(12) INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(19) World Intellectual Property Organization
International Bureau

(43) International Publication Date
16 February 2006 (16.02.2006)

PCT

(10) International Publication Number
WO 2006/015433 A1

(51) International Patent Classification[7]: C02F 1/14, 1/04

(21) International Application Number:
PCT/AU2005/001197

(22) International Filing Date: 8 August 2005 (08.08.2005)

(25) Filing Language: English

(26) Publication Language: English

(30) Priority Data:
2004 904 466 9 August 2004 (09.08.2004) AU

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(81) Designated States *(unless otherwise indicated, for every kind of national protection available)*: AE, AG, AL, AM, AT, AU, AZ, BA, BB, BG, BR, BW, BY, BZ, CA, CH, CN, CO, CR, CU, CZ, DE, DK, DM, DZ, EC, EE, EG, ES, FI, GB, GD, GE, GH, GM, HR, HU, ID, IL, IN, IS, JP, KE, KG, KM, KP, KR, KZ, LC, LK, LR, LS, LT, LU, LV, MA, MD, MG, MK, MN, MW, MX, MZ, NA, NG, NI, NO, NZ, OM, PG, PH, PL, PT, RO, RU, SC, SD, SE, SG, SK, SL, SM, SY, TJ, TM, TN, TR, TT, TZ, UA, UG, US, UZ, VC, VN, YU, ZA, ZM, ZW.

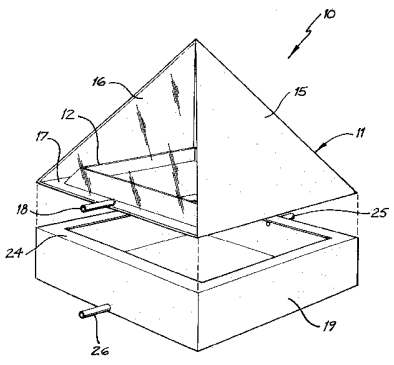
(84) Designated States *(unless otherwise indicated, for every kind of regional protection available)*: ARIPO (BW, GH, GM, KE, LS, MW, MZ, NA, SD, SL, SZ, TZ, UG, ZM, ZW), Eurasian (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European (AT, BE, BG, CH, CY, CZ, DE, DK, EE, ES, FI, FR, GB, GR, HU, IE, IS, IT, LT, LU, LV, MC, NL, PL, PT, RO, SE, SI, SK, TR), OAPI (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, ML, MR, NE, SN, TD, TG).

Published:
— *with international search report*

For two-letter codes and other abbreviations, refer to the "Guidance Notes on Codes and Abbreviations" appearing at the beginning of each regular issue of the PCT Gazette.

WO 2006/015433 A1

(54) Title: WATER PURIFIER



(57) Abstract: A water purifier (10) has a housing (11) which is located over a reservoir (19) of impure water. The housing (11) has two collector surfaces upon which water vapour is condensed. There is also a water collection gutter (17) below the collector surfaces, and an outlet (18) from the collection gutter.

WATER PURIFIER

TECHNICAL FIELD

This invention relates to water purification and more particularly to a solar desalinater or water purifier.

BACKGROUND ART

Water can be evaporated by the sun (as in solar energy) or waste heat from any convenient source, such as cooling towers, steam engines and the like. Water vapour so produced can be condensed on a cool surface and drinkable water then collected, and the remaining concentrate discharged in any convenient way. However, such a process, whilst operating effectively in nature, has yet to be efficiently harnessed commercially. The prolonged drought conditions in some parts of the world and the changing world climate have made drinkable water a valuable resource. The diminution of drinkable water supplies in many parts of the world has brought forward the need to preserve or recycle water. One process commonly used is reverse osmosis, but this is expensive, complex to operate and contributes to "greenhouse" gases.

It is an object of the present invention to provide an improved yet simple water purifier which is operated by solar energy or heat from other sources.

SUMMARY OF THE INVENTION

According to one aspect of the invention there is provided a water purifier comprising a housing which is located over a reservoir of impure water, the housing having at least one collector surface upon which water vapour is condensed, a water collection gutter below the or each collector surface, and an outlet from the collection gutter.

In a preferred form of the invention, the housing is in the shape of a pyramid having a square base with four sides being north, east, south and

west facing. The housing may be made of any convenient material, such as glass or clear UV-capped polycarbonate plastic.

