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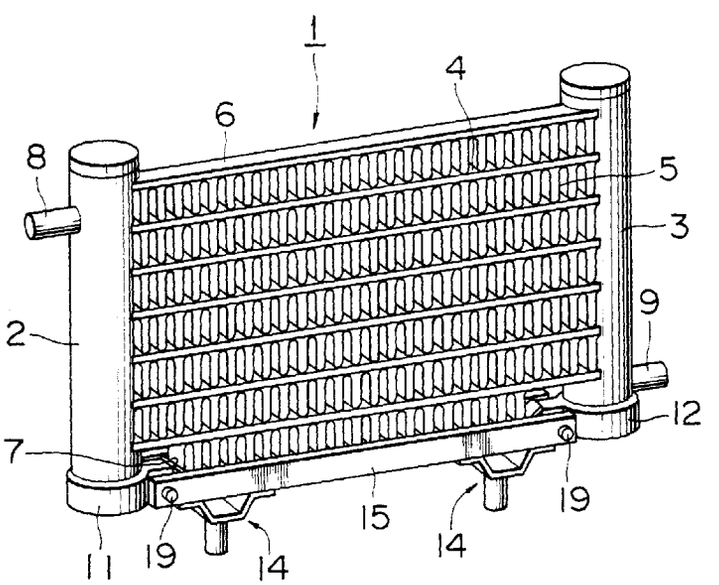
(54) Heat exchanger

(57) A heat exchanger has at least a header pipe (2, 3). A connector (11, 12) is connected to an end of the header pipe (2 3) and a side member (15) formed separately from the connector (11, 12) and having an attachment mechanism (14) for being attached to an external member (30) is fixed to the connector (11, 12). In the bracket mechanism of the heat exchanger, simplification of the shapes of the respective parts, increase of freedom on design, making the parts common, improvement of assembling ability, decrease of percentage defective in brazing and increase of the strength of the bracket mechanism itself and the strength of attachment of the heat exchanger can be achieved.

FIG. 1



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Description

The present invention relates to a heat exchanger, and more particularly to a heat exchanger having a bracket mechanism for attaching the heat exchanger to an external member.

In a heat exchanger, for example, an evaporator, a condenser or a heater core used in an air conditioner for vehicles, generally a bracket is provided for attaching and fixing the heat exchanger to an external member, for example, a frame or a body member of a vehicle. In a conventional heat exchanger, such a bracket has been connected and fixed to a header pipe or another structural member of the heat exchanger by brazing or other methods.

For example, as shown in FIGS 5-7, brackets 41 and 42 are brazed to the lower end portions of header pipes 43 and 44 of heat exchanger body 45, respectively. Each of brackets 41 and 42 has a relatively complicated shape. Attaching portions 46 and 47 provided on the respective brackets 41 and 42 and formed as rod portions are attached and fixed to external members 48 and 49.

In such a conventional structure, however, because brackets 41 and 42 must be designed depending upon the shape and size of heat exchanger body 45, many kinds of brackets having various sizes must be prepared and the shape of each bracket is likely to become relatively complicated. For example, if the dimension L between external members 48 and 49 is constant, many kinds of brackets having various sizes B must be prepared. Further, because brackets 41 and 42 must be designed depending upon the types of heat exchangers, restriction on design is great.

Further, when brackes 41 and 42 are brazed to header pipes 43 and 44, usually the assembly of the heat exchanger is placed in a furnace. At that time, although brackes 41 and 42 are positioned relative to heat exchanger body 45 by jigs, verious kinds of jigs must be prepared depending on the various kinds of brackets as well as relatively high skill is required for setting the jigs. Therefore, the heat exchanger having such a conventional structure is poor in assembling abiiity, and the percentage defective of brazing of brackets is relatively high.

