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(71) Applicant: **Zexel Valeo Climate Control Corporation**
Ohsato-gun,
Saitama 360-0193 (JP)

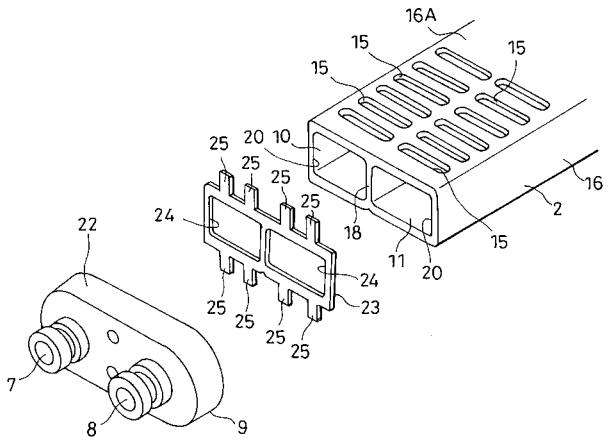
(72) Inventors:
- **TAKAYANAGI,Naoto,**
  Zexel Valeo Climate Control Corp
  Osato-gun, Saitama 3600193 (JP)
- **ETO, Yoshihisa,**
  Zexel Valeo Climate Control Corp.
  Osato-gun,Saitama 3600193 (JP)
- **OHATA, Hajime,**
  Zexel Valeo Climate Control Corp.
  Osato-gun, Saitama 3600193 (JP)
- **AKAIKE, Jun,**
  Zexel Valeo Climate Control Corp.
  Osato-gun, Saitama 3600193 (JP)

(74) Representative: **Hofmann, Harald**
Sonnenberg Fortmann,
Patent- & Rechtsanwälte,
Postfach 33 08 65
80068 München (DE)

(54) CONNECTION STRUCTURE BETWEEN HEAT EXCHANGER TANK AND CONNECTOR

(57) Projected portions 34 formed at the external circumferential edge of a tank 2 are made to engage with, at least, groove portions 36 formed at a brazing filler metal supplying member 23 and groove portions 39 formed at a connector 9 to hold the tank 2, the brazing filler metal supplying member 23 and the connector 9 together in a stable state prior to the brazing process. The structure provides a reliable means for supplying brazing filler metal material to be used to braze a tank not clad with a brazing filler metal layer and a connector formed through machining. In addition, it effectively prevents the member constituting the means for brazing filler metal supply from coming off.

FIG. 5



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Description

TECHNICAL FIELD

[0001] The present invention relates to a structure that may be adopted when connecting a tank in a heat exchanger such as an evaporator with a device constituting a refrigerating cycle such as an expansion valve or a pipe via a connector.

BACKGROUND ART

[0002] A heat exchanger connector (may also be referred to as an expansion valve mounting member) bonded to an opening of a tank in a heat exchanger (such as an evaporator) to communicate with the inner space of the heat exchanger and having intake/outlet portions to which another component (such as an expansion valve) constituting a refrigerating cycle is directly connected and a heat exchanger having such a connector are known in the related art (see, for instance, Japanese Unexamined Patent Publication No. H8-94209 and Japanese Unexamined Patent Publication No. H 10-206069).

[0003] A connector connected to an opening of a tank in a heat exchanger and used to achieve a pipe connection with another component constituting the refrigerating cycle and a heat exchanger having such a connector are also known in the related art (see, for instance, Japanese Unexamined Patent Publication No. H9-72630).

[0004] In recent years, heat exchangers having tanks and heat exchanging tubes formed independently of each other are often manufactured by forming the tanks through extrusion molding in order to reduce the manufacturing cost and the like (see, for instance, Japanese Unexamined Patent Publication No. 2001-221590).

[0005] However, when the extrusion molding method is adopted in the tank production, it is difficult to clad the outer surface of a tank with a brazing filler metal. It is also difficult to clad the outer surface of a connector formed through machining with a brazing filler metal. Thus, when such a connector is to be bonded with the heat exchanging medium intake/outlet portions of the tank, a reliable manner with which the brazing filler metal to be used during the furnace brazing process is supplied needs to be worked out.

[0006] Japanese Unexamined Patent Publication No. 2001-221590 mentioned above, however, simply states in paragraph [0041] that "the connector 6 is bonded to the header pipe 3 through brazing", without mentioning any specific means for supplying the brazing filler metal.

[0007] The applicant of the present invention conceived a means for supplying a brazing filler metal material, achieved by disposing a brazing filler metal supplying member between the tank and the connector. In order to assure a reliable supply of the brazing filler metal with the brazing filler metal supplying means, it must be ensured that the brazing filler metal supplying member does not come off prior to the brazing process.

[0008] Accordingly, an object of the present invention is to provide a reliable brazing filler metal supplying means for supplying the brazing filler metal to be used to braze a tank having no brazing filler metal layer formed at the surface thereof to a connector formed through machining while ensuring that the member constituting the brazing filler metal supplying means does not come off.

DISCLOSURE OF THE INVENTION

[0009] In order to achieve the object described above, a connection structure according to the present invention to be adopted when bonding a heat exchanger tank with a connector, comprising a heat exchanger tank having openings each formed at one of the two side ends thereof along the direction in which tubes are layered, a connector having at least either a heat exchanging medium intake portion or a heat exchanging medium outlet portion and a brazing filler metal supplying member having formed thereat a connecting hole to communicate between an opening at the heat exchanger tank and the intake/outlet portion at the connector, is characterized in that the heat exchanger tank and the connector are brazed and bonded together with a brazing filler metal material supplied to the heat exchanger tank and the connector from the brazing filler metal supplying member clamped between one of the openings at the heat exchanger tank and the intake/outlet portion formed at the connector.

[0010] The heat exchanger tank is an extrusion-molded tank formed through extrusion molding, which is divided into a plurality of chambers by a partitioning portion along the width of the heat exchanger. In addition, the connector may be formed through, for instance, machining, and is used to connect with a device constituting a refrigerating cycle such as an expansion valve. As the description above implies, the connector, which includes at least either a heat exchanging medium intake portion or the heat exchanging medium outlet portion, may only have an intake portion or an outlet portion, as well as both an intake portion and an outlet portion. Namely, the present invention may be adopted in a heat exchanger having both an intake portion and an outlet portion disposed at an end surface on one side of the heat exchanger tank along the layering direction, or in a heat exchanger having only either an intake portion or an outlet portion disposed at an end surface on one side of the heat exchanger tank along the layering direction. The brazing filler metal supplying member may be a brazing filler metal-clad member having superficial layers of, for instance, a core member on the two sides, one toward the tank and the other toward the connector both clad with a brazing filler metal material, or it may be a brazing filler metal sheet constituted of a brazing filler metal material alone.

[0011] In addition, projected portions to be held at the heat exchanger tank and the connector are formed to extend outward at the brazing filler metal supplying member. No specific restrictions are imposed with regard to

the quantity of projected portions, as long as there are at least two such projected portions.

[0012] In the structure described above, a recessed portion extending along the direction of airflow is formed on a side ranging along the direction of airflow at the outer edge of the opening at the tank and a recessed portion extending along the direction of airflow is also formed at a side of the connector ranging along the direction of airflow and located toward the brazing filler metal supplying member.

[0013] A projected portion extending along the longer side of the tank may be formed at the external circumferential edge of the opening at the tank, groove portions at which the projected portions are to be engaged may be formed at sides of the brazing filler metal supplying member, and groove portions at which the projected portions are to be engaged may also be formed at sides of the connector toward the brazing filler metal supplying member. At least one such projected portion should be formed at a position on the upstream side along the direction of airflow and at least one such projected portion should be formed at a position on the downstream side along the direction of airflow. In addition, a second projected portion extending along the longer side of the tank should be formed at the partitioning portion, with an insertion whole at which the second projected portion can be inserted formed between connecting holes at the brazing filler metal supplying member.

[0014] Yet another connection structure according to the present invention that may be adopted when bonding a heat exchanger tank with a connector, comprising a heat exchanger tank having openings each formed at one of the two side ends thereof along the direction in which tubes are layered and a connector having either a heat exchanging medium intake portion or a heat exchanging medium outlet portion, is characterized in that the heat exchanger tank is an extrusion-molded tank formed through extrusion molding, that the connector is constituted with an assembly achieved by combining a pipe portion formed through machining with a plate portion having two surfaces thereof clad with a brazing filler metal material, and that the tank and the connector are brazed and bonded together with the brazing filler metal supplied to the heat exchanger tank and the connector by disposing the plate portion between the tank and the pipe portion. Such a heat exchanger tank, too, may be divided into a plurality of chambers with a partitioning portion along the width of the heat exchanger. The connector is used to connect the tank with a pipe used to achieve a pipe connection with a device constituting the refrigerating cycle.

[0015] Yet another connection structure according to the present invention that may be adopted when bonding a heat exchanger tank with a connector, comprising a heat exchanger tank having openings formed at the two side ends along the direction in which tubes are layered, a connector having at least either a heat exchanging medium intake portion or a heat exchanging medium outlet portion, a brazing filler metal supplying member having formed thereat a connecting hole to communicate between an opening at the heat exchanger tank and the intake/outlet portion at the connector, a first jig that is allowed to come in contact with a surface of the connector located on a side opposite from the brazing filler metal supplying member and a second jig that is allowed to come into contact with a surface of the heat exchanger tank on a side opposite from the connector, is characterized in that the brazing filler metal supplying member is held by first clamping the brazing filler metal supplying member between one of the openings at the heat exchanger tank and the intake/outlet portion formed at the connector, placing the first jig in contact with the connector, placing the second jig in contact with the heat exchanger tank and then binding the first jig, the connector, the brazing filler metal supplying member, the heat exchanger tank and the second jig together with a binding member. Recessed retaining portions are formed at the first jig and the second jig on the two sides of the heat exchanger 1 along the layering direction so that the jigs, the connector, the brazing filler metal supplying member and the tank can be wound together with the binding wire member with ease and also that the winding positions can be determined easily. The binding member may be, for instance a metal wire.

