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Published:
— *with international search report*

(54) **Title:** HEAT STORAGE

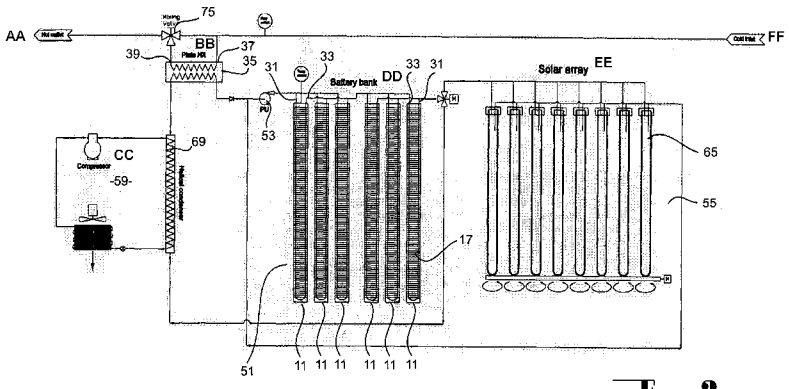

Fig 3

AA Sortie chaude
75 Vanne de mélange
BB Échangeur de chaleur à plaques
CC Compresseur
DD Banc de batteries
EE Batterie solaire
FF Entrée froide

(57) **Abstract:** A heat store (11) comprising a reservoir (13), the interior of the reservoir accommodating a first heat exchanger (17) in which the first heat exchanger have a first fluid path connected to a first inlet (31) and first outlet (33) located to the exterior of the reservoir, the first inlet and first outlet being intended in use to be connected to a further heat exchanger (65, 67, 69) associated with a heat source (55, 57, 59) the reservoir being in thermal communication with a second heat exchanger (35) having a second inlet (37) and second outlet (39). The second inlet being intended in use to be connected to a source of a supply liquid and the second outlet being intended in use to be connected to a delivery outlet, the interior of the reservoir accommodating a phase change material capable of changing phase between a liquid and a solid phase, the interior of the reservoir accommodating a nucleation activation means (41) adapted to cause nucleation of the phase change material on the phase change material being at a temperature below its melting point. A heat battery comprising a plurality of heat stores is also claimed

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"Heat Storage"

Field of the Invention

This invention relates to a heat store.

Background

The heat store according to the invention is one which utilises a phase change material which is capable of changing from a liquid to solid phase and in so able to release its latent heat. A known form of phase change material which is commonly used comprises sodium acetate tri-hydrate which will melt at 58^0C into a solution of water and sodium acetate. It is characteristic of such a phase change material that it is able to super cool below the crystallisation temperature and then crystallise as a result of some event which causes nucleation which in turn will trigger crystallisation of the medium. This triggering can be caused by lowering the phase change material to its nucleation temperature which is in the region 253^0K or by providing a nucleation site from which seed crystals will generate. It has been known to use such phase change material in heat packs which are heated by placing them in hot water and then are allowed to cool. The heat packs will cool below the crystallisation temperature of the phase change material and usually a means is provided which will trigger nucleation in order that the medium will crystallise and release its heat. Such heat packs can be used to selectively provide heat and have the advantage that they will not rise above the crystallisation temperature. While such an arrangement would seem to lend itself to larger scale situations such as providing heat for heating water and other like low temperature situations there have been problems in the past in putting the phase change material into use in such applications..

Disclosure of the Invention

Throughout the specification and claims, unless the context requires otherwise, the word "comprise" or variations such as "comprises" or "comprising", will be understood to imply the inclusion of a stated integer or group of integers but not the exclusion of any other integer or group of integers.

According to one aspect the invention resides in a heat stores comprising a reservoir, the interior of the reservoir accommodating a first heat exchanger, said first heat exchanger having a first fluid path connected to a first inlet and first outlet located to the exterior of the reservoir, said first inlet and first outlet being intended in use to be connected to a further heat exchanger associated with a heat source, the reservoir being in thermal communication with a second heat exchanger having a second inlet and second outlet located to the exterior of the reservoir said second inlet being intended in use to be connected to a source of a supply liquid and the second outlet being intended in use to be connected to a delivery outlet, the interior of the reservoir accommodating a phase change material capable of changing phase between a liquid and a solid phase, the interior of the reservoir accommodating a nucleation activation means adapted to cause nucleation of the phase change material on the phase change material being at a temperature below its melting point.

According to a preferred feature of the invention the fluid pressure of the supply fluid in the second heat exchanger is in use to be greater than the fluid pressure within the reservoir.

