

(19)



Europäisches Patentamt

European Patent Office

Office européen des brevets



(11)

EP 1 015 835 B1

(12)

EUROPEAN PATENT SPECIFICATION

(45) Date of publication and mention
of the grant of the patent:

01.10.2003 Bulletin 2003/40

(21) Application number: **98929873.2**

(22) Date of filing: **15.06.1998**

(51) Int Cl.7: **F28F 1/14**, F25B 39/04

(86) International application number:
PCT/KR98/00158

(87) International publication number:
WO 99/066281 (23.12.1999 Gazette 1999/51)

(54) **CONDENSER FOR HEAT EXCHANGER SYSTEMS**

KONDENSATOR FÜR WÄRMEAUSTAUSCHSYSTEME

CONDENSATEUR POUR SYSTEMES D'ECHANGE THERMIQUE

(84) Designated Contracting States:
DE

(43) Date of publication of application:
05.07.2000 Bulletin 2000/27

(73) Proprietor: **Lee, Chul Soo**
Koyang-city 411-060 (KR)

(72) Inventor: **Lee, Chul Soo**
Koyang-city 411-060 (KR)

(74) Representative:
Reinhard - Skuhra - Weise & Partner
Friedrichstrasse 31
80801 München (DE)

(56) References cited:
EP-A1- 0 086 470 **DE-A1- 3 411 567**

EP 1 015 835 B1

Note: Within nine months from the publication of the mention of the grant of the European patent, any person may give notice to the European Patent Office of opposition to the European patent granted. Notice of opposition shall be filed in a written reasoned statement. It shall not be deemed to have been filed until the opposition fee has been paid. (Art. 99(1) European Patent Convention).

Description

[0001] The present invention relates to a condenser for heat exchanger systems according to the preamble of claim 1. Such a heat exchanger is known for instance from DE-A1-3411 567.

[0002] As well known to those skilled in the art, a heat exchanger system such as a refrigerator, freezer or refrigerated display case is widely used for preserving food and drink at cool temperatures (for example, 2-5°C) for a lengthy period of time. Such a heat exchange system is operated by a refrigerating cycle.

[0003] Fig. 1 is a view illustrating a typical refrigerating cycle in a heat exchanger system.

[0004] As shown in the drawing, the typical refrigerating cycle includes a compressor 1, condenser 2, capillary tube 3, evaporator 4 and accumulator 5. The circulation of a refrigerant in the heat exchanger system is described below. That is, a refrigerant in the heat exchanger system is compressed by the compressor 1, thus having relatively high temperature and high pressure. The compressed refrigerant is introduced into a condenser 2, having a long refrigerant tube, in order to reduce the refrigerant from a vapor phase to a liquid phase. Thereafter, the liquid refrigerant in the condenser 2 is introduced into a capillary tube 3. At this time, the liquid refrigerant turns into a mixed refrigerant which consists of the vapor and liquid phases and has relatively low temperature and low pressure. The above mixed refrigerant is quickly vaporized in an evaporator 4 while absorbing heat from the surroundings of the heat exchanger system. The mixed refrigerant in the evaporator 4 is introduced into an accumulator 5 in order to be divided into the vapor and the liquid refrigerants. Such an accumulator 5 comprises intake and discharging tubes and a housing. That is, the vapor refrigerant in the mixed refrigerant is only introduced into the compressor 1 passing through the discharging tube, while the liquid refrigerant in the mixed refrigerant is discharged into and kept in the housing.

[0005] In a brief description, the refrigerant is compressed by the compressor 1 and is introduced into the condenser 2. At this time, the compressed refrigerant has relatively low temperature while passing through the long refrigerant tube of the condenser 2. Thereafter, the refrigerant, having low temperature, passes through the capillary tube 3, thereby allowing the current speed of the refrigerant to be fast. The refrigerant is discharged from the capillary tube 3 to the evaporator 4. In such a case, since the high pressure of the refrigerant falls, the refrigerant is quickly vaporized in the evaporator 4 while absorbing heat from the surroundings of the heat exchanger system, thus forming cool air to be circulated in the heat exchanger system.

