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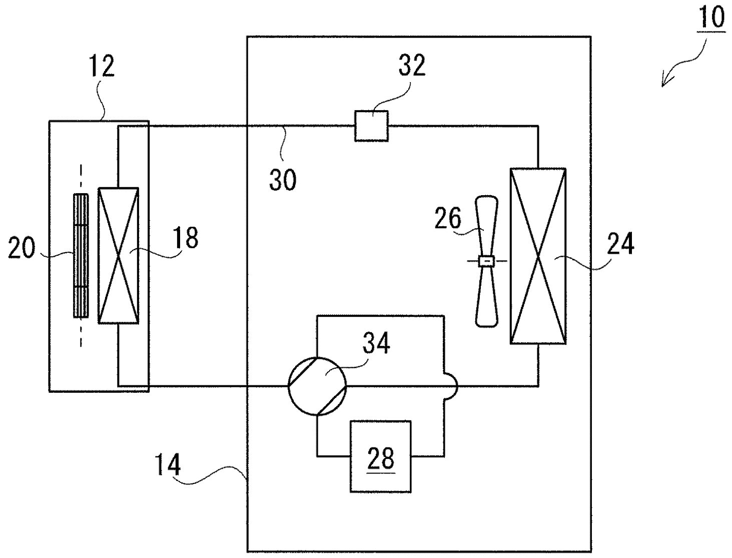
(54) HEAT EXCHANGER AND AIR CONDITIONER PROVIDED WITH SAME

(57) A heat exchanger includes: a plurality of fins each including an internal flow path through which a first fluid flows, the plurality of fins being layered to form a fin layered body with a gap through which a second fluid passes; first and second end plates respectively attached to both ends of the fin layered body in a layering direction; and a reinforcement member supported by the first and second end plates and surrounding an end portion of the fin layered body as viewed in the layering direction.

Fig. 1



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Description

TECHNICAL FIELD

[0001] The present disclosure relates to a heat exchanger and an air conditioner provided with the heat exchanger.

BACKGROUND ART

[0002] Conventionally, for example, as described in Japanese Unexamined Patent Application Publication No. 2017-180856, a plate-layered heat exchanger including a plurality of fins each formed by joining first and second plates is known. Each of the plurality of fins has an internal flow path through which a refrigerant flows. Heat exchange is performed between air flowing between the plurality of fins and the refrigerant flowing inside each of the fins.

[0003] A layered body (fin layered body) of the plurality of fins in such a plate-layered heat exchanger is produced by alternately layering first and second plates and then heating the plates while pressing the plates in a layering direction. For this purpose, each of the first and second plates is produced, for example, by press-molding a metal thin plate (brazing plate) provided with a brazing material layer on both surfaces.

SUMMARY

[0004] Meanwhile, in the case of a plate-layered heat exchanger, when the number of layered fins increases, the fin layered body has a flat plate shape that is long in a layering direction. Therefore, the fin layered body is easily deformed in a direction orthogonal to the layering direction. In particular, in a case where the fin has a lateral direction and a longitudinal direction, the fin layered body is easily deformed in the lateral direction. As a result, when an impact (external force) is applied to the fin layered body in the lateral direction and/or the longitudinal direction (for example, when the heat exchanger alone is dropped during conveyance, or a product is dropped in a state where the heat exchanger is mounted on the product), the fin layered body is deformed. When the fin layered body is deformed, the fin layered body collides with other components around the fin layered body, for example, a fan, and at least one of the fan and the fin layered body may be damaged. Furthermore, when the impact applied to the fin layered body is large, there is a possibility that the fin layered body is plastically deformed and does not return to the original shape.

[0005] Therefore, an object of the present disclosure is to improve rigidity of a fin layered body formed by layering a plurality of fins in a plate-layered heat exchanger

[0006] In order to solve the above problem, according to one aspect of the present disclosure,
provided is a heat exchanger including:

- a plurality of fins each including an internal flow path through which a first fluid flows, the plurality of fins being layered to form a fin layered body with a gap through which a second fluid passes;
- first and second end plates respectively attached to both ends of the fin layered body in a layering direction; and
- a reinforcement member supported by the first and second end plates and surrounding an end portion of the fin layered body as viewed in the layering direction.

[0007] Furthermore, according to another aspect of the present disclosure, provided is an air conditioner including:

- a compressor that delivers a refrigerant;
- a heat exchanger through which a refrigerant flows; and
- a fan that generates a flow of air passing through the heat exchanger,
- in which the heat exchanger includes:
  - a plurality of fins each including an internal flow path through which a refrigerant flows, the plurality of fins being layered to form a fin layered body with a gap through which air passes;
  - first and second end plates respectively attached to both ends of the fin layered body in a layering direction; and
  - a reinforcement member surrounding an end portion of the fin layered body as viewed in the layering direction.

[0008] According to the present disclosure, in a plate-layered heat exchanger, rigidity of a fin layered body formed by layering a plurality of fins can be improved.

BRIEF DESCRIPTION OF DRAWINGS

[0009]

- Fig. 1 is a schematic diagram of an air conditioner according to a first embodiment of the present disclosure;
- Fig. 2 is a schematic cross-sectional view of an indoor unit in the air conditioner;
- Fig. 3 is a perspective view of a heat exchanger;
- Fig. 4 is an exploded perspective view of the heat exchanger;
- Fig. 5 is a perspective view of a reinforcement member;
- Fig. 6 is a cross-sectional view of the reinforcement member taken along line A-A in Fig. 5;
- Fig. 7A is a perspective view of the heat exchanger in a state of being deformed in a longitudinal direction of a fin;
- Fig. 7B is a perspective view of the heat exchanger in

a state of being deformed in a lateral direction of the fin;

Fig. 8 is a perspective view of a reinforcement member in a heat exchanger according to a second embodiment of the present disclosure; and

Fig. 9 is a perspective view of a reinforcement member in a heat exchanger according to a third embodiment of the present disclosure.

DETAILED DESCRIPTION

[0010] A heat exchanger according to one aspect of the present disclosure includes: a plurality of fins each including an internal flow path through which a first fluid flows, the plurality of fins being layered to form a fin layered body with a gap through which a second fluid passes; first and second end plates respectively attached to both ends of the fin layered body in a layering direction; and a reinforcement member supported by the first and second end plates and surrounding an end portion of the fin layered body as viewed in the layering direction.

[0011] According to such an aspect, in a plate-layered heat exchanger, the rigidity of the fin layered body formed by layering the plurality of fins can be improved.

[0012] For example, the reinforcement member may surround one end portion of the fin layered body in a first direction that is a longitudinal direction of the fins as viewed in the layering direction.

[0013] For example, the reinforcement member may include: a main body extending in the layering direction and facing each of the plurality of fins in the fin layered body in the first direction; a first side wall portion that extends in the first direction from one end of the main body in a second direction that is a lateral direction of the fins, is disposed on one side in the second direction with respect to the fin layered body, and faces the fins; and a second side wall portion that extends in the first direction from another end of the main body in the second direction, is disposed on another side in the second direction with respect to the fin layered body, and faces the fins.

[0014] For example, one of the first side wall portion and the second side wall portion may face each of the plurality of fins in the fin layered body in the second direction, and another of the first side wall portion and the second side wall portion may face a part of the plurality of fins in the fin layered body in the second direction.

[0015] For example, both the first side wall portion and the second side wall portion may extend in the layering direction so as to face each of the plurality of fins in the fin layered body in the second direction.

[0016] For example, the main body of the reinforcement member may include a through hole.

[0017] An air conditioner according to another aspect of the present disclosure includes: a compressor that delivers a refrigerant; a heat exchanger through which a refrigerant flows; and a fan that generates a flow of air passing through the heat exchanger, in which the heat exchanger includes: a plurality of fins each including an internal flow path through which a refrigerant flows, the plurality of fins being layered to form a fin layered body with a gap through which air passes; first and second end plates respectively attached to both ends of the fin layered body in a layering direction; and a reinforcement member surrounding an end portion of the fin layered body as viewed in the layering direction.

[0018] According to such another aspect, in a plate-layered heat exchanger mounted on the air conditioner, the rigidity of the fin layered body formed by layering the plurality of fins can be improved.