BRIEF DESCRIPTION OF THE DRAWINGS

[0016]

FIG. 1(a) is a front view showing the overall structure of a heat exchanger that includes a heat exchanger tank according to the present invention and FIG. 1(b) is a side elevation of the overall structure of the heat exchanger, viewed from the side on which the heat exchanging medium intake/outlet portions are located;

FIG. 2(a) illustrates the tank disposed on the tube upper-end side in the heat exchanger in FIG. 1 and FIG. 2(b) illustrates the tank disposed on the tube lower-end side in the heat exchanger in FIG. 1;

FIG. 3(a) shows heat exchanging tubes and fins in the heat exchanger in FIG. 1 and FIG. 3(b) is a sectional view of a tank in the heat exchanger;

FIGS. 4(a), 4(b) and 4(c) show the structure of a connector that may be used to connect a tank to an expansion valve;

FIG. 5 illustrates a structure having a brazing filler metal supplying member disposed between the tank and the connector to enable brazing of the tank and the connector;

FIG. 6 shows an example of a variation of the embodiment shown in FIG. 5;

FIGS. 7(a) and 7(b) illustrate a heat exchanger adopting a structure different from that of the heat exchanger in FIG. 1 and the like;

FIG. 8 illustrates the position at which the brazing

filler metal supplying member is disposed in the heat exchanger in FIG. 7;

FIG. 9 presents an example of a variation of the embodiment shown in FIG. 8;

FIG. 10(a) illustrates an example in which the brazing filler metal supplying member is held in a manner different from all of the preceding embodiments and FIG. 10(b) shows the surface of the brazing filler metal supplying member on the opposite side;

FIG. 11 is a partial sectional view showing the connector, the brazing filler metal supplying member and the tank in an assembled state; and

FIGS. 12(a), 12(b) and 12(c) illustrate the connector, the brazing filler metal supplying member and the tank held on the two sides along the longer side of the tank by using jigs and metal wire.

BEST MODE FOR CARRYING OUT THE INVENTION

[0017] The following is a detailed explanation of the present invention, given in reference to the attached drawings.

[0018] A heat exchanger 1 shown in FIGS. 1, 2 and 3 is used as an evaporator that constitutes a refrigerating cycle in, for instance, an automotive air-conditioning system. The heat exchanger 1, which is assembled through furnace brazing, includes a pair of tanks 2 and 3, a plurality of heat exchanging tubes 4 communicating between the tanks 2 and 3, corrugated outer fins 5 layered so as to alternate with the heat exchanging tubes 4, side plates 6 and 6 disposed further outward relative to the outer fins located at the two ends along the layering direction and a connector 9 disposed at one end of the tank 2 along its longer side. In this embodiment, the connector 9 includes a heat exchanging medium intake portion 7 and a heat exchanging medium outlet portion 8, and is connected with an expansion valve (not shown).

[0019] In the heat exchanger 1, the heat exchanging medium fed from the expansion valve (not shown) flows into the side of the tank 2 where a chamber 10 is located via the intake portion 7, the heat exchanging medium is then allowed to travel between the tanks 2 and 3 via the heat exchanging tubes 4, heat exchange with the air passing between the outer fins 5 is induced as the heat exchanging medium travels between the tanks and finally the heat exchanging medium is let out from the side of the tank 2 where a chamber 11 is located via the outlet portion 8.

[0020] As shown in FIG. 3, the heat exchanging tubes 4 are oblate tubes each having the two ends thereof along the lengthwise direction, which are inserted at the tanks 2 and 3, formed as open ends, with a heat exchanging medium flow passage 13 formed therein and inner fins 14 housed therein. The heat exchanging tubes 4 are formed by rolling a single thin sheet member constituted of metal with a high level of conductivity such as aluminum in the embodiment.

[0021] The tanks 2 and 3, which are disposed so as to face opposite each other over a predetermined distance, are extrusion-molded tanks each having as its principal structural component, a cylindrical body 16 formed through extrusion molding. For this reason, no brazing filler metal layer is clad on the surfaces of the cylindrical bodies 16.

[0022] To explain the tanks 2 and 3 mainly in reference to FIGS. 3(b) and 5, the tanks 2 and 3 each include a tube insertion hole formation surface 16A where tube insertion holes 15 at which the heat exchanging tubes 4 are inserted are formed. While each tank includes openings 20 formed at the two ends along the longer side thereof, the openings 20, except for the one located near the connector 9, are blocked off with caps 12, as shown in FIGS. 1 and 2. The tanks 2 and 3 each include a partitioning portion 18 formed as an integrated part of the cylindrical body 16 so as to extend along the direction in which the heat exchanging tubes 4 are layered as shown in FIG. 5 and thus, the space inside each of the tanks 2 and 3 is divided into the chamber 10 and the chamber 11 defined side-by-side along the direction of airflow.

[0023] The chambers 10 and 11 at the tank 2 are each partitioned along the direction of airflow and thus, the chambers 10 and 11 are further divided into sub-chambers 10a and 10b and sub-chambers 11a and 11b respectively. In order to achieve a four-pass flow of the heat exchanging medium, the sub-chamber 10b and the sub-chamber 11b are made to communicate via a communicating passage 17. The chambers and 11 at the tank 2 are respectively divided into the sub-chambers 10a and 10b and the sub-chambers 11a and 11b by inserting partitioning members 21 formed as separate members independent of the cylindrical body 16 through slits 19 and 19 formed at the cylindrical body 16 of the tank 3.

[0024] As shown in FIG. 4, the connector 9 is constituted with a connector main body 22 assuming the form of a block, the heat exchanging medium intake portion 7 passing through the connector main body 22 and the heat exchanging medium outlet portion 8 likewise passing through the connector main body 22. As the connector 9 is formed through machining, no brazing filler metal layer is clad on the surface of the connector main body 22. In this embodiment, the width of the openings 20 and 20 at the tank 2 is smaller than the distance between the intake portion and the outlet portion at the expansion valve (not shown) and, for this reason, the intake portion 7 is formed by offsetting an extension valve-side intake 7A and a tank-side intake 7B with the two intakes 7A and 7B made to communicate with each other at an approximate center of the connector main body 22. The outlet portion 8 in the embodiment assumes a substantially cylindrical shape over the area ranging from the connector main body 22 through an approximate center and is flattened along the vertical direction over the area ranging from the approximate center through the tank 2.

[0025] Since neither the surface of the cylindrical body 16 at the tank 2 or the surface of the connector main body 22 at the connector 9 is clad with a brazing filler metal

layer, a brazing filler metal supplying member 23 is held between the tank and the connector as a means for connecting them to each other, as shown in FIG. 5, instead of directly placing the openings 20 in contact with the intake/outlet portions 7 and 8.

[0026] This brazing filler metal supplying member 23 may be a brazing filler metal clad member having a brazing filler metal material clad onto the surfaces of a core material on the two sides, one toward the tank 2 and the other toward the connector 9 or it may be a brazing filler metal sheet constituted of a brazing filler metal material alone. At the brazing filler metal supplying member 23, connecting holes 24 and 24 are formed so as to communicate with the openings 20 and 20 and the intake/outlet portions 7 and 8 at the connector 9. Thus, as the heat exchanger 1 is placed inside the furnace with the connecting holes 24 and 24 at the brazing filler metal supplying member 23 aligned with the openings 20 and 20 and the intake/outlet portions 7 and 8, the surface layer of the brazing filler metal supplying member or substantially the entirety of the brazing filler metal supplying member becomes melted and, as a result, the brazing filler metal is supplied into the space between the edge surface around the openings at the cylindrical body 16 and the connector main body 22, thereby enabling furnace brazing of the tank 2 and the connector main body 22.

[0027] At the brazing filler metal supplying member 23, four projected portions 25, each constituted as a thin tab projecting from an edge along the width of the tank toward the outside, are formed on both the upper and lower sides. Thus, by bending the projected portions as appropriate, e.g., by bending the two sets of projected portions 25 at the ends toward the tank 2 and bending the two sets of projected portions 25 at the center toward the connector 9, as shown in FIG. 6, the brazing filler metal supplying member 23 can be firmly fitted with both the connector 9 and the tank 2 even before the brazing process. As a result, the risk of the brazing filler metal supplying member 23 coming off or becoming offset from the predetermined position while assembling the heat exchanger 1, transferring the heat exchanger 1 to the furnace and the like is eliminated.

[0028] In addition, as shown in FIG. 6, recessed portions 13 extending along the direction of airflow may be formed, each on one of the two sides of the surface ranging along the direction of airflow, at the edges of the openings 20 at the cylindrical body 16 constituting the tank 2, and recessed portions 26 and 26 extending along the direction of airflow on the two sides of the surfaces ranging along the direction of airflow at the outer edge areas of the intake and outlet portions 7 and 8 may be formed at the connector main body 22 constituting the connector 9 on the side toward the brazing filler metal supplying member 23. In this case, when the projected portions 25 at the brazing filler metal supplying member 23 are bent, their front ends can be inserted at the recessed portions 26, which will assure a higher level of coupling strength than that achieved by coupling the brazing filler metal supplying member with the cylindrical body 16 over flat surfaces.

