

(19) **DANMARK**

(10) **DK/EP 2322880 T3**



(12) **Oversættelse af  
europæisk patentskrift**

Patent- og  
Varemærkestyrelsen

- 
- (51) Int.Cl.: **F 25 B 30/02 (2006.01)**                      **F 24 D 3/18 (2006.01)**                      **F 24 D 11/02 (2006.01)**  
**F 25 B 25/00 (2006.01)**                      **F 25 B 27/00 (2006.01)**
- (45) Oversættelsen bekendtgjort den: **2016-04-25**
- (80) Dato for Den Europæiske Patentmyndigheds bekendtgørelse om meddelelse af patentet: **2016-03-09**
- (86) Europæisk ansøgning nr.: **10014352.8**
- (86) Europæisk indleveringsdag: **2010-11-06**
- (87) Den europæiske ansøgnings publiceringsdag: **2011-05-18**
- (30) Prioritet: **2009-11-16 AT 18092009**
- (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: **Vaillant GmbH, Berghauser Strasse 40, 42859 Remscheid, Tyskland**
- (72) Opfinder: **Brecker, Heinz-Jörg, Kolpingstr. 5, 42857 Remscheid, Tyskland**  
**Lang, Rainer Dr., Amselweg 17, 51519 Odenthal-Eikamp, Tyskland**
- (74) Fuldmægtig i Danmark: **Plougmann Vingtoft A/S, Rued Langgaards Vej 8, 2300 København S, Danmark**
- (54) Benævnelse: **Varmepumpesystem**
- (56) Fremdragne publikationer:  
**CH-A- 236 721**  
**DE-A1- 3 101 138**  
**DE-U1- 29 913 264**  
**DE-U1-202009 007 774**  
**JP-A- 2004 340 533**



The invention relates to a heat pump system.

According to the prior art in the field of heat pump technology a coolant circuit of a heat pump is connected via an environmental heat source circuit to one or more environmental heat source(s).

5 If a heat pump is operated in connection with a plurality of housing units, the coolant circuit of the heat pump is generally located in the cellar; the housing units are then supplied with heat via the feed pipe and return pipe of a heating circuit and the water pipes. Thus heat is lost on the way from the heat pump to the  
10 consumer unit (radiator and/or water tap).

DE 20 2009 007 774 U1 shows a heat pump which can be connected simultaneously to a plurality of heat sources. Depending on the temperature of the sources the heat can thus be used in an optimised manner.

15 CH 236 721 shows a heat pump system with a plurality of heat pump circuits in which the evaporators and condensers are connected respectively in series. The evaporator which is flowed through first in flow technology on the heat source side is connected via its heat pump circuit to the condenser flowed through last on the side of the  
20 medium to be heated. The evaporator flowed through last in flow technology on the heat source side is connected via its heat pump circuit to the condenser flowed through first on the side of the medium to be heated. In this way it is possible, by means of a heat pump system, to achieve a greater difference in temperature in the  
25 medium to be heated than with a single-stage heat pump. However, it is a disadvantage that in this way on the side of the heat source a corresponding temperature difference is necessary so that the minimal input temperature of the heat source is necessarily relative high.

JP 2006292313 shows a heat pump system according to the preamble  
30 of claim 1 with a plurality of structurally separate heat pumps which are used for air conditioning. Heat from rooms can be transferred via said heat pumps assigned to said rooms on a common environmental heat circuit and common heat sinks.

The aim of the invention is to heat a plurality of housing units  
35 by means of a heat pump with the lowest possible heat loss.

According to the invention this this achieved according to the features of the independent claim 1 in that in a heat pump system with exactly one environmental heat source circuit, into which at least one environmental heat source is integrated as a heat source, evaporators of at least two coolant circuits of structurally separated heat pumps are connected to the one environmental heat source-circuit. This has the advantage that the environmental heat source circuit can be guided almost without loss into the individual housing units and the environmental heat is increased to a higher temperature only at the point where the heat is needed. It is not necessary to insulate the environmental heat source circuit - unlike a heating circuit - on the way to the individual housing units. Losses caused by transporting heat to places which do not require heat, because the occupants have different heating requirements for example, are thus avoided.

