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(54) **Ventilation system for ventilating a fire compartment in a building**

(57) The present invention relates to a relatively inexpensive ventilation system (1) for ventilating a fire compartment in a building with several fire compartments, separated by fire partitions (2), comprising:
- a ventilation fan (3) for supplying and/or discharging of air;
- a measuring system for detecting a fire;
- ventilation fan control means for controlling the ventilation fan (3) adapted to shut down the ventilation fan (3)

when a fire is detected;
- a compartment through-passage (4) for passing the air through a fire partition (2) to or from the ventilation fan (3);
- a fire-resistant sealing ring (5), around the compartment through-passage (4), at the location of the fire partition (2).

The present invention also relates to a method for controlling the ventilation fan (3) of such a ventilation system.

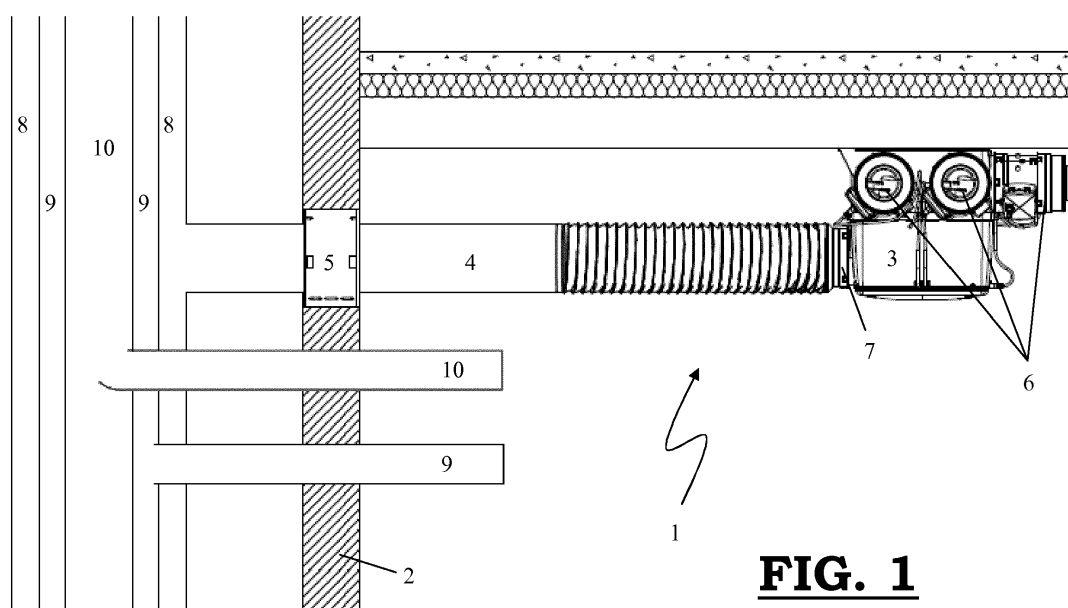


FIG. 1

Description

[0001] The present invention relates to a ventilation system for ventilating a fire compartment in a building with two or more fire compartments which are separated from one another by means of fire partitions, comprising one or more ventilation fans for supplying and/or discharging air to and/or from the fire compartment, ventilation fan control means for controlling the one or more ventilation fans and comprising at least one compartment through-passage for supplying or discharging the air to be supplied or the air to be discharged through the fire partition to or from the one or more ventilation fans.

[0002] The present invention also relates to a method for controlling the one or more ventilation fans of such a ventilation system.

[0003] Buildings with different fire compartments to which the ventilation systems according to the invention relate, are typically apartment buildings, student flats, serviced flats, etc. The different apartments, studios, (part of a) corridor with student apartments and associated bathrooms or shower rooms, etc. in such buildings form the different fire compartments thereof. The different fire compartments are usually separated from one another by means of fire partitions.

