(19) Europäisches Patentamt
European Patent Office
Office européen des brevets

(11) **EP 3 171 098 A1**

(12) EUROPEAN PATENT APPLICATION

(43) Date of publication:
24.05.2017 Bulletin 2017/21

(51) Int Cl.:
F25B 1/00 *(2006.01)* ***F24F 1/02*** *(2011.01)*
F25D 19/02 *(2006.01)*

(21) Application number: **16198687.2**

(22) Date of filing: **14.11.2016**

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

(30) Priority: **18.11.2015 BR 102015028999**

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(54) COOLING SYSTEM FOR CABINETS AND COOLING CABINET BY FORCED AIR

(57) The present invention describes a valve mechanism for refrigerating machines compressors. More specifically, the valve mechanism operates to allow the equalization of pressure between the compression chamber of a reciprocating compressor and the discharge volume of the same compressor. This equalization is aimed at reducing the torque required for departure. The present invention lies in the field of mechanical engineering, more specifically in the field of fluid and cooling mechanics.

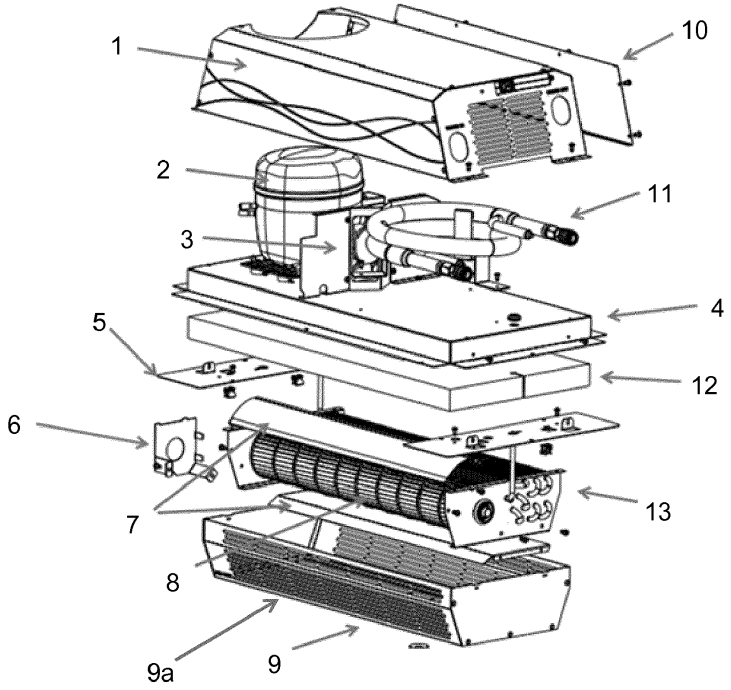

Figure 1

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Description

Field of the Invention

[0001] The present invention describes a cooling system for cabinets and cooling cabinet by forced air. The present invention lies in the fields of thermodynamic systems and cooling cabinets.

Background of the Invention

[0002] Supermarkets or trades varieties need to expose and deliver the goods to the customer so that it can simply remove the product they want from a shelf or storage location. However, when it comes to products that require refrigeration, such as beverage, dairy, meats, vegetables, meats, etc., it is necessary that they are in a cool environment.

[0003] Traditional cooling cabinets uses an axial fan which sucks the air through the bottom of the cabinet and discharges cold, by walls of the bottom shelves and top. Some versions also discharge a portion of air from the front upper part, forming an air curtain. The heat exchanger is mounted, usually at the bottom of the cabinet inside an air duct. Depending on the configuration and application of this case, the heat exchanger can operate with direct expansion cooling or a secondary fluid, where, in both cases, the cooling system is arranged remotely.

[0004] However, the systems used in the context are large and use large amounts of cooling. This fact entails, for example, greater difficulty of the system installation in refrigerated cabinets, besides decreasing the internal useful volume of the cabinet, since the cold side, that is, the region where it is discharged cold air is fixedly mounted in the cabinet, consuming its internal volume.

[0005] In a more compact form, there are options where the cooling system is mounted directly to the cabinet. In this case, the cabinet allows a greater degree of freedom regarding the installation of the same, it does not depend on prior infrastructure for the office of connection to remote cooling system. It is understood by direct mounting to the cabinet the installation of multiple independent components and, following their interconnection, so that it is no longer possible to remove the cooling unit without the need to remove part or all of cooling charge. The concept of direct cooling unit is more efficient and significantly reduces the cooling charge. However, if the cooling system fails, the entire cabinet is compromised because it presents difficulty and slowness for removal or installation of a new refrigeration unit, implying a high time with the cabinet out of operation.

[0006] Another option considers a cooling system mounted independent of the cabinet. Its assembly to the cabinet is then performed, usually on the top, at the bottom or side of the cabinet, so that the cold air is available for the interior of it. For products mounted on the top of the cabinet, the air is sucked through a central axial fan, mounted on a tray that acts as a water collector defrost as well as air duct, which directs to the heat exchanger and unloads cold by the left and right side. Another option of this same concept collects the air heated by food and offers cold to the cabinet through openings in the top, so that the evaporator be mounted outside the cabinet.

