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(54)

SUPPORT ASSEMBLY

- (57)

Support assembly (1) for a heating device (2), in particular for a heat pump, the heating device (2) having a heat exchanger (3) and at least a fan element (4) arranged in an internal space (5) of the heating device (2), the support assembly (1) comprising an air duct structure (7) forming an air duct (8) extending from the heat exchanger (3) to the fan element (4), wherein the air duct structure (7) comprises fixing means (9) for fixing at least a covering plate (10) to the air duct structure (7) of the support assembly (1).

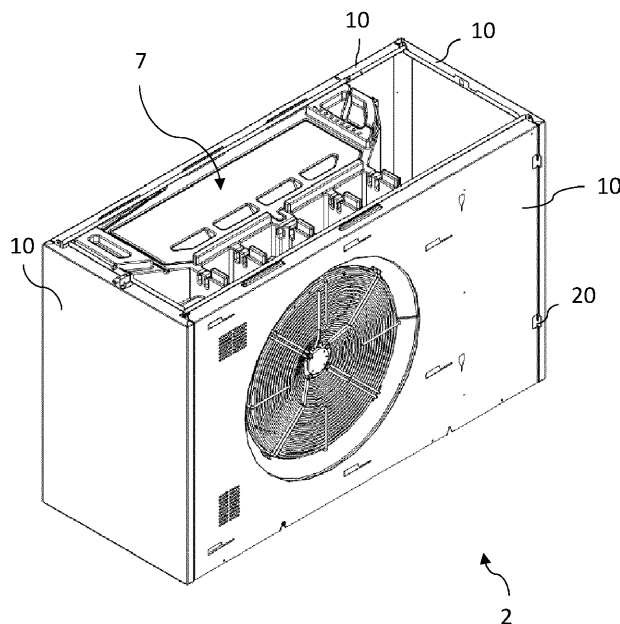


FIG. 2B

Description

[0001] The invention relates to a support assembly for a heating device, in particular for a heat pump, and to a heating device comprising said support assembly. Also, the invention relates to a heating system comprising the heating device and a use of said support assembly in a heat pump unit, in particular an outdoor heat pump unit.

[0002] A heating device like a heat pump is a device able to transfer heat. In particular, the heating device can be used to vary the temperature in a closed space of a building or to warm domestic hot water by transferring thermal energy from a fluid to another. This is obtained using a refrigeration cycle carried out in the opposite direction of the heat transfer.

[0003] Heat pumps usually have outdoor units built with a structure of panels forming an outer casing and functional elements positioned inside. These panels serve to protect the functional elements and are attached to the product on structural members, usually made of metal (e.g. steel). Several types of metal structural members (made of aluminium and/or stainless steel) can be taken into account, such as specific studs for this function, component supports such as evaporator frames or fan mounts, casing containing the electrical components, heat exchanger, etc.. In doing so, at least two opposing panels are attached directly to the product structure. The other two or more panels are attached directly to the structure or attached to these panels. However, the standard configurations of the casings of outdoor units are not the most efficient solutions for practical purposes. As a matter of fact, the assembly of the panels can be cumbersome due to a considerable numbers of components. Also, the use of parts made of steel can increase the noise of the unit during operation due to vibration between steel parts.

[0004] EP 3299741 B1 relates to an outdoor unit for an air-to-water heat pump for transferring heat from the ambient air to a heat transfer medium by means of a heat exchanger and a fan. According to a configuration, the fan is held by a fan support with a support structure made of foamed plastic, in order to keep vibrations of the fan away from the housing or the substructure. Although solving the problem of noise reduction, the assembling/disassembling of different parts can be cumbersome, especially during a maintenance process.

[0005] It is therefore desirable to find a way to protect the functional elements of a heating device, such as an outdoor unit of a heat pump in a configuration that is easy to assemble and efficient in terms of maintenance and noise reduction.

[0006] The object is solved by a support assembly for a heating device, in particular for a heat pump, the heating device having a heat exchanger and at least a fan element arranged in an internal space of the heating device, the support assembly comprising an air duct structure forming an air duct extending from the heat exchanger to the fan element, wherein the air duct structure com-

prises fixing means for fixing at least a covering plate to the air duct structure of the support assembly.

[0007] Advantageously, the covering plates can be directly attached to an internal structure of the product, i.e. the air duct structure, through dedicated fixing means. The panels therefore are not attached to the functional components of the heating device. In this way, each panel can be easily attached to, and/or removed from, said internal structure thereby saving time during assembling and maintenance. Furthermore, since the fixing means are part of the air duct structure, the assembly can be simplified and the risk of losing screws is eliminated or strongly reduced. In addition, no obstructing structures are present. Therefore, the access to internal components is facilitated including the air duct structure itself but also other components or space required for maintenance tasks, such as fan, evaporator and air duct.

[0008] Advantageously, the shape of the air duct structure is such that the assembly on a metal frame can be provided quickly and without any specific tool.

[0009] According to an example, the fixing means comprise one or more protrusions placed on a portion of the air duct structure. In addition or in alternative, the fixing means comprise one or more slots placed on a portion of the air duct structure. In addition or in alternative, the fixing means comprise one or more hinging elements placed on a portion of the air duct structure. Using for example protrusions and/or slots, the parts of the product can have a waiting position by fixing the plates partially, i.e., without screwing the plates.

[0010] In one example, the air duct structure comprises an internal surface and an external surface, wherein the internal surface comprises smooth portions and the external surface comprises angular portions. The smooth portions are configured to promote air guidance while limiting air disturbances. The angular portions are configured for allowing the attachment of several parts, such as the covering plates and/or devices.

[0011] In another example, the air duct structure is made of plastic foam, in particular expanded polypropylene. Accordingly, the covering plates are attachable to a structure that is not made of a hard material such as steel, thereby reducing or avoiding noise due to vibrations. Also, this material is strong enough to withstand the stresses. The use of such an air duct structure also reduces the thickness of the panels as they no longer have to support the weight of the entire product. This reduces the consumption of steel material if the panels are made of steel. This also improves the ergonomics of assembling and disassembling the parts.

