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Takei

(54) **FRAME FOR FORMING IMAGE FORMING APPARATUS AND MANUFACTURING METHOD OF THE FRAME**

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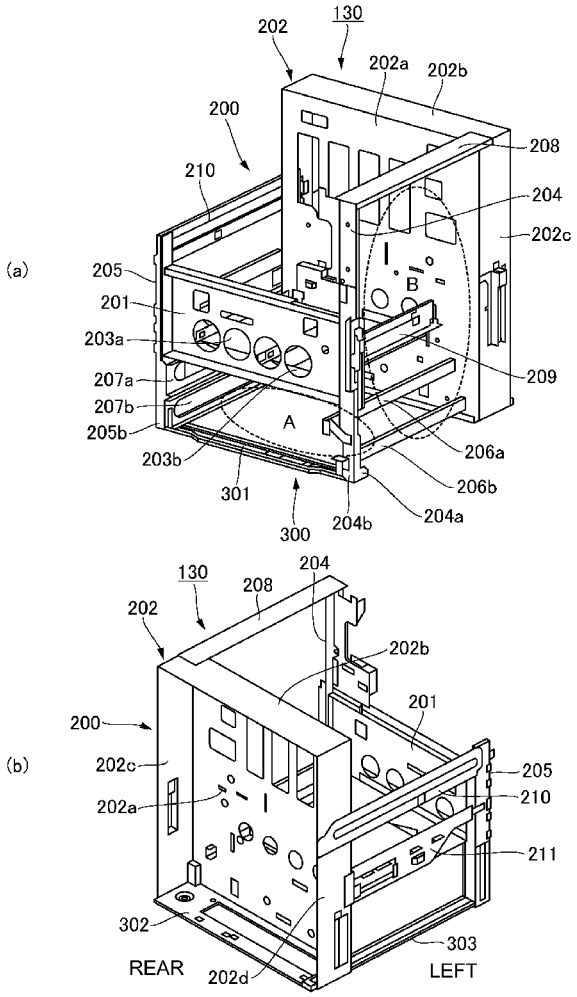
(57) **ABSTRACT**

A frame for forming an image forming apparatus for forming an image on a recording material includes a first stay, including a supporting portion for supporting the frame relative to an installation surface, for forming a bottom of the frame; a second stay, including a supporting portion for supporting the frame relative to the installation surface, for forming the bottom of the frame; a post to which the first stay and the second stay are secured; and a positioning portion, provided as a part of the post, for positioning the first stay and the second stay with respect to a horizontal plane direction. The first stay and the second stay are fixed to the post by welding.



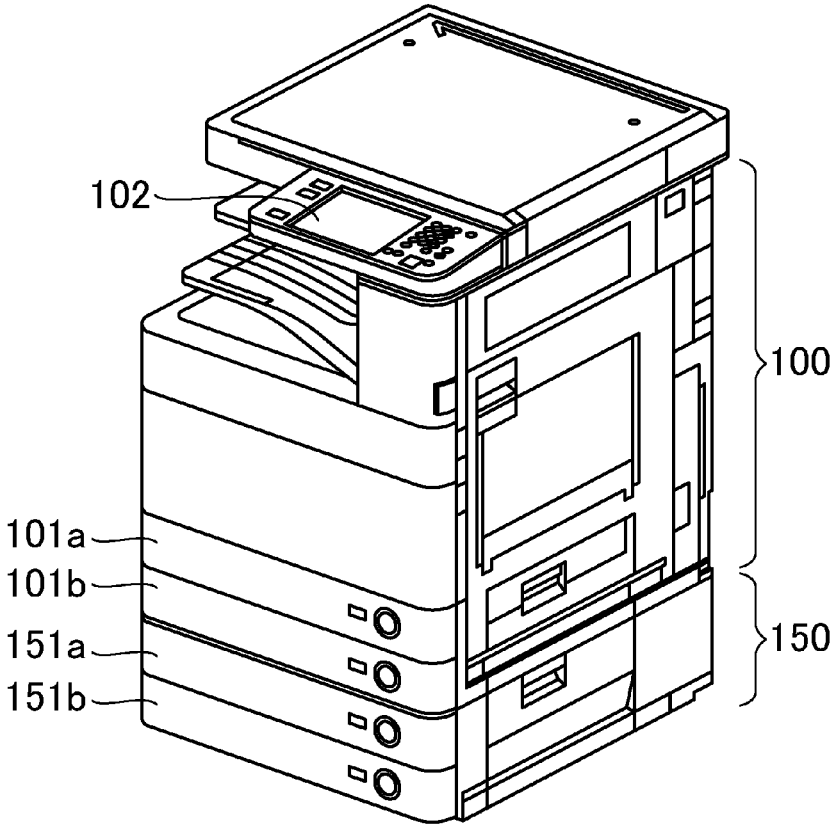


Fig. 1

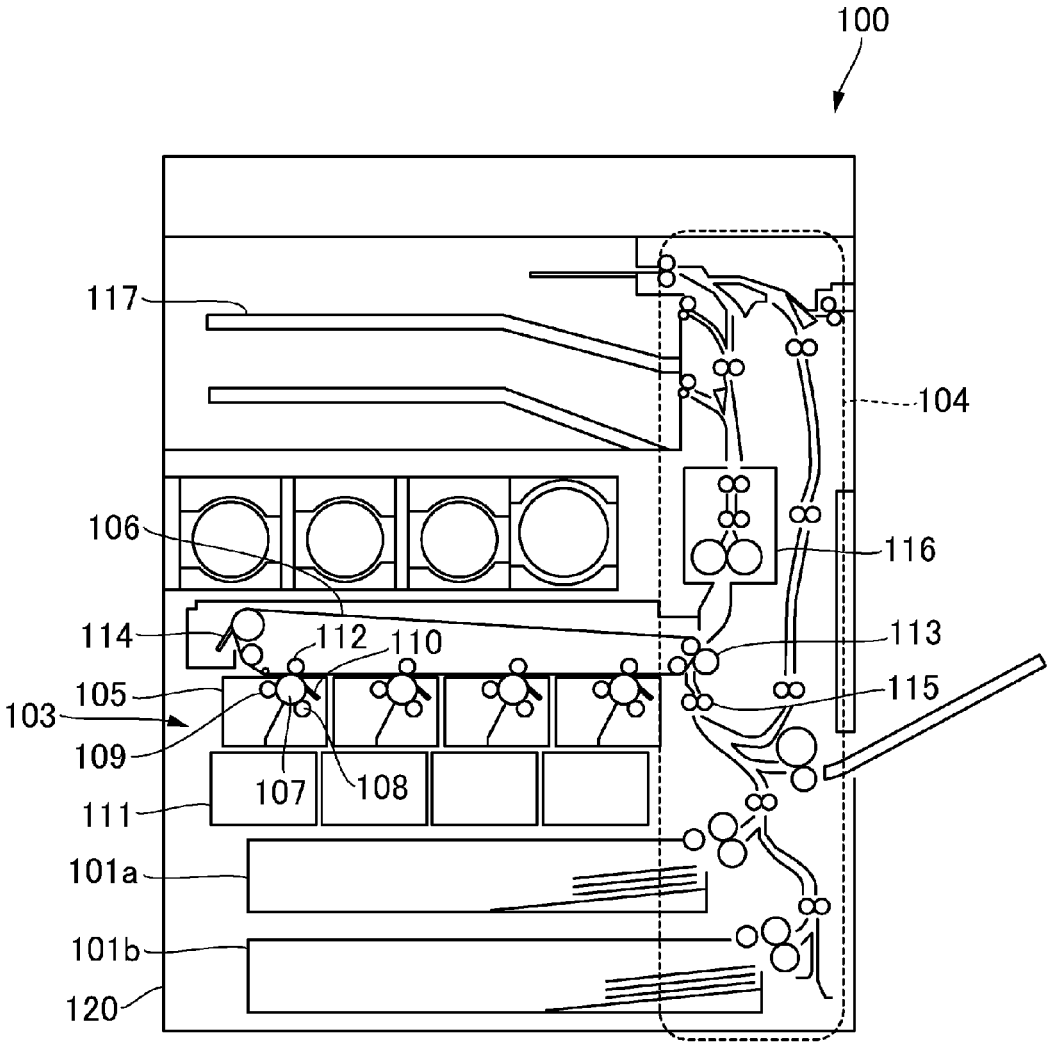

100
117
104
106
116
114
112
110
113
105
115
103
109
107
108
111
101a
101b
120

Fig. 2

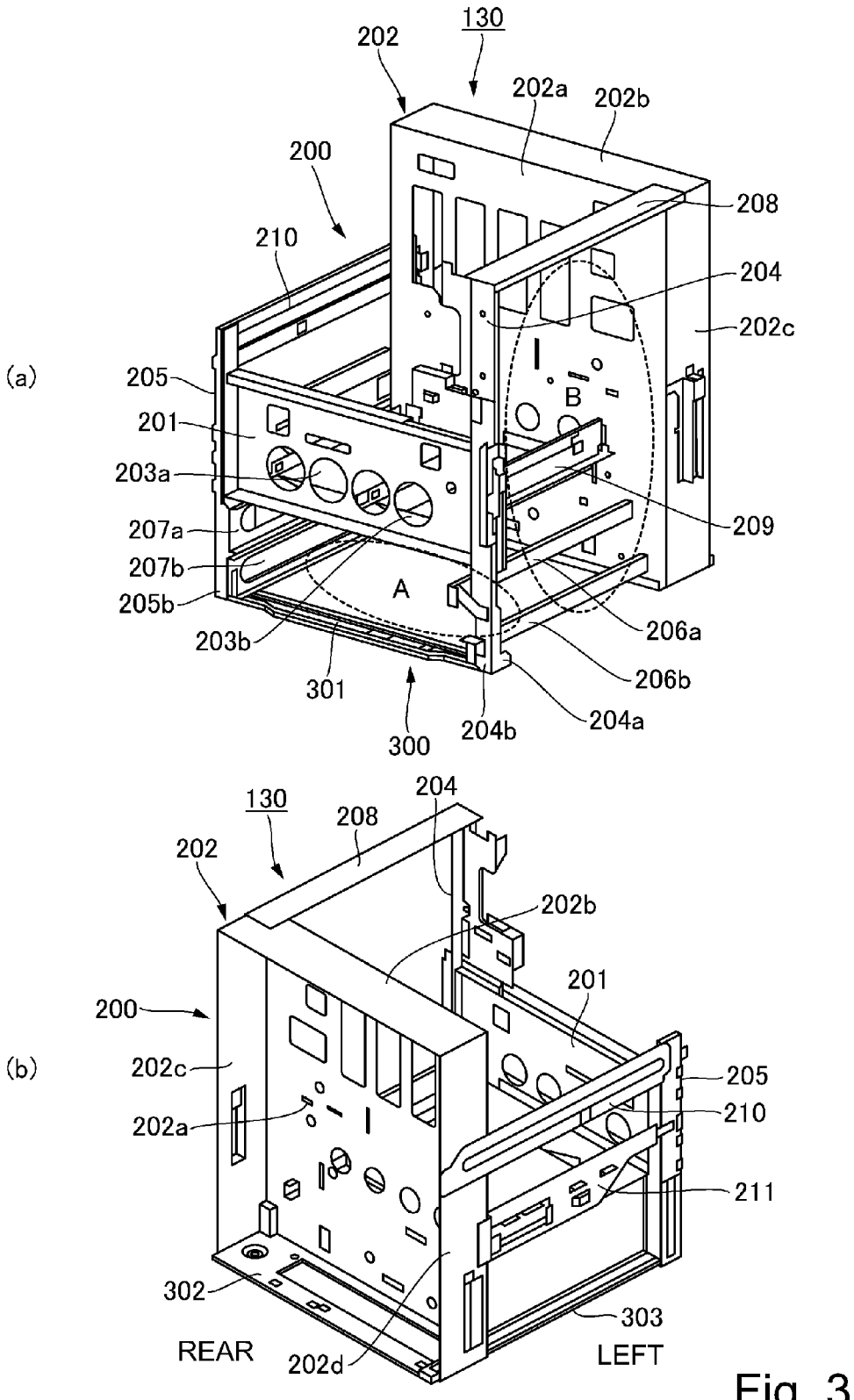

(a)
130
202
202a
202b
200
208
210
204
202c
205
201
B
203a
209
207a
207b
A
205b
206a
203b
206b
301
204a
204b
300
(b)
130
204
208
202
202b
201
200
202c
205
202a
210
211
302
303
REAR
202d
LEFT

