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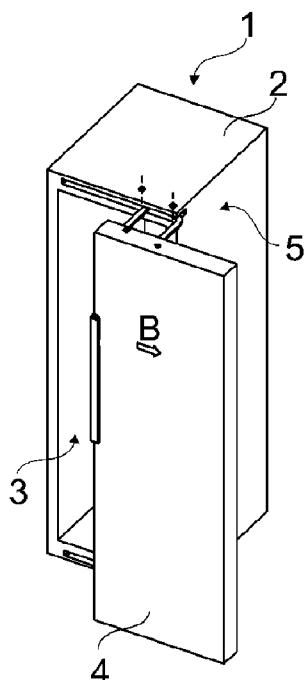
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(54) Title: REFRIGERATOR WITH A SPACE-SAVING AND SMOOTHLY OPENING DOOR

Fig. 2



(57) Abstract: The present invention relates a refrigerator (1) which comprises a main body (2) that includes a compartment (3), a door (4) and two hinge assemblies (5) which pivotally connect the door (4) to the main body (2). In the refrigerator (1) of the present invention each hinge assembly (5) comprises two vertical pivots (6, 7) which are fixed on the main body (2) and radially joined by a first hypothetical line (L1) which has a length (D), two other vertical pivots (8, 9) which are fixed on the door and radially joined by a second hypothetical line (L2) which has the same length (D), wherein said hypothetical lines (L1, L2) are parallel and two parallel pivoting arms (10) each being pivotally connected at its opposing end section (11) to the corresponding pivot (6, 7) on the main body (2) and the corresponding pivot (8, 9) on the door (4) respectively.

Description**REFRIGERATOR WITH A SPACE-SAVING AND SMOOTHLY OPENING DOOR**

[0001] The present invention relates to a refrigerator, in particular to a freezer.

The present invention more particularly relates to the door of the refrigerator.

[0002] Refrigerators are commonly known in the art. A refrigerator generally comprises a main body which includes a compartment for receiving the articles to be refrigerated. The compartment is generally accessible to the user via an openable/closable door which is movably disposed on the main body. The refrigerator doors are commonly either pivotably or slidably disposed on the main bodies through a respective pivoting mechanism or a respective sliding mechanism. The refrigeration compartment is generally hermetically sealed from the outside through a gasket which is fastened onto the periphery of the door. The gasket is generally provided with a magnetic insert which is strongly attracted by the metallic cover of the doorframe when the door is closed. The magnetic gasket holds the door in the closed position and achieves an airtight seal.

[0003] It is well known that after closing the door, the ambient air taken into the refrigeration compartment cools down whereby the inner pressure concurrently drops and the door gets firmly pressed by the atmospheric pressure onto the doorframe. When the user attempts to immediately re-open the door then he/she must overcome in addition to the magnetic force also the force arising from the atmospheric pressure. Thus, there is a problem that opening the door becomes a force-intensive and uncomfortable activity for the user. In general, depending on the opening/closing mechanism of the door, the user is required to either forcefully pull the door forwards or push the same sideways in order to open it. It is also well known that once the gasket is separated from the metal doorframe, the attractive force suddenly vanishes and the door rapidly accelerates in the direction it is being pulled or pushed. Thus, there is a problem that the door may hit the user himself/herself or any other closely standing person or object. In such instances, the user or any other person may become injured. Also the door or any other object may

become damaged.

