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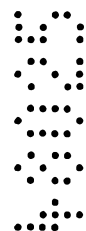
(56) Related Art
US 5909607
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**Toner Container, Toner Container Assembling Method,
Process Cartridge, and Electrophotographic Image Forming Apparatus**

Abstract of the Disclosure

A toner container (11A) for containing toner to be used for developing a latent
5 image formed on an electrophotographic photosensitive member (7) by developing
device (9), usable with a process cartridge (B) detachably mountable to a main
assembly of an electrophotographic image forming apparatus (A), the process cartridge
(B) containing the photosensitive member (7) and the developing device (9), the
container (11A) includes a first frame (11) having a toner supply opening for supplying
10 the toner to the developing device (9) and a mounting portion for mounting a rotatable
stirring member (9b) for stirring the toner contained in the toner container; a second
frame (12) coupled with the first frame (11) and having an outward projection without
interference with a rotational region of the stirring member (9b); wherein the toner
container (11A) is formed by coupling the first frame (11) and second frame (12).

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ORIGINAL

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Invention Title:	Toner Container, Toner Container Assembling Method, Process Cartridge, and Electrophotographic Image Forming Apparatus

The following statement is a full description of this invention, including the best method of performing it known to me/us:-

TONER CONTAINER, TONER CONTAINER ASSEMBLING METHOD,
PROCESS CARTRIDGE, AND
ELECTROPHOTOGRAPHIC IMAGE FORMING APPARATUS

5 FIELD OF THE INVENTION AND RELATED ART

The present invention relates to a toner container, an assembly method for the toner container, a process cartridge and an image forming apparatus usable with the process cartridge.

10 Here, the electrophotographic image forming apparatus means an apparatus which forms images on recording medium, using an electrophotographic image forming process. It includes an electrophotographic copying machine, an electrophotographic printer (for
15 example, LED printer, laser beam printer), an electrophotographic facsimile machine, an electrophotographic word processor, and the like.

The process cartridge means a cartridge having as a unit an electrophotographic photosensitive
20 member, and charging means, developing means and cleaning means, which is detachably mountable to a main assembly of an image forming apparatus. It may include as a unit an electrophotographic
25 photosensitive member and at least one of charging means, developing means and cleaning means. It may include as a unit developing means and an electrophotographic photosensitive member.

An image forming apparatus using electrophotographic process is known which is used with the process cartridge. This is advantageous in that the maintenance operation can be, in effect, carried out by the users thereof without expert service persons, and therefore, the operativity can be remarkably improved. Therefore, this type is now widely used.

Some of the process cartridges of this type comprises a toner container.

However, in order to increase the amount of the containable toner, the container volume must be increased, which is rather difficult. Beside, assuming it is possible to successfully increase the container volume, there rises another problem in that a method for efficiently feed out the toner from the large capacity toner container must be devised.

Thus, the present invention was made to further develop the aforementioned art.

SUMMARY OF THE INVENTION

In accordance with one aspect of the invention there is provided a process cartridge detachably mountable to a main assembly of an image forming apparatus, comprising:

- (i) an electrophotographic photosensitive member;
- (ii) a developing member configured and positioned with respect to said electrophotographic photosensitive member to develop a latent image formed on said electrophotographic photosensitive member;
- (iii) a developer accommodating container configured to accommodate a developer to be used by said developing member to develop the latent image; and
- (iv) a driving force transmission member, said developer container including:

- (a) a developer stirring member configured and positioned to stir the developer which is contained in said developer accommodating container and which is to be fed toward said developing member, said developer stirring member being driven by said driving force transmission member;

- (b) a first frame including:
 - a supporting portion, provided at a longitudinal end of said first frame, configured and positioned to support an end of said developer stirring member;
 - an end opening, provided at the other longitudinal end of said first frame, configured and positioned to permit transmission of a rotational driving force from said driving force transmission member to said developer stirring member;



a developer supply opening configured and positioned to permit the developer to pass toward said developing member, the developer supply opening extending in a longitudinal direction; and

a developer filling opening configured and positioned to permit the developer accommodating container to be filled with developer; and

(c) a second frame connected with said first frame so as to close said first frame, thus constituting with said first frame said developer accommodating container for the developer; and

(d) a gripping portion configured and positioned to permit said process cartridge to be gripped, said gripping portion being constituted by a part of said first frame and a part of said second frame.

In accordance with a second aspect of the invention there is provided a process cartridge detachably mountable to a main assembly of an electrophotographic image forming apparatus, said process cartridge comprising:

(i) an electrophotographic photosensitive drum;

(ii) a helical gear, provided at a longitudinal end of said photosensitive drum, configured and positioned to receive a driving force from the main assembly when said process cartridge is mounted to the main assembly;

(iii) a charging member configured and positioned to electrically charge said photosensitive drum;

(iv) a drum frame configured and positioned to support said photosensitive drum and said charging member;

(v) a developing roller configured and positioned to develop a latent image formed on said photosensitive drum;

(vi) a developing frame configured and positioned to support said developing roller; and

(vii) a developer accommodating container configured and positioned to accommodate a developer to be used by said developing roller to develop the latent image, said developer accommodating container being connected with said developing frame;

(viii) a driving force transmission member, said developer accommodating container including:

(a) a developer stirring member configured and positioned to stir the developer that is contained in said developer accommodating container and that



is to be fed toward said developing roller, said developer stirring member being driven by said driving force transmission member;

(b) a first frame including:

a supporting portion, provided at a longitudinal end of said first frame, configured and positioned to support an end of said developer stirring member;

an end opening, provided at the other longitudinal end of said first frame, configured and positioned to permit transmission of a rotational driving force from the driving force transmission member to said developer stirring member;

a developer supply opening configured and positioned to permit the developer to pass toward said developing roller, the developer supply opening extending in a longitudinal direction; and

a developer filling opening configured and positioned to permit the developer accommodating container to be filled with developer; and

(c) a second frame connected with said first frame so as to close said first frame, thus constituting with said first frame said developer accommodating container for the developer, wherein said developing frame and said developer accommodating container connected with each other are rotatably connected with said drum frame;

(ix) a removable toner seal configured and positioned to seal said developer supply opening, wherein said toner seal is pulled out of said process cartridge before said process cartridge is mounted to the main assembly by which the developer supply opening is opened; and

(x) a gripping portion configured and positioned to permit said process cartridge to be gripped provided in said first frame and said second frame, wherein said end opening and said developer filling opening are provided at the same side in the longitudinal direction of said first frame.

In accordance with a third aspect of the invention there is provided a process cartridge detachably mountable to a main assembly of an electrophotographic image forming apparatus, said process cartridge comprising:

(i) an electrophotographic photosensitive drum;

(ii) a first helical gear, provided at a longitudinal end of said photosensitive drum, configured and positioned to receive a driving force from the main assembly when said process cartridge is mounted to the main assembly;



(iii) a charging roller configured and positioned to electrically charge said photosensitive drum, wherein said charging roller is contacted to said photosensitive drum;

5 (iv) a drum frame configured and positioned to support said photosensitive drum and said charging roller;

(v) a developing roller configured and positioned to develop a latent image formed on said photosensitive drum, wherein said developing roller is provided at a longitudinal end thereof with a second helical gear engaged with said first helical gear to
10 receive a driving force for rotating said developing roller;

(vi) a developing frame configured and positioned to support said developing roller; and

(vii) a developer accommodating container configured and positioned to accommodate a developer to be used by said developing roller to develop the latent
15 image, said developer accommodating container being connected with said developing frame;

(viii) a driving force transmission member, said developer accommodating container including:

(a) developer stirring member configured and positioned to stir the
20 developer that is contained in said developer accommodating container and that is to be fed toward said developing roller, said developing stirring member being driven by said driving force transmission member;

(b) a first frame including:

a supporting portion, provided at a longitudinal end of said first frame,
25 configured and positioned to support an end of said developer stirring member;

an end opening, provided at the other longitudinal end of said first frame, in which said driving force transmission member is supported, configured and positioned to permit transmission of a rotational driving force to said developer stirring member through said second helical gear;

30 a developer supply opening configured and positioned to permit the developer to pass toward said developing roller, the developer supply opening extending in a longitudinal direction; and

a developer filling opening configured and positioned to permit the developer accommodating container to be filled with developer; and



(c) a second frame connected with said first frame so as to close said first frame, thus constituting with said first frame the developer accommodating container, wherein said developing frame and said developer accommodating container connected with each other are rotatably connected with said drum frame;

(ix) a removable toner seal configured and positioned to seal said developer supply opening, wherein said toner seal is pulled out of said process cartridge before said process cartridge is mounted to the main assembly by which the developer supply opening is opened; and

(x) a gripping portion configured and positioned to permit said process cartridge to be gripped provided in said first frame and said second frame,

wherein said end opening and said developer filling opening are provided at the same side in the longitudinal direction of said first frame,

(xi) a side cover configured and positioned to cover said end opening and side developer filling opening, and wherein said side cover is provided with a developing bias contact for receiving, from the main assembly, a developing bias voltage to be applied to said developing roller when said process cartridge is mounted to the main assembly,

wherein said first and second frames are made of plastic resin material.

In accordance with another aspect of the invention there is provided a developer accommodating container for accommodating a developer to be used by a developing member to develop a latent image formed on an electrophotographic photosensitive member in a process cartridge, said developer accommodating container comprising:

(a) a developer stirring member configured and positioned to stir the developer which is contained in said developer accommodating container and which is to be fed toward said developing member, said developer stirring member being driven by a driving force transmission member;

(b) a first frame including:

a supporting portion, provided at a longitudinal end of said first frame, configured and positioned to support an end of said developer stirring member;

an end opening, provided at the other longitudinal end of first frame, configured and positioned to permit transmission of a rotational driving force from a driving force transmission member to said developer stirring member;



a developer supply opening configured and positioned to permit the developer to pass toward said developing member, the developer supply opening extending in a longitudinal direction; and

5 a developer filling opening configured and positioned to permit the developer accommodating container to be filled with developer; and

(c) a second frame connected with said first frame so as to close said first frame, thus constituting with said first frame said developer accommodating container for the developer; and

10 (d) a gripping portion configured and positioned to permit said process cartridge to be gripped, said gripping portion being constituted by a part of said first frame and a part of said second frame.

In accordance with another aspect of the invention there is provided a developer accommodating container for accommodating a developer to be used by a developing roller supported by a developing frame in a process cartridge to develop a latent image formed on an electrophotographic photosensitive drum having a helical gear at one end thereof for receiving a driving force a main assembly of an electrophotographic image forming apparatus, being charged by a charging member, and being supported by a drum frame that also supports the charging member, said developer accommodating container comprising:

20 (a) a developer stirring member configured and positioned to stir the developer that is contained in said developer accommodating container and that is to be fed toward the developing roller, said developer stirring member being driven by a driving force transmission member;

25 (b) a first frame including:
a supporting portion, provided at a longitudinal end of said first frame, configured and positioned to support an end of said developer stirring member;

an end opening, provided at the other longitudinal end of said first frame, configured and positioned to permit transmission of a rotational driving force from the driving force transmission member to said developer stirring member,

30 a developer supply opening configured and positioned to permit the developer to pass toward the developing roller, the developer supply opening extending in a longitudinal direction; and

(c) a second frame connected with said first frame so as to close said first frame, thus constituting with said first frame said developer accommodating container



developer, wherein the developing frame and said developer accommodating container connected with each other are rotatably connected with the drum frame;

(d) a removable toner seal configured and positioned to seal said developer supply opening, wherein said toner seal is pulled out of said process cartridge before the process cartridge is mounted to the main assembly by which the developer supply opening is opened; and

(e) a gripping portion configured and positioned to permit said process cartridge to be gripped provided in said first frame and said second frame,

wherein said end opening and said developer filling opening are provided at the same side in the longitudinal direction of said first frame.

In accordance with another aspect of the invention there is provided a developer accommodating container for accommodating a developer to be used by a developing roller supported by a developing frame in a process cartridge to develop a latent image formed on an electrophotographic photosensitive drum having a first helical gear at one end thereof for receiving a driving force from a main assembly of an electrophotographic image forming apparatus and for transmitting a driving force to the developing roller by engaging a second helical gear at one longitudinal end of the developing roller, being charged by a charging roller, and being supported by a drum frame that also supports the charging roller, said developer accommodating container comprising:

(a) a developer stirring member configured and positioned to stir the developer that is contained in said developer accommodating container and that is to be fed toward the developing roller, said developing stirring member being driven by a driving force transmission member;

(b) a first frame including:

a supporting portion, provided at a longitudinal end of said first frame, configured and positioned to support an end of said developer stirring member;

an end opening, provided at the other longitudinal end of said first frame, in which the driving force transmission member is supported, configured and positioned to permit transmission of a rotational driving force to said developer stirring member through the second helical gear;

a developer supply opening configured and positioned to permit the developer to pass toward the developing roller, the developer supply opening extending in a longitudinal direction; and

a developer filling opening configured and positioned to permit the developer accommodating container to be filled with developer; and



(c) a second frame connected with said first frame so as to close said first frame thus constituting with said first frame the developer accommodating container connected with each said developing frame and said developer accommodating container
5 connected with each other are rotatably connected with said drum frame;

(d) a removable toner seal configured and positioned to seal said developer supply opening, wherein said toner seal is pulled out of the process cartridge before the process cartridge is mounted to the main assembly by which the developer supply opening opened; and

10 (e) a gripping portion configured and positioned to permit the process cartridge to be gripped provided in said first frame and said second frame,

wherein said end opening and said developer filling opening are provided at the same side in the longitudinal direction of said first frame,

(f) a side cover configured and positioned to cover said end opening and
15 said developer filling opening, and wherein said side cover is provided with a developing bias contact for receiving, from the main assembly, a developing bias voltage to be applied to the developing roller when said process cartridge is mounted to the main assembly,

wherein said first and second frames are made of plastic resin material.

20 In accordance with another aspect of the invention there is provided an electrophotographic image forming apparatus, for forming an image on a recording material, having a main assembly to which a process cartridge is detachably mountable, said apparatus comprising:

a mounting member for mounting thereon a process cartridge including:

25 (i) an electrophotographic photosensitive member;
(ii) a developing member configured and positioned with respect to said electrophotographic photosensitive member to develop a latent image formed on said electrophotographic photosensitive member;

(iii) a developer accommodating container configured to accommodate a
30 developer to be used by said developing member to develop the latent image; and a driving force transmission member, said developer accommodating container including:

(a) a developer stirring member configured and positioned to stir the developer which is contained in said developer accommodating container and which to be



fed toward said developing member, said developer stirring member being driven by said driving force transmission member;

(b) a first frame including a supporting portion, provided at a longitudinal end of said first frame, configured and positioned to support an end of said developer stirring member; an end opening, providing at the other longitudinal end of said first frame, configured and positioned to permit transmission of a rotational driving force from said driving force transmission member to said developer stirring member; a developer supply opening configured and positioned to permit the developer to pass toward said developing member, the developer supply opening extending in a longitudinal direction; and a developer filling opening configured and positioned to permit the developer accommodating container to be filled with developer;

(c) a second frame connected with said first frame so as to close said first frame, thus constituting with said first frame said developer accommodating container for the developer; and

(d) a gripping portion configured and positioned to permit said process cartridge to be gripped, said gripping portion being constituted by a part of said first frame and a part of said second frame;

a gear engageable with said electrophotographic photosensitive member when said process cartridge is mounted to said mounting member to transmit a driving force to said electrophotographic photosensitive member; and

a feeding member rotatable to feed the recording material through a path to receive the latent image developed by said developing member.

In accordance with another aspect of the invention there is provided an electrophotographic image forming apparatus, for forming an image on a recording material, having a main assembly to which a process cartridge is detachably mountable, said apparatus comprising:

a mounting member for mounting thereon a process cartridge including:

(i) an electrophotographic photosensitive drum;

(ii) a helical gear, provided at a longitudinal end of said photosensitive drum, configured and positioned to receive a driving force from the main assembly when said process cartridge is mounted to the main assembly;

(iii) a charging member configured and positioned to electrically charge said photosensitive drum;

(iv) a drum frame configured and positioned to support said photosensitive drum and said charging member;



(v) a developing roller configured and positioned to develop a latent image formed on said photosensitive drum;

(vi) a developing frame configured and positioned to support said developing roller; and

(vii) a developer accommodating container configured and positioned to accommodate a developer to be used by said developing roller to develop the latent image, said developer accommodating container being connected with said developing frame;

(viii) a driving force transmission member said developer accommodating container including:

(a) a developer stirring member configured and positioned to stir the developer that is contained in said developer accommodating container and that is to be fed toward said developing roller, said developer stirring member being driven by said driving force transmission member;

(b) a first frame including: a supporting portion, provided at a longitudinal end of said first frame configured and positioned to support an end of said developer stirring member; an end opening, provided at the other longitudinal end of said first frame, configured and positioned to permit transmission of a rotational driving force from the driving force transmission member to said developer stirring member; a developer supply opening configured and positioned to permit the developer to pass toward said developing roller, the developer supply opening extending in a longitudinal direction; and

a developer filling opening configured and positioned to permit the developer accommodating container to be filled with developer; and

(c) a second frame connecting with said first frame so as to close said first frame, thus constituting with said first frame said developer accommodating container for the developer, wherein said developing frame and said developer accommodating container connected with each other are rotatably connected with said drum frame;

(ix) a removable toner seal configured and positioned to seal said developer supply opening, wherein said toner seal is pulled out of said process cartridge before said process cartridge is mounted to the main assembly by which the developer supply opening is opened; and



(x) a gripping portion configured and positioned to permit said process cartridge to be gripped provided in said first frame and said second frame,

wherein said end opening and said developer filling opening are provided at the same side in the longitudinal direction of said first frame;

a gear engageable with said helical gear when said process cartridge is mounted to said mounting member to transmit a driving force to the helical gear and said electrophotographic photosensitive drum; and

a feeding member rotatable to feed the recording material through a path to receive the latent image developed by said developing roller.

