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(54) **VENT, VENTILATION SYSTEM AND METHOD OF INSTALLATION**

(57) A vent for providing ventilation of a building, the vent comprising: a duct, a duct closure mechanism operable between an open configuration in which an air passage is provided through the duct and a closed position in which air is blocked from passing through the duct, an air quality sensor, and a controller configured to control the duct closure mechanism between the open and closed configurations based on air quality information received from the air quality sensor.

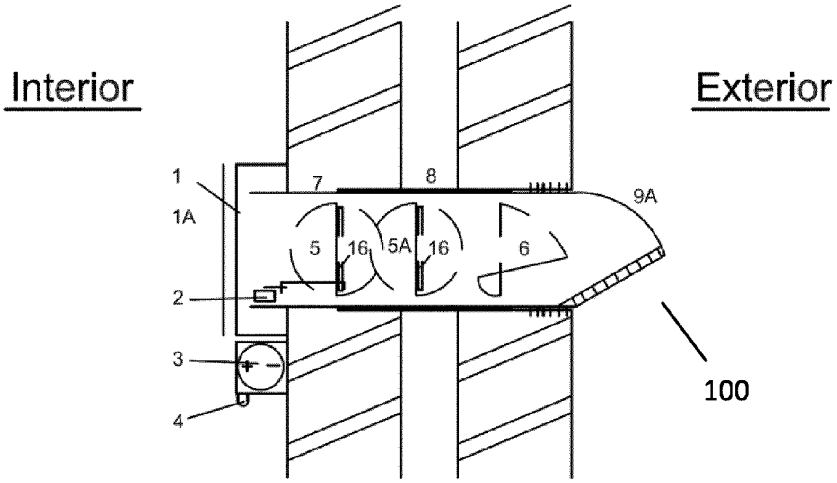

Figure 1A

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Description

Technical Field

[0001] The present disclosure relates to ventilation, and particularly, but not exclusively, to a vent for providing ventilation of a building.

Background

[0002] Many older buildings have issues with damp and mould growth which can cause health issues for inhabitants. Further, many buildings are being retro-fitted with insulation. As well as reducing heat transfer, the retro-fit insulation reduces the air passage into and out of the building, thereby reducing ventilation of the building which can lead to damp and mould growth.

[0003] Through-wall air vents may be provided to increase ventilation and reduce mould growth, but these vents then allow heat to transfer along with air through the insulated wall, thereby reducing the advantages provided by the insulation.

Summary

[0004] There is provided a vent for providing ventilation of a building, the vent comprising: a duct, a duct closure mechanism operable between an open configuration in which an air passage is provided through the duct and a closed configuration in which air is blocked from passing through the duct, an air quality sensor, and a controller configured to control the duct closure mechanism between the open and closed configurations based on air quality information received from the air quality sensor. As the vent is only open when ventilation is required, it has the benefit of conserving heat and thus energy.

[0005] Optionally, the duct closure mechanism comprises a partially open configuration wherein the duct closure mechanism is retained between the closed configuration and open configuration. The duct closure mechanism may be retained in the partially open configuration by a friction fit, or by a retention mechanism such as a projection against which the duct closure mechanism may rest. A partially open configuration permits air ventilation while increasing the heat/energy retention within the building. In certain circumstances, small amounts of ventilation may be required when the fully open configuration is not suitable as it would result in too much heat/energy loss from the building. The partially open configuration allows for increased heat/energy retention at the expense of decreased ventilation. A simple system may comprise one partially open configuration, for example, wherein the duct closure mechanism is orientated at 45 degrees relative to the duct. More complex systems may comprise a plurality of partially open configurations, each partially open configuration providing a respective different amount of ventilation, for example, each partially open configuration may have a different angle, or block a different percentage of the duct. The duct closure mechanism may be continuously operable between the open and closed configurations, such that the duct closure mechanism may be retained in one of a continuum of partially open configurations between the open and closed configurations.

[0006] Optionally, the duct may comprise an extendable portion. The extendable portion may be operable to change the length of the duct, for example extend. In this way, the duct can be adjusted to the thickness of the wall and/or glazing unit and/or roof of the building. The extendable portion may comprise a plurality of telescoping duct elements, and/or a concertina, and/or any other suitable duct extending means. The extendable portion may be reversibly extendable. In this way, the length of the duct can be repeatedly adjusted to an optimal length. During adjustment the length of the duct may be increased and/or decreased.

[0007] Optionally, the vent further comprises a vent body containing the controller, air quality sensor and optionally, further components. Optionally, the vent body is connected to an internal end of the duct and configured to allow air into and out of the internal end of the duct. The vent body may comprise fixing points and or fixings for attachment to an inside of a wall, ceiling or window of the building. Optionally, the vent is clampable to the wall, ceiling/roof or window such that the vent body and external terminal of the vent are biased against internal and external sides of the wall, ceiling/roof or window respectively, around the hole. The external terminal of the vent may comprise a seal such that the external terminal is sealable against the external side of the wall, roof or window. The seal may be a rubber seal. The duct may comprise an internal and external portion and a connection allowing the internal and external portions to be connected together. The connection may be a threaded connection. The vent may be clamped to the wall, ceiling/roof or window by a connection, for example and threaded connection between external and internal portions of the duct.

[0008] Optionally, the vent is for providing ventilation through an external wall, window or roof of a building, such as a residential building.

[0009] Optionally, the vent further comprises a fascia connectable to the vent body to cover the contents of the vent body. The vent body may further comprise one or more light sources, such as LEDs. The fascia may comprise a light diffuser.

[0010] In this application, the terms internal end of the duct and external end of the duct are used to describe the two opposing ends of the duct. The internal end of the duct describes the end of the duct suitable to be inside of the building once installed and the external end of the duct describes the end of the duct suitable to be outside of the building once installed.

[0011] Optionally, the cross section of the duct is circular.

[0012] This enables installation of the duct through a

drilled hole, such as a core hole and enables simple retrofit installation with limited, if any modifications needed to the existing wall/roof. For example, no removal of a brick or other part of a wall is required. The wall may be a brick/block wall, timber construction wall, or a non-traditional construction wall. The wall may be a cavity wall. Further, this enables the vent to be utilised through a prefabricated circular hole in a glazing unit.

[0013] Optionally, the vent further comprises an external terminal connected to an external end of the duct and configured to allow air into and out of the duct. The external terminal may comprise an insect mesh which may prevent insects entering the property through the vent.

[0014] Optionally, the external terminal is passable through a hole with internal cross section equal to an external cross section of the duct. Optionally, the external terminal does not exceed a cross section of the duct. Alternatively, the external terminal may be deformable so as to be passable through the hole. This enables the external terminal to be installed outside of the building while allowing installation to take place entirely inside the building, removing the need for scaffolding/scaling of the building, improving ease and safety in a high-rise setting.

[0015] Optionally, an external opening of the external terminal is provided at an offset angle with respect to the duct. This enables installation of the external opening in a direction pointing downwards so as to avoid water ingress.

[0016] Optionally, the external terminal has a wider cross section than the duct. In this case, the external terminal may be connected to the duct after insertion of the duct through the wall, window or roof. Alternatively, the duct and external terminal may be inserted through the wall, window or roof from the outside and then connected to the vent body. Alternatively, as described in more detail below, the vent may be inserted through a hole in a glazing unit and fixed to the glazing unit before the glazing unit is installed in a building.

