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(54) ECOLOGICAL THERMOELECTRICAL COOLING SYSTEM

(57) An ecological thermoelectric cooling system composed of a thermoelectric plate by the coupling to the same of a metal supplement on its cold generating face (1) and two dissipators, one on the free face of the metal supplement, and the other, refrigerated by natural or forced convection, on the heat generating face (2). To avoid the formation of a thermal bridge between the two faces and to increase mechanical rigidity a part made of insulating material is mounted joined to the two dissipators by rods arranged in a non - coaxial form.

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Description

The system developed consists of the formation of a completely ecological cooling module, based on the usage of commercially available semiconductor elements. For the purposes of this, a heat transmission system has had to be developed which optimizes the power generated, attaining levels of performance unknown to date in the field of gas - free cooling (ecological refrigeration).

The module consists of a Thermoelectric plate, of a type that is commercially available, to which a metal supplement is added, preferentially manufactured of aluminium, on the side which is to be used to generate cold: together with two dissipators, one on the heat emitting side and the other on the free side of the metal supplement.

The perfection of the contact between the surfaces in question (plate and supplement; plate - dissipator 1; free side of metal supplement - dissipator 2) is extremely important. For this purpose, the use of some highly conductive substance is advisable to ensure the quality of the contact (such as high conductivity silicon or copper sulphate) thereby avoiding the appearance of harmful thermal resistances.

Another critical point of the system is the design of the dissipators and especially of the heat emitting side. The one used in our module is of our own design, on the basis of a commercially available dissipator. The modifications made to this have the aim of reducing, as far as is possible, thermal resistance (dissipator - atmosphere) for forced convection working. To this end it has been machined, reducing its base to 4 mm and the width of its fins to 2 mm, while also leaving the latter completely straight. As a result of this, we obtain a thermal resistance of 0.05 ° C/W, working with an axial fan which blows the air frontally onto the dissipator. The air, as has already been mentioned, must be blown frontally with the aim of achieving maximum turbulence, using commercially available low profile fans.

Some type of holding is needed to attain the mechanical rigidity of the module. This must be achieved without giving rise to any form of thermal bridge between the cooling side and that which emits heat. Account must be taken of the fact that if this anomaly does occur (for example, through the usage of metal bolts and nuts) then the resulting losses are of a high magnitude (approximately 32 %). It is for this reason that bolts and nuts of thermally insulating material must be used, or an intermediate plate of insulating material through which metal rods are bolted, from each dissipator in alternate fashion. This second solution is the one we use.

As an example of the application of the system, a prototype has been developed, as is shown in figure 1, which consists of a tank of liquid (water, for example) to which on opposing sides six modules in two groups of three have been affixed, leaving the dissipators with refrigerating sides (1) within the tank. The dissipators with heat emitting sides (2) remain on the outside, working in forced convection mode with the aid of low profile axial fans (3). Two such fans are used for each group of three modules, as was mentioned above, while the airflow is directed in front of the fans by means of small nozzles.

The mechanical rigidity of each module is achieved through the joining of the two dissipators in the method shown in figure 2. In this figure the part made of insulating material (1) may be seen, together with the metal rods (2) that are embedded in the said part without touching one another, avoiding thermal bridges.

The supply of electricity to the modules is ensured by using a commercially available direct current power source. In the definitive model, it will be possible to include a power source manufactured in - house within the system as a whole.

In the prototype the modules are equipped with 60 W plates, attaining the following temperatures at an ambient temperature of 30° C:

Temperature on the cold side = - 10° C
Temperature on the hot side = 33° C
Water temperature = - 2° C

If the cooling coil of a drink dispenser (such as one for beer or soft drinks) is placed within this equipment, then the liquid is cooled to a suitable degree.

Amongst the advantages of the system, the following points may be listed:

- Cooling without using refrigerating gas.
- The absence of moving parts (except for the fans).
- High performance.
- Low voltage power supply.
- The simplicity of the system, given that it is very compact.
- Flexibility and ease of adaptation.

Claims

1. An ecological thermoelectric cooling system, of the type that makes use of the coldness generated by a thermoelectric plate through the coupling of the same to a metal supplement on the side generating coldness and two dissipators, respectively, one on the free side of the metal supplement, and the other on the heat generating side, cooled by natural or forced convection, essentially characterized in that mechanical rigidity as well as thermal insulation of the two faces are increased, together with interruption of the thermal bridge, by the different fixations of the two dissipators, in the non coaxial arrangement of their means of clamping.

2. An ecological thermoelectric cooling system, according to the above claim, characterized in that overall mechanical rigidity is ensured by the means of clamping or rods (2) that are attached by threading or alternatively embedding in the intermediate plate or part (1) which is made of thermal insulation material, encircling the pair constituted by the metal

supplement and the thermoelectric plate, rods (2) that are arranged in an alternative manner, that is, those that clamp the heat dissipator are offset respecting those which clamp the cold dissipator.

3. An ecological thermoelectric cooling system, according to the above claims, characterized in that the heat dissipator may have fins or be, simply, the wall of the recipient or enclosure to be cooled.

