US 20140110095A1

(19) **United States**

(12) **Patent Application Publication**

(10) **Pub. No.: US 2014/0110095 A1**

(43) **Pub. Date: Apr. 24, 2014**

Chang

(54) **HEAT-DISSIPATING APPARATUS**

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(21) Appl. No.: **13/654,791**

(22) Filed: **Oct. 18, 2012**

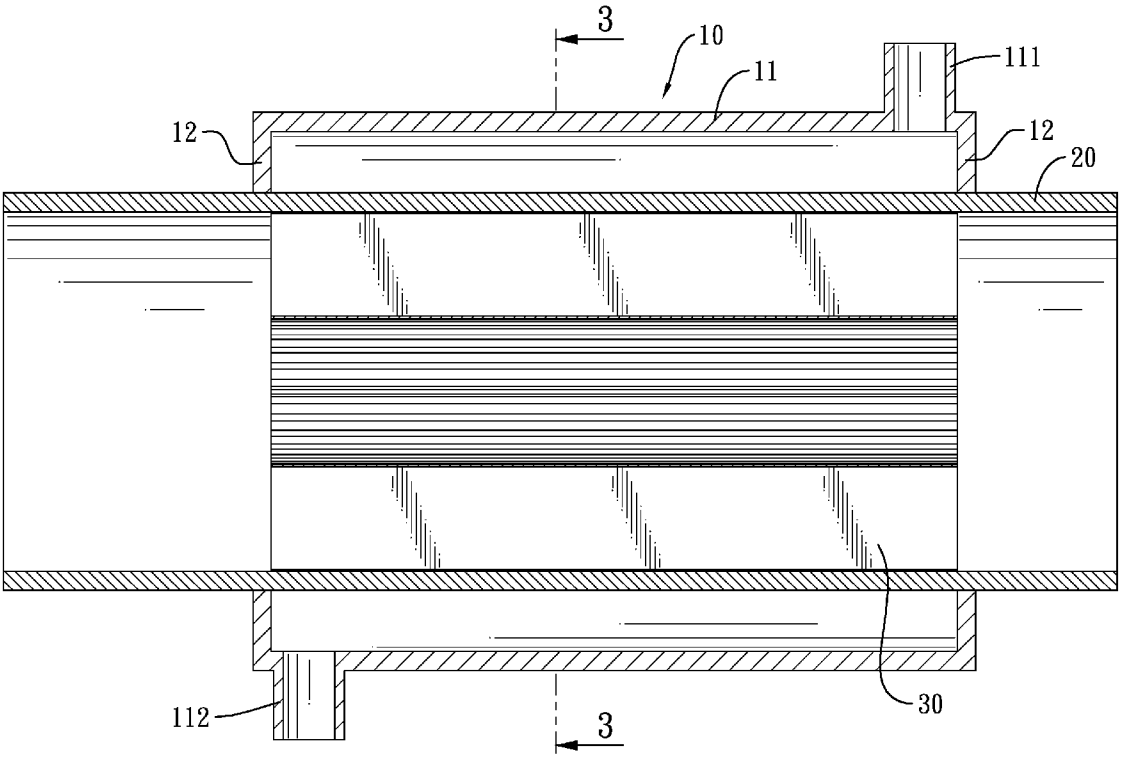
Publication Classification

(51) **Int. Cl.**
F28F 1/20 (2006.01)

(52) **U.S. Cl.**
USPC **165/181**

(57) **ABSTRACT**

A heat-dissipating apparatus has a cooling tube, a tubular conductor and a heat sink. The cooling tube has a body and an inlet and an outlet formed on the periphery of the body and communicating with an inner space of the body. The tubular conductor is mounted in the cooling tube with an outer surface of the tubular conductor engaging the inner rim of each open end to seal the open ends and defining a cooling chamber between the inner wall of the body and the tubular conductor. The heat sink is mounted inside the tubular conductor, and has multiple fins formed by continuously folding a metal sheet in a corrugated and annular form and abutting against an inner wall of the tubular conductor. The heat-dissipating apparatus increases the contact area between the heat sink and the tubular conductor and cooling channels, thereby providing a more satisfactory cooling effect.