[0017] Optionally, the air quality sensor comprises a humidity sensor and/or a temperature sensor and/or a gas sensor such as a carbon dioxide sensor and/or a carbon monoxide sensor and/or a natural gas sensor and/or particulate level sensor.

[0018] Optionally, the vent is configured to maintain the duct closure mechanism in the open configuration unless stored criteria are fulfilled. When the criteria are fulfilled, the vent is configured to move the duct closure mechanism towards the closed configuration. This results in reduced passage of air through the duct. The controller may comprise a microprocessor.

[0019] Optionally, the stored criteria may comprise: a sensed temperature is below a temperature threshold and/or a sensed humidity is below a humidity threshold and/or a sensed carbon dioxide concentration is below a carbon dioxide concentration threshold and/or a sensed carbon monoxide concentration is below a carbon monoxide concentration threshold and/or a sensed natural gas concentration is below a natural gas concentration threshold and/or a sensed harmful gas concentration is below a harmful gas concentration threshold and/or a sensed particulate level is above a particulate level threshold. Optionally, the air quality information comprises a plurality of sensed air quality parameters and the controller is configured to determine a desired position of the closure mechanism between the open and closed configurations based on the plurality of sensed air quality parameters. The sensed air quality parameters may comprise: a sensed humidity and/or a sensed temperature and/or a sensed gas concentration such as a sensed carbon dioxide concentration and/or a sensed carbon monoxide concentration and/or a sensed natural gas concentration.

[0020] Optionally, the vent further comprises an air quality alarm configured to indicate when a sensed air quality parameter from the air quality sensor is outside of an accepted range. For example, the alarm may be configured to indicate when a sensed humidity and/or temperature and/or gas concentration is outside of an accepted range. The gas may be carbon dioxide and/or carbon monoxide and/or natural gas. The air quality alarm may be contained in the vent body. The accepted ranges may be predetermined and may be stored by the controller. The alarm may be a visual (for example a light such as an LED) and/or auditory alarm.

[0021] Optionally, the vent is a passive vent. Passive ventilation means that no fan or other mechanism is incorporated to provide force causing air to flow through the duct. Passive ventilation relies on differences in air pressure, air flow and air temperature on either side of the vent to drive air flow through the vent. Passive ventilation uses the environmental characteristics of the air on either side of the vent to drive air flow through the vent. For example, as the air inside the building warms up due to the presence of humans, the warm air rises as it has a lower pressure than the cold air. This causes natural air flow inside the building which passively forces the warm air out of the vent if the vent is located at a high point in the room. A further example occurs when there is wind on the outside of the building. The wind causes high pressure pockets on the outside of the building, resulting in passive air flow through the vent and into the building.

[0022] Optionally, the passive vent relies on natural forces to ventilate the inside of the building, for example, convective forces, and/or forces caused by buoyancy, and/or forces caused by wind energy. Optionally, the passive vent relies on gravity ventilation, and/or natural draught, and/or the chimney effect, and/or convection ventilation, and/or gravity ventilation, and/or natural convection, and/or the stack effect, and/or thermal buoyancy, and/or ventilation by air movement/airflow.

[0023] Optionally, in the open configuration, the passive vent permits free flow of air through the vent. Optionally, in the open configuration, the passive vent permits free flow of air through the vent in to and/or out of the building.

[0024] The duct closure mechanism may comprise a closable element such as a flap, shutter or louvre. The duct closure mechanism may be positioned at an internal end of the duct, an external end of the duct or anywhere between the internal and external ends of the duct. Optionally, the duct closure mechanism comprises a first closable element and a second closable element, the second closable element positioned between the first closable element and an opening of the duct. In inner cities where traffic or general street noise can be an issue, or in other noisy environments, the use of two closable elements in tandem helps reduce any airborne sound.

[0025] Optionally, the first closable element and second closable element open and close in tandem with each other such that they always have a 0 degree orientation relative to each other. When in their closed configuration, the first closable element and second closable element may create a sealed airgap in the space between them. The air gap beneficially provides improved heat insulation between the inside of the building and the exterior of the building, thus improving energy conservation. Additionally, the airgap provides soundproofing such that exterior noise is dampened before it reaches the interior of the building.

[0026] Closable elements of the duct closure mechanism may be insulated. Thus, energy conservation is increased whilst also further reducing airborne sound.

[0027] Optionally, the external terminal comprises a roof tile or slate adaptor, the roof tile or slate adaptor being sized so as to replace a roof tile or slate and wherein the opening is positioned on the tile or slate adaptor such that when installed, the opening is directed generally downwards. This avoids water ingress.

[0028] Optionally, the vent further comprises a fire-protective sleeve around the duct. The fire-protective sleeve may surround a central portion of the duct such that when installed in a cavity wall, the sleeve surrounds the portion of the duct located in the cavity. This improves the safety of the vent, particularly in high-rise or protected environments. The fire-protective sleeve may be intumescent, fire-resistant or fire-reactive.

[0029] Optionally, the fire-protective sleeve is on the inner surface of the duct. Optionally, the fire-protective sleeve at least partially covers the inner surface of the duct. Optionally, the fire-protective sleeve coats a portion of the inner surface of the duct. In this way, during normal operation of the vent, the fire-protective sleeve does not restrict air flow. During a fire event within the building (or outside the building), the hot air travelling through the duct will cause the fire-protective sleeve to expand, blocking the duct and thereby preventing the fire from travelling through the vent. Additionally, once the duct is blocked off, there will be reduced airflow into the building, thus starving the fire of oxygen, helping to reduce further propagation of the fire. Further, as the fire-protective sleeve is on an inner surface of the duct, the fire-protective sleeve is activated earlier than a sleeve that is positioned on an outer surface of the duct.

[0030] Optionally, the vent further comprises a battery configured to provide power to the controller. Optionally, the vent further comprises a photovoltaic panel connected to the battery and configured to provide power to the battery from light received at a surface of the photovoltaic panel. The battery and/or photovoltaic panel may be provided in or on the vent body. The fascia may comprise the photovoltaic panel. The photovoltaic panel may be arranged at an internal end of the vent to collect light from inside of the building when the vent is installed. Alternatively, or additionally, a photovoltaic panel may be provided at an external end of the vent to collect light from outside of the building when the vent is installed.

[0031] The vent may further comprise a mains power supply. The vent may have a battery backup, allowing the unit to carry on working even in the event of a power failure.

[0032] Optionally, the duct closure mechanism is configured to move to the open configuration when no power is present in the vent. This means that if the battery is running low then the vent will open, likewise if the battery is being changed the vent will open once the battery cover is removed. The vent may be mains powered and may have a battery backup, allowing the unit to carry on working even in the event of a mains power failure.

[0033] The vent may further comprise a back draft baffle or damper in the duct. The baffle or damper may be positioned between the duct closure mechanism and an external end of the duct. The baffle or damper may be maintained in an open position, for example, just off horizontal, by gravity, and/or a spring and/or a magnet and/or an electromagnet. This means that a gust of wind can catch the baffle plate and blow it shut. When the wind dies down the baffle opens again automatically.

[0034] There is further provided a window comprising: a glazing unit, the glazing unit having a hole therethrough, and a vent as described above, the vent being arranged through the hole in the glazing unit. It may be advantageous to provide the vent in a window, for example in a high-rise building in which drilling through a wall may be impractical. Optionally, the glazing unit is double glazed or triple glazed. The hole in the glazing unit may be surrounded by one or more spacers to retain the vacuum between glazing panes.

