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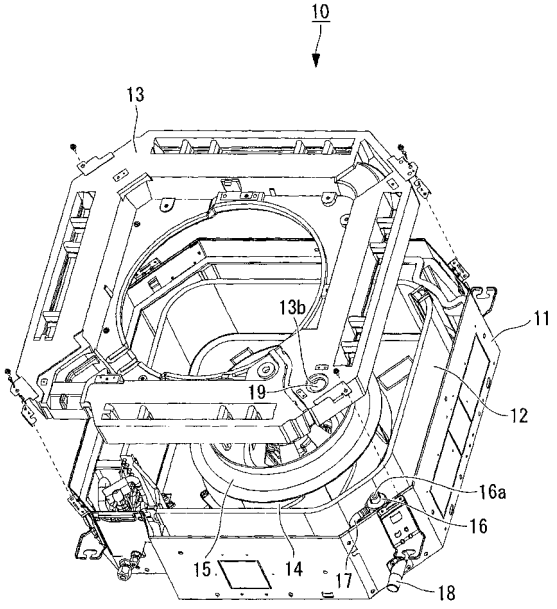
(54) INDOOR UNIT FOR AIR CONDITIONER

(57) Provided is an air-conditioner indoor unit in which the contamination condition of a drain pan can be grasped easily and quickly without removing the drain pan from the case main body, thus allowing accurate determination of whether it is time to clean the drain pan and preventing drainage accumulated in the drain pan from falling below the air-conditioner indoor unit during inspection work and soiling the floor surface, a desktop, etc. located below the air-conditioner indoor unit. Provided is an air-conditioner indoor unit (10) including, in a case main body (11) embedded in a ceiling, an indoor heat exchanger (12), a drain pan (13), an air-blower driving motor, an air blower (14), and an air deflector (15), wherein the drain pan (13) has a through-hole (13b) passing therethrough in a plate thickness direction, and a transparent member (19) is fitted in the through-hole (13b).

FIG. 1



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Description

Technical Field

[0001] The present invention relates to an air-conditioner indoor unit, and in particular, to an air-conditioner indoor unit for use in a ceiling-mounted air conditioner.

Background Art

[0002] A known example of an air-conditioner indoor unit for use in a ceiling-mounted air conditioner is disclosed in Patent Citation 1.
Patent Citation 1: Japanese Unexamined Patent Application, Publication No. 2007-271174

Disclosure of Invention

Problems to be Solved by the Invention

[0003] However, the invention disclosed in the above Patent Citation has a problem in that a drain pan must be removed from the case main body of the air-conditioner indoor unit to check the contamination condition of the drain pan, which makes inspection work troublesome, thus taking a long time for the inspection work.
Another problem is that drainage accumulated in the drain pan falls when the drain pan is removed from the case main body, soiling the floor surface, a desktop, etc. located below (vertically below) the air-conditioner indoor unit.
[0004] The present invention is made in consideration of the above-described circumstances, and it is an object thereof to provide an air-conditioner indoor unit in which the contamination condition of a drain pan can be grasped easily and quickly without removing the drain pan from the case main body, thus allowing accurate determination of whether it is time to clean the drain pan and preventing drainage accumulated in the drain pan from falling below the air-conditioner indoor unit during inspection work and soiling the floor surface, a desktop, etc. located below the air-conditioner indoor unit.
[0005] The present invention adopts the following solutions to solve the problems described above.
An air-conditioner indoor unit according to a first aspect of the present invention is an air-conditioner indoor unit including, in a case main body embedded in a ceiling, an indoor heat exchanger, a drain pan, an air-blower driving motor, an air blower, and an air deflector, wherein the drain pan has a through-hole passing therethrough in a plate thickness direction, and a transparent member is fitted in the through-hole.
[0006] With the air-conditioner indoor unit according to the first aspect of the present invention, the grime (build-up) condition inside the drain pan can be grasped easily and quickly merely by looking at the grime adhering to the inner surface of the transparent member, thus allowing accurate determination of whether it is time to clean the drain pan.
Since the contamination condition inside the drain pan can be grasped merely by looking at the grime adhering to the inner surface of the transparent member, the floor surface, a desktop, etc. located below (vertically below) the air-conditioner indoor unit can be prevented from being soiled by the drainage during inspection work.
[0007] In the air-conditioner indoor unit, it is more preferable that a plate-like reflecting plate be provided directly above the through-hole and the transparent member and higher than the maximum water level of drainage in such a manner that the upper surface and the lower surface thereof are substantially parallel to a horizontal surface.
[0008] With such an air-conditioner indoor unit, light that has entered (has been introduced into) the inside of the drain pan through the transparent member reaches a surface (lower surface) of the reflecting plate and is reflected by the reflecting plate toward the transparent member, and thereafter exits (emerges) outside the drain pan through the transparent member.
In other words, since the light reflected by the reflecting plate illuminates the inner surface of the transparent member more brightly, the grime (build-up) condition inside the drain pan can be grasped more easily and more quickly, thus allowing more accurate determination of whether it is time to clean the drain pan.
[0009] In the air-conditioner indoor unit, it is more preferable that a columnar or prismatic reflecting member be provided directly above the through-hole and the transparent member and higher than the maximum water level of drainage in such a manner that both end faces are substantially parallel to a horizontal surface.
[0010] With such an air-conditioner indoor unit, light that has entered (has been introduced into) the inside of the drain pan through the transparent member reaches the outer peripheral surface (outer surface: side surface) of the reflecting member, is reflected by the reflecting member toward the transparent member, and thereafter exits (emerges) outside the drain pan through the transparent member.
In other words, since the light reflected by the reflecting member illuminates the inner surface of the transparent member more brightly, the grime (build-up) condition inside the drain pan can be grasped more easily and more quickly, thus allowing more accurate determination of whether it is time to clean the drain pan.
Furthermore, since the reflecting member has a depth along the vertical direction (extends in the vertical direction), the inspector (worker) can perform inspection at a location (position) a little away (slightly away) from a location directly below (vertically below) the transparent member.
[0011] In the air-conditioner indoor unit, it is more preferable that a circular truncated conical or truncated pyramidal reflecting member be provided directly above the through-hole and the transparent member and higher than the maximum water level of drainage in such a man-

ner that a small-diameter-side end face is located at the bottom and a large-diameter-side end face is located at the top, and that the end faces are substantially parallel to a horizontal surface.

[0012] With such an air-conditioner indoor unit, light that has entered (has been introduced into) the inside of the drain pan through the transparent member reaches the outer peripheral surface (outer surface: side surface) of the reflecting member, is reflected by the reflecting member toward the transparent member, and thereafter exits (emerges) outside the drain pan through the transparent member.

In other words, since the light reflected by the reflecting member illuminates the inner surface of the transparent member more brightly, the grime (build-up) condition inside the drain pan can be grasped more easily and more quickly, thus allowing more accurate determination of whether it is time to clean the drain pan.

