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(54) **Title:** A FILTER ASSEMBLY FOR A HOUSEHOLD APPLIANCE

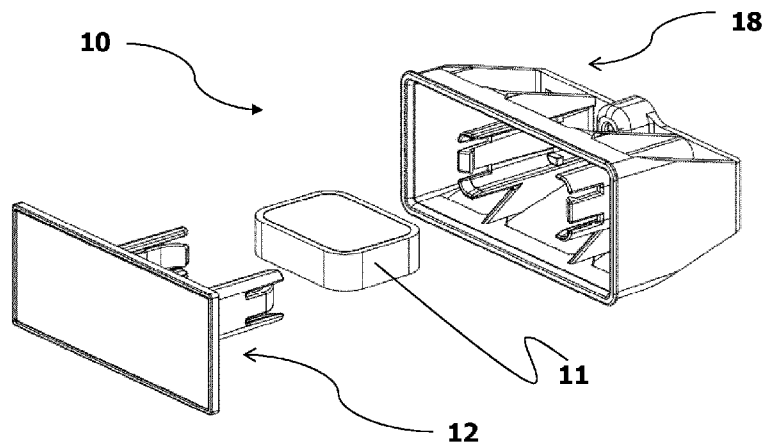


FIG. 3

(57) **Abstract:** The present invention proposes a filter assembly (10) for a household appliance, in particular for a cooling appliance (100), comprising one or more than one filter element (11) for treating the air in a cabinet. The filter element (11) is configured to be positioned at an end opening (103) of a flow channel (102) provided on an inner wall (101) facing a storage cabinet (104) of the cooling appliance (100) such that the air in the storage cabinet (104) flows around the filter element (11) just before passing through the flow channel (102) in a forced manner.

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SPECIFICATION

A FILTER ASSEMBLY FOR A HOUSEHOLD APPLIANCE

Technical Field of the Invention

The present invention relates to a filter assembly according to the preamble of claim
5 1.

Background of the Invention

A cooling appliance, such as a refrigerator is an electronic device that includes storage compartments for storing food and a cold air supply device for keeping food fresh. Food stored in the refrigerator, especially animal products, tends to diffuse unpleasant odors.
10 Moreover, products that have expired or spilled on refrigerator shelves cause these odors to increase. Therefore, refrigerators today are often provided with a deodorizing filter in order to remove unpleasant odors within the refrigerator. However, the deodorizing filters in the state of art may have difficulty in providing an effective solution to the odor problem due to various reasons such as insufficient contact area
15 between the filter and the internal air and insufficient pressure of the air passing through the filter. In addition, filter assemblies that do not allow or facilitate the replacement of the contaminated filter with a new one still pose a problem even considering the improvements in the prior art.

A state-of-the-art document numbered US2022154995A1 discloses a refrigerator
20 including a cabinet having a storage space, an evaporator provided at one side of the storage space, and a grill pan assembly forming an inner surface of the storage. The refrigerator further comprises a fluid passage to guide cold air, which is generated from the evaporator, to the storage space, and a discharge port to discharge the cold air to the storage space. The fluid passage may include a first fluid passage to receive the
25 cold air supplied from the evaporator, and a second fluid passage communicating with an outlet of the first fluid passage and split into a plurality of fluid passages. A

deodorizing device is provided in the first fluid passage to remove odor, and the cold air passing through the first fluid passage is split at the second fluid passage after passing through the deodorizing device. The deodorizing device of US2022154995A1 is configured to be inserted into the fluid passage from outside of the grill pan assembly through the mounting port such that the cold air passing through the first fluid passage passes through the deodorizing member.

Summary of the Invention

An object of the invention is to provide a filter assembly for a household appliance, in particular for a cooling appliance, which provides convenience in terms of the replacement of the contaminated filter element while enhancing deodorizing efficiency.

The present invention proposes a filter assembly for a household appliance, in particular for a cooling appliance, comprising a filter element for treating the air in a cabinet. The filter element is configured to be positioned at an end opening of a flow channel provided on an inner wall facing a storage cabinet of the cooling appliance such that the air in the storage cabinet flows around the filter element just before passing through the flow channel in a forced manner. Accordingly, the filter element is used in a more efficient way thanks to the increased pressure exerted by forced air on the filter element. On the other hand, by this arrangement, the air in the storage cabinet interacts more with the filter element as it circulates around the filter element under a vortex effect. Thus, it is ensured that undesirable odors in the storage cabinet are removed in a much shorter time. In an embodiment, the air in the storage cabinet flows in a forced manner with the help of a fan provided in the flow channel or in a chamber connected to the flow channel.

In a possible embodiment, the flow channel is a suction duct configured to return the air from the storage cabinet to an evaporator. Thus, filtering/deodorizing and suction of the evaporator are provided through the same flow channel at the same time. This arrangement helps to simplify the appliance without compromising functionality.

In a possible embodiment, the filter element is being in the form of a deodorizing cartridge. Accordingly, it is possible to replace the filter element with a new one when it is contaminated. Thus, a user-friendly arrangement is provided. In an embodiment, the filter element is also provided with an antibacterial agent that ensures the removal of both odor and bacteria in the storage cabinet.

In a possible embodiment, the filter assembly further comprises a filter holder for receiving the filter element. This arrangement provides ease of assembly and assists with the positioning of the filter element at the end opening.

In a possible embodiment, the filter holder has one or more snap-fit housings allowing the one or more filter elements to be detachably attached to the filter holder such that at least two external faces of the filter element remain uncovered when the filter element is fitted into the snap-fit housing. This snap-fit arrangement enhances the user experience since it facilitates the replacement of the filter element. Thus, the contaminated filter element can be simply pulled out of the filter holder, and a new one is inserted by pushing it into the filter holder. Besides, this arrangement allows the filter element to have multiple air contact surfaces to improve the filtering efficiency.

In a possible embodiment, the snap-fit housings are provided with at least two opposing cantilever extensions, each of the at least two opposing cantilever extensions has a clutch detail at a free extremity thereof for gripping the filter elements. This clutch arrangement enables the filter elements to be firmly attached to the snap-fit housings when the filter element is in use.

In a possible embodiment, the filter holder has a covering lid concealing the end opening when the filter holder is inserted into the end opening. Thus, integrity is provided on the inner wall while foreign substances are prevented from getting into the flow channel.

In a possible embodiment, the covering lid comprises a flat surface with the same geometry as the end opening such that the flat surface has an area equal to or larger

than the end opening. Thanks to this arrangement, planar continuity is ensured on the inner wall surface facing the storage cabinet, which improves effective coverage of the end opening and user experience.

- 5 In a possible embodiment, a ventilation gap is provided between the covering lid and the inner wall for allowing air to flow around the filter element towards the flow channel when the filter holder is inserted into the end opening. Thus, when the filter holder is placed on the end opening, the covering lid does not completely close the end opening, instead, a space narrow enough to allow the air to pass through in a pressurized
10 manner is left. In addition, by this arrangement, the air passes by contacting the uncovered external faces of the filter element.