According to a preferred feature of the invention the first heat exchanger comprises a convoluted fluid conduit having a set of closely spaced fins mounted to the exterior of the first fluid conduit. According to one embodiment, the fluid path is of a serpentine nature comprising a plurality of interconnected lengths

which are in closely spaced parallel relationship to each other and wherein the fins extend across the first heat exchanger between the lengths.

According to one embodiment the nucleation activation means comprises an activation element having a portion located within the phase change medium which is capable of being cooled to the nucleation temperature of the phase change material.

According to an alternative embodiment the nucleation means comprises a flexible member defining a surface provided with small cracks or cavities or like deformations, said surface being adapted to be able to flex.

According to another embodiment of the invention the nucleation means comprises a nucleation additive which is mixed with the phase change material.

According to another embodiment the nucleation means comprises a treatment applied to the surface of the first and/or second heat exchanger which is to be in contact with the phase change material in a manner which will promote the formation of seed crystals. According to a preferred feature of the embodiment the fins of the first and/or second heat exchanger at least are formed of an aluminium or aluminium alloy, the surface of which has been oxidised prior to location of the heat exchanger into the reservoir.

According to another aspect the invention resides in a heat battery comprising a plurality of heat stores of the form as described above in which the first heat exchangers are interconnected in series and/or parallel to each other and the battery has a third inlet and outlet which are intended in use to be connected to the heat source and wherein the second heat exchangers are interconnected in series, the battery having a fourth inlet and outlet which are connected to the source of supply fluid and the delivery outlet respectively.

The invention will be more fully understood in the light of the following description of several specific embodiments.

Brief Description of the Drawings

The description is made with reference to the accompanying drawings of which:

Figure 1 is a part sectional view of a heat store which is utilised in the first embodiment;

Figure 2 is a circuit diagram of a hot water system according to the first embodiment; and

Figure 2 is a circuit diagram of a hot water system according to the second.

Detailed Description of Specific Embodiment

The embodiment is directed to a hot water system which uses as its heating means a number of heat stores 11 which are interconnected to provide a heat battery 51. As illustrated at Figure 2 the heat battery is connected to a number of heat sources which comprise a solar collector 55, the condenser 57 of an air conditioning system and a heat pump 59.

Each heat store 11 (as shown at Figure 1) comprises a reservoir 13 which accommodates a phase change material which is able to change from a solid to a liquid phase on application of the appropriate amount of heat and which on cooling will change from a liquid to a solid phase to generate latent heat. In the case of the first embodiment the phase change material comprises sodium acetate tri-hydrate which will melt at 58^0C degrees to form an aqueous sodium acetate solution.

The reservoir 13 takes the form of a rectangular cube in which the longitudinal axis is generally upright such that one end face 15 is uppermost. In addition the interior of the reservoir accommodates a first heat exchanger 17 which comprises a convoluted conduit which defines a serpentine path comprising a plurality of interconnected lengths 19 which are in closely spaced parallel relationship to each other. Fins 21 extend across the first heat exchanger between the lengths 19. The lengths 19 are substantially upright. The conduit carries a heat exchange fluid which is circulated through the heat exchanger in order to deliver heat into the reservoir. The first heat exchanger 17 further comprises an inlet header 23, an outlet header 25 which are provided with an inlet conduit 27 and outlet conduit 29 respectively. The inlet conduit 49 is associated with a first inlet 31 provided on the outer face of the one end 15 of the reservoir while the outlet conduit 29 is associated with a first outlet 33 located on the outer face of the one end of the reservoir.

In addition the reservoir supports a second heat exchanger 35 from the inner face of the one end 15. The second heat exchanger 35 comprises a substantially cubic enclosure which is mounted to the inner face of the one end to extend inwardly into the interior of the reservoir 13. The second heat exchanger 35 comprises a plate heat exchanger (not shown). The second heat exchanger has a second inlet 37 and a second outlet 39 whereby fluid entering the second heat exchanger 35 through the second inlet 37 will be caused to flow between the plates of the second heat exchanger to exit the second heat exchanger at the second outlet 39.

The interior of the reservoir 13 accommodates a phase change material in the form of a sodium acetate tri-hydrate which is in contact with the first heat exchanger 17 and he walls of the enclosure of the second heat exchanger 35.

