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(19) **United States**(12) **Patent Application Publication****Luo et al.**(10) **Pub. No.: US 2010/0230084 A1**(43) **Pub. Date: Sep. 16, 2010**(54) **TUBE-FIN TYPE HEAT EXCHANGE UNIT
WITH HIGH PRESSURE RESISTANCE****Publication Classification**(75) Inventors: **Qin Luo**, Nanning City (CN);
Yuanhai Wei, Nanning City (CN)(51) **Int. Cl.**
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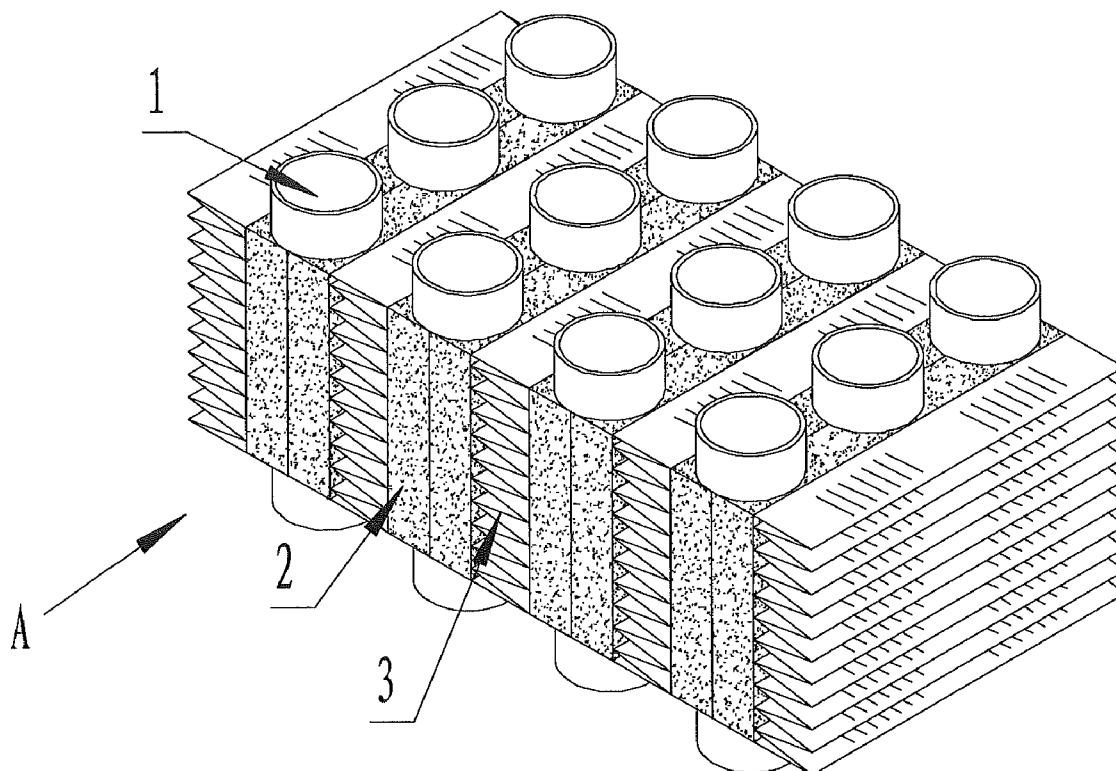
Correspondence Address:

SCHMEISER, OLSEN & WATTS
22 CENTURY HILL DRIVE, SUITE 302
LATHAM, NY 12110 (US)(73) Assignee: **NANNING BALING
TECHNOLOGY INC.,**
NANNING CITY (CN)(21) Appl. No.: **12/485,085**(22) Filed: **Jun. 16, 2009**(30) **Foreign Application Priority Data**

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(57) **ABSTRACT**

The present invention disclosed a tube-fin type heat exchange unit with high pressure resistance, wherein said heat exchange unit comprises a plurality of tubes, foam metal and a plurality of heat dissipation fins; said tubes and said heat dissipation fins are spaced arranged; said foam metal is located in the interspace between said tubes and the superface of said heat dissipation fins; and solder is disposed between said tubes and said foam metal, and between said foam metal and the superface of said heat dissipation fins to make a firm connection. The heat exchange unit of the present invention has good heat exchange performance, high pressure resistance and small volume, so it is suitable for volume production and could be widely applied in heat exchangers for vehicle, industry and civil use.