- [0004] An objective of the present invention is to provide a refrigerator with a door which solves the aforementioned problems of the prior art in a cost-effective way and which enables a smooth and space-saving opening/closing.
- [0005] This objective has been achieved by the refrigerator as defined in claim 1. Further achievements have been attained by the subject-matters respectively defined in the dependent claims.
- [0006] In the refrigerator of the present invention the door is pivotally connected to the main body through two hinge assemblies each of which comprises: two vertical pivots which are fixed on the main body and radially joined by a first hypothetical line which has a predetermined radial length; two other vertical pivots which are fixed on the door and radially joined by a second hypothetical line which has the same radial length, wherein the first and the second hypothetical lines are mutually parallel; and two parallelly pivoting arms each being pivotally connected at its opposing end section to the corresponding vertical pivot on the main body and the corresponding vertical pivot on the door respectively.
- [0007] A major advantageous effect of the present invention is that by virtue of the hinge assemblies, the door can be opened parallelly sideways, i.e., either leftwards or rightwards depending on the configuration, as the user pulls it forwards. Thus, during such rocking movement, the door remains always parallel to doorframe and moves along an arc-shaped path due to the parallelly pivoting arms. Another major advantageous effect of the present invention is that the hinge assemblies can be configured such that the door moves away from the closed position towards the user not more than a comparatively small safety distance. This safety distance can be flexibly adjusted to be much smaller than the arm length of an average adult person. Thereby, the risk that the user in front of the refrigerator or any other person on the side of the refrigerator is unexpectedly hit by the door can be eliminated or considerably reduced. Another major advantageous effect of the present invention is that the useful floor space in front of the refrigerator can be saved and the risk that the opened door

becomes a serious obstacle for the other occupants can be eliminated or considerably reduced. Thus, the refrigerator of the present invention is particularly advantageous for a user who has a relatively small kitchen with a limited floor space. Thereby, the consumer satisfaction can be increased.

- [0008] According to the present invention, the vertical pivots of the hinge assemblies, i.e., the central point of rotations are fixedly disposed on the main body and the door respectively. The pivoting arms can be pivotably connected to the vertical pivots in various different ways. In an embodiment, the vertical pivots comprise upright pins. This embodiment is particularly advantageous as the pins can be easily installed or uninstalled. The upright pins can be allowed to swivel or can be rigidly disposed on one of the relatively moving members such as the door, the main body, and the pivoting arms. The upright pins can be secured in place through a threaded connection or a clip connection. Other type of connections known to those skilled in the art can be alternatively used.
- [0009] In another embodiment, the main body and the door have mutually facing grooves which retractably accommodate the pivoting arms. This embodiment is particularly advantageous as grooves conceal the mechanical members which connect the pivoting arms and vertical pivots.
- [0010] Additional advantageous effects of the refrigerator according to the present invention will become more apparent with the detailed description of the embodiments with reference to the accompanying drawing in which:
- [0011] Figure 1 – is a schematic perspective view of a refrigerator according to an embodiment of the present invention, wherein the door is in the closed position, wherein the arrow A shows the pulling direction and the arrow B shows the pushing direction;
- [0012] Figure 2 – is a schematic perspective view of the refrigerator of Fig. 1, in the state when the door is in the semi-open position, wherein the arrow B shows the pushing direction;
- [0013] Figure 3 – is a schematic perspective view of the refrigerator of Fig. 1, in the state when the door is in the entirely open position;
- [0014] Figure 4 – is another schematic perspective view of the refrigerator of Fig.

1, in the state when the door is in the entirely open position;

[0015] Figure 5 – is a schematic top view of the refrigerator as shown in Fig. 1;

[0016] Figure 6 – is a schematic top view of the refrigerator as shown in Fig. 2;

[0017] Figure 7 – is a schematic top view of the refrigerator as shown in Fig. 3;

[0018] Figure 8 – is a schematic top view of the refrigerator as shown in Fig. 4;

[0019] Figure 9 – is a schematic front view of the refrigerator of Fig. 1;

[0020] Figure 10 – is a schematic enlarged sectional view of the refrigerator of Fig. 9, taken along the line C-C;

[0021] Figure 11 – is a schematic partially exploded view of the refrigerator of Fig. 1;

Figure 12 – is a schematic perspective enlarged view of the pivoting arm of the hinge assembly in the refrigerator of Fig. 1;

[0022] Figure 13 – is a schematic enlarged top view of the pivoting arm of Fig. 12;

[0023] Figure 14 – is a schematic enlarged side view of the pivoting arm of Fig. 12.