[0004] With ventilation systems according to the present invention, one or more ventilation fans are provided for each fire compartment. These can, if necessary, also be used to supply air through the fire partitions towards the fire compartment. It is also possible to discharge air, if necessary, via one or more discharge lines from one or more spaces, towards the ventilation fan, in which case said air can then be discharged from the ventilation fan via a common discharge duct to the outside. When a ventilation system for ventilating such a fire compartment is used to discharge air, a compartment through-passage of the ventilation system of this fire compartment usually passes the air to be discharged through the abovementioned fire partition to a common discharge duct for several fire compartments together, in which the air to be discharged of these various fire compartments together is discharged from the building. If such a ventilation system is used to supply air, this air is often also supplied via a common supply duct for several fire compartments together, following which the air is passed through a fire partition via a compartment through-passage for each fire compartment towards the ventilation fan.

[0005] Such a ventilation system for supplying air in a mechanical way but discharging it in a natural way is referred to as a so-called B system. When air is discharged from the fire compartment only by mechanical means, this is referred to as a so-called C system. Fresh air is then supplied to the fire compartment, usually via natural air supply (adjustable supply openings, ventilation grilles). When the ventilation system both discharges and supplies air by mechanical means, this is referred to as a so-called D system. Both with a C system and with

a D system, fresh air is normally supplied to so-called "dry spaces", while air is discharged from so-called "moist spaces" (or "wet spaces"). Living rooms, bedrooms, offices form the so-called "dry spaces", while kitchens, bathrooms, toilets and sculleries form the so-called "moist spaces". There are also ventilation systems in which, when required by environmental factors (such as, for example, the CO₂ in the air), air is discharged from (usually a limited number of) "dry spaces". The ventilation system according to the present invention may be any of these systems.

[0006] In order to satisfy the requirements regarding fire safety in such buildings with different fire compartments, this fire compartment has to be sealed off from the other fire compartments as quickly as possible if a fire breaks out in one of the fire compartments in order to prevent fire spreading between the different fire compartments. With existing ventilation systems, fire valves are provided for this purpose for such a fire compartment in each compartment through-passage at the location of the corresponding fire partition. Such a fire valve comprises one or more valve leaves by means of which the compartment through-passage can be sealed. During normal use, the valve leaves of such fire valves are in an open position in which there is as little obstruction as possible for the airflow through the compartment through-passage. These valve leaves are retained in this open position, for example, by means of a fusible link. In case of fire, such a fusible link will melt when the temperature at the location of the fusible link rises sufficiently, in which case the valve leaves are brought to their closed position under the effect of, for example, a spring force, in which case they seal the compartment through-passage. Electronic alternatives for this fusible link mechanism are also known. However, such fire valves are relatively expensive parts for such ventilation systems.

[0007] It is therefore an object of the present invention also to provide a less expensive ventilation system for ventilating a fire compartment in a building with two or more fire compartments which also satisfies the requirements regarding fire safety.

[0008] This object of the invention is achieved by providing a ventilation system for ventilating a fire compartment in a building with two or more fire compartments, which are separated from one another by means of fire partitions, comprising one or more ventilation fans for supplying and/or discharging air to and/or from the fire compartment, ventilation fan control means for controlling the one or more ventilation fans and comprising at least one compartment through-passage for supplying or discharging the air to be supplied or the air to be discharged through the fire partition to or from the one or more ventilation fans, in which the ventilation system comprises a measuring system with one or more fire sensors for detecting fire via the air to be supplied and/or via the air to be discharged, in which the ventilation control means are adapted to shut down the one or more ventilation fans if a fire is detected by means of the one or

more fire sensors, and in which the ventilation system comprises a fire-resistant sealing ring for each compartment through-passage which is fitted around said compartment through-passage, at the location of the corresponding fire partition.

[0009] According to the fire safety requirements, in order to ensure adequate fire safety, a fire valve has to be provided in a duct to which a working ventilation fan is connected at the location of the fire partition through which this duct is passed. Due to the measuring system by means of which a fire is detected, it is possible to shut down the one or more ventilation fans in case of fire. By shutting down the one or more ventilation fans, a compartment through-passage is no longer connected to a duct to which a working ventilation fan is connected in case of fire. With such unpressurized ducts, a sufficient degree of fire safety may already be ensured by means of a fire-resistant sealing ring instead of by means of a fire valve. Therefore, according to the invention, the same level of fire safety can thus be ensured in case of fire by shutting down the one or more ventilation fans and by providing a fire-resistant sealing ring in order to seal the duct in time to prevent fire expansion for a certain amount of time.

