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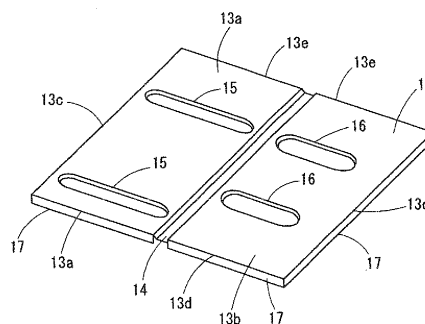
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(54) **AIR CONDITIONER INDOOR UNIT**

(57) An air conditioner indoor unit A includes a body casing 1, which accommodates a fan 2 and a heat exchanger 3. A top plate 13 is arranged in an upper portion of the body casing 1. A longitudinal reinforcement rib 14, which divides the top plate 13 into a first region 13a and a second region 13b, is formed in the top plate 13. A first lateral reinforcement rib 15, which extends between the longitudinal reinforcement rib 14 and a corresponding one of side edges 13c of the top plate 13, is formed in the first region 13a. A second lateral reinforcement rib 16, which extends between the longitudinal reinforcement rib 14 and the other side edge 13c of the top plate 13, is formed in the second region 13b. The reinforcement ribs 14, 15, 16 thus significantly increase the rigidity of the top plate 13 as a whole. Further, if the first and second lateral reinforcement ribs 15, 16 are formed by stretch-forming, torsion and flexure of the top plate 13 caused by spring back after the ribs 15, 16 are formed are decreased. As a result, the top plate 13 is mounted with increased work efficiency.

Fig.1



Description

TECHNICAL FIELD

[0001] The present invention relates to an indoor unit for an air conditioner, and, more particularly, to a configuration of a top plate of an indoor unit for an air conditioner.

BACKGROUND WART

[0002] This type of indoor unit for an air conditioner (which is, for example, an indoor unit for a built-in type air conditioner) includes a top plate having increased rigidity. Methods for increasing the rigidity of the top plate include spot welding of an L-shaped angle bar to the top plate and formation of a reinforcement rib on the top plate to which the L-shaped angle bar has been spot-welded. However, such methods for increasing the rigidity of the top plate necessitate an additional component, which is the L-shaped angle bar attached to the top plate. This not only raises the cost for manufacturing the indoor unit but also increases the weight of the indoor unit and the thickness of the top plate.

[0003] The technique for increasing the rigidity of the top plate by forming parallel reinforcement ribs on this type of top plate has been conventionally known as disclosed in Patent Document 1.

[0004] The technique disclosed in Patent Document 1 relates to a configuration of a top plate for supporting a fan and fan motor to the top plate each in a suspended state. A plurality of reinforcement ribs are formed on the top plate. However, in the technique described in Patent Document 1, deflection of the top plate caused by static pressure and torsion and flexure of the top plate caused by spring back after the top plate is formed are not considered.

Patent Document 1: Japanese Laid-Open Patent Publication No. 2006-105573

SUMMARY OF THE INTENTION

[0005] Accordingly, it is an objective of the present invention to decrease deflection of a top plate caused by static pressure and torsion and flexure of the top plate caused by spring back after the top plate is formed, without increasing the manufacturing cost and the weight.

[0006] To achieve the foregoing objective and in accordance with one aspect of the present invention, an air conditioner indoor unit having a body casing 1 accommodating a fan 2 and a heat exchanger 3 is provided. The body casing 1 has a top plate 13 arranged in an upper portion thereof. The top plate 13 has a longitudinal reinforcement rib 14 dividing the top plate 13 into first and second regions 13a, 13b, one or more first lateral reinforcement ribs 15, and one or more second lateral reinforcement ribs 16. The first lateral reinforcement ribs 15 are arranged in the first region 13a and between the

longitudinal reinforcement rib 14 and one of two side edges 13c of the top plate 13 that face the longitudinal reinforcement rib 14. The second lateral reinforcement ribs 16 are arranged in the second region 13b and between the longitudinal reinforcement rib 14 and the other side edge 13c.

