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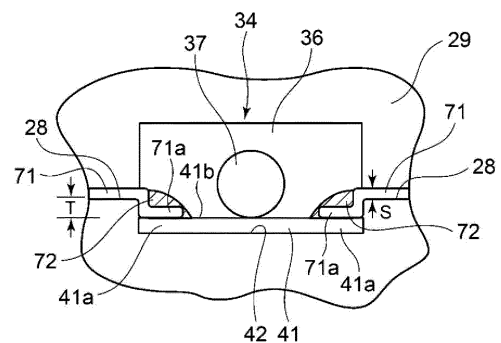
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(54) **AIR CONDITIONING INDOOR UNIT**

(57) The air-conditioning indoor unit 100 includes: a cooler 21; and a drain pan 22 configured to receive drain water generated on a surface of the cooler 21 and drain the drain water to the outside. The drain pan 22 includes: a drain pan body 22a configured to receive the drain water, the drain pan body 22a including: a drain water collecting part 33 configured to gather the drain water; a socket mounting face 42 formed at a bottom face of the drain water collecting part 33; and a socket mounting hole 27 formed in an inner face 29 of the drain water collecting part 33 and in communication with the outside; a drain socket 34 including: a drain nozzle part 35 inserted into the socket mounting hole 27; and a horizontal plate part 41 placed on the socket mounting face 42; and a waterproof sheet 71 configured to cover an inner face and a bottom face of the drain pan body 22a; and an adhesive 72 that adheres the waterproof sheet 71 to the drain pan body 22a. A top face 41b of an edge portion 41a of the horizontal plate part 41 of the drain socket 34 is positioned below the bottom face 28 of the drain water collecting part 33.

FIG. 7



**Description**

## Technical Field

**[0001]** The present invention relates to an air-conditioning indoor unit including a drain pan configured to drain water generated in a cooler and draining it to the outside.

## Background Art

**[0002]** An existing air-conditioning indoor unit includes a housing, a heat exchanger, a fan, a drain pan, and a control box. One example of such an air-conditioning indoor unit is a floor type indoor unit, or a so-called low-boy type indoor unit.

**[0003]** A drain pan in the aforementioned indoor unit has a box-like shape with a top opening and includes a drain water collecting part and a recessed water collecting part. The recessed water collecting part includes at its end a drain port, and connecting a hose to the drain port enables drainage of drain water to the outside of the indoor unit through the hose (see Patent Literature 1, for example).

## Citation List

## Patent Literature

**[0004]** Patent Literature 1: Japanese Unexamined Patent Application Publication No. 2007-132641 (paragraphs [0010]-[0012], Figs. 1 and 2)

## Summary of Invention

## Technical Problem

**[0005]** The drain pan disclosed in Patent Literature 1 is a molded product where a drain water collecting part and a socket mounting face are flush with each other. This drain pan is made of foamed polystyrene beads, which are inexpensive and highly moldable. However, molding the drain pan from polystyrene beads alone may cause water leakage through a gap between beads remaining in the molded product. To prevent the water leakage, a waterproof sheet made of synthetic resin, called skin sheet, is covered from the top opening. The waterproof sheet is adhered at a socket portion with an adhesive so that water does not leak through the gap between beads. This application of the adhesive results in formation of a mound of the adhesive. When this drain pan is used in an air-conditioning indoor unit with a natural drainage system, which is often employed in floor type indoor units, such a mound may cause insufficient drainage of drain water.

**[0006]** The present invention has been made in view of the above problem and aims at improving drainage of drain water in an air-conditioning indoor unit with a natural

drainage system.

## Solution to Problem

**[0007]** According to an embodiment of the present invention, there is provided an air-conditioning indoor unit including: a cooler; and a drain pan configured to receive drain water generated on a surface of the cooler and drain the drain water to an outside, wherein the drain pan includes: a drain pan body configured to receive the drain water, the drain pan body including: a drain water collecting part configured to gather the drain water; a socket mounting face formed at a bottom face of the drain water collecting part; and a socket mounting hole formed in an inner face of the drain water collecting part and in communication with the outside; a drain socket including: a drain nozzle part inserted into the socket mounting hole; and a horizontal plate part placed on the socket mounting face; a waterproof sheet configured to cover an inner face and a bottom face of the drain pan body; and an adhesive that adheres the waterproof sheet to the drain pan body, and a top face of an edge portion of the horizontal plate part of the drain socket is positioned below the bottom face of the drain water collecting part. Advantageous Effects of Invention

**[0008]** According to an embodiment of the present invention, the top face of the edge portion of the horizontal plate part of the drain socket placed on the socket mounting face of the drain water collecting part is positioned below the bottom face of the drain water collecting part. This creates a step between the top face of the edge portion of the horizontal plate part and the bottom face of the drain water collecting part. This step can offset the height of the applied adhesive, avoiding formation of a mound of the adhesive that may block the drain water. This results in a drain pan with improved natural drainage function.

## Brief Description of Drawings

**[0009]**

[Fig. 1] Fig. 1 is a perspective view of an exterior of an air-conditioning indoor unit in Embodiment 1 of the present invention.

