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(54) **A FORCED MECHANICAL VENTILATION SYSTEM WITH AN ADJUSTABLE WALL HATCH**

(57) A forced mechanical ventilation system for installation on a building wall,
It comprises a frame (2), a wall hatch (3) hinged to a structural member (2a) or (2b) of said frame (2), an actuator (4) pivotally mounted on a portion of the frame (2) and a fan, wherein said actuator (4) opens and closes the hatch (3) through the use of a retractable element.
The ventilation system further comprises a deflector (5) fastened to the frame (2) and configured to pivot in an opposite direction to that of the hatch (3) in response to the opening and closing of the hatch (3) to direct an airflow towards an exterior of the building at a given angle defined by the opening of the hatch (3).

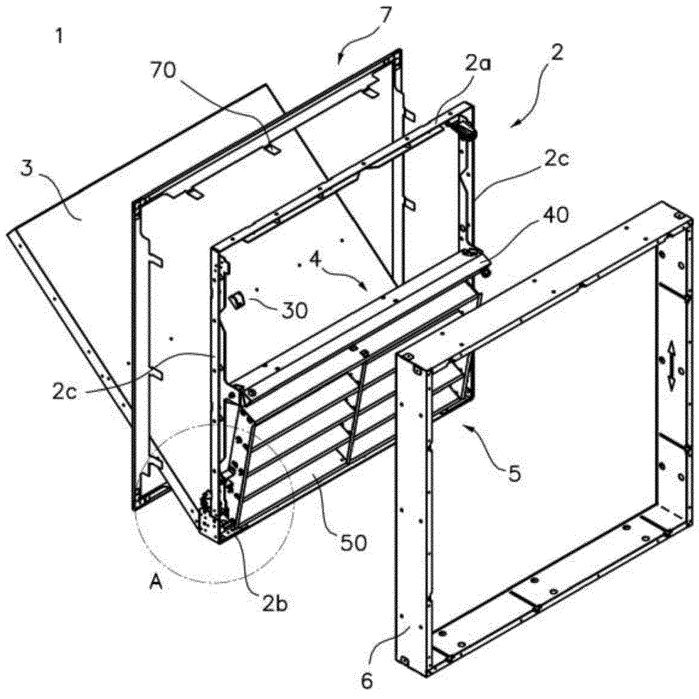

Fig. 1

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Description

Technical field

[0001] The present invention discloses an improved wall hatch, specifically designed for mechanical or forced ventilation systems. The proposed wall hatch is designed so it can be mounted in an opening of a façade or wall of a building, and preferably used for smoke and heat control ventilation systems.

[0002] The proposed mechanical wall hatch, suitable for both forced conventional ventilation systems and smoke and fire safety systems, includes a quick release mechanism which allows a flap or hatch of the wall hatch to open, at a predetermined angle in a pre-set amount of time, according to fire safety regulations and standards, whilst simultaneously complying with the output airflow of exhaust air required.

[0003] Furthermore, the mechanical wall hatch includes an air deflector, positioned in proximity to the ventilation flap or hatch, which aids in guiding an airflow towards the exterior of the building.

State of the Art

[0004] In the last few decades fire safety measures, including both active and passive fire protection measures, have developed substantially due to increasingly stricter legislations and regulations or standards when it comes to fire prevention in buildings. Due to such a rapid evolution in fire safety measures, there is a wide range of smoke and heat exhaust ventilation systems available in the market, categorized as active fire safety measures.

[0005] This wide range of ventilation systems can be narrowed down to two main types: natural smoke and heat ventilation systems and mechanical ventilation systems.

[0006] Natural smoke and heat ventilation systems create a natural airflow by opening airways such as roof or skylight vents as well as windows or other ventilation units which are part of a building façade or wall, using air flow dynamics enabling the smoke and heat to be released outside the building.

[0007] On the other hand, mechanical (also commonly referred to as forced) smoke and heat ventilation systems include the use of a fan to generate a forced airflow, extracting and guiding the smoke and heat towards the airways of the building so it can be released outside. The proposed invention, disclosed herein, belongs to mechanical or forced ventilation systems and therefore must include a fan. Furthermore, the proposed invention is designed specifically to be installed on a building façade or building wall opening and can be used for either: conventional forced ventilation systems or smoke and heat extraction systems, preferably said second application.

[0008] Ventilation systems may be further classified, according to their opening mechanism, into either mechanically opened vents or drop-out vents.