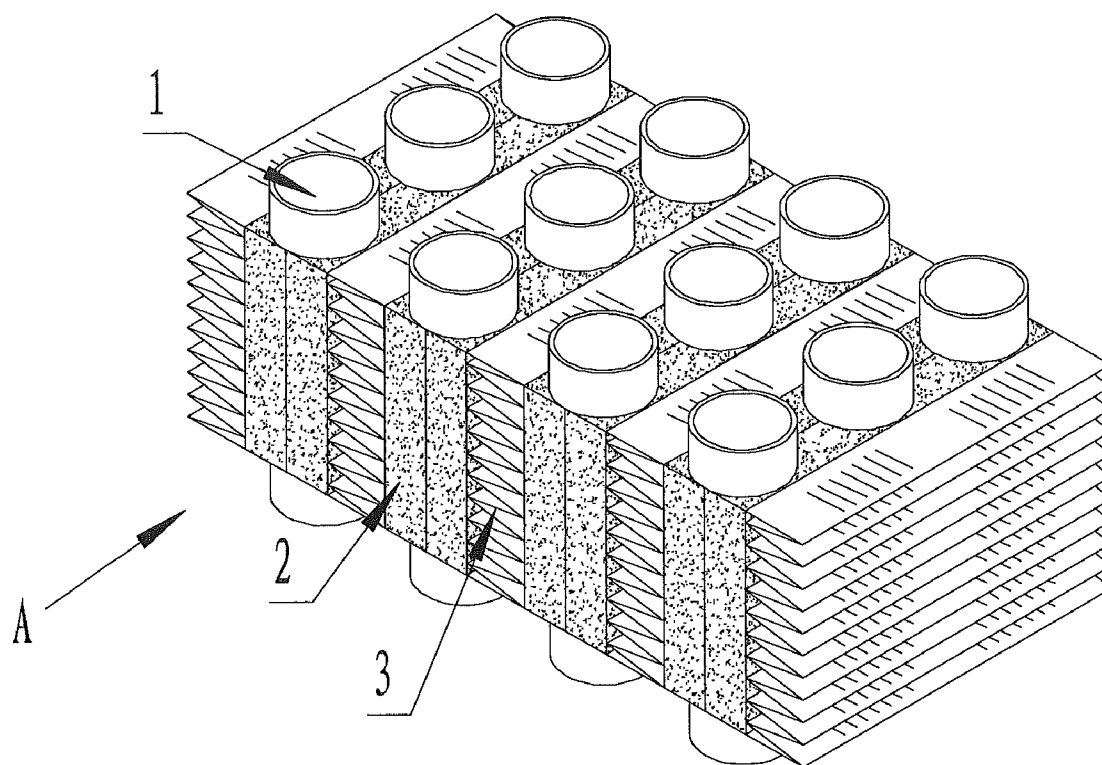


Fig 1

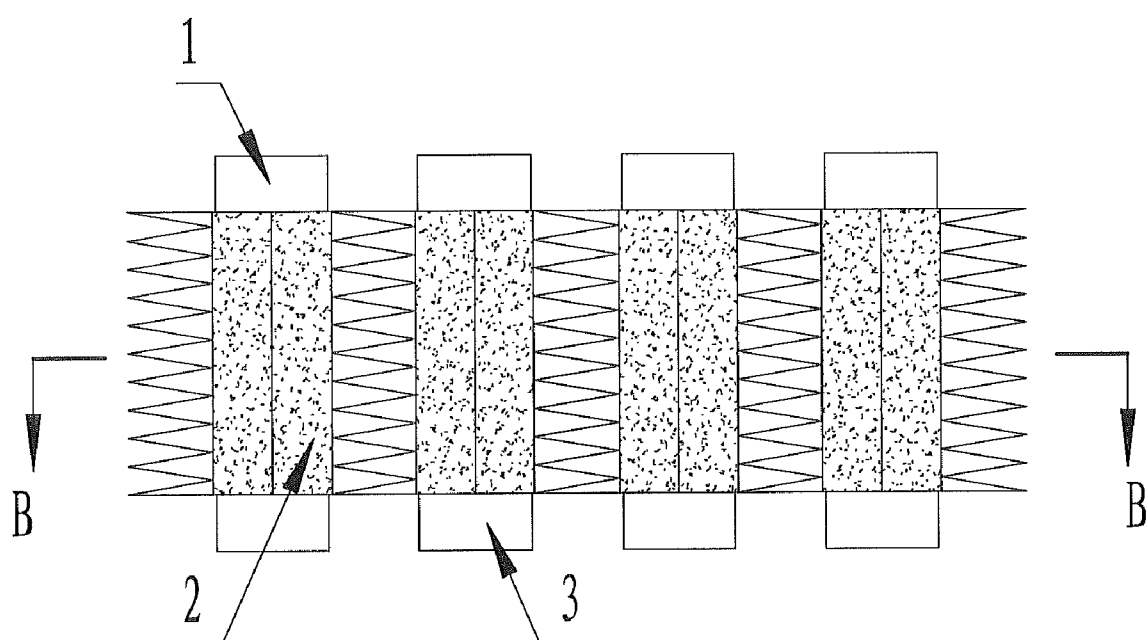


Fig 2

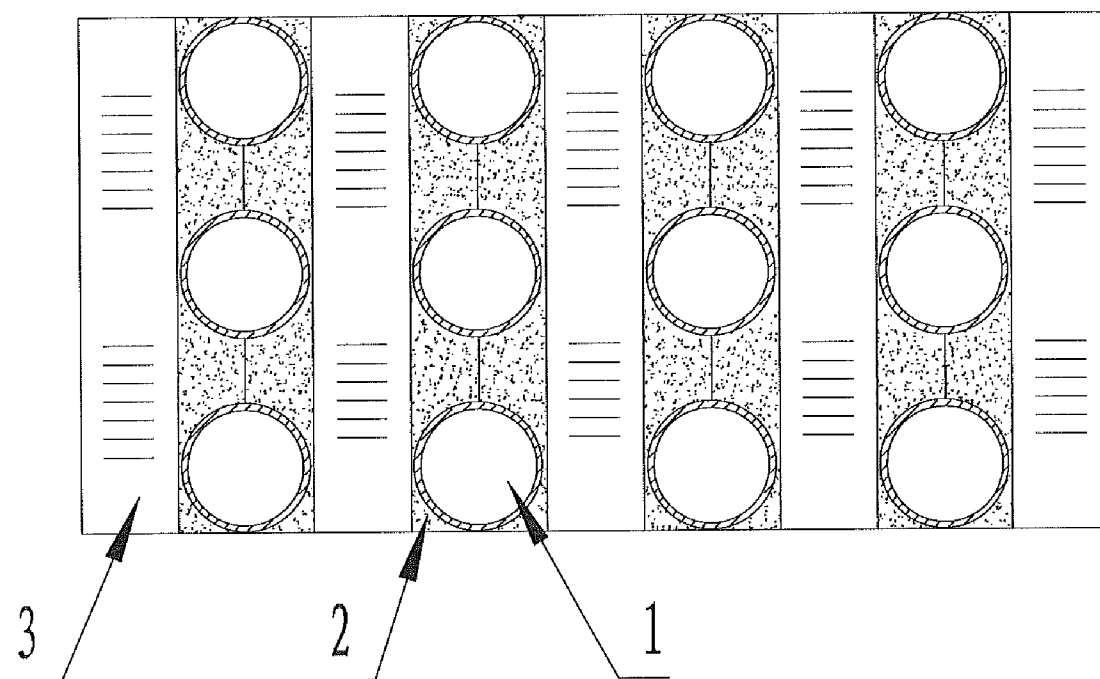


Fig 3

TUBE-FIN TYPE HEAT EXCHANGE UNIT WITH HIGH PRESSURE RESISTANCE

FIELD OF THE INVENTION

[0001] The present invention relates generally to a heat exchanger for vehicle, industry and civil use, and more specially relates to a tube-fin type heat exchange unit with high pressure resistance.

