United States Patent Application Publication	20250264843
Kind Code	A1
Publication Date	August 21, 2025
Inventor(s)	FURUKAWA; TETSUO

METHOD OF ASSEMBLING IMAGE FORMING APPARATUS AND IMAGE FORMING APPARATUS

Abstract

An image forming apparatus includes a main body, a first part having a first and a second engaging portion, a second part having a first and a second engaged portion, and a third part. An assembling method includes a first step of engaging the first engaging portion of the first part with the first engaged portion of the second part by moving the first part in a first direction relative to the second part assembled into the main body; a second step of assembling the third part to the main body by moving the third part in a second direction; and a third step of moving the first part in a third direction relative to the second part so as to release the engagement between the first engaging portion and the first engaged portion and engaging the second engaging portion with the second engaged portion.

Inventors: **FURUKAWA; TETSUO (Kanagawa, JP)**

Applicant: **CANON KABUSHIKI KAISHA** (Tokyo, JP)

Family ID: **1000008489902**

Appl. No.: **19/052913**

Filed: **February 13, 2025**

Foreign Application Priority Data

JP	2024-021767	Feb. 16, 2024

Publication Classification

Int. Cl.: **G03G21/16** (20060101); **G03G15/00** (20060101)

U.S. Cl.:

CPC **G03G21/1647** (20130101); **G03G15/657** (20130101); **G03G21/1619** (20130101);

Background/Summary

BACKGROUND

Field

[0001] The present disclosure relates to a method of assembling an image forming apparatus and an image forming apparatus.

Description of the Related Art

[0002] Conventionally, in assembling parts into an image forming apparatus, a positioning portion and a locking portion are provided on the parts to prevent the parts from being displaced during assembly, allowing an assembly worker to take their hands off the parts and perform other tasks such as securing screws. For example, since the center of gravity of the part being assembled is not on the mounting surface, when the assembly worker takes their hands off the part, the part being assembled may fall off from the mounting surface. Therefore, Japanese Patent Application Publication No. 2003-063092 discloses a configuration in which a locking portion that can be positioned is provided on the part to hold the part on the mounting surface.

[0003] In Japanese Patent Application Publication No. 2003-063092, the parts being assembled cannot be moved after being placed on the image forming apparatus. Therefore, the technology of Japanese Patent Application Publication No. 2003-063092 could not be adopted when the parts assembled first are temporarily held at a position different from the assembly position, and the parts assembled later are moved and positioned after the assembly of the parts assembled later is completed. Here, when the image forming apparatus is made smaller, it becomes difficult to secure the assembly space, and a method of changing the assembly order of the parts may be adopted. Therefore, a method may be required in which the parts assembled first are temporarily held, and the assembly of the temporarily held parts is completed after the other peripheral parts are assembled.

SUMMARY

[0004] The present disclosure has been made in consideration of the above-mentioned problems, and an object thereof is to provide an image forming apparatus equipped with a temporary holding mechanism during parts assembly.

[0005] The present disclosure provides a method of assembling an image forming apparatus, wherein the image forming apparatus includes: a first part having a first engaging portion and a second engaging portion; a second part having a first engaged portion configured to engage with the first engaging portion and a second engaged portion configured to engage with the second engaging portion, the second part being assembled with the first part; and a third part, and the method includes: a first step of engaging the first engaging portion of the first part with the first engaged portion of the second part by moving the first part in a first direction relative to the second part assembled into a main body of the image forming apparatus; a second step of assembling the third part to the main body by moving the third part in a second direction; and a third step of moving the first part in a third direction relative to the second part so as to release the engagement between the first engaging portion and the first engaged portion and engaging the second engaging portion of the first part with the second engaged portion of the second part.

[0006] The present disclosure also provides an image forming apparatus including: a first part

having a first engaging portion and a second engaging portion; a second part having a first engaged portion that is capable of being engaged with the first engaging portion and is not being engaged with the first engaging portion, and, a second engaged portion that is being engaged with the second engaging portion.
[0007] Further features of the present disclosure will become apparent from the following description of exemplary embodiments with reference to the attached drawings.

