



(11)

EP 4 574 003 A1

(12) **EUROPEAN PATENT APPLICATION**

(43) Date of publication:
25.06.2025 Bulletin 2025/26

(51) International Patent Classification (IPC):
A47L 15/42^(2006.01)

(21) Application number: **24201955.2**

(52) Cooperative Patent Classification (CPC):
**A47L 15/4291; A47L 15/4223; A47L 15/4225;
A47L 15/4285**

(22) Date of filing: **23.09.2024**

(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 ME MK MT NL
NO PL PT RO RS SE SI SK SM TR**
Designated Extension States:
BA
Designated Validation States:
GE KH MA MD TN

(72) Inventors:
• **SEREN, ERDOGAN MERT
34445 ISTANBUL (TR)**
• **POYRAZ, ONUR
34445 ISTANBUL (TR)**
• **AYDINTUG, CETIN
34445 ISTANBUL (TR)**
• **BALIKCI, ILHAN
34445 ISTANBUL (TR)**
• **KARABAY, AHMET YASIN
34445 ISTANBUL (TR)**

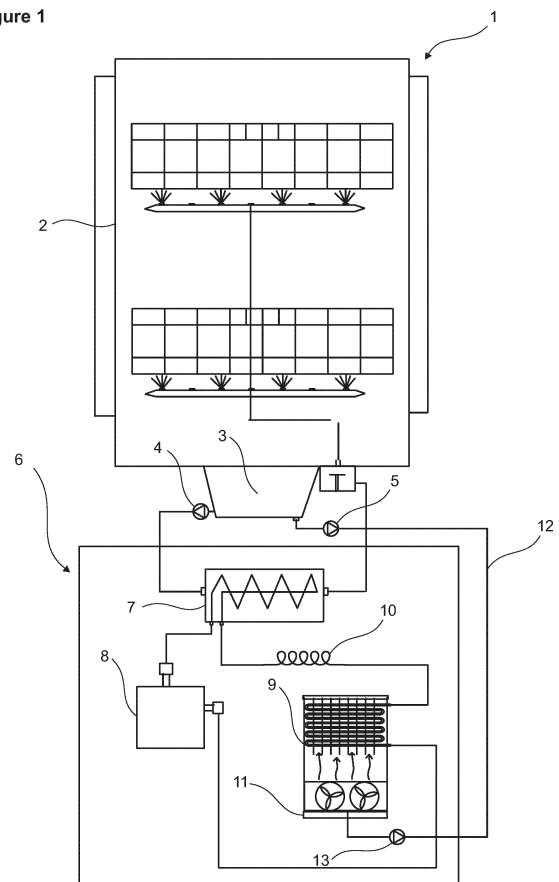
(30) Priority: **20.12.2023 TR 202317739**

(71) Applicant: **Arçelik Anonim Sirketi
34445 Istanbul (TR)**

(54) **A HEAT PUMP DISHWASHER AND THE CONTROL METHOD THEREOF**

(57) The present invention relates to a heat pump dishwasher (1) comprising a tub (2) wherein the dishes are placed; a washing water receptacle (3) which is disposed under the tub (2); a circulation pump (4) which is connected to the washing water receptacle (3) and which provides the transfer of the washing water to the tub (2); a discharge pump (5) which is connected to the washing water receptacle (3) and which provides the discharge of the dirt water; a heat pump (6) which is disposed under the tub (2) and which has at least one compressor (8), at least one evaporator (9), at least one condenser (7) and at least one capillary tube (10) which are connected to each other by means of a refrigerant fluid line through which the refrigerant fluid is circulated; a condensation receptacle (11) which is disposed under the evaporator (9) and wherein the water condensed in the evaporator (9) is collected; and a discharge hose (12) which is disposed between the condensation receptacle (11) and the discharge pump (5), one end of which is connected to the condensation receptacle (11) and the other end to the discharge pump (5), and which enables the water in the condensation receptacle (11) to be sucked and discharged when the discharge pump (5) is operated.

Figure 1



EP 4 574 003 A1

Description

[0001] The present invention relates to a heat pump dishwasher wherein the water condensed in the evaporator is discharged, and to the control method thereof.

[0002] A heat pump dishwasher comprises a compressor, a condenser, a capillary tube and an evaporator, and forms a refrigerant fluid cycle. The high temperature refrigerant fluid leaving the compressor is sent to the condenser and a hot surface is formed on the evaporator. The water is passed over or through the condenser by means of a circulation pump to be heated, and then sent to the dishwasher by means of a multi-way valve. At the condenser outlet, the refrigerant fluid is passed through the capillary tube such that the pressure and therefore temperature thereof are suddenly reduced before being sent to the evaporator.

