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(54) Oil-cooler-equipped radiator

(57) An oil cooler (6) includes a heat exchanger (8) having a plurality of element units (7) stacked in a state communicating with each other, pipe connectors (13) coupled to the heat exchanger (8) in a state communicating with spaces (O) formed respectively at both end portions in the longitudinal direction of the heat exchanger (8), and a pair of connecting pipes (P1, P2) communicating with the spaces (O) from connecting pipe attaching holes (16) formed on the tank (1b) via cylindrical portions (13a) of the pipe connectors (13). The cylindrical portions (13a) are fixed respectively to rings (19) provided on the outside of the tank (1b) at the connecting pipe attaching holes (16), and joint portions thereof are formed to be exposed to the outside of the tank (1b).

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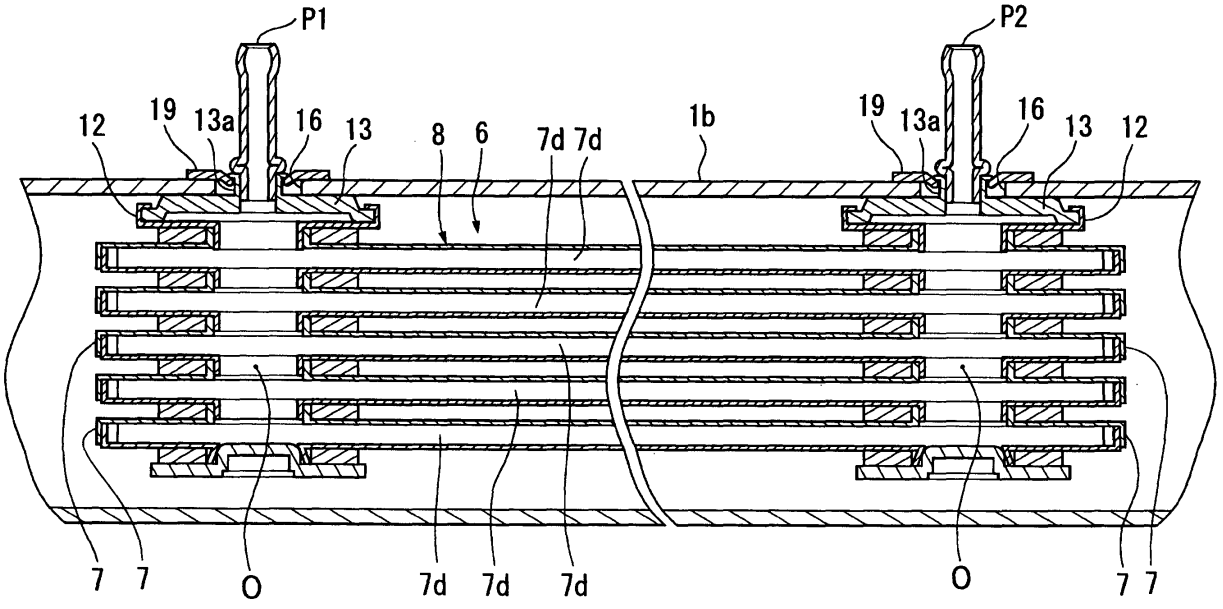

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Description

[0001] The present invention relates to an oil-cooler-equipped radiator which is brazed while an oil cooler is accommodated in a tank of the radiator for a motor vehicle, and the like.

[0002] Conventionally, techniques about an oil-cooler-equipped radiator in which an oil cooler is accommodated in a tank of the radiator have been known, which are disclosed in Japanese Patent Application Laid-open Nos. 2001-153586, Hei 10-73393, and Hei 11-142089.

[0003] Also, an all-aluminum radiator in which a tank and core portions of a radiator are formed of aluminum has been developed. In this type of radiator, brazing of a tank and an oil cooler is performed while the oil cooler is accommodated in the tank.

[0004] However, in the conventional oil-cooler-equipped radiator, for example, when the all-aluminum radiator is brazed, a pipe connector, which is a fixing portion of the oil cooler on the tank, is not smoothly heated up, which causes a problem of generating a brazing failure.

[0005] If a time period of brazing is extended, zinc diffusion in a radiator tube may proceed and degrade the corrosion resistance of the radiator tube, which is not favorable.

[0006] The present invention has been made in view of the above-described problems, and an object thereof is to provide an oil-cooler-equipped radiator in which a tank and a pipe connector are heated up quickly so as to assure brazing of the both.

[0007] An oil-cooler-equipped radiator according to the present invention has: an oil cooler which includes a heat exchanger having a plurality of element units stacked in a state communicating with each other, pipe connectors coupled to the heat exchanger in a state communicating with spaces formed respectively at both end portions in the longitudinal direction of the heat exchanger, and a pair of connecting pipes communicating with the spaces; and a radiator which includes a tank having connecting pipe attaching holes formed therein and connected to the pair of connecting pipes via cylindrical portions of the pipe connectors respectively, wherein the oil cooler is fixed with the tank by brazing and accommodated therein, and the cylindrical portions of the pipe connectors being fixed respectively to rings provided on the outside of the tank at the connecting pipe attaching holes, and joint portions of the pipe connectors and the rings are formed to be exposed to the outside of the tank.

[0008] In the above-described oil-cooler-equipped radiator, when the tank and the oil cooler are brazed, the cylindrical portions of the pipe connectors are fixed to the rings provided on the outside of the tank at the connecting pipe attaching holes, so that the rings are heated up quickly. Moreover, the joint portions of the rings and the pipe connectors are formed to be exposed to the outside, so that the entire pipe connectors are heated up quickly. Therefore, the both can be surely brazed.

[0009] Preferably, the pipe connectors are provided with heat conduction portions respectively, and the heat conduction portions being brazed on the inside of the tank in a tightly attached state.

[0010] Therefore, along with the heating up of the tank, the heat exchanger is heated up via the heat conduction portion, so that the heat conduction portion of the pipe connector and the inside of the tank can be favorably brazed, and moreover the entire oil cooler including the pipe connector can be smoothly heated up to be brazed.

[0011] The objects, features and advantages of the present invention will become apparent as the description proceeds when taken in conjunction with the accompanying drawings, in which:

FIG. 1 is an overall view showing an oil-cooler-equipped radiator according to an embodiment of the present invention;

FIG. 2 is an enlarged cross sectional view taken along the line S2-S2 in FIG. 1;

FIG. 3 is an enlarged cross sectional view taken along the line S3-S3 in FIG. 1;

FIGS. 4A and 4B are enlarged views illustrating assembly of a heat exchanger before assembled and after assembled, respectively;

FIGS. 5A and 5B are enlarged views illustrating assembly of the heat exchanger, patches, clamps, and pipe connectors before assembled and after assembled, respectively;
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FIG. 6 is an enlarged perspective view of the clamp;

FIGS. 7A and 7B are enlarged views illustrating fixation of the heat exchanger and the clamp before fixed and after fixed, respectively;

FIG. 8 is an enlarged perspective view of the pipe connector;

FIGS. 9A and 9B are enlarged views illustrating fixation of the pipe connector and the clamp before fixed and after fixed, respectively;

FIGS. 10A and 10B are enlarged views illustrating fixation of the oil cooler and a tank before fixed and after fixed, respectively; and

FIG. 11 is an enlarged cross sectional view of contact part of a connecting pipe and a tank, indicated by a circle CA in FIG. 10B.