Description

BRIEF DESCRIPTION OF THE DRAWINGS
[0008] FIG. **1** is a schematic diagram of an image forming apparatus according to an embodiment.
[0009] FIG. **2** is a diagram showing the arrangement of a paper feed unit as seen from the bottom side of the first embodiment.
[0010] FIG. **3** is a diagram explaining the configuration of the paper feed unit of the first embodiment.
[0011] FIG. **4** is another diagram explaining the configuration of the paper feed unit of the first embodiment.
[0012] FIGS. **5**A and **5**B are external views of a first paper feed shaft support member of the first embodiment.
[0013] FIG. **6** is an external view of a paper feed stay of the first embodiment.
[0014] FIG. **7** is a diagram showing the process of assembling the paper feed unit of the first embodiment into the image forming apparatus.
[0015] FIG. **8** is a continuation of the diagram explaining the process of assembling the paper feed unit of the first embodiment into the image forming apparatus.
[0016] FIG. **9** is a continuation of the diagram explaining the process of assembling the paper feed unit of the first embodiment into the image forming apparatus.
[0017] FIG. **10** is a continuation of the diagram explaining the process of assembling the paper feed unit of the first embodiment into the image forming apparatus.
[0018] FIGS. **11**A to **11**C are diagrams showing the process of assembling the paper feed shaft support member into the paper feed stay.
[0019] FIG. **12** is a flowchart explaining the process of the first embodiment.
[0020] FIG. **13** is a diagram showing the process of assembling the paper feed unit of a comparative example into the image forming apparatus.
[0021] FIG. **14** is a continuation of the diagram explaining the process of assembling the paper feed unit of the comparative example into the image forming apparatus.
[0022] FIG. **15** is a continuation of the diagram explaining the process of assembling the paper feed unit of the comparative example into the image forming apparatus.
[0023] FIG. **16** is a continuation of the diagram explaining the process of assembling the paper feed unit of the comparative example into the image forming apparatus.
[0024] FIGS. **17**A and **17**B are diagrams showing the process of assembling a substrate holder of a second embodiment into the image forming apparatus.
[0025] FIGS. **18**A and **18**B are diagrams showing the process of assembling the substrate holder into the image forming apparatus.
[0026] FIGS. **19**A to **19**C are diagrams showing the process of assembling the substrate holder into the body frame.
DESCRIPTION OF THE EMBODIMENTS
[0027] The following is a detailed description of various embodiments, features, and aspects of the present disclosure, with reference to the drawings. However, unless otherwise specified, the dimensions, materials, shapes, and relative positions of the components described in these

embodiments are not intended to limit the scope of the present disclosure to these alone. Furthermore, the materials, shapes, and other aspects of the components described once in the following description are the same as those described initially, unless otherwise specified. In particular, general or known technologies in the technical fields can be applied to configurations and processes which are not specifically illustrated or described. Furthermore, duplicated descriptions may be omitted in some cases.

First Embodiment

[0028] An image forming apparatus according to a first embodiment and its assembling method will be described using figures. Here, the overall configuration of the image forming apparatus according to the present disclosure will be described first, and then a configuration for temporarily holding parts will be described.

[0029] Note that the present disclosure is applicable as long as a first part having a plurality of engaging portions is assembled into another part. The target to which the first part is assembled may be a single part (second part). In that case, the second part has a plurality of engaging portions corresponding to a plurality of engaged portions. In addition, a configuration may be adopted in which a plurality of engaging portions (for example, a first engaging portion and a second engaging portion) of the first part are each assembled into another part. In that case, a configuration may be adopted in which the second part has a first engaged portion corresponding to the first engaging portion, and the third part has a second engaged portion corresponding to the second engaging portion. The present disclosure is also applicable to a method of assembling an image forming apparatus having such a configuration. That is, the method is a method of assembling an image forming apparatus having a temporary holding step of temporarily holding the first part, and an assembly step of finally assembling the first part.

Overall Configuration of Image Forming Apparatus

[0030] The overall configuration and image forming process will be described with reference to FIG. **1**. However, the image forming apparatus according to the present disclosure is not limited to a laser beam printer, and may be applied to other image forming apparatuses such as copiers and facsimiles.

[0031] FIG. **1** is a cross-sectional view of an apparatus body A (electrophotographic image forming apparatus body, image forming apparatus body) and a cartridge B (process cartridge) of an electrophotographic image forming apparatus **100** according to the first embodiment. Here, the apparatus body A is the main body part of the image forming apparatus **100** excluding the cartridge B.

[0032] The electrophotographic image forming apparatus **100** shown in FIG. **1** is a laser beam printer using electrophotographic technology, in which the cartridge B is detachably mounted to the apparatus body A. The apparatus body A is provided with an exposure device **3** (laser scanner unit) for forming a latent image on an electrophotographic photosensitive drum (hereinafter simply referred to as a photosensitive drum **62**) of the cartridge B when the cartridge B is mounted on the apparatus body A. In addition, a sheet tray **4** which stores a recording medium (hereinafter referred to as a sheet material PA) on which an image is to be formed is arranged below the cartridge B. The photosensitive drum **62** is an image bearing member, and is a photosensitive member (electrophotographic photosensitive member) used for electrophotographic image formation.

[0033] Furthermore, in the apparatus body A, a pickup roller **5***a*, an opposing feed roller **5***b*, a feed roller **105***b*, a conveying roller pair **5***c*, a transfer roller **7**, a fixing device **9**, a discharge roller pair **10**, a discharge tray **11**, and the like are arranged in order along the conveying direction D of the sheet material PA.

