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(54) **A HEAT EXCHANGER AND A MANUFACTURING METHOD FOR THE SAME**

WÄRMETAUSCHER UND HERSTELLUNGSVERFAHREN DAFÜR

ÉCHANGEUR DE CHALEUR ET PROCÉDÉ DE FABRICATION DE CELUI-CI

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Description

[Field of the Invention]

[0001] The present invention relates to a static heat exchanger and a manufacturing method for the same. A heat exchanger according to the preamble of claim 1 is known from US 5 322 117 A.

[Background of the Invention]

[0002] If a heat exchanger recovers the heat of the exhaust air discharged from a drying furnace etc., when ventilating the drying furnace in a factory, etc., a loss of energy can decrease and it can heighten an energy saving effect. That is, since a heat is exchanged between the exhaust air of high temperature in such a drying furnace, etc. in the factory and the air of normal temperature in such the open air, and the energy for heating the open air can be saved by supplying the open air of which the temperature rose to the drying furnace, etc.

[0003] As a heat exchanger for such a factory and for such mechanical apparatus, a cross flow typed heat exchanger which is manufactured by laminating aluminum heat transfer sheets is preferable in consideration of heat recovering efficiency. As such a heat exchanger, a heat exchanger which is manufactured by laminating rectangular heat transfer sheets is well-known. As to such as the heat exchanger, an airtight holding means for a rectangular corner part is important. As an airtight holding means, an epoxy resin is used ordinarily, and a caulking agent containing silicone is used especially when a heat resistance is required.

[0004] However, in a case where such heat exchange is applied to air supply to a painting factory, a drier of a painting process, a film coating device, a film printing dryer and a metal sheet printing dryer for a beverage can etc., if silicone is contained in the dry air supplied, the silicone adheres to a coating surface, a dent is formed on the coating film with the coating film pushed away. Even if the contained silicon is a very small quantity, a coating defect occurs, for example, a repelling such that a ground exposes on a part of coating film. Therefore, it is necessary for a heat exchanger not to use a material including silicone, and the caulking agent including silicone cannot be used for airtight holding means.

[0005] In addition, in order that a gas leak between open air and circulating air and a leak from an aluminum sheet itself are prevented, a heat exchange layered body with a large percentage of void may be used as a heat exchanger. In this case, if a caulking agent or a paint of fluorocarbon rubber system is used for airtight holding of a rectangular corner part of the layered body instead of using the caulking agent containing silicone in consideration of the above-stated point of the coating defect, the airtight holding effect may be lost since a coat of the caulking agent or the paint may have a localized necking by evaporation of so much of solvent contained in the caul-

ing agent. On the other hand, if a content of solvent in the caulking agent is lessened, the caulking agent will become hard and an application of the agent will become impossible. If a method of pressurization by inserting a fluorocarbon rubber sponge is applied instead of the caulking agent, since strength of the heat exchange layered body is low, the heat exchange layered body is deformed and, thus, the airtight holding cannot be effective.

[0006] On the other hand, a technology of an adhesion by vulcanizate thermosetting elastomer or a fluorocarbon rubber is well-known, as shown in the patent document 1.

[Prior art document]

[Patent document]

[Patent document 1]

[0007] Japanese Patent Laid-Open Application No, 2001-341206

[Summary of the Invention]

[Problem(s) to be Solved by the Invention]

[0008] Concerning to the technology disclosed in the above patent document 1, it is necessary to press with heating simultaneously in the adhesion by vulcanization. Since an object of the invention of the patent document 1 is a single plate structure of a plate typed heat exchanger, which has strength sufficient to pressure, the heating and the pressuring can be done simultaneously. However, the above pressuring with heating is inapplicable as a method of carrying out sealing a side portion of the layered body of the heat exchanger on which a plurality of thin heat transfer sheets are laminated since the heat transfer sheets have a possibility of deforming when an excessive external force is applied. The technology disclosed in the above patent document 1 has such a problem.

[0009] In order that the present invention solves the above problem, the present invention provides a heat exchanger with a fully airtightness at a corner portion of a layered body of the heat exchanger on which a plurality of heat transfer sheets laminated and to provide a manufacturing method for a heat exchanger such that an effect of the airtight holding occurs easily on the corner portion of the layered body of the heat exchanger only by heating once.

[Means for Solving the Problem]

[0010] The heat exchanger disclosed in the present invention can secure airtightness for a corner portion where leak of a fluid as object of a heat exchange tends to occur. The airtightness can be achieved by inserting a rubber in which a vulcanizing agent is mixed in an unvulcanized state to the corner portion and by heating the

rubber with the rubber being not pressurized to proceed vulcanization of the rubber simultaneously and to inflate the rubber.

[Advantages of the Invention]

[0011] A heat exchanger and a manufacturing method according to the invention are defined in claims 1 and 5, respectively. As the manufacturing method of the heat exchanger of the present invention, a plurality of heat transfer sheets are laminated, a rubber in which a vulcanizing agent is mixed in an unvulcanized state is inserted into a clearance between a corner portion of a layered body of the heat exchanger and a corner member without heating, and the rubber in an unvulcanized state is foamed to inflate by heating once. Therefore, since the rubber which is foamed to inflate advances into a clearance in the corner portion of the layered body, the layered body has an effect of its airtightness.

[0012] The method of the present invention has some advantages as follows.

[0013] If strength of the heat transfer sheet is not high, the sheet has no deformation since the sheet is not heated. Since it is not necessary to use an agent including silicon as airtight holding means and the layered body has airtightness easily and securely, silicon as a material used for manufacturing the heat exchanger is excluded and a defect of painting can be suppressed.

[0014] By forming a notch at a connecting portion of the layered body of the heat transfer sheet or at a connecting portion of the corner member and inserting a rubber in which a vulcanizing agent is mixed in an unvulcanized state to the notch, the rubber can be arranged adequately in a state of a successive stick-like form at the notches formed successively in a state of recess like form on the layered body or the corner member. Since an inflated fluorocarbon rubber proceeds into the clearance between each of the heat transfer sheets in the state where the rubber is vulcanized by heating and is foamed by a gas generated by vulcanizing to be inflated, a better condition of airtight holding can be certainly obtained.

[Brief Description of the Drawings]

[0015]

[Fig. 1]

Fig. 1 shows a perspective view of the heat exchanger concerning a 1st preferred embodiment of the present invention.