- In a possible embodiment, the filter holder further comprises at least one roof structure to be positioned between the covering lid and the inner wall when the filter holder is
15 inserted into the end opening such that the pointed end of the at least one roof structure rises upwards, opposite to the direction of gravity when the filter assembly is in use. Accordingly, the condensed moisture in the air in the storage cabinet is discharged via the inclined surface of the roof structure. Besides, any liquid spilled around the filter holder is guided away from the filter element, thus protecting the filter
20 element and the flow channel against contamination.

- In an embodiment, the roof structure has a thickness equal to or slightly larger than the ventilation gap in a way to protect the filter element from leakage and contamination when the filter holder is placed into the end opening. Accordingly, it is
25 ensured that the filter elements are maintained dry during use.

- In a possible embodiment, the filter holder comprises two opposing roof structures such that the filter holder can be inserted into the end opening in two different positions. This arrangement provides symmetry to the filter holder with an axis of
30 symmetry passing between two opposing roof structures, allowing the user to insert the filter holder in a first position or in a second position into the end opening.

In a possible embodiment, the filter assembly further comprises a retaining frame configured to be attached into the end opening for receiving the filter holder. Thus, it is ensured that the filter holder is inserted in the end opening in a more rigid and safe manner.

5

In a possible embodiment, the retaining frame has at least two guiding channels for sliding the at least two opposing cantilever extensions into the retaining frame. These guiding channels enable the filter holder to be easily mounted in an aligned and guided manner into the retaining frame. In an embodiment, the guiding channels are
10 configured to flex outward for allowing the cantilever extensions to slide through.

In a possible embodiment, each of the at least two guiding channels has a claw detail at a free extremity thereof for coupling the filter holder into the retaining frame in a detachable manner. According to this embodiment, the filter holder is provided with at
15 least two fastening recesses corresponding to the claw details. This arrangement enables the guiding channels to be locked on the filter holder without the need for an additional part on the filter holder. Accordingly, the claw details provide a snap-fit attachment between the filter holder and the retaining frame, which makes it possible to couple the filter holder and the retaining frame with push-pull action. In an
20 embodiment, each of the at least two fastening recesses is provided on a cantilever extension. This arrangement also ensures that a ventilation gap is maintained between the covering lid and the inner wall.

The present invention also proposes a cooling appliance comprising a filter assembly
25 according to any of the preceding embodiments. Accordingly, a cooling appliance having the advantages mentioned above can be achieved. In an embodiment, two independent filter assemblies are provided on an inner wall facing a storage cabinet of the cooling appliance. These filter assemblies are mounted on separate end openings of separate suction ducts both configured to return the air from the storage cabinet to
30 an evaporator. Thanks to the use of two separate filter assemblies, high filtration of the air in the storage cabinet is ensured.

The invention is to be understood in that the design applies to one or more filter elements.

Brief description of the figures

- 5 The accompanying drawings are given solely for the purpose of exemplifying the invention whose advantages over prior art were outlined above and will be explained in detail hereinafter:

Fig. 1 shows a front view of a cooling appliance comprising two filter assemblies according to the present invention.

- 10 Fig. 2 shows a perspective view of a filter holder holding a filter element, according to the present invention.

Fig. 3 shows a perspective view of a filter assembly according to the present invention in its disassembled position.

Fig. 4 shows a perspective view of a filter holder according to the present invention.

- 15 Fig. 5 shows a front cross-sectional view of a filter assembly according to the present invention in its assembled position.

Fig. 6 shows a front view of a retaining frame according to the present invention.

- 20 Fig. 7 shows a top cross-sectional view of a liner comprising the filter assembly on an inner wall facing a storage cabinet of a cooling appliance, according to the present invention.

Fig. 8 shows a perspective cross-sectional view of a storage cabinet of a cooling appliance comprising the filter assembly according to the present invention.

Fig. 9 shows a perspective cross-sectional view of the filter assembly mounted on an end opening of a flow channel, according to the present invention.

Fig. 10 shows a perspective cross-sectional view of a section of a cooling appliance comprising the filter assembly, a suction duct and an evaporator, according to the present invention.

Fig. 11 shows another perspective view of a filter assembly according to the present invention, in its disassembled position.

Fig. 12 shows another top cross-sectional view of a liner comprising the filter assembly mounted on an inner wall facing a storage cabinet of a cooling appliance, according to the present invention.

Fig. 13 shows another front cross-sectional view of a filter assembly according to the present invention in its assembled position.

Detailed description of the figures

The present invention proposes a filter assembly 10 for a household appliance, in particular for a cooling appliance 100. The filter assembly 10 mainly comprises one or more filter elements 11 for treating the air in a cabinet. The design applies to one or more filter elements, Figs. 11 – 13 show the adaption for two filter elements 11, adapted parts have primed reference numbers.

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Referring to Figs. 8 and 9, the filter element 11 is configured to be positioned at an end opening 103 of a flow channel 102 provided on an inner wall 101 facing a storage cabinet 104 of the cooling appliance 100 such that the air in the storage cabinet 104 flows around the filter element 11 just before passing through the flow channel 102 in a forced manner. Accordingly, the air in the storage cabinet 104 is forced and directed to the flow channel 102 so that it not only passes through the filter element 11 but also circulates around the filter element 11.

25

Referring to Figs. 2, 3, 7 and 12, each filter element 11 is a deodorizing cartridge having a prismatic form. More precisely, the filter element 11 has a cuboid shape with rounded corners, which facilitates the insertion and removal of the one or more filter element
5 11 in a filter holder 12, 12'.

Accordingly, the flow channel 102 is a suction duct air return duct, as seen in Fig. 10, that is configured to return the air from the storage cabinet 104 to an evaporator 105 and then recirculate the filtered air to the storage cabinet 104.

10

The filter assembly 10 has a filter holder 12, as depicted in Fig. 2 and Fig. 4, with a snap-fit housing 13 for receiving the filter element 11. The snap-fit housing 13 is surrounded by two opposing cantilever extensions 14. The filter element 11 is placed between these two slightly flexible cantilever extensions 14 by being pushed. Moreover,
15 each of the cantilever extensions 14 is provided with a clutch detail 141 at a free extremity thereof. The filter element 11 is firmly kept between the cantilever extensions 14 by means of these clutch details 141 unless an external force is applied. The clutch details 141, however, flex to allow the filter element 11 to be removed/detached from the snap-fit housing 13 in case the filter element 11 is pulled out manually.

20

Fig. 11 shows the filter assembly 10' modified for two filters 11. The filter assembly 10' has a filter holder 12', with two snap-fit housings 13 for receiving two filter elements 11.

25 Referring to Fig. 2, three external faces 111 of the filter element 11, namely two opposing external faces 111 parallel to each other and a further external face 111 extending perpendicularly between them, remain uncovered when the filter element 11 is fitted into the snap-fit housing 13.