Furthermore, since the reflecting member has a depth along the vertical direction (extends in the vertical direction) and expands in diameter toward the inner part, the inspector (worker) can perform inspection at a location directly below (vertically below) the transparent member and a location a little away (slightly away) from the location directly below.

[0013] In the air-conditioner indoor unit, it is more preferable that quantifying means be provided on the lower surface of the reflecting plate or on a side surface of the reflecting member, for quantifying the grime condition.

[0014] With such an air-conditioner indoor unit, the grime (build-up) condition inside the drain pan can be grasped quantitatively or unambiguously depending on how the quantifying means (for example, numerals) provided on the lower surface of the reflecting plate or on a side surface of the reflecting member is viewed, which can reduce differences in judgment that can be caused among inspectors (workers) who look into the drain pan through the transparent member.

[0015] In the air-conditioner indoor unit, it is more preferable that at least one light source that illuminates the lower surface of the reflecting plate or the side surface of the reflecting member be provided.

[0016] With such an air-conditioner indoor unit, since the lower surface of the reflecting plate or the side surface of the reflecting member is brightly illuminated by the light source, the grime (build-up) condition inside the drain pan can be grasped more easily and more quickly merely by looking into the drain pan through the transparent member irrespective of light that enters (is introduced into) the inside of the drain pan through the transparent member (irrespective of the brightness (illuminance) in the room), that is, even if it is dark in the room, thus allowing more accurate determination of whether it is time to clean the drain pan.

[0017] An air-conditioner indoor unit according to a second aspect of the present invention is an air-conditioner indoor unit including, in a case main body embedded in a ceiling, an indoor heat exchanger, a drain pan, a drain pump, an air-blower driving motor, an air blower, and an air deflector, wherein the drain pan has a through-hole passing therethrough in a plate thickness direction; a transparent member is fitted in the through-hole; the drain pump is disposed directly above the through-hole and the transparent member; and the side surface of an intake portion of the drain pump serves as a reflector.

[0018] With the air-conditioner indoor unit according to the second aspect of the present invention, since the side surface of the intake portion of the drain pump can be used as a reflector, the need for a separate member, such as a reflecting plate or a reflecting member, can be eliminated, which can reduce the number of parts, thus reducing the cost of manufacture.

[0019] An air-conditioner indoor unit according to a third aspect of the present invention is an air-conditioner indoor unit including, in a case main body embedded in a ceiling, an indoor heat exchanger, a drain pan, an air-blower driving motor, an air blower, and an air deflector, wherein the drain pan has a through-hole passing therethrough in a plate thickness direction; a dam extending upward and whose upper end is located higher than the maximum water level of drainage is provided around the inner rim of the through-hole; and a plug member whose outer circumferential surface is in contact with the inner circumferential surface of the through-hole and/or the inner circumferential surface of the dam is detachably mounted inside the through-hole and the dam.

[0020] With such an air-conditioner indoor unit according to the third aspect of the present invention, during inspection, the grime (build-up) condition inside the drain pan can be grasped easily and quickly merely by removing the plug member, inserting a brush or the like toward the upper surface (bottom surface) of the drain pan through the through-hole, and looking at grime adhering to the brush, thus allowing accurate determination of whether it is time to clean the drain pan.

Moreover, since the drainage accumulated in the drain pan can be blocked by the dam, the floor surface, a desktop, etc. located below (vertically below) the air-conditioner indoor unit can be prevented from being soiled by the drainage during inspection work.

[0021] In the air-conditioner indoor unit, it is more preferable that a hinge having a rotation axis that is substantially parallel to a horizontal direction be mounted on the top face of the plug member with a support member therebetween; the base end of a rod-like member be mounted to the hinge; the plug member have a through-hole at the center; and the through-hole accommodate a wire member of which one end is connected to the hinge and which rotates the distal end of the rod-like member upward by drawing the other end downward and which rotates the distal end of the rod-like member downward by pushing the other end upward.

[0022] With such an air-conditioner indoor unit, the grime (build-up) condition inside the case main body can be grasped more easily and more quickly merely by removing the plug member from the drain pan in a state in

which the distal end of the rod-like member is directed upward by drawing the other end of the wire member downward during inspection and looking at grime adhering to the distal end of the rod-like member, thus allowing more accurate determination of whether it is time to clean the drain pan.

[0023] A ceiling-mounted air conditioner according to a fourth aspect of the present invention is equipped with an air-conditioner indoor unit in which the contamination condition of a drain pan can be grasped easily and quickly without removing the drain pan from a case main body, thus allowing accurate determination of whether it is time to clean the drain pan and preventing drainage accumulated in the drain pan from falling below the air-conditioner indoor unit during inspection work and soiling the floor surface, a desktop, etc. located below the air-conditioner indoor unit.

[0024] With the ceiling-mounted air conditioner according to the fourth aspect of the present invention, inspection work on the drain pan of the air-conditioner indoor unit can be performed easily and quickly.

Advantages of the Invention

[0025] The air-conditioner indoor unit according to the present invention offers the advantages of allowing the contamination condition of a drain pan to be grasped easily and quickly without removing the drain pan from a case main body, allowing accurate determination of whether it is time to clean the drain pan, and preventing drainage accumulated in the drain pan from falling below the air-conditioner indoor unit during inspection work and soiling the floor, a desktop, etc. located below the air-conditioner indoor unit.

Brief Description of Drawings

[0026]

[Fig. 1] Fig. 1 is a schematic configuration diagram of an air-conditioner indoor unit according to a first embodiment of the present invention.

[Fig. 2] Fig. 2 is an enlarged longitudinal sectional view of a relevant part in Fig. 1.

[Fig. 3] Fig. 3 is an enlarged plan view of a relevant part of an air-conditioner indoor unit according to a second embodiment of the present invention.

[Fig. 4] Fig. 4 is an enlarged longitudinal sectional view of a relevant part of an air-conditioner indoor unit according to a third embodiment of the present invention.

[Fig. 5] Fig. 5 is an enlarged plan view of a relevant part of an air-conditioner indoor unit according to a fourth embodiment of the present invention.

[Fig. 6] Fig. 6 is an enlarged longitudinal sectional view of a relevant part of an air-conditioner indoor unit according to a fifth embodiment of the present invention.

[Fig. 7] Fig. 7 is an enlarged plan view of a relevant part of an air-conditioner indoor unit according to a sixth embodiment of the present invention.

[Fig. 8] Fig. 8 is an enlarged longitudinal sectional view of a relevant part of an air-conditioner indoor unit according to a seventh embodiment of the present invention.

[Fig. 9] Fig. 9 is an enlarged longitudinal sectional view of a relevant part of an air-conditioner indoor unit according to an eighth embodiment of the present invention.

