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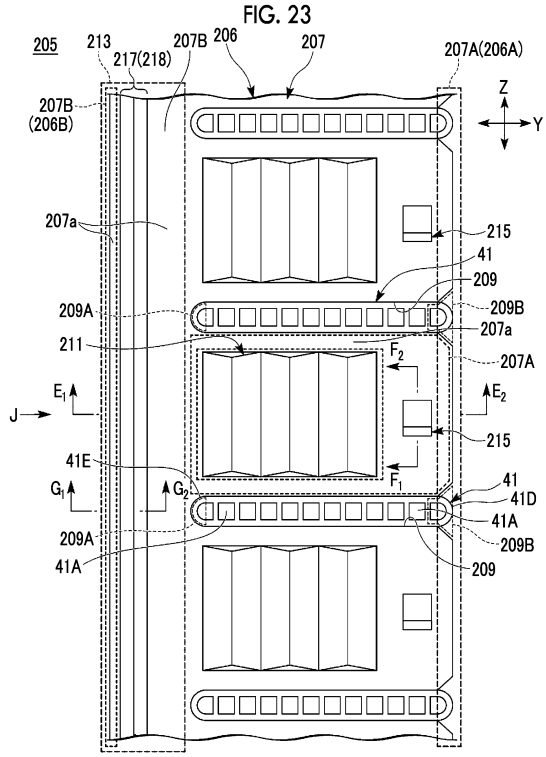
(54) **HEAT EXCHANGER, HEAT EXCHANGER UNIT, AND REFRIGERATION CYCLE DEVICE**

(57) Provided is a heat exchanger having flat tubes (41) and fins (206). Each fin includes a fin body (207) that has a plate shape, a flat tube insertion portion (209) formed on the fin body, and a communication portion (213), which extends vertically on the other side in the horizontal direction from the tube insertion portions and which has a first plane portion parallel to the vertical and horizontal direction. The communication portion is formed with a condensed water guide portion (217) bent in a direction intersecting the first plane portion, that extends continuously over the vertical direction, and in which a cross-sectional shape, when the condensed water guide portion is cut in a plane orthogonal to the vertical direction, is uniform in the vertical direction.

FIG. 23



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Description

Technical Field

[0001] The present disclosure relates to a heat exchanger, a heat exchanger unit, and a refrigeration cycle device. The present application claims priority based on Japanese Patent Application No. 2020-105446 filed in Japan on June 18, 2020, the contents of which are incorporated herein by reference.

Background Art

[0002] As a heat exchanger, a multi-flow type heat exchanger including a plurality of flat tubes, a plurality of fins, and a pair of headers is known.

[0003] The plurality of flat tubes are inserted into the plurality of fins in a state with an interval in the vertical direction. Each flat tube is formed with a plurality of flow paths disposed at intervals in the width direction. The plurality of fins are disposed at intervals in a direction in which the flat tube extends.

[0004] Each of the pair of headers extends in the vertical direction. One header is connected to the plurality of flat tubes in a state in which one end portion of each of the plurality of flat tubes is accommodated. Another header is connected to the plurality of flat tubes in a state in which another end portion of each of the plurality of flat tubes is accommodated.

[0005] When the heat exchanger is used as an evaporator, gas-liquid two-phase refrigerant is introduced into the header from the outside as refrigerant.

[0006] From the viewpoint of fully utilizing a heat transfer region of the heat exchanger, it is necessary to prevent the bias of the distribution of the refrigerant to each flat tube and the plurality of flow paths formed in each flat tube without depending on the flow rate of the refrigerant introduced into the header.

[0007] However, in a simple configuration in which the one end portion of each of the plurality of flat tubes is simply inserted into the header, the distribution of the refrigerant to each flat tube is biased due to the influence of inertial force and gravity. That is, when the flow rate of the refrigerant is small, the influence of gravity becomes dominant and a large amount of the liquid phase refrigerant is supplied to the flat tube positioned below the header. Further, when the flow rate of the refrigerant is large, the influence of the inertial force becomes dominant and a large amount of the liquid phase refrigerant is supplied to the flat tube positioned above the header.

[0008] PTL 1 discloses a heat exchanger for the purpose of preventing the flow distortion of the refrigerant due to the amount of the circulation of the refrigerant.

[0009] Specifically, PTL 1 discloses a heat exchanger including a first straightening plate that partitions between a first internal space, which is disposed at a lower portion of an internal space of a header, and a space, which is disposed above the first internal space, and a first partition plate that partitions the space, which is disposed above the first internal space, into a first outflow space and a first loop space, in which the refrigerant, which is introduced into the first internal space, is guided to the first outflow space through the two first inflow ports formed in the first straightening plate, and the refrigerant is circulated between the first outflow space and the first loop space.

[0010] On the other hand, there is a fin of a heat exchanger having a flat shape including a thin plate-shaped fin body that extends in the vertical direction, a plurality of flat tube insertion portions into which flat tubes are inserted, and a communication portion that guides condensed water from an upper side to a lower side.

[0011] The flat tube insertion portion is formed in the fin body and extends in the horizontal direction orthogonal to the vertical direction. The flat tube insertion portion is formed such that the flat tube insertion portion does not divide the fin body in the horizontal direction.

[0012] The communication portion is configured with a part, of the fin body, that is positioned outside the plurality of flat tube insertion portions. The communication portion extends continuously in the vertical direction.

[0013] When the fin having the above configuration is used, there is a problem that the fin tends to collapse at a part, of the communication portion, that faces the flat tube insertion portion in the horizontal direction. As a technique for solving such a problem, there is a heat exchanger disclosed in PTL 2.

[0014] PTL 2 discloses the formation of a heat transfer acceleration portion that is formed in a communication portion, that faces a flat tube insertion portion in the horizontal direction between fin interval adjustment portions formed at intervals in the vertical direction, and that protrudes to one side in a disposition direction (hereinafter referred to as a "fin disposition direction") of a plurality of fins. A plurality of heat transfer acceleration portions are disposed at intervals in the vertical direction.

[0015] On the other hand, PTL 3 discloses that an interval (fin pitch) between fins adjacent to each other is regulated by first and second interval holding portions formed on the plate-shaped fins.

[0016] The first interval holding portion is formed on a leading edge (an edge positioned on an upstream-side in an air flow direction) side of a flat tube in a state in which the flat tube is disposed on the fin. The second interval holding portion is formed in the fin positioned between the flat tubes disposed in the vertical direction.

[0017] PTL 3 discloses that the first and second interval holding portions are formed by folding a part of the fin.

[0018] Further, PTL 3 discloses that the part of the fin is folded so as to face the air flow direction when the first interval holding portion is formed.

[0019] Further, PTL 3 discloses a configuration in which a tip portion of the flat tube is in contact with only a part of the first interval holding portion.

Citation List

Patent Literature

[0020]

[PTL 1] Japanese Patent No. 5754490
[PTL 2] Japanese Patent No. 5397489
[PTL 3] International Publication No. 2019/239519

Summary of Invention

Technical Problem

[0021] In general, when the number of flat tubes is large, a space in the header is divided into a plurality of spaces by disposing a horizontal partition plate, which extends in the horizontal direction in a header, in the vertical direction.

[0022] In order to equalize the distribution by using the heat exchanger described in PTL 1, it is desirable to dispose the first outflow space and the first loop space continuously in the vertical direction. Therefore, it may be difficult to secure a space for providing the first internal space, and it may be difficult to provide the first internal space. Further, the number of horizontal partition plates may increase, which may complicate the manufacturing step.

[0023] Further, in PTL 1, in order to guide the refrigerant, which is introduced into the first internal space, to the first outflow space through the two first inflow ports that are formed in the first straightening plate, the state of the refrigerant may differ in the width direction of the flat tube. In this case, it may be difficult to prevent the bias of the distribution of the refrigerant with respect to the plurality of flow paths formed in each flat tube in the width direction.

[0024] On the other hand, the heat transfer acceleration portion disclosed in PTL 2 is formed by performing a press process on a plate-shaped base material member which is a base material of the fin. Therefore, a recess having a bottom is formed on another side of the heat transfer acceleration portion in the fin disposition direction. As a result, the condensed water flowing through the communication portion may be accumulated at the bottom of the heat transfer acceleration portion, and it may be difficult to drain the condensed water downward through the communication portion.

[0025] On the other hand, in PTL 3, the part of the fin is folded so as to face the air flow direction when the first interval holding portion is formed. Therefore, the first interval holding portion becomes a flow resistance, and there is a possibility that the pressure loss of air increases.

[0026] Further, in PTL 3, since the tip portion of the flat tube is in contact with only the part of the first interval holding portion, it may be difficult to improve the thermal conductivity between the fin and the flat tube.

[0027] The present disclosure has been made in order to solve the above problems, and the object of the present disclosure is to provide a heat exchanger, a heat exchanger unit, and a refrigeration cycle device capable of simplifying a manufacturing step and capable of preventing a bias in distribution of refrigerant with respect to each flat tube and a plurality of flow paths formed in each flat tube in the width direction without depending on the flow rate of the refrigerant supplied in a header.

[0028] Further, the present disclosure has been made in order to solve the above problems, and the object of the present disclosure is to provide a heat exchanger, a heat exchanger unit, and a refrigeration cycle device capable of preventing the fin from collapsing while preventing the obstruction of the flow of condensed water in a communication portion.

[0029] Further, the present disclosure has been made in order to solve the above problems, and the object of the present disclosure is to provide a heat exchanger, a heat exchanger unit, and a refrigeration cycle device capable of regulating a fin pitch while preventing a pressure loss of air and improving the thermal conductivity between a flat tube and a fin.

Solution to Problem

[0030] In order to solve the above problems, a heat exchanger according to the present disclosure is a heat exchanger exchanging heat between air and refrigerant, the heat exchanger includes: a plurality of flat tubes that have a flat-shaped outside appearance, that extend in one direction, and that include a plurality of flow paths, which are disposed in a width direction, which extend in the one direction, and through which the refrigerant flows; a plurality of fins that are disposed in an extending direction of the flat tube in a state in which the plurality of flat tubes are accommodated; and a header that is connected to the plurality of flat tubes such that one end portion of each of the plurality of flat tubes is disposed on an inner side, and through which the refrigerant flows in the inner side, in which the header includes a header body that has a tube shape extending in a vertical direction and that partitions an internal space having a column shape, a partition plate that is accommodated in the header body, that extends in a vertical direction, and that divides the internal space into a first space and a second space, where the one end portion of each of the plurality of flat tubes is disposed, in the extending direction, in a state in which the refrigerant is capable of being circulated at an upper end portion and a lower end portion of the internal space, and a nozzle portion that is disposed at a lower portion of the first space and that includes a discharge outlet for blowing out the refrigerant supplied from an outside of the header toward a bottom surface of the header body, and refrigerant circulation portions, which are a part of the first space, are each formed on both sides of the nozzle portion in a width direction.

[0031] In order to solve the above problems, a heat exchanger according to the present disclosure is a heat exchanger exchanging heat between air and refrigerant, the heat exchanger includes: a plurality of flat tubes that have a flat-shaped outside appearance, that are formed with a flow path in which the refrigerant flows inside, and that include a first end portion disposed on one side in a width direction and a second end portion disposed on the other side in the width direction; and a plurality of fins that are disposed at a predetermined pitch in an extending direction of the flat tube in a state in which the plurality of flat tubes are accommodated, in which each of the plurality of fins includes a fin body that has a plate shape and that includes a first surface disposed in the extending direction and a second surface disposed on an opposite side of the first surface, a flat tube insertion portion that is formed on the fin body, that is disposed in plural at intervals in a vertical direction orthogonal to the extending direction, that extends from one side to the other side in a horizontal direction orthogonal to the vertical direction and the extending direction, and that accommodates the flat tube inserted from a second end portion side, and a communication portion that is disposed on the other side in the horizontal direction from the plurality of flat tube insertion portions and that extends continuously in the vertical direction, the communication portion includes a first plane portion that is parallel to the vertical direction and the horizontal direction, and the communication portion is formed with a condensed water guide portion that is bent in a direction intersecting the first plane portion, that extends continuously over the vertical direction, and in which a cross-sectional shape, when the condensed water guide portion is cut in a plane orthogonal to the vertical direction, is uniform in the vertical direction.

[0032] In order to solve the above problems, a heat exchanger according to the present disclosure includes: a plurality of flat tubes that have a flat-shaped outside appearance, that are formed with a flow path in which refrigerant flows inside, and that include a first end portion disposed on one side in a width direction and a second end portion disposed on the other side in the width direction; and a plurality of fins that are disposed at a predetermined pitch in an extending direction of the flat tube in a state in which the plurality of flat tubes are accommodated, in which each of the plurality of fins includes a fin body that has a plate shape and that includes a first surface disposed in the extending direction and a second surface disposed on an opposite side of the first surface, a flat tube insertion portion that is formed on the fin body, that is disposed in plural at intervals in a first direction orthogonal to the extending direction, that extends from one side to the other side in a second direction orthogonal to the first direction and the extending direction, and that accommodates the flat tube inserted from the second end portion side, a communication portion that is disposed on the other side in the second direction from the plurality of flat tube insertion portions and that extends continuously in the first direction, a first fin pitch regulation portion that is formed by folding a part of the fin body, which is positioned between the flat tube insertion portions adjacent to each other, in the first direction so as to protrude on a first surface side, and that is in contact with the fin disposed on one side in the extending direction, in the first direction, and a second fin pitch regulation portion that is formed by folding the part of the fin body in the first direction so as to protrude on the first surface side, that is disposed at a periphery of the flat tube insertion portion positioned on a rear end portion side rather than a tip portion of the flat tube insertion portion, and that is in contact with the fin disposed on the one side in the extending direction, air that exchanges heat with the refrigerant flows in a direction from the other side toward the one side in the second direction, an outside appearance of the second end portion has a round shape or an elliptical shape, a shape of the tip portion of the flat tube insertion portion, which accommodates the second end portion, is a shape in which an outer peripheral surface of the second end portion and the fin body are in surface contact with each other, the first fin pitch regulation portion is disposed on the rear end portion side of the flat tube insertion portion, and the second fin pitch regulation portion is disposed on a tip portion side of the flat tube insertion portion.

Advantageous Effects of Invention

[0033] According to a heat exchanger, a heat exchanger unit, and a refrigeration cycle device of the present disclosure, it is possible to prevent a bias in distribution of refrigerant with respect to each flat tube and a plurality of flow paths formed in each flat tube in the width direction without depending on the flow rate of the refrigerant supplied in a header while preventing the complexity of a manufacturing step.

[0034] On the other hand, according to the heat exchanger, the heat exchanger unit, and the refrigeration cycle device of the present disclosure, it is possible to prevent a fin from collapsing while preventing the obstruction of a flow of condensed water in a communication portion.

[0035] On the other hand, according to the heat exchanger, the heat exchanger unit, and the refrigeration cycle device of the present disclosure, the fin pitch can be regulated while preventing the pressure loss of air, and the thermal conductivity between the flat tube and the fin can be improved.

Brief Description of Drawings

[0036]

Fig. 1 is a view schematically showing a schematic configuration of a refrigeration cycle device according to a first embodiment of the present disclosure.
Fig. 2 is a view schematically showing a principal portion of a heat exchanger shown in Fig. 1.
Fig. 3 is a perspective view of a flat tube shown in

Fig. 2.

Fig. 4 is a vertical cross-sectional view of a header surrounded by a region B shown in Fig. 2.

Fig. 5 is a cross-sectional view of the header shown in Fig. 4 in the C_1-C_2 line direction.

Fig. 6 is a cross-sectional view of the header shown in Fig. 4 in the D_1-D_2 line direction.

Fig. 7 is a cross-sectional view of a principal portion of a heat exchanger according to a first modification example of the first embodiment.

Fig. 8 is a vertical cross-sectional view of a principal portion of a heat exchanger according to a second embodiment.

Fig. 9 is a vertical cross-sectional view of a principal portion of a heat exchanger according to a first modification example of the second embodiment.

Fig. 10 is a vertical cross-sectional view of a principal portion of a heat exchanger according to a second modification example of the second embodiment.

Fig. 11 is a vertical cross-sectional view of a principal portion of a heat exchanger according to a third modification example of the second embodiment.

Fig. 12 is a vertical cross-sectional view of a principal portion of a heat exchanger according to a third embodiment.

Fig. 13 is a vertical cross-sectional view of a principal portion of a heat exchanger according to a first modification example of the third embodiment.

Fig. 14 is a vertical cross-sectional view of a principal portion of a heat exchanger according to a second modification example of the third embodiment.

Fig. 15 is a vertical cross-sectional view of a principal portion of a heat exchanger according to a fourth embodiment.

Fig. 16 is a vertical cross-sectional view of a principal portion of a heat exchanger according to a first modification example of the fourth embodiment.

Fig. 17 is a vertical cross-sectional view of a principal portion of a heat exchanger according to a second modification example of the fourth embodiment.

Fig. 18 is a vertical cross-sectional view of a principal portion of a heat exchanger according to a third modification example of the fourth embodiment.

Fig. 19 is a vertical cross-sectional view of a principal portion of a heat exchanger according to a fourth modification example of the fourth embodiment.

Fig. 20 is a vertical cross-sectional view of a principal portion of a heat exchanger according to a fifth modification example of the fourth embodiment.

Fig. 21 is a view schematically showing a schematic configuration of a refrigeration cycle device according to a fifth embodiment of the present disclosure.

Fig. 22 is a view schematically showing a principal portion of a heat exchanger shown in Fig. 21.

Fig. 23 is a view of a flat tube and a fin shown in Fig. 22 as viewed from A.

Fig. 24 is a perspective view of the flat tube shown in Fig. 22.

Fig. 25 is a cross-sectional view of the fin shown in Fig. 23 in the E_1-E_2 line direction and is a view showing a cross section of one fin.

Fig. 26 is a cross-sectional view of the fin shown in Fig. 23 in the F_1-F_2 line direction and is a cross-sectional view schematically showing a state in which fin pitch regulation portions are in contact with the fins disposed at positions adjacent to each other.

Fig. 27 is a cross-sectional view of the fin shown in Fig. 22 in the G_1-G_2 line direction and is a view showing a cross section of one fin.

Fig. 28 is a plan view for describing a previous step of a cutting step performed when a plurality of fins shown in Fig. 22 are manufactured.

Fig. 29 is a plan view for describing the cutting step performed when the plurality of fins shown in Fig. 22 are manufactured.

Fig. 30 is a plan view for describing another example of disposition of the plurality of fins when the plurality of fins shown in Fig. 22 are manufactured.

Fig. 31 is a view showing a principal portion of a heat exchanger according to a sixth embodiment of the present disclosure.

Fig. 32 is a cross-sectional view of a fin shown in Fig. 31 in the I_1-I_2 line direction and is a view showing a cross section of one fin.

Fig. 33 is a view showing a principal portion of a heat exchanger according to a seventh embodiment of the present disclosure.

Fig. 34 is a cross-sectional view of a fin shown in Fig. 33 in the K_1-K_2 line direction and is a view showing a cross section of one fin.

Fig. 35 is a view showing a principal portion of a heat exchanger according to an eighth embodiment of the present disclosure.

Fig. 36 is a cross-sectional view of a fin shown in Fig. 35 in the L_1-L_2 line direction and is a view showing a cross section of one fin.

Fig. 37 is a cross-sectional view of the fin shown in Fig. 35 in the N_1-N_2 line direction and is a view showing a cross section of one fin.

Fig. 38 is a view showing a principal portion of a heat exchanger according to a first modification example of the eighth embodiment of the present disclosure.

Fig. 39 is a view showing a principal portion of a heat exchanger according to a second modification example of the eighth embodiment of the present disclosure.

Fig. 40 is a view schematically showing a schematic configuration of a refrigeration cycle device according to a ninth embodiment of the present disclosure.

Fig. 41 is a view schematically showing a principal portion of a heat exchanger shown in Fig. 40.

Fig. 42 is a view of a flat tube and a fin shown in Fig. 41 as viewed from A.

Fig. 43 is a cross-sectional view of the fin shown in Fig. 42 in the Q_1-Q_2 line direction and is a view showing a cross section of one fin.

Fig. 44 is a cross-sectional view of the fin shown in Fig. 42 in the R_1-R_2 line direction and is a view showing a cross section of one fin.

Fig. 45 is a cross-sectional view of the fin shown in Fig. 42 in the S_1-S_2 line direction and is a cross-sectional view schematically showing a state in which first fin pitch regulation portions are in contact with the fins disposed at positions adjacent to each other.

Fig. 46 is a cross-sectional view of the fin shown in Fig. 42 in the T_1-T_2 line direction and is a cross-sectional view schematically showing a state in which second fin pitch regulation portions are in contact with the fins disposed at positions adjacent to each other.

Fig. 47 is a view for describing a fin according to a modification example of the ninth embodiment of the present disclosure.

Description of Embodiments

<First Embodiment>

[0037] With reference to Fig. 1, an overall configuration of a refrigeration cycle device 10 of a first embodiment will be described. In Fig. 1, a solid arrow indicates a direction in which refrigerant flows during heating operation, and a dotted arrow indicates a direction in which the refrigerant flows during cooling operation.

(Overall Configuration of Refrigeration Cycle Device)

[0038] The refrigeration cycle device 10 has a configuration in which a four-way valve 15, a compressor 16, a first heat exchanger unit 18, an expansion valve 19, and a second heat exchanger unit 23 are connected by a refrigerant pipe 14. The refrigeration cycle device 10 includes an outdoor unit 11 and an indoor unit 12.

(Overall Configuration of Outdoor Unit)

[0039] The outdoor unit 11 includes the four-way valve 15, the compressor 16, the first heat exchanger unit 18, and the expansion valve 19.

(Configuration of Four-Way Valve)

[0040] The four-way valve 15 includes connecting portions 15A to 15D to which any one of both ends of first and second refrigerant pipes 14A and 14B configuring the refrigerant pipe 14 is connected.

[0041] One end of the first refrigerant pipe 14A is connected to the connecting portion 15A. The other end of the first refrigerant pipe 14A is connected to the connecting portion 15B.

[0042] One end of the second refrigerant pipe 14B is connected to the connecting portion 15C. The other end of the second refrigerant pipe 14B is connected to the connecting portion 15D.

[0043] The four-way valve 15 having the above configuration switches the direction in which the refrigerant flows between the heating operation and the cooling operation. Specifically, during the cooling operation, the refrigerant is circulated in the order of the compressor 16, the first heat exchanger unit 18, the expansion valve 19, and the second heat exchanger unit 23.

[0044] On the other hand, during the heating operation, the refrigerant is circulated in the order of the compressor 16, the second heat exchanger unit 23, the expansion valve 19, and the first heat exchanger unit 18.

(Configuration of Compressor)

[0045] The compressor 16 is provided in the second refrigerant pipe 14B. The compressor 16 compresses the refrigerant that flows through the second refrigerant pipe 14B.

(Configuration of First Heat Exchanger Unit)

[0046] The first heat exchanger unit 18 includes a first blower 26 and a heat exchanger 27.

(Configuration of First Blower)

[0047] The first blower 26 supplies air to the heat exchanger 27.

(Overall Configuration of Heat Exchanger)

[0048] The heat exchanger 27 will be described with reference to Fig. 1 to Fig. 6. In Fig. 2 to Fig. 4 and Fig. 6, the Z direction indicates the vertical direction. In Fig. 2 to Fig. 5, the X direction indicates the extending direction of the flat tube 41 orthogonal to the Z direction. In Fig. 3, Fig. 5, and Fig. 6, the Y direction indicates the width direction of the flat tube 41 (the width direction of a nozzle portion 49) orthogonal to the X direction and the Z direction. In Fig. 2, the air flows in a direction of a paper surface (for example, a direction toward the paper surface). In Fig. 4, the arrows indicate a direction in which the refrigerant flows when the heat exchanger 27 is used as an evaporator, and H indicates the height of a header body 45 (hereinafter referred to as the "height H"), respectively.

[0049] The heat exchanger 27 is used as a condenser during the cooling operation to dissipate heat to the outside and is used as an evaporator during the heating operation to absorb heat from the outside.

[0050] The heat exchanger 27 is provided in the first refrigerant pipe 14A positioned between the four-way valve 15 and the expansion valve 19. The heat exchanger 27 includes a plurality of flat tubes 41, a plurality of fins 42, and a pair of headers 43.

(Configuration of Flat Tube)

[0051] Next, the flat tube 41 will be described with reference to Fig. 2 and Fig. 3. The flat tube 41 is a heat transfer tube in which an outside appearance has a flat shape. The flat tube 41 extends in the X direction. Inside the flat tube 41, a plurality of flow paths 41A through which the refrigerant flows are formed at intervals in the Y direction.

[0052] The plurality of flat tubes 41 include a flat tube 41F disposed at the bottom and a flat tube 41S disposed second from the bottom.

[0053] The flat tube 41 includes a pair of end portions 41B and 41C disposed in the X direction. One end portion 41B is accommodated in one header 43. The other end portion 41C is accommodated in the other header 43. The plurality of flat tubes 41 are disposed in a state with an interval in the Z direction, and both sides in the X direction are supported by the pair of headers 43.

(Configuration of Fin)

[0054] Next, the plurality of fins 42 will be described with reference to Fig. 2.

[0055] Each of the plurality of fins 42 includes a flat tube insertion portion 42A formed at intervals in the Z direction. The flat tube 41 is inserted into the flat tube insertion portion 42A.

(Configuration of Header)

[0056] Next, the configuration of the pair of headers 43 will be described with reference to Fig. 2 and Fig. 4 to Fig. 6.

[0057] The pair of headers 43 are disposed so as to face each other in the X direction. One header 43 is connected to the plurality of flat tubes 41 such that one end portion 41B of each of the plurality of flat tubes 41 is disposed on an inner side of the one header 43. The other header 43 is connected to the plurality of flat tubes 41 such that the other end portion 41C of each of the plurality of flat tubes 41 is disposed on an inner side of the other header 43.

[0058] Here, the configuration of the header 43 on the evaporator inlet side, among the pair of headers 43, will be described.

[0059] The header 43 includes a header body 45, a partition plate 47, a nozzle portion 49, and a porous plate 51.

(Configuration of Header Body)

[0060] Next, the header body 45 will be described with reference to Fig. 4 to Fig. 6. The header body 45 is a tube-shaped member that extends in the Z direction and has upper and lower ends closed. The header body 45 partitions a column-shaped internal space 53 inside.

[0061] The header body 45 includes an opening 45A and a bottom surface 45a.

[0062] The opening 45A is formed on a side wall of the header body 45. The tip portion of a first refrigerant pipe 14A is inserted into the opening 45A. The opening 45A is formed at a position facing the nozzle portion 49 in the X direction.

[0063] The bottom surface 45a has a first bottom surface 45aa, a second bottom surface 45ab, and a third bottom surface 45ac.

[0064] The first bottom surface 45aa is a surface for partitioning a lower end of a first space 54. The second bottom surface 45ab is a surface for partitioning a lower end of a second space 55.

[0065] The third bottom surface 45ac is disposed between the first bottom surface 45aa and the second bottom surface 45ab that are disposed in the X direction. The third bottom surface 45ac is connected to the first bottom surface 45aa and the second bottom surface 45ab.

(Configuration of Partition Plate)

[0066] Next, the partition plate 47 will be described with reference to Fig. 4 to Fig. 6.

[0067] The partition plate 47 is disposed in the header body 45 in a state of extending in the Z direction. In the partition plate 47, both ends of the partition plate 47, which are disposed in the Y direction, are connected to the header body 45.

[0068] The partition plate 47 divides the internal space 53 into the first space 54 and the second space 55, which are disposed in the X direction, in a state in which the refrigerant can be circulated at an upper end portion and a lower end portion of the internal space 53.

[0069] The first space 54 is disposed on a side to which the first refrigerant pipe 14A is connected. The second space 55 is disposed on a side to which the plurality of flat tubes 41 are connected. The partition plate 47 forms a circulation passage for the refrigerant.

[0070] The partition plate 47 includes an upper end surface 47a, a first surface 47b, a second surface 47c, a pair of lower end portions 47A and 47B (one lower end portion and the other lower end portion), and a cutout portion 47C.

[0071] The upper end surface 47a is disposed at a position separated downward from the header body 45 that faces the upper end surface 47a in the Z direction. The refrigerant moves between the first space 54 and the second space 55 through the opening formed between the header body 45, which faces the upper end surface 47a, and the upper end surface 47a.

[0072] The first surface 47b is a plane orthogonal to the X direction and partitions the other side of the first space 54 in the X direction.

[0073] The second surface 47c is a surface disposed on the opposite side of the first surface 47b. The second surface 47c is a plane orthogonal to the X direction and partitions one side of the second space 55 in the X direction.

[0074] The lower end portion 47A is disposed on one side in the Y direction. The lower end 47Aa of the lower end portion 47A reaches the bottom surface 45a of the header body 45.

[0075] The lower end portion 47B is disposed on the other side in the Y direction. The lower end 47Ba of the lower end portion 47B reaches the bottom surface 45a of the header body 45.

[0076] The cutout portion 47C is formed between the lower end portion 47A and the lower end portion 47B. The cutout portion 47C has a rectangular shape. The refrigerant moves between the first space 54 and the second space 55 through the opening partitioned by the cutout portion 47C and the bottom surface 45a.

(Effect of Shape on Lower End Portion Side of Partition Plate)

[0077] For example, when a round-shaped hole is used as a discharge outlet 49A of the nozzle portion 49, the refrigerant is circulated from the first space 54 to the second space 55 through the cutout portion 47C that is positioned between the lower end portion 47A and the lower end portion 47B. At this time, the lower end portions 47A and 47B can prevent the refrigerant from flowing back from the second space 55 to the first space 54.

(Configuration of Nozzle Portion)

[0078] Next, the nozzle portion 49 will be described with reference to Fig. 4 and Fig. 5.

[0079] The nozzle portion 49 is disposed in the first space 54. The nozzle portion 49 is fixed to the header body 45 and the partition plate 47. Refrigerant circulation portions 54A through which the refrigerant passes are each formed on both sides of the nozzle portion 49 in the Y direction. The refrigerant circulation portion 54A is configured as a part of the first space 54.

[0080] The nozzle portion 49 includes the discharge outlet 49A disposed on the lower end side. The discharge outlet 49A has a round shape when viewed from the Z direction.

[0081] When the heat exchanger 27 is operated as an evaporator, the refrigerant (gas-liquid two-phase refrigerant) is supplied into the nozzle portion 49 through the first refrigerant pipe 14A. The discharge outlet 49A causes the refrigerant to collide with the first bottom surface 45aa by blowing out the refrigerant in a direction toward the first bottom surface 45aa and reduces a difference in a state of the refrigerant in the Y direction. After colliding with the first bottom surface 45aa, the refrigerant flows to a lower portion of the second space 55 through the cutout portion 47C and then flows in a direction toward an upper end of the second space 55, and is guided into the plurality of flow paths 41A formed in each flat tube 41. The refrigerant, which is moved to the upper end portion of the second space 55, flows to the upper end portion of the first space 54 and then flows in a direction toward the first bottom surface 45aa.

[0082] When the heat exchanger 27 is operated as a condenser, the refrigerant that flows into the second space 55 from the plurality of flat tubes 41 flows into the first refrigerant pipe 14A through the discharge outlet 49A.

(Effect of Nozzle Portion)

[0083] By having the nozzle portion 49 with the above configuration, it is possible to reduce the difference in state of the refrigerant in the Y direction by causing the refrigerant, which is blown out from the discharge outlet 49A, to collide with the first bottom surface 45aa of the header body 45. As a result, since the refrigerant having a small difference in state in the Y direction flows from the first space 54 toward the second space 55 (a space in which one end portion 41B of each of the plurality of flat tubes 41 is disposed), the bias of the distribution of the refrigerant with respect to the plurality of flow paths 41A, which are formed in each flat tube 41 in the Y direction, can be prevented without depending on the flow rate of the refrigerant that is introduced in the header 43.

[0084] The nozzle portion 49 having the above configuration may be desirably disposed at a position lower than, for example, 1/2 the height of the header body 45, more desirably at a position lower than 1/3 of the height of the header body 45, and still more desirably at a position lower than 1/4 of the height of the header body 45.

[0085] Further, the nozzle portion 49 having the above configuration may be disposed between, for example, the flat tube 41F disposed at the bottom and the flat tube 41S disposed second from the bottom, among the plurality of flat tubes 41.

(Effect of Position Where Nozzle Portion is Provided)

[0086] For example, when the nozzle portion 49 is disposed at a position higher than 1/2 of the height H of the header body 45, since a distance from the discharge outlet 49A of the nozzle portion 49 to the first bottom surface 45aa of the header body 45 becomes too long, the flow of the refrigerant, which is blow out from the discharge outlet 49A, may slow down and it may be difficult to form a circulation flow of refrigerant in the header 43.

[0087] Therefore, by disposing the nozzle portion 49 at a position lower than 1/2 of the height H of the header body 45, it is possible to reduce the distance from the discharge outlet 49A to the first bottom surface 45aa of the header body 45, thereby it becomes easy to form the circulation flow of the refrigerant in the header 43.

[0088] Further, by disposing the nozzle portion 49 at a position lower than 1/3 of the height of the header body 45, it is possible to further reduce the distance from the discharge outlet 49A to the first bottom surface 45aa of the header body 45, thereby it becomes easier to form the circulation flow of the refrigerant in the header 43.

[0089] Further, by disposing the nozzle portion 49 at a position lower than 1/4 of the height of the header body 45, it is possible to still further reduce the distance from the discharge outlet 49A to the first bottom surface 45aa of the header body 45, thereby it becomes still easier to form the circulation flow of the refrigerant in the header 43.

[0090] As described above, by disposing the nozzle portion 49 between the flat tube 41F disposed at the bottom and the flat tube 41S disposed second from the bottom, the circulation flow of refrigerant in the header 43 can be easily formed.

[0091] Further, when the heat exchanger 27 is used as a condenser, the refrigerant (liquid phase refrigerant) that flows in the header 43 can be easily discharged to the outside of the header through the plurality of flat tubes 41.

(Configuration of Porous Plate)

[0092] Next, the porous plate 51 will be described with reference to Fig. 4.

[0093] The porous plate 51 is disposed so as to cover, in the horizontal direction, the first space 54 that is positioned above the nozzle portion 49. The porous plate 51 is fixed to the header body 45 and the partition plate 47. The porous plate 51 is formed with a plurality of holes 51A that allow the first space 54 to communicate in the Z direction. As the porous plate 51, for example, a punching plate can be used.

[0094] In Fig. 4, as an example, the punching plate is illustrated as an example of the porous plate 51, but as the porous plate 51, for example, a mesh-shaped member, a porous plate, or the like may be used.

(Effect of Porous Plate)

[0095] By including the porous plate 51 having such a configuration, it is possible to prevent the movement of gas (gas refrigerant) from flowing back in a direction from the lower side toward the upper side of the first space 54, thereby it becomes easy to form the circulation flow of the refrigerant in the header 43.

(Effect of Heat Exchanger)

[0096] According to the heat exchanger 27 of the first embodiment, by having the nozzle portion 49 with the above configuration, it is possible to reduce the difference in state of the refrigerant in the Y direction by causing the refrigerant, which is blown out from the discharge outlet 49A, to collide with the first bottom surface 45aa of the header body 45. As a result, since the refrigerant having a small difference in state in the Y direction flows from the first space 54 toward the second space 55 (a space in which one end portion 41B of each of the plurality of flat tubes 41 is disposed), the bias of the distribution of the refrigerant with respect to the plurality of flow paths 41A, which are formed in each flat tube 41 in the width direction (Y direction), can be prevented while preventing the complexity of a manufacturing step and preventing the bias of the distribution of the refrigerant with respect to each flat tube 41, by forming the circulation flow of the refrigerant (a flow that descends from the first space 54 and rises from the second space 55) in the header 43 without depending on the flow rate of the refrigerant that is introduced in the header 43.

(Effect of Heat Exchanger Unit)

[0097] According to first and second heat exchanger units 18 and 23 of the first embodiment, by providing the heat exchanger 27 having the above configuration, the heat exchange efficiency can be improved.

(Configuration of Expansion Valve)

[0098] Next, the expansion valve 19 will be described with reference to Fig. 1.

[0099] The expansion valve 19 is provided in 14A that is positioned between the first heat exchanger unit 18 and the second heat exchanger unit 23.

[0100] The expansion valve 19 lowers the pressure of the refrigerant by expanding the liquefied high-pressure refrigerant by performing the heat exchanging.

(Configuration of Indoor Unit)

[0101] The indoor unit 12 includes the second heat exchanger unit 23. The second heat exchanger unit 23 includes the heat exchanger 27 and a second blower 32.

[0102] The heat exchanger 27 that configures the second heat exchanger unit 23 is provided in the first refrigerant pipe 14A positioned between the expansion valve 19 and the four-way valve 15.

(Effect of Refrigeration Cycle Device)

[0103] According to the refrigeration cycle device 10 of the first embodiment, by having the first and second heat exchanger units 18 and 23 having the above configuration, the heat exchange efficiency can be improved.

[0104] The nozzle portion 49 and the first refrigerant pipe 14A may be integrally configured. For example, the first refrigerant pipe 14A may be inserted until the first refrigerant pipe 14A is in contact with the partition plate 47, and a round hole (the discharge outlet 49A) may be provided on the side surface in the vicinity of the tip of the first refrigerant pipe 14A.