[0009] Mechanically opened vents use mechanisms which are activated or driven through the use of springs, pneumatic actuators, electric motors or a combination thereof, whereas drop-out vents, which are usually single use vents, are those which, for example, include a plastic layer that shrinks when exposed to heat and therefore exposes the opening of the vent so that the heat and smoke can be released.

[0010] DE 4 407 276 B4, discloses a mechanism which may be driven manually or, preferably, automatically using an electric actuator or driver, configured to open and close a ventilation flap that is hinged to a frame of an exhaust vent which allow the vent to open under a predetermined amount of time and at a maximum threshold angle, according to fire safety regulations and standards. The electric actuator, such as a spindle motor, is arranged inside a casing or housing structure, pivotally mounted on the frame of the exhaust vent and includes a retractable elastic band or cord connected to an area of the ventilation flap, so it may be opened automatically at a predetermined angle and closed.

[0011] European patent application EP 2 685 041 A2 discloses a device for mounting a window into an opening of a wall which comprises a premounting element, adjustably installed in said opening, made up of a frame onto which a case of the window is installed, with an existing play between the frame of the premounting element and the case of the window, so that the frame acts as a guiding element for the case of the window, in order to position the window at an end or desired position.

[0012] The present invention aims to solve issues in mechanical ventilation systems regarding the turbulent flow which occurs when the forced airflow generated by a fan collides with a surface of the hatch in an open position, reducing the speed at which the smoke and heat is released. In order to overcome this, the present invention proposes the use of guiding means which move sequentially with the driving or actuating means, which open and close the hatch or vent at a predetermined angle, and aid in guiding the smoke towards the exterior of the building, reducing airflow turbulence and therefore increasing the speed at which heat and smoke is released towards the exterior of the building.

Brief description of the invention

[0013] In order to overcome the issues raised previously, the present invention discloses a mechanical smoke and heat ventilation system which has been designed to be installed in a suitable opening of a façade or wall of a building.

[0014] The mechanical ventilation system comprises a substantially rectangular frame, which is made up of at least an upper and a lower structural member and two lateral structural members, with a hatch (also referred to sometimes as a flap) mechanically hinged to the frame, an actuator which is used to open and close the hatch and a fan, allowing smoke and heat to be guided towards

the outside of the building.

[0015] The wall hatch, or wall flap, can be mechanically hinged to either one of the four structural members which together form the frame. However, in a particular embodiment, the hatch is preferably mechanically hinged to either one of the upper or the lower structural members of the frame, according to the operational mode of the fan, in which the fan can either generate a forced airflow into or outside the building when the hatch is in an open position.

[0016] The hatch is opened or closed through the use of an actuator which is arranged inside a protective housing or casing mounted on a portion of the frame.

[0017] In a particular embodiment, the protective housing containing the actuator is pivotally mounted in a transversal central portion of the frame between both lateral structural members of the frame, wherein each end of the housing is fixed to each one of the lateral structural members using mechanical fasteners, such as screws, so that the housing pivots around a longitudinal axis of the housing, transversal to the frame.

[0018] However, this particular arrangement of the actuator and its housing is non-limiting and other alternative arrangements of the actuator with regards to the frame, known in the current state of the art should be deemed as equivalent and obvious to a person skilled in the art.

[0019] The actuator used to modify the position of the hatch is preferably a linear actuator which is selected from, but not limited to, a group comprising: an electric chain actuator, a rack and pinion actuator, a spindle actuator, a folding arm actuator, a pneumatic cylinder or a motor reducer with an anti-side bow chain, amongst others.

[0020] In a particular embodiment of the present invention, the actuator is preferably an electric chain actuator which opens and closes the hatch through the use of a retractable element, for this particular embodiment a chain, which moves through an opening of the housing. A distal end of the retractable element is attached to a suitable fixing point, such as a hook, located on an interior surface of the hatch, so that the hatch may be either opened or closed when the actuator is operative by increasing or decreasing the length of the chain.

[0021] In other literature, the term "drive" can be used in lieu of the term "actuator" used herein and should be understood as being synonymous.

[0022] Mechanical ventilation systems use a fan to generate forced ventilation of an interior space of a building and/or to remove smoke and heat from the interior of a building, when a fire has originated, wherein the fan generates a forced flow of air towards open airways of the building, such as the present invention. However, when this flow of air, as well as the smoke and heat, collide against the hatch, before being released to the exterior of the building, the flow of air becomes turbulent which in turn reduces the speed at which smoke is released.