Explanation of Reference:

[0027]

10:	air-conditioner indoor unit
11:	case main body
12:	indoor heat exchanger
13:	drain pan
13b:	through-hole
14:	air blower
15:	air deflector
16:	drain pump
16a:	intake portion
19:	transparent member
20:	reflecting plate
30:	air-conditioner indoor unit
31:	reflecting plate
31a:	surface (lower surface)
40:	air-conditioner indoor unit
41:	reflecting member
50:	air-conditioner indoor unit
51:	reflecting member
51a:	outer peripheral surface (side surface)
60:	air-conditioner indoor unit
61:	reflecting member
70:	air-conditioner indoor unit
71:	reflecting member
71a:	outer peripheral surface (side surface)
80:	air-conditioner indoor unit
81:	light source
90:	air-conditioner indoor unit
91:	dam
92	plug member
92a:	outer circumferential surface
93:	hinge
94:	support member
95:	rod-like member
96:	wire member
L:	maximum water level

Best Mode for Carrying Out the Invention

[0028] A first embodiment of an air-conditioner indoor unit according to the present invention will be described below with reference to Figs. 1 and 2.

Fig. 1 is a schematic configuration diagram of the air-

conditioner indoor unit according to this embodiment; and Fig. 2 is an enlarged longitudinal sectional view of a relevant part in Fig. 1.

[0029] An air-conditioner indoor unit 10 constitutes a ceiling-mounted air conditioner, together with an air-conditioner outdoor unit and a refrigerant pipe (not shown). The air-conditioner outdoor unit includes a compressor for compressing a refrigerant, an outdoor heat exchanger for heat-exchange between the refrigerant and outdoor air, and an outdoor fan.

The refrigerant pipe joins the air-conditioner indoor unit 10 and the air-conditioner outdoor unit together to circulate the refrigerant between the air-conditioner indoor unit and the air-conditioner outdoor unit.

[0030] As shown in Fig. 1, the air-conditioner indoor unit 10 includes, in a case main body 11 embedded in a ceiling (not shown), an indoor heat exchanger 12, a drain pan 13, an air-blower driving motor (not shown), an air blower 14, and an air deflector 15. A ceiling panel (not shown) is mounted below the case main body 11. The ceiling panel has an intake port at the center and an exhaust port on the outer side thereof adjacent to the intake port.

[0031] During the operation of the ceiling-embedded air conditioner, the refrigerant from the outdoor unit circulates through the indoor heat exchanger 12, and the air blower 14 is driven (rotated) by the air-blower driving motor. Then, room air in the room is guided from the intake port to the air deflector 15 through an intake grill and a filter attached to the intake port and is sucked into the air blower 14, thus being propelled. The air is cooled or excessively heated into conditioned air in the process of circulating through the indoor heat exchanger 12 and is blown into the room through the exhaust port.

[0032] When room air is cooled by the indoor heat exchanger 12 during the cooling mode of the ceiling-embedded air conditioner, moisture in the room air is condensed into liquid on the surface of the indoor heat exchanger 12 and falls in the form of drainage into the drain pan 13. This drainage is collected into a drain pool 13a (see Fig. 2) formed at a corner (an edge) of the drain pan 13, is sucked up therefrom by a drain pump 16, and is discharged to the exterior of the room through a drain pipe 17, a drain socket 18, and a discharge pipe (not shown).

[0033] The drain pan 13 of the air-conditioner indoor unit 10 according to this embodiment is provided with a through-hole 13b passing through the drain pool 13a in the plate thickness direction and having a circular shape in plan view, and a transparent member (transparent object) 19 having a circular shape in plan view is fitted in the through-hole 13b. A reflecting plate 20 having a square shape in plan view (or a circular shape in plan view) is provided directly above (vertically above) the through-hole 13b and the transparent member 19 and higher than the maximum water level L of the drainage. The reflecting plate 20 is a thin plate member made of, for example, white plastic (for example, polystyrene (PS)).

[0034] With the air-conditioner indoor unit 10 according to this embodiment, light that has entered (has been introduced into) the inside of the case main body 11 (more specifically, the inside of the drain pan 13) through the transparent member 19 reaches a surface (lower surface) 20a of the reflecting plate 20 and is reflected by the reflecting plate 20 toward the transparent member 19, and thereafter exits (emerges) outside the case main body 11 (more specifically, outside the drain pan 13) through the transparent member 19. At that time, if the inner surface (upper surface) 19a of the transparent member 19 is clean without any grime (for example, an agar-like substance (slime) metabolized by pseudomonas) 21, as shown in the left half of Fig. 2, the surface 20a of the reflecting plate 20 can be visually recognized easily and clearly, and if the inner surface (upper surface) 19a of the transparent member 19 becomes dirty with the grime 21 built up thereon, as shown in the right half of Fig. 2, the surface 20a of the reflecting plate 20 becomes hardly visible or becomes impossible to be visually recognized in accordance with the degree (level) of the grime 21.

[0035] In other words, the grime (build-up) condition inside the case main body 11 can be grasped easily and quickly merely by looking into the case main body 11 (more specifically, the inside of the drain pan 13) through the transparent member 19, thus allowing accurate determination of whether it is time to clean the drain pan 13. Since the contamination condition inside the case main body 11 can be grasped merely by looking into the case main body 11 through the transparent member 19, the floor surface, a desktop, etc. located below (vertically below) the air-conditioner indoor unit 10 can be prevented from being soiled by the drainage during inspection work.

[0036] A second embodiment of the air-conditioner indoor unit according to the present invention will be described with reference to Fig. 3.

An air-conditioner indoor unit 30 according to this embodiment differs from that of the above-described first embodiment in that it has a reflecting plate 31 instead of the reflecting plate 20. Since the other components are the same as those of the first embodiment described above, descriptions of those components will be omitted here.

[0037] As shown in Fig. 3, numerals 0, 1, 2, and 3 (quantifying means) are drawn on a surface (lower surface) 31a of the reflecting plate 31, and the numerals drawn on the surface 31a of the reflecting plate 31 become hardly visible or become impossible to be visually recognized in the order 3, 2, 1, and 0 in accordance with the degree of the grime 21.

[0038] With the air-conditioner indoor unit 30 according to this embodiment, the grime (build-up) condition inside the case main body 11 can be grasped quantitatively or unambiguously merely by looking into the case main body 11 (more specifically, the inside of the drain pan 13) through the transparent member 19, which can

reduce differences in judgment that can be caused among inspectors (workers) who look into the case main body 11 through the transparent member 19.

Since the other operational advantages are the same as those of the first embodiment described above, descriptions thereof will be omitted here.

[0039] A third embodiment of the air-conditioner indoor unit according to the present invention will be described with reference to Fig. 4.

An air-conditioner indoor unit 40 according to this embodiment differs from that of the above-described embodiments in that it has a reflecting member 41 instead of the reflecting plate 20 or 31. Since the other components are the same as those of the above-described embodiments, descriptions of those components will be omitted here.

[0040] As shown in Fig. 4, the reflecting member 41 is a solid (or hollow) columnar (or prismatic) member made of, for example, white plastic (for example, polystyrene (PS)).