[0012] Hereinafter, an embodiment of an oil-cooler-equipped radiator according to the present invention will

be described with accompanying drawings.

[0013] As shown in FIG. 1, the oil-cooler-equipped radiator according to the embodiment includes a pair of seat plates 2a and 2b provided at an upper side of a radiator 100 and at a lower side of the radiator 100 with upper and lower tanks 1a and 1b, respectively; tubes 3 and corrugated fins 4 alternately disposed between the seat plates 2a and 2b; and reinforcements 5a and 5b for connecting both end portions of the seat plates 2a and 2b at their both sides so as to reinforce them.

[0014] An oil cooler 6, which will be described in detail later, is accommodated in the lower tank 1b, and all the components including the oil cooler 6 and the lower tank 1b are made of aluminum.

[0015] As shown in FIGS. 2 and 3, the oil cooler 6 according to the embodiment has a heat exchanger 8 including a plurality of element units 7 stacked in a state communicating with each other, pipe connectors 13 coupled via clamps 12 to the heat exchanger 8 in a state communicating with spaces O formed respectively at both end portions of the heat exchanger 8, and a pair of connecting pipes P1 and P2 communicating respectively with the spaces O from two connecting pipe attaching holes 16 and 16 formed on the lower tank 1b via cylindrical portions 13a of the pipe connectors 13.

[0016] Also, at each contact part between the components of the tank 1b and the oil cooler 6, a brazing material (brazing sheet) is coated on at least one side of the contact parts.

[0017] To temporarily assemble such an oil-cooler-equipped radiator, at first, as shown in FIG. 4A, a pair of shells 7b and 7c each having a periphery being raised so as to form a dish shape and having cylindrical portions 7a formed by burring on both end portions thereof is press fitted or caulked together with a corrugated inner fin 7d being interposed therebetween, thereby forming an element unit 7.

[0018] Subsequently, as shown in FIG. 4B, a plurality of element units 7, five layer units in this embodiment, are stacked with cylindrical sheets 9 being interposed therebetween, thereby forming the heat exchanger 8.

[0019] Next, as shown in FIGS. 5A and 5B, on the cylindrical portions 7a and 7a, shown in FIGS. 4A and 4B, of an outermost element unit 10 that is located at an outermost position of the element units 7 in the stacking direction thereof, patch plates PT are press fitted or caulked via sheets 9a respectively.

[0020] On the other hand, the clamp 12 and a pipe connector 13, which will be described later, are fixed via a sheet 9b on each of the cylindrical portions 7a and 7a of an outermost element unit 11 that is located at an opposite outermost position of the element units 7 in the stacking direction thereof.

[0021] Specifically, as shown in FIG. 6, the clamp 12 has a cylindrical portion 12a is formed by burring at the center portion of the clamp 12 and a peripheral edge portion 12b that is raised so as to form a dish shape having three claw portions 12c at equivalent intervals.

[0022] Then, as shown in FIGS. 7A and 7B, the cylindrical portion 12a of the clamp 12 is overlapped on the cylindrical portion 7a of the outermost element unit 11, and in this state, a jig such as a column-shaped punch P is press fitted into the space O so as to caulk them, thereby fixing the heat exchanger 8 and the clamp 12.

[0023] At this time, all cylindrical portions 7a of the respective element units 7 including the outermost element units 10 and 11 are caulked simultaneously at the time of caulking the cylindrical portion 12a.

[0024] Next, the clamp 12 and a pipe connector 13 are fixed with each other.

[0025] Specifically, as shown in FIG. 8, at the center portion of the pipe connector 13, a cylindrical portion 13a is formed by burring. On a center side portion thereof, a heat conduction portion 13b, which will be described in detail later, is formed, and a peripheral edge portion 13c thereof is raised downward in the view to form a dish shape.

[0026] Then, as shown in FIGS. 9A and 9B, the peripheral edge portions 12b of the clamp 12 and the peripheral edge portion 13c of the pipe connector 13 are overlapped with each other, and thereafter the claw portions 12c of the clamp 12 are caulked on the peripheral edge portion 13c of the pipe connector 13, thereby fixing the clamp 12 and the pipe connector 13 with each other.

[0027] Subsequently, the oil cooler 6, made by coupling the heat exchanger 8, the clamp 12, and the pipe connector 13 with each other, is accommodated in the lower tank 1b.

[0028] Specifically, the tank 1b is constituted of a first divided part 14 in a lid-like shape and a second divided part 15 having a U-shaped cross section, and on the first divided part 14, connecting pipe attaching holes 16 are formed respectively at positions corresponding to the connecting pipes P1 and P2, which will be described in detail later.

[0029] Further, the diameter of the connecting pipe attaching holes 16 is formed to be slightly larger than the outside diameter of the cylindrical part 13a of the pipe connector 13.

[0030] Moreover, as shown in FIGS. 10A and 10B, the cylindrical portion 13a of the pipe connector 13 is projected outward through the connecting pipe attaching hole 16, and the heat conduction portion 13b is tightly attached on a sidewall inner side 17 of the first divided part 14. The cylindrical portion 13a is caulked on an annular ring 19 placed on a sidewall outer side 18 of the divided part 14, and thereafter the first divided part 14 and the second divided part 15 are engaged with each other, thereby accommodating the oil cooler 6 in the tank 1b. The sidewall inner side 17 corresponds to an inside of a tank of the present invention, and the sidewall outer side 18 corresponds to an outside of a tank of the present invention.

[0031] At this time, the pipe connector 13 is jointed to the ring 19 at a joint portion 20 to be fixed thereon, and the joint portion 20 is exposed to the outside of the lower

tank 1b.

[0032] Further, as shown in FIG. 11, a predetermined gap is formed between the cylindrical portion 13a and the connecting pipe attaching hole 16, so that the position of the oil cooler can be adjusted in the range of W1 with respect to the tank 1b. Therefore, an error of the oil cooler 6 caused by assembling accuracy can be tolerated.

[0033] Incidentally, for the caulking of the tip of the cylindrical portion 13a and the ring 19, a jig such as the above-described punch is used.

[0034] Also, the inside of the ring 19 in this embodiment is formed in a slope shape as shown in FIG. 11, and accordingly this structure enables the tip of the cylindrical portion 13a to be easily caulked.

[0035] Finally, the connecting pipe P1 is press fitted into the cylindrical portion 13a of the pipe connector 13, thereby completing the temporary assembly of the oil-cooler-equipped radiator.

[0036] The oil-cooler-equipped radiator that is thus temporarily assembled is heat treated in a not-shown furnace with not-shown patches being engaged with both end portions of the tank 1b, while the oil cooler 6 is accommodated therein. Thus, respective portions of the radiator 100 as well as contact parts of respective portions of the tank 1b and the oil cooler 6 are brazed, resulting in a cooling circuit in which oil for an engine or an automatic transmission (AT) is flown from the connecting pipe P1 through the element units 7 of the heat exchanger 8 in the longitudinal direction so as to exchange the heat of oil with cooling water in the tank 1b, and then the oil is discharged from the connecting pipe P2.