In addition the reservoir accommodates a nucleation trigger 41 which is capable of being activated to cause nucleation to cause the creation of seed crystals within the phase change material whereby on the phase change material being at a temperature below its crystallisation temperature the activation of the nucleation trigger 41 will cause crystallisation of the phase change material within the reservoir. The nucleation trigger is sensitive to the temperature within the second reservoir 35 and is activated as a result of changes of temperature within the second heat exchanger 45 whereby on temperature being at a temperature above the temperature of crystallisation of the phase change material the nucleation trigger is not activated and on the temperature falling below the crystallisation temperature the nucleation trigger is activated

The heat battery of the first embodiment and as shown at Figure 2, comprises a number of heat stores 11 which are located in side by side relationship to define a heat battery 51 and are subdivided into two sets of heat stores 11. The first inlets 31 and first outlets 33 of each heat store 11 in each set are connected in parallel and the sets are connected in series. The second inlets 37 and second outlets 39 each heat store 11 are connected in series . The battery 51 has a primary inlet 61 and a primary outlet 63 which are connected to a set of heat sources through a pump 53. The heat sources comprise a heat exchanger 65 associated with a solar collector, a heat exchanger 67 associated with the condenser of an air conditioning system and a heat exchanger 69 associated with the condenser of a heat pump which may comprise a refrigerator or the like.

The fluid from each of the heat sources is caused to be circulated through the battery 51 and the respective heat sources by means of a pump 53. In addition the delivery of fluid from each of the heat sources to the inlet of the battery is controlled in accordance with the heat available from each source and the heat demands of the battery. The second inlets and outlets of each of the heat stores 11 of the battery 51 are connected in to each other series and the battery has a

water inlet 71 which is connected to a water supply whereby cold water enters the second inlet 37 of the first heat stores of the series and pass sequentially though each heat store to depart from a hot water outlet 39 of the final heat store of the battery to be delivered to a delivery outlet 73 of the battery 51..

In operation heat is collected and stored in the battery from the various heat sources as a result of a heat exchange fluid being caused to circulate through the battery 52 under the influence of the pump 53. On a flow of cold water into the heat battery 51 the nucleation trigger of the heat store closest to the water inlet 61 will be activated to cause crystallisation of the phase change material and thus raise the temperature of the water passing through the respective second heat exchanger. This action will be repeated sequentially in each of the subsequent heat stores through which the water passes until the temperature of the water has been raised to the crystallisation temperature of the phase change material. Once the temperature of the water has attained the crystallisation temperature of the phase change material it will continue to pass through the remaining heat store without triggering the phase change in those remaining heart stores. On there being only being a small draw of hot water from the battery 51, the proportion of the battery which is caused to be activated or crystallised will be limited. The amount of heat being generated by the heat store will be dependent upon the amount of hot water being drawn from the battery.

As a result of the embodiment a heat store is provided which is capable of extracting heat from a variety of heat sources such as solar collectors, air conditioning systems, heat pumps and the like and which can have a significant capacity and relatively rapid restoration capacity. In addition the heat battery will only generate heat as the need arises.

A second embodiment is illustrated at Figure 3. In the case of the second embodiment the second heat exchanger 35 is located to the exterior of the

reservoir and the heat exchanger is connected to the flow circuit provided between the heat sources and the first heat exchanger. The second inlet 37 and outlet 39 of the second heat exchanger are connected to the water supply line such that the second heart exchanger is in parallel with the water supply. The connection of the second outlet 39 into the water supply line is through a mixer valve 75 which enables the heated water from the second heat exchanger to be mixed with the cold water of the water supply line to deliver water from the delivery outlet at a desired temperature.

The flow circuit which accommodates the further heat exchanger 69 and the second heat exchanger 35 and is connected to the first heat exchanger 17 also includes a pump 53 to provide for a flow of the heat exchange medium through the respective heart exchangers. The pump is activated when water is being delivered from the delivery outlet in order that secondary heat exchanger is provided with heat from the first heat exchanger and in order that the water flowing through the second heat exchanger is heated thereby. The pump 53 when the battery is in a cooled condition at which it can accommodate more latent heat and when at least one of the heat sources is active enough to be able to deliver heat to the battery.

The second embodiment as shown in the drawings as having only two further heat exchangers 65 and 69 which is associated with a solar collector 55 and the condenser of a heat pump 59 respectively. It should be appreciated that this is for illustration purposes only and that any number of further heat exchangers can be provided as in the case of the first embodiment. The further heat exchangers 65 and 69 are connected in parallel.

As in the case of the first embodiment the heat battery 51 of the second embodiment and as shown at Figure 3 comprises a number of heat stores 11 are located in side by side relationship to define a heat battery 51. The heart stores

are divided into two sets of heat stores 11 and the first inlets 31 and first outlets 33 of the heat stores 11 in each set are connected in parallel and the sets are connected in series.

A third embodiment of the invention which is not illustrated comprises one which is similar to the first embodiment with the exception that the second heat exchanger of the heat store means 11 is located to the exterior of the heat store 11. In the third embodiment the second heat exchange is in thermal communication with the reservoir through a flow circuit which includes a third heat exchange within the reservoir whereby fluid is circulated by means of a pump through the third heat exchanger to extract the heat therefrom.