[0024] The reference signs appearing on the drawings relate to the following technical features.

1. Refrigerator
2. Main body
3. Compartment
4. Door
5. Hinge assembly
6. Pivot
7. Pivot
8. Pivot
9. Pivot
10. Arm
11. End section
12. Hole
13. Pin
14. Bore
15. Groove
16. Intermediate section

- 17. Gasket
- 18. Handle
- 19. Doorframe

[0025] The refrigerator (1) comprises a main body (2) which includes a refrigeration compartment (3), a door (4) for accessing the compartment (3), an upper hinge assembly (5) and a lower hinge assembly (5) which pivotally connect the door (4) to the main body (2).

[0026] In the refrigerator (1) of the present invention, each hinge assembly (5) comprises two vertical pivots (6, 7) which are fixed on the main body (2) and radially joined by a first hypothetical line (L1) which has a predetermined radial length D, two other vertical pivots (8, 9) which are fixed on the door (4) and radially joined by a second hypothetical line (L2) which has the same radial length (D), wherein the first and the second hypothetical lines (L1, L2) are mutually parallel and two parallelly pivoting arms (10) each being pivotally connected at its opposing end section (11) to the corresponding vertical pivot (6, 7) on the main body (2) and the corresponding vertical pivot (8, 9) on the door (4) respectively.

[0027] In an embodiment, the opposing end sections (11) of each pivoting arm (10) have bearing holes (12) respectively. In this embodiment, each vertical pivot (6 to 9) comprises a headed vertical bearing pin (13) which is adapted for insertion into the respective bearing hole (12). Each headed vertical bearing pin (13) has a threaded section (not shown). The main body (2) and the door (4) comprise threaded bores (14) for respectively receiving the threaded sections of the pins (13).

[0028] In another embodiment, the refrigerator (1) further comprises two mutually facing grooves (15) which are respectively disposed in the upper section of the main body (2) and the upper section of the door (4). The upper pivoting arms (10) are disposed into two upper grooves (15). In addition, the refrigerator (1) further comprises two other mutually facing grooves (15) which are respectively disposed in the lower section of the main body (2) and the lower section of the door (4). The lower pivoting arms (10) are disposed into the two lower grooves (15).

[0029] In another embodiment, the pivoting arms (10) each have a straight

intermediate section (16) and two arc-shaped opposing end sections (11) which extend in opposite directions.

[0030] In another embodiment, the two hinge assemblies (5) are configured such that at the open position the door (4) is shifted sideways from the closed position by its entire width (W).

[0031] In another embodiment, the refrigerator (1) is provided as a freezer.

[0032] In another embodiment, the door (4) of the refrigerator (1) has a substantially flat inner lining. In this embodiment the door (4) has no article shelves which are disposed on the inner lining.

[0033] In the subsequent description, the opening/closing of the door (4) of the present invention will be briefly explained by way of example.

[0034] First, in the closed position, the user holds the handle (18) and pulls the door (4) forwards in the direction of the arrow A (Fig. 1 and 5). As the gasket (17) is separated from the doorframe (19), the magnetic force vanishes and the door (4) starts to move forwards in the direction A and also sideways in the direction B (Fig. 2 and 6). During such rocking movement the door (4) remains always parallel to doorframe (19) and moves along an arc-shaped path due to the parallelly pivoting arms (10). At the semi-open position, the door (4) is moved forwards to a maximum distance (H) away from its closed position (Fig. 2 and 6). According to the present invention, the maximum distance (H) is much smaller than the width (W) of the door (4) and also much smaller than the arm length of an average adult person. Thereby, the user cannot be unexpectedly hit by the door (4) even when he/she pulls the same forcefully. After the semi-open position has been reached, the user continues to push the door (4) sideways in the direction B until the door (4) is entirely opened. At the entirely open position, the door (4) is shifted from the closed position by its entire width (W) (Fig. 3 and 4; Fig. 7 and 8). Thereby, the user gains access to the entire compartment (3). The user can close the door (4) by way of pushing the same in the direction which is opposed to the direction B.