[0003] During the refrigerant fluid cycle, by means of two fans disposed in front of the evaporator, the air in the casing volume where the heat pump is positioned is sucked and blown into the evaporator. Heat transfer occurs to the evaporator, which is the cold surface, from the environment where the same is disposed. Finally, the refrigerant fluid returns to the suction line of the compressor, and the refrigerant fluid cycle is completed.

[0004] Since the ambient air passed over the evaporator contains a high amount of moisture and the ambient temperature of the evaporator surface is below the dew point temperature, condensation occurs on the evaporator surface when the heat pump is in operation. As the amount of condensation on the evaporator gradually increases, the condensate is collected in the receptacle under the evaporator. In the state of the art, an additional pump is used to discharge the water collected in the receptacle. Depending on the control method, the condensate is discharged by means of the additional pump operated at certain steps of the refrigerant fluid cycle. However, in this embodiment, the additional pump is operated at least twice in a cycle and noise which can be easily heard from outside is generated during the refrigerant fluid cycle. Moreover, the efficiency is decreased and the costs are increased. Furthermore, the water which condenses and accumulates in the receptacle under the evaporator if the additional pump is blocked overflows or activates the overflow safety device, causing the dishwasher to give a water leakage error.

[0005] In the state of the art German Patent Application No. DE102012105670, a dishwasher is disclosed, wherein the heat pump is used in the drying process.

[0006] In the state of the art International Patent Application No. WO2016004990, a dishwasher is disclosed, wherein the water in the evaporator receptacle is discharged by means of a sensor measuring the amount of water in the evaporator receptacle, a circulation pump, and a valve connected to the latter.

[0007] In the state of the art European Patent Application No. EP3718461, a dishwasher is disclosed, wherein

the water in the evaporator receptacle is discharged by means of an additional pump.

[0008] The aim of the present invention is the realization of a heat pump dishwasher wherein the water condensed in the evaporator is discharged, and of the control method thereof.

[0009] The heat pump dishwasher realized in order to attain the aim of the present invention, explicated in the first claim and the respective claims thereof, comprises a discharge hose which is disposed between the condensation receptacle and the discharge pump, one end of which is connected to the condensation receptacle and the other end to the discharge pump, and which enables the water in the condensation receptacle to be sucked and discharged when the discharge pump is operated.

[0010] In the embodiment of the present invention, the washing water is collected in the washing water receptacle in the heat pump dishwasher. The washing water is taken from the washing water receptacle by means of the circulation pump and passed over the condenser in the heat pump, and then, the washing water heated by means of the condenser is transferred to the tub. When the discharge pump is operated, negative pressure occurs in the discharge hose, one end of which is connected to the condensation receptacle and the other end to the discharge pump, and the water in the condensation receptacle is sucked towards the discharge pump. The water reaching the discharge pump is discharged together with the water leaving the washing process.

[0011] In the embodiment of the invention, the discharge hose is disposed between the condensation receptacle under the evaporator and the discharge pump, and is directly connected to the inlet of the discharge pump. Thus, when the discharge pump is operated, negative pressure occurs in the discharge hose, and the water collected in the condensation receptacle is sucked from the end of the discharge hose connected to the condensation receptacle to be delivered to the discharge pump and discharged together with the discharged water.

[0012] In an embodiment of the present invention, a preferably one-way valve disposed on the discharge hose provides that there is no backpressure in the discharge hose.

[0013] In another embodiment of the present invention, the discharge hose is connected to the discharge pump at an angle of 45°, 60° or 90°.

[0014] By means of the present invention, the water in the condensation receptacle is enabled to be discharged without the need for the use of an additional pump, valve or sensor. Thus, the need for using components requiring control such as additional pump, valve and/or sensor is eliminated, saving costs. Moreover, since the additional noise source in the current embodiment is eliminated, the perception of quality is increased.

[0015] A heat pump dishwasher realized in order to attain the aim of the present invention is illustrated in the attached figures, where:

Figure 1 - is the schematic view of a dishwasher.

Figure 2 - is the top detailed schematic view of the evaporator, the condensation receptacle and the discharge hose.

[0016] The elements illustrated in the figures are numbered as follows.