Fig. 3

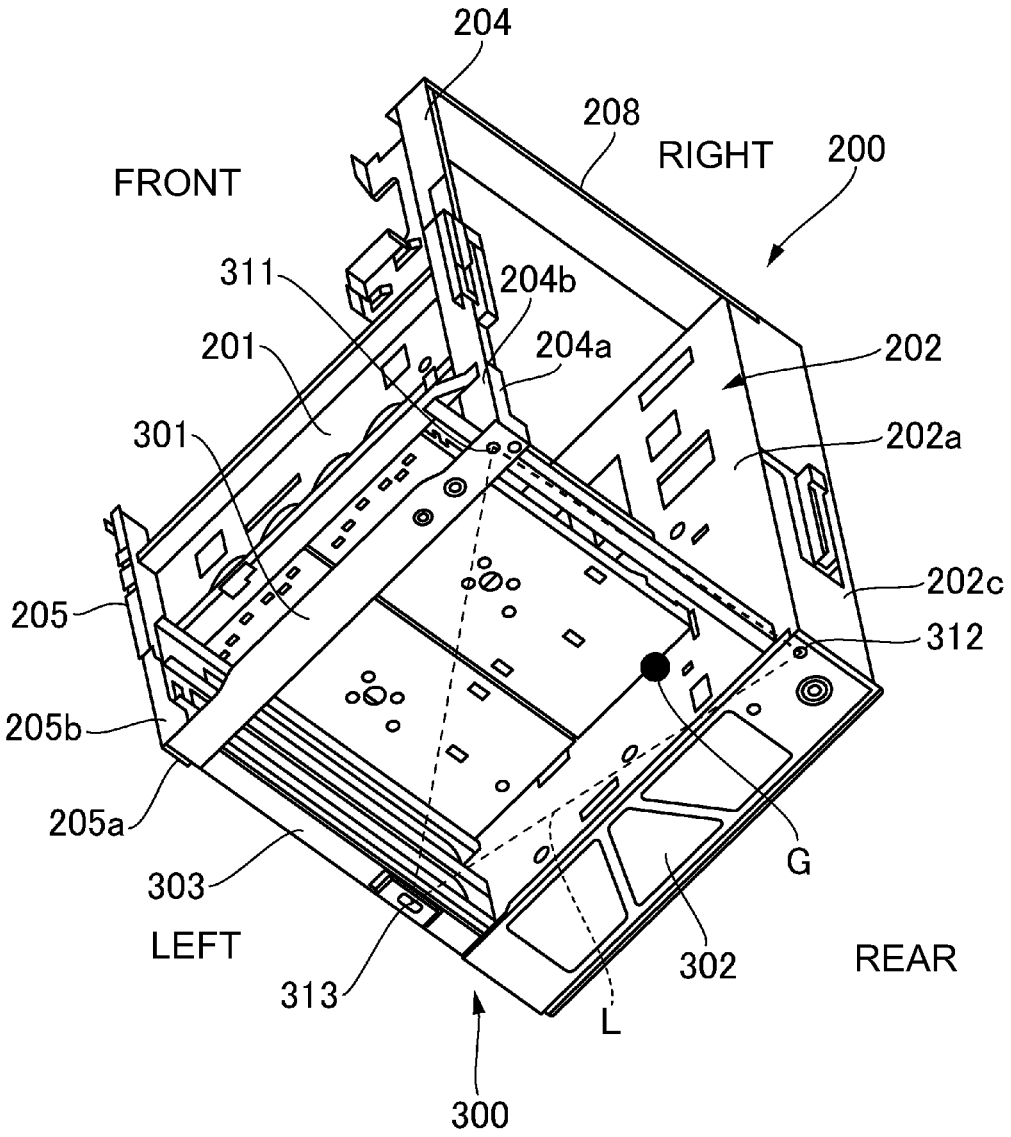
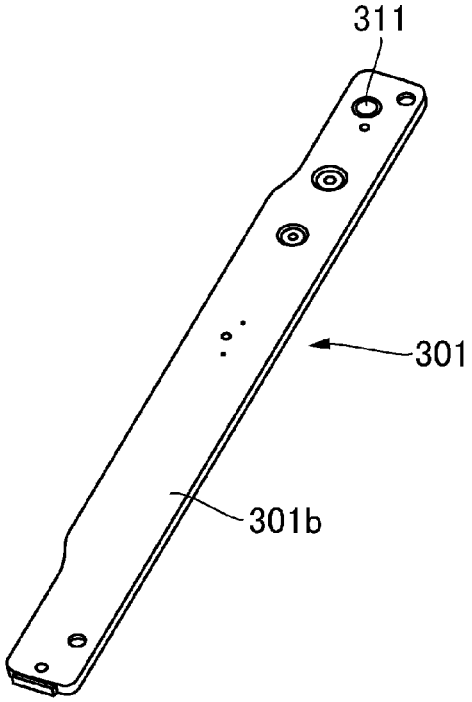

204
208
RIGHT
200
FRONT
311
204b
201
204a
202
301
202a
205
202c
312
205b
205a
G
303
LEFT
313
302
REAR
L
300

Fig. 4

(a)



(b)

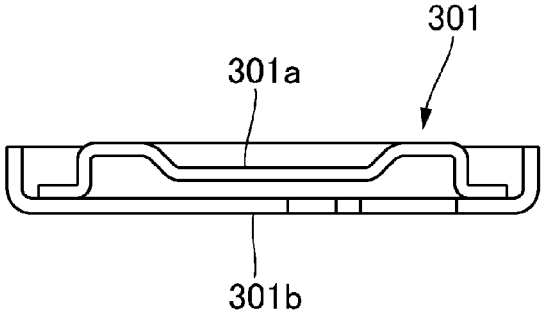


Fig. 5

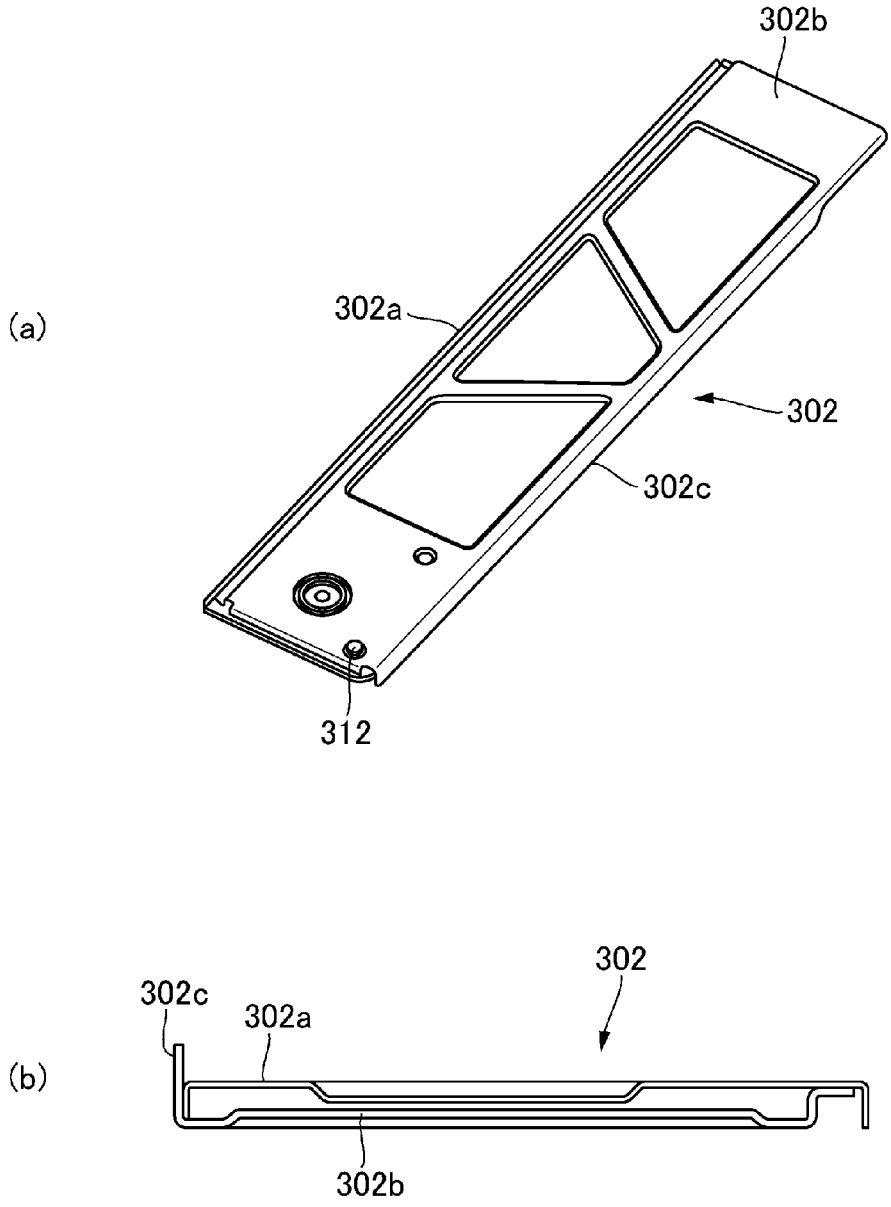


Fig. 6

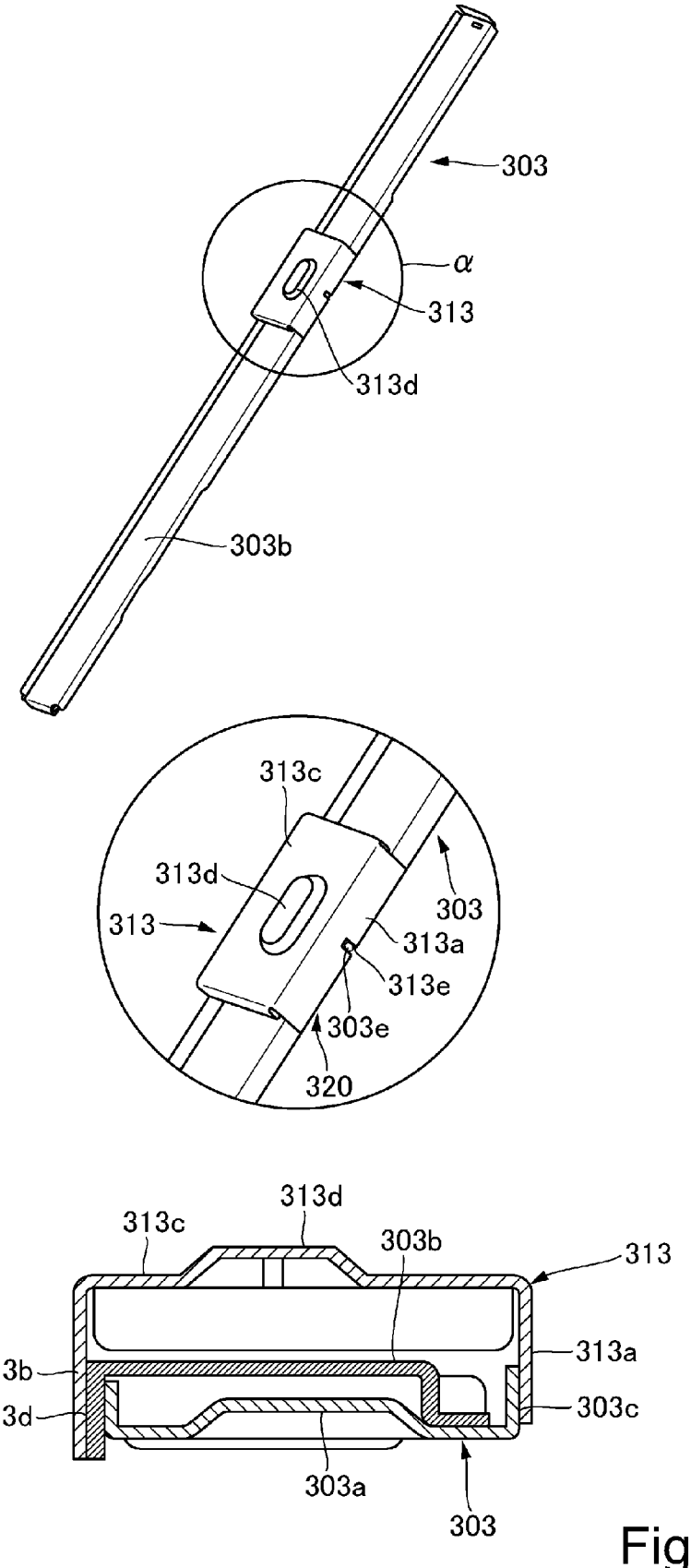

(a)
303
α
313
313d
303b
(b)
313c
313d
313
303
313a
313e
303e
320
(c)
313d
313c
303b
313
313a
313b
303d
303c
303a
303

Fig. 7

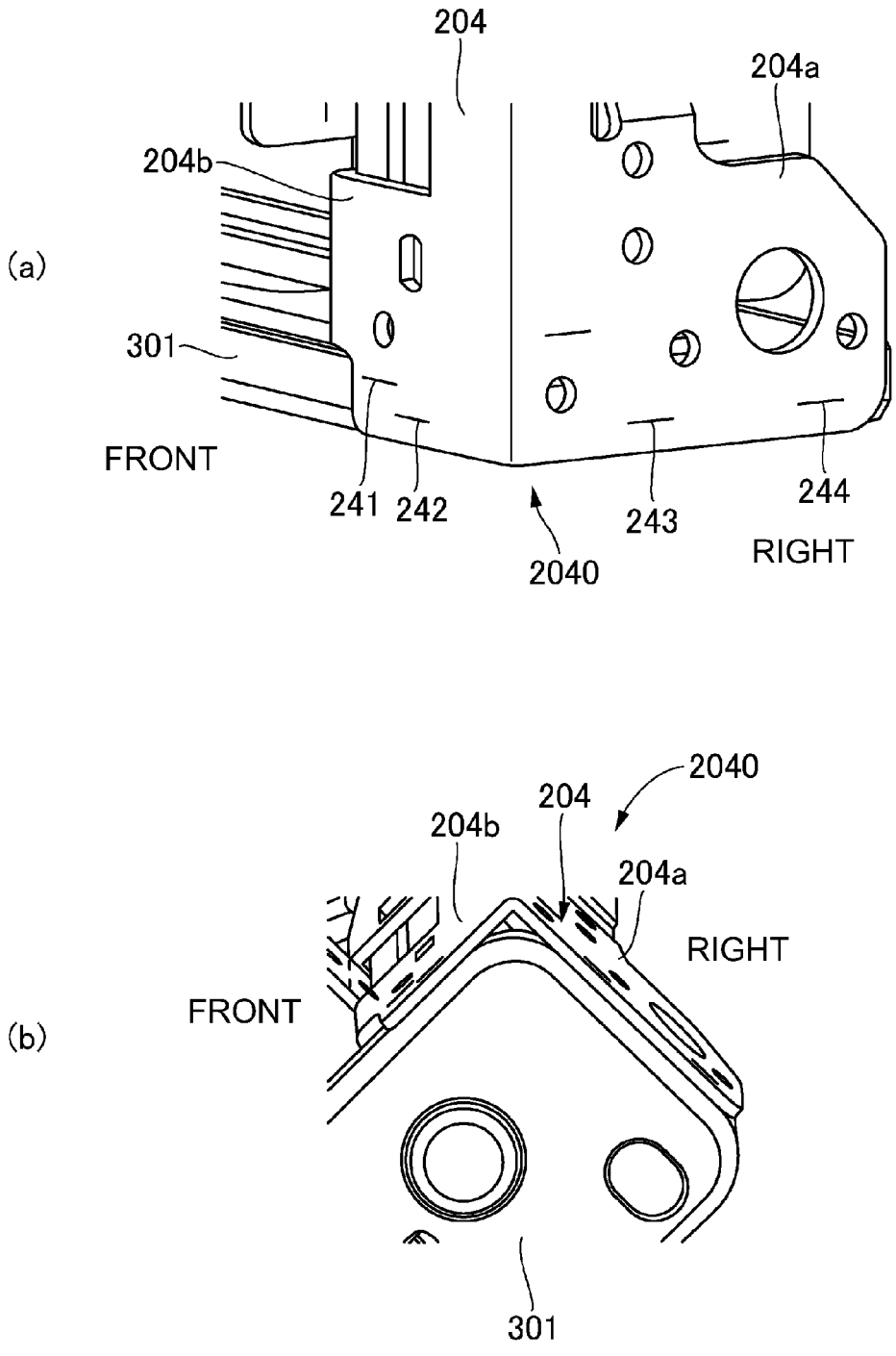

(a)
204
204a
204b
301
FRONT
241
242
243
244
2040
RIGHT
(b)
2040
204
204b
204a
RIGHT
FRONT
301

