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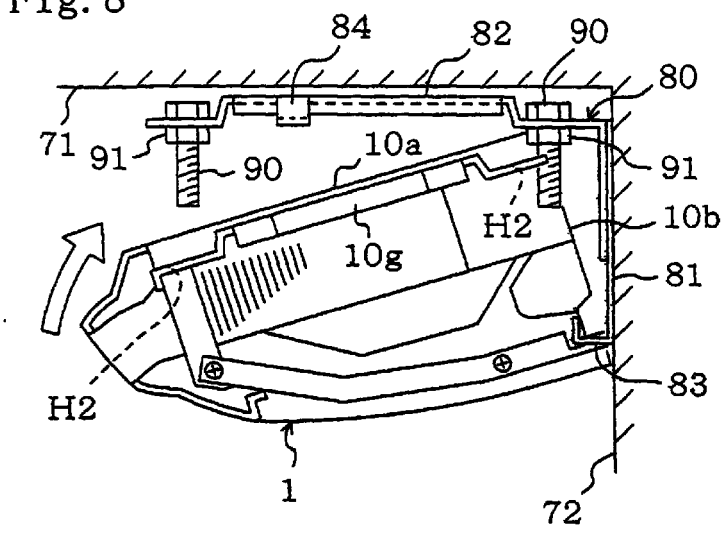
(54) AIR CONDITIONER INSTALLATION ATTACHMENT AND INSTALLATION CONSTRUCTION

(57) An air conditioner **(1)** is brought into engagement with a fixing device **(80)** after the fixing device **(80)** having a generally L-shaped configuration to extend along the top and rear faces **(10a)** and **(10b)** of the air conditioner **(1)** is fixed to the wall **(72)** or ceiling **(71)** of a room. If necessary, the air conditioner **(1)** is further secured to the fixing device **(80)** by using bolts or the like, whereby fixing strength and workability in fixing the air conditioner are improved.

Fig. 8



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Description

Technical Field

[0001] The present invention relates to a fixing device and a fixing structure for an air conditioner and, more particularly, to measures for improving fixing strength and workability in fixing the air conditioner.

Background Art

[0002] Conventional air conditioners include a wall-mounted type as disclosed in Japanese Examined Patent Publication No. SHO 59-25927 and a ceiling-suspended type as disclosed in Japanese Examined Patent Publication No. SHO 63-15494, of which the wall-mounted air conditioner is designed to be fixed by, e.g., securing a fixing board having a hook provided on an upper portion thereof to a side wall of a room and hanging the air conditioner on the hook of the fixing board.

[0003] On the other hand, the ceiling-suspended air conditioner is typically designed to be fixed to hanger bolts buried in a ceiling. In a specific example, a casing of the air conditioner is fixed to the ceiling by tightening, from above and below, a plurality of nuts screwed into the hanger bolts with the bolts extending through fixing holes formed in the casing.

[0004] However, if the depth of the casing from its front face to its rear face is increased, the fixing structure of the wall-mounted air conditioner in which only the rear face of the casing is fixed by using the fixing board presents a problem in terms of strength.

[0005] If a fixing structure as used in the conventional ceiling-suspended air conditioner is to be adopted to the wall-mounted air conditioner, a plurality of workers are required to perform a fixing operation, of which one is expected to support the air conditioner at the position at which the hanger bolts extend through the fixing holes and another is expected to tighten the nuts against the hanger bolts, so that a problem associated with workability arises.

Disclosure of Invention

[0006] The present invention has been achieved in view of the foregoing. It is therefore a first object of the present invention to enhance fixing strength in a fixing structure for a wall-mounted air conditioner. A second object of the present invention is to provide a fixing structure which is also applicable to a ceiling-suspended air conditioner and thereby improve workability.

[0007] The present invention fixes an air conditioner **(1)** by fixing, to a side wall **(72)** or ceiling **(71)** of a room, a fixing device **(80)** with which a lower portion of a rear face **(10b)** of the air conditioner **(1)** and a portion of the air conditioner **(1)** anterior thereto are engaged and then bringing the air conditioner **(1)** into engagement with the fixing device **(80)**.

[0008] Specifically, first solving means used in the present invention is a fixing device for an air conditioner, the device comprising a vertical plate member **(81)** extending along a rear face **(10b)** of an air conditioner **(1)** and a horizontal plate member **(82)** extending forwardly from the vertical plate member **(81)**, the vertical plate member **(81)** and the horizontal plate member **(82)** being formed integrally, the vertical plate member **(81)** comprising first fastening means **(83)** to be engaged with a lower portion **(10f)** of the rear face of the air conditioner **(1)** and the horizontal plate member **(82)** comprising second fastening means **(84)** to be engaged with the air conditioner **(1)** in a position anterior to the first fastening means **(83)**.

[0009] In second solving means used in the present invention, the vertical plate member **(81)** is formed with fixing holes **(H3)** for fixing the fixing device to a side wall **(72)** of a room and the horizontal member **(82)** is formed with fixing holes **(H1)** for bolts **(90, 95)** for fixing the air conditioner **(1)**.

[0010] In third solving means used in the present invention, the fixing holes **(H1)** of the horizontal plate member **(82)** are formed in positions corresponding to the hanger bolts **(95)** of a ceiling **(71)** for fixing the air conditioner **(1)**.

[0011] In fourth solving means used in the present invention, the first fastening means is first hooks **(83)** provided on a lower end portion of the vertical plate member **(81)** and the second fastening means is second hooks **(84)** provided on left and right edge portions of the horizontal plate member **(82)** to be engaged with side edge portions **(10g)** of the air conditioner **(1)**, the second hooks **(84)** being formed of an elastic material and comprising respective base portions **(84a)** located along the side edge portions **(10g)** of the air conditioner **(1)** and respective tip engaging portions **(84b)** formed to bend inwardly of the side edge portions **(10g)** of the air conditioner **(1)** from respective lower ends of the base portions **(84a)**.

[0012] Fifth solving means used in the present invention assumes a fixing structure for fixing an air conditioner **(1)** by using the fixing device **(80)** according to the first solving means. The air conditioner **(1)** comprises a first engaging portion **(10f)** to be engaged with a first fastening means **(83)** and a second engaging portion **(10g)** to be engaged with a second fastening means **(84)**.

[0013] In sixth solving means used in the present invention, the first fastening means **(83)** and second fastening means **(84)** of the fixing device **(80)** and the first engaging portion **(10f)** and second engaging portion **(10g)** of the air conditioner **(1)** are engaged with each other with a top face **(10a)** of the air conditioner **(1)** extending nearly along the horizontal plate member **(82)** of the fixing device **(80)**, a position at which the air conditioner **(1)** is engaged with the fixing device **(80)** being determined such that a gap for adjusting the position of the air conditioner **(1)** is formed between the horizontal

plate member **(82)** of the fixing device **(80)** and the top face **(10a)** of the air conditioner **(1)**.

[0014] In the first and fifth solving means, the fixing device **(80)** is fixed first to the side wall **(72)** or ceiling **(71)** of the room. Then, the first engaging portion **(10f)** as the lower portion of the rear face **(10b)** of the air conditioner **(1)** is brought into engagement with the first fastening means **(83)** and the second engaging portion **(10g)** of the air conditioner **(1)** anterior to the first engaging portion **(10f)** is brought into engagement with the second fastening means **(84)**, whereby the air conditioner **(1)** is fixed to the fixing device **(80)**.

[0015] In the second solving means, the fixing device **(80)** is fixed to the side wall **(72)** of the room by using the fixing holes **(H3)** of the vertical plate member **(81)**, the air conditioner is fastened to the fixing device in the same manner as in the first and fifth solving means, and then the air conditioner **(1)** is secured to the horizontal plate member **(82)** of the fixing device **(80)** by using the bolts **(90)**. In this case, the fastening means **(83,84)** and the engaging portions **(10f,10g)** are used to temporarily fasten the air conditioner **(1)** to the fixing device **(80)**.

[0016] In the third solving means, the fixing device **(80)** can be fixed to the hanger bolts **(95)** through the ceiling **(71)**. Thereafter, the air conditioner **(1)** can be secured to the fixing device **(80)** after it is temporarily fastened thereto in the same manner as in the second solving means.

[0017] In the fourth solving means, the side edge portions **(10g)** of the air conditioner **(1)** can be hung on the tip engaging portions **(84b)** of the second hooks **(84)** by raising the front side of the air conditioner **(1)** after hanging the lower portion **(10f)** of the rear face **(10b)** of the air conditioner **(1)** on the first hooks **(83)**. At that time, the second hooks **(84)** are widened under pressure by the side edge portions **(10g)** of the air conditioner **(1)** passing therebetween and elastically deformed. The second hooks **(84)** recover the original configurations after the side edge portions **(10g)** have passed through the tip engaging portions **(84b)** and come into engagement with the side edge portions **(10g)**.

