adjusted, e.g. optimised. For example, each of the one or more aspirators (e.g. fans and/or pumps) may each generate a static pressure. The total pressure generated by the aspiration detection system for aspirating air may be regarded as the sum of the static pressures of each of the aspirators. As such the pressure generated and/or the total air flow speed may be adjusted by interchanging the modular and/or dummy sensor units and/or by controlling, e.g. powering on or off, the aspirators as required. This may be used to achieve a desired airflow rather than using bigger or unnecessary aspirators. This may allow a balance between maximising the energy efficiency of the system whilst achieve a desired coverage area and/or sample transit time of the system.

[0104] For example, if the aspirating detection system has a relatively short network of one or more pipes (e.g. in a prison cell), the system may be operated with only one aspirator on. Any other aspirators in the system may be off. If the aspirating detection system has a relatively long network of one or more pipes (e.g. in a shopping

centre/mall or an airport), the system may be operated with many, or all of the aspirators on, as required.

[0105] The controller may be suitable for receiving an input from each of the one or more modular sensor units. The input from each of the plurality of modular sensor units may be one or more signals from each of the one or more modular sensor units. The one or more signals from the modular sensor units may correspond to the detection of the one or more conditions and/or parameters by one or more sensors.

[0106] The input received by the controller may correspond to the sensing of one or more conditions sensed by the one or more modular sensor units. The input received from each of the one or more modular sensor units may correspond to a different condition. Each of the one or more modular sensor units may be configured to sense a different condition. As such the method may comprise configuring the controller to receive an input from each of the one or more modular sensor units.

[0107] The sensor units may be for gas sensing, fire sensing, explosive detection and/or industrial leak detection.

[0108] The sensor units may each be for detecting different compounds.

[0109] In the assembled central detection unit the controller may be in electronic communication with each of the one or more modular sensor units. The electronic communication may be wired communication and/or wireless communication. The wireless communication may be performed by a number of protocols, including but not limited to infrared, WiFi, radio, Bluetooth or other known wireless forms of communication. Thus the method may comprise connecting the controller such that the controller is in electronic communication with each of the one or more modular sensor units.

[0110] The central detection unit/aspirating detection system may be the central detection unit/aspirating detection system of the first aspect. The invention may thus provide a method of assembling the central detection unit/aspirating detection system of the first aspect. Accordingly, the method of the third aspect may have one or more or all of the features (including optional features) of the central detection unit and/or aspirating detection system of the first aspect. Thus the above description may be equally applicable to the methods of the third aspect.

[0111] Applicable to the method of the third aspect, the method may comprise retrofitting an aspirating detection system (e.g. an aspirating smoke detection system) to provide a modular aspirating detection system. The method may comprise retrofitting the central detection unit to an existing network of one or more pipes. The network of one or more pipes may be configured to aspirate air from a surrounding environment. The network of pipes may be connected to the inlet of the upstream modular sensor unit. Accordingly, the intake portion of the aspirating detection system may be the network of pipes.

[0112] The network of pipes may comprise a number of sampling points through which air is aspirated, before being monitored at a central detection unit. Owing to the modular nature of the central detection unit, the central detection unit may be connected to the existing network of pipes without additional pipes being installed. Thus the network of pipes may be an existing network of pipes. Advantageously, this may reduce installation costs and may minimise damage to the structure and/or building in which the central detection unit/aspirating detection system is to be fitted. Further, the ability of the central detection unit to be retrofitted may mean that an existing aspirating detection system may be modified and/or replaced by the modular aspirating detection system, and/or modular central detection unit. This may mean that a number of conditions and/or parameters may be sensed with reduced cost.

[0113] Certain example embodiments of the invention will now be described by way of example only and with reference to the accompanying drawings in which:

Figure 1 shows a central detection unit of an aspirating detection system; and

Figure 2 shows a modular sensor unit.