Advantageous embodiments of the invention are described in the features of claims 2 to 6. Thus the environmental heat sources can be air-to-brine heat exchangers, geothermal probes, a solar absorber, exhaust air heat exchangers and/or rainwater cisterns with heat exchangers. As a plurality of environmental heat sources are provided the latter can be deactivated by means of switch valves or shut-off valves. Furthermore, a low temperature heat store for taking in environmental heat can be connected to the environmental heat source circuit. To cover the increased heat requirement individual heat pumps can be supported by a parallel or series connected additional heating device. The heating device and heat pump can thus be connected to one another structurally.

Claim 7 protects a building with a corresponding heat pump system.

Figure 1 shows a building with a heat pump system with exactly one environmental heat source circuit 9, which is connected via a feed pipe and return pipe 5 to the evaporators 14 of four heat pumps 6 and circulates in the brine. The environmental heat source circuit 9, in which a circulation pump 13 is located, is also connected to two air-to-brine heat exchangers 3, a geothermal probe 2, a solar absorber 8 and a rainwater cistern with heat exchanger 1, wherein

each of said environmental heat sources can be deactivated by means of a shut-off valve 12. Alternatively, the function of the shut-off valves 12 could also be performed by switch valves, which guide the brine circuit either through the corresponding environmental heat source or past the latter. Additional heat sources, for example an exhaust air heat exchanger can also be used according to the invention.

The four heat pumps 6 each have a coolant circuit 11 with an evaporator 14, a compressor 15, a condenser 16 and an expansion valve 17. The condenser 16 is connected to a heating circuit 7 via a heating pump 4. An optional water preparation is possible according to the invention, but not shown explicitly in the Figures.

Control units 10 are connected to the individual heat pumps 6; said control units 10 are connected to one another and to the shut-off valves 12 and the circulation pump 13 of the environmental heat source circuit 9 via data lines 18. The Figure does not show all of the data connections.

If at least one housing unit with a separate heat pump 6 requires heat, the associated control unit 10 starts up the circulation pump 13 of the environmental heat source circuit 9. At least one shut-off valve 12 of an environmental heat source is opened so that environmental heat is taken into the environmental heat source-circuit 9. The heated brine of the environmental heat source circuit 9 flows to the parallel arranged evaporators 14 of the heat pumps 6. For the heat pumps 6 requiring heat, environmental heat in the evaporator 14 is transferred to the associated coolant circuit 11. The thus heated fluid of the coolant circuit 11 is compressed in the associated compressor 15, heated again and directed to the associated condenser 16 where heat is transmitted to the corresponding heating circuit 7. The cooled coolant is relaxed in the expansion valve 17 and cooled so that it can absorb heat again in the evaporator 14.

In housing units with a separate heat pump 6, in which there is no heat requirement, the brine flows through the corresponding evaporators 14 without emitting heat.

The environmental heat sources can be operated alternatively or jointly, in series or in parallel. In this case at very different temperatures of the environmental heat sources it needs to be ensured that heat is not removed again from an environmental heat source via  
5 another environmental heat source.

Whereas according to the prior art usually the base load is covered by gas, oil or electricity and is supported only if desired or regeneratively, according to the present invention preferably the base load is covered regeneratively and only heated additionally if  
10 necessary with gas, oil or electricity.

Figure 2 differs from Figure 1 in that the heat pumps 6 are supported by additional heating devices 19; the latter can be for example conventional natural gas heating devices. The heat pumps 6 can in this case preheat the heating water which is then heated  
15 further in the serially connected additional heating devices 19. Furthermore, an overflow valve 20 is arranged parallel to the heating circuit 7. Alternatively, the additional heating devices can also be connected parallel to the heat pumps 6.

