



(43) International Publication Date
18 October 2012 (18.10.2012)

- (51) International Patent Classification:
F24J 2/20 (2006.01) *F24J 2/48* (2006.01)
- (21) International Application Number:
PCT/IN2011/000251
- (22) International Filing Date:
13 April 2011 (13.04.2011)
- (25) Filing Language: English
- (26) Publication Language: English
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- (81) Designated States (*unless otherwise indicated, for every
kind of national protection available*): AE, AG, AL, AM,

AO, AT, AU, AZ, BA, BB, BG, BH, BR, BW, BY, BZ,
CA, CH, CL, CN, CO, CR, CU, CZ, DE, DK, DM, DO,
DZ, EC, EE, EG, ES, FI, GB, GD, GE, GH, GM, GT, HN,
HR, HU, ID, IL, IN, IS, JP, KE, KG, KM, KN, KP, KR,
KZ, LA, LC, LK, LR, LS, LT, LU, LY, MA, MD, ME,
MG, MK, MN, MW, MX, MY, MZ, NA, NG, NI, NO, NZ,
OM, PE, PG, PH, PL, PT, RO, RS, RU, SC, SD, SE, SG,
SK, SL, SM, ST, SV, SY, TH, TJ, TM, TN, TR, TT, TZ,
UA, UG, US, UZ, VC, VN, ZA, ZM, ZW.

- (84) Designated States (*unless otherwise indicated, for every
kind of regional protection available*): ARIPO (BW, GH,
GM, KE, LR, LS, MW, MZ, NA, SD, SL, SZ, TZ, UG,
ZM, ZW), Eurasian (AM, AZ, BY, KG, KZ, MD, RU, TJ,
TM), European (AL, AT, BE, BG, CH, CY, CZ, DE, DK,
EE, ES, FI, FR, GB, GR, HR, HU, IE, IS, IT, LT, LU, LV,
MC, MK, MT, NL, NO, PL, PT, RO, RS, SE, SI, SK, SM,
TR), OAPI (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW,
ML, MR, NE, SN, TD, TG).

Published:

— with international search report (Art. 21(3))

(54) Title: SOLAR WATER HEATER COLLECTOR

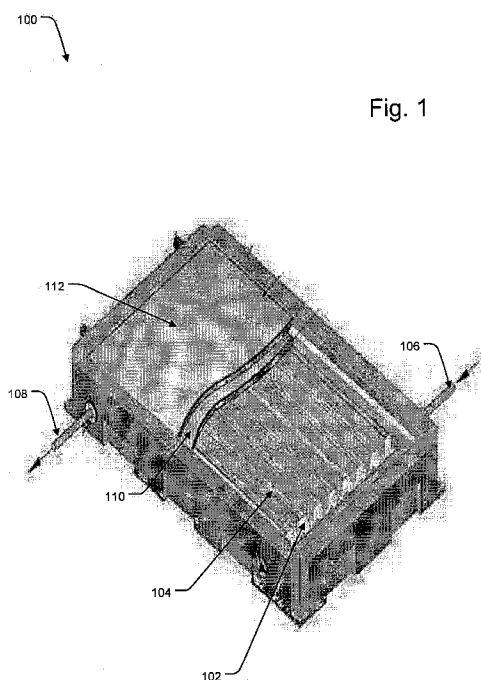


Fig. 1

(57) Abstract: Provided is a solar water heater collector (100), which uses a non-metallic body made of a suitable grade of plastic/polymer/thermoplastic material of black color. The collector (100) absorbs heat energy from the solar radiation. The collector (100) comprises a plurality of grooves (102) for forming water paths, wherein each water path includes a riser (104) and a header. The collector (100) further comprises two layers of glass sheets (110, 112) provided above the water paths. The space between the glass sheets (110, 112) creates a vacuum to provide thermal insulation. The water gets heated through direct heating by sun rays and through heat received and retained due to the black material of the collector (100). The water inside the collector (100) is sterilized by germicidal effect of UV radiation from sun.

SOLAR WATER HEATER COLLECTOR

FIELD OF INVENTION

[0001] The present invention relates to a solar water heater collector. More specifically, the invention relates to a solar water heater collector configured to absorb solar radiations from sun directly into the water to produce hot water and at the same time sterilize the water by germicidal effect of UV-radiations from sun.