[0035] Optionally, the vent is fixed to the glazing unit. Optionally, the vent is clamped to the glazing unit such that the vent body and external terminal of the vent are biased against internal and external sides of the glazing unit respectively, around the hole. The external terminal of the vent may be sealed against the external side of the glazing unit. The vent may be clamped to the glazing unit by a threaded connection between external and internal portions of the duct.

[0036] There is further provided, a method of installing a vent as described above in a building, the method comprising: drilling a hole through a wall or roof of the building, inserting the duct of the vent into the hole, and securing the vent to the wall or roof. Optionally, the step of drilling

the hole comprises using a core drill bit.

[0037] Optionally, the step of inserting the duct of the vent into the hole comprises: inserting the duct of the vent into the hole from the inside of the wall or roof, the external terminal being connected to the duct, such that inserting the duct of the vent into the hole passes the external terminal of the vent through the hole from the inside of the building. Optionally, the vent is inserted into the hole from a habitable space of the building such as a room.

[0038] Optionally, the method further comprises adjusting the length of the duct by extending or shortening the length of the extendable portion of the duct. During installation, the installer may adjust the length of the extendable portion of the duct such that the duct is adjusted to the thickness of the wall or roof of the building.

[0039] Optionally, the method further comprises positioning the external opening in a direction pointing downwards.

[0040] Optionally, the step of securing the vent to the wall or roof comprises fixing the vent body to an inside surface of the building wall/ceiling.

[0041] There is further provided a method of installing a vent as described above in a building, the method comprising:

providing a window comprising:

a glazing unit, the glazing unit having a hole therethrough, and

the vent, the vent being arranged through the hole in the glazing unit; and installing the window in a window frame of a building.

[0042] Optionally, the glazing unit is double glazed or triple glazed. Optionally, installing the window in a window frame of a building comprises installing the window in the window frame and then installing the window frame in the building. Alternatively, the window may be installed in a frame that is pre-installed in the building.

[0043] Optionally, the glazing unit is fabricated including the hole and one or more spacers to retain the vacuum between glazing panes.

[0044] Optionally, the method further comprises fixing the vent to the glazing unit. Optionally, fixing the vent to the glazing unit comprises clamping the vent to the glazing unit such that the vent body and external terminal of the vent are biased against internal and external sides of the glazing unit respectively, around the hole. Optionally, fixing the vent to the glazing unit comprises sealing an external terminal of the vent against the external side of the glazing unit, for example by clamping a rubber seal between the external terminal of the vent and the external side of the glazing unit. Optionally, fixing the vent to the glazing unit comprises clamping the vent to the glazing unit using a threaded connection between external and internal portions of the duct of the vent.

[0045] Optionally, the method further comprises adjusting the length of the duct by extending or shortening the length of the extendable portion of the duct. During installation, the installer may extend or shorten the length of the extendable portion of the duct such that the duct is adjusted to the thickness of the glazing unit.

[0046] There is further provided, a ventilation system for a building comprising a plurality of vents as described above, each of the vents installed through a wall, window or roof of the building.

[0047] There is further provided a computer-readable medium having computer-executable instructions adapted to cause a 3D printer to print a vent as described above.

[0048] The methods, vents and systems described above may be combined in any possible combination. The optional features described above are equally applicable to all of the described methods, vents and systems and are not limited to the particular method/vent/system with which they are described here. The essential features of any of the methods/vent/systems described may be optional features of any other method/vent/system described.

[0049] Further features and advantages of the present disclosure will become apparent from the claims and the following description.

Brief Description of Drawings

[0050] Embodiments of the present disclosure will now be described by way of example only, with reference to the following diagrams, in which:-

Fig. 1A is a cross-sectional view of a vent installed in a cavity wall;
Fig. 1B is a cross-sectional view of another vent installed in a cavity wall;
Fig. 2 is a schematic view of electronic components of the vent of Fig. 1A;
Fig. 3 is a perspective view of components of the vent of Fig. 1A;
Fig. 4 is a perspective, exploded view of components of the vent of Fig. 1A;
Fig. 5 is a perspective, exploded view of components of a vent;
Fig. 6A is an external view of a vent installed in a wall;
Fig. 6B is an external view of a vent installed in a wall;
Fig. 6C is an external view of a vent installed in a wall;
Fig. 7 is a schematic view of a building in which vents are installed;
Fig. 8A is a side view of a vent;
Fig. 8B is a perspective view of the vent of Fig. 8A;
Fig. 9 is a cross-sectional view of the vent of Fig. 8A installed in a roof of a building;
Fig. 10 is a cross-sectional view of a vent installed in a window.

Detailed Description

[0051] A number of different embodiments of the dis-

closure are described subsequently. In order to minimise repetition, similar features of the different embodiments are numbered with a common reference numeral. Such features are structured similarly, operate similarly, and/or have similar functions unless otherwise indicated.

[0052] Fig. 1A shows a vent 100 providing ventilation of a building via a cavity wall. Fig. 1B shows an alternative vent 200 providing ventilation of a building via a cavity wall. A further vent 300 is shown in Fig. 8A and 9. Fig. 2 shows the electronic components of the vent 100 and the vent 200. Unless otherwise described, the components of the vents 200 and 300 function in the same manner as the components in vent 100. It will be understood that the vent 100 could equally be installed in a wall of different construction, for example a timber construction wall, or a non-traditional construction wall.

[0053] The vent 100 comprises: a duct 7, a duct closure mechanism 5, an air quality sensor 10, and a controller 11. Duct closure mechanism 5, 5A is operable between an open configuration in which an air passage is provided through the duct 7 and a closed position in which air is blocked from passing through the duct 7. The controller 11 is configured to control the duct closure mechanism 5, 5A between the open and closed configurations based on air quality information received from the air quality sensor 10. As the vent 100, 200 is only open when ventilation is required, it has the benefit of conserving heat and thus energy.

[0054] Duct closure mechanism 5, 5A has three or more configurations: i) an open configuration wherein the duct closure mechanism 5, 5A is fully open; ii) a closed configuration wherein the duct closure mechanism 5, 5A is fully closed; and iii) one or more intermediate configurations wherein the duct closure mechanism 5, 5A is partially open.

[0055] The vent 100 further comprises a vent body 1 containing the controller 11, air quality sensor 10 and further components. The vent body 1 is connected to an internal end of the duct 7 and configured to allow air into and out of the internal end of the duct 7. The vent body 1 has fixing points at which it is attached to the inside of the wall.

[0056] In an alternative embodiment, the duct may comprise an extendable portion configured to extend and/or reduce the length of the duct such that it can be adjusted to the thickness of the wall of the building and/or the thickness of the glazing unit. The extendable portion may be, for example, a pair of telescoping duct members, and/or a concertina, and/or any other suitable duct extending means.

[0057] The vent 1 further comprises a fascia 1A connectable to the vent body 1 to cover the contents of the vent body 1. The fascia is shown in more detail in Fig. 4 in which the square fascia covers the square vent body 1.

[0058] An alternative fascia 1B is shown in Fig. 5 in which the fascia 1B is arranged to cover the vent body 1 and further components. The vent fascia 1B has a circle cross-section. The vent body 1 in Fig. 5 further comprises four light sources 12 and the fascia 1B comprises a light diffuser. This means that the vent of Fig. 5 can function as a light as well as a vent, thereby saving space on the wall/ceiling.