[0029] FIG. 7 shows a heat exchanger 1 adopting a structure different from that of the heat exchanger 1 in FIG. 1 and the like. The chambers 10 and 11 in the tank 3 in this heat exchanger 1 are further divided respectively into sub-chambers 10a and 10b and sub-chambers 11a and 11b by inserting partitioning members 21 through slits 19 and 19, with a communicating passage 17 formed so as to communicate between the sub-chamber 10b and the sub-chamber 11b. It is to be noted that since the positional arrangement and the like of the sub-chambers 10a, 10b, 11a and 11b at the tank 3 are very similar to those adopted at the tank 2 in FIG. 2, their illustration is not provided.

[0030] The heat exchanger in FIG. 7, however, includes connectors 9, i.e., a connector 9A and a connector 9B, each used to connect the heat exchanger 1 via a pipe having one end thereof connected to a refrigerating cycle component such as an expansion valve.

[0031] The connector 9A constituting the outlet portion 8 is installed through a side hole formed at the cylindrical body 16 at a position toward the sub-chamber 11a. In this embodiment, the connector 9B constituting the intake portion 7 is formed through cold machining and includes a pipe portion 27 extending toward the outlet portion 8 along the direction of airflow and distended portions 28 and 29 formed at the circumferential surface of the pipe portion, which can be fitted into the openings 20 and 20 to close off the openings 20 and 20. An opening 30 for achieving communication with the sub-chamber 11b is formed at the distended portion 28. No brazing filler metal layer is clad on the surface of the connector 9B. It is to be noted that the openings 20 at the tank 3 to connect with the connector 9B are formed at a position backed off further toward the center of the layered assembly of the heat exchanging tubes 4 relative to the side plate 6 so as to ensure that the dimensions of the connector 9B ranging along the radial direction do not cause an increase in the overall size of the heat exchanger 1 when the connector 9B is mounted at the openings 20.

[0032] The connector 9B and the cylindrical body 16 constituting the tank 3, too, are brazed together by using the brazing filler metal supplying member 23 disposed between them, as shown in FIG. 8, instead of directly setting the openings 20 and the intake/outlet portions 7 and 8 in contact with each other. After the heat exchanger 1 is placed in the furnace, the surface layer or substantially the entirety of the brazing filler metal supplying member 23 becomes melted and, as a result, the brazing filler metal material is supplied into the space between the connector 9B and the cylindrical body 16 constituting the tank 3, which makes it possible to braze the connector 9B and the cylindrical body 16 at the tank 3 together in the furnace. The brazing filler metal supplying member in the embodiment also includes projected portions 25 formed thereat, and the brazing filler metal supplying

member is fitted onto both the connector 9B and the tank 3 with the projected portions 25 to prevent the brazing filler metal supplying member 23 from coming off and the like prior to the brazing process.

[0033] As shown in FIG. 9, the connector 9B may be constituted with two members independent of each other, i.e., a substantially L-shaped plate portion 32 having the distended portions 28 and 29 with the opening 30 formed at the distended portion 29 and the pipe portion 27 having an opening 31 to communicate with the opening 30. The plate portion 32 may be clad with a brazing filler metal layer on each of the surfaces on the two sides thereof. This structure makes it possible to braze the connector 9B and the tank 3 in the furnace without having to use the brazing filler metal supplying member 23. In addition, the plate portion 32 may include projected portions 33 to be used to lock onto the pipe portion 27. This structure will eliminate the risk of the pipe portion 27 becoming offset from the predetermined position while the heat exchanger 1 is being assembled or while the heat exchanger is being transferred into the furnace.

[0034] Now, another embodiment that may be adopted when connecting the tank 2 and the connector 9 to each other is explained in reference to FIGS. 10 and 11. It is to be noted that the same reference numerals are assigned to components similar to those in the previous embodiments to preclude the necessity for a repeated explanation thereof.

[0035] The embodiment shown in FIGS. 10 and 11 includes projected portions 34 and 34 each extending along the longer side of the tank 2 from a position at the external circumferential edge of an opening at the tank 2. In addition, groove portions 36 and 36 to engage the projected portions 34 and 34 are formed at the sides of the brazing filler metal supplying member 23 and groove portions 39 and 39 at which the projected portions 34 and 34 are also to be engaged are formed at the two sides of the connector 9 toward the brazing filler metal supplying member 23. A recessed portion 40 indented inward is formed at each of the groove portions 39 at the connector 9 at a position on the side opposite from the tank 2. A projected portion 35 is formed at the partitioning portion 18 so as to extend along the longer side of the tank 2 from the end of the partitioning portion 18 where the tank 2 opens. Also, an insertion hole 38 passing through from the tank side to the side opposite from the tank is formed at the brazing filler metal supplying member 23 at a position between the connecting holes 24 and 24. It is to be noted that the projected portion 35 projects by an extent that allows it to project out beyond the insertion hole 38 toward the side opposite from the tank by a predetermined degree.

[0036] The structure described above enables, for instance, the following manufacturing steps. Namely, the brazing filler metal supplying member 23 is mounted at the tank 2 so as to engage the projected portions 34 at the tank 2 at the groove portions 36 at the brazing filler metal supplying member 23 and insert the projected portion 35 at the tank 2 through the insertion hole 38 at the brazing filler metal supplying member 23. With the projected portions 34 engaged at the groove portions 36 and the projected portion 35 inserted at the insertion hole 38, the brazing filler metal supplying member 23 being mounted at the tank 2 can be positioned with ease.

[0037] Next, the front end of the projected portion 35 projecting out beyond the insertion hole 38 at the brazing filler metal supplying member 23 is either bent or crushed. With this, it is ensured that the projected portion 35 does not slip out of the insertion hole 38 and thus, the brazing filler metal supplying member 23 becomes secured at the tank 2, which disallows any positional misalignment of the brazing filler metal supplying member 23 during the manufacturing process.

[0038] Then, with the projected portions 34 at the tank 2 engaged at the groove portions 39 at the connector 9, the intake/outlet portions 8 and 9 at the connector, which are present toward the tank 2, are inserted through the connecting holes 24 and 24 at the brazing filler metal supplying member 23 and also through the openings 20 and 20 at the tank 2. Finally, the front ends of the projected portions 34 at the tank 2 are pressed into the recessed portions 40 at the connector 9 by forcibly pressing the front ends of the projected portion 34 inward, and thus, the tank 2 and the connector 9 are caulked together and the brazing filler metal supplying member 23 present between the tank 2 and the connector 9 becomes held firmly on both sides by the projected portions 34 and 34.

[0039] With the tank 2, the brazing filler metal supplying member 23 and the connector 9 fitted firmly together as described above, the connector 9 or the brazing filler metal supplying member 23 is not allowed to come off inside the furnace during the brazing process.

[0040] While the tank 2, the brazing filler metal supplying member 23 and the connector 9 are firmly fitted together by interlocking the projected portions 34 at the tank with the groove portions 36 at the brazing filler metal supplying member 23, the groove portions 39 at the connector 9 and the recessed portions 40 at the connector 9 as described above, the reliability of their coupling is further enhanced by inserting the projected portion 35 at the tank 2 through the insertion hole 38 at the brazing filler metal supplying member 23. However, the projected portion 35 and the insertion hole 38 are not essential structural requirements and they may be omitted in order to reduce the production costs.

[0041] Yet another embodiment that may be adopted when connecting the tank 2 with the connector 9 is explained in reference to FIG. 12. It is to be noted that the same reference numerals are assigned to components similar to those in the previous embodiments to preclude the necessity for a repeated explanation thereof.

[0042] In the embodiment shown in FIG. 12, the brazing filler metal supplying member 23 is held fast with two jigs 41 and 42 and a wire 44. Namely, the jigs 41 and 42 each include a retaining portion 45 assuming a semispherical recessed shape to hold the wire 44 in place.

The retaining portions are formed on the two sides along the direction in which the tubes are layered to constitute the heat exchanger 1. While the jig 42 has an external shape having a sectional area substantially equal to the sectional area of the cylindrical body 16, the jig 41 assumes an external shape with a somewhat greater width along the direction of airflow than the connector 9 so as to retain the wire 44 easily. It is to be noted that air bleeding holes 43 through which the air in the heat exchanger 1 is released to the outside are formed at the jig 41 at the positions at which they will face opposite the openings at the intake/outlet portions 7 and 8 during the mounting process.

[0043] In this case, while the heat exchanger 1 is in a preassembled state with the brazing filler metal supplying member 23 disposed between the connector 9 and the cylindrical body 16 at the tank 2, the jig 41 is set in contact with the tank 2 and the connector 9, the jig 42 is set in contact with the surface of the tank 2 on the opposite side from the side where the connector 9 is present, the wire 44 is threaded through the recesses formed at the retaining portions 45 of the jigs 41 and 42 and the two ends of the wire 44 are tied together at a desirable position (the front side of the jig 41 in this example) by ensuring that the wire 44 is maintaining the desired level of tension. As a result, the connector 9, the brazing filler metal supplying member 23 and the tank 2 become bound and held together. Since this eliminates the need to form special portions at the connector 9, the brazing filler metal supplying member 23 and the tank 2 for preventing the brazing filler metal supplying member 23 from coming off, saving in the manufacturing costs is achieved.

INDUSTRIAL APPLICABILITY

[0044] According to the present invention disclosed in claims 1 through 8, a tank and a connector can be brazed in a furnace with ease with a brazing filler metal supplied into the space between the tank and the connector from a brazing filler metal supplying member without having to clad a brazing filler metal material onto the outer surfaces of the tank and the connector while manufacturing a heat exchanger having the intake portion and the outlet portion both disposed at an end surface of the heat exchanger tank on one side along the layering direction or a heat exchanger having only either the intake portion or the outlet portion disposed at an end surface of the heat exchanger tank on one side along the layering direction. As a result, it becomes substantially possible to use a heat exchanger tank formed through extrusion molding in combination with a connector formed through machining.

