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(71) Applicant: **INDUSTRIE SCAFFALATURE ARREDAMENTI - ISA SOCIETÀ PER AZIONI**
06083 Bastia Umbra (PG) (IT)

(72) Inventors:
- **CAPOSALDO, Moreno**
  06081 Assisi (PG) (IT)
- **ORTAGGI, Fabio**
  06012 Citta' di Castello (PG) (IT)

(74) Representative: **Cutropia, Gianluigi**
Ing. Claudio Baldi s.r.l.
Viale Cavallotti, 13
60035 Jesi (AN) (IT)

(54) CASSETTE UNIT FOR REFRIGERATED DISPLAY CABINETS WITH A TWO-PART BODY

(57) Cassette unit (100) comprising: a base (1), a body (2) defining a compartment (V), an evaporator (3) arranged in the compartment (V) of the body, a fan (30) mounted in the compartment (V) to allow for an airflow that passes through the evaporator (3), a compressor (4) and a condenser (5) arranged on the base (1) outside the compartment (V) of the body; the body (2) comprises: a first half-body (2a) fixed to the base (1), and a second half-body (2b) suitable for being fixed to the bottom (302) of the refrigerated display cabinet; wherein the first half-body (2a) and the second half-body (2b) are coupled tightly.

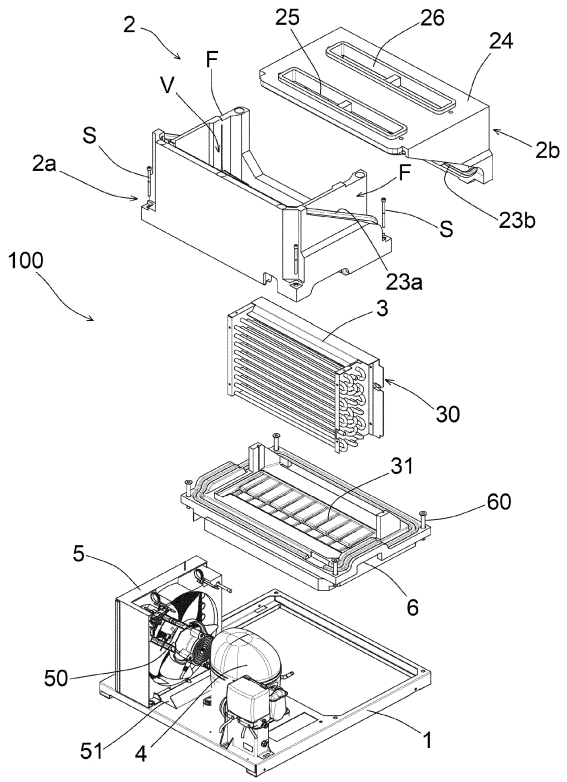

FIG. 6

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Description

[0001] The present invention relates to a cassette unit for refrigerated display cabinet with a two-part body.

[0002] A cassette unit is a complete refrigeration unit (finished machine) for the refrigeration of refrigerated displayers, such as refrigerated cabinets, refrigerated display cases, refrigerated counters, and the like. The cassette unit comprises components (compressor, condenser, lamination element, evaporator, and control electronics) that are necessary for performing a thermodynamic compression refrigeration cycle. All components are mounted in a single self-supporting structural case/base. The cassette unit is equipped with intake conduits of external air and delivery conduits of cooled air. Such a unit is inserted into the refrigerated display cabinet, in correspondence with air inlet and outlet conduits of the refrigerated display cabinet that generate a flow of cold air in the refrigerated display cabinet for the storage of consumer products.

[0003] Before the advent of the cassette units, the components of the refrigeration system were located in different areas of the refrigerated display cabinet, depending on the function they were to perform. With reference to Fig. 1, the cold function (evaporator) is arranged in the product storage area. The hot function (condenser + compressor) is arranged in an engine compartment outside the storage area.

[0004] The idea of having both the cold generation components and the heat elimination components in the same area comes from the need to reduce the complexity dictated by the numberless solutions introduced in the realization of the refrigeration systems. One of the main strengths of the cassette unit technology consists in the fact that such a unit is perfectly interfaced with the refrigeration display cabinet, and is a standalone unit that does not require the presence of the refrigeration system components (e.g., fan, evaporator) mounted inside the refrigeration display cabinet, thus resulting in easy disassembly, easy accessibility for maintenance and easy replacement on site, in case of failures that cannot be solved immediately.

[0005] In addition, the cassette unit meets the ever-increasing demand of the market for eco-sustainability and easy disposal because components and materials in line with the need to have an increasingly reduced environmental impact were evaluated in the study of this solution.

[0006] Currently, the global market offers cassette units that differ in the technical installation solutions depending on the type of end product. The cassette units can be respectively installed on a base, on a roof and on a side of a refrigerated display cabinet.

[0007] Fig. 2 illustrates a cassette unit (400) installed under a bottom (302) of a refrigerated display cabinet (300). More precisely, the bottom (302) is supported by two sides (304) in such a way as to define an empty space wherein the cassette unit is arranged.

[0008] Referring to Fig. 3, the cassette unit (400) comprises a base (1) supporting a compressor (4), a condenser (5) and a fan (50) of the condenser. A body (2) is mounted on the base and defines a compartment (V) wherein an evaporator (3) is arranged. It should be considered that the evaporator (3) is a heat exchanger that generates cold, whereas the condenser (5) is a heat exchanger that generates heat, and the compressor (4) is a motor that generates heat as well. Therefore, the body (2) is made of heat-insulating material, and a cold zone insulated from the outside is generated inside the body (2).

[0009] The bottom (302) of the refrigerated display cabinet has two openings: an air intake opening (302a) from the refrigerated display cabinet to the cassette unit, and an air delivery opening (302b) from the cassette unit to the refrigerated display cabinet. Therefore, the body (2) of the cassette unit is open at the top and comprise an intake outlet (10) and a delivery outlet (11) that are interfaced with the air intake and delivery openings (302a, 302b) of the bottom of the refrigerated display cabinet. The air is sucked in from the interior of the refrigerated display cabinet through the intake and delivery outlet (10, 11) and is sent back into the refrigerated display cabinet after being cooled by heat exchange with the evaporator (3).

[0010] With reference to Fig. 3A, the cassette unit (400) has a gasket (600) arranged along a perimeter of an upper edge (21) of the body (2), suitable for going into contact with the bottom (302) of the refrigerated display cabinet around the intake and delivery openings (302a, 302b) of the bottom of the refrigerated display cabinet.

[0011] Referring to Fig. 4, the cassette unit (400) is inserted under the bottom (302) of the refrigerated display cabinet and is pushed upward and lifted, in such a way that the gasket (600) is compressed between the upper edge (21) of the body and the bottom (302) of the refrigerated display cabinet to ensure a tight seal between the cassette unit and the refrigerated display cabinet.

[0012] Referring to Figs. 4 and 5, the cassette unit (400) is lifted by means of a lever system (500) with eccentric supports that can be located in the base (1) of the cassette unit (400) or in the sides (304) of the refrigerated display cabinet under the bottom (302) of the refrigerated display cabinet.

[0013] The lever system (500) has two control levers (501, 502). By rotating the control levers (501, 502), the cams that are integral with the control levers (501, 502) rotate by means of a bar about an axis, causing the cassette unit (400) to be lifted due to a reaction force generated between the cams of the lever system (500) and a support structure of the cassette unit integral with the refrigerated display cabinet (400).

[0014] Considering that the cassette unit is particularly heavy, the operation of the lever requires some force and is therefore not easy for the installer.

[0015] Such a type of structure of the cassette unit

(400) according to the prior art, which is shown in Fig. 3, wherein the body (2) is made in one piece and wherein the evaporator (3) and the fan (30) of the evaporator are located in the compartment (V) of the body and are supported by the body (2), is impaired by some drawbacks from the practical, structural, fluid-dynamic and thermal points of view.