Further, for brazing of brackets 41 and 42 to heat exchanger body 45 by brazing, the material of the brackets 41 and 42 are limited to a material capable of being brazed to the heat exchanger body 45. For example, when a material of heat exchanger body 45 is an aluminum alloy, the material of brackets 41 and 42 are limited to the identical material with or the same kind of material as the material of the heat exchanger body 45. When the material of brackets 41 and 42 are thus limited, increase of the strength of the brackets 41 and 42 is suppressed, and there is a fear that the strength of the brackets 41 and 42 themselves become insufficient and further the strength of attachment of the heat exchanger becomes insufficient.

Further, because brackes 41 and 42 are brazed to header pipes 43 and 44 over only a part of the peripheries of the header pipes 43 and 44 in the circumferential directions, also from this point, the percentage defective of brazing of brackets is likely to become relatively high, and the attachment strength of the heat exchanger becomes relatively low.

Furthermore, because brackes 41 and 42 are formed as separate members and they are not connected to each other, in a condition where the heat exchanger is attached to external members 48 and 49 via brackes 41 and 42, a stress due to an external force or vibration is liable to concentrate any one of the brackes 41 and 42 and the brazed surface thereof. Therefore, the attachment strength of the heat exchanger is relatively low.

It would be desirable to greatly relieve restriction on design of a bracket which has been applied depending types of heat exchangers, to make a bracket forming member common to various types of heat exchangers as well as to simplify the shape of the bracket forming member, and to substantially remove limitation on material of the bracket forming member, thereby improving the assembling ability, decreasing the percentage defective in brazing and increasing the strength of the bracket itself and the strength of attachment of a heat exchanger.

A heat exchanger according to the present invention has at least a header pipe. A connector is connected to an end of the header pipe, and a side member formed separately from the connector and having an attachment mechanism for being attached to an external member is fixed to the connector.

The connector may be brazed to the one end of the header pipe. The connector is constructed from an identical material with or the same material as that of the header pipe. The side member may be constructed from a material different from that of the connector. For exampie, when the connector is constructed from an aluminum-system material which is the same material as that of the header pipe, the side member may be constructed from an iron-system material.

Although the heat exchanger according to the present invention is not particularly restricted as long as it has at least one header pipe, for example, it can be formed as a so-called multi-flow type heat exchanger having a pair of header pipes and a plurality of parallel tubes fluidly interconnected between the header pipes. In this case, for example, the connector is connected to a lower end of each header pipe and the side member is provided to extend between both connectors.

In such a heat exchanger, a conventional bracket for attachment which has been made depending on the types of heat exchangers is divided into a connector to be connected to an end of a header pipe and a side member to be fixed to the connector. Therefore, the connector may be formed as a shape capable of being fixed

to the side member, and the shape of the connector can be simplified. At the same time, the shape of the side member formed as a separate member also can be simplified. When the structure or shape of the connecting portion between the connector and the side member is made common, a common side member can be used even if the type of the heat exchanger is changed, and the restriction on design (shape) of the side member can be substantially removed. Further, because the side member is formed as a member separate from the connector, the limitation on material of the side member can be removed. Therefore, the strength of the side member itself, ultimately the strength of the bracket mechanism including the connector and the side member and the strength of attachment of the heat exchanger to an external member, can be greatly increased by using a high-strength material as the material of the side member, for example, an iron-system material.

Further, because the shape of the connector itself can be simplified by the separate structure of the connector and the side member, the assembling ability of the connector to the header pipe and the side member to the connector can be greatly improved. Therefore, in brazing, the percentage defective on the brazing can be greatly decreased. Further, because the connector easily can be brazed simultaneously with the brazing of the heat exchanger body, the sub-assembly before the brazing may be substantially unnecessary or may be extremely simplified.

As a result, jigs for the sub-assembly which have been required depending on the types of the heat exchangers may become unnecessary, and the assembling process can be greatly simplified.

An embodiment of the invention will now be described with reference to the appropriate figures, which is given by way of example only, and is not intended to limit the present invention.

FIG. 1 is a perspective view or a heat exchanger according to an embodiment of the present invention.