In accordance with another aspect of the invention there is provided an electrophotographic image forming apparatus, for forming an image on a recording material, having a main assembly to which a process cartridge is detachably mountable, said apparatus comprising:

a mounting member for mounting thereon a process cartridge including:

(i) an electrophotographic photosensitive drum;

(ii) a first helical gear, provided at a longitudinal end of said photosensitive drum, configured and positioned to receive a driving force from the main assembly when said process cartridge is mounted to the main assembly;

(iii) a charging roller configured and positioned to electrically charge said photosensitive drum, wherein said charging roller is contacted to said photosensitive drum;

(iv) a drum frame configured and positioned to support said photosensitive drum and said charging roller;

(v) a developing roller configured and positioned to develop a latent image formed on said photosensitive drum, wherein said developing roller is provided at a longitudinal end thereof with a second helical gear engaged with said first helical gear to receive a driving force for rotating said developing roller;

(vi) a developing frame configured and positioned to support said developing roller; and

(vii) a developer accommodating container configured and positioned to accommodate a developer to be used by said developing roller to develop the latent image, said developer accommodating container being connected with said developing frame;



(viii) a driving force transmission member, said developer accommodating container including:

5 (a) a developer stirring member configured and positioned to stir the developer that is contained in said developer accommodating container and that is to be fed toward said developing roller, said developing stirring member being driven by said driving force transmission member;

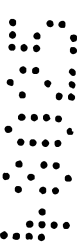
10 (b) a first frame including: a supporting portion, provided at a longitudinal end of said first frame, configured and positioned to support an end of said developer stirring member; an end opening, provided at the other longitudinal end of said first frame, in which said driving force transmission member is supported, configured and positioned to permit transmission of a rotational driving force to said developer stirring member through said second helical gear; a developer supply opening configured and positioned to permit the developer to pass toward said developing roller, the developer supply opening extending in a longitudinal direction; and a developer filling opening configured and positioned to permit the developer accommodating container to be filled with developer; and

15 (c) a second frame connected with said first frame so as to close said first frame, thus constituting with said first frame the developer accommodating container wherein said developing frame and said developer accommodating container connected with each other are rotatably connected with said drum frame;

20 (ix) a removable toner seal configured and positioned to seal said developer supply opening, wherein said toner seal is pulled out of said process cartridge before said process cartridge is mounted to the main assembly by which the developer supply opening is opened; and

25 (x) a gripping portion configured and positioned to permit said process cartridge to be gripped provided in said first frame and said second frame, wherein said end opening and said developer filling opening are provided at the same side in the longitudinal direction of said first frame,

30 (xi) a side cover configured and positioned to cover said end opening and said developer filling opening, and wherein said side cover is provided with a developing bias contact for receiving, from the main assembly, a developing bias voltage to be



applied to said developing roller when said process cartridge is mounted to the main assembly, wherein said first and second frames are made of plastic resin material:

a gear engageable with said first helical gear when said process cartridge is mounted to said mounting member to transmit a driving force to said electrophotographic photosensitive drum; and

a feeding member rotatable to feed the recording material through a path to receive the latent image developed by said developing roller.

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Figure 2 show an outer appearance of the apparatus of Figure 1.

Figure 3 is a side sectional view of a process cartridge according to an embodiment of the present invention.

Figure 4 shows a schematic outer appearance of the process cartridge of Figure 3.

Figure 5 is a right side view of the process cartridge of Figure 3.

Figure 6 is a left side view of the process cartridge of Figure 3.

Figure 7 shows an outer appearance of the process cartridge of Figure 3.

Figure 8 shows an outer appearance of the process cartridge of Figure 3, as seen from the bottom.

Figure 9, (a) shows an outer appearance of a cleaning unit of the process cartridge of Figure 3.

Figure 9, (b) shows an outer appearance of a developing unit of the process cartridge of Figure 3.

Figure 10 is a side view illustrating mounting and demounting operation of the process cartridge of Figure 3 relative to the main assembly of the image forming apparatus.

Figure 11 is a side view illustrating mounting and demounting operation of the process cartridge of Figure 3 relative to the main assembly of

the image forming apparatus.

Figure 12 is a side view illustrating mounting and demounting operation of the process cartridge of Figure 3 relative to the main assembly of
5 the image forming apparatus.

Figure 13 is a side view illustrating mounting and demounting operation of the process cartridge of Figure 3 relative to the main assembly of the image forming apparatus.

10 Figure 14 is a side view illustrating mounting and demounting operation of the process cartridge of Figure 3 relative to the main assembly of the image forming apparatus.

15 Figure 15 is a side view illustrating mounting and demounting operation of the process cartridge of Figure 3 relative to the main assembly of the image forming apparatus.

20 Figure 16 is a side view illustrating mounting and demounting operation of the process cartridge of Figure 3 relative to the main assembly of the image forming apparatus.

25 Figure 17 is a side view illustrating mounting and demounting operation of the process cartridge of Figure 3 relative to the main assembly of the image forming apparatus.

Figure 18 is a perspective view of an inside of the main assembly of the apparatus.

Figure 19, (a) is a perspective view of an inside of the main assembly of the apparatus.

Figure 19, (b) is a side view of an inside of the main assembly of the apparatus.

5 Figure 20 shows contact between a contact member and a contact point.

Figure 21 shows contact between a contact member and a contact point.

10 Figure 22 is a side view of a process cartridge according to an embodiment of the present invention.

Figure 23, (a) shows an outer appearance of a developing holder.

15 Figure 23, (b) is a perspective view of an inside of a developing device holder.

Figure 24 is a sectional view taken along a line I-I in Figure 23, (a).

Figure 25 is an enlarged view of a toner detection point in Figure 23.

20 Figure 26 is an exploded perspective view of a developing unit.

Figure 27 is a perspective view of a developing device frame or developing frame.

25 Figure 28 is a perspective view of a developing unit without the developing holder.

Figure 29 is a perspective view of a toner frame.

Figure 30 is a perspective view of the toner frame after a toner seal is mounted.

Figure 31 is a longitudinal sectional view of the toner seal of Figure 30.

5 Figure 32 is a sectional view taken along a line RO-RO of Figure 3.

Figure 33 is an exploded perspective view of a toner frame.

10 Figure 34 is a bottom view of a process cartridge.

Figure 35 is a side view illustrating a gear train of Figure 28.

Figure 36 is a side view of a toner frame.

15 Figure 37 show an internal structure of a process cartridge.

Figure 38 illustrates a coupling between a developing unit and a cleaning unit.

Figure 39 illustrates separation between a toner container and a developing frame.

20 Figure 40 illustrates a process cartridge acct a further embodiment of the present invention.

DETAILED DESCRIPTION OF THE PRESENT INVENTION

25 Hereinafter, the preferable embodiments of the present invention will be described. In the following descriptions, the widthwise direction of a process cartridge B means the direction in which the

process cartridge B is inserted or removed from the
main assembly 14 of an image forming apparatus
(hereinafter, apparatus main assembly). This
direction coincides with the direction in which the
5 recording medium is conveyed. The longitudinal
direction of the process cartridge B means the
direction perpendicular
(substantially) to the direction in which the process
cartridge B is inserted or removed from the apparatus
10 main assembly 14. This direction intersects with (is
substantially perpendicular to) the direction in which
the recording medium is conveyed. Figure 1 is a
schematic view of an embodiment of the
electrophotographic image forming apparatus (laser
15 beam printer) in accordance with the present
invention, and Figure 2 is an external perspective
view thereof. Figures 3 - 8 are drawings depicting an
embodiment of the process cartridge in accordance with
the present invention. Figure 3 is a sectional side
20 view of the process cartridge; Figure 4, an external
perspective view thereof; Figure 5, a right side view
thereof; Figure 6, a left side view thereof; Figure 7,
a perspective view as seen from above; and Figure 8 is
a perspective view as seen from below. Also in the
25 following description, the top surface of the process
cartridge B means the surface which faces upward when
the process cartridge B is in the apparatus main

assembly 14, and the bottom surface means the surface which faces downward when the process cartridge B is in the main assembly means 14.

5 [Electrophotographic Image Forming Apparatus A and Process Cartridge B]

To begin with, referring to Figures 1 and 2, a laser beam printer as an electrophotographic image forming apparatus, to which the embodiment of the present invention has been applied, will be described. Figure 3 is a side view of a process cartridge B.

Referring to Figure 1, this laser beam printer A is of a type which forms an image on recording medium, for example, recording paper, OHP sheet, or fabric, through the electrophotographic image forming process. First, a toner image is formed on a drum shaped electrophotographically sensitive member (hereinafter, photosensitive drum) as an image bearing member. More specifically, the photosensitive drum is charged by charging means, and then, a laser beam is projected onto the charged photosensitive member from optical means in response to imaging data, to form a latent image on the photosensitive member in response to the imaging data. Next, this latent image is developed into a toner image by developing means. Meanwhile, a sheet of recording medium 2 placed in a cassette 3a is conveyed, being thereby fed out, by a

conveying means 3 comprising a pair of pickup rollers 3b and 3c, and a pair of registration rollers 3d and 3e, and the like, in synchronism with the toner image formation. Next, a voltage is applied to a transfer roller 4 as transferring means, whereby the toner image formed on the photosensitive drum, which a process cartridge B comprises, is transferred onto the recording medium 2. Then, the recording medium having received the toner image is delivered to a fixing means 5. This fixing means 5 comprises a driving roller 5c and a fixing roller 5b containing a heater 5a, and applies heat and pressure to the recording medium 2, which is passed through the fixing means 5, whereby the transferred toner image is fixed. Next, the recording medium 2 now bearing the fixed toner image conveyed and discharged into a discharge tray 6, through a sheet-reversing path 3j, by a group of discharging roller pairs 3g, 3h and 3i. This discharge tray 6 is provided on the top surface of the apparatus main assembly 14 of the image forming apparatus A. The apparatus A comprises also a pivotable flapper 3k and a discharge roller pair 3m, and when this flapper 3k is operated, the recording medium 2 can be discharged without being flipped over through the discharge roller pair 3m, without going through the sheet-reversing path 3j. In this embodiment, the aforementioned pickup roller 3b,

conveyer roller pairs 3c and 3d, register roller 3e, conveyer guide 3f, discharge roller pairs 3g, 3h and 3i, and discharge roller pair 3m constitute conveying means.

5 Referring to Figures 3 - 8, in the process cartridge B, the surface of a photosensitive drum 7 as the image bearing member with a photosensitive layer 7e (Figure 20) is uniformly charged by applying a voltage to a charging roller 8, which is a charging means, while the photosensitive drum 7 is rotated. 10 Next, a laser beam carrying the image data is projected by an optical system 1 onto the photosensitive drum 7 through an exposure opening 9, whereby a latent image is formed on the photosensitive drum 7. This latent image is developed with toner by a developing means 9. 15

The charging roller 8 is placed in contact with the photosensitive drum 7 to charge the photosensitive drum 7, wherein this charging roller 8 is rotated by the rotation on the photosensitive drum 7. The developing means 9 develops the latent image formed on the photosensitive drum 7, by supplying the toner to the photosensitive drum 7, on the regions to be developed. The optical system 1 comprises a laser diode 1a, a polygon mirror 1b, a lens 1c, and a full reflection mirror 1d. 20 25

As the toner stirring member 9b of the

aforementioned developing means 9 is rotated, the
developing means 9 stirs the toner within the toner
container 11A, and sends it toward the developing
roller 9c, and as a developing roller 9c, in which a
5 magnet is fixed, is rotated, a layer of toner
triboelectrically charged by a developing blade 9d is
formed on the surface of the developing roller 9c.
The toner is supplied from this toner layer to the
photosensitive drum 7, on the region to be developed.
10 As the toner is transferred onto the photosensitive
drum 7 in correspondence with the latent image, the
latent image is visualized. This developing blade 9d
regulates the amount of the toner coated on the
peripheral surface of the developing roller 9c. Also,
15 stirring members 9e and 9f for stirring and
circulating the toner are rotatively mounted adjacent
to the developing roller 9c.

Next, a voltage with a polarity opposite to
that of the toner image is applied to the transfer
20 roller 4, whereby the toner image on the
photosensitive drum 7 is transferred onto the
recording medium 2. Then, the residual toner on the
photosensitive drum 7 is removed by a cleaning means
10. The cleaning means 10 comprises an elastic
25 cleaning blade 10a, which is disposed in contact with
the photosensitive drum 7. The toner remaining on the
photosensitive drum 7 is scraped off by the elastic

cleaning blade 10a to be collected in a waste toner collector 10b.

The process cartridge B is formed by combining: a toner chamber portion 11 of the cartridge frame (hereinafter toner chamber frame), which constitutes a portion of the toner container 11A (toner containing portion) for storing the toner; a developing chamber portion 12 of the frame (hereinafter, developing chamber frame), which contains the developing means such as the developing roller 9c; and a cleaning means portion 13 of the frame (hereinafter, cleaning means frame), which comprises the photosensitive drum 7, cleaning means such as the cleaning blade 10a, charging roller 8, and the like. This process cartridge B is removably installed in the apparatus main assembly 14 by an operator.

The process cartridge B is provided with an exposure opening 1e, which allows the light beam carrying the image data to be irradiated onto the photosensitive drum 7, and a transfer opening 13n, which allows the photosensitive drum 7 to face directly the recording medium 2. More specifically, the exposure opening 1e is provided in the cleaning means portion 13, and the transfer opening 13n is formed between the developing chamber portion 12 and cleaning means portion 13.

Next, the structure of the housing of an embodiment of the process cartridge B according to the present invention will be described.

This process cartridge B is assembled in the following manner. First, the toner chamber frame 11 and developing chamber frame 12 are joined. Then, the cleaning means frame 13 is rotatively attached to the structure formed by joining the preceding two frame portions, completing thereby a cartridge housing. 10
Next, the aforementioned photosensitive drum 7, charging roller 8, developing means 9, cleaning means 10 and the like are disposed within the housing to complete the process cartridge B. The process 15
cartridge B is removably installed in a cartridge installing means provided within the apparatus main assembly 14.

[Structure of Housing of Process Cartridge B]

20

The housing of the process cartridge B is constructed by joining the toner chamber frame 11, developing chamber frame 12, and cleaning means frame 13, and its structure will be described below.

25

Referring to Figures 3 and 9, the toner chamber frame 11 comprises a toner storing container portion 11A, in which the toner stirring member 9b for



stirring and sending out the contained toner is mounted. The developing roller 9c and developing blade 9d are mounted on the developing chamber frame 12, and the stirring members 9e and 9f, which
5 circulate the toner within the developing chamber, are rotatively mounted adjacent to the developing roller 9c. Further, an antenna rod 9h is disposed adjacent to the developing roller 9c, substantially in parallel thereto. The
10 aforementioned toner chamber frame 11 and developing chamber frame 12 are melt-welded (by the ultrasonic welding in this embodiment) to form a developing unit D as an integral second frame member (refer to Figure 9(b)).

15 The photosensitive drum 7, charging roller 8, and cleaning means 10 are mounted on the cleaning means frame 13. Further, a drum shutter member 18, which covers and protects the photosensitive drum 7 when the process cartridge B is out of the apparatus
20 main assembly 14, is attached to the cleaning means portion 13 of the frame to form a cleaning unit C as the first frame member (refer to Figure 9(a)).

Then, the developing unit D and cleaning unit C are joined with a joining member 22, in such a
25 manner as to be pivotable relative to each other, to complete the process cartridge B. More specifically, referring to Figure 9, an axis 20 is provided at the

end of an arm portion 19 formed at each of the longitudinal ends (in the axial direction of the developing roller 2c) of the developing chamber portion 12 of the frame (refer to Figure 9(b)). On the other hand, a recessed portion 21, in which the axis 20 is fitted to fix the positional relationship between the developing D and cleaning unit C, is provided at each of the longitudinal ends of the cleaning means portion 13 of the frame (refer to Figure 9(a)). The joining member 22 is mounted on the cleaning means portion 13 of the frame by inserting the axis 20 into the recessed portion 21, whereby the developing and cleaning units D and C are joined in a manner so as to pivot relative to each other about the axis 20. The joining member 22 is provided with a compression spring 22a, so that the developing chamber frame 12 is pressed downward to reliably press the developing roller 9 toward the photosensitive drum 7. Further, a spacer ring 9i having a larger diameter than the developing roller 9 is provided at each of the longitudinal end portions of the developing roller 9, wherein this ring 9i is pressed on the photosensitive drum 7 to keep a predetermined distance (approximately 300 μm) between the photosensitive drum 7 and developing roller 9c. Thus, the positional relationship between the peripheral surface of the photosensitive drum 7 and the peripheral surface of

the developing roller 9c can be precisely maintained by the elastic force of the compression spring 22a.

