



(12) **EUROPEAN PATENT APPLICATION**

(43) Date of publication:
30.09.2020 Bulletin 2020/40

(51) Int Cl.:
D06F 39/02 (2006.01)
D06F 39/12 (2006.01)
D06F 23/02 (2006.01)

(21) Application number: **20162066.3**

(22) Date of filing: **10.03.2020**

(84) Designated Contracting States:
AL AT BE BG CH CY CZ DE DK EE ES FI FR GB GR HR HU IE IS IT LI LT LU LV MC MK MT NL NO PL PT RO RS SE SI SK SM TR
Designated Extension States:
BA ME
Designated Validation States:
KH MA MD TN

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(30) Priority: **28.03.2019 CN 201920404878 U**

(54) **WASHING MACHINE WITH DRAWER-TYPE CHARGING DEVICE**

(57) A washing machine with a drawer-type charging device including a panel (4) that forms a part of a box body (2), where the panel (4) is provided with a window portion (41), the charging device penetrates through the window portion (41) and is provided with a cover portion (11), and when the charging device completely stretches into the box body (2), the cover portion (11) of the charging device is matched with the window portion (41) of the

panel (4). The window portion (41) is provided with a first supporting surface (44A) and a second supporting surface (44B) that extend and are spaced relative to a width direction of the washing machine, and the cover portion (11) is provided with a first bulge (15A) and a second bulge (15B) that are respectively supported on the first supporting surface (44A) and the second supporting surface (44B) from above.

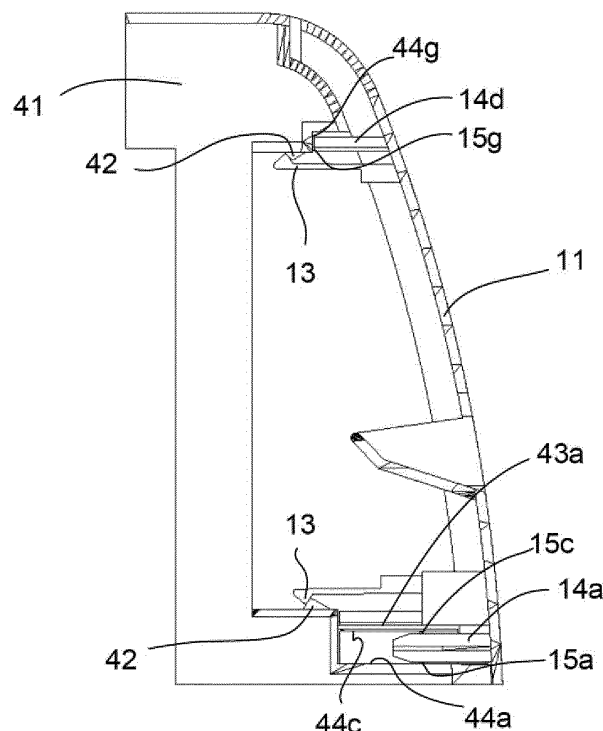


FIG. 4

Description

[0001] The invention relates to a drawer-type charging device of a washing machine, and in particular, to a connection structure between the device and a panel of the washing machine.

[0002] A washing machine often has a charging device, and treatment agents such as a detergent, a softener, a disinfectant, a bleaching agent, and the like are added by using the device in a washing process. A relatively common manner of setting the charging device is to set it on a panel of the washing machine in a drawer-type way. A cover portion of the charging device is matched with the panel of the washing machine.

[0003] A gap between the cover portion and the panel is a factor affecting an appearance effect. An oversized gap may appear to have poor product quality and reduce user satisfaction. Usually, a reasonable gap value is set by calculating during product design. However, it is found that the gap is quite difficult to control and meet a tolerance requirement after mass production of products. In addition, after a long time of use, the gap may become larger and uneven, especially an upper gap 1a (as shown in FIG. 1), and a lateral gap 1b may also become larger. The reason is that a positioning system of the cover portion and the panel is unreasonable in design or the positioning fails. There are mainly two types of positioning systems for the charging device of the washing machine on the market:

In the first type, no constraint relationship exists between the cover portion and the panel. A cover portion material has a large shrinkage rate and a large deformation, which results in a large dimension fluctuation range, and it is quite difficult to control the gap. No constraint exists between the cover portion and the panel, and no positioning relationship exists between the two. Consequently, the gap is out of control.

