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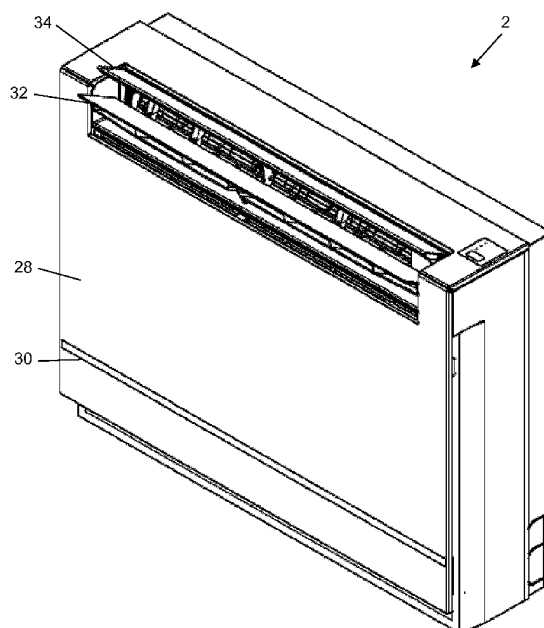
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(54) **AIR CONDITIONER WITH PLURAL VANES**

(57) An air conditioner (2) comprising a housing (4) including a heat exchanger (16) for heat exchanging air, an inlet (36) on a lower surface of the housing for receiving the air, an outlet (46) at an upper end of the housing for discharging the air, the outlet including at least a first vane (34) at a top surface (10) of the housing, and at least a second vane (32) at an upper front surface (6) of the housing, the vanes (34, 32) being selectively moveable between a closed position in which they are substantially continuous with the respective surfaces (10, 6) at which they are located, and an open position to allow air to be discharged from the outlet (46), the first and second vanes (34, 32) being opened to one or more predetermined angles for both cooling and heating operations.

Figure 2a



Description**Field of Invention**

5 **[0001]** The invention relates to an air conditioner, in particular an indoor floor-standing unit with plural vanes.

Background

10 **[0002]** Air conditioners are a type of equipment typically found in buildings to provide cool air to rooms and other spaces inside the building. There are many different types on the market, such as single unit air conditioners in which all the components are located within the housing, and split systems where some of the components are housed in an indoor unit, and others in an outdoor unit which is connected thereto.

15 **[0003]** Air conditioners typically include a compressor for pumping refrigerant around the system, compressing warm low pressure refrigerant to a high pressure hot refrigerant; a condenser for discharging the heat to the atmosphere by blowing air over the condenser's coils so that the refrigerant can be liquefied as it is cooled, an expansion valve for reducing the pressure of the liquefied refrigerant thereby expanding the refrigerant which reduces its temperature, and an evaporator in which air from the room is blown across the evaporator's coils containing the expanded refrigerant to cool the air, thereby absorbing the heat and warming the refrigerant before it is directed back to the compressor.

20 **[0004]** Thus the air conditioner circulates the refrigerant, absorbing heat from the air of a room and discharging it to the atmosphere, providing a heat exchange function through a series of phase changes. It will be appreciated that an air conditioner can be configured to provide cooled air or, in reverse, to provide heated air.

25 **[0005]** A known type of domestic air conditioner comprises a floor-standing unit which can be configured to provide cool air or hot air to a room, as for example described in EP2835586. However, such units are provided with louvres on the front panel for receiving air, which is not aesthetically pleasing, especially for a home environment in which they are typically used. In addition, the device typically uses separate vanes at the outlet for heating and cooling functions which means that the airflow is limited in each function by the other. For example, when the air conditioner is set to heating mode, a first vane on the front of the unit opens to direct heat air laterally only, and a second vane on the top of the unit is closed, preventing airflow in the top area of the unit. Similarly when the air conditioner is set to cooling mode, the second vane opens to direct cool air upwards only, and the first set of vanes is closed, preventing airflow in the front area of the unit.

30 **[0006]** An aim of the invention therefore is to provide an air conditioner which overcomes the above issues.

Summary of Invention

35 **[0007]** In an aspect of the invention, there is provided an air conditioner capable of cooling operation and heating operation, comprising:

40 a housing including a heat exchanger for heat exchanging air;
 an inlet at a lower surface of the housing for receiving the air;
 an outlet at an upper end of the housing for discharging the air;
 the outlet including at least a first vane at a top surface of the housing, and at least a second vane at an upper front surface of the housing, the vanes being selectively moveable between a closed position in which they are substantially continuous with the respective surfaces at which they are located, and an open position to allow air to be discharged from the outlet;
 45 characterised in that the first and second vanes are opened to one or more predetermined angles for both cooling and heating operations.

[0008] Advantageously the vanes are all in an open position regardless of whether the air condition is providing cool air or hot air, to maximise air flow therefrom.

50 **[0009]** In one embodiment the first and second vanes are selectively and independently moveable. Typically control means are provided to control the movement of the vanes in response to a user selection of a predetermined configuration.

[0010] In one embodiment the first vane can be opened within an approximate range of 0° to 40°, preferably 0° to 32° for cooling operation and within an approximate range of 5° to 40°, preferably 8° to 26° for heating operation.

55 **[0011]** In one embodiment the second vane can be opened within an approximate range of 90° to 130°, preferably 90° to 126° for cooling operation and within an approximate range of 60° to 130°, preferably 66° to 102° for heating operation.

[0012] Typically the vanes can be angled to direct air upwards or downwards, depending on the user's requirements.

[0013] In one embodiment the air conditioner comprises an air filter, and the front of the housing comprises a front

panel spaced apart from and concealing the air filter.

[0014] Air drawn into the air conditioner passes through the air filter to remove dust, hair and the like. Advantageously the front panel hides the air filter and other components so that the outward appearance of the air conditioner is aesthetically pleasing.

[0015] In one embodiment the front panel is provided with a slot, lateral opening or other inlet which allows air to be drawn therethrough into the air conditioner.

[0016] In one embodiment a further inlet is provided near the upper front part of the housing, parallel to the outlet and concealed by a second vane when the second vane is moved to the closed position.

[0017] Advantageously the further inlet allows more air to be drawn into the unit for conditioning by the heat exchanger.

[0018] In one embodiment the air conditioner comprises an air guide to direct air from the heat exchanger to the outlet.

[0019] In one embodiment the first vane can be moved to an angle such that it is substantially aligned with the air guide. Typically the second vane is substantially aligned with the air flow.

[0020] Advantageously this results in unimpeded air flow and allows the air to be directed further into the room.

[0021] In one embodiment the air conditioner is a floor-standing unit.

[0022] In a further aspect of the invention, there is provided an air conditioner comprising:

a housing including a heat exchanger for heat exchanging air;

an inlet on a lower surface of the housing for receiving the air;

an outlet at an upper end of the housing for discharging the air;

the outlet including at least a first vane at a top surface of the housing, and at least a second vane at an upper front surface of the housing, the vanes being selectively moveable between a closed position in which they are substantially continuous with the respective surfaces at which they are located, and an open position to allow air to be discharged from the outlet; and

an air filter through which the air passes from the inlet to the heat exchanger;

characterised by a front panel spaced apart from and concealing the air filter, and a further inlet between the outlet and front panel for receiving air, which is concealed when the second vane is in the closed position.

