US 20080236173A1

(19) **United States**

(12) **Patent Application Publication**

Shin et al.

(10) **Pub. No.: US 2008/0236173 A1**

(43) **Pub. Date: Oct. 2, 2008**

(54) **MAGNETIC HEAT EXCHANGING UNIT FOR MAGNETIC REFRIGERATOR**

(75) Inventors: **Seung Hoon Shin**, Seoul (KR); **Dong Kwan Lee**, Seoul (KR)

Correspondence Address:
EDELL, SHAPIRO & FINNAN, LLC
1901 RESEARCH BOULEVARD, SUITE 400
ROCKVILLE, MD 20850 (US)

(73) Assignee: **DAEWOO ELECTRONICS CORPORATION**, Seoul (KR)

(21) Appl. No.: **12/118,297**

(22) Filed: **May 9, 2008**

Related U.S. Application Data

(63) Continuation of application No. PCT/KR2006/004671, filed on Nov. 9, 2006.

(30) **Foreign Application Priority Data**

Nov. 10, 2005 (KR) 10-2005-0107307

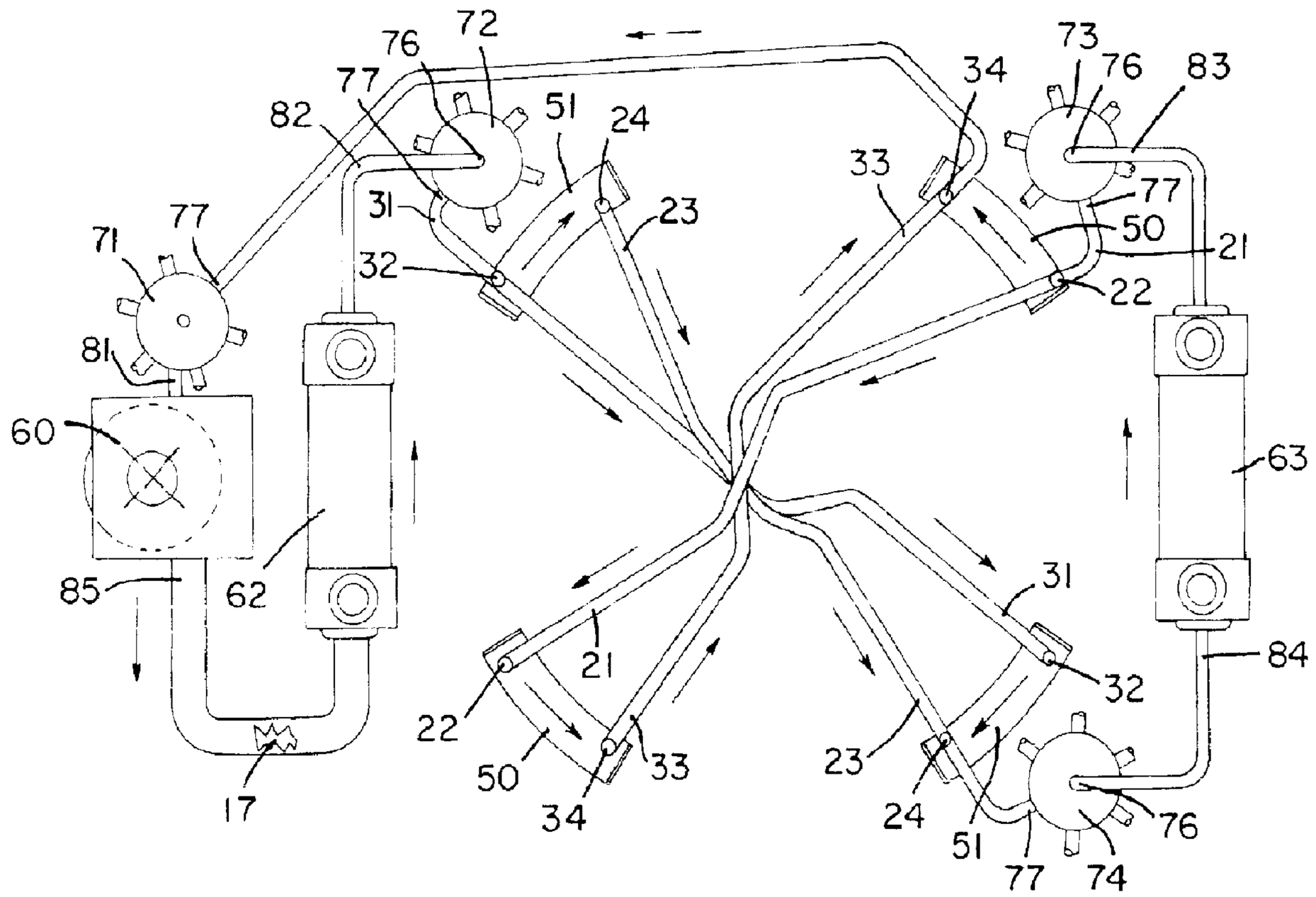
Publication Classification

(51) **Int. Cl.**
F25B 21/00 (2006.01)