[0016] In fact, the maintenance of the evaporator (3) is rather complicated since the evaporator (3) is inserted inside the body (2) with no possibility of being removed, independently of the fan (30) and the evaporator (3) that are mounted on the body (2). Due to the orientation and position of the fan (30) relative to the evaporator (3), the airflow generated by the fan (30) of the evaporator does not flow evenly through the evaporator, resulting in an efficiency loss of the heat transfer. The support of the evaporator (3) and of the fan (30) of the evaporator does not allow for a proper hermetic separation between the airflow sucked in by the fan and the airflow delivered by the evaporator, creating air leaks and by-passes at the lateral ends of the evaporator that will not pass through the evaporator, reducing the heat exchange between the air and the evaporator.

[0017] CN108626943B discloses a refrigerating and freezing device of cassette type according to the preamble of claim 1. Such a cassette unit comprises:

- a first half-body (121) suitable for being fixed to a base of the cassette unit, and
- a second half-body (60) suitable for being fixed to the bottom of the refrigerated display cabinet (20).

[0018] The first half-body (121) has a parallelepiped shape that is open at the top, and the second half-body (60) is shaped like a plate that is fixed horizontally under the bottom of the refrigerated display cabinet.

[0019] The bottom of the refrigerated display cabinet (20) is raised from the ground, and the second half-body (60) is fixed under the bottom of the refrigerated display cabinet. Therefore, in order to couple the first half-body (121) to the second half-body (60), the cassette unit must be arranged under the bottom of the refrigerated display cabinet and must be lifted by means of a vertical translation, using appropriate lifting means, otherwise the top surface of the first half-body (121) would not be brought in tight contact with the second half-body (60).

[0020] It appears evident that the use of such a lifting system to lift the cassette unit is complicated, expensive, and unreliable.

[0021] WO2010/042662 discloses a refrigeration deck system for vending machine.

[0022] The purpose of the present invention is to eliminate the drawbacks of the prior art by providing a cassette unit that is practical from a maintenance and installation point of view and has a higher thermodynamic efficiency.

[0023] Another purpose of the present invention is to provide such a cassette unit that is efficient, reliable, and space-saving.

[0024] These purposes are achieved in accordance with the invention with the features of the attached independent claim 1.

[0025] Advantageous achievements of the invention appear from the dependent claims.

[0026] The cassette unit according to the invention is defined by claim 1.

[0027] Further features of the invention will appear clearer from the following detailed description, referring to a purely illustrative and therefore non-limiting embodiment, illustrated in the appended drawings, wherein:

Fig. 1 is a schematic perspective view, illustrating a refrigerator display cabinet according to the prior art;
Fig. 2 is a side view of a cassette unit according to the prior art mounted under a bottom of a refrigerated display cabinet shown in a sectional view;
Fig. 3 is a sectional view of the cassette unit of Fig. 2;
Fig. 3A is an enlarged detail enclosed in circle A of Fig. 3, illustrating a gasket of the cassette unit;
Fig. 4 is a perspective view, illustrating the insertion of a cassette unit according to the prior art under a bottom of a refrigerated display cabinet;
Fig. 5 is a perspective view of a lever lifting system of Fig. 4;
Fig. 6 is an exploded perspective view illustrating a first embodiment of a cassette unit according to the invention;
Fig. 7 is a perspective view of the cassette unit of Fig. 6 in assembled condition;
Fig. 8 is a side view illustrating an assembly of the cassette unit according to the invention;
Fig. 9 is an exploded perspective view illustrating a second embodiment of a cassette unit according to the invention; and
Fig. 10 is a perspective view of the cassette unit of Fig. 9 in assembled condition.

[0028] With the aid of Figs. 6, 7 and 8, a first embodiment of the cassette unit according to the invention is described, it being comprehensively indicated by the reference numeral 100.

[0029] The cassette unit (100) is suitable for being arranged under a bottom (302) of a refrigerated display cabinet (300). The bottom (302) of the refrigerated display cabinet has an intake opening (302a) from the refrigerated display cabinet to the cassette unit and a delivery opening (302b) from the cassette unit to the refrigerated display cabinet.

[0030] The cassette unit (100) comprises:

- a base (1),
- a body (2) mounted on the base (1) so as to define a compartment (V),
- an evaporator (3) arranged in the compartment (V) of the body,
- a compressor (4) and a condenser (5) arranged on

the base (1) outside the compartment (V) of the body.

[0031] A fan (30) is mounted in the compartment (V) of the body to allow for an airflow that passes through the evaporator (3) and is cooled.

[0032] A second fan (50) is mounted on the base (1) outside the compartment (V) of the body to allow for an airflow that passes through the condenser (5).

[0033] The body (2) has an intake outlet (25) and a delivery outlet (26) suitable for being put in communication with the intake opening (302a) and the delivery opening (302b) of the bottom (302) of the refrigerated display cabinet.

[0034] A drip tray (31) can be arranged on the base element (6) under the evaporator (3) to collect the defrost water of the evaporator. The drip tray (31) communicates with a collection tank (51) arranged outside the body (2), near the condenser (5) and the second fan (50) of the condenser.

[0035] The body (2) comprises a first half-body (2a) suitable for being fixed to the base (1) and a second half-body (2b) suitable for being fixed to the bottom (302) of the refrigeration display cabinet. The two half-bodies (2a, 2b) can be assembled by means of coupling means (F). Such a structure facilitates a connection of the condenser (5) to the evaporator (3), through appropriate piping, when the first half-body is connected to the second half-body.

[0036] The first half-body (2a) can be coupled to the base (1) by means of first fixing means (S), such as screw means.

[0037] Advantageously, the base (1) can include a base element (6) on which the evaporator (3) is mounted. In such a case, the base element (6) has perforated through bushings (60) that are crossed by the screws of the first fixing means (S) that are screwed to the base (1) to secure the first half-body (2a) and the base element (6) to the base (1).

[0038] The base element (6) and the first half-body (2a) have grooves and ribs for a tight closure between the base and the first half-body. The two half-bodies (2a, 2b) have a wedge shape with respective inclined planes (23a, 23b) relative to the base (1). The inclined planes (23a, 23b) have an inclination of 10°-50°, preferably 30° relative to the base (1). The first half-body (2a) can be coupled to the second half-body (2b) by means of a horizontal translation of the first half-body (2a) toward the second half-body (2b), so that the inclined planes (23a, 23b) of the two half-bodies go into mutual contact to obtain a tight closure.

[0039] The coupling means (F) are provided in correspondence with the inclined planes (23a, 23b) and consist in fit-in means capable of providing a tight seal between the two half-bodies.

[0040] As shown in Fig. 8, the two half-bodies (2a, 2b) can be assembled by means of a mutual translation on a horizontal plane. In this way, it is not necessary to provide lifting means to lift the base (1) of the cassette unit so that the first half-body goes into contact with the second half-body.

[0041] The first half-body (2a) is mounted on the base (1). The second half-body (2b) has an upper wall (24) in which the intake and delivery outlets (25, 26) are obtained.

[0042] For the installation of the cassette unit (100), firstly the second half-body (2b) must be fixed to the bottom (302) of the refrigerated display cabinet by means of second fixing means, such as screws and/or sealing material, such as silicone and the like. Then, the cassette unit (100), in which the first half-body (2a) is mounted, is slidingly inserted horizontally under the bottom (302) of the refrigerated display cabinet, so that the first half-body (2a) is tightly coupled with the second half-body (2b).

[0043] In such a case, the insertion of the cassette unit (100) is performed only by means of a horizontal translation, without the need to lift the cassette unit (100). Such a solution eliminates the mechanical lifting means of the cassette unit according to the prior art.

[0044] With the aid of Figs. 9 and 10, a second embodiment of the cassette unit according to the invention is described, it being comprehensively indicated with reference numeral 200, in which parts equal or corresponding to those already described are indicated by the same reference numerals, omitting a detailed description.

[0045] The cassette unit (200) comprises a body (2) comprising:

- a first half-body (2a) suitable for being fixed to the base (1); and
- a second half-body (2b) suitable for being fixed to the bottom (302) of the refrigerated display cabinet.

[0046] The two half-bodies (2a, 2b) are tightly coupled by means of coupling means (F).

[0047] The first half-body (2a) is fixed to the base (1) by means of first fixing means (S), such as screw means.

[0048] The second half-body (2b) is fixed to the bottom (302) of the refrigerated display cabinet by means of second fixing means, such as screw and/or sealing means.

[0049] The first half-body (2a) is in the form of a plate arranged vertically on the base (1).

