

12 **EUROPEAN PATENT APPLICATION**

21 Application number: **84102075.3**

51 Int. Cl.<sup>3</sup>: **F 28 D 9/02, F 28 F 3/08**

22 Date of filing: **28.02.84**

30 Priority: **28.02.83 JP 26998/83 U**

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43 Date of publication of application: **05.09.84**  
**Bulletin 84/36**

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84 Designated Contracting States: **CH DE FR GB IT LI SE**

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54 **Cross-flow-type heat exchanger.**

57 A cross flow-type heat exchanger wherein the ridges of the heat exchange member in its laminated direction are cut off and the reinforcing plate is mounted along each cut-off portion to protect the corners from damage and to prevent the two sorts of air current from becoming mixed together.

**EP 0 117 565 A2**

EP.  
FP 8407.2  
0117565

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S P E C I F I C A T I O N

1. Title of the Invention:

Cross Flow-type Heat Exchanger

3. Background of the Invention:

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The present invention relates to a cross flow-type heat exchanger and aims at preventing air currents from becoming mixed together as well as at preventing damages of the corners.

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Fig. 1(a) indicates a general example of cross flow-type heat exchanger wherein square corrugated plates 1 are laminated in a manner that alternate layers cross perpendicularly, adjacent layers being separated by partitions 2 respectively. When air currents A and B are passed through

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1 such a heat exchanger 3 in two perpendicular directions,  
it is convenient if the air currents do not become mixed  
inside. The reference numeral 1a denotes an air passage  
or a flute.

Said heat exchanger 3, however, is detrimental in  
5 that ridges 4 in laminated direction are easily broken  
as the heat exchanger 3 unavoidably assumes the form of  
a cuboid or a prism. If the ridges 4 are damaged, the air  
currents A and B will become mixed there. In practical use,  
such a heat exchanger 3 is housed in a rectangular casing  
10 5 as shown in Fig. 1(b). In order to prevent the air  
currents A and B from becoming mixed together through  
voids between the casing 5 and the heat exchanger 3, and  
to protect the corners of the heat exchanger 3 from damages,  
it is necessary to insert two packing means 6 for each  
15 corner which double as cushions. Inserting job is rather  
difficult as the packing means 6 must be packed as close as  
possible to the corners in order to maximize the air passage  
and simultaneously must have a good air tightness. In other  
words, if the position of the packing means 6 is not aligned  
20 correctly when the heat exchanger 5 is inserted into the  
casing 5, it is difficult to correct misalignment. In  
Fig. 1(b) the reference numerals 7, 8, 9 and 10 denote  
inlets of the air currents while A', B' denote the currents  
going out of the heat exchanger 3.

25 The present invention was contrived to obviate said  
defects in prior art.

1 4. Summary of the Invention:

It is an object of the present invention to provide a cross flow-type heat exchanger which can prevent the air currents from becoming mixed together and protect the corners from damages.

5 The object has been attained by the cross flow-type heat exchanger which is characterized in that the ridges of the heat exchanger member in its laminated direction are cut off and that a reinforcing plate is mounted along each cutt-off portion. It is desirable to insert a packing means between the reinforcing  
10 plate and the casing.

5. Brief Description of the Drawings:

Fig. 1(a) is a perspective view of a conventional  
15 cross flow-type heat exchanger while Fig. 1(b) a sectional view to show the state of housing the same into a casing.

Fig. 2 shows an embodiment according to the present invention; Fig. 2(a) is a plane view of the heat exchanger while Fig. 2(b) a perspective view of a reinforcing plate  
20 to be used therein.

Fig. 3 shows another embodiment according to the present invention; Fig. 3(a) is a plane view of the heat exchanger while Fig. 3(b) a perspective view of a reinforcing plate to be used therein.

25 Fig. 4(a) is a perspective view of the heat exchanger using the embodiment shown in Fig. 3. Fig. 4(b) is a plane view to indicate the state that the heat exchanger above is mounted in a casing (a top plate thereof not shown).

1 6. Description of the Preferred Embodiments:

As stated before, the object of the present invention is achieved by cutting the corners and providing the reinforcing plates on the cut-off portions.

5 The present invention is now described referring to Figs. 2 to 4 in the attached drawings. Fig. 2(a) is a plane view of a heat exchanger 3 wherein the four corners or the ridges in the laminated direction 4 are truncated. The truncated portions 11 are reinforced with reinforcing  
10 plates 12 in the form of a flat sheet as shown in Fig. 2(b). The material of the reinforcing plates 12 is preferably the same as that of the heat exchanger 3. If high-temperature ceramic is used as the heat exchanger 3, ceramic reinforcing plates 12 are attached to the truncated portions 11 with a  
15 heat-resistant adhesive in an air-tight fashion.