Image Forming Process Section

[0034] Next, an outline of the image forming process will be described. Various operations during the process are executed by a control unit **150** of the image forming apparatus **100** controlling each component according to a program or user instructions. The control unit **150** is an information

processing device or processing circuit equipped with computing resources such as a processor and memory.

[0035] First, based on a print start signal from the control unit **150**, the photosensitive drum **62** is rotated in the direction of arrow R at a predetermined peripheral speed (process speed). A charging roller **66** (charging member) to which a bias voltage is applied contacts the outer peripheral surface of the photosensitive drum **62** and uniformly charges the outer peripheral surface of the photosensitive drum **62**.

[0036] The exposure device **3** outputs a laser beam L according to image information. The laser beam L passes through the laser aperture of the cartridge B and scans and exposes the outer peripheral surface of the photosensitive drum **62**. As a result, an electrostatic latent image corresponding to the image information is formed on the outer peripheral surface of the photosensitive drum **62**.

[0037] Meanwhile, the toner in the cartridge B is borne on the developing roller **32** and supplied to the photosensitive drum **62** to develop the latent image. As a result, the latent image is visualized as a toner image.

[0038] In addition, in synchronization with the output timing of the laser beam L, the sheet material PA stored in the lower part of the apparatus body A is sent out from the sheet tray **4** by the pickup roller **5***a*, the opposing feed roller **5***b*, the feed roller **105***b*, and the conveying roller pair **5***c* attached to the paper feed unit **101**. Then, the sheet material PA is conveyed to the transfer position between the photosensitive drum **62** and the transfer roller **7**. At this transfer position, the toner image is sequentially transferred from the photosensitive drum **62** to the sheet material PA.

[0039] The sheet material PA to which the toner image has been transferred is separated from the photosensitive drum **62** and conveyed to the fixing device **9**. Then, the sheet material PA is subjected to a pressure and heat fixing process in the nip portion constituting the fixing device **9**. As a result, the toner image is fixed to the sheet material PA. The sheet material PA to which the toner image has been fixed is discharged to the discharge tray **11** by the discharge roller pair **10**.

Configuration of Paper Feed Unit and Paper Feed Stay

[0040] Next, the configuration of the paper feed unit and paper feed stay of the image forming apparatus **100** will be described. FIG. **2** is a diagram showing the arrangement of the paper feed unit as seen from the bottom side in the first embodiment. FIGS. **3** and **4** are diagrams showing the configuration of the paper feed unit in the first embodiment. FIGS. **5**A and **5**B are external views of a first paper feed shaft support member in the first embodiment. FIG. **6** is an external view of the paper feed stay in the first embodiment.

[0041] FIG. **2** is a diagram showing the image forming apparatus as seen from the bottom side, in which the paper feed unit **101** and the paper feed stay **108** are attached to the pre-assembly apparatus body C. The paper feed stay **108** is a metal plate to which the paper feed unit **101** is attached, and the paper feed unit **101** is equipped with the pickup roller **5***a* and the feed roller **105***b* that conveys the sheet material PA to the conveying roller pair **5***c*. Here, the pre-assembly apparatus body C refers to a state before and after the paper feed unit **101** is assembled into the image forming apparatus, with the cartridge B excluded from the image forming apparatus, and has fewer assembled parts than the apparatus body A.

[0042] Here, a configuration is described in which the paper feed unit **101** as the first part is assembled into the pre-assembly apparatus body C as the second part. However, the second part does not have to be a single part, and for example, a first engaged portion and a second engaged portion may be provided on different parts.

[0043] FIG. **3** shows an external perspective view of the paper feed unit **101**. FIG. **4** shows an exploded view of the paper feed unit **101**. As shown in FIG. **3**, the paper feed unit **101** has a paper feed arm **102**, a paper feed shaft **103**, paper feed gears **104***a* and **104***b*, a pickup roller **5***a*, a feed roller **105***b*, a first paper feed shaft support member **106**, and a second paper feed shaft support member **107**.

[0044] The paper feed shaft **103** is a shaft that transmits the rotational drive to the feed roller **105***b*, the paper feed gear **104***b* is a gear that transmits the rotational drive of the paper feed shaft **103** to the paper feed gear **104***a*, and the pickup roller **5***a* is a roller that feeds the sheet material PA. The feed roller **105***b* is a roller that conveys the sheet material PA conveyed by the pickup roller **5***a* to the conveying roller pair **5***c* in the apparatus body A. The first paper feed shaft support member **106** and the second paper feed shaft support member **107** are parts that are attached to the paper feed shaft **103** and are positioned on the paper feed stay **108** in the pre-assembly apparatus body C. The paper feed arm **102** is a part that includes the paper feed gear **104***a* and the pickup roller **5***a* and is attached to the first paper feed shaft support member **106**.