[Structure of Guiding Means of Process Cartridge B]

5 Next, guiding means, which guides the cartridge B when the cartridge B is installed into the apparatus main assembly 14 or removed therefrom, will be described referring to Figures 4 - 9, wherein Figure 5 is a right-hand side view of the cartridge B relative to the direction of an arrow mark X, in which the cartridge B is inserted into the apparatus main assembly 14 (right-hand side as seen from the developing unit D side), and Figure 6 is a left-hand side view of the same.

10 As is evident from the drawings, the guiding means, which serves as a guide when the process cartridge B is inserted into the apparatus main assembly 14 or removed therefrom, is provided on each of the longitudinal end surfaces of the housing 100. This guiding means comprises a cylindrical guide 13a as a first guiding member, a long guide 12a as a second guiding member, and a short guide 13b as a third guiding member.

15 The cylindrical guide 13a, that is, a cylindrical member, projects outward from the lateral surface of the cleaning means frame 13, in line with

the axis of the photosensitive drum 7. It supports
the drum shaft 7a, which supports the photosensitive
drum 7, in such a manner as not to rotate it. The
long guide 12a is provided on each of the longitudinal
5 end surfaces of the developing chamber frame 12, and
bridges the surfaces of the developing chamber frame
12 and cleaning means frame 13. The short guide 13b
is provided on each of the longitudinal end surfaces
of the cleaning means frame 13, above the cylindrical
10 guide 13a. More specifically, the long guide 12a is
integrally formed on developing roller holders 40 and
41 (refer to Figure 23), which will be described
later. Further, the cylindrical guide 13a and short
guide 13b are integrally formed on the cleaning means
15 frame 13.

The long guide 12a extends in the direction
(arrow X direction), in which the cartridge B is
inserted, and its angle is set to be substantially
equal to an angle at which the process cartridge B is
20 inserted. The cylindrical guide 13a is disposed so as
to be fall in the path of the imaginary extension of
the long guide 12a in the cartridge inserting
direction, and the short guide 13b is substantially
parallel to the long guide 13a. Referring to Figure
25 6, the cylindrical guide 13a, second guide member 12a,
third guide member 13b are also provided on the
longitudinal side surface opposite to the one

illustrated in Figure 10, and their configuration and positions are the same as those shown in Figure 5.

These three guiding members project substantially the same distance from the external surface of the cleaning means frame 13 and developing chamber frame 12, which are in the same plane.

Hereinafter, more detailed description will be given.

The cylindrical guide 13a as the first guiding member is provided on each of the lateral surfaces C1 (right-hand side 13c) and C2 (left-hand side 13d) of the cleaning unit C, wherein the side C1 is the right-hand side portion 13c of the cleaning means frame 13, relative to the axial direction of the photosensitive drum 7, as the cartridge B is seen from the developing unit D side (as the cartridge B is seen from the downstream side of the cartridge B inserting direction). The other side C2 is the left-hand side portion of the cleaning means frame 13, relative to the axial direction of the photosensitive drum 7. This cylindrical guide 13a is a cylindrical member, which projects from each of both longitudinal end surfaces 13c and 13d of the cleaning means frame 13 in the axial direction of the photosensitive drum 7. The drum shaft 7a is supported by this cylindrical member 13a, which fits around the drum shaft 7a. In other words, the drum shaft 7a is

guided by the guiding member 16a, which will be described later, with the cylindrical member 13a being interposed, and then, the position of the drum shaft 7a is fixed by a groove 16a5 (refer to Figures 10 - 5 17).

The long guide 12a as the second guide member is provided on each of the longitudinal end surfaces D1 (right-hand portion 12c) and D2 (left-hand side 12d) of the developing unit D, wherein one surface, 10 D1, of the lateral portion is the right-hand portion 12c, relative to the axial direction of the photosensitive drum 7, of the developing chamber frame portion 12, and the other surface, D2, is the left-hand side portion 12d, relative to the axial direction 15 of the photosensitive drum 7, of the developing chamber frame portion 12. The long guide 12a is disposed away from the cylindrical guide 13a, being on the upstream side of the cylindrical guide 13a, relative to the cartridge inserting direction (arrow X 20 direction). More precisely, the long guide 12a is disposed within a region L formed between the top and bottom imaginary lines 111 and 112 (Figure 5) extended parallel in the inserting direction and tangentially from the peripheral surface of the cylindrical guide 13a, and this long guide 12a bridges between the 25 developing chamber frame portion 12 and cleaning means frame portion 13, with its inserting end portion 12a1

extending over the lateral surface area of the cleaning frame portion 13 (by an approximate distance of 1 mm to 3 mm).

The short guide 13b as the third guiding member is provided on the lateral surfaces 13c and 13d of the cleaning unit C, above the cylindrical guide 13a. More specifically, the short guide 13b is substantially directly above the cylindrical guide 13a as seen from the cartridge inserting direction. In other words, the short guide 13b is disposed within the region 15 formed between two parallel lines 113 and 114, which are drawn in such a manner as to be tangent to the peripheral surface of the cylindrical guide 13a and substantially perpendicular to the cartridge inserting direction (arrow X direction). In addition, the short guide 13b is substantially parallel to the long guide 13a.

Here, typical measurements of the guiding members will be listed. Hereinafter, a tolerable range means the measurement range adopted in this embodiment of the process cartridge.

The cylindrical guide 13a is approximately 10.0 mm in diameter (tolerable range of 7.5 mm to 10.0 mm); the long guide 12a, approximately 36.0 mm in length (tolerable range of 15.0 mm to 41.0 mm) and approximately 8.0 mm in width (tolerable range of 1.5 mm to 10.0 mm); and short guide 13b is

approximately 10.0 mm in length (tolerable range of
3.0 mm to 17.0 mm) and approximately 4.0 mm (tolerable
range of 1.5 mm to 7.0 mm) in width. Further, the
distance between the peripheral surface of the
5 cylindrical guide 13a and the inserting end portion
12a1 of the long guide 12a is approximately 9.0 mm.

The distance between the peripheral surface
of the cylindrical guide 13a and the bottom end tip
13b1 of the short guide 13b is approximately 7.5 mm
10 (tolerable range of 5.5 mm to 9.5 mm).

Next, a regulatory contact portion 13e and a
disengagement contact portion 13f, which are provided
on the top surface 13d of the cleaning unit C, will be
described. Here, the top surface means such a portion
15 of the leaning unit C surface that is going to face
upward when the process cartridge B is installed into
the apparatus main assembly 14. In this embodiment,
it is the top surface 13i of the cleaning unit C.

The regulatory contact portion 13e and
20 disengagement contact portion 13f are provided on each
of the right lateral end portion 13c and left lateral
end portion 13d of this surface 13i. This regulatory
contact 13e fixes the position of the process
cartridge B in the apparatus main assembly 14. More
25 specifically, when the process cartridge B is inserted
into the apparatus main assembly 14, the contact 13e
comes in contact with a fixing member 25 provided on

the apparatus main assembly 14 (Figures 10 - 17),
whereby the position of the process cartridge B is
regulated. The disengagement contact portion 13f
displays its function when the process cartridge B is
5 removed from the apparatus main assembly 14. More
specifically, when the process cartridge B is taken
out of the apparatus main assembly 14, it comes in
contact with the fixing member 25 to permit a moment
to function to smoothly remove the cartridge B. The
10 steps for installing or removing the process cartridge
B will be described later with reference to Figures 10
- 17.

Describing in more detail, a recessed portion
13g is provided on the cleaning unit C, on the top
15 surface 13i of the cleaning unit C, at each of the
lateral edges relative to the cartridge inserting
direction. This recess portion 13g is provided with:
the first slanted surface 13g1, which extends upward
toward the rear from the leading end of the cartridge
20 B relative to the inserting direction (arrow X
direction); the second slanted surface 13g3, which
extends downward toward the rear from the top end 13g2
of the slanted surface 13g3; and the fourth slanted
surface 13g5, which extends further downward toward
25 the rear from the bottom end 13g4 of the slanted
surface 13g3. At the bottom end 13g6 of the slanted
surface 13g5, a wall (slanted or inclined surface)

13g7 is provided. The second slanted surface 13g3 corresponds to the regulatory contact portion 13e, and the wall 13g7 corresponds to the disengagement contact portion 13f.

5 Here, the typical measurements of the portions described above will be listed.

The regulatory contact portion 13e is angled by 0 degree relative to the horizontal direction X (Figure 5) of the cartridge B in the apparatus main assembly 14, and is approximately 6.0 mm in length (tolerable range of 4.5 mm to 8.0 mm). The disengagement contact portion 13f is slanted by θ_1 (approximately 45 degrees) relative to the horizontal direction 1, and is approximately 10.0 mm in length (tolerable range of 8.5 mm to 15.0 mm).

[Steps for Installing or Removing Process Cartridge]

Next, the steps for installing the process cartridge B into the apparatus main assembly 14, or removing it therefrom, will be described with reference to Figures 10 - 19.

Let it be assumed that the process cartridge B structured as described above can be installed into the cartridge accommodating means provided within the apparatus main assembly 14, and can be removed therefrom.

Referring to Figures 18 and 19, as an

operator opens a pivotal cover 35 by pivoting it about
a supporting point 35a, a cartridge accommodating
space S, and left and right cartridge installation
guides 16, which are mounted on the corresponding
5 sides of the apparatus main assembly 14, are exposed.
Each of the cartridge installation guides 16 comprises
a pair of guide portions of its own, that is, a first
guide portion 16a and a second guide portion 16b,
which correspond to the same on the opposite side.
10 The installation of the process cartridge B into the
apparatus main assembly 14 is accomplished by
inserting the process cartridge B along the guide
portions 16a and 16b and closing the cover 15. As for
the inserting direction of the cartridge B, it is a
15 direction which intersects with the axial line of the
photosensitive drum 7; more specifically, such a
direction that is substantially perpendicular to the
axial line of the photosensitive drum 7 as illustrated
in Figures 10 - 17. In this case, the cleaning unit C
20 side is the leading side and the developing unit D
side is the tailing side.

A recessed portion 17 is provided on the
cartridge B, at each of the longitudinal ends, which
makes it easier for an operator to hold it during its
25 installation or removal (see Figure 3); the operator
uses both hands to hang onto the recessed portions, as
handholds, of the process cartridge when installing or

removing it.

Further, the process cartridge B comprises a drum shutter 18 (see Figure 3), the movement of which is linked to the movement of the cartridge B during its installation or removal. When the cartridge B is removed from the laser beam printer assembly, the shutter 18 is closed to protect the portion of the photosensitive drum 7 which faces the transfer opening. This shutter member 18 is connected to each of the tips of an arm 18a and a link member 18b, being thereby supported, both of which are rotatively supported on the cleaning means frame 13 as illustrated in Figure 6. Also referring to Figure 6, as the process cartridge B is inserted in the apparatus main assembly 14 in the arrow X direction, the leading end of the lever 23, which is fixed to the arm 18a by its base portion, strikes a stopper (unillustrated) fixed on the apparatus main assembly 14, whereby the lever 23 is rotated about a supporting point 18c where the shutter arm 18a is supported, opening thereby the shutter member 18. As the process cartridge B is taken out of the apparatus main assembly 14, the shutter member 18 is closed due to the elastic force of a torsion spring 23a.

The first guide portion 16a is the bottom portion of the guide member 16, and guides the long guide 12a and cylindrical guide 13a provided on the

process cartridge B side. This first guide portion
16a comprises a main guide portion 16a1, a stepped
portion 16a2, a recessed portion 16a3, an auxiliary
guide portion 16a4, and a positioning groove 16a5,
5 which are disposed in this order from the upstream
side toward the downstream relative to the inserting
direction. The main guide portion 16a1 guides the
long guide 12a and cylindrical guide 13a. The
auxiliary guide portion 16a4 guides the cylindrical
10 guide 13a into the positioning groove 16a5. The
positioning groove 16a5 is where the cylindrical guide
13a is fitted to regulate the position of the
cartridge B in the apparatus main assembly 14. The
second guide portion 16b is the upper portion of the
15 guide member 16, and comprises a slanted surface 16b1
and a recess 16b2, which are disposed in this order
from the upstream side toward the downstream relative
to the inserting direction.

Further, in the cartridge accommodating space
20 S of the apparatus main assembly 14, a fixed member 25
(member for regulating the rotation) is provided on
the left and right sides. It is fixed to a stay 27.
This fixed member 25 comes in contact with the
aforementioned regulatory contact portion 13e to
25 regulate the clockwise rotation of the cartridge B
(Figure 15). More specifically, the cartridge B is
accurately positioned in the apparatus main assembly

14 as the cylindrical guide 13a fits into the groove
16a5 and the regulatory contact 13e comes in contact
with the fixed member 25. Further, when the cartridge
B is taken out, the fixed member 25 comes in contact
5 with the disengagement contact portion 13f to
facilitate the smooth removal of the cartridge B.

Further, in the cartridge accommodating space
S, a pressing member 26 is disposed on the left and
right sides (refer to Figures 10 - 19). This pressing
10 member 26 pressed in the clockwise direction (Figures
10 - 17) by the elastic force of a coil spring 26a is
rotatable about a fulcrum 26b, and elastically presses
the top surface of the cartridge B, whereby the
cartridge B is prevented from being vibrated when the
15 apparatus A is subjected to vibration or the like.

Next, the relationship between the
installation guide 16 provided on the apparatus main
assembly 14 and the guide members 12a, 13a and 13b
provided on the cartridge B, during the installation
or removal of the cartridge B, will be described with
20 reference to the drawings. Figures 10 - 15 are
schematic drawings, which depict the steps for
installing the process cartridge B from the beginning
of the cartridge installation to the moment when the
process cartridge B is finally positioned in a
25 predetermined location. In Figures 10 and 15, the
full side view of the process cartridge B is depicted

with a solid line, and the installation guide member of the apparatus main assembly 14 is depicted with a double dot chain line (imaginary line). In Figures 11 - 14, which depict intermediary steps of the cartridge installation, only the guide members of the process cartridge B are depicted with the solid line, and the other portions are depicted with the double dot chain lines.

First, referring to Figure 10, at the beginning of the cartridge B installation into the apparatus main assembly 14 by an operator, the cylindrical guide 13a and long guide 12a of the cartridge B are guided by the guide portion 16a in such a manner as to slide thereon. At this moment, the short guide 13b is not guided by the guide portion 16b, being away from it by a predetermined distance E (in this embodiment, approximately 2.0 mm to 4.0 mm).

Also at this moment, the pressing member 26 rotates upward following the slanted surface 13i provided on the top surface of the cartridge B, so that it does not interfere with the cartridge installation. As the cartridge B is being further inserted, the pressing member 26 keeps on sliding on the top surface of the cartridge B, checking thereby the upward movement of the cartridge B. Even after the cartridge B has been installed in the apparatus A, the pressing member 26 keeps on pressing on the top

surface of the cartridge B as long as the cartridge B is in the apparatus A.

Next, when the process cartridge B has been further inserted and is in the state depicted in Figure 11, the cylindrical guide 13a is ready to pass the stepped portion 16a2 provided on the first installation guide portion 16a and to move onto the recess portion 16a3 provided also on the first installation guide portion 16a. This recessed portion 16a3 of the guide portion 16a is to let go the long guide 12a when the process cartridge B is inserted to a predetermined point (Figure 15), and its depth m (in this embodiment, approximately 4.0 mm to 8.0 mm) is set to be larger than the aforementioned distance E ($E < M$). It should be noted that at this moment, the short guide 13b is not in contact with the second guide portion 16b (upwardly slanted surface 16b1).

Next, as the process cartridge B is further inserted till the state depicted in Figure 12 is realized, the short guide 13b makes contact with the guide portion 16b before the cylindrical guide 13a of the cartridge B reaches the bottom of the recessed portion 16a3.

In other words, at this time, both the long and short guides 12a and 13b serve as the insertion guide, whereby the shock, which might be imparted on the cartridge B by the stepped portion or the like, is

reduced.

As the process cartridge B is further inserted, the state illustrated in Figure 13 is realized. In this state, the trailing end of the long guide 12a of the process cartridge B is at the edge of the recessed portion 16a3 of the first guide portion 16a, and the cylindrical guide 13a of the process cartridge B is in contact with the auxiliary guide portion 16a4, being ready to follow the guide portion 16a4. Next, the cylindrical guide 13a and short guide 13b of the process cartridge B are guided by the first guide portion 16a and second guide portion 16b, respectively (Figure 14).

Next, as the cartridge B is further inserted and the state illustrated in Figure 14 is realized, the short guide 13b comes to the recessed portion 16b2 of the second guide portion 16b. For a short period in which this short guide 13b drops into the recessed portion 16b2, only the cylindrical guide 13a is in contact with the apparatus main assembly 14, at the auxiliary guide portion 16a4; therefore, the process cartridge B slightly rotates in the counterclockwise direction, and lastly, the cylindrical guide 13a drops into the groove 16a5 of the guide portion 16a (Figure 15). At substantially the same time, the regulatory contact portion 13c provided on the cleaning means frame portion 13 comes in contact with the rotation

regulating portion 25a (Figure 15) of the fixed member 25 fixed to the apparatus main assembly 14. As a result, the overall position and orientation of the process cartridge B within the apparatus A is fixed.

