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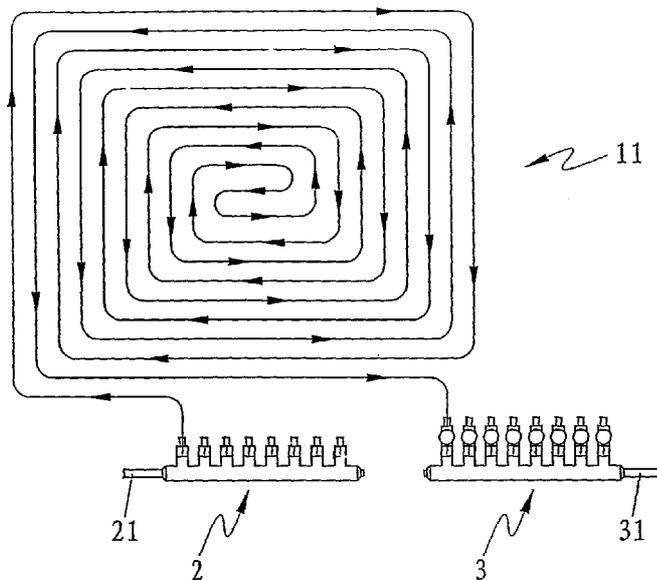
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(54) Title: A COLD WATER CIRCULATION COOLING SYSTEM



(57) Abstract: The present invention discloses a cold water circulation cooling system. Its main inventive features include a closed circuit water circulation loop (1) which is pre-laid in walls, ceiling or the likes and a cold water generation means (5) connected to the closed circuit water circulation loop. The cold water generation means includes a cold-water outlet (55) provided with a pressure pump (57) to facilitate water circulation. Water from the cold water generation means travels through the closed circuit water circulation loop and sub-loops (1, 11) respectively to take away the surrounding heat. The invention utilizes the heat transfer principle to achieve the overall results. It does not involve the conventional cold air method and so in terms of application it is more comfortable, healthy, energy saving, safe and low cost.

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A cold water circulation cooling system

Technical Field

This invention relates to a cooling system, more particularly to that of a closed circuit cold water circulation type.

5 **Technical Background**

Conventional cooling systems such as the split unit or window air-conditioners, or central air-conditioning system are using air as a medium of cooling to bring down the temperature in the vicinity concerned. Such conventional cooling systems have the following setbacks.

- 10 1) There is the presence of air blowing outlets, which have the tendency to cause uneven distribution of temperature within a room or enclosure. Conventional air-conditioners have air blowing outlets blasting out chilled air into the room. The chilled air is blown directly to the occupants, making them feel uncomfortable. Places nearer to the air outlets tend to be cooler than places further away. As a result, the temperature within the room becomes uneven. In this connection, large temperature variation within a room can make occupants really uncomfortable and may result in some kind of air-conditional or "air-con" sickness.
- 15
- 20 2) An enclosed space is required, which is prone to cause sickness among its occupants. As conventional air-conditioners require an air-tight enclosed space for maintaining low temperature, such environment is conducive for the growth and spread of bacteria, germs and so on. Therefore, such environment would cause higher incidences of air-conditional sickness among the occupants.

- 3) High operation cost is involved due to wastage of energy-related resources. For ordinary household, it is required to install in each room a separate air-conditioner, which contributes to high energy consumption. Though central air-conditioning system is available, the installation cost is high making such system equally uneconomical.

Summary of the Invention

The main objective of the present invention is to provide a cold water circulation cooling system for cooling down temperature in a room. It does not involve any air blowing outlet and is capable to achieve relatively uniform temperature distribution within the vicinity concerned. There is no requirement for an air-tight enclosure. Therefore, the present invention has the advantage of providing a more comfortable and healthy environment for its users. In addition, the invention also incurs lower running cost and less energy consumption.

In order to achieve the above objective, the present invention of a cold water circulation cooling system is characterized by a closed circuit water circulation loop which is pre-laid in walls, ceiling or the likes and a cold water generation means connected to said closed circuit water circulation loop, said cold water generation means having a cold-water outlet provided with a pressure pump to facilitate water circulation therein.

The closed circuit water circulation loop includes a plurality of sub-loops for which each room is installed with at least one of said sub-loops, a water distribution unit and a water returned unit wherein said water distribution unit includes a distribution inlet and a plurality of distribution outlets connected jointly to the entrance of said closed circuit water circulation loop, and said water

returned unit includes a returned outlet and a plurality of returned inlets connected jointly to the exit of said closed circuit water circulation loop.