[0114] Figure 1 shows an aspirating detection system 1 comprising a central detection unit 2 and a network of one or more pipes. In figure 1 the full network of pipes are not illustrated but rather the inlet pipe 7 that is connected to the network of pipes is shown. The network of pipes will comprise one or more pipes that are for sampling air from the building being monitored by the system 1. Air is aspirated through the network of pipes to the inlet pipe 7 which directs the air sample to the central detection unit 2. The air is exhausted from the aspirating detection system 1 via an exhaust 8.

[0115] The central detection unit 2 comprises a plurality of modular sensor units 3 and a controller 4 (shown as a control unit in figure 1). Each of the plurality of modular sensor units 3 has an inlet 5 and an outlet 6. Each modular sensor unit 3 also comprises an information panel 9. The panel 9 may comprise a number of buttons, lights or other visual indicators which notify a user of the operation and/or performance of the modular sensor unit 3. The aspirating detection system 1 shown in figure 1 comprises four modular sensor units 3a, 3b, 3c, 3d. However, whilst four modular sensor units 3a, 3b, 3c, 3d are illustrated, the aspirating detection system may comprise one or more modular sensor units 3 as required.

[0116] The arrows in Figure 1 indicate a direction of flow of the aspirated air and, as will be appreciated, the air flows from an inlet 5 of each modular sensor unit 3 through the modular sensor unit to an outlet 6 of each modular sensor unit 3. As such, the network of pipes and inlet pipe 7 are upstream of the modular sensor units 3, whilst the exhaust 8 is downstream of the modular sensor units 3. Accordingly, the central detection unit 2 may be

regarded as having an upstream modular sensor unit 3a, which is the most upstream or first modular sensor unit 3a. Similarly, the central detection unit 2 may be regarded as having a downstream modular sensor unit 3d, which is the most downstream or last modular sensor unit 3d. The upstream modular sensor unit 3a is connected to the network of pipes/inlet pipe 7 by its inlet 5a. The downstream modular sensor unit 3d is connected to the exhaust 8 by its outlet 6d.

[0117] It is to be appreciated that if the central detection unit 2 comprises a single modular sensor unit 3, that the inlet 5 of the single modular sensor unit 3 is to be connected to the network of pipes 7, whilst the outlet 6 of the single modular sensor unit 3 is to be connected to the exhaust 8.

[0118] The modular sensor units 3 are connected in series. As can be seen in Figure 1, the outlet 6a of the first modular sensor unit 3a is connected to the inlet 5b of a second modular sensor unit 3b. The second modular sensor unit 3b is downstream and adjacent to the first modular sensor unit 3a. Conversely, the first modular sensor unit 3a is upstream and adjacent to the second modular sensor unit 3b. The outlet 6b of the second modular sensor unit 3b is connected to the inlet 5c of the third modular sensor unit 3c. The outlet 6c of the third modular sensor unit 3c is connected to the inlet 5d of the fourth modular sensor unit 3d. Accordingly, it may be seen that the inlet 5 of each of the modular sensor units 3 is connected to the outlet 6 of an upstream and adjacent modular sensor unit 3. Conversely, the outlet 6 of each of the modular sensor units 3 is connected to the inlet of a downstream and adjacent modular sensor unit.

[0119] The flow follows the connections made between the inlets 5 and outlets 6 of each of the modular sensor units 3. As such, the flow of aspirated air through the modular sensor units 3 is continuous, and thus the modular sensor units 3 are in series with one another.

[0120] The controller 4 is arranged to receive an input from each of the modular sensor units 3. The controller 4 is not in flow communication with the modular sensor units 3, but is in electrical communication with the modular sensor units 3. The electrical communication may be conveyed by a wireless or a wired connection. Wireless connections may comprise known wireless communication methods such as Wi-Fi, radio, infrared, Bluetooth, or other known wireless communication protocols. The controller 4 includes a control panel 10, which may comprise inputs such as buttons, a touch screen, or otherwise, for programming and/or controlling the controller 4, the central detection unit 2 and/or the sensor units 3. A display 11 is also included to inform a user of the operation and/or control options of the controller 4, the central detection unit 2 and/or the sensor units 3. The controller 4 may be regarded as being housed in a control panel unit. The controller 4 centralises the operations of the modular sensor units 3. The modular sensor units 3 may be interchanged as and when required. This may include for maintenance purposes such as servicing or

repair, or to customise the central detection unit 4. The interchange of sensor units 3 may be performed without having to adjust the controller 4.