[0041] With the air-conditioner indoor unit 40 according to this embodiment, light that has entered (has been introduced into) the inside of the case main body 11 (more specifically, the inside of the drain pan 13) through the transparent member 19 reaches the outer peripheral surface (outer surface: side surface) 41a of the reflecting member 41, is reflected by the reflecting member 41 toward the transparent member 19, and thereafter exits (emerges) outside the case main body 11 (more specifically, outside the drain pan 13) through the transparent member 19. At that time, if the inner surface (upper surface) 19a of the transparent member 19 is clean without grime (for example, an agar-like substance (slime) metabolized by pseudomonas) 21, as shown in the left half of Fig. 4, the outer peripheral surface 41a of the reflecting member 41 can be visually recognized easily and clearly, and if the inner surface (upper surface) 19a of the transparent member 19 becomes dirty with the grime 21 built up thereon, as shown in the right half of Fig. 4, the outer peripheral surface 41a of the reflecting member 41 becomes hardly visible or becomes impossible to be visually recognized in accordance with the degree (level) of the grime 21.

[0042] In other words, the grime (build-up) condition inside the case main body 11 can be grasped easily and quickly merely by looking into the case main body 11 (more specifically, the inside of the drain pan 13) through the transparent member 19, thus allowing accurate determination of whether it is time to clean the drain pan 13. Since the contamination condition inside the case main body 11 can be grasped merely by looking into the case main body 11 through the transparent member 19, the floor surface, a desktop, etc. located below (vertically below) the air-conditioner indoor unit 10 can be prevented from being soiled by the drainage during inspection work. Furthermore, as shown in Fig. 4, since the reflecting member 41 has a depth along the vertical direction (extends in the vertical direction), the inspector (worker) can perform inspection at a location (position) a little away (slightly away) from a location directly below (vertically below) the transparent member 19.

[0043] A fourth embodiment of the air-conditioner indoor unit according to the present invention will be described with reference to Fig. 5.

An air-conditioner indoor unit 50 according to this embodiment differs from that of the above-described third embodiment in that it has a reflecting member 51 instead of the reflecting member 41. Since the other components are the same as those of the third embodiment described above, descriptions of those components will be omitted here.

[0044] As shown in Fig. 5, numerals 0, 1, 2, and 3 (quantifying means) are drawn on the outer peripheral surface (outer surface: side surface) 51a of the reflecting member 51 from the inner part toward the front side (from the top toward the bottom), and the numerals drawn on the outer peripheral surface 51a of the reflecting member 51 become hardly visible or become impossible to be visually recognized in the order 0, 1, 2, and 3 in accordance with the degree of the grime 21.

[0045] With the air-conditioner indoor unit 50 according to this embodiment, the grime (build-up) condition inside the case main body 11 can be grasped quantitatively or unambiguously merely by looking into the case main body 11 (more specifically, the inside of the drain pan 13) through the transparent member 19, which can reduce differences in judgment that can be caused among inspectors (workers) who look into the case main body 11 through the transparent member 19.

Since the other operational advantages are the same as those of the third embodiment described above, descriptions thereof will be omitted here.

[0046] A fifth embodiment of the air-conditioner indoor unit according to the present invention will be described with reference to Fig. 6.

An air-conditioner indoor unit 60 according to this embodiment differs from that of the above-described first and second embodiments in that it has a reflecting member 61 instead of the reflecting plate 20 or 31. Since the other components are the same as those of the first and second embodiments described above, descriptions of those components will be omitted here.

[0047] As shown in Fig. 6, the reflecting member 61 is a solid (or hollow) circular truncated conical (or truncated pyramidal) member made of, for example, white plastic (for example, polystyrene (PS)) and is disposed such that a small-diameter end face is located at the bottom and a large-diameter end face is located at the top (such that the outer peripheral surface (outer surface: side surface) 61a expands from the bottom toward the top).

[0048] With the air-conditioner indoor unit 60 according to this embodiment, light that has entered (has been introduced into) the inside of the case main body 11 (more specifically, the inside of the drain pan 13) through the transparent member 19 reaches the outer peripheral surface (outer surface: side surface) 61a of the reflecting

member 61, is reflected by the reflecting member 61 toward the transparent member 19, and thereafter exits (emerges) outside the case main body 11 (more specifically, outside the drain pan 13) through the transparent member 19. At that time, if the inner surface (upper surface) 19a of the transparent member 19 is clean without any grime (for example, an agar-like substance (slime) metabolized by pseudomonas) 21, as shown in the left half of Fig. 6, the outer peripheral surface 61a of the reflecting member 61 can be visually recognized easily and clearly, and if the inner surface (upper surface) 19a of the transparent member 19 becomes dirty with the grime 21 built up thereon, as shown in the right half of Fig. 6, the outer peripheral surface 61a of the reflecting member 61 becomes hardly visible or becomes impossible to be visually recognized in accordance with the degree (level) of the grime 21.

[0049] In other words, the grime (build-up) condition inside the case main body 11 can be grasped easily and quickly merely by looking into the case main body 11 (more specifically, the inside of the drain pan 13) through the transparent member 19, thus allowing accurate determination of whether it is time to clean the drain pan 13. Since the contamination condition inside the case main body 11 can be grasped merely by looking into the case main body 11 through the transparent member 19, the floor surface, a desktop, etc. located below (vertically below) the air-conditioner indoor unit 60 can be prevented from being soiled by the drainage during inspection work. Furthermore, as shown in Fig. 6, since the reflecting member 61 has a depth along the vertical direction (extends in the vertical direction) and expands in diameter toward the inner part, the inspector (worker) can perform inspection at a location directly below (vertically below) the transparent member 19 and at a location a little away (slightly away) from the location directly below.

[0050] A sixth embodiment of the air-conditioner indoor unit according to the present invention will be described with reference to Fig. 7.

An air-conditioner indoor unit 70 according to this embodiment differs from that of the above-described fifth embodiment in that it has a reflecting member 71 instead of the reflecting member 61. Since the other components are the same as those of the fifth embodiment described above, descriptions of those components will be omitted here.

[0051] As shown in Fig. 7, numerals 0, 1, 2, and 3 (quantifying means) are drawn on the outer peripheral surface (outer surface: side surface) 71a of the reflecting member 71 from the inner part toward the front side (from the top toward the bottom), and the numerals drawn on the outer peripheral surface 71a of the reflecting member 71 become hardly visible or become impossible to be visually recognized in the order 0, 1, 2, and 3 in accordance with the degree of the grime 21.

[0052] With the air-conditioner indoor unit 70 according to this embodiment, the grime (build-up) condition inside the case main body 11 can be grasped quantitatively or unambiguously merely by looking into the case main body 11 (more specifically, the inside of the drain pan 13) through the transparent member 19, which can reduce differences in judgment that can be caused among inspectors (workers) who look into the case main body 11 through the transparent member 19.

Since the other operational advantages are the same as those of the fifth embodiment described above, descriptions thereof will be omitted here.

[0053] A seventh embodiment of the air-conditioner indoor unit according to the present invention will be described with reference to Fig. 8.

An air-conditioner indoor unit 80 according to this embodiment differs from that of the above-described embodiments in that it has at least one light source 81 that brightly illuminates (radiates light of constant intensity onto) the surfaces (lower surfaces) 20a and 31a of the above-described reflecting plates 20 and 31 or the outer peripheral surfaces (outer surfaces: side surfaces) 41a, 51a, 61a, and 71a of the reflecting members 41, 51, 61, and 71. Since the other components are the same as those of the embodiments described above, descriptions of those components will be omitted here.