[Fig. 2]

Fig. 2 shows an outlined perspective view of a main section of the heat exchange layered body used for the heat exchanger concerning a 1st preferred embodiment of the present invention.

[Fig. 3]

Fig. 3 shows a perspective view of an end portion of a sheet of a heat exchange layered body used for

the heat exchanger concerning a 1st preferred embodiment of the present invention.

[Fig. 4]

Fig. 4 shows a cross section view of a heat exchange layered body used for the heat exchanger concerning a 1st preferred embodiment of the present invention.

[Fig. 5]

Fig. 5 shows a top view which indicates an attachment of a corner member of a casing to the heat exchange layered body of the heat exchanger concerning a 1st preferred embodiment of the present invention.

[Fig. 6]

Fig. 6 shows a side view which indicates an attachment of a corner member of a casing to the heat exchange layered body of the heat exchanger concerning a 1st preferred embodiment of the present invention.

[Fig. 7]

Fig. 7 shows cross section views of a corner portion in the heat exchanger concerning a 1st preferred embodiment of the present invention before and after vulcanization.

[Fig. 8]

Fig. 8 shows a side view of a heat exchange layered body, a top plate and a sole plate of a casing in the heat exchanger concerning a 1st preferred embodiment of the present invention after obtaining an airtight holding of the present invention.

[Fig. 9]

Fig. 9 shows an exploded perspective view of the heat exchanger concerning a 2nd preferred embodiment of the present invention.

[Fig. 10]

Fig. 10 shows a cross section view of a connecting portion between a corner member and a corner part of a heat exchange layered body in the heat exchanger concerning a preferred embodiment of the present invention.

[Fig. 11]

Fig. 11 shows a perspective view of the example of a static heat exchanger of cross flow type

[Fig. 12]

Fig. 12 shows a perspective view of the example of a static heat exchanger of counter flow type.

[The preferred embodiments of the invention]

[0016] As to the preferred embodiment of the present invention, four corners of a heat exchange layered body which is formed by laminating rectangle shaped heat transfer sheets are connected each other to corner members which have a L-shaped section, a rubber in which a vulcanizing agent is mixed in an unvulcanized state, for example, a fluorocarbon rubber is inserted between the corner member and the corner portion of the heat exchange layered body, and the rubber is made to inflate

and to be inserted inside into many of clearances in the heat exchange layered body by heating to vulcanize. Thereby, an object of the airtight holding between the corner member and the corner portion of the heat exchange layered body can be achieved.

(A 1st preferred embodiment of the present invention)

[0017] The heat exchanger concerning a 1st preferred embodiment of the present invention is explained along with Figs. 1 through 8 as follows.

[0018] Referring to Fig.1, a heat exchange layered body 11 is formed by laminating a plurality of heat transfer sheets 16 such as an aluminum sheet. Also, the heat exchange layered body 11 is assembled to a casing having metal corner members 12, a top plate 13 and a sole plate 14 which are connected by bolt, a rivet, etc. Especially as a heat transfer sheet 16, besides an aluminum sheet, when a corrosive material is included in the air to be heat-exchanged, a corrosive metal sheet such as an aluminum sheet on which a corrosion coating is applied and a stainless steel sheet, etc. may be used.

[0019] The schematic structure of the heat exchange layered body 11 is shown in Fig. 2.

[0020] Since a circulation air flow and an open air flow are completely isolated each other by the heat transfer sheet, a gas leak between them does not occur. As shown in Fig. 3, since end portions 15 of the heat exchange layered body 11 are connected by a double bending processing, a strength of the layered body increases and a leak of air from a connection portion of the end portion of the sheet does not occur, either.

[0021] An example of the heat transfer sheet 16 used for the heat exchange layered body 11 is shown in Fig. 4.

[0022] A rib 17 is mounted on the heat transfer sheet 16 to extend to an upper side of the sheet so that a direction of the open air flow B and a direction of the circulation air flow are offset at 90 degrees. For obtaining the same function, concave-convex ribs are mounted on the heat transfer sheet at an angle of 90 degrees. As stated above, as to the shape of the heat transfer sheet, an optimal thing may be suitably chosen in consideration of a heat exchange efficiency, pressure loss, etc.

[0023] In Fig. 5, an assemble process of the heat transfer layered body 11 of the heat exchanger and the corner member of the casing used for this preferred embodiment is shown as a top view. Since the corner member is made of metallic material and has an equilateral L like shaped section, the corner member has a fully strength as a part of the casing.

[0024] The corner member may have a non-equilateral L like shaped section and an opening angle of the L like shape of the corner member may be determined arbitrarily to fit to the angle of the corner portion of the heat transfer layered body. If the corner member has an L like shape as a whole, a section of the corner member may have a hollow. Also, the heat transfer layered body 11 has a plurality of the end portion 15 processed by double

bending every other one. Therefore, in a top view, the layered body has a rectangular portion of notch shape at each of corners of the body.

[0025] A stick like shaped unvulcanized rubber 18 in which a vulcanizing agent is mixed is inserted between the heat exchange layered body 11 and the corner member 12 so that the rubber may contact the above notch like portion.

[0026] Thus, concerning the connecting portion of the heat exchange layered body 11 or the corner member 12, a notch is formed in either the heat exchange layered body or the corner member and a recess portion is formed on a basis of formation of the notch. The stick like unvulcanized rubber is inserted into the recess portion in a state where heating is not carried out. After inserting the rubber, the rubber is heated to vulcanize. By foaming with the vulcanization of the rubber, the rubber is inflated to close the clearance so that the airtight is secured.

[0027] Then, as shown in Fig. 6, a leak prevention member 19 such as a fluoride rubber sheet is inserted between a sole plate 14 and a corner member 12, and the sole plate 14 and the corner member 12 are fixed with a bolt, etc. After all of the four corner members 12 and the sole plates 14 are fixed, a top plate 13 is fixed similarly.

[0028] The unvulcanized rubber 18 is vulcanized by carrying out heating the assembled heat exchanger and keeping at 175 through 200 °C for 1 hour.

[0029] If the unvulcanized rubber 18 is heated in an open state, it foams with vapor and carbon dioxide which are generated by vulcanization.

[0030] Thus, as shown in Fig. 7, the rubber can advance into inside of many of clearances of the heat exchange layered body 11, and it becomes possible to aim at the airtight state between the corner member 12 and the corner portion of the heat exchange layered body 11. Also, since the rubber is in an opened condition and, moreover, is porous by foaming, the gas generated at a time of vulcanization is easy to emit from the rubber and the vulcanization of the rubber can be completed for a short time without a secondary vulcanization for a long time.