[0012] In examples, the support assembly further comprises a base element supporting the air duct structure. The base element can comprise base fixing means for fixing at least a covering plate to the support assembly. This can further facilitate the assembly of the covering plates. Also, to increase the strengths of the support assembly, the base element can be made of metal, in particular steel.

[0013] In examples, the air duct structure comprises at least a flush surface with the covering plate, in particular wherein the air duct structure has a cuboid shape. The external geometry of the air duct structure can have a flat surface allowing the support of external covering plates, especially on the areas parallel to the heat exchanger (evaporator) and the fan element.

[0014] In examples, the air duct structure comprises at least a top opening and an access hatch connectable to the top opening for accessing the air duct from outside. The access hatch can be a top hatch located on the superior part of the air duct structure to facilitate the access in the air duct region between the fan element and the heat exchanger. Also, the air duct structure can comprise a collecting and guiding element for collecting and guiding condensate, the collecting and guiding element having a curved portion and being provided with a through-hole. The curved portion can advantageously be a bowl shape. The collecting and guiding element is located for example below the heat exchanger (evaporator) and basically serves to collect and guide (through the curved shape and the through-hole) the condensate generated in the heat exchanger. In order to correctly place the collecting and guiding element relative to the base element of the support assembly, a surface of the collecting and guiding element comprises one or more base protrusions insertable in corresponding recesses of the base element.

[0015] In examples, the air duct structure comprises at least a screw hole for placing a screw. In particular, the air duct structure comprises a plurality of screw holes for temporarily placing (i.e. inserting) screws that are removed when the panels are dismantled for maintenance. In addition, the air duct structure can comprise a condensate drip tray, located for example below the heat exchanger (evaporator), for example below the collecting and guiding element.

[0016] In another example, the air duct structure is a one-piece element. In alternative, the air duct structure can comprise a plurality of components connectable to each other, wherein the air duct structure comprises in particular a top portion, a bottom portion connected to the top portion and a hatch panel connected to the top portion.

[0017] In another aspect of the invention, a heating device, in particular a pump unit, is provided, the heating device comprising the inventive assembly and at least a covering plate fixed to the fixing means of the support assembly to cover said support assembly.

[0018] In examples, the heating device comprises at least a single covering plate covering more than one sides of the support assembly. The single covering plate can have at least a corner and/or curved portion in order to cover two consecutive sides of the support assembly.

[0019] In examples, the heating device comprises at least a covering plate covering only one side, or a portion of one side, of the support assembly. One side of the support assembly can be covered by a plurality of cov-

ering plates arranged close to each other.

[0020] In another example, one or more covering plates can be directly fixable to the air duct structure. In this way, unnecessary parts are eliminated and the number of parts is optimized.

[0021] In additional examples, the heating device comprises one or more shielding elements covering one or more covering plates. The shielding elements can be used to additionally protect some regions of the heating device, such as for example at the fan element or for reinforcing other regions of the heating device, such as for example the lateral sides.

[0022] In examples, the heating device comprises at least a first covering plate and a second covering plate, wherein the first covering plates is fixable to the support assembly and the second covering plate is fixable to the first covering plate. For example, once two plates (e.g., the front and the back plates) are fixed to the air duct structure using the fixing means present on the air duct structure, other two covering plates (e.g., the lateral plates) can be engaged to the already fixed plates with a suitable fixing system. In particular, the first covering plate and/or the second covering plate can comprise a hooking system for fixing the second covering plate to the first covering plate.

[0023] In a further aspect of the invention, a heating system is provided. The heating system further comprises at least a hydraulic element, a frigorific element, and/or an electrical element, wherein said hydraulic element, said frigorific element, and/or an electrical element is mounted on the air duct structure. In other words, the air duct structure (or rather a portion of the air duct structure) can also be used as a mounting interface for other elements, such as supports for hydraulic/frigorific elements (expansion vessel, piping, pumps, heater, heat exchanger etc...) or for electrical elements (wire support, support for an electrical box) etc... The air duct structure can also be used as a support for refrigerant components, such as the evaporator, as well as a drain box for condensate under the evaporator. This also reduces the vibrations that can be transmitted between the heat pump components and the installation site.

[0024] In a still another aspect of the invention, a use of the inventive support assembly is provided. The inventive support assembly is used in a heat pump unit, in particular an outdoor heat pump unit.

[0025] In the figures, the subject-matter of the invention is schematically shown, wherein identical or similarly acting elements are usually provided with the same reference signs.

Figure 1A-B show a perspective view of the support assembly according to an example.

Figures 2A-B show a perspective view of the support assembly coupled to covering plates according to an example.

Figures 3A-D show a perspective view of the support assembly and details coupled to covering plates and shielding elements according to an example.

Figures 4A-C show the support assembly coupled to covering plates according to different perspective views.

Figures 5A-C show the arrangement of covering plates according to different perspective views.

Figures 6A-B show a perspective view of the support assembly and of the collecting and guiding element according to an example.

[0026] Figures 1A and 1B illustrate the support assembly 1 for a heat pump unit. The assembly 1 can be coupled to a heating device 2, for example a heat pump water heater. The support assembly 1 comprises an air duct structure 7 for guiding the air flow from a heat exchanger such as an evaporator 3, which absorbs heat and modifies a fluid in a gas/vapor form at a lower temperature and low pressure, to at least a fan element 4. The air flow is guided in an air duct 8 placed between the heat exchanger 3 and the fan element 4. In the figures, only one fan element 4 is represented. However, the assembly 1 can be suitable for any number of fan elements 4 coupled to the evaporator 3. The evaporator 3 is crossed by an air circulating path. The air is conducted from the evaporator 3 to the fan element 4 and then outside the heating device 2. In particular, the heating device 2 is a heat pump, and the evaporator 3 and the fan element 4 are arranged in an internal space 5 of the device 2.