<First Modification Example of First Embodiment>

[0105] The heat exchanger 60 according to a modification example of the first embodiment will be described with reference to Fig. 7. In Fig. 7, the same configuration parts as those of the structure shown in Fig. 5 are designated by the same reference numerals. In Fig. 7, W1 indicates the width of the nozzle portion 62 in the Y direction (hereinafter referred to as a "width W1"), and W2 indicates the width of the refrigerant circulation portion 54A in the Y direction (hereinafter referred to as a "width W2 "), respectively.

(Overall Configuration of Heat Exchanger)

[0106] The heat exchanger 60 is configured in the same manner as the heat exchanger 27 except that the heat exchanger 60 includes a pair of headers 61 in place of the pair of headers 43 that configure the heat exchanger 27 of the first embodiment.

(Configuration of Header)

[0107] The header 61 is configured in the same manner as the header 43 except that the header 61 includes the nozzle portion 62 in place of the nozzle portion 49 that configures the header 43.

(Configuration of Nozzle Portion)

[0108] The nozzle portion 62 includes an discharge outlet 62A having a groove shape extending in the Y direction. The discharge outlet 62A blows out the refrigerant toward the bottom surface of the header body 45.

[0109] The width W1 of the nozzle portion 62 is configured to be wider than the width of the nozzle portion 49 shown in Fig. 5. As a result, the width W2 of the pair of refrigerant circulation portions 54A disposed on both sides of the nozzle portion 62 in the Y direction is configured to be narrower than the width of the pair of refrigerant circulation portions 54A shown in Fig. 5.

[0110] A total value (= 2 × W2) of the width W2 of the pair of refrigerant circulation portions 54A, which are disposed on both sides of the nozzle portion 62 in the width direction (Y direction), may be configured to be smaller than a value of the width W1 of the nozzle portion 62, for example.

(Effect of Heat Exchanger)

[0111] According to the heat exchanger 60 according to the modification example of the first embodiment, by forming the discharge outlet 62A into a groove shape extending in the Y direction, the difference in state of the refrigerant in the Y direction can be further reduced as compared with a case where a shape of the discharge outlet is a round shape.

[0112] Further, by making a total value (= 2 × W2) of the width W2 of the pair of refrigerant circulation portions 54A, which are disposed on both sides of the nozzle portion 62 in the width direction (Y direction), to be smaller than a value of the width W1 of the nozzle portion 62, it is possible to make a cross-sectional area of the flow path of the pair of refrigerant circulation portions 54A small. As a result, the occurrence of the flowing back of the refrigerant from the lower side toward the upper side in the first space 54 can be prevented.

<Second Embodiment>

[0113] A heat exchanger 70 according to a second embodiment will be described with reference to Fig. 8. In Fig. 8, the same configuration parts as those of the structure shown in Fig. 4 are designated by the same reference numerals. The arrows shown in Fig. 8 indicate a direction in which the refrigerant flows when the heat exchanger 70 is used as an evaporator.

(Overall Configuration of Heat Exchanger)

[0114] The heat exchanger 70 is configured in the same manner as the heat exchanger 27 except that the heat exchanger 70 includes a header 71 in place of the header 43 that configures the heat exchanger 27 of the first embodiment. The header 71 is configured in the same manner as the header 43 except that the header 71 includes a first refrigerant guide portion 73.

(Configuration of First Refrigerant Guide Portion)

[0115] The first refrigerant guide portion 73 is provided on the first bottom surface 45aa of the header body 45. The first refrigerant guide portion 73 includes a first guide surface 73a.

[0116] The first guide surface 73a is disposed such that a part of the first guide surface 73a and the discharge outlet 49A face each other in the Z direction. The first guide surface 73a guides the refrigerant in a direction from the first space 54 toward the second space 55, causes the refrigerant to collide with an inner wall surface 45b of the header body 45, which faces the first guide surface 73a in the X direction, and reduces the difference in state of the refrigerant in the width direction.

[0117] As the first guide surface 73a, for example, a recessed curved surface that is recessed in a direction separated from the lower end portion of the partition plate 47 can be used.

(Effect of Heat Exchanger)

[0118] According to the heat exchanger 70 of the second embodiment, by including the first refrigerant guide portion 73 having the above configuration, the refrigerant that is blown out from the discharge outlet 49A of the nozzle portion 49 is guided to the second space 55, and by causing the refrigerant to collide with the inner wall surface 45b of the header body 45 that partitions the second space 55, the difference in state of the refrigerant in the width direction can be reduced.

[0119] Further, when the refrigerant is gas-liquid two-phase refrigerant and the flow rate of the refrigerant that is introduced into the header body 45 is small, it is possible to prevent the refrigerant from gas-liquid separation in the first space 54 and prevent the gas phase refrigerant from rising in the first space 54. That is, the refrigerant circulation flow can be prevented from becoming difficult to form in the header body 45.

[0120] Further, by making the first guide surface 73a a recessed curved surface that is recessed in the direction separated from the lower end portion of the partition plate, the refrigerant can be smoothly guided from the first space 54 to the second space 55.

[0121] In the second embodiment, the nozzle portion 62 shown in Fig. 7 may be used in place of the nozzle portion 49 that configures the heat exchanger 70.

<First Modification Example of Second Embodiment>

[0122] A heat exchanger 80 according to a first modification example of the second embodiment will be described with reference to Fig. 9. In Fig. 9, the same configuration parts as those of the structure shown in Fig. 8 are designated by the same reference numerals. The arrows shown in Fig. 9 indicate a direction in which the refrigerant flows when the heat exchanger 80 is used as an evaporator.

(Overall Configuration of Heat Exchanger)

[0123] The heat exchanger 80 is configured in the same manner as the heat exchanger 70 except that the heat exchanger 80 includes a header 81 in place of the header 71 that configures the heat exchanger 70 of the second embodiment. The header 81 is configured in the same manner as the header 71, except that the header 81 is provided with a third refrigerant guide portion 83 with the configuration of the header 71.

(Configuration of Third Refrigerant Guide Portion)

[0124] The third refrigerant guide portion 83 is provided in a part, of the lower end portion of the partition plate 47, that is separated upward from the bottom surface 45a of the header body 45. The third refrigerant guide portion 83 includes a third guide surface 83a.

[0125] The third guide surface 83a is disposed so as to face the first guide surface 73a. The third guide surface 83a guides the refrigerant in a direction from the first space 54 toward the second space 55. As the third refrigerant guide portion 83, for example, a cylinder-shaped member extending in the width direction of the partition plate 47 can be used.

(Effect of Heat Exchanger)

[0126] According to the heat exchanger 80 of the first modification example of the second embodiment, by providing the third refrigerant guide portion 83 having the above configuration, the third guide surface 83a (the outer peripheral surface of the cylinder-shaped member) can guide the refrigerant in the direction from the first space 54 toward the second space 55.

[0127] In the first modification example of the second embodiment, the nozzle portion 62 shown in Fig. 7 may be used in place of the nozzle portion 49 that configures the heat exchanger 80.

<Second Modification Example of Second Embodiment>

[0128] A heat exchanger 90 according to a second modification example of the second embodiment will be described with reference to Fig. 10. In Fig. 10, the same configuration parts as those of the structure shown in Fig. 8 are designated by the same reference numerals. The arrows shown in Fig. 10 indicate a direction in which the refrigerant flows when the heat exchanger 90 is used as an evaporator.

(Overall Configuration of Heat Exchanger)

[0129] The heat exchanger 90 is configured in the same manner as the heat exchanger 70 except that the heat exchanger 90 includes a header 91 in place of the header 71 that configures the heat exchanger 70 of the second embodiment. The header 91 is configured in the same manner as the header 71, except that the header 91 is provided with a second refrigerant guide portion 93 with the configuration of the header 71.

(Configuration of Second Refrigerant Guide Portion)

[0130] The second refrigerant guide portion 93 is provided on the second bottom surface 45ab. The second refrigerant guide portion 93 includes a second guide surface 93a. The second guide surface 93a guides the refrigerant (the refrigerant in which the difference in state in the width direction is reduced by colliding with the first bottom surface 45aa), which flows from the lower end portion of the first space 54 to the lower end portion of the second space 55, in a direction from the lower side toward the upper side of the second space 55.

[0131] As the second guide surface 93a, for example, a recessed curved surface that is recessed in a direction separated from the lower end portion of the partition plate 47 can be used.

(Effect of Heat Exchanger)

[0132] According to the heat exchanger 90 of the second modification example of the second embodiment, by including the second refrigerant guide portion 93 having the above configuration, the refrigerant, which is generated by colliding with the first bottom surface 45aa of the header body 45, having a small difference in state in the width direction can be guided in a direction from the lower side toward the upper side of the second space 55.

[0133] Further, by making the second guide surface 93a a recessed curved surface that is recessed in a direction separated from the lower end portion of the partition plate 47, the refrigerant having a small difference in state in the width direction can be easily guided in the direction from the lower side toward the upper side of the second space 55.

[0134] In the heat exchanger 90 according to the second modification example of the second embodiment, at least one of the first refrigerant guide portion 73 and the third refrigerant guide portion 83 shown in Fig. 9 may be provided.

<Third Modification Example of Second Embodiment>

[0135] A heat exchanger 100 according to a third modification example of the second embodiment will be described with reference to Fig. 11. In Fig. 11, the same configuration parts as those of the structure shown in Fig. 10 are designated by the same reference numerals. The arrows shown in Fig. 11 indicate a direction in which the refrigerant flows when the heat exchanger 100 is used as an evaporator.

(Overall Configuration of Heat Exchanger)

[0136] The heat exchanger 100 is configured in the same manner as the heat exchanger 90 except that the heat exchanger 100 includes a header 101 in place of the header 91 that configures the heat exchanger 90 of the second modification example of the second embodiment. The header 101 is configured in the same manner as the header 91, except that the header 101 is provided with the first refrigerant guide portion 73 with the configuration of the header 91.

(Effect of Heat Exchanger)

[0137] According to the heat exchanger 100 of the third modification example of the second embodiment, the refrigerant, which is generated by colliding with the first guide surface 73a, having a small difference in state in the width direction can be smoothly guided to the direction from the lower side toward the upper side of the second space 55.

[0138] In the heat exchanger 100 according to the third modification example of the second embodiment, the third refrigerant guide portion 83 shown in Fig. 9 may be provided.

<Third Embodiment>

[0139] The heat exchanger 110 according to a third embodiment will be described with reference to Fig. 12. In Fig. 12, the same configuration parts as those of the structure shown in Fig. 4 are designated by the same reference numerals. The arrows shown in Fig. 12 indicate a direction in which the refrigerant flows when the heat exchanger 110 is used as an evaporator.

(Overall Configuration of Heat Exchanger)

[0140] The heat exchanger 110 is configured in the same manner as the heat exchanger 27, except that one end 41Fa of the flat tube 41F is moved back from a position of one end 41a of the other flat tube 41 in the direction from the first space 54 toward the second space 55, with respect to the header 43 that configures the heat exchanger 27 of the first embodiment.

[0141] As a result, it is configured such that a distance Ds1 from the one end 41Fa of the flat tube 41F to the second surface 47c of the partition plate 47 is longer than a distance Ds2 from the one end 41a of the other flat tube 41 to the second surface 47c of the partition plate 47.

(Effect of Heat Exchanger)

[0142] According to the heat exchanger 110 of the third embodiment, among the plurality of flat tubes 41, by making a distance Ds1, which is from the one end 41Fa of the flat tube 41F disposed at the bottom to the partition plate 47, longer than a distance Ds2, which is from the one end 41a of the other flat tube 41 to the partition plate 47, it is possible to increase the cross-sectional area of the refrigerant flow path formed between the one end 41Fa of the flat tube 41F disposed at the bottom and the partition plate 47.

[0143] As a result, since the degree of contraction flow at a height position of the flat tube 41F can be relaxed and the flow of the refrigerant is less likely to separate, the liquid phase refrigerant can be easily supplied to the flat tube 41F, which may be difficult for the liquid phase refrigerant to flow in due to the influence of separation (contraction flow) in the related art, thereby the distribution of the refrigerant to each flat tube 41 can be equalized.

[0144] In the heat exchanger 110 according to the third embodiment, at least one of the first refrigerant guide portion 73 shown in Fig. 9, the third refrigerant guide portion 83 shown in Fig. 9, and the second refrigerant guide portion 93 shown in Fig. 10 may be provided.

<First Modification Example of Third Embodiment>

[0145] The heat exchanger 120 according to a first modification example of the third embodiment will be described with reference to Fig. 13. In Fig. 13, the same configuration parts as those of the structures shown in Fig. 8 and Fig. 12 are designated by the same reference numerals. The arrows shown in Fig. 13 indicate a direction in which the refrigerant flows when the heat exchanger 120 is used as an evaporator.

(Overall Configuration of Heat Exchanger)

[0146] The heat exchanger 120 is configured in the same manner as the heat exchanger 70, except that one end 41Fa of the flat tube 41F is moved back from a position of one end 41a of the other flat tube 41 in the direction from the first space 54 toward the second space 55, with respect to the header 71 that configures the heat exchanger 70 of the second embodiment.

[0147] As described above, the distance Ds1, which is from the one end 41Fa of the flat tube 41F disposed at the bottom to the partition plate 47, is configured to be longer than the distance Ds2, which is from the one end 41a of the other flat tube 41 to the partition plate 47, and then the first refrigerant guide portion 73 may be provided.

[0148] Further, the heat exchanger 120 having the above configuration may be provided with the third refrigerant guide portion 83 shown in Fig. 9.

<Second Modification Example of Third Embodiment>

[0149] The heat exchanger 130 according to a second modification example of the third embodiment will be described with reference to Fig. 14. In Fig. 14, the same configuration parts as those of the structure shown in Fig. 4 are designated by the same reference numerals. The arrows shown in Fig. 14 indicate a direction in which the refrigerant flows when the heat exchanger 130 is used as an evaporator.

(Overall Configuration of Heat Exchanger)

[0150] The heat exchanger 130 is configured in the same manner as the heat exchanger 27 except that the heat exchanger 130 includes a header 131 in place of the header 43 that configures the heat exchanger 27 of the first embodiment. The header 131 is configured in the same manner as the header 43 except that the header 131 includes the partition plate 133 in place of the partition plate 47 that configures the header 43 of the first embodiment.

[0151] Positions of one ends 41a and 41Fa of the plurality of flat tubes 41 in the X direction are at the same position.

(Configuration of Partition Plate)

[0152] The partition plate 133 includes a lower end portion 133A that faces the one end 41Fa of the flat tube 41F in the X direction. The lower end portion 133A is disposed at a position deviated from a direction from the second space 55 toward the first space 54 with the partition plate 133, which excludes the lower end portion 133A, as a reference. As a result, the distance Ds1, which is from the one end 41Fa of the flat tube 41F disposed at the bottom to the partition plate 47, is configured to be longer than the distance Ds2, which is from the one end 41a of the other flat tube 41 to the partition plate 47.

(Effect of Heat Exchanger)

[0153] According to the heat exchanger 130 of the second modification example of the third embodiment, among the plurality of flat tubes 41, by disposing the lower end portion 133A of the partition plate 133 that faces the one end 41Fa of the flat tube 41F disposed at the bottom at a position deviated from the direction from the second space 55 toward the first space 54, the cross-sectional area of the refrigerant flow path, which is formed between the one end 41Fa of the flat tube 41F disposed at the bottom and the partition plate 133, can be increased.

[0154] In the heat exchanger 130 according to the second modification example of the third embodiment, at least one of the first refrigerant guide portion 73 shown in Fig. 9, the third refrigerant guide portion 83 shown in Fig. 9, and the second refrigerant guide portion 93 shown in Fig. 10 may be provided.

<Fourth Embodiment>

[0155] The heat exchanger 140 according to a fourth embodiment will be described with reference to Fig. 15. In Fig. 15, the same configuration parts as those of the structure shown in Fig. 4 are designated by the same reference numerals. The arrows shown in Fig. 15 indicate a direction in which the refrigerant flows when the heat exchanger 140 is used as an evaporator.

(Overall Configuration of Heat Exchanger)

[0156] The heat exchanger 140 is configured in the same manner as the heat exchanger 27 except that the heat exchanger 140 includes a header 141 in place of the header 43 that configures the heat exchanger 27 of the first embodiment. The header 141 is configured in the same manner as the header 43, except that the header 141 is further provided with a rectification member 143 with the configuration of the header 43 of the first embodiment.

(Configuration of Rectification Member)

[0157] The rectification member 143 is a baffle plate 145 provided on an inner wall surface 45b of the header body 45 that partitions the second space 55.

[0158] The baffle plate 145 is disposed at a position below the flat tube 41F and separated from the flat tube 41F. The baffle plate 145 extends in a direction from the inner wall surface 45b of the header body 45 toward the partition plate. The amount of protrusion of the baffle plate 145 from the inner wall surface 45b is configured to be equal to the amount of protrusion of one end portion 41B of the flat tube 41F.

(Effect of Heat Exchanger)

[0159] According to the heat exchanger 140 of the fourth embodiment, by including the baffle plate 145 (the rectification member 143) having the above configuration, the flow of the refrigerant is separated in a front stage of the one end portion 41B of the flat tube 41F that is disposed at the bottom, thereby it is possible to rectify the flow of the refrigerant at the one end of the flat tube 41F.

[0160] As a result, the liquid phase refrigerant can be easily supplied to the flat tube 41F, which may be difficult for the liquid phase refrigerant to flow in due to the influence of separation (contraction flow) in the related art, thereby the distribution of the refrigerant to each flat tube 41 can be equalized.

<First Modification Example of Fourth Embodiment>

[0161] The heat exchanger 150 according to a first modification example of the fourth embodiment will be described with reference to Fig. 16. In Fig. 16, the same configuration parts as those of the structure shown in Fig. 15 are designated by the same reference numerals. The arrows shown in Fig. 16 indicate a direction in which the refrigerant flows when the heat exchanger 150 is used as an evaporator.

(Overall Configuration of Heat Exchanger)

[0162] The heat exchanger 150 is configured in the same manner as the heat exchanger 140 except that the heat exchanger 150 includes a header 151 in place of the header 141 that configures the heat exchanger 140 of the fourth embodiment. The header 151 is configured in the same manner as the header 141, except that the header 151 is further provided with the first refrigerant guide portion 73 with the configuration of the header 141 of the fourth embodiment.

[0163] As described above, the baffle plate 145 described in the fourth embodiment and the first refrigerant guide portion 73 described in the second embodiment may be used in combination.

<Second Modification Example of Fourth Embodiment>

[0164] The heat exchanger 160 according to a second modification example of the fourth embodiment will be described with reference to Fig. 17. In Fig. 17, the same configuration parts as those of the structure shown in Fig. 15 are designated by the same reference numerals. The arrows shown in Fig. 17 indicate a direction in which the refrigerant flows when the heat exchanger 160 is used as an evaporator.

(Overall Configuration of Heat Exchanger)

[0165] The heat exchanger 160 is configured in the same manner as the heat exchanger 140 except that the heat exchanger 160 is provided with a block 164, which is a rectification member 163, in place of the baffle plate 145 that configures the heat exchanger 140 of the fourth embodiment.

(Configuration of Block)

[0166] The block 164 is disposed below the one end portion 41B so as to be in contact with a lower surface of the one end portion 41B of the flat tube 41F. The block 164 extends in a direction from the inner wall surface 45b of the header body 45 toward the partition plate 47.

[0167] The amount of protrusion of the block 164 when the inner wall surface 45b of the header body 45 is used as a reference is equal to the amount of protrusion of the one end portion 41B of the flat tube 41.

(Effect of Heat Exchanger)

[0168] According to the heat exchanger 160 of the second modification example of the fourth embodiment, by using the block 164 having the above configuration as the rectification member 163, the flow of the refrigerant is separated in a front stage of the one end portion 41B of the flat tube 41F that is disposed at the bottom, thereby it is possible to rectify the flow of the refrigerant at the one end of the flat tube 41F.

[0169] As a result, the liquid phase refrigerant can be easily supplied to the flat tube 41F, which may be difficult for the liquid phase refrigerant to flow in due to the influence of separation (contraction flow) in the related art, thereby the distribution of the refrigerant to each flat tube 41 can be equalized.

<Third Modification Example of Fourth Embodiment>

[0170] The heat exchanger 170 according to a third modification example of the fourth embodiment will be described with reference to Fig. 18. In Fig. 18, the same configuration parts as those of the structure shown in Fig. 17 are designated by the same reference numerals. The arrows shown in Fig. 18 indicate a direction in which the refrigerant flows when the heat exchanger 170 is used as an evaporator.

(Overall Configuration of Heat Exchanger)

[0171] The heat exchanger 170 is configured in the same manner as the heat exchanger 160 except that the heat exchanger 170 is provided with a block 174, which is a rectification member 173, in place of the block 164 that configures the heat exchanger 160 of the second modification example of the fourth embodiment.

(Configuration of Block)

[0172] The block 174 is disposed below the one end portion 41B so as to be in contact with a lower surface of the one end portion 41B of the flat tube 41F. The block 174 is formed on the partition plate 47 side and includes a curved surface 174a for guiding the flow of the refrigerant upward.

(Effect of Heat Exchanger)

[0173] According to the heat exchanger 170 of the third modification example of the fourth embodiment, since the block 174 has the curved surface 174a, the refrigerant can be guided above the second space 55 without the separation of the flow.

<Fourth Modification Example of Fourth Embodiment>

[0174] The heat exchanger 180 according to a fourth modification example of the fourth embodiment will be described with reference to Fig. 19. In Fig. 19, the same configuration parts as those of the structures shown in Fig. 11 and Fig. 17 are designated by the same reference numerals. The arrows shown in Fig. 19 indicate a direction in which the refrigerant flows when the heat exchanger 180 is used as an evaporator.

(Overall Configuration of Heat Exchanger)

[0175] The heat exchanger 180 is configured in the same manner as the heat exchanger 160 except that the heat exchanger 180 is further provided with the first refrigerant guide portion 73 and the second refrigerant guide portion 93 shown in Fig. 11 with the configuration of the heat exchanger 170 according to the third modification example of the fourth embodiment.

[0176] As described above, the block 174, the first refrigerant guide portion 73, and the second refrigerant guide portion 93 may be used in combination.

<Fifth Modification Example of Fourth Embodiment>

[0177] The heat exchanger 190 according to a fifth modification example of the fourth embodiment will be described with reference to Fig. 20. In Fig. 20, the same configuration parts as those of the structures shown in Fig. 14 and Fig. 19 are designated by the same reference numerals. The arrows shown in Fig. 20 indicate a direction in which the refrigerant flows when the heat exchanger 190 is used as an evaporator.

(Overall Configuration of Heat Exchanger)

[0178] The heat exchanger 190 is configured in the same manner as the heat exchanger 160 except that the heat exchanger 190 includes the partition plate 133 shown in Fig. 14 in place of the partition plate 47 that configures the heat exchanger 160 according to the second modification example of the fourth embodiment.

[0179] As described above, the block 174, the first refrigerant guide portion 73, the second refrigerant guide portion 93, and the partition plate 133 may be used in combination.

<Fifth Embodiment>

[0180] A refrigeration cycle device 200 of a fifth embodiment will be described with reference to Fig. 21. In Fig. 21, a solid arrow indicates a direction in which refrigerant flows during heating operation, and a dotted arrow indicates a direction in which the refrigerant flows during cooling operation. In Fig. 21, the same configuration parts as those of the structure shown in Fig. 1 are designated by the same reference numerals.

(Overall Configuration of Refrigeration Cycle Device)

[0181] The refrigeration cycle device 200 is configured in the same manner as the refrigeration cycle device 10 except that the refrigeration cycle device 200 includes first and second heat exchanger units 201 and 203 in place of the first and second heat exchanger units 18 and 23 that configure the refrigeration cycle device 10 of the first embodiment.

[0182] The first heat exchanger unit 201 is configured in the same manner as the first heat exchanger unit 18 except that the first heat exchanger unit 201 includes a heat exchanger 205 in place of the heat exchanger 27.

[0183] The second heat exchanger unit 203 is configured in the same manner as the second heat exchanger unit 23 except that the second heat exchanger unit 203 includes a heat exchanger 205 in place of the heat exchanger 27.

(Overall Configuration of Heat Exchanger)

[0184] The heat exchanger 205 will be described with reference to Figs. 21 to 23. In Fig. 22, the same configuration parts as those of the structure shown in Fig. 2 are designated by the same reference numerals. Further, in Fig. 22, the X direction indicates the extending direction of the flat tube 41 orthogonal to the Z direction (the vertical direction). In Fig. 23, the Y direction indicates the horizontal direction (the width direction of the flat tube 41 in a state in which the flat tube 41 is attached to the fin 206) that is orthogonal to the X direction and the Z direction, and J indicates a direction in which air flows (hereinafter referred to as a "direction J"), respectively.

[0185] The heat exchanger 205 is configured in the same manner as the heat exchanger 27 except that the heat exchanger 205 includes an gateway header 35, a turnback header 37, and a fin 206 in place of the pair of headers 43 and the fin 42.

(Configuration of Gateway Header)

[0186] The gateway header 35 is a tube-shaped member that extends in the Z direction, and an upper end and a lower end of the gateway header 35 are closed. The gateway header 35 is connected to the first refrigerant pipe 14A and one end portion of each of the plurality of flat tubes 41 (the end portion disposed on one side in the

X direction).

[0187] The gateway header 35 guides the refrigerant, which is supplied through the first refrigerant pipe 14A, to the flow paths in the plurality of flat tubes 41 and returns the refrigerant, which is turned back to the gateway header 35 through the turnback header 37, to the first refrigerant pipe 14A.

(Configuration of Turnback Header)

[0188] The turnback header 37 is disposed so as to face the gateway header 35 in the X direction. The turnback header 37 is a tube-shaped member that extends in the Z direction, and an upper end and a lower end of the turnback header 37 are closed. The turnback header 37 is connected to the other end portion of each of the plurality of flat tubes 41 (the end portion disposed on the other side in the X direction).

[0189] The turnback header 37 returns the refrigerant to the gateway header 35 through the plurality of flat tubes 41.

(Configuration of Flat Tube)

[0190] The flat tube 41 will be described with reference to Fig. 22 to Fig. 24. In Fig. 24, the same configuration parts as those of the structures shown in Fig. 22 and Fig. 23 are designated by the same reference numerals.

[0191] The flat tube 41 further includes a first end portion 41D disposed on one side of the flat tube 41 in the width direction (Y direction), a second end portion 41E disposed on the other side of the flat tube 41 in the width direction (Y direction), and an outer peripheral surface 41b.

[0192] The outside appearances of the first and second end portions 41D and 41E are a round shape or an elliptical shape.

[0193] The plurality of flat tubes 41 are supported by a plurality of fins 206 in a state with an interval in the Z direction. One end portion of each of the plurality of flat tubes 41, which is disposed in the X direction, is connected to the gateway header 35. The other end portion of each of the plurality of flat tubes 41, which is disposed in the X direction, is connected to the turnback header 37.

(Overall Configuration of Fin)

[0194] The fin 206 will be described with reference to Fig. 22, Fig. 23, and Fig. 25 to Fig. 27. In Fig. 25 to Fig. 27, the same configuration parts as those of the structures shown in Fig. 22 and Fig. 23 are designated by the same reference numerals.

[0195] The plurality of fins 206 are disposed at a predetermined pitch with respect to the X direction. The fin 206 includes a fin body 207, a plurality of flat tube insertion portions 209, a plurality of uneven portions 211, a communication portion 213, and a plurality of fin pitch regulation portions 215.

(Configuration of Fin Body)

[0196] The fin body 207 has a plate shape and extends in the Z direction. The fin body 207 includes first and second surfaces 207a and 207b disposed in the X direction, and a second plane portion 207A.

[0197] The first surface 207a is disposed so as to face the gateway header 35. The second surface 207b is a surface disposed on the opposite side of the first surface 207a. The second surface 207b is disposed so as to face the turnback header 37.

(Configuration of Second Plane Portion)

[0198] The second plane portion 207A is a part, of the fin body 207 disposed between the flat tube insertion portions 209 adjacent to each other, that excludes the uneven portion 211 and the fin pitch regulation portion 215 in the Z direction.

[0199] Of the first and second surfaces 207a and 207b, the first and second surfaces 207a and 207b that configure the second plane portion 207A are surfaces orthogonal to the X direction and parallel to the Y direction and the Z direction.

[0200] A part, of the second plane portion 207A, that is disposed on one side in the Y direction, configures one end portion 206A of the fin 206.

(Configuration of Flat Tube Insertion Portion)

[0201] The plurality of flat tube insertion portions 209 are formed on the fin body 207. The plurality of flat tube insertion portions 209 are disposed at intervals in the Z direction. The flat tube insertion portion 209 extends from one side to the other side in the Y direction. The flat tube insertion portion 209 includes a tip portion 209A disposed on the other side in the Y direction and a rear end portion 209B disposed on one side in the Y direction.

[0202] The tip portion 209A is closed and restricts a position of the second end portion 41E of the flat tube 41. The rear end portion 209B is open from the viewpoint of inserting the flat tube 41.

[0203] The rear end portion side of the flat tube insertion portion 209 is open for inserting the flat tube 41 into the flat tube insertion portion 209. The flat tube insertion portion 209 accommodates the flat tube 41 that is inserted from the first end portion 41D side.

[0204] The shape of the tip portion 209A is set to a shape such that the outer peripheral surface of the second end portion 41E and the fin body 207 partitioning the tip portion 209A are in surface contact with each other. That is, when the second end portion 41E has a round shape, the shape of the tip portion 209A is set to a round shape that makes surface contact with the second end portion 41E, and when the second end portion 41E has an elliptical shape, the shape of the tip portion 209A is set to an elliptical shape that makes surface contact with the second end portion 41E.

[0205] With such a configuration, it is possible to increase the contact area between the flat tube 41 and the fin body 207, thereby the thermal conductivity between the flat tube 41 and the fin 206 can be improved.

(Configuration of Uneven Portion)

[0206] The uneven portion 211 is formed in the fin body 207 that is positioned between the flat tube insertion portions 209 adjacent to each other in the Z direction. The periphery of the uneven portion 211 is surrounded by the second plane portion 207A.

[0207] The uneven portion 211 is formed by alternately disposing peaks and valleys protruding in a direction separated from the first surface 207a of the second plane portion 207A. The uneven portions 211 are disposed at intervals in the Z direction.

[0208] By providing the uneven portion 211 having such a configuration, it is possible to improve the heat transfer coefficient on the air side while increasing the area of the fin body 207, thereby the efficiency of the heat exchanging between the air and the fin body 207 can be increased.

(Configuration of Communication Portion)

[0209] The communication portion 213 is a part, of the fin body 207, that is disposed on the other side from the plurality of flat tube insertion portions 209 in the Y direction, and extends continuously in the Z direction. The communication portion 213 includes a first plane portion 207B and a condensed water guide portion 217.

(Configuration of First Plane Portion)

[0210] The first plane portion 207B is disposed on both sides of the condensed water guide portion 217 so as to interpose the condensed water guide portion 217 from the Y direction.

[0211] A surface, of the first and second surfaces 207a and 207b, that configures the first plane portion 207B, is a surface orthogonal to the X direction and parallel to the Y direction and the Z direction.

[0212] A part, of the first plane portion 207B, that is disposed on the other side in the Y direction, configures the other end portion 206B of the fin 206.

[0213] A surface, of the second surface 207b, that configures one end portion 206A of the fin 206, and a surface, of the second surface 207b, that configures the other end portion 206B, are disposed on the same plane.

(Configuration of Condensed Water Guide Portion)

[0214] The condensed water guide portion 217 protrudes on the first surface 207a of the first plane portion 207B in a state of being bent in a direction intersecting the first surface 207a of the first plane portion 207B. The condensed water guide portion 217 extends continuously over the Z direction. The condensed water guide portion 217 is a projecting portion 218 in which a cross-sectional shape is a V shape when cut on a plane orthogonal to the Z direction and the cross-sectional shape is uniform in the Z direction.

[0215] The first surface 207a, which configures the projecting portion 218, protrudes in a V shape in a direction from the second surface 207b of the first plane portion 207B toward the first surface 207a.

[0216] The second surface 207b, which configures the projecting portion 218, is a surface recessed in a V shape in the direction from the second surface 207b of the first plane portion 207B toward the first surface 207a.

(Configuration of Fin Pitch Regulation Portion)

[0217] The fin pitch regulation portion 215 is formed between the rear end portions of the flat tube insertion portions 209 adjacent to each other in the Z direction. The fin pitch regulation portion 215 is disposed on one side of the uneven portion 211 in the Y direction.

[0218] The fin pitch regulation portion 215 is formed by folding a part of the fin body 207 downward (one side in the Z direction). The fin pitch regulation portion 215 is formed so as to protrude on the first surface 207a.

[0219] The fin pitch regulation portion 215 keeps the pitch (fin pitch) of the fins 206 that are disposed in the X direction at a desired value by being in contact with the second surface 207b of the fin 206 disposed on one side in the X direction. The shape of the fin pitch regulation portion 215 can be, for example, an L shape.

(Cutting Step Performed When Manufacturing Plurality of Fins)

[0220] Here, with reference to Fig. 28 to Fig. 30, a cutting step that is performed when manufacturing a plurality of fins 206 will be described. In Fig. 28 to Fig. 30, the same configuration parts as those of the structure shown in Fig. 23 are designated by the same reference numerals. In Fig. 28 and Fig. 30, Cp indicates a position for cutting the structure shown in Fig. 28 (hereinafter referred to as a "cutting position Cp") in the cutting step.

[0221] The fin 206 having the above configuration is manufactured by performing a press process on a single plate member, by cutting the cutting position Cp of the structure 220 (see Fig. 28) in which a plurality of fins 206 are connected in the horizontal direction, and by separating the plurality of fins 206 into individual pieces.

(Effect of Disposing Second Surfaces of Both End Portions of Fin on Same Plane)

[0222] As described above, of the second surface 207b, a surface that configures one end portion 206A of the fin 206 and a surface that configures the other end portion 206B are disposed on the same plane.

[0223] With such a configuration, in the cutting step of the structure 220 that is performed after the manufacturing of the structure 220 in which the plurality of fins 206 are connected by performing the press process on the plate member (the base material of the plurality of fins 206), it is possible to make the second surface 207b that corresponds to the cutting position Cp being in contact with an upper surface of a stage of a cutting device. As a result, it is possible to dispose the structure 220 on the stage in a stable state, thereby the structure 220 can be cut with high accuracy.

[0224] In Fig. 28, as an example of the structure that serves as a base material for the plurality of fins 206, the case where the plurality of fins 206 are connected such that the tip portions 209A of the flat tube insertion portions 209, which configure the fins 206 adjacent to each other, face in the same direction has been described as an example, but the structure 225 that is disposed such that the rear end portions 209B of the flat tube insertion portions 209, which configure the pair of fins 206 adjacent to each other, face each other may be used as shown in Fig. 30, for example.

[0225] The heat exchanger 205 having the above configuration is used as a condenser during the cooling operation to dissipate heat to the outside and is used as an evaporator during the heating operation to absorb heat from the outside.

(Effect of Heat Exchanger)

[0226] According to the heat exchanger 205 of the first embodiment, by configuring the condensed water guide portion 217, which is formed in the communication portion 213, with a projecting portion 218 that protrudes from the first surface 207a configuring the first plane portion 207B, the condensed water can be guided in the direction from the upper side toward the lower side along the first and second surfaces 207a and 207b that configure the projecting portion 218 while preventing the obstruction of the flow of the condensed water.

[0227] Further, by providing the projecting portion 218 having the above configuration, it is possible to improve the strength of the communication portion 213. As a result, the occurrence of breakage of the fin can be prevented in a part, of the fin 206, that faces the flat tube insertion portion 209 in the Y direction (a part where the strength of the fin 206 is weak).

[0228] Further, by providing the projecting portion 218 having the above configuration, it is possible to improve the heat transfer coefficient on the air side while increasing the surface area of the condensed water guide portion 217. As a result, the heat exchange efficiency between the condensed water guide portion 217 and the air can be improved.

(Effect of First Heat Exchanger Unit)

[0229] By including the heat exchanger 205 described above having excellent drainage of condensed water, the first heat exchanger unit 201 can be operated stably.

(Effect of Refrigeration Cycle Device)

[0230] By including the first and second heat exchanger units 201 and 203 described above, the refrigeration cycle device 200 can be operated stably while improving the performance of the refrigeration cycle device 200.

<Sixth Embodiment>

[0231] The heat exchanger 230 of the sixth embodiment will be described with reference to Fig. 31 and Fig. 32. In Fig. 31, the same configuration parts as those of the structure shown in Fig. 23 are designated by the same reference numerals. In Fig. 31 and Fig. 32, the same configuration parts are designated by the same reference numerals.

(Overall Configuration of Heat Exchanger)

[0232] The heat exchanger 230 is configured in the same manner as the heat exchanger 205 except that the heat exchanger 230 includes a plurality of fins 231 in place of the plurality of fins 206 that configure the heat exchanger 205 of the fifth embodiment.

[0233] The fin 231 is configured in the same manner as the fin 206 except that the fin 231 includes a communication portion 233 in place of the communication portion 213 that configures the fin 206.

[0234] The communication portion 233 is configured in the same manner as the communication portion 213, except that the communication portion 233 includes a condensed water guide portion 235 in place of the condensed water guide portion 217 (the projecting portion 218) that is formed in the communication portion 213.