BACKGROUND OF THE INVENTION

[0002] Solar energy is one of the renewable energy sources on the planet. It is available free of cost and can be utilized for various purposes such as electricity generation, industrial purposes, domestic purposes, etc. Solar energy radiated from the sun is captured and utilized in different methods. In one application, solar energy can also be utilized for heating water. Variety of methods and systems are designed for the existing solar water heater collectors that are configured to enable heating of water.

[0003] Till date there are two basic designs of solar water heater collectors, the first using a flat plate collector and the second using evacuated tubes. A flat plate collector comprises of a copper absorber plate bounded to one or more copper tubes, painted with low emissive paints to reduce emission loss. The absorber plate and tubes are typically placed in a metal box and sealed with a glass sheet on the top to avoid emission loss from the tubes.

[0004] Evacuated tubes are another type of design for solar water heater collectors. Evacuated tubes are made up of glass tubes, wherein the glass tubes, coated with copper, along with the vacuum provides insulation effect towards atmospheric losses to the copper coated tube which collect solar heat for heating water.

[0005] The above discussed solar water heater collector designs require heat transfer mediums such as copper tubes thereby disabling the water from receiving the germicidal effect of UV from solar radiation. In none of the prior art designs do the solar radiations directly act on the water producing germicidal effect. Heat transfer mediums also reduce the rate of heating of water.

[0006] Multiple patents including US 5,645,045, US 7,083,755, US 7,431,030, and US 5,323,763 among others disclose solar water heater collectors having water paths to avoid tube based water flow mechanisms in the collectors.

[0007] US '045 discloses a solar water heater collector panel comprising of a plurality of individual channels through which water flows. Each individual channel is individually coupled with a top lens to concentrate the energy of sun. The panel is made up of a translucent plastic material, polycarbonate sheet, with refractive properties. The end caps are attached separately. It uses the refractive properties of the base to bend the solar rays and refocus them in different direction. One drawback of the patent includes the use of use of concave lens, wherein lens make the rays diffract so that they spread out without first concentrating resulting in the sunlight being scattered through the various lenses and leading to loss of energy thereby minimizing efficiency of heating. There is no provision in '045 to prevent heat radiation outwardly (from panel to atmosphere) and also no provision to prevent the cooling effect of blowing winds on the panel.

[0008] US '755 discloses a solar water heater collector panel made up of two opposing moulds. The panel includes a plurality of channel ways for water flow where tubes are formed by joining the opposing moulds. By making the panel using two opposing mould, the sun rays cannot penetrate the water directly and also cannot provide the benefit of UV rays. The sun rays are also required to pass through the plastic material which can reduce efficiency of heating when compared with glass. The panel is also not covered by glass or any additional material to prevent loss of heat to atmosphere through cooling effect of winds. The

disclosed panel can absorb maximum heat from sun only when solar radiations are falling directly on the panel.

[0009] US '030 discloses a closed tube configuration prepared by fusing two identical (symmetrical) moldings. Water passes through such a closed tube configuration. Other components such as glass covering the tubes with a gap containing insulating air are standard. Sun rays do not act directly on the water and the patent discloses no UV sterilization benefits. The tubes of '030 absorb maximum heat from sun only when solar radiations are falling directly on the panel.

[00010] US '763 discloses an absorbing area that is prepared by covering/pasting the surface of flow paths with metal foil. Sun rays do not act directly on the water and the patent discloses no UV sterilization benefits. The flow paths of '763 absorb maximum heat from sun only when solar radiations are falling directly on the panel.

[00011] There is therefore a need of a solar water heater collector that provides safe and hot drinking water by exposing water directly to sunlight to absorb maximum solar radiations. There is also a need for a solar water heater collector that allows solar radiations to directly heat the water bypassing the heat transfer mediums and has water channels which can expose water to sunlight and absorb solar energy from sun, even when the solar radiations are falling on the panel at certain angle to the panel. There is also a need for energy efficient, economic and smaller panels, made up of inexpensive materials suitable for all kind of customers reaching their needs.

OBJECTS OF THE INVENTION

[00012] It is an object of the present invention to provide hot water by using solar radiations.

[00013] It is an object of the present invention to provide a water heater collector which is long lasting, economical, efficient, needs less maintenance, capable of efficient mass production, and is easy to install.

[00014] Another object of the present invention is to provide safe drinking water by using germicidal effect of UV-rays available from solar radiation.