The present invention is not to be limited in scope by the specific embodiment described herein. The embodiment is intended for the purpose of exemplification only. Functionally equivalent products, formulations and methods are clearly within the scope of the invention as described herein.

Claims

The Claims Defining the Invention is as Follows:

1. A heat store comprising a reservoir, the interior of the reservoir accommodating a first heat exchanger, said first heat exchanger having a first fluid path connected to a first inlet and first outlet located to the exterior of the reservoir, said first inlet and first outlet being intended in use to be connected to a further heat exchanger associated with a heat source, the reservoir being in thermal communication with a second heat exchanger having a second inlet and second outlet said second inlet being intended in use to be connected to a source of a supply liquid and the second outlet being intended in use to be connected to a delivery outlet, the interior of the reservoir accommodating a phase change material capable of changing phase between a liquid and a solid phase, the interior of the reservoir accommodating a nucleation activation means adapted to cause nucleation of the phase change material on the phase change material being at a temperature below its melting point.

2. A heat store as claimed at claim 1 wherein the second heat exchanger is accommodated within an enclosure supported within the reservoir having walls which are in heat exchange relationship with the phase change material.

3. A heat store as claimed at claim 1 wherein the second heat exchanger is located to the exterior of the reservoir and is connected to a flow circuit which provides the thermal communication with the reservoir.

4. A heat store as claimed at claim 3 wherein the flow circuit includes a third heat exchanger within the reservoir.

5. A heat store as claimed at claim 3 wherein the flow circuit incorporates the first inlet and the outlet and includes a pump which is arranged to induce a fluid flow though the second and further heat exchanger.

6. A heat store as claimed at any one of the preceding claims wherein the fluid pressure of the supply fluid in the second heat exchanger is in use to be greater than the fluid pressure within the reservoir.

7. A heat store as claimed at any one of the preceding claims wherein the first heat exchanger comprises a convoluted fluid conduit having a set of closely spaced fins mounted to the exterior of the first fluid conduit.

8. A heat store as claimed at claim 3 wherein the fluid path is of a serpentine nature comprising a plurality of interconnected lengths which are in closely spaced parallel relationship to each other and wherein the fins extend across the first heat exchanger between the lengths.

9. A heat store as claimed at any one of the preceding claims wherein nucleation activation means comprises an activation element having a portion located within the phase change medium which is capable of being cooled to the nucleation temperature of the phase change material.

10. A heat store as claimed at any one of claims 1 to 9 wherein the nucleation means comprises a flexible member defining a surface provided with small cracks or cavities or like deformations, said surface being adapted to be able to flex.

11. A heat store as claimed at any one of claims 1 to 8 wherein the nucleation means comprises a nucleation additive which is mixed with the phase change material.

12.A heat store as claimed at any one of claims 1 to 8 wherein the nucleation means comprises a treatment applied to the surface of the first heat exchanger which is to be in contact with the phase change material in a manner which will promote the formation of seed crystals.

13.A heat store as claimed at any one of claims 1 to 8 wherein the fins of the first heat exchanger at least are formed of an aluminium or aluminium alloy, the surface of which has been oxidised prior to location of the heat exchanger into the reservoir.

14.A heat store substantially as herein described.

15.A heat battery comprising a plurality of heat stores, each of the heat stores comprising a reservoir, the interior of the reservoir accommodating a first heat exchanger, said first heat exchanger having a first fluid path connected to a first inlet and first outlet located to the exterior of the reservoir, said first inlet and first outlet being intended in use to be connected to a further heat exchanger associated with a heat source, the reservoir being in thermal communication with a second heat exchanger having a second inlet and second outlet said second inlet being intended in use to be connected to a source of a supply liquid and the second outlet being intended in use to be connected to a delivery outlet, the interior of the reservoir accommodating a phase change material capable of changing phase between a liquid and a solid phase, the interior of the reservoir accommodating a nucleation activation means adapted to cause nucleation of the phase change material on the phase change material being at a temperature below its melting point wherein the first heat exchangers are interconnected in series and/or parallel to each other and the battery has a third inlet and outlet which are intended in use to be connected to the heat source and wherein the second heat exchangers are interconnected in series, the

battery having a fourth inlet and outlet which are connected to the source of supply fluid and the delivery outlet respectively.

16.A heat battery as claimed at claim 15 wherein the second heat exchanger is accommodated within an enclosure supported within the reservoir having walls which are in heat exchange relationship with the phase change material.