[0010] In a specific embodiment of such a ventilation system, at least one of the abovementioned one or more fire sensors is arranged in said compartment through-passage.

[0011] Furthermore, it is, more specifically, possible with a ventilation system according to the invention, to arrange at least one of the abovementioned one or more fire sensors in a housing, in which at least one of the abovementioned one or more ventilation fans is arranged and to which at least one said compartment through-passage is connected.

[0012] In a preferred embodiment of a central ventilation system according to the present invention, the fire compartment comprises one or more spaces, the ventilation system comprises one or more corresponding discharge ducts for discharging air to be discharged from the spaces to the one or more ventilation fans, each discharge duct comprises a flow regulator (for example a regulator valve) for controlling the flow of air to be discharged through said discharge duct, the ventilation system comprises flow control means for controlling this flow regulator and this flow regulator and the flow control means are adapted to seal the corresponding discharge duct by means of the flow regulator if a fire is detected by means of the one or more fire sensors. These one or more spaces may, more specifically, be moist spaces.

[0013] In such a preferred embodiment, it is possible, in case of fire, not only to shut down the one or more ventilation fans, but also to seal the discharge ducts from spaces which are connected to the ventilation fan. Such flow regulators are often already present in such ventilation systems for controlling the flow of air to be supplied and discharged during normal operation of the ventilation system. According to the invention, these flow regulators

which are already present can now be used as an additional barrier to delay the fire spreading between compartments in case of fire. In addition, as a result of closing the flow regulators, it is ensured that no smoke spreads from one part of the burning fire compartment to another part of the fire compartment.

[0014] In such a preferred embodiment, said fire sensor is furthermore preferably arranged at the location of each flow regulator.

[0015] A specific embodiment of a ventilation system according to the present invention furthermore comprises an alarm system for generating an alarm signal when the one or more ventilation fans are being shut down in case a fire is detected by means of the one or more fire sensors.

[0016] Each compartment through-passage of a ventilation system according to the invention is preferably made of plastic, at least at the location of the corresponding fire partition.

[0017] Each compartment through-passage of a ventilation system according to the invention furthermore preferably also comprises a non-return valve between the one or more ventilation fans and the fire-resistant sealing ring. As a result of such a non-return valve, no air from other fire compartments is passed into the fire compartment where the fire is taking place. The ventilation system remains unpressurized in the burning fire compartment.

[0018] A ventilation system according to the invention furthermore preferably comprises a calculation unit for loading quantities measured by means of the abovementioned one or more fire sensors of the air to be supplied and/or the air to be discharged, for comparing these measured quantities to a fire threshold for detecting fire and for transmitting a signal upon detection of a fire to the ventilation control means in order to shut down the one or more ventilation fans.

[0019] In a particularly inexpensive embodiment, the abovementioned one or more fire sensors comprise one or more temperature sensors for measuring the temperature of the air to be supplied and/or to be discharged.

[0020] A particularly inexpensive embodiment of a ventilation system according to the present invention comprises one single temperature sensor as fire sensor for each compartment through-passage which is arranged in this compartment through-passage to determine the temperature of the air which flows through this compartment through-passage, so that the temperature of the air flows between the various fire compartments is known.

[0021] Alternatively or additionally, the abovementioned one or more fire sensors may also comprise one or more VOC sensors (sensors which measure Volatile Organic Compounds) for detecting smoke and thus fire.

[0022] Furthermore, the abovementioned one or more fire sensors preferably comprise one or more sensors for measuring the relative humidity of the air to be supplied and/or to be discharged.