[0121] Figure 2 shows a single modular sensor unit 3. Given the modularity of the sensor units 3, the structure and composition of the modular sensor unit 3 illustrated in Figure 2 may generally apply to one or more of the modular sensor units 3a, 3b, 3c, 3d illustrated in Figure 1.

[0122] As discussed above, each modular sensor unit 3 comprises an inlet 5 and an outlet 6. The modular sensor unit 3 also comprises a sensor 12. The sensor 12 may be configured to sense and/or detect one or more conditions and/or parameters associated with the aspirated air. The sensor 12 may be one of the following: a smoke sensor, a carbon monoxide sensor, a carbon monoxide sensor, an ammonia gas sensor, a hydrogen gas sensor, a chlorine gas sensor, a fluorine gas sensor, an oxygen gas sensor, a methane gas sensor, or a sulphide gas sensor. The sensor 12 may be an industrial organic chemical sensor, configured to detect gases such as formaldehyde, toluene, xylenes, acetone, isobutylene, octane, or alcohols. The sensor 12 may be a flammable gas sensor, configured to detect target gases such as hydrocarbon gas, liquid petroleum gas, natural gas, propane, pentane, or R410a. The sensor 12 may be an indoor air quality sensor, and as such may be configured to detect target odours, carbon dioxide, or other undesirable gas compounds. Each of the modular sensor units 3 may comprise a different sensor 12. The combination of different sensors 12 within the central detection unit 2 may target the monitoring and/or detection of certain conditions. Whilst the modular sensor unit 3 is shown comprising a single sensor 12, the modular sensor unit 3 could comprise a plurality of sensors 12.

[0123] For example, the central detection unit 2 may comprise a modular sensor unit 3a configured to sense one or more alcohols, and modular sensor units 3b, 3c, 3d configured to detect ammonia gas, octane, and butane. Such a system could be used, for instance, on the underside of an escalator in a transport hub such as a train station. The aspirating detection system 1 could thus detect for contraband and/or other prohibited substances, for example ones which may be fire or explosive risks, by their identifiable vapours.

[0124] In another example, the central detection unit 2 may comprise a modular sensor unit 3a configured to sense smoke, another modular sensor unit 3b to detect carbon monoxide, another modular sensor unit 3c to detect carbon dioxide, and another modular sensor unit 3d to detect smoke at a different threshold to that of the first modular sensor unit 3a. Accordingly, the central detection unit 2 could be configured for fire detection.

[0125] As the modular sensor units 3 have generally the same configuration (e.g. the same shape and/or size and/or inlets and outlets at the same relative locations), the modular sensor units 3 can be interchanged as required to provide an aspirating detection system 1 capable of detecting varying characteristics as required. The

modular sensor units 3 need not require changes to their structure, hardware, or software, to be compatible with the controller 4. Similarly the controller 4 need not require changes to its structure and/or hardware to be compatible with various different sensor units 3. The software of the controller 4 may be modified (or preinstalled) so that it can receive a process input from various different sensor units 3.

[0126] Additionally, as the modular sensor units 3 are configured such that the outlet 6 acts as the inlet 5 of another and vice versa, modular sensor units 3 may be added or removed without substantial changes to the structure of the central detection unit 2. Accordingly, a customisable central detection unit 2 is provided which, owing to the modularity of the modular sensor units 3, may reduce installation and maintenance costs of the aspirating detection system 1 whilst allowing a variety of different conditions to be sensed as required in a particular building.