5 Said water distribution unit includes at each distribution outlet therein a manual valve and said water returned unit includes at each returned inlet therein a manual valve.

Said each returned inlet of the water returned unit is provided with an electro-magnetic valve, said electro-magnetic valve being connected with an independent control unit.

10 Said closed circuit water circulation system of the present invention also includes a central control panel connected jointly with the said pressure pump, said cold water generation means and said independent control unit.

Said cold water generation means includes an open-able compartment body having multiple levels of ice-making racks therein, a warm-water inlet disposed at the top end thereof and a cold-water outlet disposed at the bottom end thereof.

15 Said warm-water inlet includes at its lower end a water channel means for directing in-coming warm water to designated ice-making racks.

Said cold-water outlet includes a heater band installed externally near to the exit end to prevent water therein from reaching the freezing point.

20 Said closed circuit water circulation loop includes on its surface facing the interior of the room a heat conducting lamination. Said heat conducting lamination is an aluminum composite board.

Unlike the conventional cooling system using cold air as a medium, the cold water circulation cooling system according to the present invention has the following advantages;

- 5 1) More comfortable: The room to be cooled is shielded off from any heat radiation coming from the ceiling and walls. Conversely, chilled air comes down from the ceiling and walls to cool down the surrounding making one feel relaxed in a cooling environment as if inside a natural cave. Without having to close the room completely, it is possible to lower the environment temperature up to 5-10 degrees centigrade. In addition, the room has very
10 uniform temperature throughout every corner making the occupants feel easy and comfortable. Users of the present invention may choose to install a conventional ceiling fan with opposite-angle blades which would help sending the chilled air down and hence further enhance circulation of air within the room.
- 15 2) More hygienic & healthy: Since there is no requirement for air-tight room, the present invention should drastically cut down cases of infection among the occupants caused by harmful bacteria, viruses and other germs. Besides, a more uniform temperature environment is achieved and with little temperature variation and it should reduce incidences of sickness relating to
20 air-conditional effect or "air-con" symptom.
- 3) Energy saver: The cooling system according to the present invention when used for cooling an entire house only consumes electricity comparable to that of a household refrigerator. There is a smart auto-timer control in the system, which can be used to avoid peak-hour charges and thus help to

minimize electricity bill. If necessary, the cold water generation means of the present invention can be modified and adapted to use solar power thus making the system even more economical.

- 5
- 4) Safety: The present invention uses water pipes of the crosslinked polyethylene type (commonly known as PEX pipes), which is of food grade quality with minimum life span of at least 50 years even under extreme operating temperatures of - 40 to 110 degrees centigrade. The pipes also have the physical flexibility to ensure that there is absolutely no requirement for making joints within the walls or ceiling during installation. In this way, it would eliminate any chance of leakage at joints due to rusts or aging of the pipes. Where pipes need to be joined to the cold water generation means, such joints are all positioned outside and therefore, maintenance and repair works can be done easily. Proper drainage means can be provided below these joints so that there is no danger of unwanted leakage that may flood the place concerned. Apart from the above, the pipes used in the present invention are not prone to rust like the conventional ones and therefore will not result in blockage which affects the smooth flow of water. In addition, in case of fire, the pipes will melt. The water so discharged will sprinkle and help to extinguish the fire.
- 10
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- 20
- 25
- 5) Low cost: The installation cost for the present invention is much lower than that of the central air-conditioning system. Such low installation cost is comparable to having to install an air-conditioner in each room of an ordinary household. However, the daily running cost for the present invention is considerably lower than other air-conditioning systems available in the market.

- 6) Low water usage: The present invention incurs very low water consumption because water is only used in closed circuit system. No water is being discharged nor any polluted by-product being emitted. The amount of water consumed is limited to about tens of liters only. Therefore, water temperature can be rapidly cooled down and maintained at less than 10 degrees centigrade. A system with operating water temperature at less than 10 degrees centigrade is sufficient to keep a household surrounding at about 25 degrees centigrade even during summer time.
- 7) Environmental friendly: As the present invention consumes very little energy, no noise, low heat emission, low coolant usage and no leakage, it is very environmental friendly.

Illustration by drawings

Fig. 1 shows an isometric view representation of an embodiment according to the present invention.

Fig. 1A shows the plan view of the closed circuit water circulation system according to the present invention.

Fig. 2 shows the plan view of the water distribution unit according to the present invention.