[0027] The assembly 1 and in particular the air duct structure 17 is made of a polymeric material, in particular of foam plastic, more particularly of polypropylene expanded (PPE). It is noted that the air duct structure 17 comprises a top portion 16, a bottom portion 17 connected to the top portion 16. This facilitates the access to the internal functional components of the heating device 2. Figure 1B shows a support assembly 1 without the top portion 16 of the air duct structure 17. It is noted that the air duct structure 17 serves to guide air flow from the evaporator 3 to the fan element 4. However, as illustrated in more detail in the following figures, the air duct structure 17 serves at the same time as a support structure for placing covering plates 10. For this purpose, the air duct structure 17 is provided with fixing means 9. For example, figure 1A shows a plurality of protrusions 9 arranged on the upper surface of the top portion 16 of the air duct structure 17. These protrusions 9 work as fixing means when engaged with corresponding slots 19 provided in the covering plate 10.

[0028] The coupling between covering plates 10 and the support assembly 1, in particular the air duct structure

7, is shown in figures 2A and 2B. In figure 2A, two covering plates 10 are fixed to the air duct structure 7 thanks to an engagement between protrusions 9 present on the upper region of the air duct structure 7 and corresponding slots 19 present on the upper region of the covering plate 10. It is noted that the covering plates are fixable to the air duct structure 7 without being necessarily in contact with the fan element 4 and/or the evaporator 3. The covering plates 10 serve as protection of the elements housed in the air duct structure 7. Accordingly, the covering plate 10 can be shaped based on their arrangement. For example, the covering plate 10 at the fan element 4 can be provided with an aperture, in particular a circular aperture, for the passage of the air flow. On the other hand, the covering plate 10 at the evaporator 3 can be a grid surface (see figure 4A). In figure 2B, other two covering plates 10 are fixed to the support assembly 1. These are lateral plates and are not fixed to the air duct structure 7 but rather to the other covering plates 10 (front and back plates) through a hooking system 20. After placing all the plates 10, the internal functional components of the heating device 2 are surrounded by the plates 10 and are therefore protected from outside.

[0029] Figures 3A-3D illustrate the passages from a disassembled configuration (Fig. 3A) to an assembled configuration (Fig. 3D). It is noted that additionally, the support assembly 1 comprises a base element 6 on which the air duct structure 7 and hence the functional components of the device 2 are arranged. These figures also show the presence of shielding elements 11 that serve to further protect or reinforce parts of the device 2 and for water sealing. The shielding elements 11 cover the covering plates. In particular, a shielding element 11 can be placed to cover the covering the front plate, i.e. the plate 10 located at the fan element 4. In this way, a screen grid structure can be placed in front of the circular aperture. Another shielding element 11 can cover a lateral covering plate 10 in order to increase the lateral strengths of the support assembly 1.

[0030] Figures 4A-C show details regarding the assembling of the covering plate 10. In particular, figure 4A shows that the back plate 10, i.e. the covering plate 10 at the evaporator's side, has a grid structure in order to facilitate the passage of air. As already mentioned, the covering plate 10 is fixable to the air duct structure 7 thanks to the engagement of protrusions 9 and slots 19. In addition, it is noted that the base element 6) comprises base fixing means 18 for fixing the covering plate 10 to the support assembly 1. Specifically, the panel 10 can be first mounting on the base fixing means 18 (for example a hinge structure) before turning it and putting in front of the protrusions 9 for a final engagement with the slots 19. Figure 4B shows a detail of the mounting of four covering plates 10. In particular, a first covering plate 10' and a second covering plate 10'' are present. The first covering plate 10' (for example the front and the back plate) is fixable to the support assembly 1 as illustrated in figure 4A and the second covering plate 10'' (for example the

lateral plates) is fixable to the first covering plate 10' through a hooking system 20 as illustrated in figure 2B. The first covering plates 10' are fixed without the need for tools (screwdriver type). For example, they are slid into a hinge 20 in the lower part and engaged with protrusions 9 in the upper part. The second covering plates 10" are also maintained without tools. They can be engaged in the two first covering plates 10' thanks to a system of hooking 20 or also be inserted in the air duct structure 7. Figure 4C illustrates a cross section of the air duct structure 7 to show that the air duct structure 7 comprises an internal surface 12 and an external surface 13, wherein the internal surface 12 comprises smooth portions 14 to promote air guidance while limiting air disturbances and the external surface 13 comprises angular portions 15 for allowing the attachment of several parts, such as the covering plates and/or devices. As shown in the figure, an access at the top of the air duct structure 7 is provided for allowing easy access to the volume between the fan element 4 and the evaporator 3 to facilitate the cleaning of this area.

[0031] Figure 5A illustrates the arrangement of the covering plates 10 and the base element 6 without the presence of internal components, i.e. the air duct structure 7 and the functional components (evaporator 3 and fan element 4). It is noted that the covering plates 10 together with the base element 6 represent a casing for the internal functional components of the heating device 2 and that the structural component, such as the air duct structure 7 represents the part of the support assembly 1 for supporting the covering plates 10. Figures 5B and 5C show the connection at the corner between two neighbouring covering plates 10. Two neighbouring covering plates 10 are connected to each other through an hooking system 20 and/or slot-protrusion system 21 at the edges of the covering plates 10.

[0032] It is noted that the support assembly 1 is dimensioned to meet the mechanical constraints of the structural functions. This includes an assembly 1 that extends from a standard casing base to a level substantially equivalent to the top of the standard casing. The wall thicknesses of the air duct structure 7 needs to withstand the stresses as well as integrate protrusions 9. The wall thicknesses can be at least 12 mm, preferably 18 mm.