[0019] Hereinafter, embodiments of the present disclosure will be described with reference to the drawings.

(First Embodiment)

[0020] Fig. 1 is a schematic diagram of an air conditioner according to an embodiment of the present disclosure. Furthermore, Fig. 2 is a schematic cross-sectional view of an indoor unit in the air conditioner.

[0021] As illustrated in Fig. 1, an air conditioner 10 according to the present first embodiment includes an indoor unit 12 disposed in a room and an outdoor unit 14 disposed outside the room.

[0022] As illustrated in Figs. 1 and 2, the indoor unit 12 includes a casing 16 installed in a room, a heat exchanger 18 that is disposed in the casing 16 and exchanges heat with indoor air, and a cross flow fan 20 that generates a flow of indoor air so that the indoor air passes through the heat exchanger 18. The casing 16 is formed with an intake port 16a that opens upward, an intake port 16b that opens forward, and a blowout port 16c that faces obliquely downward. When the cross flow fan 20 rotates, indoor air flows into the casing 16 through the intake ports 16a, 16b and passes through the heat exchanger 18. The air having passed through the heat exchanger 18 is blown out of the casing 16 through the blowout port 16c. Note that a drain pan 22 for storing moisture in the air condensed on a surface of the heat exchanger 18 is provided below the heat exchanger 18.

[0023] As illustrated in Fig. 1, the outdoor unit 14 is mounted with a heat exchanger 24 that exchanges heat with outdoor air, an axial fan 26 that generates a flow of outdoor air so that the outdoor air passes through the heat exchanger 24, and a compressor 28 that delivers a refrigerant (first fluid) passing through the heat exchangers 18, 24. The heat exchanger 18, the heat exchanger 24, and the compressor 28 are connected via a refrigerant pipe 30. An expansion valve 32 that decompresses the refrigerant and a four-way valve 34 that changes a flow direction of the refrigerant are disposed on the refrigerant pipe 30.

[0024] During a cooling operation, the refrigerant is delivered from the compressor 28, sequentially passes through the four-way valve 34, the heat exchanger 24 of the outdoor unit 14, the expansion valve 32, and the heat exchanger 18 of the indoor unit 12, and returns to the compressor 28. During a heating operation, the refrigerant is delivered from the compressor 28, sequentially passes through the four-way valve 34, the heat exchanger 18 of the indoor unit 12, the expansion valve 32, and the heat exchanger 24 of the outdoor unit 14, and returns to the compressor 28. The flow of the refrigerant during the cooling operation and the flow of the refrigerant during the heating operation are switched by the four-way valve 34. Note that, during the cooling operation, water droplets generated by dew condensation of indoor air on the surface of the heat exchanger 18 flow along the surface of the heat exchanger 18 and drop into the drain pan 22.

[0025] Fig. 3 is a perspective view of the heat exchanger according to the embodiment of the present disclosure. Furthermore, Fig. 4 is an exploded perspective view of the heat exchanger. Note that an X-Y-Z orthogonal coordinate system illustrated in the drawings is for facilitating understanding of the embodiment, and does not limit the embodiment. An X-axis direction indicates a lateral direction of a fin constituting a fin layered body in the heat exchanger, a Y-axis direction indicates a longitudinal direction of the fin, and a Z-axis direction indicates a thickness direction of the fin and a layering direction of the fin. Furthermore, in the drawings, a white arrow indicates a flow direction of air A (a second fluid) flowing into the heat exchanger 18. In the case of the present first embodiment, the air A passing through the heat exchanger 18 flows in the X-axis direction.

[0026] As illustrated in Figs. 3 and 4, the heat exchanger 18 includes a fin layered body 40. First and second end plates 42, 44 are attached to both ends of the fin layered body 40 in the layering direction, respectively. The first end plate 42 is provided with an inflow-side connection pipe 42a that is connected to a refrigerant pipe 30 and through which the refrigerant flows, and an outflow-side connection pipe 42b that is connected to the refrigerant pipe 30 and through which the refrigerant flows.

[0027] As illustrated in Fig. 4, the fin layered body 40 is formed by layering a plurality of fins 46 having a substantially rectangular shape in the thickness direction (Z-axis direction). By layering a large number of fins 46, the heat exchanger 18 has a flat plate shape elongated in the layering direction of the fins 46 as illustrated in Fig. 3. Note that, in the case of the present first embodiment, the plurality of fins 46 are layered in the left-right direction of indoor unit 12.

[0028] As illustrated in Fig. 4, an internal flow path 46a through which the refrigerant flows is provided inside each of the plurality of fins 46. In the case of the present first embodiment, each of the plurality of fins 46 is formed by joining a first plate 48 and a second plate 50 to each other in the layering direction (Z-axis direction) of the fin layered body 40. The internal flow path 46a is formed between the first plate 48 and the second plate 50.

[0029] For example, the first plate 48 and the second plate 50 are produced by processing, for example, pressing a metal thin plate, a so-called brazing plate, in which brazing material layers are provided on both surfaces. The brazing plate is produced, for example, by forming an aluminum-silicon alloy layer as a brazing material on both surfaces of a thin plate produced from an aluminum alloy. The first plate 48 and the second plate 50 are joined by the brazing material layer being melted once by heating and solidified again.

[0030] By joining the first plate 48 and the second plate 50 to each other, the internal flow path 46a through which the refrigerant flows is formed therebetween. In the case of the present first embodiment, a recess is formed on an inner surface of the first plate 48 facing the second plate 50. The second plate 50 covers the recess to form the internal flow path 46a.

[0031] Furthermore, the internal flow paths 46a communicate with the insides of tubular headers 46b, 46c provided at both ends in the longitudinal direction (Y-axis direction) of the fins 46. That is, the internal flow path 46a is provided at the center portion of the fin 46 in the longitudinal direction, and both ends thereof communicate with the insides of the headers 46b, 46c. Furthermore, each of these headers 46b, 46c is formed by joining a cylindrical portion formed in the first plate 48 and a cylindrical portion formed in the second plate 50.

[0032] The headers 46b of the plurality of fins 46 are coupled and joined to constitute an inflow-side manifold. The inflow-side manifold is connected to the inflow-side connection pipe 42a of the first end plate 42. As a result, the refrigerant that has passed through the inflow-side connection pipe 42a flows into the internal flow paths 46a of the respective fins 46.

[0033] Furthermore, the headers 46c of the plurality of fins 46 are coupled and joined to constitute an outflow-side manifold. The outflow-side manifold is connected to the outflow-side connection pipe 42b of the first end plate 42. As a result, the refrigerant flowing out of the internal flow paths 46a of the fins 46 flows toward the outflow-side connection pipe 42b.

[0034] Each of the plurality of fins 46 is layered with a gap between them. Specifically, the gap between two adjacent fins 46 is formed by joining the header 46b of one fin 46 to the header 46b of the other fin 46 and joining the header 46c of one fin 46 to the header 46c of the other fin 46. The air A flows through this gap.

[0035] According to such the heat exchanger 18, heat exchange is performed between the refrigerant flowing through the internal flow path 46a of each of the fins 46 and the air A flowing through the gap between the fins 46.

[0036] Furthermore, in the present first embodiment, as illustrated in Fig. 3, heat exchanger 18 includes a reinforcement member 52.

[0037] Fig. 5 is a perspective view of the reinforcement member. Furthermore, Fig. 6 is a cross-sectional view of the reinforcement member taken along line A-A in Fig. 5.

[0038] As illustrated in Fig. 5, the reinforcement member 52 is a member that suppresses deformation of the fin layered body 40 by being attached to the fin layered body 40. Here, the deformation of the fin layered body 40 will be described.

[0039] Fig. 7A is a perspective view of the heat exchanger in a state of being deformed in the longitudinal direction of the fin. Furthermore, Fig. 7B is a perspective view of the heat exchanger in a state of being deformed in the lateral direction of the fin.