(Configuration of Condensed Water Guide Portion)

[0235] The condensed water guide portion 235 protrudes from the first surface 207a that configures the first plane portion 207B, and is configured with an uneven portion 236 including a projecting portion 238 (two projecting portions 238 in Fig. 31 and Fig. 32 as an example), which is disposed in horizontal direction, and a recessed portion 239 (one recessed portion 239 in Fig. 31 and Fig. 32 as an example), which is disposed between the projecting portions 238 adjacent to each other in the Y direction.

[0236] The uneven portion 236 is bent in a direction intersecting with the first plane portion 207B and continuously extends over the Z direction, and a cross-sectional shape (W shape in a case of Fig. 32) of the uneven portion 236 when cut on a plane orthogonal to the Z direction is uniform in the Z direction.

(Effect of Heat Exchanger)

[0237] By using the uneven portion 236 having the above configuration as the condensed water guide portion 235, the condensed water can be guided in the direction from the upper side toward the lower side along the first and second surfaces 207a and 207b that configure the uneven portion 236 while preventing the obstruction of the flow of the condensed water.

[0238] Further, by using the uneven portion 236 as the condensed water guide portion 235, it is possible to improve the strength of the communication portion 233, thereby the occurrence of the breakage of the fin can be prevented at a part (a part where the strength of the fin 231 is weak), of the fin 231, that faces the flat tube insertion portion 209 in the horizontal direction (Y direction).

[0239] Further, by configuring the condensed water guide portion 235 with the uneven portion 236, it is possible to improve the heat transfer coefficient on the air side while increasing the surface area of the condensed water guide portion 235 as compared with the case where the condensed water guide portion 217 is configured with one projecting portion 218. As a result, the heat exchange efficiency between the condensed water guide portion 235 and the air can be improved.

<Seventh Embodiment>

[0240] The heat exchanger 240 of the seventh embodiment will be described with reference to Fig. 33 and Fig. 34. In Fig. 33, the same configuration parts as those of the structure shown in Fig. 23 are designated by the same reference numerals. In Fig. 33 and Fig. 34, the same configuration parts are designated by the same reference numerals.

(Overall Configuration of Heat Exchanger)

[0241] The heat exchanger 240 is configured in the same manner as the heat exchanger 205 except that the heat exchanger 240 includes a plurality of fins 241 in place of the plurality of fins 206 that configure the heat exchanger 205 of the fifth embodiment.

[0242] The fin 241 is configured in the same manner as the fin 206 except that the fin 241 includes a communication portion 243 in place of the communication portion 213 that configures the fin 206.

(Configuration of Communication Portion)

[0243] The communication portion 243 includes a condensed water guide portion 245 that extends continuously in the Z direction. The condensed water guide portion 245 is a step portion 246 and includes a first part 243A and a second part 243B that configure the first plane portion 207B, and a connecting portion 248.

[0244] The first part 243A is a part, of the first plane portion 207B, that is disposed on the one end portion 206A side of the fin body 207 and extends continuously in the Z direction.

[0245] The second part 243B configures the other end portion 206B of the fin 206 in the first plane portion 207B and extends continuously in the Z direction.

[0246] The second part 243B is disposed at a position offset to the other side in the X direction from a position where the first part 243A is formed. The first and second surfaces 207a and 207b that configure the second part 243B are parallel to the first and second surfaces 207a and 207b that configure the first part 243A.

[0247] The connecting portion 248 is disposed between the first part 243A and the second part 243B and extends continuously in the Z direction.

[0248] One end portion of the connecting portion 248 is connected to the first part 243A. The other end portion of the connecting portion 248 is connected to the second part 243B.

[0249] The first and second surfaces 207a and 207b that configure the connecting portion 248 are inclined with respect to the first and second surfaces 207a and 207b that configure the first and second parts 243A and 243B.

[0250] The condensed water guide portion 245 (the step portion 246) has a configuration in which a step is formed in the X direction.

(Effect of Heat Exchanger)

[0251] By using the step portion 246 having such a configuration as the condensed water guide portion 245, the condensed water can be guided in the direction from the upper side toward the lower side along the first and second surfaces 207a and 207b that configure the connecting portion 248 while preventing the obstruction of the flow of the condensed water.

[0252] Further, by configuring the condensed water guide portion 245 with the step portion 246, it is possible to improve the strength of the communication portion 243, thereby the occurrence of the breakage of the fin can be prevented at a part (a part where the strength of the fin 241 is weak), of the fin 241, that faces the flat tube insertion portion 209 in the Y direction.

[0253] Further, by configuring the condensed water guide portion 245 with the step portion 246, it is possible to improve the heat transfer coefficient on the air side while increasing the surface area of the condensed water guide portion 245. As a result, the heat exchange efficiency between the condensed water guide portion 245 and the air can be improved.

<Eighth Embodiment>

[0254] The heat exchanger 250 of the eighth embodiment will be described with reference to Fig. 35 to Fig. 37. In Fig. 35, the same configuration parts as those of the structure shown in Fig. 23 are designated by the same reference numerals. In Fig. 35 to Fig. 37, the same configuration parts are designated by the same reference numerals.

(Overall Configuration of Heat Exchanger)

[0255] The heat exchanger 250 is configured in the same manner as the heat exchanger 205 except that the heat exchanger 250 includes a plurality of fins 251 in place of the plurality of fins 206 that configure the heat exchanger 205 of the fifth embodiment.

(Configuration of Fin)

[0256] The fin 251 is configured in the same manner as the fin 206 described above except that a pedestal portion 252, which protrudes on the first surface 207a side of the first plane portion 207B is provided at the periphery of the flat tube insertion portion 209, the height H_1 of the tip 218A of the projecting portion 218 (the condensed water guide portion 217) in the X direction with the first surface 207a of the first plane portion 207B as a reference is made equal to the height H_2 of the pedestal portion 252 in the X direction with the first surface 207a of the first plane portion 207B as a reference, and the projecting portion 218 and the pedestal portion 252 are connected to each other at a position of the tip 218A of the projecting portion 218.

(Effect of Heat Exchanger)

[0257] As described above, by making the height H_1 of the projecting portion 218 and the height H_2 of the pedestal portion 252 equal to each other in the X direction and by connecting the projecting portion 218 and the pedestal portion 252 at the position of the tip 218A of the projecting portion 218, there is no possibility that the first plane portion 207B is disposed between the pedestal portion 252 and the projecting portion 218 in the Y direction. As a result, it is possible for the first plane portion 207B to be discontinuous in the Z direction between the pedestal portion 252 and the projecting portion 218, thereby the occurrence of the breakage of the fin between the pedestal portion 252 and the projecting portion 218 can be prevented.

[0258] In the eighth embodiment, the case where the projecting portion 218 (the condensed water guide portion 217) and the pedestal portion 252 are connected to each other has been described as an example, but the projecting portion 238, which configures the uneven portion 236, and the pedestal portion 252 may be connected to each other, for example.

<First Modification Example of Eighth Embodiment>

[0259] The heat exchanger 260 according to a first modification example of the eighth embodiment will be described with reference to Fig. 38. In Fig. 38, the same configuration parts as those of the structure shown in Fig. 35 are designated by the same reference numerals.

(Overall Configuration of Heat Exchanger)

[0260] The heat exchanger 260 is configured in the same manner as the heat exchanger 250 except that the heat exchanger 260 includes a fin 261 in place of the fin 251 that configures the heat exchanger 250 of the eighth embodiment.

(Configuration of Fin)

[0261] The fin 261 is configured in the same manner as the fin 251 except that the fin 261 includes a pedestal portion 263 in place of the pedestal portion 252 that configures the fin 251.

(Configuration of Pedestal Portion)

[0262] The pedestal portion 263 is configured in the same manner as the pedestal portion 252, except that an upper side of a part that is connected to the projecting portion 218 is inclined diagonally downward from the pedestal portion 263 toward the projecting portion 218.

(Effect of Heat Exchanger)

[0263] By providing the pedestal portion 263 having such a configuration, it is possible to prevent the accumulation of the condensed water on the upper portion side of a part where the pedestal portion 263 and the projecting portion 218 are connected to each other, thereby the pedestal portion 263 can be prevented from obstructing the flow of the condensed water.

<Second Modification Example of Eighth Embodiment>

[0264] The heat exchanger 270 according to a second modification example of the eighth embodiment will be described with reference to Fig. 39. In Fig. 39, the same configuration parts as those of the structure shown in Fig. 38 are designated by the same reference numerals.

(Overall Configuration of Heat Exchanger)

[0265] The heat exchanger 270 is configured in the same manner as the heat exchanger 260 except that the heat exchanger 270 includes a fin 271 in place of the fin 261 that configures the heat exchanger 260 according to the first modification example of the eighth embodiment.

(Configuration of Fin)

[0266] The fin 271 is configured in the same manner as the fin 261 except that the fin 271 includes a pedestal portion 273 in place of the pedestal portion 263 that configures the fin 261.

(Configuration of Pedestal Portion)

[0267] The pedestal portion 273 is configured in the same manner as the pedestal portion 263, except that an upper side and lower side of a part that is connected to the projecting portion 218 is inclined diagonally downward from the pedestal portion 273 toward the projecting portion 218.

(Effect of Heat Exchanger)

[0268] By providing the pedestal portion 273 having such a configuration, it is possible to prevent the accumulation of the condensed water not only on the upper portion side of the part where the pedestal portion 273 and the projecting portion 218 are connected to each other but also on the lower portion of a back side of the pedestal portion 273 (the back side of the paper surface in Fig. 39), thereby the effect of preventing the pedestal portion 273 from obstructing the flow of the condensed water can be enhanced.

<Ninth Embodiment>

[0269] The refrigeration cycle device 280 of a ninth embodiment will be described with reference to Fig. 40. In Fig. 40, a solid arrow indicates a direction in which refrigerant flows during the heating operation, and a dotted arrow indicates a direction in which the refrigerant flows during the cooling operation. In Fig. 40, the same configuration parts as those of the structure shown in Fig. 21 are designated by the same reference numerals.

(Overall Configuration of Refrigeration Cycle Device)

[0270] The refrigeration cycle device 280 is configured in the same manner as the refrigeration cycle device 200 except that the refrigeration cycle device 280 includes first and second heat exchanger units 281 and 283 in place of the first and second heat exchanger units 201 and 203 that configure the refrigeration cycle device 200 of the second embodiment. The first heat exchanger unit 281 is configured in the same manner as the first heat exchanger unit 201 except that the first heat exchanger unit 281 includes a heat exchanger 285 in place of the heat exchanger 205.

[0271] The second heat exchanger unit 283 is configured in the same manner as the second heat exchanger unit 203 except that the second heat exchanger unit 283 includes a heat exchanger 285 in place of the heat exchanger 205.

(Overall Configuration of Heat Exchanger)

[0272] The heat exchanger 285 will be described with reference to Fig. 40 to Fig. 42. In Fig. 41 and Fig. 42, the Z direction indicates a first direction. In Fig.41, the X direction indicates the extending direction of the flat tube 41 orthogonal to the Z direction. In Fig. 42, the Y direction indicates a second direction (the width direction of the flat tube 41 in a state in which the flat tube 41 is attached to the fin 290) that is orthogonal to the X direction and the Z direction, and P indicates a direction in which air flows (hereinafter referred to as a "direction P"), respectively.

[0273] In the present embodiment, as an example of the Z direction, the following description will be given by taking the case where the Z direction is the vertical direction as an example.

[0274] The heat exchanger 285 is configured in the same manner as the heat exchanger 205 except that the heat exchanger 285 includes a plurality of fins 290 in place of the plurality of fins 206 that configure the heat exchanger 205 of the second embodiment.

(Overall Configuration of Fin)

[0275] The plurality of fins 290 will be described with reference to Fig. 41 to Fig. 46. In Fig. 43 to Fig. 46, the same configuration parts as those of the structures shown in Fig. 41 and Fig. 42 are designated by the same reference numerals.

[0276] The plurality of fins 290 are disposed at a predetermined pitch with respect to the X direction.

[0277] The fin 290 is configured in the same manner as the fin 206 except that the fin 290 includes a fin body 291 in place of the fin body 207 that configures the fin 206 described in the fifth embodiment, and further includes a plurality of thermally conductive portions 305, a plurality of first fin pitch regulation portions 307, and a plurality of second fin pitch regulation portions 308.

(Configuration of Fin Body)

[0278] The fin body 291 has a plate shape and extends in the Z direction. The fin body 291 includes first and second surfaces 291a and 291b disposed in the X direction.

[0279] The first surface 291a is disposed so as to face the gateway header 35. The second surface 291b is a surface disposed on the opposite side of the first surface 291a. The second surface 291b is disposed so as to face the turnback header 37. The fin body 291 has a plate shape and includes a communication portion 303 that extends in the Z direction.

(Configuration of Thermally Conductive Portion)

[0280] The thermally conductive portion 305 is formed at the periphery of the flat tube insertion portion 209 so as to rise from the first surface 291a. The thermally conductive portion 305 protrudes in the X direction. In a state in which the flat tube 41 is inserted into the flat tube insertion portion 209, an inner peripheral surface 305a of the thermally conductive portion 305 is in surface contact with an outer peripheral surface 41b of the flat tube 41.

The height of the thermally conductive portion 305 in the X direction is set to a height at which the thermally conductive portion 305 is not in contact with the fins 290 that are disposed on the first surface 291a side when the plurality of fins 290 are disposed in the X direction.

(Effect of Thermally Conductive Portion)

[0281] By providing the thermally conductive portion 305 having such a configuration, it is possible to increase the contact area between the flat tube 41 and the plurality of fins 290. As a result, the thermal conductivity between the flat tube 41 and the plurality of fins 290 can be improved.

[0282] Further, by setting the height of the thermally conductive portion 305 in the X direction to the height at which the thermally conductive portion 305 is not in contact with the fins 290 disposed on the first surface 291a side, the thermal conductivity between the flat tube 41 and the fins 290 can be improved while regulating the fin pitch by using first and second fin pitch regulation portions 307 and 308.

(Configuration of First Fin Pitch Regulation Portion)

[0283] The first fin pitch regulation portion 307 is formed between the rear end portions of the flat tube insertion portions 209 adjacent to each other in the Z direction. The first fin pitch regulation portion 307 is disposed on one side of the uneven portion 211 in the Y direction.

[0284] The first fin pitch regulation portion 307 is formed by folding a part of the fin body 291 downward (one side in the Z direction). The first fin pitch regulation portion 307 is formed so as to protrude on the first surface 291a.

[0285] The first fin pitch regulation portion 307 keeps the pitch (fin pitch) of the fins 290 that are disposed in the X direction at a desired value by being in contact with the second surface 291b of the fin 290 disposed on one side in the X direction. The first fin pitch regulation portion 307 desirably has an L shape, for example.

(Effect of Forming First Fin Pitch Regulation Portion on Rear End Portion Side of Flat Tube Insertion Portion)

[0286] As described above, by forming the first fin pitch regulation portion 307 on the rear end portion side of the flat tube insertion portions 209 that are adjacent to each other, the deformation or buckling of the fin 290, which tends to occur in the initial stage when the flat tube 41 is inserted into the flat tube insertion portion 209, can be prevented.

(Effect of Forming First Fin Pitch Regulation Portion into L shape)

[0287] As described above, by forming the first fin pitch regulation portion 307 into an L shape, the probability that the first fin pitch regulation portion 307 is in contact with the second surface 291b can be increased as compared with the case where the first fin pitch regulation portion 307 has an I shape, for example.

[0288] Further, by forming the first fin pitch regulation portion 307 into an L shape, it is possible to increase the contact area between the first fin pitch regulation portion 307 and the second surface 291b, thereby the fin pitch can be maintained stably.

(Configuration of Second Fin Pitch Regulation Portion)

[0289] The second fin pitch regulation portion 308 is disposed at the periphery of the flat tube insertion portion 209 positioned on the upper side of the first fin pitch regulation portion 307 among the two flat tube insertion portions 209 that interpose the first fin pitch regulation portion 307 in the Z direction.

[0290] Specifically, the second fin pitch regulation portion 308 is disposed the lower side of the flat tube insertion portion 209 and near the tip portion 209A (tip portion 209A side at the rear end portion side of the flat tube insertion portion 209 with respect to the tip portion 209A).

[0291] The second fin pitch regulation portion 308 is formed by folding a part of the fin body 291 downward (one side in the Z direction) and making the part of the fin body 291 protrude on the first surface 291a.

[0292] Together with the first fin pitch regulation portion 307 described above, the second fin pitch regulation portion 308 keeps the pitch (fin pitch) of the fins 290 that are disposed in the X direction at a desired value by being in contact with the second surface 291b of the fin 290 disposed on the other side in the X direction.

[0293] The amounts of protrusion of the first and second fin pitch regulation portions 307 and 308 in the X direction are equal, and the fin pitch is set to a size that can be maintained at a desired value.

[0294] The second fin pitch regulation portion 308 desirably has an L shape, for example. By forming the second fin pitch regulation portion 308 into an L shape, the same effect as that of the first fin pitch regulation portion 307 having the L shape described above can be obtained.

[0295] The heat exchanger 285 having the above configuration is used as a condenser during the cooling operation to dissipate heat to the outside and is used as an evaporator during the heating operation to absorb heat from the outside.

(Effect of Heat Exchanger)

[0296] As described above, by folding the part of the fin body 291 downward and by forming the first and second fin pitch regulation portions 307 and 308, it is possible to prevent the first and second fin pitch regulation portions 307 and 308 from becoming a resistor for the air flowing in the P direction (a direction from the other side toward one side in the second direction) as compared with the case where the part of the fin body 291 is folded in the Y direction, thereby the pressure loss of the air can be prevented.

[0297] Further, by disposing the first fin pitch regulation portion 307 on the rear end portion side of the flat tube insertion portion 209 and by disposing the second fin pitch regulation portion 308 on the tip portion 209A side of the flat tube insertion portion 209, it is possible to dispose the first and second fin pitch regulation portions 307 and 308 at positions separated from each other in the Z direction and the Y direction. As a result, the fin pitches of the plurality of fins 290 disposed in the X direction can be regulated stably.

[0298] Further, by forming the outside appearance of the second end portion 41E of the flat tube 41 into a round shape or an elliptical shape and by forming the shape of the tip portion 209A of the flat tube insertion portion 209, which accommodates the second end portion 41E, into a shape in which the outer peripheral surface 41b of the second end portion 41E of the flat tube 41 and the fin body 291 are in surface contact with each other, it is possible to increase the contact area between the flat tube 41 and the fin body 291. As a result, the thermal conductivity between the flat tube 41 and the fin 290 can be improved.

[0299] That is, the fin pitch can be regulated stably while preventing the pressure loss of the air, and the thermal conductivity between the flat tube 41 and the fin 290 can be improved.

[0300] Further, by not forming the first and second fin pitch regulation portions 307 and 308 in the communication portion 303 that extends in the first direction (the Z direction), the first and second fin pitch regulation portions 307 and 308 do not obstruct the flow of the condensed water drained in the first direction (the Z direction), thereby good drainage can be maintained.

[0301] Further, by forming the first fin pitch regulation portion 307 by folding a part of the fin body 291 downward and by forming the second fin pitch regulation portion 308 at the periphery of the flat tube insertion portion 209, among the two flat tube insertion portions 209 that interpose the first fin pitch regulation portion 307 in the Z direction, that is positioned on the upper side of the first fin pitch regulation portion 307, it is possible to dispose positions that regulate the fin pitches at equal intervals in the Z direction, thereby the fin pitch can be regulated stably.

(Effect of First Heat Exchanger Unit)

[0302] According to the first heat exchanger unit 281, by including the heat exchanger 285 described above, the first heat exchanger unit 281 can be operated stably while improving the performance of the first heat exchanger unit 281.

[0303] The second heat exchanger unit 283 that includes the heat exchanger 285 can also obtain the same effect as the first heat exchanger unit 281.

(Effect of Refrigeration Cycle Device)

[0304] By the refrigeration cycle device 280 including the first and second heat exchanger units 281 and 283 described above, the refrigeration cycle device 280 can be operated stably while improving the performance of the refrigeration cycle device 280.

(Configuration of Fin in Modification Example)

[0305] The fin 320 according to a modification example of the ninth embodiment will be described with reference to Fig. 47. In Fig. 47, the same configuration parts as those of the structure shown in Fig. 42 are designated by the same reference numerals.

[0306] The fin 320 is configured in the same manner as the fin 290 as described above except that the first fin pitch regulation portion 307 is formed by folding a part of the fin body 291 upward, and the second fin pitch regulation portion 308 is formed at the periphery of the flat tube insertion portion 209, among the two flat tube insertion portions 209 that interpose the first fin pitch regulation portion 307 in the Z direction, that is positioned on the lower side of the first fin pitch regulation portion 307.

(Effect of Fin in Modification Example)

[0307] As described above, by forming the first fin pitch regulation portion 307 by folding a part of the fin body 291 upward and by forming the second fin pitch regulation portion 308 at the periphery of the flat tube insertion portion 209, among the two flat tube insertion portions 209 that interpose the first fin pitch regulation portion 307 in the Z direction, that is positioned on the lower side of the first fin pitch regulation portion 307, it is possible to dispose positions that regulate the fin pitches at equal intervals in the Z direction. As a result, the fin pitch can be regulated stably.

[0308] Although the desired embodiments of the present disclosure have been described in detail above, the present disclosure is not limited to such a specific embodiments, and various modifications and changes can be made within the scope of the gist of the present disclosure described in the claims.

<Additional Notes>

[0309] The heat exchangers 27, 60, 70, 80, 90, 100, 110, 120, 130, 140, 150, 160, 170, 180, 190, 205, 230, 240, 250, 260, 270, and 285, the heat exchanger units (the first heat exchanger units 18, 201, and 281 and the second heat exchanger units 23, 203, and 283), and the refrigeration cycle devices 10, 200, and 280 described in each embodiment are recognized as follows, for example.

(1) A heat exchanger 27, 60, 70, 80, 90, 100, 110, 120, 130, 140, 150, 160, 170, 180, 190 according to

a first aspect is a heat exchanger 27, 60, 70, 80, 90, 100, 110, 120, 130, 140, 150, 160, 170, 180, 190 exchanging heat between air and refrigerant, the heat exchanger includes: a plurality of flat tubes 41 that have a flat-shaped outside appearance, that extend in one direction (the X direction), and that include a plurality of flow paths 41A, which are disposed in a width direction (the Y direction), which extend in the one direction (the X direction), and through which the refrigerant flows; a plurality of fins 42 that are disposed in an extending direction (the X direction) of the flat tube 41 in a state in which the plurality of flat tubes 41 are accommodated; and a header 43 that is connected to the plurality of flat tubes 41 such that one end portion 41B of each of the plurality of flat tubes 41 is disposed on an inner side, and through which the refrigerant flows in the inner side, in which the header 43 includes a header body 45 that has a tube shape extending in a vertical direction (the Z direction) and that partitions an internal space 53 having a column shape, a partition plate 47 that is accommodated in the header body 45, that extends in a vertical direction (the Z direction), and that divides the internal space 53 into a first space 54 and a second space 55, where the one end portion 41B of each of the plurality of flat tubes 41 is disposed, in the extending direction (the X direction), in a state in which the refrigerant is capable of being circulated at an upper end portion and a lower end portion of the internal space 53, and a nozzle portion 49, 62 that is disposed at a lower portion of the first space 54 and that includes a discharge outlet 49A, 62A for blowing out the refrigerant supplied from an outside of the header 43 toward a bottom surface 45a (the first bottom surface 45aa) of the header body 45, and refrigerant circulation portions 54A, which are a part of the first space 54, are each formed on both sides of the nozzle portion 49, 62 in a width direction (the Y direction).

[0310] By having the nozzle portion 49, 62 with the above configuration, it is possible to reduce the difference in state of the refrigerant in the width direction (the Y direction) by causing the refrigerant, which is blown out from the discharge outlet 49A, 62A, to collide with the bottom surface 45a (the first bottom surface 45aa) of the header body 45. As a result, since the refrigerant having a small difference in state in the width direction (the Y direction) flows from the first space 54 toward the second space 55 (a space in which one end portion 41B of each of the plurality of flat tubes 41 is disposed), the bias of the distribution of the refrigerant with respect to the plurality of flow paths 41A, which are formed in each flat tube 41 in the width direction (Y direction), can be prevented while preventing the complexity of a manufacturing step and preventing the bias of the distribution of the refrigerant with respect to each flat tube 41, by forming the circulation flow of the refrigerant (a flow that descends from the first space 54 and rises from the second space 55) in the header 43 without depending on the flow rate of the refrigerant that is introduced in the header 43.

[0311] (2) The heat exchanger 70, 80, 100, 120, 150, 180, 190 according to a second aspect is the heat exchanger 70, 80, 100, 120, 150, 180, 190 of (1), in which the bottom surface 45a of the header body 45 may include a first bottom surface 45aa for partitioning the first space 54 and a second bottom surface 45ab for partitioning the second space 55, and the heat exchanger 70, 80, 100, 120, 150, 180, 190 may include a first refrigerant guide portion 73 that is provided on the first bottom surface 45aa and that includes a first guide surface 73a for guiding the refrigerant in a direction from the first space 54 toward the second space 55.

[0312] By including the first refrigerant guide portion 73 having such a configuration, the refrigerant that is blown out from the discharge outlet 49A, 62A of the nozzle portion 49, 62 is guided to the second space 55, and by causing the refrigerant to collide with the inner wall surface 45b of the header body 45 that partitions the second space 55, the difference in state of the refrigerant in the width direction (the Y direction) can be reduced.

[0313] Further, when the refrigerant is gas-liquid two-phase refrigerant and the flow rate of the refrigerant that is introduced into the header body 45 is small, it is possible to prevent the refrigerant from gas-liquid separation in the first space 54 and prevent the gas phase refrigerant from rising in the first space 54. That is, the refrigerant circulation flow can be prevented from becoming difficult to form in the header body 45.

[0314] (3) The heat exchanger 70, 80, 100, 120, 150, 180, 190 according to a third aspect is the heat exchanger 70, 80, 100, 120, 150, 180, 190 of (2), in which the first guide surface 73a may be a recessed curved surface that is recessed in a direction separated from a lower end portion of the partition plate 47.

[0315] As described above, by making the first guide surface 73a a recessed curved surface that is recessed in the direction separated from the lower end portion of the partition plate 47, the refrigerant can be smoothly guided from the first space 54 to the second space 55.

[0316] (4) The heat exchanger 90, 100, 180, 190 according to a fourth aspect is the heat exchanger 90, 100, 180, 190 of any one of (1) to (3), in which the bottom surface 45a of the header body 45 may include a first bottom surface 45aa for partitioning the first space 54 and a second bottom surface 45ab for partitioning the second space 55, and the heat exchanger 90, 100, 180, 190 may include a second refrigerant guide portion 93 that is provided on the second bottom surface 45ab and that includes a second guide surface 93a for guiding the refrigerant in a direction from a lower side toward an upper side of the second space 55.

[0317] By including the second refrigerant guide portion 93 having such a configuration, the refrigerant, which is generated by colliding with the first bottom surface 45aa of the header body 45, having a small difference in state in the width direction can be guided from the lower side toward the upper side of the second space 55.

[0318] (5) The heat exchanger 90, 100, 180, 190 according to a fifth aspect is the heat exchanger 90, 100, 180, 190 of (4), in which the second guide surface 93a may be a recessed curved surface that is recessed in a direction separated from a lower end portion of the partition plate 47.

[0319] As described above, by making the second guide surface 93a a recessed curved surface that is recessed in a direction separated from the lower end portion of the partition plate 47, the refrigerant having a small difference in state in the width direction (the Y direction) can be easily guided in the direction from the lower side toward the upper side of the second space 55.

[0320] (6) The heat exchanger 80 according to a sixth aspect is the heat exchanger 80 of any one of (1) to (5), the heat exchanger 80 may include a third refrigerant guide portion 83 that is provided at a part, of a lower end portion of the partition plate 47, separated upward from the bottom surface 45a of the header body 45 and that includes a third guide surface 83a for guiding the refrigerant in a direction from the first space 54 toward the second space 55.

[0321] By providing the third refrigerant guide portion 83 having such a configuration, the third guide surface 83a can guide the refrigerant in the direction from the first space 54 toward the second space 55.

[0322] (7) The heat exchanger 80 according to a seventh aspect is the heat exchanger 80 of (6), in which the third refrigerant guide portion 83 may be a cylinder-shaped member that extends in a width direction (the Y direction) of the partition plate 47.

[0323] As described above, by using the cylinder-shaped member extending in the width direction of the partition plate 47 as the third refrigerant guide portion 83, the third guide surface 83a (the outer peripheral surface of the cylinder-shaped member) can guide the refrigerant in the direction from the first space 54 toward the second space 55.

[0324] (8) The heat exchanger 27, 60, 70, 80, 90, 100, 110, 120, 130, 140, 150, 160, 170, 180, 190 according to an eighth aspect is the heat exchanger 27, 60, 70, 80, 90, 100, 110, 120, 130, 140, 150, 160, 170, 180, 190 of any one of (1) to (7), in which the nozzle portion 49, 62 may be disposed at a position lower than 1/2 of a height of the header body.

[0325] For example, when the nozzle portion 49, 62 is disposed at a position higher than 1/2 of the height H of the header body 45, since a distance from the discharge outlet 49A, 62A of the nozzle portion 49, 62 to the bottom surface (the first bottom surface 45aa) of the header body 45 becomes too long, the flow of the refrigerant, which is blow out from the discharge outlet 49A, 62A, may slow down and it may be difficult to form a circulation flow of refrigerant in the header 43.

[0326] Therefore, by disposing the nozzle portion 49, 62 at a position lower than 1/2 of the height H of the header body 45, it is possible to reduce the distance from the discharge outlet 49A, 62A to the bottom surface (the first bottom surface 45aa) of the header body 45, thereby it becomes easy to form the circulation flow of the refrigerant in the header 43.

[0327] (9) The heat exchanger 27, 60, 70, 80, 90, 100, 110, 120, 130, 140, 150, 160, 170, 180, 190 according to a ninth aspect is the heat exchanger 27, 60, 70, 80, 90, 100, 110, 120, 130, 140, 150, 160, 170, 180, 190 of any one of (1) to (7), in which the nozzle portion 49, 62 may be disposed between a flat tube 41F disposed at a bottom and a flat tube 41S disposed second from the bottom, among the plurality of flat tubes 41.

[0328] As described above, by disposing the nozzle portion 49, 62 between the flat tube 41F disposed at the bottom and the flat tube 41S disposed second from the bottom, the circulation flow of refrigerant in the header 43 can be easily formed.

[0329] Further, when the heat exchanger 27, 60, 70, 80, 90, 100, 110, 120, 130, 140, 150, 160, 170, 180, 190 is used as a condenser, the refrigerant (liquid phase refrigerant) that flows in the header 43 can be easily discharged to the outside of the header through the plurality of flat tubes 41.

[0330] (10) The heat exchanger 110, 120, 130, 190 according to a tenth aspect is the heat exchanger 110, 120, 130, 190 of any one of (1) to (9), in which in a direction in which the flat tube 41 extends, one end of each of the plurality of flat tubes 41 may be disposed so as to face the partition plate 47, and a distance Ds1 from one end of the flat tube 41F disposed at a bottom to the partition plate 47 may be longer than a distance Ds2 from one end of another flat tube 41, 41S to the partition plate 47, among the plurality of flat tubes 41.

[0331] As described above, among the plurality of flat tubes 41, by making a distance Ds1, which is from the one end 41Fa of the flat tube 41F disposed at the bottom to the partition plate 47, longer than a distance Ds2, which is from the one end 41a of the other flat tube 41 to the partition plate 47, it is possible to increase the cross-sectional area of the refrigerant flow path formed between the one end 41Fa of the flat tube 41F disposed at the bottom and the partition plate 47. As a result, since the degree of contraction flow at a height position of the flat tube 41F can be relaxed and the flow of the refrigerant is less likely to separate, the liquid phase refrigerant can be easily supplied to the flat tube 41F, which may be difficult for the liquid phase refrigerant to flow in due to the influence of separation (contraction flow) in the related art, thereby the distribution of the refrigerant to each flat tube 41 can be equalized.

[0332] (11) The heat exchanger 110, 120 according to an eleventh aspect is the heat exchanger 110, 120 of (10), in which the one end of the flat tube 41F, which is disposed at the bottom, may be disposed so as to be moved back from a position of the one end of the other flat tube 41, 41S in a direction from the first space 54 toward the second space 55.

[0333] As described above, by disposing the one end 41Fa of the flat tube 41F, which is disposed at the bottom, at a position moved back from the position of the one end 41a of the other flat tube 41 in the direction from the first space 54 toward the second space 55, the cross-sectional area of the refrigerant flow path, which is formed between the one end 41Fa of the flat tube 41F disposed at the bottom and the partition plate 47, can be increased.

[0334] (12) The heat exchanger 130, 190 according to a twelfth aspect is the heat exchanger 130, 190 of (10) or (11), in which a lower end portion 133A of the partition plate 133, which faces the one end of the flat tube 41F disposed at the bottom, may be disposed at a position deviated from a direction from the second space 55 toward the first space 54.

[0335] As described above, among the plurality of flat tubes 41, by disposing the lower end portion 133A of the partition plate 133 that faces the one end 41Fa of the flat tube 41F disposed at the bottom at a position deviated from the direction from the second space 55 toward the first space 54, the cross-sectional area of the refrigerant flow path, which is formed between the one end 41Fa of the flat tube 41F disposed at the bottom and the partition plate 133, can be increased.

[0336] (13) The heat exchanger 140, 150, 160, 170, 180, 190 according to a thirteenth aspect is the heat exchanger 140, 150, 160, 170, 180, 190 of any one of (1) to (12), the heat exchanger 140, 150, 160, 170, 180, 190 may include a rectification member 143, 163, 173 that is provided on an inner wall surface 45b of the header body 45 partitioning the second space 55, that is disposed below one end portion 41B of a flat tube 41F disposed at a bottom among the plurality of flat tubes 41, and that rectifies the refrigerant flowing from the bottom surface 45a of the header body 45 toward the one end of the flat tube 41F disposed at the bottom.

[0337] By including the rectification member 143, 163, 173 having such a configuration, the liquid phase refrigerant can be easily supplied to the flat tube 41F, which may be difficult for the liquid phase refrigerant to flow in due to the influence of separation (contraction flow) in the related art, thereby the distribution of the refrigerant to each flat tube 41 can be equalized.

[0338] (14) The heat exchanger 140, 150 according to a fourteenth aspect is the heat exchanger 140, 150 of (13), in which the rectification member 143 may be a baffle plate 145 that is disposed at a position separated from the one end portion 41B of the flat tube 41F disposed at the bottom, that extends in a direction from the inner wall surface 45b of the header body 45 toward the partition plate 47, and in which an amount of protrusion from the inner wall surface 45b of the header body 45 is equal to an amount of protrusion of the one end portion 41B.

[0339] As described above, by using the baffle plate 145 having the above configuration as the rectification member 143, the flow of the refrigerant is separated in a front stage of the one end portion 41B of the flat tube 41F that is disposed at the bottom, thereby it is possible to rectify the flow of the refrigerant at the one end of the flat tube 41F disposed at the bottom.

[0340] As a result, the liquid phase refrigerant can be easily supplied to the flat tube 41F, which may be difficult for the liquid phase refrigerant to flow in due to the influence of separation (contraction flow) in the related art, thereby the distribution of the refrigerant to each flat tube 41 can be equalized.

[0341] (15) The heat exchanger 160 according to a fifteenth aspect is the heat exchanger 160 of (13), in which the rectification member 163 may be a block 164 that is disposed below the one end portion 41B such that the block 164 is in contact with a lower surface of the one end portion 41B of the flat tube 41F disposed at the bottom, that extends in a direction from the inner wall surface 45b of the header body 45 toward the partition plate 47, and in which an amount of protrusion from the inner wall surface 45b of the header body 45 is equal to an amount of protrusion of the one end portion 41B.

[0342] As described above, by using the block 164 having the above configuration as the rectification member 163, the flow of the refrigerant is separated in a front stage of the one end portion 41B of the flat tube 41F that is disposed at the bottom, thereby it is possible to rectify the flow of the refrigerant at the one end of the flat tube 41F disposed at the bottom.

[0343] As a result, the liquid phase refrigerant can be easily supplied to the flat tube 41F, which may be difficult for the liquid phase refrigerant to flow in due to the influence of separation (contraction flow) in the related art, thereby the distribution of the refrigerant to each flat tube 41 can be equalized.

[0344] (16) The heat exchanger 170 according to a sixteenth aspect is the heat exchanger 170 of (15), in which the block 174 may include a curved surface 174a that is formed on a partition plate 47 side and that guides a flow of the refrigerant upward.

[0345] By providing the curved surface 174a having such a configuration, the refrigerant can be guided above the second space 55 without the flow being separated.

[0346] (17) The heat exchanger 27, 60, 70, 80, 90, 100, 110, 120, 130, 140, 150, 160, 170, 180, 190 according to a seventeenth aspect is the heat exchanger 27, 60, 70, 80, 90, 100, 110, 120, 130, 140, 150, 160, 170, 180, 190 of any one of (1) to (16), the heat exchanger 27, 60, 70, 80, 90, 100, 110, 120, 130, 140, 150, 160, 170, 180, 190 may include a porous plate 51 that is provided between the header body 45 partitioning the first space 54 and the partition plate 47, 133 and that is disposed at a part, of the first space 54, positioned above the nozzle portion 49, 62.

[0347] By including the porous plate 51 having such a configuration, it is possible to prevent the movement of gas (gas refrigerant) from flowing back in a direction from the lower side toward the upper side of the first space 54, thereby it becomes easy to form the circulation flow of the refrigerant in the header 43.