Brief Description of Drawings

[0023] It will be convenient to further describe the present invention with respect to the accompanying drawings that illustrate possible arrangements of the invention. Other arrangements of the invention are possible, and consequently the particularity of the accompanying drawings is not to be understood as superseding the generality of the preceding description of the invention.

Figure 1 illustrates an air conditioner according to an embodiment of the invention in which the vanes are in the closed position: (a) perspective view; (b) front view; (c) top view; (d) side view; (e) cross-sectional side view.

Figure 2 illustrates an air conditioner according to an embodiment of the invention in which the vanes are in the open position and directing airflow upwards: (a) perspective view; (b) front view; (c) top view; (d) side view; (e) cross-sectional side view (f) enlarged partial cross-sectional side view of the top of the air conditioner.

Figure 3 illustrates an air conditioner according to an embodiment of the invention in which the vanes are in the open position and directing airflow downwards: (a) perspective view; (b) front view; (c) top view; (d) side view; (e) cross-sectional side view (f) enlarged partial cross-sectional side view of the top of the air conditioner.

Detailed Description

[0024] With regard to Figures 1a-e there is illustrated a floor-standing unit 2 of an air conditioner according to an embodiment of the invention comprising a housing 4, a heat exchanger 16, air guides 18, 20, a fan 22, an air filter 24 and a drain pan 26.

[0025] The housing comprises a front portion 6, back portion 8, top portion 10, bottom portion 12, and side portions 14. The front portion 6 comprises a front panel 28 for concealing components of the unit 2 such as the air filter 24 but does not extend completely to the bottom of the unit 2, leaving a gap for airflow into the unit 2. The front panel 28 also includes a horizontal slot 30 towards the lower side through which air enters the unit 2.

[0026] First and second vanes 34, 32 are provided on the front panel 28 and top portion 10 respectively, and form a substantially continuous surface with the rest of the housing when closed as depicted.

[0027] It should therefore be appreciated that when not in use, the appearance of the air conditioner unit 2 is minimalist, which is aesthetically pleasing compared to prior art units where internal vanes, louvres and/or other components are

visible when the unit is not in use.

[0028] With reference to Figures 2a-f, the same air conditioner is illustrated as in figures 1a-e but where the vanes 34, 32 are open in the maximised 'up' position.

[0029] Air is drawn into the housing via lower inlet 36, between the lower edge of the panel 28 and the bottom portion 8, as well as slot 30 and upper inlet 38, simultaneously as indicated by respective arrows A1, A2, A3 representing airflow.

[0030] The air passes through the air filter 24 and to the heat exchanger 16 where it is heated or cooled depending on the user's requirements.

[0031] The conditioned air is then directed via an air guide 20 to an outlet 46 in the upper front surface of the housing where it is discharged by action of the fan 22 as airflow B1 and B2. The drain pan 26 collects any condensation water which is formed.

[0032] The vanes 34, 32 can be rotated about a longitudinal axis to vary the airflow. It is of particular note that in the maximum 'up' position as illustrated, the first vane 34 is aligned with the air guide 20 to form a substantially continuous surface therefore maximising the distance that the air will travel therefrom. This unimpeded airflow is advantageous compared to prior art units where the vanes are not aligned and instead act as baffles, disrupting the airflow.

[0033] With reference to Figures 3a-f, the same air conditioner is again illustrated as in figures 1a-e but this time where the vanes 34, 32 are open in the 'down' position (and maximised for distributing heated air in Figure 3f).

[0034] In this configuration, there is airflow A11, A12 and A13 through the lower inlet 36, slot 30, and upper inlet 38 respectively as before, but the conditioned air is directed by the first and second vanes 34, 32 as a downwards direction airflow B11. The first vane 34 is closed to form part of the top surface of the unit 2, and the second vane 32 is angled downwards.

[0035] The angles of the first and second vanes 34, 32 are optimised for both heating and cooling operations, which has the advantage that the mechanism is simplified as separate vanes for the different operations are not required, unlike the prior art. In addition, airflow is maximised as the same space is used for airflow whether it is heating or cooling operation, whereas in the prior art a portion of the airflow space is dedicated to heating whereas a different portion is dedicated to cooling.

[0036] The first vane 34 can be opened within an approximate range of 0° to 40°, preferably 0° to 32°, for cooling operation and within an approximate range of 5° to 40°, preferably 8° to 26°, for heating operation. The second vane can be opened within an approximate range of 90° to 130°, preferably 90° to 126° for cooling operation and within an approximate range of 60° to 130°, preferably 66° to 102° for heating operation.

[0037] Control means (not shown) are provided to set the vane positions at 5 sets of angles for each of the heating and cooling operations, as set out in Table 1 below:

Table 1

Position	Cooling		Heating	
	1 st vane	2 nd vane	1 st vane	2 nd vane
Step 1 (max up)	32°	126°	26°	102°
Step 2	29°	110°	22°	93°
Step 3	26°	102°	18°	84°
Step 4	13°	96°	14°	75°
Step 5 (max down)	0°	90°	8°	66°

[0038] The angle of the first vane 34 is with reference to its horizontal closed position, and similarly the angle of the second vane 32 is with reference to its vertical closed position.

[0039] In the maximum up position the first vane 34 is aligned with the air guide 20, and the second vane 32 is similarly aligned to be parallel to the air flow being directed by the air guide 20, to maximise the distance the air travels from the unit 2.

[0040] In the maximum down position, for cooling operation the first vane 34 is closed and the second vane 32 is substantially horizontal i.e. parallel to the floor, so as to direct cool air laterally. For heating, the first vane 34 is opened slightly and the second vane 32 directs the air at a downwards angle, since hot air rises, to maximise the heating effect.

[0041] When not in use the vanes 34, 32 are closed to form part of a substantially continuous surface.

[0042] Advantageously not only is the cosmetic appearance improved by the unit 2, but energy consumption is also reduced.

[0043] In operation, when the air conditioner is operated, the second vane 32 rotates to the angle for the selected step, then after a few seconds the first vane 34 rotates to the angle for the selected step.

[0044] If a different step is selected, both vanes 34, 32 rotate at the same time to the respective angles for the selected

step

[0045] When the air conditioner is shut down, the first vane 34 rotates to the fully open position, the second vane 32 rotates to its closed vertical position after a few seconds, and then the first vane 34 moves to its horizontal closed position.

[0046] As the unit 2 has multiple inlets in the form of lower inlet 36, slot 30, and upper inlet 38, the size of the front panel is large enough to conceal the inside of the unit 2 without significantly affecting the aesthetic appearance thereof.

[0047] It will be appreciated by persons skilled in the art that the present unit may also include further additional modifications made to the unit which does not affect the overall functioning of the unit.

