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(54) **VERTICAL DOOR SYSTEM AND REFRIGERATOR CABINET PROVIDED WITH SUCH A VERTICAL DOOR SYSTEM**

(57) Vertical door system comprising a door (1) attached to a frame (2) by means of an upper hinge (H1) provided at an upper corner of the door (1) and of a lower hinge (H2) provided at a lower corner of the door (1), the upper (H1) and lower (H2) hinges allowing the door (1) to move, in respect to the frame (2), between a first extreme position and a second extreme position, a first plate (3) fixed to the upper hinge (H1) by means of a safety screw (4) and of a fixing screw (F), and provided with a

stopper (5), a second plate (6) fixed to the upper corner of the door (1) and provided with a nose (7) positioned such that the nose (7) is in contact with the stopper (5) only when the door (1) is in its second extreme position, the safety screw (4) has a shearing resistance such that the safety screw (4) breaks when a force applied by the nose (7) to the stopper (5) exceeds a threshold value.

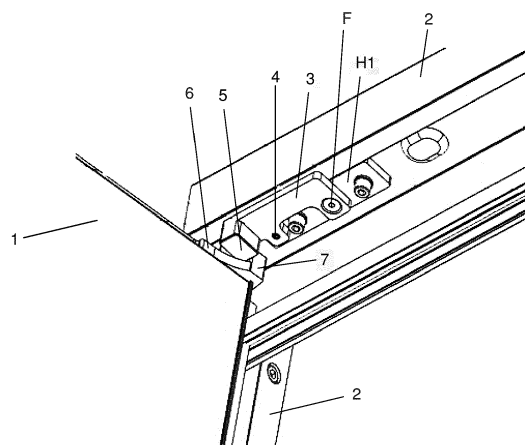


Fig. 2

Description

[0001] The invention refers to a vertical door system, in particular a vertical door system for a refrigerator cabinet, as well as to a refrigerator cabinet provided with such a vertical door system.

[0002] Vertical door systems are used in the manufacturing of refrigerator cabinets that are used for the storage and the display of perishable products available for sale.

[0003] Prior art document EP2908073A1 discloses an improved hinge group for a refrigerator cabinet vertical door system that enables limiting the non-transparent area of the door and also reducing the interspace between the closing panel and the fixed frame of the door (so as to prevent the possibility of insertion of fingers in the space), enabling at the same time a large number of openings and closings of the closing panel without wearing the cam means, as well as a good level of silent operation.

[0004] Prior art document US2019/0059613A1 discloses a refrigerator cabinet provided with hinges that may be of the torque, gravity, or electrical type.

[0005] The disadvantage of the prior art embodiments is that none of them is provided with a hinge safety mechanism. In case the door is opened (for example at an angle larger than 90°) by using excessive force, the hinge and possibly the cabinet frame will be damaged and will need replacement, thus leading to an expensive, time-consuming operation.

[0006] The present invention aims to eliminate the afore-mentioned disadvantage, by using a vertical door system provided with a simple and inexpensive hinge safety system. Another goal of the present invention is to provide a simple and inexpensive solution that enhances the thermal insulation of the interior of the refrigerator cabinet.

[0007] The vertical door system according to the invention comprises:

- a door attached to a frame by means of an upper hinge provided at an upper corner of the door and of a lower hinge provided at a lower corner of the door,
- the upper and lower hinges allowing the door to move, in respect to the frame, between a first extreme position and a second extreme position,
- a first plate fixed to the upper hinge by means of a safety screw and of a fixing screw, and provided with a stopper,
- a second plate fixed to the upper corner of the door and provided with a nose positioned such that the nose is in contact with the stopper only when the door is in its second extreme position,
- the safety screw has a shearing resistance such

that the safety screw breaks when a force applied by the nose to the stopper exceeds a threshold value.

[0008] In a preferred embodiment, the force threshold value is within the range 800 N ÷ 1200 N, preferably within the range 900 N ÷ 1100 N.

[0009] In a preferred embodiment, the vertical door system further comprises a lateral gasket, fixed along the length of a vertical side of the door that is distal in respect to the upper and lower hinges.

[0010] In a preferred embodiment, the lateral gasket is made of a flexible material and has the shape of letter T rotated at an angle of 90 degrees.

[0011] In a preferred embodiment, the lower hinge is a gravitational hinge or a hydraulic hinge.

[0012] In a preferred embodiment the angle formed by the door between its first extreme position and its second extreme position is 110°.

[0013] In a preferred embodiment, a single-door refrigerator cabinet is provided with a vertical door system according to the invention.

[0014] In a preferred embodiment, a two-doors refrigerator cabinet is provided with two vertical door systems according to the invention, wherein, when the respective doors are simultaneously in their first extreme position, the doors lie in the same plane and the respective lateral gaskets are in mutual contact and overlap along their entire length.