[0348] (18) The heat exchanger 27 according to an eighteenth aspect is the heat exchanger 27 of any one of (1) to (17), in which the discharge outlet 49A may be a hole having a round shape, and the partition plate 47 may include one lower end portion 47A that is disposed on one side in a width direction (the Y direction) and in which a lower end reaches the bottom surface 45a of the header body 45, the other lower end portion 47B that is disposed on the other side in the width direction (the Y direction) and in which a lower end reaches the bottom surface 45a of the header body 45, and a cutout portion 47C that is formed between the one lower end portion 47A and the other lower end portion 47B and that makes the refrigerant to circulate.

[0349] As described above, when the round-shaped hole is used as the discharge outlet 49A, the refrigerant is circulated from the first space 54 to the second space 55 through the cutout portion 47C that is positioned between the one lower end portion 47A and the other lower end portion 47B. At this time, the lower end portions 47A and 47B can prevent the refrigerant from flowing back from the second space 55 to the first space 54.

[0350] (19) The heat exchanger 60 according to a nineteenth aspect is the heat exchanger 60 of any one of (1) to (17), in which the discharge outlet 62A may have a groove shape extending in the width direction (the Y direction) of the nozzle portion 62, and a total value of widths W2 of two refrigerant circulation portions 54A disposed on both sides of the nozzle portion 62 in the width direction (the Y direction) may be smaller than a value of a width W1 of the nozzle portion 62.

[0351] As described above, by forming the discharge outlet 62A into a groove shape extending in the width direction (the Y direction) of the nozzle portion 62, the difference in state of the refrigerant in the width direction (the Y direction) can be further reduced as compared with a case where a shape of the discharge outlet is a round shape.

[0352] Further, by making a total value (= 2 $\times$ W2) of the width W2 of the pair of refrigerant circulation portions 54A, which are disposed on both sides of the nozzle portion 62 in the width direction (Y direction), to be smaller than a value of the width W1 of the nozzle portion 62, it is possible to make a cross-sectional area of the flow path of the pair of refrigerant circulation portions 54A small. As a result, the occurrence of the flowing back of the refrigerant from the lower side toward the upper side in the first space 54 can be prevented.

[0353] (20) A heat exchanger unit (the first and second heat exchanger units 18 and 23) according to a twentieth aspect includes: the heat exchanger according to any one of (1) to (19); and a blower (the first and second blowers 26 and 32) that sends air to the heat exchanger 27, 60, 70, 80, 90, 100, 110, 120, 130, 140, 150, 160, 170, 180, 190.

[0354] By providing the heat exchanger 27, 60, 70, 80, 90, 100, 110, 120, 130, 140, 150, 160, 170, 180, 190 having the above configuration, the heat exchange efficiency of the heat exchanger units (the first and second heat exchanger units 18 and 23) can be improved.

[0355] (21) A refrigeration cycle device 10 according to a twenty-first aspect includes the heat exchanger unit (the first and second heat exchanger units 18 and 23) of (20).

[0356] By including the heat exchanger units (the first and second heat exchanger units 18 and 23) having the above configuration, the heat exchange efficiency of the refrigeration cycle device 10 can be improved.

[0357] (22) A heat exchanger 205, 230, 240, 250, 260, 270 according to a twenty-second aspect is a heat exchanger 205, 230, 240, 250, 260, 270 exchanging heat between air and refrigerant, the heat exchanger includes: a plurality of flat tubes 41 that have a flat-shaped outside appearance, that are formed with a flow path 41A in which the refrigerant flows inside, and that include a first end portion 41D disposed on one side in a width direction and a second end portion 41E disposed on the other side in the width direction; and a plurality of fins 206, 231, 241, 251, 261, 271 that are disposed at a predetermined pitch in an extending direction (the X direction) of the flat tube 41 in a state in which the plurality of flat tubes 41 are accommodated, in which each of the plurality of fins 206, 231, 241, 251, 261, 271 includes a fin body 207 that has a plate shape and that includes a first surface 207a disposed in the extending direction (the X direction) and a second surface 207b disposed on an opposite side of the first surface 207a, a flat tube insertion portion 209 that is formed on the fin body 207, that is disposed in plural at intervals in a vertical direction (the Z direction) orthogonal to the extending direction (the X direction), that extends from one side to the other side in a horizontal direction (the Y direction) orthogonal to the vertical direction (the Z direction) and the extending direction (the X direction), and that accommodates the flat tube 41 inserted from a second end portion 41E side, and a communication portion 213, 233, 243 that is disposed on the other side in the horizontal direction (the Y direction) from the plurality of flat tube insertion portions 209 and that extends continuously in the vertical direction (the Z direction), the communication portion 213, 233, 243 includes a first plane portion 207B that is parallel to the vertical direction (the Z direction) and the horizontal direction (the Y direction), and the communication portion 213, 233, 243 is formed with a condensed water guide portion 217, 235, 245 that is bent in a direction intersecting the first plane portion 207B, that extends continuously over the vertical direction (the Z direction), and in which a cross-sectional shape, when the condensed water guide portion 217, 235, 245 is cut in a plane orthogonal to the vertical direction (the Z direction), is uniform in the vertical direction (the Z direction).

[0358] By including the condensed water guide portion 217, 235, 245 having such a configuration, the condensed water can be guided in the direction from the upper side toward the lower side along the first and second surfaces 207a and 207b that configure the condensed water guide portion 217, 235, 245 while preventing the obstruction of the flow of the condensed water.

[0359] Further, by providing the condensed water guide portion 217, 235, 245 having the above configuration, it is possible to improve the strength of the communication portion 213, 233, 243. As a result, the occurrence of breakage of the fin can be prevented in a part, of the fin 206, 231, 241, 251, 261, that faces the flat tube insertion portion 209 in the horizontal direction (the Y direction) (a part where the strength of the fin 206, 231, 241, 251, 261 is weak).

[0360] Further, by including the condensed water guide portion 217, 235, 245 having the above configuration, it is possible to improve the thermal conductivity on the air side while increasing the surface area of the condensed water guide portion 217, 235, 245. As a result, the heat exchange efficiency between the condensed water guide portion 217, 235, 245 and the air can be improved.

[0361] (23) The heat exchanger 205 according to a twenty-third aspect is the heat exchanger 205 of (22), in which the condensed water guide portion 217 may be a projecting portion 218 that protrudes from the first surface 207a configuring the first plane portion 207B.

[0362] As described above, by configuring the condensed water guide portion 217, which is formed in the communication portion 213, with a projecting portion 218 that protrudes from the first surface 207a configuring the first plane portion 207B, the condensed water can be guided in the direction from the upper side toward the lower side along the first and second surfaces 207a and 207b that configure the projecting portion 218 while preventing the obstruction of the flow of the condensed water.

[0363] Further, by providing the projecting portion 218 having the above configuration, it is possible to improve the strength of the communication portion 213. As a result, the occurrence of breakage of the fin can be prevented in a part, of the fin 206, that faces the flat tube insertion portion 209 in the Y direction (a part where the strength of the fin 206 is weak).

[0364] Further, by providing the projecting portion 218 having the above configuration, it is possible to improve the thermal conductivity on the air side while increasing the surface area of the condensed water guide portion 217. As a result, the heat exchange efficiency between the condensed water guide portion 217 and the air can be improved.

[0365] (24) The heat exchanger 230 according to a twenty-fourth aspect is the heat exchanger 230 of (22), in which the condensed water guide portion 235 may be an uneven portion 236 that includes a plurality of projecting portions 218, which protrude from the first surface 207a configuring the first plane portion 207B and which are disposed in the horizontal direction (the Y direction), and a recessed portion 239 which is disposed between the projecting portions 218 adjacent to each other in the horizontal direction (the Y direction).

[0366] By using the uneven portion 236 having such a configuration as the condensed water guide portion 235, the condensed water can be guided in the direction from the upper side toward the lower side along the first and second surfaces 207a and 207b that configure the uneven portion 236 while preventing the obstruction of the flow of the condensed water.

[0367] Further, by using the uneven portion 236 as the condensed water guide portion 235, it is possible to improve the strength of the communication portion 233, thereby the occurrence of the breakage of the fin can be prevented at a part (a part where the strength of the fin 231 is weak), of the fin 231, that faces the flat tube insertion portion 209 in the horizontal direction (Y direction).

[0368] Further, by configuring the condensed water guide portion 235 with the uneven portion 236, it is possible to improve the thermal conductivity on the air side while increasing the surface area of the condensed water guide portion 235 as compared with the case where the condensed water guide portion 217 is configured with one projecting portion 218. As a result, the heat exchange efficiency between the condensed water guide portion 235 and the air can be improved.

[0369] (25) The heat exchanger 250 according to a twenty-fifth aspect is the heat exchanger 250 of (23) or (24), in which the flat tube insertion portion 209 may include a tip portion 209A that is disposed on the other side in the horizontal direction (the Y direction) and that accommodates the second end portion 41E, the fin body 207 may include a second plane portion 207A that is disposed between the tip portions 209A adjacent to each other in the vertical direction (the Z direction) and that is parallel to the vertical direction (the Z direction) and the horizontal direction (the Y direction), a pedestal portion 252, which protrudes on a first surface 207a side of the second plane portion 207A, may be disposed at a periphery of the flat tube insertion portion 209, a height H_1 of a tip 218A of the projecting portion 218 in the extending direction (the X direction) with the first surface 207a of the second plane portion 207A as a reference may be equal to a height H_2 of the pedestal portion 252 in the extending direction (the X direction) with the first surface 207a of the second plane portion 207A as a reference, and the projecting portion 218 and the pedestal portion 252 may be connected to each other at a position of the tip 218A of the projecting portion 218.

[0370] As described above, by making the height H_1 of the projecting portion 218 and the height H_2 of the pedestal portion 252 equal to each other in the X direction and by connecting the projecting portion 218 and the pedestal portion 252 at the position of the tip 218A of the projecting portion 218, there is no possibility that the first plane portion 207B is disposed between the pedestal portion 252 and the projecting portion 218 in the horizontal direction (the Y direction). As a result, it is possible for the first plane portion 207B to be discontinuous in the vertical direction (the Z direction) between the pedestal portion 252 and the projecting portion 218, thereby the occurrence of the breakage of the fin between the pedestal portion 252 and the projecting portion 218 can be prevented.

[0371] (26) The heat exchanger 260 according to a twenty-sixth aspect is the heat exchanger 260 of (25), in which an upper side of a part, of the pedestal portion 263, that is connected to the condensed water guide portion 217 may be inclined diagonally downward from the pedestal portion 263 toward the condensed water guide portion 217.

[0372] By providing such a configuration, it is possible to prevent the accumulation of the condensed water on the upper portion side of a part where the pedestal portion 263 and the condensed water guide portion 217 (the projecting portion 218) are connected to each other, thereby the pedestal portion 263 can be prevented from obstructing the flow of the condensed water.

[0373] (27) The heat exchanger 240 according to a twenty-seventh aspect is the heat exchanger 240 of (22), in which the first plane portion 207B may include a first part 243A that is disposed on one side of the condensed water guide portion 245 in the horizontal direction (the Y direction) and that extends in the vertical direction (the Z direction), and a second part 243B that is disposed on the other side of the condensed water guide portion 245 in the horizontal direction (the Y direction), that extends in the vertical direction (the Z direction), and that is disposed at a position different from the first part 243A in the extending direction (the X direction), and the condensed water guide portion 245 may be a step portion 246 that is configured with the first part 243A, the second part 243B, and a connecting portion 248 connecting the first part 243A and the second part 243B.

[0374] By using the step portion 246 having such a configuration as the condensed water guide portion 245, the condensed water can be guided in the direction from the upper side toward the lower side along the first and second surfaces 207a and 207b that configure the connecting portion 248 while preventing the obstruction of the flow of the condensed water.

[0375] Further, by configuring the condensed water guide portion 245 with the step portion 246, it is possible to improve the strength of the communication portion 243, thereby the occurrence of the breakage of the fin can be prevented at a part (a part where the strength of the fin 241 is weak), of the fin 241, that faces the flat tube insertion portion 209 in the horizontal direction (the Y direction).

[0376] Further, by configuring the condensed water guide portion 245 with the step portion 246, it is possible to improve the thermal conductivity on the air side while increasing the surface area of the condensed water guide portion 245. As a result, the heat exchange efficiency between the condensed water guide portion 245 and the air can be improved.

[0377] (28) The heat exchanger 205, 230, 240, 250, 260 according to a twenty-eighth aspect is the heat exchanger 205, 230, 240, 250, 260 of any one of (22) to (27), in which the fin 206, 231, 241, 251, 261 may include one end portion 206A disposed on one side in the horizontal direction (the Y direction) and the other end portion 206B disposed on the other side in the horizontal direction, the condensed water guide portion 217, 235, 245 may be disposed on the one end portion 206A side with respect to the other end portion 206B, and the second surface 207b that configures the one end portion 206A and the other end portion 206B may be disposed on the same plane.

[0378] With such a configuration, in the cutting step of the structure 220 that is performed after the manufacturing of the structure 220 in which the plurality of fins 206, 231, 241, 251, 261 are connected by performing the press process on the plate member (the base material of the plurality of fins 206, 231, 241, 251, 261), it is possible to make the second surface 207b that corresponds to the cutting position Cp being in contact with an upper surface of a stage of a cutting device and dispose the structure 220 on the stage in a stable state. As a result, the cutting of the structure 220 can be performed with high accuracy. That is, the process accuracy of the fin 206, 231, 241, 251, 261 can be improved.

[0379] (29) A heat exchanger unit (the first and second heat exchanger units 201 and 203) according to a twenty-ninth aspect includes: the heat exchanger 205, 230, 240, 250, 260 according to any one of (22) to (28); and a blower (the first and second blowers 26 and 32) that sends air to the heat exchanger 205, 230, 240, 250, 260.

[0380] As described above, by the heat exchanger unit (the first and second heat exchanger units 201 and 203) including the heat exchanger 205, 230, 240, 250, 260 described above, the heat exchanger units (the first and second heat exchanger units 201 and 203) can be operated stably.

[0381] (30) A refrigeration cycle device 200 according to a thirtieth aspect includes the heat exchanger unit (the first and second heat exchanger units 201 and 203) of (29).

[0382] As described above, by including the heat exchanger units (the first and second heat exchanger units 201 and 203) described above, the refrigeration cycle device 200 can be operated stably.

[0383] (31) A heat exchanger 285 according to a thirty-first aspect includes: a plurality of flat tubes 41 that have a flat-shaped outside appearance, that are formed with a flow path 41A in which refrigerant flows inside, and that include a first end portion 41D disposed on one side in a width direction (the Y direction) and a second end portion 41E disposed on the other side in the width direction; and a plurality of fins 290 that are disposed at a predetermined pitch in an extending direction (the X direction) of the flat tube 41 in a state in which the plurality of flat tubes 41 are accommodated, in which each of the plurality of fins 290 includes a fin body 291 that has a plate shape and that includes a first surface 291a disposed in the extending direction (the X direction) and a second surface 291b disposed on an opposite side of the first surface 291a, a flat tube insertion portion 209 that is formed on the fin body 291, that is disposed in plural at intervals in a first direction (the Z direction) orthogonal to the extending direction (the X direction), that extends from one side to the other side in a second direction (the Y direction) orthogonal to the first direction (the Z direction) and the extending direction (the X direction), and that accommodates the flat tube 41 inserted from the second end portion 41E side, a communication portion 303 that is disposed on the other side in the second direction (the Y direction) from the plurality of flat tube insertion portions 209 and that extends continuously in the first direction (the Z direction), a first fin pitch regulation portion 307 that is formed by folding a part of the fin body 291, which is positioned between the flat tube insertion portions 209 adjacent to each other, in the first direction (the Z direction) so as to protrude on a first surface 291a side, and that is in contact with the fin 290 disposed on one side in the extending direction (the X direction), in the first direction (the Z direction), and a second fin pitch regulation portion 308 that is formed by folding the part of the fin body 291 in the first direction (the Z direction) so as to protrude on the first surface 291a side, that is disposed at a periphery of the flat tube insertion portion 209 positioned on a rear end portion side rather than a tip portion 209A of the flat tube insertion portion 209, and that is in contact with the fin 290 disposed on the one side in the extending direction (the X direction), air that exchanges heat with the refrigerant flows in a direction from the other side toward the one side in the second direction (the Y direction), an outside appearance of the second end portion 41E has a round shape or an elliptical shape, a shape of the tip portion 209A of the flat tube insertion portion 209, which accommodates the second end portion 41E, is a shape in which an outer peripheral surface 41b of the second end portion 41E and the fin body 291 are in surface contact with each other, the first fin pitch regulation portion 307 is disposed on the rear end portion side of the flat tube insertion portion 209, and the second fin pitch regulation portion 308 is disposed on a tip portion 209A side of the flat tube insertion portion 209.

[0384] As described above, by folding the part of the fin body 291 in the first direction (the Z direction) and by forming the first and second fin pitch regulation portions 307 and 308, it is possible to prevent the first and second fin pitch regulation portions 307 and 308 from becoming a resistor for the air flowing in a direction (the B direction) from the other side toward one side in the second direction (the Y direction) as compared with the case where the part of the fin body 291 is folded in the second direction (the Y direction), thereby the pressure loss of the air can be prevented.

[0385] Further, by disposing the first fin pitch regulation portion 307 on the rear end portion side of the flat tube insertion portion 209 and by disposing the second fin pitch regulation portion 308 on the tip portion 209A side of the flat tube insertion portion 209, it is possible to dispose the first and second fin pitch regulation portions 307 and 308 at positions separated from each other in the first direction (the Z direction) and the second direction (the Y direction). As a result, the fin pitches of the plurality of fins 290 disposed in the extending direction (the X direction) can be regulated stably.

[0386] Further, by forming the outside appearance of the second end portion 41E of the flat tube 41 into a round shape or an elliptical shape and by forming the shape of the tip portion 209A of the flat tube insertion portion 209, which accommodates the second end portion 41E, into a shape in which the outer peripheral surface of the tip portion 209A of the flat tube 41 and the fin body 291 are in surface contact with each other, it is possible to increase the contact area between the flat tube 41 and the fin body 291. As a result, the thermal conductivity between the flat tube 41 and the fin 290 can be improved.

[0387] That is, the fin pitch can be regulated stably while preventing the pressure loss of the air, and the thermal conductivity between the flat tube 41 and the fin 290 can be improved.

[0388] Further, by not forming the first and second fin pitch regulation portions 307 and 308 in the communication portion 303 that extends in the first direction (the Z direction), the first and second fin pitch regulation portions 307 and 308 do not obstruct the flow of the condensed water drained in the first direction (the Z direction), thereby good drainage can be maintained.

[0389] (32) The heat exchanger 285 according to a thirty-second aspect is the heat exchanger 285 of (31), in which the first direction (the Z direction) may be a vertical direction, the first fin pitch regulation portion 307 may be configured by folding the part of the fin body 291 downward, and the second fin pitch regulation portion 308 may be formed at the periphery of the flat tube insertion portion 209, of the two flat tube insertion portions 209 interposing the first fin pitch regulation portion 307, that is positioned an upper side of the first fin pitch regulation portion 307, in the first direction (the Z direction).

[0390] As described above, by forming the first fin pitch regulation portion 307 by folding a part of the fin body 291 downward and by forming the second fin pitch regulation portion 308 at the periphery of the flat tube insertion portion 209, among the two flat tube insertion portions 209 that interpose the first fin pitch regulation portion 307 in the first direction (the Z direction), that is positioned on the upper side of the first fin pitch regulation portion 307, it is possible to dispose positions that regulate the fin pitches at equal intervals in the first direction (the Z direction), thereby the fin pitch can be regulated stably.

[0391] (33) The heat exchanger 285 according to a thirty-three aspect is the heat exchanger 285 of (31), in which the first direction (the Z direction) may be a vertical direction, the first fin pitch regulation portion 307 may be configured by folding the part of the fin body 291 upward, and the second fin pitch regulation portion 308 may be formed at the periphery of the flat tube insertion portion 209, of the two flat tube insertion portions 209 interposing the first fin pitch regulation portion 307, that is positioned a lower side of the first fin pitch regulation portion 307, in the first direction (the Z direction).

[0392] As described above, by forming the first fin pitch regulation portion 307 by folding a part of the fin body 291 upward and by forming the second fin pitch regulation portion 308 at the periphery of the flat tube insertion portion 209, among the two flat tube insertion portions 209 that interpose the first fin pitch regulation portion 307 in the first direction (the Z direction), that is positioned on the lower side of the first fin pitch regulation portion 307, it is possible to dispose positions that regulate the fin pitches at equal intervals in the first direction (the Z direction), thereby the fin pitch can be regulated stably.

[0393] (34) The heat exchanger 285 according to a thirty-fourth aspect is the heat exchanger 285 of any one of (31) to (33), in which the first fin pitch regulation portion 307 may have an L shape.

[0394] As described above, by forming the first fin pitch regulation portion 307 into an L shape, the probability that the first fin pitch regulation portion 307 is in contact with the second surface 291b can be increased as compared with the case where the first fin pitch regulation portion 307 has an I shape, for example.

[0395] Further, by forming the first fin pitch regulation portion 307 into an L shape, it is possible to increase the contact area between the first fin pitch regulation portion 307 and the second surface 291b, thereby the fin pitch can be maintained stably.

[0396] (35) The heat exchanger 285 according to a thirty-fifth aspect is the heat exchanger 285 of any one of (31) to (34), in which the second fin pitch regulation portion 308 may have an L shape.

[0397] As described above, by forming the second fin pitch regulation portion 308 into an L shape, the probability that the second fin pitch regulation portion 308 is in contact with the first surface 291a can be increased as compared with the case where the second fin pitch regulation portion 308 has an I shape, for example.

[0398] Further, by forming the second fin pitch regulation portion 308 into an L shape, it is possible to increase the contact area between the second fin pitch regulation portion 308 and the second surface 291b, thereby the fin pitch can be maintained stably.

[0399] (36) The heat exchanger 285 according to a thirty-sixth aspect is the heat exchanger 285 of any one of (31) to (35), in which the plurality of fins 290 may further include a thermally conductive portion 305 that is formed at the periphery of the flat tube insertion portion 209, that rises from the first surface 291a side, and that is in contact with an outer peripheral surface 41b of the flat tube 41, and a height of the thermally conductive portion 305 in the extending direction (the X direction) may be a height in which the thermally conductive portion 305 is not in contact with the fin 290 that is disposed on the first surface 291a side when the plurality of the fins 290 are disposed in the extending direction (the X direction).

[0400] By including the thermally conductive portion having such a configuration, the thermal conductivity between the flat tube 41 and the fins 290 can be improved while regulating the fin pitch by using first and second fin pitch regulation portions 307 and 308.

[0401] (37) A heat exchanger unit (the first and second heat exchanger units 18 and 23) according to a thirty-seventh aspect includes: the heat exchanger 285 according to any one of (31) to (36); and a blower (the first and second blowers 26 and 32) that sends air to the heat exchanger 285.

[0402] As described above, by the heat exchanger unit (the first and second heat exchanger units 281 and 283) including the heat exchanger 285 described above, the heat exchanger unit (the first and second heat exchanger units 281 and 283) can be operated stably while improving the performance of the heat exchanger unit (the first and second heat exchanger units 281 and 283).

[0403] (38) A refrigeration cycle device 10 according to a thirty-eighth aspect includes the heat exchanger unit (the first and second heat exchanger units 281 and 283) of (37).

[0404] As described above, by the refrigeration cycle device 280 including the heat exchanger units (the first and second heat exchanger units 281 and 283) described above, the refrigeration cycle device 280 can be operated stably while improving the performance of the refrigeration cycle device 280.

Reference Signs List

[0405]

10, 200, 280 Refrigeration cycle device
11 Outdoor unit
12 Indoor unit
14 Refrigerant pipe
14A First refrigerant pipe
14B Second refrigerant pipe
15 Four-way valve
15A to 15D, 248 Connecting portion
16 Compressor
18, 201, 281 First heat exchanger unit
19 Expansion valve
23, 203, 283 Second heat exchanger unit
26 First blower
27, 60, 70, 80, 90, 100, 110, 120, 130, 140, 150, 160, 170, 180, 190, 205, 230, 240, 250, 260, 270, 285 Heat exchanger
32 Second blower
35 Gateway header
37 Turnback header
41, 41F, 41S Flat tube
41a, 41Fa One end
41A Flow path
41b Outer peripheral surface
41B, 206A One end portion
41C, 206B The other end portion
41D First end portion
41E Second end portion

42, 206, 231, 241, 251, 261, 271, 290, 320 Fin
42A, 209 Flat tube insertion portion
43, 61, 71, 81, 91, 101, 131, 141, 151 Header
45 Header body
45a Bottom surface
45aa First bottom surface
45ab Second bottom surface
45ac Third bottom surface
45b Inner wall surface
45A Opening
47, 133 Partition plate
47a Upper end surface
47A, 47B, 133A Lower end portion
47Aa, 47Ba Lower end
47b, 207a, 291a First surface
47c, 207b, 291b Second surface
47C Cutout portion
49, 62 Nozzle portion
49A, 62A Discharge outlet
51 Porous plate
51A Hole
53 Internal space
54 First space
54A Refrigerant circulation portion
55 Second space
73 First refrigerant guide portion
73a First guide surface
83 Third refrigerant guide portion
83a Third guide surface
93 Second refrigerant guide portion
93a Second guide surface
143, 163, 173 Rectification member
145 Baffle plate
164, 174 Block
174a Curved surface
207, 291 Fin body
207A Second plane portion
207B First plane portion
209A Tip portion
209B Rear end portion
211, 236 Uneven portion
213, 233, 243, 303 Communication portion
215 Fin pitch regulation portion
217, 235, 245 Condensed water guide portion
218, 238 Projecting portion
218A Tip
220, 225 Structure
239 Recessed portion
243A First part
243B Second part
246 Step portion
252, 263, 273 Pedestal portion
305 Thermally conductive portion
305a Inner peripheral surface
307 First fin pitch regulation portion
308 Second fin pitch regulation portion
B Region
Cp Cutting position
Ds1, Ds2 Distance
H, H_1, H_2 Height
J, P Direction
Vp Plane
W1, W2 Width

Claims

1. A heat exchanger exchanging heat between air and refrigerant, the heat exchanger comprising:

a plurality of flat tubes (41) that have a flat-shaped outside appearance, that are formed with a flow path in which the refrigerant flows inside, and that include a first end portion disposed on one side in a width direction and a second end portion disposed on the other side in the width direction; and
a plurality of fins (206) that are disposed at a predetermined pitch in an extending direction of the flat tube in a state in which the plurality of flat tubes are accommodated, wherein
each of the plurality of fins includes

a fin body (207) that has a plate shape and that includes a first surface (207a) disposed in the extending direction and a second surface (207b) disposed on an opposite side of the first surface,
a flat tube insertion portion (209) that is formed on the fin body, that is disposed in plural at intervals in a vertical direction orthogonal to the extending direction, that extends from one side to the other side in a horizontal direction orthogonal to the vertical direction and the extending direction, and that accommodates the flat tube inserted from a second end portion side, and
a communication portion (213) that is disposed on the other side in the horizontal direction from the plurality of flat tube insertion portions and that extends continuously in the vertical direction,

the communication portion (213) includes a first plane portion (207B) that is parallel to the vertical direction and the horizontal direction, and
the communication portion is formed with a condensed water guide portion (217,235,245) that is bent in a direction intersecting the first plane portion, that extends continuously over the vertical direction, and in which a cross-sectional shape, when the condensed water guide portion is cut in a plane orthogonal to the vertical direction, is uniform in the vertical direction.

2. The heat exchanger according to Claim 1, wherein the condensed water guide portion (217) is a projecting portion (218) that protrudes from the first surface configuring the first plane portion.

3. The heat exchanger according to Claim 1, wherein the condensed water guide portion (235) is an uneven portion (236) that includes a plurality of projecting portions (238), which protrude from the first surface configuring the first plane portion and which are disposed in the horizontal direction, and a recessed portion (239) which is disposed between the projecting portions adjacent to each other in the horizontal direction.

4. The heat exchanger according to Claim 2 or 3, wherein

the flat tube insertion portion (209) includes a tip portion (209A) that is disposed on the other side in the horizontal direction and that accommodates the second end portion,
the fin body (207) includes a second plane portion (207A) that is disposed between the tip portions adjacent to each other in the vertical direction and that is parallel to the vertical direction and the horizontal direction,
a pedestal portion (252), which protrudes on a first surface side of the second plane portion, is disposed at a periphery of the flat tube insertion portion,
a height of a tip of the projecting portion (218,238) in the extending direction with the first surface of the second plane portion as a reference is equal to a height of the pedestal portion in the extending direction with the first surface of the second plane portion as a reference, and
the projecting portion and the pedestal portion are connected to each other at a position of the tip of the projecting portion.

5. The heat exchanger according to Claim 4, wherein an upper side of a part, of the pedestal portion (252), that is connected to the condensed water guide portion (217,235,245) is inclined diagonally downward from the pedestal portion toward the condensed water guide portion.

6. The heat exchanger according to Claim 1, wherein

the first plane portion (207B) includes a first part (243A) that is disposed on one side of the condensed water guide portion (245) in the horizontal direction and that extends in the vertical direction, and a second part (243B) that is disposed on the other side of the condensed water guide portion in the horizontal direction, that extends in the vertical direction, and that is disposed at a position different from the first part in the extending direction, and
the condensed water guide portion (245) is a step portion (246) that is configured with the first part, the second part, and a connecting portion (248)

connecting the first part and the second part.

7. The heat exchanger according to any one of Claims 1 to 6, wherein

the fin includes one end portion (206A) disposed on one side in the horizontal direction and the other end portion disposed on the other side in the horizontal direction,
the condensed water guide portion (245)is disposed on the one end portion side with respect to the other end portion, and
the second surface that configures the one end portion and the other end portion is disposed on the same plane.

8. A heat exchanger unit comprising:

the heat exchanger according to any one of Claims 1 to 7; and
a blower (26,32) that sends air to the heat exchanger.