Claims

1. An air conditioner (2) capable of cooling operation and heating operation, comprising:

a housing (4) including a heat exchanger (16) for heat exchanging air;
 an inlet (36) at a lower surface of the housing for receiving the air;
 an outlet (46) at an upper end of the housing for discharging the air;
 the outlet including at least a first vane (34) at a top surface (10) of the housing, and at least a second vane (32) at an upper front surface (6) of the housing, the vanes (34, 32) being selectively moveable between a closed position in which they are substantially continuous with the respective surfaces (10, 6) at which they are located, and an open position to allow air to be discharged from the outlet (46);
characterised in that the first and second vanes (34, 32) are opened to one or more predetermined angles for both cooling and heating operations.

2. The air conditioner according to claim 1 wherein a further inlet is provided near the upper front of the housing, parallel to the outlet and concealed by a second vane when the second vane is moved to the closed position.

3. The air conditioner according to claim 1 or 2 comprising an air guide for directing air from the heat exchanger to the outlet, the first vane being moveable to an angle such that it is substantially aligned with the air guide.

4. The air conditioner according to any preceding claim wherein the first vane can be opened within an approximate range of 0° to 40° for cooling operation and within an approximate range of 5° to 40° for heating operation.

5. The air conditioner according to any preceding claim wherein the second vane can be opened within an approximate range of 90° to 130° for cooling operation and within an approximate range of 60° to 130° for heating operation.

6. The air conditioner according to any preceding claim comprising an air filter, the front of the housing comprising a front panel spaced apart from and concealing the air filter.

7. The air conditioner according to claim 6 wherein the front panel is provided with a slot, lateral opening or other inlet which allows air to be drawn therethrough into the air conditioner.

8. The air conditioner according to any preceding claim wherein the air conditioner is a floor-standing unit.

9. An air conditioner (2) comprising:

a housing (4) including a heat exchanger (16) for heat exchanging air;
 an inlet (36) on a lower surface of the housing for receiving the air;
 an outlet (46) at an upper end of the housing for discharging the air;
 the outlet including at least a first vane (34) at a top surface (10) of the housing, and at least a second vane (32) at an upper front surface (6) of the housing, the vanes (34, 32) being selectively moveable between a closed position in which they are substantially continuous with the respective surfaces (10, 6) at which they are located, and an open position to allow air to be discharged from the outlet (46); and
 an air filter (24) through which the air passes from the inlet to the heat exchanger;
characterised by a front panel (28) spaced apart from and concealing the air filter, and a further inlet (38) between the outlet (46) and front panel (28) for receiving air, which is concealed when the second vane (32) is in the closed position.

10. The air conditioner according to claim 9 wherein the front panel is provided with a slot or lateral opening which allows

air to be drawn therethrough into the air conditioner.

11. The air conditioner according to claim 9 or 10 wherein an air guide is provided for directing air from the heat exchanger to the outlet, the first vane being moveable to an angle such that it is substantially aligned with the air guide.

12. The air conditioner according to any of claims 9-11 wherein the first and second vanes are opened to one or more predetermined angles for both cooling and heating operations.