[00015] Another object of the present invention is to provide faster heating of water by exposing water directly to sunlight.

[00016] Another object of the present invention is to expose water directly to sunlight to absorb heat energy, irrespective of position of sun and angle with which the panel is receiving solar radiations.

[00017] Another object of the present invention is to heat water in more quantity at a time.

[00018] Another object of the present invention is to use thermo-siphon function, in which water is re-circulated in the panel until it gets heated.

[00019] Another object of the present invention is to make use of smaller panels thereby reducing the size of the panel and utilizing the space effectively.

[00020] Another object of the present invention is to allow installation of solar water heater panel in small area.

[00021] Another object of the present invention is to make space for more panels.

[00022] Another object of the present invention is to allow manufacture of mass units with minimal manual labor.

[00023] Another object of the present invention is to use non-metallic construction mechanism, which is corrosion resistant and has longer service life.

SUMMARY

[00024] The present disclosure relates to a simple, efficient, effective, safe and economical solar water heater collector. In an embodiment, the proposed collector uses a non-metallic body made of a suitable grade of Plastic/Polymer/Thermoplastic material of black color. The black color absorbs the heat rays from the solar radiation. The water gets heated through direct heating of water by sun rays and through heat received and retained due to black color plastic/polymer/thermoplastic used for making the panel. Heating of water and UV sterilization happens simultaneously due to direct interaction of solar radiation with water.

[00025] In another embodiment, the proposed solar water heater collector is made from a black color thermoplastic material by using molding process to ensure high productivity. The molding process ensures mass production resulting in lower production costs. In another embodiment, risers and headers of the collector are automatically formed in the moulding process and hence no components such as tubes and/or absorption and/or sheets of copper/aluminum are required. All water paths are formed in a mould by an injection moulding or blow moulding or alternate technology as one composite integrated unit. The invention uses a non metallic body (made from plastic/polymer/thermoplastic material) in which risers and headers are formed for flow of water.

[00026] In another embodiment, water paths that are molded as grooves are covered with a glass and sealed to cover the water path and form the water channels. This glass forms the channel as an integral water path, which comprises of both the risers and the headers. One more glass can be fitted in the collector assembly by keeping some space between the two glasses, wherein the space provides a vacuum to prevent thermal losses to the atmosphere. All other sides of the plastic/polymer/thermoplastic body can be thermally insulated to prevent heat

loss. In another embodiment, a polycarbonate sheet can also be used instead of glass to cover all grooves to form water circulation paths.

[00027] In yet another embodiment, thermal siphon function heat treats the water by repeat circulation. In the thermal siphon function, water is allowed to stay in the collector panel by re-circulating water therein, until water gets heated.

[00028] In a preferred embodiment, the water paths have a _ / shape with black absorbent surface allowing more efficient reception of solar radiation irrespective of the direction/position of the sun. Design of the collector panel allows heating of water and UV sterilization happens simultaneously due to direct interaction of solar radiation with water.

[00029] Design of the collector panel offers faster heating when compared with existing heater collectors. The design also allows more quantity of water being heated, increased efficiency in thermo siphon function due to more and larger water paths. The design further allows the panels to be smaller and being able to heat the same or larger amount of water when compared with existing collectors. This further allows installation in smaller areas that have a space problem or areas which need more number of collectors.

BRIEF DESCRIPTION OF THE DRAWINGS

[00030] Figure 1 illustrates a solar water heater collector panel from top view with visible water paths and glass sheets.

[00031] Figure 2 (a) and Fig 2 (b) illustrate the top and bottom covers of the collector.

[00032] Figure 3(a) illustrates the front view of solar water heater collector panel showing the shape of molded water path along with glass sheets.

[00033] Figure 3(b) illustrates the front view of solar water heater collector panel showing falling of sunlight with certain angle to the left of solar water heater collector panel.

[00034] Figure 3(c) illustrates the front view of solar water heater collector panel showing falling of sunlight directly on water flowing through water paths.

[00035] Figure 3(d) illustrates the front view of solar water heater collector panel showing falling of sunlight with certain angle to the right of solar water heater collector panel.

DETAILED DESCRIPTION

[00036] This description is directed to a solar water heater collector panel for fast heating of water and UV-sterilization of water by directly exposing water to sunlight.