[0050] The second half-body (2b) has a parallelepiped shape so as to define the compartment (V) in which the evaporator (3) is arranged. The second half-body (2b) is open at the front and on top with a front opening and an upper opening, respectively. The second half-body (2b) has a U-shaped front flange (27) that circumscribes the front opening of the second half-body (2b) and is suitable for being brought in contact with the first half-body (2a) to frontally close the compartment (V).

[0051] Also in such a case, the first half-body (2a) can be coupled to the second half-body (2b) by means of a horizontal translation of the first half-body (2a) toward the second half-body (2b), so that the first half-body (2a) goes into contact with the front flange (27) of the second half-body to close the second half-body anteriorly. So,

also in such a case, it is not necessary to provide lifting means to lift the base (1) of the cassette unit in such a way that the first half-body goes into contact with the second half-body.

[0052] The coupling means (F) secure the first half body (2a) to the second half body (2b). The coupling means (F) may be clips that fix the first half body (2a) to the front flange (27) of the second half body.

[0053] Advantageously, the body (2) comprises an intermediate wall (7) arranged between the front flange (27) of the second half body (2b) and the first half body (2a). The fan (30) of the evaporator is mounted in the intermediate wall (7). The intermediate wall (7) supports the evaporator (3).

[0054] Advantageously, the intermediate wall (7) comprises a first plate (8) and a second plate (9). The first plate (8) comprises a flange (80) that defines a housing (81) in which the fan (30) is mounted. The first plate (8) supports the evaporator (3) and drip tray (31). In such a way, the fan (30) and the evaporator (3) are firmly fixed to the first plate (8), which has a structural function.

[0055] Instead, the second plate (9) is made of insulating material to improve the insulation of the compartment (V) where the evaporator (3) is arranged from the hot zone near the condenser (5).

[0056] The first half-body (2a) and the second half-body (2b) are made of an insulating material, such as expanded polypropylene (EPP) or expanded polystyrene (EPS), which does not have structural characteristics but only thermal insulation characteristics.

[0057] Equivalent variations and modifications may be made to the present embodiments of the invention, within the scope of a person skilled in the art, but still within the scope of the invention as expressed by the appended claims.

Claims

1. Cassette unit (100) suitable for being installed under a bottom (302) of a refrigerated display cabinet having sides (304) suitable for keeping the bottom raised from the ground;

   said cassette unit (100) comprising:

   - a base (1),
   - a body (2) defining a compartment (V) that is open at the top and has an intake opening (25) and a delivery opening (26) suitable for being interfaced with respective intake and delivery outlets (302a, 302b) of the bottom (302) of the refrigerated display cabinet (300),
   - an evaporator (3) disposed in the compartment (V) of the body,
   - a compressor (4) and a condenser (5) disposed on the base (1) outside the compartment (V) of the body,

   wherein said body (2) comprises:

   - a first half-body (2a) fixed to the base (1), and
   - a second half-body (2b) suitable for being fixed to the bottom (302) of the refrigerated display cabinet;

   the first half-body (2a) and the second half-body (2b) being tightly coupled together; and
   said cassette unit (100) comprising coupling means (F) suitable for coupling the first half-body (2a) to the second half-body (2b);
   characterized in that
   said cassette unit (100) further comprises a first fan (30) mounted in the compartment (V) to allow for an airflow through the evaporator (3); and
   wherein said two half-bodies (2a, 2b) are wedge-shaped with respective inclined planes (23a, 23b) relative to the base (1), so that the first half-body (2a) can be coupled to the second half-body (2b) by means of a horizontal translation of the first half-body (2a) towards the second half-body (2b), in such a way that the inclined planes (23a, 23b) of the two half-bodies are brought in contact with each other to provide a hermetic closure; and
   said coupling means (F) comprise fit-in means disposed in correspondence with the inclined planes (23a, 23b) to provide a fit-in coupling between the two half-bodies (2a, 2b).

2. The cassette unit (100) according to claim 1, comprising first fixing means (S) suitable for fixing the first half-body (2a) to the base (1).

3. The cassette unit (100) according to claim 2, wherein said first fixing means (S) are screw means.

4. The cassette unit (100) according to any one of the preceding claims, comprising second fixing means suitable for fixing the second half-body (2b) to the bottom (302) of the refrigerated display cabinet.

5. The cassette unit (100) according to claim 4, wherein said second fixing means are screw and/or sealing means.

6. Cassette unit (200) suitable for being installed under a bottom (302) of a refrigerated display cabinet having sides (304) suitable for keeping the bottom raised from the ground;

   said cassette unit (200) comprising:

   - a base (1),

- a body (2) defining a compartment (V) that is open at the top and has an intake opening (25) and a delivery opening (26) suitable for being interfaced with respective intake and delivery outlets (302a, 302b) of the bottom (302) of the refrigerated display cabinet (300),
- an evaporator (3) disposed in the compartment (V) of the body,
- a compressor (4) and a condenser (5) disposed on the base (1) outside the compartment (V) of the body,

wherein said body (2) comprises:

- a first half-body (2a) fixed to the base (1), and
- a second half-body (2b) suitable for being fixed to the bottom (302) of the refrigerated display cabinet;

the first half-body (2a) and the second half-body (2b) being tightly coupled together; and
the cassette unit (200) comprising coupling means (F) suitable for coupling the first half-body (2a) to the second half-body (2b);
characterized in that
said cassette unit (200) further comprises a first fan (30) mounted in the compartment (V) to allow for an airflow through the evaporator (3); and
wherein the first half-body (2a) is shaped like a plate vertically arranged on said base (1) and the second half-body (2b) is shaped like a parallelepiped that is open in the front and at the top and has a front flange (27) arranged on a front edge of the second half-body, so that the first half boy (2a) can be coupled to the second half-body by means of a horizontal translation of the first half-body (2a) towards the second half body (2b), in such a way that the first half body (2a) is brought in contact with the front flange (27) of the second half-body to frontally close the second half-body.

7. The cassette unit (200) according to claim 6, wherein said coupling means (F) comprise clips (F) that tighten said front flange (27) of said second half-body and said first half-body (1a).

8. The cassette unit (200) according to claim 6 or 7, wherein:
the body (2) comprises an intermediate wall (7) disposed between the front flange (27) of the second half-body (2b) and the first half-body (2a); and the fan (30) of the evaporator (3) and the evaporator (3) are supported by said intermediate wall (7).

9. The cassette unit (200) according to claim 8, wherein said intermediate wall (7) of the body comprises a first plate (8) and a second plate (9) made of insulating material;
the first plate (8) comprises a flange (80) defining a housing (81) wherein the fan (30) is housed; and
the first plate (8) supports the evaporator (3).