[0004] In the second type, a constraint force in a depth direction of the washing machine exists between the cover portion and the panel. This solution is logically reasonable, but still has the following problems:

a. An unconstrained degree of freedom still exists in the cover portion. For example, under a gravity action of the charging device, the cover portion rotates around an axis along a width direction of the washing machine. Consequently, the gap is out of control, and especially, the upper gap is greater than expected in design.

b. A constraint mechanism is designed at a position that customers can see after the charging device is pulled out. After a long time of use, due to friction and wear, a paint loss phenomenon occurs at the panel and the charging device, and an original color of a material is revealed, thereby affecting the appearance effect and also increasing the gap.

[0005] An objective of the invention is to overcome disadvantages in the prior art.

[0006] The invention achieves the objective by using the following implementations.

[0007] A washing machine with a drawer-type charging device includes a panel that forms a part of a box body, where the panel is provided with a window portion, the charging device penetrates through the window portion and is provided with a cover portion, and the cover portion of the charging device is matched with the window portion of the panel when the charging device completely stretches into the box body. The window portion is provided with a first supporting surface and a second supporting surface that extend and are spaced relative to a width direction of the washing machine, and the cover portion is provided with a first bulge and a second bulge that are respectively supported on the first supporting surface and the second supporting surface from above, where the first bulge and the second bulge are curved structures and in point contact with the first supporting surface and the second supporting surface respectively, and the first supporting surface and the second supporting surface respectively apply a vertical upward supporting force to the first bulge and the second bulge. In this way, the cover portion is vertically supported by the first supporting surface and the second supporting surface without displacement in a gravity direction, to ensure that a gap between the cover portion and an upper part of the panel does not increase. In addition, supporting points are set at intervals along the width direction of the washing machine, and the cover portion does not rotate around an axis of a depth direction. Therefore, gaps at left and right sides are also maintained.

[0008] The first bulge and the second bulge are each a hemispherical structure.

[0009] The first bulge and the second bulge are respectively disposed at bottom parts of a first positioning pin and a second positioning pin.

[0010] The window portion is provided with a first positioning groove and a second positioning groove that have openings at front parts, the first supporting surface and the second supporting surface are respectively located at bottom parts of the first positioning groove and the second positioning groove, a top part of the first positioning groove is further provided with a third positioning surface, a top part of the second positioning groove is further provided with a fourth positioning surface, and top parts of the first positioning pin and the second positioning pin are respectively provided with a third bulge and a fourth bulge. When the cover portion is matched with the panel, the first positioning pin and the second positioning pin respectively stretch into the first positioning groove and the second positioning groove, the third bulge is in point contact with the third positioning surface, and the fourth bulge is in point contact with the fourth positioning surface. By such a structure, both the top and the bottom of the window portion in a vertical direction are positioned, to make the matching more stable.

[0011] The window portion is provided with a first positioning groove and a second positioning groove that have openings at front parts, the first supporting surface and the second supporting surface are respectively located at bottom parts of the first positioning groove and the second positioning groove, and the first positioning pin and the second positioning pin are respectively provided with bulges at left and right sides defined along the width direction of the washing machine. When the cover portion is matched with the panel, the first positioning pin and the second positioning pin respectively stretch into the first positioning groove and the second positioning groove, and the bulges at the left and right sides are respectively in point contact with left and right side faces of the first positioning groove and the second positioning groove. In this way, movement of left and right sides of the cover portion is constrained, thereby ensuring stability and controllability of the gap. On the basis of this, the gap may be designed as small as possible.

[0012] The first positioning pin and the second positioning pin are located at a lower part of the cover portion. Therefore, the first positioning pin and the second positioning pin are shielded by the charging device, and are generally not easily observed by a user when opening the charging device, to improve impressions and experience of the user.

[0013] As another implementation scheme, or additionally, the cover portion is provided with a third positioning pin, the window portion is provided with a third positioning groove containing the third positioning pin, left and right sides of the third positioning pin are respectively provided with a fifth bulge and a sixth bulge, and left and right sides in the third positioning groove are respectively provided with a fifth positioning surface and a sixth positioning surface. When the cover portion is matched with the panel, the third positioning pin stretches into the third positioning groove, and the fifth bulge and the sixth bulge are respectively in point contact with the fifth positioning surface and the sixth positioning surface. By a mechanism feature of the implementation scheme, the movement of the left and right sides of the cover portion is also constrained.

[0014] The third positioning pin is located at the lower part of the cover portion.

