(19) DANMARK

(10) DK/EP 3540327 T3

(12) Oversættelse af europæisk patentskrift

Patent- og Varemærkestyrelsen

(51) Int.Cl.: *F 24 H 4/04 (2006.01)* *F 24 D 3/18 (2006.01)* *F 24 D 11/02 (2006.01)* *F 24 D 17/02 (2006.01)* *F 24 D 19/10 (2006.01)*

(45) Oversættelsen bekendtgjort den: **2022-01-24**

(80) Dato for Den Europæiske Patentmyndigheds bekendtgørelse om meddelelse af patentet: **2021-10-20**

(86) Europæisk ansøgning nr.: **19155301.5**

(86) Europæisk indleveringsdag: **2019-02-04**

(87) Den europæiske ansøgnings publiceringsdag: **2019-09-18**

(30) Prioritet: **2018-02-07 DE 102018102670**

(84) Designerede stater: **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**

(73) Patenthaver: **Viessmann Climate Solutions SE, Viessmannstrasse 1, 35108 Allendorf, Tyskland**

(72) Opfinder: **Bätzel, Jörg, Am Kirchweg 5, 57319 Bad Berleburg, Tyskland**

(74) Fuldmægtig i Danmark: **Larsen & Birkeholm A/S Skandinavisk Patentbureau, Banegårdspladsen 1, 1570 København V, Danmark**

(54) Benævnelse: **Varmepumpeanlæg**

(56) Fremdragne publikationer:
EP-A1- 2 913 594
EP-A1- 2 933 580
JP-A- 2013 148 266
US-A1- 2012 304 677

HEAT PUMP SYSTEM

The invention relates to a heat pump system according to the preamble of patent claim 1.

A heat pump system of the type mentioned in the introduction is known from document US 2012/0304677 A1.

A heat pump system of the type mentioned in the introduction is also known from Figure 2 of the patent document DE 10 2015 114 474 A1. This heat pump system consists of a heat pump and a heat sink, wherein the heat sink is designed as a heating circuit carrying the heating circuit medium and as a hot water tank, wherein the heat pump is designed in a first operating mode referred to as normal operation for supplying ambient heat to the heat sink, and a buffer storage tank that can be loaded with heat by the heat pump is designed in a second operating mode referred to as defrosting mode for supplying heat to the heat pump. In this solution, the heat pump is designed as a so-called split device with an outer and inner unit (i.e. two system parts) and the heat sink as a heating circuit. In the solution according to the invention described below, this can also be precisely the case, but it is also perfectly possible that, on the one hand, the heat pump is designed as a pure inner unit and, on the other hand, the heat sink is designed optionally as a heating circuit and/or as a hot water tank.

The object of the invention is to improve a heat pump system of the type mentioned in the introduction. In particular, the efficiency of such a heat pump system should be further increased.

This object is achieved with a heat pump system of the type mentioned in the introduction through the features listed in the characteristic of patent claim 1.

According to the invention, it is therefore provided that a switching device (4) integrated in the heat pump (1) is provided for switching between the operating modes for the heating circuit medium, and that a valve for selectively supplying the heating circuit medium to the heating circuit and/or to the hot water tank is connected downstream of a first outlet of the switching device as seen in the direction of flow of the heating circuit medium.

Other advantageous embodiments result from the dependent patent claims.

In the interest of completeness, reference is also made to the following documents CH 607 719 A5 and AU 2013245437 A1, in which either a heat sink or a storage tank is missing compared to patent claim 1.

The heat pump system according to the invention including its advantageous embodiments in accordance with the dependent patent claims is explained in more detail below based on the graphic representation of a preferred exemplary embodiment.

In the graphic representation

Figure 1 schematically shows the heat pump system according to the invention with a storage tank and with a heating circuit and hot water tank.

The heat pump system illustrated in Figure 1 consists in a

known manner firstly of a heat pump 1 and a heat sink 2. The heat sink 2 is in this case designed as a heating circuit 2.1 and as a hot water tank 2.2. Furthermore, the heat pump 1 is designed in a first operating mode referred to as normal operation for supplying ambient heat to the heat sink 2, and a buffer storage tank 3 that can be loaded with heat by the heat pump 1 is designed in a second operating mode referred to as defrosting mode for supplying heat to the heat pump 1.