[0007] In the above-described configuration, the longitudinal reinforcement rib 14 and the lateral reinforcement ribs 15, 16 are formed on the top plate 13. This significantly increases the rigidity of the top plate 13 as a whole. If the lateral reinforcement ribs 15, 16 are formed by stretch-forming, one or more first lateral reinforcement ribs 15 and one or more second lateral reinforcement ribs 16, which are formed in the first region 13a and the second region 13b, respectively, decrease torsion and flexure of the top plate 13 caused by spring back after the first and second lateral reinforcement ribs 15, 16 are formed. This increases work efficiency when the top plate 13 is mounted.

[0008] The top plate 13 preferably has a rectangular shape, and the longitudinal reinforcement rib 14 preferably extends parallel to the side edges 13c of the top plate (13). In this configuration, the top plate 13, which is shaped rectangular, is divided into the first region 13a and the second region 13b. The longitudinal reinforcement rib 14 is usable as a member for supporting an upper end of a component arranged in the body casing, which is, for example, a partition plate 9.

[0009] The one or more first lateral reinforcement ribs 15 and the one or more second lateral reinforcement ribs 16 preferably extend in a direction perpendicular to the longitudinal reinforcement rib 14 and the side edges 13c of the top plate 13. In this configuration, the lengths of the first and second lateral reinforcement ribs 15, 16 are minimized. This simplifies formation of the first and second lateral reinforcement ribs 15, 16. If the first and second lateral reinforcement ribs 15, 16 are formed by stretch-forming, torsion and flexure of the top plate 13 caused by spring back after the lateral reinforcement ribs 15, 16 are formed, are decreased further effectively. As a result, the top plate 13 is mounted with further improved work efficiency.

[0010] The one or more first lateral reinforcement ribs 15 preferably include a pair of first lateral reinforcement ribs 15, and the one or more second lateral reinforcement ribs 16 include a pair of second lateral reinforcement ribs 16. One of the first lateral reinforcement ribs 15 and a corresponding one of the second lateral reinforcement ribs 16 are preferably aligned along a common straight line, and the other first lateral reinforcement rib 15 and the corresponding second lateral reinforcement rib 16 are preferably arranged along mutually offset straight lines.

[0011] In this configuration, the first and second lateral reinforcement ribs 15, 16 are located in accordance with the positions and the shape of the components arranged in the body casing 1.

[0012] The one or more first lateral reinforcement ribs

15 preferably include three or more first lateral reinforcement ribs 15, and the one or more second lateral reinforcement ribs 16 preferably include three or more second lateral reinforcement ribs 16. Some of the first lateral reinforcement ribs 15 and corresponding ones of the second lateral reinforcement ribs 16 are preferably aligned along common straight lines, and the other first lateral reinforcement ribs 15 and the corresponding second lateral reinforcement ribs 16 are preferably arranged along mutually offset straight lines. In this configuration, the first and second lateral reinforcement ribs 15, 16 are located further effectively in accordance with the positions and the shapes of the components arranged in the body casing 1.

[0013] The top plate 13 preferably has the side edges 13c and a pair of end edges 13d, 13e extending perpendicular to the side edges 13c. An edge bending rib 17 extending downward is preferably formed in each side edge 13c and each end edge 13d, 13e. In this configuration, the edge bending rib 17 increases the rigidity of the side edges 13c and the end edges 13d, 13e of the first and second regions 13a, 13b, which are divided by the longitudinal reinforcement rib 14 on the top plate 13. This increases the rigidity of the top plate 13 as a whole further effectively. If the first and second lateral reinforcement ribs 15, 16 are formed by stretch-forming, torsion and flexure of the top plate 13 caused by spring back after the lateral reinforcement ribs 15, 16 are formed are decreased further effectively. As a result, the top plate 13 is mounted with improved work efficiency.