[Fig. 2] Fig. 2 is a perspective view of an internal structure of the air-conditioning indoor unit in Embodiment 1 of the present invention.

[Fig. 3] Fig. 3 is an overall perspective view of a drain pan used in the air-conditioning indoor unit in Embodiment 1 of the present invention.

[Fig. 4] Fig. 4 is a perspective view of a drain socket in Embodiment 1 of the present invention.

[Fig. 5] Fig. 5 is a perspective view illustrating how a waterproof sheet is adhered to the drain socket of the drain pan in Embodiment 1 of the present invention.

[Fig. 6] Fig. 6 is a partial, sectional side view of a

longitudinal section of the drain pan in Embodiment 1 of the present invention.

[Fig. 7] Fig. 7 is a partial, sectional front view mainly illustrating an adhesion area between the waterproof sheet and the drain socket of the drain pan in Embodiment 1 of the present invention.

[Fig. 8] Fig. 8 is a partial, sectional front view mainly illustrating an adhesion area between a waterproof sheet and a drain socket of a conventional drain pan.

[Fig. 9] Fig. 9 is a perspective view of the drain socket in Embodiment 2 of the present invention.

[Fig. 10] Fig. 10 is a partial, sectional front view mainly illustrating an adhesion area between the waterproof sheet and the drain socket of the drain pan in Embodiment 2 of the present invention.

### Description of Embodiments

**[0010]** The air-conditioning indoor unit will be explained below with reference to the drawings. Throughout the drawings, including Fig. 1, like reference numerals refer to similar or corresponding parts. This holds true for all of the following embodiments in their entirety. Throughout the specification, the forms of elements as given below are by way of example only and not restrictive. When height, size and other factors are described as being high or low or large or small, it is not defined in comparison with a specific absolute value, but relatively defined according to factors such as structures and materials.

### Embodiment 1

**[0011]** Fig. 1 is a perspective view of an exterior of an air-conditioning indoor unit in Embodiment 1 of the present invention, and Fig. 2 is a perspective view of an internal structure of the air-conditioning indoor unit in Embodiment 1 of the present invention. The air-conditioning indoor unit 100 in Embodiment 1 of the present invention is a floor type indoor unit, and its main components include a rectangular, box-like housing 1 and a heat exchanger (an example of the cooler) 21, a drain pan 22, a fan 23, and a control box 24 installed inside the housing 1. The drain pan 22 is placed below the heat exchanger 21 and used to receive drain water such as condensed water generated on a surface of the heat exchanger 21 and dew condensation water generated on surfaces of pipes and other components.

**[0012]** As shown in Figs. 3 to 7, the drain pan 22 includes a drain pan body 22a, a drain socket 34, a waterproof sheet 71, and an adhesive 72. The drain pan body 22a includes a heat exchanger receiving plane 31 for receiving the heat exchanger 21, a groove 32 for guiding the drain water, and a drain water collecting part 33 for gathering the drain water. On an inner face 29 near the drain water collecting part 33, there is a socket mounting hole 27 communicating with the outside. The drain pan body 22a has a top opening and, for example, a substan-

tially rectangular tray shape in plan view to receive the drain water. The drain water collecting part 33 is formed at one end of the drain pan body 22a, and a bottom face of the groove 32 of the drain pan body 22a is inclined at an inclination angle  $\theta$  to run down toward the drain water collecting part 33. This allows the received drain water to gather in the drain water collecting part 33 naturally. A socket mounting face 42 depressed downward is formed in an area of the bottom face of the drain water collecting part 33. The bottom face and the socket mounting face 42 of the drain water collecting part 33 are slightly inclined downward toward a drain nozzle part 35. Thus, the drain water gathered in the drain water collecting part 33 is drained to the outside through a drain socket 34, which will be described below.

**[0013]** Fig. 4 is a perspective view of the drain socket 34 in Embodiment 1 of the present invention. The drain socket 34 includes an upright plate part 36 fitted onto the inner face 29 of the drain water collecting part 33 and including a drain port 37 for drainage of the drain water to the outside; the drain nozzle part 35 protruding from the drain port 37 and is inserted into the socket mounting hole 27 of the drain pan body 22a; and a flat horizontal plate part 41 extending substantially horizontally from a lower edge of the upright plate part 36 and is placed on the socket mounting face 42 of the drain water collecting part 33.

**[0014]** The waterproof sheet 71 is attached through the top opening of the drain pan body 22a at the time of molding of the drain pan and covers the inner and bottom faces of the drain pan body 22a. A portion of the waterproof sheet 71 at the drain port 37 of the drain socket 34 is cut out to form an edge portion 71a. For example, the waterproof sheet 71 is made of ABS resin with the thickness S of about 0.5 mm. The adhesive 72 provides adhesion between the waterproof sheet 71 and the drain pan 22 so that the waterproof sheet 71 does not separate from the drain pan 22. For example, the adhesive 72 is made of epoxy resin.