It is furthermore provided that the storage tank 3, which preferably has a capacity for heating circuit medium of up to 40 litres, is designed to be integrated in the heat pump 1. As can be seen from Figure 1, it is particularly preferably provided in this case that the heat pump 1 has a cuboid housing and the buffer storage tank 3 is arranged in this housing.

Furthermore, a switching device 4 integrated in the heat pump 1 is provided for switching between the operating modes for the heating circuit medium. This preferably comprises a valve, in particular, as illustrated, a preferably electrically operated three-way valve (optionally changeover valve or mixing valve).

Thanks to the switching device 4, it is possible in this case to flow through the storage tank 3 independently of the heat sink 2. The storage tank 3 can thus be loaded with as much energy as is necessary for the defrosting process. The temperature level in the storage tank 3 is thus precisely optimized for the defrosting process. Impairments of the temperature level due to heating circuits, pipes, intermediary hot water tanks or the like are circumvented, increasing the efficiency of the system.

It is now essential, as illustrated in Figure 1, that an input 5.1 of a preferably electrically operated valve 5 for selectively supplying the heating circuit medium to the heating circuit and/or to the hot water tank is connected downstream of a first outlet 4.1 of the switching device 4 as seen in the direction of flow of the heating circuit medium. The valve 5 is in this case likewise preferably designed as a three-way valve (optionally changeover or mixing valve). Moreover, it can particularly preferably be provided that the valve 5 and the switching device 4 are identical in construction, i.e. the same component is used twice.

Furthermore, it is firstly provided in a way known per se that the heat pump system has a heat exchanger 6 operating as a condenser and through which a heating circuit medium flows. It is particularly preferably provided in this case according to the invention that the switching device 4, as seen in the direction of flow of the heating circuit medium, is designed downstream of an outlet 6.1 of the heat exchanger 6 by means of its inlet 4.3 and upstream of an inlet 3.1 of the buffer storage tank 2 by means of a second outlet 4.2.

It is further particularly preferably provided that an outlet 3.2 of the buffer storage tank 3, as seen in the direction of flow of the heating circuit medium, is designed upstream of an inlet 6.2 of the heat exchanger 6.

Moreover, it is particularly preferably provided that the heating circuit 2.1 is designed to be hydraulically connected, on the one hand, to a first outlet 5.1 of the valve 5 and, on the other hand, to an inlet 6.2 of the heat exchanger 6. Furthermore, it is preferably provided that the hot water tank 2.2 is designed to be hydraulically connected,

on the one hand, to a second outlet 5.2 of the valve 5 and, on the other hand, to an inlet 6.2 of the heat exchanger 6.

If the heat pump system, as illustrated in Figure 1, consists of two system parts connected to one another, one of which is arranged in a building and the other outside the building, it is further, as illustrated, particularly preferably provided that the buffer storage tank 3 is arranged in the system part arranged in the building.

Finally, it is particularly preferably provided that a heating circuit pump 7 is arranged between the outlet 6.1 of the heat exchanger 6 and the switching device 4 for circulating the heating circuit medium.

The heat pump system according to the invention functions as follows:

In normal operation, a refrigerant of the heat pump 1 absorbs ambient heat at a comparatively low temperature level via the external unit (the evaporator with fan is shown schematically in Figure 1). The refrigerant is then transported to the heat exchanger 6, operating as a condenser, by the circulation pump which can be seen in Figure 1 in order to transfer the heat, which is then at a higher temperature level thanks to the compression, to the heating circuit medium. The refrigerant is then expanded in a known manner via the throttle illustrated in Figure 1, before returning to the evaporator.

The heating circuit medium is delivered with the help of the pump 7. From the heat exchanger 6, it first of all reaches

the switching device 4, which passes the heating circuit medium directly on to the valve 5 in normal operation. As required, the heating circuit medium is then transported to the heating circuit 2.1 and/or to the hot water tank 2.2. via the outlets 5.1 and 5.2. From there, the cooled heating circuit medium then returns to the heat exchanger 6 via the inlet 6.2 so that the circuit is finally closed.