[0018] In the sixth solving means, a predetermined gap is formed between the horizontal plate member **(82)** of the fixing device **(80)** and the top face **(10a)** of the air conditioner **(1)** when the air conditioner **(1)** is fastened to the fixing device **(80)**. This allows the inclination of the air conditioner **(1)** to be adjusted finely by, e.g, differently tightening the bolts **(90)** against the front, rear, left, and right sides of the air conditioner **(1)** in securing the air conditioner **(1)** to the horizontal plate **(82)**.

[0019] With the first and fifth solving means, the air conditioner **(1)** is installed in the room by bringing the first engaging portion **(10f)** on the lower portion of the rear face of the air conditioner **(1)** and the second engaging portion **(10g)** of the air conditioner **(1)** anterior to the first engaging portion **(10f)** into engagement with the first fastening means **(83)** and second fastening means **(84)** of the fixing device **(80)** fixed to the side wall **(72)** or ceiling **(71)** of the room. This provides strong fixation even if the air conditioner **(1)** is of the type having a large depth and thereby attains the first object.

[0020] With the second solving means, after the vertical plate member **(81)** of the fixing device **(80)** is fixed to the side wall **(72)** of the room, the air conditioner **(1)** is temporarily fastened to the fixing device **(80)** and then secured to the horizontal plate member **(82)**. This provides stronger fixation.

[0021] With the third solving means, if the fixing device **(80)** is fixed to the hanger bolts **(95)** through the ceiling **(71)**, the air conditioner **(1)** can be fastened temporarily to the fixing device **(80)** and then secured thereto. This obviates the necessity for a worker who supports the air conditioner **(1)** in tightening the nuts against the hanger bolts **(95)**. Thus, the fixing device **(80)** is also applicable to the ceiling-suspended air conditioner **(1)** and fixing workability can be enhanced, whereby the second object is attained. The third solving means also offers the advantage that the air conditioner **(1)** can be fixed to either of the side wall **(72)** and ceiling **(71)** of the room and placement flexibility is enhanced.

[0022] With the fourth solving means, the air conditioner **(10)** can be fastened to the fixing device **(80)** by merely raising the front side of the air conditioner **(1)** after hanging the lower portion **(10f)** of the rear face **(10b)** of the air conditioner **(1)** on the first hooks **(83)**, so that fixation is performed easily.

[0023] With the sixth solving means, the air conditioner **(1)** having, e.g., a large depth and therefore likely to be inclined forwardly when it is fixed is prevented from being inclined forwardly and can be held in a horizontal position. Even if the ceiling **(71)** or the side wall **(72)** is inclined, the inclination of the air conditioner **(1)** can be adjusted in accordance with the inclination of the ceiling **(71)** or the side wall **(72)**.

Brief Description of Drawings

[0024]

Figure **1** is a perspective view of an air conditioner according to an embodiment of the present invention;

Figure **2** is an exploded perspective view of the air conditioner of Figure **1**;

Figure **3** is a vertical cross-sectional view of the air conditioner of Figure **1**;

Figure **4** is a plan view showing the placement of components in the air conditioner of Figure **1**;

Figure **5** is a front view showing the placement of the components in the air conditioner of Figure **1**;

Figure **6** is a side view showing the placement of the components in the air conditioner of Figure **1**;

Figure **7** is an exploded perspective view showing a fixing structure for the air conditioner of Figure **1**;

Figure **8** is a view showing the fixation of the air conditioner of Figure **1** to a side wall of a room;

Figure **9** is a view showing a vertical plate member of a fixing device used in the fixing structure of Figure **7**;

Figure **10** is a partial enlarged view of the air conditioner secured to the fixing device;

Figure **11** is a partial enlarged view showing the fastening of the air conditioner to the fixing device; and

Figure **12** is a view showing the fixation of the air conditioner to the ceiling of the room.

Best Mode for Carrying Out the Invention

[0025] Referring now to the drawings, the embodiments of the present invention will be described in detail.

[0026] As shown in Figure **1**, an air conditioner **(1)** of the present embodiment is installed at a corner portion defined by a ceiling **(71)** of a room and a side wall **(72)** of the room. The air conditioner **(1)** has a casing **(10)** fixed to the ceiling **(71)** or the side wall **(72)** via a fixing device **(80)**, which will be described later but not shown in Figure **1**.

[0027] The casing **(10)** is composed of a main body **(11)** configured as a flat and horizontally elongated rectangular parallelepiped and a swelling portion **(13)** which protrudes downwardly from the bottom face of the main body **(11)**. The main body **(11)** of the casing **(10)** is configured to have a reduced thickness in the vertically direction such that it is placed along the ceiling **(71)** of the room and protrudes in a reduced amount from the ceiling **(71)** in the fixed state.

[0028] As shown in Figures **1** and **3**, the swelling portion **(13)** of the casing **(10)** is designed to protrude from the bottom face of the main body **(11)** gradually downwardly from the front side toward the rear side. That is, the swelling portion **(13)** is configured to protrude gradually downwardly toward the side wall **(72)** of the room **(70)** in the fixed state.

[0029] Specifically, the swelling portion **(13)** have a front surface or a lower surface configured as an inclined surface **(14)** inclined gently downwardly from the front edge thereof continued to the main body **(11)** toward the rear surface. The casing **(10)** is configured as a whole to be thinner on the front side than on the rear side. On the other hand, the rear surface of the swelling portion **(13)** is formed as a vertically rising face **(15)** along the side wall **(72)** of the room, which is continued to the rear face of the main body **(11)**. The both side surfaces of the swelling portion **(13)** are continued to the side portions of the lower face of the main body **(11)**.

[0030] The front edge of the inclined surface **(14)** of the swelling portion **(13)** is located slightly posterior to the front end of the main body **(11)**, while the both side edges of the swelling portion **(13)** are located slightly interior to the both side ends of the main body **(11)**. The front and both side portions of the main body **(11)** are formed with respective projecting edge portions **(12)** projecting forwardly and bilaterally of the swelling portion **(13)**. The projecting edge portions **(12)**, i.e., the front edge and both edge portions of the main body **(11)** of the casing **(10)** are composed of a combination of curved surfaces to have slightly rounded configurations, as shown in Figures **3**, **5**, and **6**.

[0031] The casing **(10)** is formed with an air inlet **(41)** for introducing room air from below into the casing **(10)** by suction and with air outlets **(43, 44)** for discharging conditioned air into the room. The air inlet **(41)** is formed in the inclined surface **(14)** of the swelling portion **(13)** of the casing **(10)**, while the air outlets **(43, 44)** are formed in the main body **(11)** of the casing **(10)** from the front face thereof to the both side faces thereof. Of the air outlets **(43, 44)**, the portion located in the front face of the main body **(11)** is formed into the front air outlet **(43)** and the portions located in the both side faces of the main body **(11)** are formed into the side air outlets **(44)**. Since the main body **(11)** of the casing **(10)** is formed with the projecting edge portions **(12)**, the air inlet **(41)** and the air outlets **(43, 44)** are located at a specified distance from each other.

[0032] On the other hand, the casing **(10)** is composed of a top panel **(10a)**, a rear panel **(10b)**, front panels **(10c, 10d)**, and right and left side panels **(10e)**, as shown in the exploded perspective view of Figure **2**. The top panel **(10a)**, the rear panel **(10b)**, and the front panels **(10c, 10d)** are members fixed to each other to be integrated. The side panels **(10e)** are detachable from the top panel **(10a)**, the rear panel **(10b)**, and the front panels **(10c, 10d)**. The side panels **(10e)** can be attached to the air conditioner after the air conditioner is assembled without the side panels **(10e)** and fixed to the ceiling **(71)** or to the side wall **(72)**. The side panels **(10e)** are attached to the casing **(10)** of the air conditioner **(1)** fixed to the ceiling **(71)** or to the side wall **(72)** with the fixing device **(80)**, thereby covering up and hiding the fixing device **(80)** from the outside.

[0033] The front air outlet **(43)** is formed between the front panels **(10c, 10d)** of the casing **(10)**. A horizontal flap **(51)** is disposed in the front air outlet **(43)**. The horizontal flap **(51)** is held by stays **(51a)** such that the discharge angle of the front air outlet **(43)** is adjustable. One of the stays **(51a)** is provided with a swing unit **(51b)** for changing the angle of the horizontal flap **(51)**. On the other hand, a horizontal flap **(51)** and a swing mechanism (not shown) for adjusting the angle of the horizontal flap **(51)** are incorporated in each of the side panels **(10e)** such that the direction in which the conditioned air is discharged from the side air outlets **(44)** is manually adjustable.