[0045] In particular, according to the present invention disclosed in claims 3 and 4, projected portions formed at the brazing filler metal supplying member are bent to hold onto the tank and the connector, which makes it possible to hold together the tank, the brazing filler metal supplying member and the connector in a stable manner prior to the brazing process to eliminate the risk of the brazing filler metal supplying member coming off prior to the brazing process and to facilitate the manufacturing process.

[0046] According to the present invention disclosed in claim 4, the brazing filler metal supplying member, the tank and the connector are held together even more firmly, and thus, the tank, the brazing filler metal supplying member and the tank can be coupled in an even more stable manner.

[0047] In particular, according to the present invention disclosed in claim 5, projected portions formed at the external circumferential edge of the tank are made to engage with groove portions formed at the brazing filler metal supplying member and then with groove portions formed at the connector. Since this allows the tank, the brazing filler metal supplying member and the connector to be held together in a stable manner prior to the brazing process, the risk of the brazing filler metal supplying member coming off prior to the brazing process is eliminated and the manufacturing process is facilitated. Holes extending toward the center may be formed at the groove portions of the connector, and the front ends of the projected portions may be bent inward to be inserted at these holes.

[0048] In addition, according to the present invention disclosed in claim 6, a second projected portion formed at the partitioning portion of the tank is inserted at a hole formed at the brazing filler metal supplying member and then the second projected portion is crushed or the like inside the hole to prevent any misalignment, which might allow the opening on one side and the connecting hole on the other side to communicate with each other, from occurring during the brazing process. As a result, the tank and the brazing filler metal supplying member can be held together with even more accuracy and reliability.

[0049] According to the present invention disclosed in claim 7, the brazing filler metal material can be supplied from the plate portion into the space between the tank and the pipe portion of the connector without cladding the surface of the tank with the brazing filler metal while manufacturing a heat exchanger having only either the intake portion or the outlet portion disposed at an end surface of the heat exchanger tank on one side along the layering direction. As a result, it becomes substantially possible to connect a tank formed through extrusion molding to the pipe portion of a connector formed through machining. Furthermore, since the brazing filler metal is supplied from the plate portion of the connector, a brazing filler metal supplying member constituted with a brazing filler metal clad member or a brazing filler metal sheet is no longer required.

[0050] According to the present invention disclosed in claim 8, special portions for preventing slippage of the brazing filler metal supplying member do not need to be formed at the connector, the brazing filler metal supplying member and the tank, and thus, the manufacturing cost can be lowered.

Claims

1. A connection structure for bonding a heat exchanger tank with a connector, comprising:

   a heat exchanger tank (2) having opening each formed at one of the two side ends thereof along the direction in which tubes are layered;
   a connector (9) having at least either a heat exchanging medium intake portion (7) or a heat exchanging medium outlet portion (8); and
   a brazing filler metal supplying member (23) having formed thereat a connecting hole to communicate between an opening at said heat exchanger tank (2) and said intake/outlet portion at said connector (9),
   wherein said heat exchanger tank (2) and said connector (9) are brazed and bonded together with a brazing filler metal material supplied to said heat exchanger tank (2) and said connector (9) from said brazing filler metal supplying member (23) held between one of the openings at said heat exchanger tank (2) and said intake/outlet portion (7,8) formed at said connector (9).

2. A connection structure for bonding a heat exchanger tank with a connector according to claim 1,
   wherein said heat exchanger tank (2) is an extrusion-molded tank formed through extrusion molding, which is divided into a plurality of chambers (10,11) by a partitioning portion (18) along the width of said heat exchanger (1).

3. A connection structure for bonding a heat exchanger tank with a connector according to claim 1 or 2,
   wherein projected portions (25) to be held at said heat exchanger tank (2) and said connector (9) are formed to extend outward at said brazing filler metal supplying member (23).

4. A connection structure for bonding a heat exchanger tank with a connector according to claim 3,
   wherein a recessed portion (13) extending along the direction of airflow is formed on a side ranging along the direction of airflow at said external circumferential edge of each opening at the tank (2), and a recessed portion (26) extending along the direction of airflow is also formed at a side of said connector (9) ranging along the direction of airflow and located toward said brazing filler metal supplying member (23).

5. A connection structure for bonding a heat exchanger tank with a connector according to claim 1 or 2,
   wherein a projected portion (35) extending along the longer side of the tank (2) is formed at an external circumferential edge of the opening at the tank (2), a groove portion (36) at which the projected portion (35) is to be engaged is formed at a side of said brazing filler metal supplying member, and a groove portion (39) at which the projected portion is to be engaged is also formed at a side of said connector (9) toward said brazing filler metal supplying member (23).

6. A connection structure for bonding a heat exchanger tank with a connector according to claim 4,
   wherein a second projected portion extending along the longer side of the tank is formed at said partitioning portion (18), with an insertion hole at which said second projected portion (35) can be inserted formed between said connecting holes (38) at said brazing filler metal supplying member (23).

7. A connection structure for bonding a heat exchanger tank with a connector according to claim 1 or 2, comprising:

   a heat exchanger tank (2) having openings each formed at one of the two side ends thereof along the direction in which tubes are layered; and
   a connector (9) having either a heat exchanging medium intake portion (7) or a heat exchanging medium outlet portion (8);

   wherein said heat exchanger tank (2) is an extrusion-molded tank formed through extrusion molding and said connector (9) is constituted with an assembly achieved by combining a pipe portion (27) formed through machining with a plate portion (32) having two services thereof clad with a brazing filler metal material; and
   wherein the tank (2) and said connector (9) are brazed and bonded to each other with the brazing filler metal supplied to said heat exchanger tank (2) and said connector (9) by disposing said plate portion (32) between the tank (2) and the pipe portion (27).

8. A connection structure for bonding a heat exchanger tank with a connector, comprising:

   a heat exchanger tank (2) having openings each formed at one of the two side ends thereof along the direction in which tubes (4) are layered;
   a connector (9) having at least either a heat exchanging medium intake portion (7) or a heat exchanging medium outlet portion (8);
   a brazing filler metal supplying member (23) having formed thereat a connecting hole to communicate between an opening at said heat exchanger tank (2) and said intake/outlet portion (7,8) at said connector (9) ;
   a first jig (41) that is allowed to come in contact with a surface of said connector (9) located on a side opposite from the side where said brazing

filler metal supplying member (23) is present; and

a second jig (42) that is allowed to come into contact with a surface of said heat exchanger tank (2) on a side opposite from the side where said connector (9) is present,

wherein said brazing filler metal supplying member (23) is held by first clamping said brazing filler metal supplying member (23) between one of the openings at said heat exchanger tank (2) and said intake/outlet portion (7,8) formed at said connector (9), placing said first jig (41) in contact with said connector (9), placing said second jig (42) in contact with said heat exchanger tank (2) and then binding said first jig (41), said connector (9), said brazing filler metal supplying member (23), said heat exchanger tank (2) and said second jig (42) together with a binding member.

FIG. 1

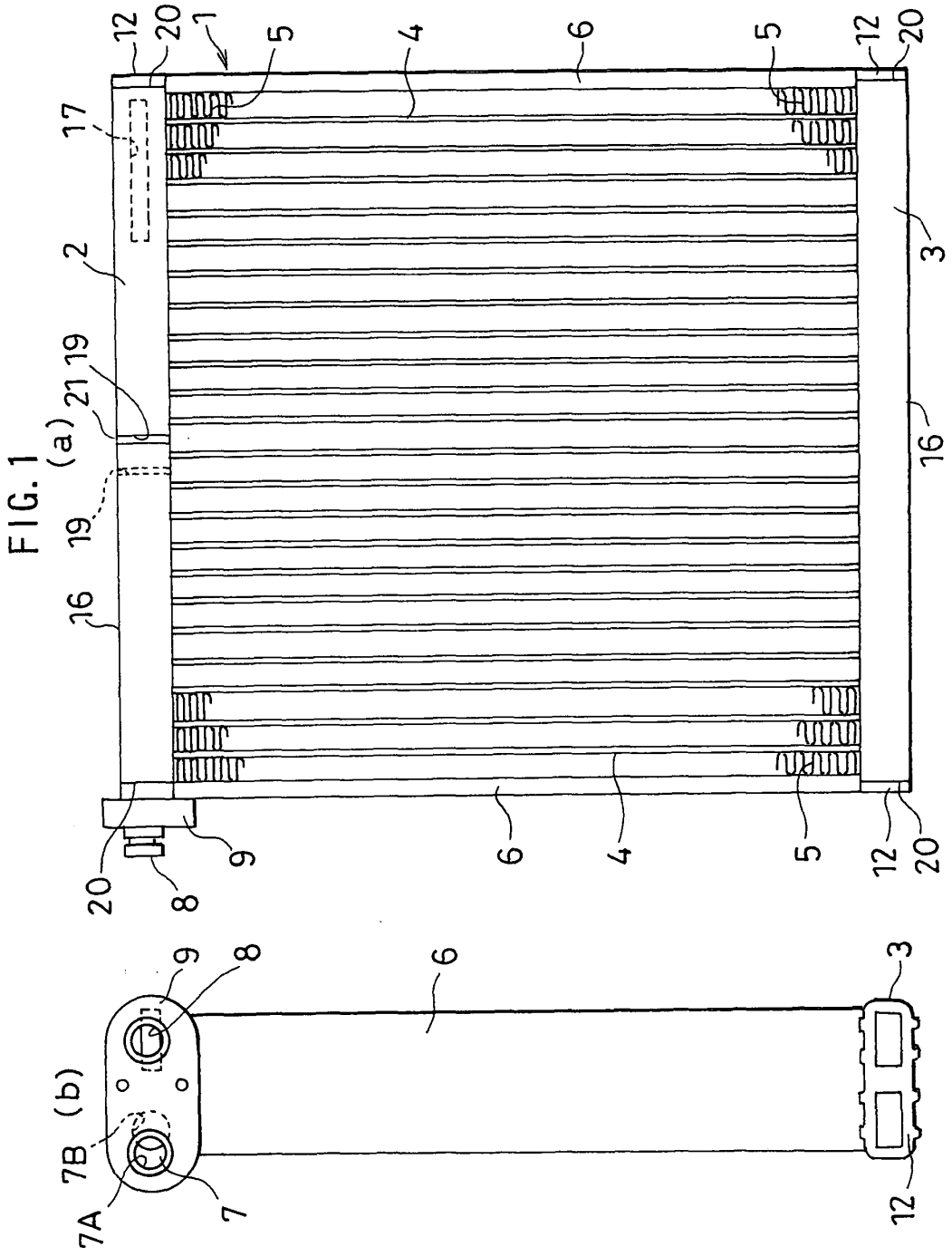
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FIG. 2