[0023] The object of the present invention is also achieved by providing a method for controlling the one or more ventilation fans of a ventilation system using an above-described calculation unit, in which the fire sensors measure quantities of the air to be supplied and/or the air to be discharged, in which the calculation unit loads the quantities measured by means of the fire sensors and compares them to a fire threshold in order to detect a fire, and in which the calculation unit, upon detecting a fire, transmits a signal to the ventilation control means in order to shut down the one or more ventilation fans.

[0024] In a particular such method for controlling the one or more ventilation fans of a ventilation system using one or more temperature sensors, the one or more temperature sensors measure the temperature of the air to be supplied and/or the air to be discharged, the calculation unit loads the measured temperature and compares this measured temperature to a temperature threshold as a fire threshold and the calculation unit detects fire if the measured temperature rises above this temperature threshold.

[0025] The temperature threshold is in this case preferably set at 72°C. Still more preferably, the calculation unit in this case detects a fire if the measured temperature remains above the fire threshold for more than 90 seconds.

[0026] In a particular method according to the present invention, the calculation unit determines the temperature of the air to be discharged as the maximum temperature of the temperatures measured by the various temperature sensors as fire sensors.

[0027] In a further particular method according to the present invention for controlling the one or more ventilation fans in a ventilation system with one or more sensors for measuring relative humidity, the sensors for measuring relative humidity measure the relative humidity of the air to be supplied and/or the air to be discharged, the calculation unit loads the measured relative humidity and compares the measured relative humidity with a humidity threshold value as a fire threshold, and the calculation unit detects a fire if the measured relative humidity drops below this humidity threshold value.

[0028] Preferably, the humidity threshold value is set at 60%.

[0029] Particularly preferably, the calculation unit, if both temperature sensors and sensors are present for measuring relative humidity, only detects fire if the temperature is above the temperature threshold and if the relative humidity drops below the humidity threshold value.

[0030] The present invention will now be explained in more detail by means of the following detailed description of a preferred ventilation system according to the present invention and of a method for controlling the ventilation fan thereof. The sole aim of this description is to give illustrative examples and to indicate further advantages and features of this ventilation system, and can therefore

by no means be interpreted as a limitation of the area of application of the invention or of patent rights defined in the claims.

[0031] In this detailed description, reference numerals are used to refer to the attached drawing (Fig. 1) which diagrammatically shows a ventilation system according to the present invention.

[0032] The illustrated ventilation system (1) is designed to be installed in an apartment in an apartment building. The various apartments in this apartment building are separated from a common shaft which comprises a common discharge duct (8) by means of fire partitions (2). This common discharge duct (8) is concentric with a supply duct (9) for gas boilers in the various apartments and concentric with a waste gas discharge duct (10). All compartment discharge ducts (4) of the various ventilation systems (1) in this apartment building are usually connected to one or more common discharge ducts (8). The air which is discharged by the corresponding ventilation system (1) from the corresponding apartment is brought through the fire partition (2) into the common discharge duct (8) via each compartment discharge duct (4).

[0033] This illustrated ventilation system (1) comprises a ventilation fan (3) for discharging air from the apartment. The housing (3) which contains the ventilation fan is connected, on one side, to the compartment discharge duct (4) and, on the other side, to different discharge ducts for discharging air from moist spaces in the apartment and optionally from one or more dry spaces in this apartment, such as, for example, a bedroom, towards the housing (3). The discharge ducts which are connected to the moist spaces and optionally dry spaces are not shown. However, the different flow regulators (6) which are connected on one side to openings in the housing (3) and to which these discharge ducts can be connected on the other side are illustrated.

[0034] The compartment discharge duct (4) is made from plastic at the location of the fire partition (2). Around this plastic portion of the compartment discharge duct (4), a fire-resistant sealing ring (5) is fitted at the location of the fire partition (2).

[0035] Between the ventilation fan (3) and the fire-resistant sealing ring (5), the compartment discharge duct (4) comprises a non-return valve (7).