[0045] As shown in FIG. **4**, the paper feed shaft **103** is attached to the paper feed gear **104***b*, the feed roller **105***b*, the first paper feed shaft support member **106**, and the second paper feed shaft support member **107**. The paper feed arm **102** is attached to the first paper feed shaft support member **106**, the paper feed arm **102** is attached to the paper feed gear **104***a* and the pickup roller **5***a*, and the paper feed gear **104***a* is connected to the paper feed gear **104***b* by a gear drive train. Therefore, when the paper feed shaft **103** rotates, the feed roller **105***b* and the paper feed gear **104***b* rotate, and the paper feed gear **104***a* connected to the paper feed gear **104***b* by a gear drive train and the pickup roller **5***a* coaxial with the paper feed gear **104***a* rotate.

[0046] FIG. **5**A shows an external perspective view of the first paper feed shaft support member **106**. FIG. **5**B shows a front view of the first paper feed shaft support member **106**.

[0047] The first paper feed shaft support member **106** shown in FIG. **5**A is provided with a first engaging portion **106***a* that is L-shaped in side view, and this shape is for temporarily holding the first paper feed shaft support member **106** on the paper feed stay **108**. The first paper feed shaft support member **106** is also provided with second engaging portions **106***b* and **106***c* that are L-shaped in side view and a positioning boss **106***d*, and this shape is for positioning the first paper feed shaft support member **106** on the paper feed stay **108**.

[0048] As shown in FIG. **5**B, the width of the shape of the first engaging portion **106***a* that engages with the paper feed stay **108** is indicated as L**1**, and the width of the shape of the second engaging portions **106***b* and **106***c* that engage with the paper feed stay **108** is indicated as L**2**.

[0049] In the paper feed stay **108** shown in FIG. **6**, the width of the first engaged portion **108***a* that engages with the first engaging portion **106***a* of the first paper feed shaft support member **106** is indicated as L**3**. The first engaged portion **108***a* is provided at one end of a hole **108***e* that has a shape having a long side and a short side. In addition, the width of the second engaged portions **108***b* and **108***c* that engage with the second engaging portions **106***b* and **106***c* of the first paper feed shaft support member **106** is indicated as L**4**. The second engaged portion **108***b* is provided at the other end of the hole **108***e*. The second engaged portion **108***c* is provided at one end of a hole **108***f* having a shape with a long side and a short side. The holes **108***e* and **108***f* are arranged on the paper feed stay **108** so that the long side direction and the short side direction are aligned and the other hole is located on the extension of one of the long sides. The second engaged portions **108***b* and **108***c* are provided on the same side in the long side direction (the left side in the figure) of the holes **108***e* and **108***f*, respectively. The paper feed stay **108** also has a positioning hole **108***d* that engages with the positioning boss **106***d*.

[0050] In this embodiment, the width L**1** of the first engaging portion **106***a* of the first paper feed shaft support member **106** is set to be larger than the width L**3** of the first engaged portion **108***a* of the paper feed stay **108** (L**1**>L**3**). Therefore, the first engaging portion **106***a* is lightly press-fitted into the first engaged portion **108***a* and temporarily held. It is preferable that the widths of L**1** and L**3** are set to such an extent that the first engaging portion **106***a* is lightly press-fitted into the first engaged portion **108***a*, and the widths are appropriately set according to the material of each member.

[0051] In addition, since the width L**2** of the second engaging portions **106***b* and **106***c* of the first paper feed shaft support member **106** is set smaller than the width L**4** of the second engaged

portions **108***b* and **108***c* of the paper feed stay **108** (L**2**<L**4**), the second engaging portions **106***b* and **106***c* are positioned by fitting into the second engaged portions **108***b* and **108***c*.

[0052] It is also possible to consider a configuration in which the first engaging portion **106***a* engages with both the first engaged portion **108***a* and the second engaged portion **108***b*. However, after the light press-fit between the first engaging portion **106***a* and the first engaged portion **108***a* is released, the first engaging portion **106***a* is scraped off and becomes smaller than the width L**1**. Therefore, if the first engaging portion **106***a* is positioned by fitting into the second engaged portion **108***b* when the width L**1** of the first engaging portion **106***a* is reduced, the mounting position of the parts will change, resulting in problems such as a deterioration in printing accuracy. Therefore, it is preferable to avoid engaging the first engaging portion **106***a* with the second engaged portion **108***b*.

Description of Paper Feed Unit Assembly

[0053] Next, the assembly operation of the paper feed unit according to this embodiment, the temporary holding operation, and the assembly completion operation will be described. FIGS. **7** to **10** are diagrams explaining the process of assembling the paper feed unit into the image forming apparatus. FIGS. **11**A to **11**C are diagrams explaining the process of assembling the first paper feed shaft support member into the paper feed stay. FIG. **12** is a flowchart explaining the process of assembling the first paper feed shaft support member into the paper feed stay.