5 In this state, the position of the process cartridge B is fixed by the cylindrical guide 13a alone, and the other guides (long and short guides 12a and 13b) are not in contact with any portion of the installation guide member 16 of the apparatus main assembly 14; therefore, the position of the cartridge B is accurately fixed.

The positional relationship between the regulatory contact portion 13e and rotation regulating portion 25a, which will be described later in detail, is such that the moment, which is generated on the process cartridge B as the process cartridge B is driven, is received by the contact between regulatory contact portion 13e and rotation regulating portion 25a. The distance from the contact point between the regulatory contact portion 13e and rotation regulating portion 25 to the center of the cylindrical guide 13a is longer than the distance between the long guide 12a and the center of the cylindrical guide 13a, and the distance between the short guide 13b and center of the cylindrical guide 13a. Therefore, the orientation of the process cartridge B remains more stable when the process cartridge B is driven.

In a state shown in Figure 15, a helical drum gear 7b provided on the photosensitive drum 7, at one of the axial ends, engages with a driving helical gear 28 provided on the apparatus main assembly 14. Thus, 5 the driving force is transmitted from the apparatus main assembly 14 to the photosensitive drum by way of the gears 28 and 7b, wherein as the driving force is transmitted from the helical gear 28 to helical gear 7b, the cartridge B is subjected to a 10 force that works in the clockwise direction (Figure 17). However, the movement generated on the cartridge B is regulated by the contact portion 13e.

The pressing member 26 presses down the process cartridge B from above. Therefore, even if 15 the cylindrical guide 13a fails to drop into the groove 16a5 of the apparatus main assembly 14, a moment is generated about the contact point between the rotation regulating portion 25a and contact portion 13e, whereby the cylindrical guide 13a is 20 caused to drop into the groove 16a5.

Next, referring to Figures 16 and 17, the steps for taking the process cartridge B out of the apparatus main assembly 14 will be described. In the drawing, the direction indicated by an arrow Y is the 25 direction in which the process cartridge B is removed.

Referring to Figure 16, when the process cartridge B is to be removed from the apparatus main

assembly 14, the operator grabs a handle portion 17
(to provide the handle, recessed portions, are formed
on the cartridge B) and lifts the cartridge B by the
handle portion 17 (direction of an arrow a), whereby
5 the process cartridge B is rotated counterclockwise
about the cylindrical guide 13a. As a result, the
disengagement contact portion 13f of the process
cartridge B makes contact with the disengagement
contact portion 25b of the fixed member 25 provided on
10 the apparatus main assembly 14. As the process
cartridge B is further lifted, it is rotated about the
contact point F between the disengagement contact
portion 13f and disengagement contact portion 25b of
the fixed member 25. As a result, the cylindrical
15 guide 13a is lifted out of the groove 16a5. At this
moment, the engagement between the drum gear 7b and
driving gear 28 is smoothly broken. In this state,
the process cartridge B can be pulled straight out of
the apparatus A, following the steps depicted in
20 Figures 14, 13, 12, 11 and 10 in that order.

As described above, according to this
embodiment, the long guide as the second guide member
is extended in the cartridge inserting direction in
such a manner as to bridge the lateral surfaces of the
25 developing unit D and cleaning unit C; therefore, the
process cartridge is prevented from wobbling during
the installation or removal. As a result, the

cartridge installation becomes more reliable, which improves the operational efficiency.

The guiding means, which serves as the guide when the process cartridge is inserted into the apparatus main assembly 14 or removed therefrom, is constituted of three guide members: cylindrical guide 13a, long guide 12a, and short guide 13b, and the process cartridge B is guided by at least two guides during its installation or removal; therefore, even if there is a stepped portion or the like on the installation guide members of the apparatus main assembly 14, the shock, to which the process cartridge B might be subjected, is cushioned.

The position of the process cartridge B is fixed by the rotation regulating portion 25a oriented to control the moment, which is generated on the cartridge B as the cartridge is driven, and the cylindrical guide 13a, whereas the other guides (long and short guides 12a and 13b) remain in non-contact with the guide members of the apparatus main assembly 14; therefore, the orientation of the process cartridge B remains more stable while the image forming apparatus is driven (during the image formation).

As for the guiding means for installing or removing the cartridge B, the embodiment described above exemplifies a guiding means comprising three

guide members positioned at different locations. However, the embodiment described above is not limited to this example, but instead, it may be a guiding means comprising at least a cylindrical guide as the first guide member, and a long guide as the second guide member, or a guiding means comprising an additional guide member or guide members besides the three mentioned above. Such an arrangement can also stabilize the cartridge B during the installation or removal, and improves the operational efficiency.

Referring to Figures 9, (a) and 9, (b), a spur gear 7n is disposed on the photosensitive drum 7, at the end opposite, relative to the axial direction, to the end where the drum gear 7b is disposed. When the process cartridge B is mounted in the apparatus main assembly 14, this spur gear 7n engages with a gear (unillustrated), which is disposed in the apparatus main assembly 14 on the same axis as the transfer roller 4. As it engages with the unillustrated gear, the driving force is transmitted from the process cartridge to rotate the transfer roller 4.

A reference numeral 9u designates a helical gear, which is disposed at one of the axial ends of the developing roller 9c. It engages with the aforementioned spur gear 7b, whereby the driving force for rotating the developing roller 9c is transmitted

by way of the helical drum gear 7b.

[Toner Container Frame (toner container)] .

5 Referring to Figures 3, 29, 30, 32 and 33, a
toner container frame (toner container) will be
described in detail. Figure 29 is a perspective view
before a toner seal is welded; Figure 30, a
perspective view after the toner is filled; Figure 32,
a plan view a top frame 11a; and Figure 33 is a
10 perspective view of the disassembled toner container
frame.

A toner container frame 11 is constituted of
two components: a top frame 11a (first frame) and a
bottom frame 11b (second frame). On each of the
15 longitudinal end surfaces of the top frame 11a, a
recessed portion 17 is provided. It is disposed close
to the top surface of the top frame, and serves as the
handhold described above. The bottom frame 11b is
provided with a number of ribs 11c. They are disposed
20 in parallel to the longitudinal direction of the
process cartridge B, with intervals of approximately 5
mm, on the exterior surface, which becomes the bottom
portion when the process cartridge B is assembled.
When grasping the process cartridge B, the operator
25 uses both hands, holding onto the recessed portion 17
and ribs 11c. In this case, the ribs 11c prevent the
hands from slipping when grasping the process

cartridge B. The top and bottom frames 11a and 11b are joined at a welding surface U, and the welding rib is melted by forced vibration, welding the frames 11a and 11b together. The methods for joining two frames are not limited to the forced vibration method. For example, they may be welded using heat welding, ultrasonic welding, or the like, or may be simply glued. Before joining two frames 11a and 11b, the stirring member 9b is assembled into the top frame 11a, and then a coupling member 11e is put through a hole 11e1, and engaged to the end portion of the stirring member 9b (state illustrated in Figure 29). The hole 11e1 is located at one of the longitudinal ends of the top frame 11a. On the same side as this hole 11e1, a toner filling opening 11d for filling the toner is located. The diameter of this toner filling opening 11d is approximately 30 mm. In other words, the hole 11e1 and toner filling opening 11d are located next to each other. The toner frame 11 is provided with an opening 11i for feeding the toner from the toner frame 11 to the developing frame 12, and a seal, which will be described later, is welded to cover this opening 11i. After the seal is welded, the toner is filled through the toner filling opening 11d, and then the toner filling opening 11d is covered with a toner cap 11f, completing a toner unit J. The toner cap 11f is formed of soft material such as

polyethylene or polypropylene, and is pressed into the toner filling opening 11d of the toner frame 11 so that it does not come off. Next, the toner unit J is joined with the developing frame 12, which will be
5 described later, using ultrasonic welding, constituting a part of a completed developing unit D. The joining methods are not limited to ultrasonic welding. They may be glued together, or may be snap-fitted using the elasticity of their materials.

10 Referring to Figure 3, the angle θ of a slanted surface K, constituting a part of the bottom frame 11b of the toner frame 11, must be such an angle that the toner located in the deeper end of the toner chamber slides down, naturally and continuously, in
15 response to toner consumption. More specifically, the angle θ is the angle formed between the slanted surface K of the process cartridge B and the horizontal surface Z, with the apparatus main assembly 14 being leveled. The preferable value for the angle
20 θ is approximately 60 degrees. When rotating, the stirring member 9b reaches beyond the plane of the slanted surface K. Therefore, the bottom frame 11b is provided with a recessed portion 11g to afford a clearance for the rotating stirring member 9b; it
25 bulges outward. The rotational diameter of the stirring member 9b is approximately 30 mm. (According to this embodiment, the bottom surface of the bottom

frame 11b dips approximately 3.6 mm. The depth of this recessed portion has only to be approximately 2.0 mm to 10 mm.) The reason for this arrangement is as follows. If the sweeping area of the stirring member 9b is above the slanted surface K, it is possible that the toner settling between the tip of the toner feeding (stirring) member 9b and the slanted surface K is not fed into the developing frame 12, being left unused. However, in this embodiment, the toner is reliably fed from the toner frame 11 into the developing frame 12.

Referring to Figure 29, the stirring member 9b is formed of a rod of steel or the like material, having a diameter of approximately 3 mm and being in the form of a rectangular frame to improve toner stirring/feeding performance. Each of the opposing longitudinal ends of the stirring member 9b is provided with a supporting axis 9b1. The supporting axis 9b1 on one end is fitted in a hole 11r, which is located on the internal surface of the top frame 11a, adjacent to the opening 11i of the top frame 11a, and the supporting member 9b1 on the other end is fixed to the coupling member 11e.

As described above, the toner frame 11 is constituted of two members, that is, the top and bottom frames 11a and 11b, and the bottom wall of the bottom frame 11b is provided with the recessed portion

11g to afford a clearance for the toner feeding member 9b; therefore, it is possible to provide even a large capacity process cartridge with reliable toner feeding performance, without increasing cost.

5 The foregoing can be summarized as follows.

 The toner frame (toner container) 11 constitutes a part of a replaceable process cartridge for an electrophotographic image forming apparatus, which comprises an electrophotographic photosensitive member (7, 7e), and developing means 9 for developing the latent image formed on the electrophotographic photosensitive member. It stores the toner used in the developing means 9 for developing the latent image, and comprises the top frame 11a, and the bottom frame 11b which is joined with the top frame 11a. The top frame 11a comprises the opening 11i for supplying the stored toner to the developing means 9, and a stirring member mount 9b1 (Figure 29) where the stirring member 9b for stirring the stored toner is rotatively mounted. The bottom frame 11b is provided with the recessed portion 11g (as seen from within), that is, a bulge (as seen from outside), to afford the clearance for the sweeping area of the stirring member 9b. Further, the top frame 11a is provided with the welding surface U (joining surface) where the bottom frame 11b is welded (Figure 29, 33 and 36). The angle of this welding surface, that is, the angle which is

formed between this welding surface and the horizontal line 12 when the shorter edge of the rectangular opening 11i (Figure 29) is vertically oriented, is approximately 20 to 40 degrees. Further, the top frame 11a is provided with the hole 11e1 (transmission opening), through which the coupling member 11e (transmission member) for transmitting the driving force from the apparatus main assembly to the stirring member 9b, when the process cartridge is in the image forming apparatus, is put. One end of the coupling member 11e is engaged with the stirring member 9b, and the other end is engaged with the toner feeding gear 9s to receive the driving force. The stirring member 9b is formed of a metallic rod, and is in the form of a rectangular frame. Further, the top frame 11a is provided with the toner filling opening 11d (filling opening), which is disposed next to the hole 11e1 (Figure 29). It is to this toner filling opening 11d that the toner cap 11f for sealing the toner filling opening 11d is attached. Further, the top frame 11a is provided with a groove 11n which extends in parallel to the plane of the opening 11i. This groove 11n is where the developing frame 12, in which the developing roller 9c of the developing means 9 is mounted, is joined. Further, the top frame 11a is provided with a cover film plate 53 (seal mount) where a cover film 51 for sealing the opening 11i and a tear

tape 52 (toner seal) for unsealing the opening 11i are attached. The cover film plate 53 is also in parallel to the plane of the opening 11i. Further, the top frame 11a is provided with the handhold (recessed portion) 17, which is where the longitudinal end surfaces of the process cartridge are indented to offer the handhold. The recessed portion 11g (bulge) of the bottom frame 11b is in the form of a longitudinally sliced cylinder, having an arc shaped cross section. It is disposed close to the opening 11i, relative to the widthwise direction of the bottom frame 11b, and extends in the longitudinal direction of the opening 11i, along substantially the entire length the opening 11i. Further, the top frame 11a is provided with a slanted surface L. The angle of the slanted surface L, that is, the angle which is formed between this slanted surface L and the vertical line when the shorter edge of the opening 11i is vertically oriented, is approximately 10 to 40 degrees (Figure 36). This slanted surface L is located above the opening 11i, sloping down toward the opening 11i and extending in parallel to the longitudinal direction of the opening 11i, along substantially the entire length of the opening 11i.

The toner frame (toner container) 11 is assembled in the following manner. First, the top frame 11a, which is provided with the opening 11i for

supplying the stored toner into the developing means
9, and the stirring member mount 9b1 where the
stirring member 9b is mounted, is prepared. Next, the
bottom frame 11, which is provided with the recessed
5 portion 11g bulging outward to afford the clearance to
the sweeping area of the stirring member 9b, is
prepared. Finally, the two frames, 11a and 11b, are
joined to complete the toner frame (toner container)
11.

10 It is predictable that the toner within the
toner frame 11 will move suddenly due to vibration,
impact, or the like, during the shipment of the
process cartridge B from factory to user.

15 Therefore, plural partitioning plates 11p are provided
within the top frame 11a of the toner frame 11.

They are arranged in the longitudinal
direction of the top frame 11a (Figures 3, 32 and 33).
In this embodiment, three partitioning plates 11p are
20 disposed at three different locations. As for the
configuration of the partitioning plate 11p, the edge
11p1 facing the toner feeding member 9b forms a
substantial quadrant in such a manner as to surround
the toner feeding member 9b, and the edge 11p2 facing
25 the bottom frame 11b holds a slight gap therefrom.
Further, as seen from the longitudinal direction of
the top frame 11a, the edge 11p1 is positioned so that



the partitioning plate 11p partially blocks the toner filling opening 11d.

In order to prevent the toner from shifting within the toner container 11A, the partitioning plate 11p should be as large as possible. However, when the toner filling opening 11d is faced upward to fill the toner, the partitioning plate 11p is situated directly below the toner filling opening 11d, and if the partitioning plate 11p blocks the toner filling opening 11d entirely, it is difficult to fill the toner into the deepest corner of the toner container 11A. Therefore, the partitioning plate 11p should be formed as it is in this embodiment, so that the toner can be filled all the way into the deepest corner through the space which is not blocked by the partitioning plate 11d. Further, the partitioning plate 11p occupies a substantial part of the cross-sectional area perpendicular to the longitudinal direction of the toner frame 11; therefore, even when the process cartridge B is subjected to vibration, impact, or the like, the partitioning plate 11p can prevent the toner from shifting and becoming compacted.

25 [Toner Frame Structure Facing Developing Frame]

Referring to Figure 3, 29 and 31, at the joint between the toner frame 11 and developing frame



12, the opening 11i for feeding the toner from the toner frame 11 into the developing frame 12 is provided. The opening 11i is surrounded by a recessed surface 11k, on which the cover film plate 53 is thermally welded. The depth of this recessed surface 11k is such that after the cover film plate 53 is welded to the recessed surface 11, the outward facing surface of the cover film plate 53 becomes substantially level with the surface 11j of the toner frame 11 (top frame 11a). On the recessed surface 11k, plural dowels 11m are disposed in a straight line along one of the longitudinal edges of the opening 11i (in this embodiment, five dowels 11m are disposed at five different locations). Also, two dowels 11o are disposed on the surface 11j along one of the widthwise edges of opening 11i; these two dowels 11o are not on the recessed surface 11k. Further, along each of the longitudinal external edges of the surface 11j, a groove 11n is disposed in parallel to the one on the opposing side. The bottom surface 11n2 of this groove 11n is above the level of the surface 11j (closer to the developing frame 11 than the surface 11i) (Figure 31).

The surface of the developing frame 12, which comes directly in contact with the surface of the toner frame 11, is a surface 12u. Along each of the longitudinal edges of this surface 12u, a tongue 12v,

which fits into the groove 11n of the toner frame 11,
is provided. At the end surface of this tongue 12v,
an angular ridge 12v1, used for ultrasonic welding, is
provided (Figure 31); the angular ridge 12 is melted
5 by ultrasonic welding to weld the toner frame 11 and
developing frame 12, along their longitudinal external
edges.