[0036] The ventilation system (1) furthermore comprises:

- ventilation fan control means for controlling the ventilation fan (3);
- a measuring system with, for each flow regulator (6) to which a bathroom, kitchen or scullery is connected, a temperature sensor for measuring the temperature of the air to be discharged via the corresponding discharge duct which is fitted in the discharge duct at the location of this flow regulator (6) and, for each flow regulator (6) to which a bathroom, kitchen or scullery is connected, a sensor for measuring the

relative humidity of the air to be discharged which is also fitted in the discharge duct at the location of this flow regulator (6);

- a calculation unit for comparing the measured temperature of the air to be discharged to a temperature threshold and for comparing the measured relative humidity to a humidity threshold value;
- flow control means for controlling the flow regulators (6).

[0037] These ventilation fan control means, the measuring system, the calculation unit and the flow control means are all arranged in this ventilation system (1) at the location of the housing (3) of the ventilation fan, partly on a central electronic circuit board containing a central processing unit which, for example, comprises a micro-processor, and partly on the flow regulators.

[0038] The temperature threshold in this ventilation system (1) is set at 72°C and the humidity threshold value at 60%. The temperature of the air to be discharged is defined as the maximum temperature of the temperatures measured using the various sensors. The relative humidity of the air corresponding to this maximum temperature is also used as a control parameter. The control of both the ventilation fan (3) and the flow regulators (6) is adjusted in such a manner that, in addition to the normal control of the ventilation fan (3) and the flow regulators (6) with regulation of the ventilation flow of air to be discharged from the various spaces, the ventilation fan control means now also shut down the ventilation fan (3) and the flow control means close the flow regulators (6) to seal the respective discharge ducts when the calculation unit indicates to the ventilation fan control means and to the flow control means that the temperature of the air to be discharged remains above 72°C for 90 seconds and the relative humidity drops below 60% at the same time.

[0039] In case of a fire in the apartment in which this ventilation system (1) is fitted, the ventilation fan (3) is thus shut down by means of this ventilation system (1), resulting in an unpressurized system, and the flow regulators (6) seal the various discharge ducts to prevent smoke from spreading. The fire-resistant sealing ring (5) throttles the plastic section of the compartment discharge duct (4) at the location of the fire partition (2) and thus seals this compartment discharge duct (4) in order to prevent fire spreading between the various fire compartments for a certain period of time. During the short period of time when the fire-resistant sealing ring (5) does not yet completely seal the compartment discharge duct (4), the non-return valve (7) prevents air from the other apartments from entering the burning apartment via the common discharge duct (8).

Claims

1. Ventilation system (1) for ventilating a fire compartment in a building with two or more fire compartments

which are separated from one another by means of fire partitions (2), comprising one or more ventilation fans (3) for supplying and/or discharging air to and/or from the fire compartment, ventilation fan control means for controlling the one or more ventilation fans (3) and comprising at least one compartment through-passage (4) for supplying or discharging the air to be supplied or the air to be discharged through the fire partition (2) to or from the one or more ventilation fans (3), **characterized in that** the ventilation system (1) comprises a measuring system with one or more fire sensors for detecting fire via the air to be supplied and/or via the air to be discharged, **in that** the ventilation control means are adapted to shut down the one or more ventilation fans (3) if a fire is detected by means of the one or more fire sensors, and **in that** the ventilation system (1) comprises a fire-resistant sealing ring (5) for each compartment through-passage (4) which is fitted around said compartment through-passage (4), at the location of the corresponding fire partition (2).

2. Ventilation system (1) according to one of the preceding claims, **characterized in that** at least one of the abovementioned one or more fire sensors is arranged in said compartment through-passage (4).
3. Ventilation system (1) according to one of the preceding claims, **characterized in that** at least one of the abovementioned one or more fire sensors is arranged in a housing (3), in which at least one of the abovementioned one or more ventilation fans (3) is arranged and to which at least one said compartment through-passage (4) is connected.
4. Ventilation system (1) according to one of the preceding claims, **characterized in that** the fire compartment comprises one or more spaces, **in that** the ventilation system (1) comprises one or more corresponding discharge ducts for discharging air to be discharged from the spaces to the one or more ventilation fans (3), **in that** each discharge duct comprises a flow regulator (6) for controlling the flow of air to be discharged through said discharge duct, **in that** the ventilation system (1) comprises flow control means for controlling this flow regulator (6), and **in that** this flow regulator (6) and the flow control means are adapted to seal the corresponding discharge duct by means of the flow regulator (6) if a fire is detected by means of the one or more fire sensors.
5. Ventilation system (1) according to Claim 4, **characterized in that** said fire sensor is arranged at the location of each flow regulator (6).
6. Ventilation system (1) according to one of the preceding claims, **characterized in that** said ventilation system (1) comprises an alarm system for generat-