Fig. 3(a) is a plane view of another embodiment wherein respective truncated portions 11 are provided with crenatures or indentations 13. In this case reinforcing plates are adapted to assume T-shaped sections as shown in Fig. 3(b)  
20 in order to conform to the shape of the truncated portions. The reinforcing plates 14 are easily but firmly mounted to the portions 11 simply by inserting the projections 14a of the reinforcing plates 14 into the crenatures 13, improving the preventive effects against mixing of the air currents.  
25 Fig. 4(a) shows an example of attaching the reinforcing plates 14.

As described above, by truncating the corners 4 of

1 the heat exchanger 3 and attaching the reinforcing plates  
12 or 14 to the truncated portions 11, the corners can be  
protected from damages and simultaneously the air currents  
can be prevented from becoming mixed.

5 Truncation of the corners 4 and crenatures or indent-  
ations in the portions 11 may be provided collectively after  
corrugated plates 1 and partitions 2 have been laminated or  
may be provided to each plate before they are laminated. In  
the case that the corrugated plates 1 are cast mold products, they  
10 may be molded to have truncated portions 11 and crenated  
portions 13.

When the heat exchanger 3 mentioned above is housed  
in a casing as shown in Fig. 4(b), packing means 6 are  
packed into the portions having a triangle cross section  
15 which are defined by the casing 5 and the reinforcing  
plates 14 (or 12) at the corners. As the portions to contain  
the packing members 6 are shaped triangular, there is no  
possibility of displacement at the time of attaching.  
Mounting of the heat exchanger 3 and the packing members 6  
20 is thus extremely simple. As only one packing member 6  
suffices for each corner, manufacturing cost can also be  
reduced. Fig. 4(b) shows the top plate of the casing 5  
being omitted.

In the embodiment shown in Fig. 4(b), the casing 5  
25 is of a collapsible type or a sectioned type, further  
facilitating mounting of the heat exchanger 3 and packing  
means 6. If the heat exchanger 3 is subjected to high

1 temperatures, rock wool or other materials are used for  
packing means 6. Packing means are inserted above and  
underneath the heat exchanger 3 to act as cushion, although  
they are not shown in Fig. 4(b).

5       As described in the foregoing, the cross flow-type  
heat exchanger according to the present invention can  
protect the corners from damages and simultaneously can  
prevent the air currents from becoming mixed. Further,  
packing means can be simply and firmly mounted even when  
10 the heat exchanger must be housed in a casing.

1 7. Claims:

(1) A cross flow-type heat exchanger wherein a casing is provided with a parallel sides heat exchange member having air passages oriented in such a manner that alternate layers cross each other perpendicularly, which is characterized  
5 in that the ridges of said heat exchanger member in the laminated direction are cut off and that a reinforcing plate is mounted along said each cut-off portion.

(2) The cross flow-type heat exchanger as claimed in Claim 1 which is characterized in that said heat exchange  
10 member is housed in a casing with a packing means inserted between the reinforcing plate mounted on said cut-off portion and said casing.