PRIOR ART

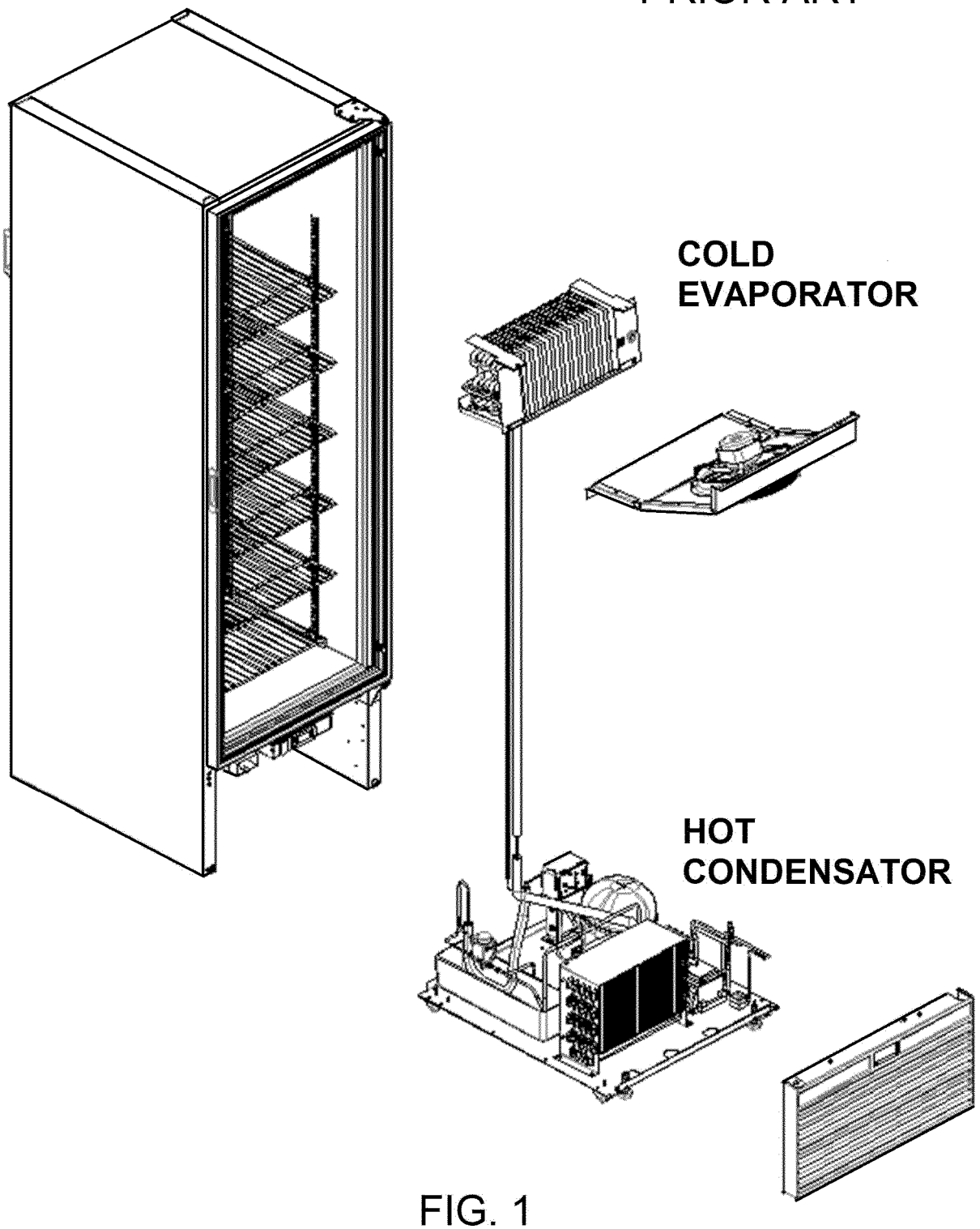

FIG. 1

PRIOR ART

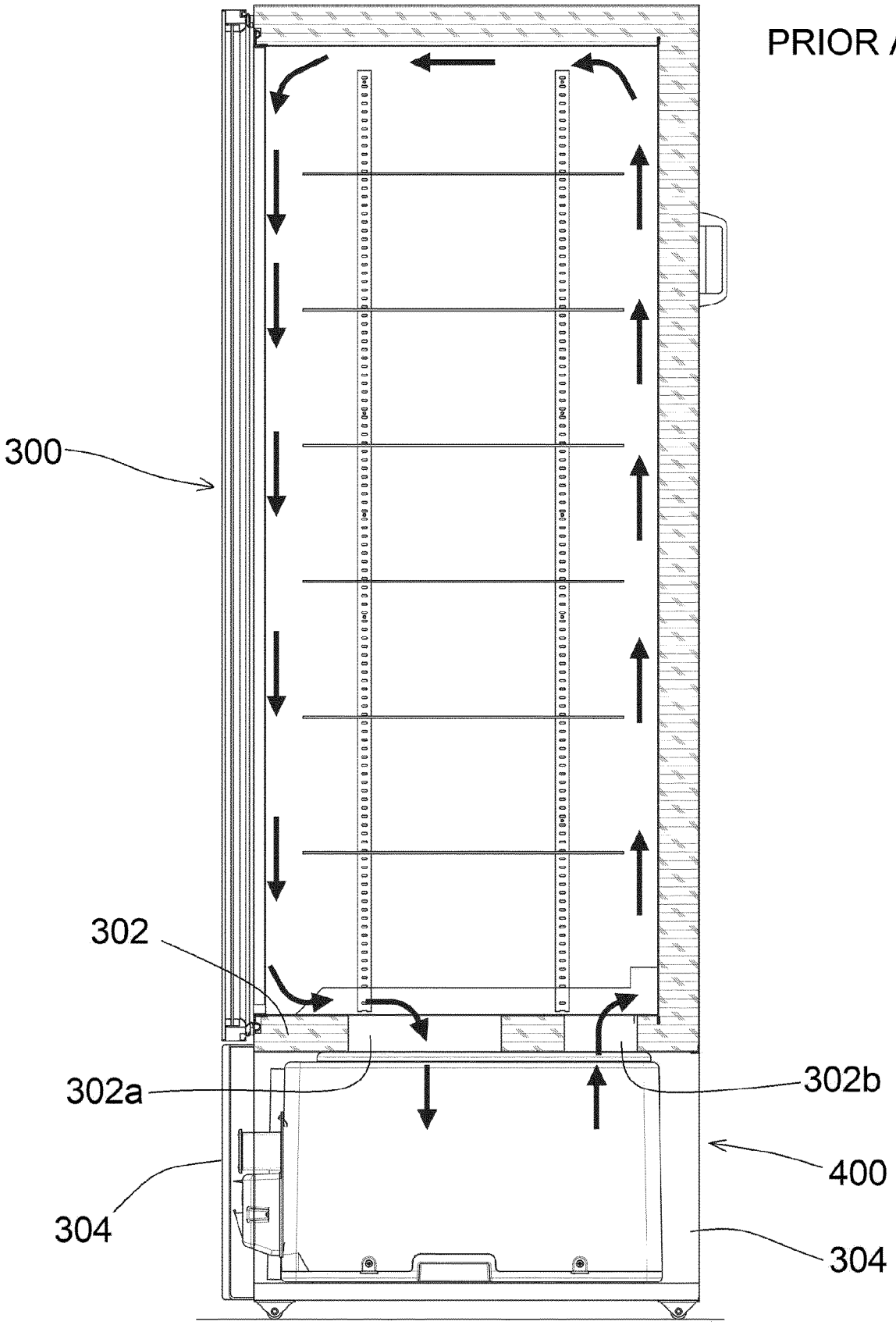

FIG. 2

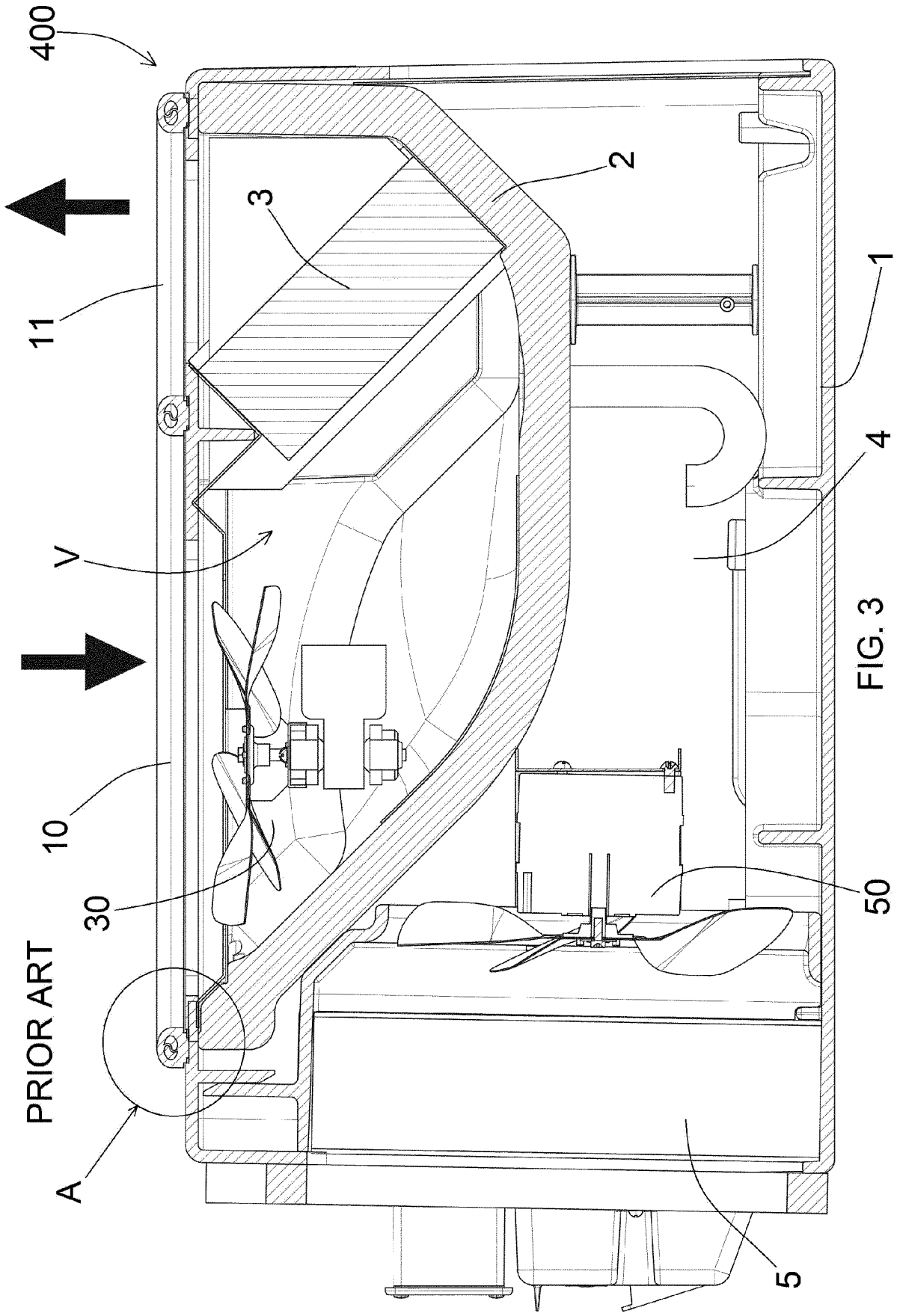

FIG. 3

PRIOR ART

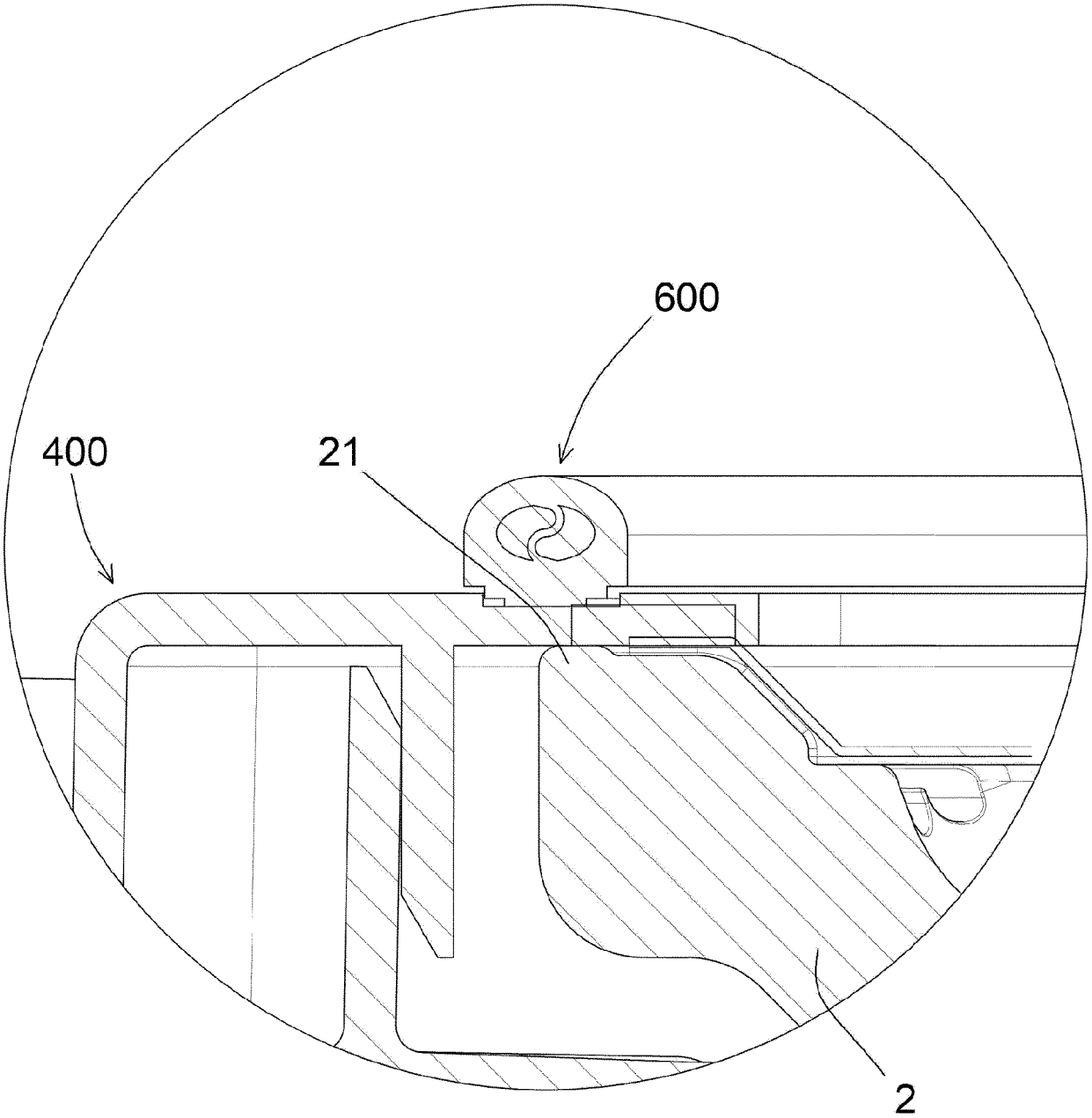