Fig. 8

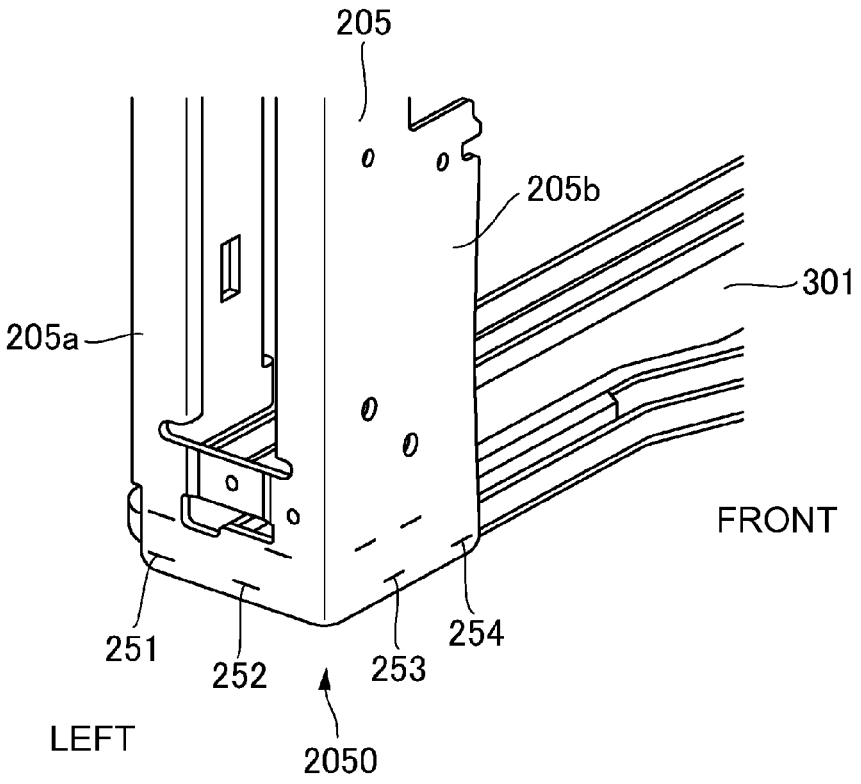


Fig. 9

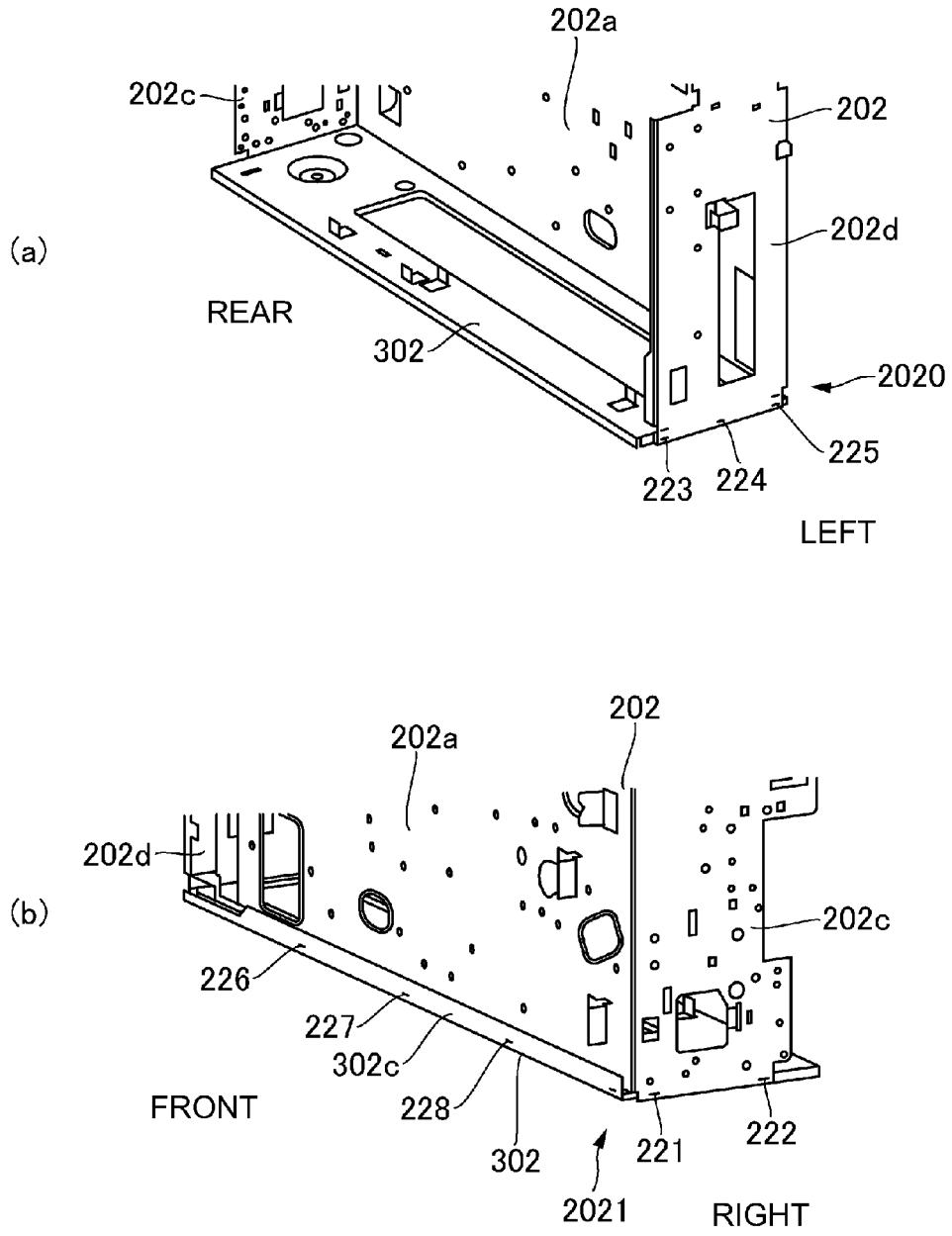
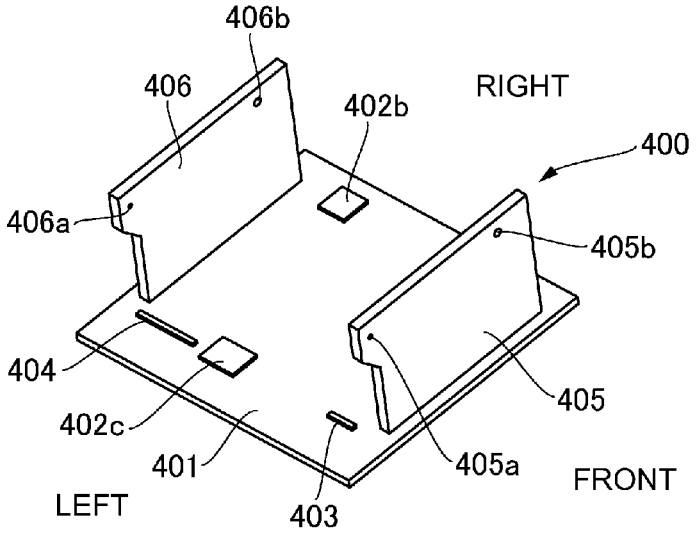

(a)
202a
202c
202
202d
REAR
302
2020
225
223
224
LEFT
(b)
202
202a
202d
202c
226
227
302c
FRONT
228
302
221
222
2021
RIGHT

Fig. 10

(a)


406b
406
RIGHT
402b
400
406a
405b
404
405
402c
401
405a
FRONT
LEFT
403

(b)