**[0015]** A description will be given on an adhesion structure of the waterproof sheet 71 around the drain socket 34. As shown in Fig. 5, the waterproof sheet 71 is cut around the drain socket 34 to surround the drain port 37, and the adhesive 72 is applied to an adhesion area 51 to make the waterproof sheet 71 adhere to the drain socket 34. Also, as shown in Fig. 7, the edge portion 71a of the waterproof sheet 71 cut around the drain port 37 of the drain socket 34 is placed on a top face 41b of an edge portion 41a of the horizontal plate part 41 of the drain socket 34, and the adhesive 72 is applied over the edge portion 71a and the top face 41b.

**[0016]** The top face 41b of the edge portion 41a of the horizontal plate part 41 of the drain socket 34 placed on the socket mounting face 42 of the drain water collecting part 33 is positioned below the bottom face 28 of the drain water collecting part 33. The height T from the top face 41b of the edge portion 41a of the horizontal plate part 41 to the bottom face 28 of the drain water collecting part

33 is set larger than the thickness S of the waterproof sheet 71; for example, the height T is set to about 2.5 mm. This height T creates a step between the top face 41b of the edge portion 41a of the horizontal plate part 41 and the bottom face 28 of the drain water collecting part 33, and creating this step avoids formation of a mound of the adhesive 72 in adhering the waterproof sheet 71 to the drain socket 34. More specifically, the adhesive 72 is applied over the top face of the edge portion 71a of the waterproof sheet 71 and the top face 41b of the edge portion 41a of the horizontal plate part 41 of the drain socket 34 so as to allow the applied adhesive 72 to slope down toward the top face 41b of the horizontal plate part 41. Applying the adhesive 72 in this way ensures that the drain water is not blocked by the adhesive 72, resulting in a drain pan with improved natural drainage function.

**[0017]** An operation of the air-conditioning indoor unit 100 will be described below. In the air-conditioning indoor unit 100, the heat exchanger 21 is assembled inside the housing 1, and the drain pan 22 is placed below the heat exchanger 21. The drain pan 22 includes the drain socket 34 provided with the drain nozzle part 35 projecting to the outside, and attaching a hose 22b to the drain nozzle part 35 completes installation of the air-conditioning indoor unit 100. Then, upon driving of the fan 23, a suction port 25 in a lower part of the housing 1 suctions indoor air to let it pass through the heat exchanger 21, where the indoor air is cooled and air-conditioned. The air-conditioned air is blown into the room through a blow duct 26 in an upper part of the housing 1. The drain water generated on the surface of the heat exchanger 21 during the air-conditioning drops onto, and is received by, the drain pan 22.

**[0018]** As described above, in the drain pan 22 of the air-conditioning indoor unit 100 in Embodiment 1, the top face 41b of the edge portion 41a of the horizontal plate part 41 of the drain socket 34 is positioned below the bottom face 28 of the drain water collecting part 33. This allows for adhesion of the waterproof sheet 71 without having to form a mound of the adhesive 72 that may block the drain water. This ensures drainage of the drain water to the outside.

**[0019]** Additionally, the adhesive 72 is applied such that the applied adhesive 72 slopes down toward the top face 41b of the horizontal plate part 41. This facilitates guiding of the drain water on the waterproof sheet 71 toward the horizontal plate part 41 and eventually the drain port 37, ensuring drainage of the drain water to the outside. This can also reduce the amount of adhesive 72 to be applied, enabling low-cost manufacturing.

**[0020]** The bottom face of the groove 32 of the drain pan body 22a is inclined toward the drain water collecting part 33, and the bottom face and the socket mounting face 42 of the drain water collecting part 33 are slightly inclined toward the drain nozzle part 35. This facilitates natural drainage, to the outside, of the drain water generated in the heat exchanger 21 and other components

and received by the drain pan 22, allowing to maintain good drainage of the drain water.

**[0021]** For comparison, in a conventional drain pan, the top face 41b of the horizontal plate part 41 placed on the socket mounting face 42 lies flush with the bottom face of the drain water collecting part 33, as shown in Fig. 8. In that case, when the adhesive 72 is used for adhesion between the edge portion 71a of the waterproof sheet 71 and the edge portion 41a of the horizontal plate part 41, a mound of the adhesive 72 is created on the waterproof sheet 71, acting like a dam. This results in the drain water accumulating on the waterproof sheet 71 to the depth of about 2 to 5 mm, which is undesirable.

## 15 Embodiment 2

**[0022]** A description will now be given on the air-conditioning indoor unit in Embodiment 2 of the present invention. Fig. 9 is a perspective view of the drain socket in Embodiment 2 of the present invention. Fig. 10 is a partial, sectional front view mainly illustrating an adhesion area between the waterproof sheet and the drain socket of the drain pan in Embodiment 2 of the present invention. In Figs. 8 and 9, the same reference numerals as those in Figs. 4 and 7 refer to the same or corresponding components, and detailed description thereof will be omitted.

**[0023]** The drain socket 341 used for the air-conditioning indoor unit 100 in Embodiment 2 of the present invention differs from the drain socket in Embodiment 1 in that the drain socket 341 includes an elevated portion 38 raised above the edge portion 41a of the horizontal plate part 41.