[0007] These settings enable the modularization of the refrigeration unit and a quick replacement of the same in a fault advent. Also brings the benefits of efficiency and reduced charge cooling. However, these settings bring some restrictions for its direct application in the office. The first, whose cold region is inserted in the cabinet, is effective for direct ventilation in the cabinet, but inefficient when engaged in air ducts, since it requires two distinct ducts and overlapping, one for the air intake at the bottom of the tray, where the air inlet of the axial fan is, another duct in the left and right sides, which are the cold air outlets. The second option is opposed to this, that is effective in mounting pipelines because it allows a minimum internal space but inefficient cabinet if required direct ventilation in the cabinet.

[0008] Thus, what is clear from the literature, no documents were found suggesting or anticipating the teachings of the present invention, so that the solution proposed here has novelty and inventive activity against the state of the art.

Summary of the Invention

[0009] Thus, the present invention aims to solve the listed problems in the art from a size of the cooling system and reduced weight by using a suitable venting means of the cold side, with a horizontal vent stream, allowing also the application of direct ventilation in the cabinet or in air ducts, in order to reduce the internal useful volume occupied for the installation of said system in a refrigerated cabinet.

[0010] In a first object the present invention provides a cooling system for cabinets comprising:

a. hot region (HR) having:

i. a cooling compressor assembly;
ii. cooling fluid condensation means;

B. cold region (CR) having:

i. Heat exchanger (13);
ii. venting means;
iii. air inlet (14);
iv. air outlet (15),

wherein:

- hot region (HR) and cold region (CR) are separated by a thermal insulating medium (12);
- the cooling compressor set, the cooling fluid condensation means, an expansion device and the heat exchanger on the cold side (13) are

associated with each other through a cooling circuit;
- the air inlet (14) and the air outlet (15) are intermediated by the heat exchanger (13) and a venting means; and

[0011] In a second object, the present invention provides a refrigeration cabinet by forced air adapted to receive at least one cooling system as defined above wherein:

a. the cabinet comprises an opening region for the insertion of said cooling system;
b. said system is fixed to the cabinet through the mounting region;
c. air inlet (14) from the cabinet is facing heated region (HA) and/or an opening of the cooling cabinet capable of providing access to the heated region (HA); and
d. the air outlet (15) is facing the cold region (CR) of the cooling cabinet and/or an opening of the cooling cabinet capable of providing access to a cold region (CR).

[0012] Also, in a third object, the present invention provides a cooling system for refrigerated environment comprising:

a. hot region (HR) having:

i. cooling fluid compressor set;
ii. cooling fluid condensation means;

b. cold region (CR) having:

i. heat exchanger (13);
ii. venting means;
iii. air inlet (14);
iv. air outlet (15),

wherein:

- the hot region (HR) and the cold region (CR) are separated by a thermal insulation means (12);
- the cooling fluid compressor set, the cooling fluid condensation means, an expansion device, and the heat exchanger on the cold side (13) are associated between them, by a cooling circuit;
- the air inlet (14) and the air outlet (15) are intermediated by the heat exchanger (13) and venting means; and
- the venting means is comprised by a fan (8) of tangential type associated with air deflector (7), or by a fan (8) of axial type.

[0013] The common inventive concept to all the claimed protection contexts refers to the use of a cooling system in refrigerated cabinets, more specifically, in cooling cabinets by forced air, allowing a horizontal air flow, using a means of ventilating comprising a fan (8) proper, and allow reversal of the direction of air flow through the positioning system. It also allows the direct application in the cabinet or in air ducts, as operating characteristics or design of the cabinet.

[0014] These and other objects of the invention will be immediately appreciated by those versed in the art and by companies with interests in the sector, and will be described in sufficient detail to reproduce in the description below.

Brief Description of the Figures

[0015] In order to better define and clarify the content of this patent application, these figures are presented:

Figure 1 shows an exploded view of the cooling system presented in the present invention. Where specified: cover (1), the compressor (2), a fan compressor (3), the base (4), base support (5), engine support (6), air deflectors (7), fan (8), tray (9), baffle tray (9a), access cover (10), condenser (11), thermal insulation (12) and a heat exchanger (13).
Figure 2 shows a second exploded view of the cooling system presented in the present invention. Where specified: cover (1) compression means (2), a fan for compression means (3), the base (4), base support (5), engine support (6), air deflectors (7) fan (8), tray (9), baffle tray (9a), access cover (10), condenser (11), thermal insulation (12) and an evaporator (13).
Figure 3 shows the exploded view of the cooling system presented in this invention with the fan version of axial type evaporator and, in this case, the air-cooled condenser may also be presented in water cooled version. Are indicated: cover (1) compression means (2), a fan for compression means (3), the base (4), fan (8), the tray (9), condenser (11), thermal insulator (12) and an evaporator (13).
Figure 4 shows an implementation scheme of the system proposed in the present invention in a refrigeration cabinet. As indicated: the top of the cabinet (TG), a thermal insulator (12), the hot region (HR) of the cooling system, the cold region (CR) of the cooling system, air inlet (14), air outlet (15), a heated region of the cabinet (HA) and the cold region of the cabinet (CR), both of which are in the inner region of the cabinet (IR).
Figure 5 shows a side view of an embodiment of the proposed system implemented in a refrigerated cabinet in order to detail the hot region (HR) of the cooling system, the cold region (CR) of the cooling system, a region heated cabinet (HA) and the cold region of the cabinet (CR) and the inner region of the cabinet (IR).