[0059] In Fig. 9, the complete vent assembly 1C comprises the vent body and fascia provided as one integra unit.

[0060] Fig. 3 shows duct 7 of the vent 100, 200. The cross-section of the duct 7 is circular. The vent 100 further comprises an external terminal 9A connected to an external end of the duct 7 and configured to allow air into and out of the duct 7. The external terminal 9, 9A comprises an insect mesh 15.

[0061] The external terminal 9A is passable through a hole with internal cross section equal to an external cross section of the duct 7. As shown in Fig 1A, the external terminal 9A does not exceed a cross section of the duct 7 which enables the external terminal 9A to be installed outside of the building while allowing installation to take place entirely inside the building, removing the need for scaffolding/scaling of the building, improving ease and safety in a high-rise setting. The external opening of the external terminal 9A is provided at an offset angle with respect to the duct 7 and, as shown in Fig. 1A, the external opening is installed angled in a downward direction so as to avoid water ingress.

[0062] In the alternative vent 200 shown in Fig. 1B, the external terminal 9 has a wider cross section than the duct 7. In this case, the external terminal 9 may be connected to the duct after insertion of the duct 7 through the wall. Alternatively, the duct 7 and external terminal 9 may be inserted through the wall from the outside and then connected to the vent body 1.

[0063] The air quality sensor 10 utilised in vent 100 and vent 200 comprises a humidity sensor, temperature sensor, carbon dioxide sensor and carbon monoxide sensor.

[0064] The vent 100, 200 is configured to maintain the duct closure mechanism 5, 5A in the open configuration unless stored criteria are fulfilled. When the criteria are fulfilled, the controller 11 is configured to move the duct closure mechanism 5, 5A towards the closed configuration utilising the servomotor and/or electromagnet 2. This results in reduced passage of air through the duct 7.

[0065] The controller 11 comprises a microprocessor, mounted on a PCB. The stored criteria include: a sensed temperature is below a temperature threshold, a sensed humidity is below a humidity threshold, a sensed carbon dioxide concentration is below a carbon dioxide concentration threshold and a sensed carbon monoxide concentration is below a carbon monoxide concentration threshold. The air quality information sent from the air quality sensor 10 to the controller 11 comprises a plurality of sensed air quality parameters and the controller 11 is configured to determine a desired position of the closure mechanism 5, 5A between the open and closed configurations based on the plurality of sensed air quality parameters. The sensed air quality parameters include: a

sensed humidity, a sensed temperature, a sensed carbon dioxide concentration and a sensed carbon monoxide concentration.

[0066] The vent 100, 200 further comprises an air quality alarm 10A configured to indicate when a sensed air quality parameter from the air quality sensor 10 is outside of an accepted range. The air quality alarm 10A is contained in the vent body 1. The accepted ranges may be predetermined and may be stored by the controller 11. The alarm 10A is an auditory alarm.

[0067] Vent 100, 200 provides passive ventilation meaning that no fan or other mechanism is used to provide force causing air to flow through the duct. Passive ventilation relies on differences in air pressure, air flow and air temperature on either side of the vent 100, 200 to drive air flow through the vent 100, 200. When in the open or partially open configuration, differences between the environmental characteristics inside the building and outside the building cause air to flow passively through the vent 100, 200. When in the closed configuration, passive ventilation between the inside and outside of the building through the vent is stopped.

[0068] The duct closure mechanism 5, 5A is positioned between the internal and external ends of the duct. The duct closure mechanism 5, 5A of vent 100 comprises a first closable element which is flap 5 and a second closable element, flap 5A, the second closable element 5A positioned between the first closable element 5 and an opening of the duct 7. The duct closure mechanism 5 of vent 200 comprises only a first closable element, flap 5.

[0069] In the open configuration, the first closable element 5 and second closable element 5A are orientated in parallel with a central axis of the duct 7. In the closed configuration, the first closable element 5 and second closable element 5A are orientated perpendicular with the central axis of the duct 7. In the one or more intermediate configurations, the first closable element 5 and second closable element 5A are orientated between parallel (0 degrees) and perpendicular (90 degrees) with the central axis of the duct 7. A duct closure mechanism 5, 5A with only one intermediate configuration preferably uses a 45-degree orientation between the first and second closable elements 5, 5A and the central axis of the duct 7. A duct closure mechanism 5, 5A with more than one intermediate configuration comprises a range of different partially open orientations, each with a different respective orientation angle.

[0070] During operation of the duct closure mechanism 5, 5A, the first closable element 5 and second closable element 5A open and close in tandem with each other (i.e., the relative orientation between the first closable element 5 and second closable element 5A is 0 degrees in all configurations).

[0071] When in their closed configuration, the first closable element 5 and second closable element 5A contact an inner surface of the duct 7, creating a sealed airgap between the first and second closable elements 5, 5A such that air flow through the duct 7 is blocked. The airgap provides heat insulation and noise dampening.

[0072] Closable elements 5, 5A of the duct closure mechanism are insulated using insulation 16.

[0073] As shown in Fig. 6A, the external terminal 9A of the vent 100 is a circle. The external terminal of vent 200 is a square as shown in Fig. 6B. Another alternative is shown in Figure 6C, where external terminal 9B is a circle, but the external opening is angled to match the angle of the vent, rather than angled downwards as in Fig. 6A. Alternative geometries may be used for the external terminal.

[0074] An alternative external terminal 13 is shown in Figs. 8A, 8B and 9. The external terminal 13 comprises a roof tile or slate adaptor, the roof tile or slate adaptor being sized so as to replace a roof tile or slate. The external opening is positioned on the tile or slate adaptor such that when installed, the opening is directed generally downwards. The duct 7 in the vent 300 of Figs, 8A, 8B and 9 is bendable such that when installed, it can extend through a ceiling or wall which is horizontal or vertical and out through the slanted roof.

[0075] As shown in Figs. 1A, 1B and 3, the vent 100, 200 further comprises a fire-protective sleeve 8 around the duct 7. The fire- protective sleeve surrounds a central portion of the duct 7 such that when installed in a cavity wall as shown in Figs. 1A and 1B, the sleeve 8 surrounds the portion of the duct 7 located in the cavity.

[0076] In an alternate embodiment of the vent 100, 200, the fire-protective sleeve 8 coats an inner surface of the duct 7. The fire-protective sleeve 8 is positioned on the inner surface of the duct 7 such that it contacts the duct 7 and does not restrict air flow through the duct 7 during normal operation. In the event of a fire, the hot air travelling through the duct 7 will cause the fire-protective sleeve 8 to expand and close off the duct 7, preventing the fire from travelling through the vent 100, 200.

[0077] The vent 100, 200 further comprises a battery 3 configured to provide power to the controller 11. The vent 100, 200 also includes a battery status indicator 4. As shown in Fig. 2, the vent 100, 200 further comprises a photovoltaic panel 14 connected to the battery 3 and configured to provide power to the battery from light received at a surface of the photovoltaic panel 14. The battery 3 is contained in the vent body 1. The fascia 1A, 1B comprises the photovoltaic panel 14.

[0078] The duct closure mechanism 5, 5A is configured to move to the open configuration when no power is present in the vent 100, 200. This means that if the battery 3 is running low then the vent will open, likewise if the battery 3 is being changed the vent 100, 200 will open once the battery cover is removed.