Depending on the required heating power the heat pump 6 can be  
20 operated monovalently (that is without an additional heat generator) or bivalently (that is with an additional heating device 19). During monovalent operation the housing unit is only supplied with heat and warm water from the heat pump 6. If the required amount of heat is greater than the heat output of the heat pump 6, the heat pump is  
25 operated bivalently. Here a distinction is made between bivalent-alternative and bivalent-parallel operation.

During bivalent-alternative operation the heat pump 6 covers the heating requirements of the housing unit up to a defined external temperature alone. Below this external temperature the additional  
30 heating device 19 covers the heating requirements alone.

During bivalent-parallel operation the heat pump 6 covers the required heating output up to a defined external temperature alone. Below this external temperature the additional heating device 19 is connected so that both heat generators supply the housing unit with  
35 heat in parallel. The lower the external temperature the higher the participation of the additional heating device 19 in providing heat.

When using an air-to-brine heat exchanger 3 from a defined minimum external temperature the additional heating device 19 supplies the housing unit alone with heat, as no heat can be taken from the external air economically.

5           As the temperature of the environmental heat source circuit 9, which takes up the environmental heat, in the case of using an air-to-brine heat exchanger 3 is always 1 or 2 Kelvin below the external air temperature, the brine carrying feed pipe and return pipe 5 when installed into the housing block should be insulated vapour-tight  
10 with closed-cell insulating material with a high water vapour diffusion resistance (e.g. trade name Armaflex), so that no air humidity condenses on the cold pipes. The heat insulation of the pipes of the environmental heat source circuit 9 is not necessary however, as the environmental heat source circuit 9 does not emit  
15 heat in the house, but rather because of the prevailing temperature level of the brickwork and the rooms takes up heat and the absorbed heat of the feed pipe can be used in the heat pumps 6. The return pipe of the environmental heat source circuit 9 also absorbs heat from the walls and the rooms. The absorbed heat reduces the available  
20 temperature difference at the environmental heat exchanger and should therefore be lowered.

          Also when using the other environmental heat sources the temperature of the environmental heat source circuit 9 is so low that outside the house insulation is not necessary and in the house there  
25 is also absolutely no need for it, as long as the condensation of air humidity on the pipes is avoided. When they are installed into the brickwork it can be assumed that there will be no condensation on the pipes.

          Optionally a low temperature heat storage unit can be installed  
30 for storing environmental heat in the environmental heat source circuit 9. If a low temperature heat storage unit is integrated into the system, if no heat is required but environmental heat is available (e.g. sun radiation), the heat can be stored temporarily.

          The heat pump 6 can be integrated into a wall-suspended housing  
35 in order to take up as little space as possible in the housing units. In this case the heat pump 6 can be installed in front of or behind a

6

wall heating device with which it forms an assembled unit. The device which is secured directly onto the wall then has connection points for the other device. As a rule the heat pump 6 is designed at the same time as a connection point for the additional heating device 19 so that a commercially available heating device can be attached to the heat pump 6.