[0006] Particularly, the condenser consists of a long refrigerant tube between the compressor and the capillary tube. The above long refrigerant tube is bent in a desired shape by a bending process. Thus, the high

temperature of the refrigerant spontaneously falls while the refrigerant passes through the long refrigerant tube of the condenser 2. Alternatively, the heat of the refrigerant may be forcibly radiated by a cooling fan mounted around the condenser 2 when necessary. In this case, the performance of the condenser, namely, the liquefaction of a vapor refrigerant, is based on the radiant heat efficiency of the vapor refrigerant.

[0007] However, the above condenser is problematic in that the radiant heat of the refrigerant passing through the condenser is unexpectedly reduced during the height of the warm-weather seasons. In addition, the cooling fan is forcibly operated, thereby generating a noise and increasing power consumption.

Disclosure of the Invention

[0008] Accordingly, the present invention has been made keeping in mind the above problems occurring in the prior art, and an object of the present invention is to provide a condenser for heat exchanger systems, which has a radiating pipe filled with a condensing medium containing a liquid such as a brine, antifreezing solution or water having a relatively high density, thus increasing the radiant heat of the condenser and reducing the electric power consumption of the condenser, and prolonging the life span of the condenser.

[0009] In order to accomplish the above object, the present invention provides a condenser for heat exchanger systems, comprising: a condensing tube connected to a refrigerant tube located between a compressor and a capillary tube in order to allow a refrigerant in a heat exchanger system to pass through the condensing tube; a liquid tube integrally formed on a side wall of the condensing tube by an extrusion process; and a radiating pipe having a long zigzag shape and including a plurality of radiating fins formed on its outer surface, and mounted to the liquid tube in such a manner that both ends of the liquid tube are connected to a liquid supplying inlet and a drain outlet of the radiating pipe, respectively, so a condensing medium in the radiating pipe is effectively circulated through the radiating pipe and the liquid tube.

[0010] As a preferred embodiment two or more condensing tubes are horizontally and integrally formed on both side walls of the liquid tube by an extrusion process.

Brief Description of the Drawings

[0011] The above and other objects, features and other advantages of the present invention will be more clearly understood from the following detailed description taken in conjunction with the accompanying drawings, in which:

Fig. 1 is a view illustrating a typical refrigerating cycle in a heat exchanger system;

Fig. 2 is a view illustrating a refrigerating cycle in a heat exchanger system in accordance with the present invention;

Fig. 3 is a view illustrating the construction of a condenser for heat exchanger systems in accordance with the first embodiment of the present invention.

Fig. 4 is an expanded sectional view illustrating the condenser of Fig. 3; and

Fig. 5 is an expanded sectional view illustrating the construction of a condenser for heat exchanger systems in accordance with the second embodiment of the present invention.

Best Mode for Carrying Out the Invention

[0012] Fig. 2 is a view illustrating a refrigerating cycle in a heat exchanger system in accordance with the present invention. Figs. 3 and 4 are views illustrating the construction of a condenser for heat exchanger systems in accordance with the first embodiment of the present invention.

[0013] As shown in Figs. 2 to 4, the refrigerating cycle "A" includes a compressor 10, condenser 20, capillary tube 30, evaporator 40 and accumulator 50. The circulation of a refrigerant in the heat exchanger system is described below. That is, the refrigerant in the heat exchanger system is compressed by the compressor 10, thus having relatively high temperature and high pressure. The compressed refrigerant is introduced into the condenser 20, having a long refrigerant tube, in order to reduce the refrigerant from a vapor phase to a liquid phase. Thereafter, the liquid refrigerant in the condenser 20 is introduced into the capillary tube 30. At this time, the liquid refrigerant turns into a mixed refrigerant which consists of the vapor and liquid phases and has low temperature and low pressure. The above mixed refrigerant is quickly vaporized in the evaporator 40 while absorbing heat from the surroundings of the heat exchanger system. The mixed refrigerant in the evaporator 40 is introduced into the accumulator 50 in order to be divided into the vapor and liquid refrigerants.