[0037] When the brazing is carried out, the rings 19 provided on the outside of the tank are heated up quickly, and in addition the joint portions 20 of the pipe connectors 13 and the rings 19 are formed to be exposed to the outside, so that the entire pipe connectors 13 are smoothly heated up. Therefore, both the tank 1b and the pipe connector 13 can be surely brazed.

[0038] Also, along with the heating up of the tank 1b, the heat exchanger 8 is heated up via the heat conduction portion 13b and the clamp 12, so that the heat conduction portion 13b of the pipe connector 13 and the inside of the tank can be favorably brazed, and moreover the entire oil cooler 6 can be smoothly heated up to be brazed.

[0039] In the foregoing, the embodiment of the present invention has been described, but the specific configuration of the present invention is not limited to the above-described embodiment, and any design modification and so on without departing from the spirit of the present invention will be embraced in the present invention.

[0040] For example, the position adjustment range W1 of the oil cooler 6 can be set in a discretionary range by appropriately changing the diameters of the connecting pipe attaching hole 16 and ring 19 and the shape of the cylindrical portion 13a.

[0041] Further, in this embodiment, the case of brazing the temporarily assembled oil cooler 6 while it is temporarily accommodated in the tank 1b of the temporarily assembled radiator 100 is described. However, the temporarily assembled oil cooler may be brazed alone in a preceding step, and in the following step, it may be accommodated in the tank 1b of the temporarily assembled radiator 100 to thereby braze the radiator 100 and the oil cooler 6 together.

Claims

1. An oil-cooler-equipped radiator, comprising:

an oil cooler (6) which includes a heat exchanger (8) having a plurality of element units (7) stacked in a state communicating with each other, pipe connectors (13) coupled to said heat exchanger (8) in a state communicating with spaces (O) formed respectively at both end portions in the longitudinal direction of said heat exchanger (8), and a pair of connecting pipes (P1, P2) communicating with the spaces (O); and
a radiator (100) which includes a tank (1b) having connecting pipe attaching holes (16) formed therein and connected to said pair of connecting pipes (P1, P2) via cylindrical portions (13a) of said pipe connectors (13), respectively, **characterized in that**
said oil cooler (6) is fixed with said tank (1b) by brazing and accommodated therein, and
the cylindrical portions (13a) of said pipe connectors (13) being fixed respectively to rings (19) provided on the outside of said tank (1b) at the connecting pipe attaching holes (16), and joint portions (20) of the pipe connectors (13) and the rings (19) are formed to be exposed to the outside of said tank (1b).

2. An oil-cooler-equipped radiator according to claim 1, **characterized in that** further
the pipe connectors (13) are provided with heat conduction portions (13b) respectively, and
said heat conduction portions (13b) being brazed on the inside of said tank (1b) in a tightly attached state.