**Patentkrav**

1. Varmepumpesystem med præcist ét miljømæssigt varmekildekredsløb (9) med en saltlage i hvilken flere miljømæssige varmekilder (1, 2, 3, 8) er integrerede  
5 som varmekilder,  
**kendetegnet ved at** parallelt anbragte fordampere (14) af mindst to kølemiddelkredsløb (11) af varmepumper (6) som er strukturelt separeret fra hinanden, hvor fordamperne er forbundet til det ene miljømæssige varmekildekredsløb (9), at individuelle miljømæssige varmekilder (1, 2, 3, 8) er i  
10 stand til at blive deaktiveret ved hjælp af omkoblingsventiler eller lukkeventiler (12), at ved varmepumper (6) hvor intet varmekrav er til stede, strømmer saltlagen igennem den tilsvarende fordamper (14) uden derved at afgive varme, og at præcis én cirkulationspumpe (13) er lokaliseret i det miljømæssige varmekildekredsløb (9).  
15
2. Varmepumpesystem ifølge krav 1, **kendetegnet ved at** mindst en luft-til-saltlage-varmeveksler (3), geotermisk probe (2), solabsorber (8), udblæsningsluft-varmeveksler og/eller regnvandscisterne med varmeveksler (1) bruges som en miljømæssig varmekilde.  
20
3. Varmepumpesystem ifølge et af kravene 1 eller 2, **kendetegnet ved at** et lavtemperaturs varmelager er forbundet til det miljømæssige varmekildekredsløb (9).  
25
4. Varmepumpesystem ifølge et af kravene 1 til 3, **kendetegnet ved at** en yderligere opvarmningsindretning (19) er anbragt parallelt eller i serie med mindst en varmepumpe (6) for at opvarme et opvarmningskredsløb (7) og/eller er anbragt til at være forbindeligt til brugsvand.  
30
5. Varmepumpesystem ifølge krav 4, **kendetegnet ved at** varmepumpen (6) og den yderligere opvarmningsindretning (19) forbindes med hinanden, hvor den ene indretning indeholder forbindelser til fastgørelsen og den elektriske, hydrauliske og gasformige forsyning af den anden indretning.

**6.** Varmepumpesystem ifølge et af de foregående krav, **kendetegnet ved at** regulatorer (10) er forbundet til de individuelle varmepumper (6), hvor disse regulatorer (10) er forbundet til cirkulationspumpen samt til omkoblings- eller lukkeventilerne (12) (13) af det miljømæssige varmekildekredsløb (9) via data 5 linjer (18).

**7.** Bygning med flere beboelsesenheder, som er separeret fra hinanden, og et varmepumpesystem ifølge et af kravene 1 til 6, **kendetegnet ved at** varmepumperne (6) som er separeret fra hinanden er installeret i forskellige 10 beboelsesenheder og er forbundet til flere forskellige miljømæssige varmekilder (1, 2, 3, 8) via det fælles saltlagekredsløb (9).

**Fra:** [- PVS Patent- og Varemærkestyrelsens officielle postkasse](#)  
**Til:** [G - PVS Ploumann](#)  
**Emne:** VS: Validering af EP2322880 - Rettelses af indleverede kravsat - PV ref.: P58356DK01  
**Dato:** 15. april 2016 11:04:25  
**Vedhæftede filer:** [image002.png](#)  
[image003.png](#)  
[2322880\\_DK\\_Translation.pdf](#)

---

---

**Fra:** Cathrine Søgaard Bjørnbak [<mailto:CSJ@pv.eu>]  
**Sendt:** 15. april 2016 10:59  
**Til:** - PVS Patent- og Varemærkestyrelsens officielle postkasse  
**Emne:** Validering af EP2322880 - Rettelses af indleverede kravsat - PV ref.: P58356DK01

Til rette vedkommende

Vi har i dag valideret EP2322880 via jeres online-formular. Desværre er der sket en fejl under print af kravsettet, hvorfor der mangler en side. Vedhæftet er det fulde kravsat, som skal erstatte det tidligere indleverede.

Vi beklager de gener dette måtte medføre og takker for jeres hjælp.

Med venlig hilsen

**Cathrine Søgaard Bjørnbak**  
**Plougmann Vingtoft**

Patent Coordinator

T. [+45 33 63 93 94](tel:+4533639394)

[csi@pv.eu](mailto:csi@pv.eu)  
[www.pv.eu](http://www.pv.eu)



**PLOUGMANN VINGTOFT®**

NOTICE: As our clients, please observe our Business Terms.

This e-mail from Plougmann Vingtoft a/s, and any attachment, is confidential and may contain legally privileged information. If you have received it in error, please delete it from your system, do not use or disclose the information in any way, and notify me immediately. Please note that from time to time, our scanners/filters may eliminate legitimate e-mail from our clients. Accordingly, if your e-mail contains important instructions, please make sure that you receive our acknowledgement of those instructions. Thank you.