FIG. 3A

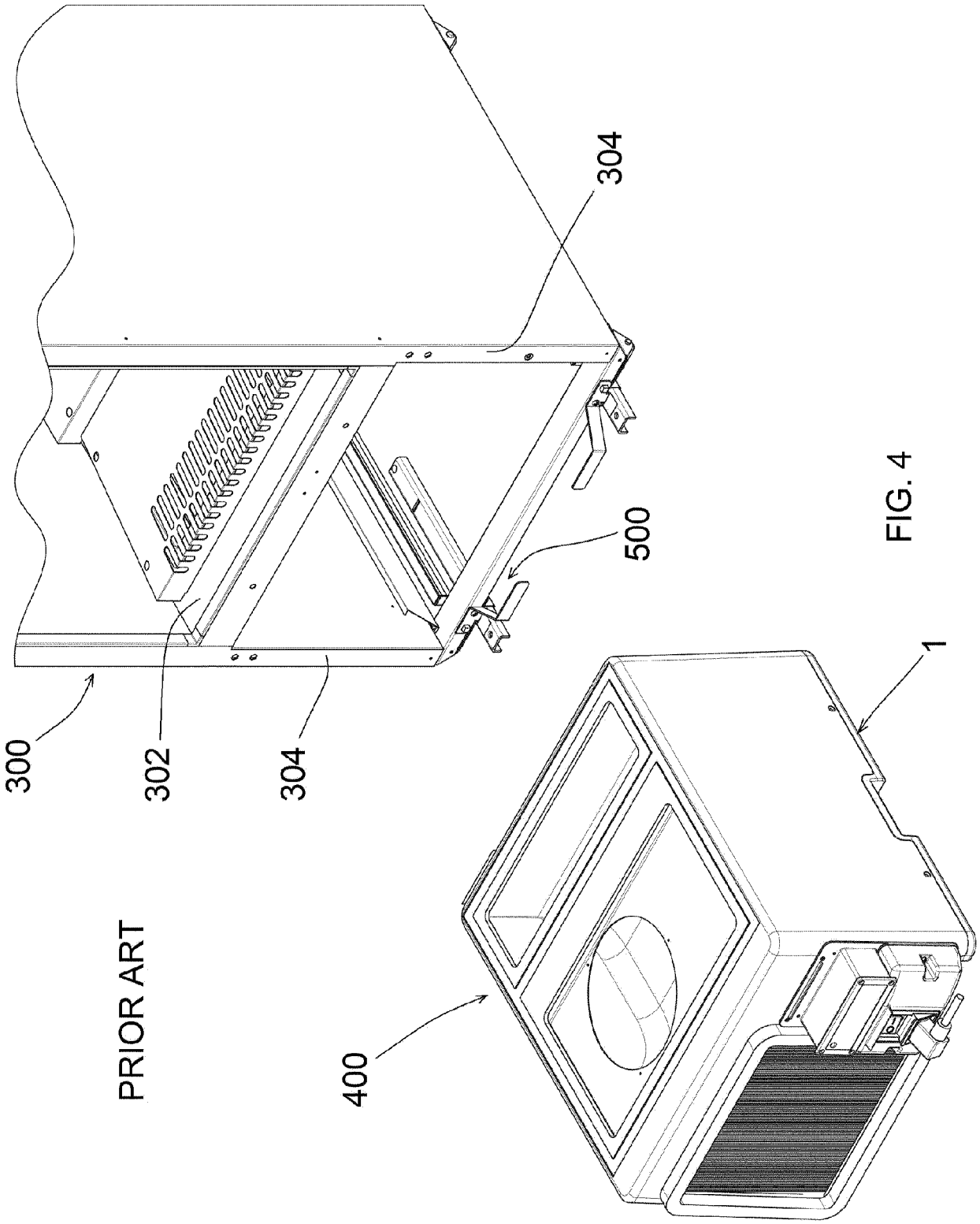

FIG. 4

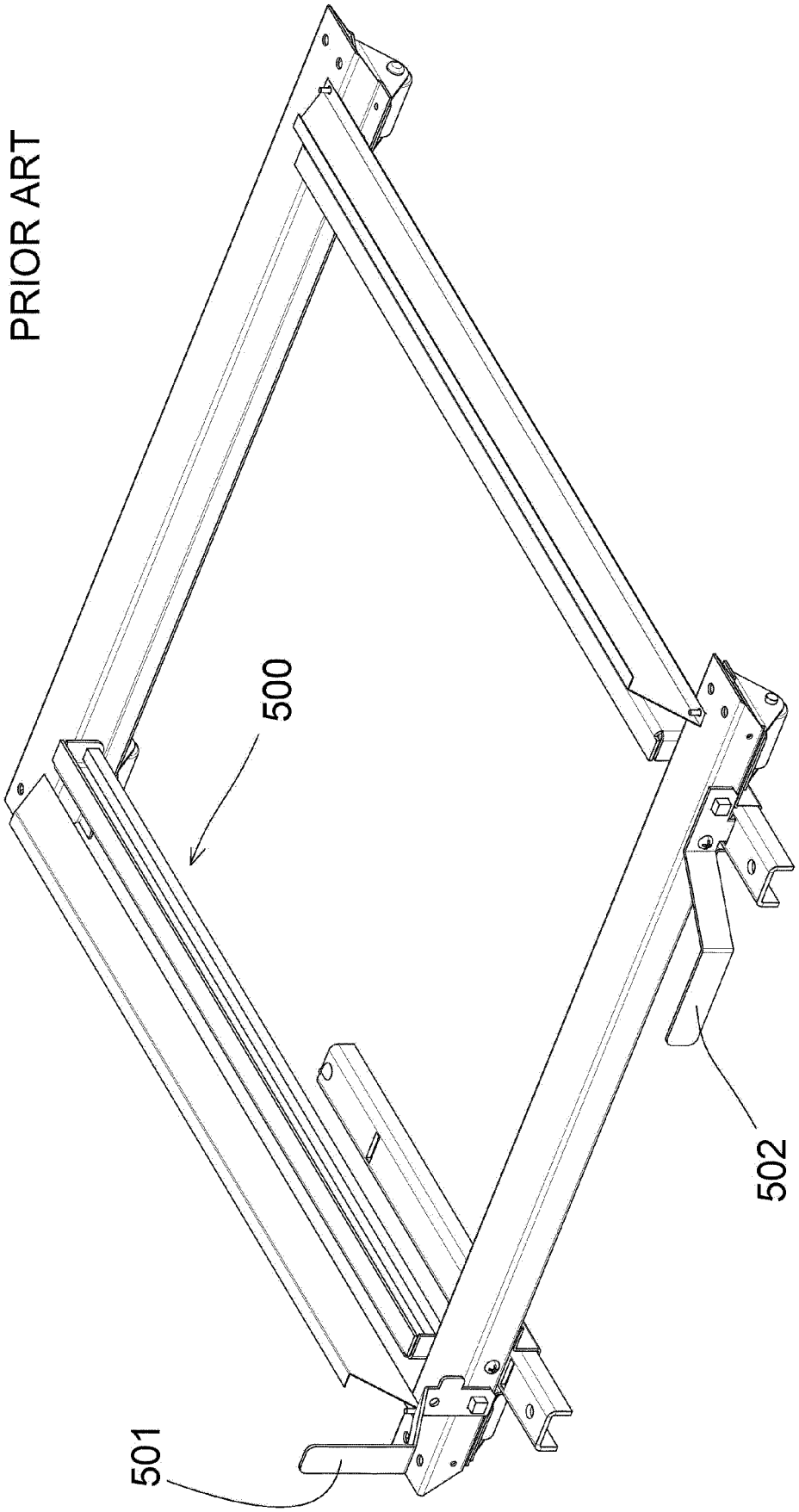

FIG. 5

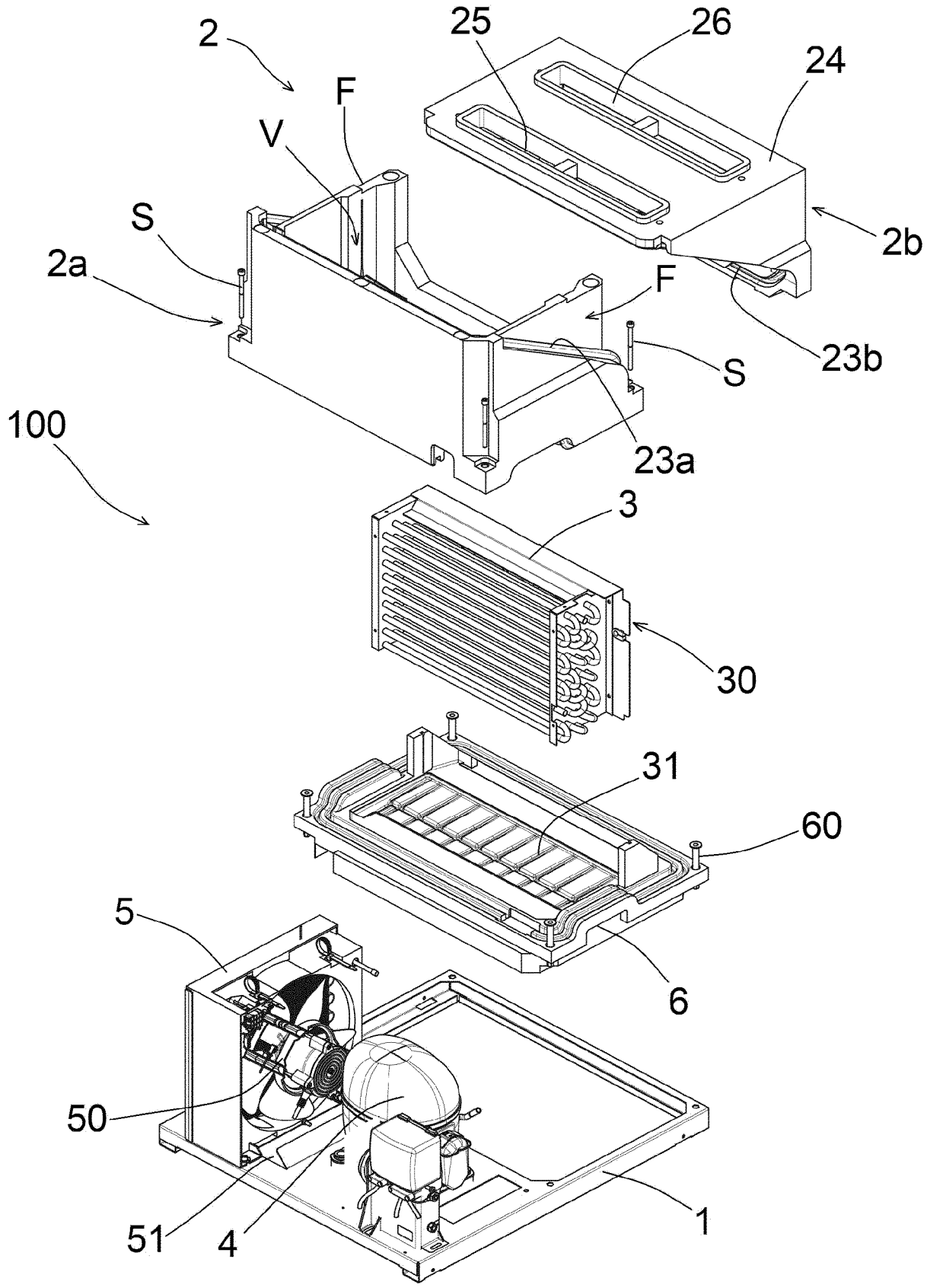

FIG. 6

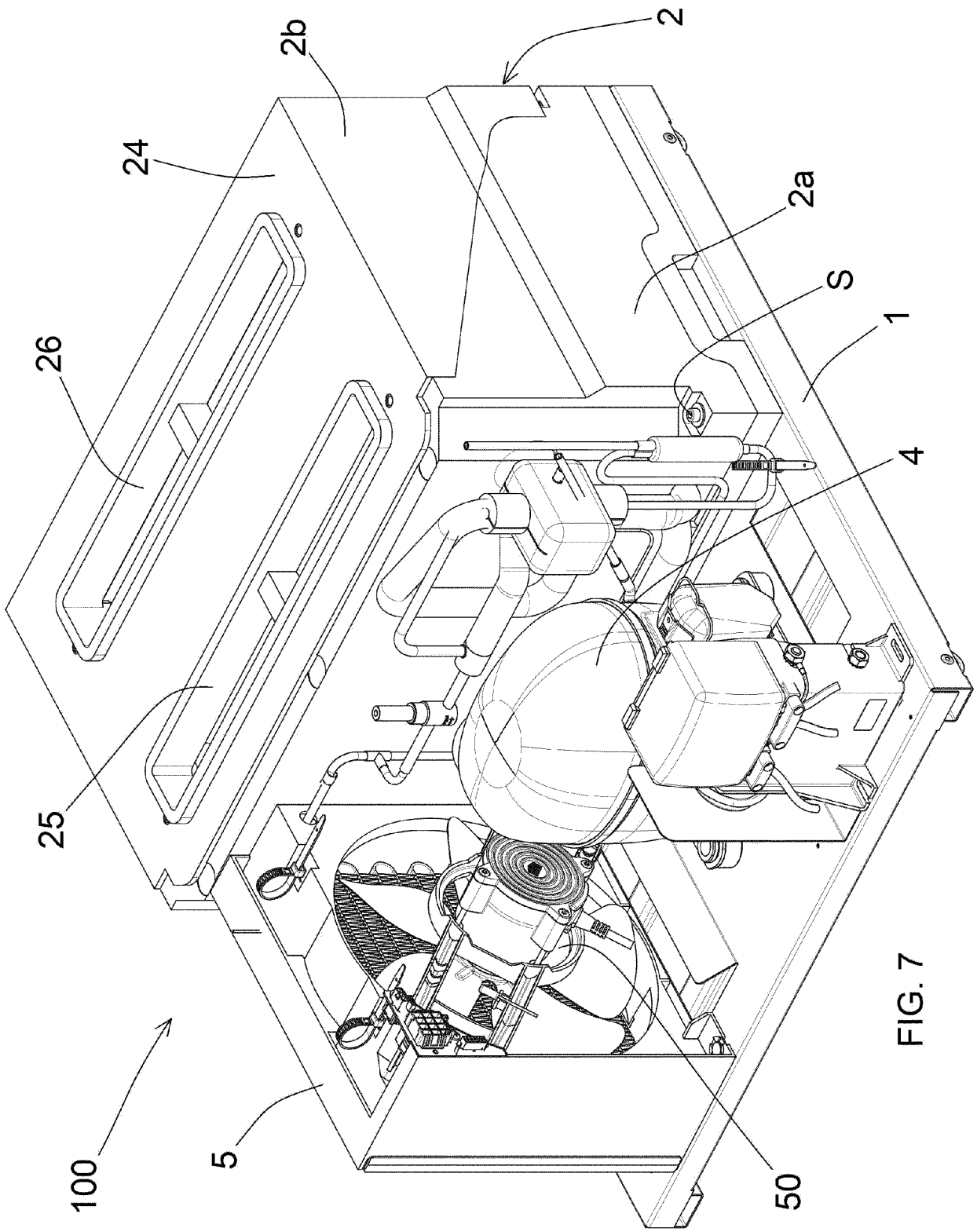

FIG. 7