1. Dishwasher
2. Tub
3. Washing water receptacle
4. Circulation pump
5. Discharge pump
6. Heat pump
7. Condenser
8. Compressor
9. Evaporator
10. Capillary tube
11. Condensation receptacle
12. Discharge hose
13. Valve

[0017] The heat pump dishwasher (1) comprises a tub (2) wherein the dishes are placed; a washing water receptacle (3) which is disposed under the tub (2); a circulation pump (4) which is connected to the washing water receptacle (3) and which provides the transfer of the washing water to the tub (2); a discharge pump (5) which is connected to the washing water receptacle (3) and which provides the discharge of the dirt water; a heat pump (6) which is disposed under the tub (2) and which has at least one compressor (8), at least one evaporator (9), at least one condenser (7) and at least one capillary tube (10) which are connected to each other by means of a refrigerant fluid line through which the refrigerant fluid is circulated; a condensation receptacle (11) which is disposed under the evaporator (9) and wherein the water condensed in the evaporator (9) is collected; and a discharge hose (12) which is disposed between the condensation receptacle (11) and the discharge pump (5), one end of which is connected to the condensation receptacle (11) and the other end to the discharge pump (5), and which enables the water in the condensation receptacle (11) to be sucked and discharged when the discharge pump (5) is operated.

[0018] In the embodiment of the present invention, the

washing water is collected in the washing water receptacle (3) in the heat pump dishwasher (1). The washing water is taken from the washing water receptacle (3) by means of the circulation pump (4) and passed over the condenser (7) in the heat pump (6), and then, the washing water heated by means of the condenser (7) is transferred to the tub (2). At this stage, the heat pump (6) operates as follows:

The compressor (8) pressurizes the refrigerant fluid and sends the same to the condenser (7). Upon being pressurized by the compressor (8), the pressure and hence the temperature of the refrigerant fluid increase. Thus, the condenser (7) is heated. The water taken from the washing water receptacle (3) by means of the circulation pump (4) is passed over the condenser (7) and the washing water is heated. At the same time, the refrigerant fluid leaving the condenser (7) is directed to the capillary tube (10) and the pressure and hence the temperature of the refrigerant fluid are reduced. The refrigerant fluid leaving the capillary tube (10) is sent to the evaporator (9). Since the evaporator (9) is air sourced, the air passing over the evaporator (9) is moved away from the dishwasher (1) and sent to the environment, and thus heat transfer is performed from the environment to the evaporator (9). The refrigerant fluid leaving the evaporator (9) is sucked again by the compressor (8) and the refrigerant fluid cycle is completed. Since the temperature of the ambient air passing over the evaporator (9) is much higher than the surface temperature of the evaporator (9) and the surface temperature of the evaporator (9) is below the dew point temperature of the air, the air is dehumidified and condensed on the surface of the evaporator (9). The water droplets condensing on the surface of the evaporator (9) are collected in the condensation receptacle (11) disposed under the evaporator (9). When the discharge pump (5) is operated, negative pressure occurs in the discharge hose (12), one end of which is connected to the condensation receptacle (11) and the other end to the discharge pump (5), and the water in the condensation receptacle (11) is sucked towards the discharge pump (5). The water reaching the discharge pump (5) is discharged together with the water leaving the washing process (Figure 1).

[0019] In the embodiment of the invention, the discharge hose (12) is disposed between the condensation receptacle (11) under the evaporator (9) and the discharge pump (5), and is directly connected to the inlet of the discharge pump (5). Thus, when the discharge pump (5) is operated, negative pressure occurs in the discharge hose (12), and the water collected in the condensation receptacle (11) is sucked from the end of the discharge hose (12) connected to the condensation receptacle (11) to be delivered to the discharge pump (5) and discharged together with the discharged water.

[0020] In an embodiment of the present invention, the dishwasher (1) comprises a valve (13) disposed on the discharge hose (12). In the preferred embodiment of the present invention, the valve (13) is a one-way valve. In

this embodiment of the present invention, the valve (13) enables the water sucked from the condensation receptacle (11) to flow towards the discharge pump (5) and prevents the water from returning to the condensation receptacle (11) through the discharge hose (12). Thus, any backpressure in the discharge hose (12) is prevented.

[0021] In another embodiment of the present invention, the dishwasher (1) comprises the discharge hose (12) which is connected to the discharge pump (5) at a 45° angle.

[0022] In another embodiment of the present invention, the discharge hose (12) is connected to the discharge pump (5) at a 60° angle.