17.A heat battery comprising a plurality of heat stores, each of the heat stores comprising a reservoir, the interior of the reservoir accommodating a first heat exchanger, said first heat exchanger having a first fluid path connected to a first inlet and first outlet located to the exterior of the reservoir, said first inlet and first outlet being intended in use to be connected to a further heat exchanger associated with a heat source, the reservoir being in thermal communication with a second heat exchanger having a second inlet and second outlet said second inlet being intended in use to be connected to a source of a supply liquid and the second outlet being intended in use to be connected to a delivery outlet, the interior of the reservoir accommodating a phase change material capable of changing phase between a liquid and a solid phase, the interior of the reservoir accommodating a nucleation activation means adapted to cause nucleation of the phase change material on the phase change material being at a temperature below its melting point wherein the first heat exchangers are interconnected in series and/or parallel to each other and the battery has a third inlet and outlet which are intended in use to be connected to the heat source and wherein the second heat exchangers are interconnected in series, the battery having a fourth inlet and outlet which are connected to the source of supply fluid and the delivery outlet respectively.

18.A heat battery as claimed at claim 17 wherein the second heat exchanger is located to the exterior of the reservoir and is connected to a flow circuit which provides the thermal communication with the reservoir.

19.A heat battery as claimed at claim 18 wherein the flow circuit includes a third heat exchanger within the reservoir.

20.A heat battery store as claimed at claim 18 wherein the flow circuit incorporates the first inlet and the outlet and includes a pump which is arranged to induce a fluid flow though the second and further heat exchanger.

21.A heat battery as claimed at any one of 15 to 21 wherein the fluid pressure of the supply fluid in the second heat exchanger is in use to be greater than the fluid pressure within the reservoir.