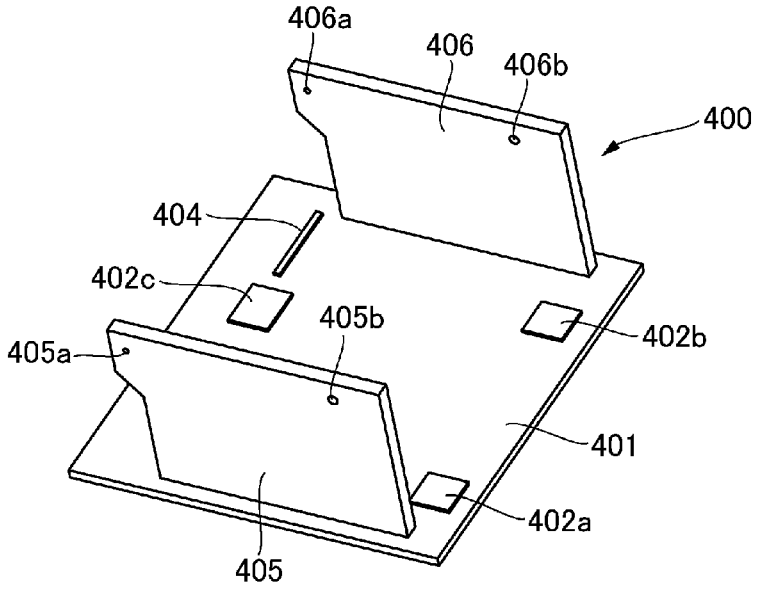

406a
406
406b
400
404
402c
405b
402b
405a
401
402a
405

Fig. 11

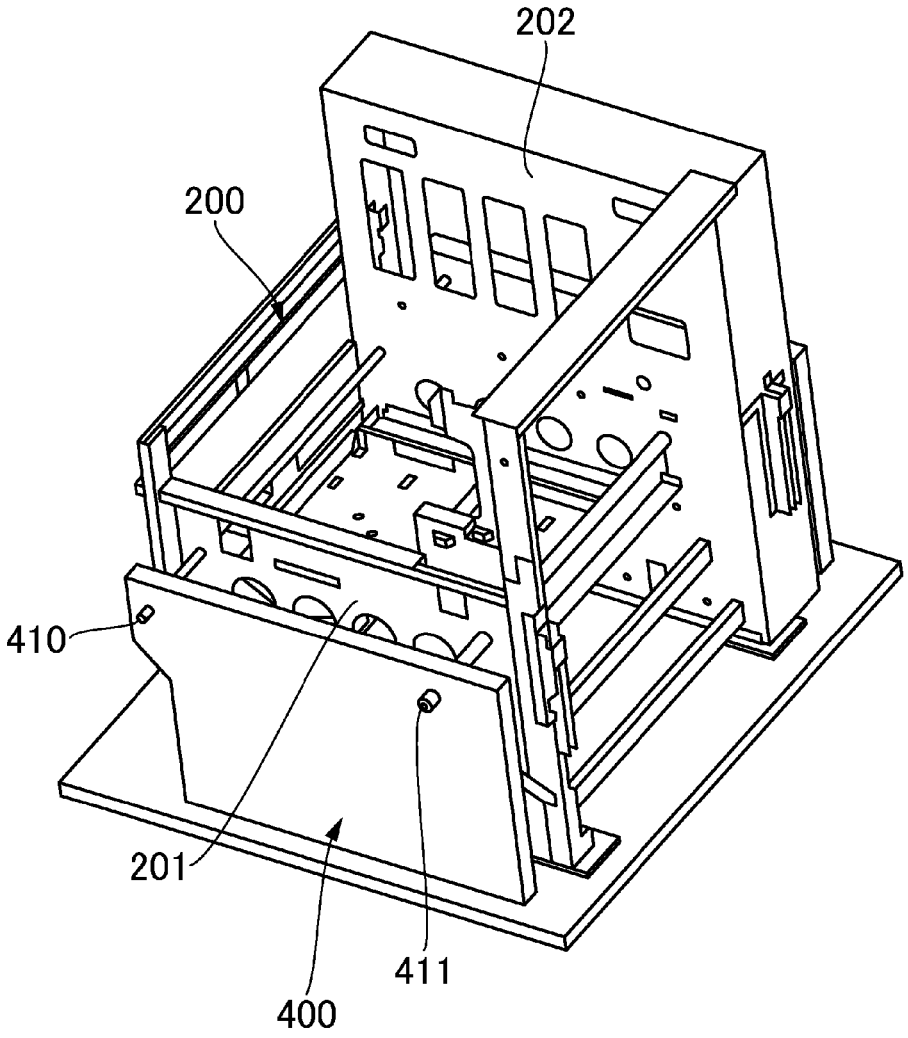


Fig. 12

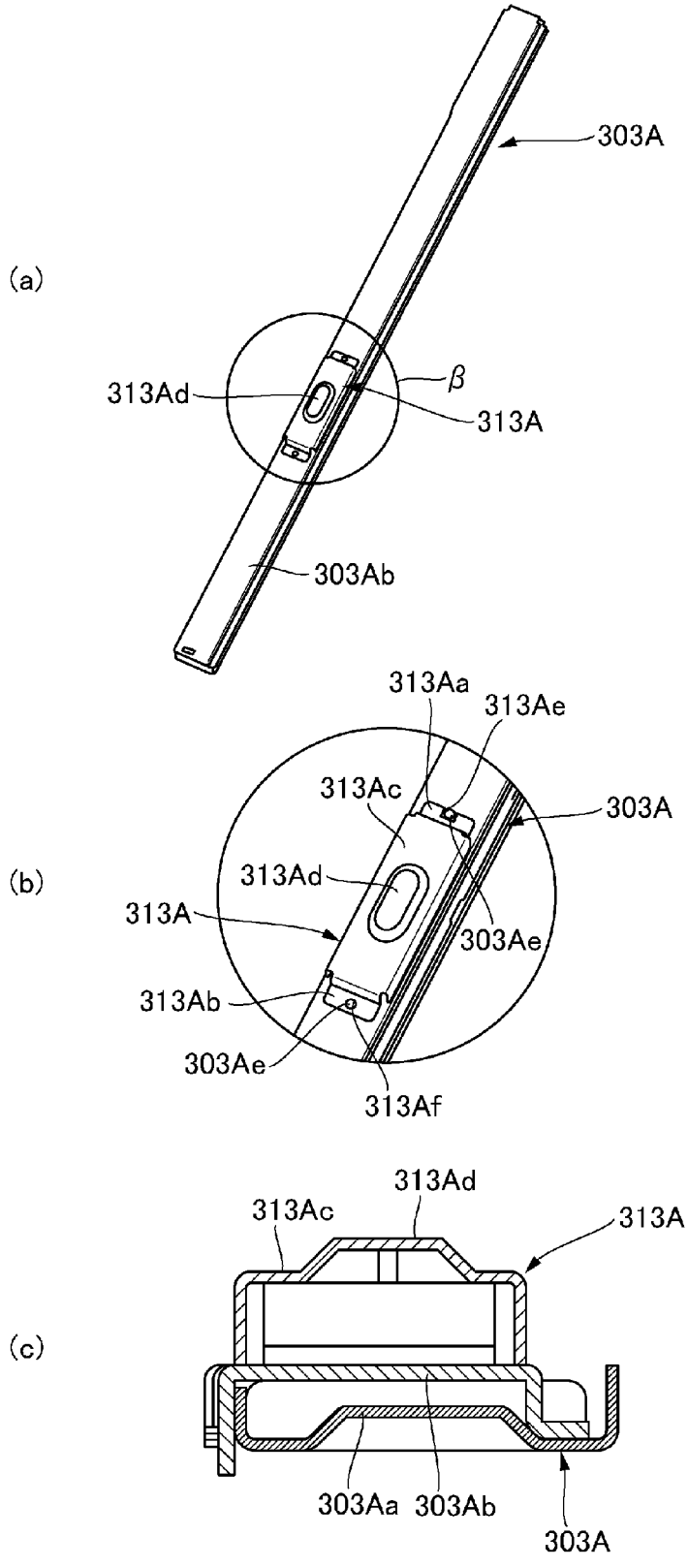

(a)
303A
β
313Ad
313A
303Ab
(b)
313Aa
313Ae
313Ac
303A
313Ad
313A
303Ae
313Ab
303Ae
313Af
(c)
313Ad
313Ac
313A
303Aa
303Ab
303A

Fig. 13

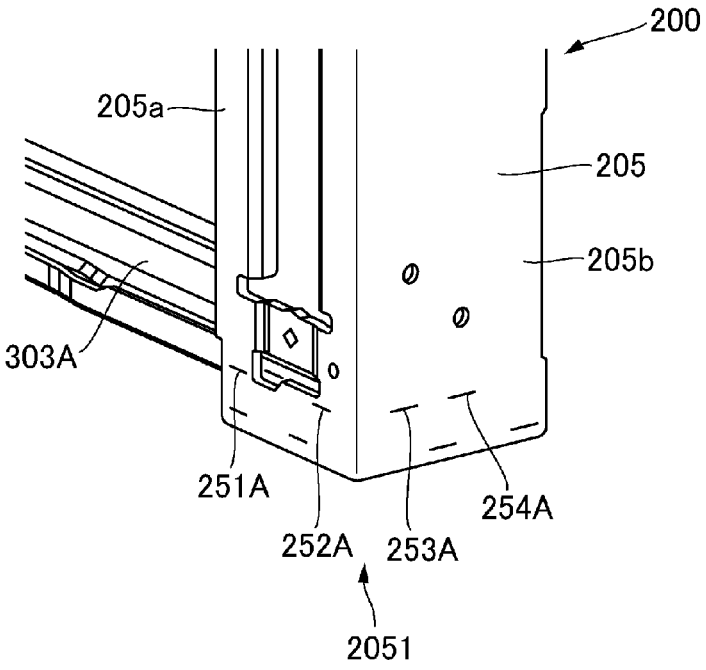

200
205a
205
205b
303A
251A
252A
253A
254A
2051

Fig. 14

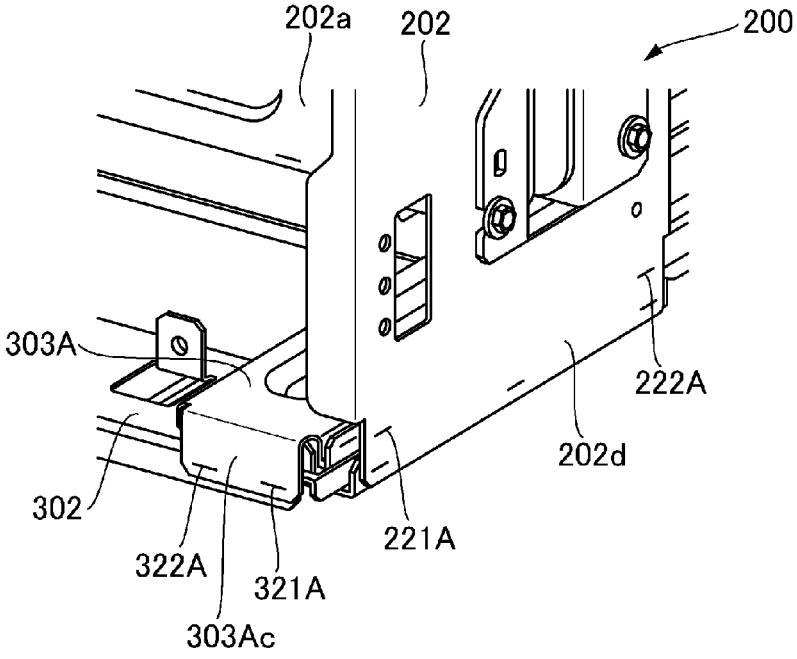

202a
202
200
303A
222A
202d
302
322A
321A
303Ac
221A

Fig. 15

FRAME FOR FORMING IMAGE FORMING APPARATUS AND MANUFACTURING METHOD OF THE FRAME

FIELD OF THE INVENTION AND RELATED ART

[0001] The present invention relates to a frame for forming an image forming apparatus such as a printer, a facsimile machine, a copying machine or a multi-function machine having a plurality of functions of these machines, and relates to a manufacturing method of the frame.

[0002] As a frame (structure) for forming the image forming apparatus, a structure in which a bottom plate is provided at a bottom of a main assembly frame in which an image forming portion is provided has been conventionally known. Further, a so-called three-point supporting structure in which a supporting portion for supporting the image forming apparatus is provided at three positions of the bottom plate has also been known (for example, Japanese Laid-Open Patent Application 2013-156569).

[0003] However, as described above, in the case where the frame for the image forming apparatus is constituted by providing the bottom plate at the bottom of the main assembly frame, a cost increases. For this reason, it would be considered that the bottom of the frame is constituted by using a plurality of stays in combination. However, in the case where the bottom is constituted by the plurality of stays and supporting portions are provided on separate stays, positional accuracy of the supporting portions provided at a plurality of positions lowers due to a mounting tolerance of the stays relative to the main assembly frame or a mounting tolerance of the supporting portions relative to the stays. That is, as in the conventional frame, in the case where the bottom is constituted by a single bottom left, such a tolerance is small, but in the case where the bottom is constituted by the plurality of stays, a variation is liable to generate in positional relationship among the respective stays or in positional relationship among the supporting portions provided on the stays. Further, when a degree of the variation in positional relationship among the supporting portions with respect to an up-down direction is large, even when an installation surface is flat, there is a possibility that an installed image forming apparatus leans.

SUMMARY OF THE INVENTION

[0004] The present invention has been accomplished in view of the above-described circumstances so as to realize a frame for an image forming apparatus and a manufacturing method of the frame which are capable of suppressing a variation in positional relationship among supporting portions with respect to an up-down direction even when a bottom of the image forming apparatus is constituted by a plurality of stays.

[0005] A principal object of the present invention is to enhance mounting accuracy of the plurality of stays forming the bottom.

[0006] According to an aspect of the present invention, there is provided a frame for forming an image forming apparatus for forming an image on a recording material, the frame comprising: a first stay, including a supporting portion for supporting the frame relative to an installation surface, for forming a bottom of the frame; a second stay, including a supporting portion for supporting the frame relative to the installation surface, for forming the bottom of the frame; a post to which the first stay and the second stay are secured; and a positioning portion, provided as a part of the post, for positioning the first stay and the second stay with respect to a horizontal plane direction, wherein the first stay and the second stay are fixed to the post by welding.

[0007] Further features of the present invention will become apparent from the following description of exemplary embodiments with reference to the attached drawings.

BRIEF DESCRIPTION OF THE DRAWING

[0008] FIG. **1** is a perspective view of an image forming apparatus and a sheet feeding unit in First Embodiment.

[0009] FIG. **2** is a schematic view of the image forming apparatus in the First Embodiment.

[0010] In FIG. **3**, (a) is a perspective view of a frame (structure) for the image forming apparatus as seen from above in a front side, and (b) is a perspective view of the frame for the image forming apparatus as seen from above in a rear side, in the First Embodiment.

[0011] FIG. **4** is a perspective view of the frame for the image forming apparatus as seen from below in the First Embodiment.

[0012] In FIG. **5**, (a) is a perspective view of a lower front stay, and (b) is a sectional view of the lower front stay, in the First Embodiment.

[0013] In FIG. **6**, (a) is a perspective view of a rear bottom stay, and (b) is a sectional view of the rear bottom stay, in the First Embodiment.

[0014] In FIG. **7**, (a) is a perspective view of a lower left stay, (b) is an enlarged view of an α portion in (a) of FIG. **7**, and (c) is a sectional view of the lower left stay, in the First Embodiment.

[0015] In FIG. **8**, (a) is a perspective view of a connecting portion between the lower front stay and a rear-side post as seen from above, and (b) is a perspective view of a connecting portion between the lower front stay and the rear-side post as seen from below, in the First Embodiment.

[0016] FIG. **9** is a perspective view of a connecting portion between the lower front stay and a left-side post as seen from above in the First Embodiment.

[0017] In FIG. **10**, (a) is a perspective view of a connecting portion between the rear bottom stay and a left-side plate as seen from a rear side, and (b) is a perspective view of the connecting portion between the rear bottom stay and the left-side plate as seen from a front side, in the First Embodiment.

[0018] In FIG. **11**, (a) is a perspective view of a positioning jig as seen from above, and (b) is a perspective view of the positioning jig as seen from above with an angle different from an angle in (a) of FIG. **11**, in the First Embodiment.

[0019] FIG. **12** is a perspective view of a state in which the frame for the image forming apparatus is disposed on the positioning jig, as seen from above in the First Embodiment.

[0020] In FIG. **13**, (a) is a perspective view of a lower left stay, (b) is an enlarged view of a β portion in (a) of FIG. **13**, and (c) is a perspective view of the lower left stay, in Second Embodiment.

[0021] FIG. **14** is a perspective view of a connecting portion between the lower left stay and a left-side post as seen from above in the Second Embodiment.

[0022] FIG. **15** is a perspective view of a connecting portion among the lower left stay, a rear-side plate and a rear bottom plate as seen from above in the Second Embodiment.

DESCRIPTION OF THE EMBODIMENTS

First Embodiment

[0023] First Embodiment of the present invention will be described using FIGS. **1** to **12**. First, a general structure of an image forming apparatus in this embodiment will be described using FIGS. **1** and **2**.

[Image Forming Apparatus]

[0024] An image forming apparatus **100** in this embodiment is a full-color printer employing an electrophotographic type. Such an image forming apparatus **100** is mountable on an upper surface (mounting surface) of an optional sheet (paper) feeding module **150** as shown in FIG. **1**. The image forming apparatus **100** and the optional sheet feeding module **150** include two-stage sheet feeding cassette **101***a*, **101***b* and two-stage sheet feeding cassettes **151***a*, **151***b*, respectively. The respective sheet feeding cassettes accommodate recording materials (sheet materials such as sheets (papers) and OHP sheets) different in size and basis weight. It is possible to select the recording material to be used, through an operating portion **102** of the image forming apparatus **100** or an external terminal such as a personal computer connected with the image forming apparatus **100**. In the following description, a side where a user operates the image forming apparatus **100** is referred to as a front side, and a back (rear) surface side of the image forming apparatus **100** is referred to as a rear surface. Left and right of the image forming apparatus **100** are those as seen from the front side.

[0025] The image forming apparatus **100** includes an image forming portion **103** for forming a toner image and a recording material feeding portion **104** for feeding a recording material onto which the toner image formed by the image forming portion **103** is transferred. The image forming portion **103** has a constituting of a so-called tandem type in which a plurality of process cartridges **105** as a plurality of image forming stations are arranged in a travelling direction of an intermediary transfer belt **106**. At the image forming stations, toner images of yellow, magenta, cyan and black are formed, respectively.

[0026] In the image forming apparatus **100** in this embodiment as described above, the plurality (**4** in this embodiment) of process cartridges **105** are detachably mounted to an apparatus main assembly **120**. The respective process cartridges **105** have the same constitution, and therefore in the following, a leftmost process cartridge **105** will be described, and other process cartridges will be omitted from illustration of reference numerals or symbols and omitted from description.