[0023] In yet another embodiment of the present invention, the discharge hose (12) is connected to the discharge pump (5) at an angle of 90°.

[0024] By means of the present invention, the water in the condensation receptacle (11) is enabled to be discharged without the need for the use of an additional pump, valve or sensor. Thus, the need for using components requiring control such as additional pump, valve and/or sensor is eliminated, saving costs. Moreover, since the additional noise source in the current embodiment is eliminated, the perception of quality is increased.

Claims

1. A heat pump dishwasher (1) **comprising** a tub (2) wherein the dishes are placed; a washing water receptacle (3) which is disposed under the tub (2); a circulation pump (4) which is connected to the washing water receptacle (3) and which provides the transfer of the washing water to the tub (2); a discharge pump (5) which is connected to the washing water receptacle (3) and which provides the discharge of the dirt water; a heat pump (6) which is disposed under the tub (2) and which has at least one compressor (8), at least one evaporator (9), at least one condenser (7) and at least one capillary tube (10) which are connected to each other by means of a refrigerant fluid line through which the refrigerant fluid is circulated; and a condensation receptacle (11) which is disposed under the evaporator (9) and wherein the water condensed in the evaporator (9) is collected, **characterized by** a discharge hose (12) which is disposed between the condensation receptacle (11) and the discharge pump (5), one end of which is connected to the condensation receptacle (11) and the other end to the discharge pump (5), and which enables the water in the condensation receptacle (11) to be sucked and discharged when the discharge pump (5) is operated.
2. A dishwasher (1) as in Claim 1, **characterized by** the discharge hose (12) which is disposed between the

condensation receptacle (11) under the evaporator (9) and the discharge pump (5) and which is directly connected to the inlet of the discharge pump (5).

3. A dishwasher (1) as in Claim 1, **characterized by** a valve (13) disposed on the discharge hose (12).
4. A dishwasher (1) as in Claim 3, **characterized by** the one-way valve (13).
5. A dishwasher (1) as in Claim 3 or 4, **characterized by** the valve (13) which enables the water sucked from the condensation receptacle (11) to flow towards the discharge pump (5) and which prevents the water in the discharge hose (12) from returning to the condensation receptacle (11).
6. A dishwasher (1) as in Claim 1, **characterized by** the discharge hose (12) which is connected to the discharge pump (5) at a 45° angle.
7. A dishwasher (1) as in Claim 1, **characterized by** the discharge hose (12) which is connected to the discharge pump (5) at a 60° angle.
8. A dishwasher (1) as in Claim 1, **characterized by** the discharge hose (12) which is connected to the discharge pump (5) at a 90° angle.