[0023] In order to overcome the problems associated with the appearance of a turbulent flow of air, the proposed ventilation system further includes a deflector which is mechanically fastened to the frame in such a manner that it can pivot in an opposite direction to that of the hatch, in response to the opening and closing of the hatch.

[0024] The mechanical elements or fasteners used in order to attach the deflector to the frame, are placed on one or both of the structural lateral members of the frame and, in a particular embodiment, consist of a first attachment point fixed directly to the deflector which can rotate or pivot, and a second attachment point which comprises a lever mechanism connecting said first attachment point and the deflector, allowing the deflector to pivot and move in time with the opening and closing of the ventilation flap or hatch, although in an opposite direction. Therefore, the deflector is tilted at a given angle according to the position of the hatch.

[0025] The deflector is positioned in an area of the frame where the flow of air, smoke and/or heat generates the greatest turbulence upon impact with an inner surface of the hatch, allowing the deflector to direct the forced flow of air, as well as smoke and/or heat, towards the exterior of the building at a given opening angle of the hatch, according to fire safety regulations and standards, if the forced mechanical ventilation system, disclosed herein, is used for such applications.

[0026] In certain embodiments, the deflector may include a plurality of guiding elements, such as blades, ailerons, flaps, or other suitable elements which are usually slender flat components that are made of a suitable material which can withstand high temperatures. These guiding elements are preferably arranged parallel to one another and separated equidistantly. Furthermore, these guiding elements may be arranged on the deflector at a predetermined angle.

[0027] The mechanical ventilation system disclosed herein further comprises an adjustable external frame which is mounted in a suitable cavity or opening of a building wall or façade, so that the frame, to which the hatch and deflector are mounted, can be mounted inside this adjustable external frame in a slidably adjustable configuration.

[0028] Therefore, the frame is slidably mounted inside the adjustable external frame using mechanical fasteners, guiding rails, grooves, releasable locking mechanisms or a combination thereof, in order to obtain a correct alignment between the frame and hatch with the building wall or fagade.

[0029] It should be noted that the hatch is limited in an embodiment to a maximum angular opening, in which said maximum angle is set between 50º and 60º, and the actuator which modifies the position of the hatch must open the hatch up to said maximum angle in a pre-set time. The maximum angular opening is determined according to certain characteristics of the mechanical ventilation system, such as: the size of the hatch and the maximum airflow generated by the fan, although this an-

gle must never be smaller than the minimum angle defined by suitable safety standards and regulations according to the use of the disclosed forced ventilation system.

[0030] It will be understood that references to geometric position, such as parallel, perpendicular, tangent, etc. allow deviations up to ± 5° from the theoretical position defined by this nomenclature.

[0031] It will also be understood that any range of values given may not be optimal in extreme values and may require adaptations of the invention to these extreme values are applicable, such adaptations being within reach of a skilled person.

[0032] Other features of the invention appear from the following detailed description of an embodiment.

Brief description of the Figures

[0033] The foregoing and other advantages and features will be more fully understood from the following detailed description of an embodiment with reference to the accompanying drawings, to be taken in an illustrative and not limitative, in which:

- **FIG. 1** illustrates the different components which, when assembled together, comprise the forced mechanical ventilation system disclosed herein; and

- **FIG. 1A** illustrates a detailed view of a hinge and lever mechanism, as seen in FIG. 1, which enable a wall hatch and a deflector to move synergistically, according to the present invention.

Detailed description of an embodiment

[0034] The foregoing and other advantages and features will be more fully understood from the following detailed description of an embodiment with reference to the accompanying drawings, to be taken in an illustrative and non-limitative manner, in which:

FIG. 1 shows a forced mechanical ventilation system 1, according to the present invention, conceived for installation in an opening of a building wall or façade, comprising a frame 2, a wall hatch (or wall flap) 3, an actuator 4, a deflector 5, an adjustable external frame 6 and, optionally, an embellishment 7.

[0035] The wall hatch 3 is mechanically hinged to said frame 2 by means of a hinge mechanism 8 (as seen in Fig. 1A), which, according to this particular embodiment, mechanically fastens the wall hatch 3 to a lower transversal structural member 2b of the frame 2.

[0036] The actuator 4, although referenced in this figure, is not shown as it is located inside a housing 40, which is pivotally fastened to opposite extending members 20 of lateral structural members 2c of frame 2. This allows the housing 40 of the actuator 4 to tilt or rotate in a limited manner around a longitudinal axis, which is parallel to the upper and lower structural members 2a, 2b of frame 2, according to the position of the wall hatch 3.