[0034] An air passage **(45)** connected from the air inlet **(41)** to each of the air outlets **(43, 44)** is formed in the casing **(10)**. Two fans **(20R, 20L)** for sucking the room air from below and laterally discharging the air and

a heat exchanger **(30)** for generating the conditioned air from the room air are disposed in the air passage **(45)**. An air filter **(65)** is disposed below the centrifugal fans **(20R, 20L)** and adjacent the air inlet **(41)**.

[0035] Each of the fans **(20R, 20L)** is formed as a so-called turbo fan which is a kind of centrifugal fan. A drive shaft **(26)** of a fan motor **(25)** extending vertically (in upward and downward directions) is coupled to each of the fans **(20R, 20L)**. The fans **(20R, 20L)** are rotatively driven by the respective fan motors **(25)** to laterally discharge the air sucked from below.

[0036] Each of the fans **(20R, 20L)** is attached to the casing **(10)** by mounting the fan motor **(25)** on the top panel **(10a)** of the main body **(11)** of the casing **(10)** from the lower side of the top panel **(10a)**. A bellmouth **(27)** for guiding, to each of the fans **(20R, 20L)**, the room air flown from the air inlet **(41)** to the air passage **(25)** is disposed below each of the fans **(20R, 20L)**.

[0037] The fans **(20R, 20L)** are arranged in parallel, at a given spacing widthwise in the main body **(11)** of the casing **(10)**, while the casing **(10)** has a partition board **(64)** disposed between the two centrifugal fans **(20R, 20L)**. The casing **(10)** is provided with the right fan **(20R)** located on the right side and with the left fan **(20L)** located on the left side with the partition board **(64)** interposed therebetween when the casing **(10)** is viewed from the front side thereof. Each of the fans **(20R, 20L)** rotates clockwise when the casing **(10)** is viewed from above.

[0038] On the other hand, the heat exchange portion **(30)** is provided in the main body **(11)** of the casing **(10)**. The heat exchange portion **(30)** is formed of a front heat exchange portion **(31)** located in the main body **(11)** of the casing **(10)** adjacent the front face thereof and side heat exchange portions **(32)** located in the main body **(11)** of the casing **(10)** adjacent the side faces thereof to have a generally U-shaped configuration when viewed in plan view. The heat exchanger **(30)** is formed as a so-called crossfin heat exchanger composed of a large number of fins in the form of vertical plate members and a heat transfer pipe extending through the fins, though they are not depicted. The fins are arranged in parallel to each other except for the corner portions thereof located between the front heat exchange portion **(31)** and the side heat exchange portions **(32)**. The angles of the fins at the corner portions are gradually changing conformally to the curved configuration of the heat transfer pipe.

[0039] A thermal insulator **(35)** formed to have a generally U-shaped configuration when viewed in plan view, similarly to the heat exchanger **(30)**, is disposed on the upper side of the heat exchanger **(30)**. A drain pan **(36)** similarly formed of a thermal insulating material to have a generally U-shaped configuration when viewed in plan view is disposed on the lower side of the heat exchanger **(30)**. As the materials of the thermal insulator **(35)** and the drain pan **(36)**, there can be used, e.g., blowing styrole or the like.

[0040] Figures **4** through **6** are layouts each showing a positional relationship among individual components in the casing **(10)**, which represent only the outer configurations of the casing **(10)** and the individual components schematically. The interior of the swelling portion **(13)** serves as a space for accommodating an optional item **(60)** to accommodate, e.g., either of a high efficiency air filter or deodorizer. As the high efficiency air filter, a so-called HEPA filter (high efficiency particulate air filter) or an electrostatic filter can be used. As the deodorizer, an optical deodorizing unit which deodorizes a stinking substance by using an optical catalyst can be used.

[0041] Between the left and right centrifugal fans **(20R, 20L)**, a switch box **(61)** is disposed. Between the centrifugal fans **(20R, 20L)** and the rear panel **(10b)** on the rear side of the casing **(19)**, a refrigerant pipe **(62a)** and a drain pipe **(62b)** are disposed along the rear panel **(10b)**. **(63)** denotes a pipe cover, in which the two pipes **(62a, 62b)** are disposed to extend.

[0042] The casing **(10)** of the air conditioner **(1)** is designed to be fixable to either of the ceiling **(71)** and wall **(72)** of the room via the fixing device **(80)** shown in Figure **2**. The fixing device **(80)** is composed of a vertical plate member **(81)** extending along the rear panel **(10b)** which is a member composing the rear face of the casing **(10)** and a horizontal, plate member **(82)** extending forwardly from the vertical plate member **(81)**, which are formed integrally. The horizontal plate member **(82)** is designed to extend along the top panel **(10a)** which is a member composing the upper face of the casing **(10)**. The fixing device **(80)** is formed of the vertical plate member **(81)** and the horizontal plate member **(82)** to have a generally L-shaped side configuration when viewed in side view. In the present embodiment, the horizontal member **(82)** is composed of two arms each having an L-shaped cross section, which are disposed separately on the left and right sides of the casing **(10)**.

[0043] As shown in detail in Figure **7**, the arms **(82)** and the top panel **(10a)** of the air conditioner **(1)** are formed with fixing holes **(H1, H2)** for the passage of bolts for fixation. The fixing holes **(H1)** of the fixing device **(80)** are composed of oblong holes. Of the fixing holes **(H2)** of the casing **(10)**, the front-side ones are composed of oblong holes and the rear-side ones are composed of slits. This allows the casing **(10)** to adjust the position thereof in a front-to-rear direction relative to the fixing device **(80)**.

[0044] The vertical plate member **(81)** of the fixing device **(80)** is formed with fixing holes **(H3)** for fixing the fixing device **(80)** to the wall **(72)** by using bolts or the like. As shown in Figure **9**, a large number of fixing holes **(H3)** are formed in the vertical plate member **(81)** to allow the fixing device **(80)** to be fixed in an arbitrary position to the wall.

[0045] The fixing device **(80)** is provided with an engaging mechanism to be engaged with the casing **(10)** of the air conditioner **(1)**. The engaging mechanism

is composed of first hooks **(83)** provided on the vertical plate member **(81)** to be engaged with a lower portion **(10f)** of the rear panel **(10b)** of the casing **(10)** and second hooks **(84)** provided on the arms **(82)** to be engaged with the side edge portions of the top panel **(10a)** of the casing **(10)**. The first hooks **(83)** constitute first fastening means, while the second hooks **(84)** constitute second fastening means.

[0046] The first hooks **(83)** are provided on the lower end portion of the vertical plate member **(81)**, while the second hooks **(84)** are provided on the left and right end portions of the arms **(82)**. The second hooks **(84)** are formed of an elastic material to comprise base portions **(84a)** located on the left and right sides of the top panel **(10a)** of the casing **(10)** of the air conditioner **(1)** to extend therealong and tip engaging portions **(84b)** formed to bend inwardly at acute angles from the lower ends of the base portions **(84a)**.

[0047] On the other hand, the air conditioner **(1)** comprises a first engaging portion to be engaged with the first hooks **(83)** as the first fastening means and second engaging portions to be engaged with the second hooks **(84)** as the second fastening means. Specifically, the lower portion **(10f)** of the rear panel **(10b)** of the casing **(10)** is formed as the first engaging portion to be engaged with the first hooks **(83)** and the side edge portions **(10g)** of the top panel **(10a)** of the casing **(10)** are formed as the second engaging portions to be engaged with the tip engaging portions **(84b)** of the second hooks **(84)**.

[0048] By using the fixing device **(80)**, the air conditioner **(1)** can be fixed to the side wall **(72)** of the room as follows. First, bolts **(90)** for fixing the air conditioner **(1)** are inserted downwardly through the fixing holes **(H2)** formed in the arms **(82)** of the fixing device **(80)** and tightened against the arms **(82)** of the fixing device **(80)** by using nuts **(91)** (Figure **10**). The fixing device **(80)** is fixed to the wall by inserting nails or bolts in the fixing holes **(H3)** formed in the vertical plate member **(81)**.

[0049] Next, as shown in Figure **8**, the lower portion **(10f)** of the rear panel **(10b)** of the casing **(10)** is hung on the first hooks **(83)** of the fixing device **(80)**. Then, the front-side portion of the air conditioner **(1)** is raised by using the hooked lower end portion **(10f)** as a support so that the side edge portions of the top panel **(10a)** are hung on the second hooks **(84)**. The side edge portions **(10g)** of the top panel **(10a)** come into engagement with the second hooks **(84)** when they move to positions higher in level than the tip engaging portions **(84b)**, while the tip engaging portions **(84b)** of the second hooks **(84)** are outwardly widened under pressure (Figure **11**) when the top panel **(10a)** passes between the second hooks **(84)**.