22. A heat battery substantially as herein described with reference to the accompanying drawings

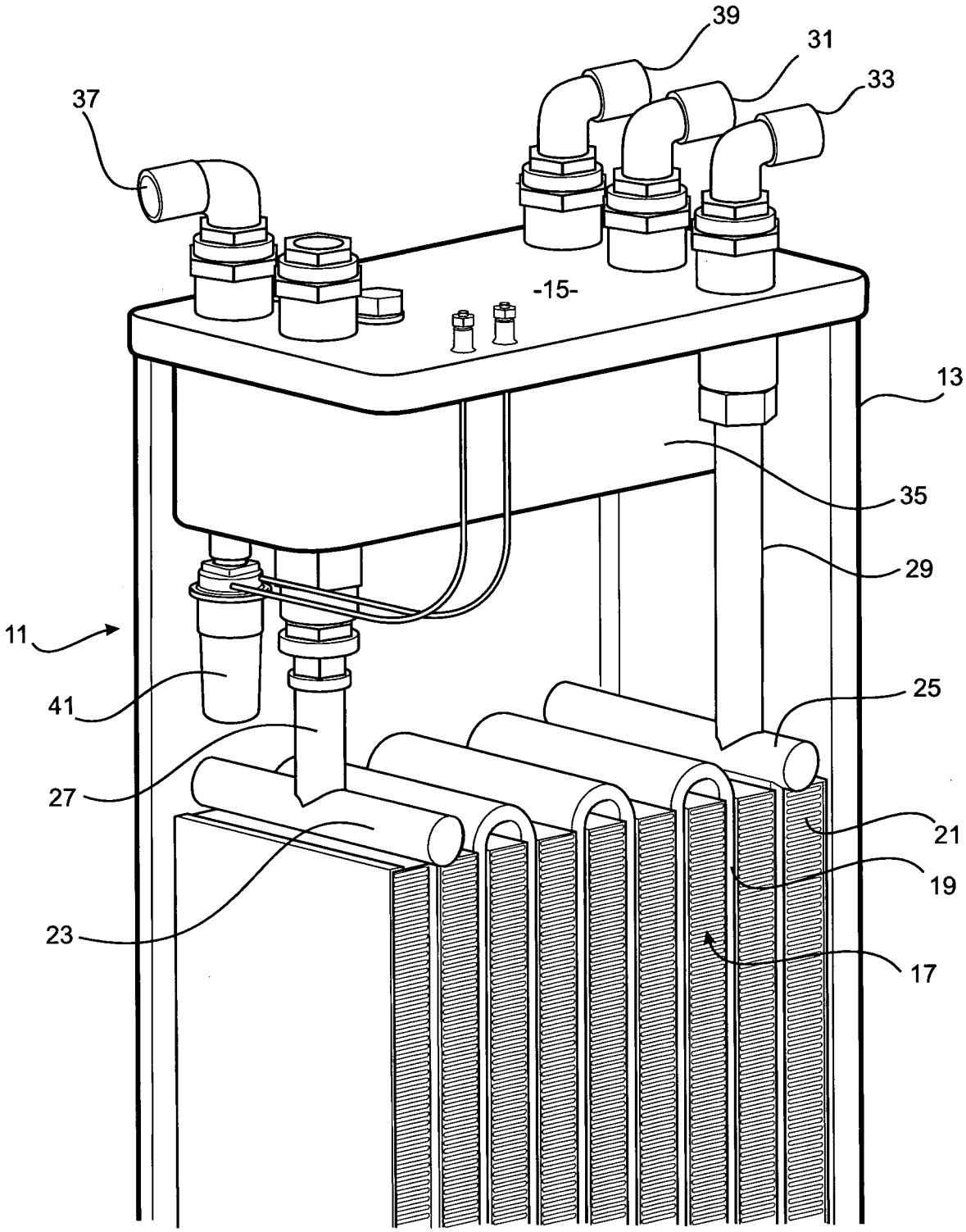

Fig.1

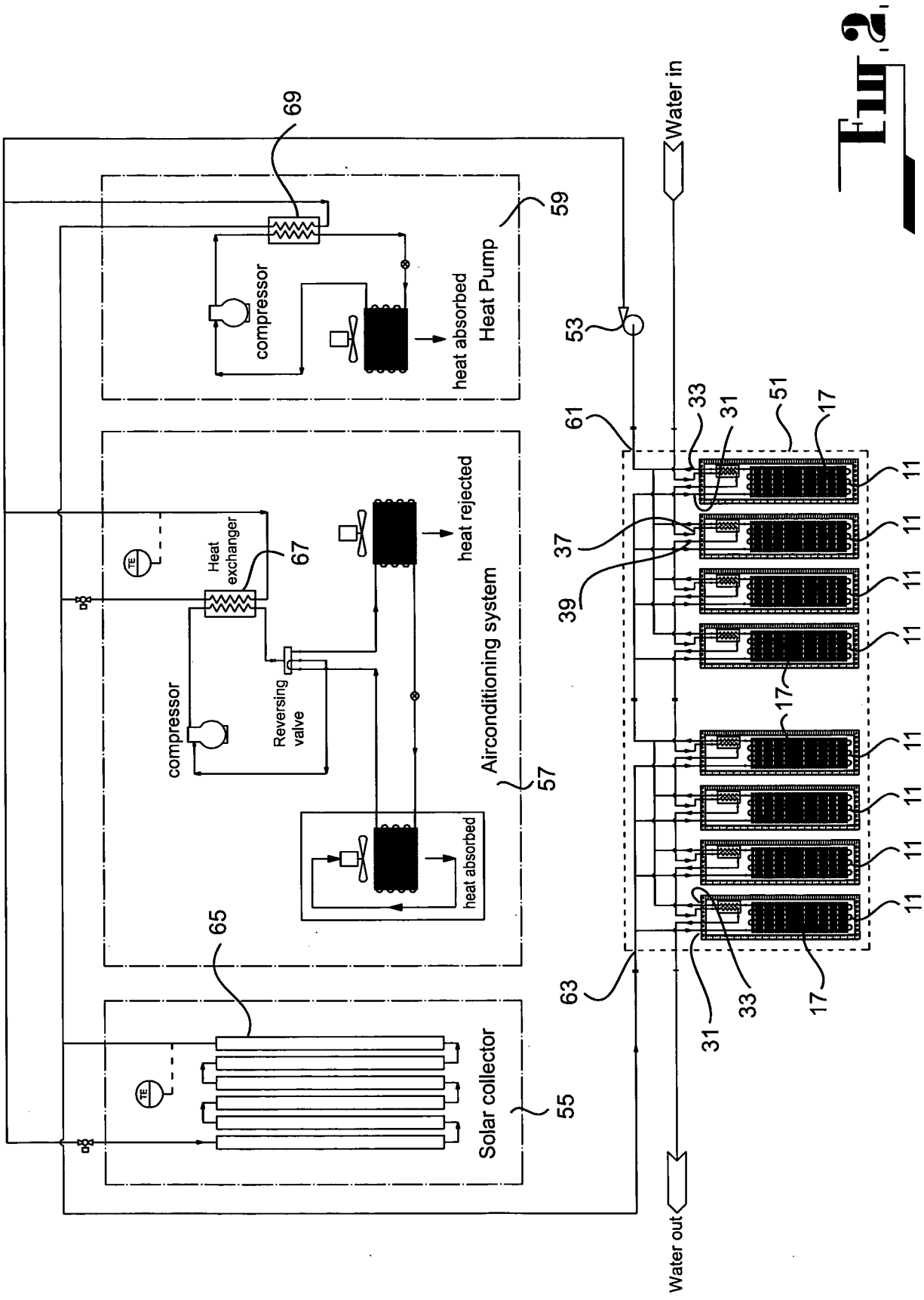
Water in
69
59
Heat Pump
compressor
heat absorbed
53
61
33
31
51
17
37
39
11
Heat exchanger
67
heat rejected
Reversing valve
compressor
Airconditioning system
57
heat absorbed
65
63
Solar collector
55
Water out