[0037] The housing 40 of the actuator 4, has an opening (not shown in these Figs.) through which a retractable element, such as a chain or a cord, exits and having one of its ends fastened to a hook 30 (or other suitable fixation means) located in an inner surface of the wall hatch 3. Therefore, when the actuator 4 is in use, it opens and closes the wall hatch 3, by extending or retracting said retractable element, as know in the art according to DE 4 407 276.

[0038] The deflector 5, previously mentioned, used in the forced mechanical ventilation system 1 comprises a plurality of guiding elements 50 used to redirect a forced airflow generated by a fan towards an opening defined by an angle of the wall hatch 3 in an open position.

[0039] The deflector 5 is mechanically fastened to the lateral structural members 2c of frame 2 by means of a lever mechanism 9, which is also connected to the hinge mechanism 8 used to fasten the wall hatch 3 to frame 2, so that when the wall hatch 3 is opened by means of actuator 4, the deflector 5 tilts in an opposite direction so that the forced airflow generated by the fan is redirected instead of colliding directly against an inner surface of the wall hatch 3, avoiding the generation of turbulent conditions which difficult ventilation.

[0040] Finally, frame 2 of the forced mechanical ventilation system 1 is installed onto the adjustable external frame 6 which is mounted in a cavity or suitable opening of a building wall or façade.

[0041] The frame 2 is installed inside the adjustable external frame 6 in such a manner, that it is slidably adjustable using either one of mechanical fasteners, guiding rails, releasable locking mechanisms or a combination thereof, in order to position the frame 2 adequately with regards to adjustable external frame so that the wall hatch 3 can be opened and closed properly, enabling the forced mechanical ventilation system 1 to perform correctly.

[0042] For this particular embodiment, the forced mechanical ventilation system 1 includes an embellishment 7. The embellishment 7 has a plurality of tabs 70 which are inserted into openings or slots of both the frame 2 and the external adjustable frame 6, wherein the slots in both frames, 2, 6 are preferably aligned. By inserting said plurality of tabs 70 into the slots, the embellishment 7 is retained and placed against frame 2, covering it.

[0043] **FIG. 1A** is detailed, large-scale, representation of both the hinge mechanism 8 and the lever mechanism 9 used to move both the wall hatch 3 and the deflector 5, in opposite directions, as seen in **FIG. 1** with reference A.

[0044] It will be understood that various parts of one embodiment of the invention can be freely combined with parts described in other embodiments, even being said combination not explicitly described, provided there is no harm in such combination.

Claims

1. A forced mechanical ventilation system (1), for installation on a building wall, comprising:

   - a frame (2),
   - a wall hatch (3) mechanically hinged to either an upper structural member (2a) or a lower structural member (2b) of said frame (2),
   - an actuator (4) arranged inside a housing (40), said housing (40) being pivotally mounted on a portion of the frame (2) so that it pivots around a longitudinal axis of the housing (40), transversal to the frame (2), and
   - a fan,

   wherein said actuator (4) opens and closes said hatch (3) through the use of a retractable element exiting the housing (40),
   characterised in that it further comprises a deflector (5) fastened to the frame (2) and configured to pivot in an opposite direction to that of the hatch (3) in response to the opening and closing of the hatch (3) and configured to direct an airflow towards an exterior of the building at a given angle defined by the opening of the hatch (3),
   wherein said deflector (5) is positioned in an area of the frame (2) where said airflow generates the greatest turbulence due to direction of impact with an inner surface of the hatch (3), and
   wherein the deflector (5) comprises a plurality of guiding elements (50).

2. Forced mechanical ventilation system (1) according to claim 1, wherein the deflector (5) is tilted at a given angle according to the position of the hatch (3).

3. Forced mechanical ventilation system (1) according to claim 1 or 2, wherein the deflector (5) is pivoted by a lever mechanism (9) connected to the hinging mechanism (8) of the hatch (3).

4. Forced mechanical ventilation system (1) according to claim 1, further comprising an adjustable external frame (6) mounted in a cavity of said building wall.

5. Forced mechanical ventilation system (1) according to claim 4, wherein the frame (2) is mounted on an interior of the adjustable external frame (6).

6. Forced mechanical ventilation system (1) according to claim 5, wherein the frame (2) is slidably adjustable inside the adjustable external frame (6) using mechanical fasteners, guiding rails, releasable locking mechanisms or a combination thereof.