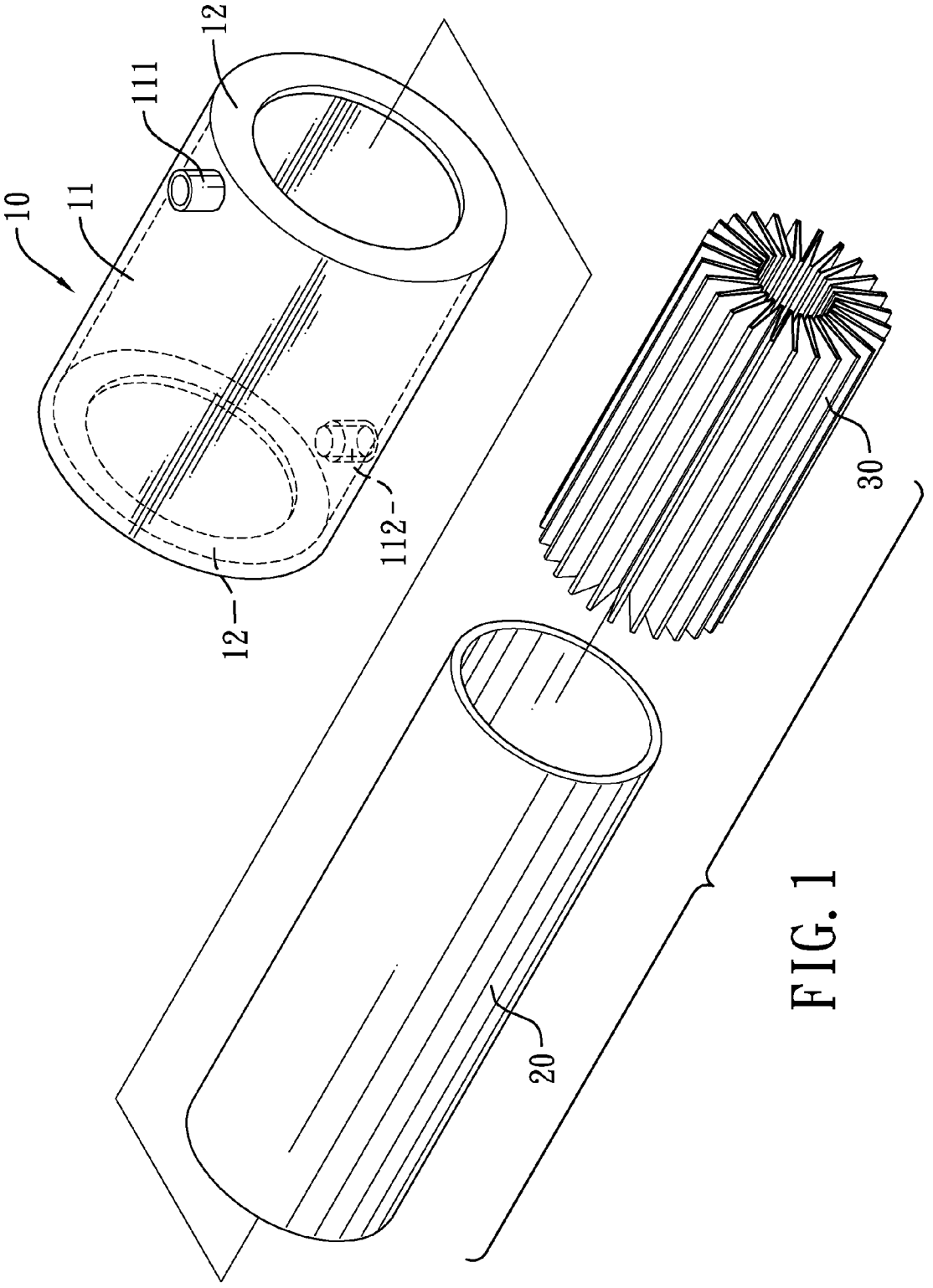


FIG. 1

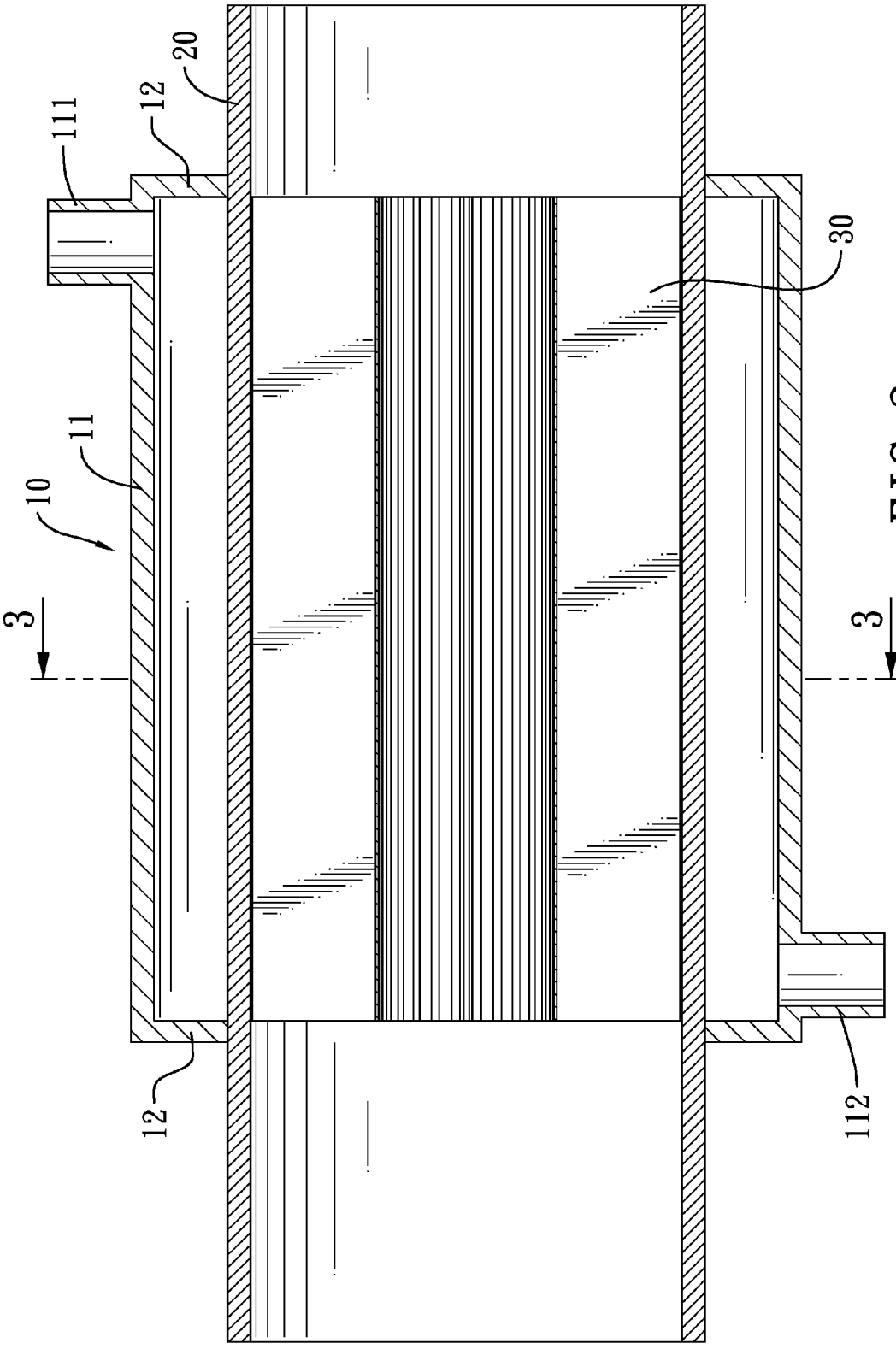


FIG. 2

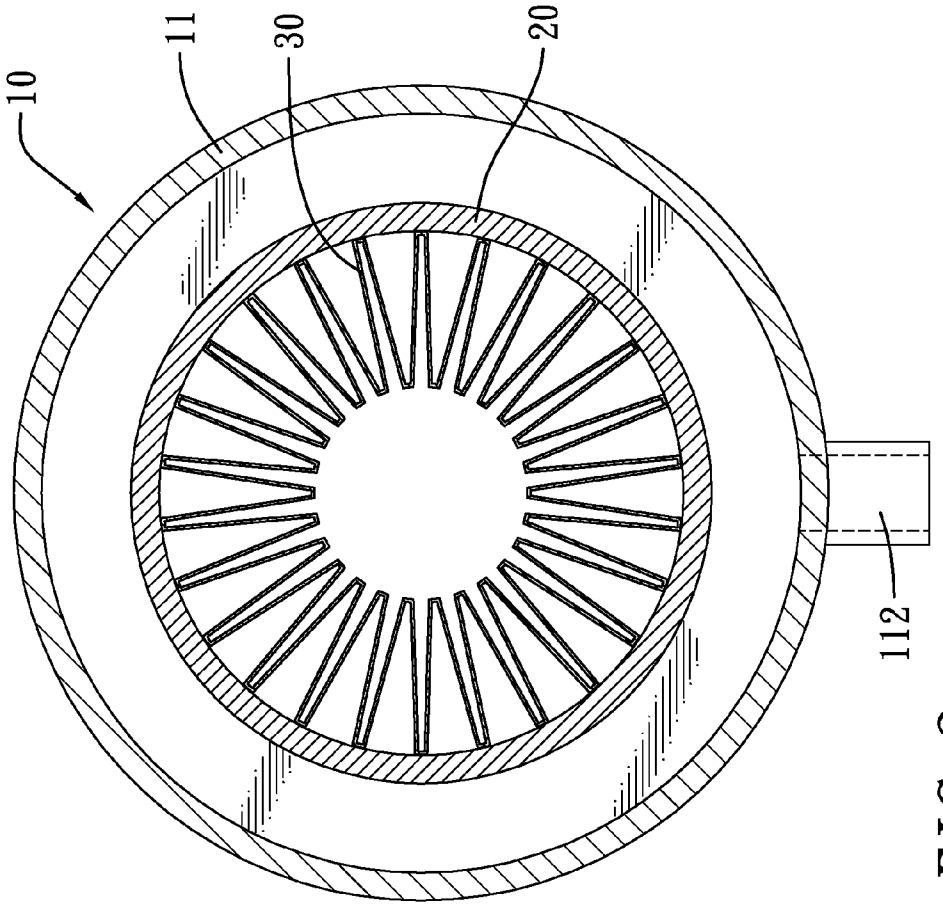


FIG. 3

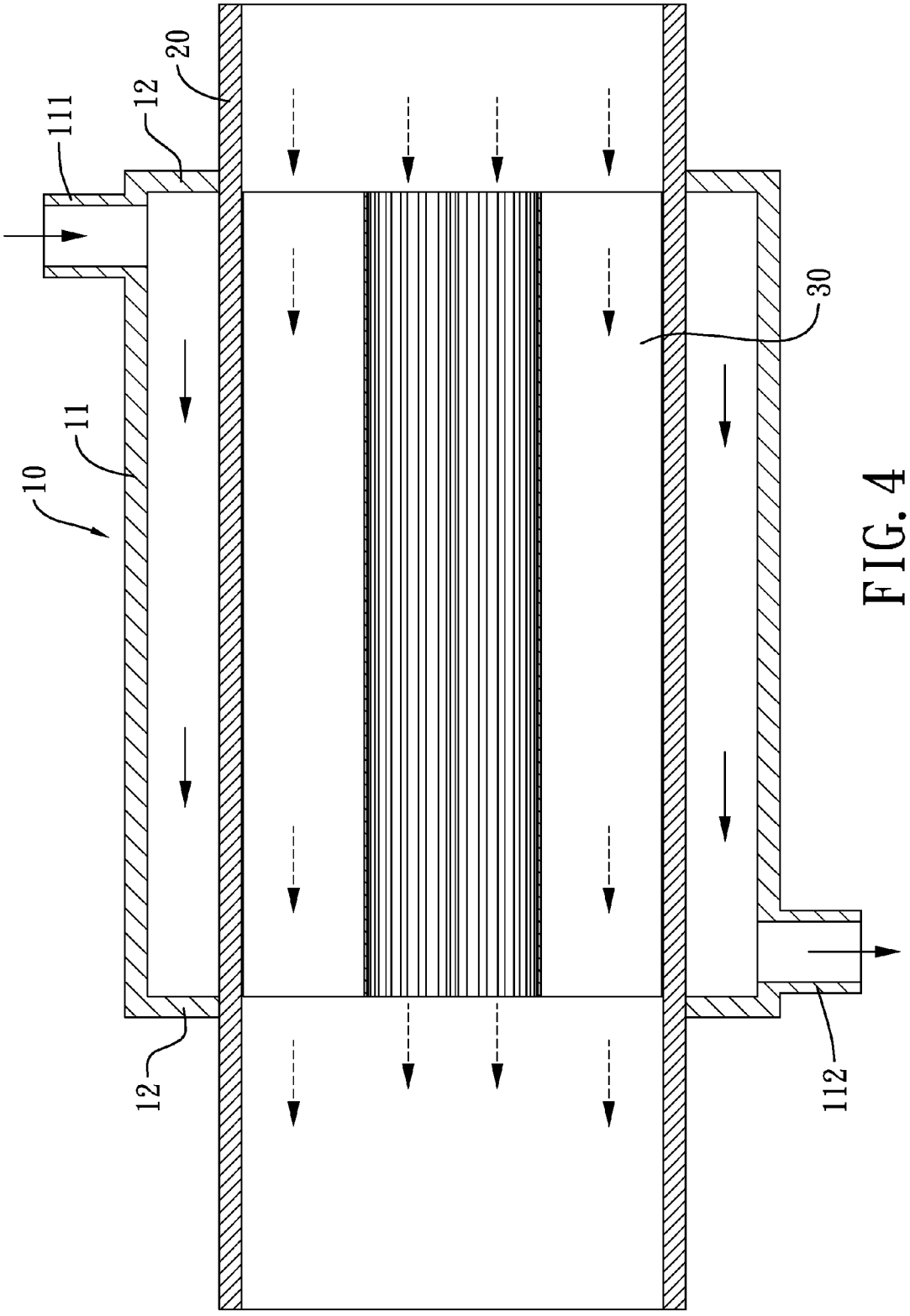


FIG. 4

HEAT-DISSIPATING APPARATUS

BACKGROUND OF THE INVENTION

[0001] 1. Field of the Invention

[0002] The present invention relates to a heat-dissipating apparatus and more particularly to a heat-dissipating apparatus providing a satisfactory heat-dissipating effect through an enhanced arrangement of heat transfer path.

[0003] 2. Description of the Related Art