Detailed Description of the Invention

[0016] The descriptions that follow are presented by way of example and not limiting the scope of the invention and will understand more clearly the object of the present application.

[0017] The present invention provides a cooling system, which can be seen in Figures 1, 2 or 3, to be installed in refrigerated cabinets, to maintain an appropriate temperature within said cabinet for the product kept in the same. Where the cooling system for a hot region (HR) and a cold region (CR) in the hot region (HR) is defined comprising the components which have a temperature rise at the time of working, and the cold region (RF) region defined by providing the air under conditions of low temperatures, responsible for cooling the inner region (IR) of the cabinet.

[0018] In the present invention, means a refrigerated cabinet, an environment for the storage of products or any type of object that needs to be cooled to an appropriate temperature. As shelves or cabinets air forced available in grocery stores that store refrigerated products, or frozen, for which it must maintain proper product temperature to prevent the same from becoming unusable. Also, the offices listed in this invention may be of the modular type, that is, the cabinet is associative with other cases of the same type, or different from operating together.

[0019] The hot area (HR) disposed external to the refrigerated cabinet, is composed of a cooling compressor assembly and condensing cooling media, where the process involved occurs by conventional means. The cooling may be any fluid capable of being regulated compressed and condensed in the process. In one example, the cooling used in the present invention is a natural cooling R-290, but not limited to this.

[0020] In one embodiment, the cooling compressor set used in the present invention comprises at least one compressor (2) and at least one fan to the compressor (3), this is not necessarily required. The compressor (2) has the primary function to accomplish the compression of cooling for further cooling process, promoting the pressure differential for the system operation, while the compressor fan (3) is used to ensure air insufflating to said compressor (2) and/or condenser.

[0021] In an embodiment, means condensing cooling, can be understood by any component capable of performing exchange of the high pressure side of the heat and allowing condensation of the cooling, by heat exchange with a fluid which can be, for example, air, water or any other fluid that is provided by the structure of the installed product, such as a capacitor (11) water or air.

[0022] The cold region (CR) arranged inside the cooled cabinet comprises a heat exchanger (13), venting means air inlet (14) and air outlet (15). In this region, the air heated by the products stored in the cabinet, heated area (HA) is cooled and sent to the insufflation region's cabinet, cold region (CR), cooling the region of interest of the cabinet, internal region (IR), as can be seen in figure 4.

[0023] In an embodiment, the means for ventilating the cold region (CR) comprises a fan (8) and the tangential air deflectors (7) where the air exits tangentially to the axis of said fan (8). The tangential fan (8) allows a reduction in size of the cooling system proposed in the present invention, resulting in the fact that the space that the cold region (CR) occupies the internal volume of the cabinet is reduced. In a second embodiment, the venting means comprises a fan (8) of axial type, wherein said axial fan (8) is used to depth with the cold region (CR) penetrates the inside of the cabinet is larger as necessarily requires a space to direct air to the heat exchangers (13). Already with the use of the tangential fan (8), the depth dimension is reduced to at most the width of the fan impeller or from the heat exchanger (13), whichever is greater. This configuration allows the performance of the refrigeration system is maintained, when compared to systems using fans of the axial type.

[0024] The said tangential fan (8) has the function of moving the return air cabinet, i.e. the hot air through the evaporator for cooling and its supply to the cabinet, delivering cold air. Also, to enable the generation of vortices that maximize and direct air tangential fan insufflation (8), are used air deflectors (7).

[0025] In one embodiment, the heat exchanger (13) arranged in the system is defined by a serpentine displayed adjacently along the length of the tangential fan (8). In one example, as can be seen in Figures 1 and 2, the coil (13) is arranged parallel to the tangential fan (8), running all along its length. This configuration reduces the air velocity through the heat exchanger (13), which reduces the pressure loss between the inlet pressure and air outlet in said heat exchanger.

[0026] With regard to the fan (8) axially, although even occupy greater internal volume, this concept also permits their use directly on the cabinet or ducts, similar to that observed with the configuration using the cross-flow fan as a function the arrangement of the components. In this case, the size reduction of the product allows its application even in smaller offices, known as product 1 port. The version that uses the tangential fan only allows its assembly into larger offices, known as 2 products or multiple ports.

[0027] In the embodiment of the fan (8) axial heat exchanger (13) is defined by serpentine arranged in a region opposite to the region of installing said axial fan (8).

[0028] Furthermore, the venting means, both the blower (8) tangentially when the ventilator (8) axially, is arranged in the cooling cabinet structure, which thus does not belong to the cooling unit assembly i.e., the refrigeration unit is provided without the venting means.