Figure 1a

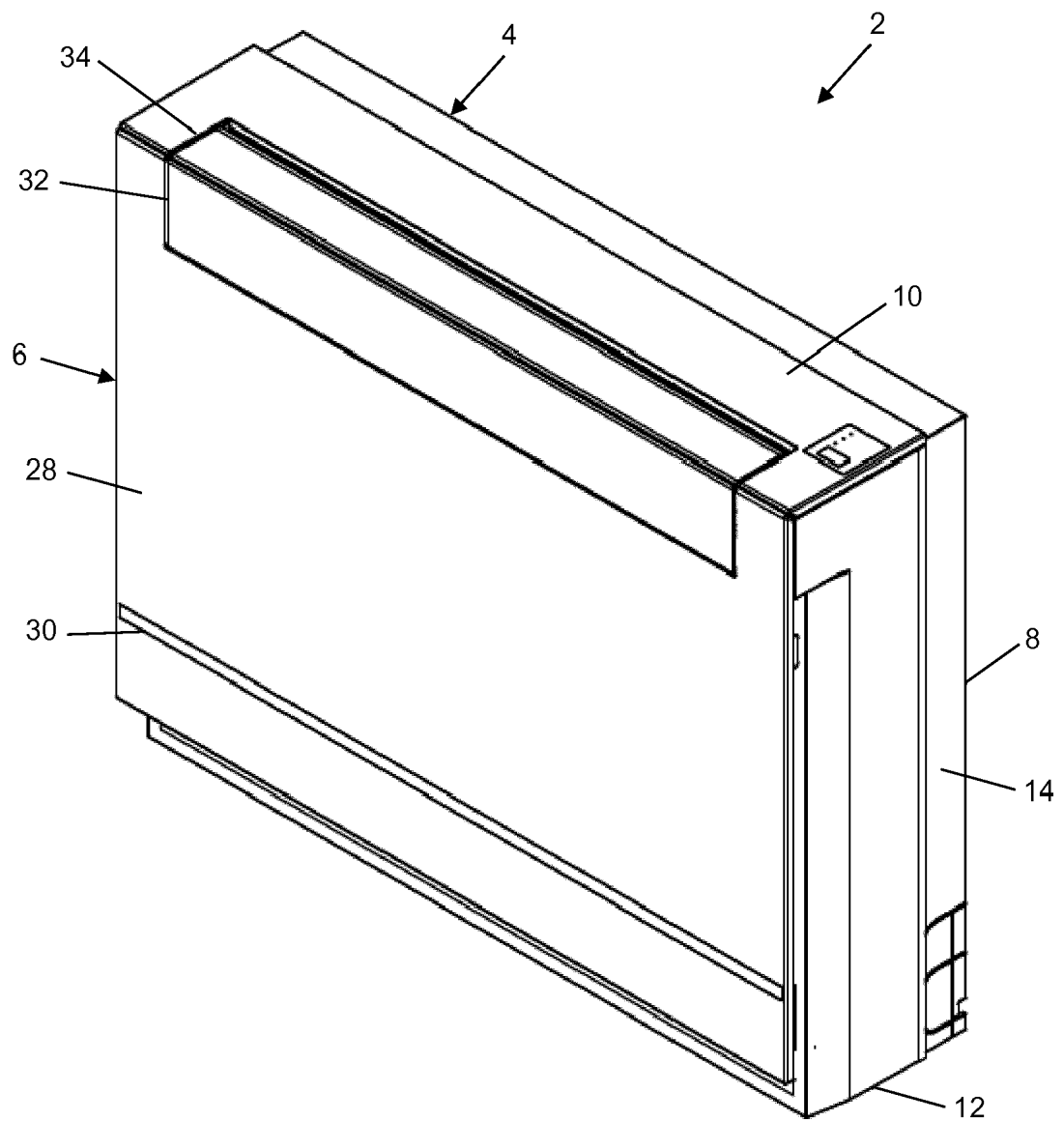


Figure 1b

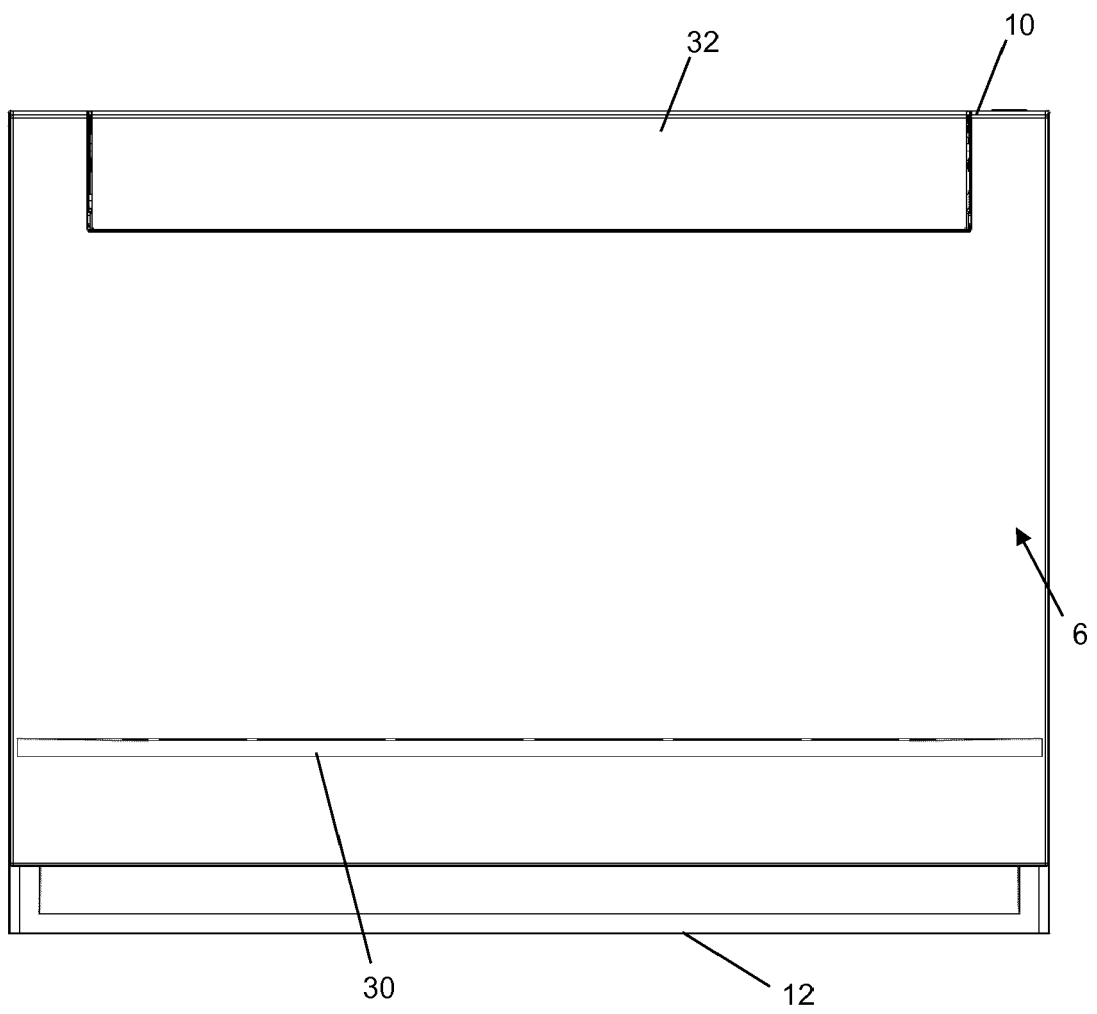


Figure 1c

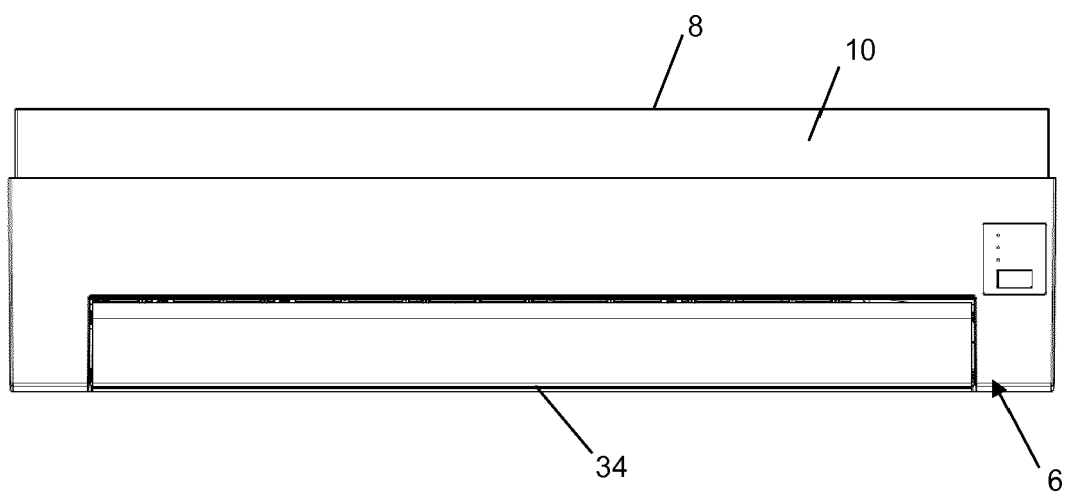


Figure 1d

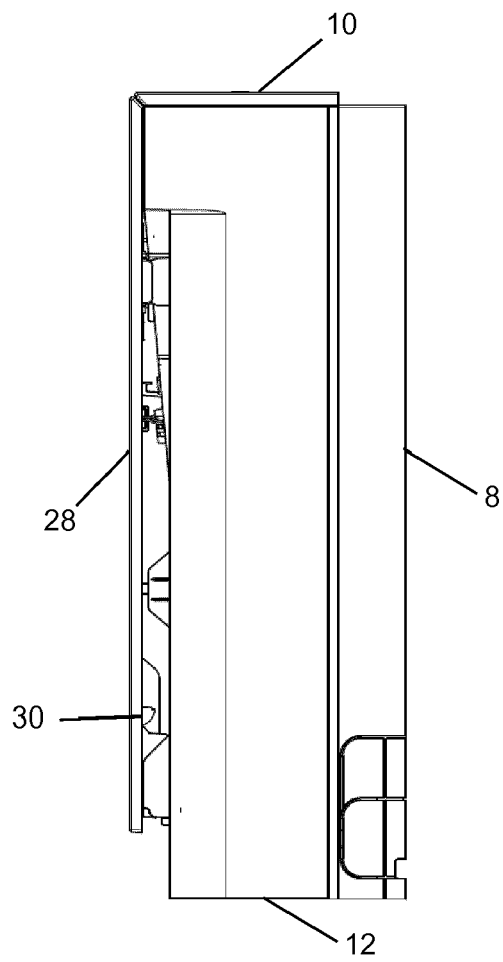


Figure 1e

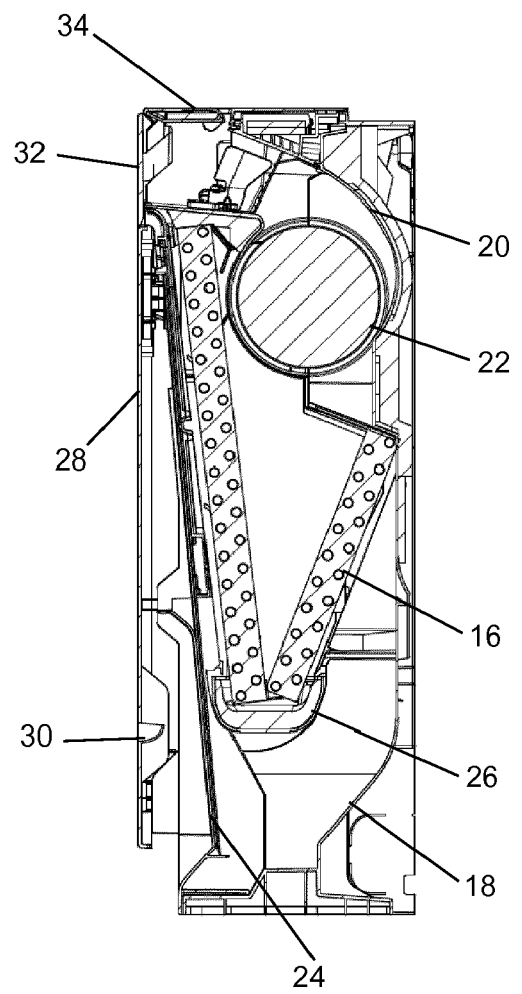


Figure 2a