FIG. 2 is an enlarged, exploded, partial perspective view of a bracket mechanism of the heat exchanger depicted in FIG. 1.

FIG. 3 is an enlarged plan view of a connector of the heat exchanger depicted in FIG. 1.

FIG. 4 is a side view of the connector depicted in FIG. 3.

FIG. 5 is a perspective view of a conventional heat exchanger.

FIG. 6 is a bottom view of the heat exchanger depicted in FIG. 5.

FIG. 7 is an enlarged side view of a bracket of the heat exchanger depicted in FIG. 5.

Referring to FIGS. 1 and 2, a heat exchanger 1 is provided according to an embodiment of the present invention. Heat exchanger 1 in this embodiment is constructed as a multi-flow type heat exchanger. Heat exchanger 1 includes a pair of header pipes 2 and 3, a plurality of parallel heat transfer tubes 4 fluidly interconnected between the pair of header pipes 2 and 3 and a plurality of corrugated fins 5 disposed between on both surfaces of each heat transfer tube 4. In this embodiment, each heat transfer tube 4 is formed as a flat tube. End plates 6 and 7 are provided on the upper surface of the uppermost fin 5 and on the lower surface of the lowermost fin 5, respectively. Inlet pipe 8 is connected to header pipe 2 and outlet pipe 9 is connected to header pipe 3, respectively. Each end portion of each heat transfer tube 4 is inserted into a corresponding tube insertion hole 10 provided on header pipes 2 and 3, and connected to the header pipes 2 and 3. A heat medium, for example, refrigerant, is introduced into header pipe 2 through inlet pipe 8, and after circulated in heat exchanger 1, it is discharged from header pipe 3 through outlet pipe 9.

Connectors 11 and 12 are provided on the end portions of header pipes 2 and 3, respectively. In this embodiment, each connector 11 or 12 is connected to the lower end of header pipe 2 or 3. Each connector 11 or 12 is formed from a rectangular parallelopiped portion 11a or 12a and a cylindrical portion 11b or 12b, and has a through hole 20, an header insertion hole 23 and a through hole 24 formed at the bottom of the header insertion hole 23, as shown in FIGS. 3 and 4. The lower end portions of the respective header pipes 2 and 3 are inserted header insertion holes 23 of the respective connectors 11 and 12, and the connectors 11 and 12 are connected to the respective header pipes 2 and 3 over their entire circumferences. The connector 11 or 12 can be easily and precisely positioned relative to header pipe 2 or 3 by bringing the lower end surface of the header pipe 2 or 3 into contact with bottom surface 25 of header insertion hole 23 of the connector 11 or 12. These connectors 11 and 12 are made from the same kind of an aluminum-system material as that of header pipes 2 and 3. Connectors 11 and 12 are brazed to the lower ends of header pipes 2 and 3 each plugged by a cap 13, respectively.

Side member 15 having an attachment mechanism 14 for being attached to an external member 30 is provided between connectors 11 and 12. Side member 15 is formed as a channel member and has a U-shaped cross section. Rectangular parallelopiped portion 11a or 12a of each connector 11 or 12 is positioned between the leg portions of the U-shaped cross section of side member 15. A through hole 16 and a screw hole 18 formed by connected nut 17 are provided on each end portion of side member 15, and through hole 20 is defined on rectangular parallelopiped portion 11a or 12a of each connector 11 or 12. A bolt 19 is inserted into through hole 16 and through hole 20 and screwed into screw hole 18. Thus, side member 15 is fixed to both connectors 11 and 12. Where, the fixing mechanism between side member 15 and connectors 11 and 12 is not particularly restricted, and other appropriate mechanisms may be employed.

In this embodiment, side member 15 is constructed

from an iron-system material different from an aluminum-system material of connectors 11 and 12 and the heat exchanger body. Although the material of side member 15 is not particularly restricted to such an iron-system material, when another material is selected, it is preferred to select a high-strength material from the purpose of the present invention.