[0014] The longitudinal reinforcement rib 14 is preferably formed through bending. In this configuration, spring back does not occur after the longitudinal reinforcement rib 14 is formed. Also, the top plate 13 is formed by the first and second regions 13a, 13b, which are fully separated areas, thus preventing the first and second lateral reinforcement ribs 15, 16 from being twisted or flexed after the lateral reinforcement ribs 15, 16 are formed. This improves work efficiency when the top plate 13 is mounted.

[0015] The one or more first lateral reinforcement ribs 15 and the one or more second lateral reinforcement ribs 16 are formed by stretch-forming. This configuration simplifies the steps for molding the first and second lateral reinforcement ribs 15, 16.

BRIEF DESCRIPTION OF THE DRAWINGS

[0016]

Fig. 1 is a perspective view showing a top plate of an air conditioner indoor unit according to a first embodiment of the present invention;

Fig. 2 is a longitudinal cross-sectional view showing the air conditioner indoor unit of the first embodiment of the invention;

Fig. 3(a) is a diagram showing a die, or, specifically, an edge bending punch and a rib forming punch,

which are used to mold a top plate of the air conditioner indoor unit of the first embodiment of the invention;

Fig. 3(b) is a diagram showing a holder for the die;

Fig. 3(c) is a diagram showing a die block of the die;

Fig. 3(d) is a diagram showing a blank; and

Fig. 4 is a perspective view showing a top plate of an air conditioner indoor unit according to a second embodiment of the present invention.

BEST MODE FOR CARRYING OUT THE INVENTION

First Embodiment

[0017] An indoor unit for an air conditioner according to a first embodiment of the present invention will now be described with reference to Figs. 1 to 3(d).

[0018] Atop plate 13, which is illustrated in Fig. 1, is optimal for use in a body casing 1 of an air conditioner indoor unit A (for 2 HP(1.5 kW)) shown in Fig. 2.

[0019] With reference to Fig. 2, the air conditioner indoor unit A is a built-in type arranged in the path of a duct and includes the rectangular parallelepiped body casing 1. The body casing 1 accommodates a fan 2 and a heat exchanger 3.

[0020] A sirocco fan having a scroll type fan casing 5 and a multi-blade impeller 6, which is arranged in the fan casing 5, is employed as the fan 2. The fan 2 draws air from an air inlet port 7 of the fan casing 5 and blasts the air through an outlet port 8, which is arranged in the distal end of the fan casing 5.

[0021] The space in the body casing 1 is divided into a fan chamber 10 and a heat exchange chamber 11 by a partition plate 9. The fan 2 is arranged in the fan chamber 10 with a distal portion of the fan casing 5 supported by the partition plate 9.

[0022] The heat exchanger 3 is arranged in the heat exchange chamber 11 in an inclined state. Indoor air W_r is drawn through an inlet duct 4a, which communicates with the fan chamber 10, and sent into the heat exchange chamber 11 through the fan 2. The heat exchanger 3 selectively cools and heats the indoor air W_r that has been blasted out from the fan 2. After having been cooled or heated, the air is blasted out into the room from an outlet duct 4b as conditioned air W . A drain pan 12 is arranged in the heat exchange chamber 11.

[0023] As illustrated in Fig. 1, a longitudinal reinforcement rib 14, which divides a top plate 13 of the body casing 1 into first and second regions 13a, 13b, is formed in the top plate 13. The first region 13a has two first lateral reinforcement ribs 15, which are formed between the longitudinal reinforcement rib 14 and the corresponding one of two side edges 13c of the top plate 13. The second region 13b has two lateral reinforcement ribs 16, which are formed between the longitudinal reinforcement rib 14 and the corresponding one of the two side edges 13c of the top plate 13. Edge bending ribs 17 extending downward are formed along the side edges 13c and end edges

13d, 13e, which extend perpendicular to the side edges 13c, of the top plate 13. The edge bending ribs 17 thus increase the rigidity of the top plate 13 at the side edges 13c and the end edges 13d, 13e of the first and second regions 13a, 13b.