[0033] Figure 6A illustrates a detail of the support assembly 1. In particular, the air duct structure 7 comprises a top opening 28 and an access hatch 22 connectable to the top opening 28 in order to open and close said opening 28 when necessary. For example, the access hatch 22 can be connected by means of a hinge structure located on a side of the opening 28 or can be connected in a removable way from the opening 28 by means for example of a snap-fit structure, as shown in the figure. Thanks to the opening and to the access hatch 22 it is possible to access from outside to the air duct 8, i.e. to the internal space between the fan element 4 and the heat exchanger 3. This can be useful for example during maintenance or for cleaning purposes. The figure also

shows the presence of a plurality of screw holes 25 located on the upper region of the air duct structure 7, for example close to the top opening 28. The screw holes 25 are arranged to form for example a row of holes, these holes being configured to receive the screws used to fix the covering plates 10 to the air duct structure 7. This is extremely useful when the covering panels 10 are disassembled (for example for maintenance) and the corresponding fixing screws are unscrewed. Instead of leaving the unscrewed screws on the floor, these are tidily placed in the screw holes 25, avoiding the risk of misplacing them. At the bottom portion, the air duct structure 7 also comprises a condensate drip tray 26 provided with a drain hole 29 for collecting and draining the condensate, for example from the evaporator 3.

[0034] Figure 6B illustrates a collecting and guiding element 23 having a curved portion 30 with the form of a bowl. The collecting and guiding element 23 can be located below the evaporator 3 to collect the condensate and the particular curved portion 30 serve to guide the condensate to the through hole 24. The collecting and guiding element 23 can be coupled to the condensate drip tray 26 (for example placed between the evaporator 3 and the tray 26) or can replace said condensate drip tray 26. It is noted that the collecting and guiding element 23 is provided with one or more base protrusions 27 for correctly placing it relative to a base, for example the base element 6.

Reference Signs

[0035]

1	Support assembly
2	Heating device
3	Heat exchanger
4	Fan element
5	Internal space
6	Base element
7	Air duct structure
8	Air duct
9	Fixing means
10	Covering plate
11	Shielding element
12	Internal surface
13	External surface
14	Smooth portion
15	Angular portion
16	Top portion
17	Bottom portion
18	Base fixing means
19	Slot
20	Hooking system
21	Slot/protrusion system
22	Access hatch
23	Collecting and guiding element
24	Through-hole
25	Screw hole

- 26 Condensate drip tray
- 27 Base protrusions
- 28 Top opening
- 29 Drain hole
- 30 Curved portion

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Claims

1. Support assembly (1) for a heating device (2), in particular for a heat pump, the heating device (2) having a heat exchanger (3) and at least a fan element (4) arranged in an internal space (5) of the heating device (2), the support assembly (1) comprising an air duct structure (7) forming an air duct (8) extending from the heat exchanger (3) to the fan element (4), wherein the air duct structure (7) comprises fixing means (9) for fixing at least a covering plate (10) to the air duct structure (7) of the support assembly (1). 10
2. Support assembly (1) according to claim 1, **characterized in that:** 15
 - a. the fixing means (9) comprise one or more protrusions placed on a portion of the air duct structure (7); and/or
 - b. the fixing means (9) comprise one or more slots placed on a portion of the air duct structure (7); and/or
 - c. the fixing means (9) comprise one or more hinging elements placed on a portion of the air duct structure (7). 25
3. Support assembly (1) according to any one of claims 1 to 2, **characterized in that** the air duct structure (7) comprises an internal surface (12) and an external surface (13), wherein the internal surface (12) comprises smooth portions (14) and the external surface (13) comprises angular portions (15). 30
4. Support assembly (1) according to any one of claims 1 to 3, **characterized in that** the air duct structure (7) is made of plastic foam, in particular expanded polypropylene. 35
5. Support assembly (1) according to any one of claims 1 to 4, **characterized in that** the support assembly (1) further comprises a base element (6) supporting the air duct structure (7), wherein: 40
 - a. the base element (6) comprises base fixing means (18) for fixing at least a covering plate (10) to the support assembly (1); and/or
 - b. the base element (6) is made of metal, in particular steel. 45
6. Support assembly (1) according to any one of claims 1 to 5, **characterized in that** 50

- a. the air duct structure (7) comprises at least a flush surface with the covering plate (10), in particular wherein the air duct structure (7) has a cuboid shape; and/or
- b. the air duct structure (7) comprises at least a top opening (28) and an access hatch (22) connectable to the top opening (28) for accessing the air duct (8) from outside; and/or
- c. the air duct structure (7) comprises a collecting and guiding element (23) for collecting and guiding condensate, the collecting and guiding element (23) having a curved portion (30), in particular in the form of a bowl, and being provided with a through-hole (24); and/or
- d. the air duct structure (7) comprises at least a screw hole (25) for placing a screw; and/or
- e. the air duct structure (7) comprises a condensate drip tray (26).

7. Support assembly (1) according to any one of claims 1 to 6, **characterized in that** 55
 - a. the air duct structure (7) is a one-piece element; or
 - b. the air duct structure (7) comprises a plurality of components connectable to each other, wherein the air duct structure (7) comprises in particular a top portion (16), a bottom portion (17) connected to the top portion (16) and a hatch panel connected to the top portion (16).
8. Heating device (2), in particular a pump unit, comprising the support assembly (1) according to any one of claims 1 to 7 and at least a covering plate (10) fixed to the fixing means (9) of the support assembly (1) to cover said support assembly (1). 60
9. Heating device (2) according to claim 8, **characterized in that** the heating device (2) comprises 65
 - a. at least a single covering plate (10) covering more than one sides of the support assembly (1); and/or
 - b. at least a covering plate (10) covering only one side, or a portion of one side, of the support assembly (1). 70
10. Heating device (2) according to any one of claims 8 to 9, **characterized in that** one or more covering plates (10) are directly fixable to the air duct structure (7). 75
11. Heating device (2) according to any one of claims 8 to 10, **characterized in that** the heating device (2) comprises one or more shielding elements (11) covering one or more covering plates (10). 80
12. Heating device (2) according to any one of claims 8

to 11, **characterized in that** the heating device (2) comprises at least a first covering plate (10') and a second covering plate (10''), wherein the first covering plate (10') is fixable to the support assembly (1) and the second covering plate (10'') is fixable to the first covering plate (10'). 5

