



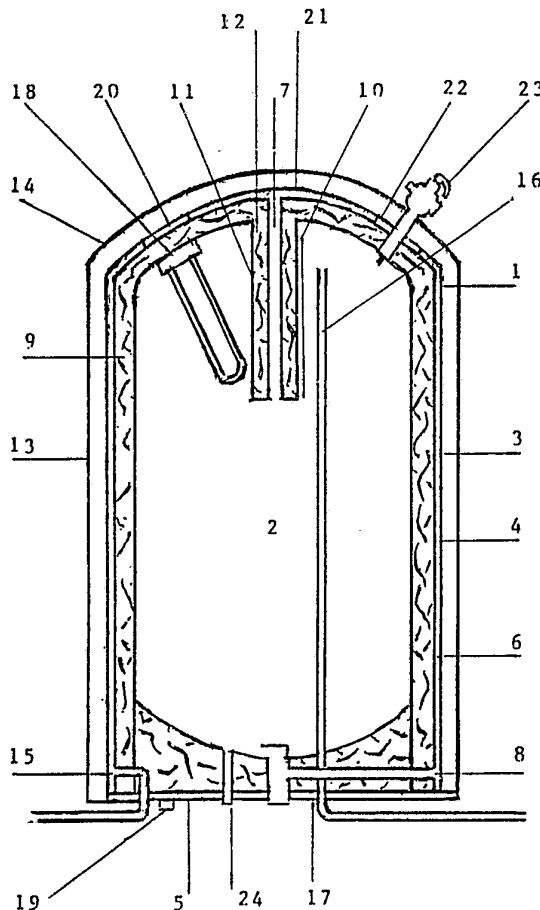
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<p>(21) International Application Number: PCT/AU88/00407 (22) International Filing Date: 18 October 1988 (18.10.88) (71)(72) Applicant and Inventor: COLLERAN, Robert, James [AU/AU]; 5 Boyd Crescent, Hamilton Hill, W.A. 6163 (AU). (81) Designated States: AT, BB, BE (European patent), BG, BJ (OAPI patent), BR, CF (OAPI patent), CG (OAPI patent), CH, CM (OAPI patent), DE, DK, FI, FR (European patent), GA (OAPI patent), GB, HU, IT (European patent), JP, KP, KR, LK, LU, MC, MG, ML (OAPI patent), MR (OAPI patent), MW, NL, NO, RO, SD, SE, SN (OAPI patent), SU, TD (OAPI patent), TG (OAPI patent), US.</p>		<p><b>Published</b> <i>With international search report.</i></p>

(54) Title: SOLAR WATER HEATER

(57) Abstract

A solar water heater which incorporates a solar collector with a storage tank including a means of surrounding the solar water heater storage tank (2) with a cylindrical closed ended solar absorber (1) which is a double walled jacket containing water and which is connected to the storage tank top and bottom so that a thermosiphonic flow can be induced. There is also a means of providing insulation to the storage tank by filling the cavity (9) between it and the surrounding water jacket with insulating material. The inflow conduit (7) located at the top extends some depth of the storage tank to minimise reverse thermosiphoning. A diaphanous cover (13) contains heat and admits solar radiation. A supplementary valve (23) may be operated by a liquid which vapourises at a prescribed temperature.



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## SOLAR WATER HEATER

This invention is a solar water heater which is of relatively simple construction and which incorporates the solar collector with the storage tank thus alleviating the need for supplementary solar collector panels.

Being vertical in configuration with a surrounding diaphanous casing it can receive sun radiation from any direction and can therefore be easily located.

The solar heater is of upright configuration as shown in Figure 1 which is a cross section drawing of it. It has an upright tank and is placed in a sunlit location such as a rooftop and it has its outer surface dark coloured to act as the absorber 1.

The invention is comprised of an outer surrounding cylindrical water jacket which encompasses a central storage tank 2. The water jacket is made up from two cylinders with preferably domelike lids, one 3 fitted over the other 4 which is just slightly shorter in height and diameter. Both cylinders can be fixed to the base 5 and this container shall be hereafter referred to as the outer container 6. Water held in the narrow cavity of the outer container 6 will become heated by sun radiation onto its outer wall the absorber 1.

A central storage tank hereafter referred to as the inner container 2 which is shorter and narrower than the outer container 6 has interconnecting open-ended pipes at the top 7 and the bottom 8 ideally located centrally and which induce a thermosiphon flow when the container 6 water is hotter than that in the inner container 2. The heated water entering the inner container 2 through the top interconnection 7 as the cooler water is expelled through the bottom opening 8.

The cavity between the inner and outer container can be filled with insulating material 9, the only contact points being the interconnection top 7 and bottom 8 and where the inner container 2 becomes attached to the base 9.

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In order to minimise reverse thermosiphoning the top inflow pipe 7 can protrude about one third of the depth of the inner container as indicated 10.

4 To negate heat transfer loss at the connection between the two containers the inflow pipe 7 can be circumscribed by another pipe 11 of wider diameter and covering the part of the inflow pipe that protrudes into the inner container 2 and the cavity between them can be filled with insulating material 12.