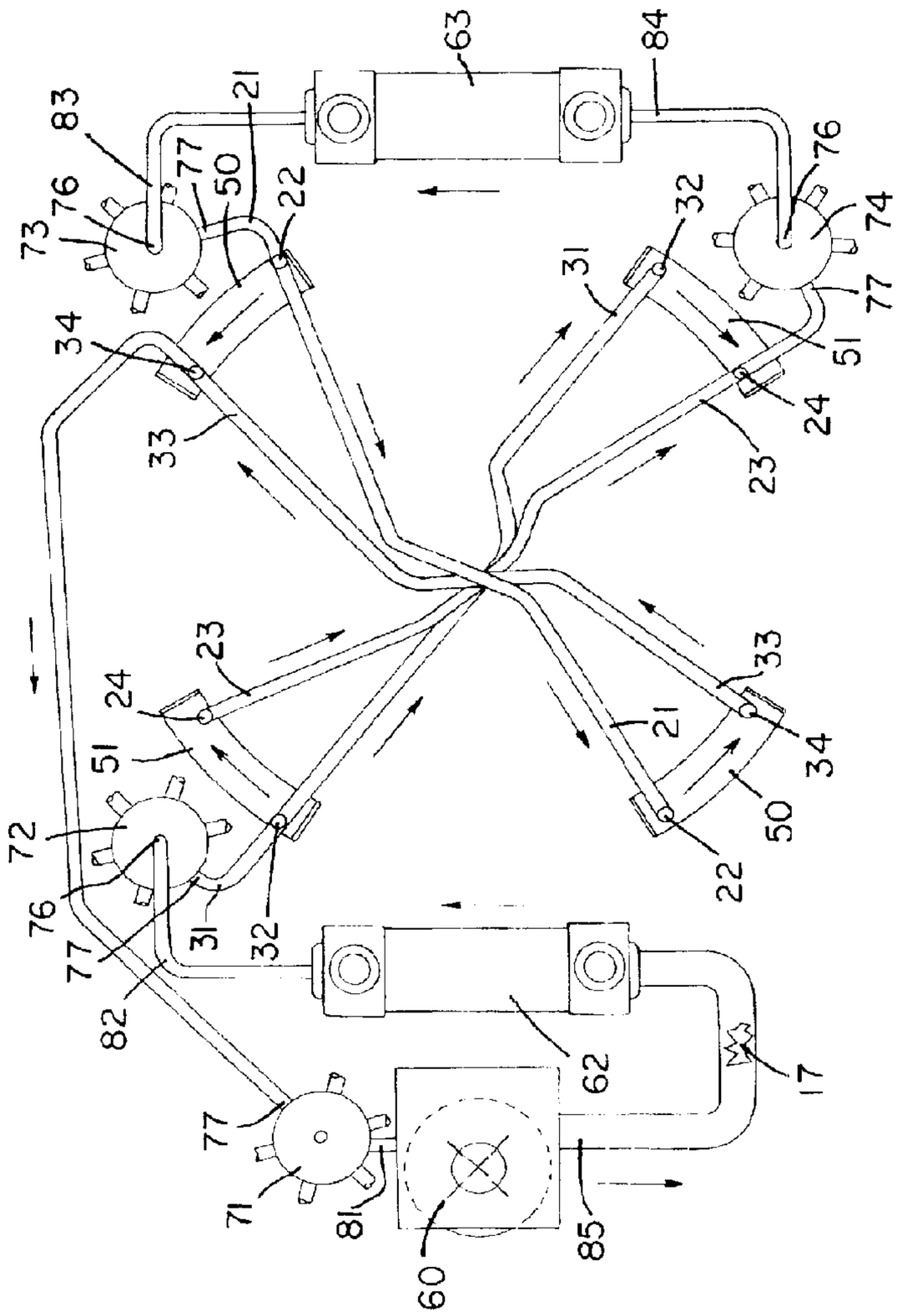
(52) **U.S. Cl.** **62/3.1**

(57) **ABSTRACT**