[0031] After heating and proceeding the vulcanization, as shown in Fig. 8, a leak prevention members 20 such as angled string like fluorocarbon rubber is pushed to insert between the heat exchange layered body 11 and a top plate 13 and between the heat exchange layered body 11 and the sole plate 14 so that the rubber fills between them. Then, a rubber based coating, for example, fluorocarbon rubber paint, is applied to the portions and the airtight effect is made high thereby. Similarly, the rubber based coating is applied between the corner member 12 and top plate 13 and between the corner member 12 and the sole plate 14 into which the leak prevention member 19 is inserted.

[0032] After a completion of application of the rubber based coating, the coating is allowed to stand at room temperature for 20 to 30 minutes, and the coating holds

at 200 °C for 1 hour to come to cure. This process may be carried out in advance of the vulcanization by heating of the unvulcanized rubber 18.

[0033] The conventional general usage for the unvulcanized rubber is explained as follows. The unvulcanized rubber in which the vulcanizing agent is mixed is pressed with heating in a metallic mold (it is 10 to 45 minutes at 170 to 180 °C). Thereby, the rubber is formed and a primary vulcanization is carried out. Then, after taking out the rubber from the metallic mold, physical properties of the rubber are stabilized by heating again for a secondary vulcanization (it is 24 hours at 200 to 230 °C). Therefore, a finished product is obtained after the above secondary vulcanization.

[0034] A usage of the unvulcanized rubber of the present invention is different from the above conventional usage. As to a method of the present invention, focusing on that the rubber is foamed by the gas generated by a vulcanization reaction if the unvulcanized rubber mixed with the vulcanizing agent is heated rapidly, the corner portion of the heat transfer layered body, which has many of clearances, can be structured simply and securely with airtight.

(2nd preferred embodiment of the present invention)

[0035] Another preferred embodiment of the heat exchanger concerning of the present invention is shown in Fig. 9. This heat exchanger is a rectangular cross typed one in which a flat plate like heat transfer sheet and a heat transfer sheet processed with waves as a spacer are laminated to be orthogonal alternately. Also, similarly to the 1st preferred embodiment, as to this heat exchanger, an airtight holding is realizable by heating of the unvulcanized rubber 18 mounted between the heat exchange layered body 11 and the corner member 12.

[0036] Also, concerning to the above 1st preferred embodiment, the notch at the connecting portion of the corner member 12 and the corner portion of the heat exchange layered body 11 is formed as shown in Fig. 10 (a). However, the notch is not restricted as shown in the above Fig 10 (a), and it is possible to use various forms shown in Fig. 10 (b) through (f). Furthermore, a form of the notch other than such illustrated forms may be adopted arbitrarily.

[0037] The heat exchanger of the present invention is manufactured by the above methods and can be used in the painting factory where materials containing silicone cannot be used in a passage for air supply, a film printing drier, a metal sheet printing drier for drink cans and other driers. Furthermore, it can be used as heat exchanger in a room where a poor contact of an electric relay, etc. may occur due to silicone atmosphere.

[0038] In each of the preferred embodiments of the present invention, the heat exchanger is explained as of a cross flow type as shown in Fig. 12. However, the present invention is not restricted in this type. The present invention can also be realized in a counter flow type and

an oblique alternating current flow type.

[Industrial applicability]

[0039] As explained above, the present invention can provide the heat exchanger with a high airtight nature even at a place where a material which contains silicone cannot be used.

[0040] The present invention provides a heat exchanger. The heat exchanger can exchange heat at a place where a material containing silicone cannot be used.

[0041] The heat exchanger of the present invention has a heat exchange layered body which is secured by a corner member 12, a top plate 13, a sole plate 14. An unvulcanized rubber 18 in which a vulcanized agent is mixed is inserted into a connecting portion between the corner member 12 and a corner portion of the heat exchange layered body. The unvulcanized rubber 18 is made to foam and inflate by heating. Thereby, the heat exchanger has a high airtightness in a short time in a process of its manufacturing and can be used in a painting factory, etc. where a material including silicon cannot be used.

[Description of Notations]

[0042]

- 10 heat exchanger
- 11 heat exchange layered body
- 12 corner member
- 13 top plate
- 14 sole plate
- 15 end portion
- 16 heat transfer sheet
- 17 rib
- 18 rubber
- 19 leak prevention member
- 20 leak Prevention member

Claims

1. A heat exchanger (10) comprising:

a heat exchange layered body (11) formed by laminating heat transfer sheets (16), and a first flow passage for a first fluid and a second flow passage for a second fluid formed between said heat transfer sheets (16) alternately, said first fluid and said second fluid being a object for heat exchange, said first fluid and said second fluid being enable to exchange heat of the fluid; wherein said heat exchanger (10) includes a corner member (12) which has a L like shaped cross section being mounted at a corner portion of said heat transfer layered body (11), **charac-**

terized in that

an unvulcanized rubber (18) in which a vulcanizing agent is mixed being inserted between said corner member (12) and said corner portion of said heat transfer layered body (12) in advance ; 5
and

said unvulcanized rubber (18) is foamed to inflate between said corner member (12) and said corner portion of said heat exchange layered body (11) by heating for proceeding a vulcanization of said rubber (18) so that said rubber (18) is foamed to inflate and advances into a clearance in the corner portion of the layered body (11) and said rubber (18) closes between said corner member (12) and said corner portion of said heat exchange layered body (11) in a state of airtight. 10