4. An ecological thermoelectric cooling system, according to the above claims 1 and 2, characterized in that the heat dissipator incorporates a finned heat exchanger working in forced convection with the aid of fans.

5. An ecological thermoelectric cooling system, according to the above claims, characterized in that it permits the alternate cooling or heating of any type of material, solid, liquid or gas.

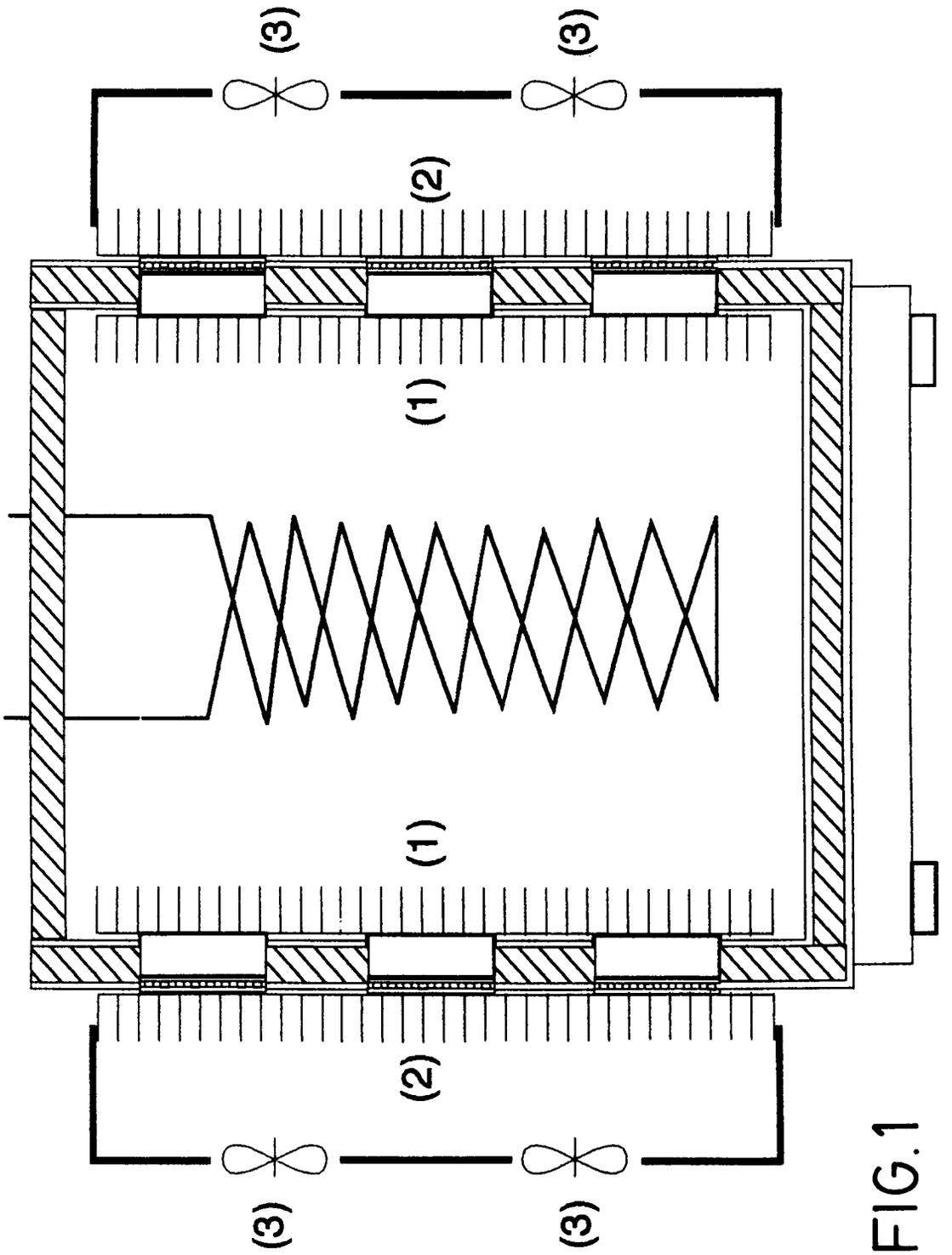

FIG.1

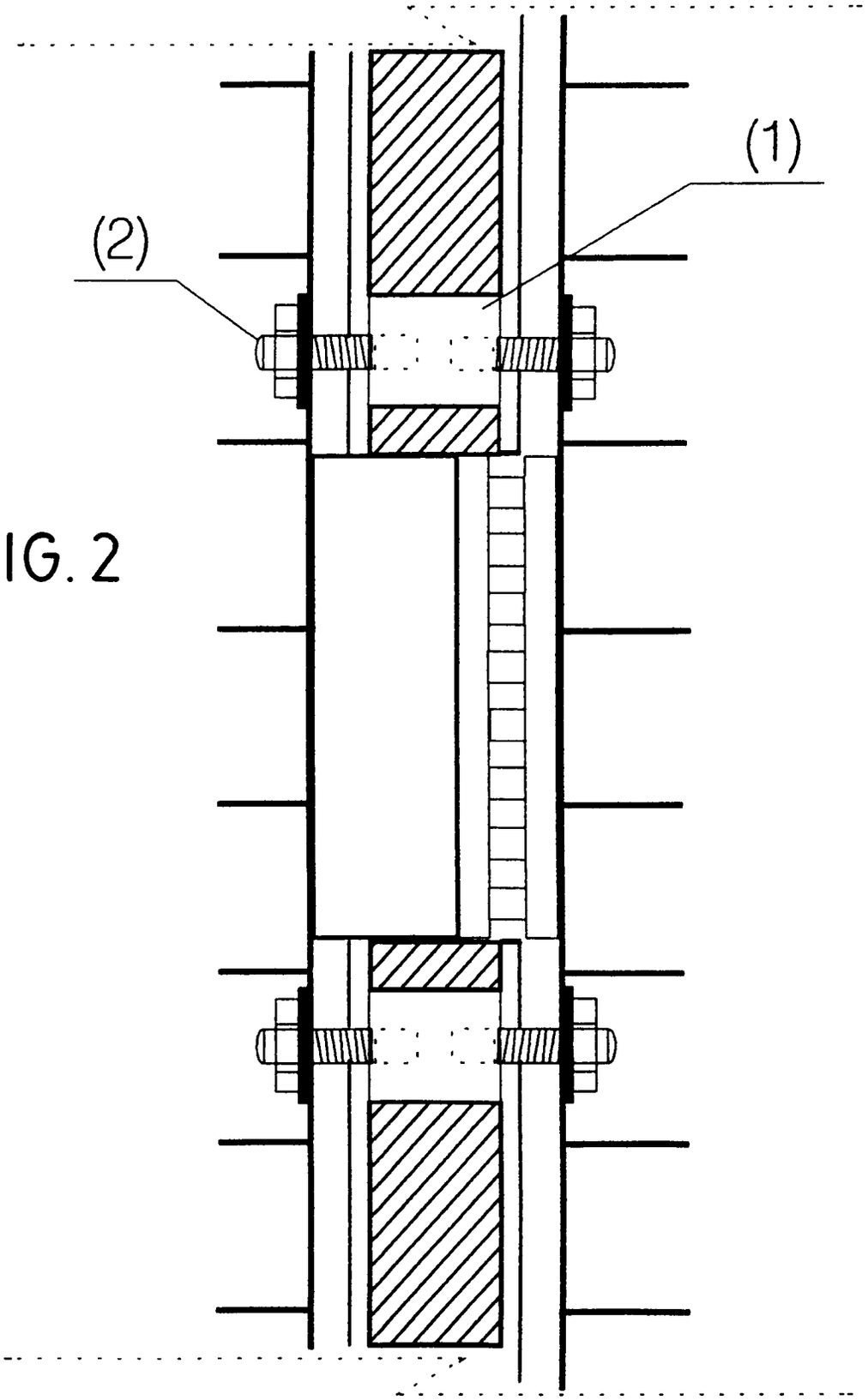

FIG. 2

INTERNATIONAL SEARCH REPORT

International Application No
PCT/ES 95/00099

A. CLASSIFICATION OF SUBJECT MATTER
IPC 6 F25B21/02

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 6 F25B

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 practical, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X Y	US,A,3 733 836 (CORINI) 22 May 1973 see column 2, line 22 - column 5, line 49; figures 1-4	1,4 2,3
Y	US,A,3 450 572 (RIETVELD) 17 June 1969 see column 2, line 32 - column 4, line 2; figures 1-7	2
Y	US,A,3 212 274 (EIDUS) 19 October 1965 see column 4, line 9 - line 32; figure 7	3
X	US,A,4 726 193 (BURKE) 23 February 1988 see column 2, line 18 - column 3, line 40; figures 1-3	1,4
X	WO,A,93 20392 (CIMACAR) 14 October 1993 see page 2, line 30 - page 4, line 23; figures 1-3	1,4

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[X] Further documents are listed in the continuation of box C.

[X] Patent family members are listed in annex.

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"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

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"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

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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
20 November 1995	23. 11. 95

Name and mailing address of the ISA	Authorized officer
European Patent Office, P.B. 5818 Patentlaan 2 NL - 2280 HV Rijswijk Tel. (+ 31-70) 340-2040, Tx. 31 651 epo nl, Fax (+ 31-70) 340-3016	Boets, A

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INTERNATIONAL SEARCH REPORT

International Application No
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C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US,A,2 932 953 (BECKET) 19 April 1960 see column 2, line 43 - column 5, line 15; figures 1-11	1,4
P,X	US,A,5 398 510 (GILLEY) 21 March 1995 see column 3, line 21 - column 6, line 41; figures 1-3	1,2,4
A	US,A,3 040 539 (GAUGLER) 26 June 1962 see column 1, line 63 - column 3, line 56; figures 1-4	1,2,4
A	US,A,3 137 141 (KISTLER) 16 June 1964 see column 1, line 39 - column 3, line 31; figures 1-6	1,4
A	US,A,3 247 577 (JAREMUS) 26 April 1966	

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