[0015] The vertical door system according to the invention provides the advantage of a simple and inexpensive hinge safety system: the single part that has to be replaced is the safety screw. Moreover, until the screw is replaced, the door can work normally and the refrigerator cabinet can be kept in operation (i.e. no need to be disconnected from power until the safety screw is replaced).

[0016] Another advantage of the invention is that it provides increased thermal insulation by means of a door lateral flexible gasket of a particular shape.

[0017] The invention will be better understood from the following embodiments, explained in detail and based on the figures, that represent:

Figure 1: a front view of a prior art refrigerator cabinet provided with two conventional vertical doors;
 Figure 2: a view of the upper part of the vertical door system according to the invention;
 Figure 3: a view of the door in its closed position;
 Figure 4: a view of the door in its open position;
 Figure 5: a detailed exploded view of the upper part of the vertical door system;
 Figure 6: a detailed exploded view of the lower part of the vertical door system;
 Figure 7: a profile view of the vertical door system;
 Figure 8: a detail of the upper part of Figure 7;
 Figure 9: a view from above of the vertical door system;

Figure 10: a view from above of the doors lateral gaskets;

Figure 11: a profile view of the left door lateral gasket.

[0018] Figure 1 shows a front view of a prior art refrigerator cabinet provided with two conventional vertical doors.

The vertical door system according to the invention is fully compatible with any type of prior art refrigerator cabinet (i.e. the conventional vertical doors of the prior art refrigerator cabinet can be dismantled and replaced with a vertical door system according to the invention).

[0019] Figure 2 shows the upper part of the vertical door system according to the invention: a door **1** is attached to a frame **2** by means of an upper hinge **H1** provided at the upper left corner of the door **1** and of a lower hinge (not represented in Figure 2) provided at the lower left corner of the door **1**. The door **1** is of a type that is commonly used for refrigerator cabinets.

The door **1** is capable to move, in respect to the frame **2**, between a first extreme position (closed position) and a second extreme position (open to the maximum position), by means of the upper **H1** and lower **H2** hinges.

The frame **2** is designed to be further fixed to a refrigerator cabinet (not represented in Figure 2).

A first plate **3** is fixed to the upper hinge **H1** by means of a safety screw **4** and of a fixing screw **F**. The safety screw **4** and the fixing screw **F** are not screwed in the frame **2**. On the other hand, the upper hinge **H1** is fixed to the frame **2** by means of two further screws (i.e. other than the safety and fixing screws). The first plate **3** is provided with a stopper **5**. The stopper **5** is situated at an extremity of the first plate **3** that is proximal to the left side of the door **1**. The stopper **5** is a protuberance that is preferably integral with the first plate **2**. A second plate **6** is fixed to the upper left corner of the door **1** and is provided with a nose **7** positioned such that the nose **7** is in contact with the stopper **5** only when the door **1** is in its second extreme position.

The nose **7** is a protuberance that is preferably integral with the second plate **6**.

Both the stopper **5** and the nose **7** have preferably a parallelepipedic shape with rounded edges. However, they both may have any other adequate shape, such as a cube, a truncated pyramid, a truncated cone, etc.

The safety screw **4** has a shearing resistance such that the safety screw **4** breaks when a force applied by the nose **7** to the stopper **5** exceeds a threshold value. When a user opens the door **1** and tries to open it at a greater angle than the one normally allowed by the nose **7** + stopper **5** configuration (i.e. beyond the door **1** second extreme position), the nose **7** contacts and applies a force to the stopper **5**. If said force exceeds a threshold value, the safety screw **4** breaks because it is subjected to a shearing stress that exceeds its shearing resistance.

[0020] The user will immediately notice that something is not in order because he will feel a jolt at his hand and he will hear the breaking noise made by the safety screw

4. Being now aware of the abnormal situation, the user will stop applying excessive force to the door **1**.

In spite of the broken safety screw **4**, the door **1** and the refrigerator cabinet will continue to perform their functions normally (because the upper hinge **H1** was preserved intact), until the broken safety screw **4** will be replaced with a proper new one.

[0021] Experimental measurements indicated that said force threshold value lies somewhere within the range $800\text{ N} \div 1200\text{ N}$. In most of the cases, users that tried to open the door beyond its second extreme position, determined the nose **7** to apply to the stopper **5** a force within the range $900\text{ N} \div 1100\text{ N}$.

[0022] In Figure 2 the vertical door system shows only one door **1**. However, in case of a refrigerator cabinet provided with two doors (as depicted, for example, in Figures 3 and 4), said cabinet will be provided with two vertical door systems (each system associated to its respective door).