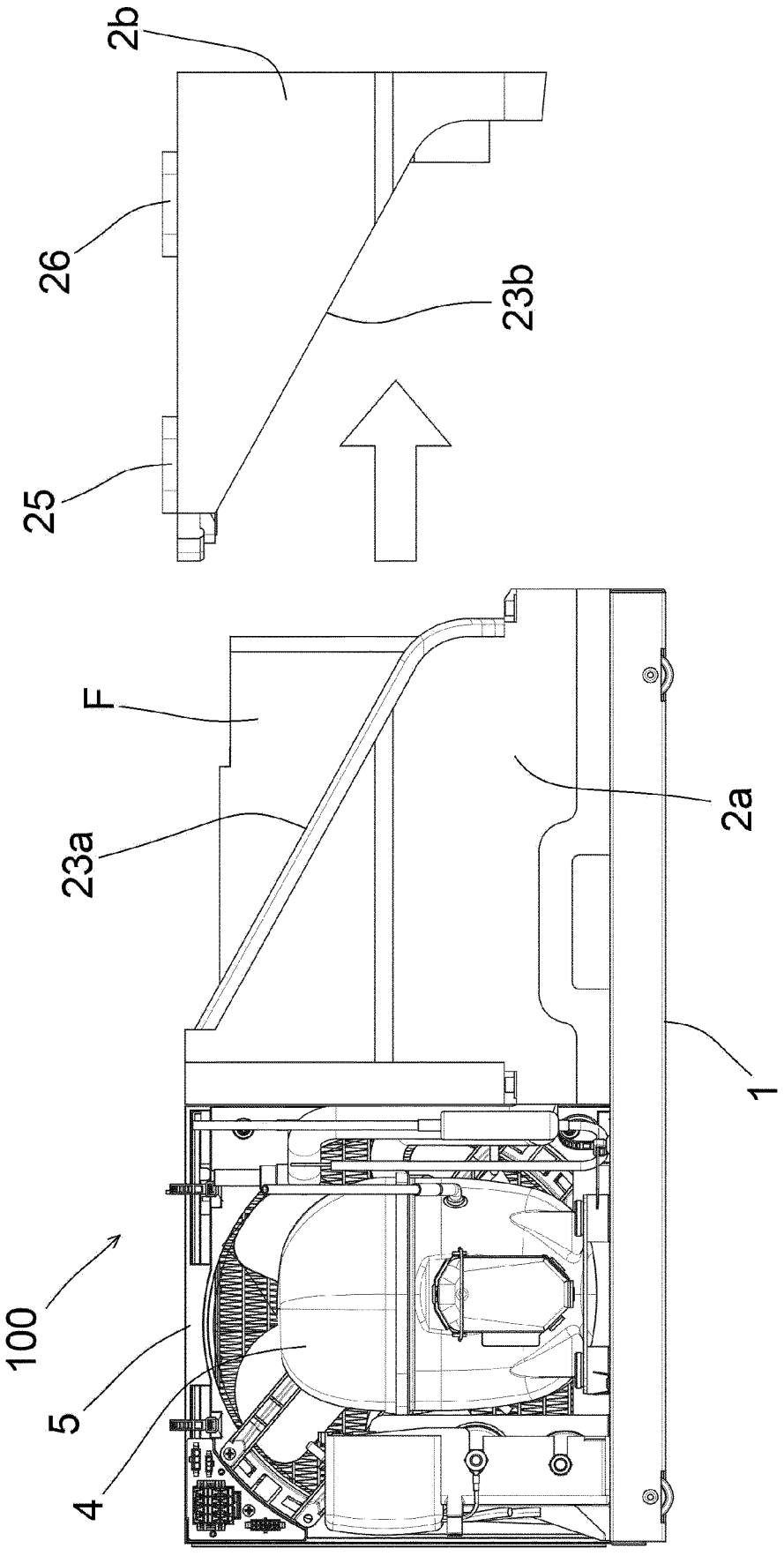

FIG. 8

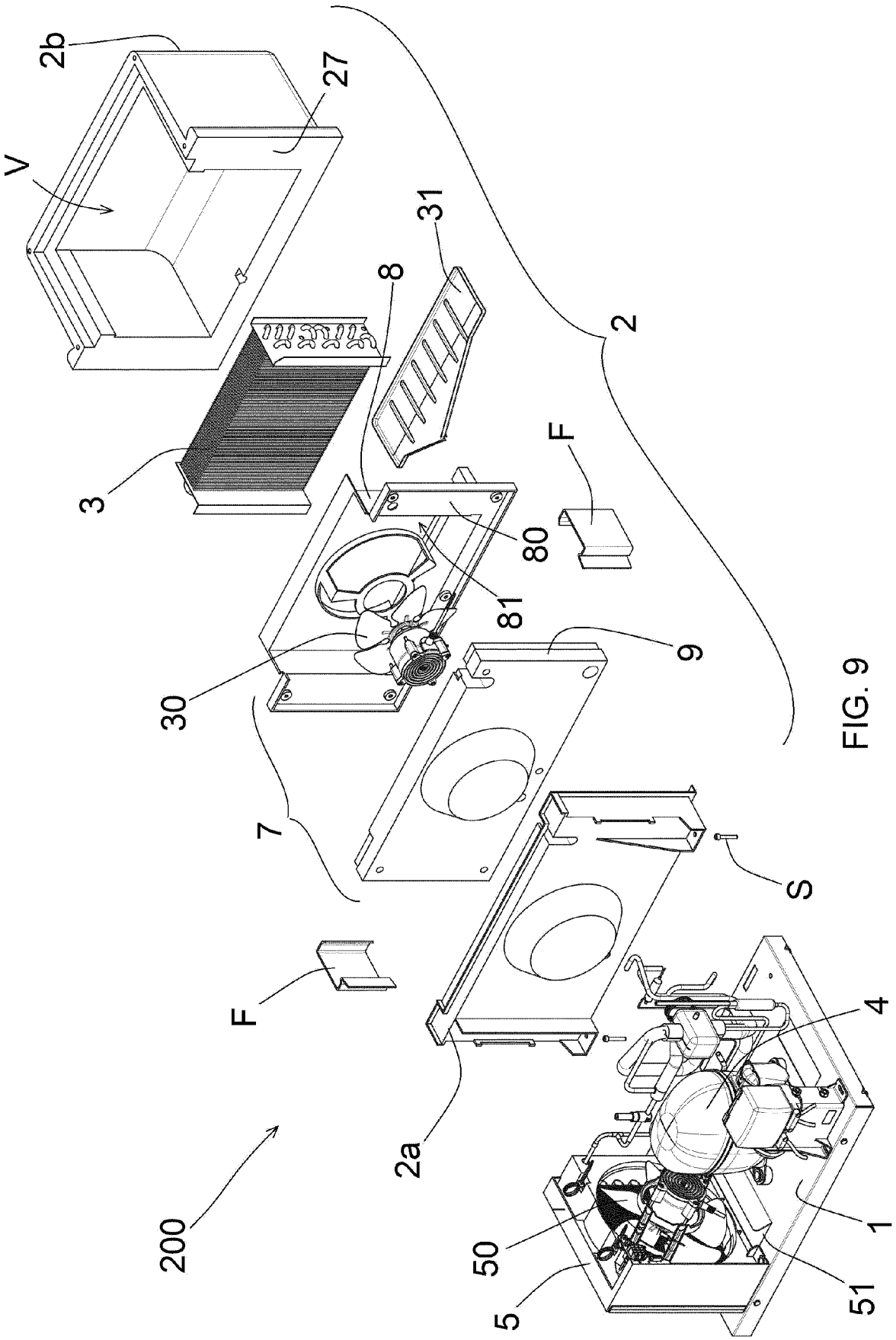

FIG. 9

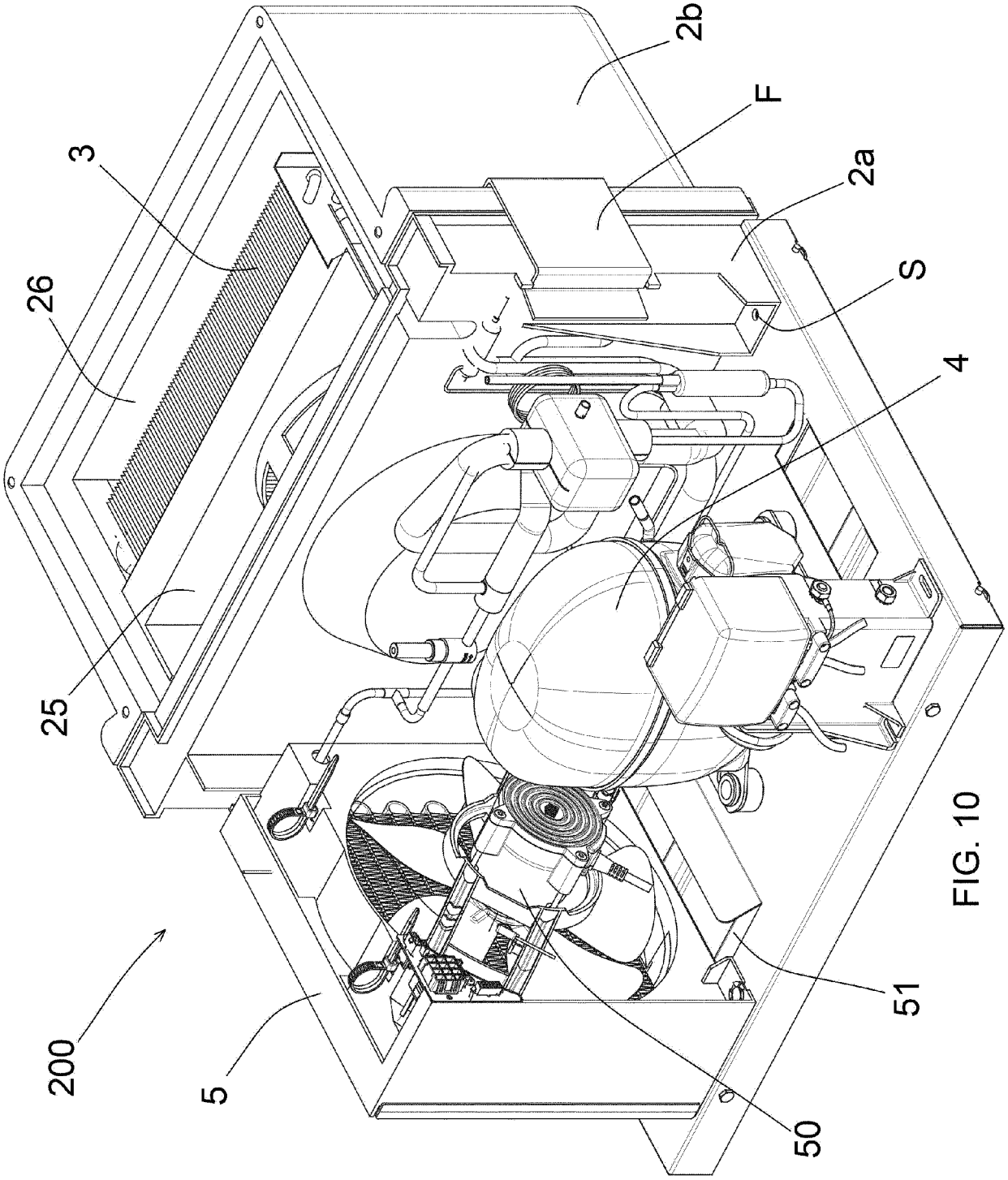

FIG. 10

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EUROPEAN SEARCH REPORT

Application Number
EP 23 16 2608

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Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
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TECHNICAL FIELDS SEARCHED (IPC)

F25D
F25B

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
The Hague	7 July 2023	Kolev, Ivelin

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07-07-2023

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