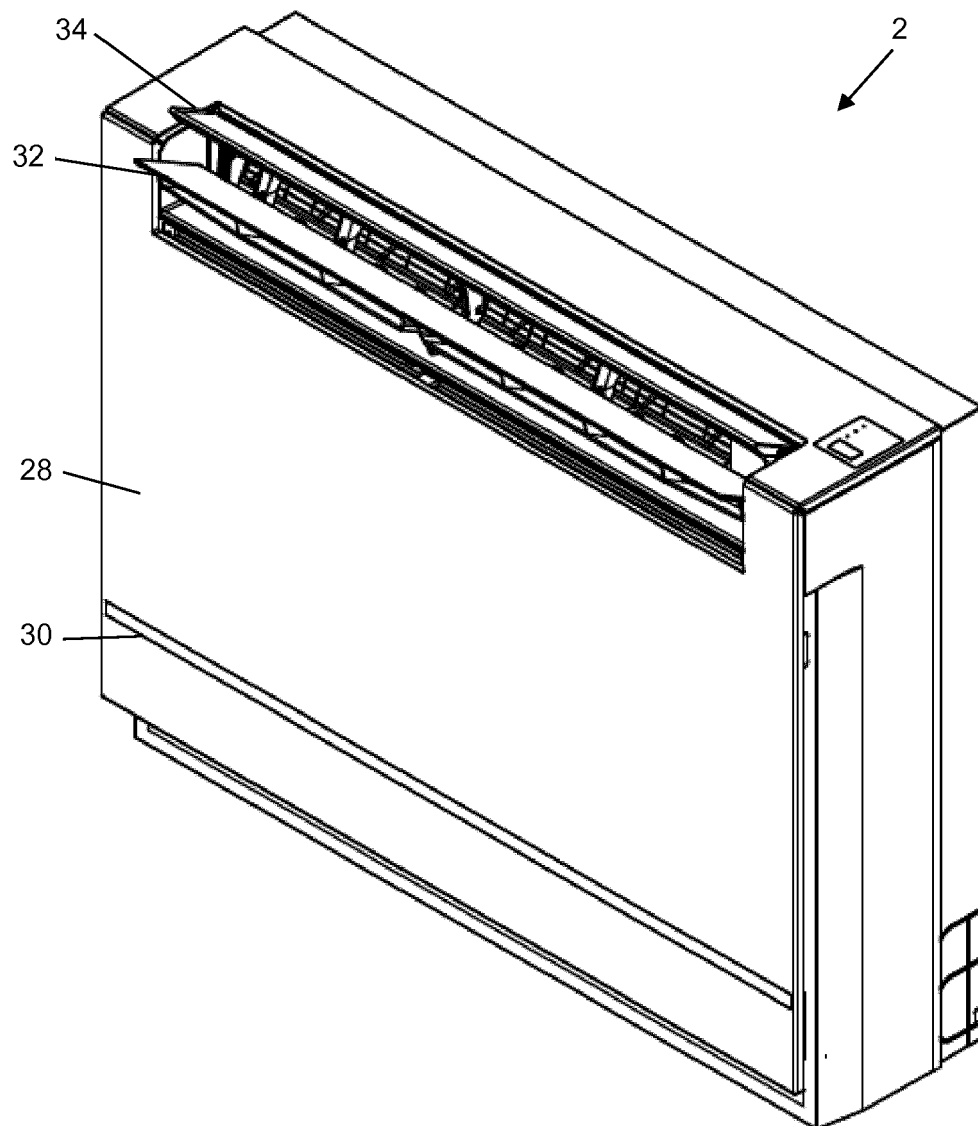


Figure 2b

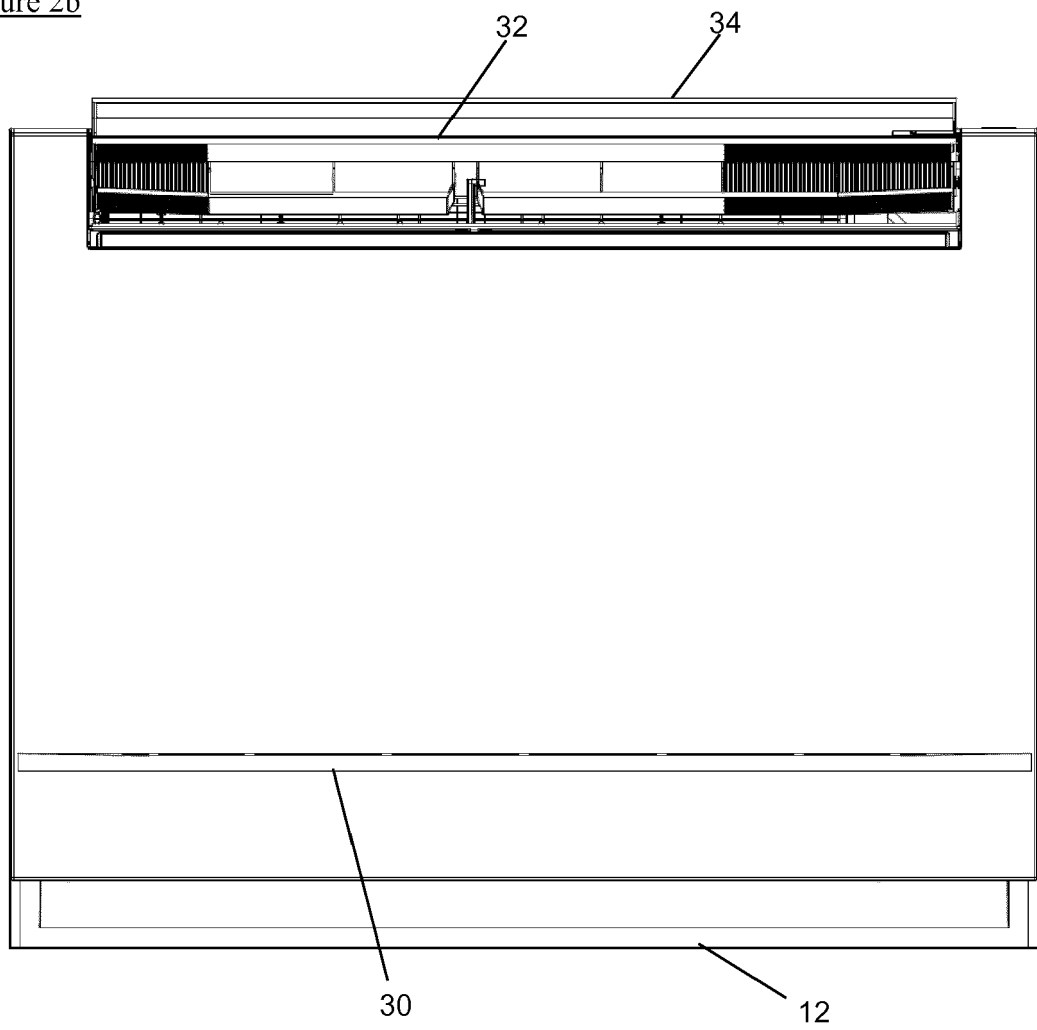


Figure 2c

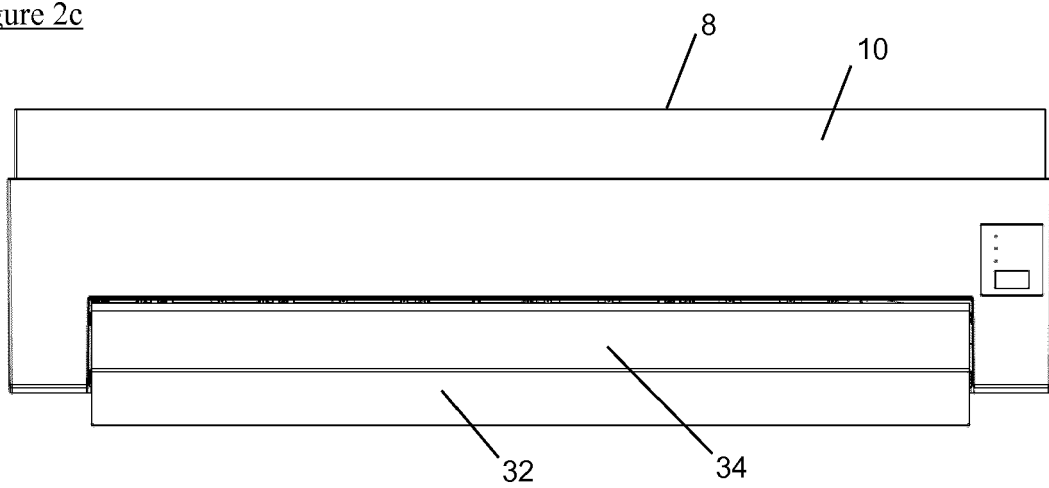


Figure 2d

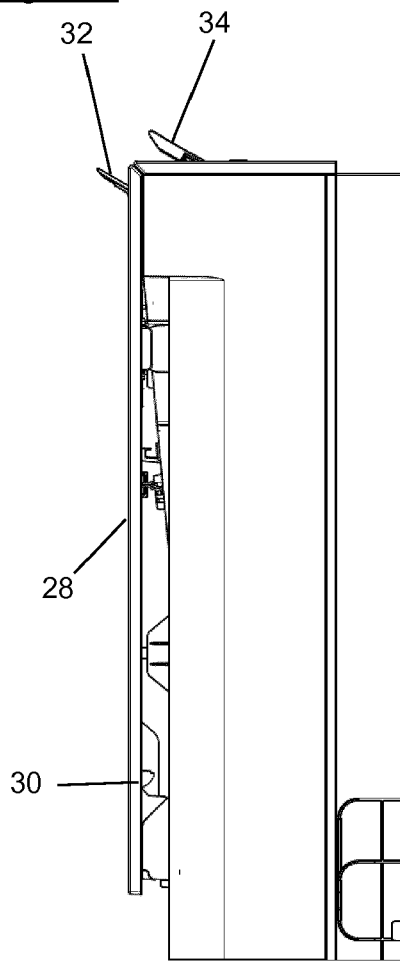


Figure 2e

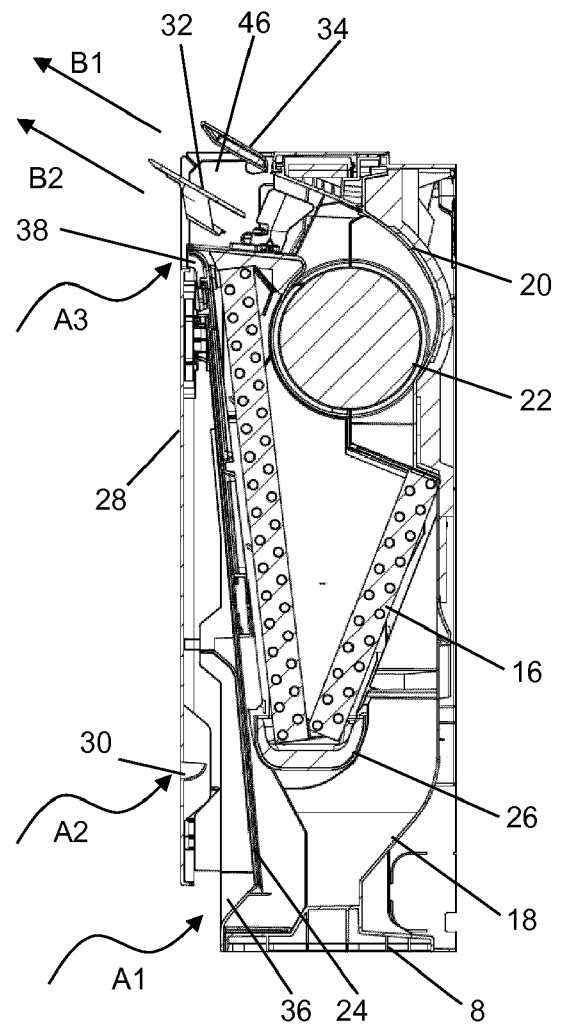


Figure 2f

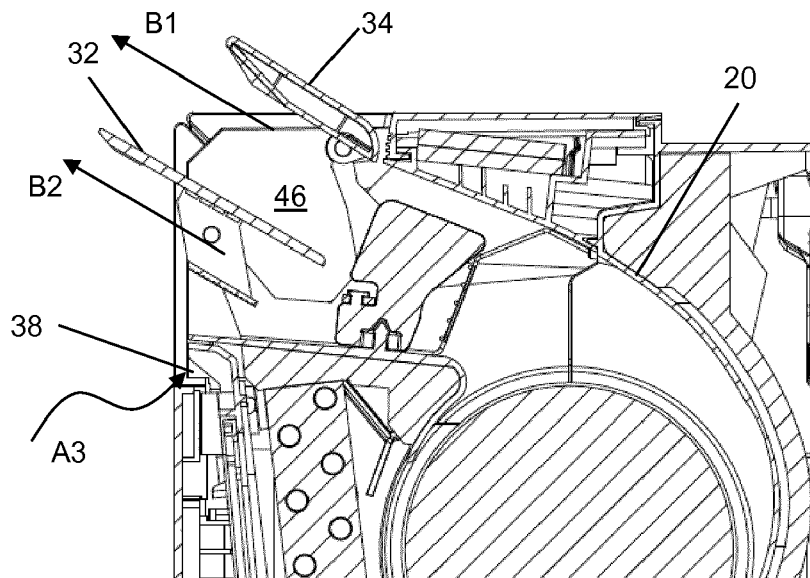