[0054] Furthermore, FIGS. **13** to **16** are diagrams explaining the process of assembling the paper feed unit into the image forming apparatus when the configuration of this embodiment is not used.

[0055] In this embodiment, first, as shown in FIG. **7**, the paper feed unit **101** is placed in the pre-assembly apparatus body C in the direction of arrow E. At that time, as shown in FIG. **11**A, the protruding portions of the first engaging portion **106***a* and the second engaging portions **106***b* and **106***c* of the first paper feed shaft support member **106** are stationary in the holes **108***e* and **108***f* of the paper feed stay **108** (FIG. **12**, START.fwdarw.step S**1**)

[0056] Next, as shown in FIG. **8**, after placing the paper feed unit **101** on the paper feed stay **108**, a paper feed shaft support R**106** is temporarily held by the paper feed stay **108** by moving the paper feed unit **101** in the direction of arrow F. At that time, as shown in FIG. **11**B, the first engaging portion **106***a* of the first paper feed shaft support member **106** moves in the direction of arrow F and is lightly press-fitted into and engaged with the first engaged portion **108***a* of the paper feed stay **108**. Here, as shown in FIGS. **3** and **4**, the second paper feed shaft support member **107** can be removed from the paper feed shaft **103** in the direction of arrow F. However, the first paper feed shaft support member **106** is lightly press-fitted into the paper feed stay **108** and temporarily held therein, which restricts the amount of movement of the second paper feed shaft support member **107** and prevents the second paper feed shaft support member **107** from coming off (FIG. **12**, step S**1**.fwdarw.step S**2**). S**2** corresponds to the first step.

[0057] In this state, the first engaging portion **106***a* and the first engaged portion **108***a* are lightly press-fitted into each other, so the first paper feed shaft support member **106** is held by the paper feed stay **108** and will not come off unless a certain amount of pressure (opposite to the direction of arrow F) is applied to the first paper feed shaft support member **106**.

[0058] By doing so, even if some external force is applied to the pre-assembly apparatus body C in the subsequent assembly work, the first paper feed shaft support member **106** will not come off from the paper feed stay **108**, so it is possible to prevent the first paper feed shaft support member **106** from coming off during the assembly work and interfering with the assembly work of other parts.

[0059] Next, as shown in FIG. **9**, in a state in which the paper feed unit **101** is temporarily held in the pre-assembly apparatus body C, other parts of the image forming apparatus are assembled. At that time, the first paper feed shaft support member **106** maintains the state of FIG. **11**B (FIG. **12**, step S**2**.fwdarw.step S**3**). The other parts include, for example, a conveying guide **118**. As shown in FIG. **1**, the conveying guide **118** is a part that guides conveying between the opposing feed roller

5*b* and the conveying roller pair **5***c* when the sheet material PA loaded on the sheet tray **4** is conveyed to the conveying roller pair **5***c* by the pickup roller **5***a* and the opposing feed roller **5***b*. S**3** corresponds to the second step.

[0060] Here, in the posture during assembly of the parts, the conveying guide **118** has an overlapping portion that overlaps with the paper feed unit **101** in the direction of gravity. This overlapping portion corresponds to a third part. The conveying guide **118** itself, including the overlapping portion, may be considered as a third part. Therefore, if there was no temporary holding mechanism for the paper feed unit **101**, after assembling the conveying guide **118**, the worker would need to move the paper feed unit **101** in a direction different from the direction of gravity so as to enter the gap between the conveying guide **118** and the pre-assembly apparatus body C.

[0061] On the other hand, if there is a temporary holding mechanism, the worker can naturally move the paper feed unit **101** in the direction of gravity before assembling the conveying guide **118**. Then, the paper feed unit **101** is moved in a horizontal direction (in the first direction indicated by arrow F) and temporarily held, and then various components such as the conveying guide **118** are assembled. In assembling the conveying guide **118** into the main body, the second direction, which is the moving direction of the conveying guide **118**, is different from the first direction and the third direction described later. The second direction may be the direction of gravity, and in that case, the conveying guide **118** is assembled into the main body so that at least a part of the conveying guide **118** overlaps with the paper feed unit **101** when seen in the second direction. In the assembled state, the third part is downstream of the first part and faces the first part in the direction of gravity.