Given that the external unit of such a heat pump system tends to ice up in certain weather conditions, it is necessary to defrost it every now and then. This is done in a known manner first of all by reversing the heat pump circuit, i.e. the evaporator is now used as condenser and the heat exchanger 6 as evaporator.

It is now essential for the heat pump system according to the invention that the heat for the defrosting process is not extracted from the heat sink 2, i.e. in particular from the heating circuit 2.1 and/or the hot water tank 2.2, but rather from the storage tank 3, which is specially provided for this purpose and integrated in the housing of the heat pump 1, and which has already been supplied with warm heating circuit medium during normal operation, preferably at the end of normal operation, i.e. a tank of warm heating circuit medium is already created during normal operation, and is then available in defrosting mode as a heat source for defrosting the evaporator working as a condenser.

Reference list

1	heat pump
2	heat sink
2.1	heating circuit
2.2	hot water tank
3	storage tank
3.1	inlet
3.2	outlet
4	switching device
4.1	first outlet
4.2	second outlet
4.3	inlet
5	valve
5.1	first outlet
5.2	second outlet
5.3	inlet
6	heat exchanger
6.1	outlet
6.2	inlet
7	heating circuit pump

P A T E N T K R A V

1. Varmepumpeanlæg, omfattende en varmepumpe (1) og en varmeforbruger (2), hvor varmeforbrugeren (2) er udformet som varmekredsløb (2.1), som leder varmekredsløbsmedium, og som varmtvandstank (2.2), hvor varmepumpen (1) i en første driftsart, som betegnes som normaldrift, er udformet til tilførsel af omgivelsesvarme til vareforbrugeren (2), og en buffertank (3), som kan lades med varme fra varmepumpen (1), i en anden driftsart, som betegnes som afrimningsdrift, er udformet til tilførsel af varme til varmepumpen (1), hvor buffertanken (3) er udformet integreret i et hus i varmepumpen (1),
kendetegnet ved,

at der til omkobling mellem driftsarterne til varmekredsløbsmediet er tilvejebragt en omkoblingsindretning (4), som er integreret i varmepumpen (1), og
at der nedstrøms fra en første udgang (4.1) i omkoblingsindretningen (4) set i varmekredsløbsmediets strømningsretning er tilvejebragt en ventil (5) til valgfri tilførsel af varmekredsløbsmediet til varmekredsløbet (2.1) og/eller til varmtvandstanken (2.2).

2. Varmepumpeanlæg ifølge krav 1, hvor dette omfatter en varmeveksler (6), som arbejder som kondensator og gennemstrømmes af et varmekredsløbsmedium,
kendetegnet ved,
at omkoblingsindretningen (4) set i varmekredsløbsmediets strømningsretning er udformet nedstrøms fra en udgang (6.1) i varmeveksleren (6) og med en anden udgang (4.2) opstrøms fra en indgang (3.1) i buffertanken (2).

3. Varmepumpeanlæg ifølge krav 2,
kendetegnet ved,
at en udgang (3.2) i buffertanken (3) set i varmekredsløbsmediets strømningsretning er udformet opstrøms fra en indgang (6.2) i varmeveksleren (6).

4. Varmepumpeanlæg ifølge krav 1 og 2,
kendetegnet ved,
at varmekredsløbet (2.1) er udformet hydraulisk forbundet på den ene side med en første udgang (5.1) i ventilen (5) og på den anden side med en indgang (6.2) i varmeveksleren (6).

5. Varmepumpeanlæg ifølge krav 1 og 2,
kendetegnet ved,
at varmtvandstanken (2.2) er udformet hydraulisk forbundet på den ene side med en anden udgang (5.2) i ventilen (5) og på den anden side med en indgang (6.2) i varmeveksleren (6).

6. Varmepumpeanlæg ifølge et af kravene 1 til 5, hvor dette består af to indbyrdes forbundne anlægsdele, hvoraf en er placeret i en bygning og en udenfor bygningen,
kendetegnet ved,
at buffertanken (3) er placeret i den i bygningen placerede anlægsdel.

7. Varmepumpeanlæg ifølge et af kravene 1 til 6,
kendetegnet ved,
at buffertanken (3) har en kapacitet på maksimalt 40 liter.

