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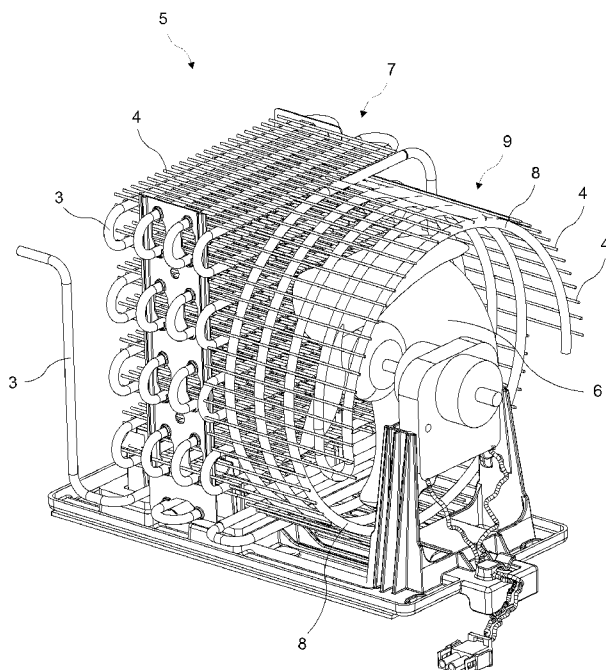
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[Continued on next page]

(54) Title: A COOLING DEVICE COMPRISING A CONDENSER COOLED BY A FAN

Figure 2



(57) Abstract: The present invention relates to a cooling
device (1) comprising a body, a compressor (2) providing the
refrigeration cycle to be performed, a coil shaped condenser
(5) providing the refrigerant to be condensed, having at least
one refrigerant tube (3) wherein the refrigerant circulates and
more than one wire (4) increasing the heat transfer and form-
ing a rigid configuration by being fastened to the refrigerant
tubes (3), a fan (6) which provides the condenser (5) and the
compressor (2) to be cooled by blowing air thereon and a
machine room (10) wherein the compressor (2), the condenser
(5) and the fan (6) operate.



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GW, ML, MR, NE, SN, TD, TG).

Description**A COOLING DEVICE COMPRISING A CONDENSER COOLED BY A FAN**

[0001] The present invention relates to a cooling device wherein the compressor and the condenser operating in the machine room are cooled by the fan.

[0002] In the refrigerant cycle realized in cooling devices, for example in refrigerators, the heat absorbed from the interior of the cooling device is discharged to the outer environment by means of the condenser. In conventional refrigerators, the static type condenser that operates according to the natural heat convection principle is preferred and in no-frost refrigerators, the coil type condenser that operates according to the forced heat convection principle is preferred. In no-frost refrigerators, the compressor and the condenser generally operate in the machine room which is called the cabinet base region and which is situated at the bottom portion of the refrigerator body. The condenser and the compressor are provided to be cooled by means of a fan situated in the machine room. In known embodiments, the fan is generally of axial type and an air guide is disposed around the fan in order to guide the air blown in the axial direction by the fan directly to the condenser. The air guide occupies space in the machine room and due to the turbulences that occur in the air flow, the condenser and the compressor cannot be cooled efficiently. Moreover, the elements operating in the machine room, especially the fan that rotates at high speed, are required to be protected by being closed all around due to safety reasons. In some embodiments, in order to provide security, the fan operates in a casing or the machine room is closed by a lid. The elements such as the fan casing and the machine room lid slow down the air flow and an effective cooling cannot be provided in the condenser and the compressor.

[0003] In the cooling device explained in the state of the art International Patent Application No. WO2008040724, the air that is received into the machine room by being sucked from the outer environment by means of a fan is delivered onto a condenser casing which is composed of telescopic bodies and wherein the condenser is situated.

[0004] In the refrigerator explained in the United States Patent No. US5592829,

the fan disposed between the compressor and the coil shaped condenser directs the ambient air onto the compressor by sucking it from over the condenser.

[0005] In the refrigerator explained in the Australian Patent No. AU762033, a partition is disposed between the condenser and the fan and an air guide disposed around the fan is placed in the opening situated on the partition.

[0006] The aim of the present invention is the realization of a cooling device comprising a condenser which is provided to be efficiently cooled by the air blown by the fan.