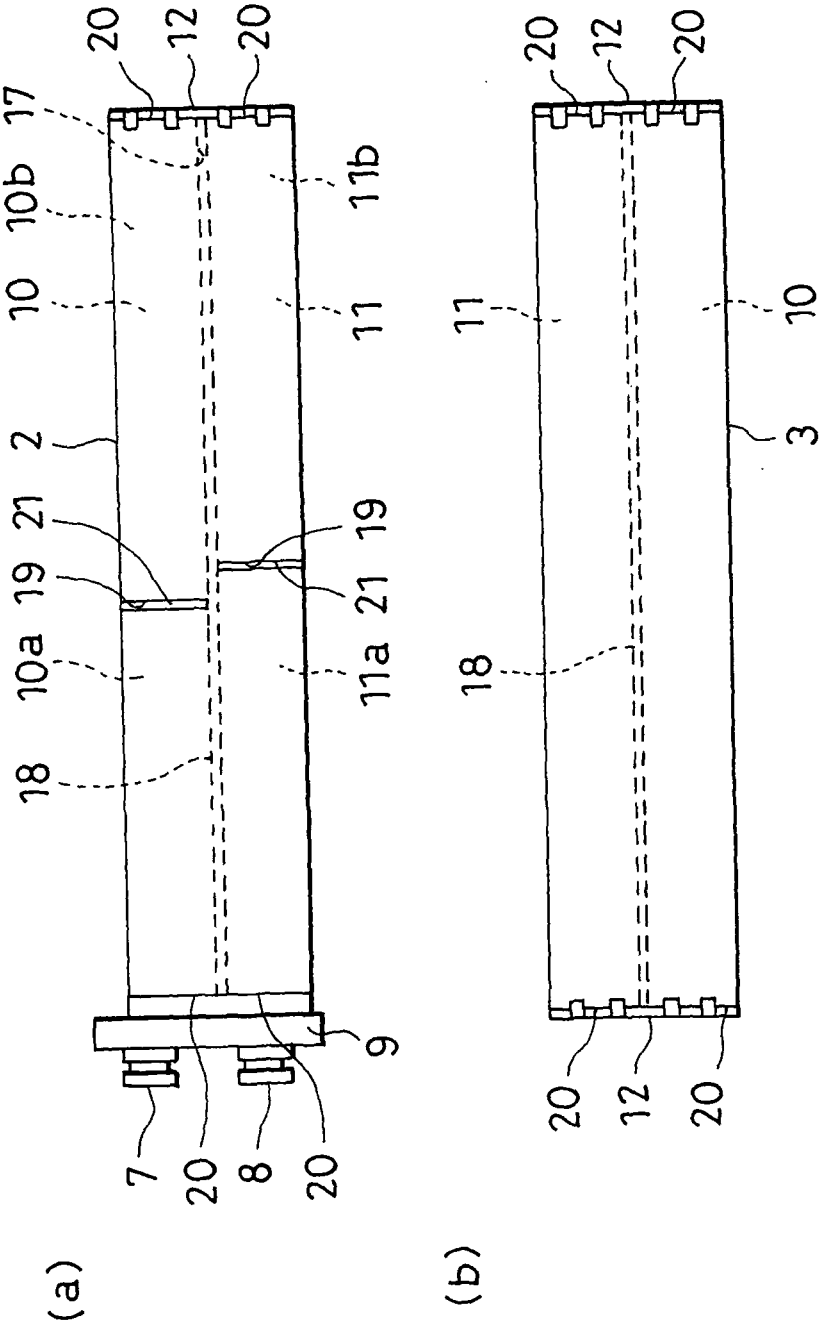
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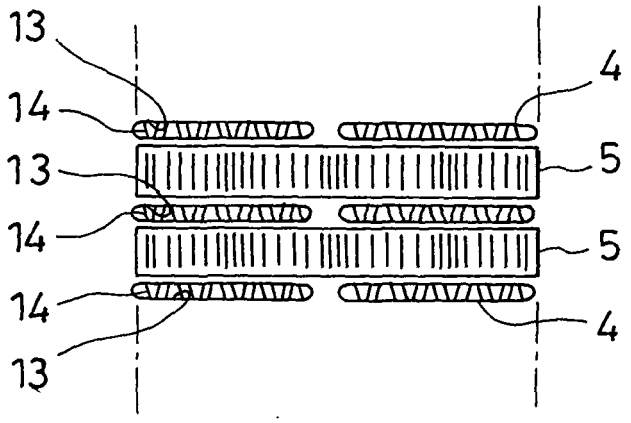
FIG. 3

(a)



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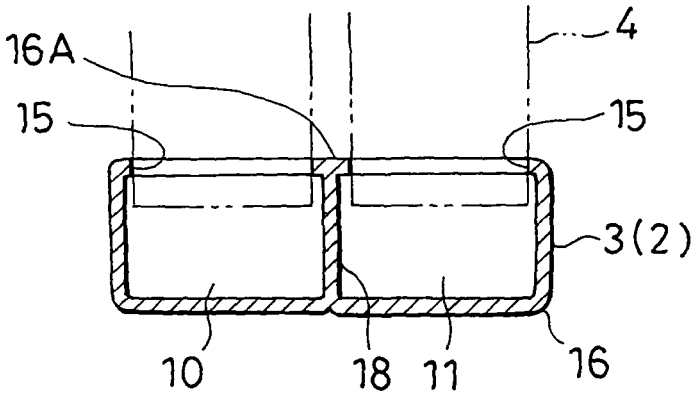