Preferably, the east and west facing sides are clear or transparent to allow the passage of sunlight to the impure water in the reservoir. The north and south facing sides are silvered or aluminised to allow the reflection of the sunlight and respectively provide two collector surfaces.

BRIEF DESCRIPTION OF THE DRAWINGS

Fig. 1 is a plan view of a water purifier according to one embodiment of the invention,

Fig. 2 is a cross sectional view taken through II-II of the water purifier shown in Fig. 1,

Fig. 3 is a perspective view of the water purifier shown in Fig. 1 with the housing separated from a pool for containing impure water,

Fig. 4 is a view similar to that of Fig. 3 but further showing a serpentine arrangement of tubing for conveying waste heat, and

Fig. 5 is a view of a scaled up water purification system employing a plurality of preferred water purifiers of the invention.

DETAILED DESCRIPTION OF THE INVENTION

The water purifier 10 shown in the drawings comprises a housing 11 which, in this instance, is in the shape of a pyramid having a square base and four triangular sides 13, 14, 15 and 16 which, for the sake of convenience, will be called the north facing side 13, the east side facing side 14, the south facing side 15 and the west facing side 16. The sides of the housing 11 are made from UV-capped polycarbonate plastic, but other convenient, transparent and stable materials may be used.

The east and west facing sides 14 and 16 are clear or transparent to allow the passage of sunlight. The north and south facing sides are silvered or aluminised to allow the reflection of the sunlight from their outside surfaces and to provide two collector surfaces at their respective inside surfaces.

Around the internal periphery of the square base, there is a water collection and flow gutter 17 defined between the sides of the housing 11 and an endless inner wall 12. The peripheral gutter 17 has an outlet 18. The portion of the base confined by the inner wall 12 is open and, in use, the housing 11 is placed over a reservoir of impure water which, in this case, is a trough or pool 19, but may be a pond. The walls of the pool 19 may be made of a black, water impervious material, such as black plastic or black tiles to improve heat absorption. The pool 19 has a ledge 24 upon which the housing 11 rests, a supply pipe 25 and a drain pipe 26.

Water vapour resulting from evaporation of water in the reservoir is condensed on the two collector surfaces of the north and south facing sides 13, 15 and runs down those surfaces into the peripheral gutter 17. The cooling and condensation of the water vapour could be further enhanced by double glazing the sides of the housing 11 and passing waste coolant water between the two layers of glazing.

By way of example, the square base of the housing 11 is 80cm x 80cm and each triangular side 13, 14, 15 and 16 has a base to apex height of 80cm and is 6mm in thickness. The peripheral gutter 17 could be 5cm wide and 10cm high as determined by the vertical height of the inner wall 12.

The outlet 18 may be connected to a suitable storage container and the concentrate remaining in the pool or pond can be returned to its source or otherwise responsibly discharged.

Although the invention has been described with reference to a housing in the shape of a pyramid, other shapes such as a rectangular prism, a dome, or an inverted cone could be used.

Purifiers according to the present invention could be used with or without modification in domestic applications. For example, a purifier of the present invention may be attached to the roof of a building or modified to follow the slope of an east west roof in order to catch the sun. A scaled up version could be used in industrial applications to process many litres of sea water or contaminated water so as to supply drinkable or potable water to towns and other users. As well as being operated by solar energy in the manner as described above, the operation and yield of water purifiers of the present invention may be improved by the use of heat (particularly waste heat) from other sources that is used to increase the temperature of the reservoir of impure water to between 50°C and 80°C.

Fig. 4 shows a serpentine arrangement of tubing 20 located on or over the floor of the pool 19 and adapted to convey waste heat, say, in the form of warm effluent from an industrial process, therethrough whilst submerged in the reservoir of impure water. The warm effluent enters the tubing 20 through an entry port 21 and exits through an egress port 22. At a pool temperature of 50°C, the yield of drinkable or potable water from the water purifier 10 was just under 1 litre per day. The yield of potable water may be increased by about ten times for each doubling in size of the base of the housing. At higher temperatures, say, up to 80°C, there are expected to be even higher yields.