[0029] Figure 4 shows an arrangement of the cooling system proposed in the present invention in a refrigerated cabinet, which it is seen that the system mounting region is able to provide the cold region (CR) being disposed in a region cooling cabinet, i.e. the part where the desired products are stored, where it is cooled. And thus, the hot

region (HR) being arranged in an insulated cabinet region, preventing the heat produced by the operation of the components to be transferred to the cold region (CR). For this, the hot region (HR) and cold region (CR) are separated by a thermal insulator (12) being arranged externally of the cabinet.

[0030] It is understood by thermal insulation (12) any material that reduces heat transfer from the hot region (HR) to the cold region (CR). Where, in one embodiment, the insulating medium used in the invention can be EPS (expanded polystyrene), whose thermal conductivity is around 0.033 W/mK, PU (Polyurethane), whose thermal conductivity is around 0.02 W/mK or other insulating elements not listed.

[0031] Thus, the system is mounted on the refrigerated cabinet via a mounting region, which comprises a base (4) and the supports of the base (5). The base (4) ensures the system structure and the insulator housing (12) between the cold regions (CR) and hot (HR), and enable mounting components thereon. The base support (5) allows the mounting of the refrigeration system to the cabinet, and allows the association of a sealing member such as a gasket at the interface between the system and the cabinet, and acoustically isolating heat. The sealing element is installed around the interface between the case and the proposed system, avoiding physical contact with the metal parts, and prevent cold air leakage to the outside or entry of insects and dust.

[0032] The air intakes (14) disposed in the cold region (CR) are responsible for allowing air to enter the heated region (HA) of the cabinet, which air is hot, so that it is cooled and forwarded to the inner region (IR) of the cabinet through the air vents (15). For this, the air inlet (14) and the air outlet (15) are intermediated by the heat exchanger (13) and the fan (8) allowing horizontal ventilation. The concept of horizontal ventilation is defined by the fact that the air flow moves horizontally within the environment to which the system is applied, for example, in a cooling cabinet.

[0033] Thus, the ventilating means enables the direction of air flow is defined according to system setup, in which the direction is determined by the position which the proposed system is installed. The direction of air flow is set with variations by 180 °.

[0034] Furthermore, in the cold region (RF) is disposed a condensates tray (9), which acts as an air duct in the heat exchanger (13) and allows the collection of defrost water, avoiding dripping office. This fact implies that the system allows the circulation of air flow in both directions, by simply reversing the refrigeration unit and the drain connection of readjustment.

[0035] The tray (9), presented on the concept with tangential blower, comprising baffles (9a) that allow directing the air entering or exiting the system. That is, the cold air reaches the inner region (IR) of the refrigerated cabinet directed by deflector (9a) on the system air outlet. In one exemplification, the air deflectors (9a) of the tray can provide an adjustable air outlet angle being adaptable to the installation environment.

[0036] The present invention also provides a refrigeration cabinet by forced air adapted to receive the proposed cooling system described herein, where the arrangements are shown in Figures 4 and 5. The case comprises an opening region for the insertion of the proposed cooling system in order to facilitate installation of the refrigeration unit. Thus, the system is then set in said cabinet cooling air forced through mounting region contained in the system itself, wherein the base support (5) allows the insertion of fasteners for coupling the system to the cabinet.

[0037] In addition, assembly of the system is defined by the air inlet (14) of the system facing the heated region (HA) of the cabinet, or to an opening of the cooling cabinet capable of providing access to the heated region (HA), such as an insufflation duct.

[0038] Thus, the air outlet (15) faces the cooled area (CR) of the refrigeration cabinet or to an opening of a refrigerating cabinet capable of providing access to the cold region (CR), so that, the cold air is blown into the inner region (IR) of the cooling cabinet, doing it directly. Another way to perform the cold supply air in the inner region (IR) of the cooling cabinet is engaging said cooling system air ducts arranged in the top of the cooling cabinet (TG), allowing the provision of cooled air to a compartment single or a modular office. Thus, air outlet (15) is engaged wholly or partly to the ventilation ducts, and can provide cold air insufflating the inner region (IR) of the cabinet.

[0039] The forced air cabinet proposed in the present invention is associative the at least one second cooling cabinet, and may be the same or different designs, where all forced air cabinets associated share one or more cooling units. Thus, the total capacity of the cooling unit cooling is appropriate the sum of the thermal demand of all cabinets associated with the assembly, once the set of associated cabinets can share more than one refrigeration unit when in operation.

[0040] Thus, the present invention enables the cooling cabinet with a small-sized cooling system which occupies little internal volume of the cabinet, in addition to a low weight, ease of installation of the same and provides a circulation of air flow in both directions in a horizontal ventilation.

[0041] Those skilled in the art will value the knowledge presented herein, and may play the invention shown in the embodiments, and other embodiments which fall within the scope of the appended claims.