[0015] The window portion is provided with a seventh positioning surface facing the front of the depth direction of the washing machine, the cover portion is provided with a plurality of seventh bulges, and when the cover portion is matched with the window portion, the seventh bulges are in point contact with the seventh positioning surface.

[0016] In addition, the cover portion is provided with a plurality of hooks that extend along the depth direction of the washing machine, and the window portion is provided with a plurality of locking bulges matched with the hooks.

[0017] The following describes specific implementations of the invention with reference to the accompanying

drawings.

FIG. 1 is a top view of a cover portion of a charging device and a panel of a usual washing machine;

FIG. 2 is a schematic front view of a washing machine;

FIG. 3 is a schematic lateral view of a charging device and a panel that are in an open state;

FIG. 4 is a schematic lateral view of a cover portion of a charging device and a panel that are in a matching state;

FIG. 5 is a local structural diagram of a panel, which mainly displays a structure of a window portion;

FIG. 6 is a schematic structural diagram of a back part of a cover portion of a charging device;

FIG. 7 is a local enlarged diagram of the cover portion of the charging device in FIG. 6; and

FIG. 8 is a local schematic diagram of a cover portion and a panel that are in a matching state.

[0018] As shown in FIG. 2, a washing machine 100 is provided with a box body 2. A charging device 10 designed as a drawer-type structure is disposed on the box body 2 in a drawer-type way. In a matching state, a cover portion 11 of the charging device 10 is flush with the box body 2. The box body 2 includes a panel 4 located at a front side of the washing machine. The charging device 10 is disposed on the panel 4. The panel 4 of the washing machine shown in FIG. 2 includes a control piece 5 and is separate from a front panel 6 located below the panel 4. In other embodiments, the panel may alternatively integrally extend to a bottom part of the box body 2.

[0019] As shown in FIG. 3, the charging device 10 includes the cover portion 11 and a treatment agent placing portion 12. The cover portion 11 is fixedly connected to the treatment agent placing portion 12. The treatment agent placing portion 12 penetrates through a window portion 41 of the panel 4 and may move along a depth direction Y of the washing machine. When the treatment agent placing portion 12 completely stretches into the panel 4, the cover portion 11 is matched with the window portion 41.

[0020] As shown in FIG. 4 to FIG. 8, the window portion 41 of the panel 4 is provided with four groups of locking bulges 42, which are respectively matched with four hooks 13 that extend along the depth direction Y of the washing machine and that are on the cover portion 11. A lower part of the window portion 41 is provided with a first positioning groove 43a, a second positioning groove 43b, and a third positioning groove 43c that have openings at front parts, which respectively contain, along the

depth direction Y of the washing machine, a first positioning pin 14a, a second positioning pin 14b, and a third positioning pin 14c disposed at a lower part of the cover portion 11. In this way, the cover portion 11 is basically connected to the window portion 41 of the panel 4. However, further positioning is still required to ensure a stable connection between the cover portion 11 and the panel 4.

[0021] When a position relationship between two parts is determined, fixing one part needs to constrain 6 degrees of freedom of the one part, and constraining 6 degrees of freedom of the other part is an essence of the positioning system design. In the design of the charging device and the panel, the panel is fixed by default. How to constrain degrees of freedom of the charging device, especially the cover portion, is a main direction of the design. In the product design, a "3-2-1 principle" about the positioning system in geometric dimension and tolerance is followed to constrain 6 degrees of freedom of a part. The principle is as follows: It is assumed that 3 mutually perpendicular planes in the space form a datum coordinate system, and are a first datum plane, a second datum plane, and a third datum plane; when a part is fixed in the coordinate system, the following selection needs to be performed in order: at least three points on the part are selected to be in contact with the first datum plane (constraining 3 degrees of freedom), at least two points on the part are selected to be in contact with the second datum plane (constraining 2 degrees of freedom), and at least one point on the part is selected to be in contact with the third datum plane (constraining one degree of freedom). Therefore, the 6 degrees of freedom of the part are all constrained.