Fig. 3 shows the plan view of the water returned unit and the control system thereof according to the present invention

Fig. 4 shows front cross-sectional view of the cold water generation means according to the present invention

Fig. 5 shows the top cross-sectional view of the cold water generation means according to the present invention

Fig. 6 shows a cross-section view of the assembly involving the crosslinked polyethylene pipe, insulation foam and heat conducting material according to the present invention

Specific Embodiments

The cold water circulation cooling system according to the present invention is ideal for use in apartments, houses, offices, shopping malls, hotel and & factories and so on. As shown in Fig. 1, its main inventive features include a closed circuit water circulation loop, water distribution unit, water returned unit, central control panel and cold water generation means, which have the following details.

Said closed circuit water circulation loop 1 is pre-laid in the walls, ceiling and the likes. As such, manifold independent sub-loops 11 of similar nature are installed in individual smaller rooms. (Circuit route for independent sub-loop is shown in Fig. 1A while Fig. 1 shows the overall water circulation system). For bigger rooms, two or more independent sub-loops 11 can be installed. The kind of pipes used for said closed circuit water circulation loop is the crosslinked polyethylene type. Such kind of pipes possesses many properties such physical flexibility, resistant to high and low temperatures (- 40 degree to 110 degree centigrade). When reaching 200 degree centigrade, such pipes would not melt but only become soft, resistant to high pressure (20Mpa), non-poisonous, healthy and safe for use.

Said water distribution unit 2 (as shown in Fig. 2) is provided with a distribution

inlet 21 and a plurality of distribution outlets 22. Each distribution outlet 22 is connected to a closed circuit sub-loop 11 of the overall closed circuit water circulation loop 1. Each distribution outlet is also provided with a manual valve 23 at the entrance thereof to facilitate the control and opening of a particular closed circuit sub-loop 11 that is connected to it.

Said water returned unit 3 (as shown in Fig. 3) is provided with a returned outlet 31 and a plurality of returned inlets 32. Each returned inlet 32 is connected to a closed circuit sub-loop 11 of the overall closed circuit water circulation loop 1. Each returned inlet 32 is provided with an electro-magnetic valve 33 at the entrance thereof. Said electro-magnetic valve 33 is connected to an independent control unit 34. Preferably, each returned inlet 32 is also provided with a manual valve 35. Said manual valve 35 has the function to continue operating the water circulation system in the event that the electro-magnetic valve 33 fails to function.

As illustrated in Fig. 3, said central control panel 4 is connected to each and every independent control unit 34. Said central control panel is also connected to the cold water generation means 5.

As shown in Fig. 4 and Fig. 5, said cold water generation means 5 includes a well insulated open-able compartment body 51. Within the housing of said compartment body 51, there are multiple levels of ice-making racks 52. At the top end of said compartment body 51, a warm-water inlet 53 is provided, said warm-water inlet being connected to the returned outlet 31 of the water returned unit 3. At the lower end of said warm-water inlet 53, there is provided a water channel means 54. As the present embodiment has four ice-making racks 52 to a level of the compartment body, said water channel means 54 assumes the configuration of H shape. Said water channel means 54 is provided with channel

grooves 541 capable to divert the returned warm water into the four designated ice-making racks 52.

At the bottom end of the compartment body 51, there is provided a cold-water outlet 55, said cold-water outlet being connected to the distribution inlet 21 of the water distribution unit 2. Said cold-water outlet 55 includes a heater band 56 installed externally near to its exit end so as to prevent water therein from reaching the freezing point. At the exit of the cold-water outlet 55, a pressure pump 57 is provided to ensure that the water there from has sufficient pressure to circulate round the cooling system to take away heat and at the same time cool down the surrounding. The basic principle of the cold water generation means 5 is similar to that of an ordinary household freezer where it uses a compressor 58 and coolant to achieve the freezing effect. The above-mentioned pressure pump 57 and compressor 58 are electrically controlled by the central control panel 4 respectively.

As illustrated in Fig. 6, the present invention requires that the surface of the walls, ceiling or the likes (Refer to ceiling 6 in Fig. 6) facing the interior of the room be first applied with an insulation layer 7. Said heat insulation layer 7 is a pre-cast foam having grooves thereon to facilitate crosslinked polyethylene pipes of said closed circuit water circulation loop 1 to be fitted on. Once the fitting has been done, a heat conducting lamination 8 such as an aluminum material board is then added on with the purpose to increase the radiation surface area and capability.

The working principle of the present invention is as follows. Warm water (20°C - 30°C) from the water returned unit 3 flows into the cold water generation means 5 through the warm-water inlet 53. When inside the compartment body 51, the warm water travels through the water channel means 54 into the

ice-making racks 52 as explained earlier. Within the ice-making racks 52, the warm water will be condensed into ice. The ice that has been formed in the various ice-making racks 52 will quickly help to chill down on-coming warm water. The chilled water will flow down until the bottom of the compartment
5 body where the cold-water outlet 55 is located. Subsequently, the chilled water (about 4^oC) is pressurized by the pressure pump 57. Pressurized chilled water will then be pumped into and through the water distribution unit 2 into the overall closed circuit water circulation loop 1 and eventually into the respective sub-loops 11 concerned.