Fig. 2

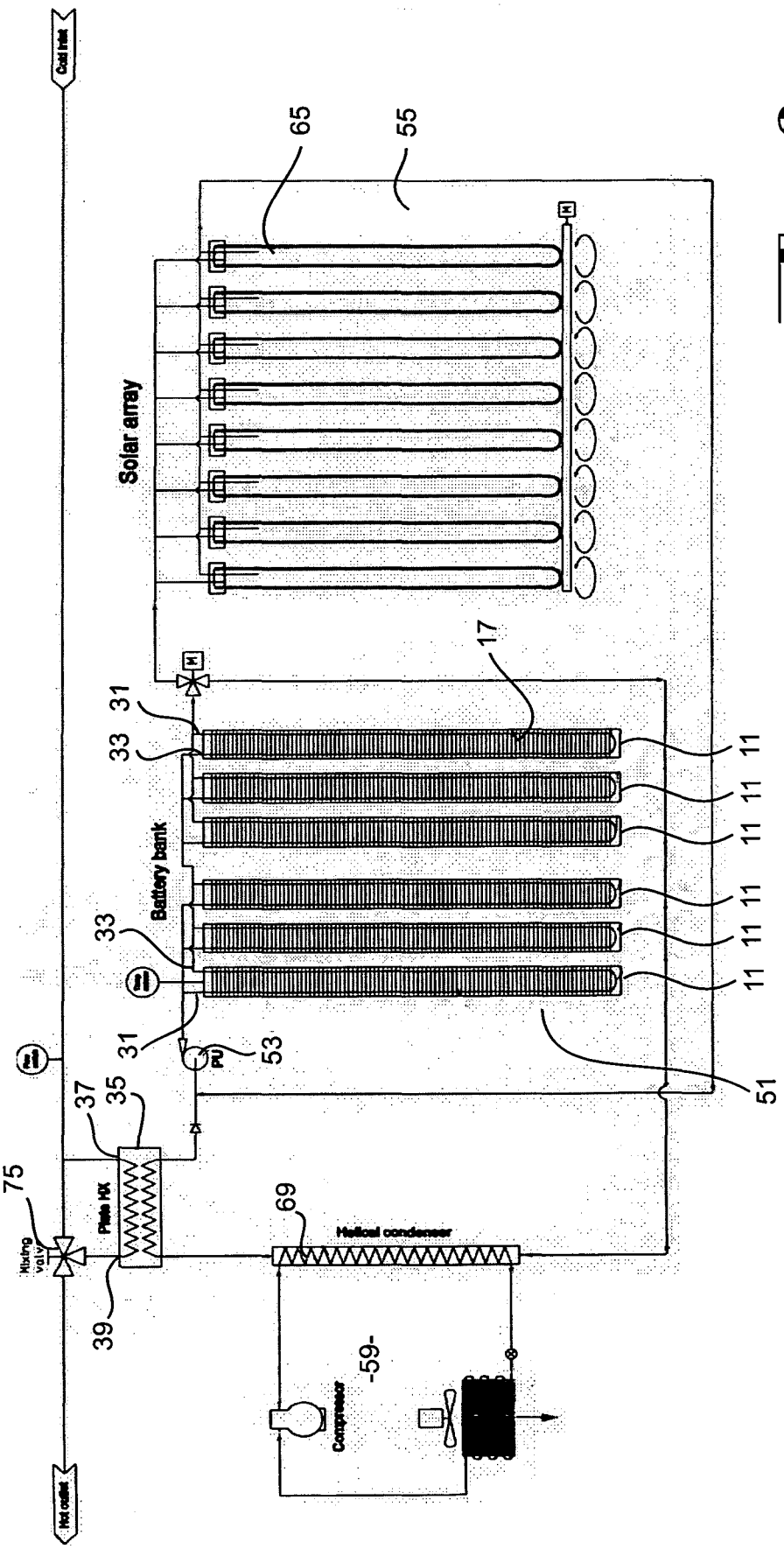
Cold inlet
Hot outlet
Solar array
Battery bank
Plate HX
Helical condenser
Compressor
Mixing valve
PU
65
55
17
31
33
11
53
51
37
35
75
69
39
-59-

Fig. 3

INTERNATIONAL SEARCH REPORT

International application No.
PCT/AU2008/001730

A. CLASSIFICATION OF SUBJECT MATTER

Int. Cl.