[00037] Multiple and varied embodiments are given below with reference to the accompanying drawings. The figures are intended to allow those who are having ordinary skills in the art to understand the invention. The description given with respect to the diagrams and can be modified according to the understanding of the person involved in the art. It is to be understood that omissions and substitutions of equivalents are intended to cover the application or implementation without departing from the spirit and scope of the claims of the present invention. Also, it is to be understood that the phraseology and terminology used herein is for the purpose of description and should not be regarded as limiting.

[00038] In an embodiment, it would be appreciated that even though, in the present disclosure, a solar water heater collector panel is explained only with reference to the panel having water paths comprising of risers and headers, the whole set up can include various other instruments and parts and works in co-ordination with other parts. Such other parts can provide support to the panel, provide water supply and act as water level controllers, which are commonly known to a person involved in the art and thus not described. It should be evidently

considered that other parts are present with the panel helping in proper working of it.

[00039] Figure 1 illustrates the top view of a solar water heater collector 100. The collector 100, also interchangeably referred to as panel 100 hereinafter, includes a plurality of grooves 102 for water paths, wherein each water path includes a riser 104 and a header. The water paths are created as a mould by grooves 102, which act as virtual tubes (pipes) when closed from the top. The water path, through the groove 102 and the shape of the riser 104, forms a _/_ shape. _/_ shape of the water path provides maximum exposure for water to the sunlight as would also be described subsequently.

[00040] In an implementation, valves 106 and 108 can be provided for inlet and outlet of water respectively. In yet another embodiment, more than one inlet 106 and/or outlet 108 valves can be configured for the collector 100.

[00041] In an embodiment, the water paths are closed from the top by a glass or poly glass or poly carbonate sheet 110. In yet another embodiment, another glass sheet 112 can be fitted in the assembly by keeping the distance between the two sheets to provide thermal insulation. The vacuum created between two sheets 110 and 112 increases the thermal insulation. In an embodiment, other five sides of the collector are thermally insulated to reduce the heat loss.

[00042] As can be seen from the illustration, the proposed water heater collector 100 does not use a heat transfer medium but instead heats the water directly by solar heat rays allowing the water to get exposed to solar heat rays and UV – rays. As a result the water gets heated and also gets sterilized.

[00043] In another preferred embodiment, the proposed collector design uses a body made from non metallic material such as engineering/industrial plastics, polymers etc. The material used for the body can be black in color to absorb the solar heat rays. The non metallic construction further allows protection from corrosion and a hence longer life of the collector.

[00044] Figure 2 illustrates the cover 200 of the solar water heater collector 100 as disclosed in the present disclosure. Fig. 2(a) illustrates the top cover and Fig. 2(b) illustrates the bottom cover of the collector 100.

[00045] Figure 3(a) illustrates the front view of the solar water heater collector 300, having molded water channel paths 302 formed as grooves, a glass sheet 304 covering and/or sealing the molded water channel paths 302, and a second glass sheet 306 over the glass sheet 304. The second glass sheet 306, when put and configured over the glass sheet 304 forms a vacuum providing insulation effect towards atmospheric losses.

[00046] In an embodiment, the molded water channel paths 302 have a _/_ shape and include 308 (a), 308 (b), and 308 (c) as components. _/_ shape allows much higher reception of sun rays irrespective of the sun direction thereby increasing the efficiency of water heating. For instance, the total surface area exposed to sun at any given time would be equal of surface area of 308 (a) + 308 (b) + 308 (c).

[00047] Figure 3 (b) illustrates front view of a solar water heater collector panel, exposing water to sunlight during rising of sun i.e., in the morning. In the morning hours, as the sun rises, there is a certain angle of the sunrays to Earth. As sun is making a certain angle to Earth, sunrays fall on the panel with certain angle. Figure 3(b) illustrates a panel, wherein sunlight is falling with certain angle to the surface of the panel. Water is allowed to flow in the water path made through the grooves 302. As the water paths have a _/_ shape, water is exposed to sunlight even at that angle allowing the water flowing through the channel paths to effectively get heated.

[00048] Figure 3(c) illustrates front view of solar water heater collector panel, exposing water directly to sunlight, during mid day. Figure 3(c) illustrates a collector panel, wherein sunlight is directly falling on panel. In an embodiment, water is allowed to flow through the water path made through the grooves 302. As

the water is exposed to sunlight directly, _ / shape of the water path, allows maximum reception of sun rays and therefore high efficiency of water heating.