30 Moreover, the filter holder 12 comprises a covering lid 15 having a planar form that extends on a plane parallel to the inner wall 101 when the filter holder 12 is inserted into the end opening 103. Referring to Fig. 4 and Fig. 8, the covering lid 15 is provided

with a flat surface 151 facing the storage cabinet 104. The flat surface 151 has the same geometry as the end opening 103, namely a rectangular geometry, such that the flat surface 151 has an area equal to or larger than the end opening 103. Accordingly, the covering lid 15 conceals the end opening 103 provided on the inner wall 101 when the filter holder 12 is inserted into the end opening 103 as can be deduced from Fig. 1. However, according to this configuration, the covering lid 15 does not fit inside the end opening 103 in such a way that a perfectly flat surface is provided on the inner wall 101 when the filter holder 12 is inserted into the end opening 103. Instead, a ventilation gap 16 is provided between the covering lid 15 and the inner wall 101 as depicted in Fig. 9, such that the air in the storage cabinet 104 is directed to flow around the filter element 11 towards the flow channel 102.

Referring to Fig. 2, a roof structure 17 is provided on the covering lid 15, positioned on top of the filter element 11 when the filter assembly 10 is in use. The roof structure 17 has a thickness equal to or slightly larger than the ventilation gap 16 in a way to protect the filter element 11 and the flow channel 102 from leakage and contamination when the filter holder 12 is placed into the end opening 103. Accordingly, the roof structure 17 has two downwardly inclined surfaces configured to sweep away the condensed moisture, thus preventing its contact with the filter element 11 when the filter assembly 10 is in use.

The filter holder 12, 12' comprises two opposing roof structures 17, 17' as seen in Figs. 5 and 13. These two roof structures 17 are provided along two opposing longitudinal sides 21 of the casing frame 20. The two roof structures 17, 17' are provided for the two opposing external faces 111 of the filter element or elements 11 to constitute a symmetrical configuration with respect to the filter holder 12, 12' in both vertical and horizontal planes. Accordingly, even if the filter holder 12, 12' is rotated 180° in the vertical plane, the positions of its elements remain the same.

The filter assembly 10 also comprises a retaining frame 18 configured to be placed in the end opening 103 for receiving the filter holder 12. Accordingly, the retaining frame 18 is provided already installed on the inner wall 101 previous to the insertion of the

filter holder 12 into the end opening 103. Referring to Fig. 6, the retaining frame 18 comprises two guiding channels 19 for sliding the two opposing cantilever extensions 14. Accordingly, each of the guiding channels 19 has a claw detail 191 at a free extremity thereof. These claw details 191 are configured to be coupled with fastening
5 recesses 142 provided on the opposing cantilever extensions 14 as depicted in Fig. 2 when the filter holder 12 and the retaining frame 18 are assembled.

When the filter holder 12 is manually pulled out, the guiding channels 19 flex such that the claw details 191 let loose of the fastening recesses 142, thus allowing the filter
10 holder 12 to be detached from the retaining frame 18.

The present invention further proposes a cooling appliance 100 comprising a filter assembly 10 according to the invention. Referring to Fig. 1, two independent filter assemblies 10 are provided on an inner wall 101 facing a storage cabinet 104 of the
15 cooling appliance 100. These filter assemblies 10 are mounted on separate end openings 103 of separate suction ducts 102 both configured to return the air from the storage cabinet 104 to an evaporator 105.

Reference list:

- | | | |
|----|---------|----------------------|
| | 100 | Cooling appliance |
| 5 | 10, 10' | Filter assembly |
| | 101 | Inner wall |
| | 102 | Flow channel |
| | 103 | End opening |
| | 104 | Storage cabinet |
| 10 | 105 | Evaporator |
| | 11 | Filter element |
| | 111 | External face |
| | 12, 12' | Filter holder |
| | 13, 13' | Snap-fit housing |
| 15 | 14 | Cantilever extension |
| | 141 | Clutch detail |
| | 142 | Fastening recess |
| | 15 | Covering lid |
| | 151 | Flat surface |
| 20 | 16 | Ventilation gap |
| | 17 | Roof structure |
| | 18 | Retaining frame |
| | 19 | Guiding channel |
| | 191 | Claw detail |
| 25 | 20 | Casing frame |
| | 21 | Longitudinal side |

CLAIMS

1. A filter assembly (10) for a household appliance, in particular for a cooling appliance (100), comprising one or more than one filter element (11) for treating the air in a cabinet; **characterized in that** the one or more than one filter element (11) is
5 configured to be positioned at an end opening (103) of a flow channel (102) provided on an inner wall (101) facing a storage cabinet (104) of the cooling appliance (100) such that the air in the storage cabinet (104) flows around the one or more than one filter element (11) just before passing through the flow channel (102) in a forced manner.
- 10 2. The filter assembly (10) according to claim 1, wherein the flow channel (102) is a suction duct configured to return the air from the storage cabinet (104) to an evaporator (105).
- 15 3. The filter assembly (10) according to claim 1 or 2, wherein the one or more than one filter element (11) is being in the form of a deodorizing cartridge.
4. The filter assembly (10) according to any one of the preceding claims, wherein the filter assembly (10) further comprises a filter holder (12) for receiving the one or more
20 than one filter element (11).
5. The filter assembly (10) according to claim 4, wherein the filter holder (12) has one or more than one snap-fit housing (13) allowing the one or more than one filter element (11) to be detachably attached to the filter holder (12) such that at least two external
25 faces (111) of the one or more than one filter element (11) remain uncovered when the one or more than one filter element (11) is fitted into the snap-fit housing (13).
6. The filter assembly (10) according to claim 5, wherein the snap-fit housings (13) are provided with at least two opposing cantilever extensions (14), each of the at least two
30 opposing cantilever extensions has a clutch detail (141) at a free extremity thereof for gripping the one or more than one filter element (11).

7. The filter assembly (10) according to claim 6, wherein the filter holder (12) has a covering lid (15) concealing the end opening (103) when the filter holder (12) is inserted into the end opening (103).

5

8. The filter assembly (10) according to claim 7, wherein the covering lid (15) comprises a flat surface (151) with the same geometry as the end opening (103) such that the flat surface (151) has an area equal to or larger than the end opening (103).

10 9. The filter assembly (10) according to claim 7 or 8, wherein a ventilation gap (16) is provided between the covering lid (15) and the inner wall (101) for allowing air to flow around the one or more than one filter element (11) towards the flow channel (102) when the filter holder (12) is inserted into the end opening (103).

15 10. The filter assembly (10) according to claim 9, wherein the filter holder (12) further comprises at least one roof structure (17) to be positioned between the covering lid (15) and the inner wall (101) when the filter holder (12) is inserted into the end opening (103) such that the pointed end of the at least one roof structure (17) rises upwards, opposite to the direction of gravity when the filter assembly (10) is in use.

20

11. The filter assembly (10) according to claim 10, wherein the filter holder (12) comprises two opposing roof structures (17) such that the filter holder (12) can be inserted into the end opening (103) in two different positions.

25 12. The filter assembly (10) according to any one of the claims 6 to 11, wherein the filter assembly (10) further comprises a retaining frame (18) configured to be placed in the end opening (103) for receiving the filter holder (12).

30 13. The filter assembly (10) according to claim 12, wherein the retaining frame (18) has at least two guiding channels (19) for sliding the at least two opposing cantilever extensions (14) into the retaining frame (18).