FIG. 1

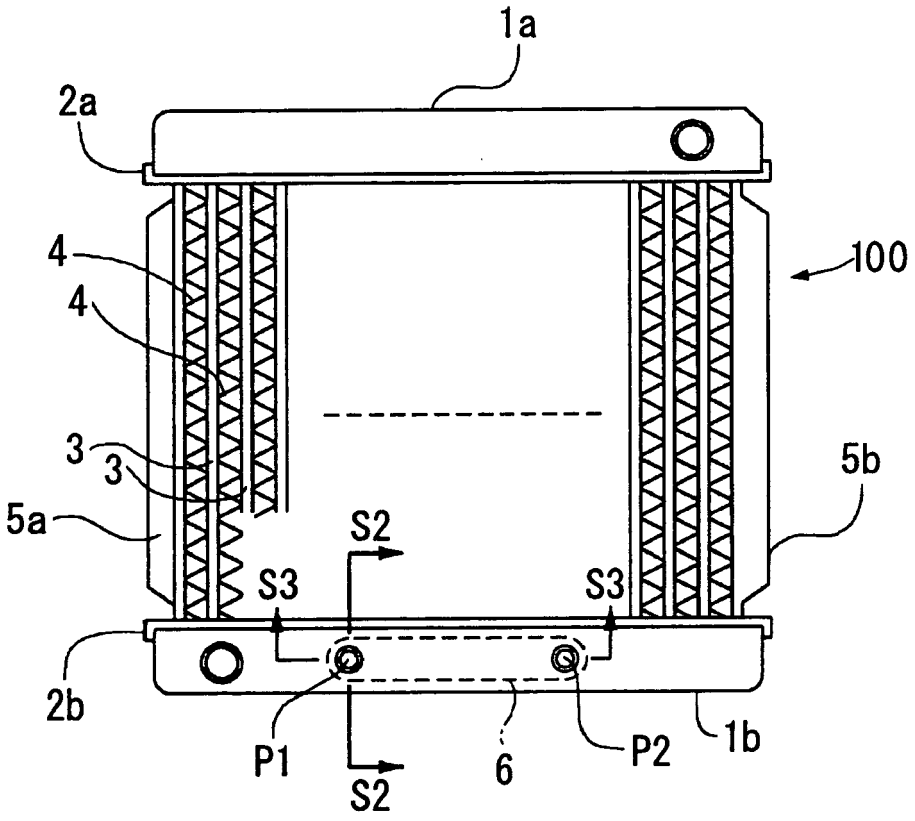


FIG. 2

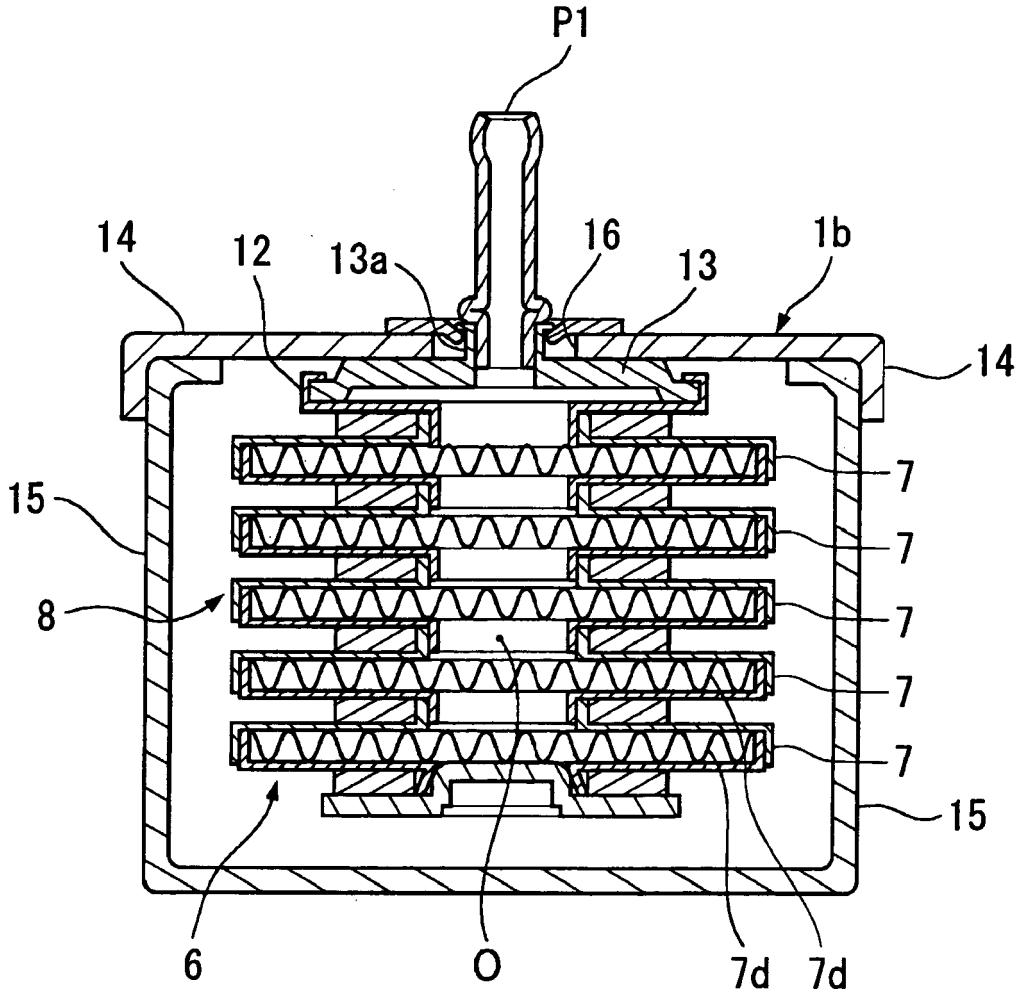


FIG. 3

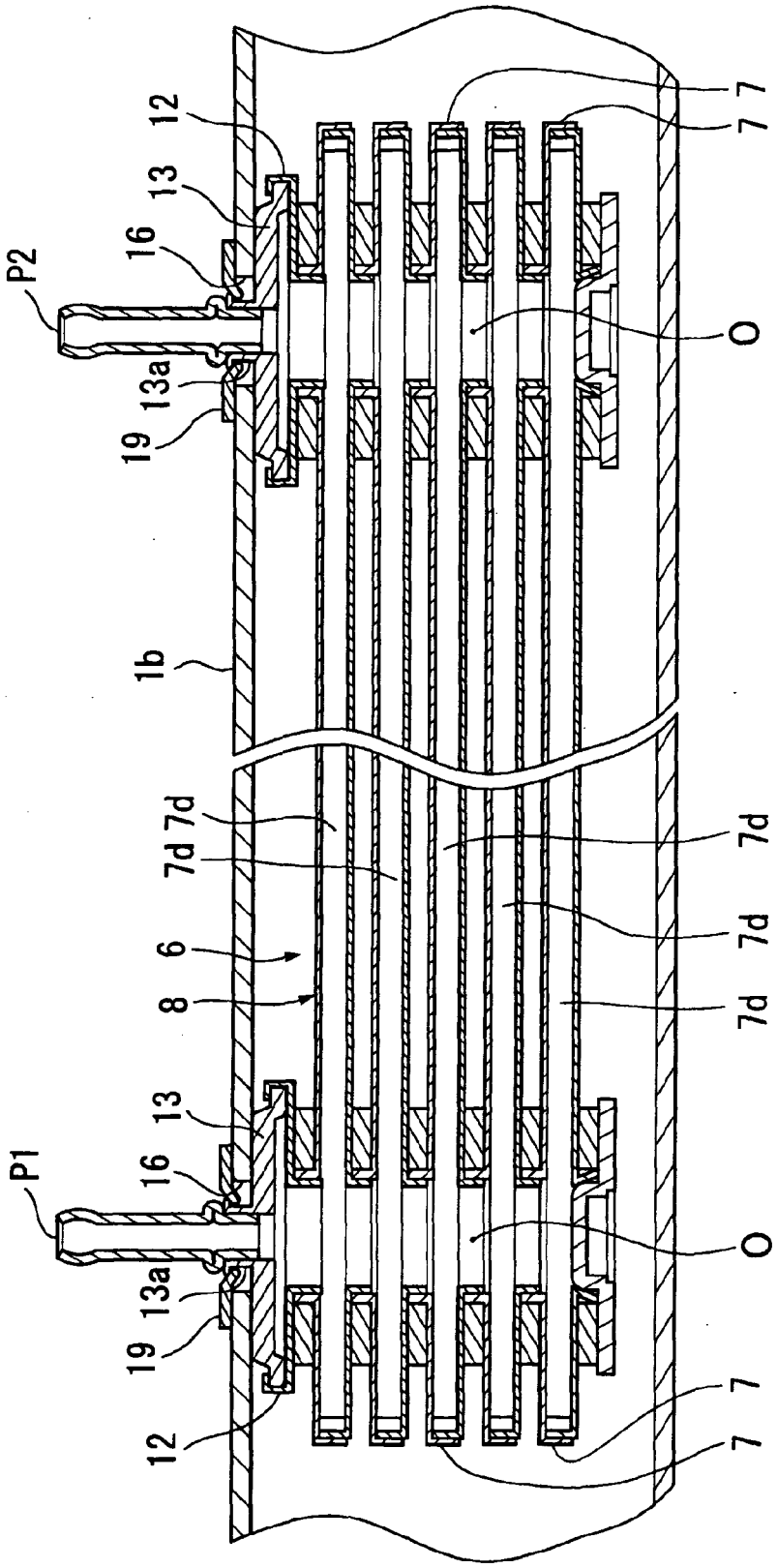


FIG. 4A

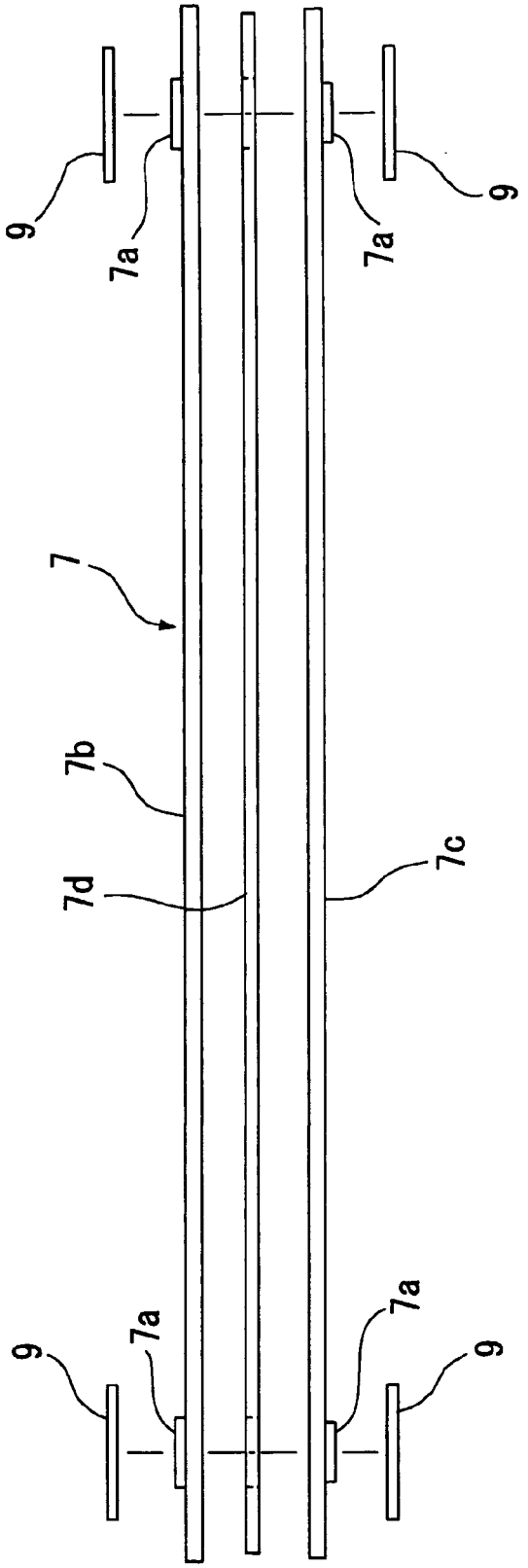


FIG. 4B

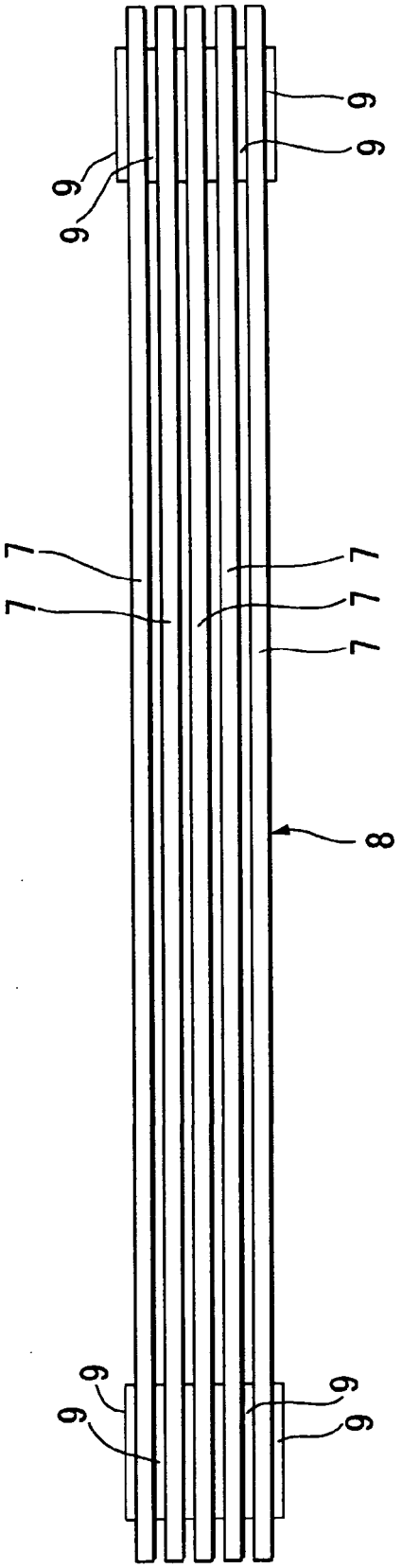


FIG. 5A

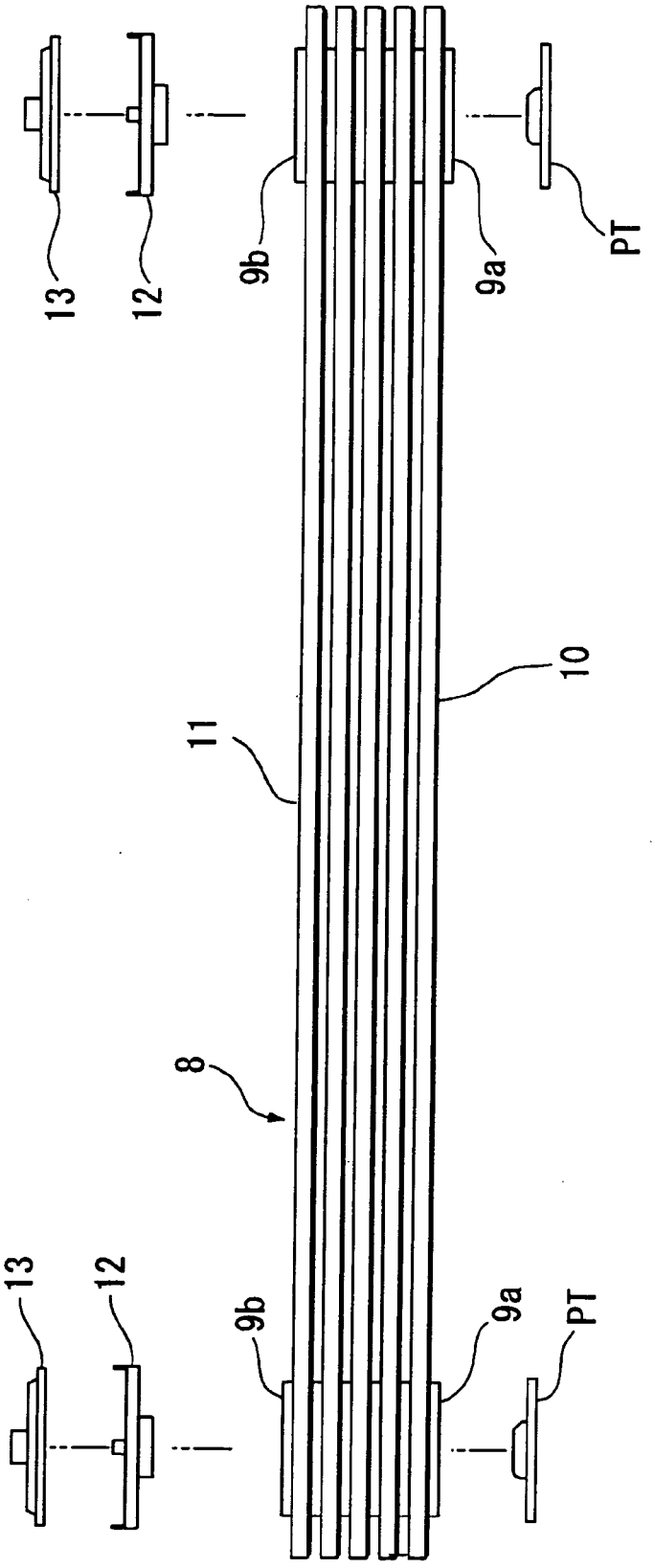


FIG. 5B

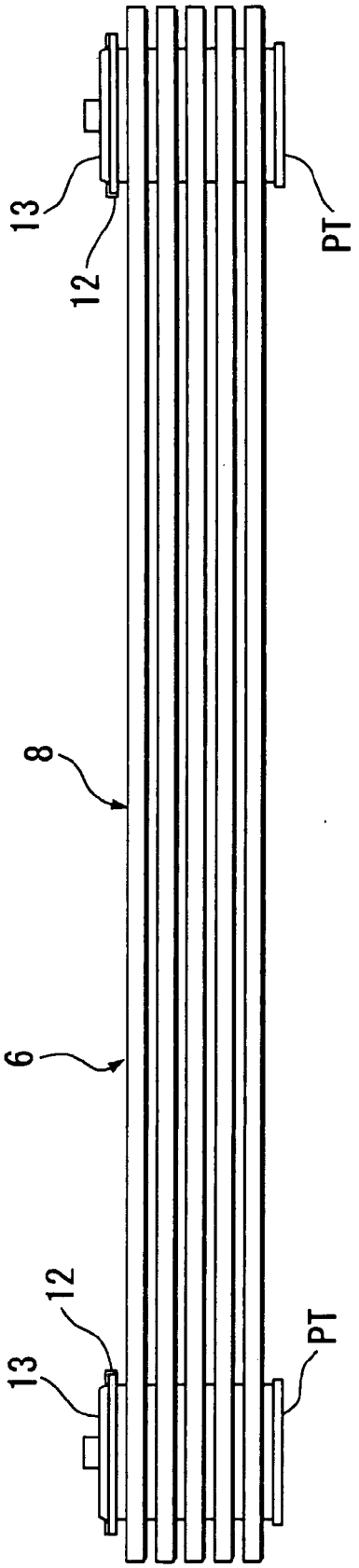


FIG. 6