ing an alarm signal when the one or more ventilation fans (3) are being shut down in case a fire is detected by means of the one or more fire sensors.

7. Ventilation system (1) according to one of the preceding claims, **characterized in that** each compartment through-passage (4) is made of plastic, at least at the location of the corresponding fire partition (2). 5
8. Ventilation system (1) according to one of the preceding claims, **characterized in that** each compartment through-passage (4) between the one or more ventilation fans (3) and the fire-resistant sealing ring (5) comprises a non-return valve (7). 10
9. Ventilation system according to one of the preceding claims, **characterized in that** the ventilation system (1) comprises a calculation unit for loading quantities measured by means of the abovementioned one or more fire sensors of the air to be supplied and/or the air to be discharged, for comparing these measured quantities to a fire threshold for detecting fire and for transmitting a signal upon detection of a fire to the ventilation control means in order to shut down the one or more ventilation fans (3). 15 20 25
10. Ventilation system (1) according to one of the preceding claims, **characterized in that** the abovementioned one or more fire sensors comprise one or more temperature sensors for measuring the temperature of the air to be supplied and/or to be discharged. 30
11. Ventilation system (1) according to one of the preceding claims, **characterized in that** the abovementioned one or more fire sensors comprise one or more VOC sensors for detecting smoke. 35
12. Ventilation system (1) according to one of the preceding claims, **characterized in that** the abovementioned one or more fire sensors comprise one or more sensors for measuring the relative humidity of the air to be supplied and/or to be discharged. 40
13. Method for controlling the one or more ventilation fans (3) of a ventilation system (1) according to Claim 9, **characterized in that** the fire sensors measure quantities of the air to be supplied and/or the air to be discharged, **in that** the calculation unit loads the quantities measured by means of the fire sensors and compares them to a fire threshold in order to detect a fire, and **in that** the calculation unit, upon detecting a fire, transmits a signal to the ventilation control means in order to shut down the one or more ventilation fans (3). 45 50 55
14. Method according to Claim 13, for controlling the one or more ventilation fans (3) of a ventilation system

according to Claim 10, **characterized in that** the temperature sensors measure the temperature of the air to be supplied and/or the air to be discharged, **in that** the calculation unit loads the measured temperature and compares it to a temperature threshold as a fire threshold, and **in that** the calculation unit detects fire if the measured temperature rises above this temperature threshold.

15. Method according to Claim 13 or 14 for controlling the one or more ventilation fans (3) in a ventilation system (1) according to Claim 12, **characterized in that** the sensors for measuring relative humidity measure the relative humidity of the air to be supplied and/or the air to be discharged, **in that** the calculation unit loads the measured relative humidity and compares it with a humidity threshold value as a fire threshold, and **in that** the calculation unit detects a fire if the measured relative humidity drops below this humidity threshold value. 15 20 25 30