Claims

1. Cooling system for cabinets, **characterized by** comprising:

    a. hot region (HR) having:

i. cooling fluid compressor set;
ii. cooling fluid condensation means;

b. cold region (CR) having:

i. heat exchanger (13);
ii. venting means;
iii. air inlet (14);
iv. air outlet (15),

wherein:

- the hot region (HR) and the cold region (CR) are separated by a thermal insulation means (12);
- the cooling fluid compressor set, the cooling fluid condensation means, an expansion device, and the heat exchanger on the cold side (13) are associated between them, by a cooling circuit;
- the air inlet (14) and the air outlet (15) are intermediated by the heat exchanger (13) and venting means.

2. Cooling system for cabinets, according to claim 1, **characterized by** the fact that the venting means is comprised by at least one fan (8) of tangential fan type associated with an air deflector (7).

3. Cooling system for cabinets, according to claim 1, **characterized by** the fact that the venting means is comprised by at least one fan (8) of axial fan type.

4. Cooling system for cabinets, according to claim 1, **characterized by** the fact that the venting means is disposed on the cabinet structure.

5. Cooling system for cabinets, according to claim 1, **characterized by** comprising assembly region of the cooling system with the cabinet capable of promoting the disposition of cold region (CR) in a cabinet cooling region and the hot region (HR) in an insulated region of the cabinet.

6. Cooling system for cabinets, according to claim 5, **characterized by** the fact that the assembly region comprises at least one base (4) mounted to at least one base support (5), wherein at least one sealing member is associated to said base support (5).

7. Cooling system for cabinets, according to claims 1 and 2, **characterized by** the fact that the heat exchanger (13) is defined by a condenser disposed adjacent through the length of a tangential fan (8).

8. Cooling system for cabinets, according to any of claims 1 to 5, **characterized by** the fact that the venting means id adapted to make possible the horizontal ventilation flow, being the flow direction determined by the system positioning.

9. Cooling cabinet by forced air **characterized by** the fact that is adapted to receive at least a cooling system as defined on claims 1 to 6, wherein:

a. cabinet comprises an opening region for the insertion of said cooling system;
b. said system is fixed to the cabinet by means of an assembly region;
c. the air inlet (14) coming from the cabinet faces the heated region (HR) and/or for a cooling cabinet opening capable of providing access to the heated region (HR); and
d. the air outlet (15) faces the cooled region (CR) of cooling cabinet and/or for a cooling cabinet opening capable of promoting access to the cooled region (CR).

10. Cooling cabinet by forced air, according to claim 6, **characterized by** the fact that the air outlet (15) is capable of inflating cold air inside (IR) of cabinet in a direct manner.

11. Cooling cabinet by forced air, according to claim 6, **characterized by** the fact that the air outlet (15) is capable of inflating cold air inside (IR) of cabinet in a direct manner, being coupled totally or partially in ducts.

12. Cooling cabinet by forced air, according to claims 6 to 7, **characterized by** the fact that it is associative to at least a second cooling cabinet by forced air, wherein the cooling unit is shared for all associate cabinets.

13. Cooling system for cooled environments, **characterized by** comprising:

a. hot region (HR) having:

i. cooling fluid compressor set;
ii. cooling fluid condensation means;

b. cold region (CR) having:

i. heat exchanger (13);
ii. venting means;
iii. air inlet (14);
iv. air outlet (15),

wherein:

- the hot region (HR) and the cold region (CR) are separated by a thermal insulation means (12);
- the cooling fluid compressor set, the cool-

ing fluid condensation means, an expansion device, and the heat exchanger on the cold side (13) are associated between them, by a cooling circuit;

- the air inlet (14) and the air outlet (15) are intermediated by the heat exchanger (13) and venting means; and
- the venting means is comprised by a fan (8) of tangential type associated with air deflector (7), or by a fan (8) of axial type.