[0040] Furthermore, as described above, and as illustrated in Fig. 3, the heat exchanger 18, that is, the fin layered body 40 is a structural body having a flat plate shape elongated in the layering direction (Z-axis direction) of the fins 46 and having a gap between the fins 46. Therefore, as illustrated in Fig. 7A, when an external force F1 acts in the longitudinal direction (Y-axis direction) of the fin 46, the fin layered body 40 is easily bent and deformed in the longitudinal direction of the fin 46. Furthermore, as illustrated in Fig. 7B, when an external force F2 acts in the lateral direction (X-axis direction) of the fin 46, the fin layered body 40 is easily bent and deformed in the lateral direction of the fin 46. Such external forces F1 and F2 are generated, for example, when the heat exchanger 18 falls during conveyance. As a matter of course, when such external forces F1 and F2 increase, the fin layered body 40 may be plastically deformed and cannot return to the original shape.

[0041] In order to suppress the deformation of the fin layered body 40 due to such external forces F1 and F2, that is, in order to improve rigidity of the fin layered body 40, the reinforcement member 52 is provided in the heat exchanger 18.

[0042] As illustrated in Figs. 5 and 6, in the case of the present first embodiment, the reinforcement member 52 is produced by pressing a thin metal plate, for example, a stainless steel thin plate. The reinforcement member 52 is a member that is long in the layering direction (Z-axis direction) of the fin 46. Furthermore, the reinforcement member 52 has a "U" shape as viewed in the layering direction, and surrounds one end portion of the fin layered body 40 in the longitudinal direction (Y-axis direction) of the fin 46. That is, as viewed in the layering direction, the reinforcement member 52 surrounds three sides of the one end portion of the fin layered body 40 except for a direction from the one end portion toward the other end portion of the fin layered body 40.

[0043] In the case of the present first embodiment, the reinforcement member includes a band-shaped main body 52a extending in the layering direction (Z-axis direction) of the fin 46, a first side wall portion 52b extending in the longitudinal direction (Y-axis direction) of the fin 46 from one end in the lateral direction (X-axis direction) of the fin 46 in the main body 52a, and a second side wall portion 52c extending in the longitudinal direction of the fin 46 from the other end in the lateral direction of the fin 46 in the main body 52a.

[0044] In the case of the present first embodiment, the main body 52a of the reinforcement member 52 extends in the layering direction (Z-axis direction) of the fin 46 from the first end plate 42 toward the second end plate 44, and is in contact with each of the plurality of fins 46 in the fin layered body 40 while facing each other in the longitudinal direction (Y-axis direction) of the fins 46. Furthermore, in the case of the present first embodiment, a size of the main body 52a of the reinforcement member 52 in the lateral direction (X-axis direction) of the fin 46 is smaller than a size of the fin 46 in the lateral direction although the reason will be described later.

[0045] In the case of the present first embodiment, similarly to the main body 52a, the first side wall portion 52b of the reinforcement member 52 extends in the layering direction (Z-axis direction) of the fins 46 from the first end plate 42 toward the second end plate 44, and is in contact with each of the plurality of fins 46 in the fin layered body 40 while facing each other in the lateral direction (X-axis direction) of the fins 46. Furthermore, the first side wall portion 52b is disposed on one side in the lateral direction of the fin 46 with respect to the fin layered body 40, that is, on a downstream side in the flow direction of the air A in the case of the present first embodiment, and faces each of the plurality of fins 46.

[0046] Moreover, in the case of the present first embodiment, the first side wall portion 52b extends so as to be substantially orthogonal to the main body 52a. Moreover, an extending length of the first side wall portion 52b from the main body 52a is set to a length that does not interfere with the flow of the air A flowing in the lateral direction (X-axis direction) along a central portion (that is, a portion provided with the internal flow path 46a) in the longitudinal direction (Y-axis direction) of each of the fins 46. For example, the first side wall portion 52b extends from the main body 52a so as not to overlap the internal flow path 46a as viewed in the lateral direction of the fin 46.

[0047] Note that, in the case of the present first embodiment, the reinforcement member 52 is supported by the first and second end plates 42, 44 via the first side wall portion 52b. Specifically, a first attachment portion 52d attached to the first end plate 42 and a second attachment portion 52e attached to the second end plate 44 are provided at both ends of the first side wall portion 52b in the layering direction (Z-axis direction) of the fins 46. The first and second attachment portions 52d, 52e are fixed to the first and second end plates 42, 44, for example, via screws or the like. Accordingly, the reinforcement member 52 is not fixed to the plurality of fins 46 in the heat exchanger 18.

[0048] In the case of the present first embodiment, the second side wall portion 52c of the reinforcement member 52 extends in the layering direction (Z-axis direction) of the fins 46 similarly to the first side wall portion 52b, but the extending length thereof is short. That is, the second side wall portion 52c faces and is in contact with a part of the fin 46 in the fin layered body 40 in the lateral direction (X-axis direction) of the fin 46. Furthermore, the second side wall portion 52c is disposed on the other side in the lateral direction of the fin 46 with respect to the fin layered body 40, that is, on the upstream side in the flow direction of the air A in the case of the present first embodiment, and faces a part of the fin 46.

[0049] Moreover, in the case of the present first embodiment, the second side wall portion 52c extends so as to be substantially orthogonal to the main body 52a. Moreover, an extension length of the second side wall portion 52c from the main body 52a is set to a length that does not interfere with the flow of the air A flowing in the lateral direction (X-axis direction) along a central portion (that is, a portion provided with the internal flow path 46a) in the longitudinal direction (Y-axis direction) of each of the fins 46. For example, the second side wall portion 52c extends from the main body 52a so as not to overlap the internal flow path 46a as viewed in the lateral direction of the fin 46.

[0050] Moreover, in the case of the present first embodiment, the second side wall portion 52c faces the first side wall portion 52b at an interval in the lateral direction (X-axis direction) of the fin 46. That is, one end of the fin 46 in the fin layered body 40 in the longitudinal direction (Y-axis direction) is disposed between the first side wall portion 52b and the second side wall portion 52c. As a result, as viewed in the layering direction (Z-axis direction) of the fins 46, one end of the fin layered body 40 is surrounded by the main body 52a, the first side wall portion 52b, and the second side wall portion 52c of the reinforcement member 52.

[0051] According to such a reinforcement member 52, in a case where the external force F1 acts on the fin layered body 40 in the longitudinal direction (Y-axis direction) of the fin 46 as illustrated in Fig. 7A, the main body 52a of the reinforcement member 52 suppresses deflection deformation in the longitudinal direction of the fin layered body 40, that is, partial displacement in the longitudinal direction (particularly, displacement in the longitudinal direction of the central portion in the longitudinal direction).

[0052] Furthermore, as illustrated in Fig. 7B, in a case where the external force F2 acts on the fin layered body 40 in the lateral direction (X-axis direction) of the fin 46, the first and second side wall portions 52b, 52c of the reinforcement member 52 suppress deflection deformation in the lateral direction of the fin layered body 40, that is, partial displacement in the lateral direction (particularly, displacement in the lateral direction of the central portion in the longitudinal direction (Y-axis direction)).

[0053] Furthermore, the reinforcement member 52 of the present first embodiment is suitable for being attached to the end portions located on the lower side of the longitudinal direction (Y-axis direction) of the fin 46 in both end portions of the heat exchanger 18 (fin layered body 40).

[0054] More specifically, as illustrated in Fig. 2, the heat exchanger 18 is disposed above the drain pan 22. Furthermore, the heat exchanger 18 is disposed in the indoor unit 12 with the longitudinal direction of the fin 46 substantially aligned with the vertical direction of the indoor unit 12. At this time, when the reinforcement member is attached to the end portions of the heat exchanger 18 located on the lower side, moisture in the air condensed on the surfaces of the plurality of fins 46 may remain in the reinforcement member 52 and may not move to the drain pan 22.

[0055] As a countermeasure, in the case of the present first embodiment, a size of the main body 52a of the reinforcement member 52 in the lateral direction (X-axis direction) of the fin 46 is smaller than a size in the lateral direction of the fin 46. Thus, moisture in the air condensed on the surface of the fin 46 can move to the drain pan 22 through the lower portion of the fin 46 that is not covered with the main body 52a of the reinforcement member 52.