13. Heating device (2) according to claim 12, **characterized in that** the first covering plate (10') and/or the second covering plate (10'') comprise a hooking system (20) for fixing the second covering plate (10'') to the first covering plate (10'). 10

14. Heating system comprising the heating device (2) according to any one of claims 8 to 12, the heating system further comprising at least a hydraulic element and/or a frigorific element and/or an electrical element, wherein said hydraulic element and/or frigorific element and/or electrical element is mounted on the air duct structure (7). 15 20

15. Use of the support assembly (1) according to any one of claims 1 to 7 in a heat pump unit (2), in particular an outdoor heat pump unit (2). 25

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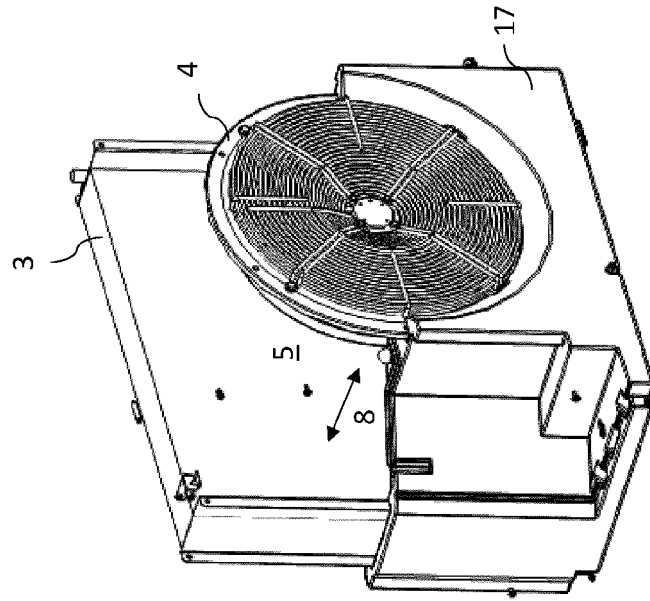