Claims

1. A central detection unit (2) for an aspirating detection system (1), the central detection unit (2) comprising:
 - a plurality of modular sensor units (3); and
 - a controller (4) for receiving an input from each of the plurality of modular sensor units (3).
2. A central detection unit (2) as claimed in claim 1, wherein the modular sensor units (3) are interchangeable.
3. A central detection unit (2) as claimed in claim 1 or 2, wherein the modular sensor units (3) are each configured to sense a different condition.
4. A central detection unit (2) as claimed in claim 3, wherein the different conditions comprise one or more of the presence of carbon monoxide, ammonia gas, hydrogen gas, chlorine gas, oxygen, methane gas, and/or sulphides.
5. A central detection unit (2) as claimed in any of claims 1 to 4, wherein the modular sensor units (3) are connected in series.
6. An aspirating detection system (1), wherein the aspirating detection system (1) comprises the central detection unit as claimed in any preceding claim; and a network of one or more pipes for providing air to each of the modular sensor units.
7. A kit for assembling a central detection unit (2) for an aspirating detection system (1), the central detection unit (2) comprising:
 - one or more modular sensor units (3) and a controller
 - (4) for receiving an input from each of the one or more modular sensor units (3), the kit comprising:
 - the controller (4); and
 - a plurality of modular sensor units (3) from which the one or more modular sensor units (3) can be selected.
8. The kit as claimed in claim 7, wherein the kit is for retrofitting the central detection unit (2) to a pre-installed aspirating detection system.
9. The kit as claimed in claim 7 or 8, wherein the central detection unit (2) is the central detection unit of any of claims 1 to 5.
10. A method of assembling a central detection unit (2) for an aspirating detection system (1), the method comprising:
 - providing a controller (4);
 - providing a plurality of modular sensor units (3);
 - selecting one or more of the plurality of modular sensor units (3); and
 - assembling the central detection unit (2) from the controller (4) and the one or more selected modular sensor units (3).
11. A method as claimed in claim 10, wherein the modular sensor units (3) are interchangeable.
12. A method as claimed in claim 10 or 11, wherein the modular sensor units (3) are each configured to sense a different condition.
13. A method as claimed in claim 12, wherein the different conditions comprise one or more of the presence of carbon monoxide, ammonia gas, hydrogen gas, chlorine gas, oxygen, methane gas, and/or sulphides.
14. A method as claimed in any of claims 10 to 13, wherein the modular sensor units (3) are connected in series.
15. A method as claimed in any of claims 10 to 14, comprising:
 - retrofitting the central detection unit (2) to a network of one or more pipes (7);
 - wherein the network of one or more pipes (7) is configured to aspirate air from a surrounding environment.