[0027] The process cartridge **105** includes a photosensitive drum **107** which is a drum-shaped electrophotographic photosensitive member as an image bearing member, a charging roller **108**, a developing device **109** and a drum cleaner **110**. The photosensitive drum **107** is rotationally driven at a predetermined process speed by an unshown drum motor. A surface of the photosensitive drum **107** is electrically charged uniformly by the charging roller **108** as a charging means. The charged surface of the photosensitive drum **107** is irradiated with a laser beam on the basis of image information by an exposure device **111** as an imaging portion (exposure means), so that an electrostatic latent image is formed. The electrostatic latent image on the photosensitive drum **107** is developed as a developer image (toner image) by deposition of a toner by the developing device **109**. The toner image on the photosensitive drum **107** is primary-transferred onto the intermediary transfer belt **106** as an intermediary transfer member by applying a primary transfer bias to between a primary transfer roller **112** as a primary transfer means and the photosensitive drum **107**. A transfer residual toner remaining on the photosensitive drum **107** after the transfer is removed by the drum cleaner **110**.

[0028] The above-described steps are executed in the respective process cartridges **105**, so that the respective color toner images formed on the photosensitive drums **107** of the process cartridges **105** are superposedly transferred onto the intermediary transfer belt **106**. Thus, a full-color toner images is formed on the intermediary transfer belt **106**. The toner image on the intermediary transfer belt **106** is secondary-transferred onto the recording material fed, by the recording material feeding portion **104** described later, to a secondary transfer portion formed by the intermediary transfer belt **106** and a secondary transfer roller **113** as a secondary transfer means. The toner remaining on the intermediary transfer belt **106** after the transfer is removed by a belt cleaner **114**.

[0029] The recording material feeding portion **104** is constituted by a plurality of feeding rollers, and picks up the recording material accommodated in the associated one of the sheet feeding cassettes **101***a*, **101***b*, **151***a*, **151***b* and then feeds the recording material to the secondary transfer portion. The feeding of the recording material to the secondary transfer portion is performed by being timed to the toner image on the intermediary transfer belt **106** by a registration roller pair **115**. In an example shown in FIG. **2**, the recording material is fed from the associated one of the sheet feeding cassettes **101***a*, **101***b* disposed at a lower portion of the apparatus main assembly, toward an upper portion of the apparatus main assembly. For this purpose, the recording material feeding portion **104** is disposed along a substantially up-down direction (vertical direction) in one side (right side as seen from the front side of the image forming apparatus) of the apparatus main assembly.

[0030] The recording material on which the toner image is transferred at the secondary transfer portion is heated and pressed by a fixing device **116**, so that the toner image is fixed. The recording material on which the toner image is fixed is discharged on a discharge tray **117**.

[0031] Here, as described above, in the image forming apparatus **100**, image formation and feeding of the recording material are effected. For this reason, when a frame structure (frame) of the image forming apparatus **100** is distorted, an image defect and an improper operation generate in some cases. On the other hand, in the optional sheet feeding module **150**, even when the frame is somewhat distorted, the distorted frame has no influence on a function of feeding the recording material and delivering the recording material to the image forming apparatus. Accordingly, suppression of distortion of the frame structure of the image forming apparatus **100** is important for the purpose of suppressing the image defect and the improper operation.

[Frame Structure]

[0032] A frame structure **130** as an image forming apparatus frame (structure) constituting the apparatus main assembly **120** will be described using FIGS. **3** and **4**. The frame structure **130** includes a main assembly frame **200** and a bottom (portion) **300**. Inside the main assembly frame **200**, the image forming portion **103** and the recording material feeding portion **104** which are as described above are dis-

posed. The bottom **300** is disposed at a lower position of the main assembly frame **200** with respect to the up-down direction (vertical direction) and in the neighborhood of an installation surface (mounting surface). First, a constitution of the main assembly frame **200** will be described.

[Main Assembly Frame]

[0033] The main assembly frame **200** is constituted by connecting, as a plurality of frame members disposed with respect to the up-down direction, a front-side plate **201**, a rear-side plate **202** (side plate), a left-side post **205** (first post) and a right-side post **204** (second post) via various stays and side plates. First, the front-side plate **201** and the rear-side plate **202** are connected by main bases **203***a*, **203***b* to which the exposure device **111** is to be mounted. The front-side plate **201** is connected to end supported by the right-side post **204** at a right end thereof and is connected to and supported by the left-side post **205** at a left end thereof. The rear-side plate **202** is constituted by a side plate portion **202***a* disposed with respect to the up-down direction, and an upper plate portion **202***b*, a right plate portion **202***c* and a left plate portion **202***d* which are provided so as to project from an upper end, a right end and a left end, respectively, of the side plate portion **202***a*. In a space defined by these plate portions **202***a* to **202***d*, various electrical components such as a motor for driving the image forming apparatus **200** are to be disposed.

[0034] The right-side post **204** is disposed so as to extend to the neighborhood of the installation surface in a downward direction and includes a first side wall **204***a* and a second side wall **204***b* which are parallel with respect to the up-down direction and which are perpendicular to each other. The left-side post **205** is disposed so as to extend to the neighborhood of the installation surface in a downward direction and includes a first side wall **205***a* and a second side wall **205***b* which are parallel with respect to the up-down direction and which are perpendicular to each other. The first side walls **204***a*, **205***a* are disposed opposed to each other so that wall surfaces thereof are perpendicular to a left-right direction, and the second side walls **204***b*, **205***b* are disposed so that wall surfaces thereof are perpendicular to the front-rear direction and oppose the rear-side plate **202** and so that the second side walls **204***b*, **205***b* are in the same plane parallel to the left-right direction.

[0035] In the neighborhood of the installation surface between the right-side post **204** and the rear-side plate **202**, the post **204** and the plate **202** are connected by lower right stays **206***a*, **206***b*. The lower right stays **206***a*, **206***b* are provided with rails for not only regulating positions of the right-side post **204** and the rear-side plate **202** with respect to the front-rear direction but also taking the sheet feeding cassettes **101***a*, **101***b* in and out. The lower right stays **206***a*, **206***b* are disposed inside (leftward) the first side wall **204***a* of the right-side post **204** to ensure a space in which the recording material fed from the above-described optional sheet feeding module **150** to the recording material feeding portion **104**.

[0036] In the neighborhood of the installation surface between the left-side post **205** and the rear-side plate **202**, the post **204** and the plate **202** are connected by lower left side plates **207***a*, **207***b*. The lower left side plates **207***a*, **2067** are disposed at positions opposing the lower right stays **206***a*, **206***b* and are provided with rails for not only regulating positions of the left-side post **205** and the rear-side plate **202** with respect to the front-rear direction but also taking the sheet feeding cassettes **101***a*, **101***b* in and out. Accordingly, the sheet feeding cassettes **101***a*, **101***b* are mountable in and demountable from the apparatus main assembly **120** by the rails provided on the lower right stays **106***a*, **106***b* and the lower left side plates **207***a*, **207***b*.

[0037] The right-side post **204** and the rear-side plate **202** are connected at an upper end by an upper right stay **208** and connected at an intermediary portion with respect to the up-down direction by an intermediary right stay **209**. The left-side post **205** and the rear-side plate **202** are connected at an upper end by an upper left stay **210** and connected at an intermediary portion with respect to the up-down direction by an intermediary left stay **211**. These stays **208** to **211** regulate positions of the right-side post **204**, the left-side post **205** and the rear-side plate **202** with respect to the front-rear direction.

[0038] The respective posts, stays, side plates and the like which constitute the main assembly frame **200** as described above are connected to each other by connecting members such as screws or by welding or the like. By employing such a constitution, between the front-side plate **201** and the bottom **300**, a lower front opening A through which the two-stage sheet feeding cassettes **101***a*, **101***b* are mountable and demountable is provided. Further, as described above, the recording material feeding portion **104** is disposed in the right side, and therefore in the case where the recording material jammed at the recording material feeding portion **104** is removed or in the like case, a right surface opening B through which the user has access to the inside of the image forming apparatus **100** is provided.

[Bottom (Portion)]

[0039] A structure of the bottom (portion) **300** will be described. The bottom **300** is constituted by a plurality of stays **301** (first stay), **303** (second stay), **302** (third stay) fixed at a lower portion of the main assembly frame **200**. These stays **301**, **303**, **302** are provided with three supporting portions **311** (first supporting portion), **313** (second supporting portion), **312** (third supporting portion) for supporting the image forming apparatus **100** relative to the installation surface. In the case of this embodiment, the installation surface of the image forming apparatus **100** is the upper surface of the sheet feeding module **150**, but in the case where the image forming apparatus **100** is disposed directly on a floor surface, the floor surface is the installation surface. In this embodiment, a so-called 3-point supporting structure in which the image forming apparatus **100** is supported by the three supporting portions **311**, **312**, **313** only.

[0040] Of the plurality of stays, the lower front stay **301** as the first stay is provided with the first supporting portion **311** of the three supporting portions. Of the plurality of stays, the rear bottom stay **302** as the third stay is provided with the third supporting portion **312** of the three supporting portions. Of the plurality of stays, the lower left stay **303** as the second stay is provided with the second supporting portion **313** of the three supporting portions. A positional relationship among the first to third stays is not limited thereto, but may also be any combination of the stays with the supporting portions. In this embodiment, the lower front stay **301** as the first stay is disposed in the neighborhood of the installation surface between the right-side post **204** and the left-side post **205**, so that positions of these posts are regulated with respect to a widthwise direction (left-right direction). The rear bottom stay **302** as the third stay is disposed at the bottom of the rear-side plate **202**, so that a bottom of the main assembly frame at a rear portion is formed. The lower left stay **303** as the

second stay connects the left-side post **205** and the rear bottom stay **302** in the neighborhood of the installation surface.

[Arrangement of Supporting Portions]

[0041] Arrangement positions of the three supporting portions **311**, **312**, **313** will be described using FIG. **4**. First, the first supporting portion **311** and the third supporting portion **312** are provided in the neighborhood of a right front corner and a right rear corner, respectively, of the bottom **300** so as to sandwich the recording material feeding portion **104** (FIG. **2**). The second

supporting portion **313** is disposed in the neighborhood of a left end center of the bottom **300** so that the center of gravity G of the image forming apparatus **100** is positioned inside a line (broken line) L connecting the three supporting portions **311**, **312**, **313**.

[0042] As described above, the various electrical components such as the driving portion which is a heavy object, and an electrical portion are disposed on the rear-side plate **202** constituting a rear side of the image forming apparatus **100**. The recording material feeding portion **104** is disposed in the right side of the image forming apparatus **100**. For this reason, the position of the center of gravity G is positioned in a right rear side of a center of the image forming apparatus **100**. That is, the center of gravity G of the image forming apparatus **100** is in a position closest to the right-rear-side third supporting portion **312** of the three supporting portions **311**, **312**, **313**. In the case where the image forming apparatus **100** is installed alone on the installation surface, the supporting portions **311**, **312**, **313** disposed at three positions contact the installation surface, and therefore an attitude of the image forming apparatus **100** is uniquely determined by heights of the three supporting portions **311**, **312**, **313**. Therefore, by supporting the image forming apparatus **100** at the 3 positions (points), even in the case where a degree of flatness of the installation surface of the image forming apparatus **100** is low, twisting and distortion of the image forming apparatus **100** can be suppressed.

[Stays Constituting Bottom]

[0043] A structure of each of the 3 stays **301**, **302**, **303** constituting the bottom **300** will be described. First, the lower front stay **301** disposed in the front side of the image forming apparatus **100** will be described using (a) and (b) of FIG. **5**. The lower front stay **301** is constituted by a combination of a first plate member **301***a* and a second plate member **301***b* each formed by subjecting a metal plate to bending. As shown in (b) of FIG. **5**, the first plate member **301***a* is formed by being bent in a substantially crank shape at each of end portions with respect to the widthwise direction perpendicular to a longitudinal direction. The second plate portion **301***b* is formed by being bent in one direction at each of the widthwise end portions. Then, the first plate portion **301***a* and the second plate portion **301***b* are combined so as to form a closed cross-section as shown in (b) of FIG. **5**, and are connected with each other by welding. By constituting the lower front stay **301** so as to form the closed cross-section, geometrical moment of inertia can be made large, so that a degree of deformation of the image forming apparatus **100** due to the weight of the image forming apparatus **100** can be remarkably suppressed.

[0044] By subjecting the second plate member **301***b* disposed in a lower surface side of the lower front stay **301** to drawing, the first supporting portion **311** is formed integrally with the lower front stay **301**. That is, as shown in (a) of FIG. **5**, a part of the longitudinal end portion of the second plate member **301***b* is subjected to the drawing so as to be pushed out downward, so that at a lower surface of the second plate member **301***b*, the first supporting portion **311** projecting downward more than another portion is formed.

[0045] Next, the rear bottom stay **302** disposed in the rear side of the image forming apparatus **100** will be described using (a) and (b) of FIG. **6**. The rear bottom stay **302** is constituted by a combination of a first plate member **302***a* and a second plate member **302***b* each formed by subjecting a metal plate to bending. As shown in (b) of FIG. **6**, the first plate member **302***a* is formed by being not only depressed at an intermediary portion but also bent in one direction at each of end portions with respect to the widthwise direction perpendicular to a longitudinal direction. The second plate portion **302***b* is formed by being bent in a substantially crank shape at each of the widthwise end portions. One widthwise end portion as the front-side portion of the second plate member **302***b* in a disposed state of the second plate member **302***b* disposed in a lower surface side of the rear bottom stay **302** constitutes a projected plate portion **302***c* projected upward more than the first plate member **302***a* disposed in an upper surface side in a state in which the first plate member **302***a* and the second plate member **302***b* are disposed in combination. Then, the first plate portion **302***a* and the second plate portion **302***b* are combined so as to form a closed cross-section as shown in (b) of FIG. **6**, and are connected with each other by welding.