[0050] Then the air conditioner **(1)** is thus brought into engagement with the fixing device **(80)**, the fixing bolts **(90)** pass through the fixing holes **(H2)** of the top panel **(10a)** of the casing **(10)**. By tightening the nuts **(92)** against the fixing bolts **(90)** from below, the air conditioner **(1)** can be fastened to the fixing device **(80)**. Thus, in this structure, the engaging mechanism is used to temporarily fasten the air conditioner **(1)** to the fixing device **(80)**. Figure **10** shows a state in which the air conditioner **(1)** is locked by using a double nut **(92)**. After the air conditioner **(1)** is fastened to the fixing device **(80)**, the side panels **(10e)** are attached to the casing **(10)**, whereby the fixation of the air conditioner **(1)** is completed.

[0051] In the present embodiment, the position at which the air conditioner **(1)** is engaged with the fixing device **(80)** is determined such that a small gap of about 5 millimeters is formed between the arms **(82)** of the fixing device **(80)** and the top panel **(10a)** of the casing **(10)** when the air conditioner **(1)** is temporarily fastened to the fixing device **(80)**. The gap is provided for the adjustment of the position of the air conditioner **(1)**. Because the depth of the air conditioner **(1)** is larger than the height thereof, the air conditioner **(1)** is likely to be inclined forwardly when it is fixed. The gap is provided especially for preventing the air conditioner **(1)** from being inclined forwardly by differently tightening the bolts and nuts **(90, 91, 92)** against the front and rear sides of the casing **(10)**. If the air conditioner **(1)** is forwardly inclined, it can be held in a horizontal position by tightening up the front side thereof, while leaving the gap on the rear side.

[0052] Figure **12** shows the fixation of the air conditioner **(1)** to the ceiling **(71)** of the room which is performed by using the fixing device **(80)**. In this case, the fixing holes **(H2)** of the top panel **(10a)** of the casing **(10)** and the fixing holes **(H1)** of the arms **(82)** of the fixing device **(80)** are formed in positions corresponding to hanger bolts **(95)** of the ceiling **(71)** for fixing the air conditioner **(1)**.

[0053] In this case, the fixing device **(80)** is fixed first by sandwiching it between nuts **(96)** screwed to the hanger bolts **(95)** through the ceiling **(71)** from above and below. After the fixing device **(80)** is fixed to the hanger bolts **(95),** the lower portion **(10f)** of the rear panel **(10b)** of the casing **(10)** is hung on the first hooks **(83)** and the front end portion of the air conditioner **(1)** is raised by using the hooked lower portion **(10f)** as a support, whereby the air conditioner **(1)** is temporarily fastened to the fixing device **(80)**, similarly to the case of fixing the air conditioner **(1)** to the side wall **(72)**. By tightening nuts **(97)** against the hanger bolts **(95)** protruding downwardly from the top panel **(10a)** and attaching the side panels **(10e)** to the casing **(10),** the fixation of the air conditioner **(1)** is completed.

[0054] A description will be given to the air conditioning operation of the air conditioner **(1)**. The fans **(20R, 20L)** are driven by the fan motor **(25)** to rotate and introduce the room air by suction from the air inlet **(41)** into the casing **(10)**. The room air introduced by suction into the casing **(10)** flows through the air passage **(45)**, passes through the bellmouth **(27)**, flows into the fans

(20R, 20L), and laterally flows out of the fans **(20R, 20L)** toward each of the air outlets.

[0055] The room air passes through the heat exchanger **(30)**, while flowing toward the air outlets **(43, 44)**. A refrigerant of a refrigerating circuit passes through the heat exchanger **(30)**, though it is not depicted. During a cooling operation, the refrigerant evaporates by heat-exchanging with the room air in the heat exchanger **(30)**, thereby cooling the room air and generating low-temperature conditioned air. During a heating operation, the refrigerant condenses by heat-exchanging with the room air in the heat exchanger **(30)**, thereby heating the room air and generating high-temperature conditioned air. It follows therefore that the conditioned air generated in the heat exchanger **(30)** is discharged from the air outlets **(43, 44)** in three directions into the room.

[0056] Since the air inlet **(41)** and the air outlets **(43,44)** are located at a specified distance from each other, a so-called air short circuit in which the conditioned air discharged from the air outlets **(43, 44)** is sucked again from the air inlet **(41)** does not occur.

[0057] The present embodiment achieves the following effects. That is, since the fixing device **(80)** is used to fix the air conditioner **(1)** to the side wall **(72)** of the room and the top side of the casing **(10)** is fastened to the fixing device **(80)**, sufficient fixing strength is obtainable even if the air conditioner has a large depth.

[0058] Moreover, since the air conditioner **(1)** is fastened temporarily to the fixing device **(80)** and then secured thereto whether the air conditioner **(1)** is fixed to the side wall **(72)** or to the ceiling **(71)**, the worker who supports the air conditioner **(1)** in tightening up the nuts **(92, 97)** is no more required so that only one worker is sufficient to perform the fixing operation, which improves workability.

[0059] Since the gap is provided between the arms **(82)** and the top panel **(10a)** of the casing **(10)** when the air conditioner **(1)** is brought into engagement with the fixing device **(80)**, the casing **(10)** is prevented from being inclined forwardly. Even if the ceiling **(71)** or the sidewall **(72)** is inclined, e.g., the gap between the air conditioner **(1)** and the ceiling **(71)** can be adjusted advantageously.

[0060] According to the foregoing embodiment of the prevent invention, the following structure may also be provided. Although the air conditioner **(1)** having the casing **(10)** composed of the main body **(11)** and the swelling portion **(13)** has been described in the foregoing embodiment, the present invention is also applicable to the air conditioner **(1)** having a casing configured as a rectangular parallelepiped on the whole. The present invention is not limited to the air conditioner having a casing with a large depth and is also applicable to an air conditioner of the type having a smaller depth.

[0061] Although the lower portion **(10f)** (first engaging portion) of the rear panel **(10b)** of the casing **(10)** is hung on the first hooks **(83)** in the foregoing embodiment, it is also possible to form holes in the lower portion of the rear panel **(10b)** of the casing **(10)** and hang the lower portion on the first hooks **(83)** through the holes. Although the side edge portions **(10g)** of the top panel **(10a)** of the casing **(10)** are hung on the second hooks **(84)** in the foregoing embodiment, the portion hung on the second hooks **(84)** is not limited to the top panel **(10a)** of the casing **(10)** and a lower portion may also be hung on the second hooks **(84)**. In short, it is sufficient for the portion of the casing **(10)** anterior to the first engaging portion **(10f)** to be hung on the second hooks **(84)**.

[0062] Although the horizontal panel member **(82)** is separated into the left and right parts each formed as an arm having an L-shaped cross section in the foregoing embodiment, the configuration thereof is determined appropriately in accordance with the configuration of the casing **(10)** and need not necessarily be separated into the left and right parts.

[0063] The fixing device **(80)** may also be used exclusively for a wall-mounted application. In that case, fixing means other than the bolts **(90)** may also be used. To fix the fixing device **(80)** to the side wall **(71)** of the room, proper fixing means other than bolts may also be used.

[0064] Although the first hooks **(83)** as the first fastening means and the second hooks **(84)** as the second fastening means **(84)** are used as the mechanism for temporarily fastening the air conditioner **(1)** to the fixing device **(80)** in the foregoing embodiment, the air conditioner can also be fixed to the side wall or the like of the room by using only the hooks **(83, 84)** without using the bolts **(90)** or the like if the air conditioner is for, e.g., home use and has a smaller depth.

Claims

1. A fixing device for an air conditioner, the device comprising a vertical plate member **(81)** extending along a rear face **(10b)** of an air conditioner **(1)** and a horizontal plate member **(82)** extending forwardly from the vertical plate member **(81)**, the vertical plate member **(81)** and the horizontal plate member **(82)** being formed integrally,

   the vertical plate member **(81)** comprising first fastening means **(83)** to be engaged with a lower portion **(10f)** of the rear face of the air conditioner **(1)** and the horizontal plate member **(82)** comprising second fastening means **(84)** to be engaged with the air conditioner **(1)** in a position anterior to the first fastening means **(83)**.

2. The fixing device of claim 1, wherein the vertical plate member **(81)** is formed with fixing holes **(H3)** for fixing the fixing device to a side wall **(72)** of a room and the horizontal member **(82)** is formed with

fixing holes **(H1)** for bolts **(90, 95)** for fixing the air conditioner **(1)**.

3. The fixing device of claim 2, wherein the fixing holes **(H1)** of the horizontal plate member **(82)** are formed in positions corresponding to the hanger bolts **(95)** of a ceiling **(71)** for fixing the air conditioner **(1)**.