[0062] Then, as shown in FIG. **10**, the paper feed unit **101** is moved in the direction of arrow G (a third direction opposite to the first direction) different from the direction of arrow F (the first direction), and the assembly of the paper feed shaft support R**106** into the paper feed stay **108** is completed. The first direction and the third direction may be horizontal directions. In that case, the first direction and the third direction may be opposite directions. At that time, as shown in FIG. **11**C, the second engaging portions **106***b* and **106***c* of the first paper feed shaft support member **106** move in the direction of arrow G and engage with the second engaged portions **108***b* and **108***c* of the paper feed stay **108**. In addition, the positioning boss **106***d* of the first paper feed shaft support member **106** engages with the positioning hole **108***d* of the paper feed stay **108**, and the positioning is performed. In addition, when the paper feed unit **101** is moved in the direction of arrow G, the paper feed shaft **103** shown in FIGS. **3** and **4** engages with a gear coupling mechanism **109** shown in FIG. **9**, enabling drive transmission, and the assembly of the paper feed shaft **103** is completed.

[0063] The gear coupling mechanism **109** is a mechanism that includes a hole through which one end of the paper feed shaft **103** is inserted and a coupling portion at the tip of the hole. If the paper feed shaft **103** is the third engaging portion of the paper feed unit **101**, the coupling mechanism **109** corresponds to the third engaged portion that engages with the paper feed shaft **103** on the apparatus body side. In the axial direction of the paper feed shaft, the first engaging portion is located between the second engaging portion and the third engaging portion. The paper feed shaft **103** is a shaft that receives drive from the drive portion, and the first direction is the direction of the shaft. In this case, the assembly of the paper feed shaft **103** cannot be completed without movement in the direction of arrow G shown in FIG. **10**. Therefore, after waiting for the completion of the assembly of the parts that transmit drive into the paper feed shaft **103** in FIG. **9**, it is necessary to move the paper feed unit **101** in the direction of arrow G in FIG. **10** (FIG. **12**, step S**3**.fwdarw.step S**4**). S**4** corresponds to the third step.

[0064] In this embodiment, the movement direction for temporary holding (direction of arrow F) and the movement direction for completing assembly (direction of arrow G) are opposite to each other, but depending on the shape of the paper feed stay **108**, it is possible to make them the same direction or perpendicular to the direction of arrow G.

Comparative Example

[0065] FIGS. **13** to **16** show explanatory diagrams for assembling the paper feed unit into the pre-assembly apparatus body C when this embodiment is not used.

[0066] When this embodiment is not used, a paper feed unit **111**, in which the second paper feed shaft support member **107** is removed from the paper feed unit **101**, is placed on the pre-assembly apparatus body C along the trajectory in the direction of arrow K as shown in FIG. **13**. The reason why it cannot be placed straight like the direction of arrow E in FIG. **7** is that a complex trajectory is required so as not to collide with the parts assembled into the pre-assembly apparatus body C in FIG. **9**. With the trajectory in the direction of arrow K, the paper feed unit **111** cannot be assembled quickly and easily, and the assembly speed decreases.

[0067] Next, as shown in FIG. **14**, the paper feed unit **111** is moved in the direction of arrow G, and the first paper feed shaft support member **106** is assembled into the paper feed stay **108**.

[0068] Next, as shown in FIG. **15**, the second paper feed shaft support member **107** is placed on the pre-assembly apparatus body C along a trajectory in the direction of arrow M. Here, as with the paper feed unit **111** in FIG. **13**, it cannot be placed straight because a complex trajectory is required so as not to collide with the parts assembled into the pre-assembly apparatus body C in FIG. **9**, which slows down the assembly speed.

[0069] Then, as shown in FIG. **16**, the paper feed unit **111** is moved in the direction of arrow G, and the second paper feed shaft support member **107** is assembled into the paper feed stay **108**.

[0070] As a result, in the case of the comparative example as shown in FIGS. **13** to **16**, an assembly trajectory that is aimed at a limited gap is required so as not to collide with the parts already assembled, which slows down the assembly speed. Conversely, by using the configuration of this embodiment, the order of parts assembly can be changed, making it possible to further increase the assembly speed.

Effects of This Embodiment

[0071] With the above-described configuration, when assembling the paper feed unit **101** into the pre-assembly apparatus body C, the first engaging portion **106***a* of the first paper feed shaft support member **106** is lightly press-fitted into and engaged with the first engaged portion **108***a* of the paper feed stay **108**, so that the paper feed unit **101** can be temporarily held in the pre-assembly apparatus body C. By doing so, it is possible to assemble other surrounding parts of the image forming apparatus while the paper feed unit **101** is temporarily held as shown in FIG. **9**, and to complete the assembly of the paper feed unit **101** when this is completed.