9. A refrigeration cycle device comprising:
the heat exchanger unit according to Claim 8.

FIG. 1

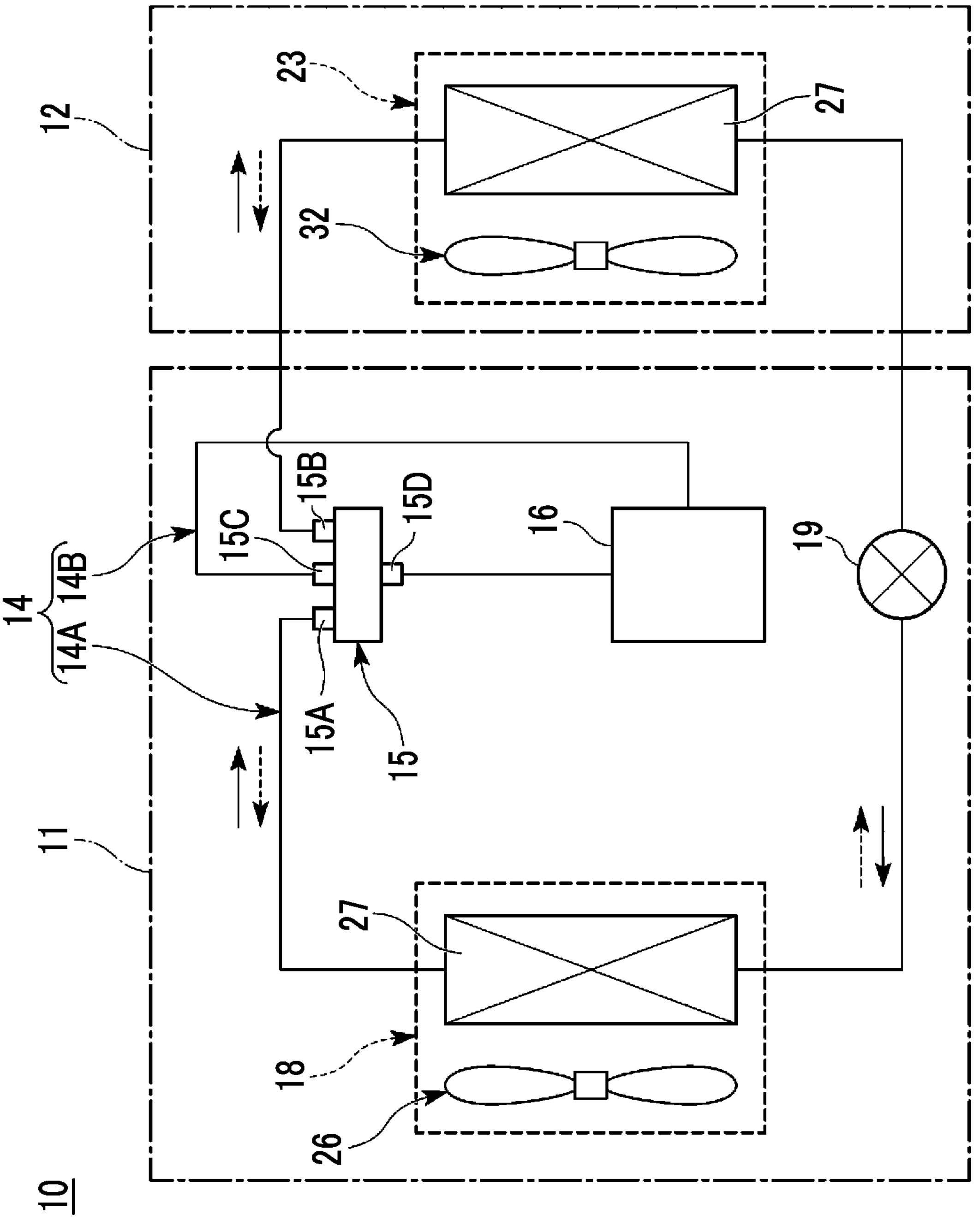


FIG. 2

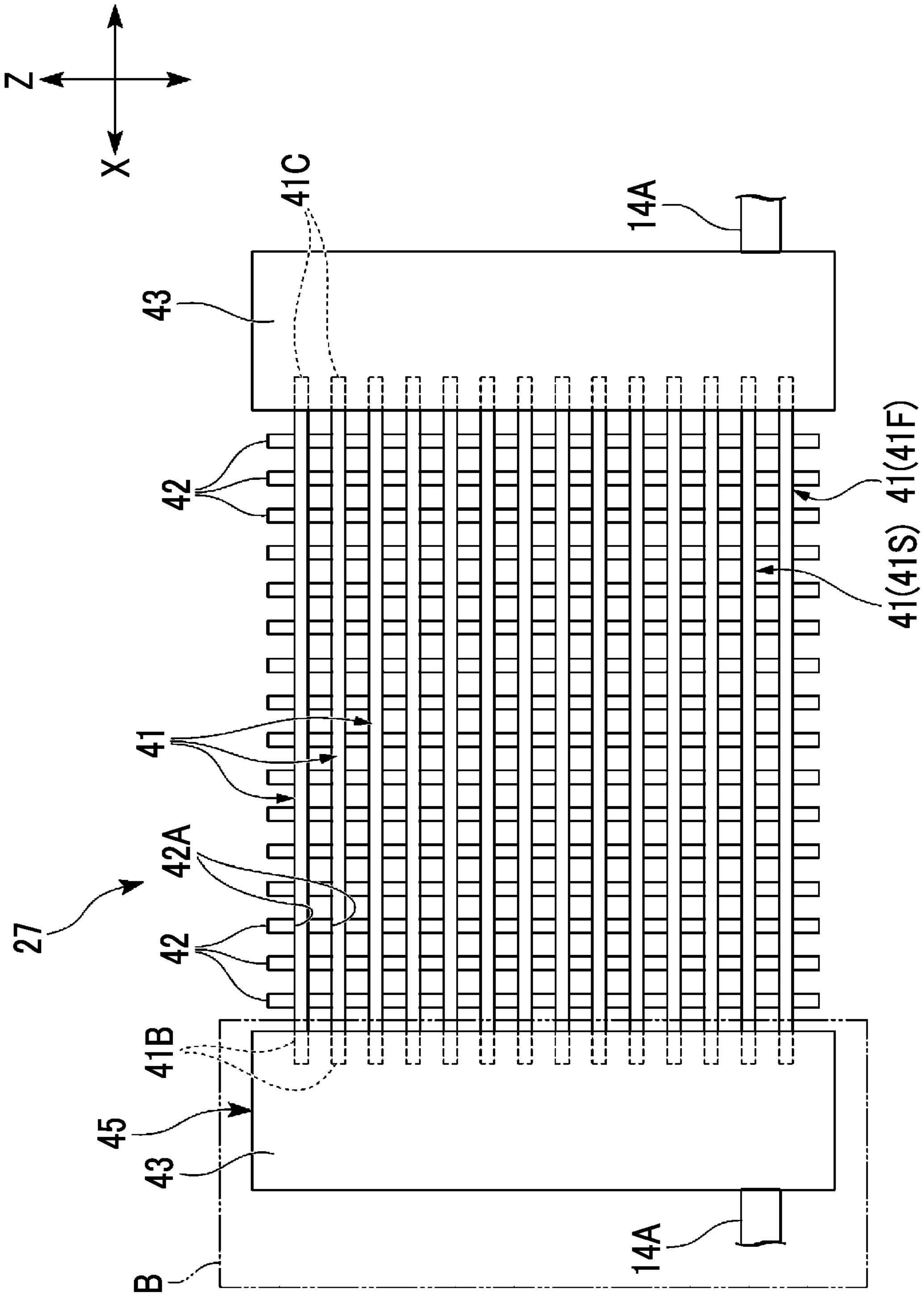


FIG. 3

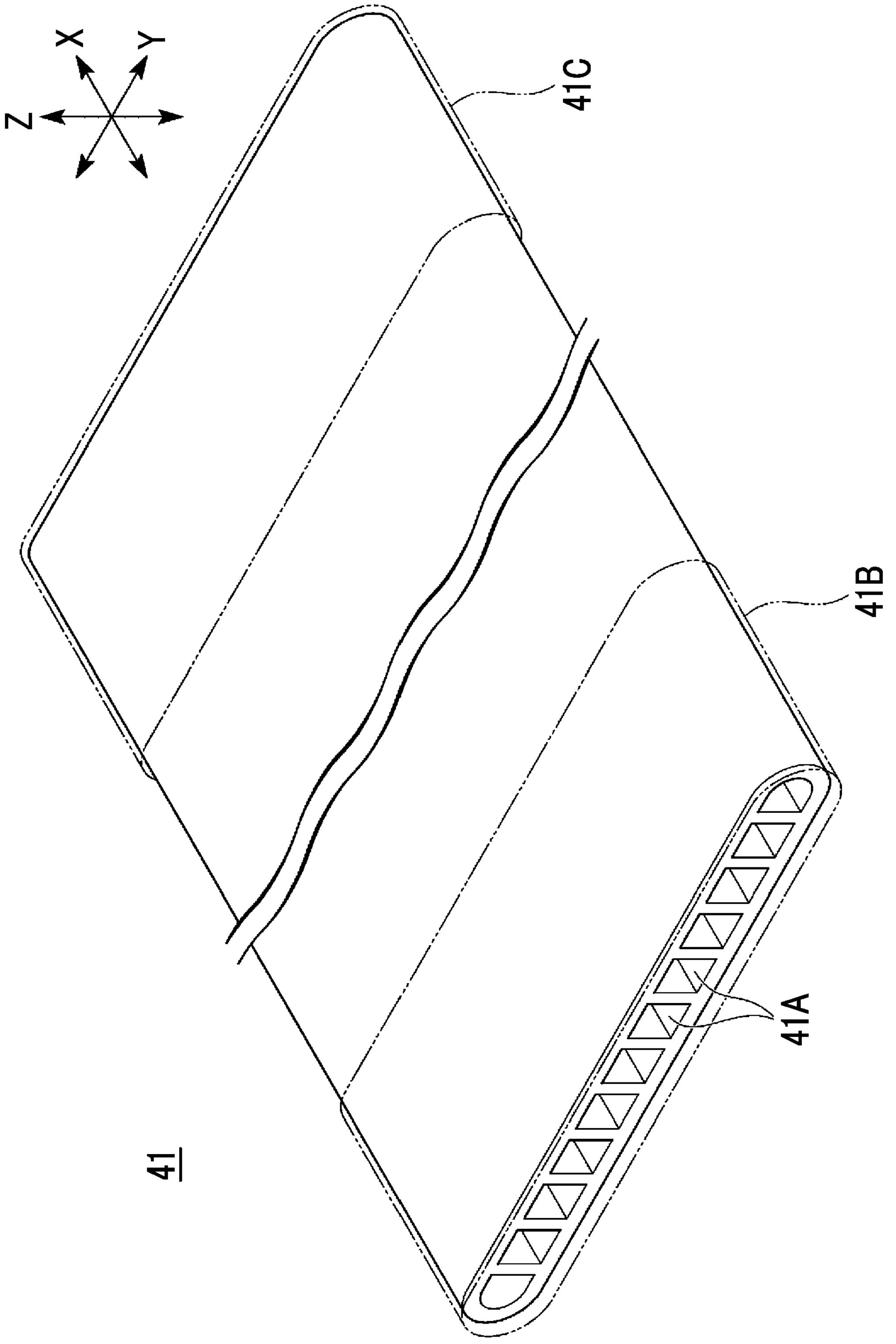
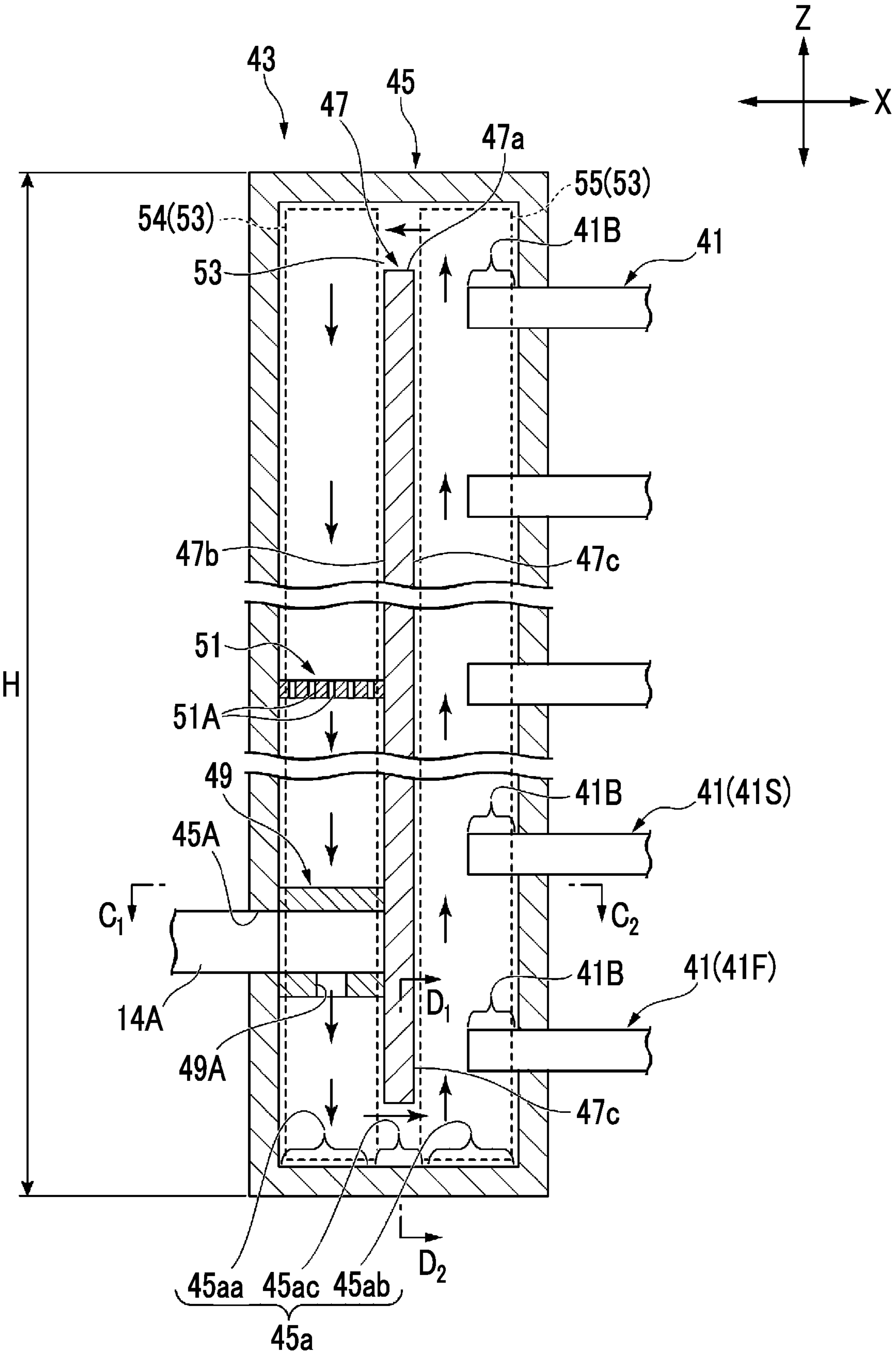


FIG. 4


Z
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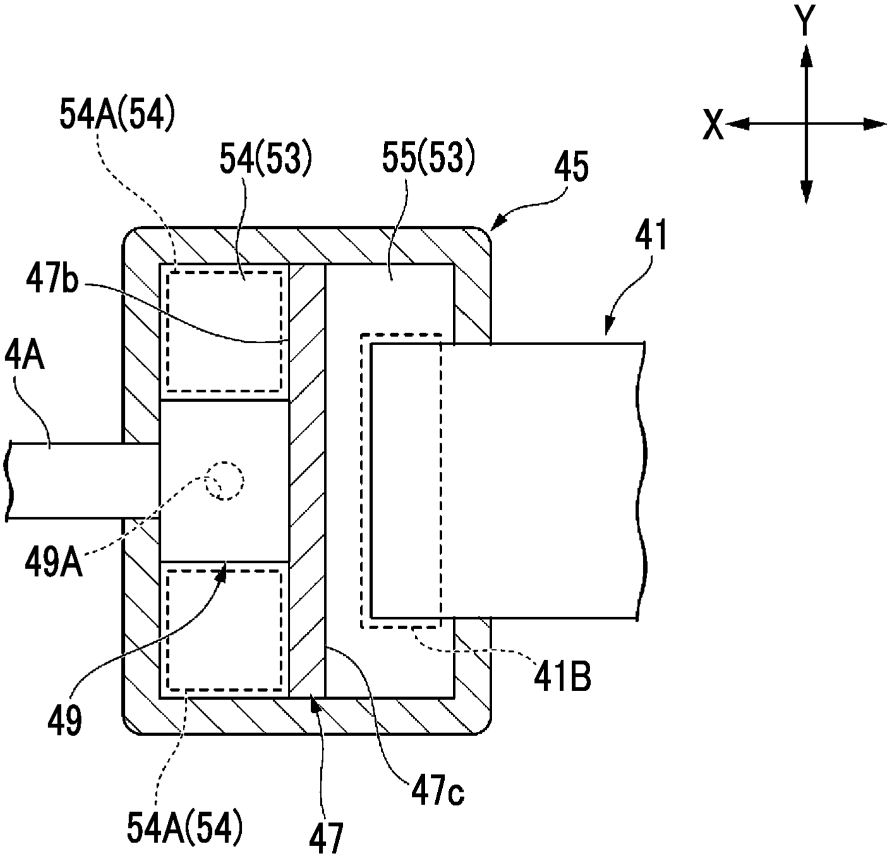
54(53)
41B
41
53
47b
47c
51
H
51A
49
41B
41(41S)
45A
C1
C2
41B
41(41F)
D1
14A
49A
47c
D2
45aa
45ac
45ab
45a

FIG. 5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X
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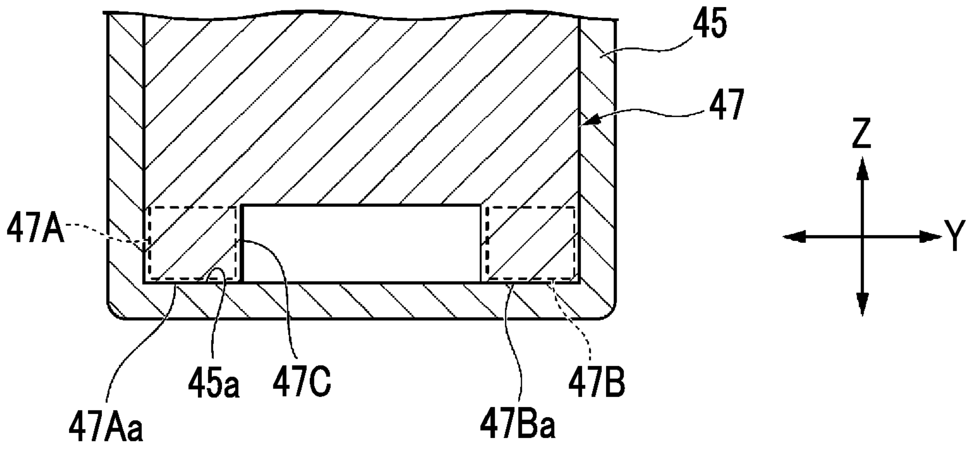
54(53)
55(53)
45
41
47b
14A
49A
41B
49
47c
54A(54)
47

FIG. 6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47
Z
Y
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45a
47C
47B
47Aa
47Ba

FIG. 7

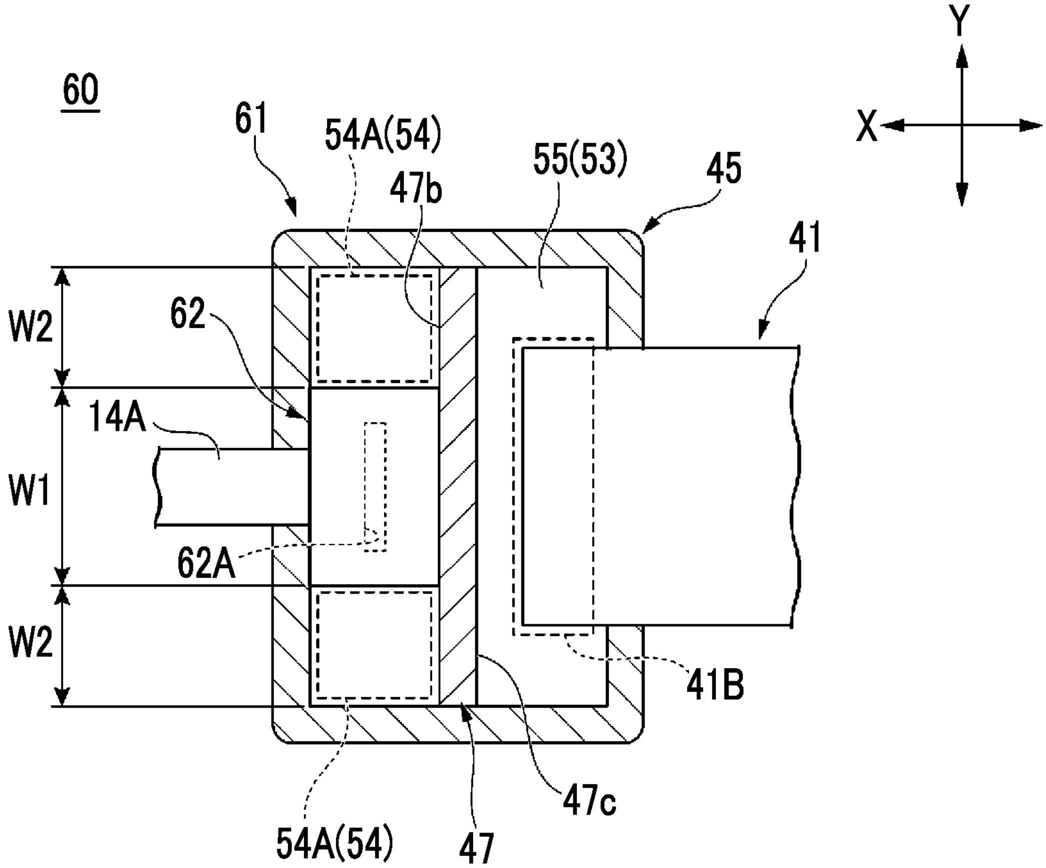
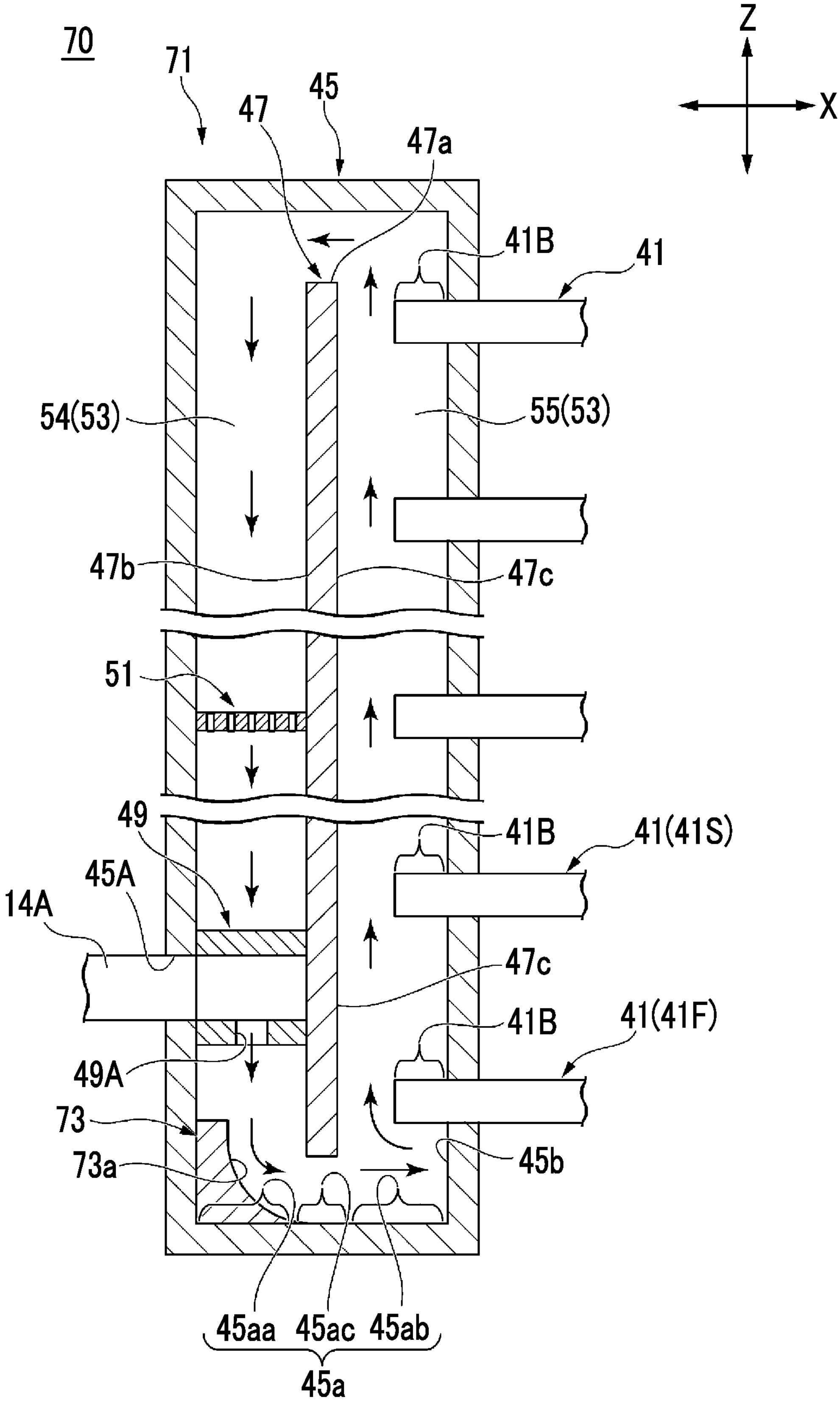


FIG. 8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55(53)
47b
47c
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41B
41(41S)
45A
14A
47c
41B
41(41F)
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73a
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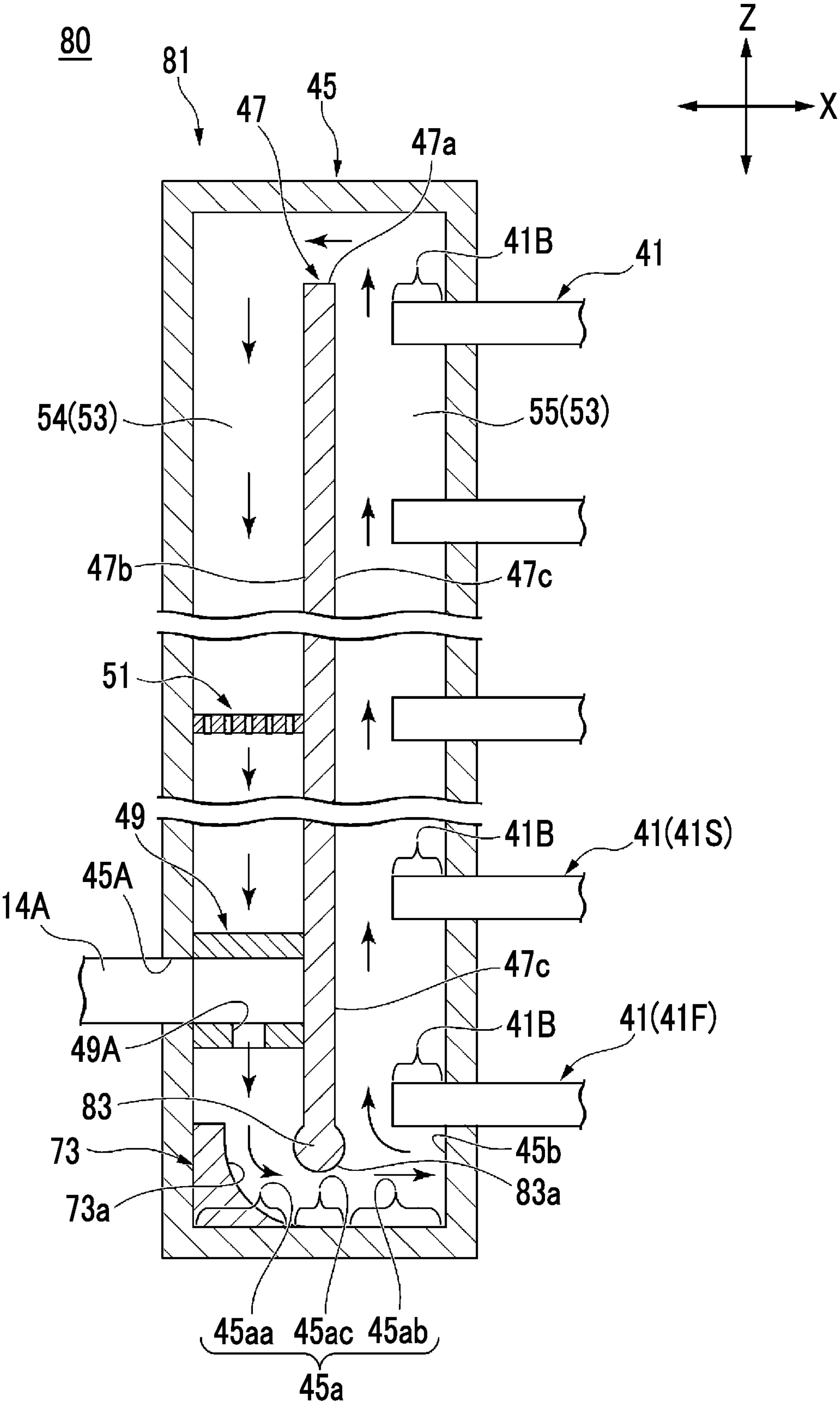
45ac
45ab
45a

FIG. 9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47b
47c
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41B
41(41S)
45A
14A
47c
49A
41B
41(41F)
83
73
45b
83a
73a
45aa
45ac
45ab
45a

FIG. 10

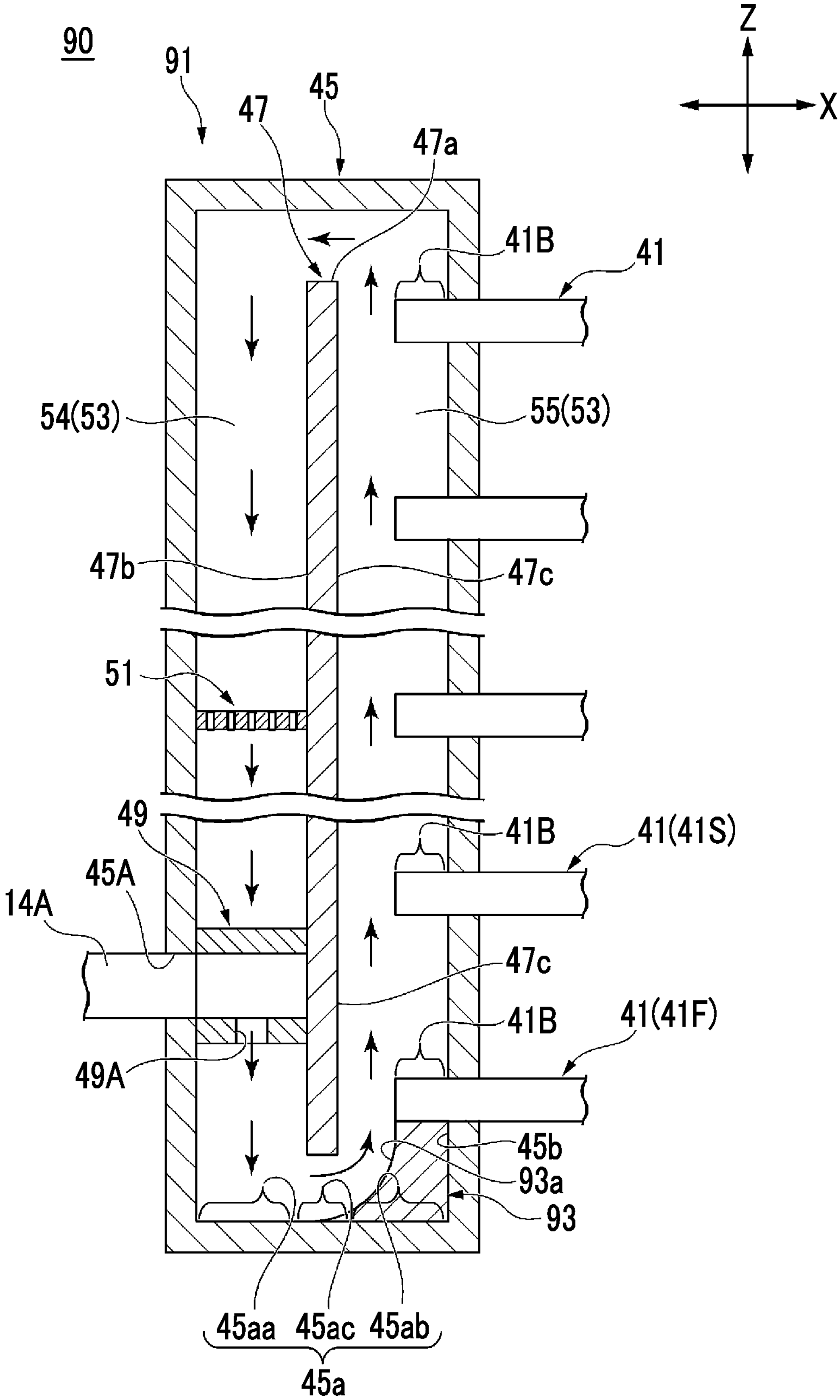

90
91
45
47
47a
Z
X
41B
41
54(53)
55(53)
47b
47c
51
49
41B
41(41S)
45A
14A
47c
41B
41(41F)
49A
45b
93a
93
45aa
45ac
45ab
45a

FIG. 11

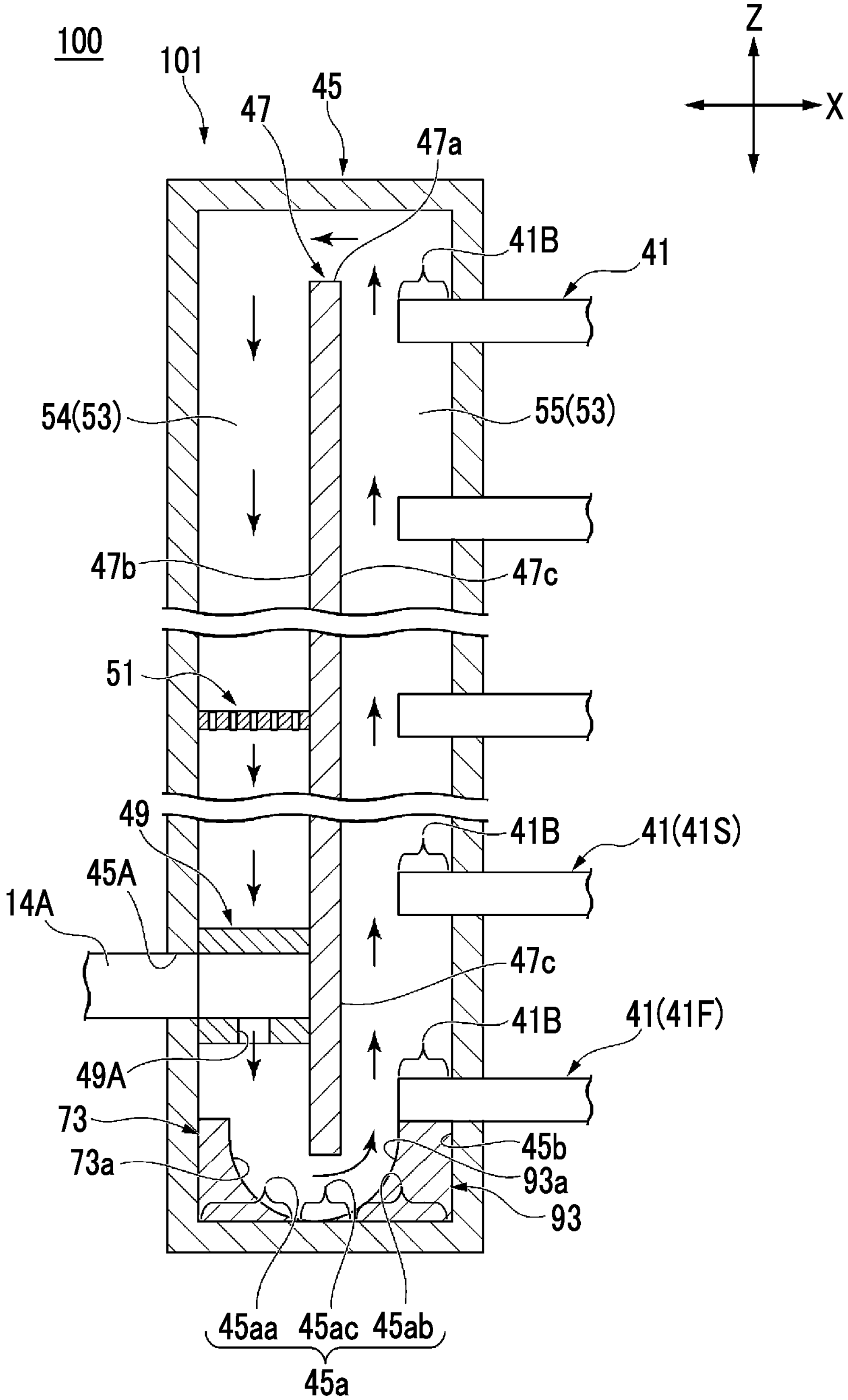

100
101
45
47
47a
Z
X
41B
41
54(53)
55(53)
47b
47c
51
49
41B
41(41S)
45A
14A
47c
41B
41(41F)
49A
73
73a
45b
93a
93
45aa
45ac
45ab
45a

FIG. 12

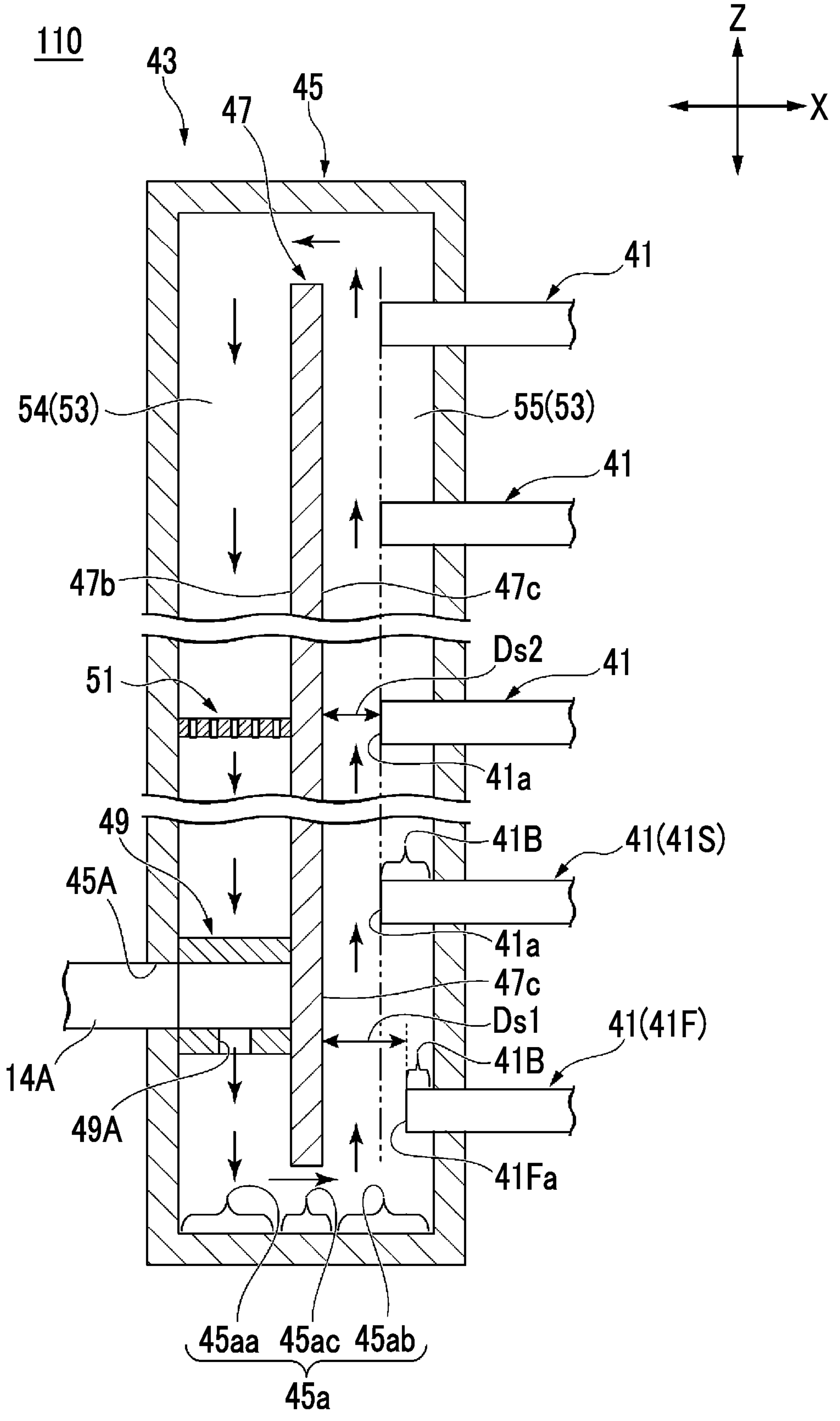

110
43
45
47
Z
X
41
54(53)
55(53)
41
47b
47c
Ds2
41
51
41a
49
41B
41(41S)
45A
41a
47c
Ds1
41(41F)
14A
41B
49A
41Fa
45aa
45ac
45ab
45a

FIG. 13

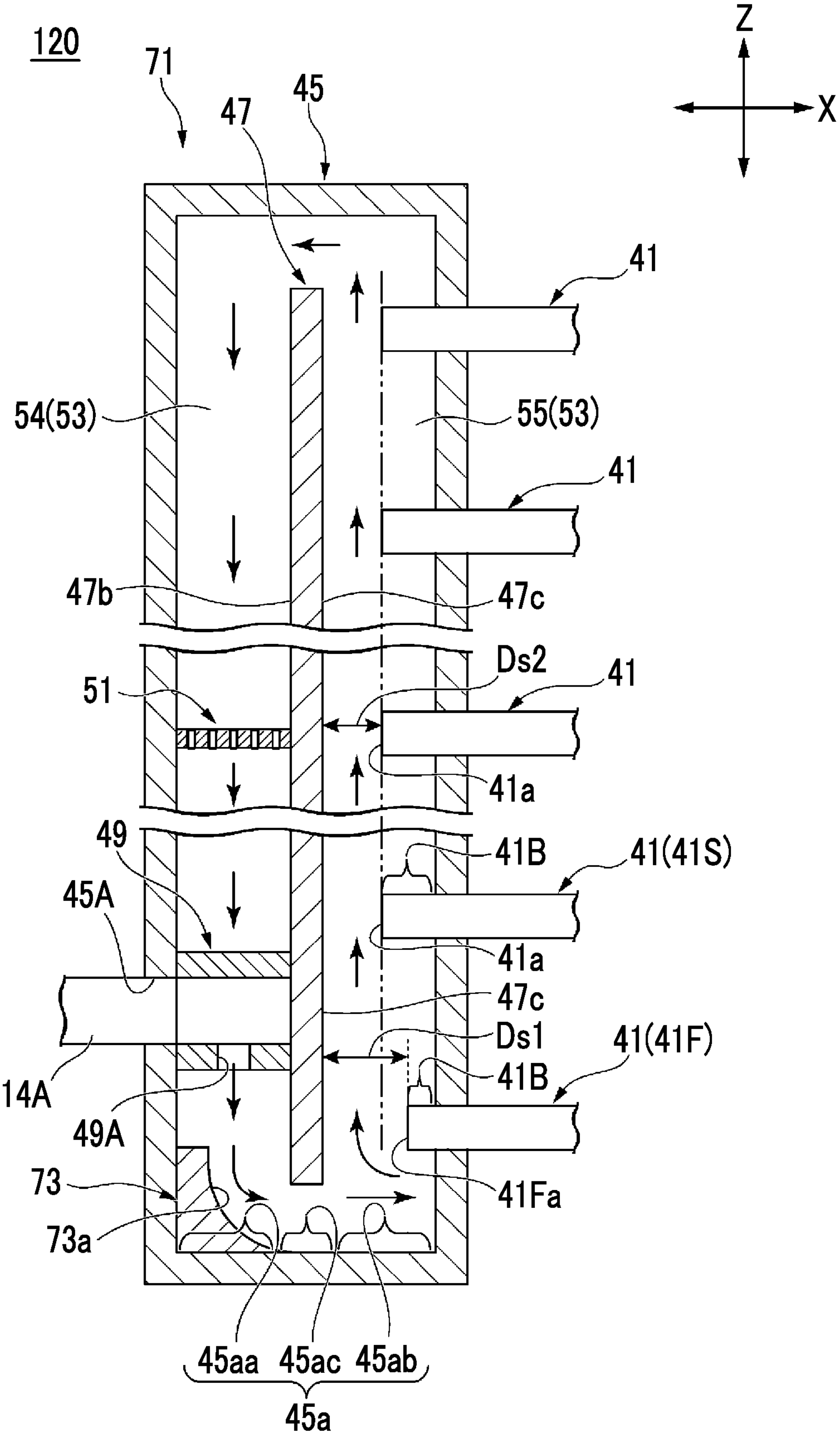

120
71
47
45
Z
X
41
54(53)
55(53)
41
47b
47c
Ds2
41
51
41a
49
41B
41(41S)
45A
41a
47c
Ds1
41(41F)
14A
41B
49A
73
41Fa
73a
45aa
45ac
45ab
45a