Referring to Figure 30, the cover film plate
53, which is loosely fitted onto the recessed surface
10 11k of the toner frame 11, is provided with holes 53c,
which correspond to the plural dowels 11m. The holes
53c1, which exactly fit to the corresponding end
dowels 11m1, are round, and the holes 53c other than
the round holes 53c1 are elongated so as to be loosely
15 fitted to the corresponding dowels 11m other than the
end dowels 11m1. More specifically, the positional
relationship between the dowels 11m and hole 53c is
such that when the dowels 11m1 and 11m are fitted in
the corresponding holes 53c1 and 53c, the dowel 11m is
20 positioned at the middle of the elongated holes 53c in
the longitudinal direction of the elongated holes 53c.
Further, the cover film plate 53 is provided with an
opening 53b (having approximately the same size as the
opening 11i), which corresponds to the opening 11i.
25 In order to seal this opening 53b, a cover film 51,
which can be easily torn in the longitudinal
direction, is pasted on the cover film plate 53; the

four peripheral areas of the cover film 51 are pasted on corresponding four peripheral areas of the opening 53b. On the cover film 51, the tear tape 52 for tearing the cover film 51 to unseal the opening 53b is welded. The tear tape 52 is extended from one of the longitudinal ends of the opening 53b to the other end, where it is doubled back and put through the starting end, between the toner frame 11 and an elastic seal member 54 (Figure 27), such as a piece of felt, which is pasted on the flat developing frame surface 12u, directly facing the toner frame 11, at the starting end. The doubled back end of the tear tape 52 is exposed from between the toner frame 11 and developing frame 12 (Figures 6 and 30). On the inward side surface of the seal member 54, a synthetic resin film tape 55 with a small friction coefficient is pasted. Also on the flat surface 12u, an elastic seal member 56 is pasted at the longitudinal end opposite from where the seal member 54 is pasted (Figure 27).

In order to make it easier to align the toner frame 11 and developing frame 12 when joining two frames 11 and 12, the surface 11j of the toner frame 11 is provided with a round hole 11r and a square hole 11q, which engage with a cylindrical dowel 12w1 and square column dowel 12w2, respectively, provided on the developing frame 12; the round hole 11r engages with the dowel 12w1, and the square hole 11q loosely

engages with the dowel 12w2. The seal member 56 is fitted around the cylindrical dowel 12w1, and also is glued to the flat surface 12u. Further, in the flat surface 12u of the developing frame 12, which directly comes in contact with the toner frame 11, recessed portions 12y are provided, in which the dowels 11m and 11o of the toner frame 11 loosely fit.

Before the toner frame 11 and developing frame 12 are joined, each frame is independently assembled as a subcomponent. Thereafter, the cylindrical positioning dowel 12w1 and square column positioning dowel 12w2 of the developing frame 12 are fitted into the round positioning hole 11r and square positioning hole 11q of the toner frame 11, respectively. Also, the tongue 12v of the developing frame 12 is fitted into the groove 11n of the toner frame 11. Then, as the toner frame and developing frame 12 are pressed together, the seal members 54 and 56 are compressed, and ridges 12z, which are integrally formed as spacers with the developing frame, at each of the longitudinal ends, approach the surface of the toner frame 11. The ridges 12z are aligned in the widthwise direction of the developing frame 12, with an interval substantially equal to the width of the tear tape 52, to allow the tear tape 52 to be put through. With the toner frame 11 and developing frame 12 being pressed together as

described above, ultrasonic vibration is applied between the tongue 12v and groove 11n, whereby the angular ridge 12v1 is melted and welded to the bottom of the groove 11n by the frictional heat. As a result, the edges 11n1 of the grooves 11n of the toner frame 11, and the ridges 12z, as the spacers, of the developing frame 12, firmly contact their counterparts, sealing the entire joint between the toner frame 11 and developing frame 12, except for the gap left between the surface 11j of the toner frame 11 and the flat surface 12u of the developing frame 12. The cover film 51 and tear tape 52 are confined in this gap.

In order to feed the toner stored in the toner frame 11 into the developing frame 12, the operator has only to pull the end portion 52a (Figure 6) of the tear tape 52, which is exposed from the process cartridge B, by hand. As the tear tape 52 is pulled, the cover film 51 is torn open to unseal the opening 53b (11i), allowing the toner to be fed from the toner frame 11 into the developing frame 12.

Since the joining portions of the toner frame 11 and developing frame 12 are structured as described in the foregoing, that is since the surface of the cover film plate 53 and the surface 11j of the toner frame 11 are substantially at the same level, the tear tape 52 can be smoothly pulled out from between the

two frames 11 and 12 by applying to the tear tape 52 a
sufficient amount of force for tearing the cover film
51 as described above. The cover film plate 53 is
located by the dowel 11m1 at one of its longitudinal
5 ends, that is, the end opposite to where the tear tape
52 is pulled out, and in addition, it is disposed on
the recessed surface 11k of the toner frame 11;
therefore, it is not liable to be dislocated.

Further, the dowels 11m are aligned in a straight line
10 in the longitudinal direction, and the cover film
plate 53 is fitted to these dowels 11m; therefore,
even the easily deformable cover film 51 can be
precisely located to allow it to remain flat.

Further, even if the assembly process moves on to the
15 subsequent steps before the welded joint between the
cover film plate 53 and toner frame 11 is solidified
and stabilized, the cover film plate 53 is not
dislocated.

When the toner frame 11 and developing frame
20 12 are joined using ultrasonic welding method,
frictional heat is generated to melt the angular ridge
12v1. This frictional heat is liable to cause thermal
stress in the toner frame 11 and developing frame 12,
which might result in the thermal deformation of the
25 toner frame 11 and developing frame 12. However,
according to this embodiment, the groove 11n of the
toner frame 11 and the tongue 12v of the developing

frame 12 are engaged across substantially the full length in the longitudinal direction. In other words, the joint portions between the toner frame 11 and developing frame 12 are reinforced as to frames 11 and 12 are joined; therefore, the thermal deformation due to the thermal stress is not likely to occur.

As described above, the grooves 11n, handholds (recessed portions) 17, partitioning plates 11p, toner filling opening 11d, hole 11e1, round hole 11r, square hole 11q, and cover film plate mount (recessed surface 11k, dowels 11m and opening 11i), of the top frame 11a are integrally formed with the top frame 11a. Also, the ribs 11c and recessed portion 11g, of the bottom frame 11b are integrally formed with the bottom frame 11b. The material for the top and bottom frames 11a and 11b is a plastic material, for example, polyethylene, ABS resin (acrylonitrile-butadiene-styrene copolymer), polycarbonate, polyethylene, and polypropylene.

Figure 36 is a side view of the toner frame 11 used in this embodiment; the surface 11j of the toner frame 11, which is joined with the developing frame 12, is vertically oriented.

The toner frame 11 employed in this embodiment is provided with two slanted surfaces K and L, which allow the toner (single component toner) stored in the storage portion 11A to efficiently

descend toward the opening 11i. Both slanted surfaces K and L extend across the entire longitudinal length of the toner frame 11. The slanted surface L is located above the opening 11i, and the slanted surface K is located immediately behind the opening 11i (being slanted in the widthwise direction of the toner frame 11). The slanted surface L belongs to the top frame 11a, and the slanted surface K is formed as a part of the structure of the bottom frame 11b. The angle θ_2 of the slanted surface L relative to a vertical line 11 (joining surface 11j) is approximately 10 degrees to 40 degrees (in this embodiment, θ_2 is set at 24 degrees). The angle θ_3 of the slanted surface K, relative to the horizontal plane 12, perpendicular to the vertical line 11, is approximately 20 to 40 degrees (in this embodiment, θ_3 is set at approximately 27 degrees). In other words, the configuration of the top frame 11a in this embodiment is regulated so that when the bottom frame 11b is joined with the top frame 11a, the joined bottom frame 11b holds the aforementioned angle. Therefore, even if the toner storage portion 11A is such a toner storage portion that contains a large amount (for example, no less than 800 g), the toner can be efficiently fed toward the opening 11i.

Next, the developing frame will be further described in detail.

[Developing Frame]

The developing frame will be described with reference to Figures 3, 26, 27 and 28. Figures 26 is
5 an exploded perspective view of the developing frame 12, illustrating how the components are assembled;
Figure 27, a perspective view of the developing frame 12 and toner stirring member 9e and 9f, as seen from
the direction of the surface to be welded,
10 illustrating how the stirring members 9e and 9f are assembled into the frame 12; and Figure 28 is a
perspective view of the developing unit without the developing frame holder.

As described above, the developing roller 9c,
15 developing blade 9d, toner stirring members 9e and 9f, and antenna rod 9h for detecting the amount of the
remaining toner, are assembled into the developing frame 12.

The developing blade 9d comprises a 1 - 2 mm
20 thick metallic plate 9d1, and a urethane rubber blade 9d2 fixed to the metallic plate 9d2 by means of hot
melting, double-side adhesive tape, or the like. It regulates the amount of toner coated on the peripheral
surface of the developing roller 9c. The flatness of
25 a blade accommodating flat surface 12i, as a blade mount, provided on the developing frame 12 is
regulated; it is approximately 0.05 mm. This flat

surface 12i is provided with dowels 12i1 and screw
holes 12i2. The dowels 12i1 are fitted into the holes
9d3 provided on the metallic plate 9d1. Thereafter,
the metallic plate 9d1 is screwed onto the flat
5 surface 12i, using the screw holes 9dr provided on the
metallic plate 9d1, and the screw holes 12i2. Also on
the developing frame 12, an elastic seal member 12s
formed of MOLTPLANE or the like is pasted to prevent
toner invasion. It is disposed above the metallic
10 plate 9d1, extending in the longitudinal direction
thereof. In addition, an elastic seal member 12s1 is
pasted on the developing member, at each of the
longitudinal ends, covering from both ends of the
elastic seal member 12s to a round surface 12j, which
15 follows the contour developing roller 9c. Further, on
the mandible-like portion 12h, a thin elastic seal
member 12s2 is pasted. This elastic seal member 12s2
contracts the generatrix of the developing roller 9c.

One 9d1a of the longitudinal ends of the
20 developing blade 9d is bent by approximately 90
degrees. This bent portion 9d1a equalizes the
voltages of the metallic plate 9d1 and developing
roller 9c by contacting a development bias contact
point 121 (Figure 23(a) and 23(b)), supported on a
25 developing frame holder 40 which will be described
later. This arrangement is made because the amount of
the toner is detected on the basis of the change in

the capacitance between the antenna rod 9h for detecting the amount of the remaining toner, and the developing roller 9c, and this capacitance must be prevented from irregularly changing due to the
5 influence of the metallic plate 9d1.

Next, a developing roller unit G will be described. The developing roller unit G comprises:
(1) developing roller 9c; (2) spacer roller 9i for keeping constant the distance between the peripheral
10 surface of the developing roller 9c and the peripheral surface of the photosensitive drum 7; (3) developing roller bearing 9j for locating the developing roller 9c on the developing frame 12; (4) sleeve cap 9o which is placed on both ends of the developing roller 9c so
15 that leakage does not occur between the aluminum cylindrical portion of the photosensitive drum 7 and the aluminum cylindrical portion of the developing roller 9c; (5) developing roller gear 9k (helical gear) which rotates the developing roller 9c as it
20 receives the driving force from the helical gear 7b mounted on the photosensitive drum 7; (6) coil spring contact point 9l, one end of which is in engagement with the developing roller gear 9k mounted at one end of the developing roller gear 9k; and (7) magnet 9g
25 which is contained in the developing roller 9c to adhere the toner to the peripheral surface of the developing roller 9c. This developing unit G is

attached to the developing roller mount 12X of the
developing frame 12 in the following manner. First, a
hole 9j1 provided on each of the developing roller
bearings 9j is aligned with the hole 12p provided at
5 each of the longitudinal ends of the developing frame
12, and a pin provided on the development holder 40,
which will be described later, is inserted through the
holes 9j1 and 12d. Then, the developing frame holder
40 is fixed to the developing frame 12 using screws.

10 As described above, in this embodiment, when
the developing roller 9c is mounted on the developing
frame 12, the developing roller unit G is assembled
first. Then, the assembled developing roller unit G
is mounted on the developing frame 12 with the use of
15 developing frame holder 40. By going through these
steps, assembly efficiency is improved compared to the
case in which the developing roller 9c along is
directly mounted on the developing frame 12.

The developing roller unit G is assembled
20 through the following steps. To begin with, each end
of the developing roller 9c is covered with the sleeve
cap 9o. Next, the spacer roller 9i is mounted at each
end of the developing roller 9c; the spacer roller 9i
is placed on the outward side of the sleeve cap 9o.
25 Then, the developing roller bearing 9j is mounted on
the outward side of the spacer roller 9i. Next, the
developing roller gear 9k is mounted at one of the

longitudinal ends of the developing roller 9c, on the outward side of the bearing 9j, and the coil spring contact point 9l is mounted on the further outward side. At this point in the assembly, one end 9g1 of magnet 9g, which has a D-shaped cross section, projects from one end of the developing roller 9c, that is, the end where the developing roller gear 9k is mounted, and the other end of the magnet 9g, which is cylindrical, projects from the other end of the developing roller 9c. This is the way developing roller unit G is assembled.

Next, the antenna rod 9h for detecting the amount of the remaining toner will be described. One end of the antenna rod 9h is U-shaped. This U-shaped portion 9h1 is placed in contact with, being thereby electrically connected to, the toner detection contact point 122 mounted on the developing frame holder 40 which will be described later. This antenna rod 9h is attached to the developing frame 12 in the following manner. First, the end portion 9h3 of the antenna rod 9h is inserted into the developing frame 12 through a through hole 12b, provided on the side plate 12A of the developing frame 12. Then, the inserted end portion 9h3 is put through a through hole 12k provided on the other side plate of the developing frame 12, being supported thereby. In other words, the antenna rod 9h is located and supported by the through holes

12b and 12k. In the through hole 12b, a seal member (unillustrated) formed of felt, sponge, or the like, is inserted to prevent toner invasion.

Further, the tip portion 9h2 of the U-shaped
5 portion 9h1 is inserted into an approximately 5 mm deep hole 12o of the developing frame 12 to locate the antenna rod 9h in the axial direction. Also, this arrangement improves the rigidity of the U-shaped portion 9h1 as the contact point which contacts the
10 toner detection contact point 122 which will be described later. The through hole 12k, into which the end portion 9h3 of the antenna rod 9h has been inserted, is plugged from outside using thermal welding or the like method, so that toner invasion can
15 be prevented. Next, the toner stirring members 9e and 9f will be described. The toner stirring members 9e and 9f are shaped like a crank, and stir the toner as they rotate. They are disposed near the developing roller 9c and antenna rod 9h, across the toner path
20 which the toner having been stored in the toner container 11A passes as it is fed toward the developing roller 9c. The toner stirring members 9e and 9f are fixed in perpendicular to each other.

In assembling the toner stirring members 9e
25 and 9f onto the developing frame 12, to begin with, the end portions 9e3 and 9f3 of the toner stirring members 9e and 9f, respectively, are inserted through

corresponding through holes 12t and 12r provided on
the side plate 12A of the developing frame 12, which
is on the same side as the one through which the
antenna rod 9h is inserted. Then, the end portions
5 9e3 and 9f3 are inserted into corresponding through
holes 12m and 12n, provided on the side plate 12B,
which is the opposite side plate of the side plate
12A. Thereafter, each of the through holes 12m and
12n are plugged from outside by the thermal welding
10 method, as are the through holes 12k for the antenna
rod 9h. After the stirring members 9e and 9f are
inserted into the developing frame 12 as described
above, stirring gears 9m and 9n are fitted into the
through holes 12t and 12r. At this time, notches 9m1
15 and 9n1, which are cut in the axial direction at the
end portions of the gears 9m and 9n, respectively, are
engaged with the crank arms 9e2 and 9f2 of the toner
stirring members 9e and 9f, respectively. Further,
the journals 9e1 and 9f1 of the stirring members 9e
20 and 9f are fitted into center holes (unillustrated)
provided at the deeper ends of the notches 9m1 and 9n1
of the gear 9m and 9n, respectively, supporting
thereby the toner stirring members 9e and 9f on the
developing frame 12.

25 When the toner frame 11 and developing frame
12 are joined, the side plate 12A of the developing
frame 12, which is located on the side from which the

antenna rod 9h and toner stirring members 9e and 9f are inserted, overlaps the side plate of the toner frame 11, covering the toner cap 11f provided on the top frame 11a of the toner frame 11. Also, on the side plate 12A, a hole 12x is provided, in which a toner feeding gear 9s (Figure 28) for transmitting the driving force to the toner feeding member 9b is rotatively fitted. The toner feeding gear 9s is linked with the coupling member 11e (Figures 29 and 30), which is rotatively supported by the toner frame 11a and is engaged with the end portion of the toner feeding member 9b, whereby the driving force is transmitted to the toner feeding member 9b.

Next, how the driving force is transmitted will be described.