[0072] If other parts of the image forming apparatus are assembled before assembling the paper feed unit **101**, the assembly trajectory of the paper feed unit **101** will interfere with the other parts. As a result, it may become impossible to place the paper feed unit **101** in the pre-assembly apparatus body C, or the assembly trajectory may be aimed at a limited gap, which slows down the assembly speed. On the other hand, if the paper feed unit **101** is assembled first, there is a concern that the paper feed unit **101** may come off from the pre-assembly apparatus body C during the assembly of other parts. Thus, a function for temporarily holding the paper feed unit **101** on the pre-assembly apparatus body C is necessary. If space is secured around the paper feed unit **101** to ensure assembly space, the paper feed unit **101** can be assembled, but this increases the size of the image forming apparatus and increases costs. In addition, the paper feed unit **101** can be temporarily held by using an assembly jig or a separate part that temporarily holds the paper feed unit **101** during assembly, but this increases the number of assembly steps, which increases the cost of assembly.

[0073] Therefore, in this embodiment, a configuration is adopted in which a temporary holding engaging portion and an assembly completion engaging portion are provided on the parts when assembling parts into the image forming apparatus. Then, the assembly completion engaging portion is not used when the temporary holding engaging portion is used, and the temporary holding engaging portion is not used when the assembly completion engaging portion is used. By

doing so, even if the parts are arranged in a narrow space, the paper feed unit can be temporarily held and assembled. As a result, it is possible to prevent the image forming apparatus from becoming larger due to the need for assembly space, and to prevent the cost from increasing due to the need to use additional parts for assembly work.

Second Embodiment

[0074] In the first embodiment, a case where a paper feed unit is assembled into an image forming apparatus has been described. However, the units and parts to be assembled are not limited to the paper feed unit, and any parts that can be attached to and detached from an image forming apparatus may be used. For example, the present disclosure can be applied when assembling a substrate holder of a main body unit into a body frame.

[0075] Next, the assembly operation of the substrate holder and the body frame according to the second embodiment, and the temporary holding and assembly completion operations will be described. The assembly operation is performed in the order of (1) attaching the substrate holder, (2) moving the substrate holder to the temporary holding position, (3) attaching the cables to the electric substrate of the substrate holder, and (4) moving the substrate holder to the assembly completion position.

[0076] FIGS. **17**A, **17**B, **18**A, and **18**B are diagrams explaining the process of assembling the substrate holder into an image forming apparatus. FIGS. **19**A to **19**C are diagrams for explaining the process of assembling the substrate holder into a body frame formed by assembling a first body frame **202** and a second body frame **203** into a third body frame **204**.

[0077] (1) First, as shown in FIG. **17**A, the substrate holder **201** is placed on the first body frame **202** and the second body frame **203** in the direction of arrow H. At that time, as shown in FIG. **19**A, the protruding portions of the first engaging portion **201***a* and the second engaging portions **201***b* and **201***c* of the substrate holder **201** are stationary in the holes **203***e* and **203***f* of the second body frame **203**.

[0078] Next, as shown in FIG. **17**B, the substrate holder **201** is moved in the direction of arrow J, so that the substrate holder **201** is temporarily held by the second body frame **203**. At this time, as shown in FIG. **19**B, the first engaging portion **201***a* of the substrate holder **201** moves in the direction of arrow J and is lightly press-fitted into and engaged with the first engaged portion **203***a* of the second body frame **203**.

[0079] In this state, the first engaging portion **201***a* and the first engaged portion **203***a* are lightly press-fitted into each other, so the substrate holder **201** is held by the second body frame **203**. At this time, the substrate holder **201** will not come off from the second body frame **203** unless a certain amount of pressure (in the direction opposite to arrow J) is applied.

[0080] Next, as shown in FIG. **18**A, with the substrate holder **201** temporarily held by the second body frame **203**, the cable **205** is passed through the hole **204***a* of the third body frame **204**. Then, the cable **205** is connected to the cable connector of the electric substrate (not shown) attached to the substrate holder **201**. At this time, the substrate holder **201** maintains the state shown in FIG. **19**B. Therefore, the gap L**5** between the substrate holder **201** and the third body frame **204** is wider than that in FIG. **17**A, and it is possible to secure a working space for passing the cable **205** through the gap L**5** and connecting it to the cable connector of the electric substrate (not shown).

[0081] Then, as shown in FIG. **18**B, the substrate holder **201** is moved in the direction of arrow K, and the substrate holder **201** is completely assembled into the second body frame **203**. At that time, as shown in FIG. **19**C, the second engaging portions **201***b* and **201***c* of the substrate holder **201** move in the direction of arrow K and engage with the second engaged portions **203***b* and **203***c* of the second body frame **203**. In addition, the positioning boss **201***d* of the substrate holder **201** engages with the positioning hole **203***d* of the second body frame **203**, and the substrate holder **201** is positioned.