FIG. 4

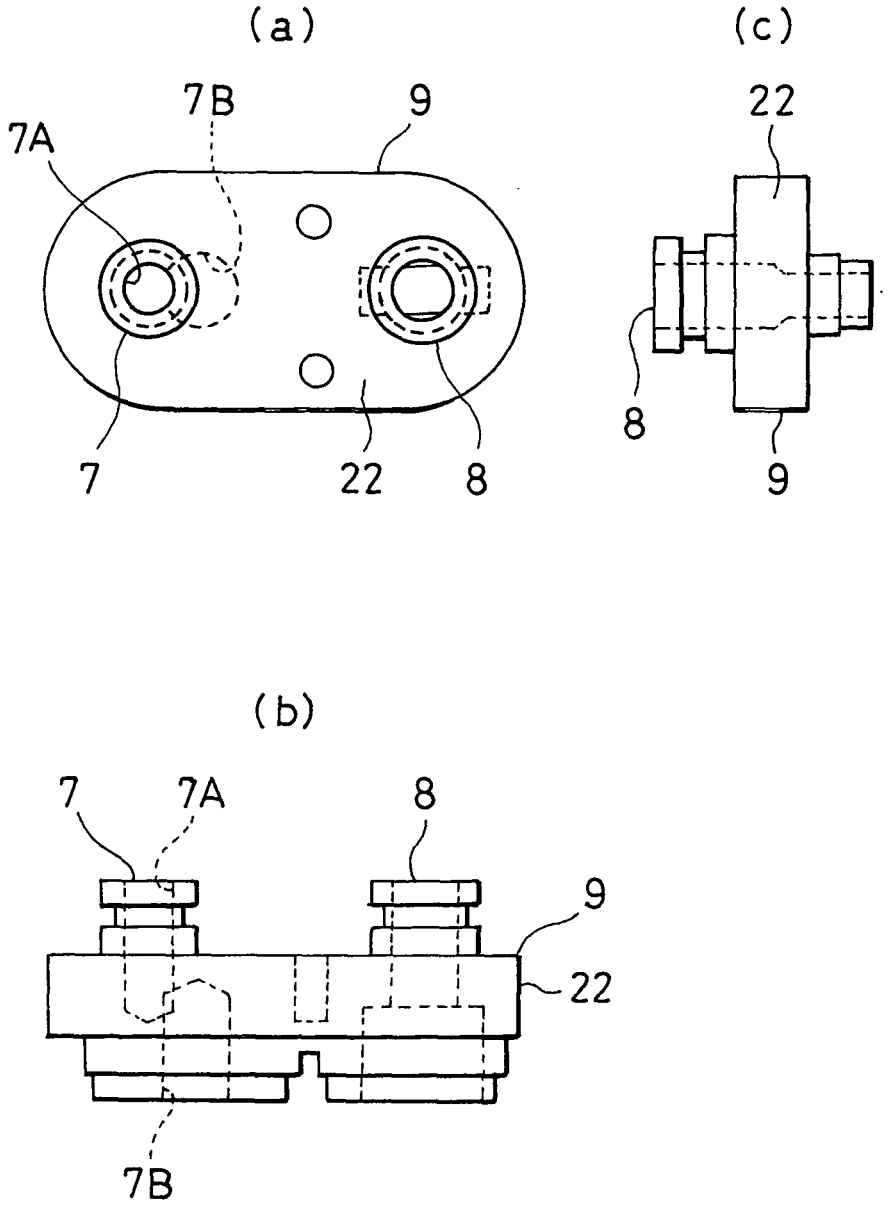

FIG. 5

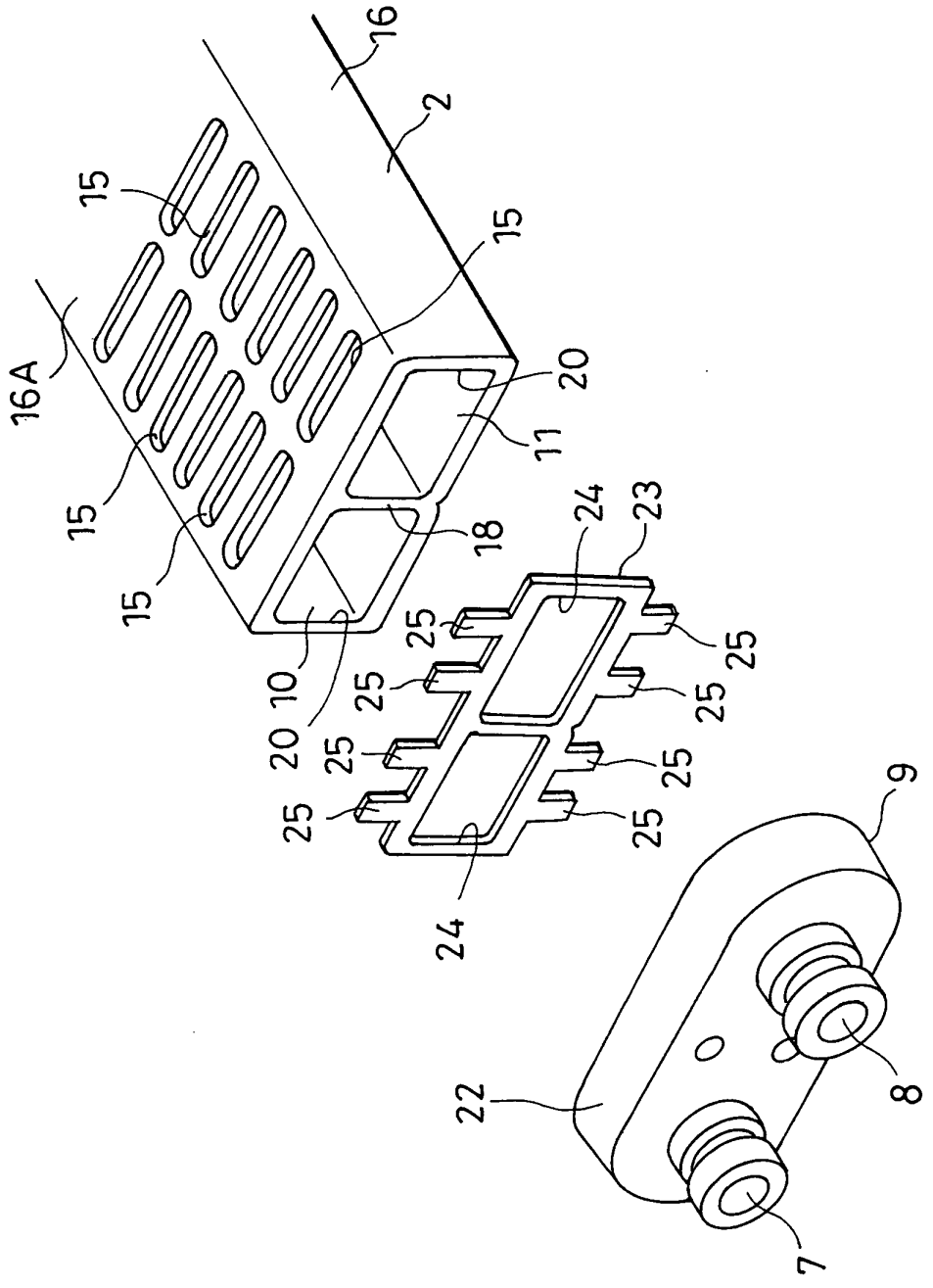
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FIG. 6

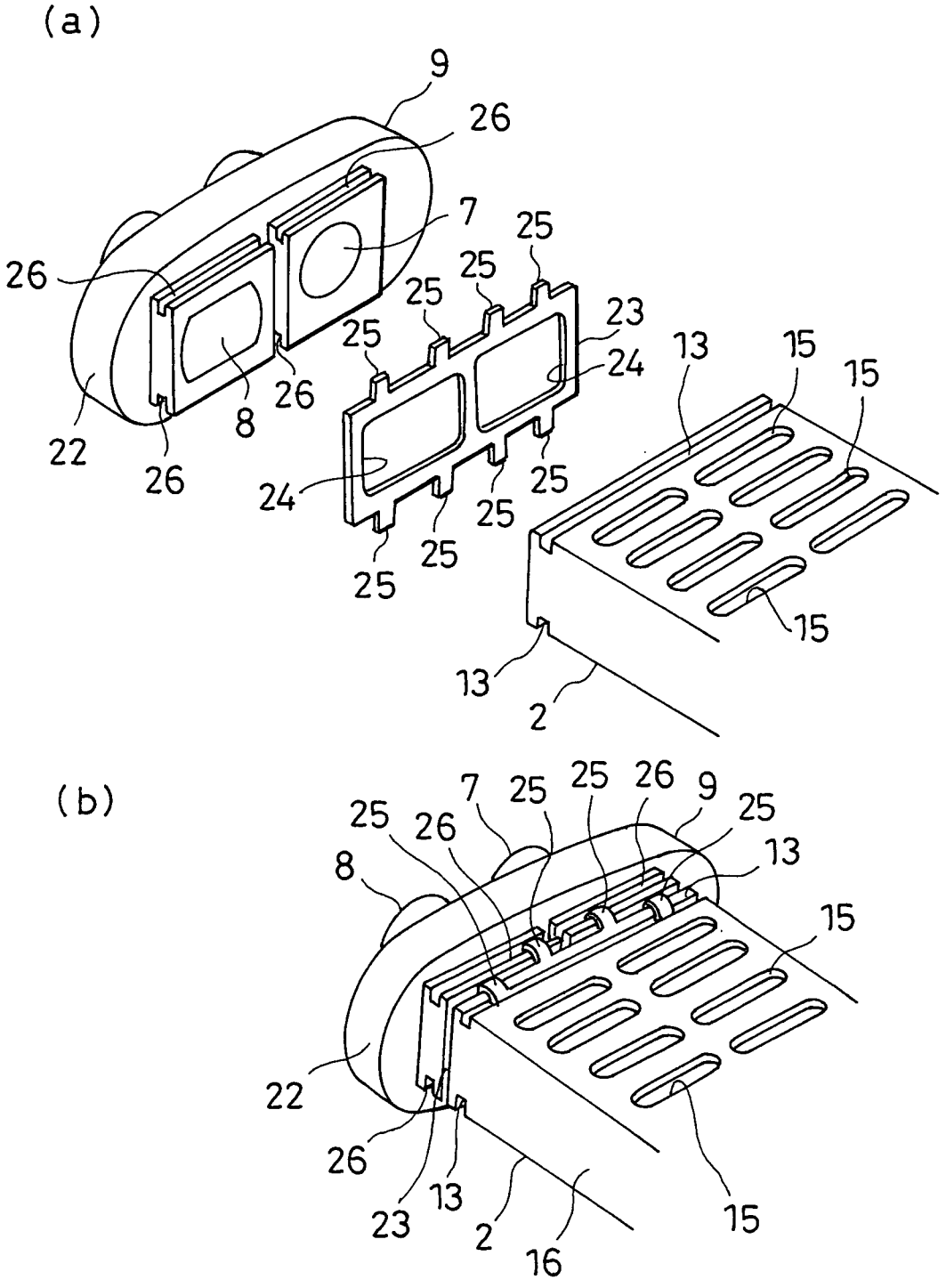
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FIG. 7