**[0024]** More specifically, the elevated portion 38 continuous from the upright plate part 36 of the drain socket 341 is formed at the center of the horizontal plate part 41 and at a position higher than the edge portion 41a of the horizontal plate part 41. The edge portion 71a of the waterproof sheet 71 is placed on the edge portion 41a of the horizontal plate part 41 around the elevated portion 38. The drain water collecting part 33 of the drain pan body 22a is formed with the socket mounting face 42 having an uneven surface conforming to the bottom shape of the horizontal plate part 41 of the drain socket 341. The height of the elevated portion 38 is made equal to the height of the waterproof sheet 71 covering the bottom face 28 of the drain water collecting part 33. The adhesive 72 is filled onto the edge portion 41a of the horizontal plate part 41 around the elevated portion 38 up to the height flush with a top face of the elevated portion 38.

**[0025]** As described above, in Embodiment 2, the edge portion 71a of the waterproof sheet 71 is placed on the edge portion 41a of the horizontal plate part 41 around the elevated portion 38, the height of the elevated portion 38 is made equal to the height of the waterproof sheet 71, and the adhesive 72 is filled into the recess on the edge portion 41a of the horizontal plate part 41 around

the elevated portion 38 up to the height flush with the top face of the elevated portion 38. This avoids formation of a mound of the adhesive 72, preventing the adhesive 72 from blocking the drain water. This also allows for easy control of the amount of adhesive 72 to be applied.

**[0026]** The drain pan according to the present invention is not limited to that used for the floor type air-conditioning indoor unit. The shapes described in the above embodiments may be applicable to any other drain pan as long as it includes a drain pan body, a drain socket, and a waterproof sheet. Also, the height T of the step may be optionally changed as long as the adhesive 72 does not block the drain water.

#### Reference Signs List

**[0027]** 1 housing 21 heat exchanger (cooler) 22 drain pan 22a drain pan body 22b hose 23 fan 24 control box 25 suction port 26 blow duct 27 socket mounting hole 28 bottom face 29 inner face 31 heat exchanger receiving plane 32 groove 33 drain water collecting part 34, 341 drain socket 35 drain nozzle part 36 upright plate part 37 drain port 38 elevated portion 41 horizontal plate part 41a edge portion 41b top face 42 socket mounting face 51 adhesion area 71 waterproof sheet 71a edge portion 72 adhesive 100 air-conditioning indoor unit S thickness T height  $\theta$  inclination angle

#### Claims

##### 1. An air-conditioning indoor unit comprising:

a cooler; and

a drain pan configured to receive drain water generated on a surface of the cooler and drain the drain water to an outside, wherein the drain pan includes:

a drain pan body configured to receive the drain water, the drain pan body including: a drain water collecting part configured to gather the drain water; a socket mounting face formed at a bottom face of the drain water collecting part; and a socket mounting hole formed in an inner face of the drain water collecting part and in communication with the outside;

a drain socket including: a drain nozzle part inserted into the socket mounting hole; and a horizontal plate part placed on the socket mounting face;

a waterproof sheet configured to cover an inner face and a bottom face of the drain pan body; and

an adhesive that adheres the waterproof sheet to the drain pan body, and

a top face of an edge portion of the horizontal plate part of the drain socket is positioned below the bottom face of the drain water collecting part.

2. The air-conditioning indoor unit of claim 1, wherein the adhesive is applied such that applied adhesive slopes down toward the top face of the horizontal plate part.

3. The air-conditioning indoor unit of claim 1, wherein the horizontal plate part includes an elevated portion raised above the edge portion of the horizontal plate part, the elevated portion has height equal to height of the waterproof sheet covering the bottom face of the drain water collecting part, and the adhesive is filled onto the edge portion of the horizontal plate part around the elevated portion.

4. The air-conditioning indoor unit of any one of claims 1 to 3, wherein the bottom face of the drain pan body is inclined downward toward the drain water collecting part.

5. The air-conditioning indoor unit of any one of claims 1 to 4, wherein the socket mounting face is inclined downward toward the drain nozzle part.