[0023] Figure 3 shows the door **1** in its first extreme position (the closed position) while Figure 4 shows the door **1** in its second extreme position (the open to the maximum position). In these two figures the safety screw **4** and the fixing screw **F** are not visible.

[0024] Figure 5 shows in detail the exploded view of the upper part of the vertical door system.

[0025] Figure 6 shows in detail the exploded view of the lower part of the vertical door system. The lower hinge **H2** was represented as a hydraulic hinge. In practice, the lower hinge **H2** may also be a gravitational hinge.

[0026] In Figures 5 and 6, in order to avoid the overcrowding of the drawings, reference numbers were assigned only to the essential parts of the door system.

The parts that do not bear a reference number are simple known connecting elements (i.e. screws, washers, bushings, etc.) that are commonly used in the art.

The frame **2** consists of a plurality of parts (lateral parts, corner parts, upper and lower parts) assembled together by means of connecting elements.

The upper **H1** and lower **H2** hinges are also known types of hinges, and consist, each, of a plurality of parts (plate, pin, bushing, bearing, etc) assembled together. Only for simplicity reason the references **H1** and **H2** in figures 2, 5, 6, and 8 indicate only one part of the respective hinge.

[0027] Figure 7 shows a lateral (profile) view of the vertical door system. In this view, the door **1** is provided with a handle **8**. A user can open or close the door **1** by pulling or respectively pushing the handle **8**.

[0028] Figure 8 shows a detail of the upper part of Figure 7. In this view the door **1** is in its first extreme position (closed position) wherein a gap between the stopper **5** and the nose **7** is clearly visible (the stopper **5** and the nose **7** are not in contact).

[0029] Figure 9 shows a view from above of a central zone of a two-doors refrigerator cabinet provided with the vertical door system (in fact, one door system for each door). The doors **1** of the refrigerator cabinet lie in the same plane when they are in their closed position.

Each door **1** is provided with a handle **8** and with a lateral gasket **G** made of a flexible material, and fixed along the length of a vertical side of the door **1** that is distal in respect to the associated upper and lower hinges (not shown in Figure 9).

When the doors **1** are in their closed position, the two lateral gaskets **G** are in mutual contact and overlap along their entire length, fact that provides an enhanced thermal insulation of the interior of the refrigerator cabinet.

[0030] Said length of each lateral gasket **G** corresponds substantially to the height of the associated door **1**.

The gasket **G** can be made of rubber, silicone or any other suitable heat-insulating flexible material.

[0031] Figure 10 shows, at a greater scale, the lateral gaskets **G** from Figure 9. Each lateral gasket **G** has the shape of letter "T" rotated at a 90° angle.

When both doors are in their closed position, the two lateral gaskets **G** are approximately symmetrically arranged. This particular shape and arrangement of the lateral gaskets **G** ensure the maximization of the overlapping area **A**, fact that further enhances the thermal insulation of the interior of the refrigerator cabinet.

[0032] Figure 11 shows a front view of the left lateral gasket **G** of Figure 10, where the overlapping area **A** is clearly visible.

Claims

1. Vertical door system comprising:

- a door **(1)** attached to a frame **(2)** by means of an upper hinge **(H1)** provided at an upper corner of the door **(1)** and of a lower hinge **(H2)** provided at a lower corner of the door **(1)**,

- the upper **(H1)** and lower **(H2)** hinges allowing the door **(1)** to move, in respect to the frame **(2)**, between a first extreme position and a second extreme position,

- a first plate **(3)** fixed to the upper hinge **(H1)** by means of a safety screw **(4)** and of a fixing screw **(F)**, and provided with a stopper **(5)**,

- a second plate **(6)** fixed to the upper corner of the door **(1)** and provided with a nose **(7)** positioned such that the nose **(7)** is in contact with the stopper **(5)** only when the door **(1)** is in its second extreme position,

- the safety screw **(4)** has a shearing resistance such that the safety screw **(4)** breaks when a force applied by the nose **(7)** to the stopper **(5)** exceeds a threshold value.

2. Vertical door system according to claim 1, wherein the force threshold value is within the range 800 N

÷ 1200 N, preferably within the range 900 N ÷ 1100 N.

3. Vertical door system according to claims 1-2, further comprising a lateral gasket **(G)**, fixed along the length of a vertical side of the door **(1)** that is distal in respect to the upper **(H1)** and lower **(H2)** hinges.