Figure 1

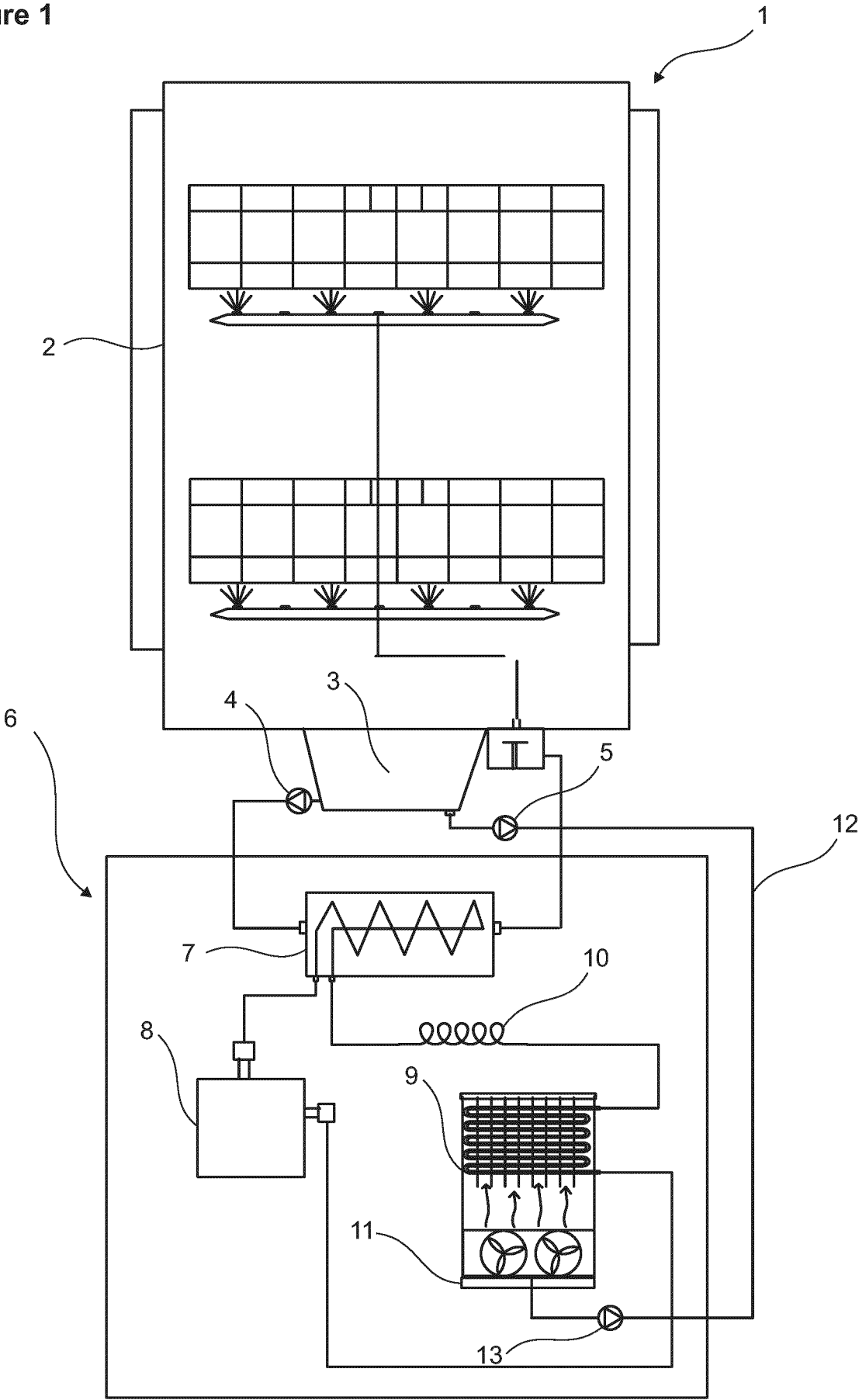
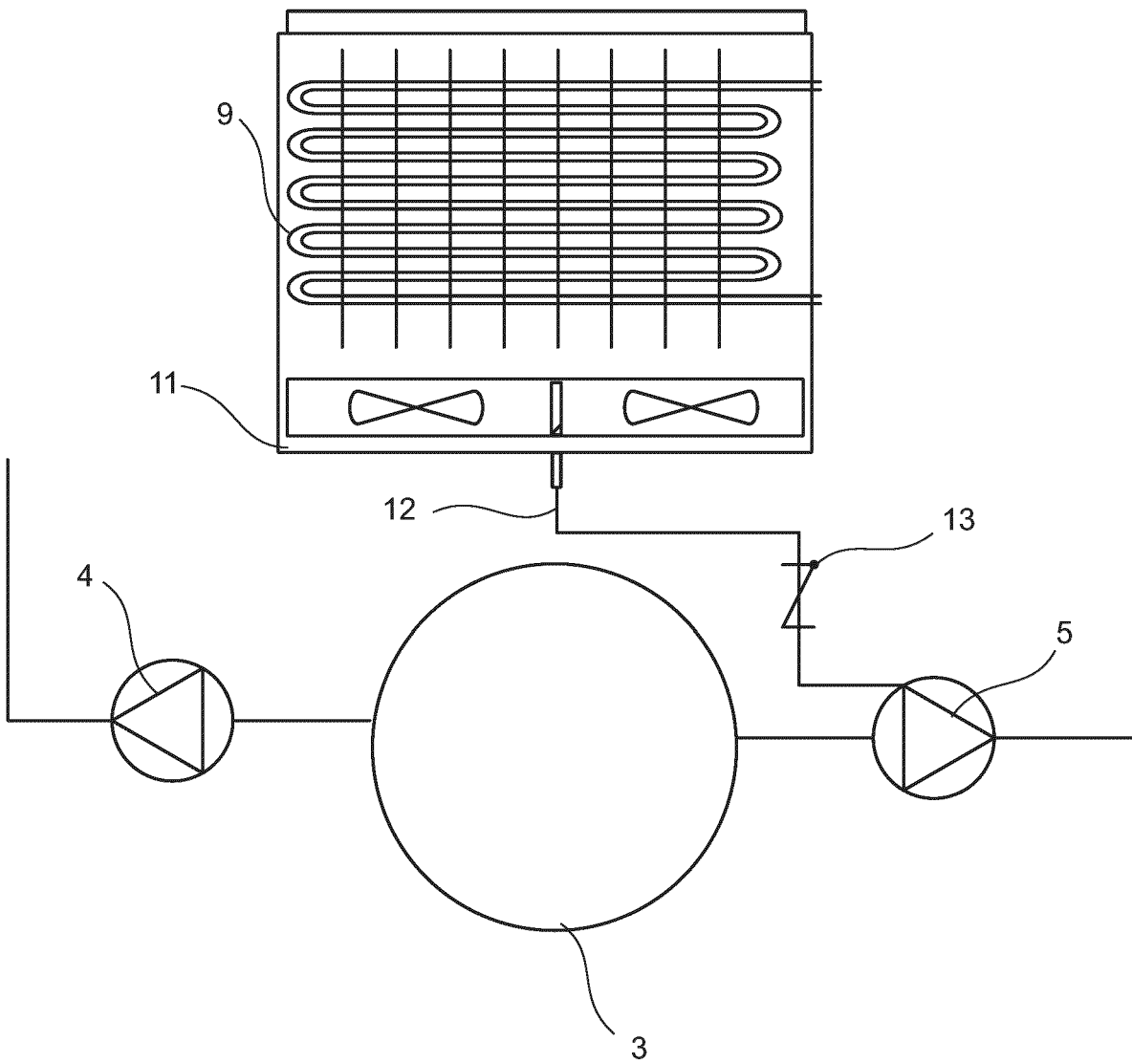