FIG. 1B

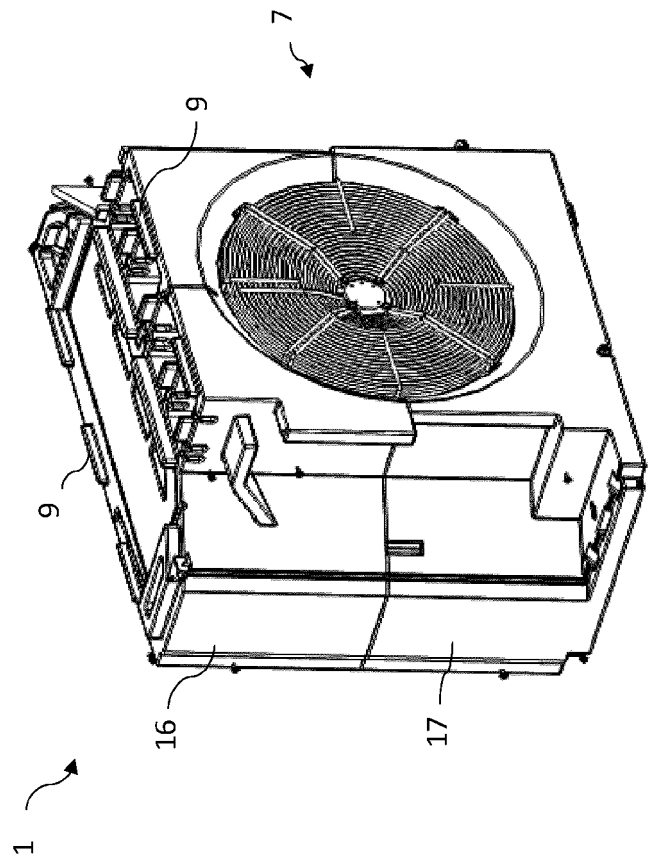


FIG. 1A

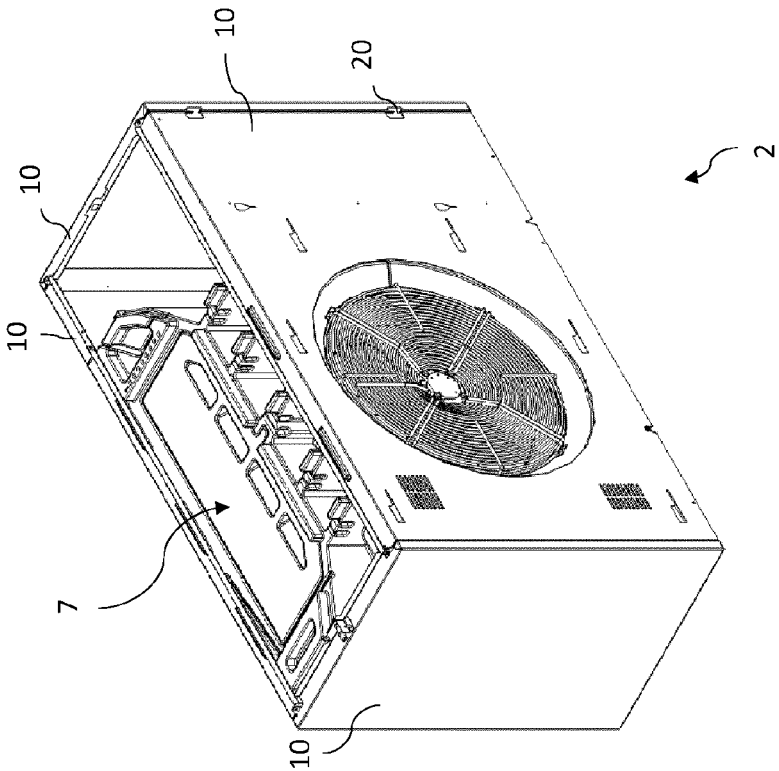


FIG. 2B

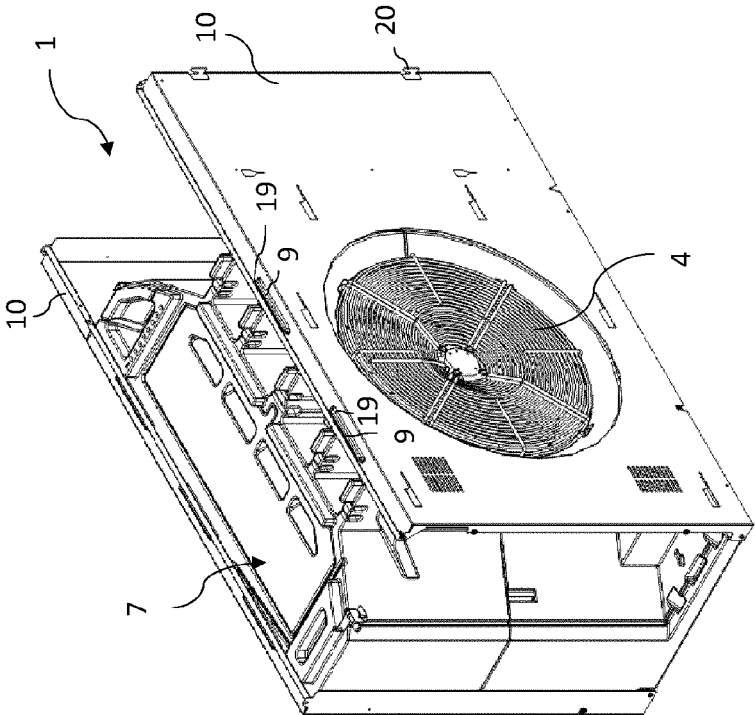
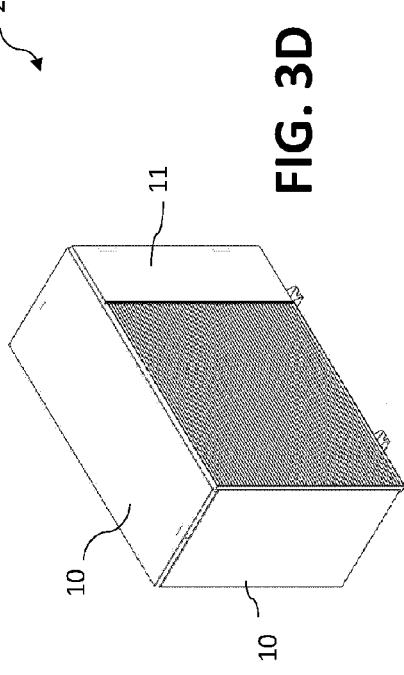
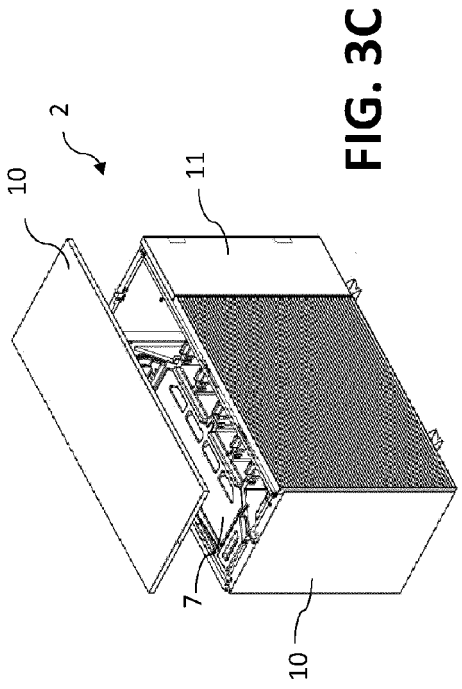
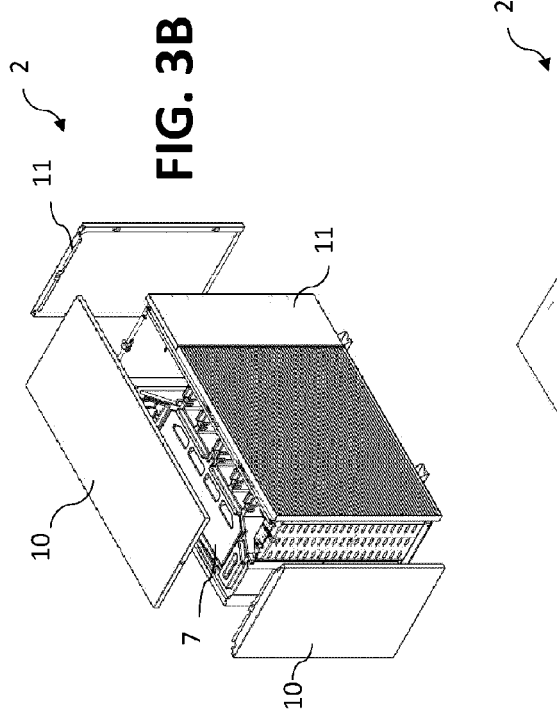
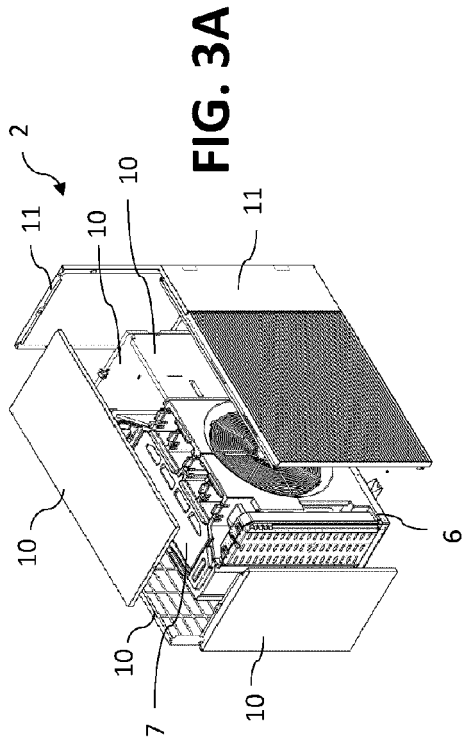