[0014] In addition, the condenser 20 includes a condensing tube 21 and liquid tube 22. That is, the condensing tube 21 communicates with a refrigerant tube 26 located between the compressor 10 and the capillary tube 30 as shown in Fig. 3. For convenience' sake, the condensing tube 21 is linearly illustrated in Fig. 3, but it actually has a long spiral shape in order to improve the efficiency of the condenser 20.

[0015] The liquid tube 22 is integrally formed on a side wall 23 of the condensing tube 21 of the condenser 20. Such a liquid tube 22 is connected to a radiating pipe 25, having a long zigzag shape, in such a manner that both ends of the liquid tube 22 are connected to a liquid supplying inlet 25b and a drain outlet 25c of the radiating pipe 25, respectively. Also, a plurality of radiating fins 25a are formed on the outer surface of the radiating pipe 25. The liquid tube 22 is filled with a condensing medium

such as a calcium chloride solution, sodium chloride or magnesium chloride solution containing a medium such as a brine, antifreezing solution or water having a relatively high density.

[0016] As shown in Fig. 4, slits 23a are longitudinally formed at both top and bottom portions of the side wall 23 formed between the condensing and liquid tubes 21 and 22, respectively, thus allowing the condensing and liquid tubes 21 and 22 to be widely distanced from each other when necessary. In addition, a plurality of radiating fin 24 are radially formed on the outer surfaces of the condensing and liquid tubes 21 and 22, thereby increasing the efficiency of the condenser 20.

[0017] In order to increase the capacity of the condenser 20, the length of the radiating pipe 25 has to be long. That is, another extending tube (not shown), having a condensed construction, is connected between the liquid supplying inlet 25b and the drain outlet 25c of the liquid tube 22 at its both ends. In addition, a pump (not shown) is mounted to the radiating pipe 25 at a desired position. Alternatively, a cooling fan (not shown), operated by a control means, may be mounted around the radiating pipe 25 in order to improve the radiant heat of the radiating pipe 25.

[0018] The manufacturing process of the condenser according to this invention is described below. The liquid tube 22 is integrally formed on the condensing tube 21 by an extrusion process, thus allowing the configuration of the condensing and liquid tubes 21 and 22 to be formed into a peanut shape. Thereafter, the single body of the condensing and liquid tubes 21 and 22 is cut in a desired length. In this case, since the slits 23a are longitudinally formed both top and bottom portions of the side wall 23 formed between the condensing and liquid tubes 21 and 22, thus allowing the condensing and liquid tubes 21 and 22 to be widely distanced from each other when necessary.

[0019] Thereafter, both ends of the condensing tube 21 are respectively connected to the refrigerant tube 26 by a welding process, thus allowing the refrigerant to flow through the condensing tube 21. In addition, both ends of the liquid tube 22 are connected to the liquid supplying inlet 25b and the drain outlet 25c of the radiating pipe 25, respectively, thus allowing the condensing medium to be circulated through the liquid tube 22 and the radiating pipe 25.

[0020] Therefore, the circulation of a refrigerant in the heat exchanger system is described below. That is, the refrigerant in the heat exchanger system is compressed by the compressor 10, thus having relatively high temperature and high pressure. The compressed refrigerant is introduced into the condenser 20 in order to reduce the refrigerant from a vapor phase to a liquid phase. Thereafter, the liquid refrigerant in the condenser 20 is introduced into the capillary tube 30. At this time, the liquid refrigerant turns into a mixed refrigerant which consists of the vapor and liquid phases and has low temperature and low pressure. The above mixed refrigerant

is quickly vaporized in the evaporator 40 while absorbing heat from the surroundings of the heat exchanger system.