[0004] Heating devices are one kind of mechanism extensively applied to various heat-generating equipments for lowering the temperature of the heat-generating equipments. Given a hydraulic machine as an example, friction is oftentimes caused among the mechanical parts of a power unit of the hydraulic machine while an engine of the power unit is running. Such friction constantly converts its kinetic force into heat to overheat all the mechanical parts of the hydraulic machine. To prevent a breakdown or fault of a machine after the machine has been operated for a while, lubricant inside a lubrication path of the machine plays a critical role. Such lubricant not only mitigates friction among mechanical parts but also transfers heat generated by mechanical parts to a heat-dissipating apparatus to lower the temperature of the mechanical parts, thereby providing a temperature-dropping effect to the power unit.

[0005] A conventional heat-dissipating apparatus currently used to lower temperature of lubricant has a tubular body, a fan, two end plates and multiple communicating pipes. The tubular body has two openings formed through two ends of the tubular body. The fan is mounted at one of the openings of the tubular body. The two end plates are spaced apart from each other and are securely mounted inside the tubular body to seal the two ends and define a cooling chamber. The tubular body further has an inlet duct and an outlet duct formed on two sides of a periphery of the tubular body to communicate with the cooling chamber. The communicating pipes are arranged in the cooling chamber with two ends of each communicating pipe respectively penetrating through the end plates and communicating with the ambient environment outside the tubular body for the air in the ambient environment to circulate through the communicating pipes. Each communicating pipe also has a heat-radiating fin mounted therein.

