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(54) Title: HEATING AND COOLING SYSTEM

(57) Abstract: A building part of the walls or ceilings or floor of which has panels made of a thermally conducting material, the panels having pipes located therein, the pipes can selectively be connected to a source of high or low temperature fluid whereby the panels adopt a temperature different to ambient temperature whereby the panels cause heating or cooling of the area of the building in which they are located.
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.
HEATING AND COOLING SYSTEM

Technical Area

This invention relates to a heating and cooling system and particularly one which is environmentally friendly and which uses a minimum amount of power.

The system is specifically useful for small buildings such as houses and small commercial buildings, but can also be applied on a larger scale.

Background to the Invention

The object of the invention is to provide a system by means of which a building can be heated and/or cooled with the use of minimal non-renewable resources.

Outline of the Invention

The invention in its broadest sense provides a building part of the walls or ceiling or floor of which has panels made of a thermally conducting material, the panels having pipes located therein which pipes can selectively be connected to a source of high or low temperature fluid whereby the panels adopt a temperature...
different to ambient temperature whereby the panels cause heating or cooling of the area of the building in which they are located.

A preferment to be used in association with the invention is means to cool water to be passed through the sheet, including a bore passing into the ground, pipes passing into the bore and comprising a continuous path for a liquid to be passed therethrough and being connected either directly or by way of a heat exchanger to the pipes in the walls or ceiling.

The invention also provides a method of cooling a fluid to a temperature below ambient temperature which comprises providing a borehole having at least one continuous pipe therein which extends from the upper surface to the borehole and returns to adjacent this position and means to cause the fluid to pass through this pipe whereby the temperature of the fluid is reduced from the temperature at which it enters the bore hole, the reduction in temperature varying depending on the difference in the ambient temperature and the temperature at the lower end of the borehole.

In a further aspect of the invention we provide a heat bank which is adapted to be heated by the sun or ambient air, which heat-bank has passing therethrough pipes whereby a liquid in the pipes can be heated; the pipes being connected directly or indirectly to the pipes in the wall or ceiling members.
It is preferred that the heat-transfer liquid is water.

Description of an Embodiment of the Invention

In order that the invention may be more readily understood, there shall be described, in relation to the accompanying drawings, which show, one particular form of the invention, as applied to a house.

In these drawings:

Fig 1 is a schematic view of the house to which the invention is applied; and Fig 2 shows one form of arrangement whereby the pipes can be interconnected.

In this drawing the house, shown schematically at 10 has walls 11, floors 12 and roof 13.

Some or all of the walls 14, as will be described later, have heat transfer tubes running therethrough. Similar tubes 15 can be provided in the floor 12 and, although not shown, can be provided in a ceiling.

As illustrated, the building 10 is also provided with solar panel 16, to heat water. This can supply head directly to water to be used, but it may be preferred that it
provides heat to a heat bank which can provide hot water for use in the building and also provide a source of heat to heat the building as will be described hereinafter.

There is a further solar panel 18 to provide electricity.

As will be described herein, the heat transfer tubes 14, 15 and others enable the building to be heated or cooled and the system is generally sealed so that the complete building can be located at a remote area. Provided a satisfactory water supply, normally by tanks filled from run off from the roof, or a bore, and a method of controlling sewage, either a septic tank or a 'long drop' toilet can be provided, the building is largely self-contained and is not reliant on external utilities.

Also, the heating and cooling system is effectively sealed so it is not wasteful on resources.

The sheets used for the walls and ceilings, and even, if required for floors, are made of cement and before the cement is located in a form, or the like, pipes are laid in a pattern within the panel and these pipes maybe of PVC, copper or other metal, and once located, the cement is poured to form the panel.

The pipes are preferably in the form of a continuous pipe having an input and an
output and may be of the order of 8-10 mm in diameter and may, in one exemplification be spaced approximately 80 mm apart.

The sheet so made can then be used to form the walls and/or ceiling of an area to be heated or cooled. The sheets can provide both internal dividing walls for the area and may also provide finished outwardly-directed surfaces which may be adapted to be painted. Alternatively, the sheets could be attached to the walls and/or ceiling of an existing building.