[0007] The cooling device realized in order to attain the aim of the present invention, explicated in the first claim and the respective claims thereof, comprises a machine room wherein the compressor and the condenser operate, and the compressor and the condenser are provided to be cooled by means of an axial fan. The condenser comprises two portions with different geometries. The refrigerant flow tube which passes through the first portion is in serpentine form and the air blown by the fan in the axial direction acts thereon. The second portion of the condenser has a helical flow tube which is joined with the flow tube extended from the first portion, and the helical flow tube surrounds the fan along the depth of the fan. The air blown by the fan in the radial direction acts on the second portion surrounding the fan.

[0008] In an embodiment of the present invention, some of the heat exchanger wires disposed in the condenser is fastened around the helical flow tube by being extended from the first portion towards the second portion and forms a cage configuration around the fan together with the helical flow tube.

[0009] In another embodiment of the present invention, the serpentine and helical flow tubes are produced by forming a single-piece metal tube.

[0010] In another embodiment of the present invention, the serpentine and helical flow tubes are produced separately and joined by welding.

[0011] In the cooling device of the present invention, a separate casing for protecting the fan or a lid for covering the machine room are not required. The air blown by the fan in the radial direction is effectively utilized without

using an air guide, the volume occupied by the condenser is decreased and the efficiency of the condenser is increased.

[0012] The cooling device realized in order to attain the aim of the present invention is illustrated in the attached figures, where:

[0013] Figure 1 – is the schematic view of the machine room of the cooling device of the present invention.

[0014] Figure 2 – is the perspective view of the condenser and the cooling fan disposed in the cooling device of the present invention.

[0015] The elements illustrated in the figures are numbered as follows:

1. Cooling device
2. Compressor
3. Refrigerant tube
4. Wire
5. Condenser
6. Fan
7. First portion
8. Helical refrigerant tube
9. Second portion
10. Machine room

[0016] The cooling device (1) comprises a body, a compressor (2) providing the refrigeration cycle to be performed, a coil shaped condenser (5) having at least one refrigerant tube (3) wherein the refrigerant circulates, a fan (6) which provides the condenser (5) and the compressor (2) to be cooled by blowing air thereon and a machine room (10) wherein the compressor (2), the condenser (5) and the fan (6) operate.

[0017] The condenser (5) disposed in the cooling device (1) of the present invention is composed of two portions and comprises a first portion (7), located in front of the fan (6), the refrigerant tube (3) passing through which is in serpentine form and whereon the air blown by the fan (6) in the axial direction acts, and a second portion (9) integrated to the first portion (7), located around the fan (6), whereon the air blown by the fan (6) in the radial direction acts and having a helical refrigerant tube (8) that is joined with the refrigerant tube (3) extended from the first portion (7), that

surrounds the fan (6) along at least the depth (D) of the fan (6) fins in the axial direction.

- [0018] The air blown by the fan (6) in the axial direction flows directly to the first portion (7) of the condenser (5) and provides the first portion (7) to be cooled by acting on the serpentine refrigerant tubes (3). The fan (6) is of axial type and blows a large portion of the air in the axial direction during its operation; however, the fan (6) inevitably blows some amount of air also in the radial direction. The air blown by the fan (6) in the radial direction acts on the helical refrigerant tubes (8) in the second portion (9) surrounding the fan (6) and the air blown by the fan (6) in the radial direction is effectively utilized without using an air guide.
- [0019] In an embodiment of the present invention, the cooling device (1) comprises more than one wire (4) disposed on the refrigerant tubes (3), which increases the heat transfer and forms a rigid configuration by being fastened to the refrigerant tubes (3) and which is fastened around the helical refrigerant tube (8) by being extended from the first portion (7) to the second portion (9) of the condenser (5), protecting the fan (6) by forming a cage configuration around the fan (6) together with the helical refrigerant tube (8). The wires (4) are provided to be used commonly by the first and the second portions (7, 9), separate wires (4) are not used for the second portion (9) which has a different geometry than that of the first portion (7), ease of production is provided and a rigid configuration is obtained.
- [0020] In another embodiment of the present invention, the serpentine refrigerant tube (3) disposed in the first portion (7) of the condenser (5) and the helical refrigerant tube (8) disposed in the second portion (9) thereof are produced by making two separate forms suitable for both portions (7, 9) out of a single-piece metal tube.
- [0021] In another embodiment of the present invention, the serpentine refrigerant tube (3) and the helical refrigerant tube (8) are produced separately and joined by welding.
- [0022] In the cooling device (1) of the present invention, since the fan (6) is protected by the helical refrigerant tube (8) surrounding the fan (6) and the

wires (4) fastened to the helical refrigerant tube (8), a casing for protecting the fan (6) or a lid for covering the machine room (10) are not required.