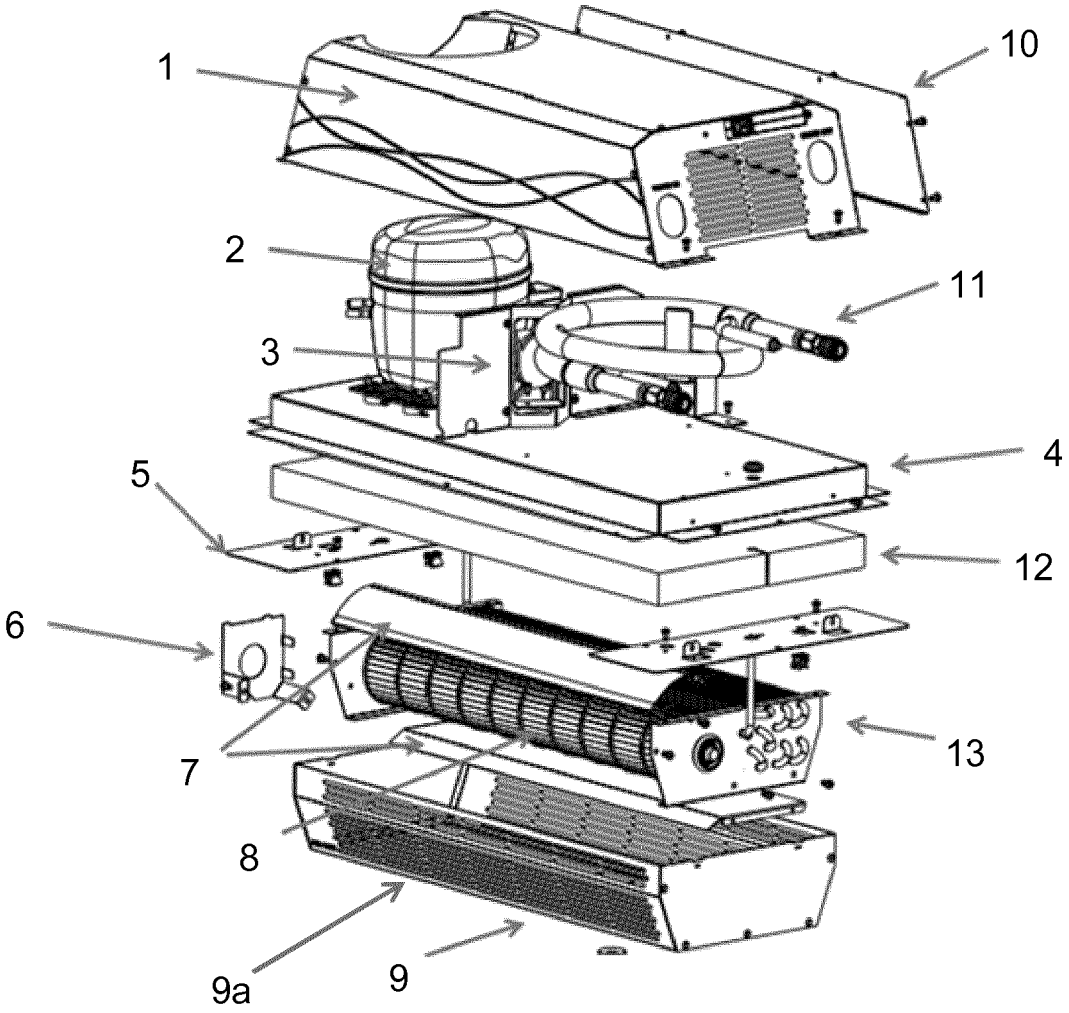

Figure 1

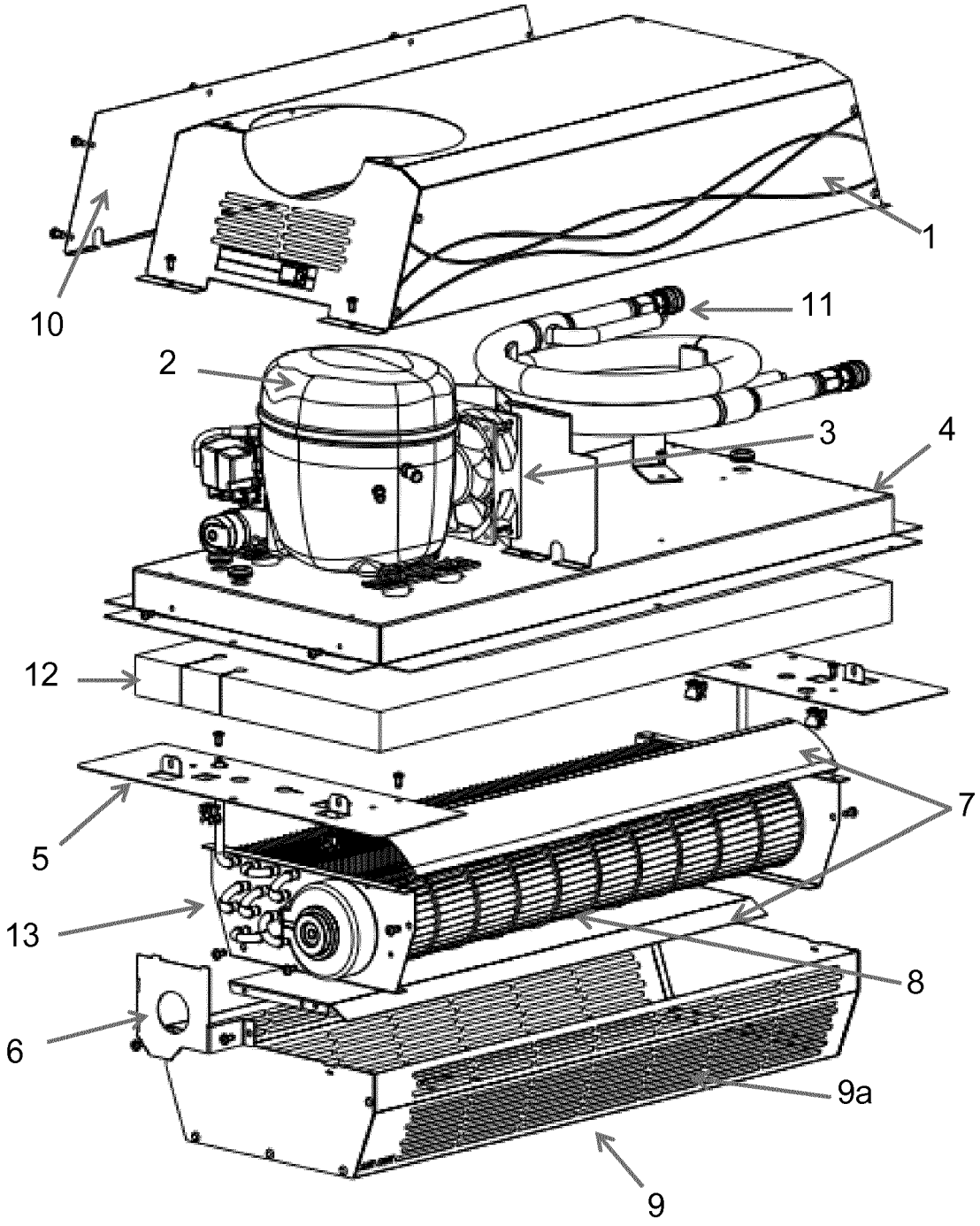

Figure 2

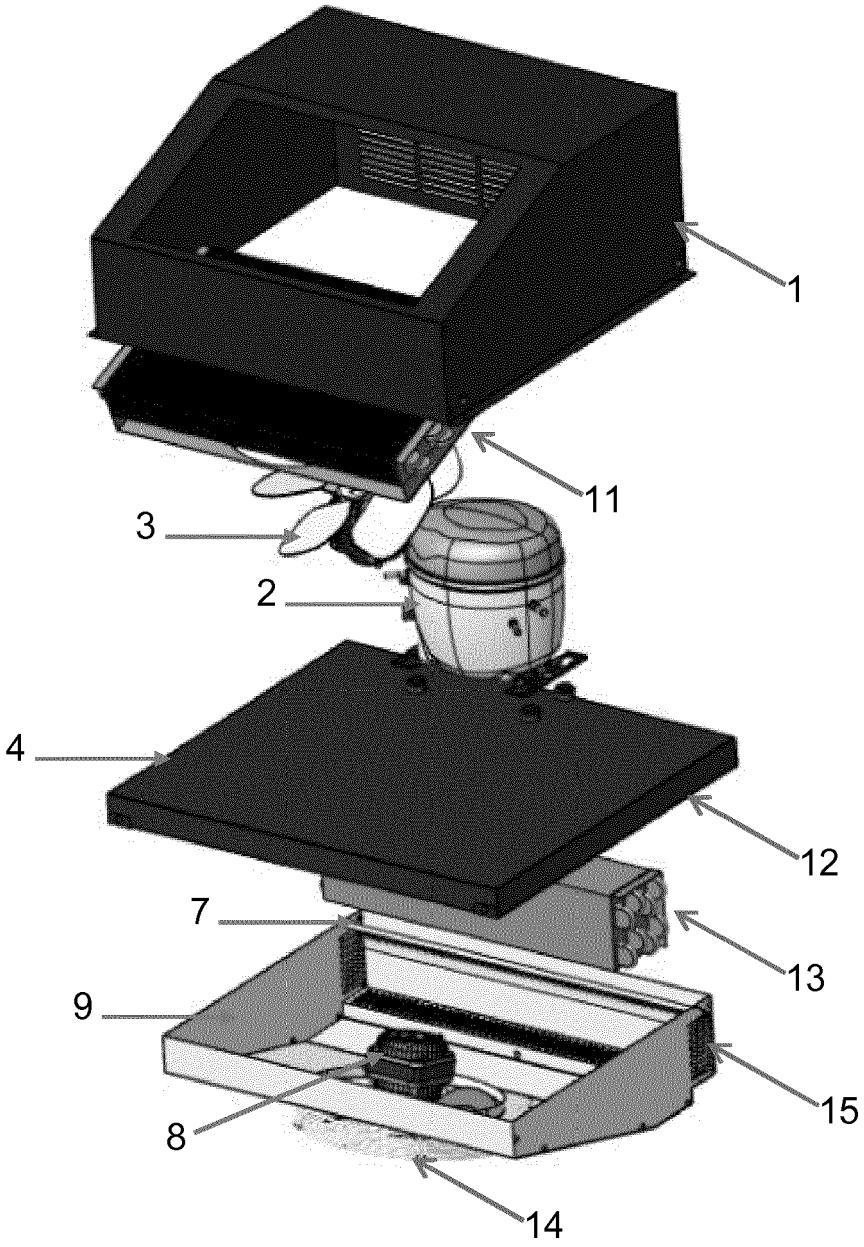

Figure 3

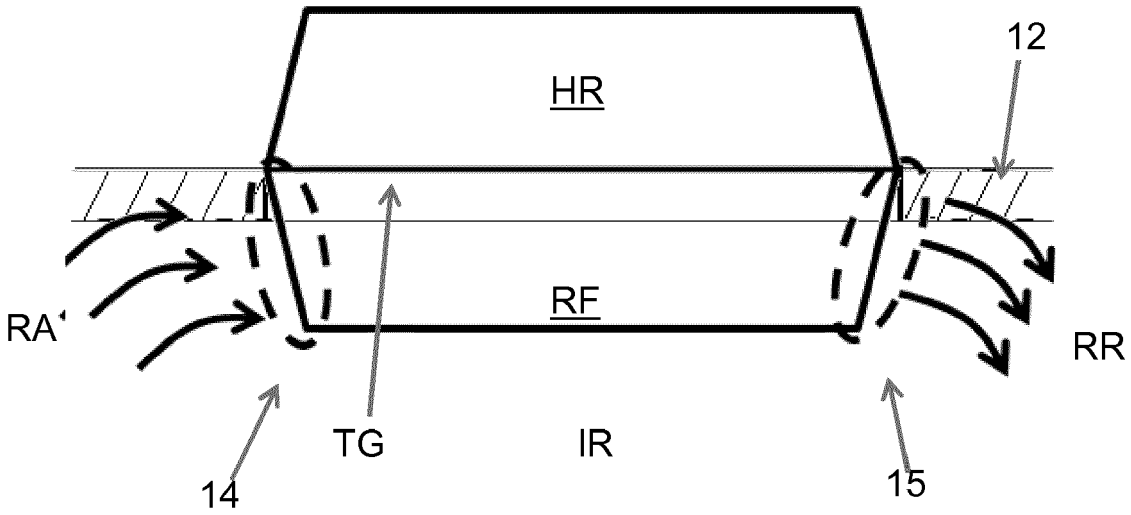

Figure 4

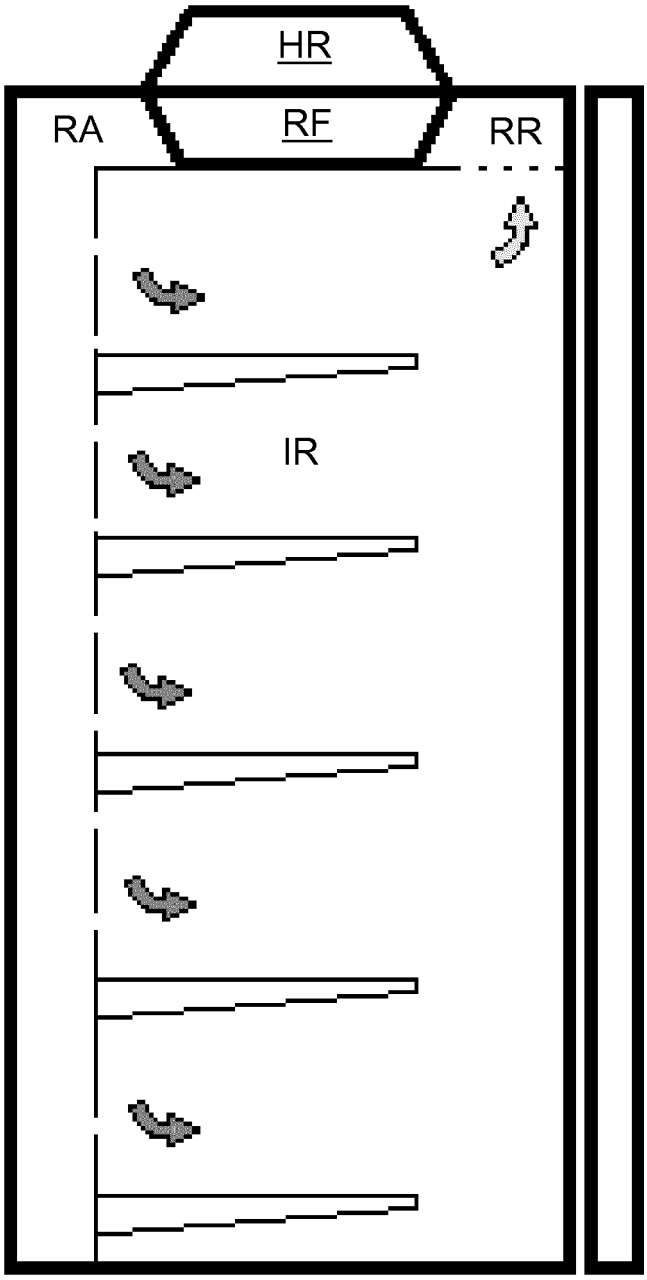

Figure 5

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EUROPEAN SEARCH REPORT

Application Number
EP 16 19 8687

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
X	US 2 914 927 A (CORHANIDIS SEBASTIEN S) 1 December 1959 (1959-12-01) * the whole document *	1-13	INV. F25B1/00 F24F1/02 F25D19/02
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TECHNICAL FIELDS SEARCHED (IPC)

F25B
F24F
F25D

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
The Hague	21 March 2017	Boyer, Olivier

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
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EPO FORM 1503 03.82 (P04C01)

ANNEX TO THE EUROPEAN SEARCH REPORT ON EUROPEAN PATENT APPLICATION NO. EP 16 19 8687

This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report. The members are as contained in the European Patent Office EDP file on
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21-03-2017

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