[0056] Note that, as illustrated in Figs. 7A and 7B, the external forces F1, F2 also act on the reinforcement member 52 via the fin layered body 40. The reinforcement member 52 has an L-shaped structure so as not to be deformed by the external forces F1, F2. That is, the main body 52a and the first side wall portion 52b extend over the entire area in the layering direction (Z-axis direction) of the fin 46 while being orthogonal to each other, so that the reinforcement member 52 has high rigidity.

[0057] According to the present first embodiment as described above, in the plate-layered heat exchanger 18, the rigidity of the fin layered body 40 formed by layering the plurality of fins 46 can be improved.

(Second Embodiment)

[0058] A difference between the heat exchanger according to the present second embodiment and the heat exchanger according to the first embodiment is a reinforcement member. Therefore, the present second embodiment will be described focusing on the reinforcement member.

[0059] Fig. 8 is a perspective view of a reinforcement member in a heat exchanger according to the second embodiment of the present disclosure.

[0060] As illustrated in Fig. 8, a reinforcement member 152 in a heat exchanger 118 according to the present second embodiment is a member elongated in the layering direction (Z-axis direction) of a fin 46 similarly to the reinforcement member 52 of the first embodiment described above. Furthermore, the reinforcement member 152 has a "U" shape as viewed in the layering direction, and surrounds one end portion of a fin layered body 40 in the longitudinal direction (Y-axis direction) of the fin 46.

[0061] The reinforcement member 152 includes a belt-shaped main body 152a extending in the layering direction (Z-axis direction) of the fin 46, a first side wall portion 152b extending in the longitudinal direction (Y-axis direction) of the fin 46 from one end of the main body 152a in the lateral direction (X-axis direction) of the fin 46, and a second side wall portion 152c extending in the longitudinal direction of the fin 46 from the other end of the main body 152a in the lateral direction of the fin 46.

[0062] In the case of the present second embodiment, the main body 152a of the reinforcement member 152 extends in the layering direction (Z-axis direction) of the fin 46 from a first end plate 42 toward a second end plate 44, and is in contact with each of a plurality of the fins 46 in the fin layered body 40 while facing each other in the longitudinal direction (Y-axis direction) of the fins 46. Furthermore, in the case of the present second embodiment, a size of the main body 152a of the reinforcement member 152 in the lateral direction (X-axis direction) of the fin 46 is substantially equal to a size of the fin 46 in the lateral direction.

[0063] In the case of the present second embodiment, both the first and second side wall portions 152b, 152c extend in the layering direction (Z-axis direction) of the fin 46 from the first end plate 42 toward the second end plate 44, similarly to the main body 152a. As a result, both the first and second side wall portions 152b, 152c face and are in contact with each of the plurality of fins 46 in the fin layered body 40 in the lateral direction (X-axis direction) of the fin 46. That is, the first and second side wall portions 152b, 152c face each other over the entire layering direction. As a result, as viewed in the layering direction (Z-axis direction) of the fin 46, one end of the fin layered body 40 is surrounded by the main body 152a, the first side wall portion 152b, and the second side wall portion 152c of the reinforcement member 152.

[0064] According to the present second embodiment as described above, similarly to the first embodiment described above, in the plate-layered heat exchanger 118, the rigidity of the fin layered body 40 formed by layering the plurality of fins 46 can be improved.

[0065] Note that, considering that moisture in the air condensed on the surfaces of the fins 46 moves to a drain pan 22, the reinforcement member 152 of the present second embodiment is suitable for being attached to the end portions located on the upper side at both end portions of the heat exchanger 118 (fin layered body 40) in the longitudinal direction (Y-axis direction) of the fins 46.

(Third Embodiment)

[0066] A difference between a heat exchanger according to the present third embodiment and the heat exchanger according to the first embodiment is a reinforcement member. Furthermore, a reinforcement member according to the present third embodiment is an improvement of the reinforcement member according to the second embodiment. Therefore, the present third embodiment will be described focusing on this reinforcement member.

[0067] Fig. 9 is a perspective view of a reinforcement member in a heat exchanger according to the third embodiment of the present disclosure.

[0068] As illustrated in Fig. 9, a reinforcement member 252 in a heat exchanger 218 according to the present third embodiment is a member elongated in the layering direction (Z-axis direction) of a fin 46 similarly to the reinforcement member 52 of the first embodiment described above. Furthermore, the reinforcement member 252 has a "U" shape as viewed in the layering direction, and surrounds one end portion of a fin layered body 40 in the longitudinal direction (Y-axis direction) of the fin 46.

[0069] The reinforcement member 252 includes a belt-shaped main body 252a extending in the layering direction (Z-axis direction) of the fin 46, a first side wall portion 252b extending in the longitudinal direction (Y-axis direction) of the fin 46 from one end of the main body 252a in the lateral direction (X-axis direction) of the fin 46, and a second side wall portion 252c extending in the longitudinal direction of the fin 46 from the other end of the main body 252a in the lateral direction of the fin 46.

[0070] In the case of the present third embodiment, the main body 252a of the reinforcement member 252 extends in the layering direction (Z-axis direction) of the fin 46 from a first end plate 42 toward a second end plate 44, and is in contact with each of a plurality of the fins 46 in the fin layered body 40 while facing each other in the longitudinal direction (Y-axis direction) of the fins 46. Furthermore, in the case of the present third embodiment, a size of the main body 252a of the reinforcement member 252 in the lateral direction (X-axis direction) of the fin 46 is substantially equal to a size of the fin 46 in the lateral direction.

[0071] In the case of the present third embodiment, both the first and second side wall portions 252b, 252c extend in the layering direction (Z-axis direction) of the fin 46 from the first end plate 42 toward the second end plate 44, similarly to the main body 252a. As a result, both the first and second side wall portions 252b, 252c face and are in contact with each of the plurality of fins 46 in the fin layered body 40 in the lateral direction (X-axis direction) of the fin 46. That is, the first and second side wall portions 252b, 252c face each other over the entire layering direction. As a result, as viewed in the layering direction (Z-axis direction) of the fin 46, one end of the fin layered body 40 is surrounded by the main body 252a, the first side wall portion 252b, and the second side wall portion 252c of the reinforcement member 252.

[0072] Furthermore, in the case of the present third embodiment, a plurality of through holes 252d are formed in the main body 252a of the reinforcement member 252 in consideration of movement of moisture in the air condensed on the surface of the fin 46 to a drain pan 22. As a result, moisture in the air condensed on the surface of the fin 46 can pass through the through holes 252d and move to the drain pan 22.

[0073] According to the present third embodiment as described above, similarly to the first embodiment described above, in the plate-layered heat exchanger 218, the rigidity of the fin layered body 40 formed by layering the plurality of fins 46 can be improved.

[0074] Although the present disclosure has been described above with reference to the above-described embodiments, the present disclosure is not limited to the above-described embodiments.

[0075] For example, in the case of the above-described the first embodiment to the third embodiment, as illustrated in Figs. 3, 8, and 9, the reinforcement members 52, 152, 252 are attached only to one end portion of the fin layered body 40 in the longitudinal direction (Y-axis direction) of the fin 46. However, the embodiment of the present disclosure is not limited thereto. The reinforcement members may be attached to both end portions of the fin layered body 40 in the longitudinal direction (Y-axis direction) of the fin 46. At this time, the reinforcement member attached to one end portion of the fin layered body 40 and the reinforcement member attached to the other end portion may be different. For example, the reinforcement member 152 according to the second embodiment may be attached to one end portion of the fin layered body 40 located on the upper side, and the reinforcement member 52 according to the first embodiment or the reinforcement member 252 according to the third embodiment may be attached to the other end portion.

[0076] Furthermore, in the case of the above-described first embodiment, as illustrated in Figs. 3 and 5, the reinforcement member 52 is attached to one end of the fin layered body 40 in the longitudinal direction (Y-axis direction) of the fin 46. However, the embodiment of the present disclosure is not limited thereto. As long as the flow of air flowing in the gap between the fins 46 is not disturbed, the reinforcement member may be attached to one end of the fin layered body 40 in the lateral direction (X-axis direction) of the fin 46. In this case, for example, the reinforcement member 52 is provided with a plurality of through holes through which air passes.