Referring to Figures 28 and 35, the stirring gears 9m and 9n, and the toner feeding gear 9s, receive the driving force from the developing roller gear 9k. More specifically, to begin with the stirring gear 9m receives the driving force through a small gear 9g1 of an idler gear 9g as a stepped gear. Receiving this driving force, the stirring member 9e rotates. The idler gear 9g receives the driving force from the developing roller gear 9k since the large gear 9g3 of the idler gear 9g meshes with the developing roller gear 9k. The received driving force is transmitted from the middle gear 9g2 of the idler

gear 9g to an idler gear 9r as a stepped gear. Then, the driving force is further transmitted from the small gear 9rl of the idler gear 9r to the toner feeding gear 9s, rotating thereby the stirring member 9b (through the coupling member 1le). Further, the driving force is transmitted from the toner feeding gear 9s to the stirring gear 9n by way of an idler gear 9t to rotate the stirring member 9f. It should be noted here that all the idler gears, 9q, 9r and 9t, are rotatively mounted on corresponding dowels, 12e 12f and 12g, which are integrally formed with the developing frame 12. These dowels 12e, 12f and 12g are approximately 2 mm to 3 mm in diameter, and their end portions are supported by the developing frame holder 40 which will be described later; therefore, the dowels 12e, 12f and 12g do not deform due to load. Further, the rigidity of dowels 12e, 12f or 12g is increased by padding or stepping their base portions, or the like means.

The gear train described above is disposed on the same side surface as the previously described U-shaped portion 9hl of the antenna 9h.

With the adoption of the above structure, a single member (in this embodiment, the developing frame holder 40) can support the gears constituting the gear train, and establish electrical connection for the toner remaining detecting contact point. In

addition, all of the toner stirring members 9e and 9f,
antenna rod 9h, gears 9o, 9r, 9s and 9t constituting
the gear train, and stirring gears 9m and 9n, can be
assembled into the developing frame 12 from the same
5 side relative to the longitudinal direction of the
developing frame 12. Therefore, assembly efficiency
can be greatly improved.

The mandible-like portion 12h of the
developing frame 12 doubles as a conveying guide for
10 the recording medium 2, such as recording paper. In
order to increase the rigidity, the developing frame
12 may be formed using the blow molding method.

Referring to Figure 27, a reference numeral
12P designates an opening which extends in the
15 longitudinal direction of the developing frame 12. As
the toner frame 11 and developing frame 12 are joined,
this opening 12P aligns with the opening 11i of the
toner frame 11, allowing the toner stored in the toner
frame 11 to be supplied to the developing roller 9c.
20 The aforementioned stirring members 9e and 9f, and
antenna rod 9h, are mounted across the entire
longitudinal length of this opening 12P.

Further, according to this embodiment, the
developing frame 12 comprising the developing roller
25 mount 12X, side plate 12A, developing blade mount
(blade accommodating flat surface 12i), antenna rod 9h
mount (through holes 12b, 12k and 12o), stirring

member mount (through holes 12t, 12r, 12m and 12n),
gear mount (dowels 12e, 12f and 12g), and the like, is
integrally formed with these portions. The material
for the developing frame 12 is the same as the
5 aforementioned material for the toner frame 11.

[Developing frame holder 40]

Next, the developing frame holder 40 will be
described.

10 Referring to Figures 4 - 9 and Figures 23 -
25, description will be given as to the developing
frame holder 40. Figure 23(a) is a perspective view
of the developing frame holder, which is mounted on
the driving side, as seen from the outside of the
15 developing frame 12; Figure 23(b) a perspective view
of the same as seen from inside; Figure 24, an
enlarged sectional view of the Figure 3(b) at (I)-(I)
line; and Figure 25 is an enlarged perspective view of
the toner detecting contact point.

20 The developing unit D is completed by
attaching the development holders 40 and 41 at the
corresponding lateral ends of the developing frame
assembly, having been finished up to the stage
illustrated in Figure 28. In this case, the
25 developing roller unit G is mounted in the following
manner. First, one of two pins 40d provided at
different locations of the developing frame holder is

engaged with the hole 9j1 of the aforementioned
developing roller bearing, and the other pin 40d is
engaged with the hole 12p of the developing frame 12.
Next, the developing frame holders 40 and 41 are fixed
5 to the developing frame 12 with screws, in such a
manner that the developing roller bearings 9j are
sandwiched between the corresponding developing frame
holders 40 and 41, and the developing frame 12. At
this time, the screws are put through the
10 corresponding holes 401 of the holders 40 and 41.
Next, one end 9g1 of the magnet 9g (Figures 3 and 28)
contained in the developing roller 9c is engaged with
a D-shaped hole 40e provided on the developing frame
holder 40, and the other end 9g2 is engaged with a
15 hole (unillustrated) provided on the developing frame
holder 41, whereby the position of the magnet 9g in
the longitudinal direction is fixed. The angles of
the magnetic poles of the magnet 9g are determined as
the end portion 9g1, having the aforementioned D-
20 shaped section, is engaged with the D-shaped hole 40e
of the developing frame holder 40.

Next, rotational shafts 20, which are
integrally formed with the developing frame holders 40
and 41 and project therefrom, are placed into recessed
25 portions 21 (Figure 9(b)) of the cleaning frame, and
covered with connector members 22 (Figure 7), whereby
the developing unit D is rotatively supported on the

cleaning frame 13 which supports the photosensitive drum 7, and in addition, the compression spring 22a attached to the connector members 22 is compressed against the spring seats 40h of the developing frame holders 40 and 41, stabilizing the distance between the photosensitive drum 7 and developing roller 9c (preventing the distance from widening).

As already described, the long guide 12a is disposed on the external surfaces of the developing frame holders 40 and 41. In addition, the metallic plate toner detecting contact point 122 for detecting the amount of the remaining toner, and the developing bias contact point 121, are fitted on the developing frame holder 40; these contact points 121 and 122 are fixed to the developing frame holder 40 as the dowels provided on the internal surface of the developing frame holder 40 are forced into the locking hole of the contact points.

To begin with, how the toner detection contact point 122 is attached will be described with reference to the drawings.

Figure 24 is a sectional view of Figure 23(b), at the (I)-(I) line, and Figure 25 is an enlarged view of the toner detection contact point illustrated in Figure 23(b) and the adjacencies thereof. The toner detection contact point 122 has an external contact point portion 122a and an internal

contact portion 122b. The external contact point
portion 122a is disposed on the external surface of
the holder 40, and when the process cartridge B is in
the apparatus main assembly 14, it contacts a toner
5 detection contact point member 126 provided on the
apparatus main assembly 14. The internal contact
point portion 122b presses on the U-shaped portion 9h1
of the antenna rod 9h. Referring to Figure 24, the
external contact point portion 122a is at
10 substantially the same level as the side plate 40a of
developing frame holder 40. The internal contact
point portion 122b is disposed within the developing
frame holder 40, opposing the antenna rod 9h.

Referring to Figure 25, the toner detection
15 contact point 122 is mounted on the developing frame
holder 40, with its locking flap 122c1 cut out of the
mounting base 122c being fitted around the dowel 40h
which projects inwardly from the side plate 40a, and
the mounting base 122c being in contact with the side
20 plate 40a. Further, from the mounting base 122c, an
angled portion 122d is extended at an angle, and from
the angled portion 122d, the internal contact point
122b is extended at an angle, so that the internal
contact point 122b becomes parallel to the side plate
25 40a. Further, a connective portion 122e, which is
bent outward at 90 degrees from the mounting base
122c, projects outward along one of the edges of the



first rectangular hole 40c formed in the side plate
40a. Then, the connective portion 122e is bent at 90
degrees in the direction opposite to the direction in
which the connective portion 122e is already bent,
5 constituting the external contact point portion 122a.
The external contact point portion 122a is in contact
with the bottom surface of a recessed portion 40i
formed in the side plate 40a. The depth of this
recessed portion 40i is substantially the same as the
10 thickness of the external contact point portion 122a
(Figure 24). Therefore, the outward facing surface of
the external contact point portion 122a, and the
outward facing surface 40a1 of the side plate 40, are
at substantially the same level. Further, the end
15 portion of the external contact point portion 122a is
put through the second rectangular hole 40j formed in
the side plate 40a, reaching the interior of the side
wall 40a, with an end fixing portion 122f being
engaged with a dowel 40k projecting from one of the
20 walls of the second rectangular hole 40j. This is the
way that toner detection contact point is mounted on
the developing frame holder 40.

Referring to Figure 24, a width L2 of the
first hole 40c, of the side plate 40a, is greater than
25 a distance L1 between the side wall facing surface of
the mounting base 122c of the toner detection contact
point 122 and the outwardly facing surface of the

external contact point portion 122a, and is also greater than the height of the end fixing portion 122f. Further, a gap large enough to allow the end fixing portion 122f of the toner detection contact point 122 to be passed through is provided between the
5 end surface of the dowel 40k within the second hole 40j and the opposing surface of the second hole.

The toner detection contact point 122 is mounted in the following manner. First, the end
10 fixing portion 122f is inserted into the first hole 40c, from the inside of the developing frame holder 40. Then, the end fixing portion 122f is inserted into the second hole 40j by rotating the toner detection contact point 122 in the clockwise direction of Figure
15 24. Subsequently, the hole 122c of the mounting base 122c is engaged with the dowel 40k. On the other hand, the end fixing portion 122f rides over the dowel 40k due to its own elasticity, and the hole of the end fixing portion 122f engages with the dowel 40k.

20 The developing bias contact point 121 will be described.

The developing bias contact point 121 comprises a plate spring portion 121a located within the developing frame holder 40; an internal contact point portion 121b; and an external contact point
25 portion 121c located on the outwardly facing surface 40a1. As the developing frame holder 40 is attached

to the developing fram 12, the plate spring portion
121a elastically contacts the bent portion 9d1a of the
metal plate substantially equal to the potential of
the developing roller 9c. The internal contact point
5 portion 121b is fitted around a boss 40f provided with
th aforementioned hole 40e , being elastically in
contact with the coil spring contact point 91 which is
fitted around the 40f (contact pressure is approx.
100g to 300g). The frictional area of the internal
10 contact point portion 121b may be coated with
electrically conductive grease if desired. The
external contact point portion 121c is disposed in the
recessed portion of the side plate 40a, and its
external surface outwardly facing surface 40a1 of the
15 developing frame holder 40. When the process
cartridge B is in the apparatus main assembly 14 ,
external contact point portion 121c is in contact with
a developing frame contact point member 125 provided
in the apparatus main assembly 14, and receives the
20 developing bias to be applied from the apparatus main
assembly 14 to the developing roller 9c. The
developing bias received from the apparatus main
assembly 14 is applied to the developing roller 9c
through the developing bias contact point 121 and coil
25 spring contact point 91.

As the developing frame holder 40 is
attached to the developing frame 12, the internal

contact point portin 122b in the form of a plate
spring comes in contact with the U-shaped portion 9h1
of the antenna rod 9h illustrated in Figure 28;
therefore, the toner detection contact point 122 is
5 electrically connected to the antenna rod 9h. The
contact pressure between the antenna rod 9h and
internal contact point portion 122b is approx. 100g.
When the process cartridge B is in the apparatus main
assembly 14, the external contact point portion 122a
10 provided on the outwardly facing surface 40a1 of the
developing frame holder 40 is electrically connected
to the contact point member 126 provided in the
apparatus main assembly 14. Therefore, an electrical
signal, correspondent to the capacitance which changes
15 in response to the change in the amount of toner
between the developing roller 9c and antenna rod 9h is
transmitted to the developing frame 12 through the
antenna rod 9h, and toner detection contact point 122.
As the control section (not shown) detects that the
20 electric signal transmitted to the contact point
member 126 has reached a predetermined value, it
signals a need for process cartridge exchange. Three
engagement holes 40g provided in the internal surface
of the developing frame holder 40 are engaged with the
25 corresponding end portions of the dowels 12e, 12f and
12g which serve as the gear shafts for the gears 9q,
9r and 9the illustrated in Figure 35. In other words,

the dowels 12e, 12f and 12g are supported by the
developing frame holder 40 and the developing frame
12, coming between the two. The engagement hole 40m
provided in the internal surface of the developing
5 frame holder 40, rotatably supports the stirring gear
9m.

As is evident from the foregoing
description, the fact that various functions are
assigned to a single component (developing frame
10 holder) leads to improvement in assembling efficiency,
and also, cost reduction.

Further, according to this embodiment,
developing frame holder 40 comprises the rotatable
shaft 20 , spring seat 40b , long guide 12a ,
15 engagement hole (hole 40a) for magnet 9g, mount (boss
40f and the like) for the developing bias contact
point 121, mount (dowel 40h, first hole 40c),
developing frame holder 40 (dowel 40k and the like)
for the toner detection contact point 122, engagement
20 hole 40m, pin 40d, screw hole 40l, and the like, and
these portions are integral formed with the developing
frame holder 40. The developing frame holder 41
comprises the rotatable shaft 20, spring seat 40b,
long guide 12a, and the like, and these portions are
25 integrally formed with the developing frame holder 41.
Each of the developing frame holders 40 and 41 is
formed, as a single piece component of acrylonitrile-

styrene copolymer resin (containing glass filler by 20%).

The positions of the developing frame holders 40 and 41 are fixed as the pins 40d of the developing frame holders 40 and 40 are inserted into the corresponding holes 12p of the developing frame 12. Then, the developing frame holders 40 and 41 are fixed to the developing frame 12 with the use of screws put through the screw holes 40l (developing frame holders 40 and 41), and screw holders 12r1 (developing frame 12).

[Structure of Bottom Surface of Cleaning Frame]

The developing frame 12 and cleaning frame 13 are provided with guide ribs 12l and 13m, which project from the bottom surfaces thereof, respectively, extending in parallel in the moving direction of the recording medium or material 2. Both guide ribs 12l and 13m are arranged in such a manner that the outermost ribs 12l and 13m fall within the path of the widest piece of recording medium 2 by a small margin. In this embodiment, the outermost ribs are located approx. 5mm inwardly from the edges of the path of the widest piece of recording medium 2. The remainder of the ribs are spread between the outermost ribs to facilitate conveyance of the recording medium 2. The image forming apparatus in this embodiment is

of a type that can accommodate recording medium 2 of different sizes, and the recording medium 2 is centered regardless of size (center line CL, coincides with the center line of the recording medium 2).

5 Therefore, the arrangement of the ribs provided on the bottom surface of the developing frame 12 and cleaning frame 13 is symmetrical relative to the (center line CL). The rib height is set at predetermined values for the developing frame 12 and cleaning frame 13,
10 respectively, to facilitate conveyance of the recording medium 2. By adopting the above structure, the image disturbance due to the contact between the pre-fixation toner image and the bottom surface of the cleaning frame 13 can be prevented, while improving conveyance efficiency. Figure 34 shows an example of
15 measurement in millimeter between the center line CL and various ribs, along with the symbols correspondent to the standard sizes (Japan Industrial Standard) for the recording medium 2. For example, a symbol A3L stands for an A3 size recording medium fed in the longitudinal direction; a symbol A4s stands for an A4 size recording medium fed in the widthwise direction. A symbol ENV stands for a recording medium of envelope size, and EXE corresponds to a recording medium of an
20 EXE size. The guide ribs 12l and/or 13m, located 5.0mm, 13.0mm and 28mm away from the center line CL, are the ribs which make contact with the center line

of the recording medium 2.

Figure 34 is a schematic view of the bottom portion of the cleaning frame 13 as seen from the sheet conveyance direction. This embodiment is different in that the height of guide ribs 13m is symmetrically increased in relation to the distance from the center line; both ribs of each rib pair correspondent to one of the various sheet sizes of the recording medium 2 have the same height. This rib arrangement can reliably prevent the ribs located toward the center line CL from coming in contact with the image bearing surface of the recording medium 2, reliably preventing the image disturbance. The horizontal rib arrangement in this embodiment is the same as the embodiment in which the rib height is the same for all ribs.

[Structure of Electrical Contact Points]

Hereinafter referring to Figures 5, 8, 9 and 19, the connection and placement of the contact points, which establishes electrical connections between the process cartridge B and the laser beam printer main assembly 14 when the former is installed into the latter, will be described.

The process cartridge B is provided with a plurality of electrical contact points: (1)
Electrically conductive grounding contact point 119

electrically connected to the photosensitive drum 7 to ground the drum 7 through the apparatus main assembly 14; (2) Electrically conductive charging bias contact point 120 electrically connected to the charging
5 roller shaft 8a in order to apply a charge bias from the apparatus main assembly 14 to the charging roller 8; (3) Electrically conductive developing bias contact point 121 electrically connected to the developing
10 roller 9c in order to apply a developing bias from the apparatus main assembly 14; and (4) Electrically conductive toner remaining detecting contact point 122 electrically connected to an antenna rod 9h in order to detect the amount of the remaining toner. All of these four contact points 119 - 122 are exposed on the
15 lateral surface (right-hand side) of the cartridge frame, with intervals large enough to prevent electrical leakage among them. As described before, the ground contact point 119 and charge bias contact point 120 are disposed on the cleaning means frame 13,
20 and development bias contact 121 and toner remainder detecting contact point 122 are disposed on the development chamber frame 12 (developer holder 40). It should be noted here that the toner remaining detecting contact point 122 doubles as a cartridge
25 detecting contact point for detecting the presence (or absence) of the process cartridge within the apparatus main assembly 14.