FIG. 1

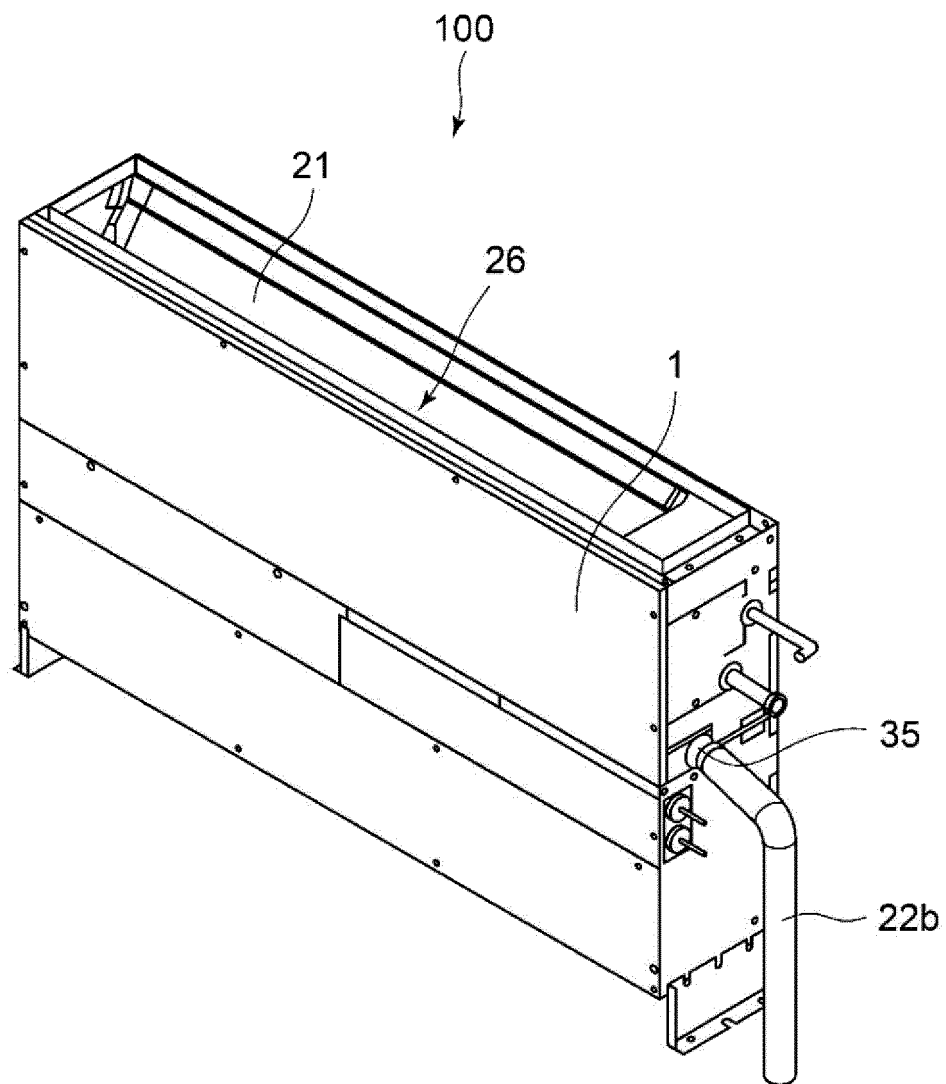


FIG. 2

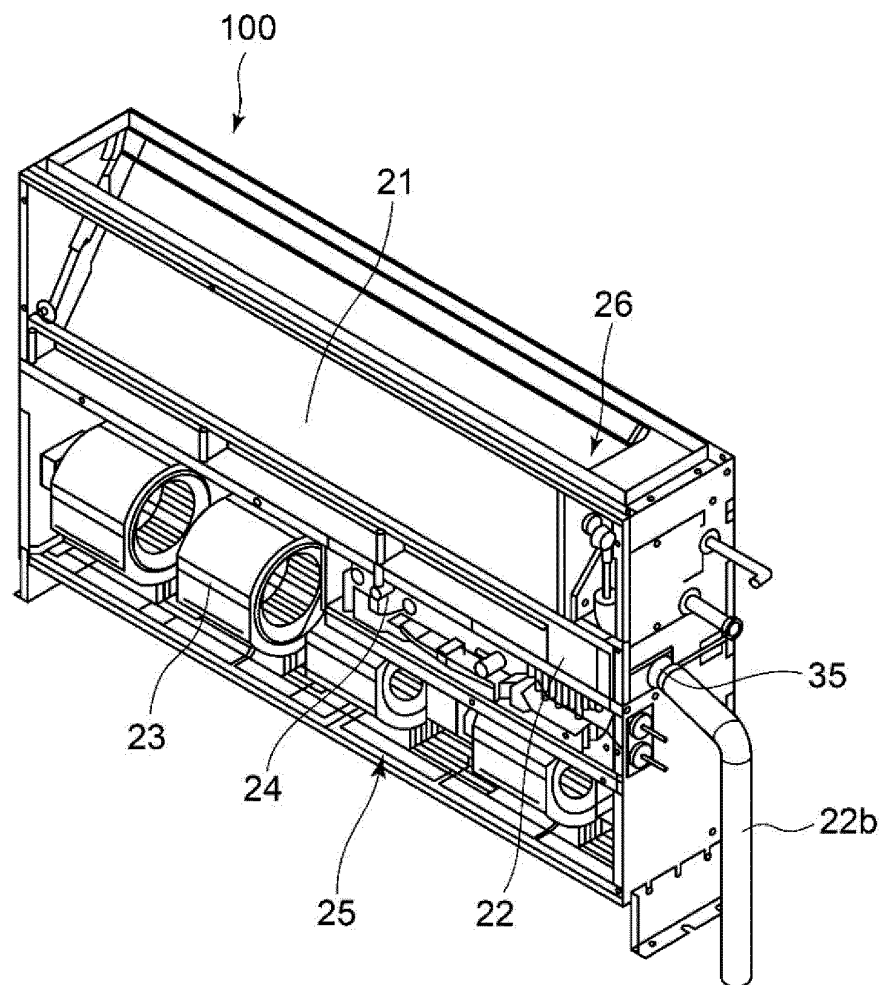


FIG. 3

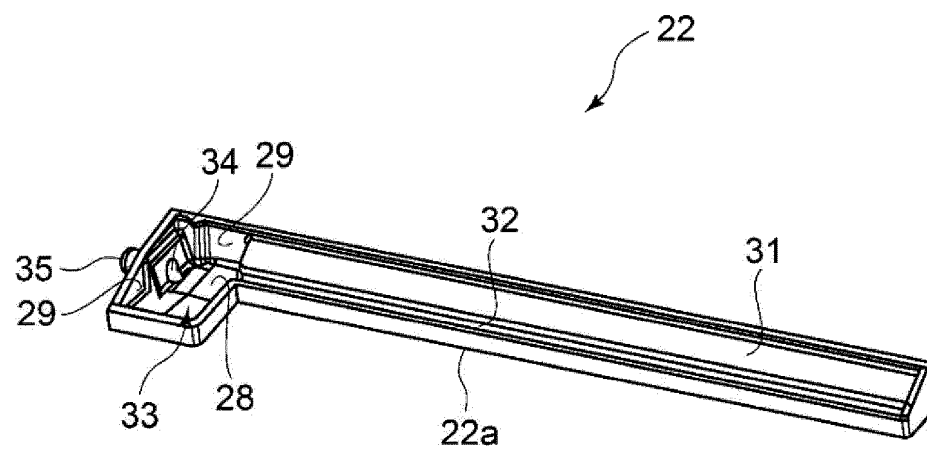


FIG. 4

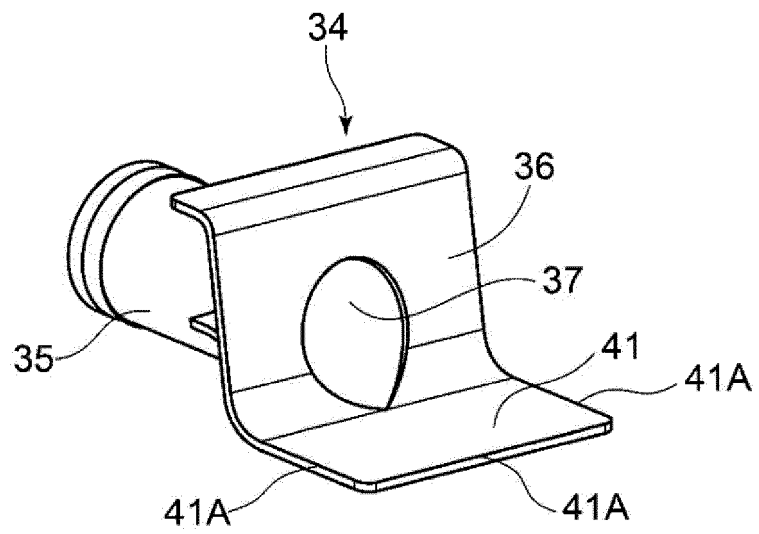


FIG. 5

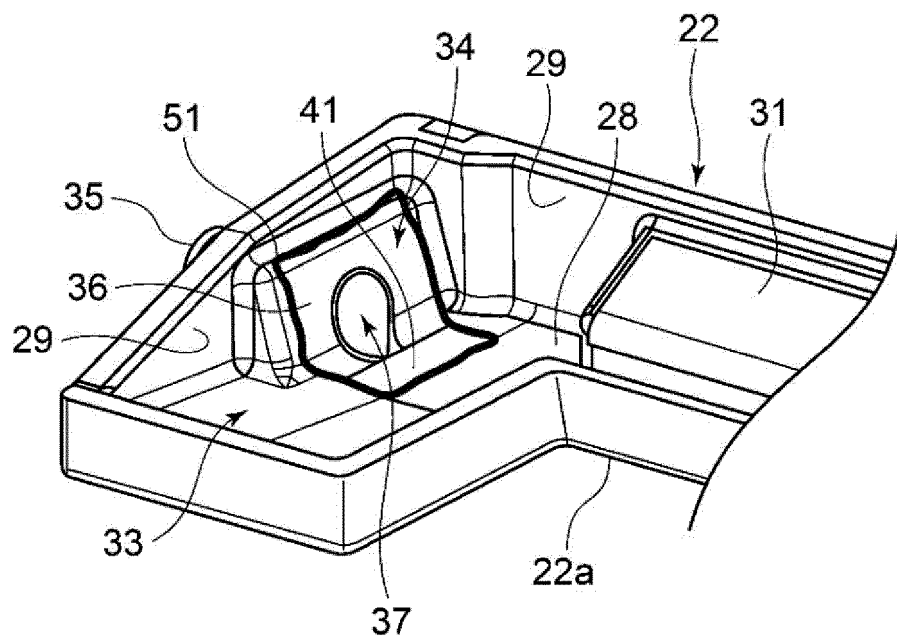




FIG. 6

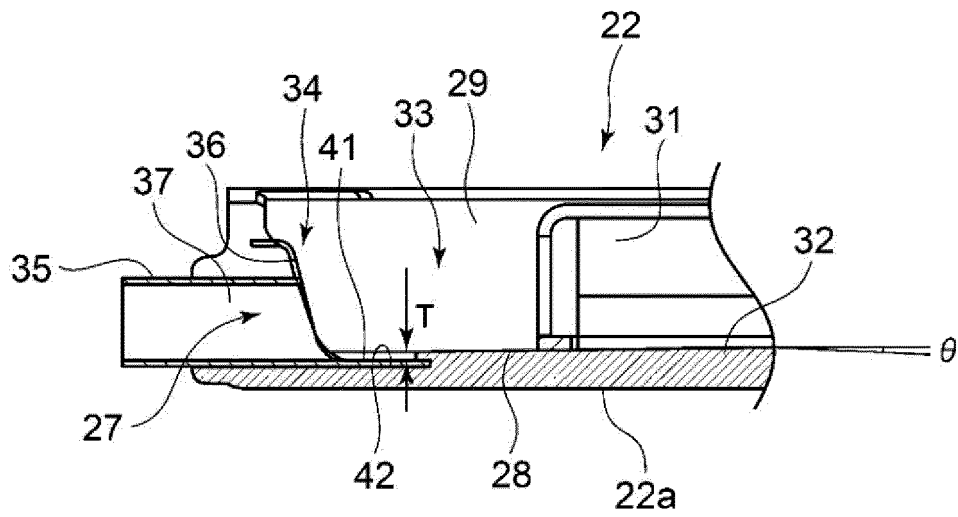


FIG. 7

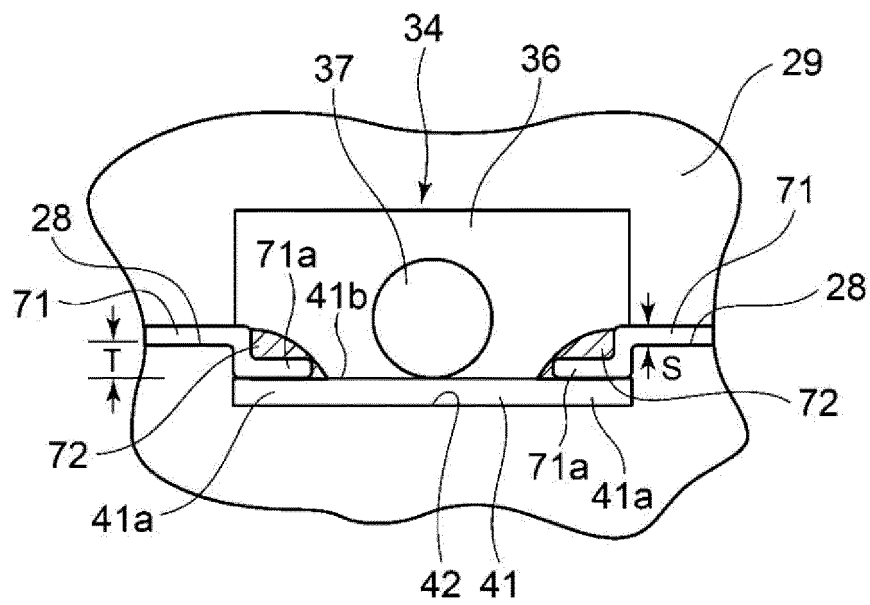


FIG. 8

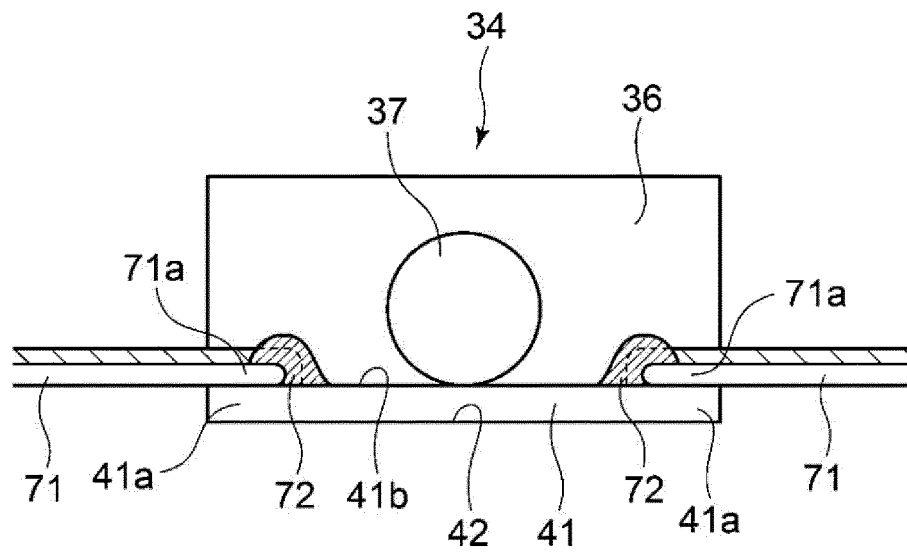


FIG. 9

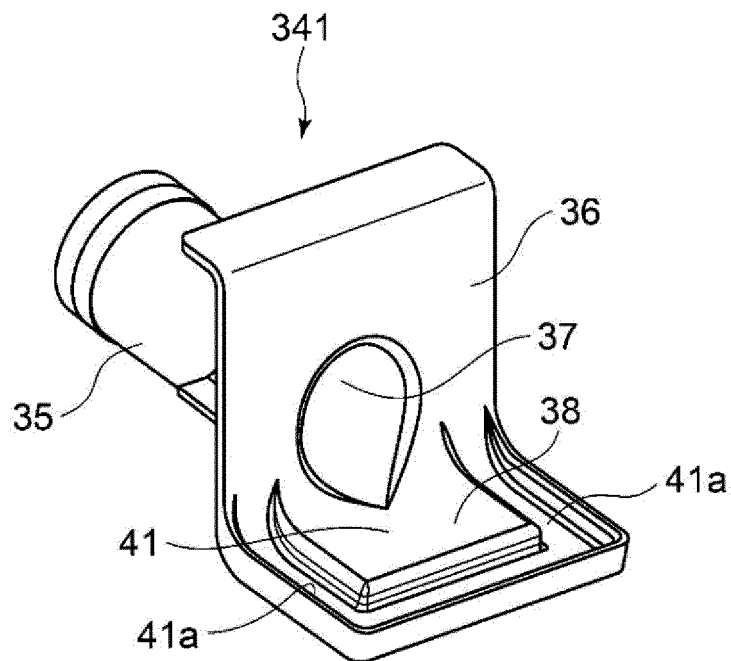
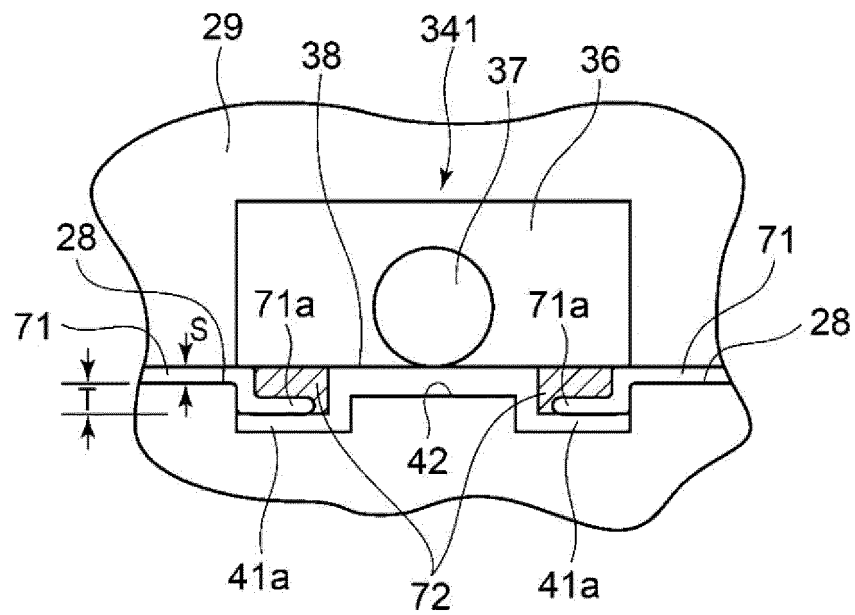


FIG. 10



## INTERNATIONAL SEARCH REPORT

International application No.

PCT/JP2017/023667

## A. CLASSIFICATION OF SUBJECT MATTER

F24F13/22(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)