[00049] Figure 3(d) illustrates front view of a solar water heater collector panel, exposing water to sunlight during setting of sun i.e., in the evening. In the evening hours, as the sun is about to set, there is a certain angle of the sunrays to Earth. As sun is making a certain angle to Earth, sunrays fall on the panel with certain angle. Figure 3(d) illustrates a panel, wherein sunlight is falling with certain angle to the surface of the panel. Water is allowed to flow in the water path made through the grooves 302. As the water paths have a _ / shape, water is exposed to sunlight even at that angle allowing the water flowing through the water paths to effectively get heated.

[00050] In an embodiment, the solar water heater collector of the proposed disclosure finds its application in one or more of residential premises, townships, hospitals, hotels, restaurants, textile industries, pharmaceutical industries, food products processors, pre-heated water for steam generators, laundries, chemical industries, paint industries, beauty parlors, super markets/malls, swimming pools for UV sterilization and heating of water, and distilleries.

[00051] It will of course be realized that the present disclosure has been given only by way of illustrative examples of the invention and that all such modifications and variations thereto as would be apparent to persons skilled in the art are deemed to fall within the broad scope and ambit of the invention as herein set forth.

ADVANTAGES OF THE INVENTION

[00052] The present solar water heater collector panel provides faster heating of water by exposing water directly to sunlight.

[00053] The present invention uses _ / shaped water paths for water flow, thereby exposing water directly to sunlight to absorb heat energy, irrespective of position of sun and angle with which the panel is receiving solar radiations.

[00054] The present invention heats water in more quantity at a time.

[00055] The present invention uses thermo-siphon function, in which water is re-circulated in the panel until it gets heated.

[00056] The present invention uses germicidal effect of UV-rays as water is directly exposed to sunlight to get heated resulting in purification of water along with heating process.

[00057] The present invention makes use of smaller panels as panel is made up of molded grooves/water paths, thereby reducing the size of the panel and utilizing the space effectively.

[00058] The present invention allows installation of solar water heater panel in small area, as panel size is reduced.

[00059] The present invention makes space for more panels as size is reduced, thereby increasing heat absorption capacity and utilizing solar energy effectively.

[00060] The present invention is economically beneficial, as the panel is made up of glass sheets, which are inexpensive compared to copper tubes of prior art.

[00061] The present invention allows manufacture of mass units with minimal manual labor.

[00062] The present invention, by means of its non-metallic construction, is corrosion resistant and has longer service life.

CLAIMS

1. A solar water heater collector for heating water using solar radiations, comprising:

a plurality of water paths molded to have _/ shaped grooves;

a first glass sheet configured to cover said plurality of water paths; and

a second glass sheet placed above said first glass sheet, wherein space between first glass sheet and second glass sheet creates a vacuum to provide thermal insulation, further wherein said collector allows direct absorption of solar radiation from sun to water to produce hot water and sterilizes water by germicidal effect of UV radiations from the sun.

2. The collector as claimed in claim 1, wherein said collector is made from industrial plastics/polymers by a moulding process to form said plurality of water paths.