Under the floor of the building, or, if required in the ceiling, the pipes 31, 33 and 35 and the pipes 32, 34 and 36 extending from the sheets, one set being the inlet set and the other the outlet set may be manifolded to larger pipes 37, 38 which could be 20-30 mm in diameter.

It is preferred that these larger pipes 37, 38 which have manifolded thereto the pipes from the wall or ceiling can be restricted to serving a particular area and these pipes themselves may be further connected to other pipes, although such an arrangement is not shown in the drawings.

These pipes can, themselves, be connected to further similar pipes from other areas.

If required, the pipes for a particular area may be provided with a valve means
39, 40, 41 whereby the flow of liquid therethrough can be controlled so that there can be selective heating or cooling of an area. These valves can be controlled electrically or otherwise remotely, if required, or could be mechanical valves which can be accessed from the area which they control.

Ultimately, all of the pipes may be connected together, so there is a single inlet and a single outlet serving the whole, or part, of the area.

These pipes are adapted to receive hot or cooled water and because of the heat transfer between the pipes imbedded in the panels and the panels themselves, these will be heated or cooled and then both radiation from and convection caused by the heated or cooled panels will effect heating or cooling of the adjacent area.

Thus, the heating and cooling of the areas is a completely static phenomena as far as people in the area of concern, the whole of the heat emanating from or returning to the wall or ceiling panels.

To provide heat or cold to the areas, we may provide a heat-bank 17, for heat and, as mentioned this heat bank may have two sets of pipes therein, one of which is adapted to pass to the panels and the other to provide hot water for use in the building.
The heat-bank may be formed of bricks, rocks, gravel, or the like, or could even be a bath of liquid which has a high boiling point so that substantial heat can be stored for use overnight or when there is no or little sun.

The pipes from the volume to be heated can be passed through this heat-bank, and may take an elongated path to maximise the transfer and the contents of the pipes can be caused to circulate by an electric pump, or the like, so that as the pipes pass through the heat-bank, the fluid therein carried along the pipes is warmed by contact with the inner walls of the pipes, which themselves are warmed from the general environment of the heat-bank.

As mentioned above, the fluid in the pipe may be circulated by a small electric pump which is located in the line.

The output from the heat-bank is connected to the input of the panels and as the liquid is circulated, so the heat in the liquid is transmitted by way of the pipes in the panels to the panel body and the panel body adopts a temperature higher than ambient and this effects radiation to the area to be heated.

To cool the area, we use the cooling method to be described later. It will be understood that if the water is at a temperature different to ambient, then the panels will warmer or cooler than the surrounding area and there will be radiation from the panels into the area or absorption of heat from the area. The difference in
temperature in the area will then lead to convection in the area and thus, generally, the area will be maintained at a constant temperature which will tend towards the temperature of the panels.

The power to operate the pump 40 can be obtained from the solar power panel 18, or some form of battery charged therefrom. Because of the form of heating and cooling, it is not necessary that the flow of water be great.

Where a volume is to be cooled, we provide a bore 20, which may be 100 m deep and between 100 to 200 mm in diameter although this will depend on the volume of fluid to be cooled. Into this bore there are located at least two PVC pipes 22, and preferably four such pipes, which may be of the order of 50 mm in diameter and which are continuous. If there are four pipes, the output of the first-two pipes can be fed to the input of the second two pipes, so the water is caused to pass into the bore twice, traverse the 100 m depth of the bore, and return to the surface, twice.

If required, the bore hole can be back filled or filled with water to ensure good heat transfer to the pipes.

As the temperature within the bore-hole will be generally lower than the temperature of the adjacent landmass, and certainly the temperature inside a building, then this water can be caused to pass through the manifolds and pipes,
as previously referred to and, in this case, the pipes absorb heat from the panels, the panels become cooler than the ambient air and there is an effective cooling of the ambient air.

It has been found that the temperature at the bottom of the bore hole is of the order of 14° to 18°. Thus, provided the water is in the pipes for a sufficient time, it will come to a temperature close to this. It is for this reason that it may be preferred to cause the water in the pipes to traverse the length of the pipes twice.

We are thus providing a closed system, or where both heating and cooling are provided two closed systems, a substantial part of each of which, the pipes passing through the panels, is common.

Mentioned earlier was the provision of valves to control the flow of heating or cooling fluid into the panels. Further valves preferably solenoid operated, can be provided to switch the liquid flow from passage through the heat-exchanger to passage through the pipes in the bore.