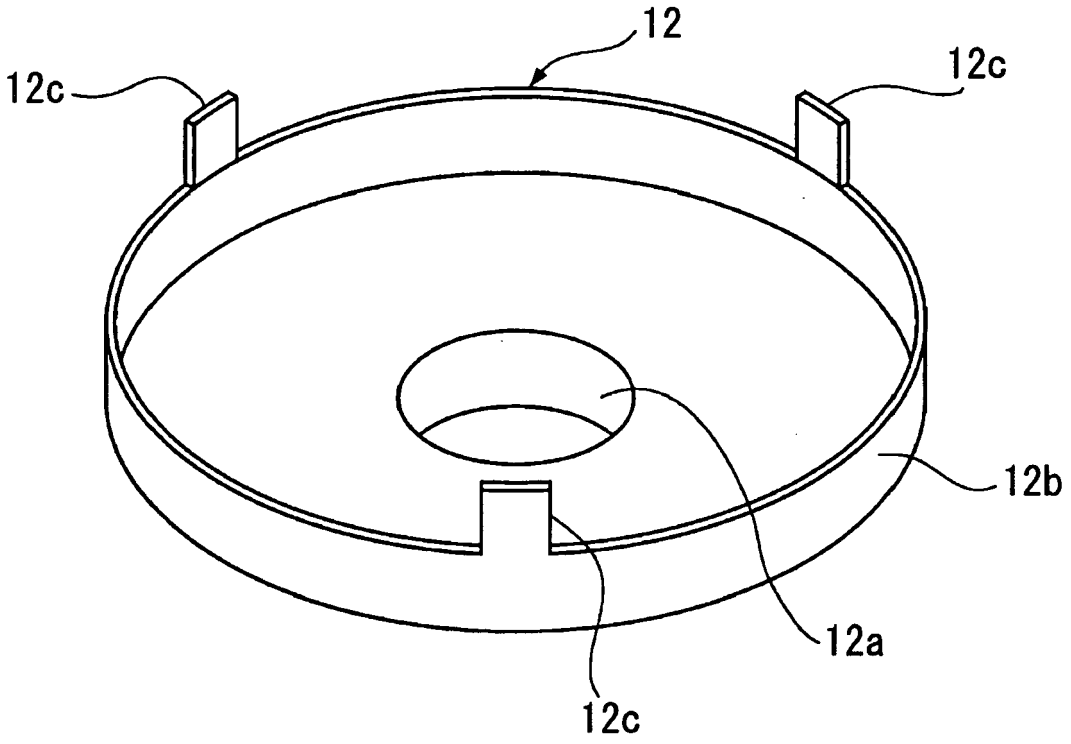


FIG. 7A

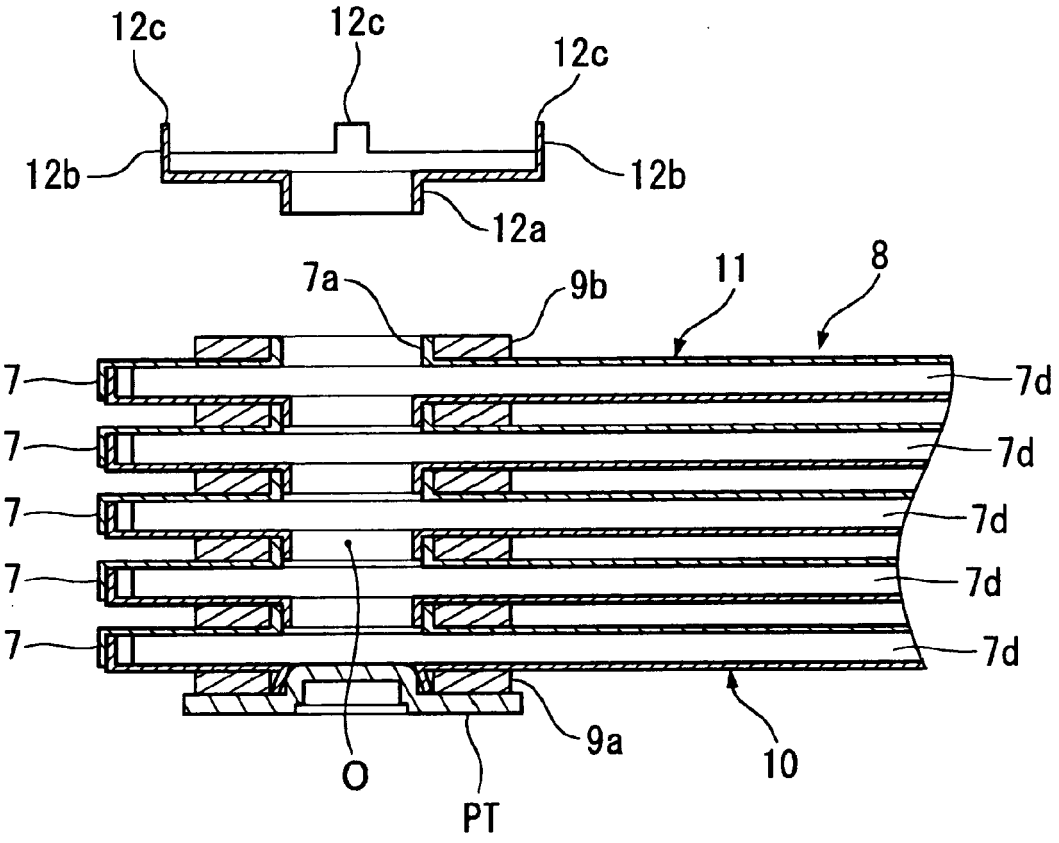


FIG. 7B

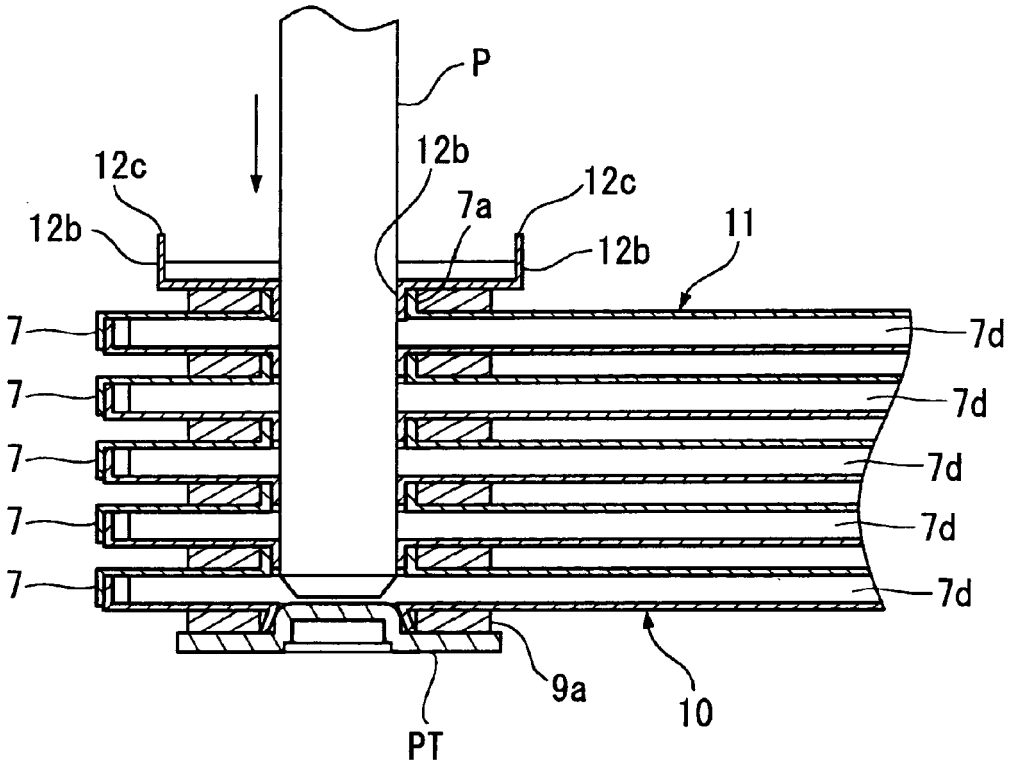


FIG. 8

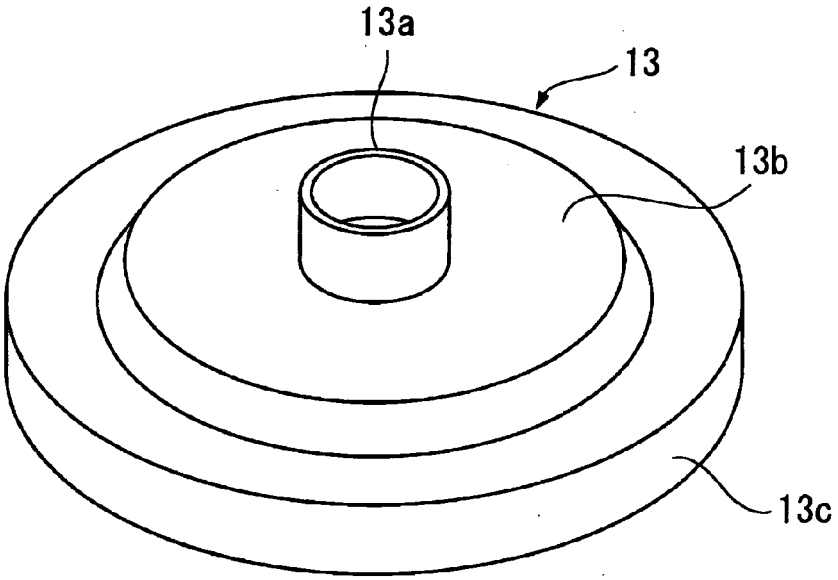


FIG. 9A

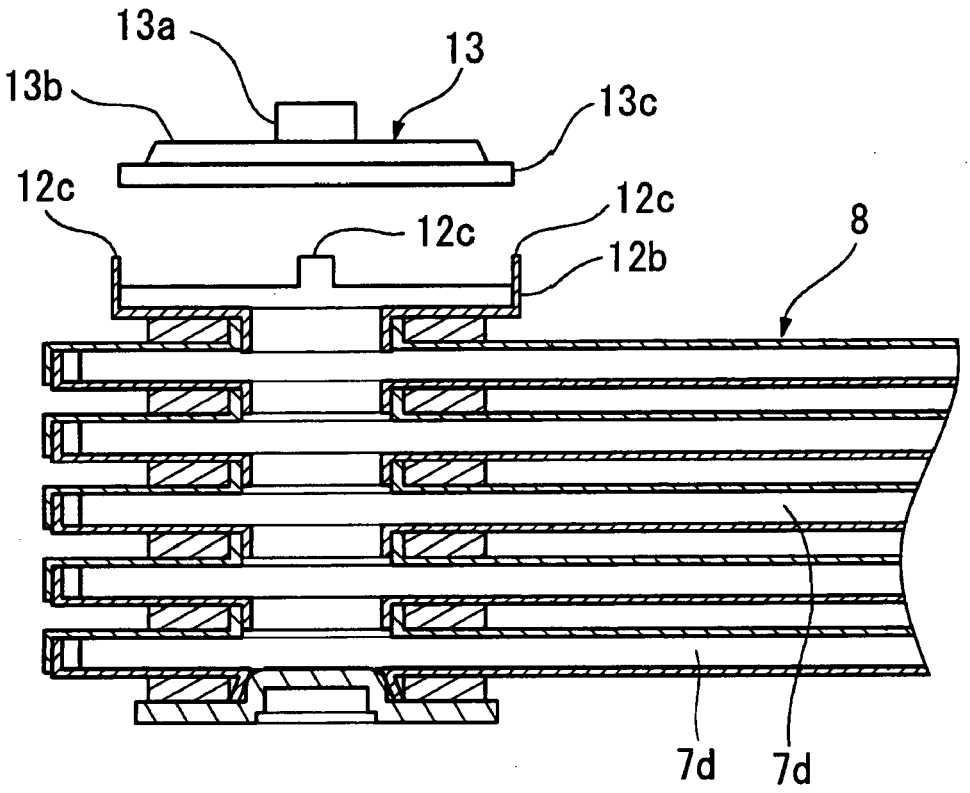


FIG. 9B

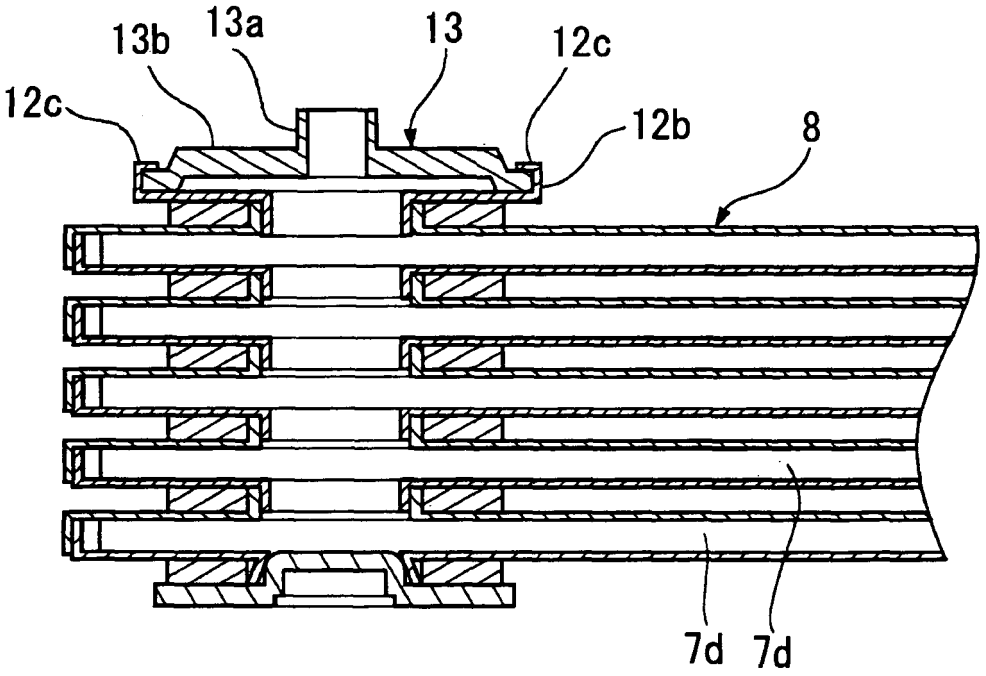


FIG. 10A

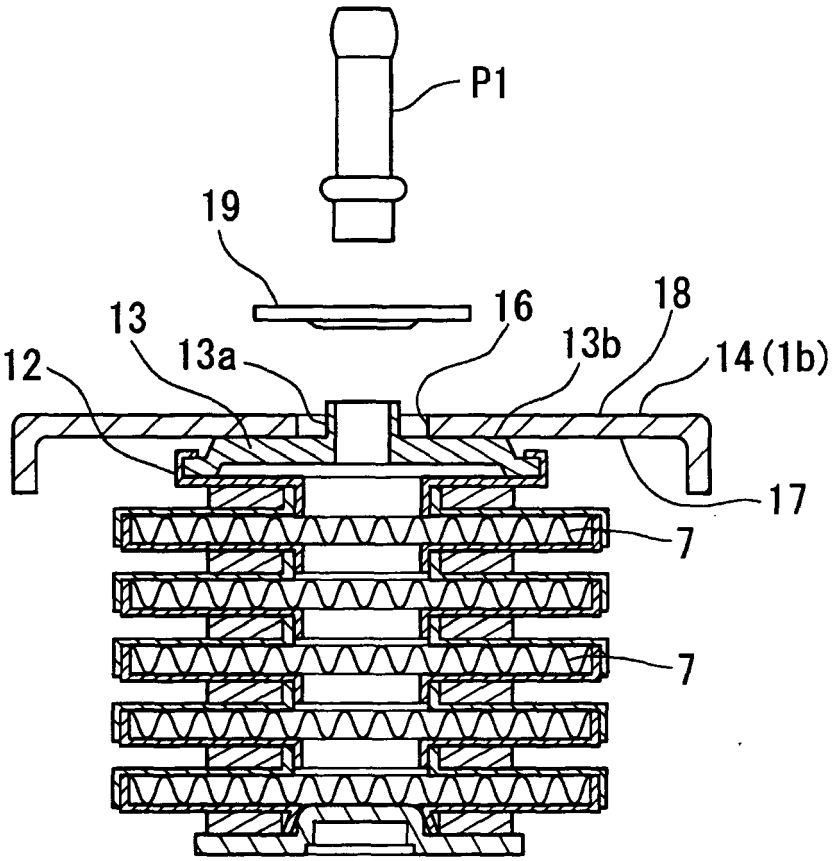


FIG. 10B

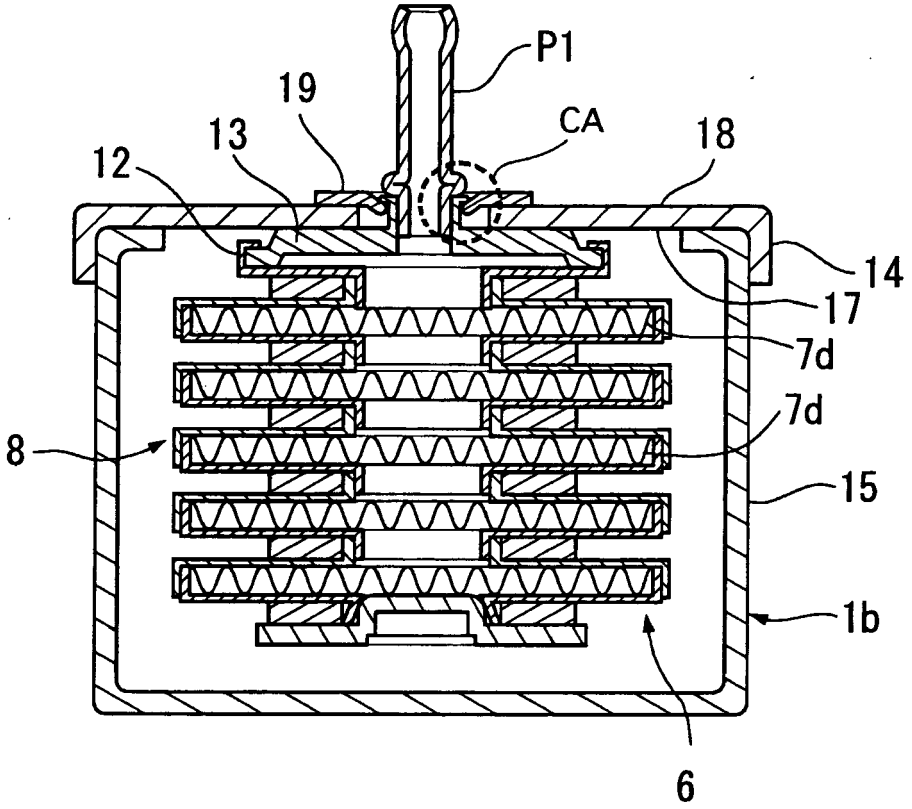