BACKGROUND OF THE INVENTION

[0002] The general high-pressure resistant heat exchangers use filmed tubes, ribbed tubes or tube bundles as core heat exchange units. Although such types of heat exchange units are able to work under high pressure, the surface heat transfer areas thereof are small and the heat exchange efficiency thereof is low. In order to obtain satisfactory heat exchange efficiency, such heat exchange units must have large volume, which results in huge volume, heavy weight, high cost and high energy consumption of the heat exchangers.

[0003] The general compact heat exchangers use tube-fin type heat exchange units as core heat exchange units. Although such heat exchange units have large surface heat transfer areas and high heat exchange efficiency, they could not work under the pressure over 0.4 Mpa. So they could not be used in heat exchanger equipments which have high working pressure, such as oil coolers, water heaters, steam boilers and so on.

[0004] In recent years, research on compact heat exchange units consisting of foam metal and tubes has been conducted. And the foam metal is used for replacing the finned tubes. However, there exists a relationship of powder series between the pressure drawdown and the flow rate in foam metal, such compact heat exchange units could only be used in the case of low flow rate for the high flow resistance thereof. Further, the foam metal is easily blocked and has high requirement for environmental cleanliness, which restricts the application thereof.

SUMMARY OF THE INVENTION

[0005] The present invention is to provide a tube-fin type heat exchange unit with high pressure resistance, in order to solve the above-described problems, wherein the heat exchange unit of the present invention has a large heat transfer surface, high heat exchange efficiency and high pressure resistance.

[0006] The heat exchange unit of the present invention comprises a plurality of tubes, foam metal and a plurality of heat dissipation fins. The tubes and the heat dissipation fins are spaced arranged. The foam metal is located in the interspace between the tubes and the superface of the heat dissipation fins. Solder is disposed between the tubes and the foam metal, and between the foam metal and the superface of the heat dissipation fins. The tube, the heat dissipation fin and the foam metal are jointed by the solder to form a heat exchange cell which is repeatedly arranged to form the heat exchange unit of the present invention. The high-pressure liquid flows within the tubes, while the low-pressure liquid flows within the heat dissipation fins.

[0007] Other advantages and novel features will become more apparent from the following detailed description when

taken in conjunction with the accompanying drawings. In the drawings, all the views are schematic.

BRIEF DESCRIPTION OF THE DRAWINGS

[0008] FIG. 1 is a tridimensional structural diagram of the heat exchange unit of the present invention;

[0009] FIG. 2 is a view of FIG. 1 in direction A;

[0010] FIG. 3 is a sectional view of FIG. 2 in direction B-B.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

[0011] The present invention will be described further referring to the accompanying drawings and the embodiments.

[0012] Referring to FIG. 1, the tube-strip type heat exchange unit with high pressure resistance of the present invention comprises a plurality of tubes (1), foam metal (2) and a plurality of heat dissipation fins (3). Tubes (1) and heat dissipation fins (3) are spaced arranged. Foam metal (2) is located in the interspace between tubes (1) and the superface of heat dissipation fins (3). Solder is disposed between tubes (1) and foam metal (2), and between foam metal (2) and heat dissipation fins (3). So tubes (1), foam metal (2) and heat dissipation fins (3) are jointed by soldering to form the heat exchange unit.

[0013] In details, the diameter and wall thickness of tubes (1) could be modified according to the volume and pressure resistance requirement for the heat exchange unit. Tubes (1) could be arranged in a single line or in multiple lines, depending on the thickness requirement for the heat exchange core body. Tubes (1) could be contacted with each other or be separated from each other in a certain distance when they are arranged in multiple lines. Tubes with ribs or fins inside could be used to avoid the boundary layer formed by the liquid on the inner surface of tubes (1) and enhance the heat transfer coefficient.