[0021] Particularly, when the vapor refrigerant, having a relatively high temperature, passes through the condensing tube 21 of the condenser 20, the condensing medium, having high density, passes from the radiating pipe 25 to the liquid tube 22. At this time, the heat of the vapor refrigerant, having about 80°C and passing through the condensing tube 21, is transmitted to the condensing medium which has a normal temperature and passes through the liquid tube 22. Thus, the vapor refrigerant easily turns into the liquid refrigerant, while the condensing medium has relatively high temperature.

[0022] In such a case, the circulation of the condensing medium, having high temperature, is described below. First, when the capacity of the condenser 20 is small, the condensing medium has relatively low temperature while spontaneously passing through the long radiating pipe 25. That is, the condensing medium, having relatively high temperature and passing the liquid supplying inlet 25b, is introduced into the upper portion of the radiating pipe 25. Thereafter, the high temperature of the condensing medium falls while the refrigerant passes from the upper portion to the lower portion of the radiating pipe 25. Thus, the condensing medium, having a normal temperature, is discharged into the drain outlet 25c of the radiating pipe 25.

[0023] Second, when the capacity of the condenser 20 is large, the condensing medium, having relatively high temperature and passing the liquid supplying inlet 25b, forcibly passes from the upper portion to the lower portion of the radiating pipe 25 by a pump (not shown) which is mounted to the radiating pipe 25 at a desired position. In this case, the radiating pipe 25, having a condensed construction, is exposed to the outside of the condenser 20, thus allowing the piping work of the radiating pipe 25 to be easily carried out. Alternatively, a cooling fan (not shown), operated by a control means, may be mounted around the radiating pipe 25 in order to effectively increase the radiant heat of the radiating pipe 25.

[0024] Fig. 5 is a view illustrating the construction of a condenser for heat exchanger systems in accordance with the second embodiment of the present invention.

[0025] In the second embodiment, the condenser includes a liquid tube 22 and two condensing tubes 21a and 21b. That is, the condensing tubes 21a and 21b are horizontally and integrally formed on both side walls of the liquid tube 22 by an extrusion process. Thus, the heat of vapor refrigerants, passing through the condensing tubes 21a and 21b, is more quickly transmitted to the condensing medium passing through the liquid tube 22. As a result, the radiant heat of the condenser is effectively and quickly carried out.

Industrial Applicability

[0026] As mentioned above, a condenser for heat exchanger systems of this invention is provided with a radiating pipe filled with a condensing medium containing a liquid such as a brine, antifreezing solution or water having a relatively high density, thus increasing the radiant heat of the condenser and reducing the electric power consumption of the condenser, and prolonging the life span of the condenser.

[0027] In addition, when the capacity of the condenser is small, the condensing medium, having heat transmitted from a vapor refrigerant, has a normal temperature while passing through the long radiating pipe. When the capacity of the condenser is large, the condensing medium, having relatively high temperature, is forcibly circulated through the radiating pipe by a pump. Alternatively, a cooling fan may be mounted around the radiating pipe in order to effectively increase the radiant heat of the radiating pipe.

[0028] Furthermore, the radiating pipe, having a condensed construction, is exposed to the outside of the condenser, thus allowing the piping work of the radiating pipe to be easily carried out.

Claims

1. A condenser (20) for heat exchanger systems, comprising:

a condensing tube (21) connected to a refrigerant tube (26) located between a compressors (10) and a capillary tube (30) in order to allow a refrigerant in a heat exchanger system to pass through said condensing tube; **characterised in that** the condenser further comprises a liquid tube (22) integrally formed on a side wall of said condensing tube by an extrusion process; and

a radiating pipe (25) having a long zigzag shape and including a plurality of radiating fins (25a) formed on its outer surface, and mounted to said liquid tube in such a manner that both ends of said liquid tube are connected to a liquid supplying inlet (25b) a drain outlet (25a) of said radiating pipe, respectively, so a condensing medium in said radiating pipe is effectively circulated through said radiating pipe and said liquid tube.