[0022] As shown in FIG. 5, the window portion 41 is provided with a first supporting surface 44a and a second supporting surface 44b that extend and are spaced relative to a width direction X of the washing machine. The first supporting surface 44a and the second supporting surface 44b are coplanar, and preferably may be on a horizontal plane. The first supporting surface 44a is located at a bottom part of the first positioning groove 43a, and the second supporting surface 44b is located at a bottom part of the second positioning groove 43b. A top part of the first positioning groove 43a is further provided with a third positioning surface 44c, and a top part of the second positioning groove 43b is further provided with a fourth positioning surface 44d. Bottom parts of the first positioning pin 14a and the second positioning pin 14b are respectively provided with a first bulge 15a and a second bulge 15b that are hemispherical structures. After the cover portion 11 is matched with the window portion 41 of the panel 4, the first bulge 15a and the second bulge 15b are respectively supported on the first supporting surface 44a and the second supporting surface 44b without gap from above, and are respectively in point contact with the first supporting surface 44a and the second supporting surface 44b. The first supporting surface 44a and the second supporting surface 44b respectively apply a vertical upward supporting force to the first bulge 15a

and the second bulge 15b. Top parts of the first positioning pin 14a and the second positioning pin 14b are respectively provided with a third bulge 15c and a fourth bulge 15d. When the cover portion 11 is matched with the panel 4, the third bulge 15c is in point contact with the third positioning surface 44c, and the fourth bulge 15d is in point contact with the fourth positioning surface 44d. In this way, two degrees of freedom of the cover portion 11 moving along a height direction Z of the washing machine and rotating around the depth direction Y of the washing machine are constrained.

[0023] Compared with usual gap matching, the first bulge 15a and the second bulge 15b are respectively supported on the first supporting surface 44a and the second supporting surface 44b without gap from above. A problem of a larger gap caused due to gravity is resolved. In addition, each matching form is point matching, rather than face matching. In this way, a product size is better managed and accuracy is higher. Therefore, the gap is easier to control.

[0024] As shown in FIG. 5, the cover portion 11 is provided with a third positioning pin 14c, and the window portion 41 is provided with a third positioning groove 43c containing the third positioning pin 14c. Left and right sides of the third positioning pin 14c are respectively provided with a fifth bulge 15e and a sixth bulge 15f. Left and right sides in the third positioning groove 43c are respectively provided with a fifth positioning surface 44e and a sixth positioning surface 44f. When the cover portion 11 is matched with the panel 4, the third positioning pin 14c stretches into the third positioning groove 43c, and the fifth bulge 15e and the sixth bulge 15f are respectively in point contact with the fifth positioning surface 44e and the sixth positioning surface 44f. The fifth bulge 15e and the sixth bulge 15f are curved structures, for example, may be spherical structures. In this way, a degree of freedom of the cover portion 11 moving along the width direction X of the washing machine is constrained.

[0025] In other optional implementations, the first positioning pin 14a and the second positioning pin 14b are respectively provided with bulges (not shown in the accompanying drawing) at left and right sides defined along the width direction of the washing machine. When the cover portion 11 is matched with the panel 4, the first positioning pin 14a and the second positioning pin 14b respectively stretch into the first positioning groove 43a and the second positioning groove 43b, and the bulges at the left and right sides are respectively in point contact with left and right side faces of the first positioning groove 43a and the second positioning groove 43b.

[0026] As shown in FIG. 5, the window portion 41 is provided with a seventh positioning surface 44g facing the front of the depth direction Y of the washing machine. The cover portion 11 is provided with a plurality of fourth positioning pins 14d, and a front end of each fourth positioning pin 14d is provided with a seventh bulge 15g. When the cover portion 11 is matched with the window

portion 41, the seventh bulge 15g is in point contact with the seventh positioning surface 44g. With matching between the locking bulges 42 and the hooks 13, three degrees of freedom of moving along the depth direction Y of the washing machine, rotating around the width direction X, and rotating around the height direction Z are constrained. The seventh bulge 15g is a curved structure, for example, may be a spherical structure.

[0027] In this way, after assembly, sixth degrees of freedom of the charging device 10 are all constrained, and the charging device 10 is fixed relative to the position of the panel 4. Specific embodiments described above and shown in the accompanying drawings are only used to illustrate the invention, but not all of the invention. Within the scope of the basic technical idea of the invention, any form of modification made by a person of ordinary skill in the related art to the invention is within the protection scope of the invention.