4. The fixing device of claim 1, wherein the first fastening means is first hooks **(83)** provided on a lower end portion of the vertical plate member **(81)** and the second fastening means is second hooks **(84)** provided on left and right edge portions of the horizontal plate member **(82)** to be engaged with side edge portions **(10g)** of the air conditioner **(1)**,

the second hooks **(84)** being formed of an elastic material and comprising respective base portions **(84a)** located along the side edge portions **(10g)** of the air conditioner **(1)** and respective tip engaging portions **(84b)** formed to bend inwardly of the side edge portions **(10g)** of the air conditioner **(1)** from respective lower ends of the base portions **(84a)**.

5. A fixing structure for fixing an air conditioner **(1)** by using a fixing device **(80)** as recited in claim 1, the air conditioner **(1)** comprising a first engaging portion **(10f)** to be engaged with a first fastening means **(83)** and a second engaging portion **(10g)** to be engaged with a second fastening means **(84)**.

6. The fixing structure of claim 5, wherein the first fastening means **(83)** and second fastening means **(84)** of the fixing device **(80)** and the first engaging portion **(10f)** and second engaging portion **(10g)** of the air conditioner **(1)** are engaged with each other with a top face **(10a)** of the air conditioner **(1)** extending nearly along the horizontal plate member **(82)** of the fixing device **(80)**,

a position at which the air conditioner **(1)** is engaged with the fixing device **(80)** being determined such that a gap for adjusting the position of the air conditioner **(1)** is formed between the horizontal plate member **(82)** of the fixing device **(80)** and the top face **(10a)** of the air conditioner **(1)**.

Fig. 1

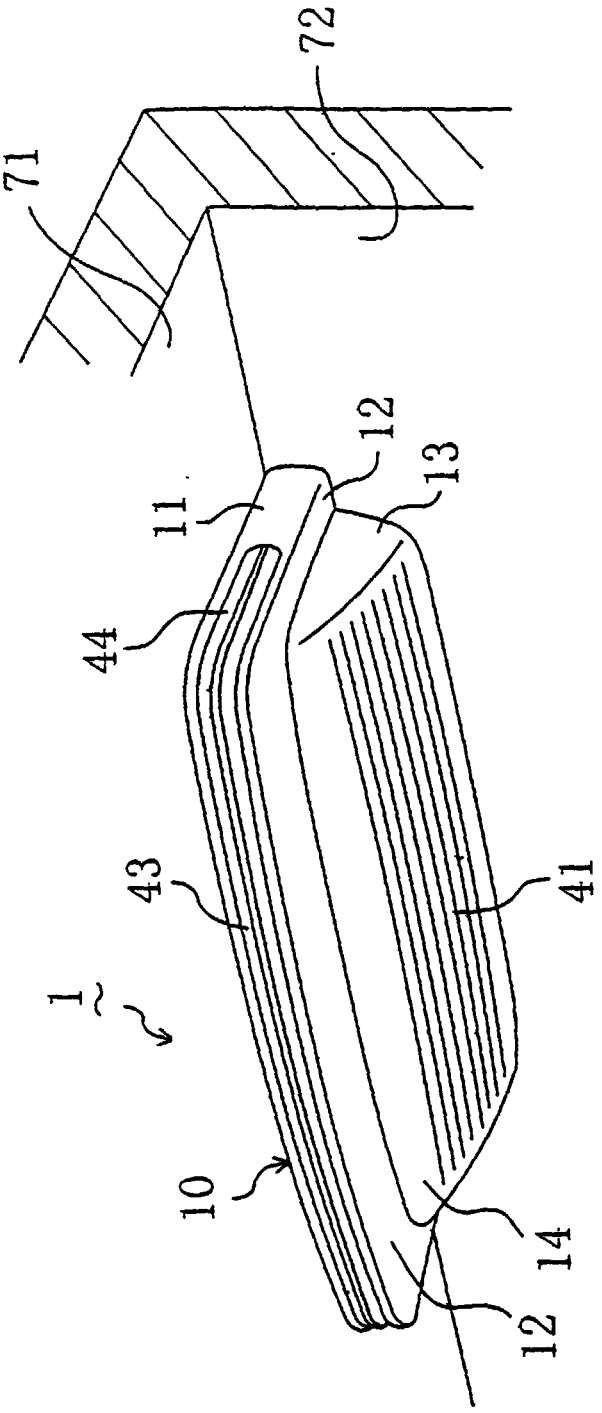
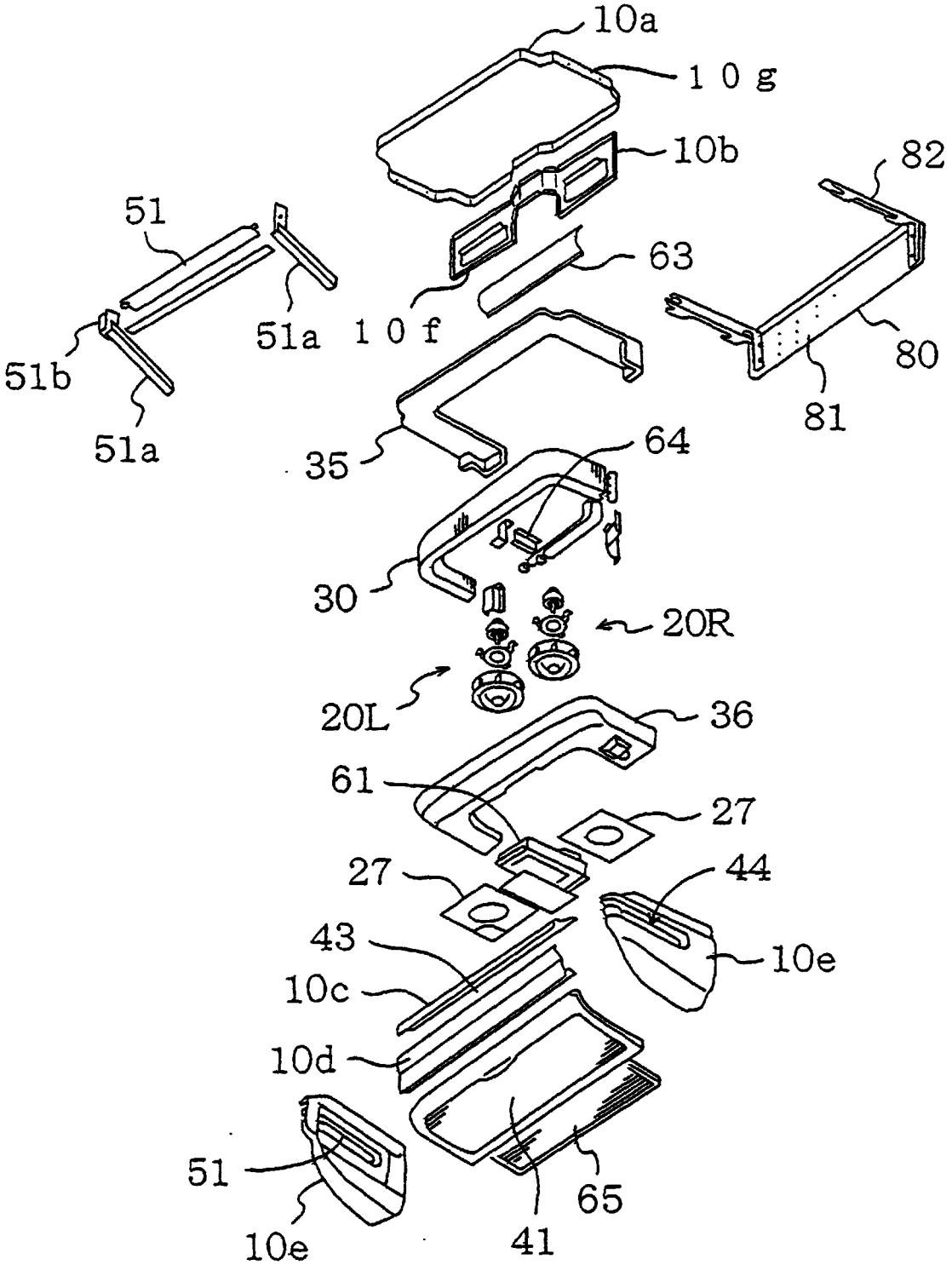


Fig. 2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44
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10e
10c
10d
51
65
10e
41