[0079] The vent 100, 200 further comprises a back draft baffle 6 in the duct 7. The baffle 6 s positioned between the duct closure mechanism 5, 5A and an external end of the duct 7. The baffle 6 is maintained in an open position, for example, just off horizontal, by gravity and a spring. This means that a gust of wind can catch the baffle 6 and blow it shut. When the wind dies down the

baffle 6 opens again automatically.

[0080] In order to install the vent described above in the wall, the following method may be used. The method includes: drilling a hole through a wall or roof of the building using a core drill bit, inserting the duct of the vent into the hole from the inside of the wall or roof, the external terminal being connected to the duct, such that inserting the duct of the vent into the hole passes the external terminal of the vent through the hole from the inside of the building, positioning the external opening in a direction pointing downwards and securing the vent to the wall or roof.

[0081] Fig. 10 shows vent 300 arranged through a glazing unit 330. The glazing unit 330 has a hole therethrough. Vent 300 is similar to vents 100 and 200 described above, except that no second closable element and baffle are provided in the duct 7. This allows vent 300 to have a shorter duct 7 than vents 100 and 200. However, it will be appreciated that in other embodiments, vent 300 could be adapted to have a longer duct and incorporate a second closable element and/or a baffle.

[0082] The common features of vents 100, 200 and 300 are labelled with common reference signs to aid understanding and for brevity will not be explained again with reference to vent 300.

[0083] Vent 300 is arranged through the hole in the double glazing unit 330. The hole in the glazing unit 330 is surrounded by a spacer 320 to retain the vacuum between glazing panes.

[0084] The vent 300 is clamped to the glazing unit 330 such that the vent body 1 and external terminal 9 of the vent are biased against internal and external sides of the glazing unit 330 respectively, around the hole. The vent 300 is clamped to the glazing unit 330 by virtue of a threaded connection between external and internal portions of the duct 7. The external terminal 9 of the vent is sealed against the external side of the glazing unit 330 by a rubber seal being clamped between the external terminal 9 of the vent and the external side of the glazing unit 330.

[0085] As shown in Fig. 7, multiple vents 100, 200 may be installed in a building, each of the vents installed through a wall, window or roof of the building, thereby forming a ventilation system.

[0086] Although particular embodiments of the disclosure have been disclosed herein in detail, this has been done by way of example and for the purposes of illustration only. The aforementioned embodiments are not intended to be limiting with respect to the scope of the appended claims.

[0087] It is contemplated by the inventors that various substitutions, alterations, and modifications may be made to the invention without departing from the scope of the invention as defined by the claims.

Claims

1. A vent for providing ventilation of a building, the vent comprising:

   a duct,
   a duct closure mechanism operable between an open configuration in which an air passage is provided through the duct and a closed position in which air is blocked from passing through the duct,
   an air quality sensor, and
   a controller configured to control the duct closure mechanism between the open and closed configurations based on air quality information received from the air quality sensor.

2. A vent according to claim 1, wherein the vent further comprises an external terminal connected to an end of the duct and configured to allow air into and out of the duct, and wherein the external terminal is passable through a hole with internal cross section equal to an external cross section of the duct.

3. A vent according to claim 2, wherein the external terminal does not exceed a cross section of the duct.

4. A vent according to any preceding claim wherein the vent is configured to maintain the duct closure mechanism in the open configuration unless the controller causes the duct mechanism to close, or part-close.

5. A vent according to any preceding claim, wherein the air quality information comprises a plurality of sensed air quality parameters and the controller is configured to determine a desired position of the closure mechanism between the open and closed configurations based on the plurality of sensed air quality parameters.

6. A vent according to any preceding claim, wherein the vent further comprises an air quality alarm configured to indicate when a sensed air quality parameters from the air quality sensor is outside of an accepted range.

7. A vent according to any preceding claim, wherein the vent provides passive ventilation.

8. A vent according to any preceding claim, wherein the duct closure mechanism comprises a first closable element and a second closable element, the second closable element positioned between the first closable element and an opening of the duct.

9. A vent according to claim 2, wherein the external terminal comprises a roof tile or slate adaptor, the roof tile or slate adaptor being sized so as to replace

a roof tile or slate and wherein the opening is positioned on the tile or slate adaptor such that when installed, the opening is directed generally downwards.

10. A vent according to any preceding claim, wherein the vent further comprises a fire-protective sleeve around the duct.

11. A vent according to any one of claims 1 to 9, wherein the vent further comprises a fire-protective sleeve on an inner surface of the duct.

12. A vent according to any preceding claim, wherein the vent further comprises:

a battery configured to provide power to the controller, and
a photovoltaic panel connected to the battery and configured to provide power to the battery from light received at a surface of the photovoltaic panel.

13. A vent according to any preceding claim, wherein the vent further comprises a back draft baffle or damper in the duct.

14. A method of installing a vent according to any preceding claim in a building, the method comprising:

drilling a hole through a wall or roof of the building,
inserting the duct of the vent into the hole, and
securing the vent to the wall or roof.

15. A window comprising:

a glazing unit, the glazing unit having a hole therethrough, and
a vent according to any of claims 1 to 13, the vent being arranged through the hole in the glazing unit.