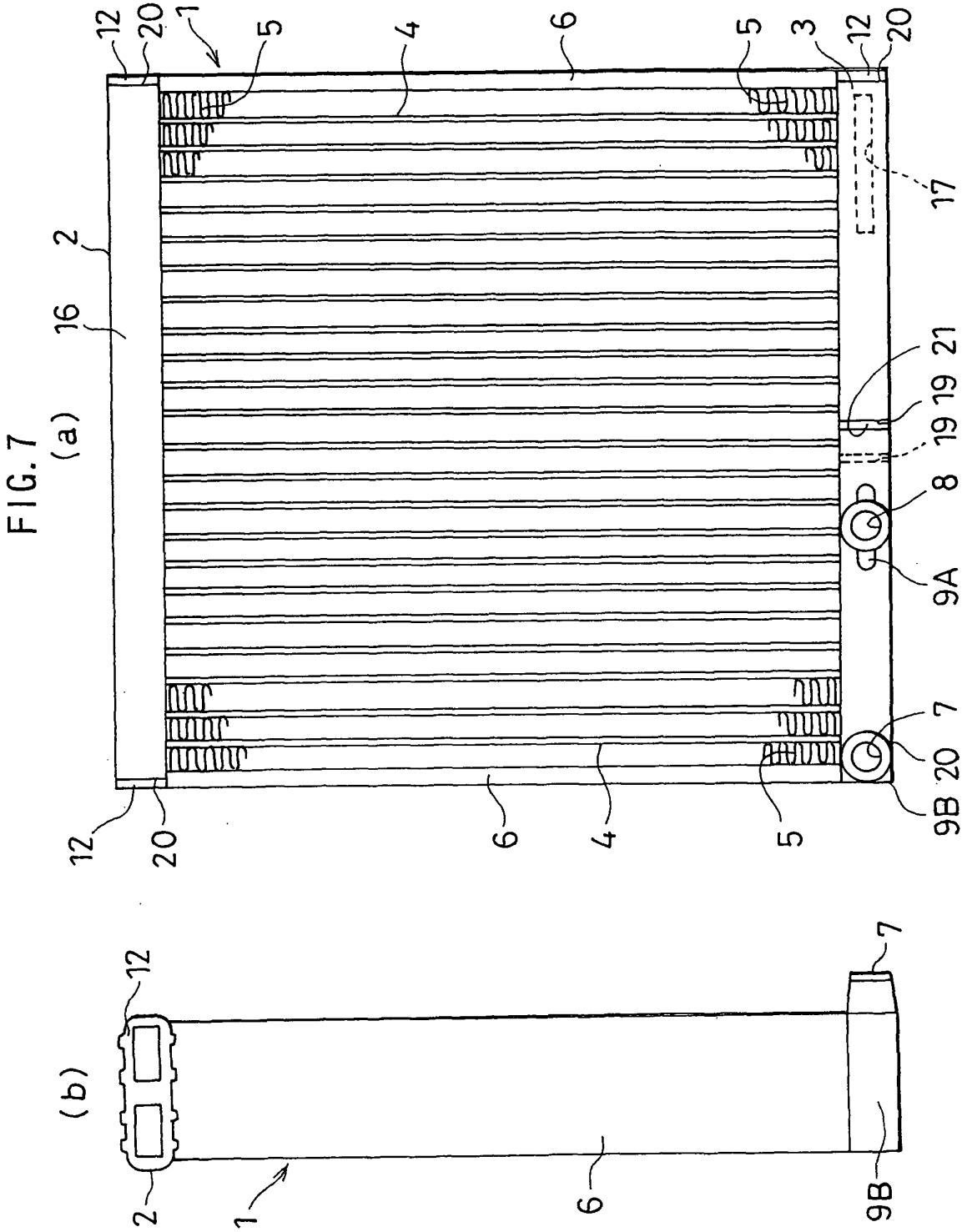
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FIG. 8