10 As such, the chilled cold water circulates in the closed circuit water circulation loop 1 and the relevant sub-loops 11 to take away heat along its way and at the same time, cool down the surrounding walls, ceiling and the likes as well as the heat conducting lamination. Through the heat transfer principle, the cooled surfaces will bring down the temperature of the surrounding air, which then sinks
15 down to replace the warmer air below resulting in a gentle movement of air. Having gone through the circulation process within the closed circuit system, the originally cold water will get warmed up as it returns to the water returned unit 3 and hence will be sent back to the cold water generation means 5 once again.

Said independent control unit 34 has the function to control and regulate the flow
20 of water in individual sub-loop 11 through the opening and closing of the returned inlet 32 concerned. In this way, the invention has the advantage to control the cooling effect of individual rooms as may be required by the users.

In addition, the present invention has the provision to incorporate into the central control panel 4 the function of an intelligent timer control so as to enable users of
25 the cooling system to shut off the freezer compressor 58 during peak hours to

avoid high charges. During off peak hours, the ice making process can be resumed. According to the present invention, the freezer compressor 58 and the pressure pump 57 have the properties to work independently of each other. It implies that during peak hours for the purpose of saving electricity charges, users
5 can still operate the system by shutting off the freezer compressor 58 but turning on the pressure pump 57. While at night when the environment is cooler, one can shut off the pressure pump 57 as well. One can also take advantage of the off peak hours to store up the sufficient ice for use during peak hours or when the environment is hot such that the freezer compressor 58 and the pressure pump 57
10 can operate to cool down the environment within a short time.

Claims:

1. A cold water circulation cooling system is characterized by a closed circuit water circulation loop (1) which is pre-laid in wall, ceiling or the likes and a cold water generation means (5) connected to the closed circuit water circulation loop, said cold water generation means having a cold-water outlet (55) provided with a pressure pump (57) to facilitate water circulation therein.
5
2. A cold water circulation cooling system according to Claim 1 wherein said closed circuit water circulation loop (1) includes a plurality of sub-loops (11) for which each room is installed with at least one of said sub-loops, a water distribution unit (2) and a water returned unit (3) wherein said water distribution unit includes a distribution inlet (21) and a plurality of distribution outlets (22) connected jointly to the entrance of said closed circuit water circulation loop (1), and said water returned unit includes a returned outlet (31) and a plurality of returned inlets (32) connected jointly to the exit of said closed circuit water circulation loop.
10
15
3. A cold water circulation cooling system according to Claim 2 wherein said water distribution unit (2) includes at each distribution outlet (22) therein a manual valve (23) and said water returned unit (3) includes at each returned inlet (32) therein a manual valve (35).
20
4. A cold water circulation cooling system according to Claim 2 wherein each returned inlet (32) of said water returned unit (3) is provided with an electro-magnetic valve (33), said electro-magnetic valve being connected to an independent control unit (34).

5. A cold water circulation cooling system according to Claim 1 and Claim 4 wherein said closed circuit water circulation loop (1) includes a central control panel (4) connected jointly to said pressure pump (57), said cold water generation means (5) and said independent control unit (34).
- 5 6. A cold water circulation cooling system according to Claim 1 wherein said cold water generation means (5) includes an open-able compartment body (51) having multiple levels of ice-making racks (52) therein, a warm-water inlet (53) disposed at the top end thereof and a cold-water outlet (55) disposed at the bottom end thereof.
- 10 7. A cold water circulation cooling system according to Claim 6 wherein said warm-water inlet (53) includes at its lower end thereto a water channel means (54) for directing in-coming warm water to designated ice-making rack (52).
8. A cold water circulation cooling system according to Claim 1 wherein said cold-water outlet (55) includes a heater band (56) installed externally near the exit end to prevent water therein from reaching the freezing point.
15
9. A cold water circulation cooling system according any one of Claim 1, Claim 2 and Claim 6 wherein said closed circuit water circulation loop (1) includes on its surface facing the interior of the room to be cooled a heat conducting lamination (8).
- 20 10. A cold water circulation cooling system according to Claim 9 wherein said heat conducting lamination (8) is an aluminum composite board.