Further, in this embodiment, attachment mechanism 14 to external member 30 is constructed from a supporting member 21 connected to the lower surface of side member 15 and a rod member 22 connected to the lower surface of the supporting member 21 and extending downward. Rod member 22 is engaged and fixed to external member 30, for example, a rubber vibration isolator. Where, this attachment mechanism 14 also is not particularly restricted, and other appropriate mechanisms may be employed.

In the heat exchanger 1 thus constituted, the bracket mechanism for attachment of the heat exchanger 1 is divided into connectors 11 and 12 and side member 15. Since, for the shape of connectors 11 and 12, merely the connecting structure to header pipes 2 and 3 and the connecting structure to side member 15 may be considered, the shape of connectors 11 and 12 can be simplified. By this simplification of the shape of connectors 11 and 12, connectors 11 and 12 can be easily assembled to header pipes 2 and 3, and even in brazing, they can be easily brazed in a furnace simultaneously with the heat exchanger body and the percentage defective in the brazing can be decreased. Further, because of simple connectors 11 and 12, an extruded product, a forged product or a cast product can be applied for the manufacture of the connectors 11 and 12, thereby decreasing the manufacturing cost.

Moreover, since side member 15 also having a simple shape is connected and fixed to simple connectors 11 and 12, the assembling ability as a whole is very good. Therefore, particular jigs are not required for the assembly.

Further, if the diameters of header pipes 2 and 3 of different types of heat exchangers are the same, common connectors 11 and 12 can be used. Besides, if the connecting structure between connectors 11 and 12 and side member 15 is designed to be common, the side member 15 is also made common for different types of heat exchangers. By these common parts, even if jigs for assembly are required, it becomes possible to make the jigs common as well as particular jigs having complicated shapes become unnecessary. Moreover, even if the width of the heat exchanger body varies, as long as the diameter of header pipes is the same, a desired bracket mechanism can be easily completed merely by changing the length of side member 15.

Further, the freedom on design for connectors 11 and 12 and side member 15 can be greatly increased by the simple shapes of connectors 11 and 12 and side member 15 and the separate structure thereof.

Furthermore, by the separate structure of connectors 11 and 12 and side member 15, the limitation on material of side member 15 is substantially removed, and it is possible to make the side member 15 from a high-strength material such as an iron-system material. As a result, of course the strength of side member 15, the strength of the whole of the bracket mechanism, ultimately the strength of attachment of the heat exchanger1, can be greatly increased.

Still further, in the above-described embodiment, since each connector 11 (12) is connected and brazed to each header pipe 2 (3) over the entire periphery of the header pipe 2 (3) in the circumferential direction, the connection strength therebetween is very great. Moreover, because both connectors 11 and 12 are integrally connected by side member 15, the strength for attachment of the heat exchanger due to this bracket mechanism is very great.

Although connectors 11 and 12 and side member 15 are constructed from different materials in the above-described embodiment, they may be constructed from the same kind of materials and the side member may be connected to the connectors by brazing. Even in such a structure, at least simplification of the shapes of the respective parts, increase of freedom on design due to the simplification of the shapes, improvement of assembling ability and decrease of percentage defective in brazing can be achieved.

Claims

1. A heat exchanger having at least a header pipe (2, 3) characterized in that a connector (11, 12) is connected to an end of said header pipe (2, 3) and a side member (15) formed separately from said connector (11, 12) and having an attachment mechanism (14) for being attached to an external member (30) is fixed to said connector (11, 12).

2. The heat exchanger according to claim 1, wherein said connector (11, 12) is brazed to said end of said header pipe (2, 3).

3. The heat exchanger according to claim 2, wherein said connector (11, 12) is brazed to said end of said header pipe (2, 3) over the entire periphery of said header pipe (2, 3) in the circumferential direction.

4. The heat exchanger according to any preceding claim, wherein said connector (11, 12) is constructed from an identical material with or the same material as that of said header pipe (2, 3).