[0006] From the foregoing, when high-temperature liquid as a result of heat absorption flows in the tubular space through the inlet duct, heat of the liquid is transferred to the heat-radiating fin in each communicating pipe as the liquid contacts an outer surface of the communicating pipe. Meanwhile, the air flowing into each communicating pipe through the ambient environment carries away the heat transferred to the heat-radiating fin. Hence, before flowing to the outlet duct of the tubular body, the high-temperature liquid first drops its temperature to become a low-temperature liquid and returns to a working area for heat absorption and circulation.

[0007] Despite the foregoing heat-dissipating apparatus, the temperature-dropping effect provided by the heat-dissipating apparatus for cooling the high-temperature liquid is still not enough because the communicating pipes are distributed inside the tubular body and the contact area of the heat-radiating fin inside each communication pipe with the air in the ambient environment is limited.

SUMMARY OF THE INVENTION

[0008] An objective of the present invention is to provide a heat-dissipating apparatus with an enhanced cooling effect by increasing a contact area and cooling channels of the heat-dissipating apparatus.

[0009] To achieve the foregoing objective, the heat-dissipating apparatus has a cooling tube, a tubular conductor and a heat sink.

[0010] The cooling tube has a body, two open ends, an inlet and an outlet.

[0011] The body has two ends, a periphery, an inner wall and an inner space.

[0012] The two open ends are respectively formed at the two ends of the body. Each open end has an inner rim.

[0013] The inlet and the outlet are formed on the periphery of the body and communicate with an inner space defined by the body.

[0014] The tubular conductor is mounted in the cooling tube with an outer surface of the tubular conductor engaging the inner rim of each open end to seal the open ends, defines a cooling chamber between the inner wall of the body of the cooling tube and the tubular conductor, and has an inner wall.

[0015] The heat sink is made of a heat-conducting metal material, is mounted inside the tubular conductor, has multiple fins formed by continuously folding a metal sheet in a corrugated and annular form and abutting against an inner wall of the tubular conductor, and defines multiple cooling channels between the inner wall of the tubular conductor and the fins.

[0016] From the foregoing, high-temperature liquid enters the cooling chamber defined between the cooling tube and the tubular conductor through the inlet of the body, then flows out of the cooling tube through the outlet, and in the mean time, air in the ambient environment flows in the tubular conductor. As the liquid flowing in the cooling tube and the air in the ambient environment has a temperature difference, the heat arising from the temperature difference is conducted to the tubular conductor. The heat sink is mounted in the tubular conductor and contacts the inner wall of the tubular conductor to provide a larger heat-dissipating area. Accordingly, as long as air in the ambient environment continuously flows in the cooling channels between the tubular conductor and the heat sink to carry away heat on the heat sink, a satisfactory cooling effect for the high-temperature liquid can be provided.

[0017] Other objectives, advantages and novel features of the invention will become more apparent from the following detailed description when taken in conjunction with the accompanying drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

[0018] FIG. **1** is an exploded perspective view of a heat-dissipating apparatus in accordance with the present invention;

[0019] FIG. **2** is a cross-sectional side view of the heat-dissipating apparatus in FIG. **1**;

[0020] FIG. **3** is a cross-sectional end view of the heat-dissipating apparatus along line **3-3** in FIG. **2**; and

[0021] FIG. **4** is an operational cross-sectional side view of the heat-dissipating apparatus in FIG. **2**.

DETAILED DESCRIPTION OF THE INVENTION

[0022] With reference to FIGS. **1** and **2**, a heat-dissipating apparatus in accordance with the present invention has a cooling tube **10**, a tubular conductor **20** and a heat sink **30**.

[0023] The cooling tube **10** has a body **11**, two open ends **12**, an inlet **111** and an outlet **112**.