[0046] By subjecting the second plate member **302***b* disposed in a lower surface side of the rear bottom stay **302** to drawing, the third supporting portion **312** is formed integrally with the rear bottom stay **302**. That is, as shown in (a) of FIG. **6**, a part of the longitudinal end portion of the second plate member **302***b* is subjected to the drawing so as to be pushed out downward, so that at a lower surface of the second plate member **302***b*, the third supporting portion **312** projecting downward more than another portion is formed.

[0047] Next, the lower left stay **303** disposed in the left side of the image forming apparatus **100** will be described using (a), (b) and (c) of FIG. **7**. The lower left stay **303** is constituted by a combination of a first plate member **303***a* and a second plate member **303***b* each formed by subjecting a metal plate to bending. As shown in (c) of FIG. **7**, the first plate member **303***a* is formed by being not only depressed at an intermediary portion but also bent in one direction at each of end portions with respect to the widthwise direction perpendicular to a longitudinal direction. The second plate portion **303***b* is formed by being bent in one direction at one widthwise end portion and by being bent in a substantially crank shape at the other widthwise end portion. Then, the first plate portion **303***a* and the second plate portion **303***b* are combined so as to form a closed cross-section as shown in (c) of FIG. **7**, and are connected with each other by welding.

[0048] The second supporting portion is constituted separately from the lower left stay **303** and is fixed to the lower left stay **303**. In a state in which the second supporting portion **313** is not fixed to the lower left stay **303** but is positioned with respect to an in-plane direction perpendicular to the up-down direction, the second supporting portion **313** is disposed movably in the up-down direction. In the case of this embodiment, the lower left stay **303** is disposed along the front-rear direction, and therefore the second supporting portion **313** is disposed movably in the front-rear direction in a state in which

the second supporting portion **313** is positioned relative to the lower left stay **303** with respect to the front-rear direction and the left-right direction.

[0049] Specifically, the lower left stay **303** includes a pair of side surfaces **303***c*, **303***d* which are parallel to the up-down direction and which are parallel to each other. The side surface **303***c* in one side is an outside surface of the bent portion formed by bending the first plate member **303***a* at one widthwise end portion, and the other side surface **303***d* is an outside surface of the bent portion formed by bending the second plate member **303***b* at the other widthwise end portion.

[0050] The second supporting portion **313** includes a pair of side wall portions **313***a*, **313***b*, a connecting portion **313***c* and a contact portion **313***d*. The pair of side wall portions **313***a*, **313***b* are disposed opposed to the pair of side surfaces **303***c*, **303***d*, respectively. The connecting portion **313***c* connects lower end portions of the pair of the side wall portions **313***a*, **313***b*. The contact portion **313***d* is provided on the connecting portion **313***c* and is contacted to the installation surface. The thus-constituted second supporting portion **313** includes the pair of side wall portions **313***a*, **313***b* and the connecting portion **313***c* each formed by bending the metal plate. By subjecting the connecting portion **313***c* to the drawing, the contact portion **313***d* is formed integrally with the connecting portion **313***d*. That is, as shown in (c) of FIG. **7**, a part of the connecting portion **313***c* is subjected to the drawing so as to be pushed out downward, so that at a lower surface of the connecting portion **313***c*, the contact portion **313***d* projecting downward more than another portion is formed.

[0051] The above-described first supporting portion **311** and the third supporting portion **312** are formed so that each of contact surfaces with the installation surface has a substantially circular shape. On the other hand, the contact portion **313***d* constituting the second supporting portion **313** is formed so that an area of the contact surface thereof is larger than an area of each of the contact surfaces of the first supporting portion **311** and the third supporting portion **312**. Specifically, the contact surface of the contact portion **313***d* has such a shape that end portions of a flat surface extending in the front-rear direction which is an arrangement direction of the lower left stay **303** are formed in an arcuate shape. This is because the two supporting portions **311**, **312** are disposed in the right side of the image forming apparatus **100** and on the other hand, only one supporting portion **313** is disposed in the left side of the image forming apparatus **100**. That is, an installation area in a side where the single supporting portion is disposed is made large, so that stability of the image forming apparatus **100** relative to the installation surface is improved. As a result, for example, even in the case where such an external force that the user puts his (her) weight on the image forming apparatus **100** acts on the image forming apparatus **100**, it is possible to prevent the image forming apparatus **100** from leaning with reliability.

[0052] The lower left stay **303** includes a projected portion **303***e* as an engaging portion as shown in (b) of FIG. **7**. The projected portion **303***e* is formed so as to project from each of the pair of side surfaces **303***c*, **303***d*. On the other hand, the second supporting portion **313** is provided with a cut-away portion **313***e* as a portion-to-be-engaged engaging with the projected portion **303***e*. The cut-away portion **313***e* is formed in each of the pair of side wall portions **313***a*, **313***b* and is cut away from each of upper end portions of the side wall portions **313***a*, **313***b* with respect to the up-down direction, so that the projected portion **303***e* can enter the cut-away portion **313***e*.

[0053] Assembling of the second supporting portion **313** with the lower left stay **303** is made in the following manner. First, the second supporting portion **313** is disposed so that the pair of side wall portions **313***a*, **313***b* sandwich the pair of side surfaces **303***c*, **303***d* of the lower left stay **303** and so that the cut-away portion **313***e* and the projected portion **303***e* are aligned with each other. Then, the second supporting portion **313** is moved in an upward direction relative to the lower left stay **303**, so that not only the projected portion **303***e* enters the cut-away portion **313***e* but also the pair of side wall portions **313***a*, **313***b* oppose the pair of side surfaces **303***c*, **303***d*, respectively. As a result, the second supporting portion **313** is positioned relative to the lower left stay **303** with respect to the in-plane direction in a state in which the second supporting portion **313** is not fixed to the lower left stay **303**. In this embodiment, a stay-side positioning portion **320** (positioning portion) is constituted by the pair of side surfaces **303***c*, **303***d*, the pair of side wall portions **313***a*, **313***b*, the projected portion **303***e* and the cut-away portion **313***e*.

[0054] That is, the pair of side wall portions **313***a*, **313***b* and the pair of side surfaces **303***c*, **303***d* are contacted to or close to each other, the second supporting portion **313** is positioned relative to the lower left stay **313** with respect to a direction (left-right direction), of the in-plane direction, perpendicular to the pair of side surfaces **303***c*, **303***d*. Further, by engagement between the cut-away portion **313***e* and the projected portion **303***e*, the second supporting portion **313** is positioned relative to the lower left stay **313** with respect to a direction (front-rear direction), of the in-plane direction, parallel to the pair of side surfaces **303***c*, **303***d*. At this time, the projected portion **303***e* is movable relative to the cut-away portion **313***e* in the up-down direction, and therefore the second supporting portion **313** is movable relative to the lower left stay **303** in the up-down direction in a state in which the second supporting portion **313** is positioned with respect to the front-rear direction and the left-right direction. The second supporting portion **313** is fixed to the lower left stay **303** by welding after positional adjustment (height adjustment) of the three supporting portions **311**, **312**, **313** with respect to the up-down direction is made as described later.

[Positioning and Fastening of Stays to Main Assembly Frame]

[0055] Next, positioning and fastening of the above-described 3 stays **301**, **302**, **303** to the main assembly frame **200** will be described using FIGS. **8** to **10** while making reference to FIG. **4**. The lower front stay **301** and the rear bottom stay **302** as the first stay and the third stay, respectively, are disposed movably in the up-down direction in a state in which these stays are not fixed to the main assembly frame **200** but are positioned relative to the main assembly frame **200** with respect to the in-plane direction (horizontal plane direction) perpendicular to the up-down direction. On the other hand, the lower left stay **303** as the second stay is, after being fixed to the main assembly frame **200** with respect to the up-down direction and the in-plane direction, disposed movably in the up-down direction in a state in which the second supporting portion **313** is positioned relative to the lower left stay **303** with respect to the in-plane direction. Specific description will be made below.

[0056] First, the positioning and the fastening of the lower front stay **301** will be described using FIGS. **8** and **9**. In FIG. **8**, (a) and (b) are perspective views each showing a state in which the lower front stay **301** is positioned relative to the

right-side post **204** and is fastened to the right-side post **204**. The right-side post **204** includes, as described above, the first side wall **204***a* and the second side wall **204***b* which are parallel to the up-down direction and which are perpendicular to each other. The lower front stay **301** is disposed in contact with or close to only the first side wall **204***a* and the second side wall **204***b* at a right end portion thereof. The first side wall **204***a* is disposed in parallel to the front-rear direction, and the second side wall **204***b* is disposed in parallel to the left-right direction. For this reason, the right end portion of the lower front stay **301** is disposed movably in the up-down direction in a state in which the right end portion is positioned by the first side wall **204***a* and the second side wall **204***b* with respect to the front-rear direction and the left-right direction. In this embodiment, a first positioning portion **2040** is constituted by the first side wall **204***a* and the second side wall **204***b*. That is, the first positioning portion **2040** positions the lower front stay **301** with respect to the left-right direction (horizontal plane direction) but does not position the lower front stay **301** with respect to the up-down direction (vertical direction). The right end portion of the lower front stay is, as described later, fixed to the right-side post **204** at fastening portions **241** to **244** by welding after the positioned adjustment (height adjustment) of the three supporting portions **311**, **312**, **313** with respect to the up-down direction.

[0057] FIG. **9** is a perspective view showing a state in which the lower front stay **301** is positioned relative to the left-side post **205** and is fastened to the left-side post **205**. The left-side post **205** includes, as described above, the first side wall **205***a* and the second side wall **205***b* which are parallel to the up-down direction and which are perpendicular to each other. The lower front stay **301** is disposed in contact with or close to only the first side wall **205***a* and the second side wall **205***b* at a left end portion thereof. The first side wall **205***a* is disposed in parallel to the front-rear direction, and the second side wall **205***b* is disposed in parallel to the left-right direction. For this reason, the left end portion of the lower front stay **301** is disposed movably in the up-down direction in a state in which the right end portion is positioned by the first side wall **205***a* and the second side wall **205***b* with respect to the front-rear direction and the left-right direction (horizontal plane direction). In this embodiment, a second positioning portion **2050** is constituted by the first side wall **205***a* and the second side wall **205***b*. The left end portion of the lower front stay **301** is, as described later, fixed to the left-side post **205** at fastening portions **251** to **254** by welding after the positioned adjustment (height adjustment) of the three supporting portions **311**, **312**, **313** with respect to the up-down direction. That is, the second positioning portion **2050** positions the lower front stay **301** with respect to the left-right direction (horizontal plane direction) but does not position the lower front stay **301** with respect to the up-down direction (vertical direction). In this way, the lower front stay **301** is disposed movably in the up-down direction in a state in which the lower front stay **301** is positioned relative to the right-side post **204** and the left-side post **205** with respect to the front-rear direction and the left-right direction, and after the height adjustment of the respective supporting portions, is fixed to the right-side post **204** and the left-side post **205** by welding.

[0058] Next, the positioning and the fastening of the rear bottom stay **302** will be described using FIG. **10**. In FIG. **10**, (a) and (b) are perspective views each showing a state in which the rear bottom stay **302** is positioned relative to the rear-side plate **202** and is fastened to the rear-side plate **202**. The right-side post **204** includes, as described above, the side plate portion **202***a*, and the right plate portion **202***c* and the left plate portion **202***d* which are projected rearward from right and left end portions, respectively, of the side plate portion **202***a*. Here, the side plate portion **202** is disposed in parallel to the left-right direction, and the right plate portion **202***c* and the left plate portion **202***d* and disposed in parallel to the front-rear direction. Accordingly, each of a combination of the side plate portion **202***a* and the right plate portion **202***c* and a combination of the side plate portion **202***a* and the left plate portion **202***d* provides a relationship between the first side wall and the second side wall which are perpendicular to each other. At a front-side end portion of the rear bottom stay **302**, as described above, the projected plate portion **302***c* is formed.

[0059] The rear bottom stay **302** is disposed in contact with or closely to only the right portion **202***c* and the left plate portion **202***d* of the rear-side plate **202** at end portions thereof with respect to the left-right direction. That is, the rear bottom stay **302** is disposed in contact with or closely to only the side plate portion **202***a*, the right plate portion **202***c* and the left plate portion **202***d*. For this reason, the rear bottom stay **302** is disposed movably in the up-down direction in a state in which the rear bottom stay **302** is positioned by the side plate portion **202***a*, the right plate portion **202***c* and the left plate portion **202***d* with respect to the front-rear direction and the left-right direction (horizontal plane direction). In this embodiment, a third positioning portion **2020** is constituted by the side plate portion **202***a* and the left plate portion **202***d*, and a fourth positioning portion **2021** is constituted by the side plate portion **202***a* and the right plate portion **202***c*. That is, the third and fourth positioning portions position the rear bottom stay **302** with respect to the left-right direction (horizontal plane direction) but does not position the lower front stay **301** with respect to the up-down direction (vertical direction). The rear bottom stay **302** is, as described later, fixed to the rear-side plate **202** at fastening portions **221** to **228** by welding after the positioned adjustment (height adjustment) of the three supporting portions **311**, **312**, **313** with respect to the up-down direction.

[0060] The lower left stay **303** is, as shown in FIG. **4**, disposed on the upper surfaces of the lower front stay **301** and the rear bottom stay **302** so as to extends onto the upper surfaces. In this state, a front end portion of the lower left stay **303** is disposed in contact with or closely to the first side wall **205***a* and the second side wall **205***b* of the left-side post **205**. A rear end portion of the lower left stay **303** is disposed in contact with or closely to the left plate portion **202***d* of the rear-side plate **202** and the rear bottom stay **302**. Accordingly, in this state, the lower left stay **303** is movable relative to the main assembly frame **200** in the up-down direction in a state in which the lower left stay **303** is positioned relative to the main assembly frame **200** with respect to the front-rear direction and the left-right direction.