Fig. 8 shows a concrete example equipped with two light sources 81 that brightly illuminate the surface 20a of the reflecting plate 20 described in the first embodiment.

[0054] Examples of the light source 81 include a light-emitting diode (LED) and a miniature bulb.

[0055] With the air-conditioner indoor unit 80 according to this embodiment, since the surfaces (lower surfaces) 20a and 31a of the reflecting plates 20 and 31 or the outer peripheral surfaces (outer surfaces: side surfaces) 41a, 51a, 61a, and 71a of the reflecting members 41, 51, 61, and 71 are brightly illuminated by the light source 81, the grime (build-up) condition inside the case main body 11 can be grasped easily and quickly merely by looking into the case main body 11 (more specifically, the inside of the drain pan 13) through the transparent member 19 irrespective of light that enters (is introduced into) the inside of the case main body 11 (more specifically, the inside of the drain pan 13) through the transparent member 19 (irrespective of the brightness (illuminance) in the room), that is, even if it is dark in the room, thus allowing accurate determination of whether it is time to clean the drain pan 13.

Since the other operational advantages are the same as those of the embodiments described above, descriptions thereof will be omitted here.

[0056] An eighth embodiment of the air-conditioner indoor unit according to the present invention will be described with reference to Fig. 9.

The drain pan 13 of the air-conditioner indoor unit 90 according to this embodiment is provided with the through-hole 13b passing through the drain pan 13 or the drain pool 13a in a plate thickness direction and having a circular shape in plan view, and a dam 91 extending upward and whose upper end is located higher than the maximum water level L of the drainage is provided around

a rim inside (at the upper side of) the through-hole 13b. In addition, a plug member (for example, a rubber plug) 92 whose outer circumferential surface 92a is in contact (or tight contact) with the inner circumferential surface of the through-hole 13b and/or the inner circumferential surface of the dam 91 is detachably mounted inside the through-hole 13b and the dam 91.

[0057] A hinge 93 having a rotation axis that is substantially parallel to the horizontal direction is mounted on the top face of the plug member 92 with a support member 94 therebetween. The base end of a rod-like member 95 that is circular in cross section is mounted to the hinge 93.

The plug member 92 has a through-hole (not shown) at the center. The through-hole accommodates a wire member 96 one end of which is connected to the hinge 93 and which rotates the distal end of the rod-like member 95 upward by drawing the other end downward and which rotates the distal end of the rod-like member 95 downward by pushing the other end upward.

The rod-like member 95 is set at a length so that the distal end of the rod-like member 95 is located a little higher than the upper surface (bottom surface) of the drain pool 13a or comes into contact with the upper surface (bottom surface) of the drain pool 13a in the state shown in Fig. 9, that is, in a state in which the wire member 96 is pushed up to the highest position.

[0058] With the air-conditioner indoor unit 90 according to this embodiment, the grime (build-up) condition inside the case main body 11 can be grasped easily and quickly merely by removing the plug member 92 from the drain pan 13 in a state in which the distal end of the rod-like member 95 is directed upward by drawing the other end of the wire member 96 downward during inspection and looking at the grime 21 adhering to the distal end of the rod-like member 95, thus allowing accurate determination of whether it is time to clean the drain pan 13.

Moreover, since the drainage accumulated in the drain pan 13 or the drain pool 13a can be blocked by the dam 91, the floor surface, a desktop, etc. located below (vertically below) the air-conditioner indoor unit 90 can be prevented from being soiled by the drainage during inspection work.

[0059] The present invention is not limited to the embodiments described above, and various modifications, changes, and combinations can be made without departing from the technical spirit of the present invention.

For example, the drain pump 16 may be disposed directly above (vertically above) the through-hole 13b and the transparent member 19, and a white-colored intake portion 16a of the drain pump 16 (see Fig. 1) may be used instead of the reflecting plate 20 or 31 or the reflecting member 41, 51, 61, or 71 described above.

[0060] The quantifying means described in the second, fourth, and sixth embodiments is not limited to numerals but may be anything that has the same function, such as symbols, patterns, gradation, or colors.

Claims

1. An air-conditioner indoor unit comprising, in a case main body embedded in a ceiling, an indoor heat exchanger, a drain pan, an air-blower driving motor, an air blower, and an air deflector, wherein
the drain pan has a through-hole passing therethrough in a plate thickness direction, and a transparent member is fitted in the through-hole.

2. The air-conditioner indoor unit according to Claim 1, wherein a plate-like reflecting plate is provided directly above the through-hole and the transparent member and higher than the maximum water level of drainage in such a manner that the upper surface and the lower surface thereof are substantially parallel to a horizontal surface.

3. The air-conditioner indoor unit according to Claim 1, wherein a columnar or prismatic reflecting member is provided directly above the through-hole and the transparent member and higher than the maximum water level of drainage in such a manner that both end faces are substantially parallel to a horizontal surface.

4. The air-conditioner indoor unit according to Claim 1, wherein a circular truncated conical or truncated pyramidal reflecting member is provided directly above the through-hole and the transparent member and higher than the maximum water level of drainage in such a manner that a small-diameter-side end face is located at the bottom and a large-diameter-side end face is located at the top, and that the end faces are substantially parallel to a horizontal surface.

5. The air-conditioner indoor unit according to one of Claims 2 to 4, wherein quantifying means is provided on the lower surface of the reflecting plate or on a side surface of the reflecting member, for quantifying the grime condition.

6. An air-conditioner indoor unit comprising, in a case main body embedded in a ceiling, an indoor heat exchanger, a drain pan, a drain pump, an air-blower driving motor, an air blower, and an air deflector, wherein
the drain pan has a through-hole passing therethrough in a plate thickness direction; a transparent member is fitted in the through-hole; the drain pump is disposed directly above the through-hole and the transparent member; and the side surface of an intake portion of the drain pump serves as a reflector.

7. The air-conditioner indoor unit according to one of Claims 1 to 6, wherein at least one light source that illuminates the lower surface of the reflecting plate or the side surface of the reflecting member is pro-

vided.

8. An air-conditioner indoor unit comprising, in a case main body embedded in a ceiling, an indoor heat exchanger, a drain pan, an air-blower driving motor, an air blower, and an air deflector, wherein
the drain pan has a through-hole passing therethrough in a plate thickness direction; a dam extending upward and whose upper end is located higher than the maximum water level of drainage is provided around the inner rim of the through-hole; and a plug member whose outer circumferential surface is in contact with the inner circumferential surface of the through-hole and/or the inner circumferential surface of the dam is detachably mounted inside the through-hole and the dam.

9. The air-conditioner indoor unit according to Claim 8, wherein a hinge having a rotation axis that is substantially parallel to a horizontal direction is mounted on the top face of the plug member with a support member therebetween; the base end of a rod-like member is mounted to the hinge; the plug member has a through-hole at the center; and the through-hole accommodates a wire member one end of which is connected to the hinge and which rotates the distal end of the rod-like member upward by drawing the other end downward and which rotates the distal end of the rod-like member downward by pushing up the other end.