FIG. 14

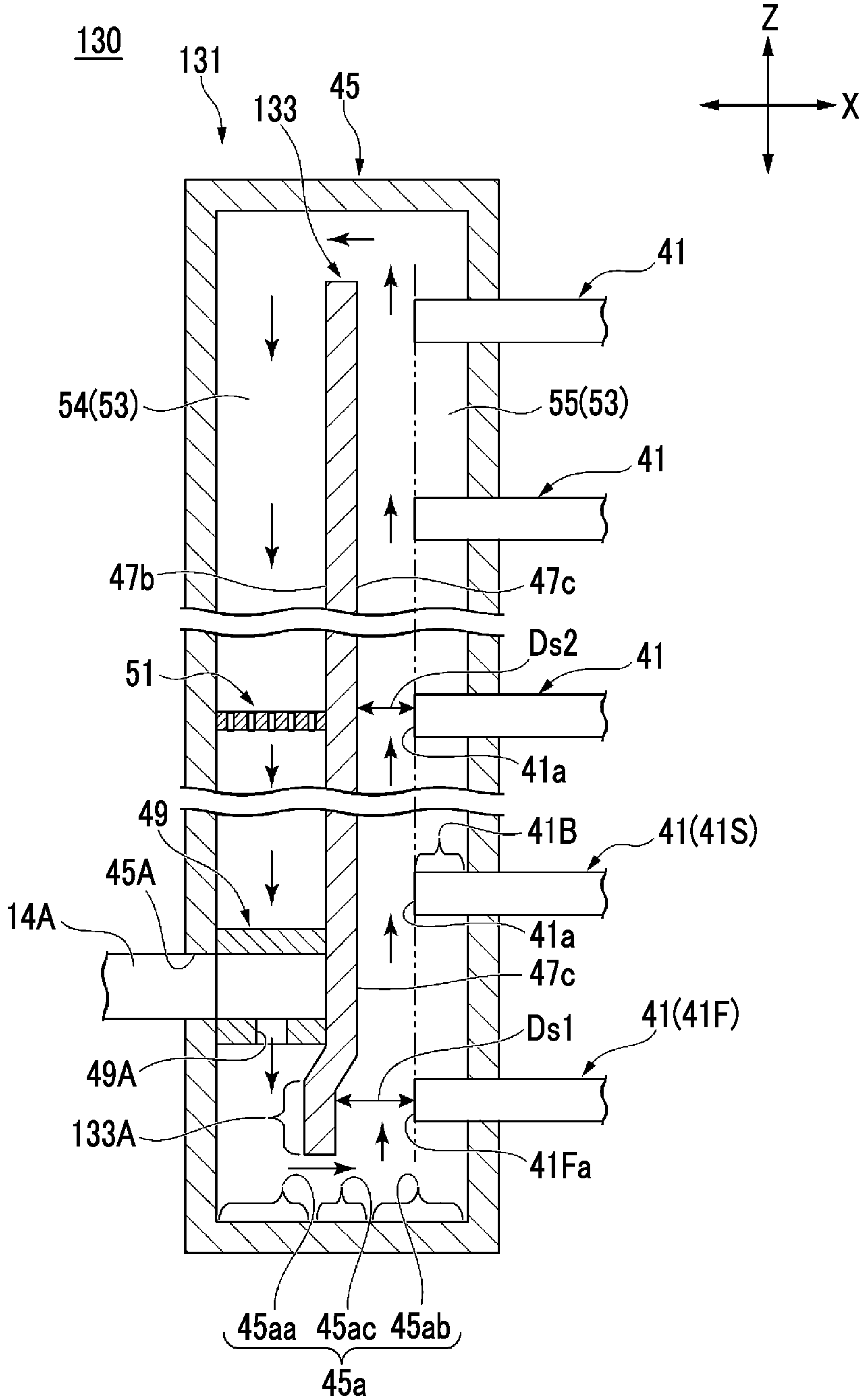

130
131
133
45
Z
X
41
54(53)
55(53)
41
47b
47c
Ds2
41
51
41a
49
41B
41(41S)
45A
14A
41a
47c
Ds1
41(41F)
49A
133A
41Fa
45aa
45ac
45ab
45a

FIG. 15

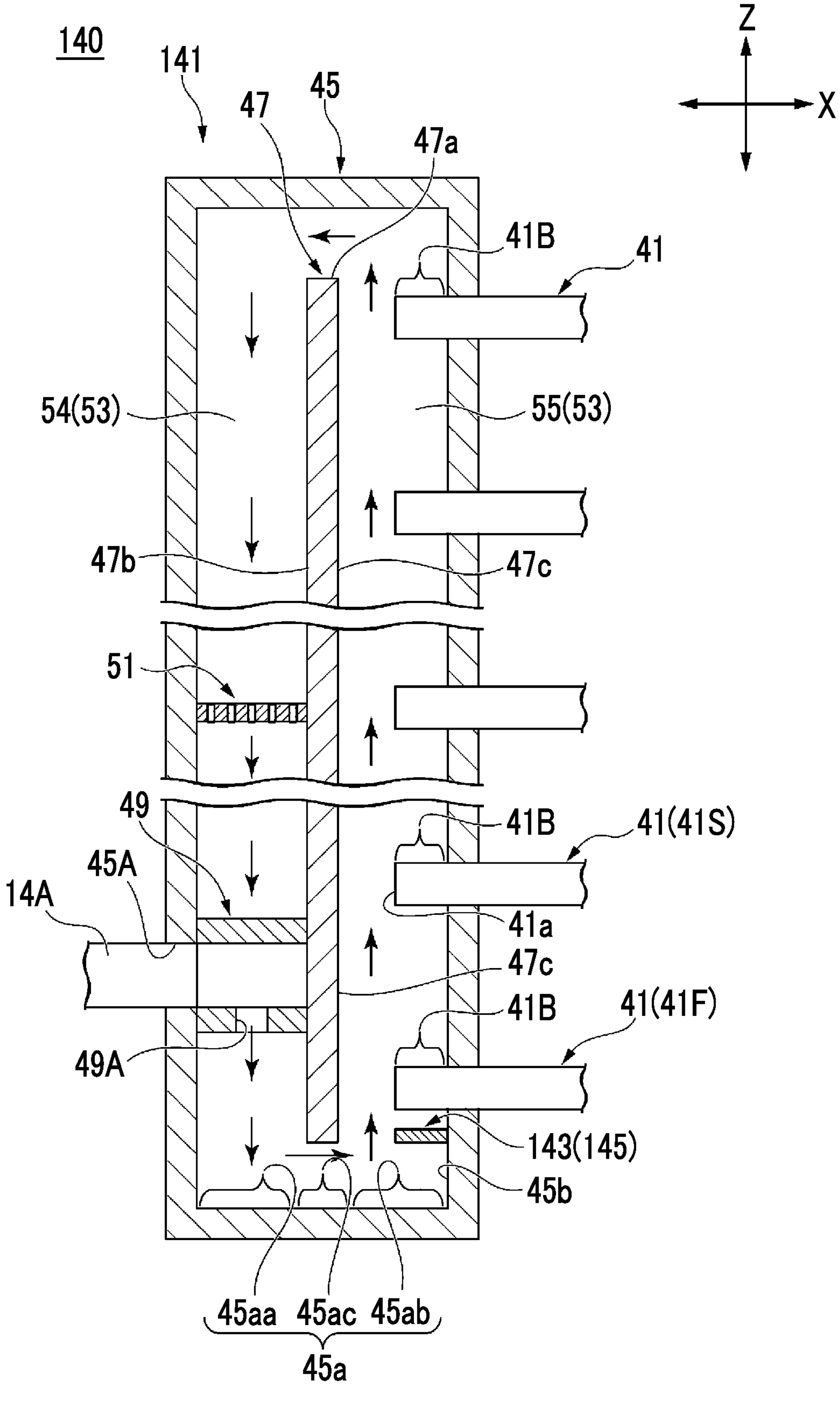

140
141
47
45
47a
Z
X
41B
41
54(53)
55(53)
47b
47c
51
49
41B
41(41S)
45A
14A
41a
47c
41B
41(41F)
49A
143(145)
45b
45aa
45ac
45ab
45a

FIG. 16

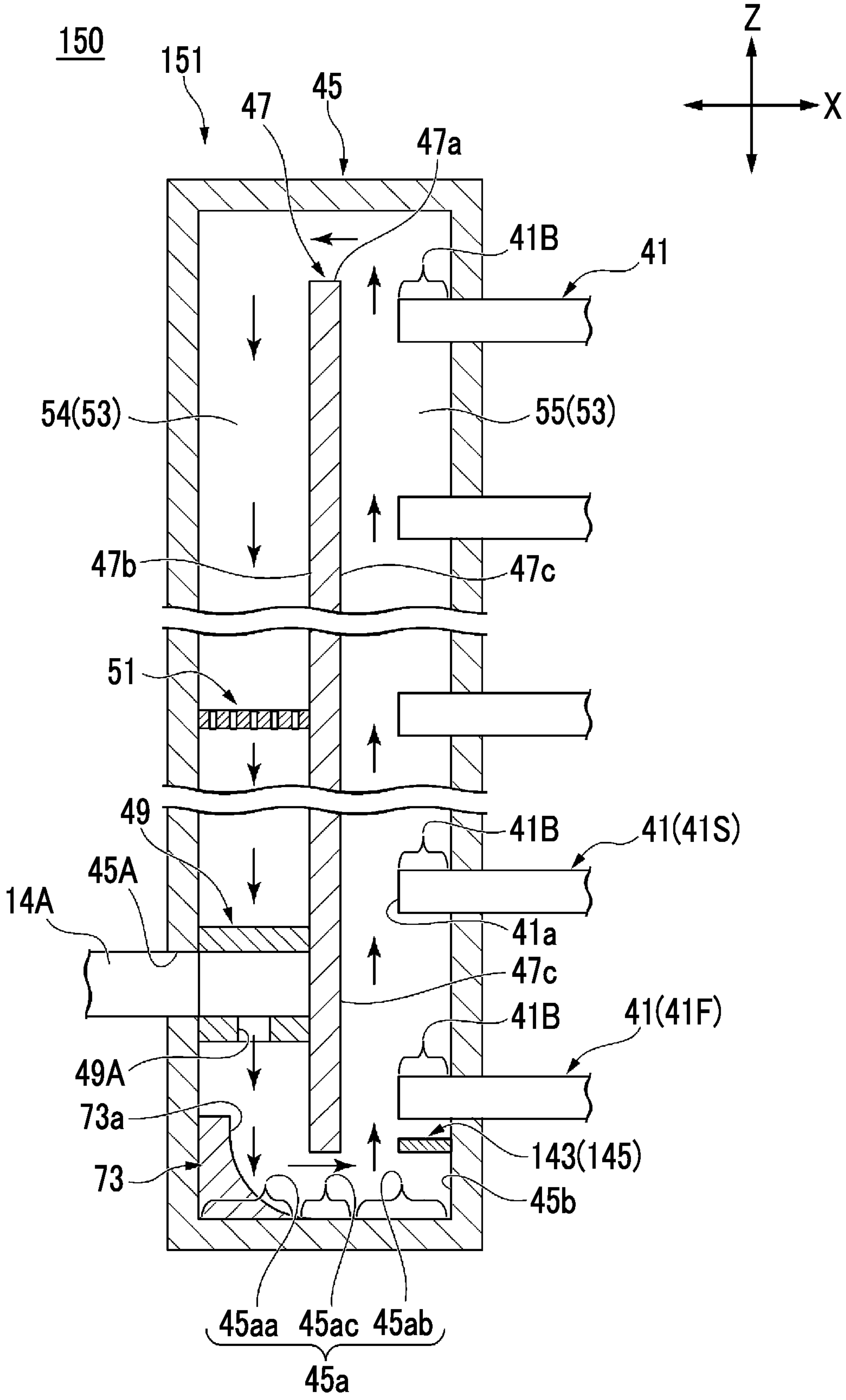

150
151
47
45
47a
Z
X
41B
41
54(53)
55(53)
47b
47c
51
49
41B
41(41S)
45A
14A
41a
47c
41B
41(41F)
49A
73a
143(145)
73
45b
45aa
45ac
45ab
45a

FIG. 17

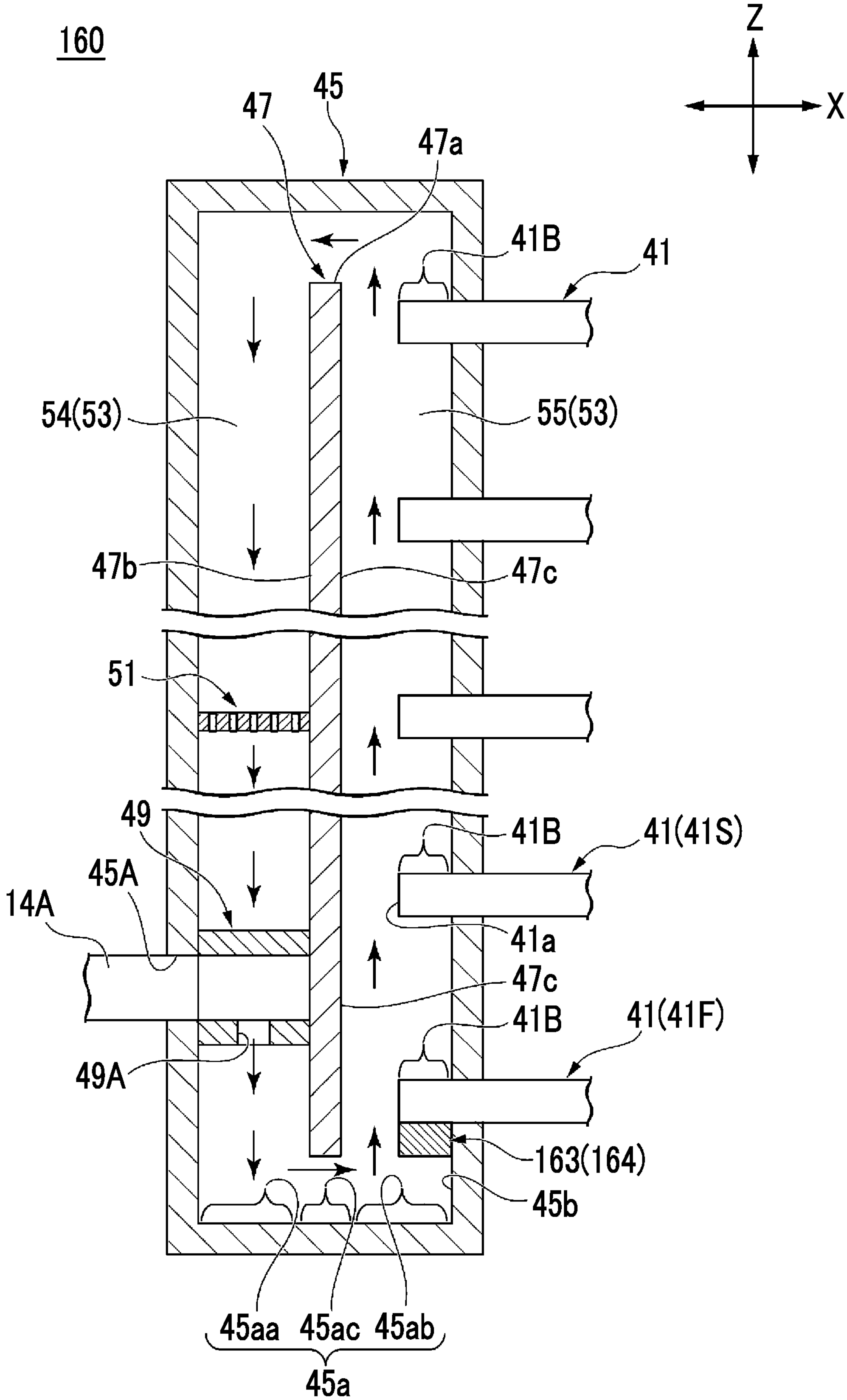

160
Z
X
47
45
47a
41B
41
54(53)
55(53)
47b
47c
51
49
41B
41(41S)
45A
14A
41a
47c
41B
41(41F)
49A
163(164)
45b
45aa
45ac
45ab
45a

FIG. 18

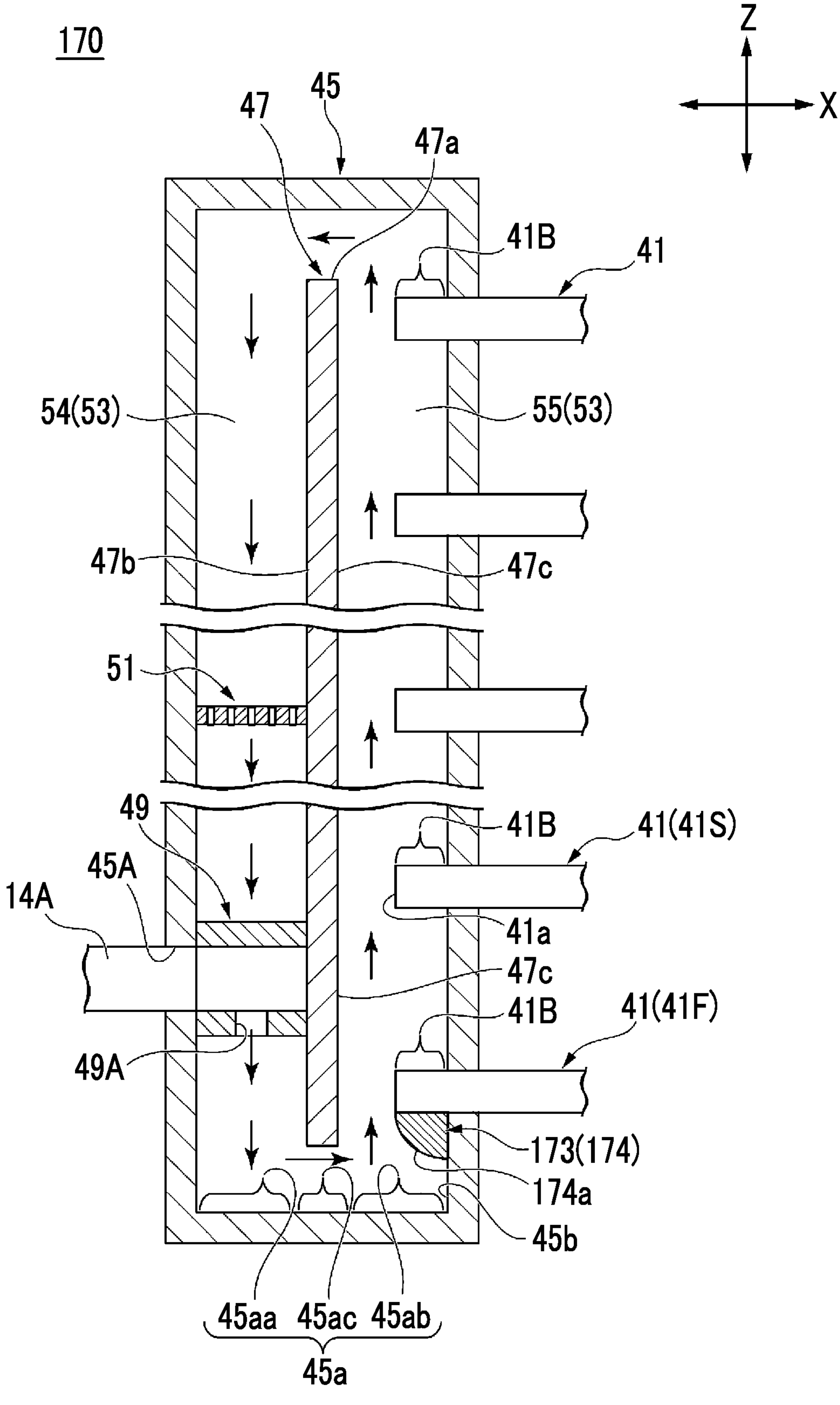

170
Z
X
47
45
47a
41B
41
54(53)
55(53)
47b
47c
51
49
41B
41(41S)
45A
14A
41a
47c
41B
41(41F)
49A
173(174)
174a
45b
45aa
45ac
45ab
45a

FIG. 19

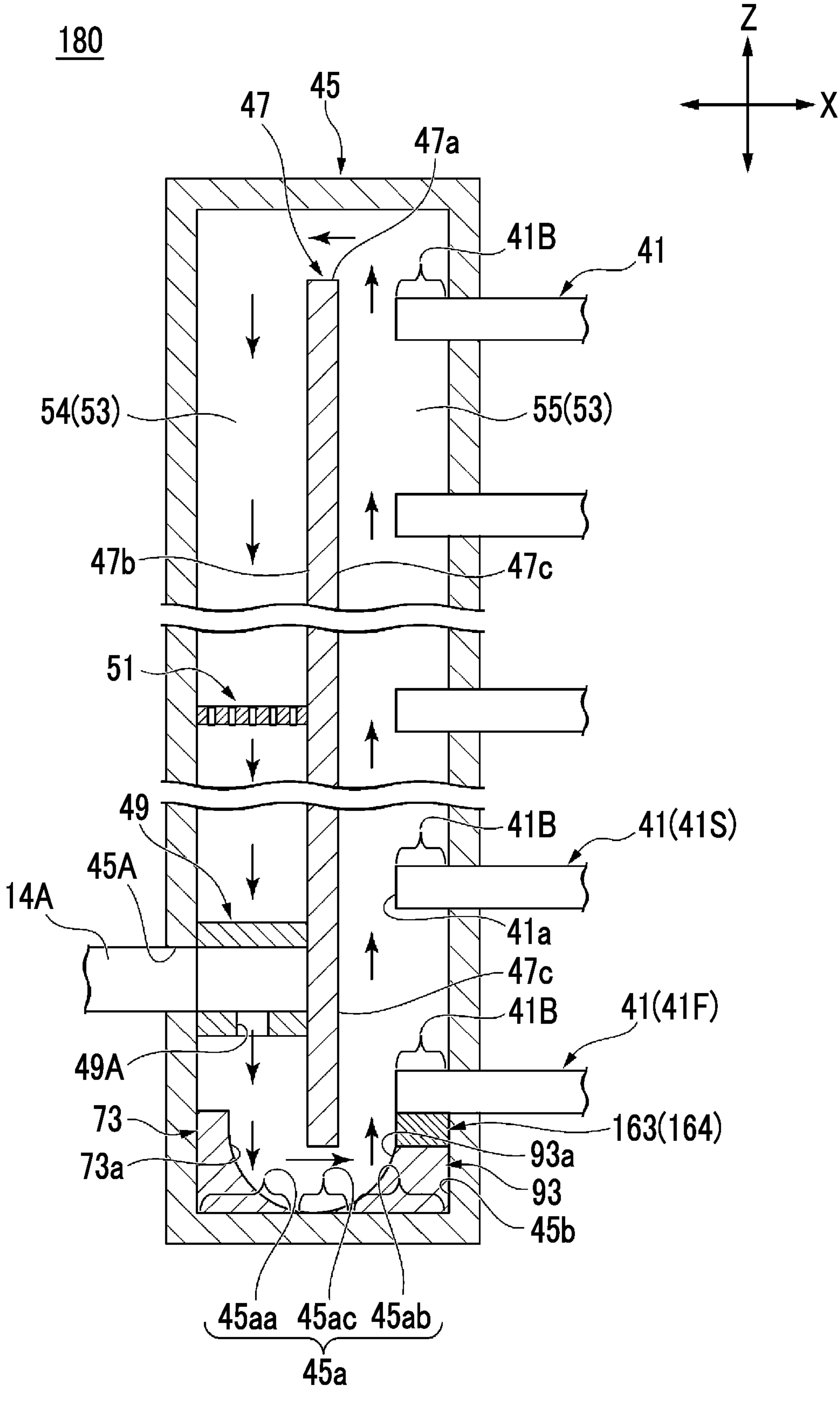

180
Z
X
47
45
47a
41B
41
54(53)
55(53)
47b
47c
51
49
41B
41(41S)
45A
14A
41a
47c
41B
41(41F)
49A
73
163(164)
73a
93a
93
45b
45aa
45ac
45ab
45a

FIG. 20

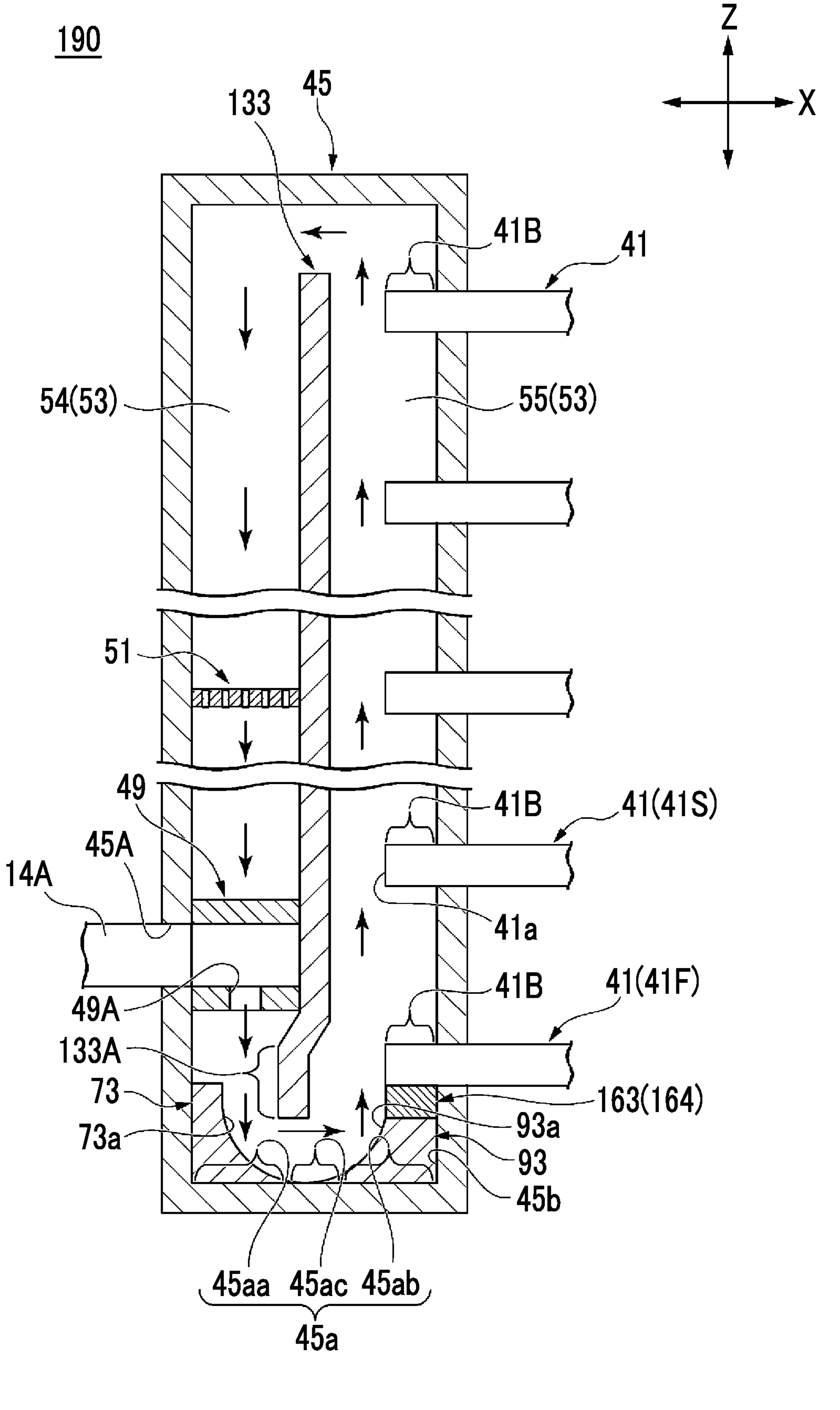

190
Z
X
133
45
41B
41
54(53)
55(53)
51
49
41B
41(41S)
45A
14A
41a
49A
41B
41(41F)
133A
73
163(164)
73a
93a
93
45b
45aa
45ac
45ab
45a

FIG. 21

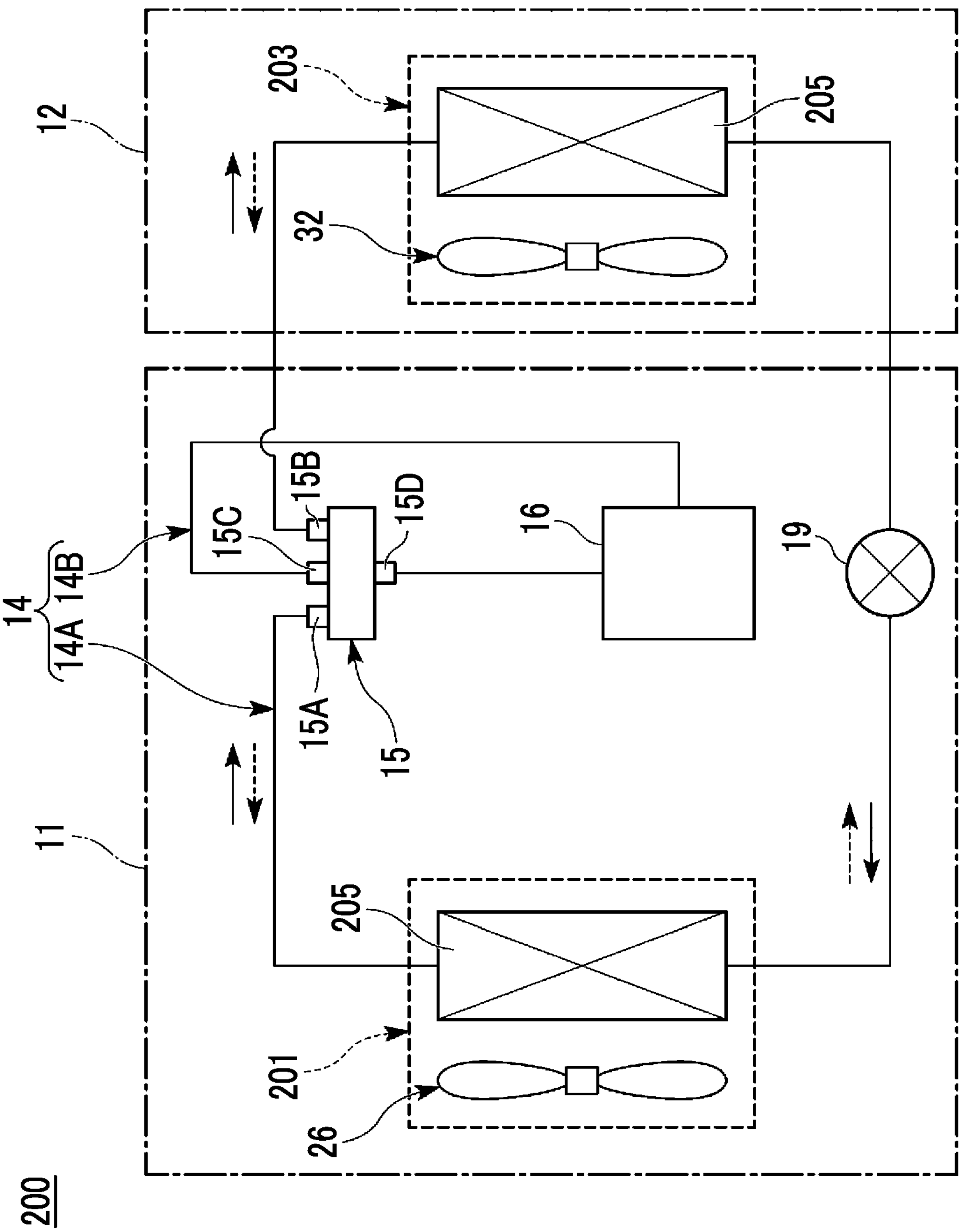


FIG. 22

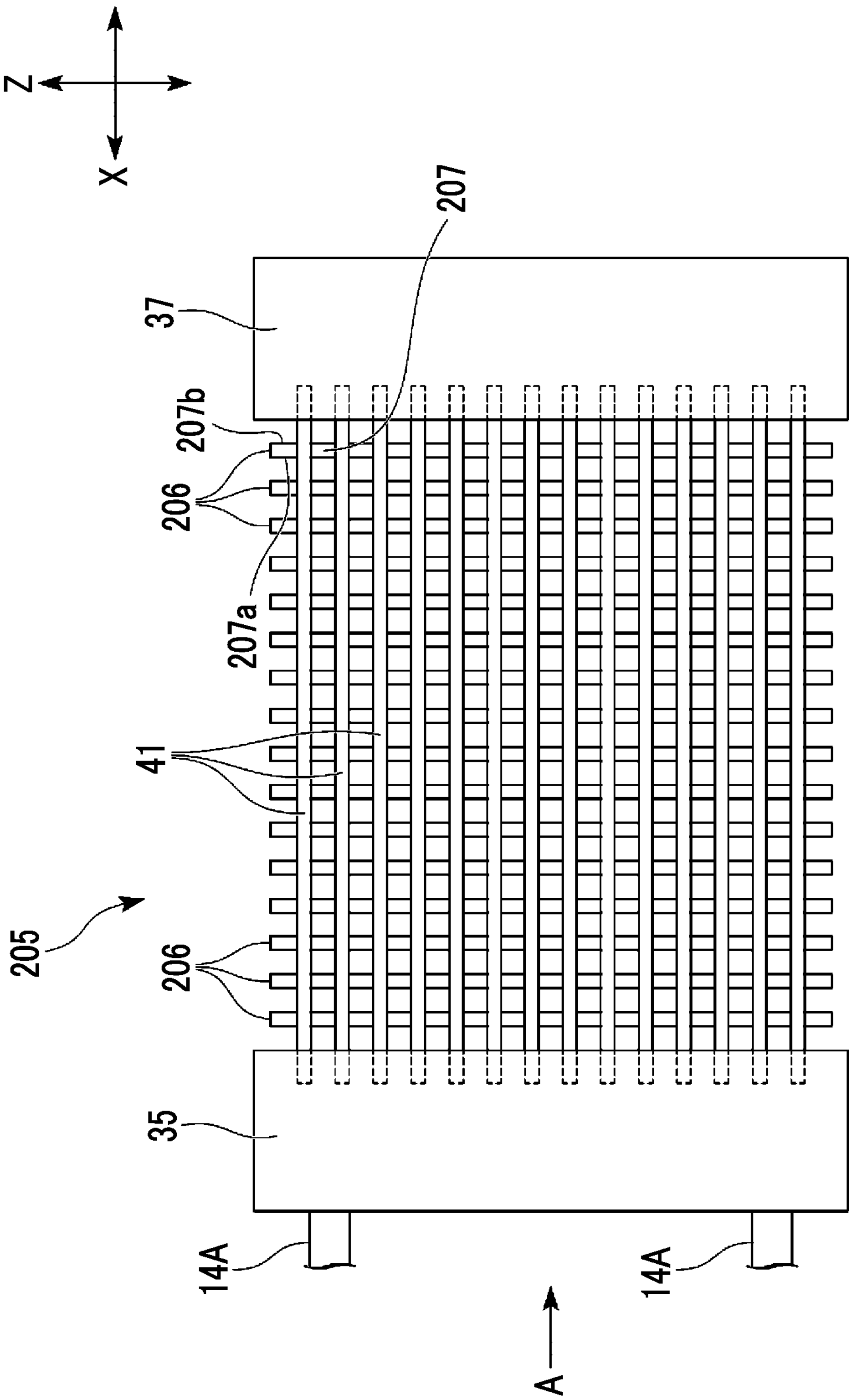


FIG. 23

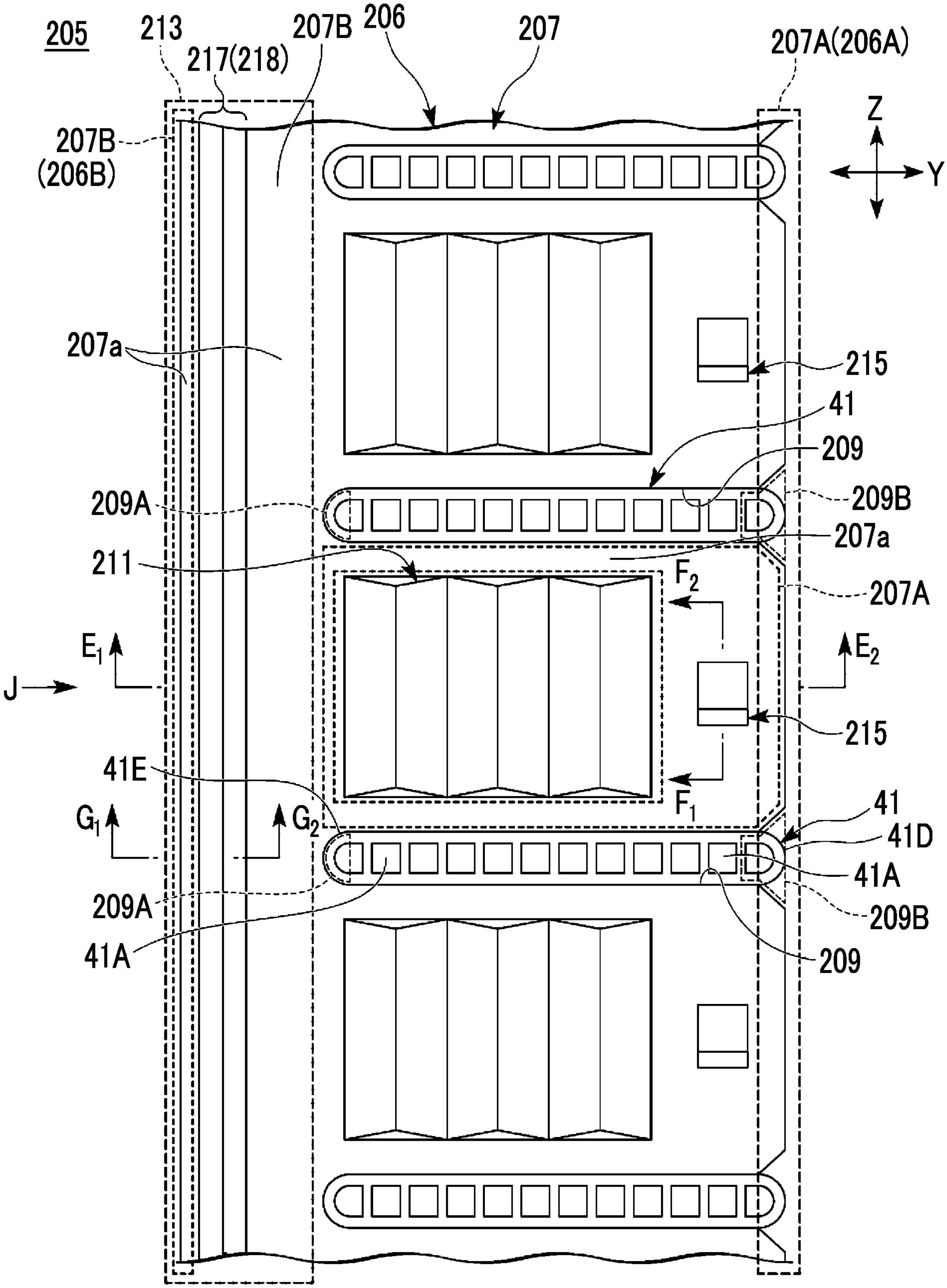

205
213
217(218)
207B
206
207
207A(206A)
Z
Y
207B
(206B)
207a
215
41
209
209A
209B
207a
211
207A
F_2
E_1
E_2
J
215
41E
F_1
41
G_1
G_2
41D
41A
209A
209B
41A
209