2. The condenser as claimed in Claim 1, wherein at least two or more condensing tubes (21a, 21b) are horizontally and integrally formed on both side walls of said liquid tube by an extrusion process.

Patentansprüche

1. Kondensator (20) für Wärmeaustauschersysteme, bestehend aus einem Kondensatorrohr (21), welches mit einem zwischen einem Kompressor (10) und einem Kapillarrohr (30) angeordneten Kühlmittelrohr (26) verbunden ist, um es einem Kühlmittel in einem Wärmeaustauschersystem zu ermöglichen durch das Kondensatorrohr zu fließen; **dadurch gekennzeichnet, dass** der Kondensator weiterhin besteht aus einem Flüssigkeitsrohr (22), welches an einer Seitenwand des Kondensatorrohrs integriert durch einen Extrusionsvorgang ausgebildet ist; und einem langen zu einer Zickzackform gefalteten Kühlrohr (25), welches an seiner Oberfläche eine Vielzahl von angeformten Kühlrippen (25a) aufweist, und welches so mit dem Flüssigkeitsrohr verbunden ist, dass beide Enden des Flüssigkeitsrohrs jeweils mit einem Flüssigkeitszulauf (25b) und einem Ablauf (25c) des Kühlrohrs verbunden sind, und so ein Kühlmittel in diesem Kühlrohr wirksam durch dieses und durch das Flüssigkeitsrohr umläuft.
2. Kondensator nach Anspruch 1, **dadurch gekennzeichnet, dass** mindestens zwei oder mehr Kondensatorrohre (21a, 21b) horizontal an beiden Seitenwänden des Flüssigkeitsrohrs integriert durch einen Extrusionsvorgang ausgebildet sind.

sé en ce que deux au moins ou plusieurs de tuyaux de condensation (21a, 21b) sont formés horizontalement et intégralement aux deux parois latérales dudit tuyau de liquide par un procédé d'extrusion.

Revendications

1. Condensateur (20) pour systèmes d'échange thermique comportant un tuyau de condensation (21) raccordé à un tuyau frigorifique (26) disposé entre un compresseur (10) et un tube capillaire (30) pour permettre un débit d'un frigorigène d'un système d'échange thermique par ledit tuyau de condensation; **caractérisé en ce que** le condensateur comporte de plus un tuyau de liquide (22) formé à une paroi latérale dudit tuyau de condensation par un procédé d'extrusion; et un tuyau de radiateur (25) d'une forme pliée en zigzag comportant une pluralité d'ailettes de radiateur (25a) sur sa surface extérieure, et étant relié audit tuyau de liquide de façon que les deux extrémités dudit tuyau de liquide sont raccordés respectivement à une entrée de liquide (25b) et à une sortie de liquide (25c) dudit tuyau de radiateur pour permettre de circuler efficacement un agent de réfrigération dans ledit tuyau de radiateur par ledit tuyau de radiateur et par ledit tuyau de liquide.
2. Condensateur selon la revendication 1, **caracté-**