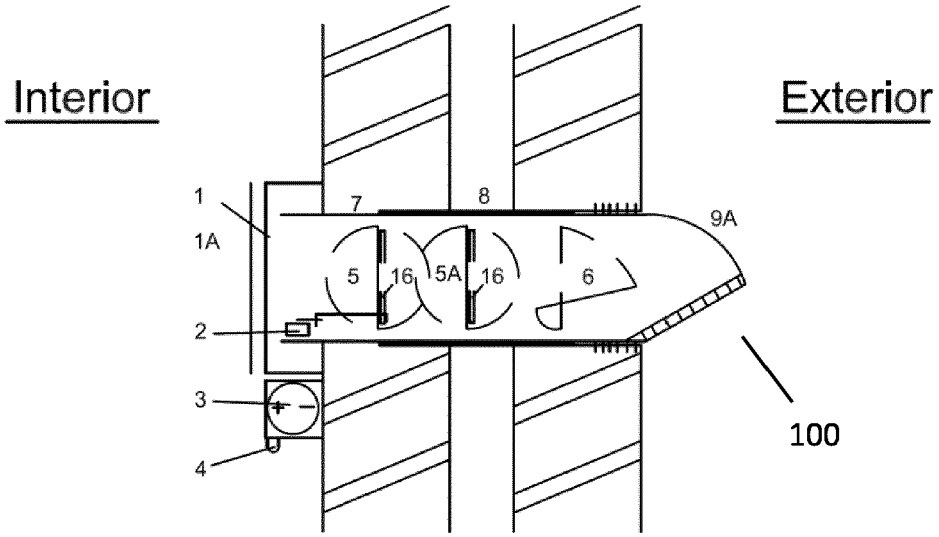

Figure 1A

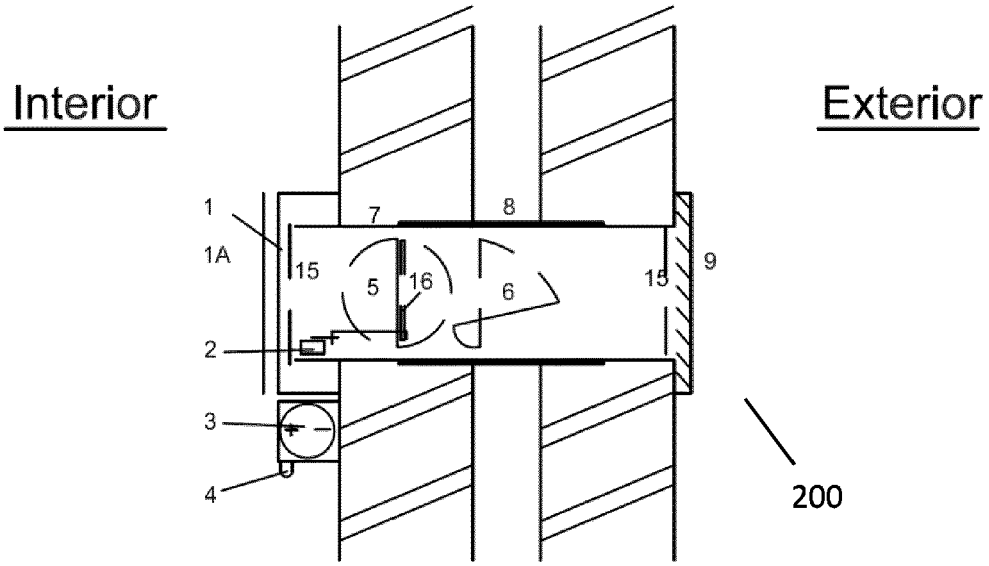

Figure 1B

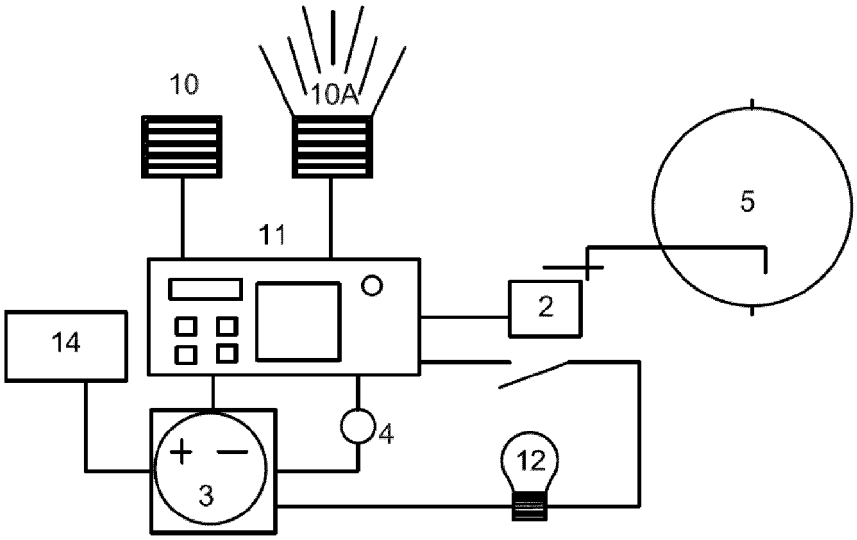

Figure 2

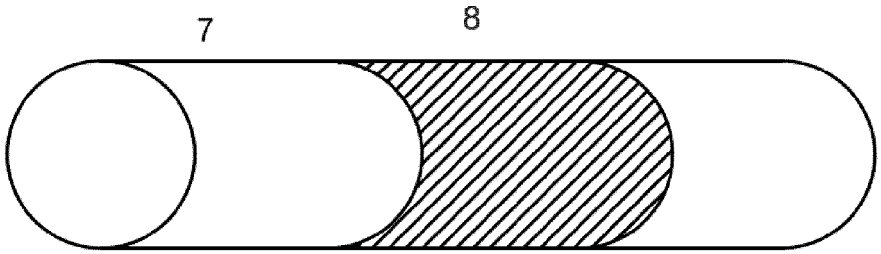

Figure 3

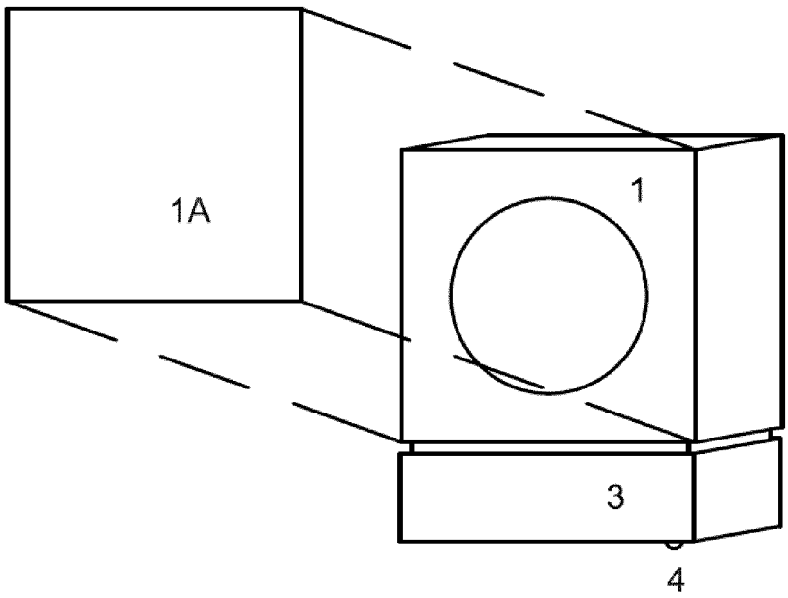

Figure 4

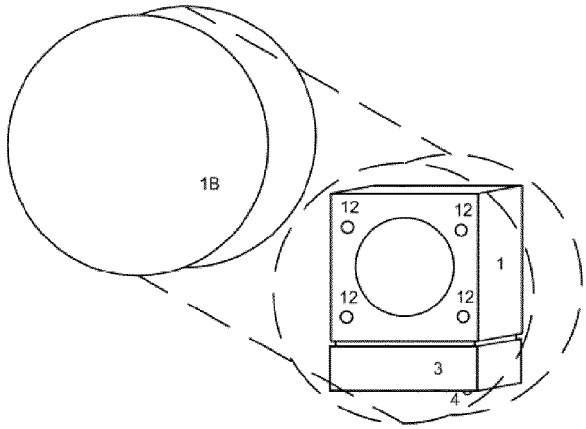

Figure 5

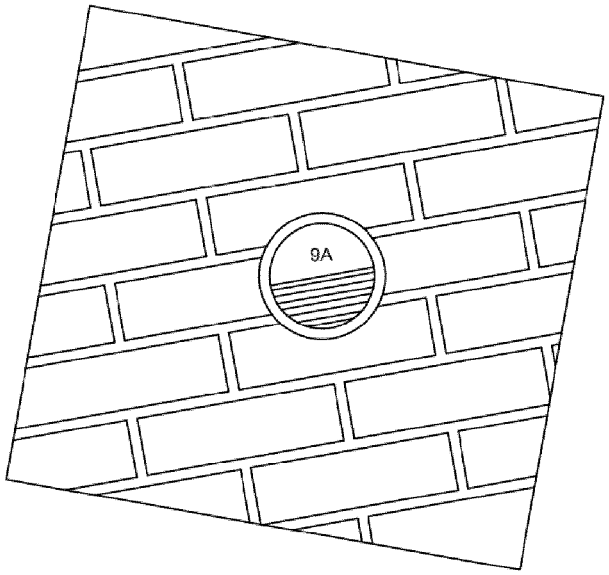

Figure 6A

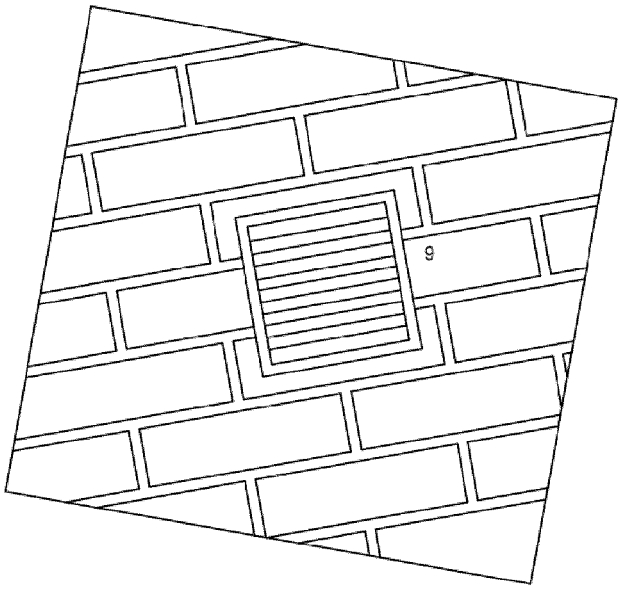

Figure 6B

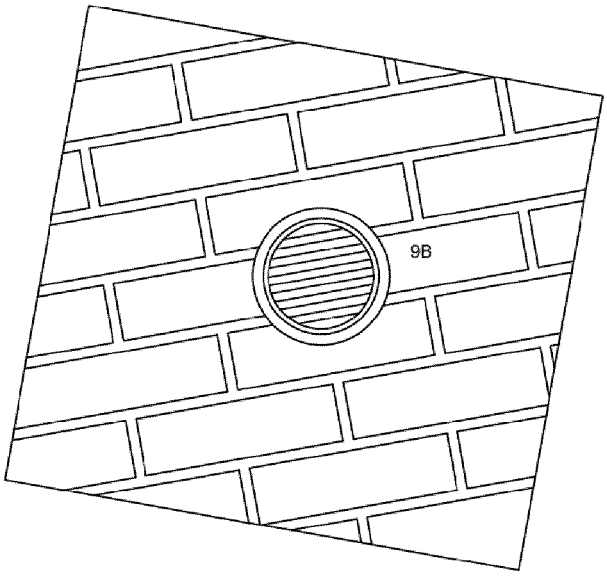

Figure 6C

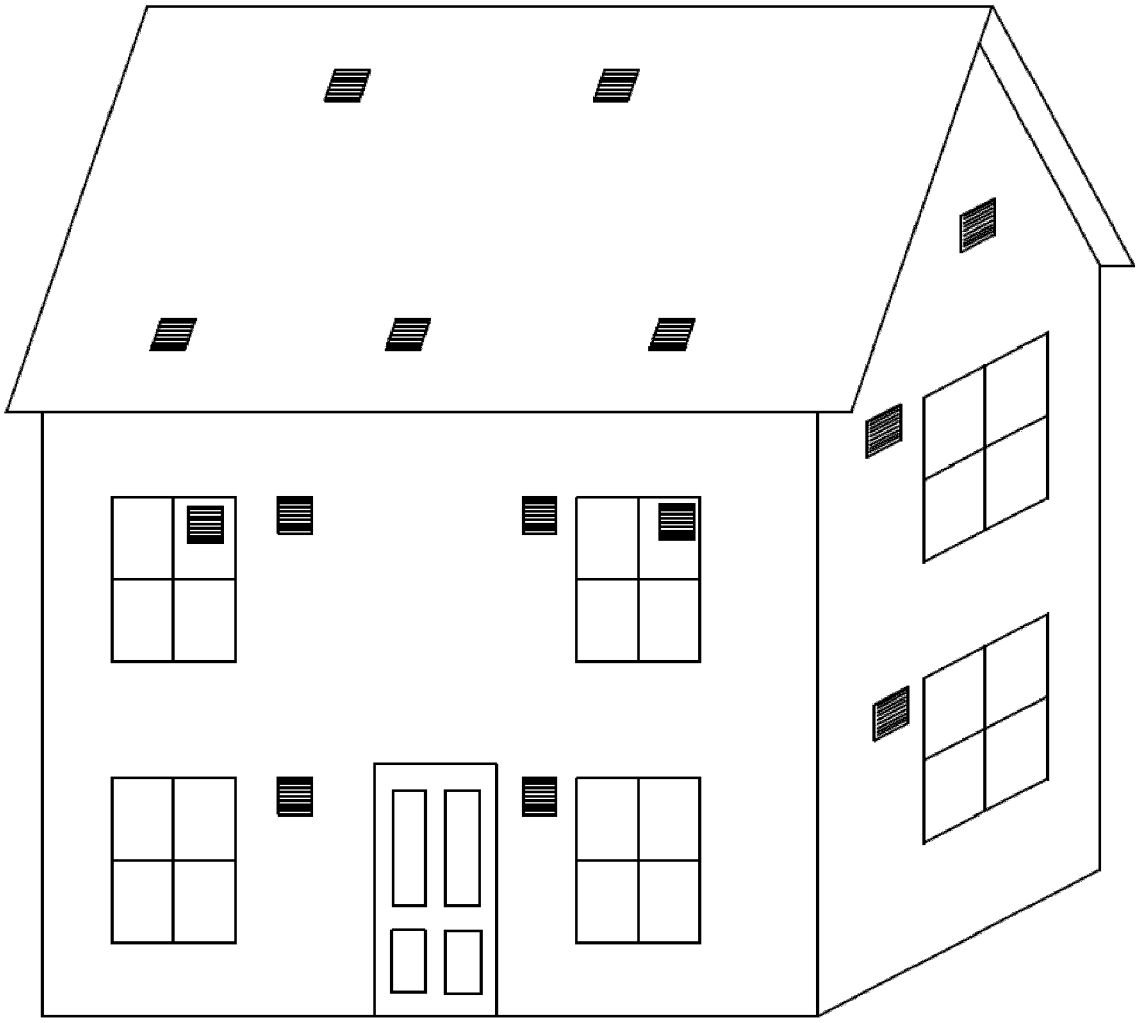