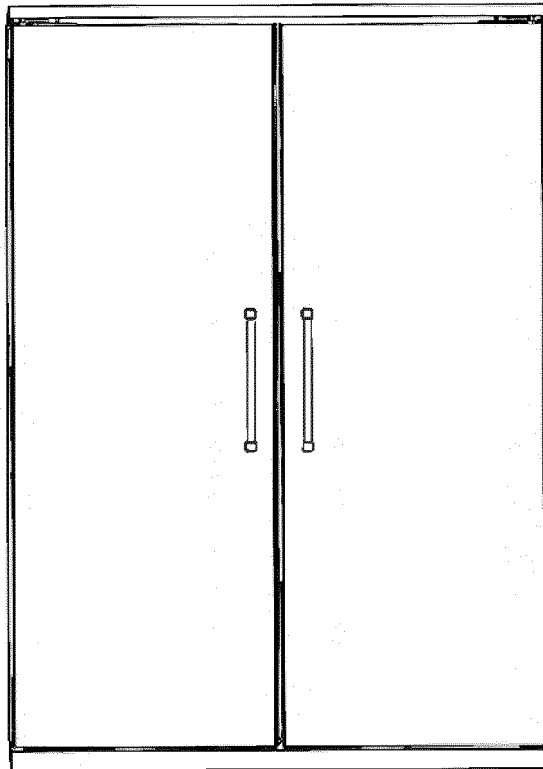
4. Vertical door system according to claim 3, wherein the lateral gasket **(G)** is made of a flexible material and has the shape of letter T rotated at an angle of 90 degrees.

5. Vertical door system according to claims 1-4, wherein the lower hinge **(H2)** is a gravitational hinge or a hydraulic hinge.

6. Vertical door system according to claims 1-5, wherein the angle formed by the door **(1)** between its first extreme position and its second extreme position is 110°.

7. A single-door refrigerator cabinet provided with a vertical door system according to claims 1-6.

8. A two-doors refrigerator cabinet provided with two vertical door systems according to claims 3-6, wherein, when the respective doors **(1)** are simultaneously in their first extreme position, the doors **(1)** lie in the same plane and the respective lateral gaskets **(G)** are in mutual contact and overlap along their entire length.