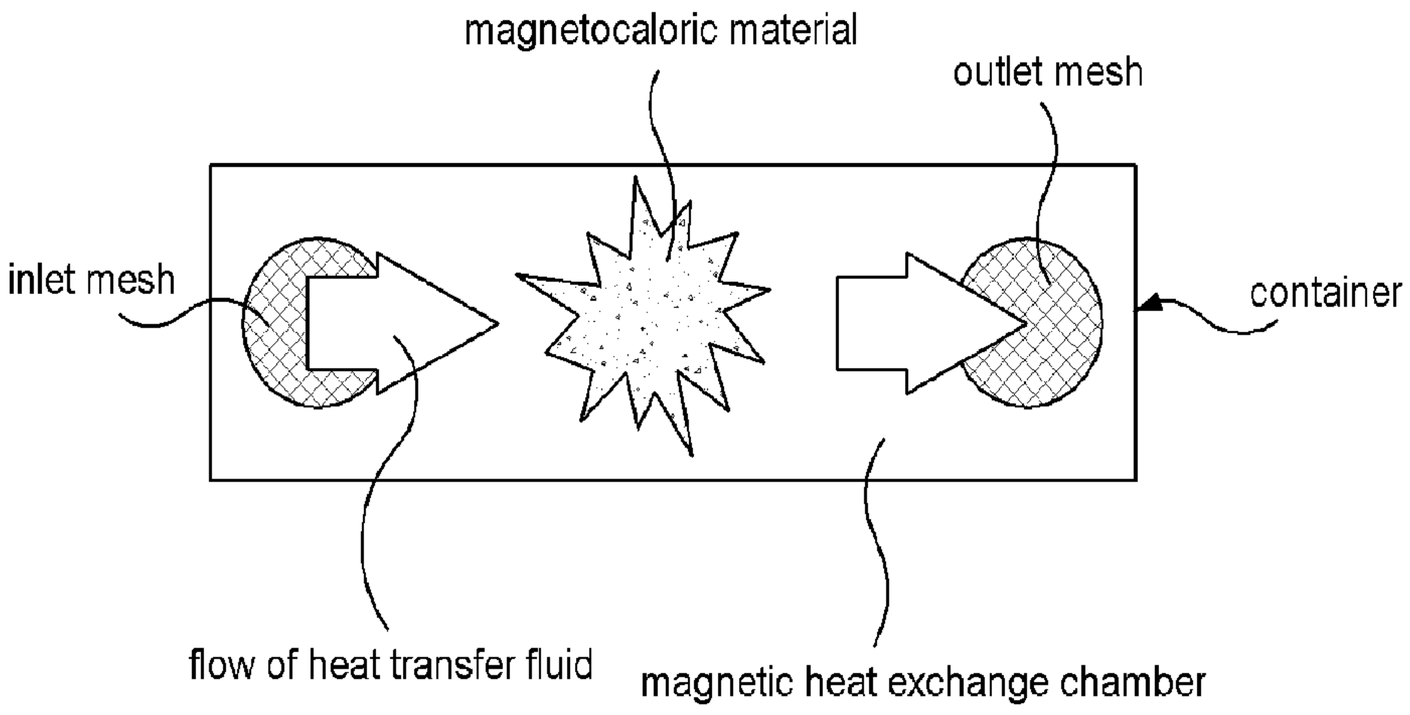
A magnetic refrigerator includes a magnetic heat exchange unit including a magnet.