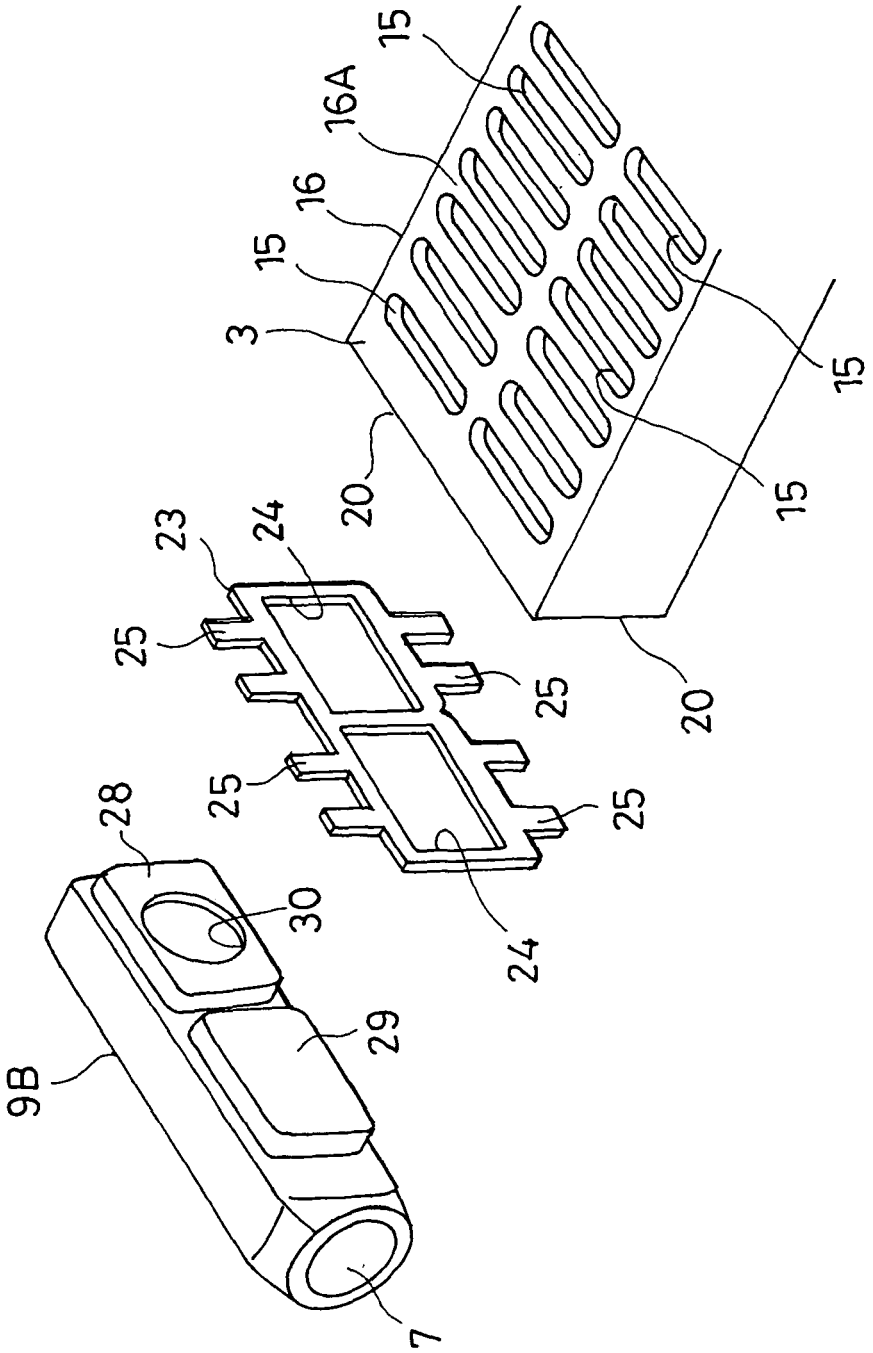


FIG. 9

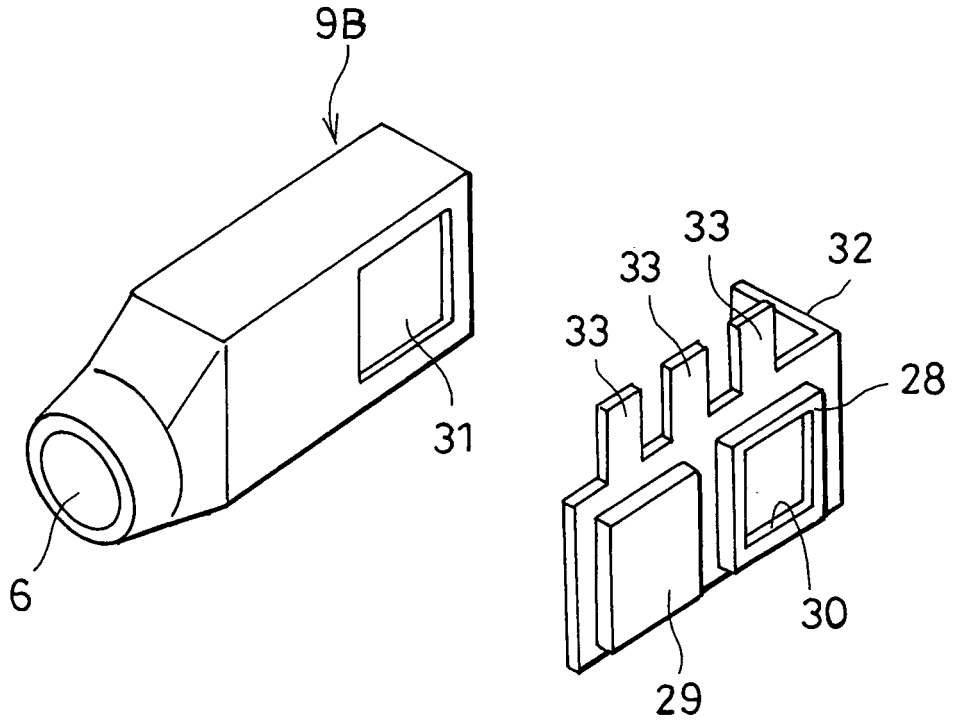


FIG. 10

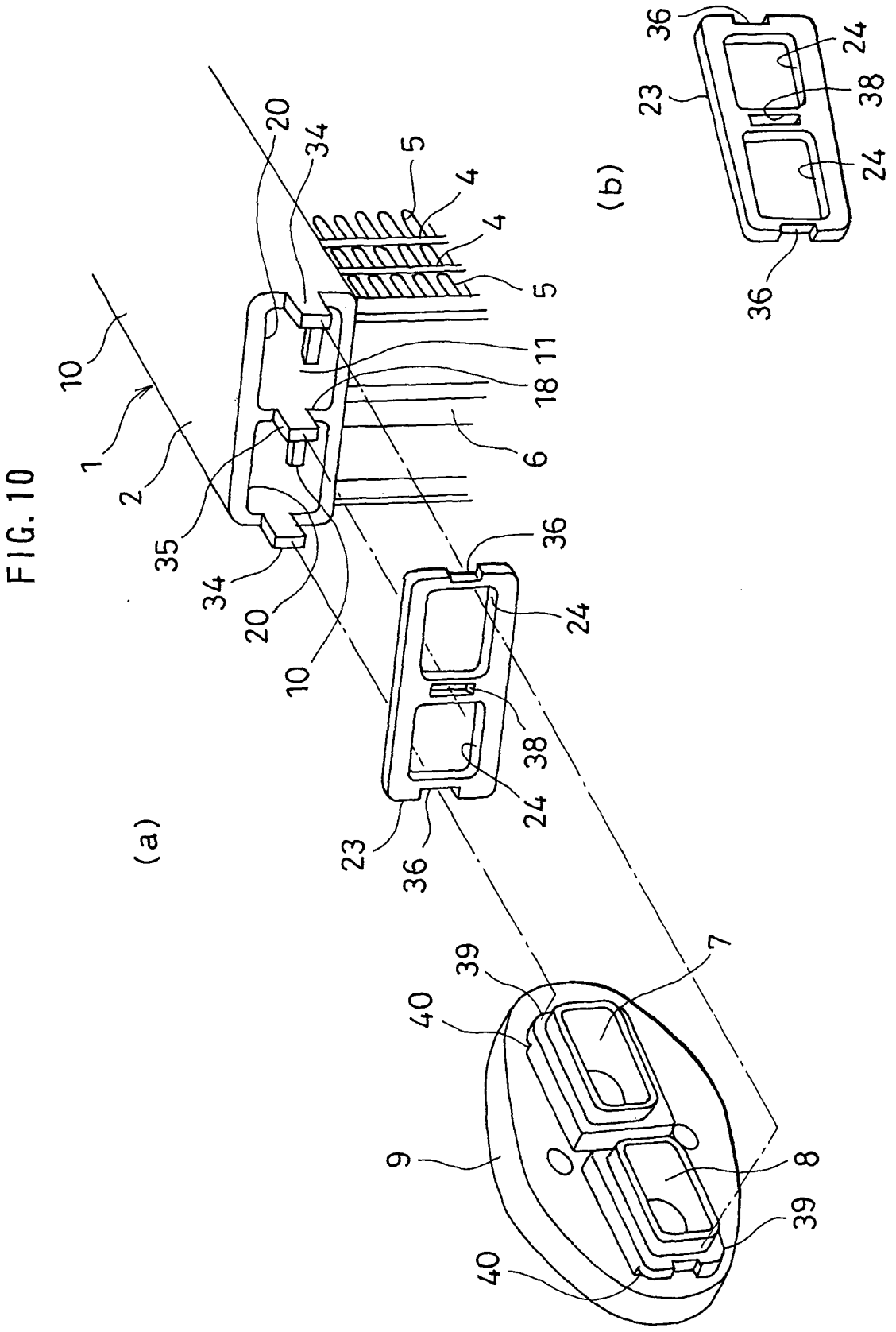


FIG. 11

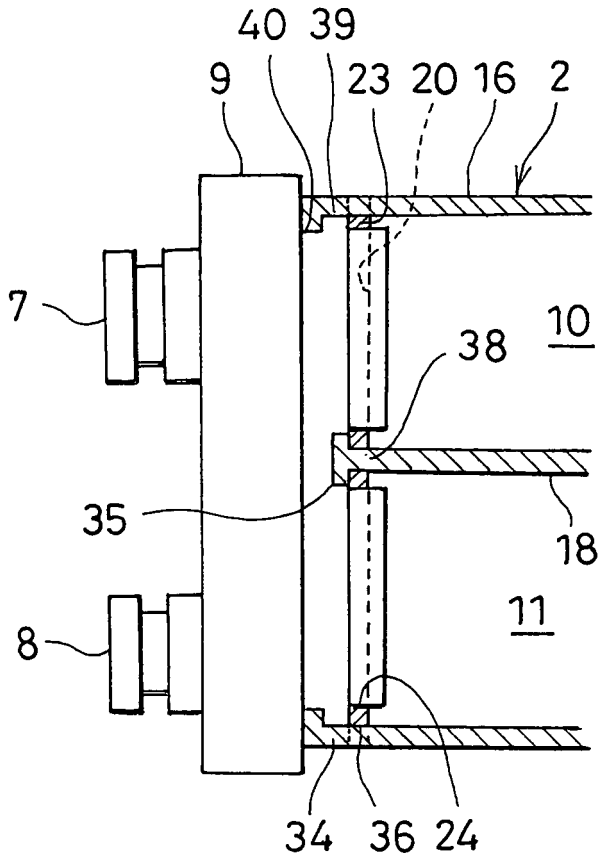
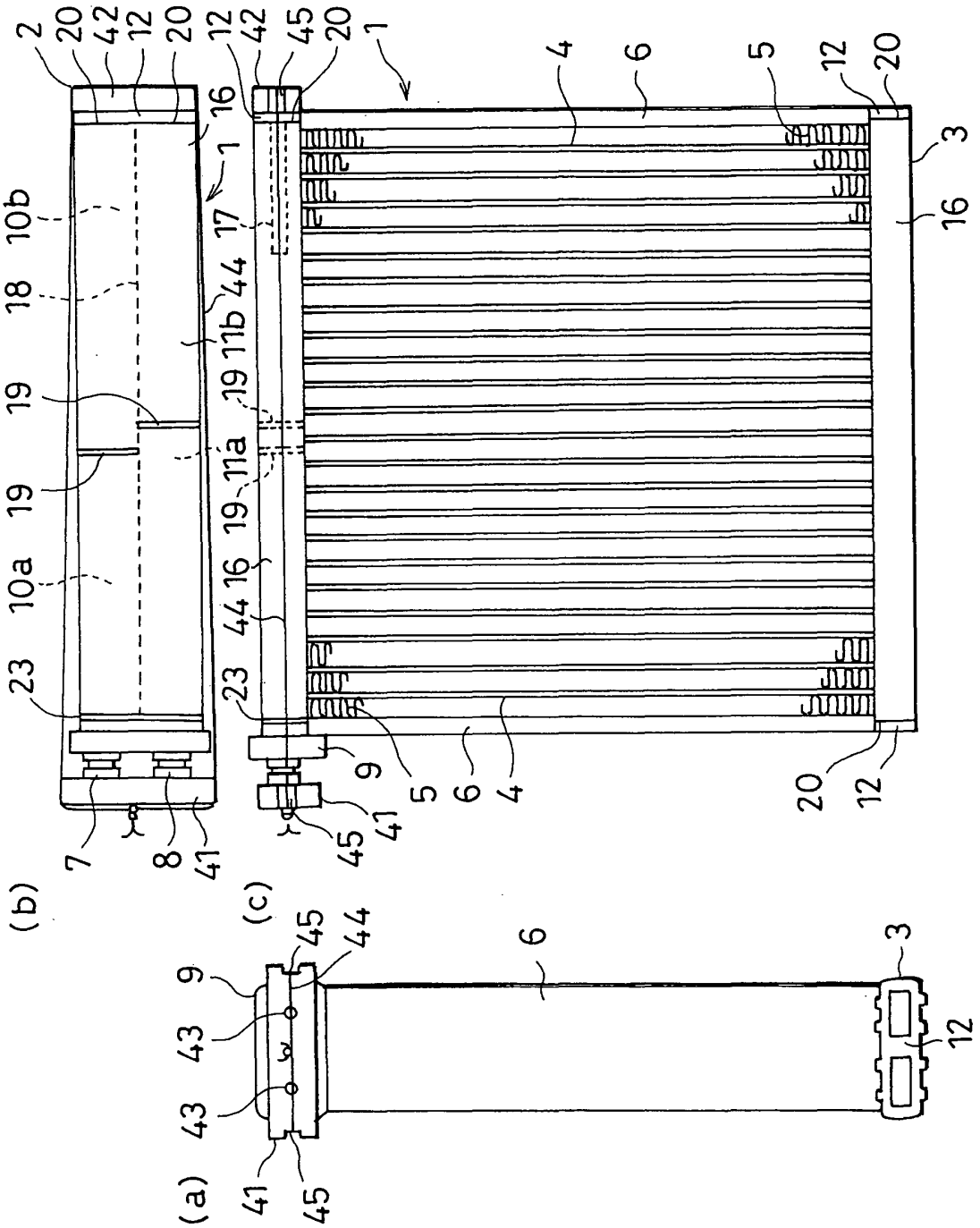


FIG. 12



INTERNATIONAL SEARCH REPORT

International application No.
PCT/JP2004/003271

A. CLASSIFICATION OF SUBJECT MATTER
Int.Cl[7] F28F9/02

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
Int.Cl[7] F28F9/02

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched
Jitsuyo Shinan Koho 1922-1996 Toroku Jitsuyo Shinan Koho 1994-2004
Kokai Jitsuyo Shinan Koho 1971-2004 Jitsuyo Shinan Toroku Koho 1996-2004

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y A	JP 9-72630 A (Showa Aluminum Corp.), 18 March, 1997 (18.03.97), All pages (Family: none)	1-4,7 8
Y A	JP 2002-11570 A (Kabushiki Kaisha Zexel Vareo Kuraimeto Control), 15 January, 2002 (15.01.02), All pages (Family: none)	1-4,7 8
Y A	JP 5-318098 A (Showa Aluminum Corp.), 03 February, 1993 (03.02.93), All pages (Family: none)	1-4,7 8

☒ Further documents are listed in the continuation of Box C. ☐ See patent family annex.

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"O" document referring to an oral disclosure, use, exhibition or other means
"P" document published prior to the international filing date but later than the priority date claimed
"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
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"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
08 June, 2004 (08.06.04)	29 June, 2004 (29.06.04)
Name and mailing address of the ISA/ Japanese Patent Office Facsimile No.	Authorized officer Telephone No.

Form PCT/ISA/210 (second sheet) (January 2004)

INTERNATIONAL SEARCH REPORT

International application No.
PCT/JP2004/003271

C (Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	Document 4: JP 2001-133192 A (Showa Aluminum Corp.), 18 May, 2001 (18.05.01), All pages (Family: none)	4-6

Form PCT/ISA/210 (continuation of second sheet) (January 2004)