2. A heat exchanger (10) according to Claim 1, wherein said heat exchanger (10) comprises 20
a notch formed at a corner portion of said layered body (11) or a connecting portion of said corner member (12) to said heat transfer layered body (11) so that said unvulcanized rubber (18) is enable to be attached on said notch. 25
3. A heat exchanger (10) according to Claim 1 or 2, wherein said heat exchanger (10) comprises
a flat plate like shaped member (13, 14) being arranged and secured to both end portions in a laminating direction of said heat transfer layered body (11), and 30
a stick-like formed rubber (20) being inserted between said flat plate like shaped member (13, 14) and said heat transfer layered body (11). 35
4. A heat exchanger (10) according to Claim 1 or 2, wherein said heat exchanger (10) comprises
a flat plate like shaped member (13, 14) being arranged and secured to both end portions (15) in a laminating direction of said heat transfer layered body (11), and 40
a stick-like formed rubber (20) being inserted between said flat plate like shaped member (13, 14) and said heat transfer layered body (11), 45
and wherein a rubber paint (19) is applied between an end portion of said corner member (12) and said flat plate like shaped member (13, 14).
5. A manufacturing method of a heat exchanger (10) 50
wherein the method has following steps;
a step for arranging an L like shaped corner member (12) at a heat transfer layered body (11) formed by laminating heat transfer sheets (16),
a step for inserting an unvulcanized rubber (18) in which a vulcanized agent is mixed between said corner member (12) and a corner portion of said heat transfer layered body (11) in advance, 55

a step for mounting said unvulcanized rubber (18) and said corner member (12) to said heat transfer layered body (11), and

a step for heating said rubber (18) to proceed vulcanization of said rubber (18) so that said rubber (18) inflates by foaming said rubber (18) associated with the vulcanization and closes between said corner member (12) and said corner portion of said heat exchange layered body (11) in a state of airtight.

Patentansprüche**1. Wärmetauscher (10) mit:**

einem Wärmetauschschichtkörper (11), der durch Laminieren von Wärmeübertragungsplatten (16) gebildet ist, und
einem ersten Strömungsdurchlass für ein erstes Fluid und einem zweiten Strömungsdurchlass für ein zweites Fluid, der abwechselnd zwischen den Wärmeübertragungsplatten (16) ausgebildet ist,
wobei das erste Fluid und das zweite Fluid Ziel des Wärmeaustauschs sind,
wobei das erste Fluid und das zweite Fluid in der Lage sind, Wärme des Fluids auszutauschen;

wobei der Wärmetauscher (10) aufweist:

ein ECKelement (12), das einen L-förmigen Querschnitt aufweist und an einem Eckabschnitt des Wärmetauschschichtkörpers (11) angebracht ist, **dadurch gekennzeichnet, dass**
ein unvulkanisierter Gummi (18), in den ein Vulkanisationsmittel gemischt ist, zwischen das ECKelement (12) und den Eckabschnitt des Wärmetauschschichtkörpers (12) im Voraus eingefügt wird; und
der unvulkanisierte Gummi (18) aufgeschäumt wird, um sich zwischen dem ECKelement (12) und dem Eckabschnitt des Wärmetauschschichtkörpers (11) auszudehnen, indem erhitzt wird, um eine Vulkanisation des Gummis (18) vorzunehmen, so dass der Gummi (18) zum Ausdehnen aufgeschäumt wird, in einen Spalt in dem Eckabschnitt des Schichtkörpers (11) vorrückt und der Gummi (18) zwischen dem ECKelement (12) und dem Eckabschnitt des Wärmetauschschichtkörpers (11) in einem luftdichten Zustand abschließt.

2. Wärmetauscher (10) nach Anspruch 1, wobei der Wärmetauscher (10) aufweist:

eine Kerbe, die an einem Eckabschnitt des Schichtkörpers (11) oder einem Verbindungs-

abschnitt des Eckelements (12) mit dem Wärmetauscherschichtkörper (11) ausgebildet ist, so dass der unvulkanisierte Gummi (18) in der Lage ist, sich in der Kerbe festzusetzen.

3. Wärmetauscher (10) nach Anspruch 1 oder 2, wobei der Wärmetauscher (10) aufweist:

ein flaches plattenförmig geformtes Element (13, 14), das an beiden Endabschnitten in einer Schichtungsrichtung des Wärmetauscherschichtkörpers (11) angeordnet und befestigt ist, und einen stabähnlich geformten Gummi (20), der zwischen das flache plattenförmig geformte Element (13, 14) und den Wärmetauscherschichtkörper (11) eingesetzt ist.

4. Wärmetauscher (10) nach Anspruch 1 oder 2, wobei der Wärmetauscher (10) aufweist:

ein flaches plattenförmig geformtes Element (13, 14), das an beiden Endabschnitten in einer Schichtungsrichtung des Wärmetauscherschichtkörpers (11) angeordnet und befestigt ist, und einen stabähnlich geformten Gummi (20), der zwischen das flache plattenförmig geformte Element (13, 14) und den Wärmetauscherschichtkörper (11) eingesetzt ist,

wobei zwischen einem Endabschnitt des Eckelements (12) und dem flachen plattenförmig geformten Element (13, 14) eine Gummifarbe (19) aufgebracht ist.

5. Herstellungsverfahren eines Wärmetauschers (10), wobei das Verfahren folgende Schritte aufweist; einen Schritt zum Anordnen eines L-ähnlich geformten Eckelements (12) an einem Wärmetauscherschichtkörper (11), der durch Laminieren von Wärmeübertragungsplatten (16) gebildet ist, einen Schritt zum Einführen eines unvulkanisierten Gummis (18), in den ein Vulkanisationsmittel gemischt ist, im Voraus zwischen das Eckelement (12) und einen Eckabschnitt des Wärmetauscherschichtkörpers (11), einen Schritt des Anbringens des unvulkanisierten Gummis (18) und des Eckelements (12) an dem Wärmetauscherschichtkörper (11) und einen Schritt des Erwärmsens des Gummis (18), um die Vulkanisation des Gummis (18) auszuführen, so dass sich der Gummi (18) durch Aufschäumen des Gummis (18) im Zusammenhang mit der Vulkanisation ausdehnt und zwischen dem Eckelement (12) und dem Eckabschnitt des Wärmetauscherschichtkörpers (11) in einem luftdichten Zustand abschließt.

Revendications

1. Echangeur de chaleur (10) comprenant :

un corps stratifié d'échange de chaleur (11) formé en déposant en couche des feuilles de transfert de chaleur (16), et un premier passage d'écoulement pour un premier fluide et un second passage d'écoulement pour un second fluide, formés entre lesdites feuilles de transfert de chaleur (16) de manière alternée, ledit premier fluide et ledit second fluide étant un objet pour l'échange de chaleur, ledit premier fluide et ledit second fluide permettant d'échanger la chaleur du fluide ; dans lequel ledit échangeur de chaleur (10) comprend :

un élément de coin (12) qui a une section transversale en forme de L qui est montée au niveau d'une partie de coin dudit corps stratifié de transfert de chaleur (11), **caractérisé en ce que :**

un caoutchouc non vulcanisé (18) dans lequel un agent de vulcanisation est mélangé, étant inséré entre ledit élément de coin (12) et ladite partie de coin dudit corps stratifié de transfert de chaleur (12), à l'avance ; et ledit caoutchouc non vulcanisé (18) est expansé pour gonfler entre ledit élément de coin (12) et ladite partie de coin dudit corps stratifié d'échange de chaleur (11) par chauffage pour procéder à une vulcanisation dudit caoutchouc (18) de sorte que ledit caoutchouc (18) est expansé pour gonfler et avance dans un jeu dans la partie de coin du corps stratifié (11) et ledit caoutchouc (18) se ferme entre ledit élément de coin (12) et ladite partie de coin dudit corps stratifié d'échange de chaleur (11) dans un état étanche à l'air.