The liquid passing through the pipes may preferably be plain water, although if more efficient heat transfer is required, they may use saline, or some other satisfactory liquid.

The liquid is normally treated before being passed into the system so that algae
growth and the like is inhibited.

As mentioned, in operation there may be provided valve means to isolate or connect areas to the system and also valve means so that the liquid in the system can selectively be passed through the heat-sink or to the bore.

The electric pump 40 which can effect circulation of the liquid and depending on whether this is connected to the heat-bank or to the pipes passing into the bore, so liquid which is warmer or cooler than ambient, is passed through the pipes in the panels, and this may be a selective passage if various valves are provided to isolate or connect separate panels and the panels are heated or cooled to a temperature above ambient and if heated, they will radiate heat into the area and, if cooled, will accept heat from the air in the area, thus heating or cooling the body in which the panels are located.

It will be seen that this heating and cooling is basically completely passive as far as occupants of the volumes are concerned, so there is no substantial air-flow which can carry dust and other irritants into and from the volumes.

Whilst we have described the heating as being by way of a heat-bank and the cooling by way of a liquid passing down a bore, it is to be understood that the panels of the invention could well be used in association with other forms of heat exchangers, such as furnaces, air-conditioning systems or heat pumps, and one
would still get the benefit of the arrangement as far as the passive heating and cooling of the volume, but without the environmental advantage of using the temperature of the air to heat the heat-bank or the coolness of the earth underground to cool the liquid in the pipes passing therethrough.

Various modifications may be made in the system of the invention without departing from the spirit and scope thereof.
We claim:

1. A building part of the walls or ceiling or floor of which has panels made of a thermally conducting material, the panels having pipes located therein which pipes can selectively be connected to a source of high or low temperature fluid whereby the panels adopt a temperature different to ambient temperature whereby the panels cause heating or cooling of the area of the building in which they are located.

2. A building as claimed in claim 1 wherein the panels comprise the wall, ceiling or floor of the building.

3. A building as claimed in claim 1 wherein the panels are connected to the framing of the building.

4. A building as claimed in claim 1 wherein the panels are connected to the wall, ceiling or floor of the building.

5. A building as claimed in any one of claims 1 to 4 wherein the panels are made of cement or cementitious material.

6. A building as claimed in any preceding claim wherein the pipes in each panel comprise a continuous pipe located in the panel the portions of the
pipe being spaced one from the other and the pipes occupying a substantial part of the area of the panel.

7. A building as claimed in any preceding claim wherein the pipes are of a synthetic plastics material.

8. A building as claimed in any one of claims 1 to 7 wherein the pipes are of metal.

9. A building as claimed in any preceding claim wherein the pipes of more than one panel are manifol ded and the manifold is connected to the source of high or low temperature fluid.

10. A building as claimed in any preceding claim wherein the pipes can be selectively connected to or disconnected from the source of high or low temperature fluid.

11. A building as claimed in any preceding claim wherein the source of high temperature fluid is a heat bank which is adapted to act to supply high temperature fluid.

12. A building as claimed in claim 10 wherein the heat bank is in connection with a solar panel whereby heat can be supplied to the heat bank during
daylight hours.

13. A building as claimed in any preceding claim wherein the source of low temperature fluid is by way of a borehole having at least one fluid pipe extending substantially the whole length of the borehole and returning to the upper portion thereof whereby fluid carried by the pipe is cooled as it passes through the pipe.

14. A building as claimed in claim 12 wherein there are more than one pipe extending through the borehole and wherein the fluid is caused to pass the length of the pipe on more than one occasion.

15. A building as claimed in claim 14 wherein the borehole is filled after the pipes have been located to ensure good heat transfer from the walls of the borehole to the pipes.

16. A building as claimed in any preceding claim wherein the fluid is circulated by a pump.

17. A building as claimed in claim 16 wherein the pump is powered by electricity obtained from a solar power panel.

18. A building as claimed in any preceding claim wherein the fluid is water.
19. A method of cooling a fluid to a temperature below ambient temperature which comprises providing a borehole having at least one continuous pipe therein which extends from the upper surface to the borehole and returns to adjacent this position and means to cause the fluid to pass through this pipe whereby the temperature of the fluid is reduced from the temperature at which it enters the borehole, the reduction in temperature varying depending on the difference in the ambient temperature and the temperature at the lower end of the borehole.