Claims

1. A washing machine with a drawer-type charging device, comprising a panel (4) that forms a part of a box body (2), wherein the panel is provided with a window portion (41), the charging device (10) penetrates through the window portion and is provided with a cover portion (11), and when the charging device completely stretches into the box body, the cover portion of the charging device is matched with the window portion of the panel, **characterized in that** the window portion is provided with a first supporting surface (44a) and a second supporting surface (44b) that extend and are spaced relative to a width direction (X) of the washing machine, and the cover portion is provided with a first bulge (15a) and a second bulge (15b) that are respectively supported on the first supporting surface and the second supporting surface from above, wherein the first bulge and the second bulge are curved structures and in point contact with the first supporting surface and the second supporting surface respectively, and the first supporting surface and the second supporting surface respectively apply a vertical upward supporting force to the first bulge and the second bulge.
2. The washing machine according to claim 1, **characterized in that** the first bulge and the second bulge are each a hemispherical structure.
3. The washing machine according to claim 1, **characterized in that** the first bulge and the second bulge are respectively disposed at bottom parts of a first positioning pin (14a) and a second positioning pin (14b).
4. The washing machine according to claim 3, **characterized in that** the window portion is provided with

a first positioning groove (43a) and a second positioning groove (43b) that have openings at front parts, the first supporting surface and the second supporting surface are respectively located at bottom parts of the first positioning groove and the second positioning groove, a top part of the first positioning groove is further provided with a third positioning surface (44c), a top part of the second positioning groove is further provided with a fourth positioning surface (44d), and top parts of the first positioning pin and the second positioning pin are respectively provided with a third bulge and a fourth bulge; and when the cover portion is matched with the panel, the first positioning pin and the second positioning pin respectively stretch into the first positioning groove and the second positioning groove, the third bulge (15c) is in point contact with the third positioning surface (44c), and the fourth bulge (15d) is in point contact with the fourth positioning surface (44d).

5. The washing machine according to claim 3, **characterized in that** the window portion is provided with a first positioning groove and a second positioning groove that have openings at front parts, the first supporting surface and the second supporting surface are respectively located at bottom parts of the first positioning groove and the second positioning groove, and the first positioning pin and the second positioning pin are respectively provided with bulges at left and right sides defined along the width direction of the washing machine; and when the cover portion is matched with the panel, the first positioning pin and the second positioning pin respectively stretch into the first positioning groove and the second positioning groove, and the bulges at the left and right sides are respectively in point contact with left and right side faces of the first positioning groove and the second positioning groove.
6. The washing machine according to claim 3, **characterized in that** the first positioning pin and the second positioning pin are located at a lower part of the cover portion.
7. The washing machine according to claim 1, **characterized in that** the cover portion is provided with a third positioning pin (14c), the window portion is provided with a third positioning groove (43c) containing the third positioning pin, left and right sides of the third positioning pin are respectively provided with a fifth bulge (15e) and a sixth bulge (15f), and left and right sides in the third positioning groove are respectively provided with a fifth positioning surface (44e) and a sixth positioning surface (44f); and when the cover portion is matched with the panel, the third positioning pin stretches into the third positioning groove, and the fifth bulge and the sixth bulge are

respectively in point contact with the fifth positioning surface and the sixth positioning surface.

8. The washing machine according to claim 1, **characterized in that** the window portion is provided with a seventh positioning surface (44g) facing the front of a depth direction of the washing machine, the cover portion is provided with a plurality of seventh bulges (15g), and when the cover portion is matched with the window portion, the seventh bulges are in point contact with the seventh positioning surface.
9. The washing machine according to claim 8, **characterized in that** the cover portion is provided with a plurality of hooks (13) that extend along the depth direction (Y) of the washing machine, and the window portion is provided with a plurality of locking bulges (42) matched with the hooks.
10. The washing machine according to claim 1, **characterized in that** the first supporting surface and the second supporting surface extend horizontally and are coplanar.

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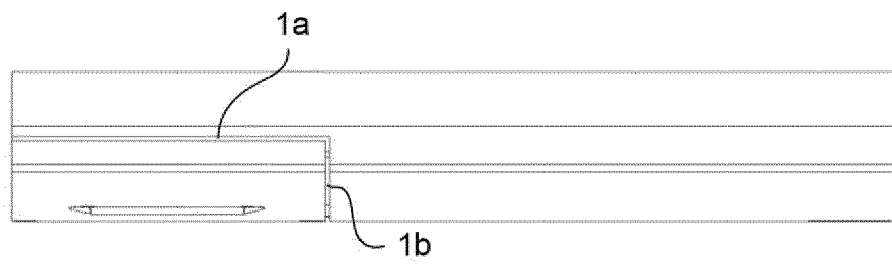