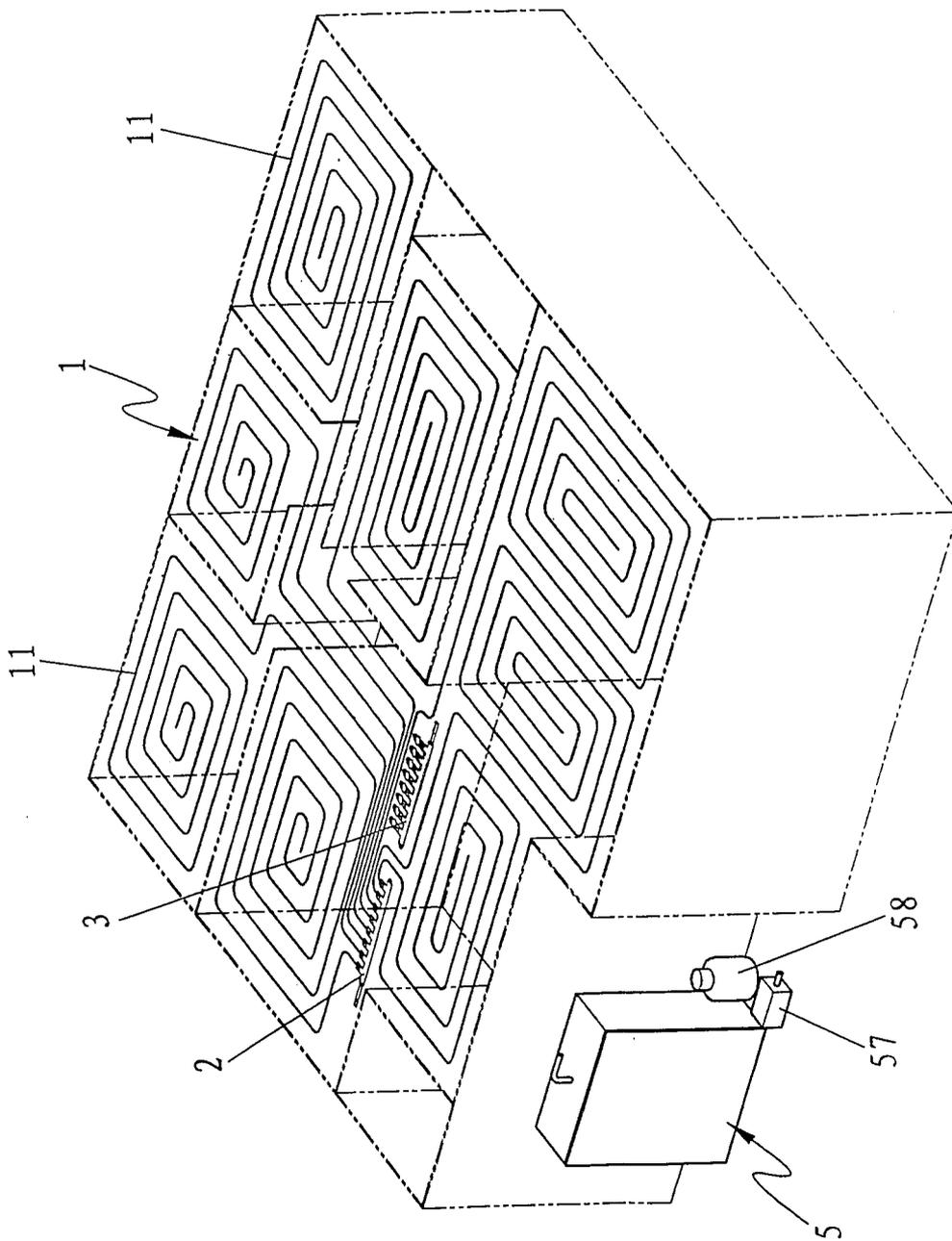


Fig. 1

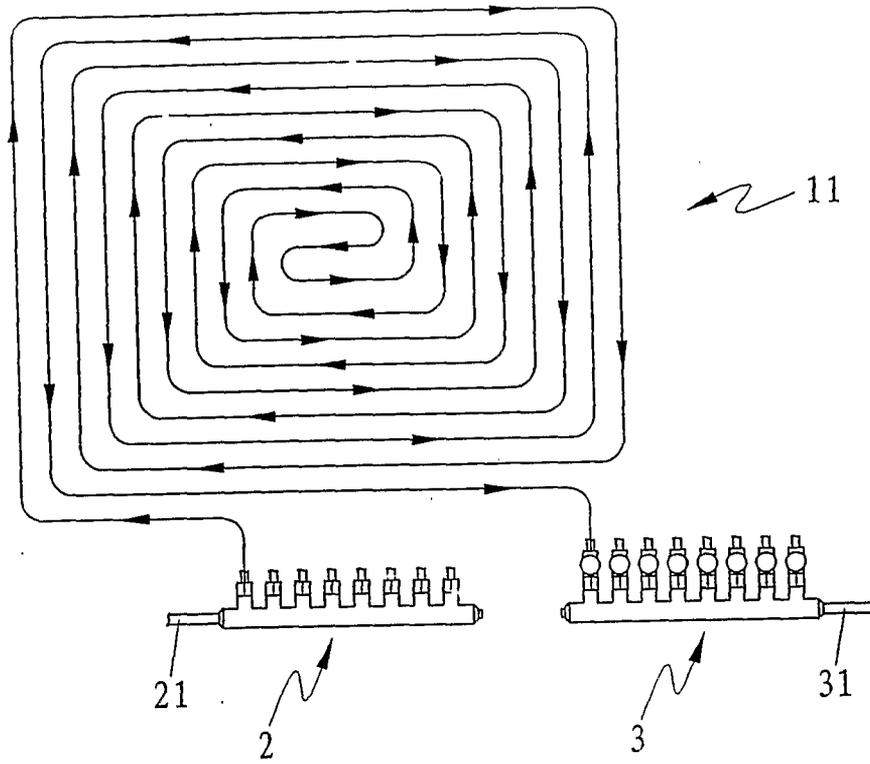


Fig. 1 A

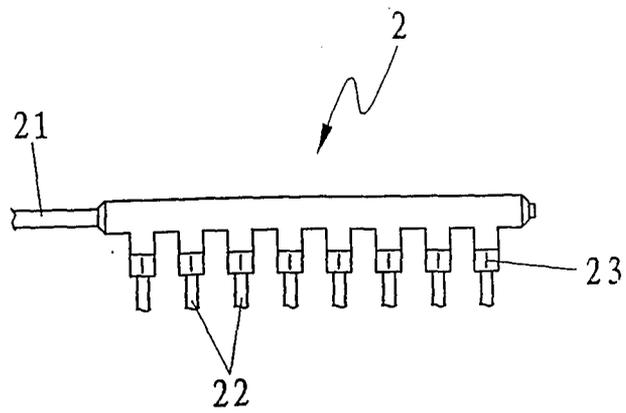


Fig. 2

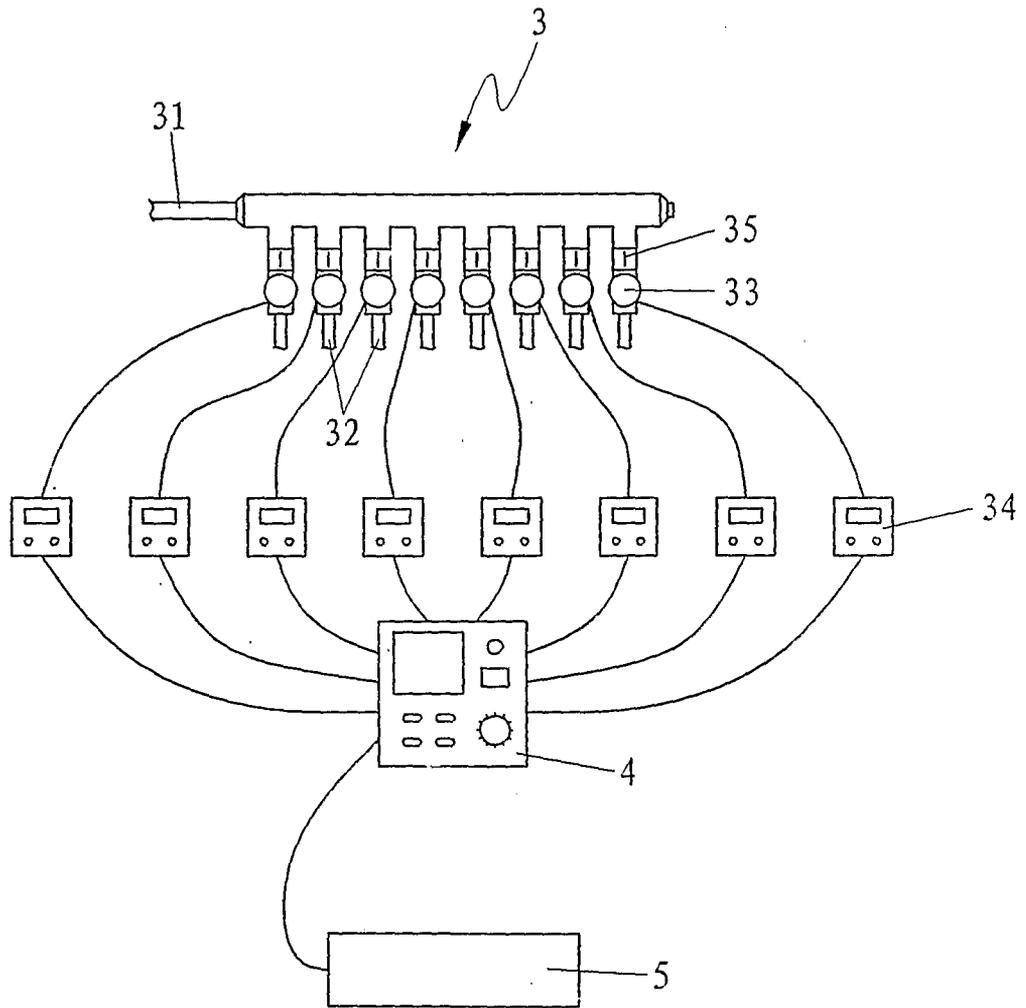


Fig. 3

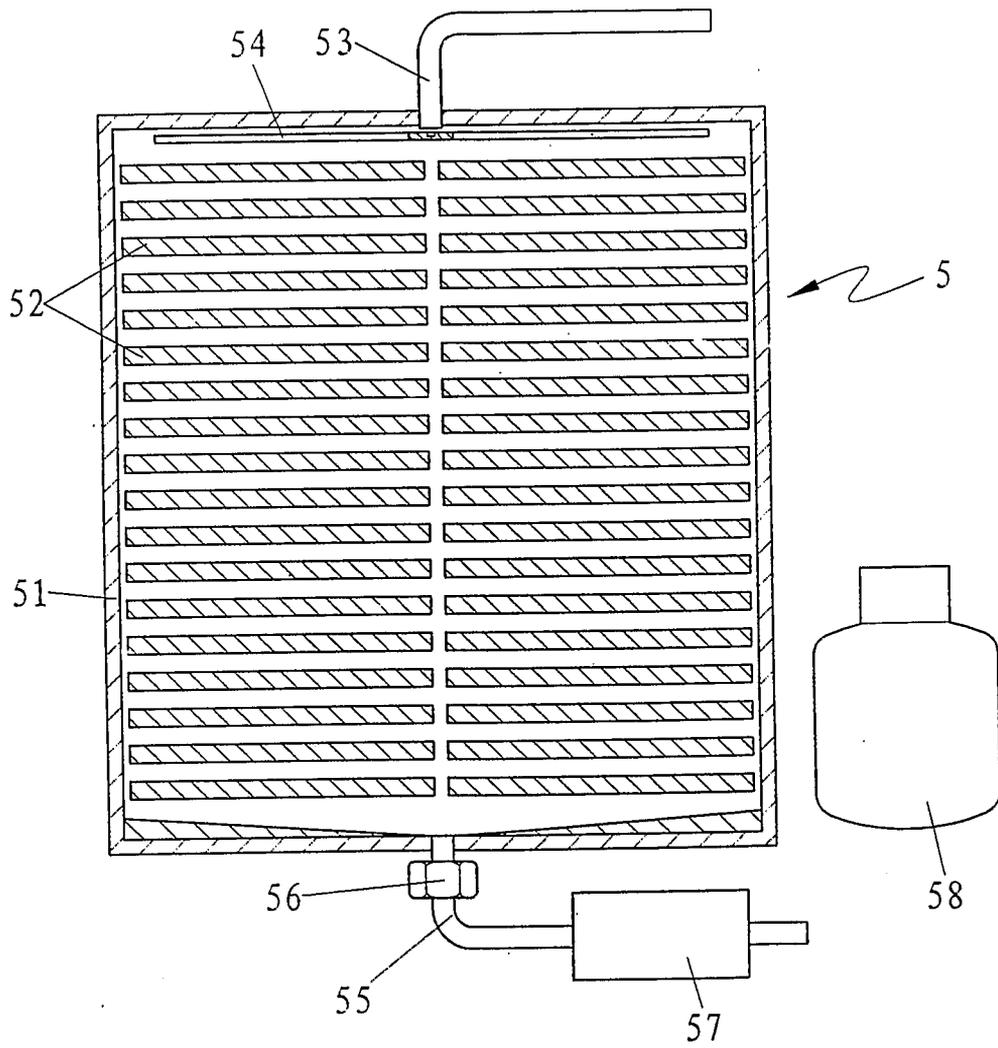


Fig. 4

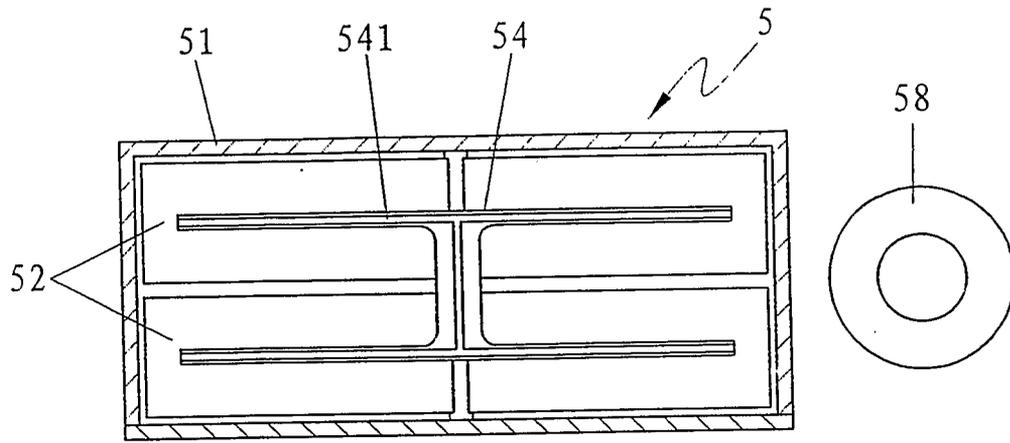


Fig. 5

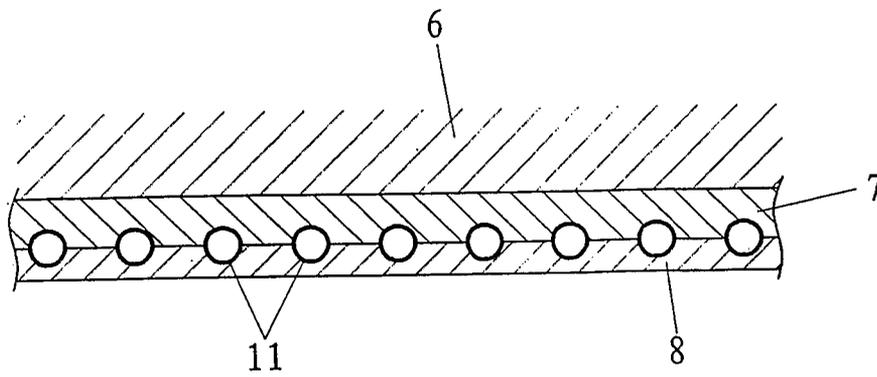


Fig. 6

INTERNATIONAL SEARCH REPORT

International application No.
PCT/MY2007/000027**A. CLASSIFICATION OF SUBJECT MATTER****F24F 5/00(2006.01)i**

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 8 : F24F ; F25B 1/00; 30/00