[0035] In another embodiment, the two hinge assemblies (5) are configured such that the maximum distance (H) is about 30 mm (Fig. 2 and 6).

- [0036] In another embodiment, the straight intermediate sections (16) of the pivoting arms (10) are inclined about zero degrees relative to the doorframe (19) when the door (4) is at the closed position (Fig. 1 and 5).
- [0037] In another embodiment, the straight intermediate sections (16) of the pivoting arms (10) are projecting at about 90 degrees relative to the doorframe (19) when the door (4) is at the semi-open position (Fig. 2 and 6).
- [0038] In another embodiment, the straight intermediate sections (16) of the pivoting arms (10) are inclined about 135 degrees relative to the doorframe (19) when the door (4) is at the entirely open position (Fig. 3 and 4; Fig. 7 and 8).
- [0039] A major advantageous effect of the present invention is that the door (4) opens parallelly sideways as the user pulls it forwards. During this rocking movement, the door (4) remains always parallel to doorframe (19) and moves along an arc-shaped path. Another major advantageous effect of the present invention is that the door (4) moves towards the user not more than a comparatively small safety distance (H). This safety distance (H) can flexibly adjusted to be much smaller than the arm length of an average adult person. Thereby, the risk that the user in front of the refrigerator (1) or any other person on the side of the refrigerator (1) is unexpectedly hit by the door (4) can be eliminated or considerably reduced. Another major advantageous effect of the present invention is that the useful floor space in front of the refrigerator (1) can be saved and the risk that the open door (4) becomes a serious obstacle for the other occupants can be eliminated or considerably reduced. Thus, the refrigerator (1) of the present invention is particularly advantageous for a user who has a relatively small kitchen with a limited floor space. Other additional advantageous effects of the present invention can be taken from the aforementioned embodiments.

Claims

1. A refrigerator (1), in particular a freezer, comprising a main body (2) which includes a refrigeration compartment (3), a door (4) for accessing the compartment (3), two hinge assemblies (5) which pivotally connect the door (4) to the main body (2), **characterized in that** each hinge assembly (5) comprising two vertical pivots (6, 7) which are fixed on the main body (2) and radially joined by a first hypothetical line (L1) which has a predetermined radial length (D), two other vertical pivots (8, 9) which are fixed on the door (4) and radially joined by a second hypothetical line (L2) which has the same radial length (D), wherein the first and the second hypothetical lines (L1, L2) are mutually parallel; and two parallelly pivoting arms (10) each being pivotally connected at its opposing end section (11) to the corresponding vertical pivot (6, 7) on the main body (2) and the corresponding vertical pivot (8, 9) on the door (4) respectively.
2. The refrigerator (1) according to claim 1, **characterized in that** the opposing end sections (11) of each pivoting arm (10) comprise bearing holes (12) respectively, and each vertical pivot (6 to 9) comprises a headed vertical bearing pin (13) which is adapted for insertion into the respective bearing hole (12), wherein each headed vertical bearing pin (13) comprising a threaded section; and, the main body (2) and the door (4) comprising threaded bores (14) for respectively receiving the threaded sections of the pins (13).
3. The refrigerator (1) according to claim 2, **characterized in that** two mutually facing grooves (15) which are respectively disposed into the upper section of the main body (2) and the upper section of the door (4), wherein the upper pivoting arms (10) are disposed into the two upper grooves (15) and two other mutually facing grooves (15) which are respectively disposed into the lower section of the main body (2) and the lower section of the door (4), wherein the lower pivoting arms (10) are disposed into the two lower grooves (15).
4. The refrigerator (1) according to any one of claims 1 to 3, **characterized in that** the pivoting arms (10) each have a straight intermediate section (16) and two arc-shaped opposing end sections (11) which extend in opposite directions.
5. The refrigerator (1) according to claim 4, **characterized in that** the door (4) has a closed position and an open position, wherein the door (4) has

predetermined width (W), and wherein the two hinge assemblies (5) are configured such that at the open position the door (4) is shifted sideways from the closed position by its entire width (W).