5 The absorber 1 is encased by a diaphanous and preferably translucent cover 13 which is usually cylindrical with a domelike lid 14. The translucent effect can be obtained by using a transparent material with a prismatic or similar pattern. The diaphanous cover 13 & 14 admits and reflects sun radiation from any angle onto the absorber contained within it as well as mitigating heat loss besides containing heat. The translucency of the covering obscures the absorber 1 so that the appearance is enhanced.

6 Water from the mains supply usually enters the outer container 6 close to the bottom 15 and the heated water is drawn off from the top strata of the inner container 2 through a pipe 16 which has an open end at its top and which can extrude through the bottom of the inner container 2 and through the base 17.

Auxillary heating can be provided and one means is by using an electric immersion heater 18 which can be fitted into the top of the inner container 2 and set above the opening of the inlet 10 in order to prevent heated water from reverse thermosiphoning as much as possible.

7 The temperature of the water heated by the immersion heater 18 can be controlled by a thermostat fixed onto the top of the inner container 2 but this is not shown in the illustration and electrical wiring can be passed down through the insulation 9 to a terminal 19 on the base 17.

Holes through the top of the outer container which have sealed rims 20 & 21 provide access to the immersion heater 18 and thermostat and a third such hole prevents the relief valve 23 from making contact with the outer contain-

er 6 as the relief valve is fitted into a pipe which protrudes through the opening provided. The holes in the top of the outer container 6 all have insulated plugs that fit into them and the immersion heater plug and the thermostat plug have lids which conduct heat.

9 Two or more of the described solar water heaters can be interconnected by joining the outflow pipe 16 from one to the inner container 2 of the other usually to a connection provided at the bottom of the tank 24.

Three alternative methods of preventing reverse thermosiphoning are as follows:

(1) A valve comprised of a small receptacle containing a liquid which has a low boiling point and the receptacle is immersed in water in a small container usually fixed top  
10 centre on the outer container 6 so that when heated by sun radiation the liquid will boil causing the receptacle to float and in doing so will unplug the top thermosiphon inlet 7 .

(2) A light sensor which electrically operates a solenoid which in turn works a plug type valve which opens the inf-  
low thermosiphon pipe when activated by sunlight.

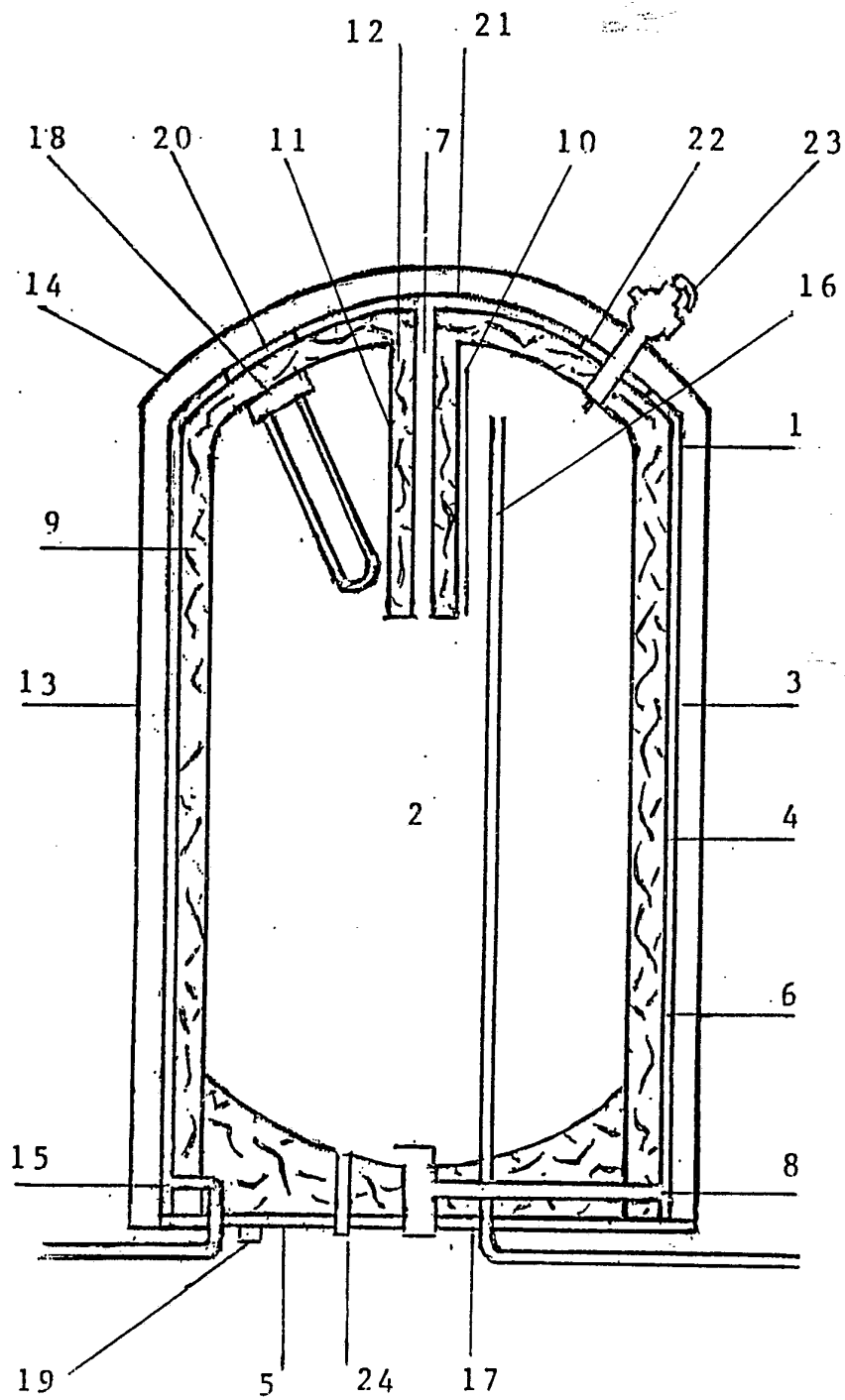
(3) A solenoid which operates a plug type valve which opens the thermosiphon inlet and controlled by a thermostat which  
11 in turn is operated by sun radiation heat.