2. Echangeur de chaleur (10) selon la revendication 1, dans lequel ledit échangeur de chaleur (10) comprend :

une encoche formée au niveau d'une partie de coin dudit corps stratifié (11) ou une partie de raccordement dudit élément de coin (12) sur ledit corps stratifié de transfert de chaleur (11) de sorte que ledit caoutchouc non vulcanisé (18) peut être fixé sur ladite encoche.

3. Echangeur de chaleur (10) selon la revendication 1

ou 2, dans lequel ledit échangeur de chaleur (10) comprend :

une partie en forme de plaque plate (13, 14) étant agencée et fixée sur deux parties d'extrémité dans une direction de stratification dudit corps stratifié de transfert de chaleur (11), et un caoutchouc en forme de bâtonnet (20) étant inséré entre ledit élément en forme de plaque plate (13, 14) et ledit corps stratifié de transfert de chaleur (11). 5 10

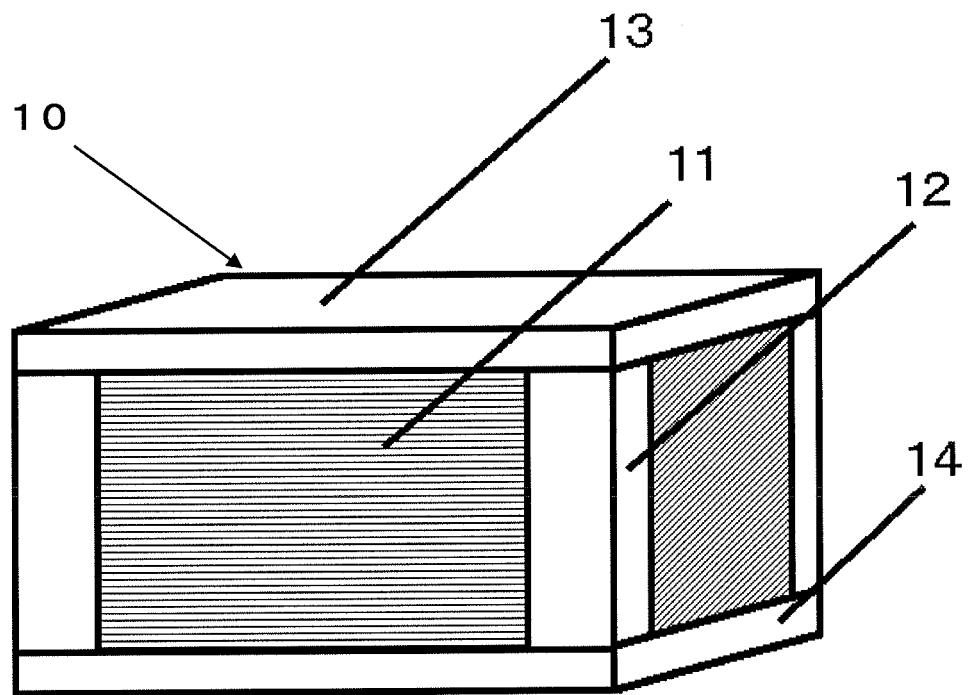
4. Echangeur de chaleur (10) selon la revendication 1 ou 2, dans lequel ledit échangeur de chaleur (10) comprend : 15

un élément en forme de plaque plate (13, 14) qui est agencé et fixé sur les deux parties d'extrémité (15) dans une direction de stratification dudit corps stratifié de transfert de chaleur (11), et le caoutchouc en forme de bâtonnet (20) étant inséré entre ledit élément en forme de plaque plate (13, 14) et ledit corps stratifié de transfert de chaleur (11), et dans lequel une peinture caoutchouc (19) est appliquée entre une partie d'extrémité dudit élément de coin (12) et ledit élément en forme de plaque plate (13, 14). 20 25 30

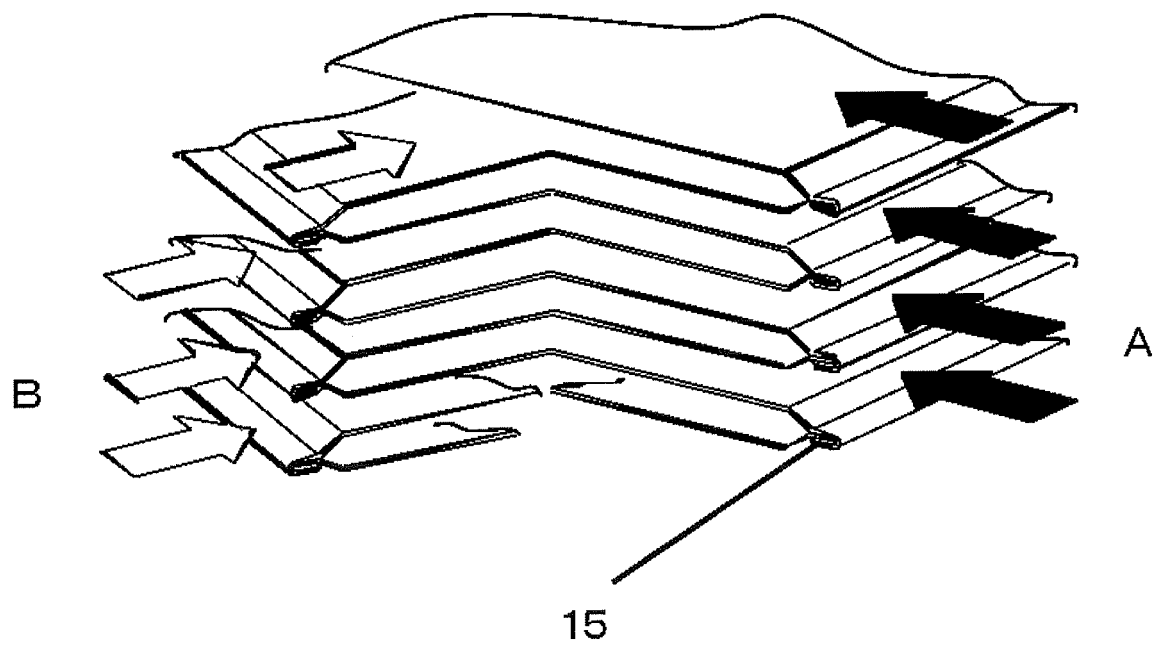
5. Procédé de fabrication d'un échangeur de chaleur (10), dans lequel le procédé comprend les étapes suivantes :