Fig. 1

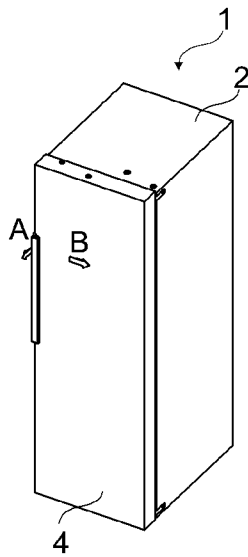


Fig. 2

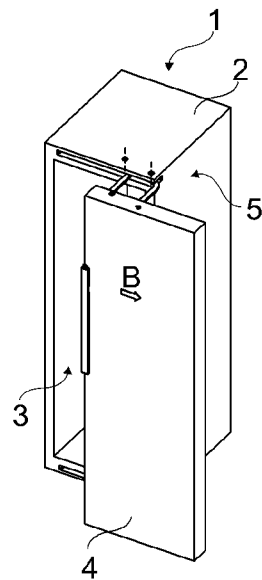


Fig. 3

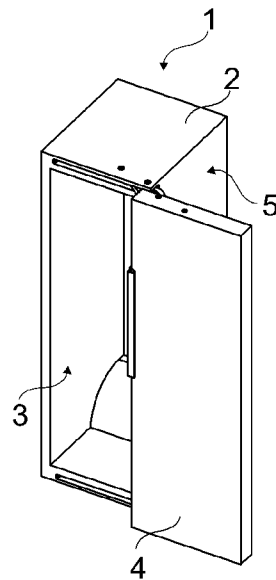


Fig. 4

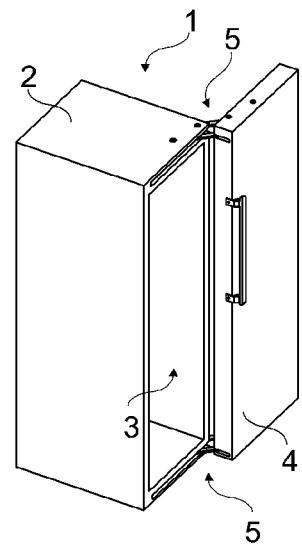


Fig. 5

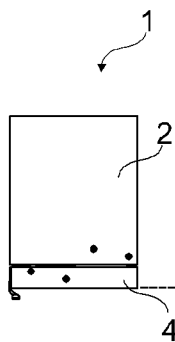


Fig. 6

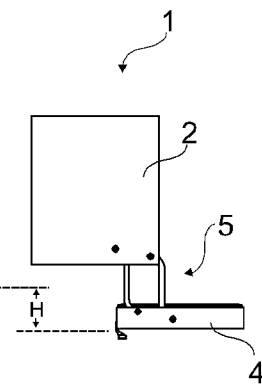


Fig. 7

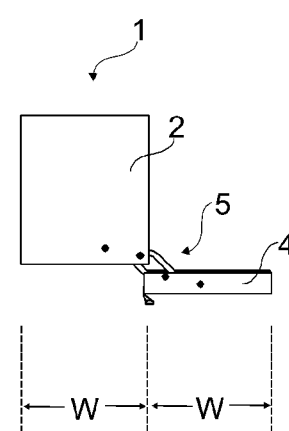


Fig. 8

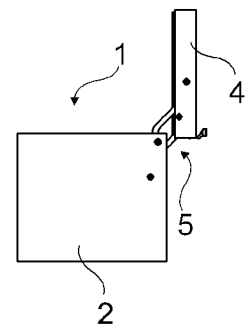


Fig. 9

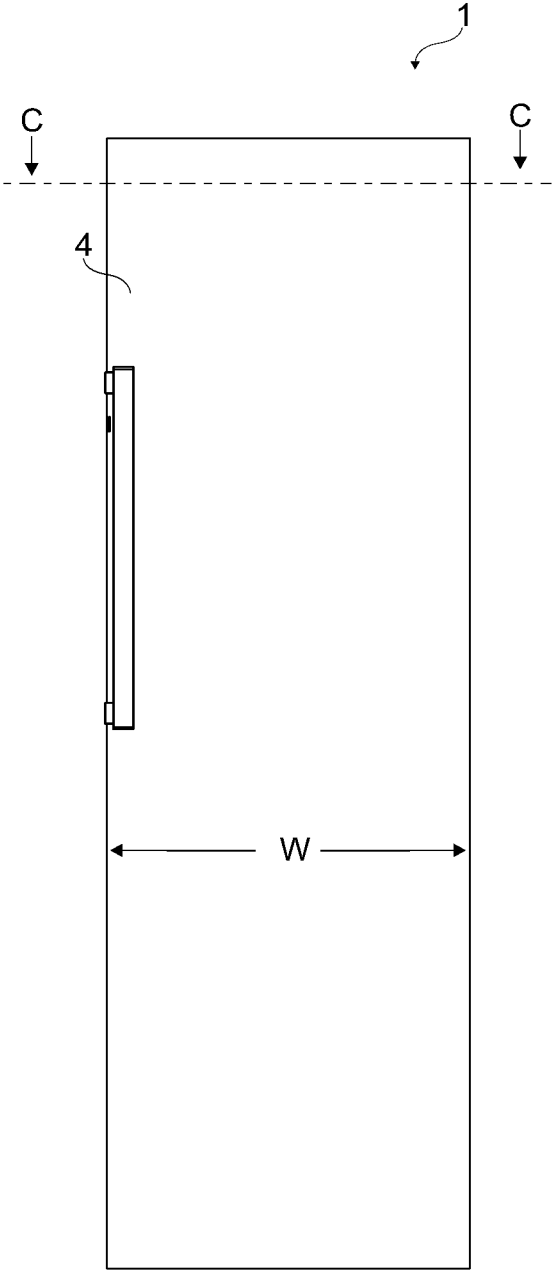


Fig. 10