FIG. 2A



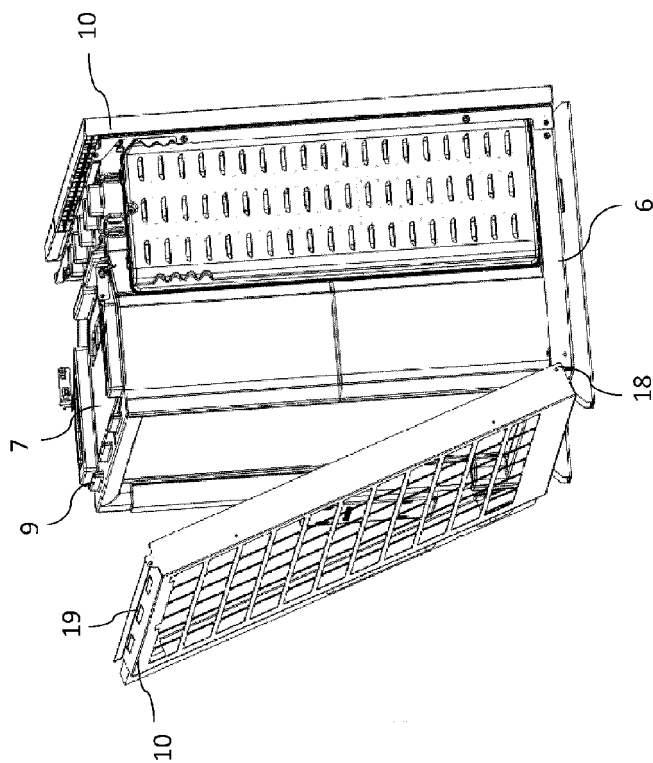


FIG. 4A

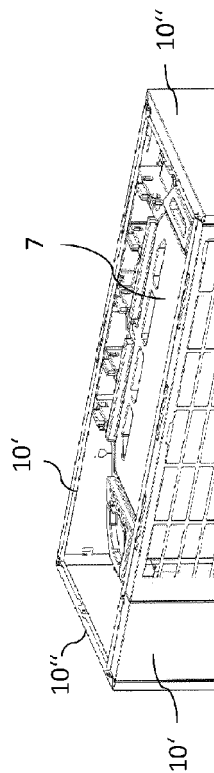


FIG. 4B

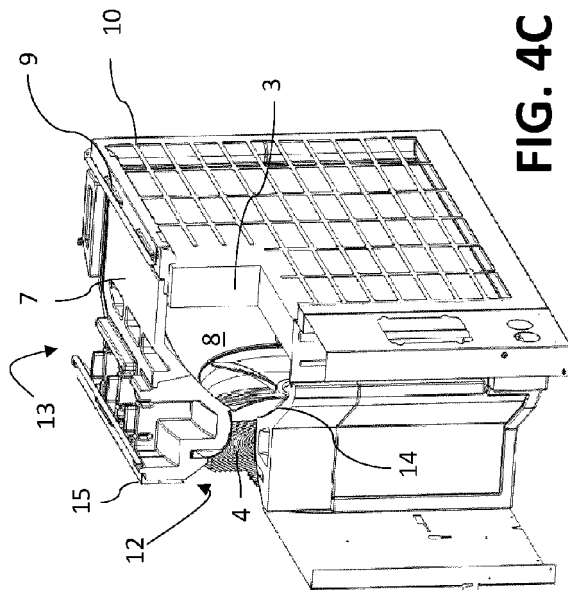


FIG. 4C

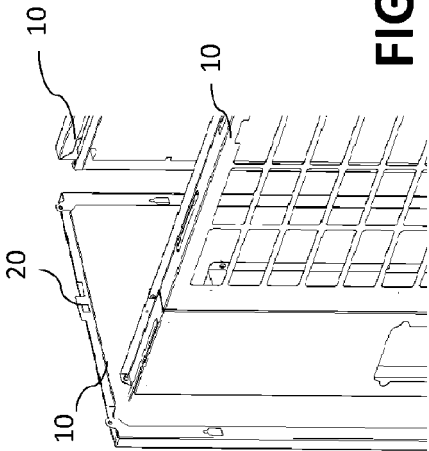


FIG. 5B

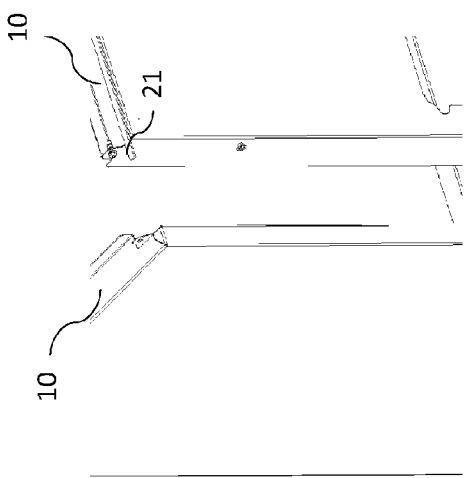


FIG. 5C

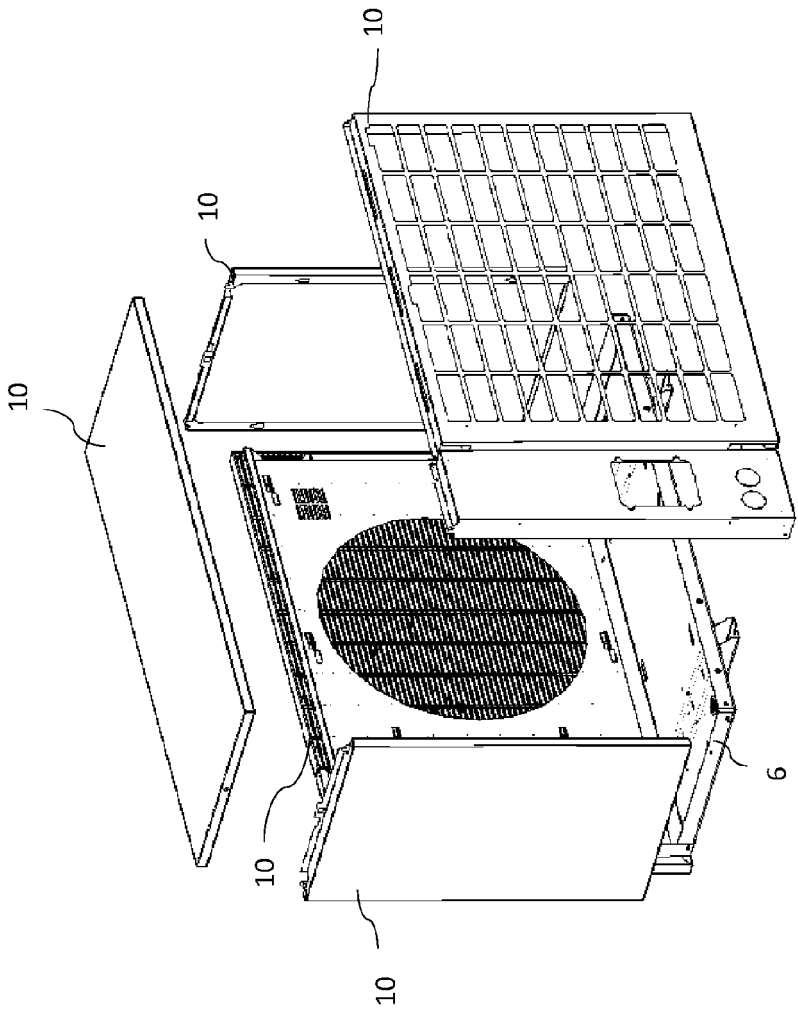


FIG. 5A