Figure 7

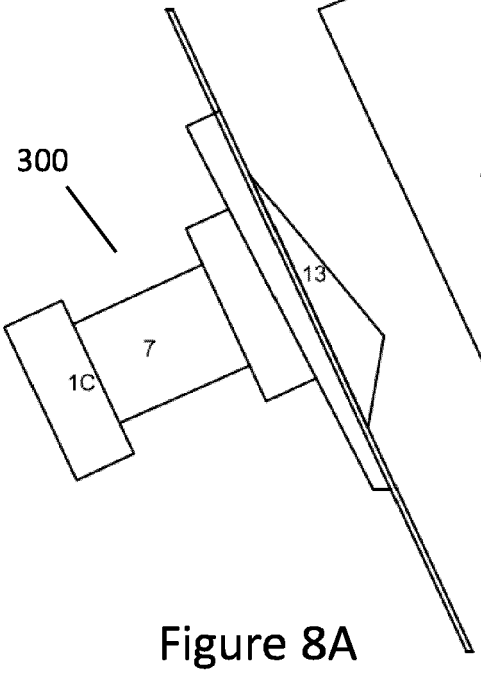

Figure 8A

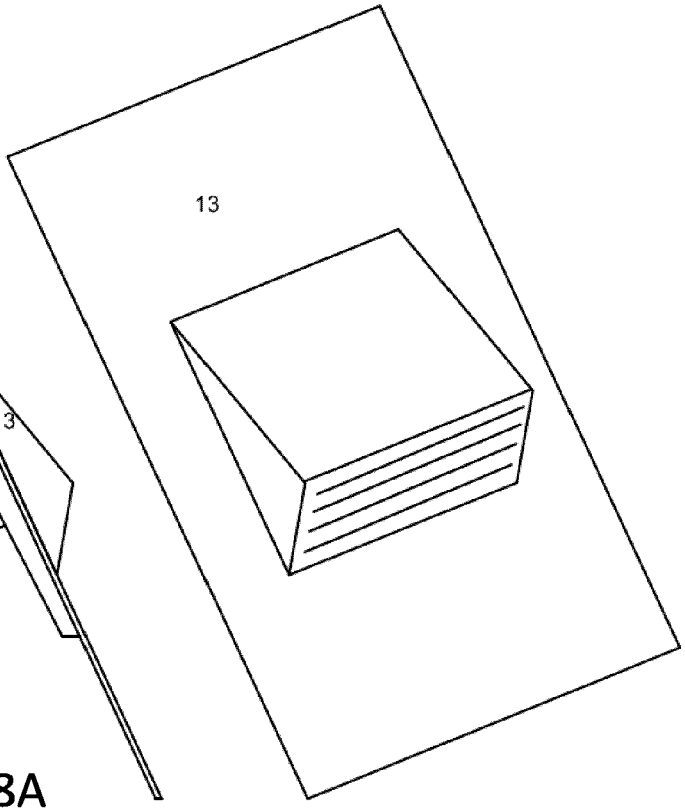

Figure 8B

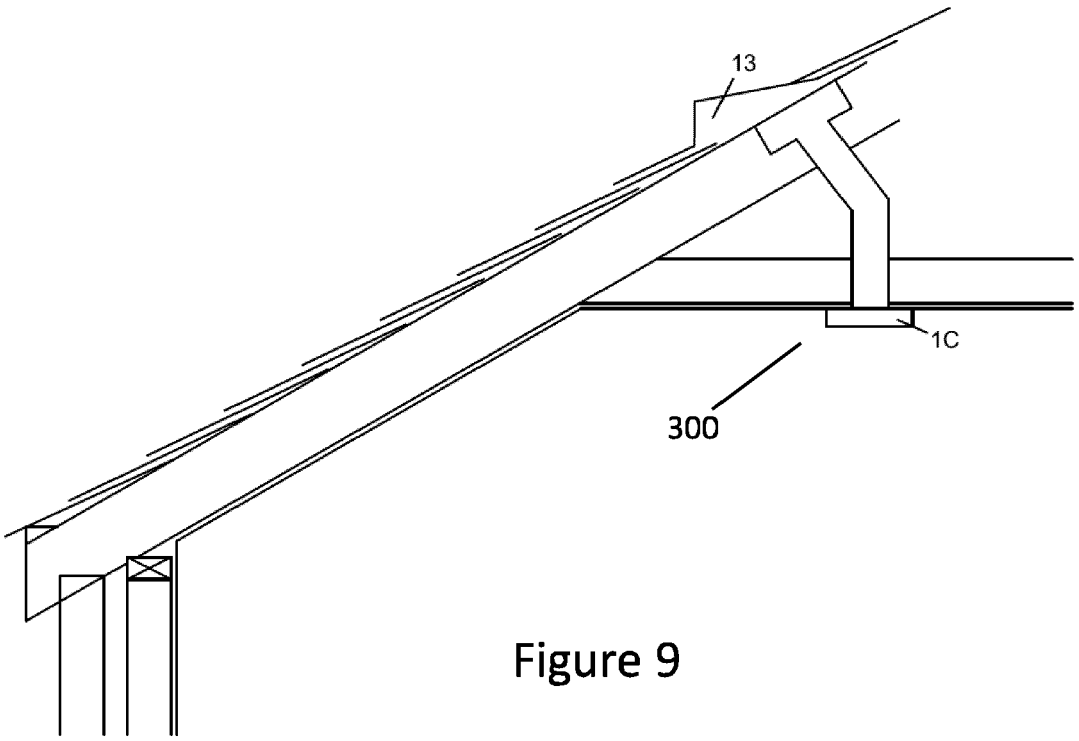

Figure 9

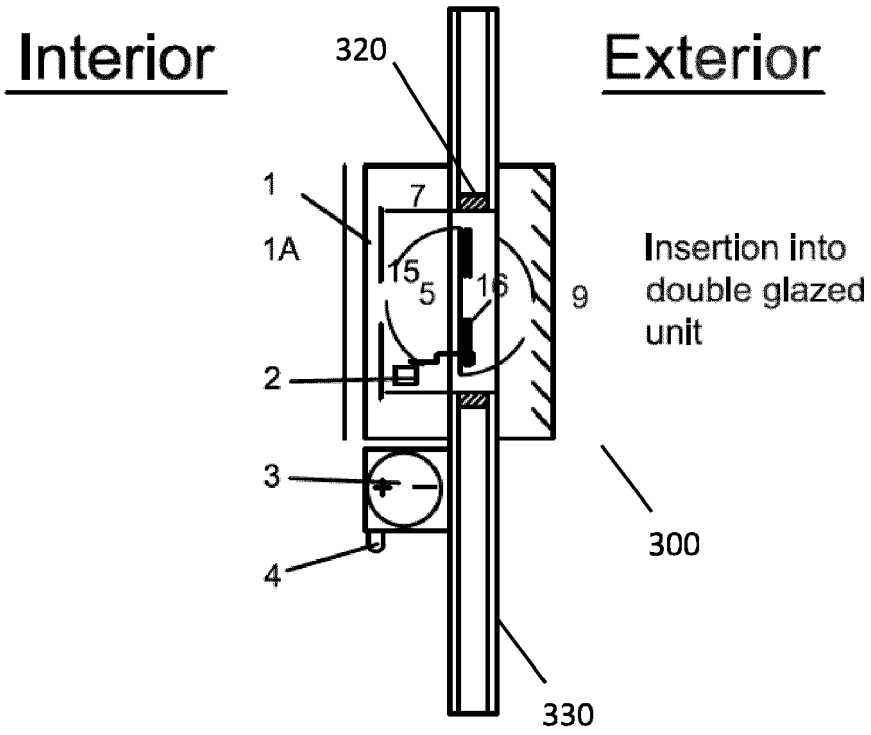
Interior
Exterior
320
1
1A
7
15
5
16
9
2
3
4
Insertion into double glazed unit
300
330

Figure 10

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EUROPEAN SEARCH REPORT

Application Number
EP 24 16 2075

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A	WO 2022/161585 A1 (LIVING BETTER AS [DK]) 4 August 2022 (2022-08-04) * page 10 - page 14; claims 1-10; figures 1-2 *	1-15	
A	WO 2014/036612 A1 (CSR BUILDING PRODUCTS LTD [AU]) 13 March 2014 (2014-03-13) * abstract; claims 1-51 *	1-15	
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			F24F

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
Munich	19 July 2024	Silex, Anna

CATEGORY OF CITED DOCUMENTS

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L : document cited for other reasons

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