[0014] Heat dissipation fins (3) have a wavy shape or a rectangular shape to obtain large surface heat transfer areas and high heat transfer efficiency. Heat dissipation fins (3) of wavy shape could be in the form of single wave or double wave. Especially, heat dissipation fins (3) could be a persiennes structure, which have a heat transfer efficiency twice higher than that of heat exchange units comprising finned tubes. The wave crests of the wavy shaped heat dissipation fin and the upper surface of the rectangular shaped heat dissipation fin seem as superface.

[0015] One side of foam metal (2) is flat and closely contacts with the superface of heat dissipation fins (3), while the other side of foam metal (2) has a circular-arc shape and enwraps tubes (1). Foam metal (2) could have an open-cell structure or a close-cell structure, and could be formed by direct molding or impact molding from blank material.

[0016] The heat exchange unit of the present invention is assembled by heat dissipation fins (3), foam metal (2) and tubes (1) in a repeated form. Solder is disposed between tubes (1) and foam metal (2), and between foam metal (2) and the wave crests of heat dissipation fins (3) of wavy shape. Tubes (1), foam metal (2) and heat dissipation fins (3) are impacted and jointed by the solder in a soldering furnace, to form the heat exchange unit of the present invention.

[0017] The present invention uses tubes as passages for high-pressure liquid, so the heat exchange unit could work under the pressure of 1~6 Mpa. In addition, the interspace

between the tubes and the superface the heat dissipation fins is filled with foam metal for the good plasticity thereof to overcome the defect of small contact areas between the tubes and the heat dissipation fins. The heat transfer between the tubes and the heat dissipation fins is rapid and high efficient for the good heat conductivity of the foam metal. Furthermore, the heat dissipation fins with a wavy or rectangular shape have large heat transfer surface, which makes the heat transfer efficiency of the heat exchange unit of the present invention 50% higher than that of the existing heat exchange units with finned tubes or tube bundles, and makes the volume of the heat exchange unit of the present invention 30%~50% smaller than that of the existing heat exchange units with finned tubes or tube bundles. Also, the heat exchange unit of the present invention has low flow resistance, which is hardly blocked and easy to clean. Thus, the heat exchange unit of the present invention can be widely applied in heat exchangers for vehicle, industry and civil use.

What claimed is:

1. A tube-fin type heat exchange unit with high pressure resistance, wherein said heat exchange unit comprises a plurality of tubes, foam metal and a plurality of heat dissipation fins; said tubes and said heat dissipation fins are spaced arranged; said foam metal is located in the interspace between said tubes and the superface of said heat dissipation fins; and solder is disposed between said tubes and said foam metal, and between said foam metal and the superface of said heat dissipation fins to make a firm connection.

2. A tube-fin type heat exchange unit with high pressure resistance according to claim 1, wherein said tubes have ribs or fins inside.

3. A tube-fin type heat exchange unit with high pressure resistance according to claim 1, wherein one side of said foam metal is flat and closely contacts with the superface of said heat dissipation fins, and the other side of said foam metal has a circular-arc shape and enwraps said tubes.

4. A tube-fin type heat exchange unit with high pressure resistance according to claim 1, wherein said foam metal has an open-cell structure or a close-cell structure.

5. A tube-fin type heat exchange unit with high pressure resistance according to claim 1, wherein said heat dissipation fins have a wavy shape.

6. A tube-fin type heat exchange unit with high pressure resistance according to claim 5, wherein said heat dissipation fins of wavy shape are in the form of single wave or double wave.

7. A tube-fin type heat exchange unit with high pressure resistance according to claim 6, wherein said foam metal is located in the interspace between said tubes and the wave crests of said heat dissipation fins; and said solder is disposed between said tubes and said foam metal, and between said foam metal and the wave crests of said heat dissipation fins.

8. A tube-fin type heat exchange unit with high pressure resistance according to claim 1, wherein said heat dissipation fins have a rectangular shape.

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