PRIOR ART

Fig. 1

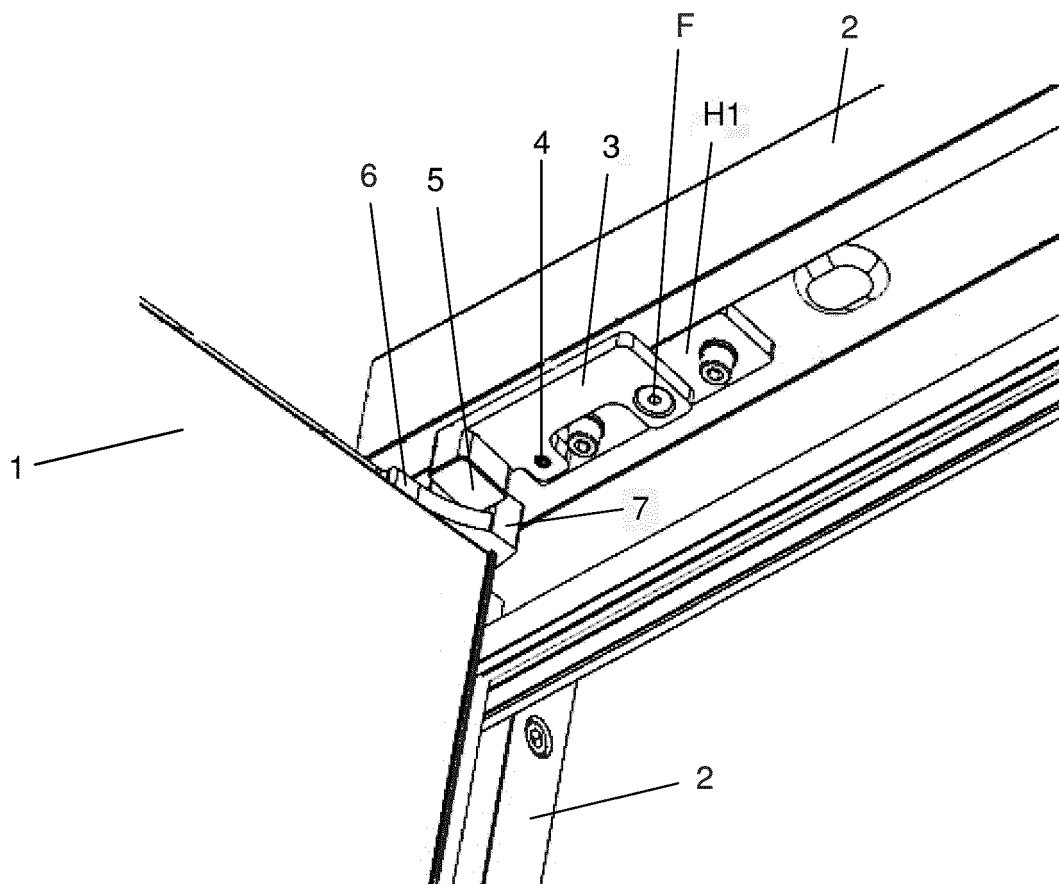


Fig. 2

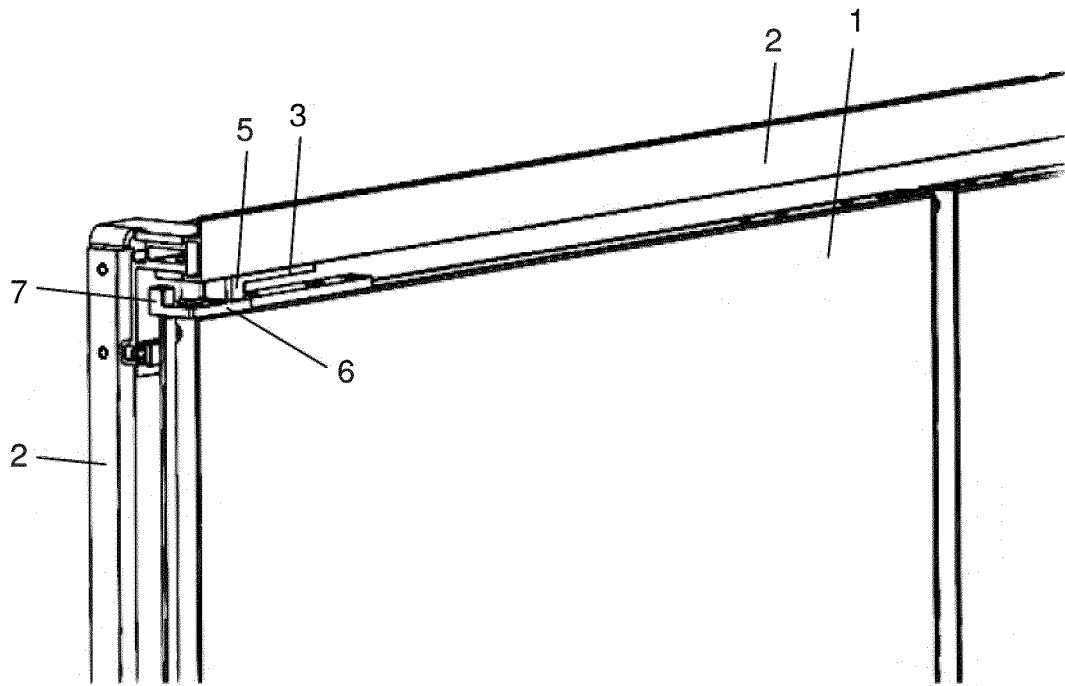


Fig. 3

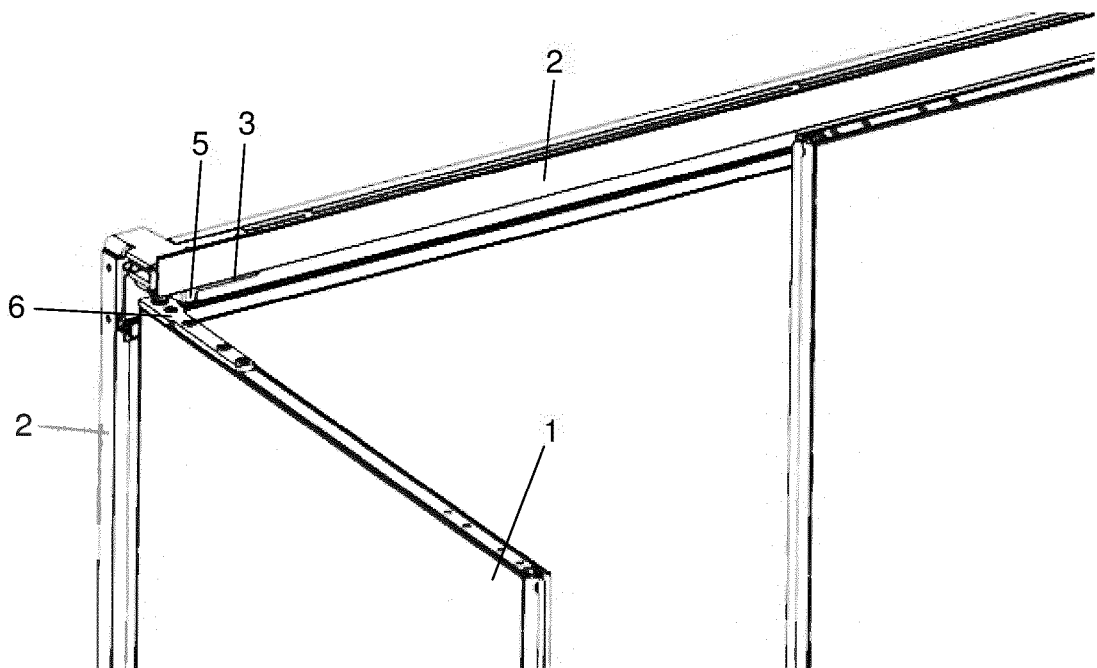


Fig. 4

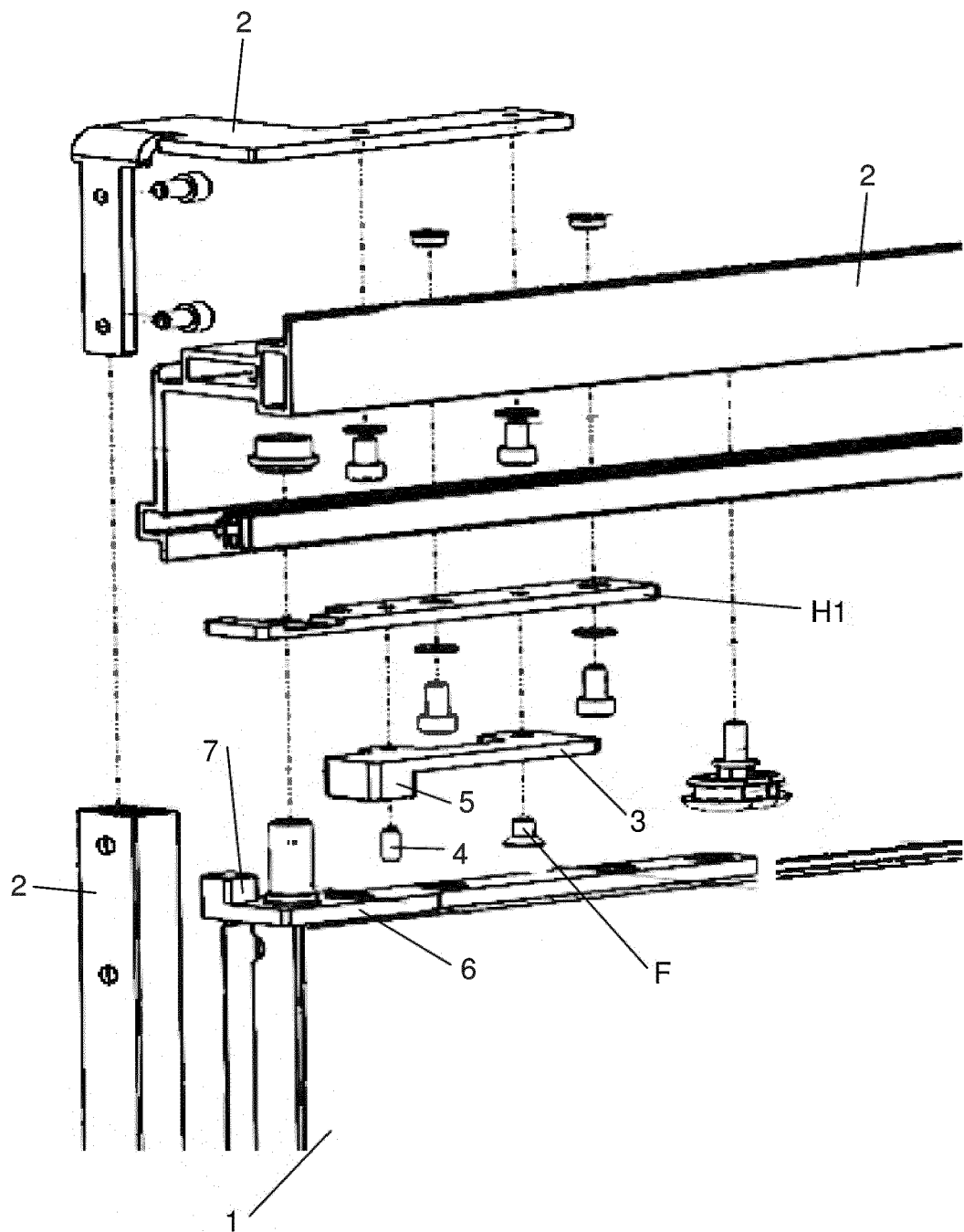


Fig. 5