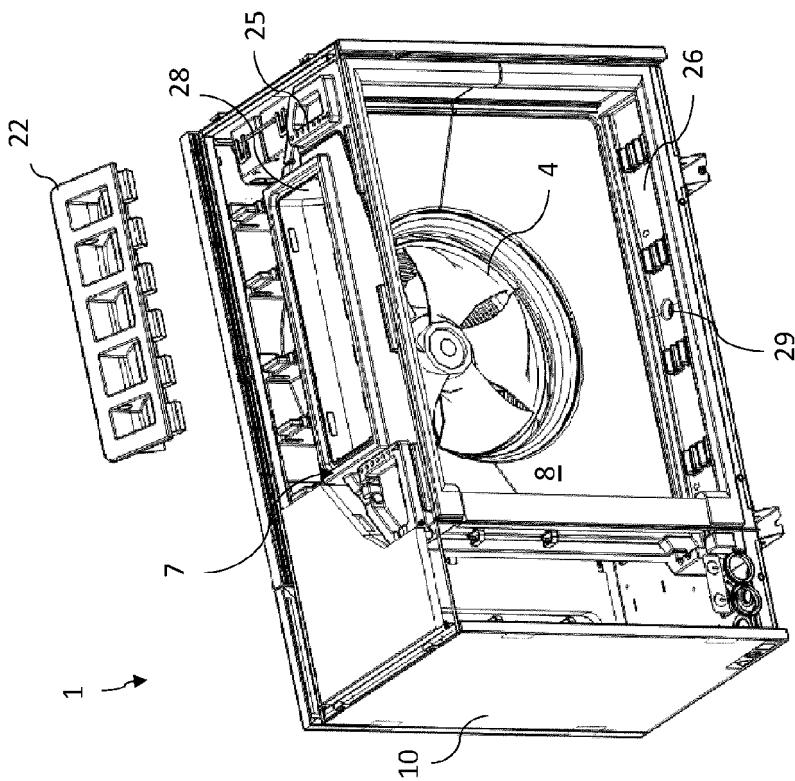


FIG. 6A

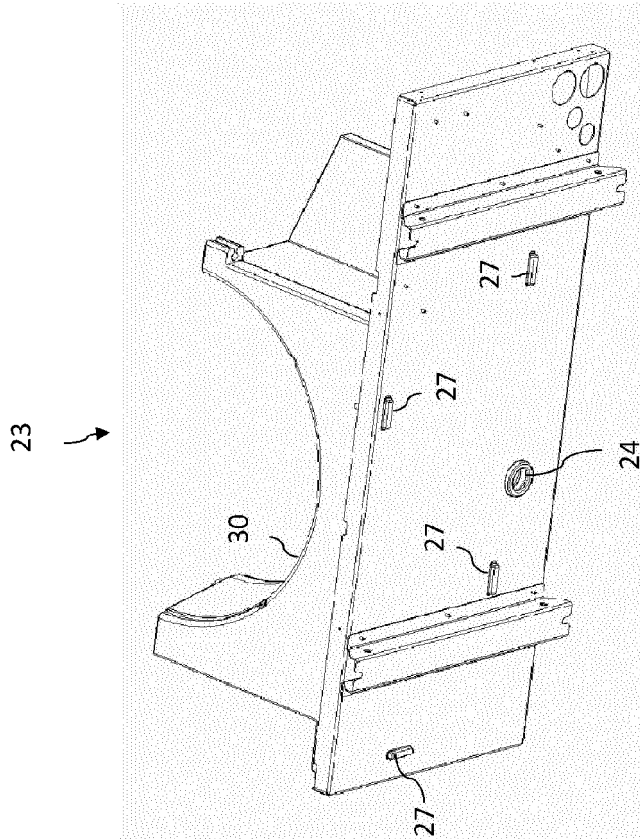


FIG. 6B



EUROPEAN SEARCH REPORT

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Place of search

Munich

Date of completion of the search

25 November 2022

Examiner

Valenza, Davide

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