[0024] The longitudinal reinforcement rib 14 is a recessed groove that extends parallel to the side edges 13c of the top plate 13 and divides the top plate 13 into the first and second regions 13a, 13b. In the present embodiment, the longitudinal reinforcement rib 14 is formed through bending. The top plate 13 is divided into the first and second regions 13a, 13b, each of which has a rectangular shape, by the longitudinal reinforcement rib 14. After the longitudinal reinforcement rib 14 is formed, the first and second regions 13a, 13b are prevented from being distorted through machining. The longitudinal reinforcement rib 14 functions as a member for supporting an upper end of the partition plate 9 (see Fig. 2).

[0025] To minimize the length of each of the first and second lateral reinforcement ribs 15, 16, it is preferable that the first and second lateral reinforcement ribs 15, 16 both extend perpendicular to the side edges 13c of the top plate 13. However, the first and second lateral reinforcement ribs 15, 16 may be inclined with respect to a direction perpendicular to the longitudinal reinforcement rib 14 (up to approximately 45°). The numbers of the first and second lateral reinforcement ribs 15, 16 may be selected in accordance with the size of the corresponding one of the first and second regions 13a, 13b, respectively. The first lateral reinforcement ribs 15 may be shaped differently in the first region 13a, and the second lateral reinforcement ribs 16 may be shaped differently in the second region 13b. The positions of the first and second lateral reinforcement ribs 15, 16 may be determined in accordance with the shapes and the positions of the devices arranged in the body casing 1. For example, with reference to Fig. 1, one of the first lateral reinforcement ribs 15 in the first region 13a and the corresponding one of the second lateral reinforcement ribs 16 in the second region 13b are aligned along a straight line in a direction perpendicular to the longitudinal reinforcement rib 14 and the side edges 13c of the top plate 13. The other one of the first lateral reinforcement ribs 15 and the corresponding one of the second lateral reinforcement ribs 16 are arranged along offset straight lines in directions perpendicular to the longitudinal reinforcement rib 14 and the side edges 13c of the top plate 13, without being aligned along a line.

[0026] The first and second lateral reinforcement ribs 15, 16 of the top plate 13 are formed by stretch-forming.

[0027] Stretch forming of the top plate 13 will hereafter be described.

[0028] The stretch forming is performed using a die illustrated in Figs. 3(a) to 3(c). The top plate 13 is formed using a blank 13' shown in Fig. 3(d).

[0029] First, the blank 13' shown in Fig. 3(d) is mounted on a die block X, which is illustrated in Fig. 3(c). The blank 13' is maintained by a holder Y, which is shown in Fig. 3

(b) and arranged on the blank 13'. In this state, by pressing an edge bending punch Za and a rib forming punch Zb, which are illustrated in Fig. 3(a), against the blank 13', the top plate 13 is shaped. Before the stretch forming, the longitudinal reinforcement rib 14 is formed in the blank 13' in advance through bending. Generally, the stretch forming simplifies the molding steps but causes torsion and flexure of a formed product caused by spring back after the product is formed.

[0030] However, in the present embodiment, as has been described, the longitudinal reinforcement rib 14 and the first and second lateral reinforcement ribs 15, 16 are formed on the formed top plate 13, thus significantly increasing the rigidity of the top plate 13 as a whole. Further, since the first and second lateral reinforcement ribs 15, 16 are formed in the corresponding first and second regions 13a, 13b, which are separated from each other by the longitudinal reinforcement rib 14, torsion and flexure of the top plate 13 caused by spring back after the first and second lateral reinforcement ribs 15, 16 are formed are decreased. This improves work efficiency when the top plate 13 is mounted.

Second Embodiment

[0031] As illustrated in Fig. 4, a configuration of a top plate for an air conditioner indoor unit according to a second embodiment of the present invention will hereafter be described mainly about the differences from the first embodiment.