The air blown by the fan (6) in the radial direction is utilized and an additional air guide for directing the air in the axial direction is not required. In the condenser (5), less number of refrigerant tubes (3, 103) is used in total compared to the known embodiments, the volume occupied by the condenser (5) in the machine room (10) is decreased and the efficiency of the condenser (5) is increased.

[0023] It is to be understood that the present invention is not limited by the embodiments disclosed above and a person skilled in the art can easily introduce different embodiments. These should be considered within the scope of the protection postulated by the claims of the present invention.

Claims

1. A cooling device (1) **comprising** a compressor (2) providing the refrigeration cycle to be performed, a condenser (5) having at least one refrigerant tube (3) wherein the refrigerant circulates and a fan (6) which provides the condenser (5) and the compressor (2) to be cooled by blowing air thereon, **characterized** by the condenser (5) comprising a first portion (7) located in front of the fan (6), the refrigerant tube (3) passing through which is in serpentine form and a second portion (9) integrated to the first portion (7), located around the fan (6), having a helical refrigerant tube (8) that is joined with the refrigerant tube (3) extended from the first portion (7), that surrounds the fan (6) along at least the depth (D) of the fan (6) fins in the axial direction..
2. A cooling device (1) as in Claim 1, **characterized by** more than one wire (4) disposed on the refrigerant tubes (3), which is fastened around the helical refrigerant tube (8) by being extended from the first portion (7) to the second portion (9) of the condenser (5), protecting the fan (6) by forming a cage configuration around the fan (6) together with the helical refrigerant tube (8).
3. A cooling device (1) as in Claim 1 or 2, **characterized by** the condenser (5), the serpentine refrigerant tube (3) and the helical refrigerant tube (8) of which are produced by forming a single-piece metal tube.
4. A cooling device (1) as in Claim 1 or 2, **characterized by** the condenser (5), the serpentine refrigerant tube (3) and the helical refrigerant tube (8) of which are produced separately and joined by welding.