14. The filter assembly (10) according to claim 13, wherein each of the at least two guiding channels (19) has a claw detail (191) at a free extremity thereof for coupling the filter holder (12) into the retaining frame (18) in a detachable manner, wherein the filter holder (12) is provided with at least two fastening recesses (142) corresponding
5 to the claw details (191).

15. A cooling appliance (100) comprising a filter assembly (10) according to any one of the preceding claims.

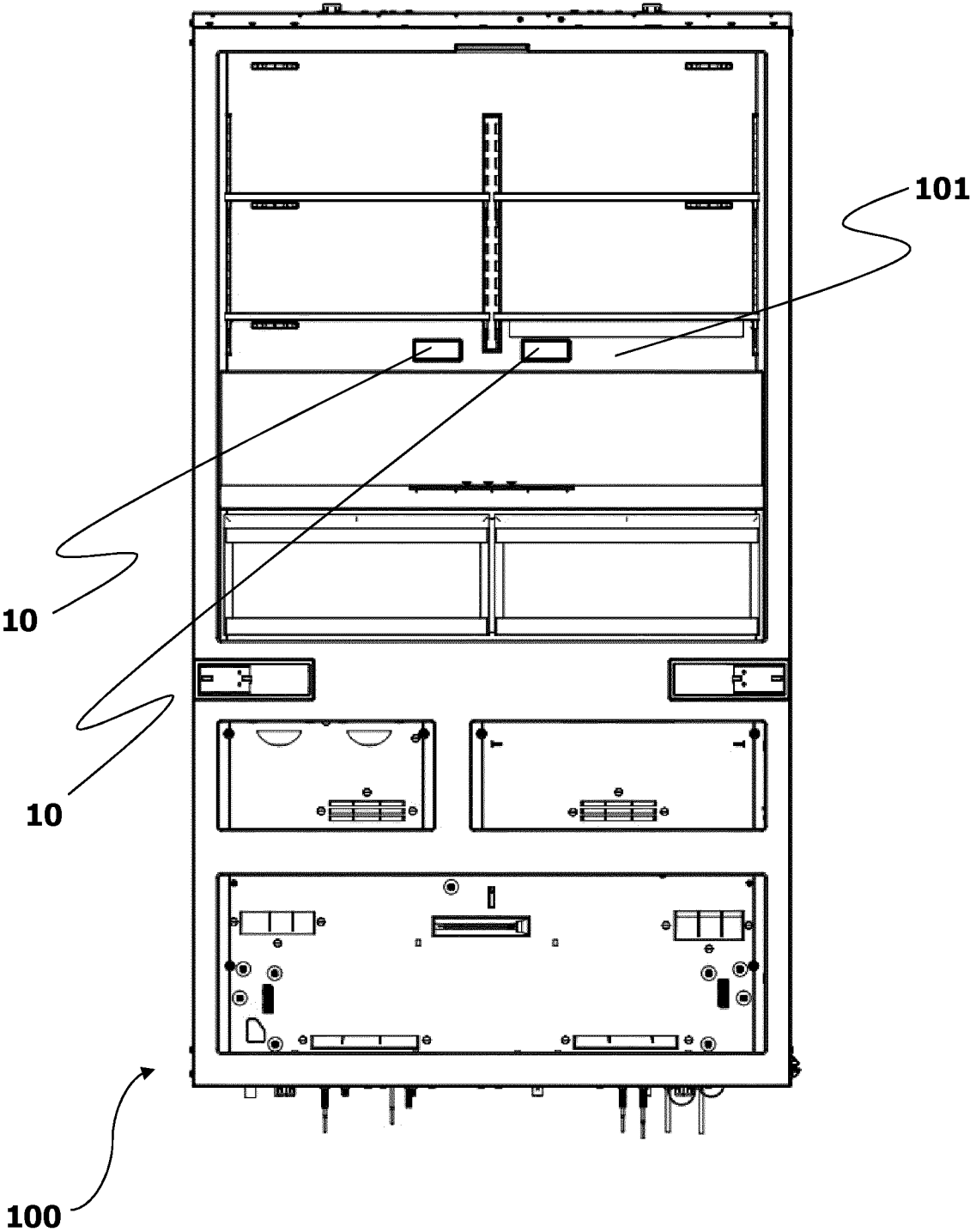
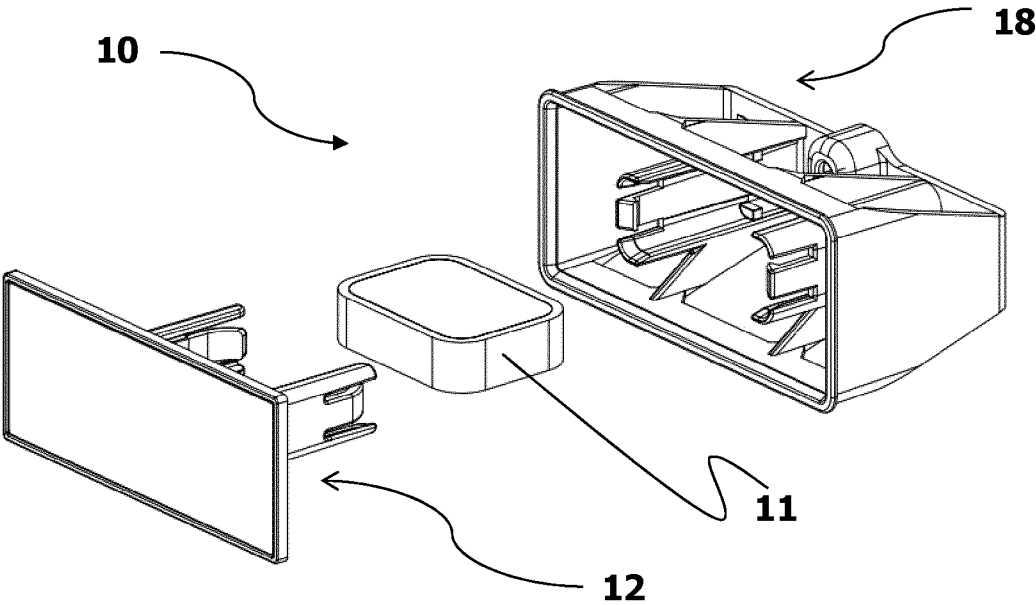
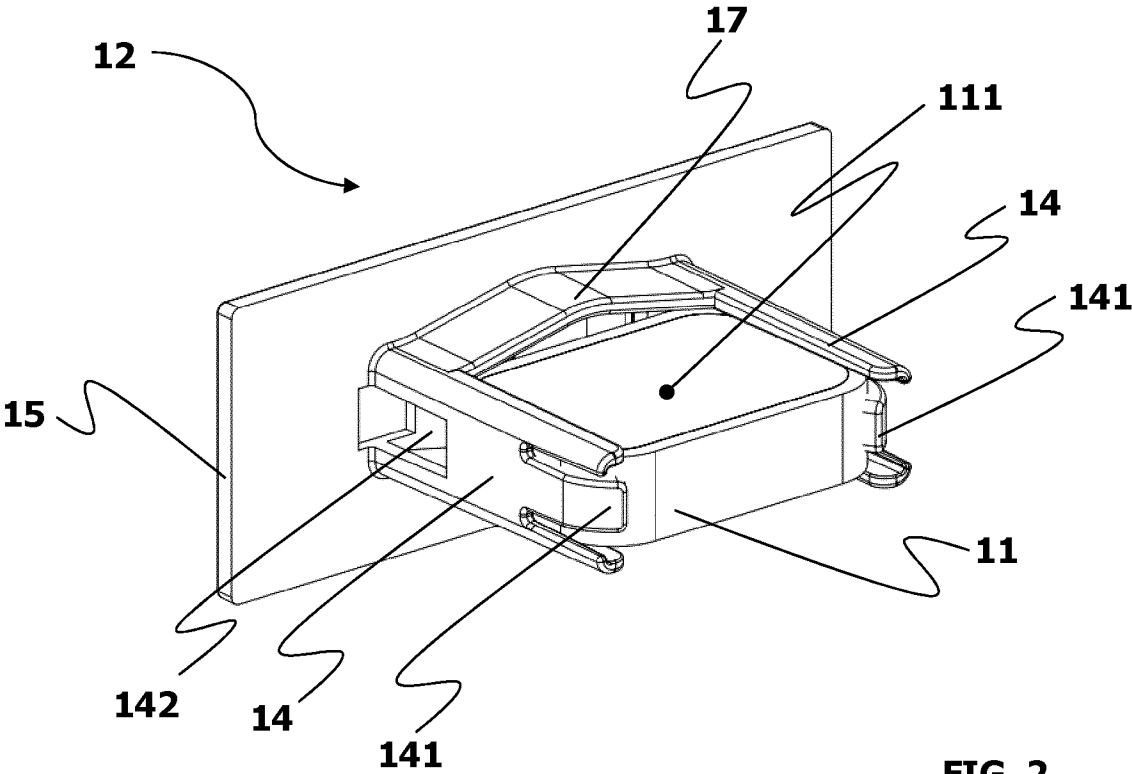