FIG. 1

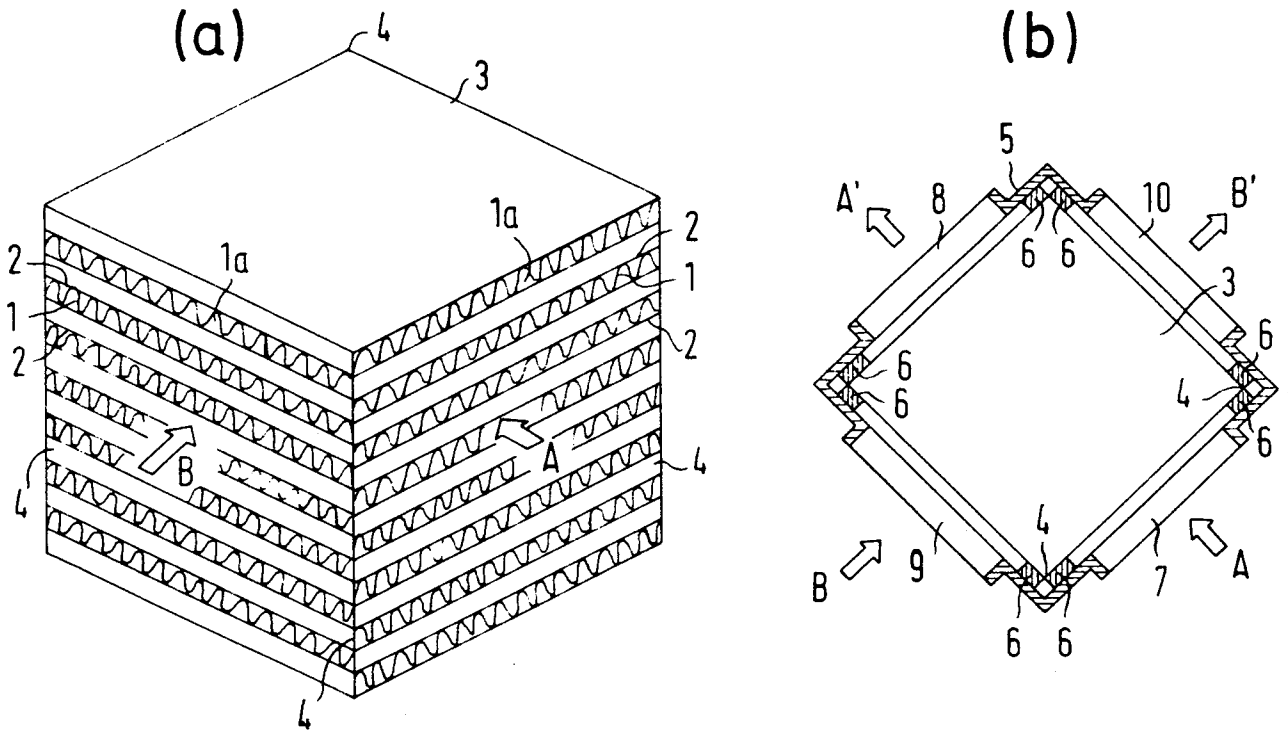


FIG. 2

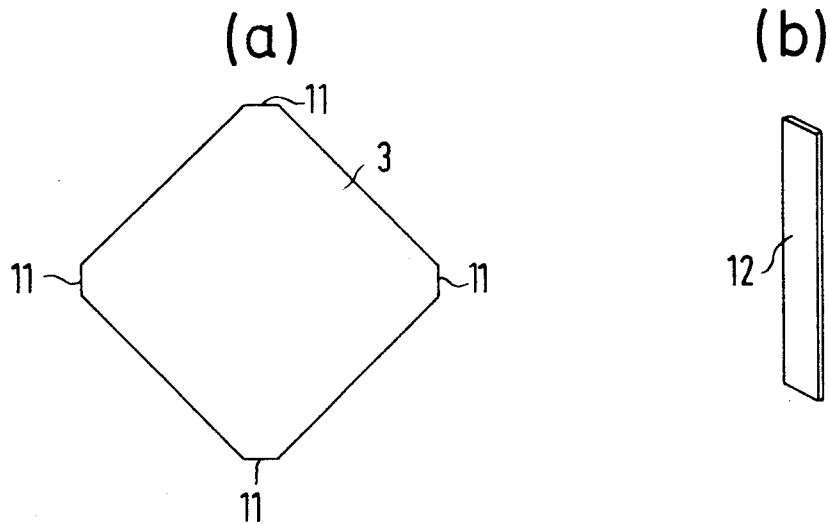


FIG. 3

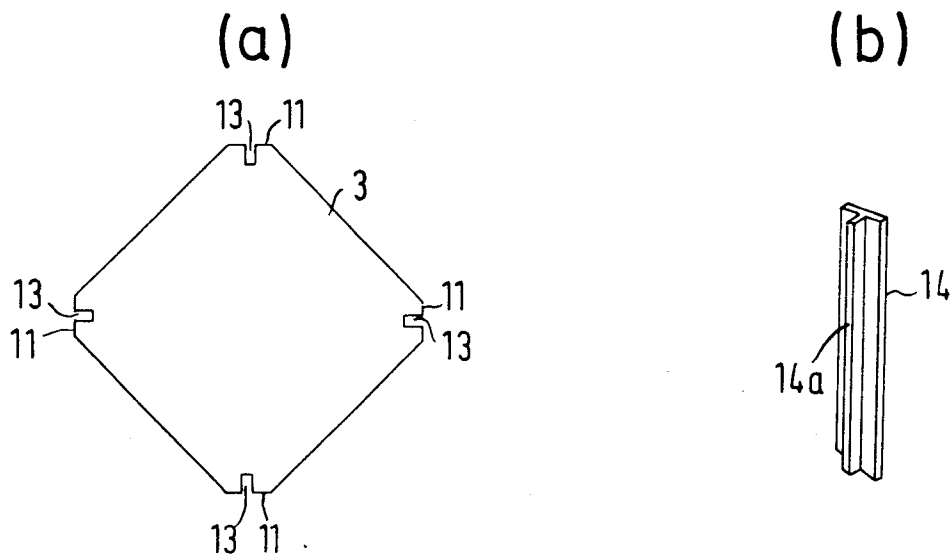


FIG. 4