[0032] In a top plate 13 of an air conditioner indoor unit (for 5 HP (3.75 kW)) of the second embodiment, four first lateral reinforcement ribs 15 are formed in a first region 13a, and four second lateral reinforcement ribs 16 are arranged in a second region 13b. In the second embodiment, like the first embodiment, some of the first lateral reinforcement ribs 15 and the corresponding ones of the second lateral reinforcement ribs 16 are aligned along common straight lines, and the other ones of the first lateral reinforcement ribs 15 and the corresponding other ones of the second lateral reinforcement ribs 16 are arranged along offset straight lines without being aligned along common straight lines. Specifically, two of the first lateral reinforcement ribs 15 in the first region 13a and the corresponding two of the second lateral reinforcement ribs 16 in the second region 13b are aligned along common straight lines in directions perpendicular to the longitudinal reinforcement rib 14 and the side edges 13c of the top plate 13. The other two of the first lateral reinforcement ribs 15 and the corresponding other two of the second lateral reinforcement ribs 16 are arranged along offset straight lines in directions perpendicular to the longitudinal reinforcement rib 14 and the side edges 13c of the top plate 13, without being aligned along common straight lines.

[0033] The configuration of the other components of the second embodiment is the same as the configuration of the corresponding components of the first embodi-

ment, and the advantages of the second embodiment are equivalent to those of the first embodiment. Accordingly, explanation of the configuration of these components and the advantages of the second embodiment are omitted herein.

[0034] In the first and second embodiments, the air conditioner indoor unit is embodied as a built-in type indoor unit, but the present invention may be used in other types of air conditioner indoor units.

Claims

1. An air conditioner indoor unit having a body casing (1) accommodating a fan (2) and a heat exchanger (3), the body casing (1) having a top plate (13) arranged in an upper portion thereof, the top plate (13) having a longitudinal reinforcement rib (14) dividing the top plate (13) into first and second regions (13a, 13b), one or more first lateral reinforcement ribs (15) and one or more second lateral reinforcement ribs (16), the first lateral reinforcement ribs (15) are arranged in the first region (13a) and between the longitudinal reinforcement rib (14) and one of two side edges (13c) of the top plate (13) that face the longitudinal reinforcement rib (14), and wherein the second lateral reinforcement ribs (16) are arranged in the second region (13b) and between the longitudinal reinforcement rib (14) and the other side edge (13c).
2. The air conditioner indoor unit according to claim 1, wherein the top plate (13) has a rectangular shape, the longitudinal reinforcement rib (14) extending parallel to the side edges (13c) of the top plate (13).
3. The air conditioner indoor unit according to claims 1 or 2, wherein said one or more first lateral reinforcement ribs (15) and said one or more second lateral reinforcement ribs (16) extend in a direction perpendicular to the longitudinal reinforcement rib (14) and the side edges (13c) of the top plate (13).
4. The air conditioner indoor unit according to claim 3, wherein said one or more first lateral reinforcement ribs (15) include a pair of first lateral reinforcement ribs (15), and said one or more second lateral reinforcement ribs (16) include a pair of second lateral reinforcement ribs (16), and wherein one of the first lateral reinforcement ribs (15) and a corresponding one of the second lateral reinforcement ribs (16) are aligned along a common straight line, and the other first lateral reinforcement rib (15) and the corresponding second lateral reinforcement rib (16) are arranged along mutually offset straight lines.
5. The air conditioner indoor unit according to claim 3, wherein said one or more first lateral reinforcement

ribs (15) include three or more first lateral reinforcement ribs (15), said one or more second lateral reinforcement ribs (16) include three or more second lateral reinforcement ribs (16), and wherein some of the first lateral reinforcement ribs (15) and corresponding ones of the second lateral reinforcement ribs (16) are aligned along common straight lines, and the other first lateral reinforcement ribs (15) and the corresponding second lateral reinforcement ribs (16) are arranged along mutually offset straight lines,

6. The air conditioner indoor unit according to any one of claims 1 to 5, wherein the top plate (13) has the side edges (13c) and a pair of end edges (13d, 13e) extending perpendicular to the side edges (13c), an edge bending rib (17) extending downward being formed in each side edge (13c) and each end edge (13d, 13e).
7. The air conditioner indoor unit according to any one of claims 1 to 6, wherein the longitudinal reinforcement rib (14) is formed through bending.
8. The air conditioner indoor unit according to any one of claims 1 to 7, wherein said one or more first lateral reinforcement ribs (15) and said one or more second lateral reinforcement ribs (16) are formed by stretch-forming.