F28D 20/02 (2006.01) ***F24D 15/02*** (2006.01) ***F24H 7/00*** (2006.01) ***C09K 5/06*** (2006.01)

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)

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 practicable, search terms used)

WPI and EPODOC: IPC: F28D20/02, F24H7/00, F24D15/02, F28D21/00, C09K5/06 & key words (phase change, heat exchanger, heat store, nucleate, activate, vessel, container, tank, reservoir); Google Patents: key words (heat store, phase change, heat exchanger, activate, nucleate)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 4258696 A (GOPAL) 31 March 1981 Abstract; col 3, line 44 to col 4, line 62; col 6, lines 58-65; col 5, line 49; col 6, lines 1-8; figs.1-4	1-6, 9-12
X	GB 2237629 A (MALCOLM GEORGE CIULOW et al.) 8 May 1991 Abstract; page 4, lines 6-17; page 11, line 4-31; page 10, lines 10-28; figs.1-6	1-3, 5-6, 9, 11, 15-21
Y		7-8, 13
Y	PERRY and GREEN, 'PERRY'S CHEMICAL ENGINEER'S HANDBOOK, Sixth Edition, McGraw-Hill Book Company, See section 11, pages 28 and 30	7-8, 13

[X] Further documents are listed in the continuation of Box C [X] See patent family annex

* Special categories of cited documents:

"A" document defining the general state of the art which is not considered to be of particular relevance

"E" earlier application or patent but published on or after the international filing date

"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)

"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art

"&" document member of the same patent family

Date of the actual completion of the international search
16 December 2008

Date of mailing of the international search report
07 JAN 2009

Name and mailing address of the ISA/AU

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INTERNATIONAL SEARCH REPORT

International application No.
PCT/AU2008/001730

C (Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	*US 6400896 B1 (LONGARDNER) 4 June 2002* Abstract; col 1, line 52 to col 3, line 46; col 4, line 46 to col 7, line 5; fig.1 For Y indications GB 2237629 is combined with PERRY and GREEN, 'PERRY'S CHEMICAL ENGINEER'S HANDBOOK'	1, 3

INTERNATIONAL SEARCH REPORT

International application No.
PCT/AU2008/001730

Box No. II Observations where certain claims were found unsearchable (Continuation of item 2 of first sheet)

This international search report has not been established in respect of certain claims under Article 17(2)(a) for the following reasons:

1. ☐ Claims Nos.:
because they relate to subject matter not required to be searched by this Authority, namely:

2. ☒ Claims Nos.: **14, 22**
because they relate to parts of the international application that do not comply with the prescribed requirements to such an extent that no meaningful international search can be carried out, specifically:

The claims 14 and 22 do not comply with Rule 6.2(a) because they rely on references to the description and/or drawings.

3. ☐ Claims Nos.:
because they are dependent claims and are not drafted in accordance with the second and third sentences of Rule 6.4(a)

Box No. III Observations where unity of invention is lacking (Continuation of item 3 of first sheet)

This International Searching Authority found multiple inventions in this international application, as follows:

1. ☐ As all required additional search fees were timely paid by the applicant, this international search report covers all searchable claims.
2. ☐ As all searchable claims could be searched without effort justifying additional fees, this Authority did not invite payment of additional fees.
3. ☐ As only some of the required additional search fees were timely paid by the applicant, this international search report covers only those claims for which fees were paid, specifically claims Nos.:
4. ☐ No required additional search fees were timely paid by the applicant. Consequently, this international search report is restricted to the invention first mentioned in the claims; it is covered by claims Nos.:

Remark on Protest

☐ The additional search fees were accompanied by the applicant's protest and, where applicable, the payment of a protest fee.

☐ The additional search fees were accompanied by the applicant's protest but the applicable protest fee was not paid within the time limit specified in the invitation.

☐ No protest accompanied the payment of additional search fees.

INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No.
PCT/AU2008/001730

This Annex lists the known "A" publication level patent family members relating to the patent documents cited in the above-mentioned international search report. The Australian Patent Office is in no way liable for these particulars which are merely given for the purpose of information.

Patent Document Cited in Search Report		Patent Family Member					
US	4258696	NONE					
GB	2237629	AU	66227/90	BR	9007792	CA	2071535
		CN	1051244	EP	0497827	FI	921829
		GR	90100774	HU	56952	IE	903853
		IL	96123	IN	179313	NO	921625
		PT	95699	WO	9106612	ZA	9008613
US	6400896	AU	2002307419	WO	03095896		

Due to data integration issues this family listing may not include 10 digit Australian applications filed since May 2001.

END OF ANNEX