A scaled up water purification system 23 employing a plurality of water purifiers of the present invention is shown in Fig. 5, and is suited to operating in

conjunction with a large industrial plant 24, such as a power plant, where waste heat is a by-product of the plant's industrial process.

Each water purifier in this system is constructed of glass panels supported by steel frames over a segmented reservoir (or individual ponds) of water to be purified. Pipes placed in each reservoir are used to conduct waste heat fed through pipes 25 from the plant 24 to the impure water. Impure water from a river or other source is pumped into each reservoir by inflow piping 26, and concentrated impure water may be released (after suitable treatment) back into the source by outflow piping 27. At a pond temperature of 80°C, the yield of drinkable or potable water from the water purification system of Fig. 5, would be expected to be sufficient to supply the needs of a small town.

Purified water produced from sea water by the water purifier described with reference to Figs. 1 to 3 has been analysed by the National Measurement Institute of the Australian Government, and been found to have very minute trace concentrations of calcium, iron, potassium, sodium, chloride and sulphate, and was of drinkable quality. These concentrations were found to be lower than those in commercially available, bottled drinking water.

It will be apparent to persons skilled in the art that various modifications may be made in details of design and construction of the water purifier and system described above without departing from the scope and ambit of the invention.

CLAIMS:

1. A water purifier comprising a housing which is located over a reservoir of impure water, the housing having at least one collector surface upon which water vapour is condensed, a water collection gutter below the or each collector surface, and an outlet from the collection gutter.

2. The water purifier of claim 1 wherein the housing is in the shape of a pyramid having a square base with four sides being north, east, south and west facing.

3. The water purifier of claim 1 wherein the housing is made of glass or clear UV-capped polycarbonate plastic.

4. The water purifier of claim 2 wherein the east and west facing sides are clear or transparent to allow the passage of sunlight to the impure water in the reservoir.

5. The water purifier of claim 4 wherein the north and south facing sides are silvered or aluminised to allow the reflection of the sunlight and respectively provide two collector surfaces.

6. The water purifier of claim 2 wherein the water collection gutter is defined between the sides of the housing and an endless inner wall.

7. The water purifier of claim 6 wherein the portion of the base confined by the inner wall is open.

8. The water purifier of claim 1 wherein the reservoir has a ledge upon which the housing rests.

9. A water purification system comprising a plurality of water purifiers of claim 1, each water purifier being adapted to be located over a reservoir of impure water, pump means for feeding impure water from a source thereof into each reservoir through inflow piping, and outflow piping from each reservoir for discharging concentrated impure water back into the source.

10. The system of claim 10 further including pipe means for conducting waste heat from an industrial plant through the reservoir of impure water.