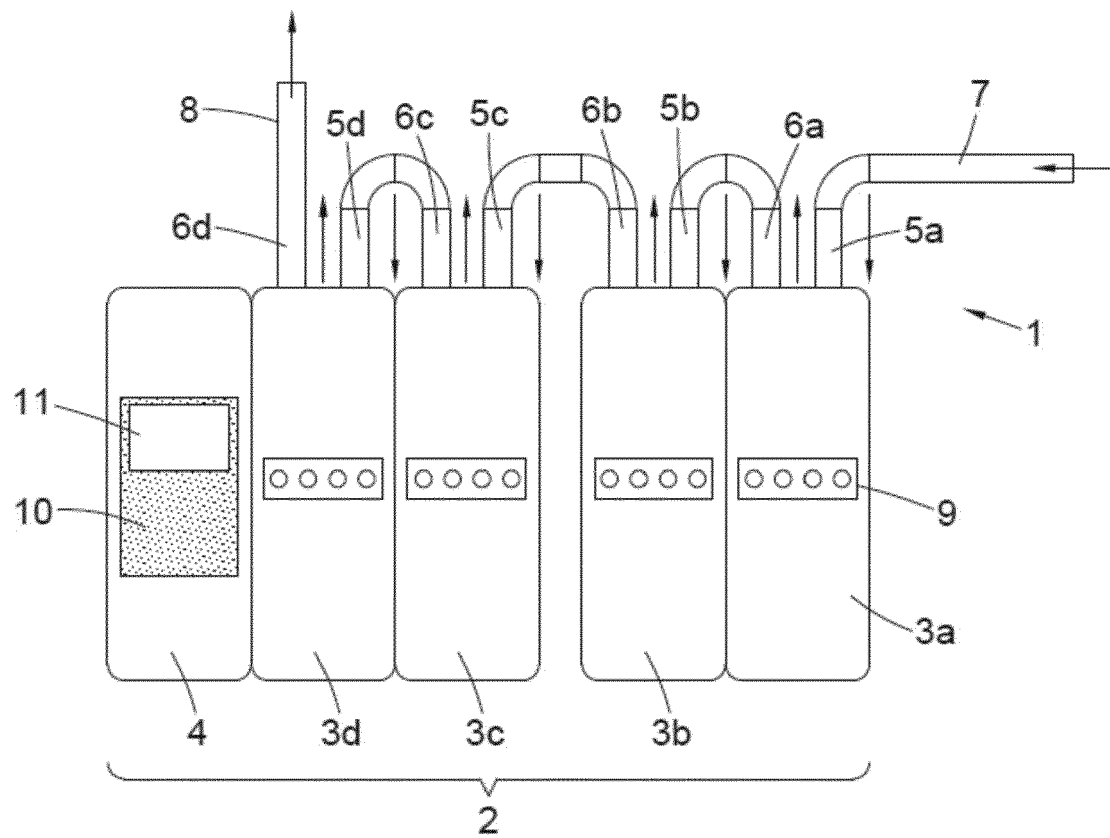


Fig. 1

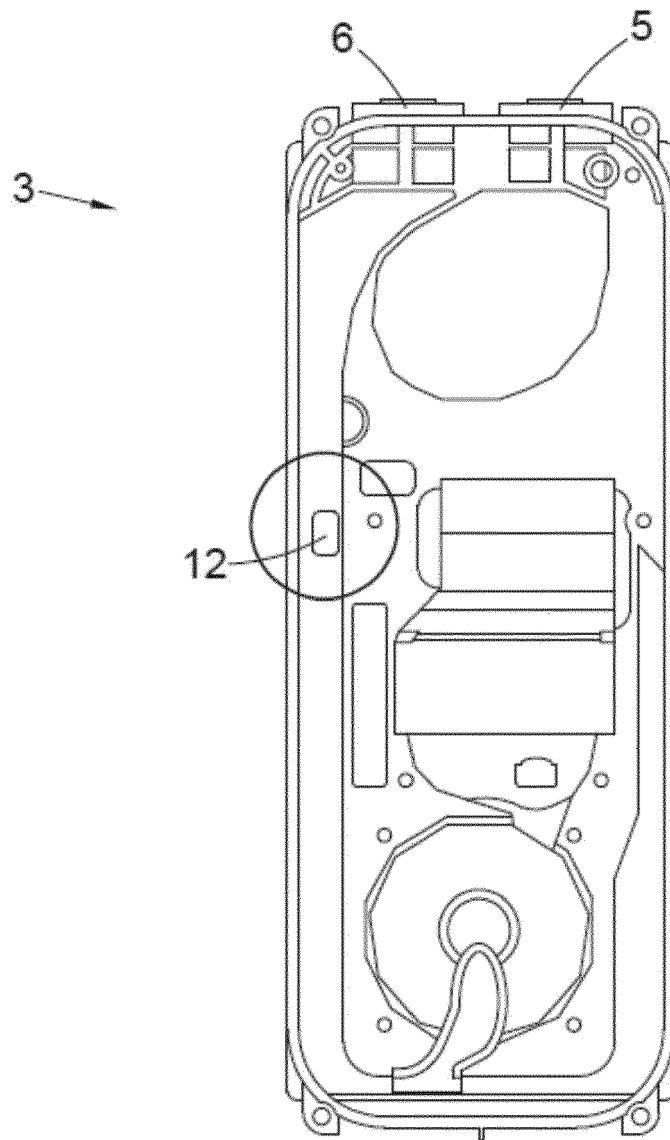


Fig. 2



EUROPEAN SEARCH REPORT

Application Number
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The present search report has been drawn up for all claims			
Place of search Munich		Date of completion of the search 9 September 2020	Examiner Meister, Mark
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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