Figure 2





EUROPEAN SEARCH REPORT

Application Number

EP 24 20 1955

5

10

15

20

25

30

35

40

45

50

55

3

EPO FORM 1503 03.82 (P04C01)

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,D	WO 2016/004990 A1 (ELECTROLUX APPLIANCES AB [SE]) 14 January 2016 (2016-01-14)	1-5,8	INV. A47L15/42
Y	* the whole document *	6,7	
X	EP 3 173 513 B1 (ELECTROLUX APPLIANCES AB [SE]) 13 May 2020 (2020-05-13)	1-5	
Y	* paragraphs [0128] - [0174]; figures *	6-8	
Y	EP 3 473 155 A1 (MIELE & CIE [DE]) 24 April 2019 (2019-04-24)	6-8	
A	EP 2 682 036 A2 (MIELE & CIE [DE]) 8 January 2014 (2014-01-08)	1-8	
A	KR 2008 0091660 A (DAEWOO ELECTRONICS CORP [KR]) 14 October 2008 (2008-10-14)	1-8	TECHNICAL FIELDS SEARCHED (IPC)
	* the whole document *		A47L
The present search report has been drawn up for all claims			
Place of search Munich		Date of completion of the search 14 February 2025	Examiner Prosig, Christina
CATEGORY OF CITED DOCUMENTS X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons & : member of the same patent family, corresponding document			

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

EP 24 20 1955

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
The European Patent Office is in no way liable for these particulars which are merely given for the purpose of information.

14-02-2025

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
WO 2016004990 A1	14-01-2016	CN 106455901 A	22-02-2017
		EP 3166466 A1	17-05-2017
		US 2017143181 A1	25-05-2017
		WO 2016004990 A1	14-01-2016

EP 3173513 B1	13-05-2020	AU 2013392438 A1	24-12-2015
		CN 105392937 A	09-03-2016
		EP 3008236 A1	20-04-2016
		EP 3173513 A1	31-05-2017
		PL 3008236 T3	28-09-2018
		WO 2014198300 A1	18-12-2014

EP 3473155 A1	24-04-2019	EP 3473155 A1	24-04-2019
		EP 3473156 A1	24-04-2019
		ES 2910123 T3	11-05-2022
		ES 2912124 T3	24-05-2022
		PL 3473155 T3	20-06-2022
		PL 3473156 T3	27-06-2022

EP 2682036 A2	08-01-2014	DE 102012105904 A1	09-01-2014
		EP 2682036 A2	08-01-2014

KR 20080091660 A	14-10-2008	NONE	

REFERENCES CITED IN THE DESCRIPTION

This list of references cited by the applicant is for the reader's convenience only. It does not form part of the European patent document. Even though great care has been taken in compiling the references, errors or omissions cannot be excluded and the EPO disclaims all liability in this regard.

Patent documents cited in the description

- DE 102012105670 [0005]
- WO 2016004990 A [0006]
- EP 3718461 A [0007]