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Korean utility models and applications for utility models since 1975
Japanese utility models and applications for utility models since 1975

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

eKIPASS(KIPO internal) & keywords: "radiative cooling" and "panel"

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X Y	KR 10-0403237 B1 (KUMHO INDUSTRIAL CO., LTD. ; KIM, KWANG WOO) 30 OCTOBER 2003 See claim 1; page 3, line 51-page 4, line 18; figures 8, 11a-11c and 17.	1, 8 2-5, 9, 10
Y	KR 20-0400452 Y1 (AIKANG CO., LTD.) 08 NOVEMBER 2005 See claim 1; page 3, line 19-page 4, line 22; figure 1.	2-5
Y	JP 05-141708 A (HITACHI PLANT ENG. & CONSTRUCTION CO., LTD.) 08 JUNE 1993 See paragraph [0008]; figures 1-3.	9, 10
A	JP 07-139767 A (TOSHIBA CO., LTD.) 30.MAY.1995 See claims 1-6; figures 1, 2, 8 and 9	1-10

 Further documents are listed in the continuation of Box C. 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 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

11 OCTOBER 2007 (11.10.2007)

Date of mailing of the international search report

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INTERNATIONAL SEARCH REPORT

International application No.

PCT/MY2007/000027**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.:
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:

3. Claims Nos.: 5
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 an additional fee, this Authority did not invite payment of any additional fee.
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/MY2007/000027

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
KR 10-0403237 B1	30.10.2003	None	
KR 20-0400452 Y1	08.11.2005	None	
JP 05-141708 A	08.06.1993	None	
JP 07-139767 A	30.05.1995	None	