FIG. 1



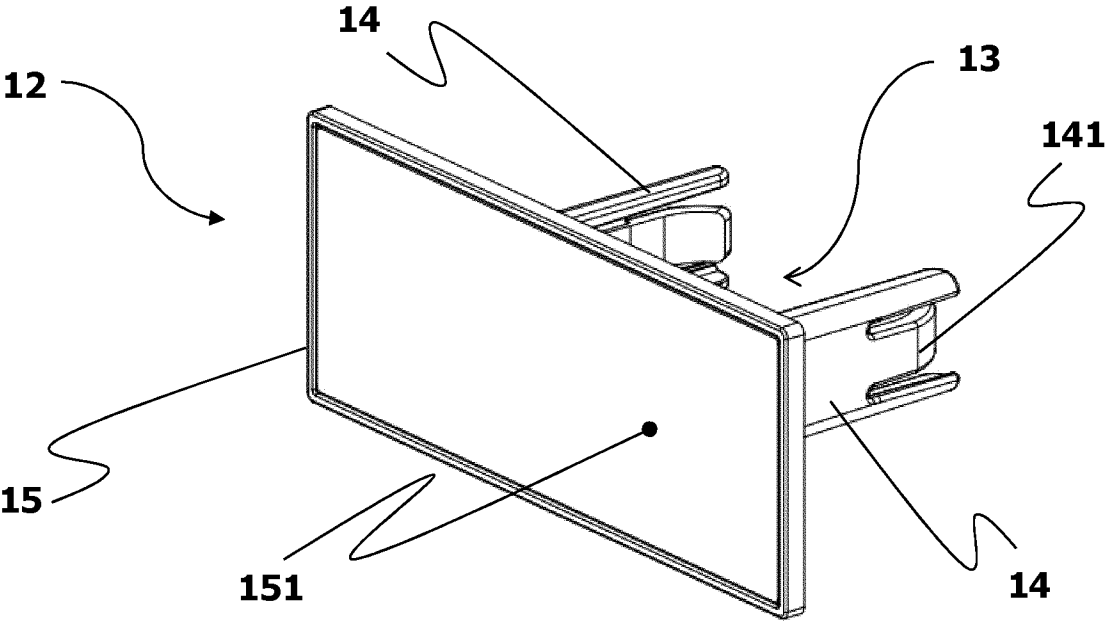


FIG. 4

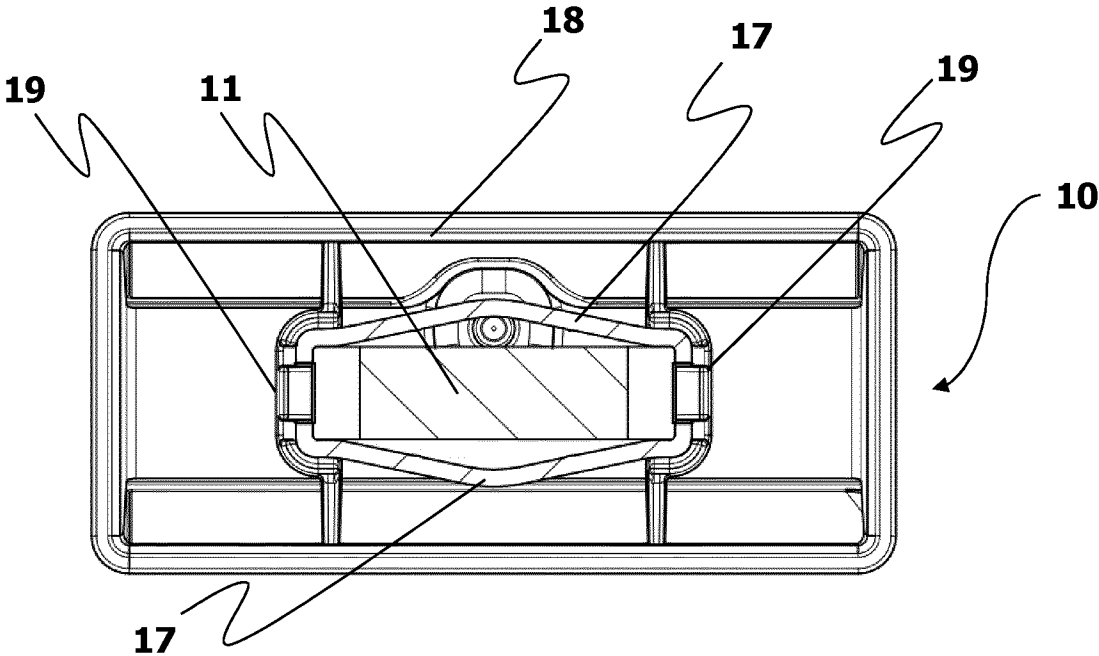


FIG. 5

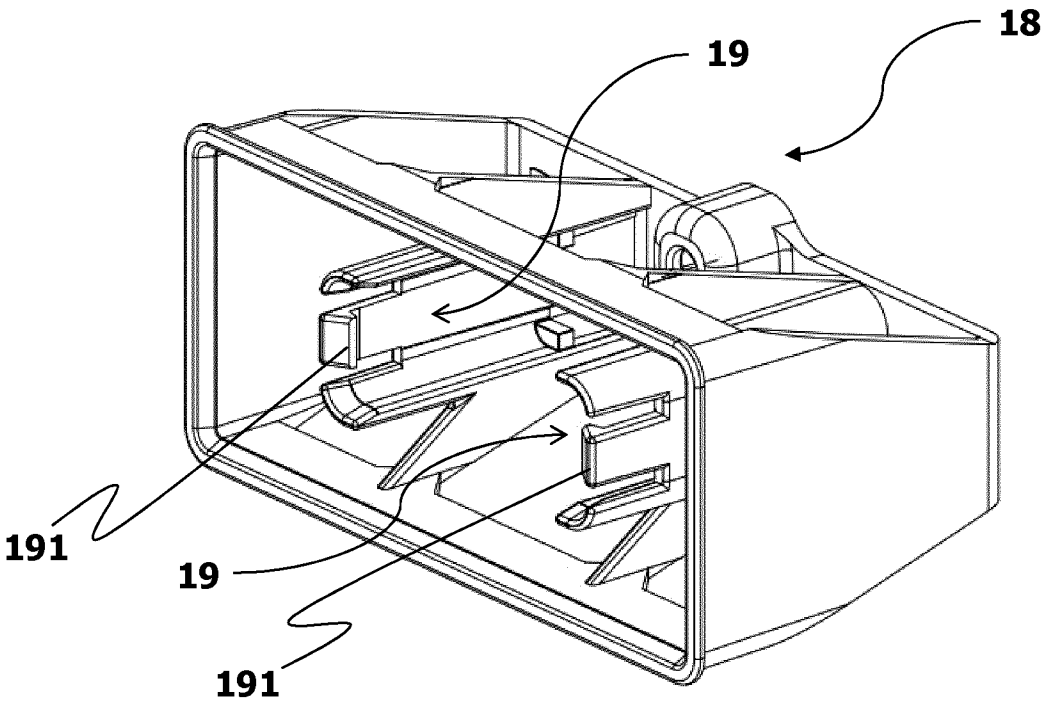


FIG. 6

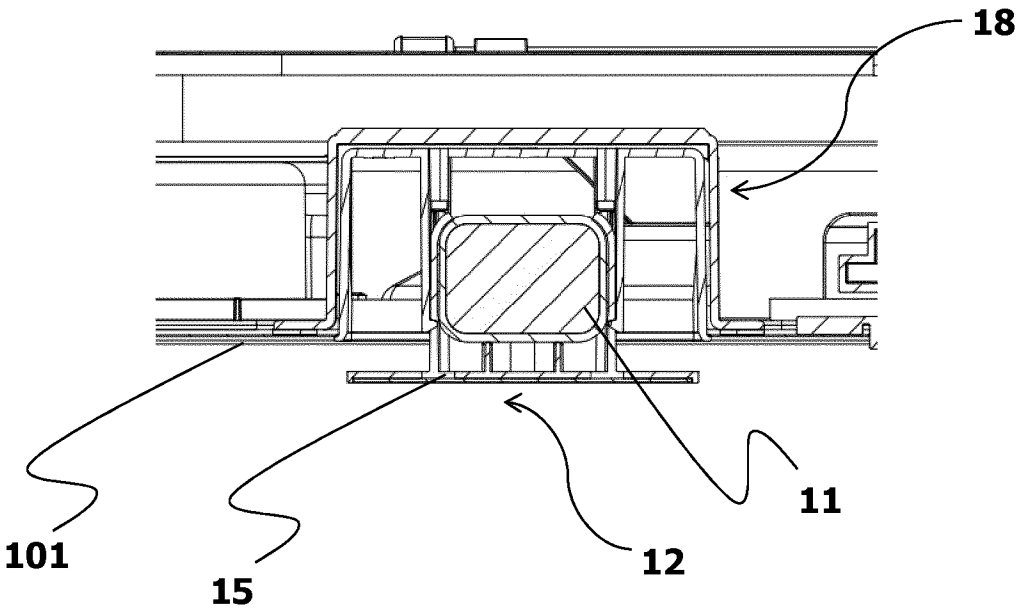


FIG. 7

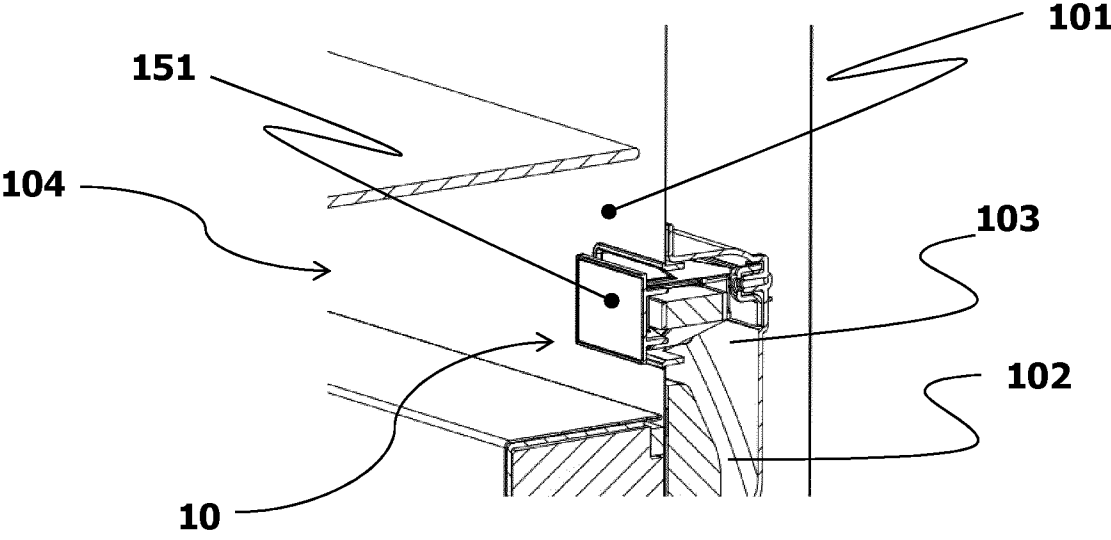


FIG. 8

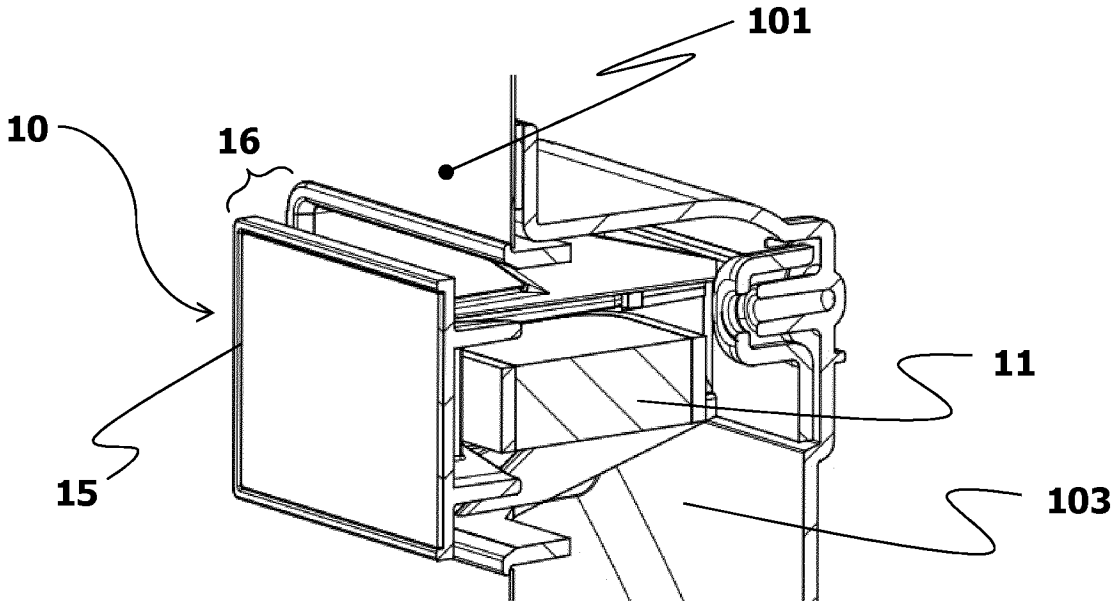


FIG. 9

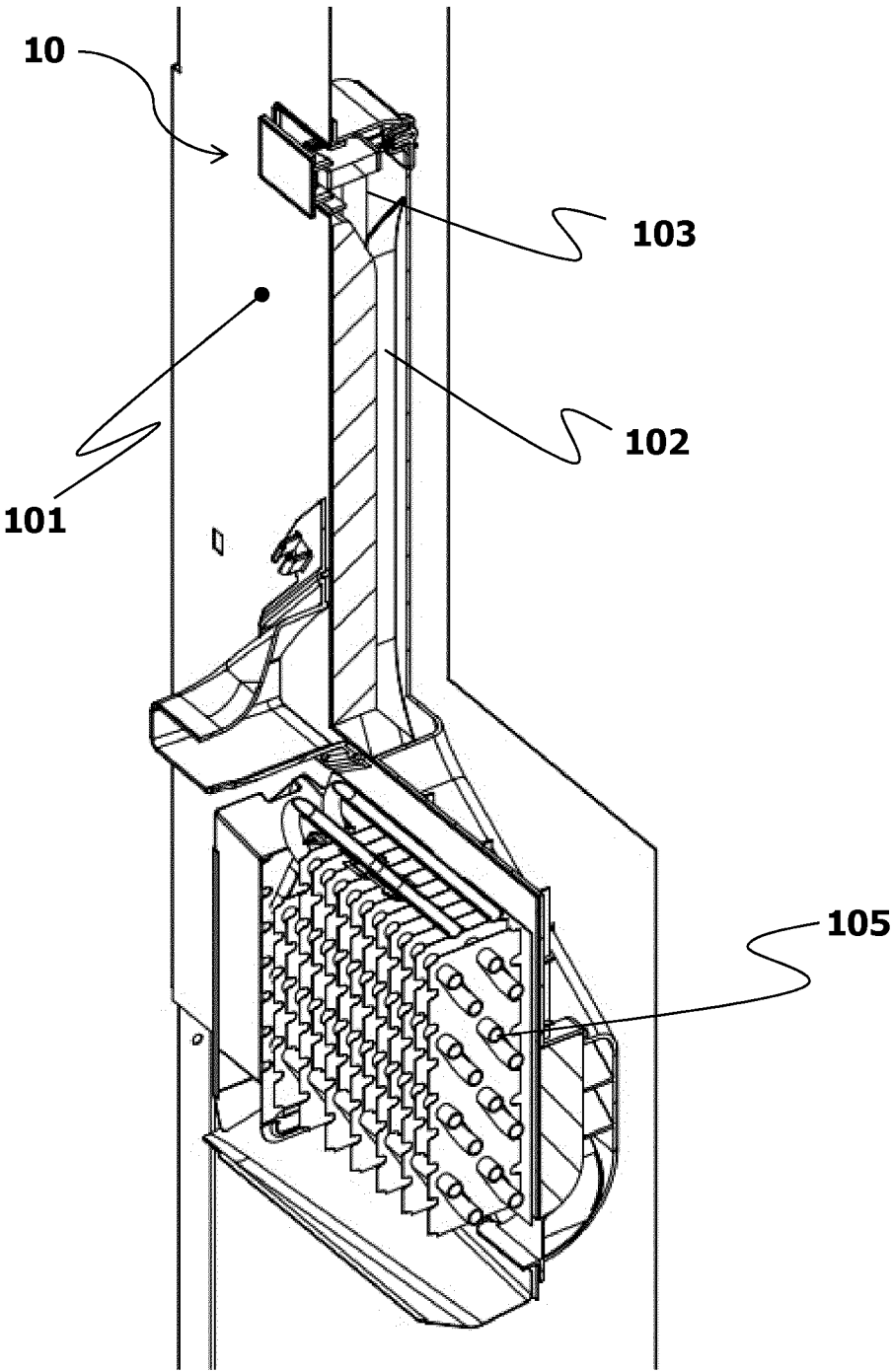


FIG. 10

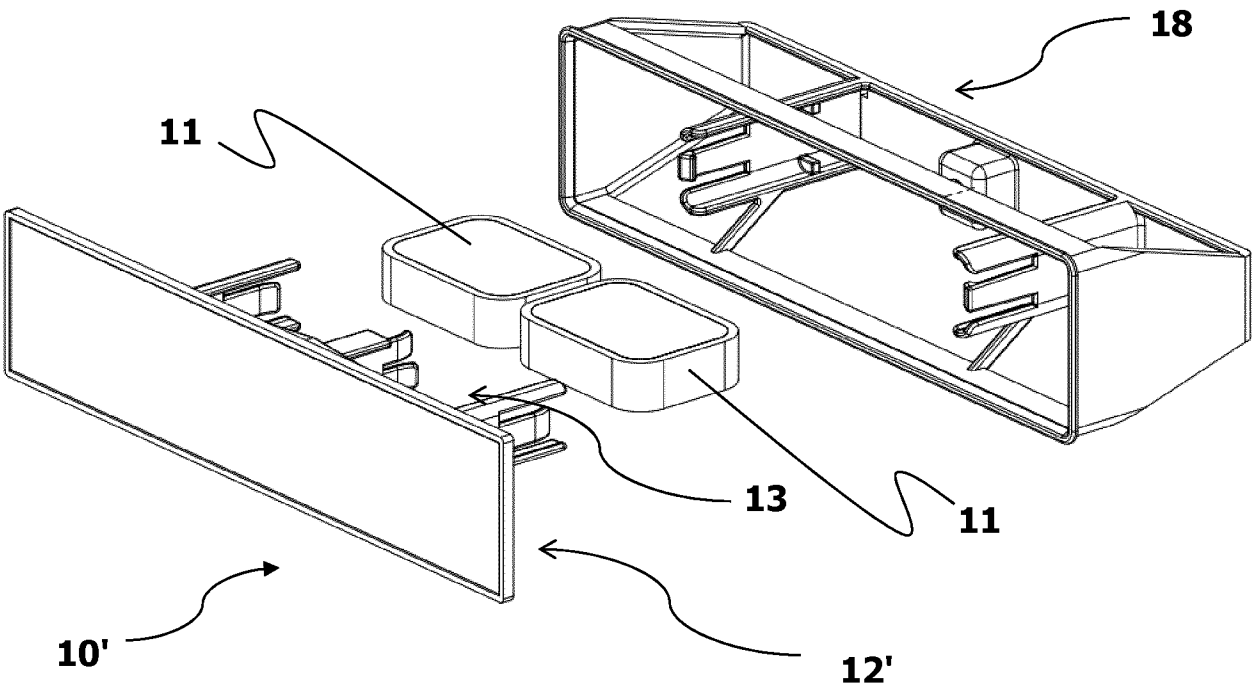


FIG. 11