F24F13/22

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	1996-2017
Kokai Jitsuyo Shinan Koho	1971-2017	Toroku Jitsuyo Shinan Koho	1994-2017

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	Microfilm of the specification and drawings annexed to the request of Japanese Utility Model Application No. 190493/1984 (Laid-open No. 104120/1986) (Daikin Industries, Ltd.), 02 July 1986 (02.07.1986), specification, page 12, lines 6 to 11; fig. 1, 3 to 5 (Family: none)	1, 4-5 2-3

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

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"&amp;" document member of the same patent family

Date of the actual completion of the international search  
30 August 2017 (30.08.17)Date of mailing of the international search report  
12 September 2017 (12.09.17)Name and mailing address of the ISA/  
Japan Patent Office  
3-4-3, Kasumigaseki, Chiyoda-ku,  
Tokyo 100-8915, Japan

Authorized officer

Telephone No.

## INTERNATIONAL SEARCH REPORT

International application No.

PCT/JP2017/023667

## C (Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y A	Microfilm of the specification and drawings annexed to the request of Japanese Utility Model Application No. 121869/1990 (Laid-open No. 78416/1992) (Matsushita Refrigeration Co.), 08 July 1992 (08.07.1992), specification, page 1, line 15 to page 2, line 16; fig. 3 to 4 (Family: none)	1, 4-5 2-3
A	CD-ROM of the specification and drawings annexed to the request of Japanese Utility Model Application No. 33560/1993 (Laid-open No. 6618/1995) (Matsushita Refrigeration Co.), 31 January 1995 (31.01.1995), entire text; all drawings (Family: none)	1-5
A	JP 2007-132641 A (Sanki Engineering Co., Ltd.), 31 May 2007 (31.05.2007), entire text; all drawings (Family: none)	1-5

Form PCT/ISA/210 (continuation of second sheet) (January 2015)

**REFERENCES CITED IN THE DESCRIPTION**

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**Patent documents cited in the description**

- JP 2007132641 A [0004]