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The claims defining the invention are as follows:

- 1 An upright cylindrical tank surrounded top and sides by a water jacket whereby both containers are separated from each other by insulation but have interconnections top and bottom through which water that has been heated by sun radiation on the outer cover will thermosiphon.
- 2 As one special means of minimising reverse thermosiphoning the open pipe connection from the outer water jacket can protrude about one third of the depth of the central storage tank to a level below any auxillary immersion heater so that heated water above the bottom of the pipe cannot rise into it.
- 3 The diaphanous vertical and preferably translucent and cylindrical casing which has a domelike top and which will focus sun radiation onto the encased vertical cylindrical absorber.
- 4 A valve comprised of a small receptacle containing a liquid which has a low boiling point. The receptacle is immersed in water in a small container usually fixed top centre on the outer container so that when heated by sun radiation the liquid will boil causing the receptacle to float and when lifting will unplug the thermosiphon inlet.


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# INTERNATIONAL SEARCH REPORT

International Application No PCT/AU 88/00407

<b>I. CLASSIFICATION OF SUBJECT MATTER</b> (if several classification symbols apply, indicate all) <sup>6</sup>		
According to International Patent Classification (IPC) or to both National Classification and IPC		
Int. Cl. <sup>4</sup> F24J 2/44, 2/50, 2/46, F16K 33/00		
<b>II. FIELDS SEARCHED</b>		
Minimum Documentation Searched <sup>7</sup>		
Classification System	Classification Symbols	
IPC <sup>3</sup>	F24J 3/02	
IPC <sup>4</sup>	F24J 2/44, 2/50, 2/46, F16K 33/00	
Documentation Searched other than Minimum Documentation to the Extent that such Documents are Included in the Fields Searched <sup>8</sup>		
AU : IPC as above		
<b>III. DOCUMENTS CONSIDERED TO BE RELEVANT <sup>9</sup></b>		
Category <sup>10</sup>	Citation of Document, <sup>11</sup> with indication, where appropriate, of the relevant passages <sup>12</sup>	Relevant to Claim No. <sup>13</sup>
X,Y	US,A, 4294229 (MALONEY) 13 October 1981 (13.10.81)	(1,4)
X	DE,A, 2951869 (URBANEK) 2 July 1981 (02.07.81)	(1)
X	US,A, 4419983 (HOLLAND) 13 December 1983 (13.12.83)	(1)
X	US,A, 4356813 (HOFFMAN) 2 November 1982 (02.11.82)	(3)
Y	Derwent Abstract Accession No 88-019594/03 Class Q66, SU,A, 1314175 (KOLOBOV) 30 May 1987 (30.05.87)	(4)
A	AU,A, 62452/86 (SEIDEL) 10 March 1988 (10.03.88) See figure 8	(1)
A	US,A, 4076015 (MATTSON) 28 February 1978 (28.02.78)	(3)
<p><sup>10</sup> Special categories of cited documents:</p> <p>"A" document defining the general state of the art which is not considered to be of particular relevance</p> <p>"E" earlier document but published on or after the international filing date</p> <p>"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)</p> <p>"O" document referring to an oral disclosure, use, exhibition or other means</p> <p>"P" document published prior to the international filing date but later than the priority date claimed</p> <p>"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</p> <p>"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step</p> <p>"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.</p> <p>"Z" document member of the same patent family</p>		
<b>IV. CERTIFICATION</b>		
Date of the Actual Completion of the International Search	Date of Mailing of this International Search Report	
10 January 1989 (10.01.89)	25 JANUARY 1989 (25.01.89)	
International Searching Authority	Signature of Authorized Officer	
Australian Patent Office	 (R. HALLETT)	



ANNEX TO THE INTERNATIONAL SEARCH REPORT ON  
INTERNATIONAL APPLICATION NO. PCT/AU 88/00407

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.

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Patent Document Cited in Search Report	Patent Family Members		
US 4294229	US 4257477	US 4355682	
US 4076015	US 4077393 US 4210128	US 4178911 US 4287882	US 4204521

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END OF ANNEX