Fig. 3

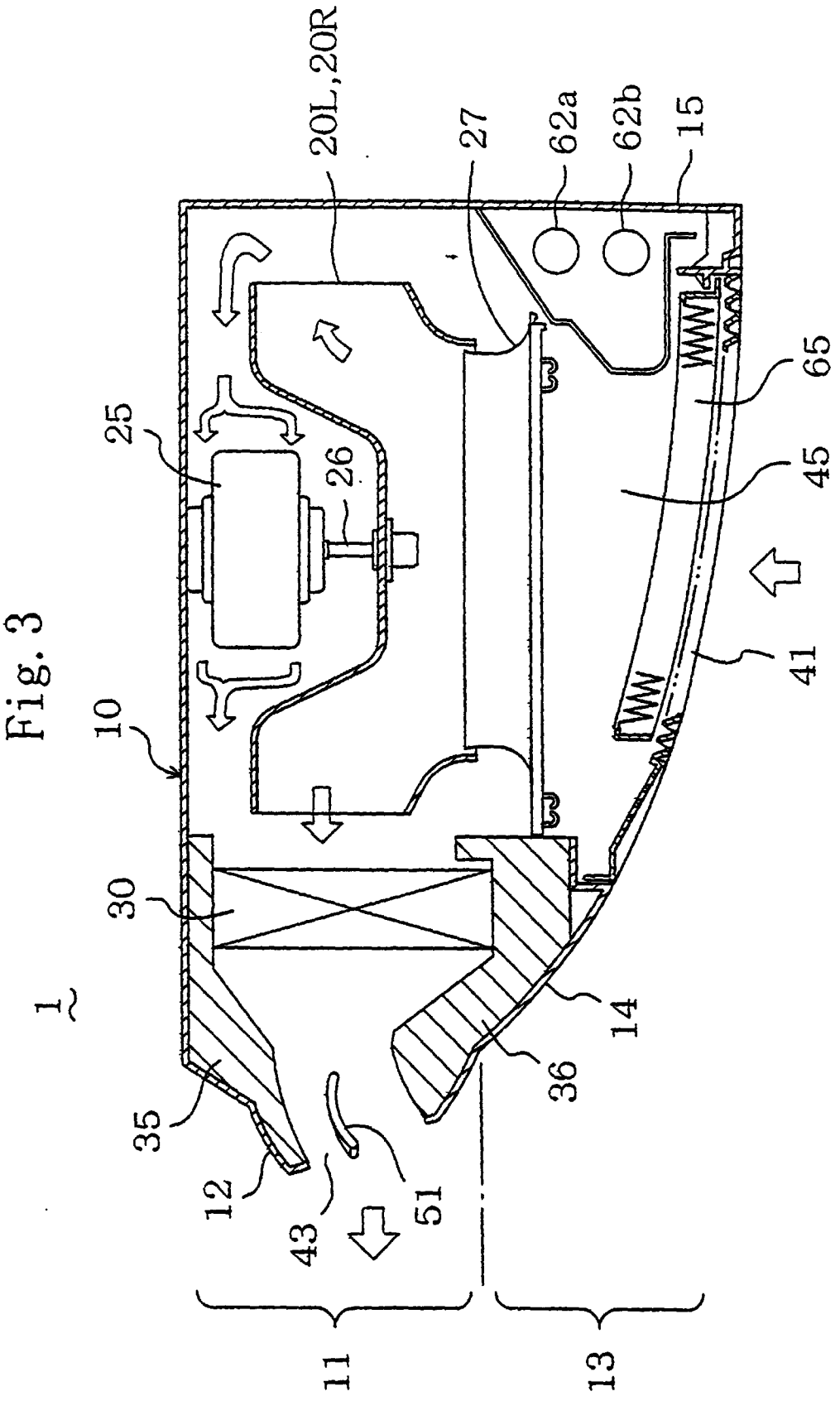


Fig. 4

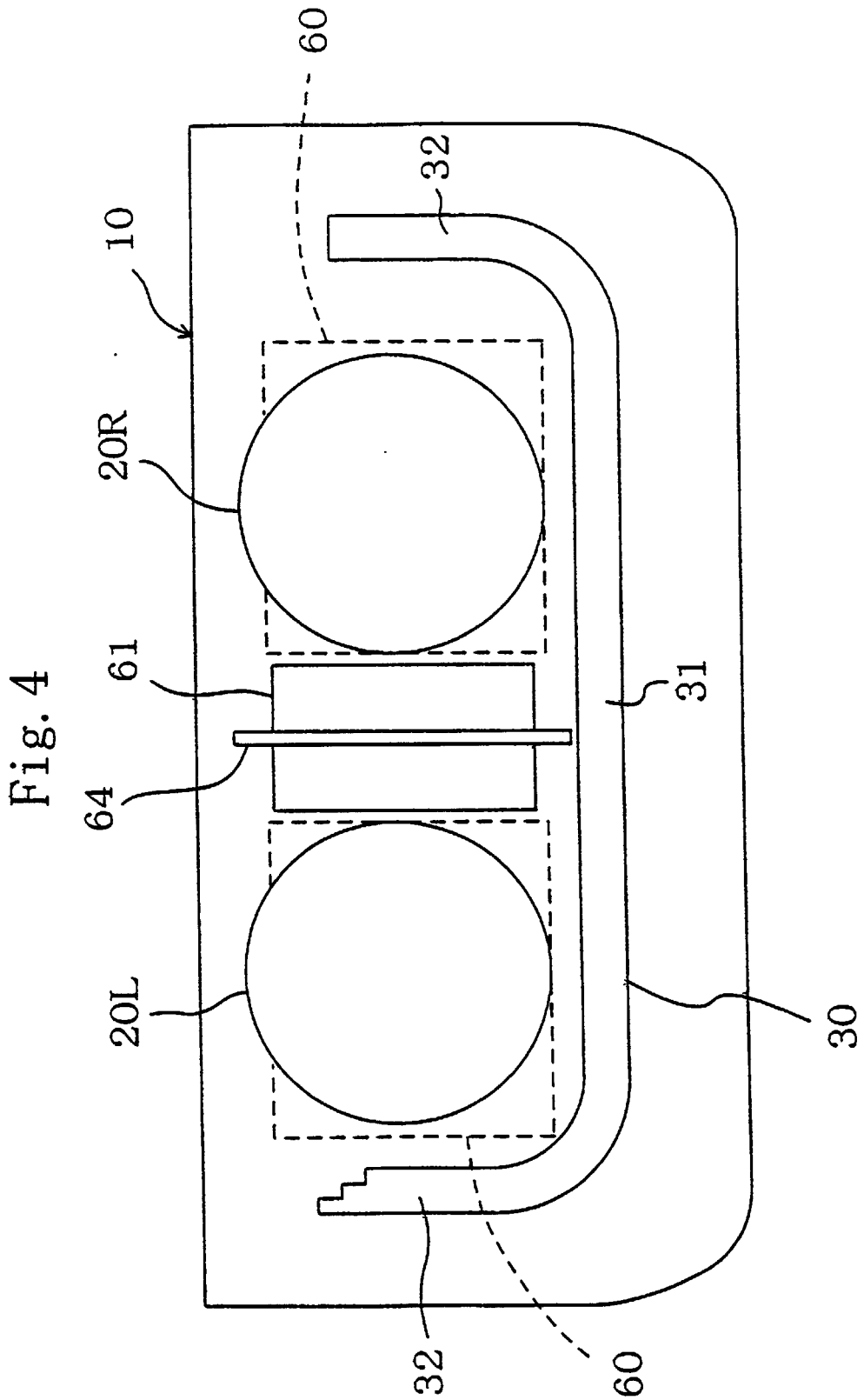


Fig. 5

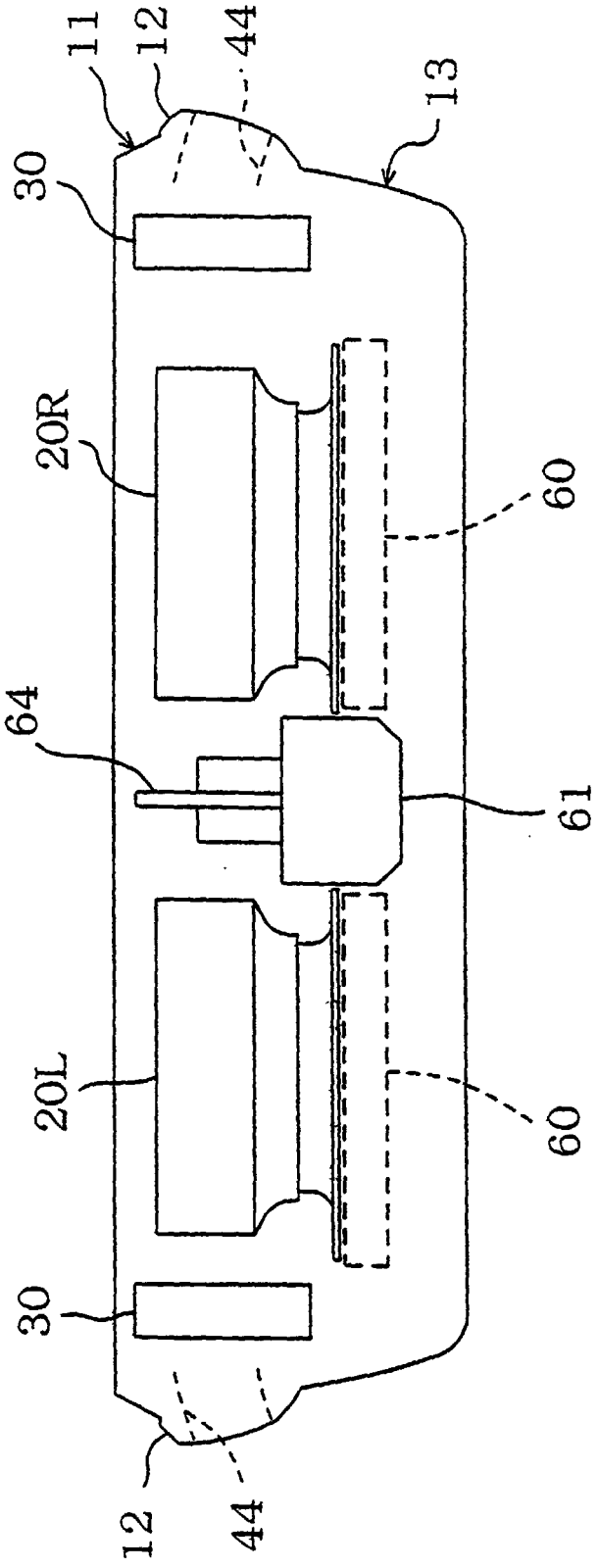


Fig. 6

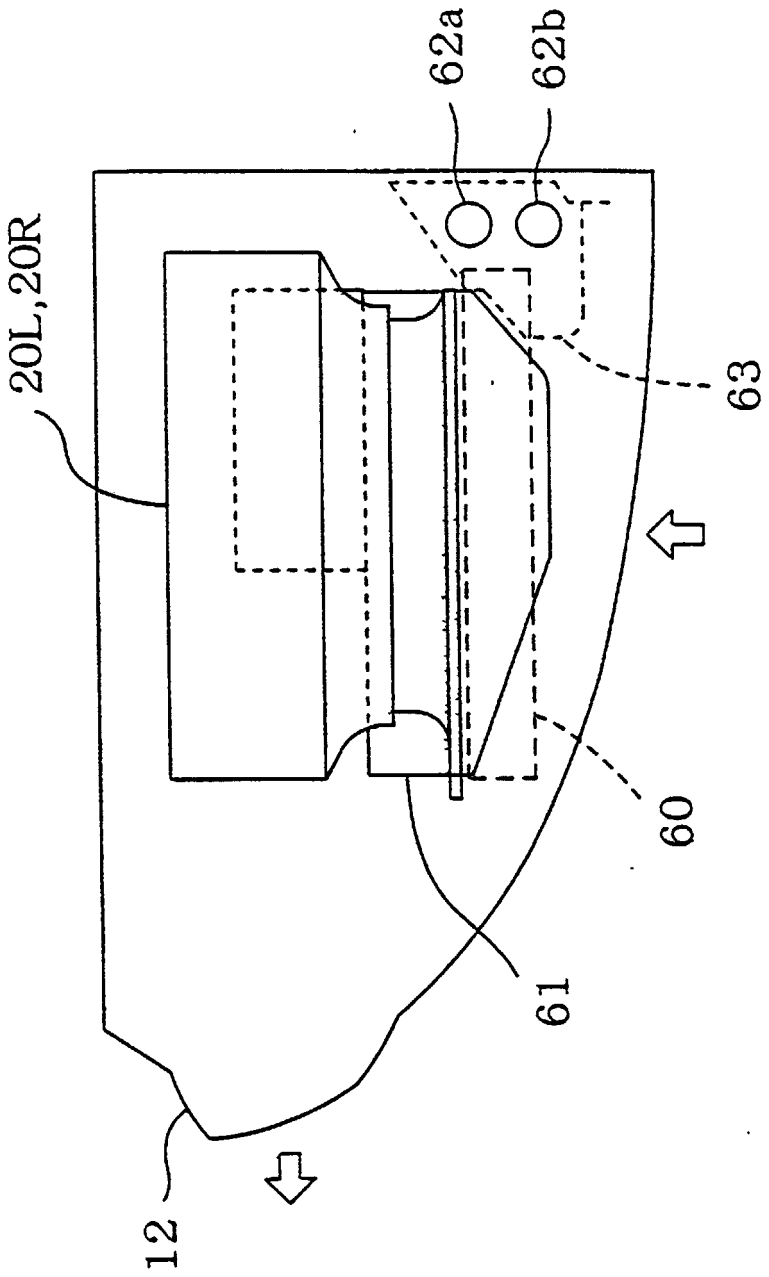


Fig. 7

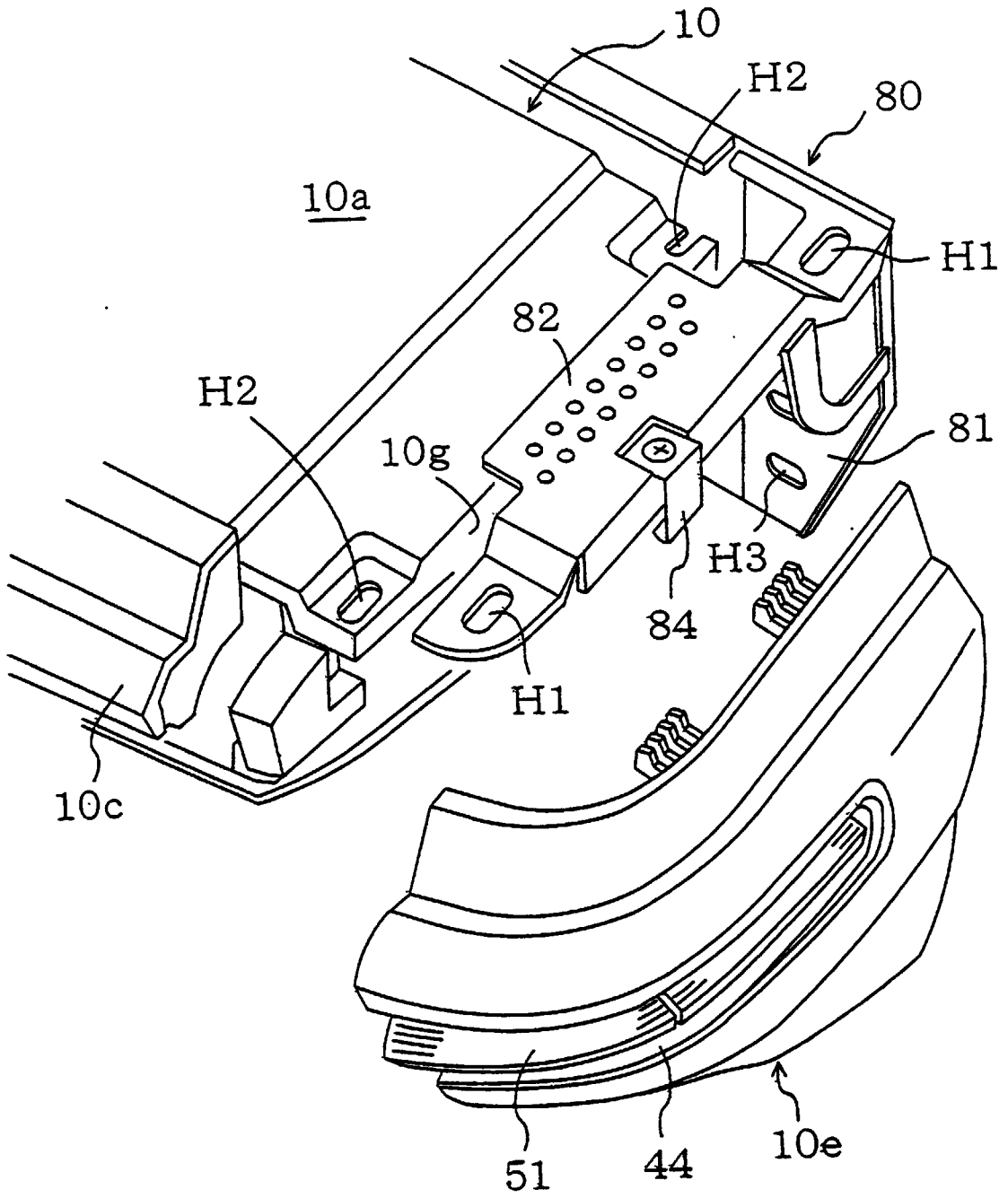


Fig. 8

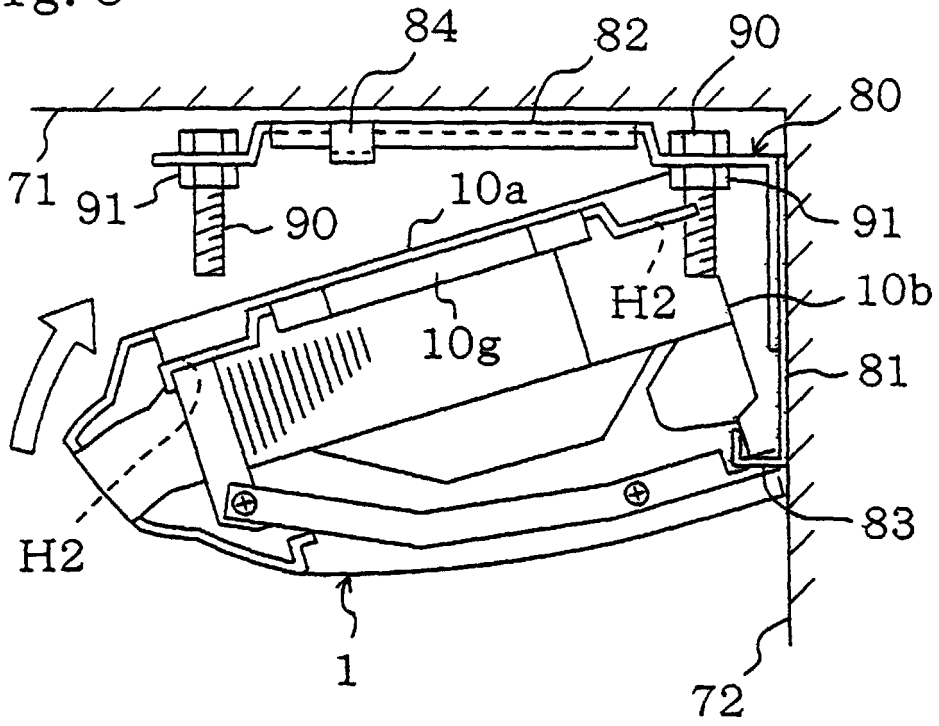
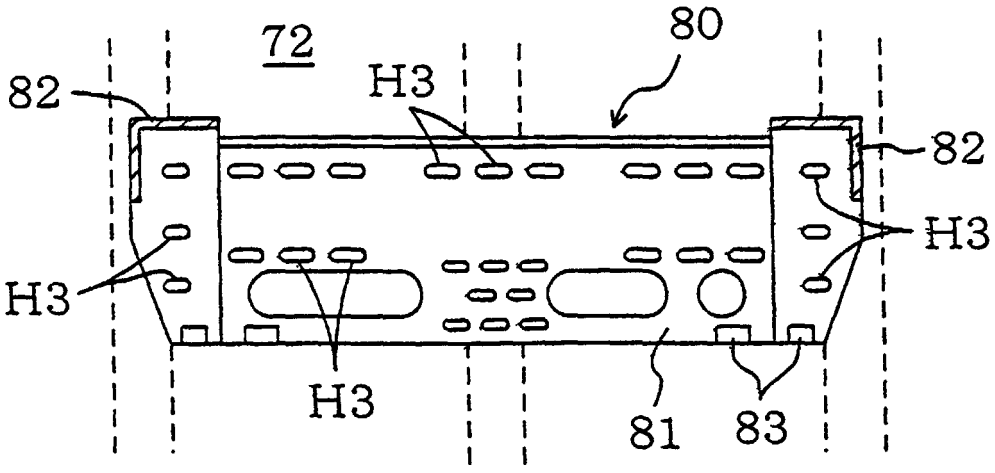

84
82
90
80
71
91
90
10a
91
H2
10b
10g
81
H2
83
1
72

Fig. 9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H3
82
H3
H3
H3
81
83

Fig. 10

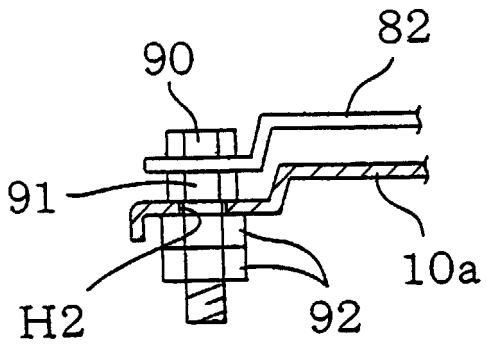


Fig. 11

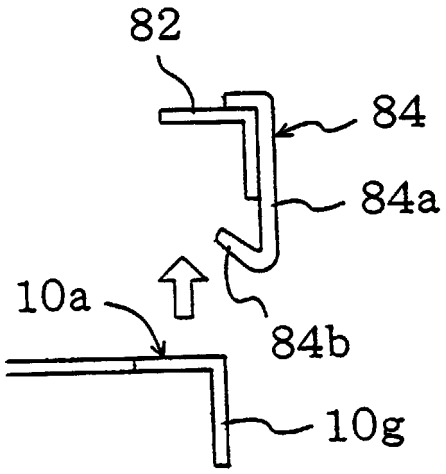
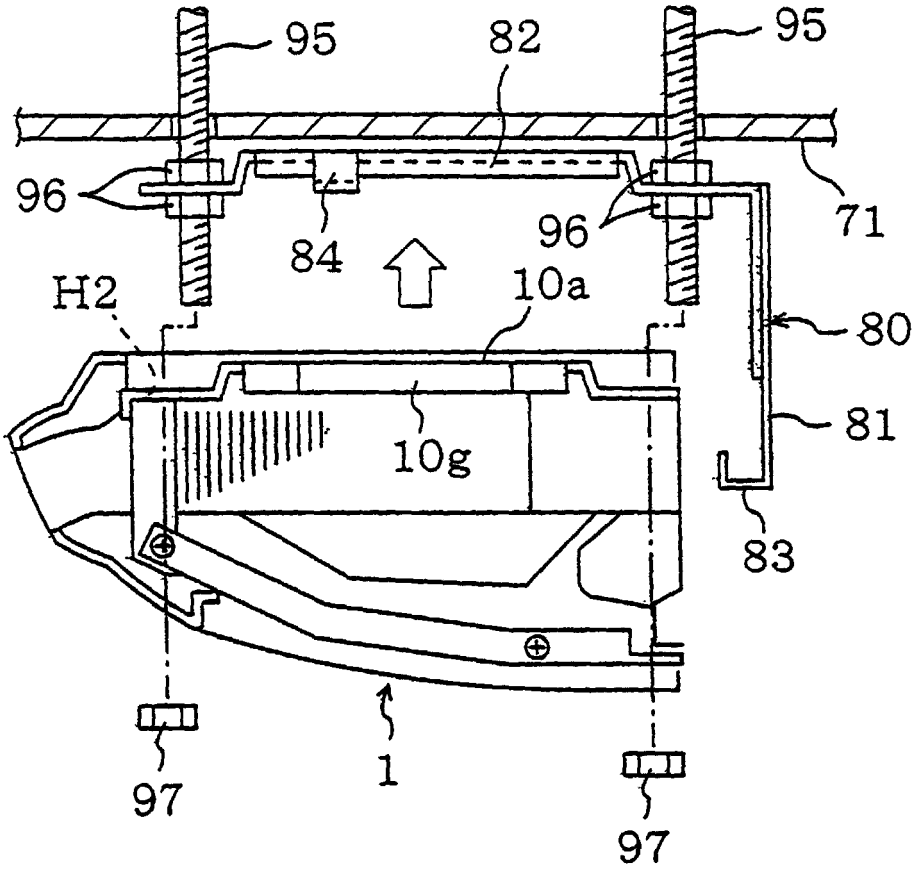


Fig. 12



INTERNATIONAL SEARCH REPORT

International application No.
PCT/JP99/06640

A. CLASSIFICATION OF SUBJECT MATTER
Int.Cl[7] F24F 13/32

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)
Int.Cl[7] F24F 13/32

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched
Jitsuyo Shinan Koho 1926-1996 Toroku Jitsuyo Shinan Koho 1994-2000
Kokai Jitsuyo Shinan Koho 1971-2000 Jitsuyo Shinan Toroku Koho 1996-2000

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	JP, 55-100916, U (DAIKIN INDUSTRIES, LTD.), 14 July, 1980 (14.07.80) (Family: none)	1-6
Y	JP, 56-175617, U (Fuji Electric Co., Ltd.), 25 December, 1981 (25.12.81) (Family: none)	1-6

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

* Special categories of cited documents:
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"O" document referring to an oral disclosure, use, exhibition or other means
"P" document published prior to the international filing date but later than the priority date claimed
"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
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"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art
"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
14 February, 2000 (14.02.00)	22 February, 2000 (22.02.00)
Name and mailing address of the ISA/ Japanese Patent Office	Authorized officer
Facsimile No.	Telephone No.

Form PCT/ISA/210 (second sheet) (July 1992)