[0061] However, as described above, the second supporting portion **313** provided on the lower left stay **303** is constituted separately from the lower left stay **303**, and is movable relative to the lower left stay **303** in a state in which the second supporting portion **313** is positioned relative to the lower left stay **303** with respect to the front-rear direction and the left-right direction. For this reason, in this embodiment, the lower left stay **303** is fixed by welding to the first side wall **205***a* and the second side wall **205***b* of the left-side post **205** at the front end portion thereof and to the side plate portion **202***a* and the

left plate portion **202***b* of the rear-side plate **202** at the rear end portion thereof. Thereafter, the second supporting portion **313** is, as described above, disposed movably relative to the lower left stay **303** in the up-down direction in a state in which the second supporting portion **313** is positioned relative to the lower left stay **303**, and then is fixed to the lower left stay **303** after the height adjustment of the respective supporting portions is made.

[0062] The lower left stay **303** is disposed above the lower front stay **301** and the rear bottom stay **302**. In this embodiment, as described above, the second supporting portion **313** provided on the lower left stay **303** disposed above the lower front stay **301** and the rear bottom stay **302** is prepared as the separate member from the lower left stay **303**. This is because the lower left stay **303** is positioned above the lower front stay **301** and the rear bottom stay **302** and therefore a distance between the lower surface thereof and the installation surface is larger than those in the cases of other stays. That is, in the case where the supporting portion for the lower left stay **303** is formed in a projected shape by subjecting the metal plate to the drawing similarly as in the cases of the lower front stay **301** and the rear bottom stay **302**, the supporting portion is not readily projected correspondingly to the above-described distance. Accordingly, as in this embodiment, the supporting portion is prepared as the separate member, so that even when the distance from the installation surface is large, the formation of the projected portion can be easily made.

[Height Adjusting Method of Supporting Portions]

[0063] Next, a method of positional adjustment (height adjustment) of the three supporting portions **311**, **312**, **313** with respect to the up-down direction will be described using FIGS. **11** and **12**. As described above, each of the lower front stay **301**, the rear bottom stay **302** and the lower left stay **303** is not provided with a positioning portion relative to the main assembly frame **200** with respect to the up-down direction. Accordingly, a positioning jig **400** for positioning each of the stays with respect to the up-down direction in order to adjust the height of each of the supporting portions will be described using (a) and (b) of FIG. **11**. The positioning jig **400** is prepared by disposing, on an upper surface of a base **401**, receiving portions **402***a*, **402***b*, **402***c* for the three supporting portions **311**, **312**, **313**. These receiving portions **402***a*, **402***b*, **402***c* are regulated so that their upper surfaces are positioned in the same flat plane. On the upper surface of the base **401**, a receiving portion **403** for the lower front stay **301** and a receiving portion **404** for the rear bottom stay **302** are disposed. Further, two walls **405**, **406** are provided to stand from the upper surface of the base **401** with respect to the vertical direction, and are provided with two through holes **405***a*, **405***b* and two through holes **406***a*, **406***b*, respectively.

[0064] When the respective stays are welded to the main assembly frame **200**, as shown in FIG. **12**, the main assembly frame **200** is installed on the positioning jig **400**. The front-side plate **201** and the rear-side plate **202** of the main assembly frame **200** are provided with through holes at positions corresponding to the holes **405***a*, **405***b*, **406***a*, **406***b*. When the main assembly frame **200** is installed on the positioning jig **400**, not only a supporting bar **410** is passed through the hole **405***a*, the associated through hole of the main assembly frame **200** and the hole **406***a* but also a supporting bar **411** is passed through the hole **405***b*, the associated through hole of the main assembly frame **200** and the hole **406***b*. As a result, the main assembly frame **200** is supported by the positioning jib **400** via the supporting bars **410**, **411**. Then, the respective stays are disposed at predetermined positions as described above so that the three supporting portions **311**, **312**, **313** are mounted on the receiving portions **402***a*, **402***b*, **402***c*, respectively.

[0065] The first supporting portion **311** and the third supporting portion **312** provided on the lower front stay **301** and the rear bottom stay **302**, respectively, are disposed close to one end portions of the stays. For this reason, when the first supporting portion **311** and the third supporting portion **312** are only mounted on the receiving portions **402***a*, **402***b*, there is a possibility that the stays are disposed in an inclined state. Therefore, in this embodiment, on the upper surface of the base **401**, at opposite end portions to the receiving portions **402***a*, **402***b* in a region where the lower front stay **301** and the rear bottom stay **302** are disposed, receiving portions **403**, **404** for the lower front stay **301** and the rear bottom stay **302** are provided. Heights of the receiving portions **403**, **404** are set in consideration of projection amounts of the first supporting portion **311** and the third supporting portion **312** from the associated stays. Thus, the respective stays are horizontally disposed in a state in which the first supporting portion **311** and the third supporting portion **312** are mounted on the receiving portions **402***a*, **402***b* and the lower front stay **301** and the rear bottom stay **302** are mounted on the receiving portions **403**, **404**.

[0066] On the other hand, in this state, the lower left stay **303** is mounted on the lower front stay **301** and the rear bottom stay **302**. The second supporting portion **313** provided on the lower left stay **303** is mounted on a receiving portion **402***c* in a state in which the second supporting portion **313** is disposed on the lower left stay **303** at a predetermined position as described above. At this time, the respective stays **301**, **302**, **303** are movable relative to the main assembly frame **200** in the up-down direction in a state in which the second supporting portion **313** is positioned relative to the lower left stay **303** with respect to the front-rear direction and the left-right direction. For this reason, as described above, relative positions of the respective members with respect to the up-down direction are adjusted, so that the respective supporting portions **311**, **312**, **131** can be mounted on the receiving portions **402***a*, **402***b*, **402***c*. Further, at this time, the respective members are positioned with respect to the front-rear direction and the left-right direction and are movable only in the up-down direction, and therefore when a positioning operation is performed, the respective members do not readily deviate with respect to the front-rear direction or the left-right direction or do not readily lean with respect to the horizontal direction. Accordingly, the adjusting operation as described above is easily performed.

[0067] In this way, the supporting portions **311**, **312**, **313** are mounted on the receiving portions **402***a*, **402***b*, **402***c*, so that lower surfaces of the supporting portions are positioned on the same flat plane. Then, in this state, the stays **301**, **302**, **303** are welded to the associated posts or side plates of the main assembly frame **200**, so that the stays are fixed to the main assembly frame **200**. Further, the second supporting portion **313** is welded to the lower left stay **303**, so that the second supporting portion **313** is fixed to the lower left stay **303**. As a result, in a state in which the positioning of the supporting portions is made, the bottom **300** is fixed to the main assembly frame **200**, so that the frame structure **130** is formed.

[0068] In summary, the frame structure **130** is manufactured by the following manufacturing method. First, the lower front stay **301** and the rear bottom stay **302** are disposed movably relative to the main assembly frame **200** in the up-down direction in a state in which the stays **301**, **302** are positioned relative to the main assembly frame **200** with respect to the in-plane direction perpendicular to the up-down direction (first step). Then, at least one of the lower front stay **301** and the rear bottom stay **302** are moved in the up-down direction, so that the positional adjustment of the three supporting portions **311**, **312**, **313** is performed (second step). Finally, the lower front stay **301** and the rear bottom stay **302** are fixed to the main assembly frame (third step). In this embodiment, in the first step, also the lower left stay **303** is disposed movably relative to the main assembly frame **200** in a state in which the lower left stay **303** is positioned relative to the main assembly frame **200** with respect to the in-plane direction perpendicular to the up-down direction. In the second step, the second supporting portion **313** is moved relative to the lower left stay **303** in the up-down direction. In the third step, the second supporting portion **313** is fixed to the lower left stay **303**.

[0069] In this embodiment, the frame structure **130** is manufactured using the positioning jig **400** as described above, so that the positioning of the supporting portions **311**, **312**, **313** can be easily performed. Further, the inside unit (such as the process cartridge **105**) of the image forming apparatus **100** is positioned by the front-side plate **201** and the rear-side plate **202**, and therefore the inside unit and a plane formed by the supporting portions **311**, **312**, **313** can be made parallel to each other. In actuality, a degree of parallelism of the process cartridge **105** with the supporting portions **311**, **312**, **313** can be roughly suppressed to 0.5 or less although it varies depending on accuracy of the jig.

[0070] As described above, according to this embodiment, even when the bottom **300** is constituted by the plurality of stays **301**, **302**, **303**, a variation in positional relationship among the supporting portions **311**, **312**, **313** with respect to the up-down direction can be suppressed. The lower front stay **301** and the rear bottom stay **302** are movable relative to the main assembly frame **200** in the up-down direction in a state in which the stays **301**, **302** are not fixed to the main assembly frame **200** but are positioned relative to the main assembly frame **200** with respect to the in-plane direction. For this reason, the lower front stay **301** and the rear bottom stay **302** are moved in the up-down direction, so that the height adjustment of the supporting portions **311**, **312**, **313** can be performed. In this embodiment, the second supporting portion **313** is movable in the up-down direction in a state in which the portion **313** is positioned relative to the lower left stay **303** with respect to the in-plane direction. In either case, after the height adjustment of the supporting portions **311**, **312**, **313** is performed, the stays or the supporting portions are fixed to the main assembly frame or the stays, so that a variation in positional relationship among the supporting portions **311**, **312**, **313** with respect to the up-down direction can be suppressed.

[0071] When the image forming apparatus **100** is mounted on, e.g., a horizontal surface of the floor as the installation surface, the inside unit is horizontal with respect to the direction of gravity, so that a function such as a toner feeding function subjected to the influence of the gravitation can be stabilized. Further, distortion of the frame structure **130** can be suppressed, so that not only stabilization of the feeding of the recording material by the recording material feeding portion **104** can be realized but also the deviation in positional relationship among the members such as the photosensitive drum can be suppressed, and thus it is possible to suppress generation of an image defect, improper operation and the like.

Second Embodiment

[0072] Second Embodiment of the present invention will be described using FIGS. **13** to **15**. In the First Embodiment described above, the second supporting portion **313** provided on the lower left stay **303** was made movable in the up-down direction in the state in which the portion **313** was positioned with respect to the front-rear direction and the left-right direction. On the other hand, in this embodiment, a second supporting portion **313**A is fixed to a lower left stay **303**A in a state in which the portion **313**A is positioned also with respect to the up-down direction. Other constitutions and actions are similar to those in the First Embodiment described above, and therefore redundant description and illustration are omitted or simplified and in the following, a portion different from the First Embodiment will be principally described.

[0073] The lower left stay **303**A is, similarly as in the First Embodiment, constituted by combining a first plate member **303**Aa and a second plate member **303**Ab each formed by subjecting a metal plate to bending. The first plate member **303**Aa and the second plate member **303**Ab are similar to the first left member **303***a* and the second plate member **303***b* in the First Embodiment. Also a second supporting portion **313**A in this embodiment is constituted as a separate member from the lower left stay **303** similarly as in the First Embodiment. However, the second supporting portion **313**A is different from the second supporting portion **313** in the First Embodiment, and is fixed to a lower surface of the second plate member **303**Ab constituting a lower surface side of the lower left stay **303**A as shown in (a), (b) and (c) of FIG. **13**.

[0074] For this reason, the second supporting portion **313**A is formed by bending the metal plate, and includes a pair of abutting portions **313**Aa, **313**Ab, a connecting portion **313**Ac and a contact portion **313**Ad. The pair of abutting portions **313**Aa, **313**Ab are formed by being bent in one direction from ends of the connecting portion **313**Ac with respect to the longitudinal direction (arranging direction or front-rear direction of the lower left stay **303**A) and then by bending free ends in a direction substantially parallel to the connecting portion **313**Ac. Further, a part of the connecting portion **313**Ac is subjected to drawing so as to be pushed out downward, so that the contact portion **313**Ad projecting downward more than other portion is formed on the lower surface of the connecting portion **313**Ac. The contact portion **313**Ad is similar to the contact portion **313***d* in the First Embodiment.

[0075] The lower left stay **303** includes a projected portion **303**A as an engaging portion as shown in (b) of FIG. **7**. The projected portion **303**A is formed so as to project from each of two positions of the lower surface of the second plate member **303**Ab. On the other hand, the second supporting portion **313**A is provided with a cut-away portion **313**Ae and a hole **313**Af as portions-to-be-engaged engaging with the projected portion **303**Ae. The cut-away portion **313**Ae is cut away in the front-rear direction at the free end of the abutting portion **313**Aa, so that one projected portion **303**Ae can enter the cut-away portion **313**Ae. The hole **313**Af is formed by penetrating through a part of a free end portion of the abutting portion **313**Ab, so that the other projected portion **303**Ae can enter the hole **313**Af.

[0076] Assembling of the second supporting portion **313**A with the lower left stay **303**A is made in the following manner. First, the pair of abutting portions **313**Aa, **313**Ab are abutted against the surface of the second plate member **303**Ab while engaging the cut-away portion **313**Ae and the hole **313**Af with the projected portions **303**Ae. By the engagement of the cut-away portion **313**Ae and the hole **313**Ap with the projected portions **303**Ae, the second supporting portion **313**A is positioned relative to the lower left stay **303**A with respect to the in-plane direction (front-rear direction and front-rear direction). Further, the pair of abutting portions **313**Aa, **313**Ab are abutted against the surface of the second plate member **303**Ab, so that the second supporting portion **313**A is positioned relative to the lower left stay **303**A with respect to the up-down direction. Then, in this state, the second supporting portion **313**A is fixed to the lower left stay **303**A by welding.

[0077] In the case of this embodiment, the abutting portions **313**Aa, **313**Ab of the second supporting portion **313**A are abutted against the surface of the second plate member **303**Ab, and therefore a contact area between the second supporting portion **313**A and the second stay **303**A can be sufficiently ensured. For this reason, when the image forming apparatus **100** is installed on the installation surface, a deformation of the second supporting portion **313**A due to a load exerted on the second supporting portion **313**A can be suppressed.

[0078] In this embodiment, as described above, the second supporting portion **313**A is fixed to the lower left stay **303**A in a state in which the portion **313**A is positioned relative to the stay **303**A with respect to the up-down direction in addition to the in-plane direction, and therefore the height adjustment of the second supporting portion **313**A is made by the lower left stay **303**A. Positioning and fastening of the lower left stay **303**A to the main assembly frame **200** will be described using FIGS. **14** and **15**.