FIG. 24

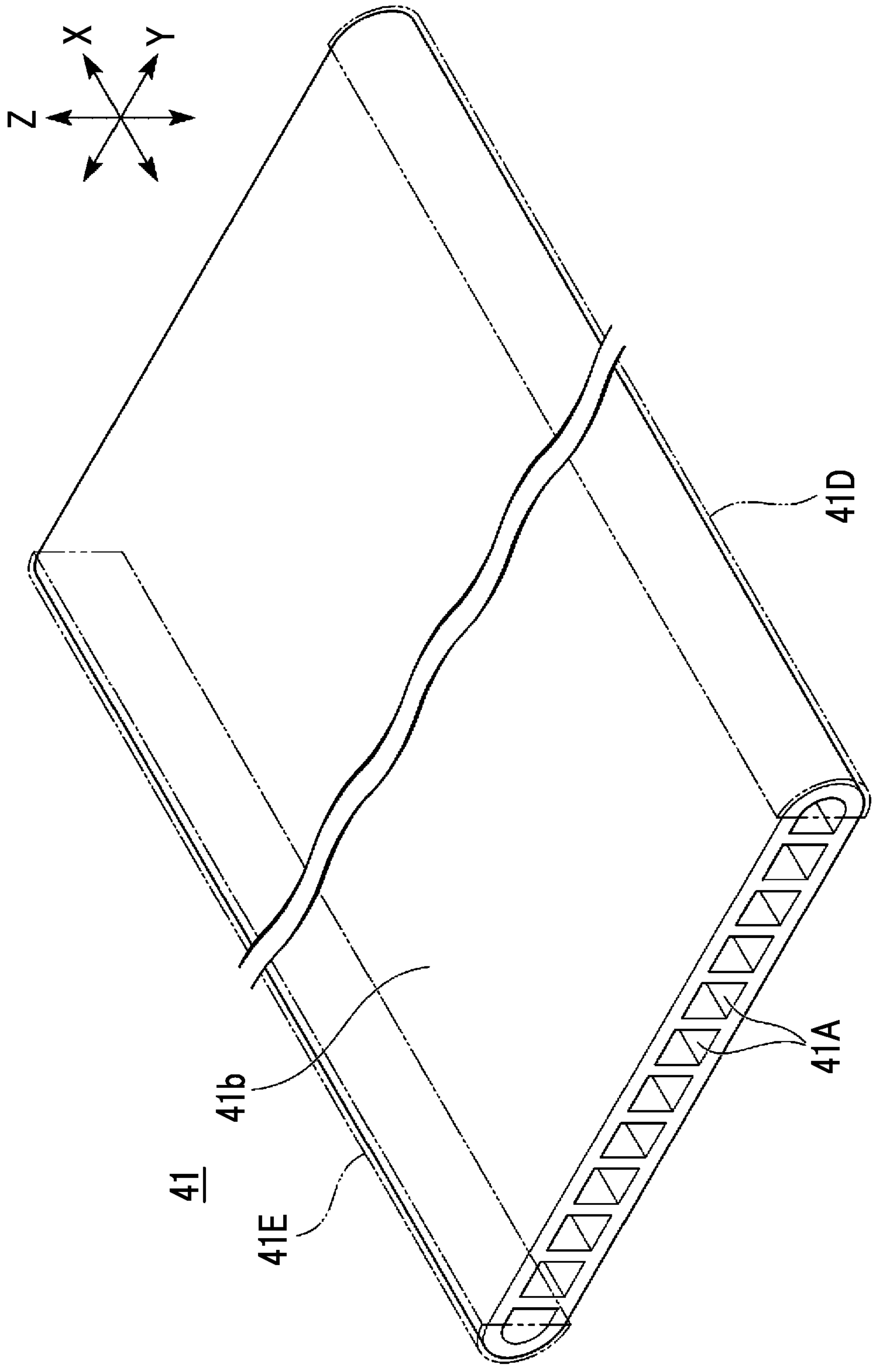


FIG. 25

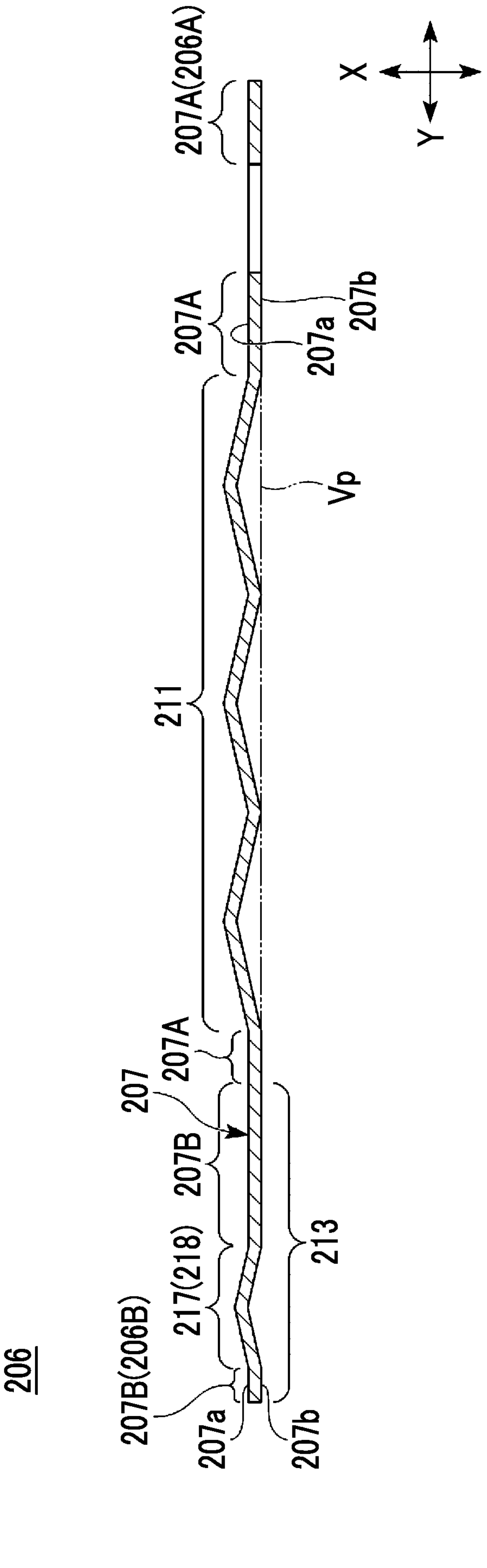

207A(206A)
X
Y
207A
207a
207b
Vp
211
207A
207
207B
217(218)
213
207B(206B)
207a
207b
206

FIG. 26

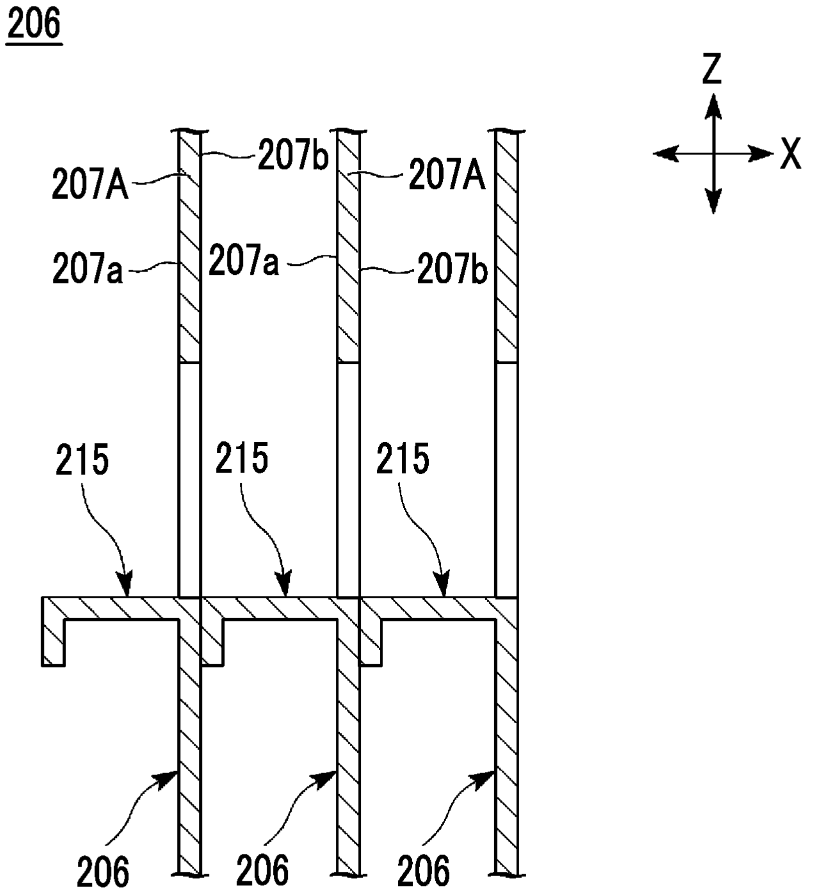

206
Z
X
207A
207b
207A
207a
207a
207b
215
215
215
206
206
206

FIG. 27

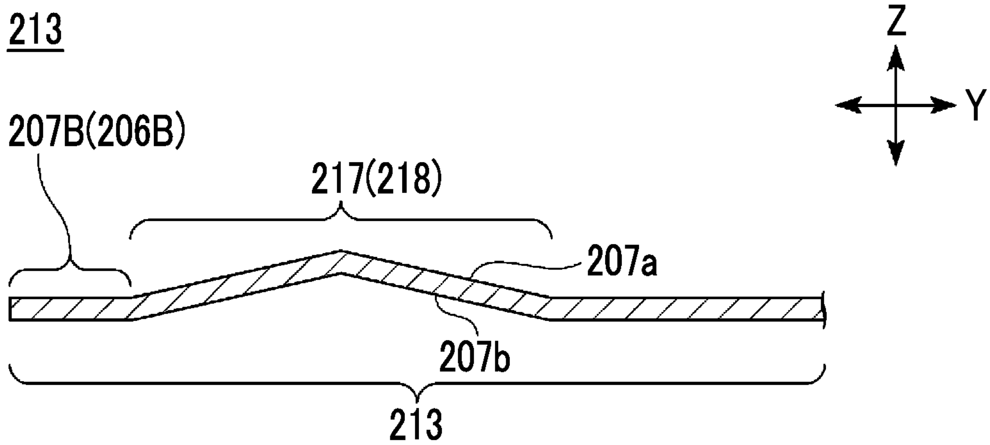

213
Z
Y
207B(206B)
217(218)
207a
207b
213

FIG. 28

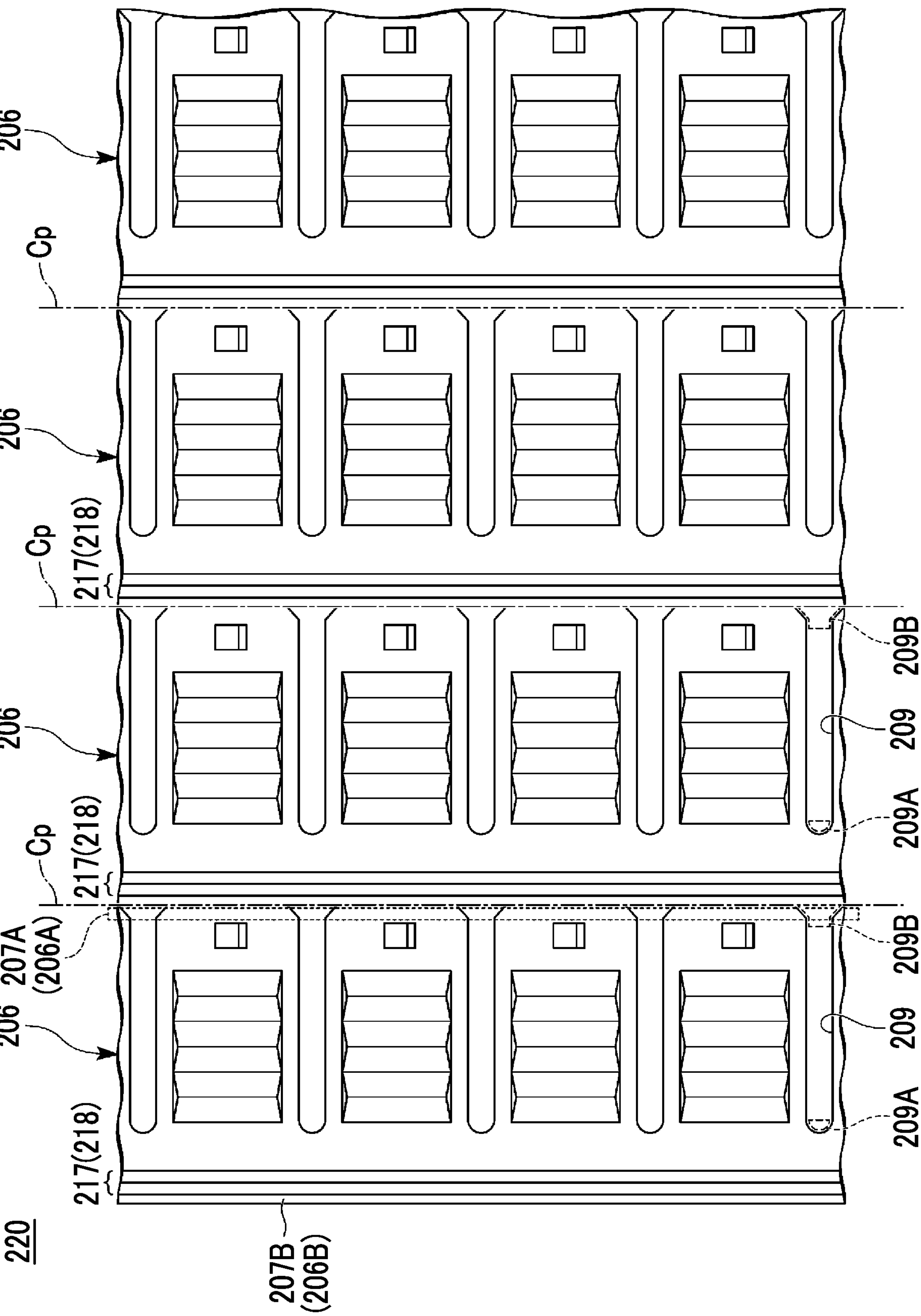
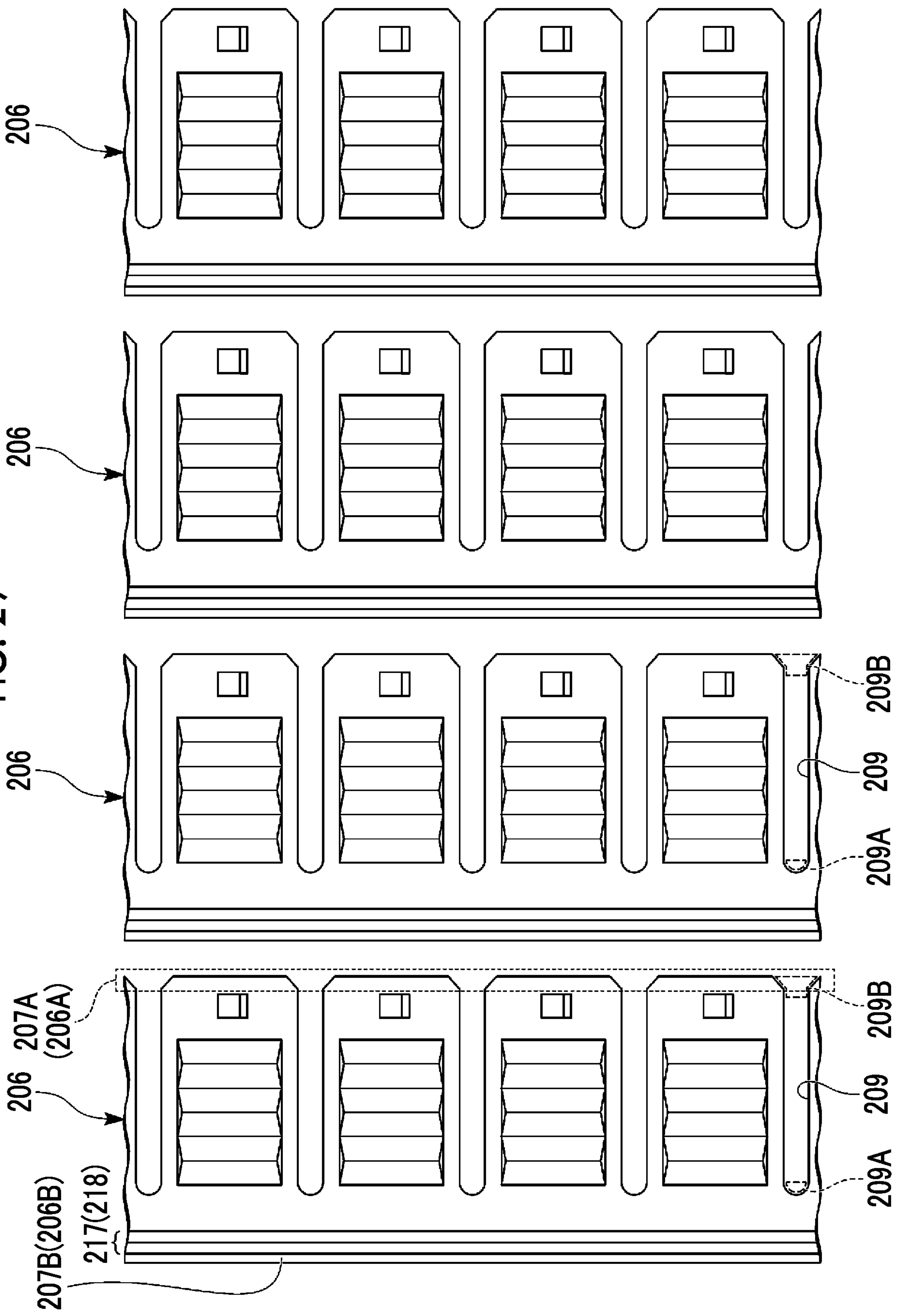

206
206
206
206
Cp
Cp
Cp
217(218)
217(218)
217(218)
207A
(206A)
209B
209
209A
209B
209
209A
220
207B
(206B)

FIG. 29


206
206
206
206
207A
(206A)
209B
209
209A
209B
209
209A
217(218)
207B(206B)

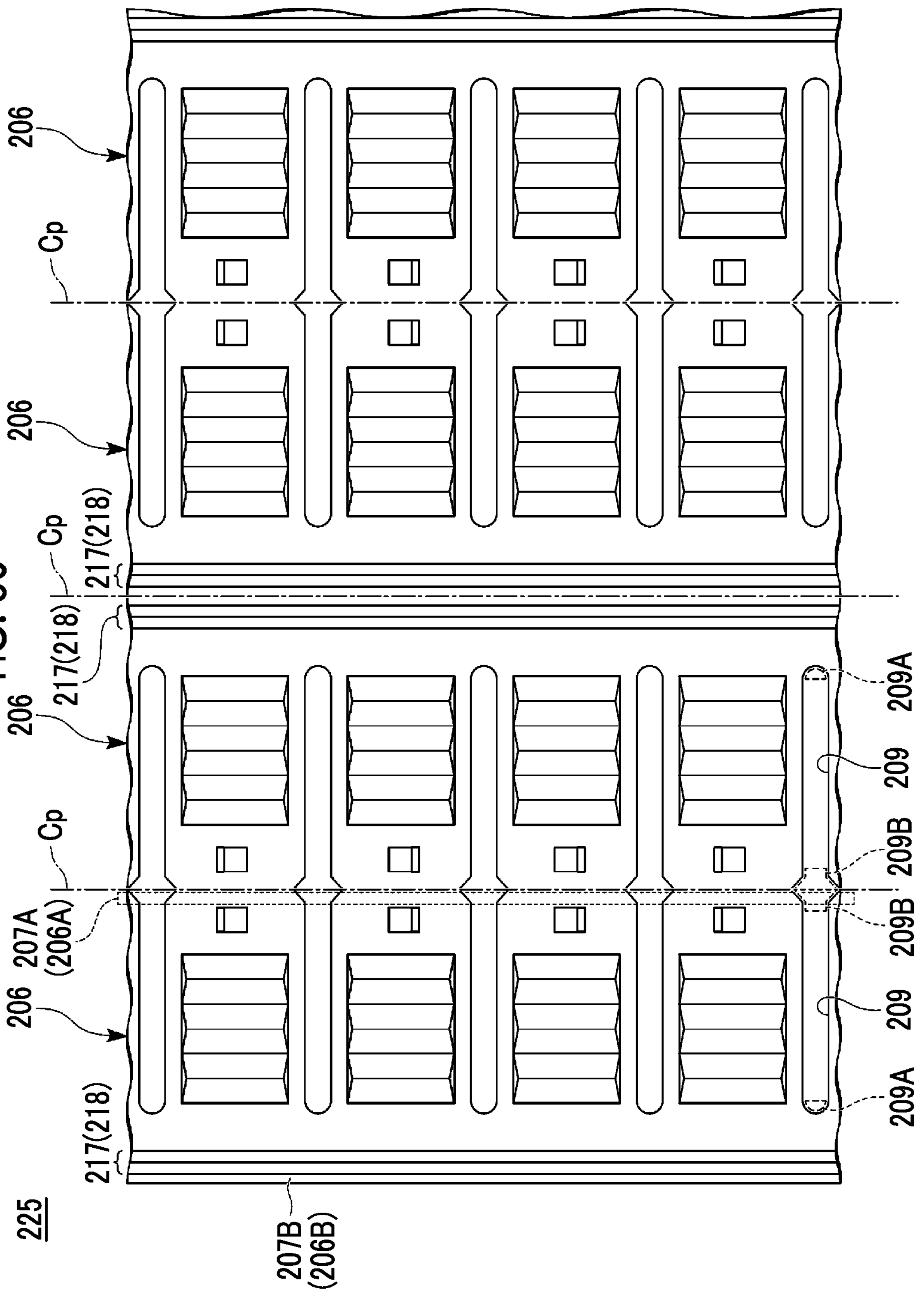


FIG. 30

FIG. 31

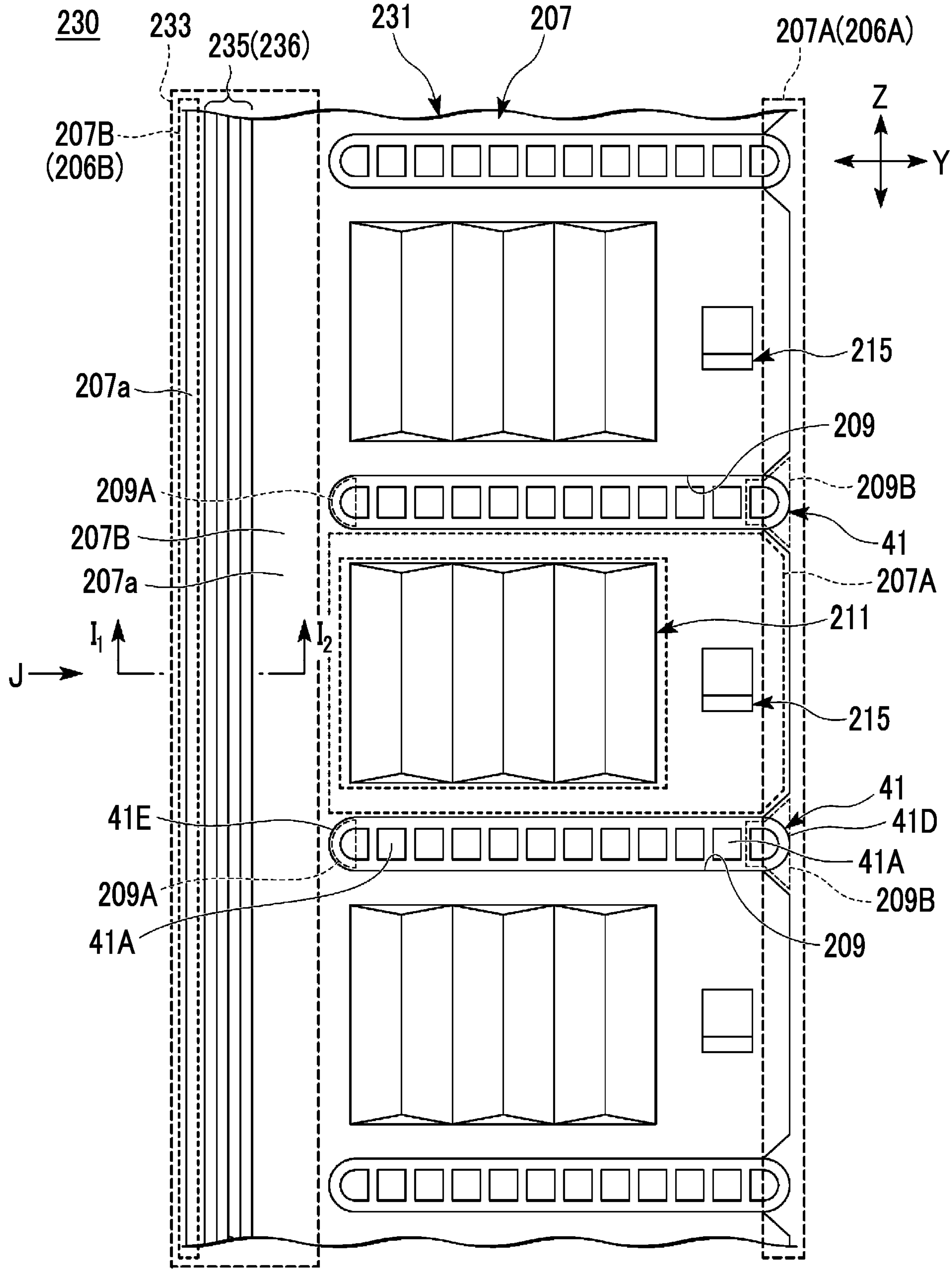

230
233
235(236)
231
207
207A(206A)
Z
Y
207B
(206B)
215
207a
209
209A
209B
207B
41
207a
207A
211
I_1
I_2
J
215
41
41E
41D
41A
209A
209B
41A
209

FIG. 32

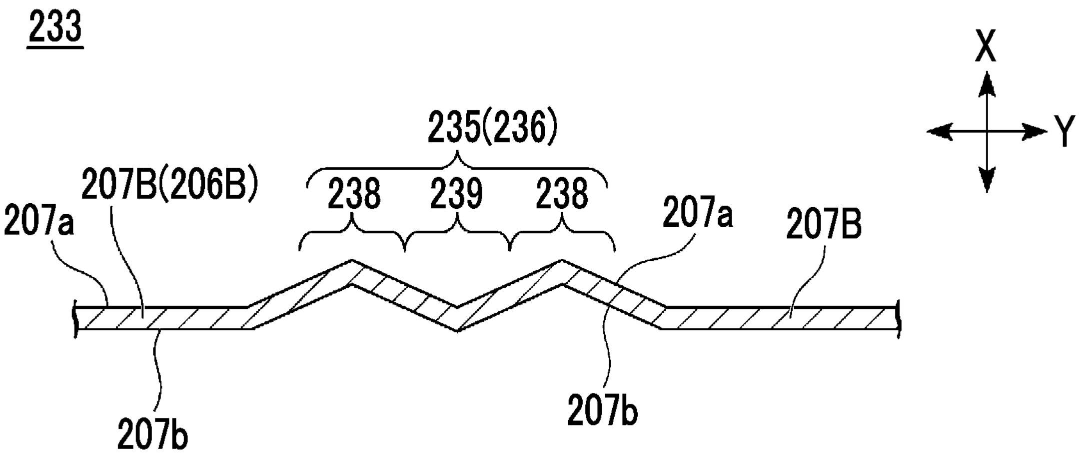


FIG. 33

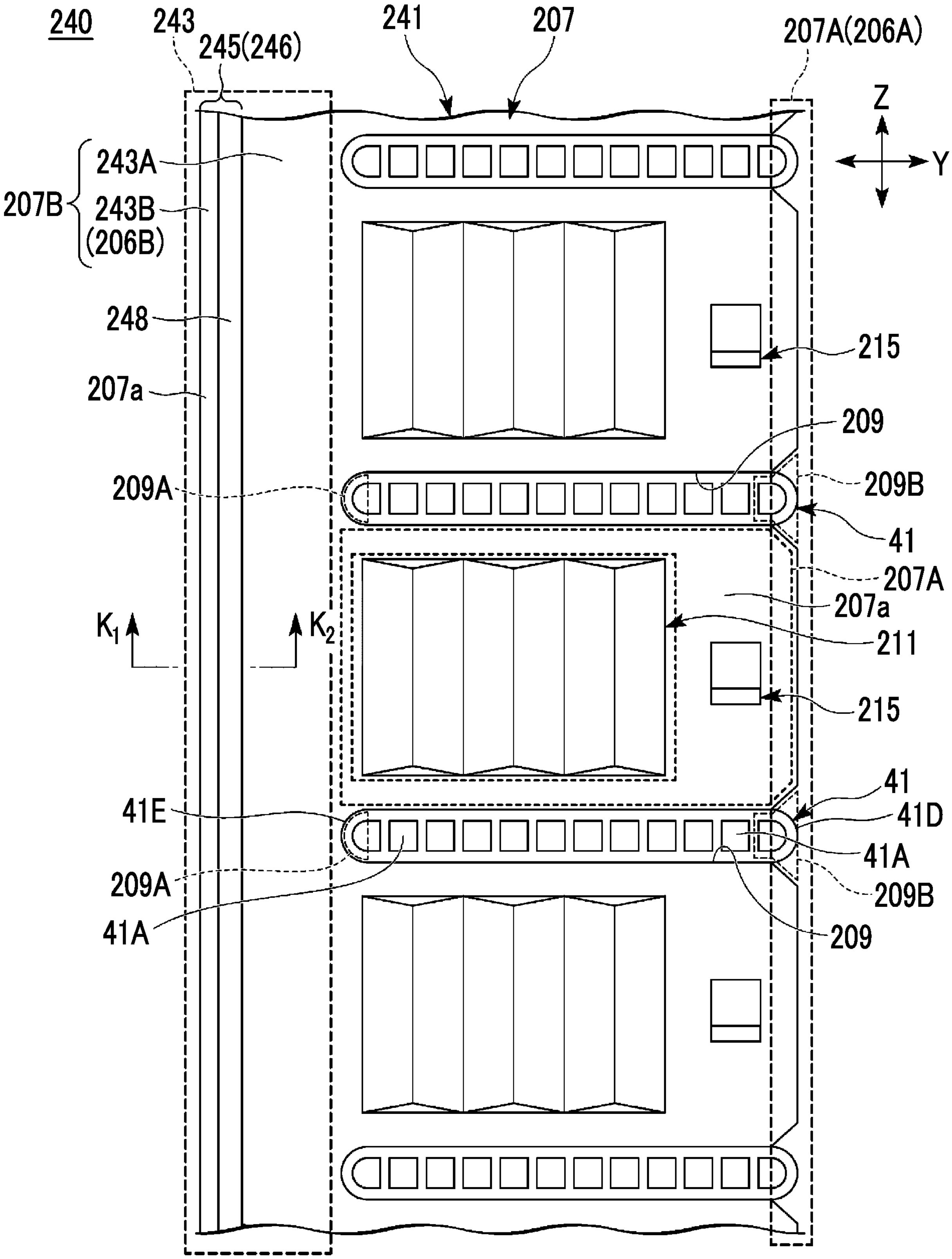

240
243
245(246)
241
207
207A(206A)
Z
Y
207B
243A
243B
(206B)
248
207a
215
209
209A
209B
41
207A
207a
211
K1
K2
215
41
41E
41D
41A
209A
209B
41A
209

FIG. 34

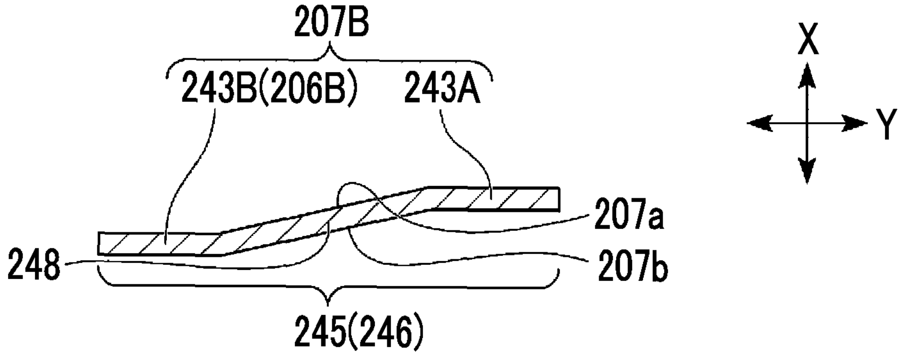


FIG. 35

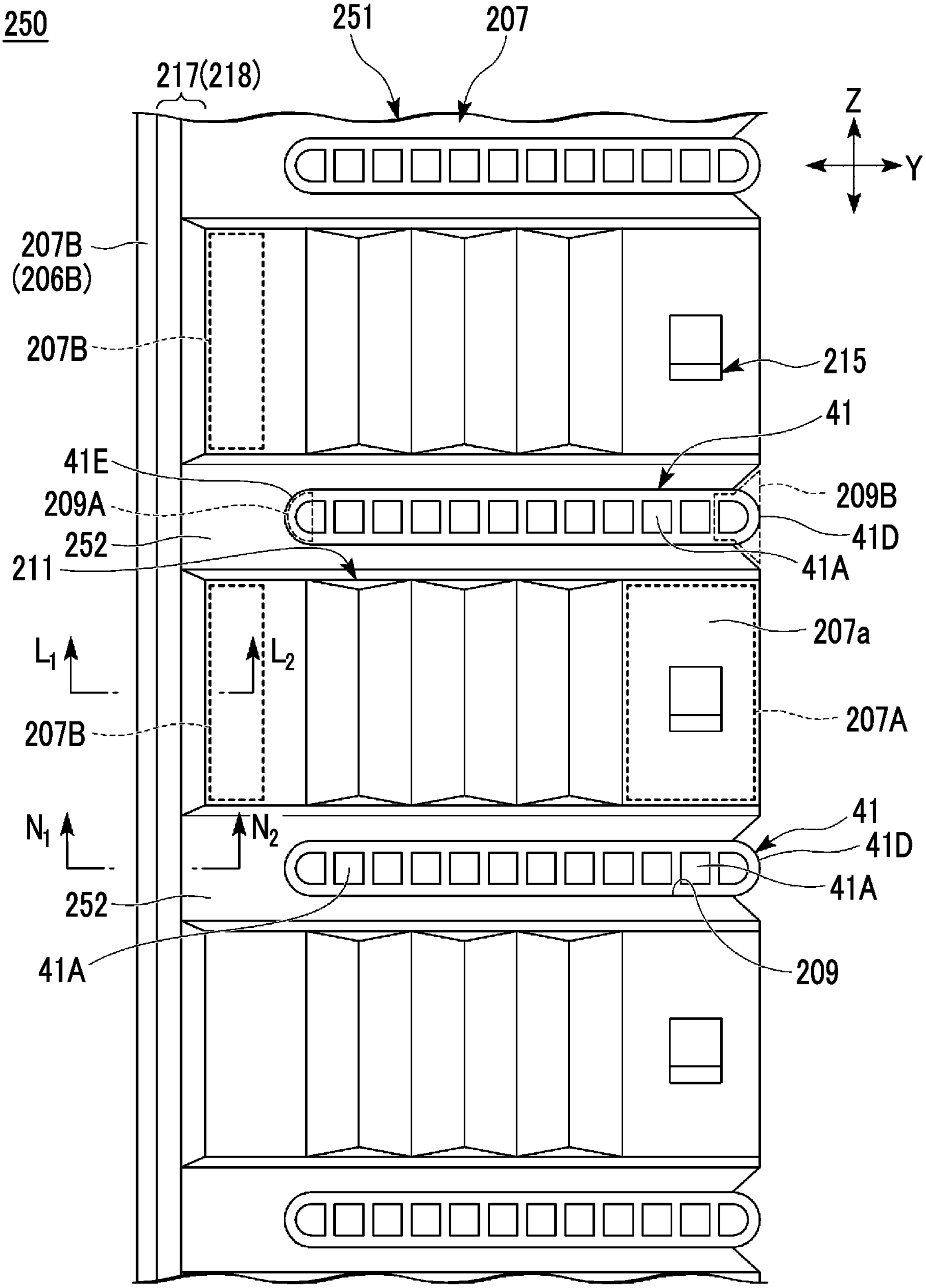

250
251
207
217(218)
Z
Y
207B
(206B)
207B
215
41
41E
209A
252
211
209B
41D
41A
207a
L1
L2
207A
207B
N1
N2
41
41D
41A
252
41A
209