Figure 1

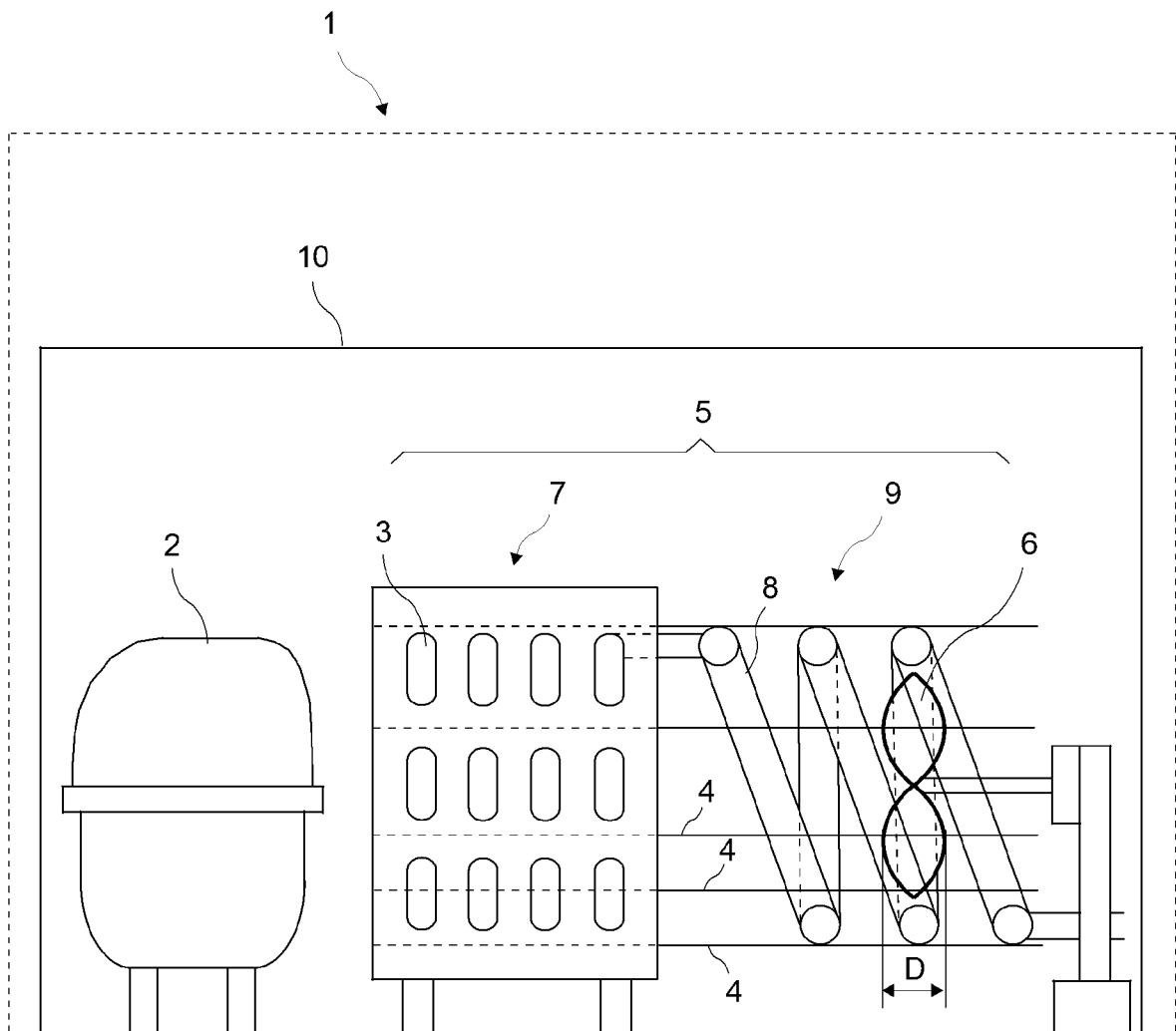
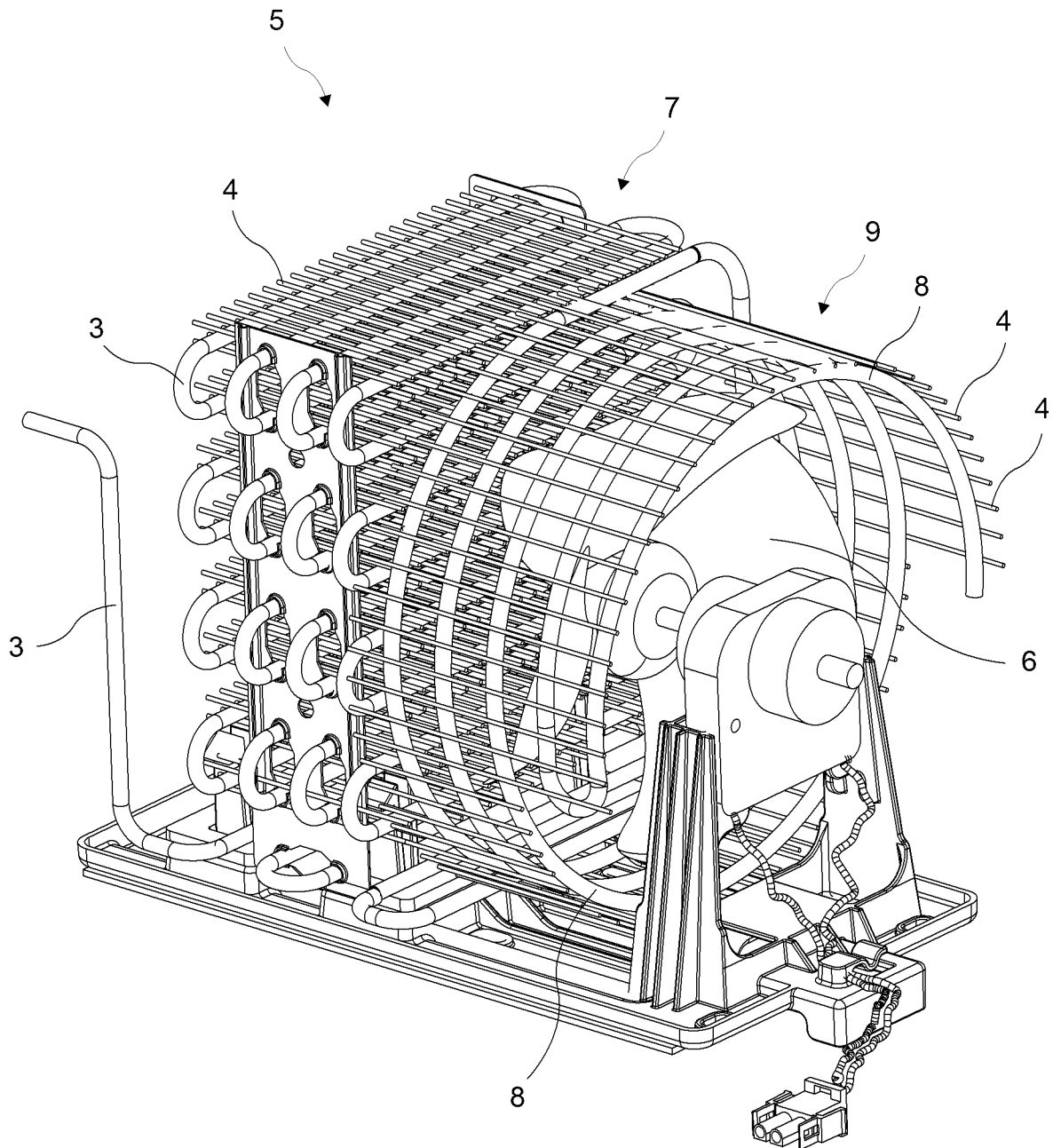