[0079] The lower left stay **303**A is, similarly as in the First Embodiment, mounted on the upper surfaces of the lower front stay **301** and the rear bottom stay **302** so as to extend onto the lower front stay **301** and the rear bottom stay **302**. In this state, the front end portion of the lower left stay **303**A is, as shown in FIG. **14**, disposed so as to contact or approach the first side wall **205***a* and the second side wall **205***b* of the left-side post **205**. The rear end portion of the lower left stay **303**A is, as shown in FIG. **15**, disposed so as to contact or approach the left plate portion **202***d* of the rear-side plate **202** and the rear bottom stay **302**. The side plate portion **202***a* of the rear-side plate **202** is provided with the cut-away portion or the through hole through which the lower left stay **303**A is passable, so that the rear end portion of the lower left stay **303**A passes through the side plate portion **202***a* to reach a rear end edge portion of the rear bottom stay **302**. The rear end portion of the lower left stay **303**A is provided with a bent portion **303**Ac bent from an end portion of the first plate member **303**Aa, so that an inside surface of the bent portion **303**Ac contacts the rear end edge portion of the rear bottom stay **302**. As a result, the lower left stay **303**A is movable relative to the main assembly frame **200** in the up-down direction in a state in which the stay **303**A is positioned relative to the frame **200** with respect to the front-rear direction and the left-right direction. In this embodiment, the first side wall **205***a* and the second side wall **205***b* constitute a third positioning portion **2051**.

[0080] To the lower left stay **303**A, the second supporting portion **313**A is fixed in advance as described above. Accordingly, for example, by using the positioning jig **400** described above, the positional adjustment (height adjustment) of the supporting portions **311**, **312** other than the second supporting portion **313** with respect to the up-down direction is performed. Thereafter, the lower left stay **303**A is fixed by welding to the rear-side post **205** at fastening portions **251**A to **254**A and to the rear-side plate **202** and the rear bottom stay **302** at fastening portions **221**A, **222**A, **321**A, **322**A.

[0081] Also in such a case in this embodiment, the second supporting portion **313**A is prepared as the separate member from the lower left stay **303**A. For this reason, similarly as in the First Embodiment, even when the distance between the lower left stay **303**A and the left-side is large, the formation of the projected portion can be easily made.

Other Embodiments

[0082] In the above-described embodiments, the respective stays constituting the bottom were fixed to the main assembly frame by welding, but may also be fixed by another fastening means such as a screw. This is also true for the fixing between the supporting portions and the stays. In the above-described embodiments, the second supporting portion was prepared as the separate member from the lower left stay, but may also be formed integrally with the lower left stay similarly as in the cases of the first supporting portion and the third supporting portion.

[0083] In the embodiments described above, the 3 stays were made movable in the up-down direction in the state in which the stays were positioned relative to the main assembly frame with respect to the in-plane direction. However, in a state in which any one of the stays is made immovable relative to the main assembly frame in both of the in-plane direction and the up-down direction, other two stays may be made movable in the up-down direction in a state in which the two stays are positioned with respect to the in-plane direction. For example, in the Second Embodiment, the rear bottom stay **302** is fixed to the main assembly frame **200** and then the lower front stay **301** and the lower left stay **303** are moved in the up-down direction, so that heights of the first and second supporting portions **311**, **313**A may be made equal to the height of the third supporting portion **312**.

[0084] In the First Embodiment described above, the second supporting portion **313** was made movable relative to the lower left stay **303** in the up-down direction, and other supporting portions were provided integrally with the associated stays. However, the three supporting portions may also be prepared as separate members from the associated stays so that the three supporting portions are movable in the up-down direction similarly as in the case of the second supporting portion **313**. In this case, in a state in which the 3 stays are fixed to the main assembly frame, the respective supporting portions are disposed movably in the up-down direction in a state in which the supporting portions are positioned relative to the associated stays with respect to the in-plane direction. A constituent portion for positioning the first supporting portion **311** movably relative to the lower front stay **301** in the up-down direction is a first stay-side positioning portion. A constituent portion for positioning the third supporting portion **312** movably relative to the rear bottom stay **302** in the up-down direction is a third stay-side positioning portion. A constituent portion for positioning the second supporting portion **313** movably relative to the lower left stay **303** in the

up-down direction is a second stay-side positioning portion. Then, after the height adjustment of the respective supporting portions, the supporting portions are fixed to the associated stays by welding. In this case, in a state in which any one of the supporting portions is fixed to or integrally formed with the associated stay, other two supporting portions may also be made movable in the up-down direction in a state in which the two supporting portions are positioned relative to the associated stays with respect to the in-plane direction.

[0085] Further, of the 3 stays and the three supporting portions, one stay and one supporting portion are fixed to the main assembly frame, and other two stays and other two supporting portions may also be made movable in the up-down direction. For example, in the First Embodiment, the rear bottom stay **302** is fixed to the main assembly frame **200**, and then the lower front stay **301** is disposed movably in the up-down direction relative to the main assembly frame **200**. In this case, the first positioning portion **2040** and the second positioning portion **2050** correspond to a main assembly-side positioning portion. Further, the second supporting portion **313** is disposed movably in the up-down direction relative to the lower left stay **303**. Then, heights of the first and second supporting portions **311**, **313** may also be made equal to the height of the third supporting portion **312**.

[0086] In the above-described explanation, the so-called 3-point supporting structure in which the number of positions of the supporting portions for supporting the image forming apparatus on the installation surface was 3 was described, but the present invention is also applicable to a constitution, including 3 or more supporting portions, such as a 4-point supporting structure. For example, a constitution including three stays and four supporting portions will be considered. In this case, it is assumed that two supporting portions are provided on the same stay and other two supporting portions are provided on other two stays, respectively. Also in this case, similarly as in the above-described explanation, the respective stays or supporting portions are disposed movably in the up-down direction in a state in which the stays or supporting portions are positioned with respect to the in-plane direction, so that the height adjustment of the supporting portions can be performed. For example, the supporting portions are fixed to the associated stays in advance. At this time, the two supporting portions are fixed on the same stay, and therefore a degree of a variation in positional relationship of the two supporting portions with respect to the up-down direction is small. Accordingly, when other two supporting portions fixed on other two stays are subjected to the height adjustment relative to the two supporting portions fixed on the same stay, a variation in positional relationship among the four supporting portions with respect to the up-down direction can be suppressed.

[0087] Further, a constitution including 4 stays and four supporting portions will be considered. In this case, it is assumed that the four supporting portions are fixed to the four stays separately. Also in this case, of the four stays, any two stays are in the same relationship as that between the first stay and the second stay described above in the respective embodiments, so that the height adjustment can be made similarly as in the above-described embodiments. This is also true for the case where the supporting portions are made movable in the up-down direction relative to the stays.

[0088] The "supporting portion" referred to in the present invention includes not only the case where the single supporting portion contacts the installation surface at a single contact portion as described above in the embodiments but also the case where the single supporting portion contacts the installation surface at two or more contact portions. For example, an interval between the two contact portions is made small to constitute the single supporting portion. Here, in a constitution including three supporting portions, when any one of the supporting portions contacts the installation surface at two contact portions between which an interval is large, a resultant structure is consequently not different from the 4-point supporting structure. For this reason, in this case, the interval between the two contact portions is made small, for example, ⅓ of a length of the stay, with respect to the arranging direction, on which the associated supporting portion is provided.

[0089] According to the present invention, even when the bottom is constituted by the plurality of stays, a variation in positional relationship among the supporting portions with respect to the up-down direction can be suppressed.

[0090] While the present invention has been described with reference to exemplary embodiments, it is to be understood that the invention is not limited to the disclosed exemplary embodiments. The scope of the following claims is to be accorded the broadest interpretation so as to encompass all such modifications and equivalent structures and functions.

[0091] This application claims the benefit of Japanese Patent Application No. 2015-001113 filed on Jan. 6, 2015, which is hereby incorporated by reference herein in its entirety.

What is claimed is:

1. A frame for forming an image forming apparatus for forming an image on a recording material, said frame comprising:

a first stay, including a supporting portion for supporting said frame relative to an installation surface, for forming a bottom of said frame;

a second stay, including a supporting portion for supporting said frame relative to the installation surface, for forming the bottom of said frame;

a post to which said first stay and said second stay are secured; and

a positioning portion, provided as a part of said post, for positioning said first stay and said second stay with respect to a horizontal plane direction,

wherein said first stay and said second stay are fixed to said post by welding.

2. A frame according to claim **1**, wherein said post is a first state to which one end of said first stay is fixed, and said developing portion is a first positioning portion, and

wherein said frame further comprises a second post to which the other end of said first stay is fixed by welding and comprises a second positioning portion, provided on said second post, for positioning said first stay with respect to the horizontal plane direction.

3. A frame according to claim **1**, wherein said frame includes a side plate.

4. A frame according to claim **3**, wherein said first stay is provided in a side opposing a side where said side plate is provided in said frame.

5. A frame according to claim **3**, wherein one end of said second stay is fixed to said post, and said positioning portion is a first positioning portion, and

wherein the other end of said second stay is fixed to said side plate by welding.

6. A frame according to claim 3, wherein said side plate includes a positioning portion for positioning said second stay with respect to the horizontal plane direction.

7. A frame according to claim 3, wherein said second stay is provided on a surface perpendicular to said side plate.

8. A frame according to claim 3, further comprising a third stay, including a supporting portion for supporting said frame relative to the installation surface and comprising a third positioning portion for positioning said third stay with respect to the,

wherein said third stay is fixed to said side plate by welding in a lower side of said side plate with respect to a vertical direction.

9. A frame according to claim 1, wherein the supporting portion of said second stay is fixed to said second stay by welding.

10. A frame according to claim 9, wherein said second stay includes a fourth positioning portion for positioning the supporting portion of said second stay with respect to the horizontal plane direction.

11. A frame for forming an image forming apparatus for forming an image on a recording material, said frame comprising:

a stay, including a supporting portion for supporting said frame relative to an installation surface, for forming a bottom of said frame;

a first post to which one end of said stay is secured;

a second post to which the other end of said stay is secured;

a first positioning portion, provided as a part of said first post, for positioning said stay with respect to a horizontal plane direction; and

a second positioning portion, provided as a part of said second post, for positioning said stay with respect to the horizontal plane direction,

wherein said stay is fixed to said first post and said second post by welding.

12. A frame according to claim 11, wherein said frame includes a side plate provided in a side opposing said stay.

13. A frame according to claim 12, wherein said stay is a first stay,

wherein said frame includes a second stay, including a supporting portion for supporting said frame relative to the installation surface, for forming the bottom of said frame, and

wherein one end of said second stay is fixed to said first post by welding, and the other end of said second stay is fixed to said side plate by welding.

14. A frame according to claim 13, wherein said side plate includes a positioning portion for positioning said second stay with respect to the horizontal plane direction.

15. A frame according to claim 12, further comprising a third stay, including a supporting portion for supporting said frame relative to the installation surface and comprising a third positioning portion for positioning said third stay with respect to the horizontal plane direction,

wherein said third stay is fixed to said side plate by welding in a lower side of said side plate with respect to a vertical direction.

16. A frame according to claim 13, wherein the supporting portion of said second stay is fixed to said second stay by welding.

17. A frame according to claim 16, wherein said second stay includes a fourth positioning portion for positioning the supporting portion of said second stay with respect to the horizontal plane direction.

18. A manufacturing method of a frame for an image forming apparatus in which the frame includes a plate of stays provided at a bottom thereof and said fixed to a main assembly frame and includes at least three supporting portions, provided on the plate of stays and in which of the plate of stays, a first stay is provided with a first supporting portion and a second stay is provided with a second supporting portion, said manufacturing method comprising:

a first step of disposing the first stay and the second stay relative to the main assembly frame by moving the first stay and the second stay in a vertical direction in a state in which the first stay and the second stay are positioned relative to the main assembly frame with respect to a horizontal plane direction;

a second step of performing positional adjustment of the three supporting portions with respect to the vertical direction by moving at least one of the first stay and the second stay in the vertical direction; and

a third step of fixing the first stay and the second stay to the frame by welding.

19. A manufacturing method of a frame for an image forming apparatus in which the frame includes a plate of stays provided at a bottom thereof and said fixed to a main assembly frame and includes at least three supporting portions, provided on the plate of stays and in which of the plate of stays, a first stay is provided with a first supporting portion and a second stay is provided with a second supporting portion, said manufacturing method comprising:

a first step of disposing the first supporting portion relative to the first stay by moving the first supporting portion in a vertical direction in a state in which the first supporting portion is positioned relative to the first stay with respect to a horizontal plane direction and of disposing the second supporting portion relative to the second stay by moving the second supporting portion in the vertical direction in a state in which the second support portion is positioned relative to the second stay with respect to the horizontal plane direction;

a second step of performing positional adjustment of the three supporting portions with respect to the vertical direction by moving at least one of the first supporting portion and the second supporting portion in the vertical direction; and

a third step of fixing the first supporting portion and the supporting portion to the first stay and the second stay, respectively, by welding.

20. A manufacturing method of a frame for an image forming apparatus in which the frame includes a plate of stays provided at a bottom thereof and said fixed to a main assembly frame and includes at least three supporting portions, provided on the plate of stays and in which of the plate of stays, a first stay is provided with a first supporting portion and a second stay is provided with a second supporting portion, said manufacturing method comprising:

a first step of disposing the first stay relative to the main assembly frame by moving the first supporting portion in a vertical direction in a state in which the first stay is positioned relative to the main assembly frame with respect to a horizontal plane direction and of disposing the second supporting portion relative to the second stay

by moving the second supporting portion in the vertical direction in a state in which the second support portion is positioned relative to the second stay with respect to an in-plane direction;

a second step of performing positional adjustment of the three supporting portions with respect to the vertical direction by moving at least one of the first stay and the second supporting portion in the vertical direction; and

a third step of fixing the first stay and the supporting portion to the main assembly frame and the second stay, respectively, by welding.

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