The grounding contact point 119 is constituted of the electrically conductive axial shaft 7a of the photosensitive drum 7, or an electrically conductive insert molded in the shaft 7 of resin material. In this embodiment, it is constituted of a metallic shaft 7a of iron or the like. The other contact points 120, 121 and 122 are approximately 0.1 mm to 0.3 mm thick electrically conductive metallic pieces, for example, stainless steel piece, phosphor bronze piece, or the like, which are planted on the surface so as for their leg portions to reach into the process cartridge interior. The charging bias contact point 120 is exposed on the driving side surface (lateral side C1) of the cleaning unit C, and the developing bias contact point 121 and toner remaining detecting contact point 122 are exposed on the driving side surface (lateral side D1) of the developing unit D.

More specifically, referring to Figure 20, in this embodiment, the helical drum gear 7b is provided at one end of the photosensitive drum 7 in the axial direction of the drum 7 as described before. This helical drum gear 7b engages with the helical driver gear 28 provided on the apparatus main assembly 14 to rotate the drum 7. As this helical gear 7b rotates, it generates a thrust (in the direction of an arrow d in Figure 20), pressing thereby the drum 7, which is

mounted on the cleaning means frame portion 13 with
the allowance of some play in its longitudinal
direction, toward the direction of the helical gear
7b. As a result, one 7b1 of the lateral surfaces of
5 the helical gear 7b remains in contact with the
internal surface 13k1 of one 13k of the lateral
surfaces of the cleaning means frame portion 13 of the
cartridge frame, whereby the position of the drum 7
within the cartridge B in the axial direction is
10 regulated. The grounding contact point 119 and
charging bias contact point 120 are exposed on the one
13k of the lateral surfaces of the cleaning means
portion 13 of the frame, wherein the grounding contact
point 119 is at the end of the drum shaft 7a, and
15 projects outward slightly (approximately 0.8 mm)
beyond the end of the aforementioned cylindrical guide
13a. This drum shaft 7a is put through the drum
cylinder 7d (aluminum cylinder in this embodiment)
covered with a photosensitive layer 7e, and is
20 supported at each end by the cylindrical guide 13a,
which in turn is supported on the lateral walls 13c
and 13d. The drum cylinder 7d and shaft 7a are
connected with a grounding plate 7f, which is in
contact with both the internal surface 7d1 of the drum
25 cylinder 7d and peripheral surface 7a1 of the shaft
7a.

The charging bias contact point 120 is

located almost directly above the long guide 12, that is, adjacent to the cleaning means portion 13 of the frame, which supports the charging roller 8 (Figure 9(a)). Also, the charging bias contact point 120 is
5 electrically connected to the charging roller shaft 8a through an electrically conductive member 120a, which is in contact with the charging roller shaft 8a.

Next, the developing bias contact point 121 and toner remaining detecting contact point 122 will
10 be described. These two contact points 121 and 122 are located on one surface, D1, of the lateral surface of the developing unit D, that is, the same side as the lateral surface 13k of the cleaning means portion 13 of the frame. The developing bias contact point
15 121 is located directly below the long guide 12a and adjacent to the right-hand end of the frame portion 12c where the magnet 9g contained in the developing roller 9c is supported (Figure 5), and is electrically connected to the developing roller 9c through the coil
20 spring contact point 91, which is in contact with the lateral end of the developing roller 9c (Figure 9(b)). Referring to Figure 5, the toner remaining detecting contact point 122 is disposed on the upstream side of the long guide 12a relative to the cartridge inserting
25 direction (arrow X direction in Figure 8), and is connected to an antenna rod 9h, which is disposed on the side of the toner container 11A and extends in the

longitudinal direction of the developing roller 9c in parallel with the developing roller 9c as shown in Figure 9(b), through the electrically conductive member 9f, which is in contact with an antenna rod 9h.

5 The antenna rod 9h is disposed so as to hold a predetermined distance from the developing roller 9c. The capacitance between this antenna rod 9h and developing roller 9c varies in response to the amount of the toner present between two components; therefore, the amount of the remaining toner is detected by measuring this capacitance change as a potential difference change, through a control section (unillustrated) in the apparatus main assembly 14.

10 Here, the terminology "amount of the remaining toner" means an amount of the toner that creates a predetermined amount of capacitance by being present between the developing roller 9c and antenna rod 9h. In other words, the detection of the predetermined amount of capacitance means that the amount of the toner remaining in the toner chamber 11A has reached the predetermined amount.

15 Thus, it is detected by the control section, which is provided in the apparatus main assembly 14 and is connected to the cartridge B through the toner remaining detecting contact point 122, that the capacitance has reached a predetermined first value; whereby it is determined that the amount of the toner

remaining in the toner chamber 11a has reached the
predetermined amount. When it is detected that the
capacitance has reached the aforementioned first
determined value, the apparatus main assembly 14
5 signals the need for process cartridge B exchange (for
example, flashing light, buzzing sound). When the
capacitance detected by the control section matches a
predetermined second value, which is smaller than the
first value, the detecting circuit determines that the
10 cartridge B has been installed in the apparatus main
assembly 14. The control section circuit does not
allow the apparatus main assembly 14 to be driven
unless it detects that the cartridge B has been
installed in the apparatus main assembly. In other
15 words, the control section does not allow the
apparatus main assembly 14 to start forming images.

It may be arranged so that a warning signal
(for example, blinking light or the like) may be
provided to inform the operator of the absence of the
20 cartridge B in the apparatus.

Next, a description will be given as to the
connection between the contact point provided on the
cartridge B and the contact point member provided on
the apparatus main assembly 14.

25 Referring to Figure 19, four contact point
members, which make contact with corresponding contact
points 119 - 122 when the process cartridge is

installed in the apparatus A, are provided on one of
the lateral walls of the cartridge accommodating space
S of the image forming apparatus A (grounding contact
point member 123 which electrically contacts the
5 grounding contact point 119, charging bias contact
point member 124 which electrically contacts the
charging bias contact point 120, developing contact
point member 125 which electrically contacts the
developing bias contact point 121, and toner detection
10 contact point member 126 which electrically contacts
the toner remaining detecting contact point 122).

As shown in Figures 19(a) and 19(b), the
grounding contact point member 123 is disposed in
correspondence to the groove 16a5. The developing
15 bias contact point member 125 and toner remaining
detecting contact point member 126 are disposed below
the first guide portion 16a. The charging bias
contact point member 124 is
disposed above the second guide portion 16b.

20 Here, the positional relationship between the
contact points and guides will be described.

First, referring to Figure 5, as for the
positional relationship in the vertical direction (as
seen from the horizontal direction), the developing
25 bias contact point 121 is the bottommost one; the
toner remaining detecting contact point 122, long
guide 12a and cylindrical guide 13a (grounding contact

point 119) are disposed above the bias contact point 121, being at about the same level; above them is the short guide 13b, and the topmost one is the charging bias contact point 120. As for the positional relationship in the cartridge inserting direction (arrow X direction), the toner remaining detecting contact point 122 is the most upstream one; next is the long guide 12a; at a further downstream location is the charging bias contact point 120 and developing bias contact point 121; and at the most downstream locations are short guide 13b and cylindrical guide 13a (grounding contact point 119). Arranging the contact points as described above allows the charging bias contact point 120 to be positioned near the charging roller 8; the developing bias contact point 121, near the developing roller 9c; the toner remaining detecting contact point 122, near the antenna rod 9h; and the grounding contact point 119 to be positioned near the photosensitive drum 7. Therefore, the wiring for the contact points can be shortened.

The measurements of the contact points are as follows: the charging bias contact point 120 is approximately 10.0 mm in height and width (tolerable range of 8.0 mm to 12.0 mm); developing bias contact point 121, approximately 9.0 mm in height (tolerable range of 6.0 mm to 12.0 mm) and approximately 8.0 mm

(tolerable range of 5.0 mm to 11.0 mm); toner remaining detecting contact point 122, approximately 8.0 mm (tolerable range of 6.0 mm to 10.0 mm) in height and approximately 9.0 mm (tolerable range of 7.0 mm to 11.0 mm) in width; and grounding contact point 119 is circular and its diameter is approximately 7.0 mm. The charging bias contact point 120, developing bias contact point 121, and toner remaining detecting contact point 122 are rectangular.

10 The grounding contact point member 123 is an electrically conductive plate spring member, and is mounted in the groove 16a5, in which the cylindrical guide 13a (in which the drum shaft 7a of the photosensitive drum 7 is fitted), on which the
15 grounding contact point 119 of the cartridge B is mounted, is disposed to fix the position of the cartridge B, whereby the grounding contact point member 123 is grounded through the chassis of the apparatus main assembly (Figures 19 and 26). The
20 other contact point members 124, 125 and 126 are mounted in the corresponding holder covers 127 in such a manner as to be projected therefrom by the corresponding compression springs 129. This arrangement will be described referring to the
25 charging bias contact point member 124. Referring to Figure 20, the charging bias contact point member 124 is placed under a holder cover so that it projects but

does not come off, and
then, this holder cover 127 is fixed to a circuit
board 128 mounted on one of the lateral walls of the
apparatus main assembly, whereby the contact point
5 members are electrically connected to the wiring
patterns by the electrically conductive compression
springs 129, correspondingly.

Next, referring to Figure 21, it will be
described with reference to the charging bias contact
10 point member 120 how the contact points on the
cartridge side come in contact with the corresponding
contact point members on the image forming apparatus
side when the process cartridge B is installed into
the image forming apparatus A. Figure 21 is an
15 explanatory drawing, which depicts the state of the
process cartridge B in the image forming apparatus A,
wherein an arrow mark H designates the movement of the
charging bias contact point 124 on the apparatus main
assembly, relative to the process cartridge B, when
20 the cartridge B is installed into the image forming
apparatus A. It should be noted here that Figure 21
is a cross-section of Figure 5 at a line O.

During the installation of the process
cartridge B into the image forming apparatus A using
25 the guide members 16a and 16b as the guide, the
charging bias contact point member 124 is in the state
(a) depicted in Figure 21 before it reaches the

predetermined position where it is to be fixedly disposed. At this time, the charging bias contact point member 124 is not in contact with the flat surface 20 of the cleaning means portion 13 of the frame. As the cartridge B is further inserted, the charging bias contact point member 124 is advanced to a position (b) in Figure 21. In this state, it remains in contact with the slanted surface 31 (Figure 5) formed on the right lateral wall 13c of the cleaning means portion 13 of the frame; slides on this slanted surface 31, whereby it is gradually pressed, compressing thereby gradually the compression spring 129; and smoothly moves onto the flat surface 32 where the charging bias contact point 120 is exposed. When the inserted cartridge B arrives at the predetermined location, the contact member 124 arrives at a position (c) in Figure 21, where it makes contact with the charging bias contact point 120. The other contact point members 125 and 126 come in contact with the contact points 121 and 122, respectively, in the same manner.

With such an arrangement as described above being in place, when the cartridge B is guided by the guide member 16 into the predetermined cartridge accommodating location, the contact points and the corresponding contact point members are reliably placed in contact with each other.

Further, when the process cartridge B is positioned at the predetermined location in the apparatus main assembly 14, the grounding contact point member 123 in the form of a plate spring makes contact with the grounding contact point 119 projecting from the cylindrical guide 13a (Figure 20). As the process cartridge B is inserted into the apparatus main assembly 14, the grounding contact point 119 and grounding contact member 123 electrically contact with each other, grounding thereby the photosensitive drum 7. The charging bias contact point 120 and charging bias contact member 124 electrically contact with each other, allowing thereby a high voltage (superposed voltage of AC and DC voltages) to be applied to the charging roller 8. The developing bias contact point 121 and developing contact member 125 make electrical contact with each other, allowing thereby a high voltage to be applied to the developing roller 9c. The toner remaining detecting contact point 122 and toner remaining detecting contact member 126 make electrical contact with each other, allowing thereby information reflecting the capacitance to be transmitted to the apparatus main assembly 14.

Next, a case in which the photosensitive 7 is rotated by driving the image forming apparatus A, will be described. The photosensitive drum 7 is given an

approximately 2 mm to 3 mm thrust play in the axial direction so that it is easier to install the process cartridge B into the image forming apparatus A.

Therefore, it is necessary for the charging bias

5 contact point member 124 or the like to be capable of projecting by a distance larger than the thrust play.

Further, in this embodiment, a plate spring 45 is provided, which presses the process cartridge B toward

10 one side (side where the contact point members 123 - 126 are located) of the apparatus main assembly when the cartridge B is in the apparatus main assembly.

This plate spring 45 is on the side opposite to the side where the contact point members are located, above the first installation guide 16a.

15 Further, when the contact points 119 - 122 of the process cartridge B are disposed, as they are in this embodiment, on the side where the helical drum gear 7b is disposed (lateral wall on the driving

20 side), the connection for mechanically driving the cartridge B by the apparatus main assembly through the helical drum gear 7b, and the electrical connection between the cartridge B and apparatus main assembly through the contact points 119 - 122, can be made on the same side of the cartridge B. Therefore, when the

25 aforementioned side of the cartridge B is used as the referential side, the integrated error in the component sizes can be reduced, which makes it

possible to mount more accurately the contact points and helical gear. Further, when a helical drum gear with teeth cut in such a direction as to generate a thrust directed toward the side where the helical drum gear is positioned is used, the position of the photosensitive drum 7 in the axial direction is fixed on the side where the contact points are located; therefore, in this case, the accuracy in the positional relationship between the photosensitive drum 7 and the contact points is also improved, in addition to the aforementioned effects. Further, when a lever 23 (Figure 6) for opening or closing the drum shutter 18 is located, as it is in the aforementioned embodiment, on the side opposite to the one where the contact points 119 - 122 are located, the frictional resistance generated on one side of the cartridge by the contact points 119 - 122 as the cartridge B is inserted into the image forming apparatus A, and the resistance (or pressure), which is med by the lever 23 (Figure 6) for opening or closing the drum shutter member 18, are distributed toward the longitudinal ends of the cartridge B when the process cartridge B is inserted into the image forming apparatus A; in other words, the resistance generated when the cartridge B is inserted is evenly distributed in the longitudinal direction of the cartridge B. Therefore, the cartridge B can be smoothly inserted.

Further, as described in the preceding embodiment, when all the contact points of the process cartridge B are positioned on one and the same lateral wall of the cartridge frame, and the process cartridge B is placed under the elastic pressure generated by the plate spring, it is possible to provide stable electrical connections between the contact points and the corresponding contact point members on the apparatus main assembly side.

Figure 22 illustrates an arrangement in which the contact points are located on the side where the aforementioned lever 23 is located. This arrangement can also sufficiently provide the aforementioned effects.

Hereinafter, other embodiments of the present invention will be described with reference to Figures 37 - 40.

[Structure of Housing]

The housing of the process cartridge B in this embodiment is formed by joining the toner container 111, developing frame 112, and cleaning frame 113. The structure of this housing will be described below.

Referring to Figures 37, the toner container 111 comprises a toner storing portion 119a, in which the toner stirring member 119b is mounted. The developing roller 119c and developing blade 119d are

mounted on the developing chamber frame 112, and the stirring member 119e, which circulates the toner within the developing chamber, is rotatively mounted adjacent to the developing roller 119c. The
5
aforementioned toner container 111 and developing chamber frame 112 are melt-welded to form a developing unit.

The photosensitive drum 117, charging roller 118, and cleaning means 111 are mounted on the
10
cleaning means frame 113. Further, a drum shutter member 118, which covers and protects the photosensitive drum 117 when the process cartridge B is out of the apparatus main assembly 114 (Figure 1), is attached to the cleaning frame 113 to form a
15
cleaning unit.

Then, the developing unit and cleaning unit are joined to complete the process cartridge B. More specifically, referring to Figures 38, (a) and 38, (b), a cover member for rotatively supporting each of
20
the end portions of the developing roller 119c is attached to each of the longitudinal ends of the developing frame 112. An axis 120 is provided at the end of an arm portion 119 formed on this cover member (Figure 38 illustrates only one side). On the other
25
hand, a recessed portion 121, is provided at each of the longitudinal ends of the cleaning frame. The joining member 122 with a recess portion 112a is

mounted on the cleaning frame 113 with the use of screws after inserting the axis 20 into the recessed portion 121, whereby the developing and cleaning units and are jointed in a manner so as to pivot from each other about the axis 121, allowing thereby the developing roller 119c to be pressed toward the photosensitive drum 117 due to the weight of the developing unit D itself. Also, the joining member 122 is provided with a compression spring 122a, so that the developing frame 112 is pressed to reliably press the developing roller 119c toward the photosensitive drum 117. Further, a spacer ring 119f (unillustrated) is provided at each of the longitudinal end portions of the developing roller 119c, wherein this ring 119f is pressed on the photosensitive drum 117 to keep a predetermined distance between the photosensitive drum 117 and developing roller 119c.

20 [Structure of Toner Container]

Next, the structure of the toner container 111 will be described in further detail. Referring to Figure 37, the toner container 111 is formed by welding together an actual container portion 111a, which is the first container portion, and a cover member 111b, which is the second container portion.