Fig.1

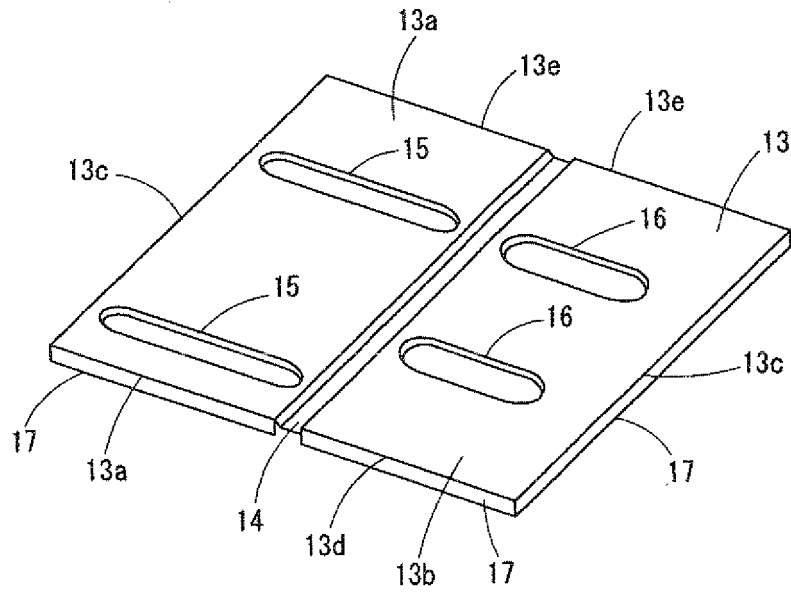


Fig.2

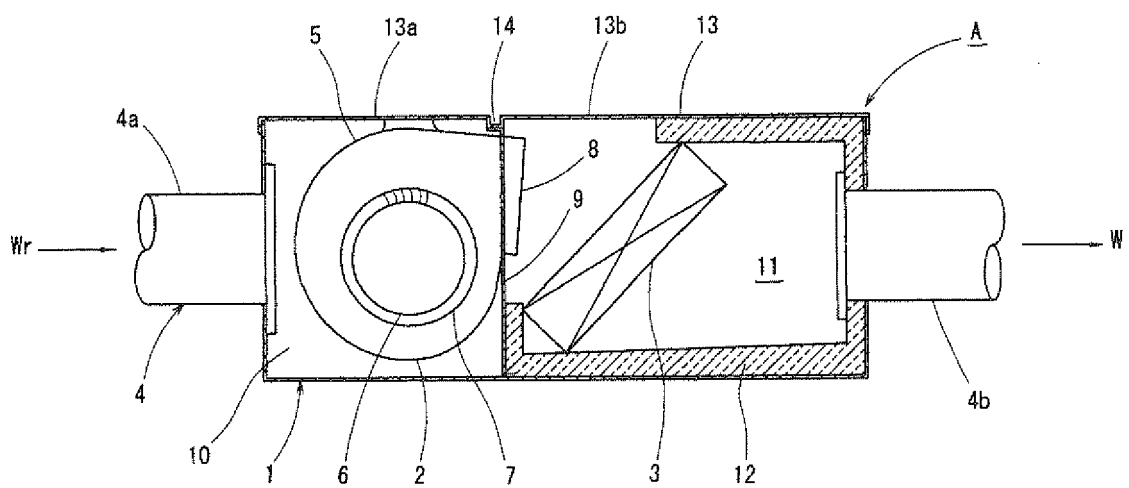


Fig.3 (a)

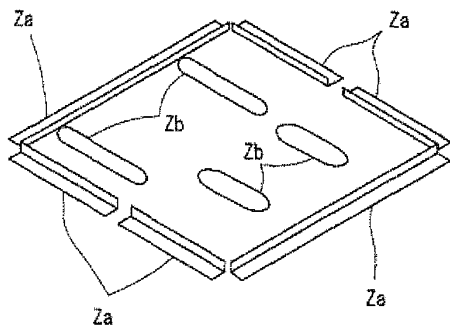


Fig.3 (c)