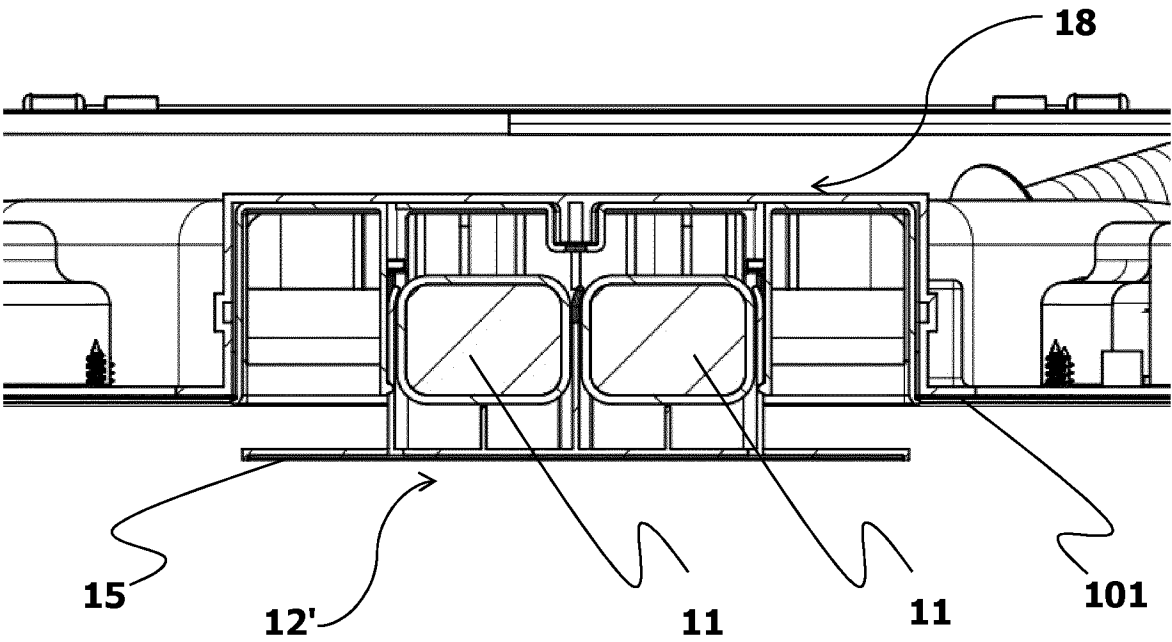


FIG. 12

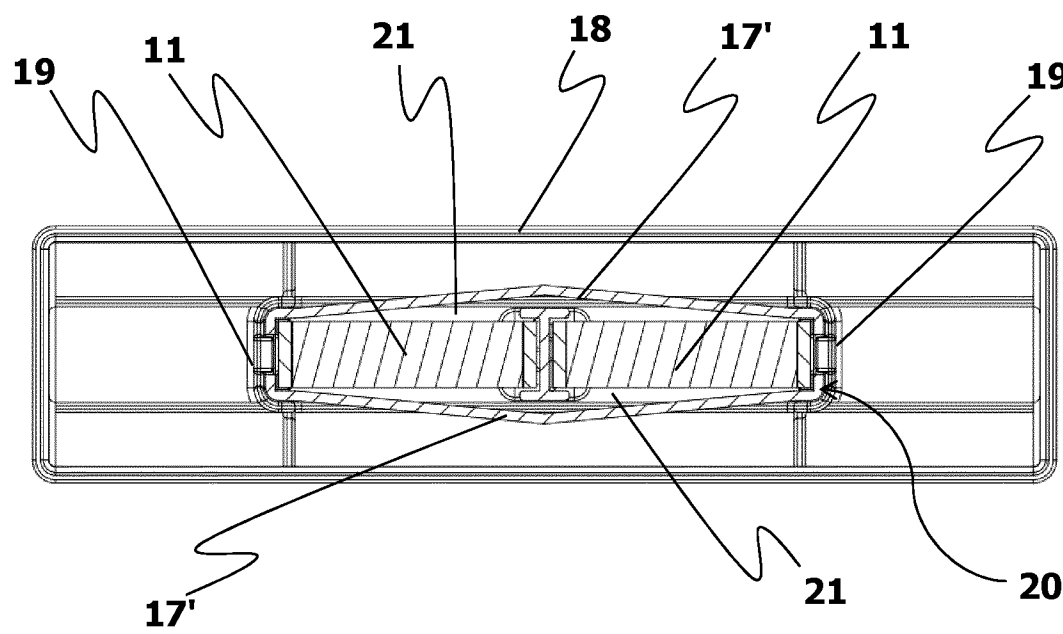


FIG. 13

INTERNATIONAL SEARCH REPORT

International application No
PCT/EP2023/083810

A. CLASSIFICATION OF SUBJECT MATTER INV. F25D17/06 F25D17/04 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		
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 S61 228281 A (HITACHI LTD) 11 October 1986 (1986-10-11) figures 1-3 -----	1-5, 15
X	EP 2 476 979 A2 (SAMSUNG ELECTRONICS CO LTD [KR]) 18 July 2012 (2012-07-18) figures 1-7 -----	1, 15
X	JP S62 162874 A (HITACHI LTD) 18 July 1987 (1987-07-18) figures 1, 2 -----	1, 15
A	KR 2021 0153988 A (LG ELECTRONICS INC [KR]) 20 December 2021 (2021-12-20) figures 1-13 -----	1-15
A	KR 2011 0085724 A (WINIAMANDO INC [KR]) 27 July 2011 (2011-07-27) figures 1-10 -----	1-15
☐ Further documents are listed in the continuation of Box C. ☒ See patent family annex.		
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Date of the actual completion of the international search		Date of mailing of the international search report
5 March 2024		15/03/2024
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INTERNATIONAL SEARCH REPORT

Information on patent family members

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