7. Forced mechanical ventilation system (1) according to claim 1, wherein the housing (40) of the actuator (4) is mounted on a central portion of the frame (2) and fixed to each one of a lateral structural member of the frame (2).

8. Forced mechanical ventilation system (1) according to claim 1, wherein the actuator (4) is a linear actuator selected from a group comprising: an electric chain actuator, a rack and pinion actuator, a spindle actuator, a folding arm actuator, a pneumatic cylinder or a motor reducer with an anti-side bow chain.

9. Forced mechanical ventilation system (1) according to claim 1, wherein the actuator (4) is an electric chain actuator.

10. Forced mechanical ventilation system (1) according to claim 1, wherein the hatch (3) is limited to a maximum angular opening between 50º and 60º according to the size of the hatch (3) and the maximum airflow generated by the fan.

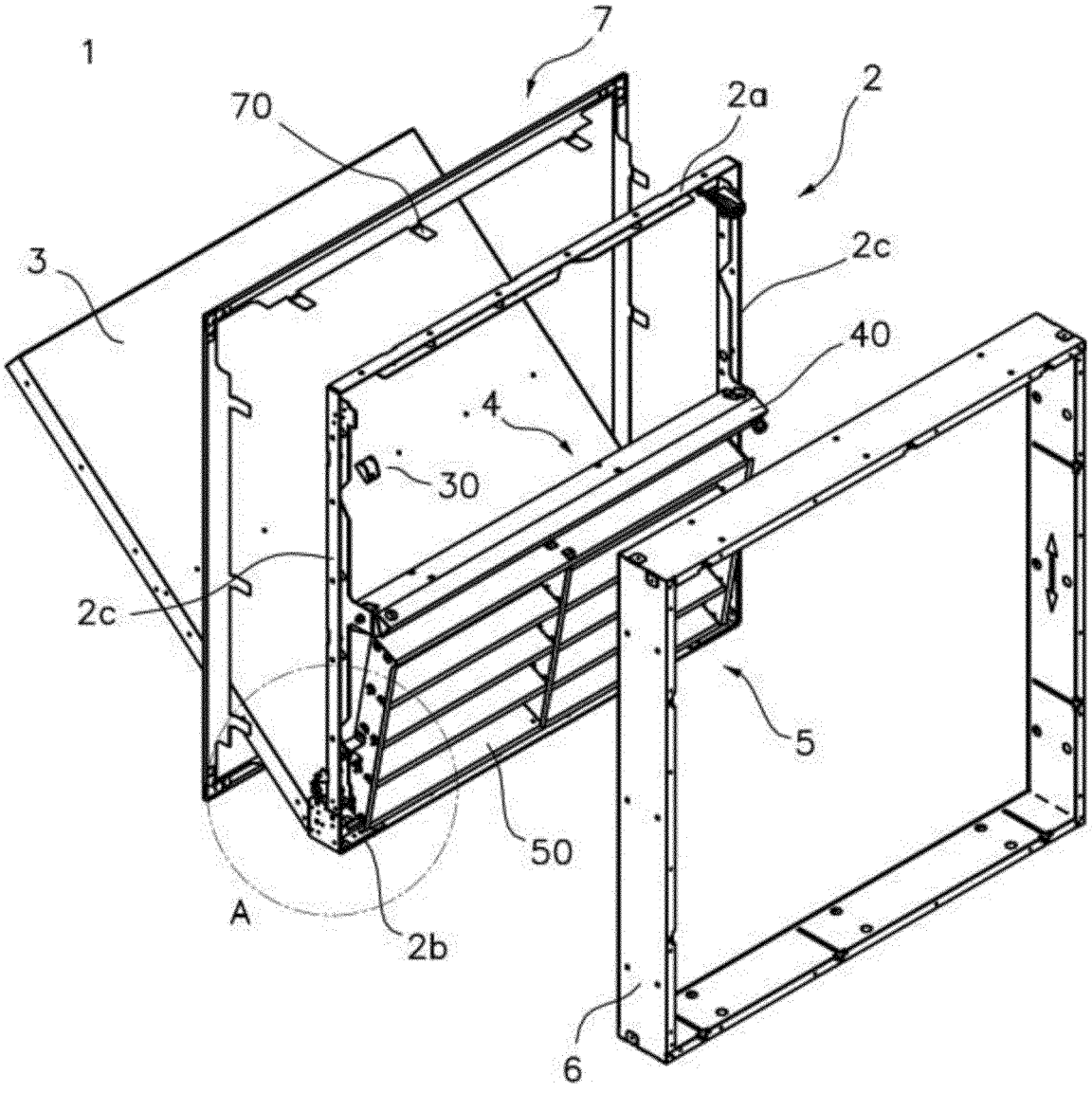

Fig. 1

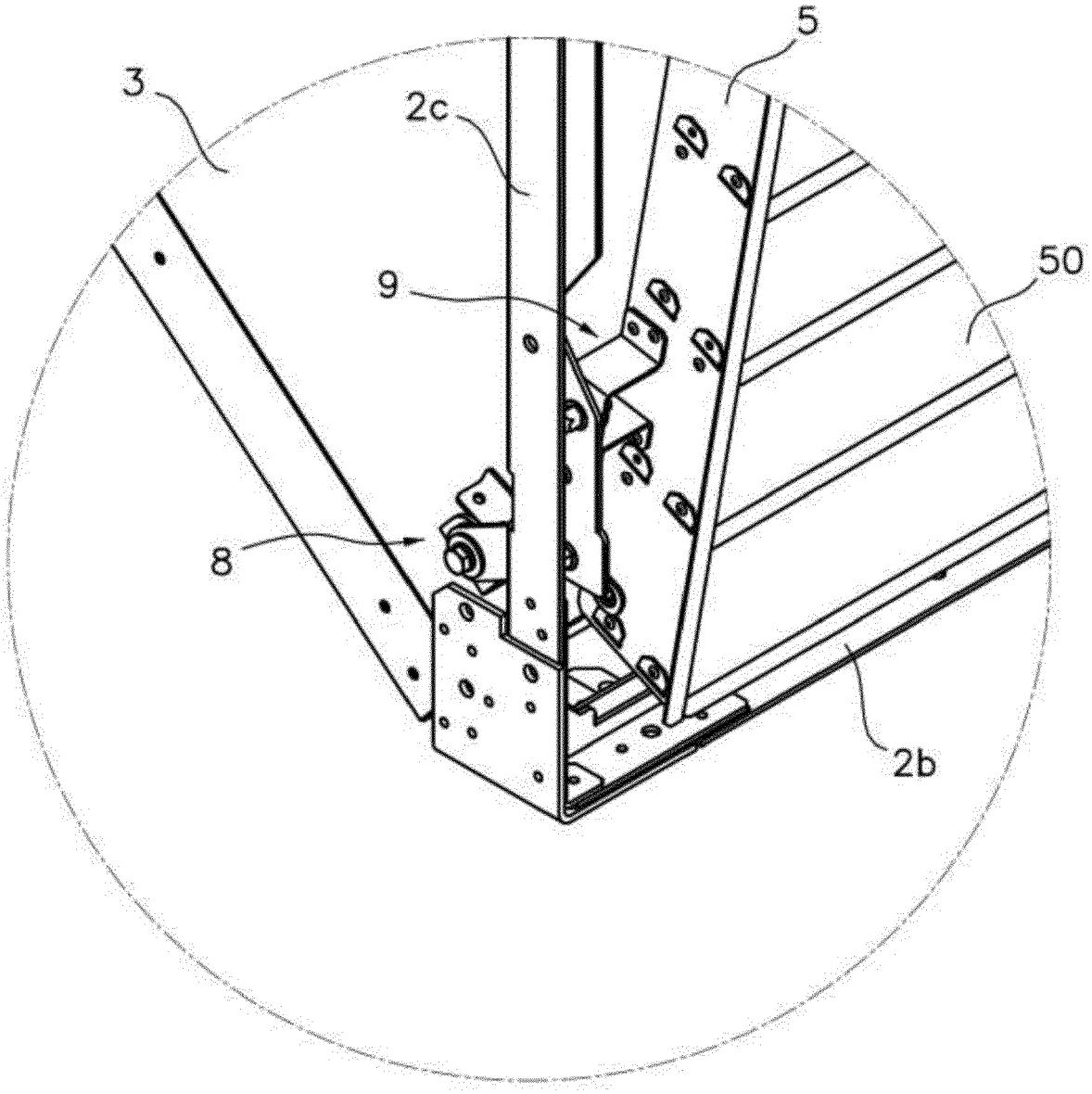

Fig. 1A

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EUROPEAN SEARCH REPORT

Application Number
EP 19 38 2545

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The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
Munich	25 November 2019	Anconetani, Mirco

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
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For more details about this annex : see Official Journal of the European Patent Office, No. 12/82

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