FIG. 1

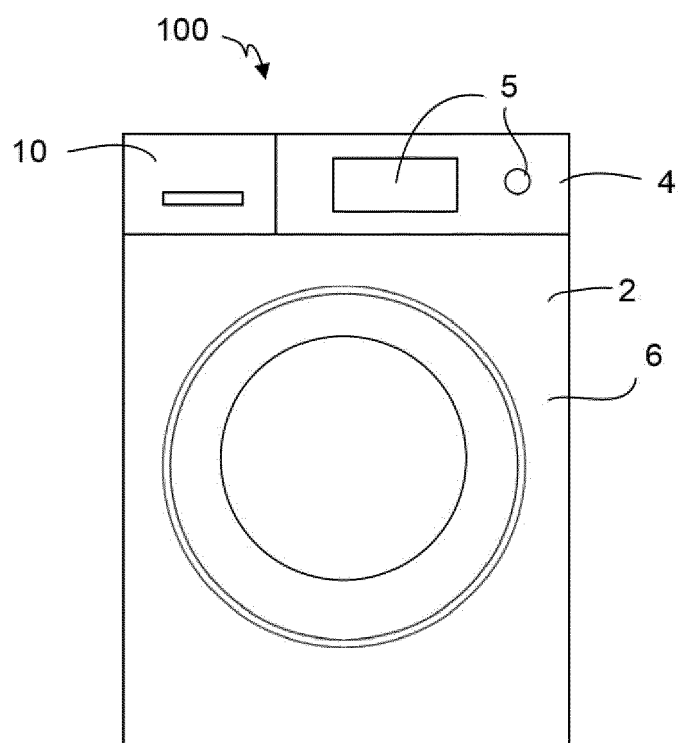


FIG. 2

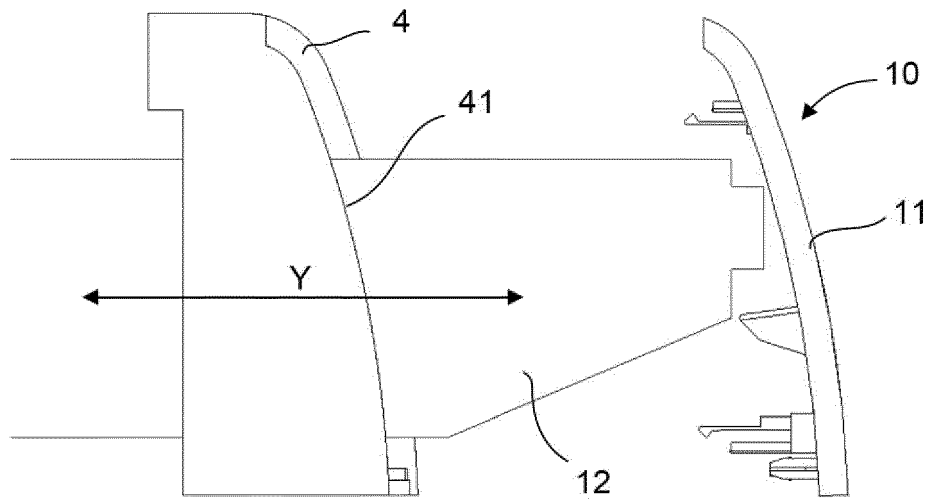


FIG. 3

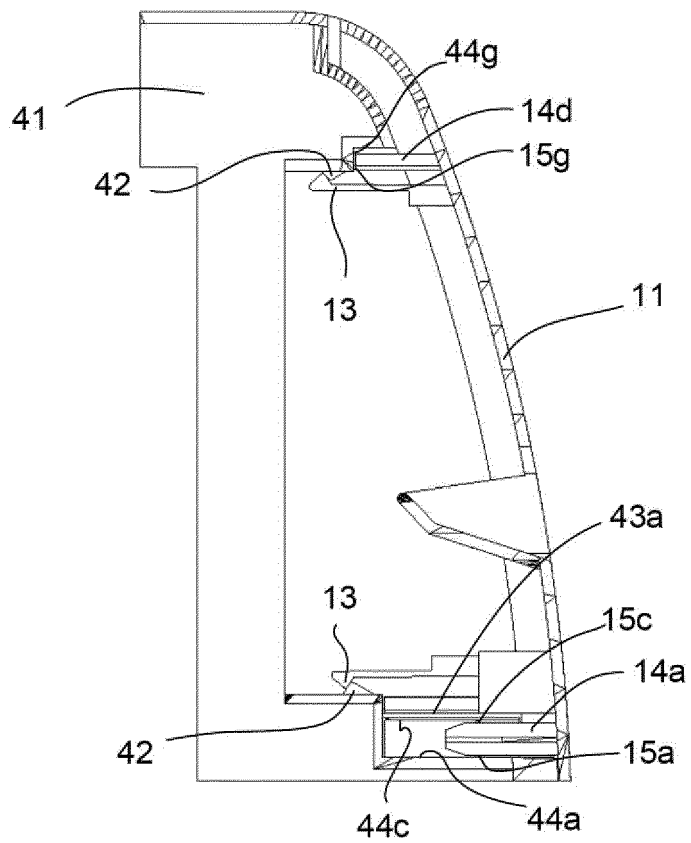


FIG. 4

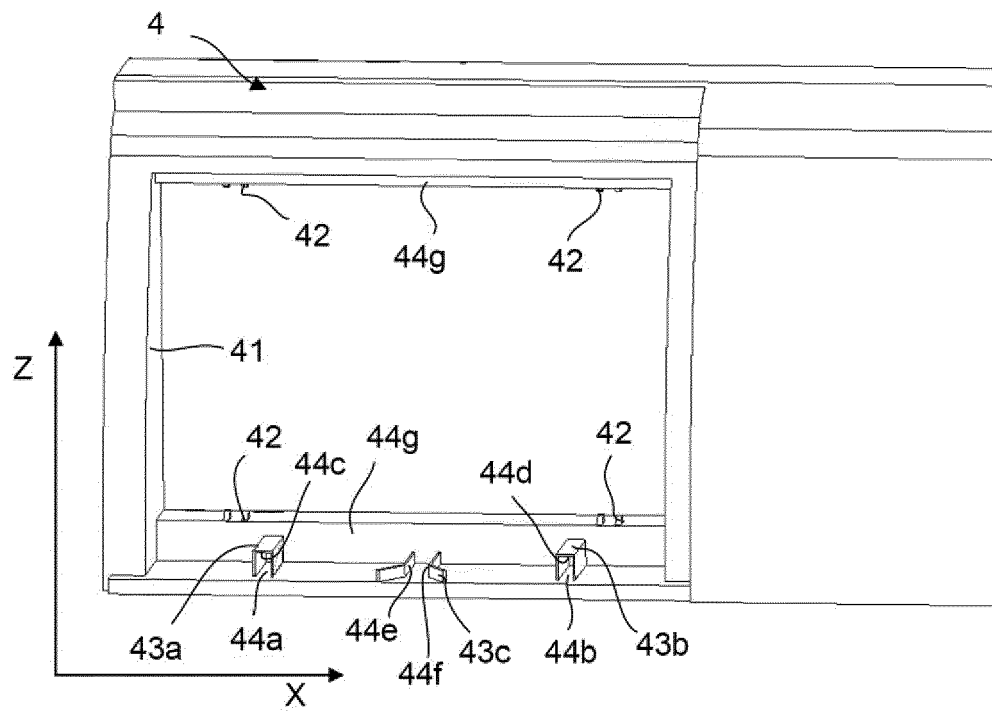


FIG. 5

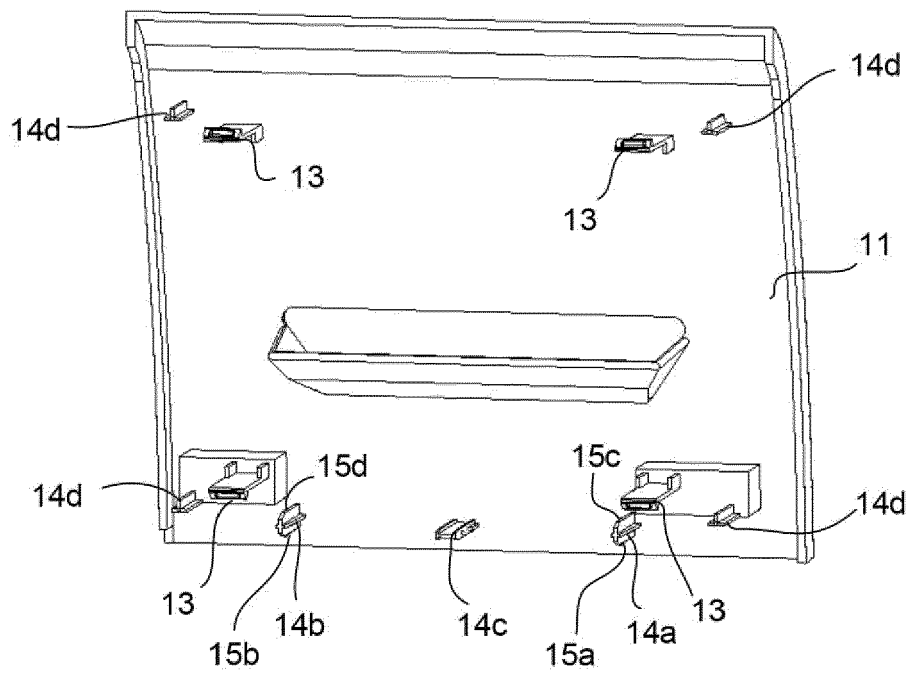