Effects of This Embodiment

[0082] With the above-described configuration, when the substrate holder **201** is assembled into the

body frame, the first engaging portion **201***a* of the substrate holder **201** is lightly press-fitted into and engaged with the first engaged portion **203***a* of the second body frame **203**, so that the substrate holder **201** can be temporarily held on the second body frame **203**.
[0083] By doing so, as shown in FIG. **18**A, the gap L**5** between the substrate holder **201** and the third body frame **204** is wider than that in FIG. **17**A. This makes it possible to secure a working space for passing the cable **205** through the gap L**5** and connecting it to the cable connector of the electric substrate (not shown). By securing the working space, it becomes possible to insert a finger into the gap L**5** and pass the cable **205** through the gap L**5** to connect it to the cable connector of the electric substrate (not shown).
[0084] Here, if the length of the cable **205** is designed to be the minimum necessary to reduce costs, the cable **205** may not be able to be assembled before the substrate holder **201** is assembled into the second body frame **203** because the cable length is insufficient. Or, even if the substrate holder **201** can be assembled into the second body frame **203**, the cable may come off while the substrate holder **201** is being assembled into the second body frame **203**.
[0085] By adopting the configuration of the second embodiment, it is possible to reduce the cost of the cable and improve the assembly stability while preventing the main body from becoming larger due to the need to secure assembly space.
[0086] According to the present disclosure, it is possible to provide an image forming apparatus equipped with a temporary holding mechanism during part assembly.
[0087] While the present disclosure has been described with reference to exemplary embodiments, it is to be understood that the disclosure 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.
[0088] This application claims the benefit of priority from Japanese Patent Application No. 2024-021767, filed on Feb. 16, 2024, which is hereby incorporated by reference herein in its entirety.

Claims

1. A method of assembling an image forming apparatus, wherein the image forming apparatus including: a first part having a first engaging portion and a second engaging portion; a second part having a first engaged portion configured to engage with the first engaging portion and a second engaged portion configured to engage with the second engaging portion, the second part being assembled with the first part; and a third part, the method comprising: a first step of engaging the first engaging portion of the first part with the first engaged portion of the second part by moving the first part in a first direction relative to the second part assembled into a main body of the image forming apparatus; a second step of assembling the third part to the main body by moving the third part in a second direction; and a third step of moving the first part in a third direction relative to the second part so as to release the engagement between the first engaging portion and the first engaged portion and engaging the second engaging portion of the first part with the second engaged portion of the second part.
2. The method of assembling the image forming apparatus according to claim 1, wherein the second direction is the direction of gravity, and in the second step, the third part is assembled into the main body so as to overlap with the first part when seen in the second direction.
3. The method of assembling the image forming apparatus according to claim 2, wherein the first direction and the third direction are horizontal directions, and the first direction is opposite to the third direction.
4. The method of assembling the image forming apparatus according to claim 3, wherein the main body has a third engaged portion, the first part has a third engaging portion engaged with the third engaged portion, in the first direction, the second engaging portion is located between the first engaging portion and the third engaging portion, and in the third step, the first part is moved in the

third direction relative to the second part so as to release the engagement between the first engaging portion and the first engaged portion, so that the third engaging portion engages with the third engaged portion.

5. The method of assembling the image forming apparatus according to claim 4, wherein the first part is a paper feed unit for feeding a recording material, the paper feed unit has a shaft that receives drive, and the first direction is the direction of the shaft.

6. The method of assembling the image forming apparatus according to claim 4, wherein the first part is a substrate holder that is attached to a body frame of the image forming apparatus.

7. The method of assembling the image forming apparatus according to claim 1, wherein one of the first engaging portion and the first engaged portion has a hole shape and the other has a protruding portion that fits into the hole, and when the first engaging portion and the first engaged portion engage with each other, they are in a lightly press-fit state.

8. An image forming apparatus comprising: a first part having a first engaging portion and a second engaging portion; a second part having a first engaged portion that is capable of being engaged with the first engaging portion and is not being engaged with the first engaging portion, and, a second engaged portion that is being engaged with the second engaging portion.

9. The image forming apparatus according to claim 8, further comprising: a third part that is downstream of the first part in the direction of gravity and faces the first part in the direction of gravity.

10. The image forming apparatus according to claim 9, further comprising: a third engaging portion, wherein the first part having a third engaging portion that is being engaged with the third engaged portion, and the second engaging portion is located between the first engaging portion and the third engaging portion in a first direction that is a horizontal direction.

11. The image forming apparatus according to claim 10, wherein the first part that is a paper feed unit that feeds a recording material, the paper feed unit has a shaft that receives drive, and the first direction is the direction of the shaft.

12. The image forming apparatus according to claim 10, wherein the first part is a substrate holder that is attached to a body frame of the image forming apparatus.

13. The image forming apparatus according to claim 8, wherein one of the first engaging portion and the first engaged portion has a hole shape and the other has a protruding portion that fits into the hole, and when the first engaging portion and the first engaged portion engage with each other, they are in a lightly press-fit state.