3. The collector as claimed in claim 2, wherein said industrial plastics/polymers are black in color.

4. The collector as claimed in claim 1, wherein said plurality of water paths comprises of risers and headers.

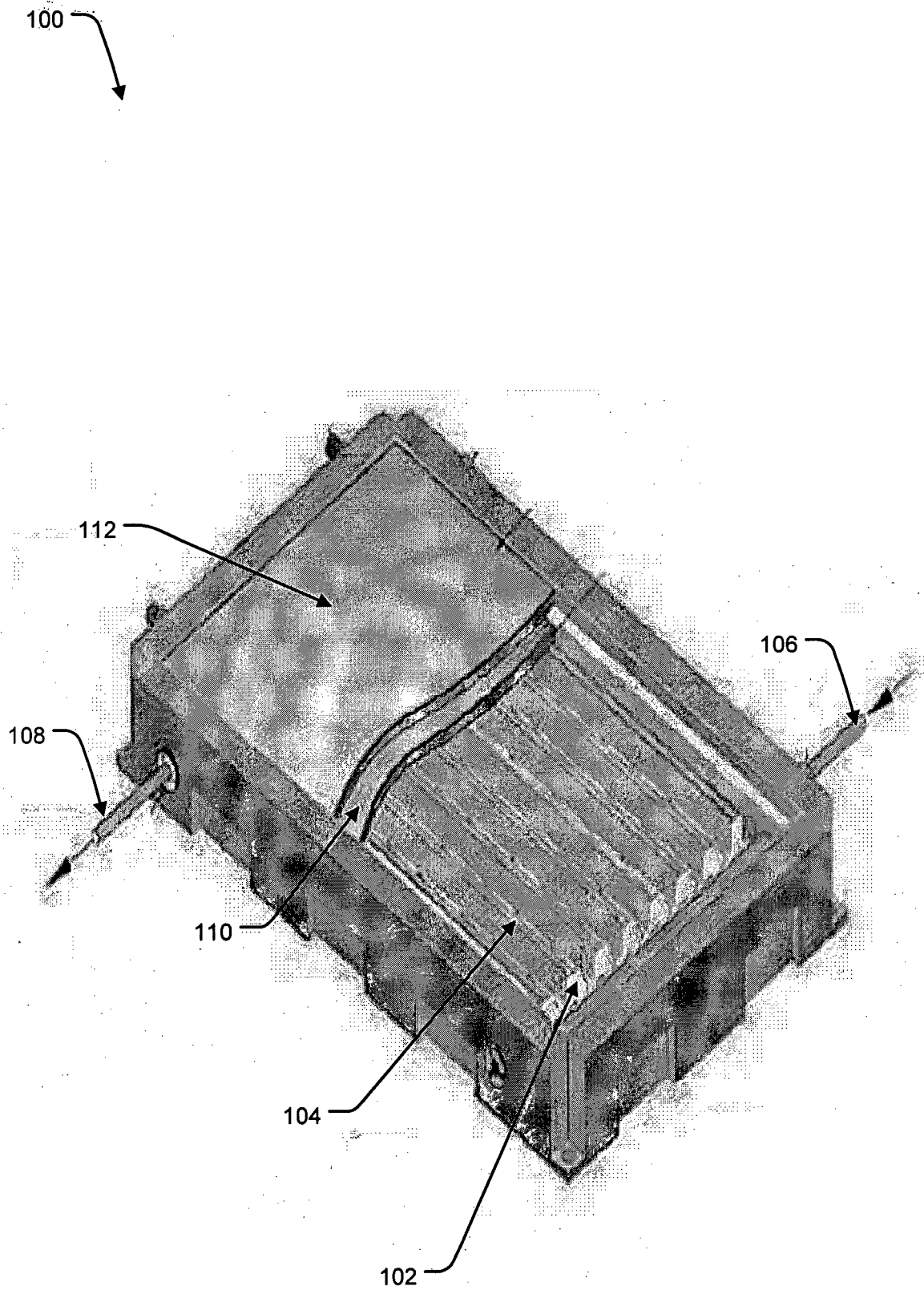


Fig. 1

200

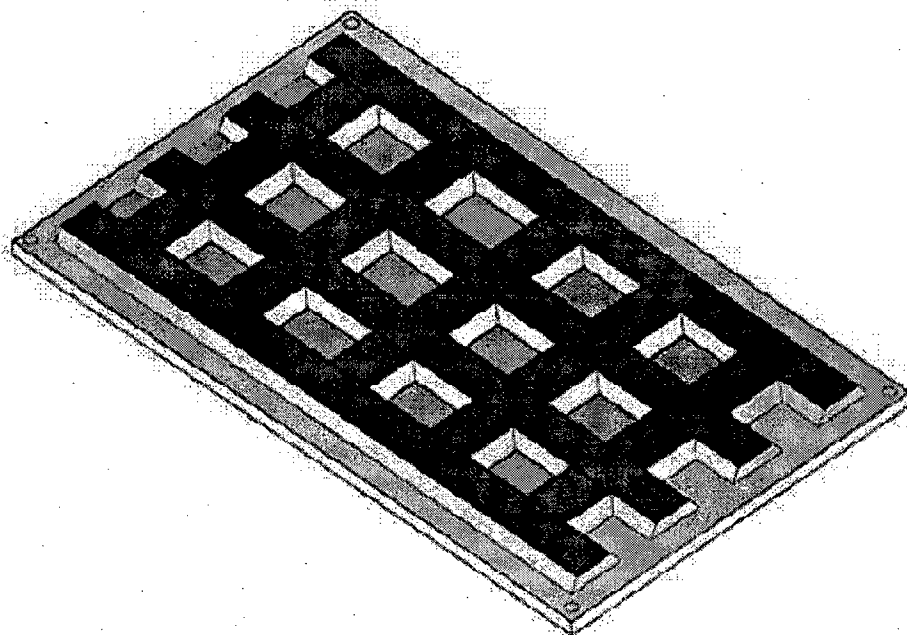


Fig. 2 (a)