5. The heat exchanger according to any preceding claim, wherein said side member (15) is constructed from a material different from that of said connector (11, 12).

6. The heat exchanger according to claim 5, wherein said connector (11, 12) is constructed from an aluminum-system material and said side member (15) is constructed from an iron-system material.

7. The heat exchanger according to any preceding claim, wherein said side member (15) has a U-shaped cross section.

8. The heat exchanger according to any preceding claim, wherein said connector (11, 12) and said side member (15) are fixed to each other via a bolt (19).

9. The heat exchanger any preceding claim, wherein said heat exchanger is formed as a multi-flow type heat exchanger having a pair of header pipes (2, 3) and a plurality of parallel tubes (4) fluidly interconnected between said pair of header pipes (2, 3).

10. The heat exchanger according to claim 9, wherein said connector (11, 12) is connected to a lower end of each of said pair of header pipes (2, 3) and said side member (15) extends between both connectors (11, 12).

FIG. 1

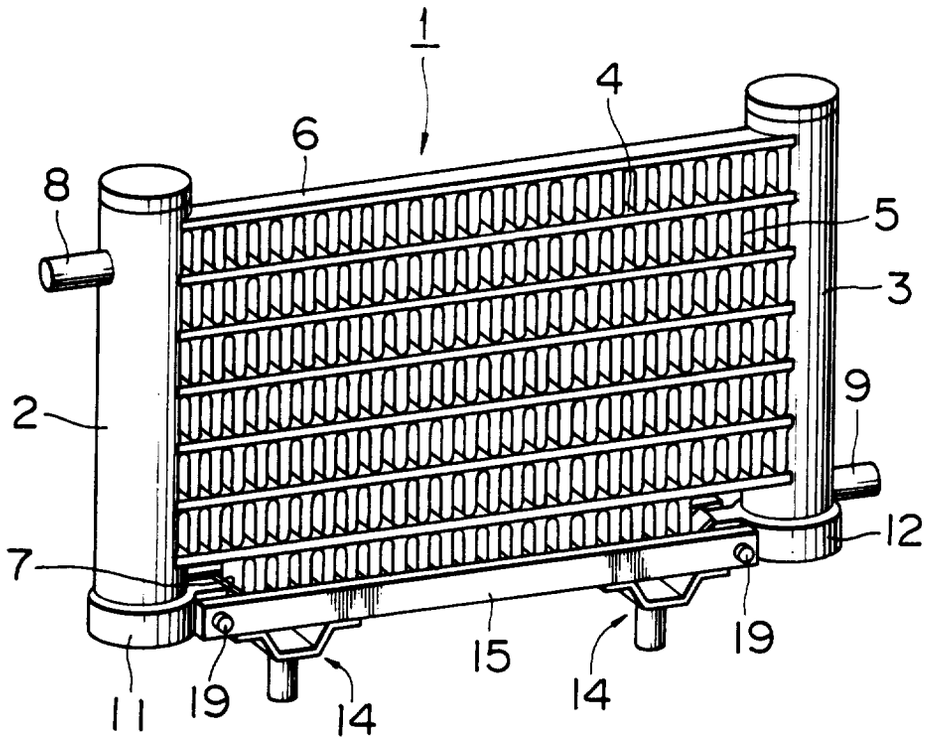


FIG. 2

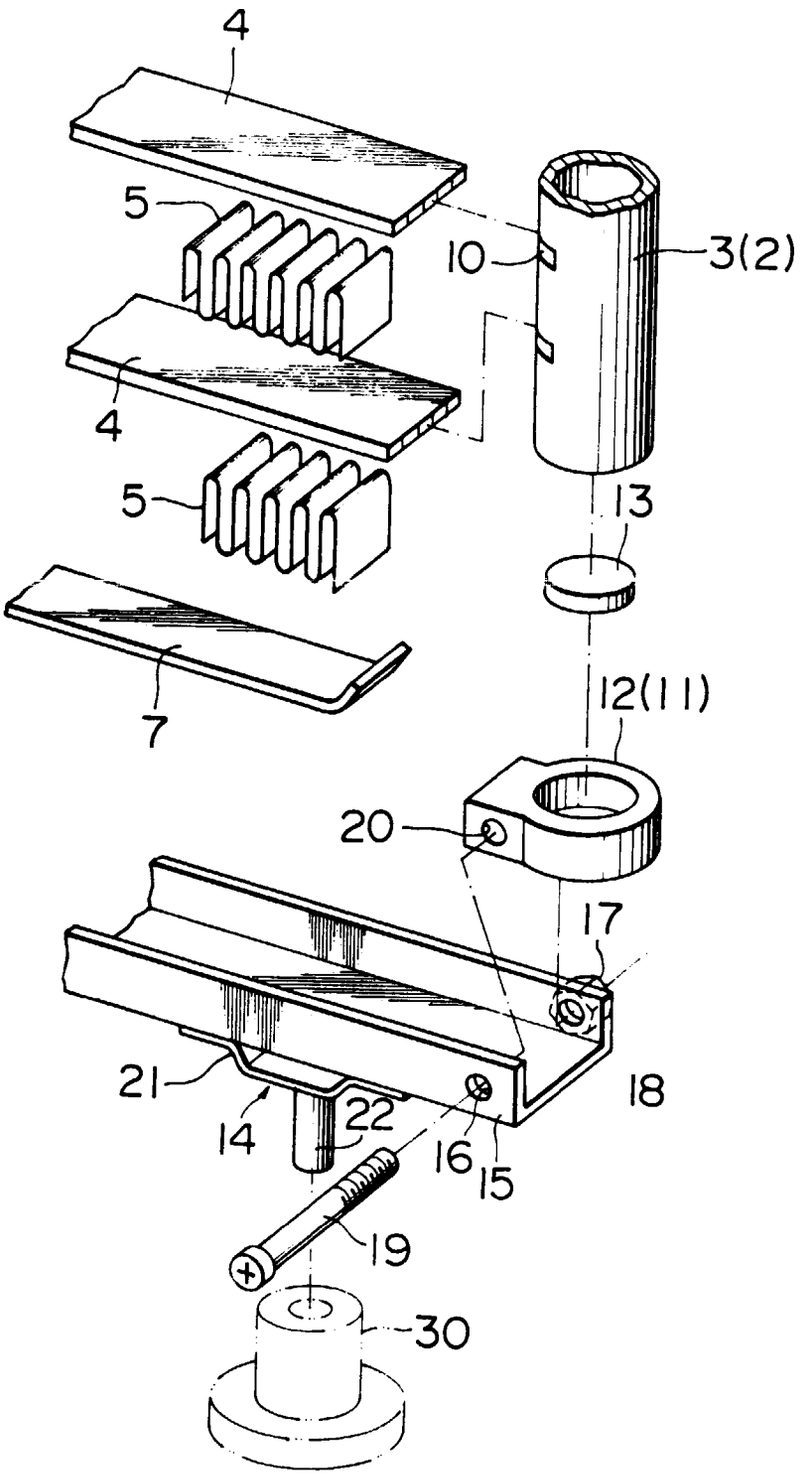


FIG. 3

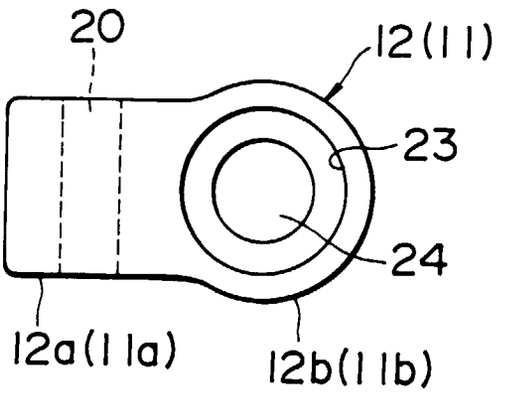


FIG. 4

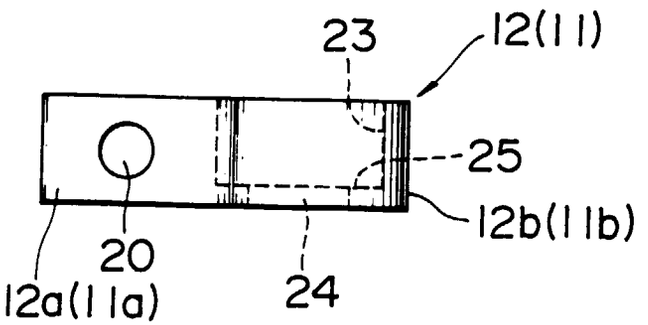


FIG. 5

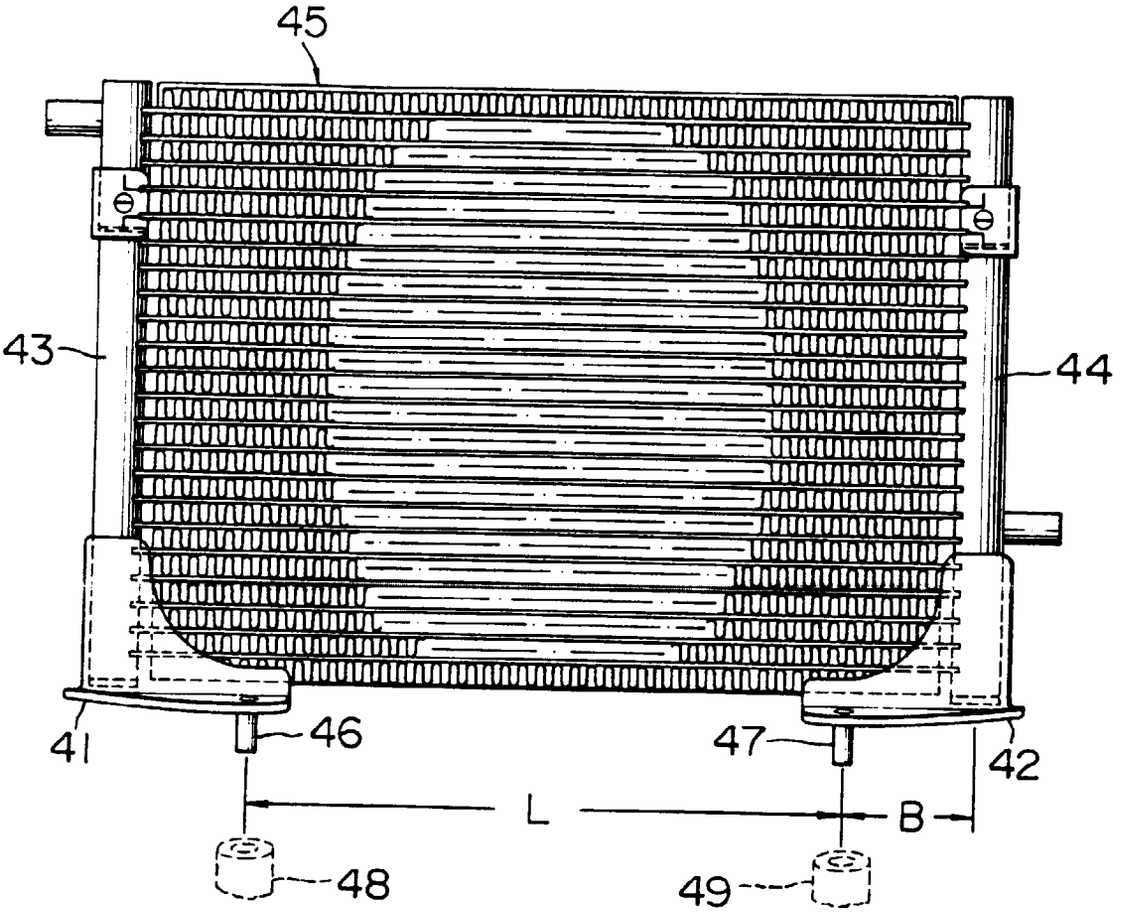


FIG. 6

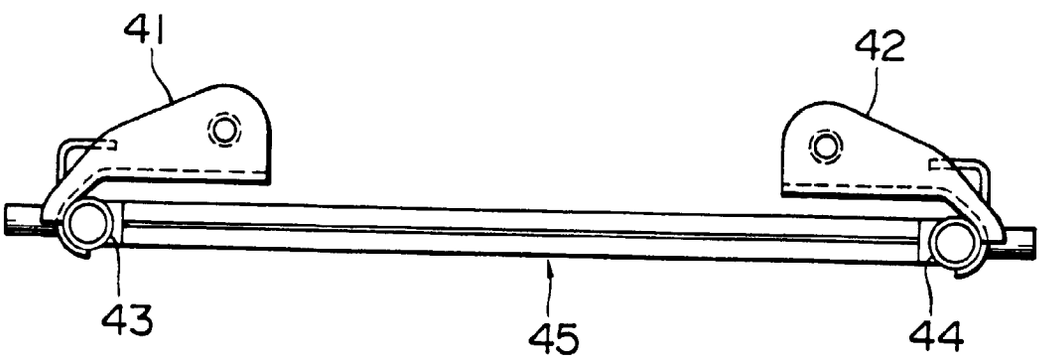
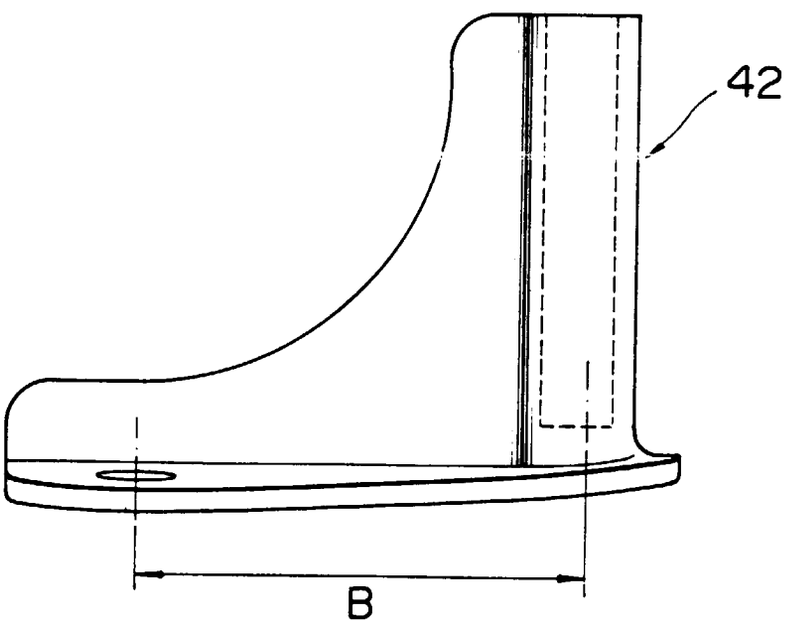


FIG. 7



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EUROPEAN SEARCH REPORT

Application Number
EP 97 30 2478

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int.Cl.6)
X	US 5 441 100 A (UEDA ET AL) * column 3, line 29 - column 4, line 28 * * column 6, line 5 - column 8, line 7; figures 1-4,9-17 * ---	1-4,7-10	F28F9/00
X	US 5 429 182 A (HANAFUSA) * column 5, line 3 - column 6, line 37; figures 1-7 * ---	1,2,7-10	
X	US 4 367 793 A (MACINTOSH) * column 2, line 35 - column 4, line 33; figures 1-4 * -----	1,7-10	

TECHNICAL FIELDS SEARCHED (Int.Cl.6)

F28F

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
THE HAGUE	9 June 1997	Beltzung, F

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
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