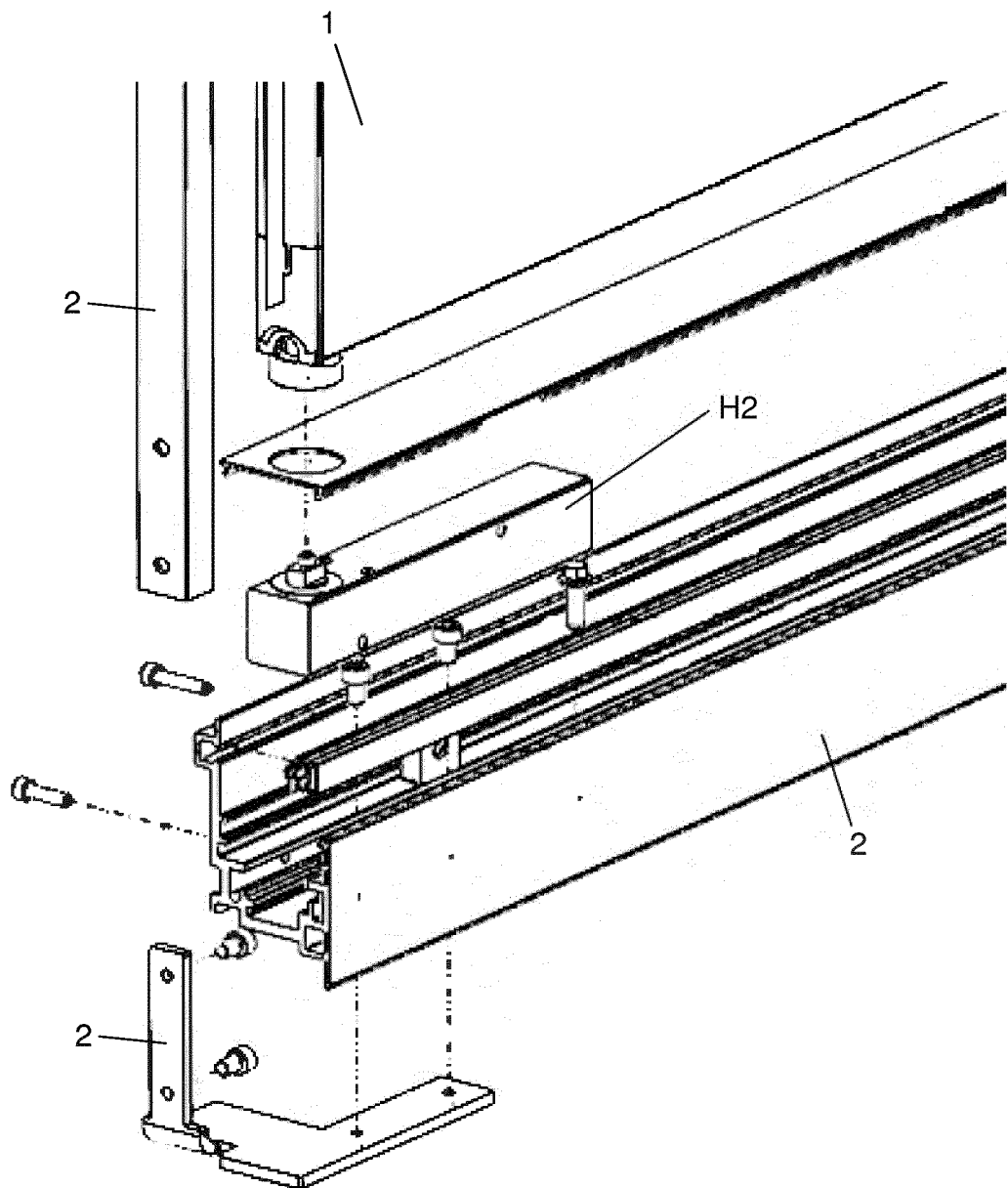


Fig.6

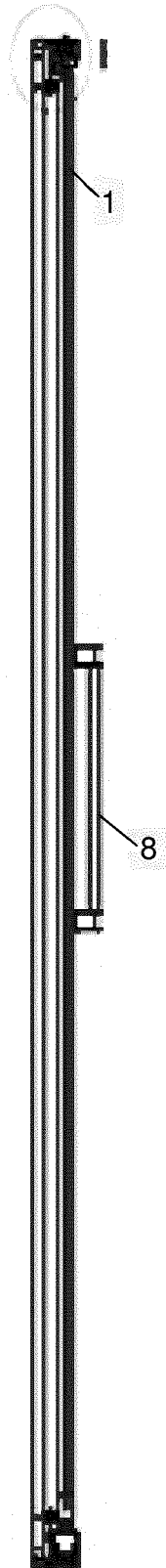


Fig. 7

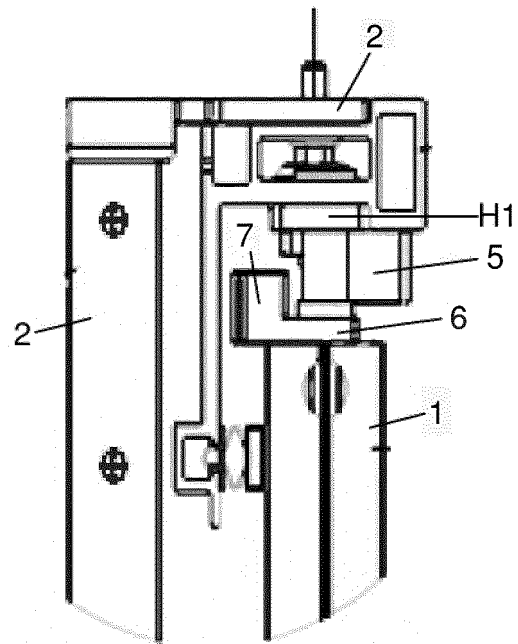


Fig. 8

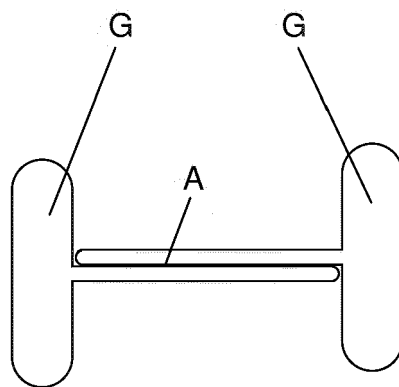
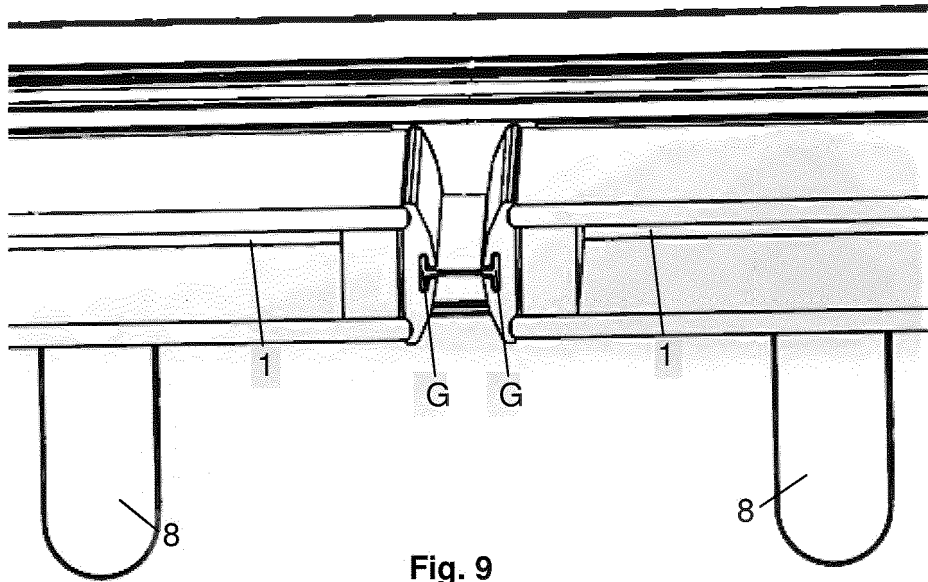