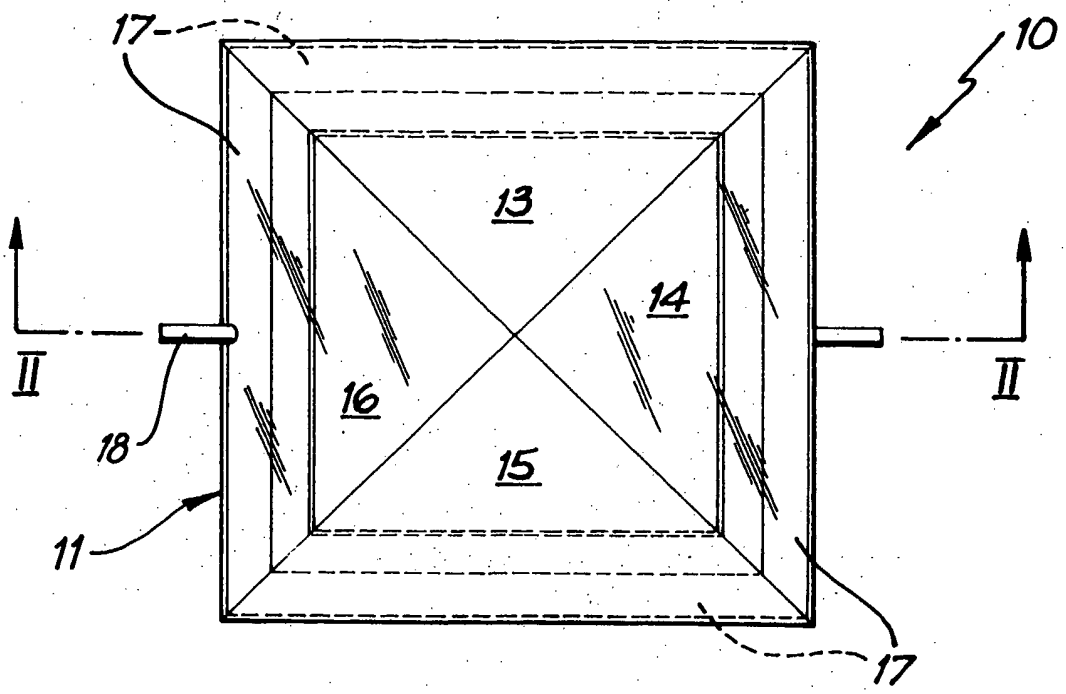


FIG. 1

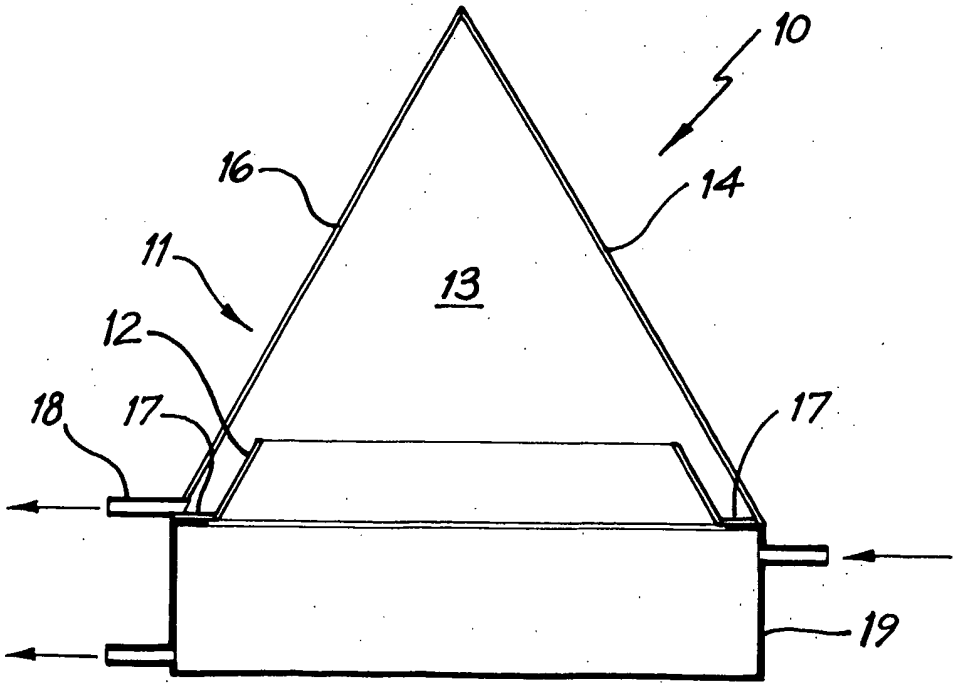


FIG. 2

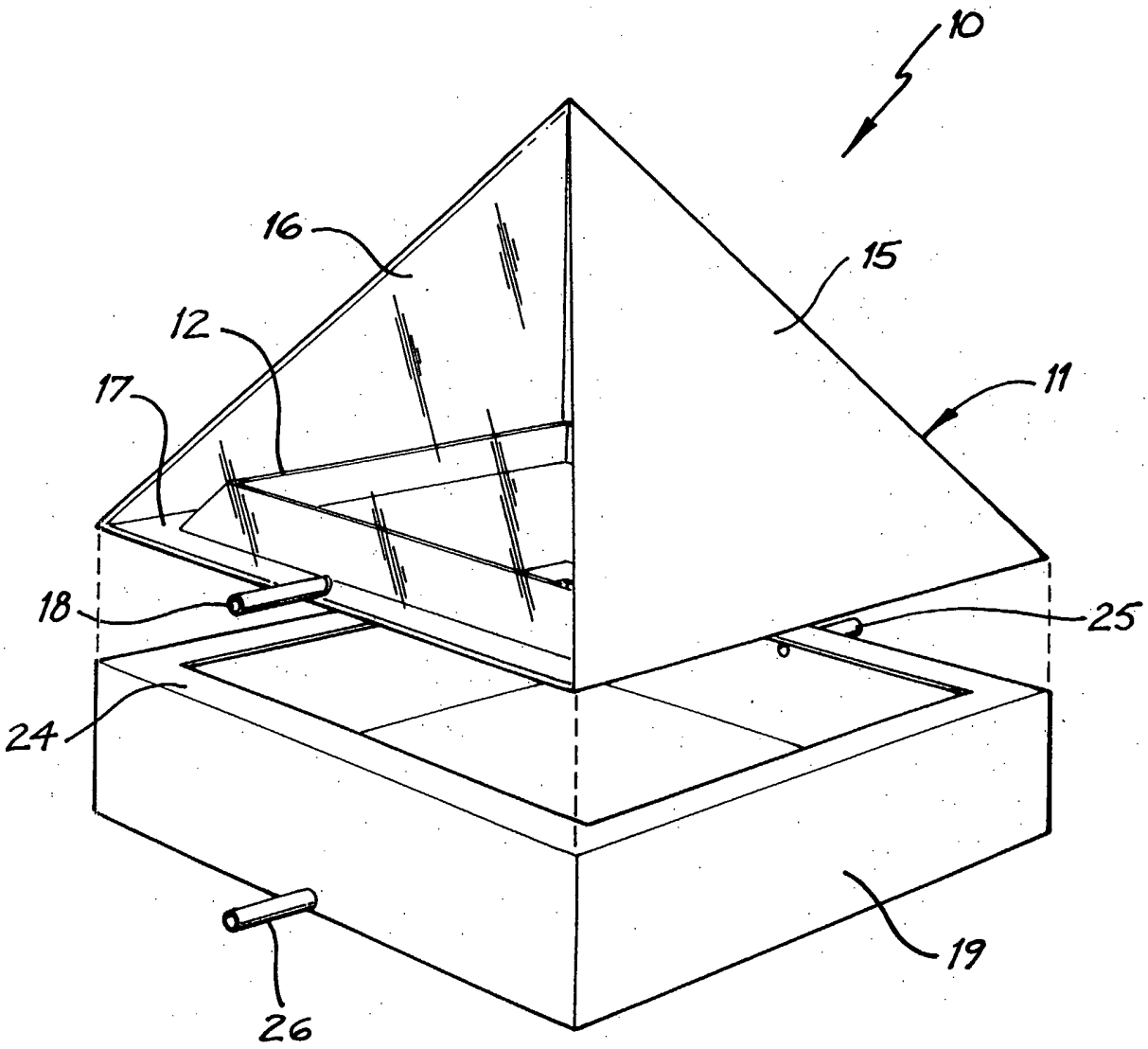


FIG. 3

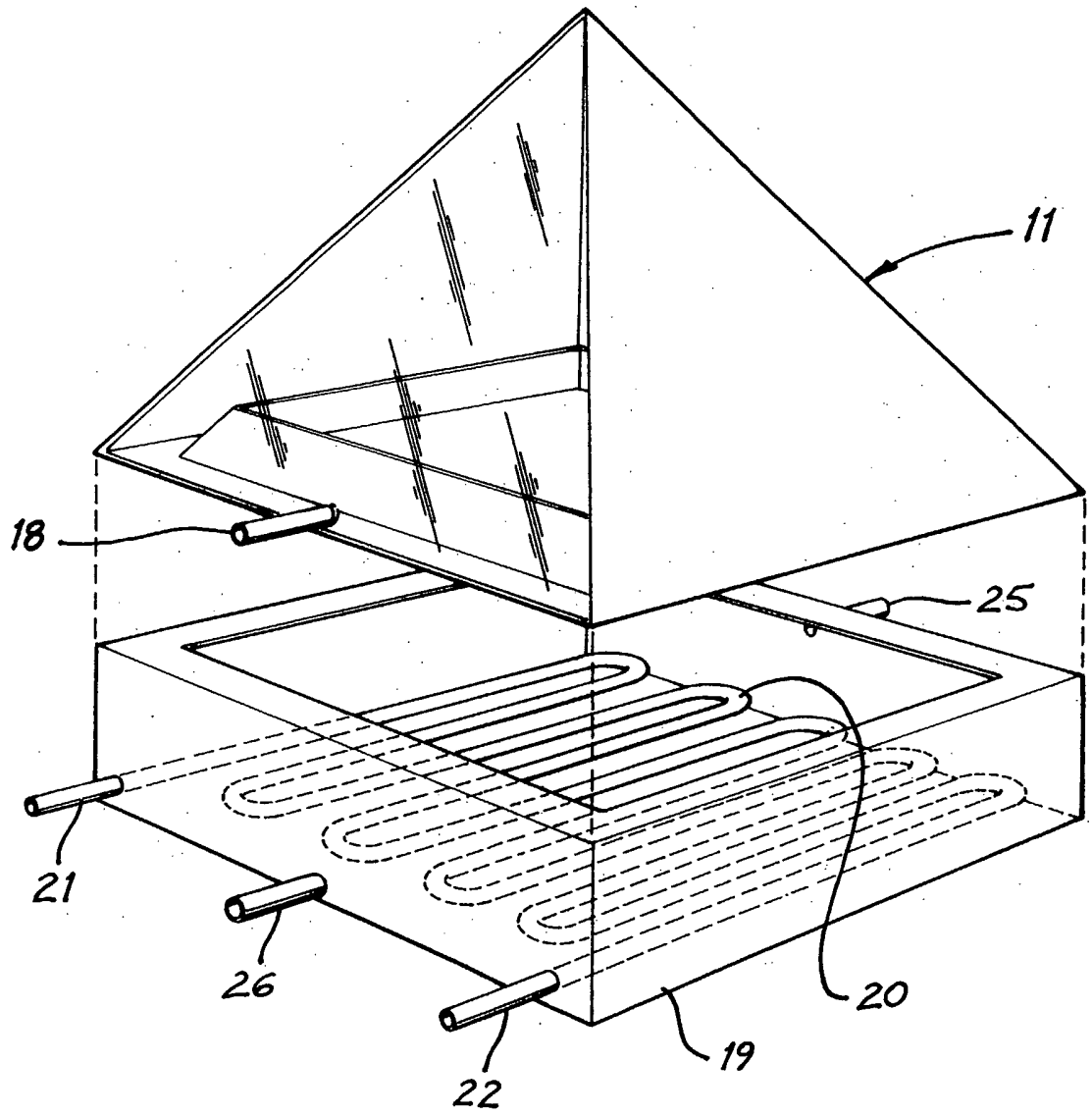


FIG. 4

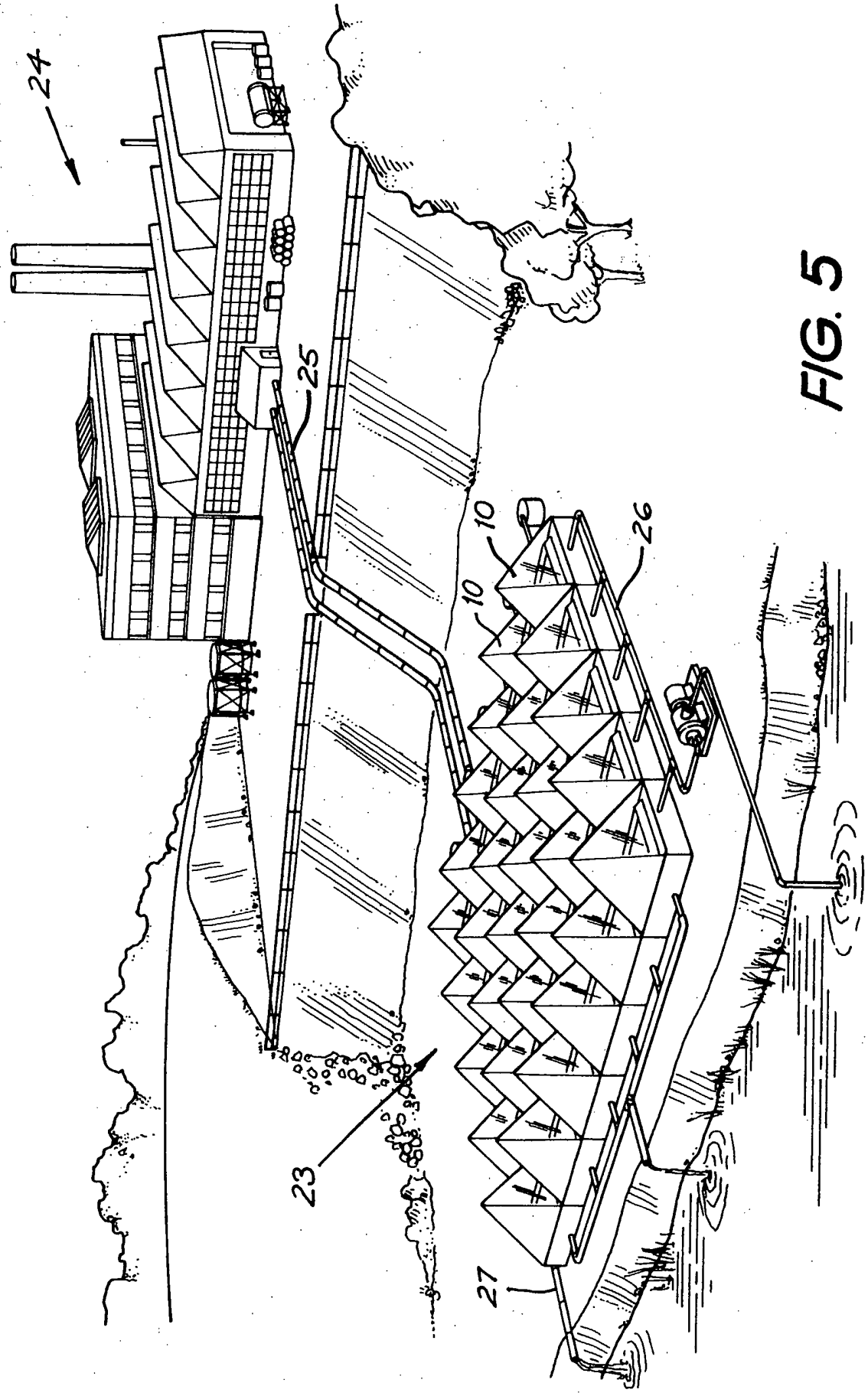


FIG. 5

INTERNATIONAL SEARCH REPORT

International application No.
PCT/AU2005/001197

A. CLASSIFICATION OF SUBJECT MATTER

Int. Cl. [7]: C02F 1/14, 1/04

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)
REFER ELECTRONIC DATA CONSULTED

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)