8. Varmepumpeanlæg ifølge et af kravene 1 til 7,
kendetegnet ved,
at varmepumpen (1) omfatter et blokformet hus, og buffertanken (3) er placeret i dette hus.

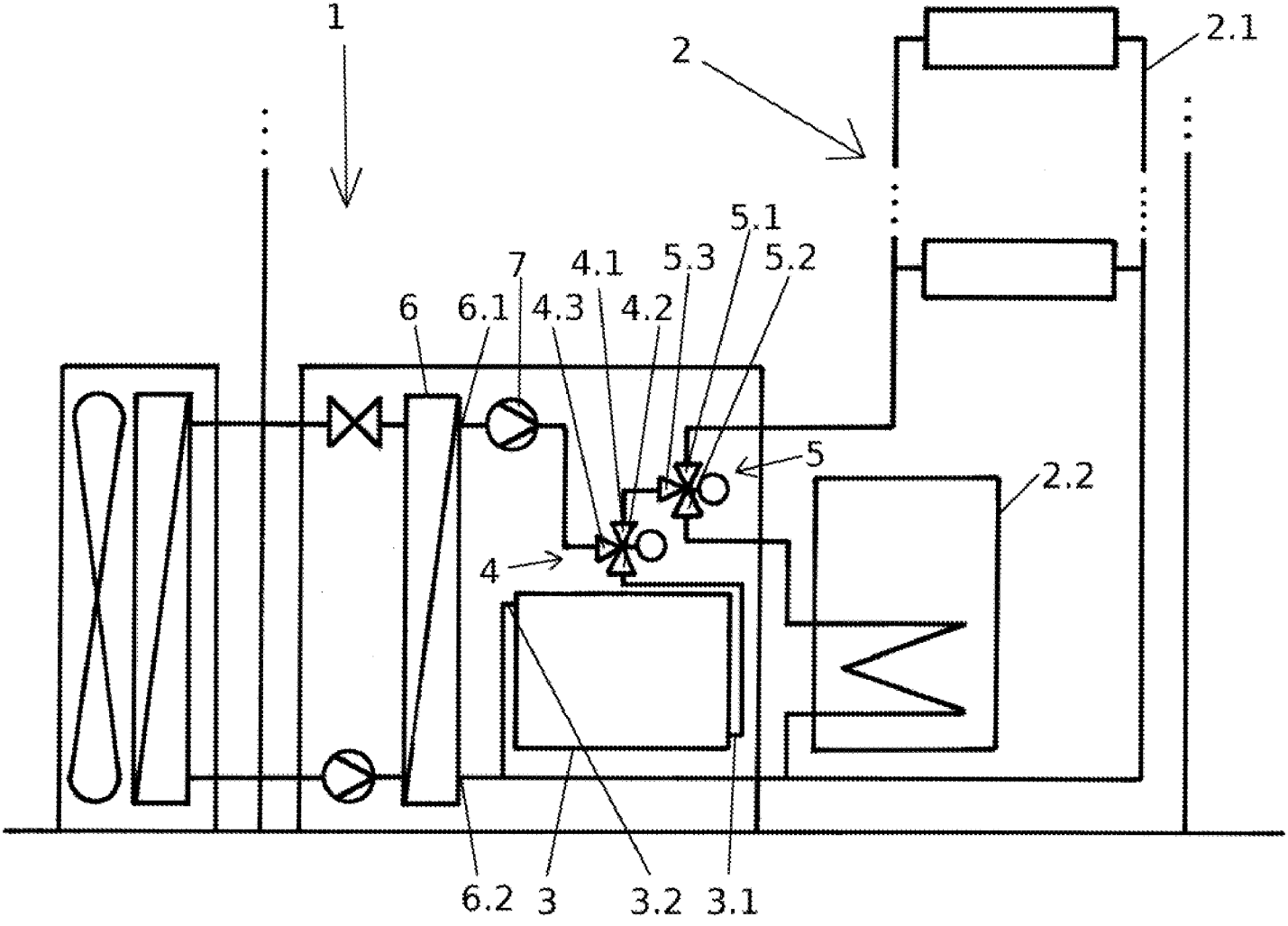


Figure 1