[0077] Furthermore, in the case of the above-described the first embodiment to the third embodiment, the first side wall portions 52b, 152b, 252b and the second side wall portions 52c, 152c, 252c at least partially face each other in the lateral direction (X-axis direction) of the fin 46. However, the embodiment of the present disclosure is not limited thereto. In the reinforcement member, the first side wall portion and the second side wall portion may not face each other. For example, the first side wall portion may be provided at the center in the layering direction (Z-axis direction), and the second side wall portion may be provided outside in the layering direction. However, in consideration of the bending stiffness of the reinforcement member, it is preferable that the first side wall portion and the second side wall portion at least partially face each other.

[0078] Moreover, the heat exchanger according to the first embodiment described above is provided in an air conditioner that performs indoor air conditioning. However, the embodiment of the present disclosure is not limited thereto. The heat exchanger according to the embodiment of the present disclosure can be used in a device that needs to perform heat exchange between a first fluid and a second fluid.

[0079] That is, in a broad sense, a heat exchanger according to an embodiment of the present disclosure includes: a plurality of fins each including an internal flow path through which a first fluid flows, the plurality of fins being layered to form a fin layered body with a gap through which a second fluid passes; first and second end plates respectively attached to both ends of the fin layered body in a layering direction; and a reinforcement member supported by the first and second end plates and surrounding an end portion of the fin layered body as viewed in the layering direction.

[0080] The present disclosure is applicable not only to a heat exchanger that performs heat exchange between a refrigerant and air but also between a first fluid and a second fluid.

Claims

1. A heat exchanger comprising:

   a plurality of fins each including an internal flow path through which a first fluid flows, the plurality of fins being layered to form a fin layered body with a gap through which a second fluid passes;
   first and second end plates respectively attached to both ends of the fin layered body in a layering direction; and
   a reinforcement member supported by the first and second end plates and surrounding an end portion of the fin layered body as viewed in the layering direction.

2. The heat exchanger according to claim 1, wherein the reinforcement member surrounds one end portion of the fin layered body in a first direction that is a longitudinal direction of the fins as viewed in the layering direction.

3. The heat exchanger according to claim 2, wherein the reinforcement member includes:

   a main body extending in the layering direction and facing each of the plurality of fins in the fin layered body in the first direction;
   a first side wall portion that extends in the first direction from one end of the main body in a second direction that is a lateral direction of the fins, is disposed on one side in the second direction with respect to the fin layered body, and faces the fins; and
   a second side wall portion that extends in the first direction from another end of the main body in the second direction, is disposed on another side in the second direction with respect to the fin layered body, and faces the fins.

4. The heat exchanger according to claim 3, wherein

   one of the first side wall portion and the second side wall portion faces each of the plurality of fins in the fin layered body in the second direction,

and
another of the first side wall portion and the second side wall portion faces a part of the plurality of fins in the fin layered body in the second direction.

5. The heat exchanger according to claim 3, wherein both the first side wall portion and the second side wall portion extend in the layering direction so as to face each of the plurality of fins in the fin layered body in the second direction.

6. The heat exchanger according to claim 3, wherein the main body of the reinforcement member includes a through hole.

7. An air conditioner comprising:

a compressor that delivers a refrigerant;
a heat exchanger through which a refrigerant flows; and
a fan that generates a flow of air passing through the heat exchanger,
wherein the heat exchanger includes:

a plurality of fins each including an internal flow path through which a refrigerant flows, the plurality of fins being layered to form a fin layered body with a gap through which air passes;
first and second end plates respectively attached to both ends of the fin layered body in a layering direction; and
a reinforcement member surrounding an end portion of the fin layered body as viewed in the layering direction.