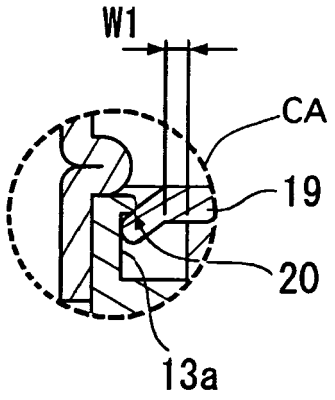


FIG. 11



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EUROPEAN SEARCH REPORT

Application Number
EP 05 29 1205

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
Y	PATENT ABSTRACTS OF JAPAN vol. 2002, no. 02, 2 April 2002 (2002-04-02) -& JP 2001 272195 A (CALSONIC KANSEI CORP), 5 October 2001 (2001-10-05) * abstract; figures 14,15 * -----	1,2	F28F9/02 F28F9/04
Y	PATENT ABSTRACTS OF JAPAN vol. 2003, no. 12, 5 December 2003 (2003-12-05) -& JP 2005 003227 A (CALSONIC KANSEI CORP), 6 January 2005 (2005-01-06) * abstract; figures 13,14 * -----	1,2	
			TECHNICAL FIELDS SEARCHED (IPC) F28F

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
The Hague	17 November 2005	Beltzung, F

CATEGORY OF CITED DOCUMENTS

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17-11-2005

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
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For more details about this annex : see Official Journal of the European Patent Office, No. 12/82

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- JP 10073393 A **[0002]**
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