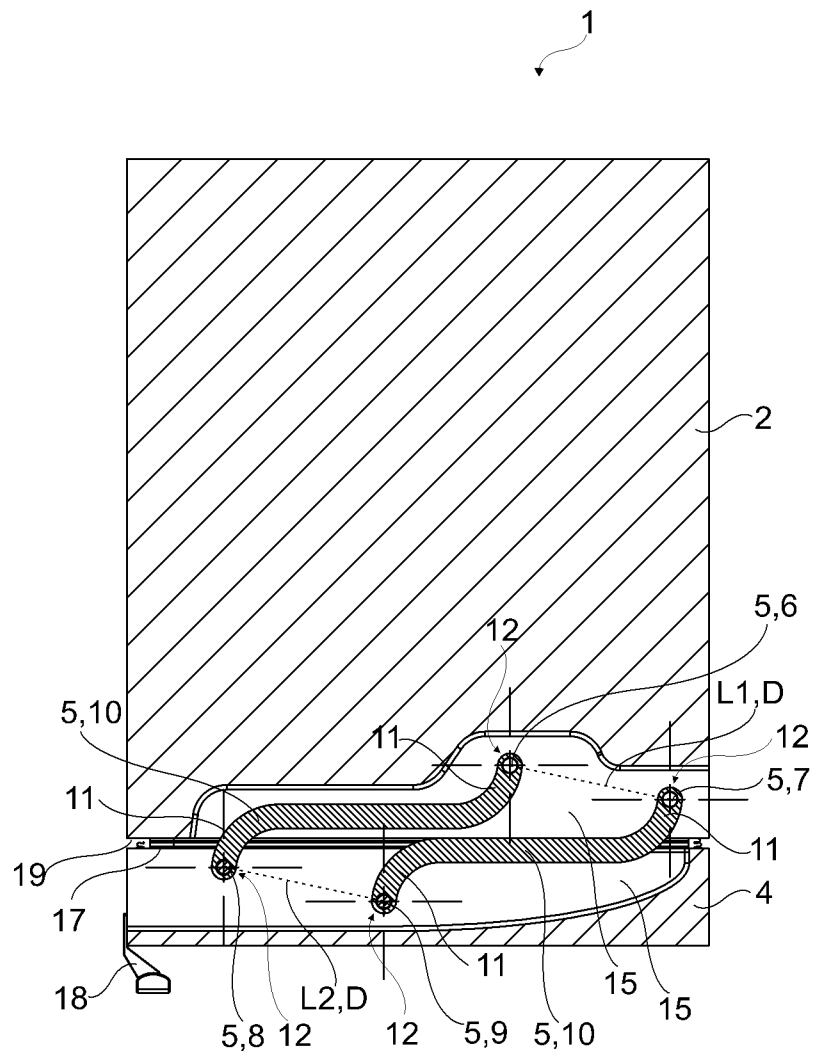


Fig. 11

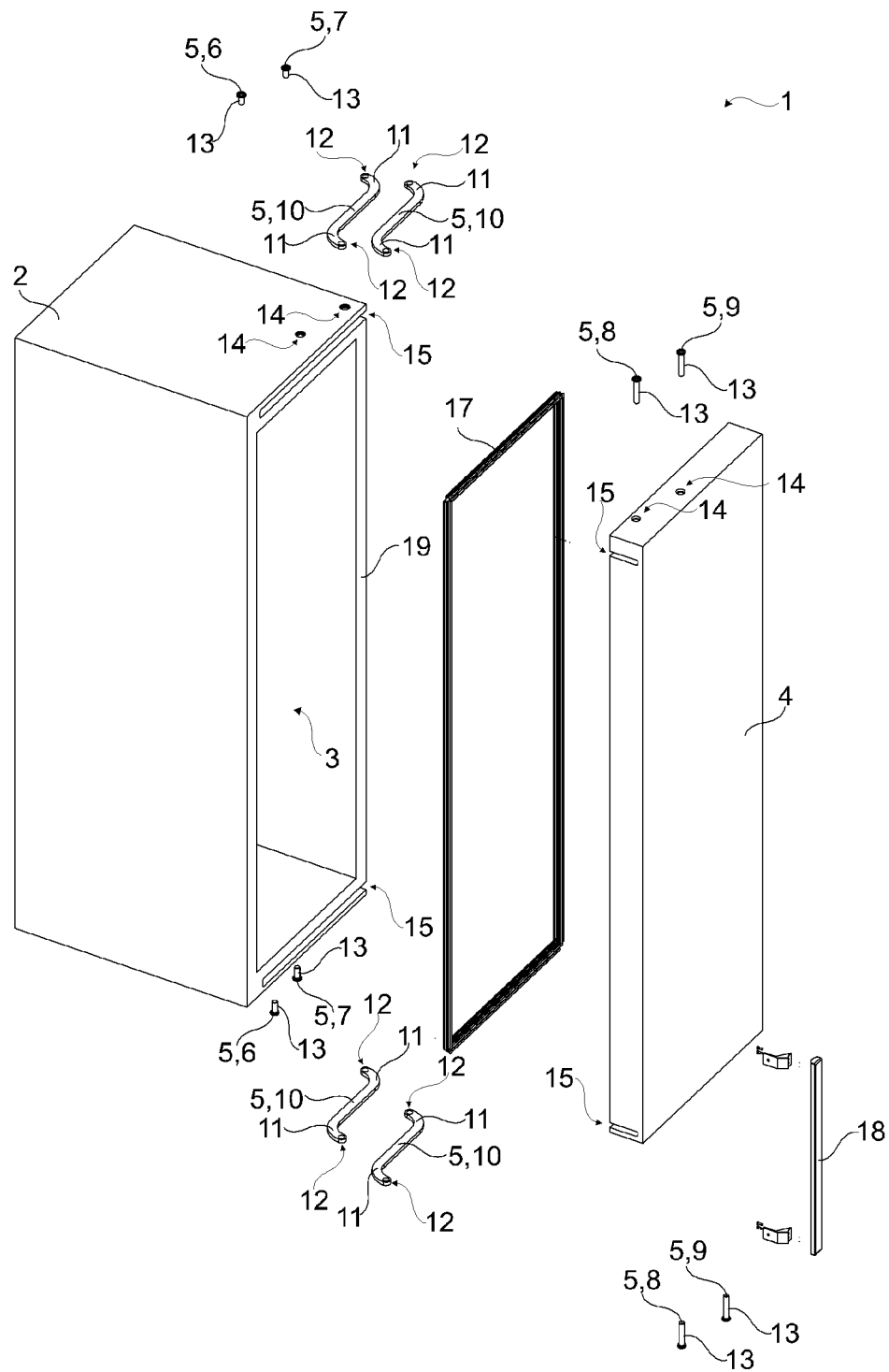


Fig. 12

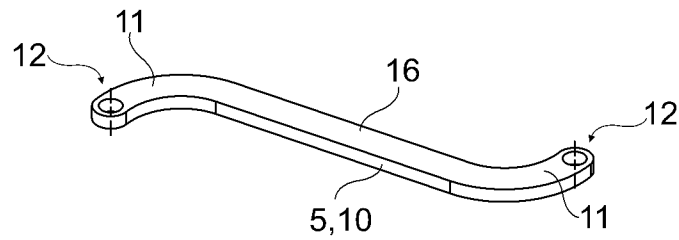


Fig. 13

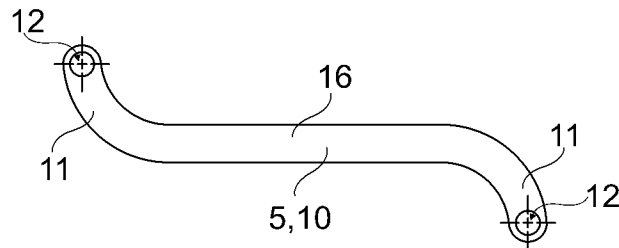
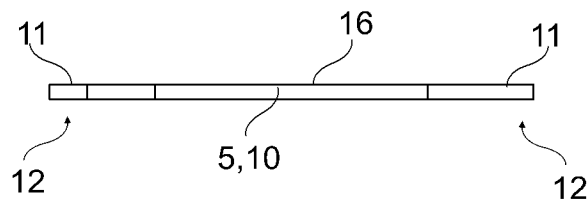


Fig. 14



INTERNATIONAL SEARCH REPORT

International application No
PCT/EP2015/057089

A. CLASSIFICATION OF SUBJECT MATTER

INV. F25D23/02 E05D3/14 E05D5/02 E05D15/34
ADD.

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
F25D E05D

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

EPO-Internal, WPI Data

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	JP S63 81178 U (N.N.) 28 May 1988 (1988-05-28) abstract; figures 1,2,3,7 -----	1-5
X	DE 20 2008 000760 U1 (LIEBHERR HAUSGERAETE [DE]) 28 May 2009 (2009-05-28) abstract; figures 1,2,3 -----	1-5
X	DD 5 496 A8 (NESTLER ROBERT) 6 August 1953 (1953-08-06) abstract; figure 1 -----	1
A	EP 2 239 404 A2 (SUGATSUNE KOGYO [JP]) 13 October 2010 (2010-10-13) the whole document -----	1-5
A	EP 1 666 821 A2 (LG ELECTRONICS INC [KR]) 7 June 2006 (2006-06-07) the whole document -----	1-5



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INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No

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Patent document cited in search report		Publication date	Patent family member(s)	Publication date
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