Fig. 1

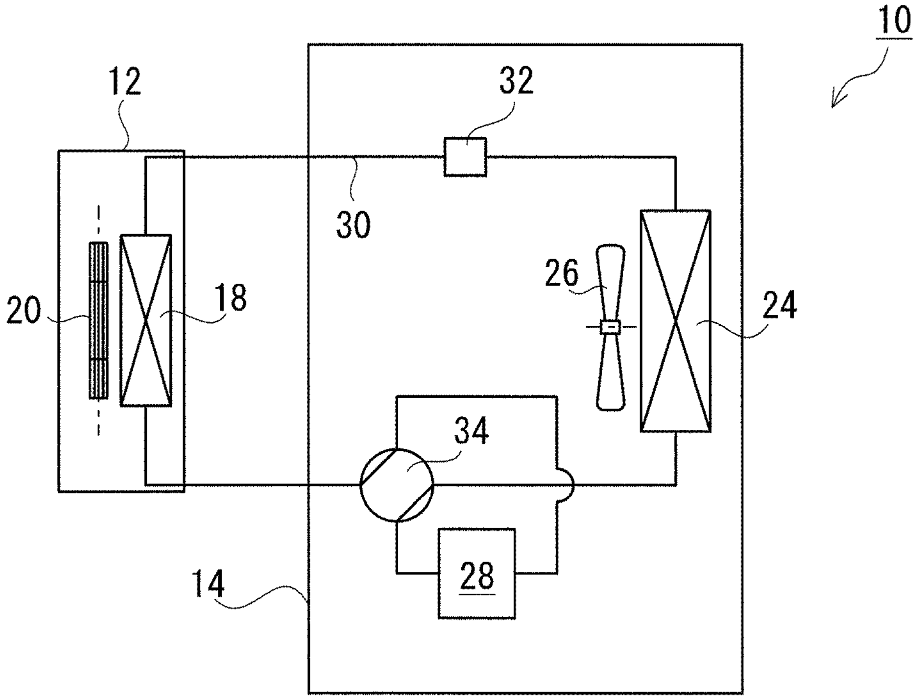


Fig. 2

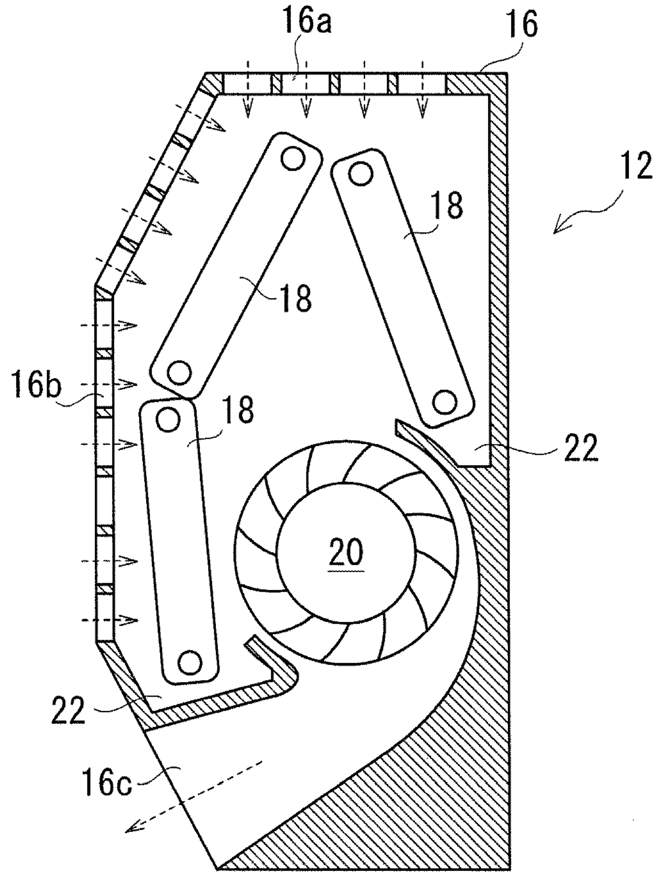


Fig. 3

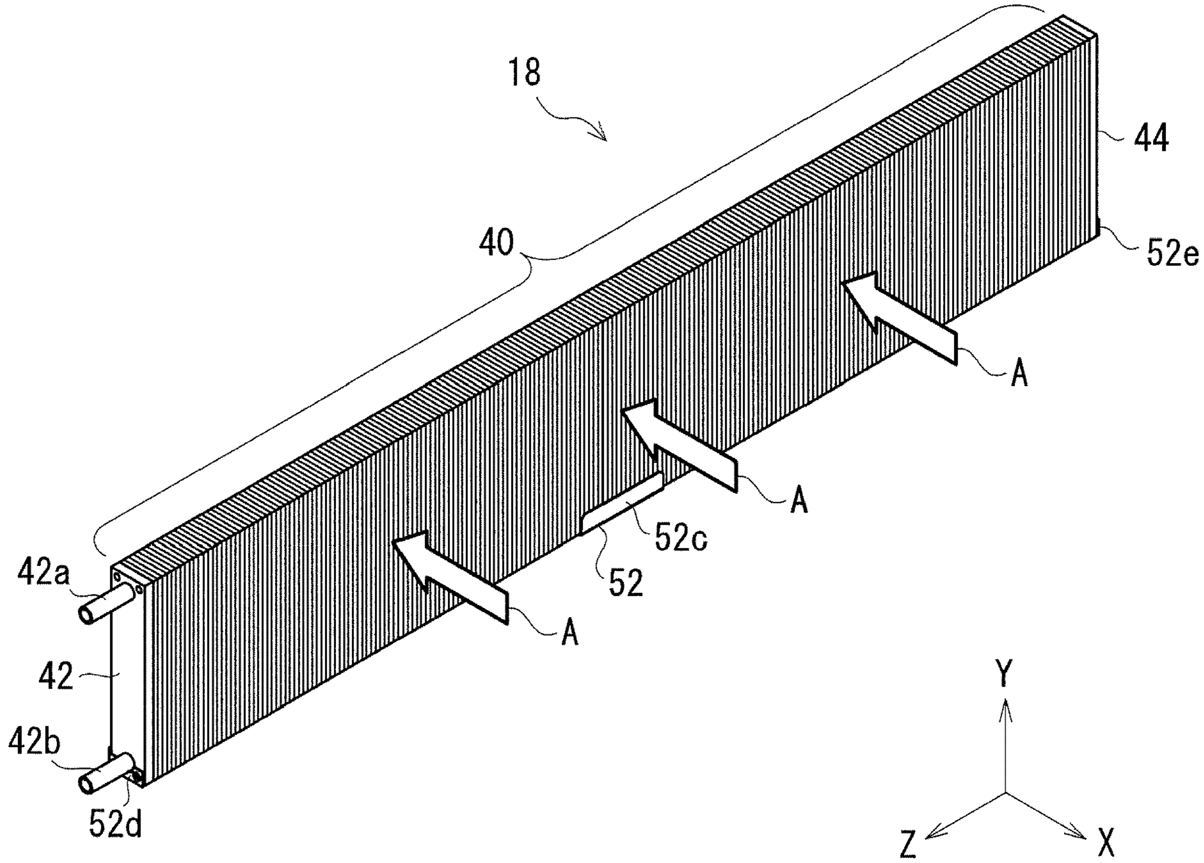


Fig. 4

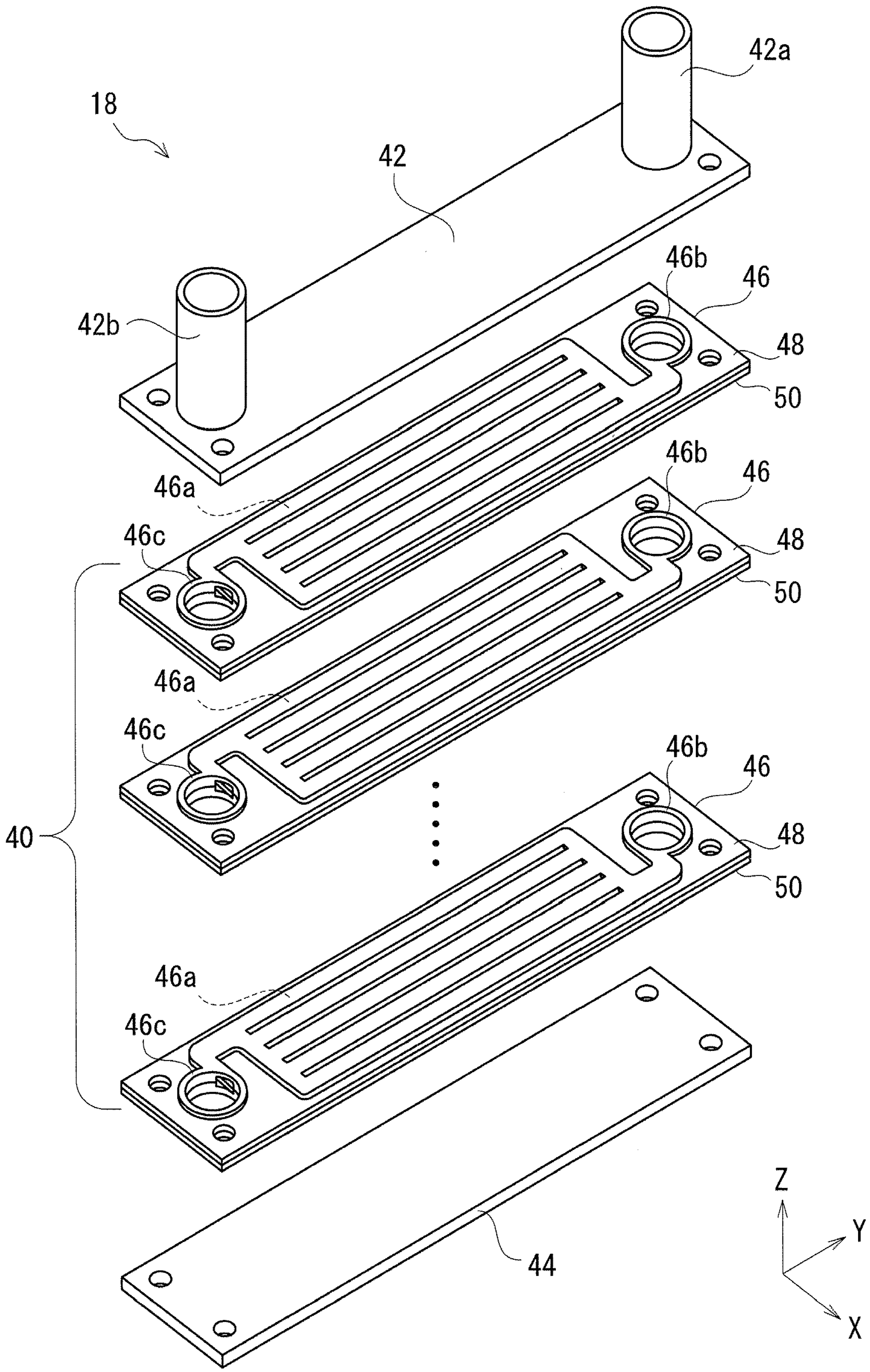


Fig. 5

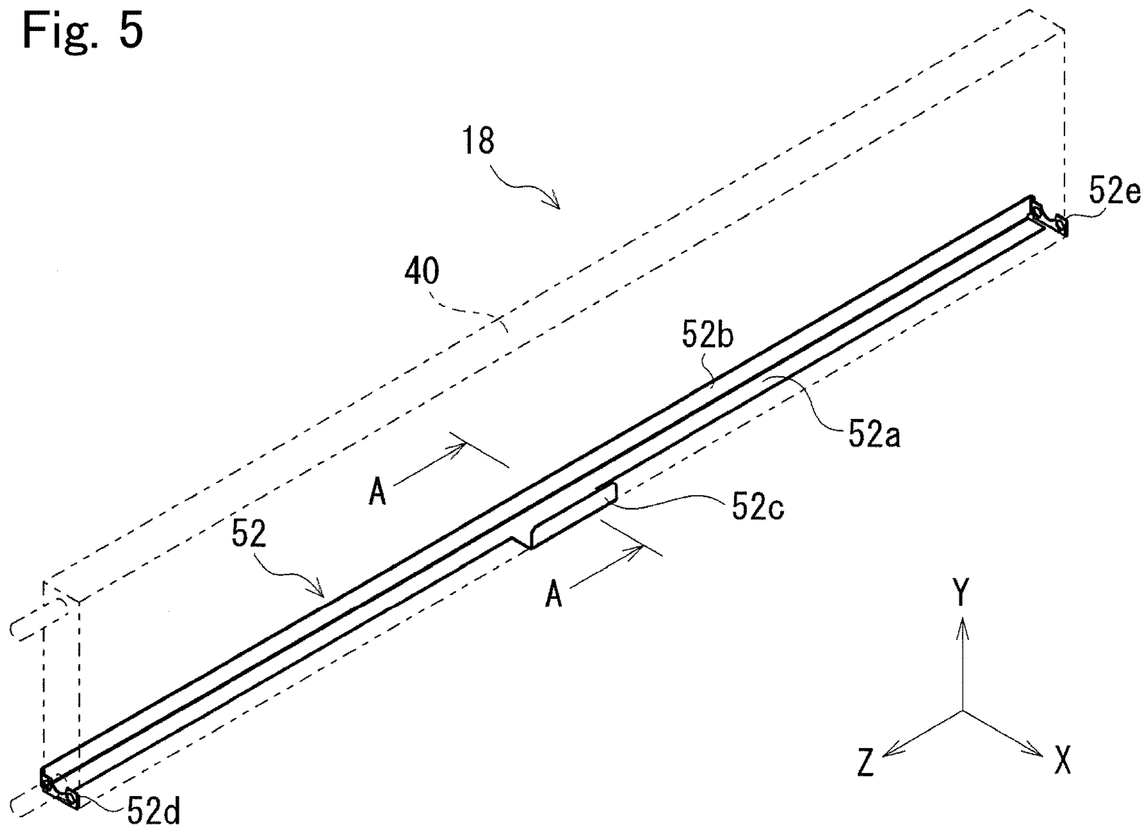


Fig. 6

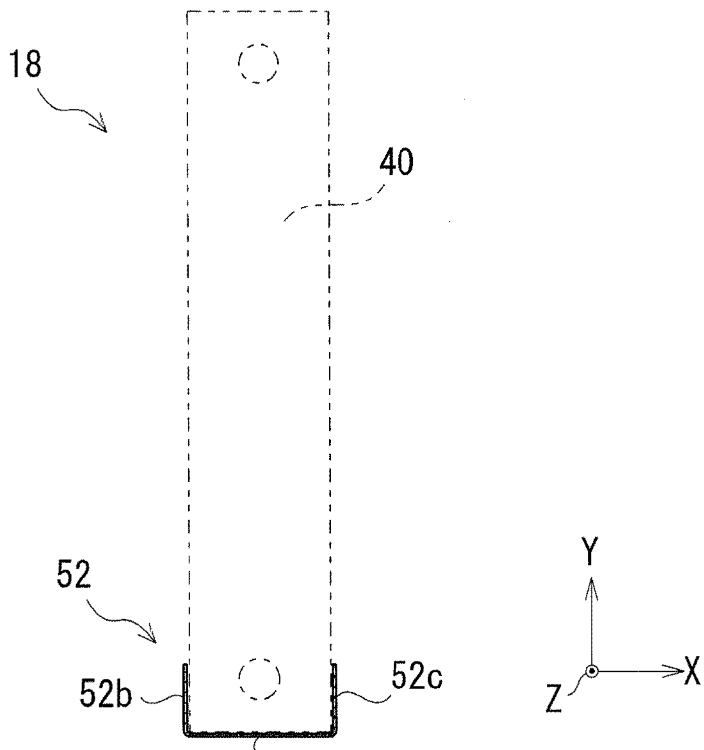


Fig. 7A

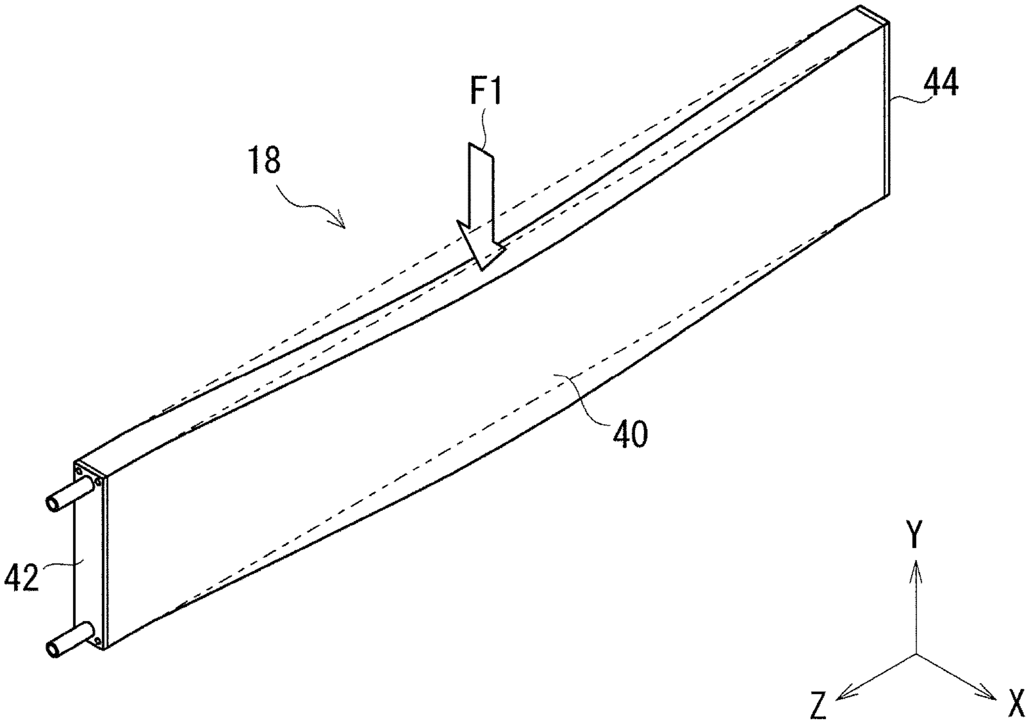


Fig. 7B

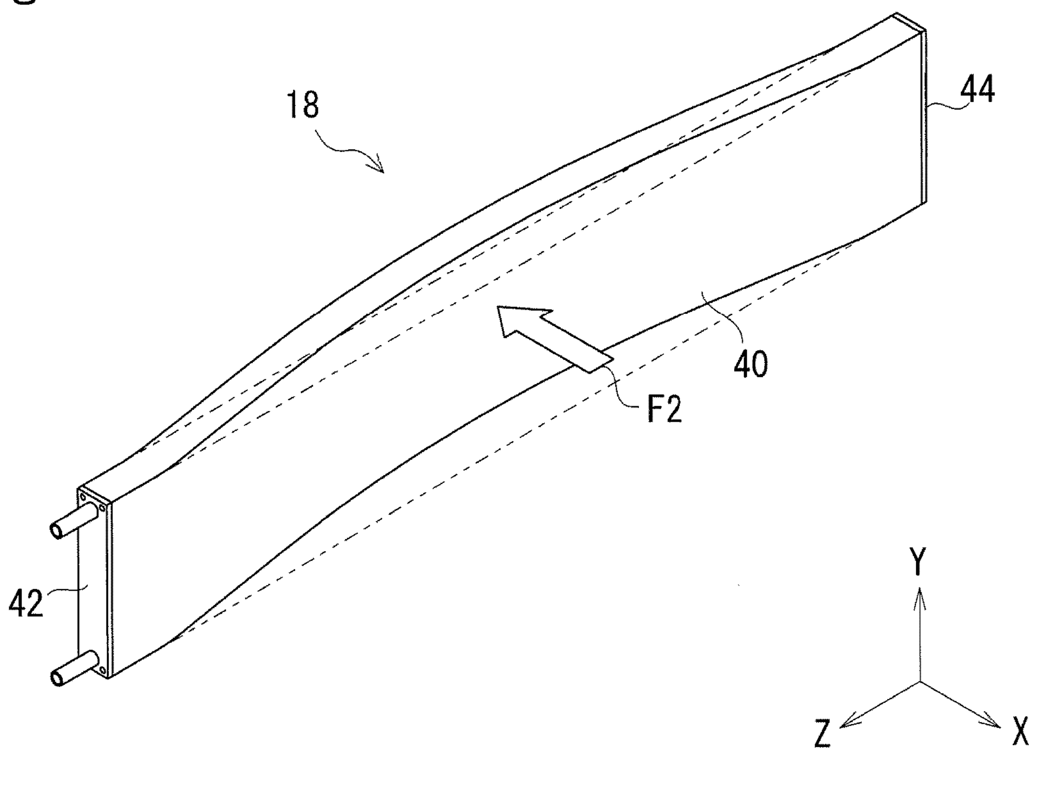


Fig. 8

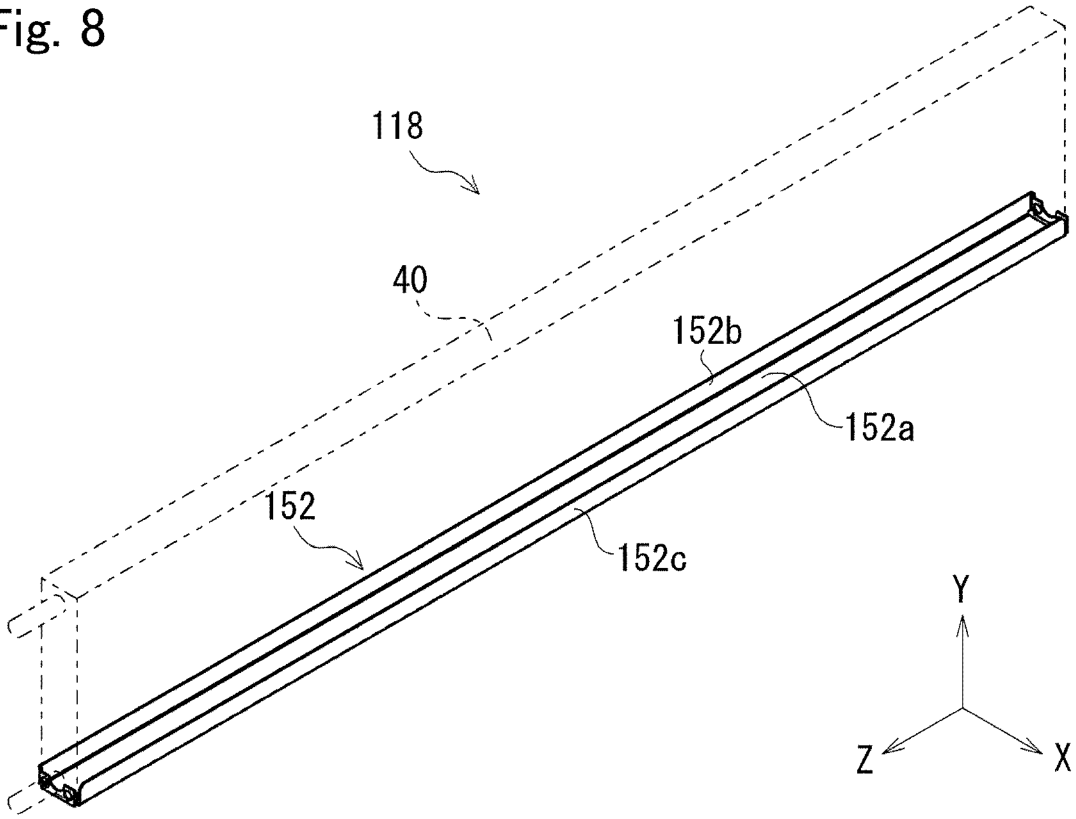
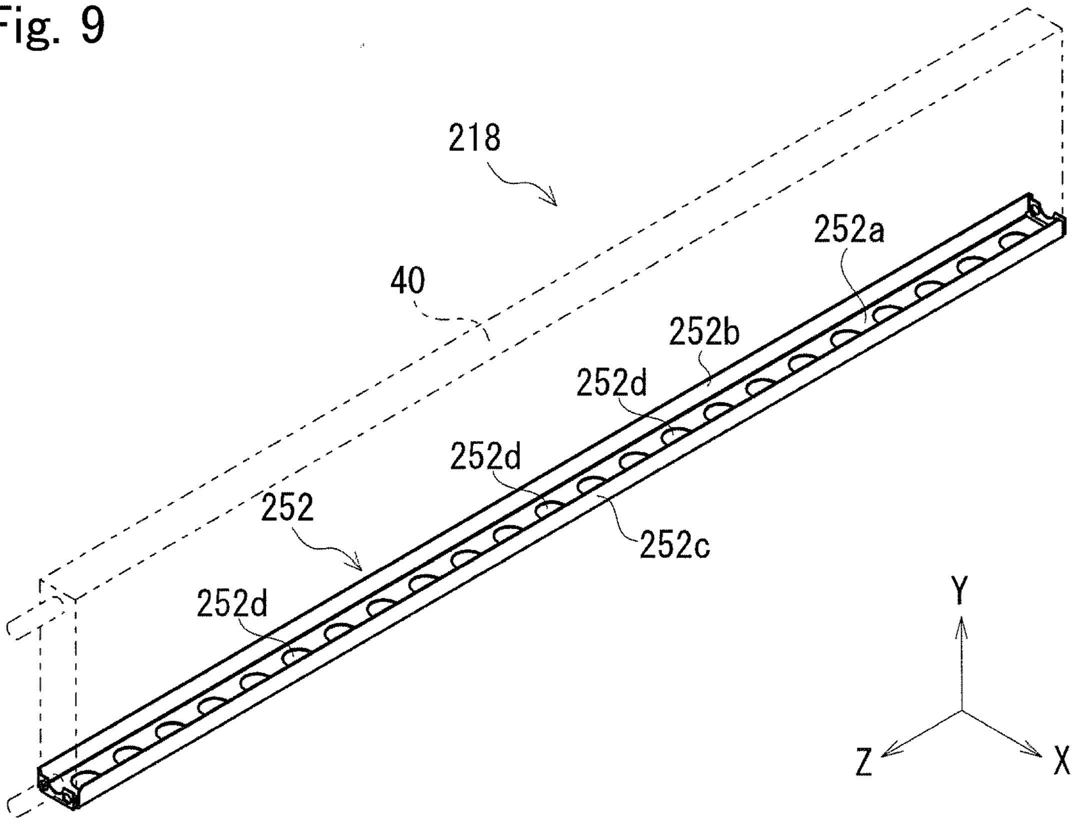

118
40
152b
152a
152
152c
Y
Z
X

Fig. 9


218
40
252a
252b
252d
252d
252
252c
252d
Y
Z
X

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EUROPEAN SEARCH REPORT

Application Number
EP 24 19 1711