FIG. 1

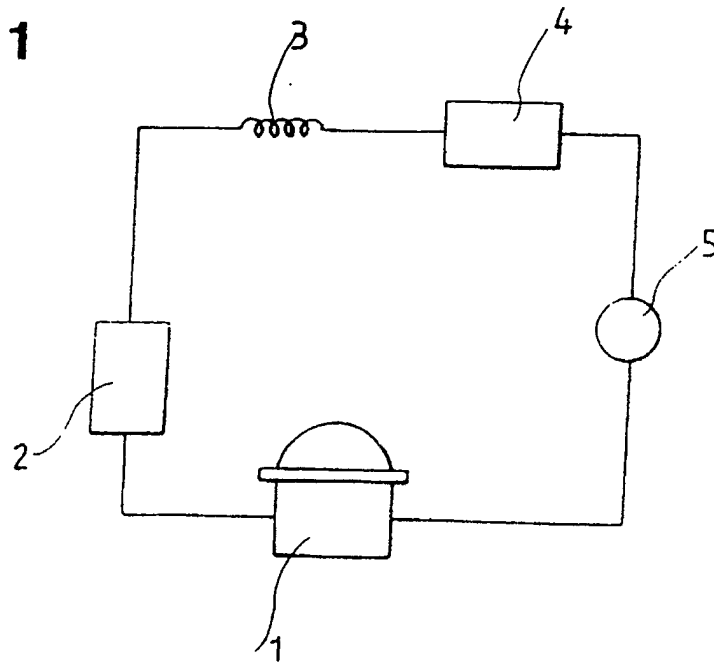


FIG. 2

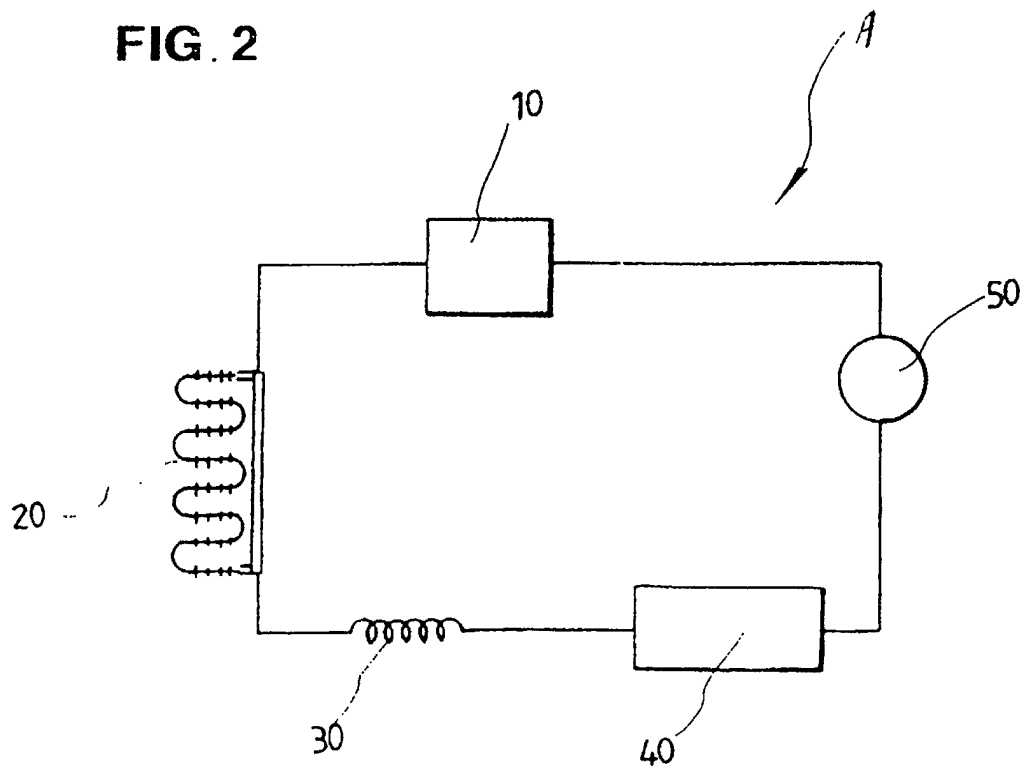