10. A ceiling-mounted air conditioner comprising:

an air-conditioner indoor unit according to one of Claims 1 to 9;
an air-conditioner outdoor unit including a compressor for compressing a refrigerant and an outdoor heat exchanger for exchanging heat between the refrigerant and outdoor air; and
a refrigerant pipe that joins the air-conditioner indoor unit and the air-conditioner outdoor unit together for circulating the refrigerant between the air-conditioner indoor unit and the air-conditioner outdoor unit.

FIG. 1

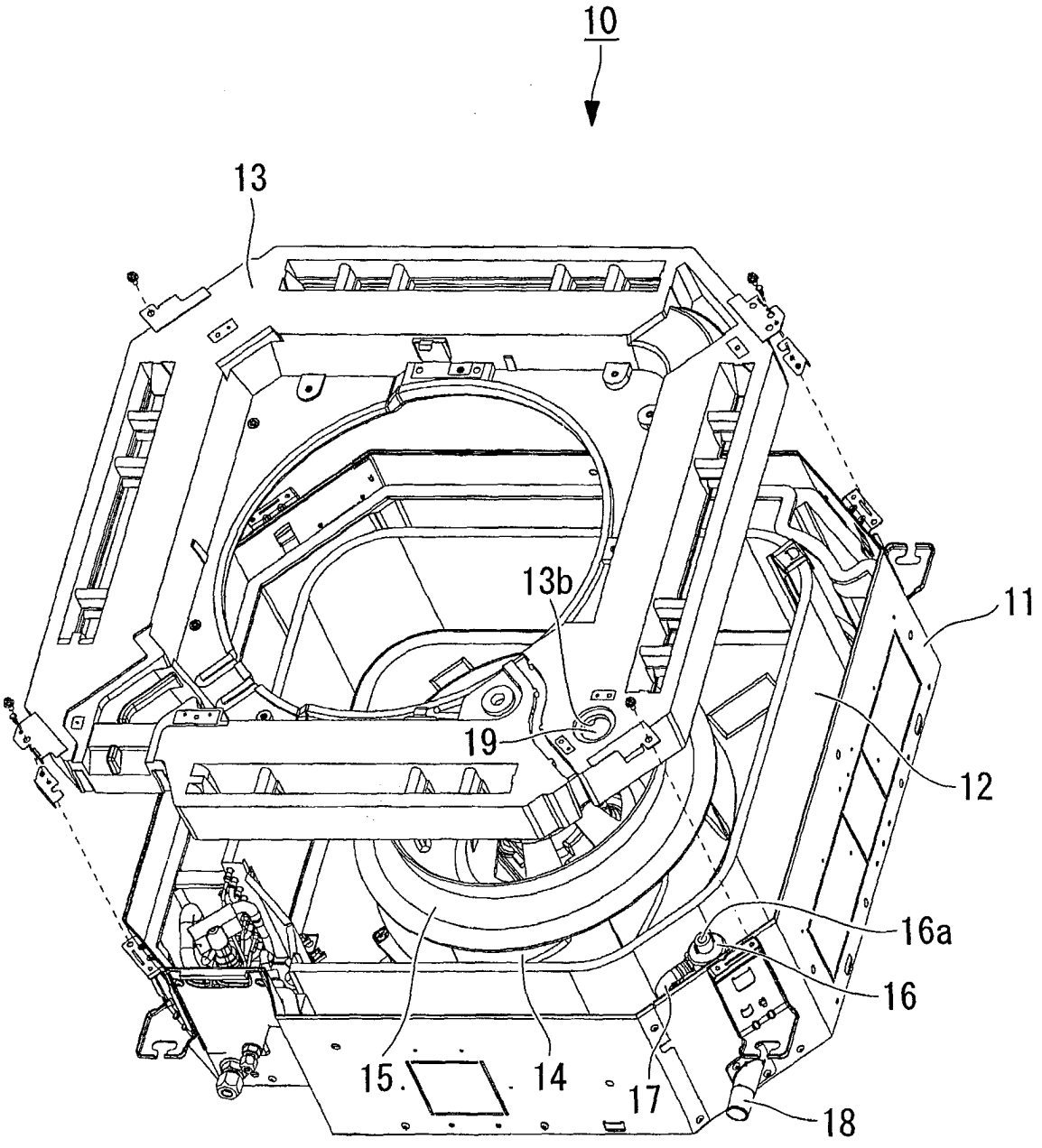


FIG. 2

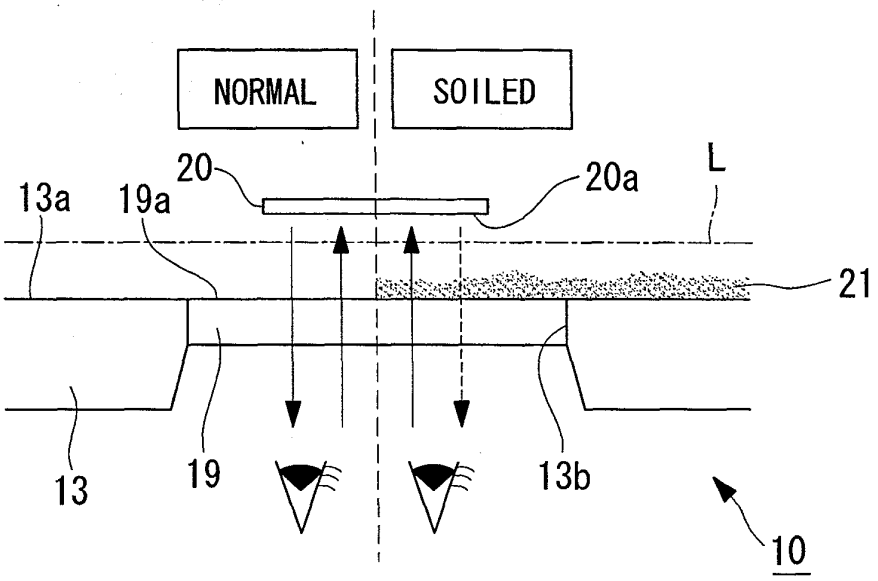


FIG. 3

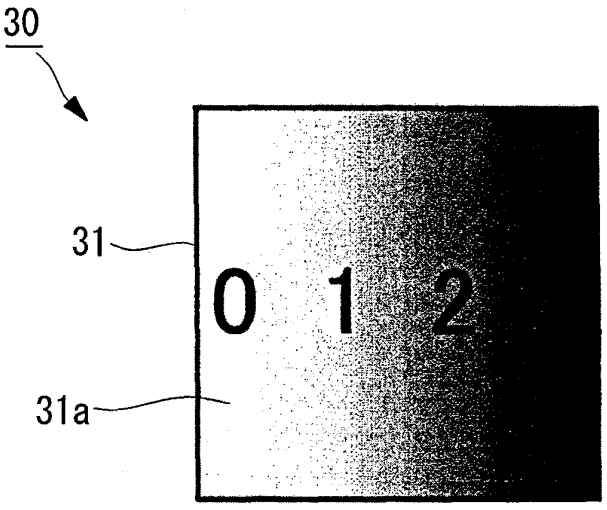


FIG. 4

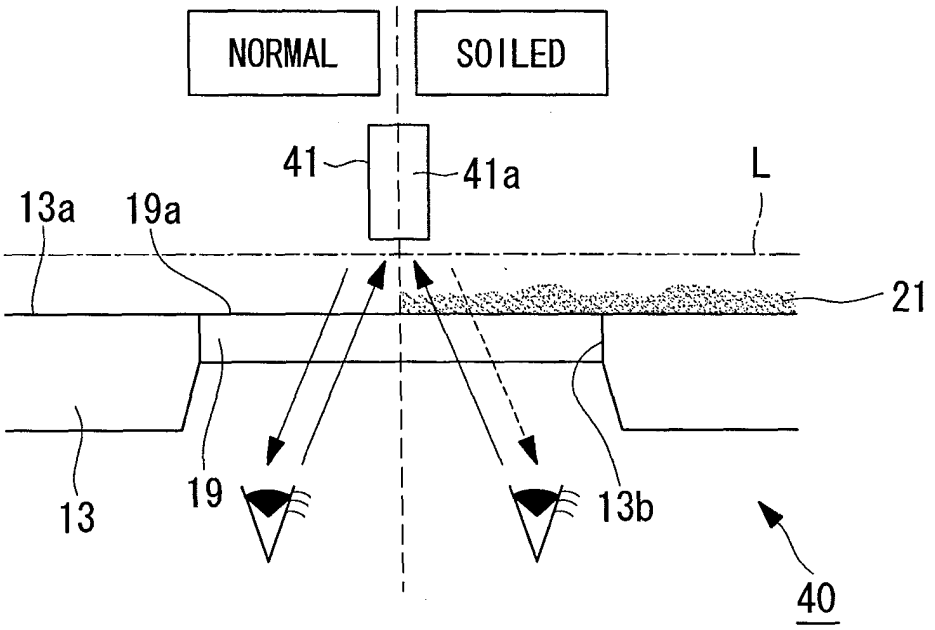


FIG. 5

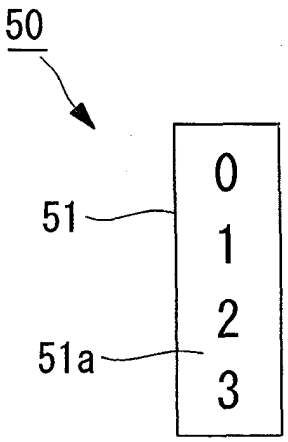
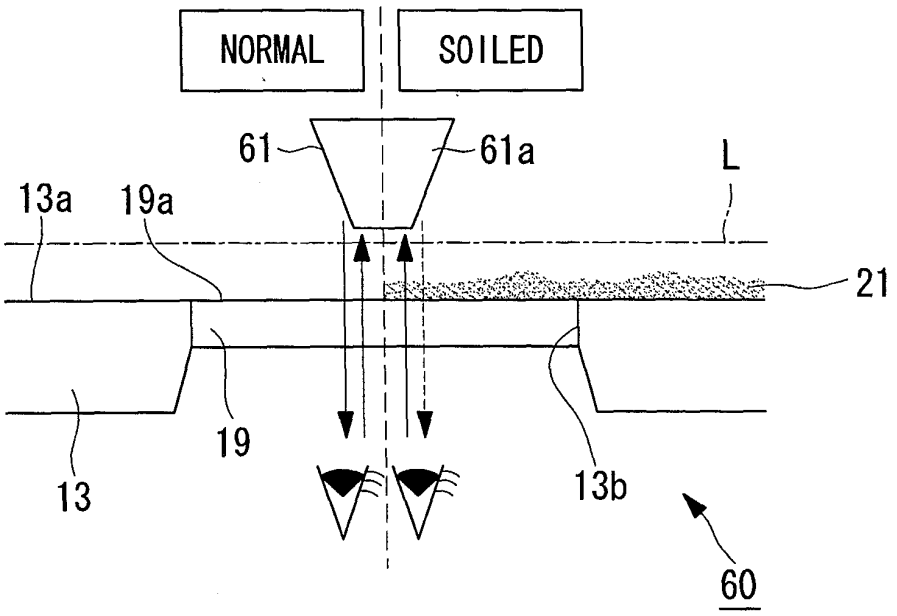


FIG. 6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SOILED
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61a
L
13a
19a
21
19
13
13b
60

FIG. 7

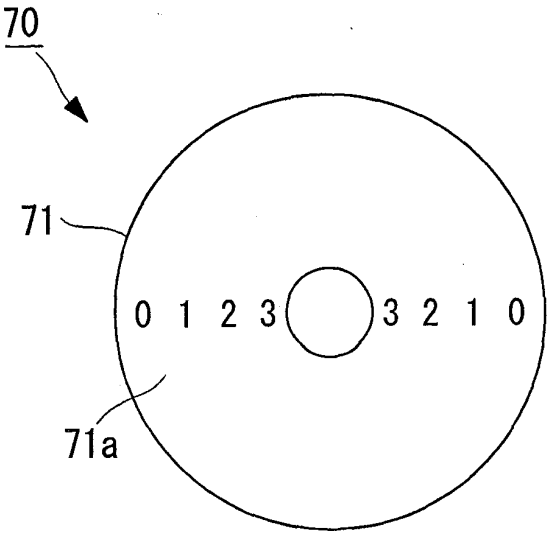
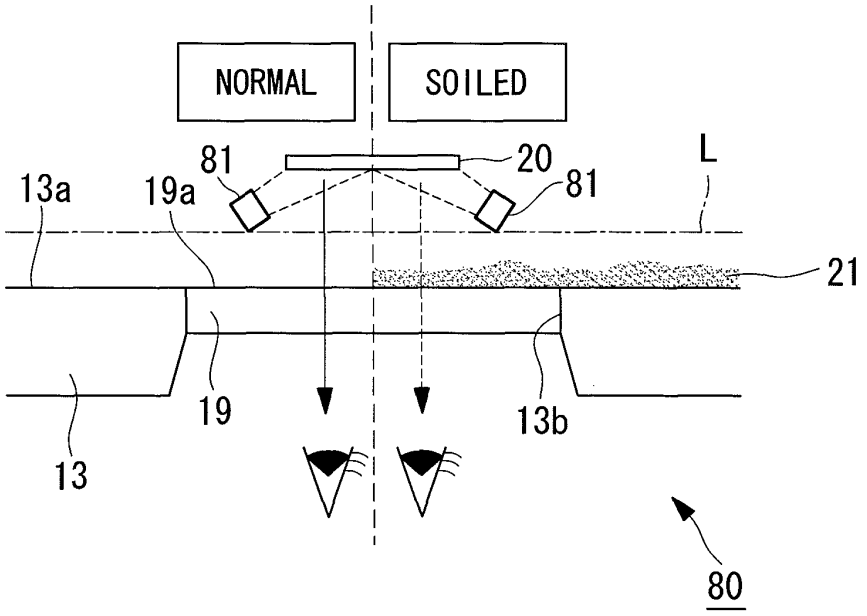