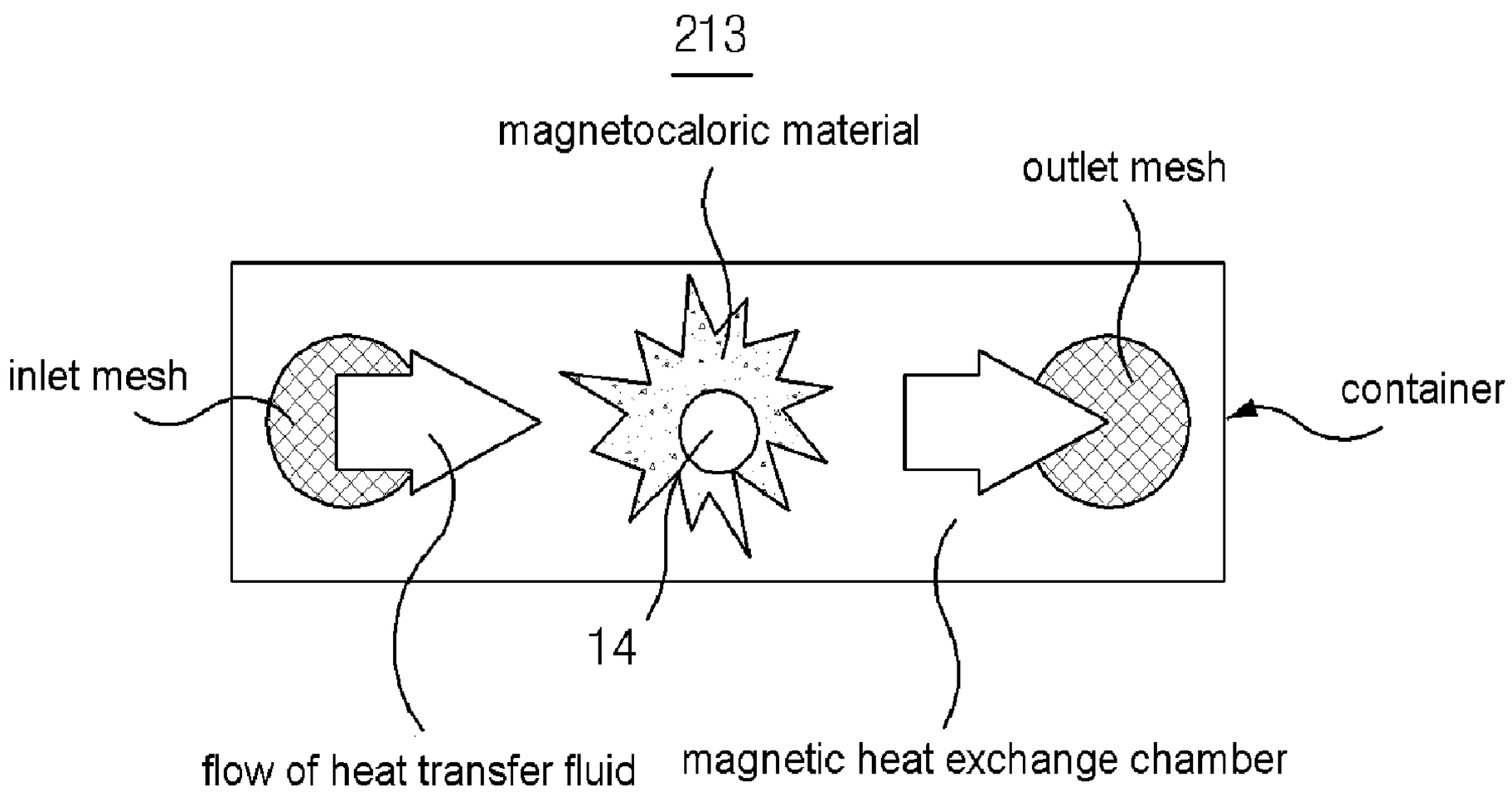
[Fig. 1]


63
84
83
21
77
50
22
73
76
76
32
74
31
77
34
51
33
24
23
23
24
33
21
51
34
50
72
22
76
31
32
77
82
62
17
77
71
81
85
60