[0024] The open ends **12** are respectively formed at two ends of the body **11**. The inlet **111** and the outlet **112** are formed on a periphery of the body **11** and communicate with an inner space defined by the body **11**. In the present embodiment, the inlet **111** and the outlet **112** are respectively formed on two different positions on the periphery of the body **11** and are respectively adjacent to two ends of the body **11** such that liquid flowing into the cooling tube **10** through the inlet **111** can smoothly flow out of the outlet **112**.

[0025] The tubular conductor **20** is mounted in the cooling tube **10** with an outer surface of the tubular conductor **20** engaging an inner rim of each open end **12** to seal the open ends **12**, and defines a cooling chamber between an inner wall of the body of the cooling tube **10** and the tubular conductor **20**.

[0026] With reference to FIG. **3**, the heat sink **30** is made of a heat-conducting metal material, is mounted inside the tubular conductor **20**, and has multiple fins. The fins are formed by continuously folding a metal sheet in a corrugated and annular form, and abut against an inner wall of the tubular conductor **20** to increase a contact area of the heat sink **30** with air of the ambient environment. The heat sink **30** further defines multiple cooling channels between the inner wall of the tubular conductor **20** and the fins. To be securely mounted on the inner wall of the tubular conductor **20**, the heat sink **30** is preheated for an outer edge of each fin to start melting, and then the outer edge of each fin can be securely connected with the inner wall of the tubular conductor **20**.

[0027] With reference to FIG. **4**, operation of the heat-dissipating apparatus is shown. When a high-temperature liquid enters the cooling chamber defined between the cooling tube **10** and the tubular conductor **20** through the inlet **111** of the body **11** and flows out of the cooling tube **10** from the outlet **112** of the body **11**, an air pump can be activated to drive air of the ambient environment to enter one end of the tubular conductor **20** and flow out of the other end of the tubular conductor **20** through the heat sink **30**. As part of air from the ambient environment passes through the cooling channels defined between the inner wall of the tubular conductor **20** and the fins and there is a temperature difference exists between the high-temperature liquid and the air from the ambient environment, the heat generated by the temperature difference is transmitted from the high-temperature liquid to the tubular conductor **20** first. Due to the contact area of the fins and the tubular conductor **20**, heat conducted to the tubular conductor **20** is further conducted to the fins and part of the heat is swiftly carried away by air flowing through the cooling channels. As long as the air in the ambient environment is constantly driven to pass through the cooling channels between the tubular conductor **20** and the heat sink **30** and carry the heat away, the heat-dissipating apparatus provides a satisfactory cooling effect to the high-temperature liquid.

[0028] In sum, the heat-dissipating apparatus can significantly and swiftly lower the temperature of a liquid to be cooled to attain a satisfactory cooling effect.

[0029] Even though numerous characteristics and advantages of the present invention have been set forth in the foregoing description, together with details of the structure and function of the invention, the disclosure is illustrative only. Changes may be made in detail, especially in matters of shape, size, and arrangement of parts within the principles of the invention to the full extent indicated by the broad general meaning of the terms in which the appended claims are expressed.

What is claimed is:

1. A heat-dissipating apparatus comprising:

a cooling tube having:

a body having two ends, a periphery, an inner wall and an inner space;

two open ends respectively formed at the two ends of the body, each open end having an inner rim; and

an inlet and an outlet formed on the periphery of the body and communicating with the inner space defined by the body;

a tubular conductor mounted in the cooling tube with an outer surface of the tubular conductor engaging the inner rim of each open end to seal the open ends, defining a cooling chamber between the inner wall of the body of the cooling tube and the tubular conductor, and having an inner wall; and

a heat sink made of a heat-conducting metal material, mounted inside the tubular conductor, having multiple fins formed by continuously folding a metal sheet in a corrugated and annular form and abutting against the inner wall of the tubular conductor, and defining multiple cooling channels between the inner wall of the tubular conductor and the fins.

2. The heat-dissipating apparatus as claimed in claim **1**, wherein the inlet and the outlet are respectively formed on two different positions on the periphery of the body and are respectively adjacent to the two ends of the body.

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