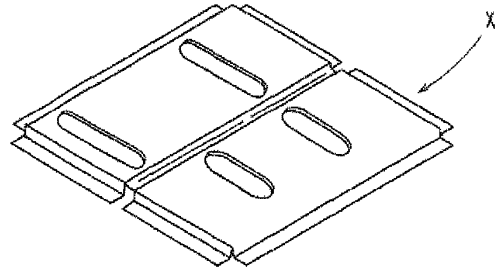


Fig.3 (b)

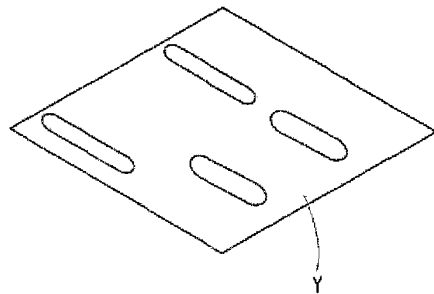


Fig.3 (d)

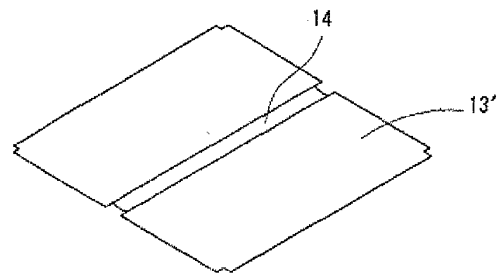
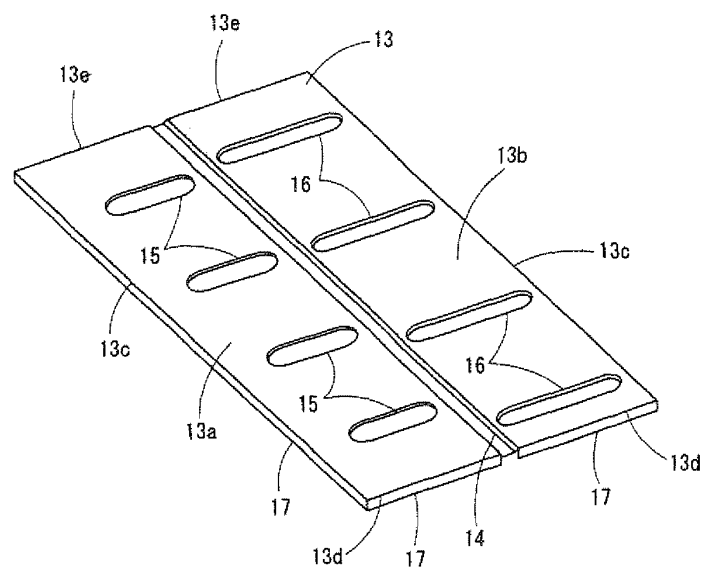


Fig.4



INTERNATIONAL SEARCH REPORT

International application No.

PCT/JP2008/073106

A. CLASSIFICATION OF SUBJECT MATTER F24F13/20 (2006.01) i		
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) F24F13/20		
Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched Jitsuyo Shinan Koho 1922-1996 Jitsuyo Shinan Toroku Koho 1996-2009 Kokai Jitsuyo Shinan Koho 1971-2009 Toroku Jitsuyo Shinan Koho 1994-2009		
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.
A	JP 2005-233529 A (Mitsubishi Electric Corp.), 02 September, 2005 (02.09.05), Full text; all drawings (Family: none)	1-8
A	JP 10-197004 A (Daikin Industries, Ltd.), 31 July, 1998 (31.07.98), Full text; all drawings (Family: none)	1-8
☐ Further documents are listed in the continuation of Box C. ☐ See patent family annex.		
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Date of the actual completion of the international search 13 March, 2009 (13.03.09)		Date of mailing of the international search report 31 March, 2009 (31.03.09)
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