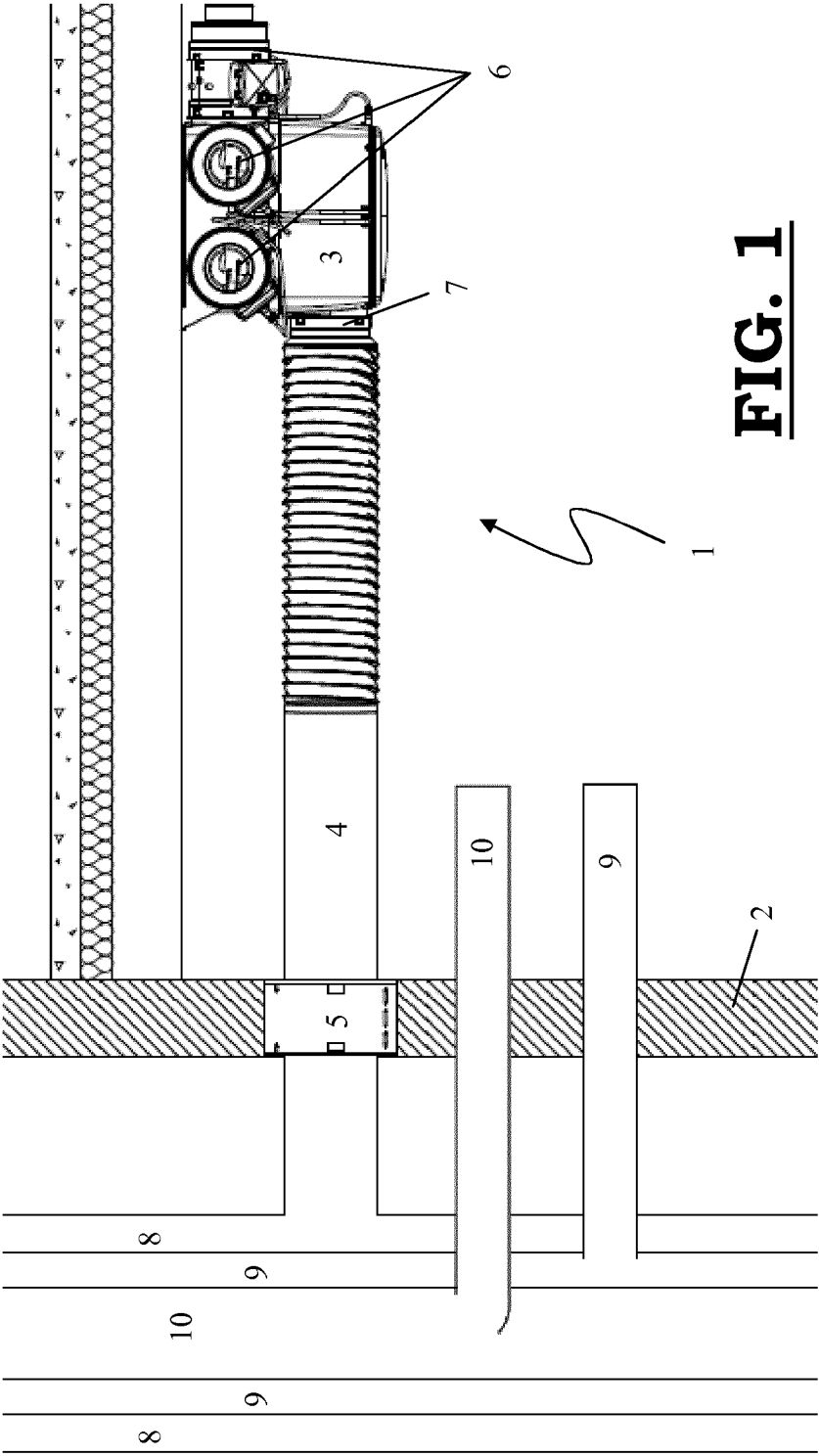


FIG. 1



EUROPEAN SEARCH REPORT

Application Number
EP 12 18 8482

DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
Y	US 5 788 571 A (IVISON JOHN T [CA] ET AL) 4 August 1998 (1998-08-04) * column 2, line 19 - column 4, line 26 * * claims; figures *	1	INV. F24F11/00 F24F1/00
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The present search report has been drawn up for all claims			TECHNICAL FIELDS SEARCHED (IPC)
			F24F
Place of search		Date of completion of the search	Examiner
Munich		17 January 2013	Mattias Grenbäck
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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EPO FORM 1503 03.82 (P04C01)

**ANNEX TO THE EUROPEAN SEARCH REPORT
ON EUROPEAN PATENT APPLICATION NO.**

EP 12 18 8482

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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17-01-2013

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