FIG. 6

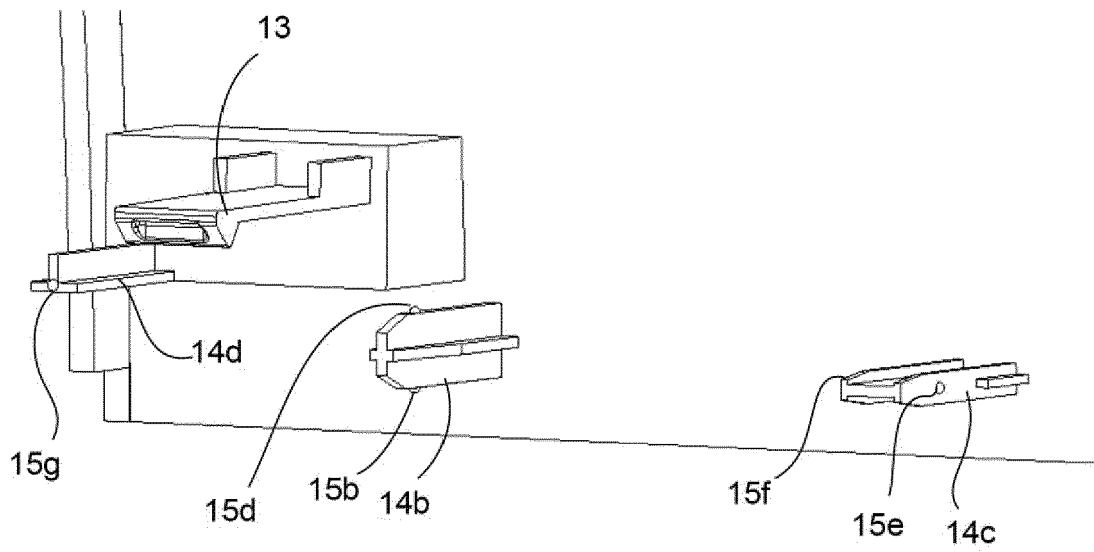


FIG. 7

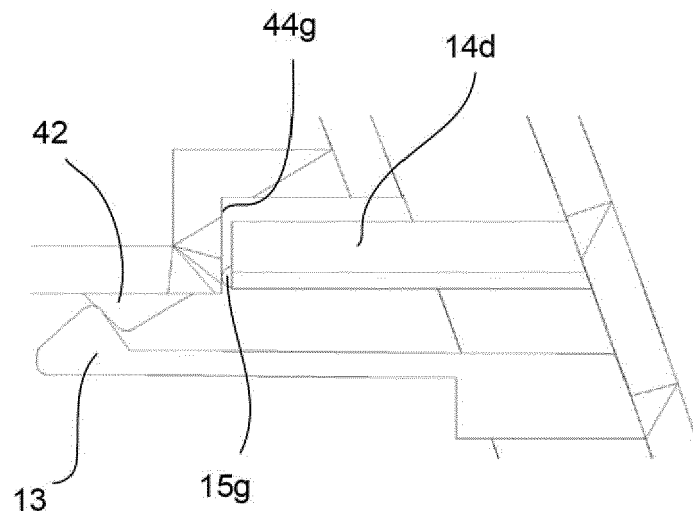


FIG. 8



EUROPEAN SEARCH REPORT

Application Number
EP 20 16 2066

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Place of search Munich		Date of completion of the search 15 June 2020	Examiner Werner, Christopher
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**ANNEX TO THE EUROPEAN SEARCH REPORT
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