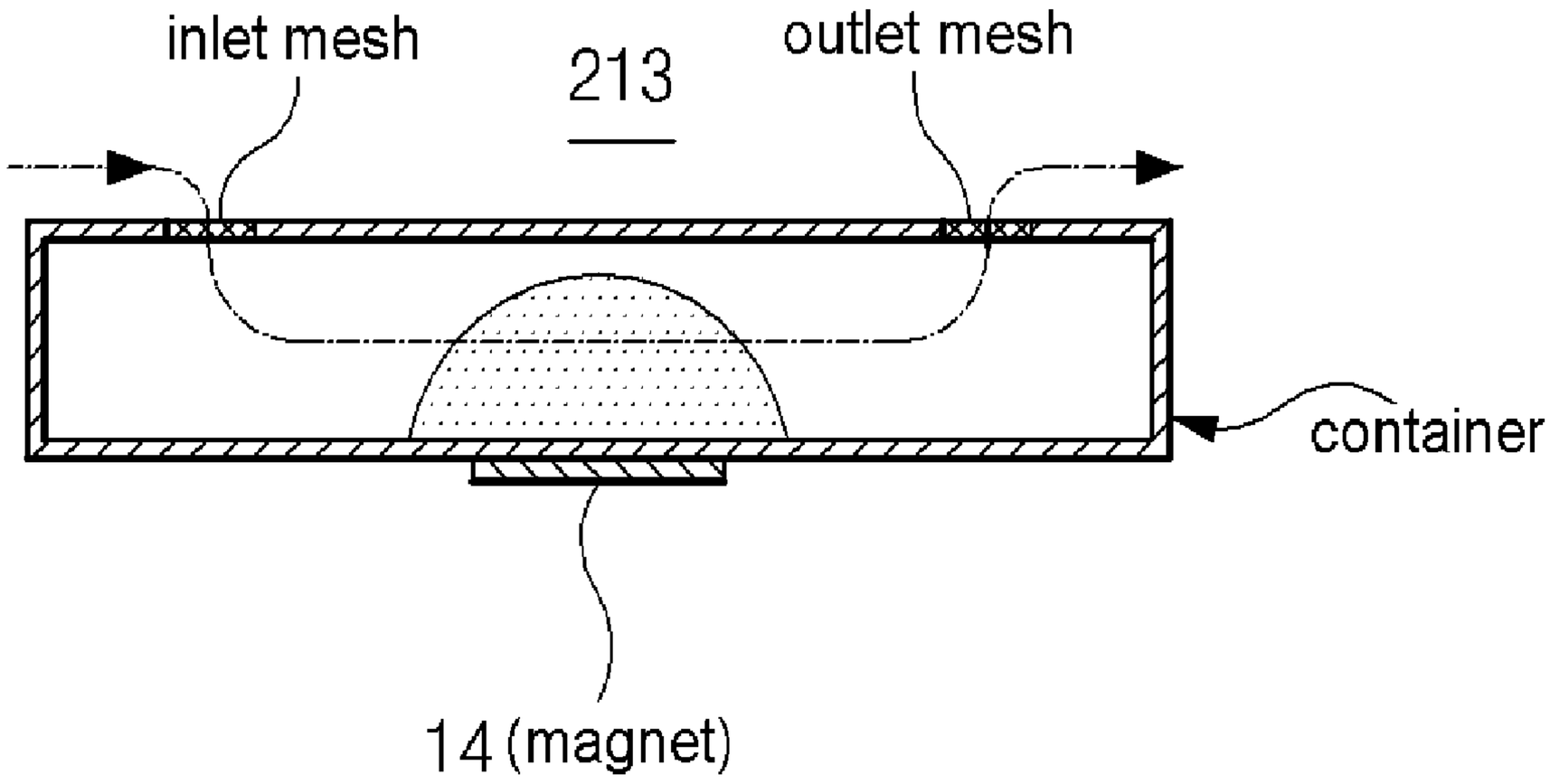
[Fig. 2]


13
magnetocaloric material
outlet mesh
inlet mesh
container
flow of heat transfer fluid
magnetic heat exchange chamber

[Fig. 3]


213
magnetocaloric material
outlet mesh
inlet mesh
container
14
flow of heat transfer fluid
magnetic heat exchange chamber