une étape pour agencer un élément de coin en forme de L (12) au niveau d'un corps stratifié de transfert de chaleur (11) formé en déposant en couche des feuilles de transfert de chaleur (16), une étape pour insérer un caoutchouc non vulcanisé (18) dans lequel un agent vulcanisé est mélangé entre ledit élément de coin (12) et une partie de coin dudit corps à plusieurs de couches de transfert de chaleur (11), à l'avance, une étape pour monter ledit caoutchouc non vulcanisé (18) et ledit élément de coin (12) sur ledit corps stratifié de transfert de chaleur (11), et une étape pour chauffer ledit caoutchouc (18) pour procéder à la vulcanisation dudit caoutchouc (18) de sorte que ledit caoutchouc (18) se gonfle en faisant subir une expansion audit caoutchouc (18) associé à la vulcanisation et se ferme entre ledit élément de coin (12) et ladite partie de coin dudit corps stratifié d'échange de chaleur (11) dans un état étanche à l'air. 35 40 45 50 55

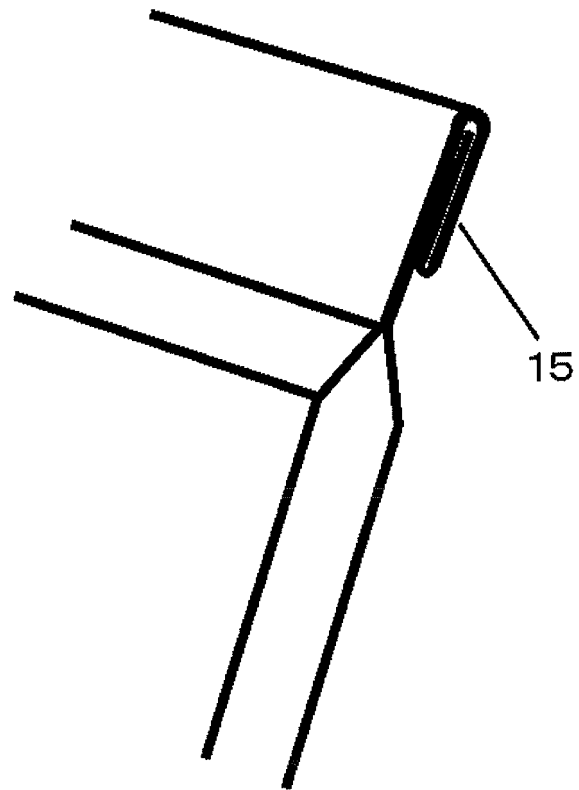
【 1 】



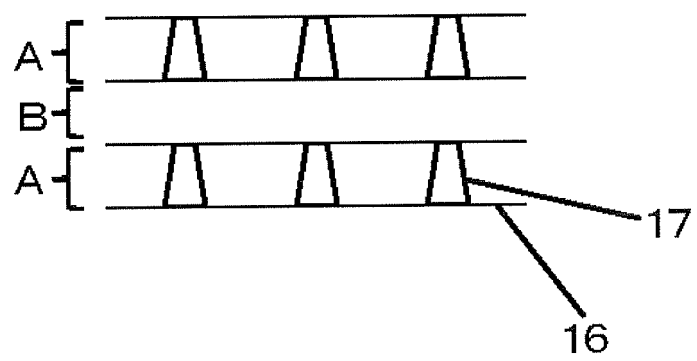
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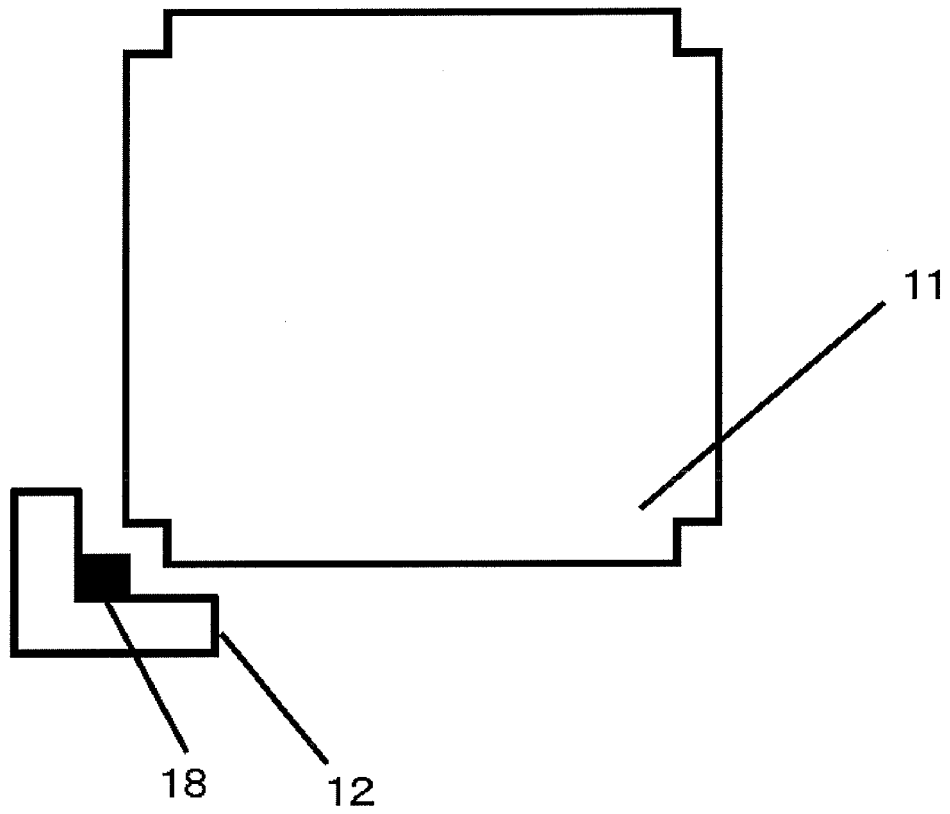
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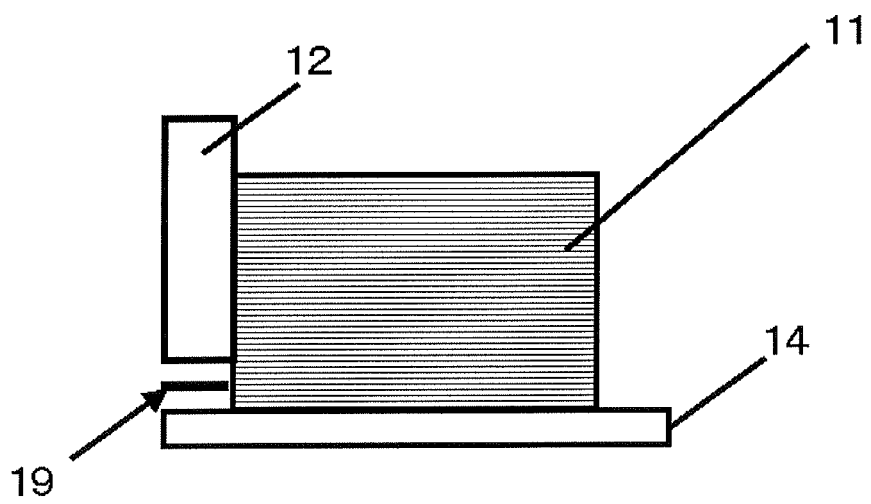
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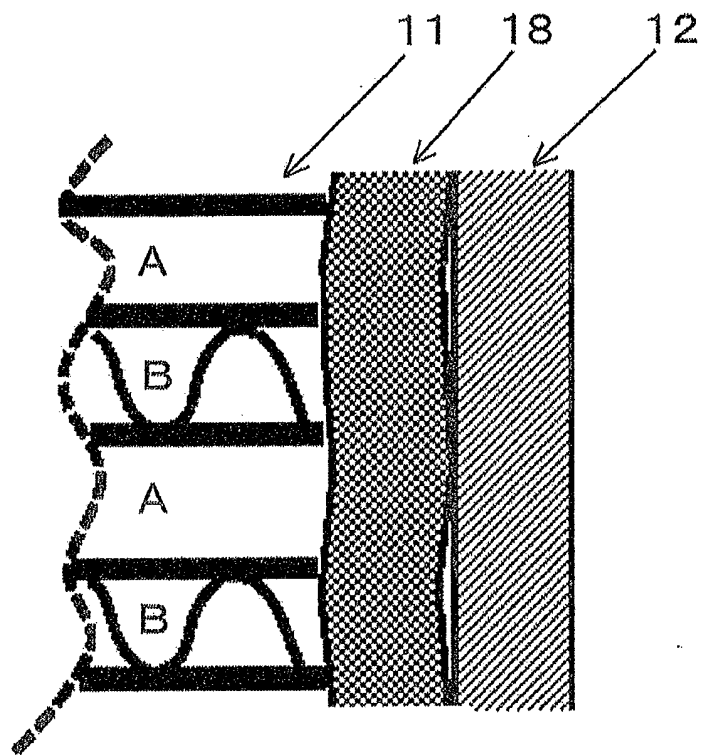
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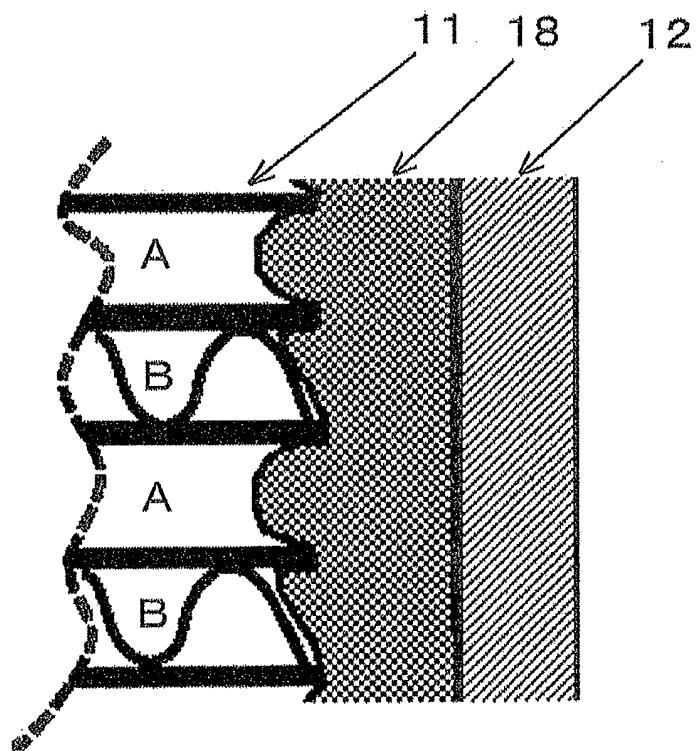
【 6 】