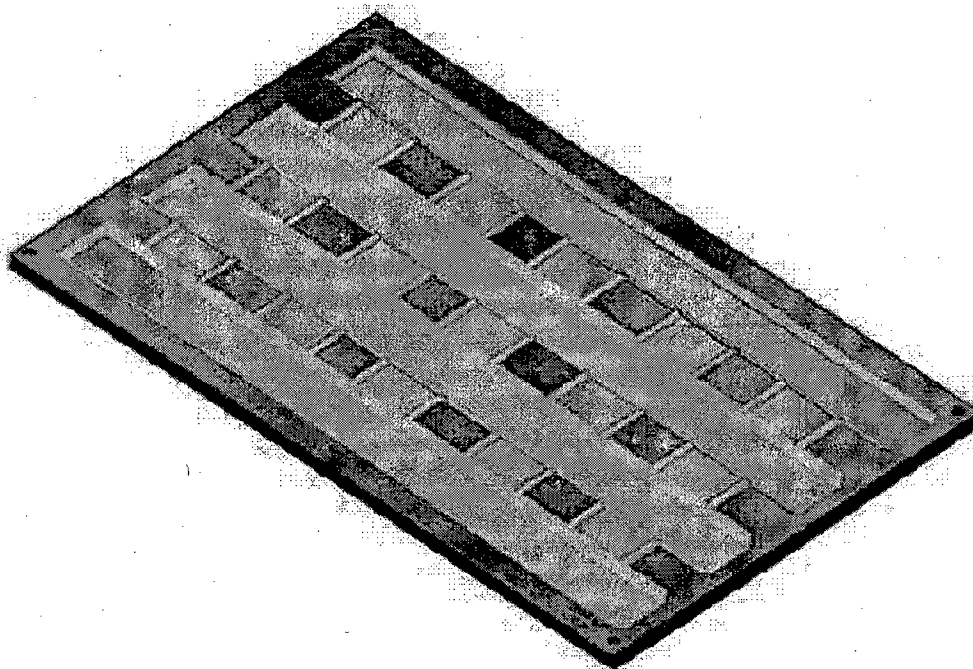


Fig. 2 (b)