Figure 3a

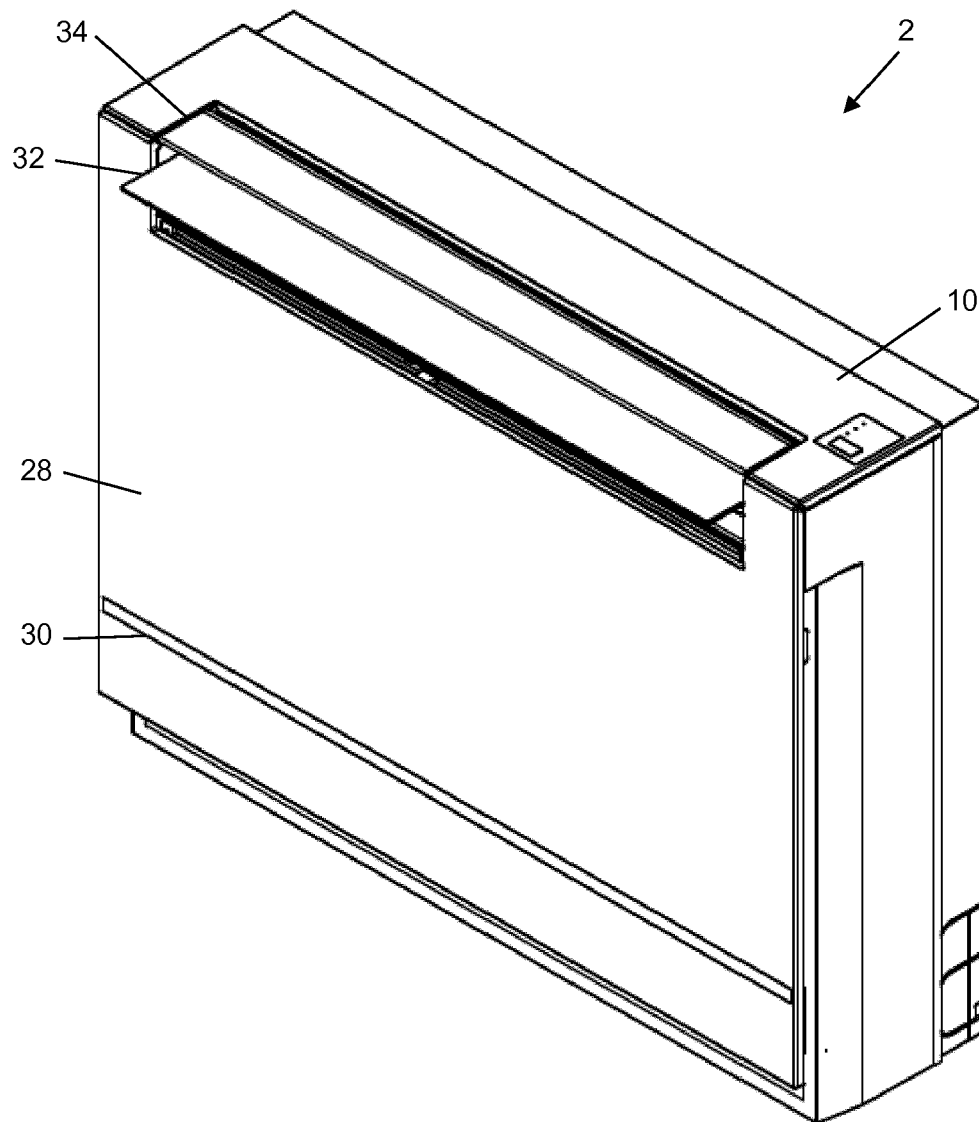


Figure 3b

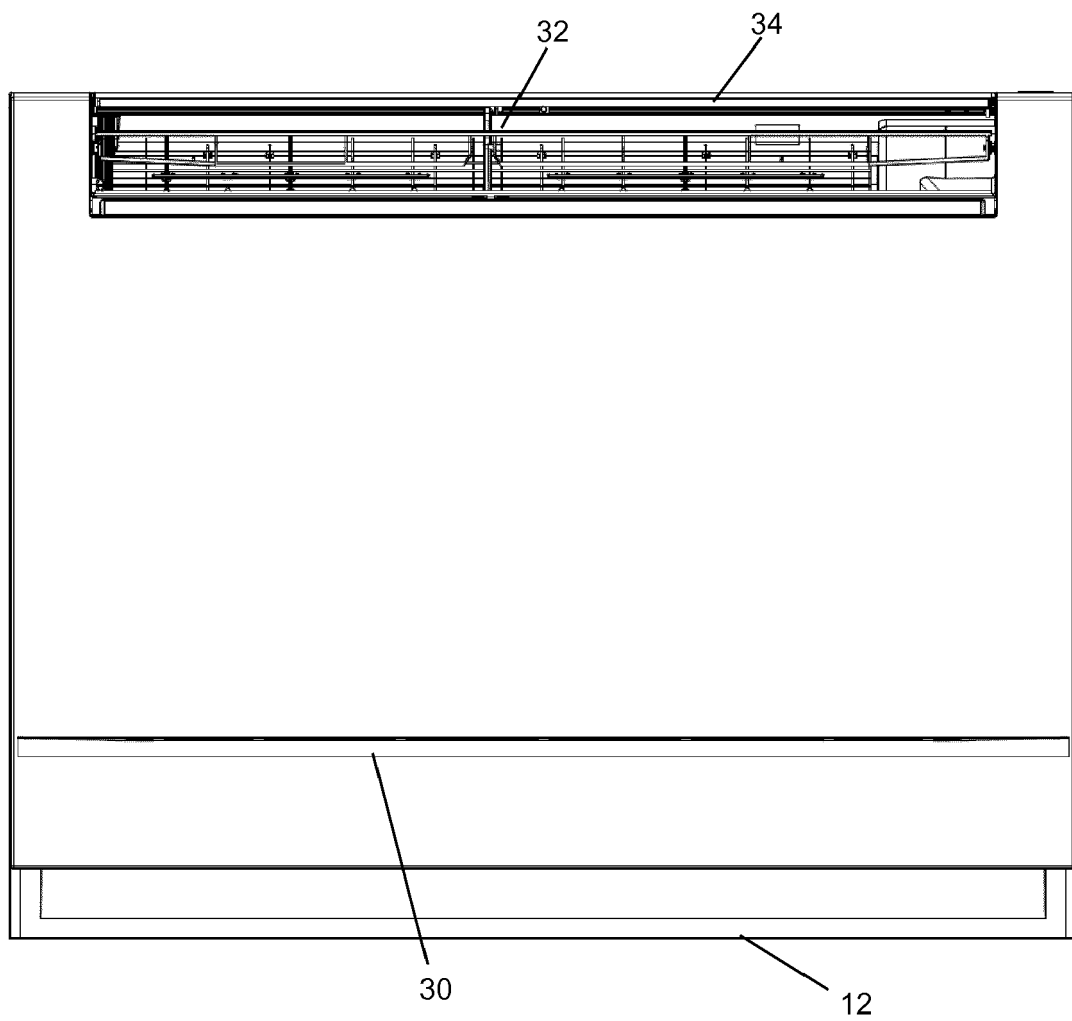


Figure 3c

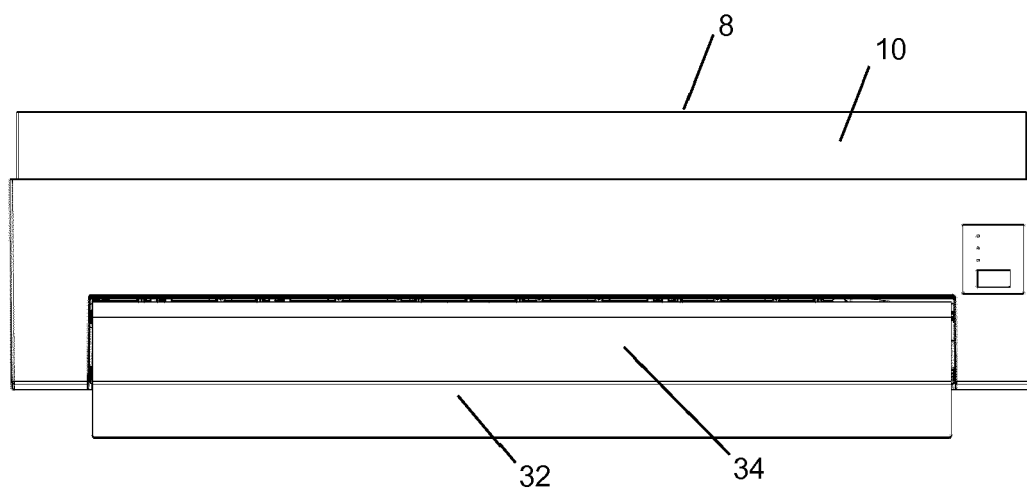


Figure 3d

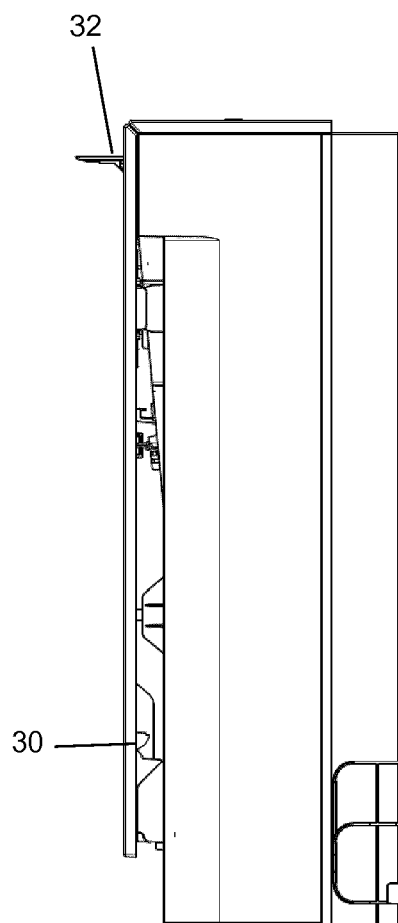


Figure 3e

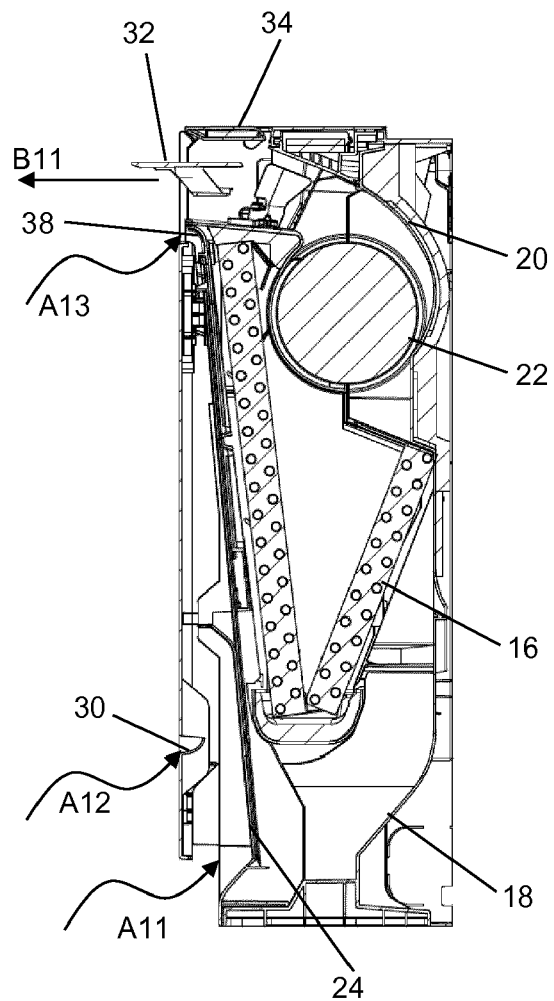