【7】

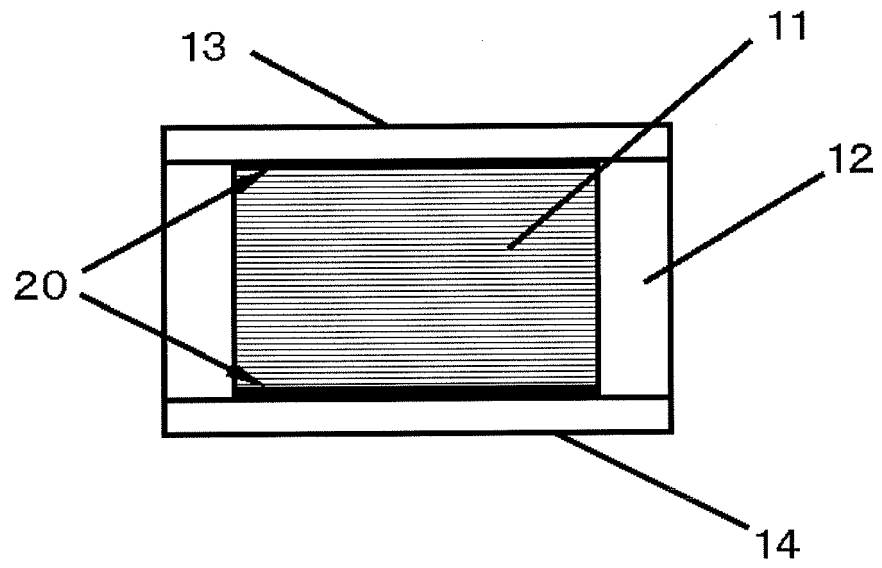


Before vulcanization

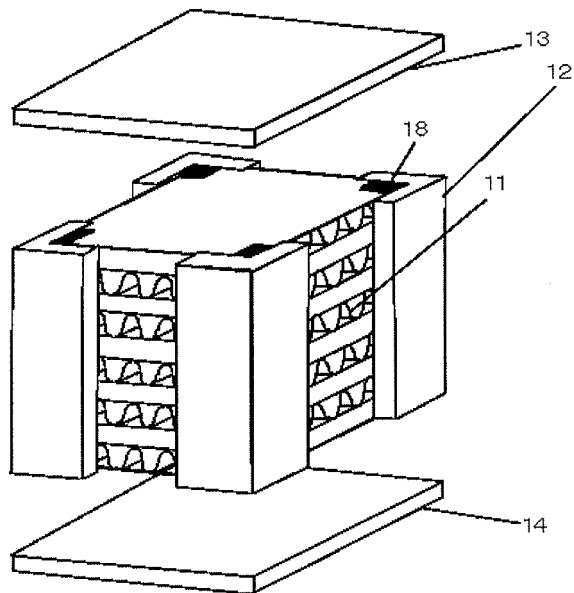


After vulcanization

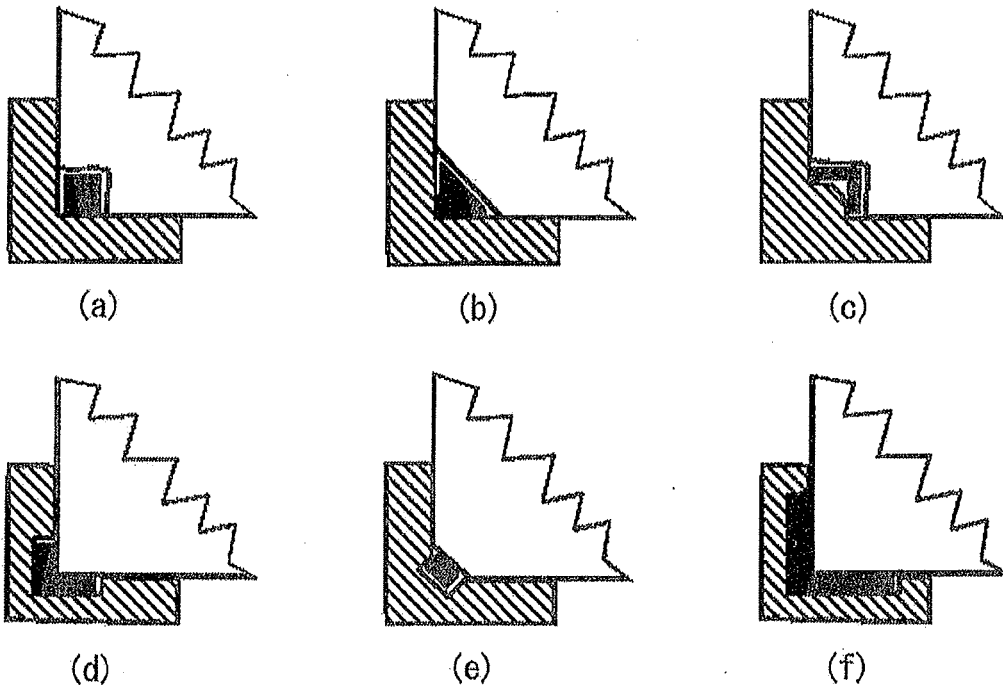
【 8 】



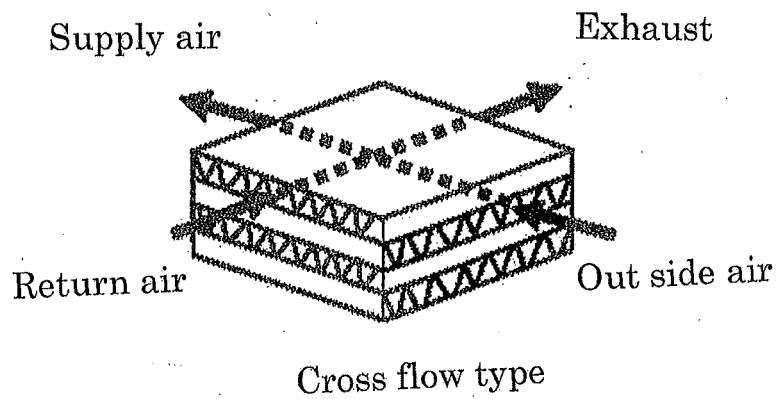
【 9 】



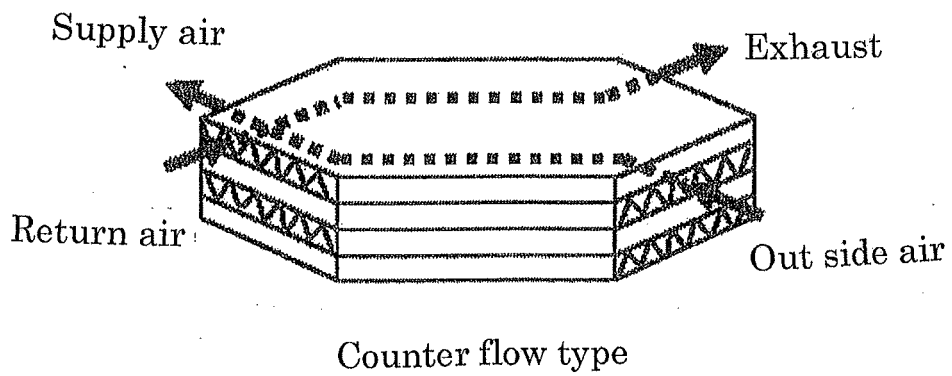
【10】



【11】



【12】



REFERENCES CITED IN THE DESCRIPTION

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Patent documents cited in the description

- US 5322117 A [0001]
- JP 2001341206 A [0007]