FIG. 3

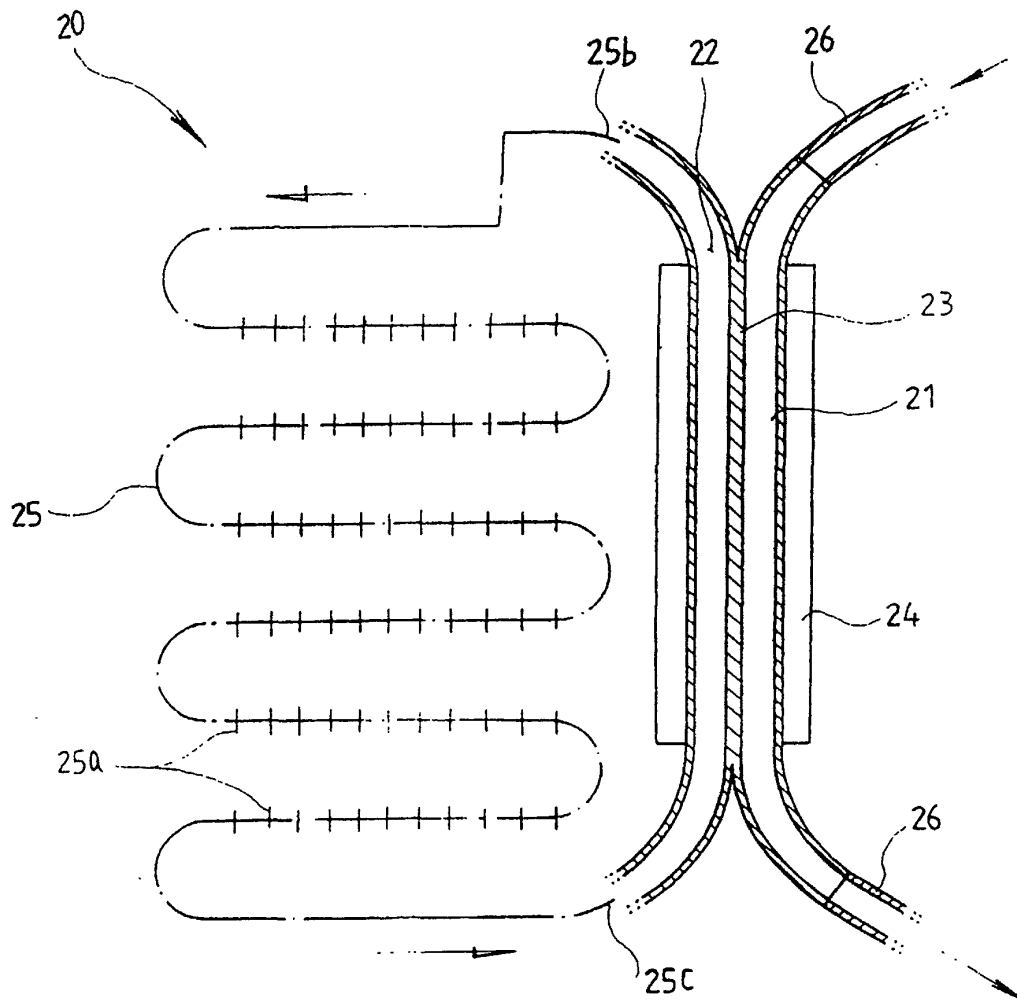


FIG. 4

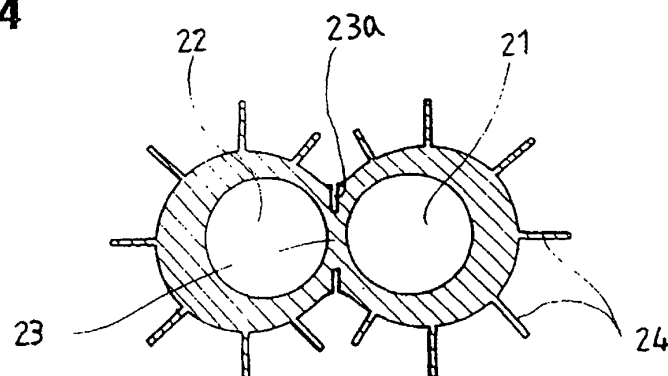


FIG. 5