FIG. 36

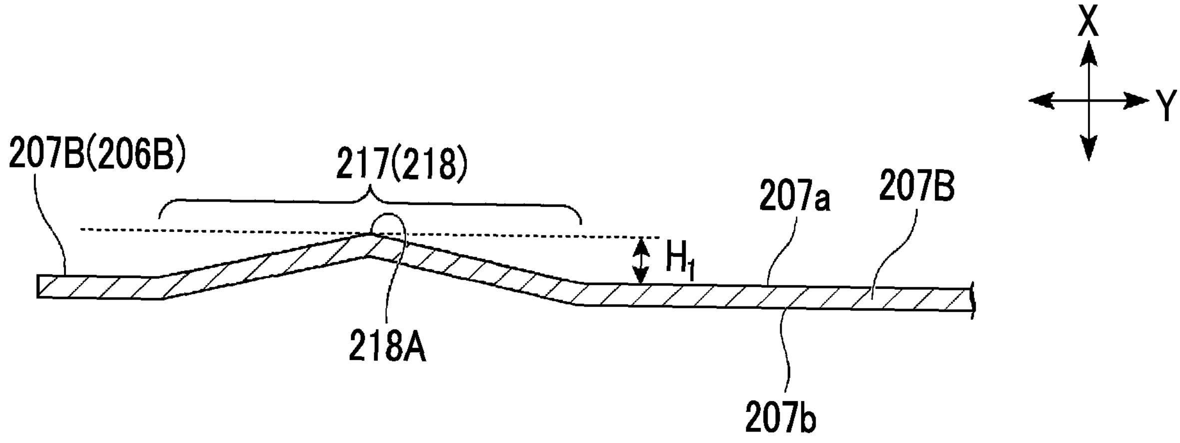

X
Y
207B(206B)
217(218)
207a
207B
H_1
218A
207b

FIG. 37

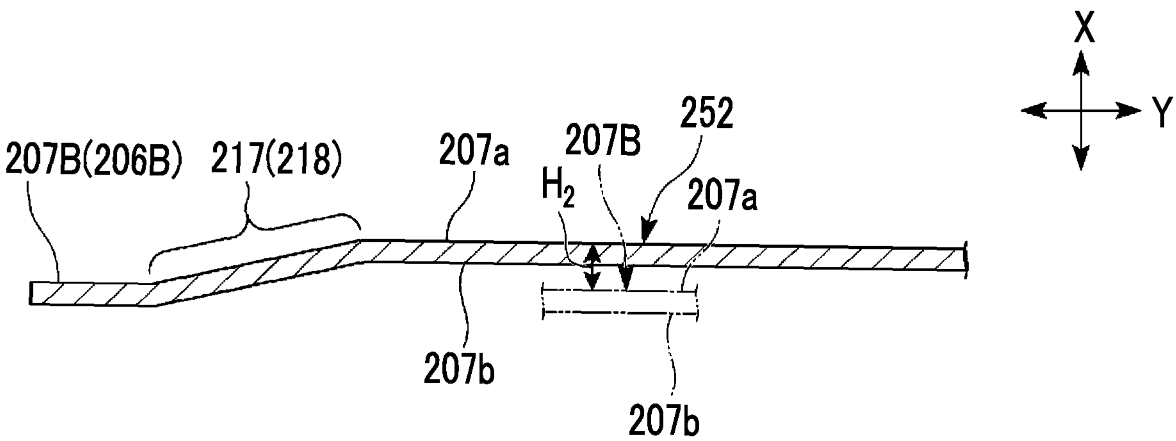

X
Y
252
207B
207B(206B)
217(218)
207a
H_2
207a
207b
207b

FIG. 38

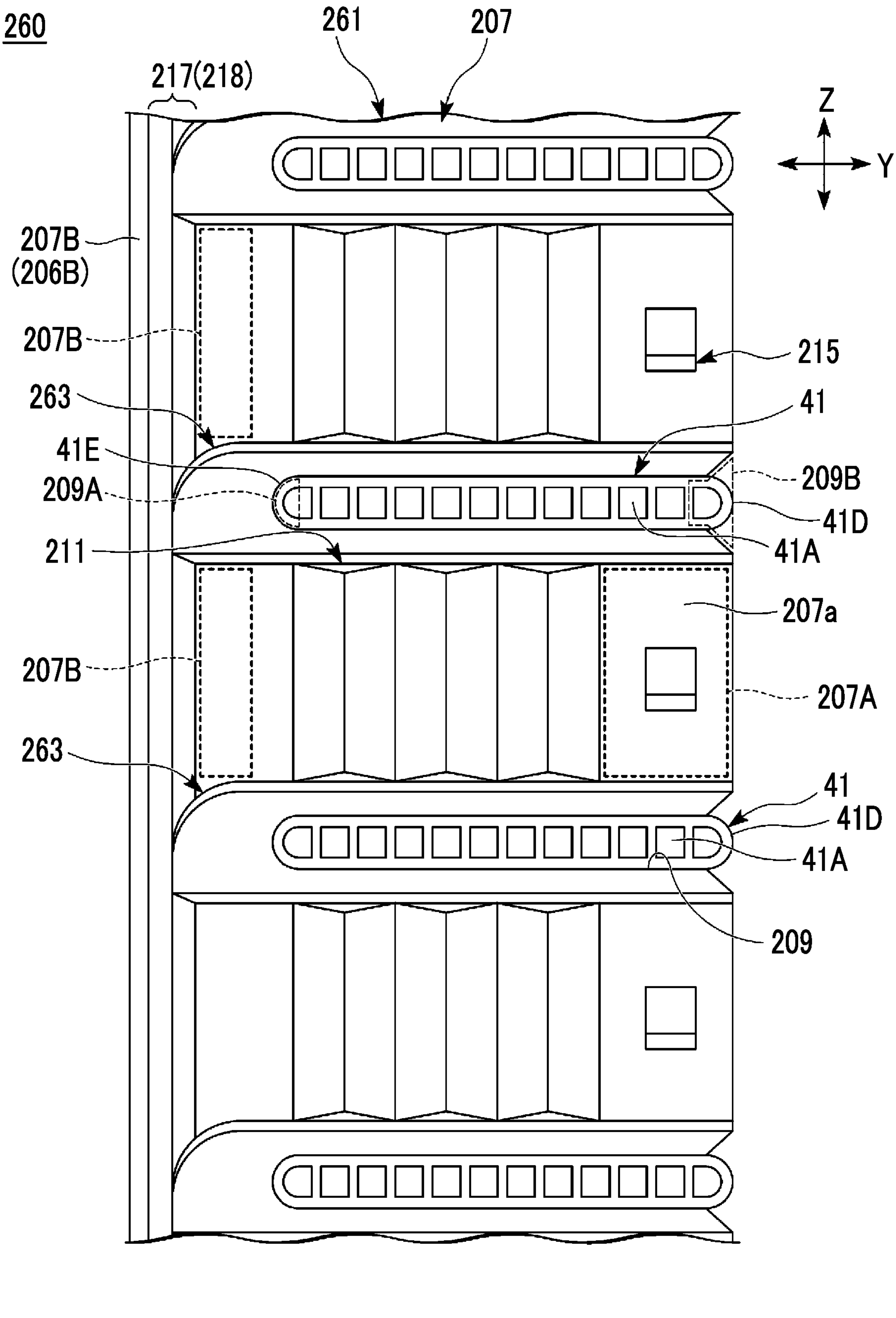

260
261
207
217(218)
Z
Y
207B
(206B)
207B
215
263
41
41E
209B
209A
41D
211
41A
207a
207B
207A
263
41
41D
41A
209

FIG. 39

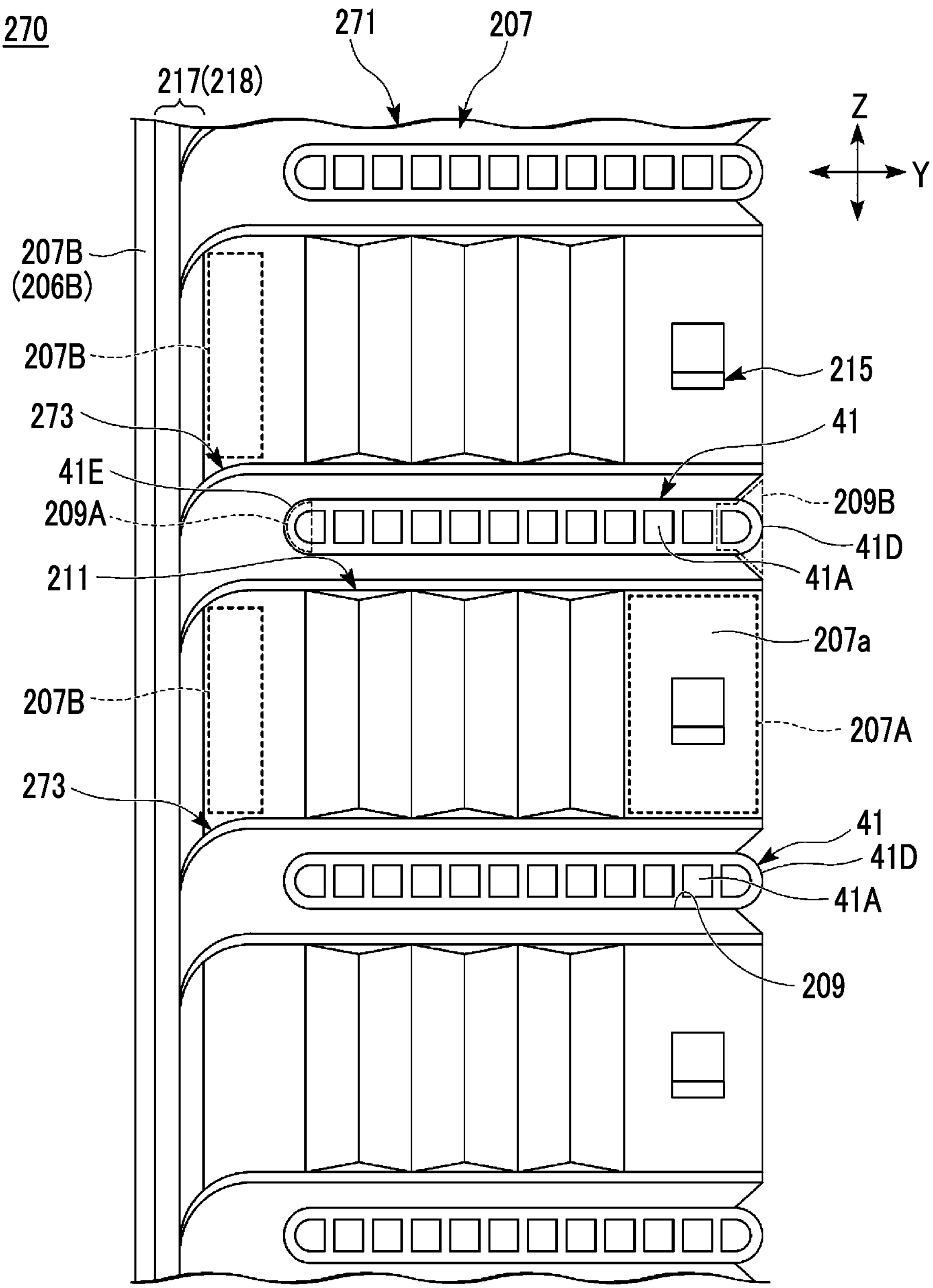

270
271
207
217(218)
Z
Y
207B
(206B)
207B
215
273
41
41E
209B
209A
41D
211
41A
207a
207B
207A
273
41
41D
41A
209

FIG. 40

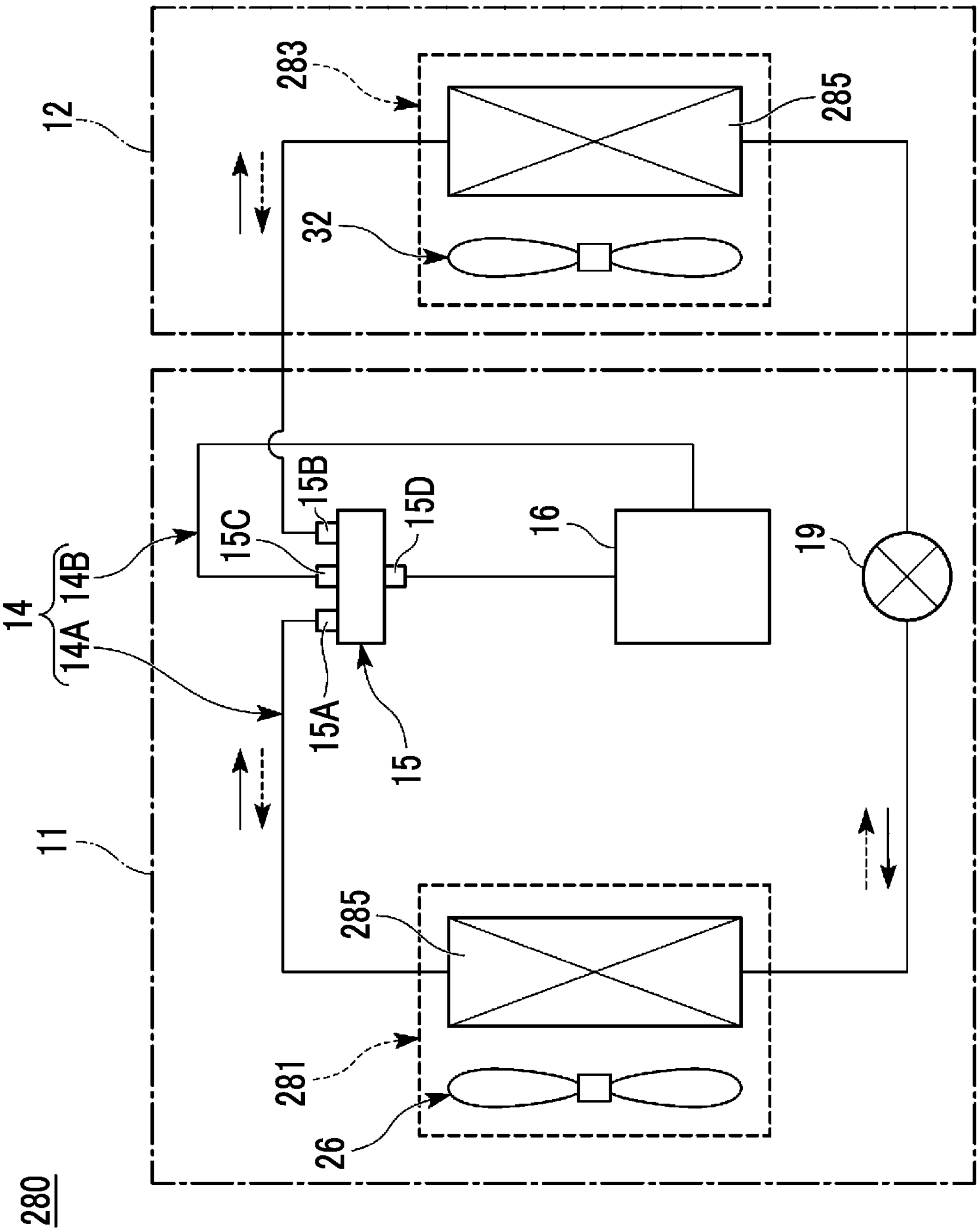


FIG. 41

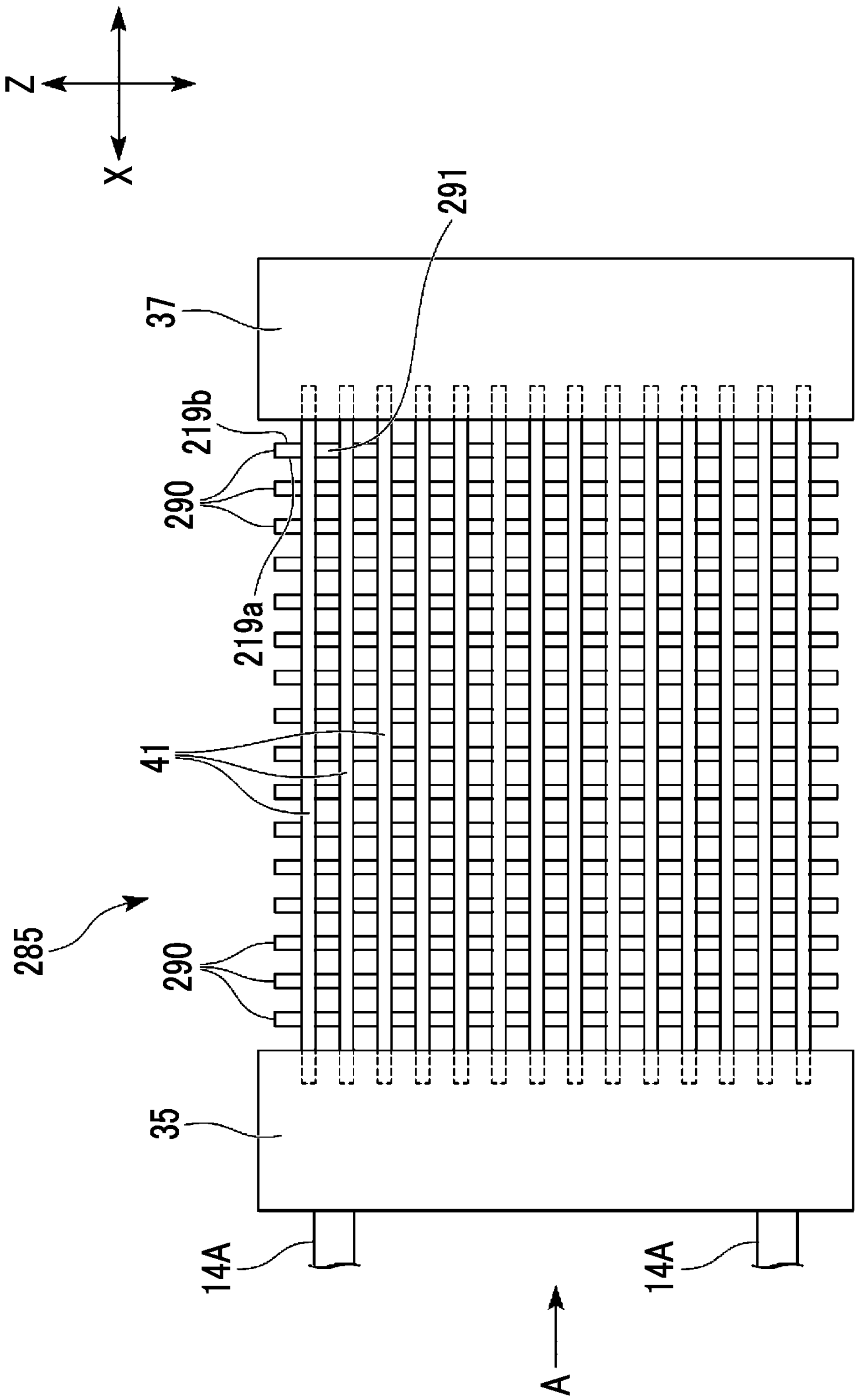


FIG. 42

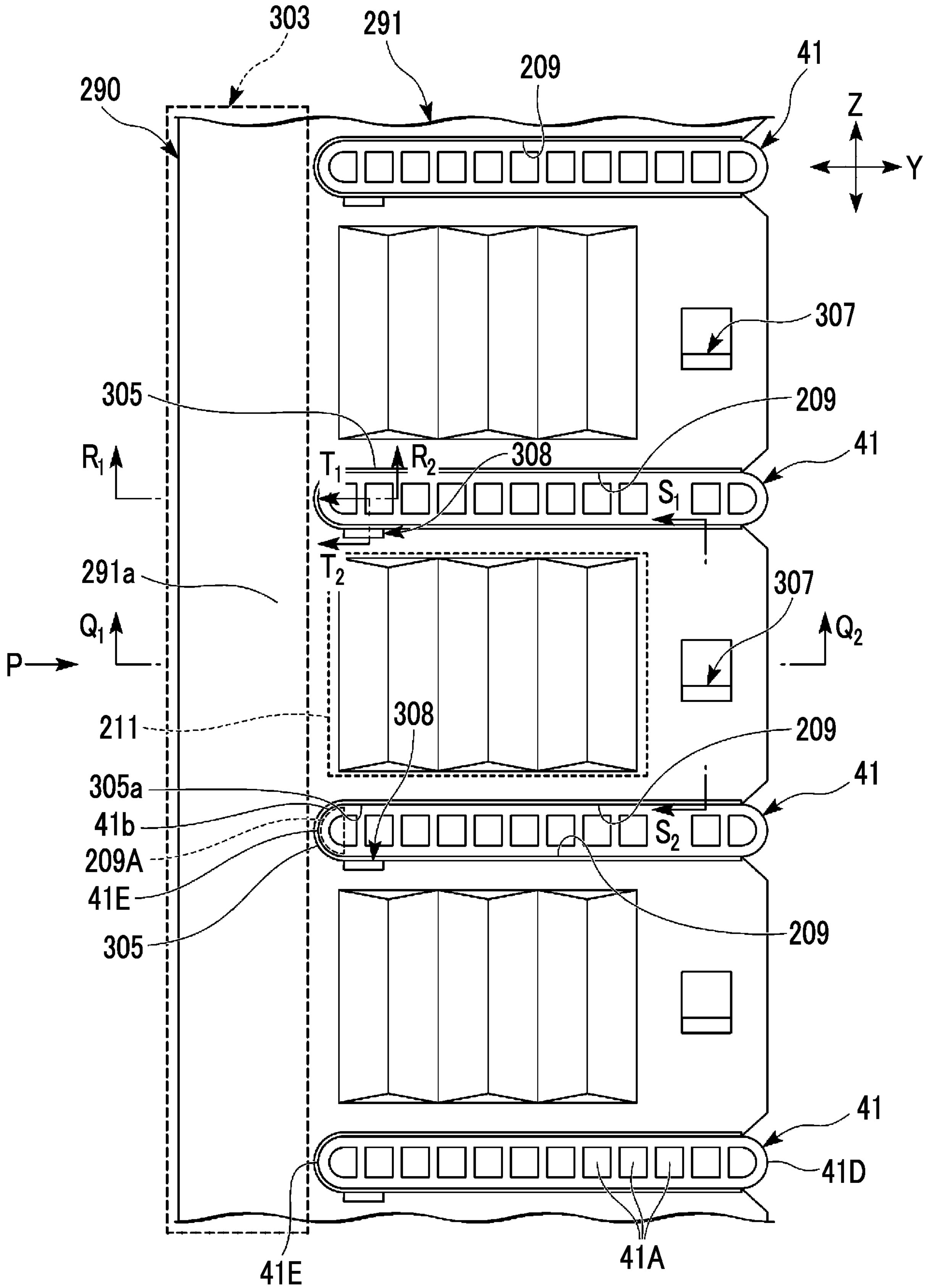

303
291
209
41
290
Z
Y
307
305
209
R1
T1
R2
308
41
S1
291a
T2
307
Q1
Q2
P
211
308
209
305a
41b
209A
41E
305
41
S2
209
41
41D
41E
41A

FIG. 43

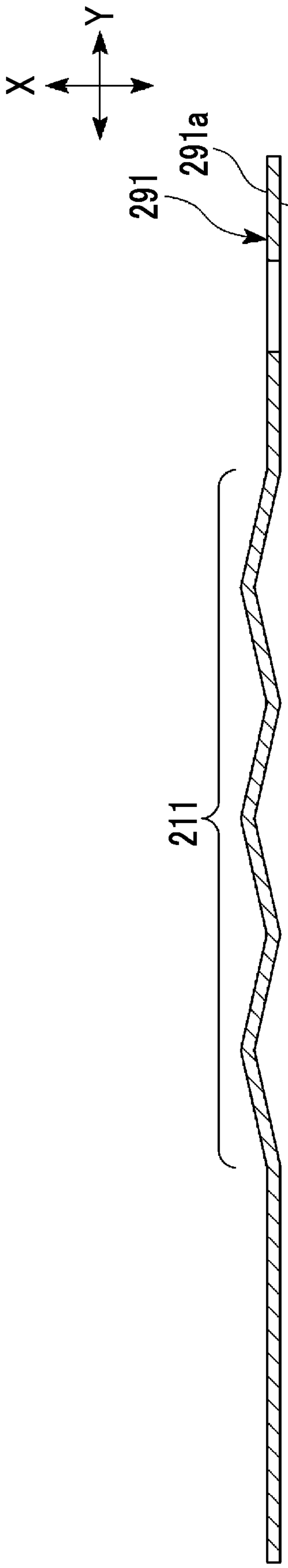


FIG. 44

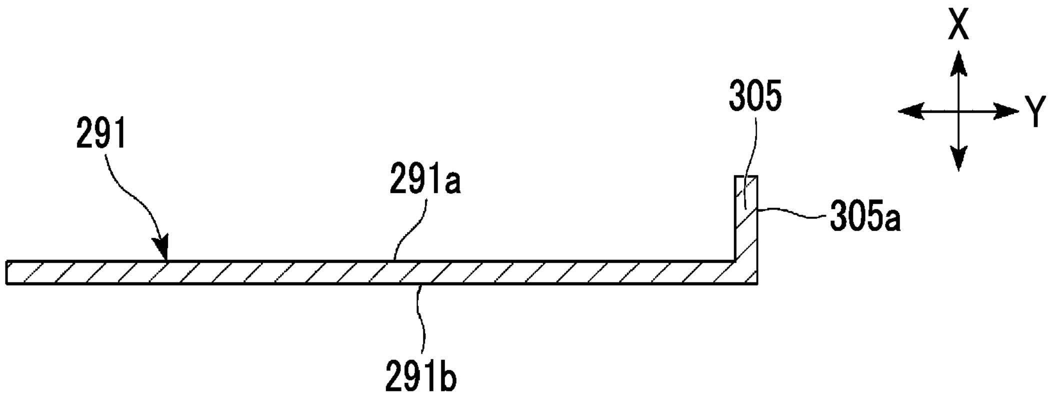


FIG. 45

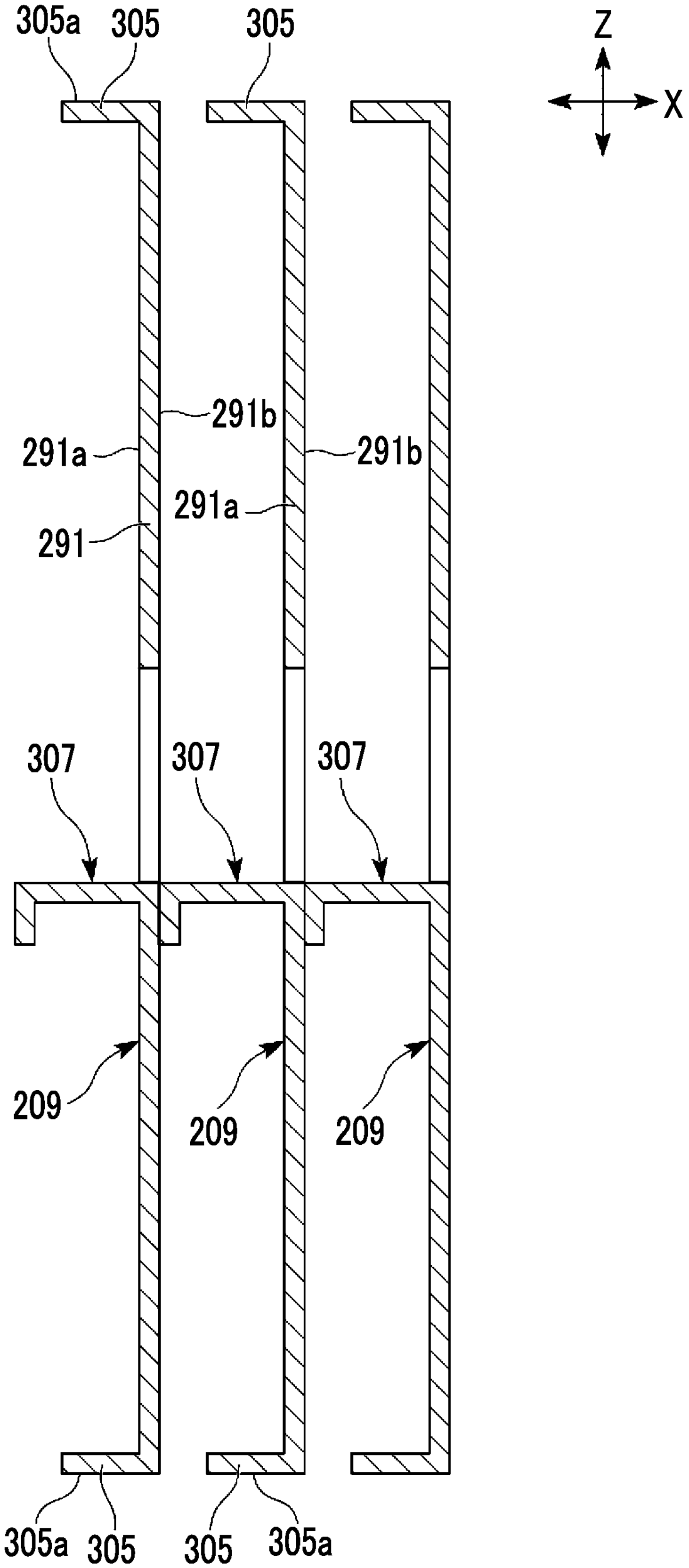

305a
305
305
Z
X
291b
291a
291b
291a
291
307
307
307
209
209
209
305a
305
305
305a

FIG. 46

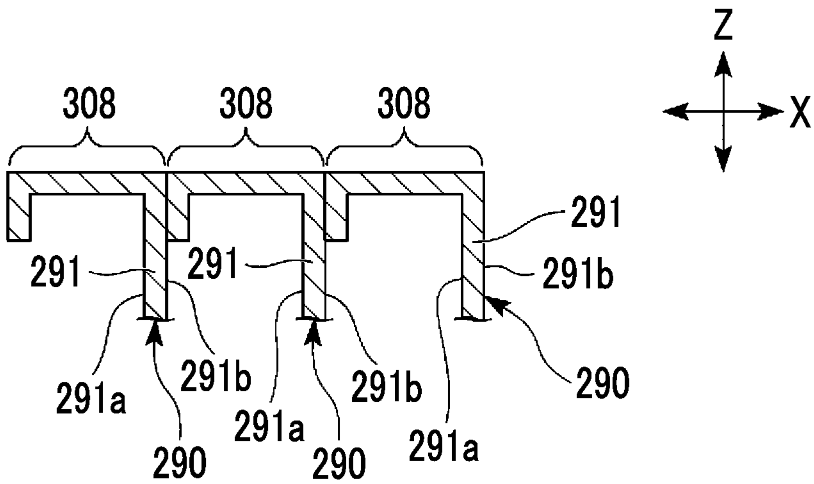
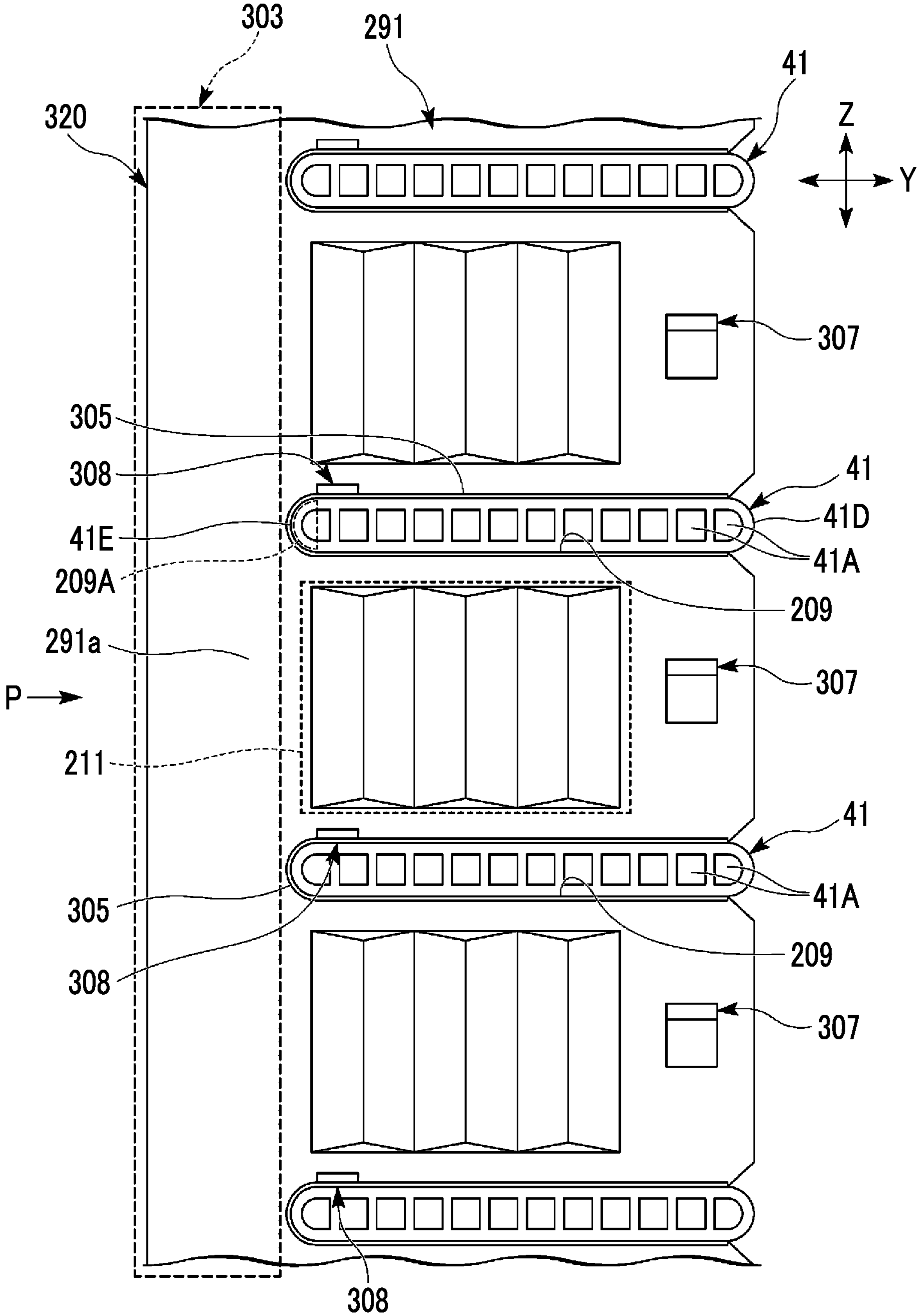

Z
X
308
308
308
291
291
291
291b
291b
291b
291a
291a
291a
290
290
290

FIG. 47


303
291
41
320
Z
Y
307
305
308
41
41D
41E
41A
209A
209
291a
307
P
211
41
305
41A
209
308
307
308

REFERENCES CITED IN THE DESCRIPTION

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Patent documents cited in the description

- JP 2020105446 A **[0001]**
- JP 5754490 B **[0020]**
- JP 5397489 B **[0020]**
- WO 2019239519 A **[0020]**