Fig. 10

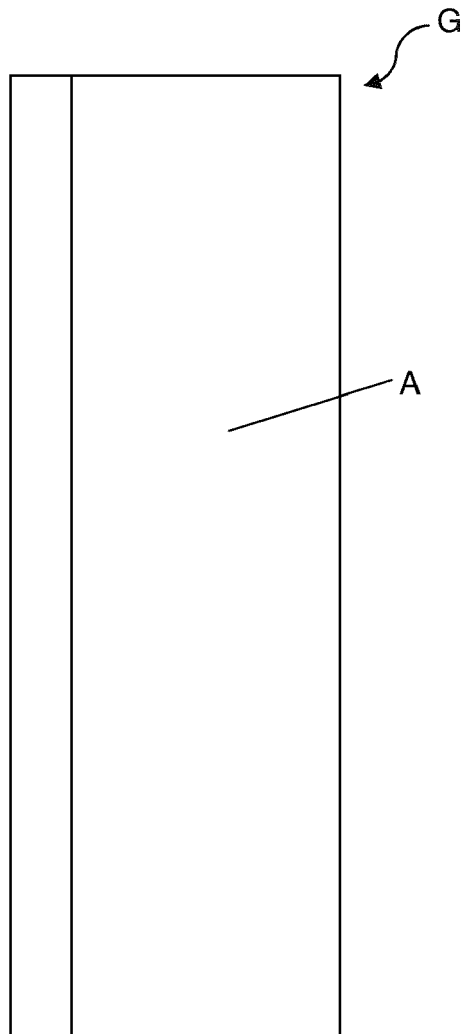


Fig. 11



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Application Number

EP 21 19 7322

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			TECHNICAL FIELDS SEARCHED (IPC)
			F25D
The present search report has been drawn up for all claims			
Place of search The Hague		Date of completion of the search 2 March 2022	Examiner Yousufi, Stefanie
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