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
X	US 2014/246185 A1 (ONETTI DEMETRIO [FR] ET AL) 4 September 2014 (2014-09-04) * figure 1 * -----	1-7	INV. F28D1/03 F28F21/08
X	JP 3 192719 U (.) 28 August 2014 (2014-08-28) * figure 1 * -----	1-7	
X	DE 11 2017 001593 T5 (PANASONIC IP MAN CO LTD [JP]) 27 December 2018 (2018-12-27) * figure 26 * -----	1-7	

TECHNICAL FIELDS SEARCHED (IPC)
F28D F28F

The present search report has been drawn up for all claims

1

Place of search	Date of completion of the search	Examiner
Munich	17 December 2024	Mellado Ramirez, J

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EP 24 19 1711

This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report. The members are as contained in the European Patent Office EDP file on
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17-12-2024

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
US 2014246185 A1	04-09-2014	CN 103988041 A	13-08-2014
		EP 2764313 A1	13-08-2014
		FR 2980837 A1	05-04-2013
		KR 20140088122 A	09-07-2014
		US 2014246185 A1	04-09-2014
		WO 2013050394 A1	11-04-2013
JP 3192719 U	28-08-2014	NONE	
DE 112017001593 T5	27-12-2018	CN 108885072 A	23-11-2018
		DE 112017001593 T5	27-12-2018
		JP 6528283 B2	12-06-2019
		JP 2017180857 A	05-10-2017
		WO 2017169411 A1	05-10-2017

EPO FORM P0459

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Patent documents cited in the description

- JP 2017180856 A **[0002]**