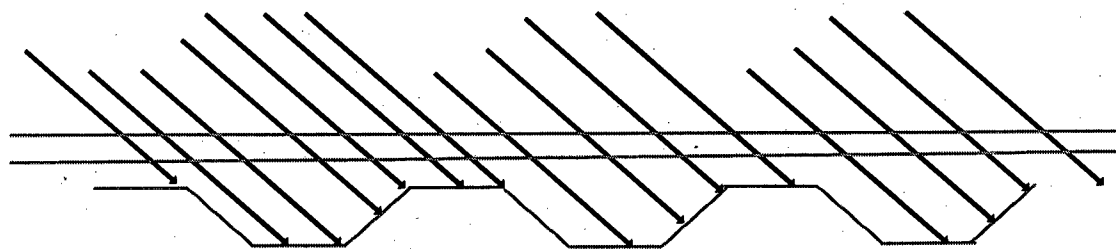
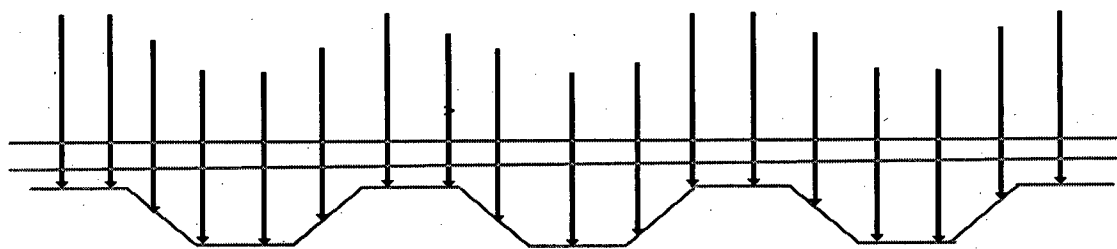
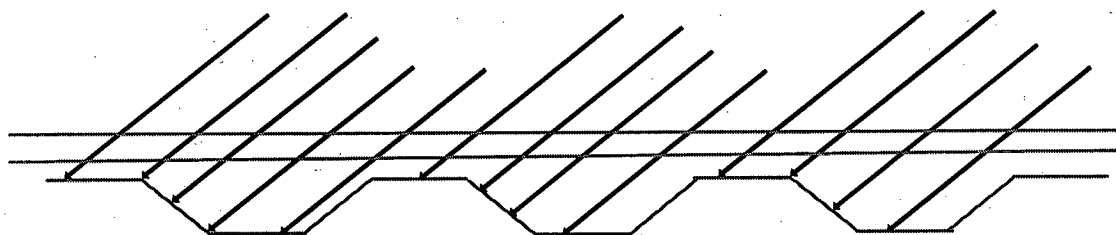
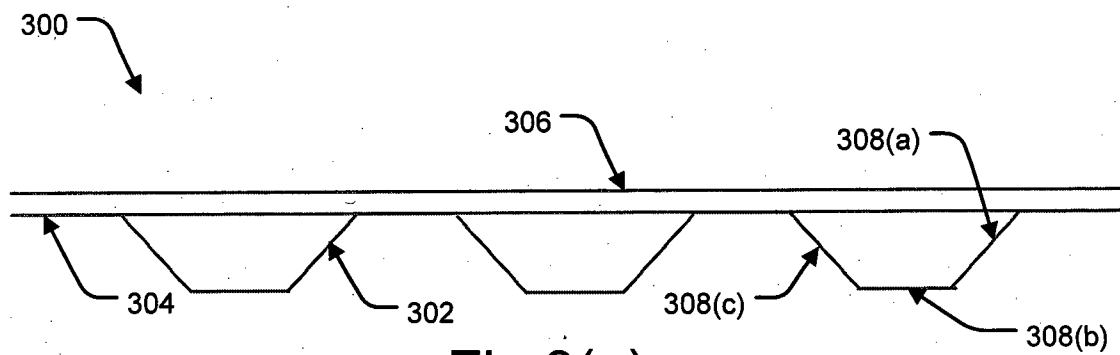


Fig. 3

INTERNATIONAL SEARCH REPORT

International application No.

PCT/IN2011/000251

A. CLASSIFICATION OF SUBJECT MATTER

See extra sheet

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)

IPC: F24J2

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, EPODOC, CNPAT, CNKI: trapezia, trapezium, trapezoid+, water, direct, contact, heat+, trough, groove, concave, baffle, passage, conduit, channel, path, plate, board, vacuum

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
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Y	RU2023214C1(VSEROSSIJSKIY NII ELEK SELSKOG) 15 Nov. 1994(15.11.1994) abstract and figure	1-4
A	NL7601275A(INSTALLATIE TECHNIEK BREDERO B) 11 Aug. 1977(11.08.1977) the whole document	1-4
A	FR2319860A1(NEWMAN TONKS LTD) 25 Feb. 1977(25.02.1977) the whole document	1-4

☒ Further documents are listed in the continuation of Box C.☒ See patent family annex.

* Special categories of cited documents:	“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
“A” document defining the general state of the art which is not considered to be of particular relevance	“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
“E” earlier application or patent but published on or after the international filing date	“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
“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)	“&” document member of the same patent family
“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	

Date of the actual completion of the international search 06 Jan. 2012(06.01.2012)	Date of mailing of the international search report 19 Jan. 2012 (19.01.2012)
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INTERNATIONAL SEARCH REPORT

International application No.

PCT/IN2011/000251

C (Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	WO2010099620A1(UNIV MCMASTER et al.) 10 Sep. 2010(10.09.2010) the whole document	1-4
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INTERNATIONAL SEARCH REPORT

International application No.

PCT/IN2011/000251

Continuation of CLASSIFICATION OF SUBJECT MATTER:

F24J2/20 (2006.01) i

F24J2/48 (2006.01) i

INTERNATIONAL SEARCH REPORT
Information on patent family members

International application No.
PCT/IN2011/000251

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