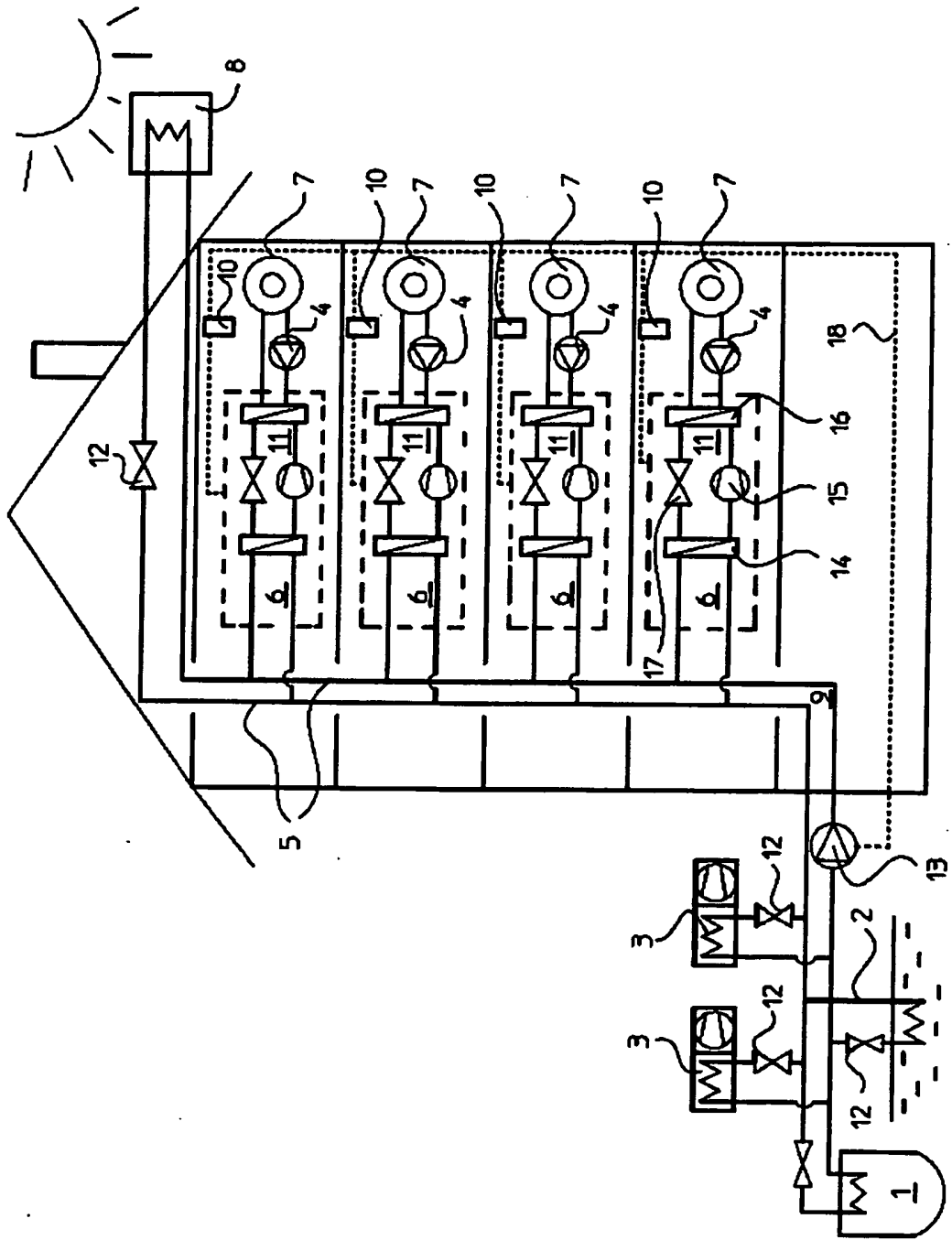


Fig. 1

Fig. 2