20. A method as claimed in claim 19 wherein there are more than one pipe extending through the borehole and wherein the fluid is caused to pass the length of the pipe on more than one occasion.

21. A method as claimed in claim 20 wherein the borehole is filled after the pipes have been located to ensure good heat transfer from the walls of the borehole to the pipes.

22. A method as claimed in any one of claims 19 to 21 wherein the fluid is circulated by a pump.

23. A method as claimed in any preceding claim wherein the fluid is water.
System Drawing of the new Cooling and Heating Technology

- Roof with good insulation and ventilation system to protect the house from lost energy in winter - and to keep energy in the summer.
- Air exchanger converts fresh air to cool or warm room temperature. The air exchanger could be connected with the cool or warm water recycling system and contains a special allergy filter.
- Earth drilling 100 - 200mm diameter and to 100m deep.
- Cool down / heat up pipe system (CHP system) installed in a part of the building (all kind of construction parts: walls, ceilings, floors, stairs or fitting out).
- Warm water recycling system for room heating. Heat energy - supply from sun, earth or water collector but also possible to get from heat pumps and other natural energy (ocean, lake, river, cave water, ground water, etc.).
- Cool water recycling system for room cooling. Cool energy - supply from an earth-drilling or earth-collector pipe system but also possible to get from heat pumps and other natural energy (ocean, lake, river, cave water, ground water, etc.).

Global Cooling and Heating Systems Ltd.
### INTERNATIONAL SEARCH REPORT

#### A. CLASSIFICATION OF SUBJECT MATTER

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According to International Patent Classification (IPC) or to both national classification and IPC.

#### B. FIELDS SEARCHED

Documented search 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: F28D/IC, F24H 7/06, F24D 3/12, 3/14, 3/16, 3/100, E04B 2/1C, PARTITION+ OR CEILING+ OR PANEL+ OR WALL+ OR FLOOR+, RADIAT+ OR RADIANT+ OR CONVECT+ OR HEAT+ OR COOL+, FLUID OR WATER, ROOM+ OR HOUSE+ OR BUILDING+

#### C. DOCUMENTS CONSIDERED TO BE RELEVANT

<table>
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<td>EP 1382915 A1 (SULZER HANS DIETRICH)</td>
<td>21 January 2004</td>
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<td>See abstract, figures</td>
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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 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
  - "A" document member of the same patent family

Date of the actual completion of the international search: 16 February 2007

Date of mailing of the international search report: 23 Feb 2007

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Matthew Forward
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Form PCT/ISA/210 (second sheet) (April 2005)
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This International Application does not comply with the requirements of unity of invention because it does not relate to one invention or to a group of inventions so linked as to form a single general inventive concept.

In assessing whether there is more than one invention claimed, I have given consideration to those features which can be considered to potentially distinguish the claimed combination of features from the prior art. Where different claims have different distinguishing features they define different inventions.

This International Searching Authority has found that there are different inventions as follows:

- Claims 1-18 define panels forming a part of walls, ceiling or floor of a building wherein, panels are made of thermally conducting material comprising pipes which can be selectively connected to a source of high or low temperature fluid whereby panels cause heating or cooling of the area of the building in which they are located.

  It is considered that thermally conducting panels comprising pipes connected to a source of high or low temperature fluid comprises a first distinguishing feature.

- Claims 19-23 defines a method of cooling a fluid to a temperature below the ambient temperature comprising a borehole having at least one continuous pipe which extends from the upper surface to the borehole and return back to the surface wherein the fluid is passed through the said pipe whereby the temperature of the fluid is reduced from the temperature at which it enters the borehole.

  It is considered that the method of cooling a fluid by using a pipe running into a borehole and passing the fluid through the said pipe comprises a second distinguishing feature.

Since the above mentioned groups of claims do not share either of the distinguishing features identified, a "technical relationship" between the inventions as defined in PCT rule 13.2 does not exist. Accordingly the international application does not relate to one invention or to a single inventive concept.
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.;
   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:

See supplement box-A

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.: 1-18

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

END OF ANNEX