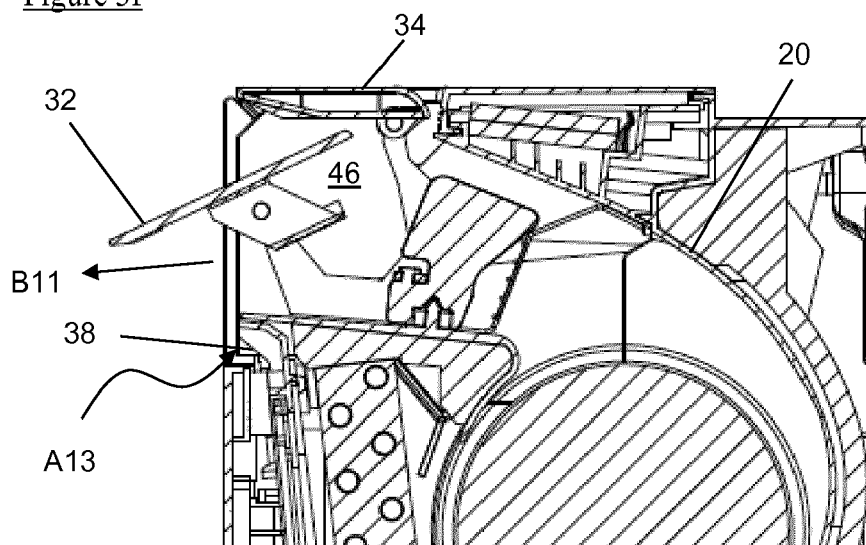


Figure 3f





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Place of search Munich		Date of completion of the search 1 June 2018	Examiner Mattias Grenbäck
CATEGORY OF CITED DOCUMENTS X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document		T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons & : member of the same patent family, corresponding document	

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**ANNEX TO THE EUROPEAN SEARCH REPORT
ON EUROPEAN PATENT APPLICATION NO.**

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