Figure 2



INTERNATIONAL SEARCH REPORT

International application No
PCT/EP2011/071865

A. CLASSIFICATION OF SUBJECT MATTER

INV. F25B39/04 F28D1/047 F28D1/04
ADD.

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
F25B F28D

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

EPO-Internal

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 3 251 409 A (HERBERT RICHARD M) 17 May 1966 (1966-05-17) column 2, line 12 - column 4, line 46; figures 1-3	1-4
X	US 2 218 596 A (ASHLEY CARLYLE M) 22 October 1940 (1940-10-22) column 2, line 33 - column 4, line 75; figures 1,4	1-4
X	US 4 321 803 A (SMITH HAYDEN N) 30 March 1982 (1982-03-30) column 2, line 29 - column 5; figures 1-7	1-4
X	JP 2003 322456 A (HITACHI HOME & LIFE SOLUTIONS) 14 November 2003 (2003-11-14) paragraph [0017] - paragraph [0063]; figures 1-14	1-4
	-/-	



Further documents are listed in the continuation of Box C.



See patent family annex.

* Special categories of cited documents :

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Szilagyi, Barnabas

INTERNATIONAL SEARCH REPORT

International application No
PCT/EP2011/071865

C(Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT		
Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	JP 2008 261615 A (MITSUBISHI ELECTRIC CORP) 30 October 2008 (2008-10-30) paragraph [0011] - paragraph [0055]; figures 4,9,11,13,15 -----	1-4
A	US 1 709 176 A (HYDE ROLLIN M) 16 April 1929 (1929-04-16) the whole document -----	1
A	US 2004/216865 A1 (LEE DONG HA [KR] ET AL) 4 November 2004 (2004-11-04) paragraph [0030] - paragraph [0061]; figures 1-9 -----	1

INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No

PCT/EP2011/071865

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
US 3251409	A	17-05-1966	NONE
US 2218596	A	22-10-1940	NONE
US 4321803	A	30-03-1982	NONE
JP 2003322456	A	14-11-2003	NONE
JP 2008261615	A	30-10-2008	NONE
US 1709176	A	16-04-1929	NONE
US 2004216865	A1	04-11-2004	NONE
		CN 1542389 A	03-11-2004
		JP 3947744 B2	25-07-2007
		JP 2004333117 A	25-11-2004
		US 2004216865 A1	04-11-2004