70
71
0 1 2 3
3 2 1 0
71a

FIG. 8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SOILED
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20
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13a
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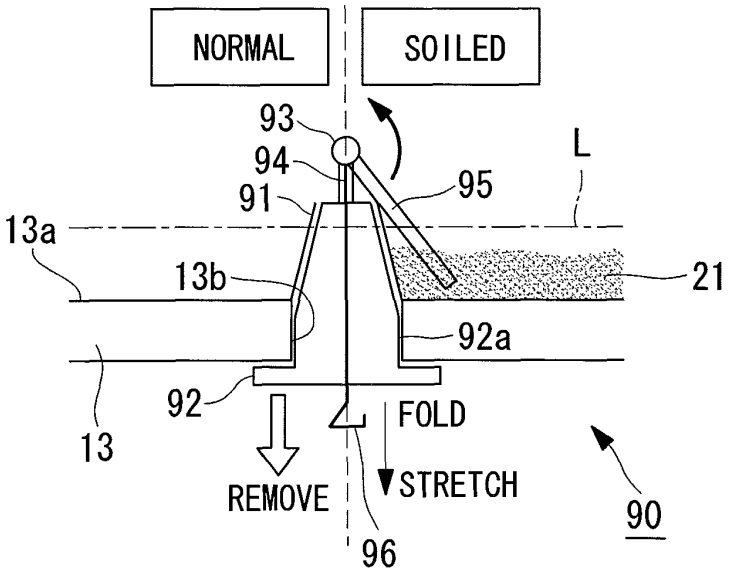
21
19
13b
13
80

FIG. 9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94
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95
L
13a
13b
21
92a
92
13
FOLD
STRETCH
REMOVE
96
90

INTERNATIONAL SEARCH REPORT

International application No.
PCT/JP2008/067956

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, G01N21/00-21/958

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 1996-2008
Kokai Jitsuyo Shinan Koho 1971-2008 Toroku Jitsuyo Shinan Koho 1994-2008

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.
X Y	JP 2007-24454 A (Mitsubishi Electric Corp.), 01 February, 2007 (01.02.07), Par. Nos. [0019] to [0034]; Figs. 1 to 4 (Family: none)	1,10 2,7
X Y	JP 2000-274877 A (Sanyo Electric Co., Ltd.), 06 October, 2000 (06.10.00), Par. Nos. [0025], [0026]; Fig. 3 (Family: none)	1,10 2,7

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

* Special categories of cited documents:
"A" document defining the general state of the art which is not considered to be of particular relevance
"E" earlier application or patent but published on or after the international filing date
"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)
"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
"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone
"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
21 October, 2008 (21.10.08)	04 November, 2008 (04.11.08)
Name and mailing address of the ISA/ Japanese Patent Office Facsimile No.	Authorized officer Telephone No.

Form PCT/ISA/210 (second sheet) (April 2007)

INTERNATIONAL SEARCH REPORT

International application No.
PCT/JP2008/067956

C (Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	Microfilm of the specification and drawings annexed to the request of Japanese Utility Model Application No. 72449/1987(Laid-open No. 181944/1988) (Yamamoto Co., Ltd.), 24 November, 1988 (24.11.88), Page 4, line 16 to page 5, line 5; Figs. 1, 2 (Family: none)	2
Y	JP 2007-178097 A (Hitachi, Ltd.), 12 July, 2007 (12.07.07), Par. Nos. [0024], [0037] (Family: none)	7
Y	JP 10-220802 A (Matsushita Refrigeration Co.), 21 August, 1998 (21.08.98), Par. Nos. [0028] to [0031]; Fig. 5 (Family: none)	7
A	JP 9-53837 A (Daikin Industries, Ltd.), 25 February, 1997 (25.02.97), Par. No. [0023]; Fig. 4 (Family: none)	1-10
A	JP 2002-181707 A (Sankyo Co., Ltd.), 26 June, 2002 (26.06.02), Par. Nos. [0016] to [0018] (Family: none)	5
A	JP 2003-149149 A (Idemitsu Kosan Co., Ltd., Nitto Kogyo Co., Ltd.), 21 May, 2003 (21.05.03), Par. No. [0004] (Family: none)	5
A	JP 8-122263 A (Hirata Kyogyo Kumiai), 17 May, 1996 (17.05.96), Par. No. [0007] (Family: none)	5

Form PCT/ISA/210 (continuation of second sheet) (April 2007)

INTERNATIONAL SEARCH REPORT

International application No.
PCT/JP2008/067956

Box No. II Observations where certain claims were found unsearchable (Continuation of item 2 of first sheet)

This international search report has not been established in respect of certain claims under Article 17(2)(a) for the following reasons:

1. ☐ Claims Nos.:
because they relate to subject matter not required to be searched by this Authority, namely:

2. ☐ Claims Nos.:
because they relate to parts of the international application that do not comply with the prescribed requirements to such an extent that no meaningful international search can be carried out, specifically:

3. ☐ Claims Nos.:
because they are dependent claims and are not drafted in accordance with the second and third sentences of Rule 6.4(a).

Box No. III Observations where unity of invention is lacking (Continuation of item 3 of first sheet)

This International Searching Authority found multiple inventions in this international application, as follows:

The inventions of claims 1-10 are not so linked as to form a single general inventive concept.
That is, the search has revealed that the matter stated in claim 1 is disclosed in documents 1 and 2, and therefore, the matter is not novel.
Accordingly, the inventions of claims 1-10 have no common matter containing a special technical feature within the meaning of PCT Rule 13.2, second sentence.

1. ☐ As all required additional search fees were timely paid by the applicant, this international search report covers all searchable claims.
2. ☒ As all searchable claims could be searched without effort justifying additional fees, this Authority did not invite payment of additional fees.
3. ☐ As only some of the required additional search fees were timely paid by the applicant, this international search report covers only those claims for which fees were paid, specifically claims Nos.:

4. ☐ No required additional search fees were timely paid by the applicant. Consequently, this international search report is restricted to the invention first mentioned in the claims; it is covered by claims Nos.:

Remark on Protest
the

☐ The additional search fees were accompanied by the applicant's protest and, where applicable, payment of a protest fee.

☐ The additional search fees were accompanied by the applicant's protest but the applicable protest fee was not paid within the time limit specified in the invitation.

Form PCT/ISA/210 (continuation of first sheet (2)) (April 2007)

REFERENCES CITED IN THE DESCRIPTION

This list of references cited by the applicant is for the reader's convenience only. It does not form part of the European patent document. Even though great care has been taken in compiling the references, errors or omissions cannot be excluded and the EPO disclaims all liability in this regard.

Patent documents cited in the description

- JP 2007271174 A **[0002]**