[Fig. 4]


inlet mesh
213
outlet mesh
container
14 (magnet)

MAGNETIC HEAT EXCHANGING UNIT FOR MAGNETIC REFRIGERATOR

CROSS REFERENCE TO RELATED APPLICATIONS

[0001] This application is a continuation of International Application No. PCT/KR2006/004671, filed on Nov. 9, 2006, entitled "Magnetic Heat-Exchanging Unit for Magnetic Refrigerator," which claims priority under 35 U.S.C. §119 to Application No. KR 10-2005-0107307 filed on Nov. 10, 2005, the entire contents of which are hereby incorporated by reference.

FIELD OF THE INVENTION

[0002] The present invention relates to a magnetic heat exchange unit for a magnetic refrigerator including a magnet.

BACKGROUND

[0003] A conventional magnetic refrigerator is disclosed in U.S. Pat. No. 6,668,560. As shown in FIGS. **1** and **2**, in accordance with the conventional magnetic refrigerator, while a heat transfer fluid **17** entering into a cold side inlet port **22** through a cold side inlet port pipe **21** flows to a hot side outlet port **34**, the heat transfer fluid **17** absorbs a heat generated by a magnetocaloric effect of a magnetocaloric material **12** having a magnetic field applied thereto and exits to a hot side outlet port pipe **33** through a hot side outlet port ports **34** to cool the magnetocaloric material **12**. A hot side sequentially passes the hot side outlet port pipe **33**, a valve **71**, a pump **60**, and a hot heat exchanger **62** and flows into a magnetic heat exchange compartment **13**. In a hot side inlet port pipe **31**, the hot side is divided into the hot side inlet port pipe **31** and a cold side outlet port **23**, and meets a cold side at a cold side outlet port pipe **24** and proceed to a valve **74**. When the hot side moves from a hot side inlet port **32** to the cold side outlet port pipe **24**, the hot side is cooled by passing the magnetocaloric material **12** already cooled by the hot side. The cold side that has passed through the valve **74** passes a cold heat exchanger **63** and flows to pipes **83** and **21** to repeat a cycle (a detailed description is omitted. See U.S. Pat. No. 6,668,560 for omitted reference numerals).

[0004] However, the conventional magnetic heat exchange unit **13** comprises a magnetic heat exchange compartment including a container containing the magnetocaloric material passing a flow of the heat transfer fluid.

[0005] When the heat transfer fluid enters through an inlet mesh, passes through the heat transfer fluid and exits via a outlet mesh, a separation of the heat transfer fluid in a form of a powder and the heat transfer fluid is established by the outlet mesh, thereby the heat transfer fluid is lost.

[0006] Moreover, the heat transfer fluid is accumulated at the outlet mesh which the exit of the heat transfer fluid according to an intensity of a flow of the heat transfer fluid to block the flow of the heat transfer fluid.

SUMMARY

[0007] It is an object of the present invention to provide a magnetic heat exchange unit for a magnetic refrigerator that prevents a loss of a heat transfer fluid and that allows the heat transfer fluid to flow smoothly.

[0008] In order to achieve the above-described object, there is provided a magnetic heat exchange unit, comprising: a container including an inlet port, an outlet port and a magnetic heat exchange chamber; a magnetocaloric material contained in the magnetic heat exchange chamber, the magnetocaloric material exchanging heat by allowing a flow of a heat transfer fluid to pass through; and a magnet for applying an attractive force to the magnetocaloric material.

[0009] In accordance with the magnetic heat exchange unit, the loss of the magnetocaloric material is suppressed by holding the magnetocaloric material with the magnet, thereby allowing the heat transfer fluid to flow smoothly.

[0010] The magnet may be attached to the container or may be disposed in the magnetocaloric material.

[0011] The magnetic heat exchange unit in accordance with the present invention may further comprise a mesh disposed at the inlet port and the outlet port, respectively to further prevent the loss of the magnetocaloric material.

[0012] In addition, it is preferable that the magnetocaloric material comprises a gadolinium.

[0013] According to present invention, a magnetic heat exchange unit for a magnetic refrigerator that prevents a loss of a heat transfer fluid and that allows the heat transfer fluid to flow smoothly can be provided.