DWPI IPC C02F 1/14, 1/04 & Key words(gutter+ or laund+)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	WO 2001/093972 A1 (LUDWIG) 13 December 2001 whole document	1-10
X	US 2003/0057084 A1 (LUDWIG) 27 March 2003 whole document	1-10
X	AU 14225/99 (743610) B2 19 August 1999 whole document	1-10
X	DE 3501396 A1 (LINKE B) 17 July 1986 & Derwent Abstract No. 86-190614/30, Class D15, DE3501396 A (LINKE B) 17 July 1986	1-10

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

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"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
26 October 2005	- 7 NOV 2005
Name and mailing address of the ISA/AU AUSTRALIAN PATENT OFFICE PO BOX 200, WODEN ACT 2606, AUSTRALIA E-mail address: pct@ipaustralia.gov.au Facsimile No. (02) 6285 3929	Authorized officer **ASOKA DIAS-ABEYGUNAWARDENA** Telephone No : (02) 6283 2141

INTERNATIONAL SEARCH REPORT

International application No.
PCT/AU2005/001197

C (Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	FR 2452302 (AGENCE NATIONALE DE VALORISATION) 24 October 1980 & Derwent Abstract Accession No. 04238 D/04, Class D15 J01 FR2452302 (AGENCE NAT VALORISATION) 28 November 1980	1-10
X	DE 3015254 A1 (KRAFTWERK UNION AG) 22 October 1981 & Derwent Abstract Accession No.79964 D/44.DE 3015254 (KRAFTWERK UNION AG) 22 October 1981	1-10

INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No.
PCT/AU2005/001197

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					
WO	0193972	AU	68267/01	MX	PA02012136	US	6797124
		US	2002060147	US	2003057084		
AU	1422599	AU	14225/99				
DE	3501396						
FR	2452302	EG	14992	GR	67201	IN	154012
		MA	18789	OA	6687		
DE	3015254	IL	62684	IN	152037		

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

END OF ANNEX