BRIEF DESCRIPTION OF THE DRAWINGS

[0014] FIG. **1** is a plan view illustrating a heat transfer fluid in a conventional rotational magnet magnetic refrigerator.

[0015] FIG. **2** is a plan view exemplifying a magnetic heat exchange unit including a magnetocaloric material of FIG. **1**.

[0016] FIGS. **3** and **4** are a plan view and a lateral view respectively exemplifying a magnetic heat exchange unit including a magnetocaloric material in accordance with a preferred embodiment of the present invention.

DETAILED DESCRIPTION

[0017] The above-described objects and other objects and characteristics and advantages of the present invention will now be described in detail with reference to the accompanied drawings.

[0018] FIGS. **3** and **4** are a plan view and a lateral view respectively exemplifying a magnetic heat exchange unit including a magnetocaloric material in accordance with a preferred embodiment of the present invention.

[0019] As shown in FIGS. **3** and **4**, the magnetic heat exchange unit **213** comprises a container, a magnetocaloric material contained in the container and a magnet **14** for applying an attractive force to the magnetocaloric material.

[0020] A magnetic heat exchange compartment containing the magnetocaloric material, and an inlet port and an outlet port for passing a flow of the heat transfer fluid are formed in the container. A pipe is connected to the inlet port and the outlet port.

[0021] It is preferable that the inlet port **16** and the outlet port **17** are arranged on a plane as shown in FIG. **4** in order to prevent the loss of the heat transfer fluid and to allow the heat transfer fluid to flow smoothly.

[0022] The magnetocaloric material has a characteristic wherein a temperature thereof is varied when a magnetic field is applied. A material having such characteristic includes a gadolinium (Gd) of a fine powder type. The gadolinium has pores having a high osmosis to the flow of the heat transfer fluid, and a superior absorption and emission of a heat. It is preferable that the magnet **14** is attached to the container or disposed in the magnetocaloric material.

[0023] As shown in FIGS. **3** and **4**, when the magnet is attached to the container, the magnet is attached on an outer wall (or an inner wall) of the container to attract the magnetocaloric material.

[0024] The magnet **14** causes the magnetocaloric material to lump together so that the loss by the flow of the heat transfer fluid is prevented.

[0025] In addition, the accumulation of the magnetocaloric material at the outlet port **17** is minimized to allow the heat transfer fluid to flow smoothly.

[0026] Particularly, the inlet mesh and the outlet mesh are installed at the inlet port and the outlet port, the loss of the magnetocaloric material is suppressed even more.

[0027] While the present invention has been particularly shown and described with reference to the preferred embodiment thereof, it will be understood by those skilled in the art that various changes in form and details may be effected therein without departing from the spirit and scope of the invention as defined by the appended claims

[0028] As described above, the magnetic heat exchange unit in accordance with the present invention provides following advantages.

[0029] The loss of the magnetocaloric material is suppressed by holding the magnetocaloric material with the magnet, and the magnetocaloric material the heat transfer fluid may be easily separated, thereby preventing the blocking of the outlet port and allowing the heat transfer fluid to flow smoothly.

[0030] In addition, when the meshes are installed at the inlet port and the outlet port, the loss of the magnetocaloric material is minimized by a filtering even when the magnetocaloric material is lost.

What is claimed is:

1. A magnetic heat exchange unit, comprising:

a container including an inlet port, an outlet port and a magnetic heat exchange chamber;

a magnetocaloric material contained in the magnetic heat exchange chamber, the magnetocaloric material exchanging heat by allowing a flow of a heat transfer fluid to pass through; and

a magnet for applying an attractive force to the magnetocaloric material.

2. The magnetic heat exchange unit in accordance with claim **1**, wherein the magnet is attached to the container.

3. The magnetic heat exchange unit in accordance with claim **1**, wherein the magnet is disposed in the magnetocaloric material.

4. The magnetic heat exchange unit in accordance with claim **1**, further comprising a mesh disposed at the inlet port and the outlet port, respectively.

5. The magnetic heat exchange unit in accordance with claim **4**, wherein the magnetocaloric material comprises gadolinium.

* * * * *