The actual container portion 111a is shaped

like a bathtub. As the toner container is joined with the developing frame 112, its bottom wall constitutes the first toner descension surface 111c, which slopes down toward the developing roller 119c. The actual
5 container portion 111a is structured so that when the process cartridge B is in the image forming apparatus A (Figure 1), the first toner descension surface 111c is inclined approximately 65° to 80° , relative to the horizontal line, allowing the toner within the toner
10 storing portion 119a to descend due to its own weight along the first toner descension surface toward the developing roller 119c.

In the bottommost end of the first toner descension surface 111c, a toner discharge opening
15 111d is provided, through which the toner stored in the toner storing portion 119a is discharged into the developing chamber. The toner discharge opening 111d is provided with a flange 111e, which is welded to the flange 112a of the developing frame 112 to unite the
20 toner container 111 and developing frame 112.

The cover member 111b is welded to the actual container portion 111a to cover the top of the actual container portion 111a. The top surface of the cover member 111b has a recessed portion 117 as a handhold.
25 A portion of the cover member 111b, on the developing frame side, constitutes the second toner descension surface 111f, which projects into the actual container

portion 111a, creating thereby a recessed portion 111g in the external surface of the cover member 111b.

The second toner descension surface 111f slopes down toward the toner discharge opening 111d of the actual container portion 111a. The top cover 111a is structured so that when the process cartridge B is in the image forming apparatus A, the angle of the second toner descension surface 111f, relative to the horizontal line, falls within a range of approximately 60° to 70°. Therefore, the toner in the toner storing portion 119a descends due to its own weight along the toner descension surface 111f toward the toner discharge opening 111d.

The recessed portion 111g constitutes a tool recess in which tools are inserted when assembling the developing unit, which will be described later.

As described above, the first and second toner descension surfaces 111c and 111f leading, respectively, to the toner discharge opening 111d are inclined at such an angle as to allow the toner to descend due to its own weight; therefore, the entire amount of the toner in the toner storing portion 119a successfully descends toward the toner discharge opening 111d. It is understood that the toner descending along the first toner descension surface 111c, and the toner descending along the second toner descension surface 111f interfere with each other,

becoming compacted, near the toner discharge opening 111d. However, in this embodiment, the toner stirring/feeding member 119b is disposed adjacent to the toner discharge opening 111d; therefore, the toner is fed by the stirring/feeding member 119b into the developing chamber through the toner discharging opening 111d, without becoming caked.

The stirring member 119b is formed by bending a rod into a shape of a crank. With one end projecting outward from the toner container 111, and linking with unillustrated driving means, the stirring member 119b is rotatable in the direction of an arrow mark in Figure 37. As the stirring member 119b rotates, the toner is conveyed while being loosened.

Referring to Figure 39, when assembling the toner container 111, it is started from the actual container portion 111a among the various components. First, the toner discharge opening 111d of the actual container portion 111a is sealed with a sealing member 123. The sealing member 123 is no less than twice as long as the toner discharge opening 111d in the longitudinal direction. It is welded to the flange 111e formed around the discharge opening 111d, being extended from one longitudinal end of the toner discharge opening 111d to the other, and the remainder of the sealing member 123 is doubled back, so that the loose end of the sealing member 123 is exposed from

between the joint of the toner container 111 and
developing frame 112. When the process cartridge B is
put to use, a user pulls the sealing member 123 out by
grasping the exposed loose end of the sealing member
5 123, peeling it from the flange 111e to expose the
toner discharge opening 111d.

When welding the sealing member 123, the
cover member 111b will not have been attached to the
actual container portion 111a; therefore, the top of
10 the actual container portion 111a is open.
Consequently, a welding pad for welding the sealing
member 123 can be inserted from the top of the actual
container portion 111a, to be placed behind the flange
111e, making it easier to weld the sealing member 123.

15 After the toner discharge opening 111d is
sealed with the sealing member 123 as described above,
the cover member 111b is welded to the top portion of
the actual container portion 111a. In order to weld
together the cover member 111b and actual container
20 portion 111a, an energy director 111h and an
accommodating portion 111i are provided on the cover
member 111b and the actual container portion 111a,
respectively. Since the energy director 111h and
accommodating portion 111i are formed so as to project
25 outward from the toner container 111, the welding horn
and welding pad can be placed at a predetermined
location, with no difficulty.

After the sealing member 123 and cover member 111b are welded to the actual container portion 111a, a predetermined amount of toner is filled into the toner container 111 through an unillustrated toner filling opening, and then, the toner filling opening is sealed with a cap or the like.

Then, the toner container 111 and developing frame 112 are welded together. In this case, the flange 111e of the toner container 111 is joined with the flange 112a of the developing frame 112, and the longitudinal edges of these flanges 111e and 112a are welded together. As for the widthwise edges of the flanges 111e and 112a, they are not welded so that the sealing member 123 can be exposed as described above. In order to prevent toner leakage from these portions which are not welded, a toner leakage prevention seal 124 formed of foamed polyurethane or the like is attached to the pertinent portions of the flange 112a of the developing frame 112, which is joined with the counterpart of the toner container 111, as illustrated in Figure 39.

Referring to Figure 37, since these flanges 111e and 112a are formed so as to project downward from the process cartridge B, the welding horn and welding pad can be applied with no difficulty when they are welded together along their longitudinal edges.

In this embodiment, in order to increase the capacity of the toner storing portion 119a, the cover member 111b is rendered to bulge upward. However, the cover member 111b is provided with the recessed portion 111g; therefore, welding tools such as the welding pad can be inserted through this recessed portion 111g, making it easier to weld the top portion of the welding joint between the flanges 111e and 112a.

After the toner container 111 and developing frame 112 are united as described above, the developing members such as the developing roller 119c, developing blade 119d, stirring member 119e, and the like, are assembled into the united frames, completing the developing unit.

Even when the toner container 111 is rendered to bulge upward in order to increase the capacity of the toner storing portion 119a as described above, the toner can be reliably fed into the developing chamber by forming the aforementioned two slanted surfaces, the first and second toner descension surface 111c and 111f, without a need for a dedicated toner feeding mechanism.

Further, the toner container 111 is constituted of two components; the actual container portion 111a and cover member, which have no undercut portion, and therefore, can be easily formed of

plastic material by injection molding. As a result, the toner container 111 can be manufactured with low cost.

Further, the container 111 is provided with the recessed portion 111g to accommodate the welding tools; therefore, even when the capacity of the toner container 111 is increased, the toner container 111 and developing frame 112 can be easily welded together.

Next, another embodiment will be described with reference to Figure 40. In this drawing, the members with the same functions as those of the preceding embodiment (Figures 37 - 39) are assigned the same referential symbols to adopt their descriptions.

The process cartridge B of this embodiment is different from the one in the preceding embodiment in that the actual container portion 111a is open at the bottom though it is also shaped like a bathtub, and therefore, the cover member 111b must be welded to the bottom of the actual container portion 111a. It is also different in that the cover member 111b and sealing member are attached in a different order.

Referring to Figure 40, the actual container portion 111a, that is, the first container portion, of the toner container 111 in this embodiment is shaped like an inverted bathtub, with the bottom being open.

The top surface of the actual container portion 111a is provided with the recessed portions 117 as the handholds. One of the walls of the actual container portion 111a, on the side of the developing frame 112, projects inward, constituting the first toner descension surface 111c; the exterior side of the first toner descension surface 111 constitutes the recessed portion 111g. The angle of the first toner descension surface 111c is the same as the angle of the second toner descension surface formed on the cover member 111b of the preceding embodiment.

On the other hand, the cover member 111b welded to the bottom of the actual container portion 111a is provided with the second toner descension surface 111f. The angle of the second toner descension surface 111f is the same as the angle of the first toner descension surface 111c of the first toner descension surface 111c formed on the actual container portion 111a in the preceding embodiment.

With the structure described above, the toner in the toner storing portion 119a descends due to its own weight along the toner descension surfaces 111c and 111f toward the toner discharge opening 111d.

When assembling the toner container 111 from the bathtub shaped actual container portion 111a with the open bottom, the cover member 111b is first welded to the actual container portion 111a. In this case,

the welding pad is inserted from the side of the toner discharge opening 111d to weld the joint adjacent to the edges of the toner discharge opening 111d.

Therefore, in this embodiment, the cover member 111b
5 is welded to the actual container portion 111 before the toner discharge opening 111d is sealed with the sealing member 123, which makes this embodiment different from the first embodiment.

After the cover member 111b is welded, the
10 toner discharge opening is sealed by welding the sealing member 123 thereon. When welding the sealing member 123, the welding pad can be inserted from the recessed portion 111g provided on the actual container portion 111a; therefore, the sealing member 123 can be
15 easily welded to the flange 111c.

Thereafter, the toner is filled, and the developing members such as the developing roller 119c and the like are assembled into the pertinent frame portions, to complete the developing unit. This step
20 is the same as the one in the preceding embodiment.

Even when the actual container portion 111a with the open bottom is employed, the same results as the preceding embodiment can be obtained by providing the actual container portion 111a with the first and
25 second toner descension surface 111c and 111f.

As described above, according to the present invention, predetermined sections of the toner

container are formed into the first and second slanted
toner descension surfaces; therefore, even when the
toner container is bulged upward in order to increase
the capacity of the toner storing portion in the
5 developing apparatus or process cartridge, the toner
can be reliably fed into the developing chamber.

Further, the toner container is assembled
from two components; the actual container portion and
cover member, which have no undercut portion, and
10 therefore, can be easily formed of plastic material by
injection molding. As a result, the toner container
can be manufactured with low cost.

Further, the toner container is provided with
the recessed portion for the welding tools; therefore,
15 even when the capacity of the toner container is
increased, the toner container and developing frame
can be easily welded together.

Further, in each of the preceding
embodiments, the process cartridge B is of a type
20 which is used to form a monochrome image, but the
present invention is also applicable to a multicolor
process cartridge, which comprises two or more
developing means and is used to form a multicolor
image (image of two colors, three colors, or full-
25 color).

As for the electrophotographic photosensitive
member, it is not limited to the aforementioned

photosensitive drum 7. The photoconductive material is usable as the photosensitive material. As for the photoconductive material, amorphous silicon, amorphous selenium, zinc oxide, titanium oxide, organic photoconductor (OPC), or the like, is usable. Further, as for the configuration of a base member on which the photosensitive material is placed, a base member in the form of a drum or a belt is used. For example, in the case of the base member of the drum type, the photoconductive material is coated, deposited, or placed by the like means on a cylinder of aluminum alloy or the like.

As for the developing method, the present invention is compatible with various well-known methods such as the double component magnetic brush developing method, cascade developing method, touch down developing method, cloud developing method, and the like.

Further, as to the structure of the charging means, the so-called contact charging method is employed in the first embodiment, but it is needless to say that the present invention is also applicable to other conventional charging methods such as the one in which a metallic shield of aluminum or the like is placed on three sides of a tungsten wire, and positive



or negative ions generated by applying a high voltage to the tungsten wire are transferred onto the surface of the photosensitive drum to charge it uniformly.

5 Further, the aforementioned charging means may be of the blade type, (charging blade), pad type, block type, rod type, wire type, or the like, in addition to the roller type described previously.

10 As for the method for cleaning the residual toner on the photosensitive drum, the cleaning means may be constituted of a blade, fur brush, magnetic brush, or the like.

15 As described above, all of the plural electrical contact points of the process cartridge are disposed on only one of the lateral surfaces of the cartridge frame; therefore, the electrical connection between the process cartridge and image forming apparatus can be reliably established by positioning the process cartridge in such a manner as to be
20 pressed by elastic means toward its lateral surface where the electrical contact points are disposed.

Further, the electrical connection, as well as the driving mechanism connection, between the process cartridge and image forming apparatus can be
25 more reliably established by means of disposing the helical gear and electrical contact points on the side toward which the electrophotographic photosensitive

member is pressed by the rotation of the helical gear for transmitting the driving force to the photosensitive member.

Further, the distance the wiring must be
5 routed within the process cartridge can be shortened by means of disposing each of the contact points in the same manner as described in the preceding embodiments.

10 Further, the electrical circuit board of the apparatus main assembly, to which the aforementioned electrical contact points are to be connected, can be vertically arranged on the lateral surface of the apparatus main assembly; therefore, the apparatus size can be
15 reduced.

As described in the foregoing, the toner supply performance is high even if the amount of toner is large.

While the invention has been described with
20 reference to the structures disclosed herein, it is not confined to the details set forth and this application is intended to cover such modifications or changes as may come within the purposes of the improvements or the scope of the following claims.

25



The claims defining the invention are as follows:

1. A process cartridge detachably mountable to a main assembly of an image forming apparatus, comprising:

5 (i) an electrophotographic photosensitive member;

(ii) a developing member configured and positioned with respect to said electrophotographic photosensitive member to develop a latent image formed on said electrophotographic photosensitive member;

(iii) a developer accommodating container configured to accommodate a
10 developer to be used by said developing member to develop the latent image; and

(iv) a driving force transmission member, said developer container including:

(a) a developer stirring member configured and positioned to stir the developer which is contained in said developer accommodating container and
15 which is to be fed toward said developing member, said developer stirring member being driven by said driving force transmission member;

(b) a first frame including:

a supporting portion, provided at a longitudinal end of said first frame, configured and positioned to support an end of said developer stirring member;

20 an end opening, provided at the other longitudinal end of said first frame, configured and positioned to permit transmission of a rotational driving force from said driving force transmission member to said developer stirring member;

25 a developer supply opening configured and positioned to permit the developer to pass toward said developing member, the developer supply opening extending in a longitudinal direction; and

a developer filling opening configured and positioned to permit the developer accommodating container to be filled with developer; and

30 (c) a second frame connected with said first frame so as to close said first frame, thus constituting with said first frame said developer accommodating container for the developer; and

(d) a gripping portion configured and positioned to permit said process cartridge to be gripped, said gripping portion being constituted by a part of said first frame and a part of said second frame.



2. A process cartridge according to claim 1, wherein said photosensitive member is in the form of a drum, wherein a longitudinal end of said photosensitive member is provided with a helical gear for receiving the driving from the main assembly when said process cartridge is mounted to the main assembly, and wherein said driving force
5 transmission member transmits the driving force received by the helical gear from the main assembly, to said developer stirring member.

3. A process cartridge according to claim 2, wherein said helical gear is provided at the same longitudinal end of said process cartridge as an end having said end opening and
10 said developer filling opening.

4. A process cartridge according to any one of claims 1 to 3, wherein said end opening and said developer filling opening are covered by a side cover.

15 5. A process cartridge according to any one of claims 1 to 4, wherein said developer supply opening is sealed by a removable seal, wherein said seal is pulled out of said process cartridge before said process cartridge is mounted to the main assembly, by which said developer supply opening is opened.

20 6. A process cartridge according to claim 4, wherein said side cover is provided with a developing bias contact for receiving, from the main assembly, a developing bias voltage to be applied to said developing member.

7. A process cartridge according to any one of claims 1 to 6, wherein said first
25 frame further includes a plurality of partition members, extending in a widthwise direction of said first frame, for preventing the developer in said developer accommodating container from moving in the longitudinal direction.

8. A process cartridge according to claim 7, wherein as seen from the longitudinal
30 direction of said first frame, a part of each of said partition members partly blocks the view through said developer filling opening.

9. A process cartridge according to any one of claims 1 to 8, wherein said driving
force transmission member enters said end opening.



10. A process cartridge according to any one of claims 1 to 9, wherein said end opening and said developer filling opening are provided at the same side in the longitudinal direction of said first frame.

5 11. A process cartridge according to any one of claims 1 to 10, wherein the part of said first frame constituting said gripping portion is in the form of a recess.

12. A process cartridge according to any one of claims 1 to 11, wherein said second frame is provided on its outer surface with a plurality of ribs extending in the longitudinal
10 direction, as the part of said second frame constituting said gripping portion.

13. A process cartridge detachably mountable to a main assembly of an electrophotographic image forming apparatus, said process cartridge comprising:

(i) an electrophotographic photosensitive drum;
15 (ii) a helical gear, provided at a longitudinal end of said photosensitive drum, configured and positioned to receive a driving force from the main assembly when said process cartridge is mounted to the main assembly;

(iii) a charging member configured and positioned to electrically charge said photosensitive drum;

20 (iv) a drum frame configured and positioned to support said photosensitive drum and said charging member;

(v) a developing roller configured and positioned to develop a latent image formed on said photosensitive drum;

25 (vi) a developing frame configured and positioned to support said developing roller; and

(vii) a developer accommodating container configured and positioned to accommodate a developer to be used by said developing roller to develop the latent image, said developer accommodating container being connected with said developing frame;

30 (viii) a driving force transmission member, said developer accommodating container including:

(a) a developer stirring member configured and positioned to stir the developer that is contained in said developer accommodating container and that is to be fed toward said developing roller, said developer stirring member being driven by said driving force transmission member;



(b) a first frame including:

a supporting portion, provided at a longitudinal end of said first frame, configured and positioned to support an end of said developer stirring member; an end opening, provided at the other longitudinal end of said first frame, configured and positioned to permit transmission of a rotational driving force from the driving force transmission member to said developer stirring member;

a developer supply opening configured and positioned to permit the developer to pass toward said developing roller, the developer supply opening extending in a longitudinal direction; and

a developer filling opening configured and positioned to permit the developer accommodating container to be filled with developer; and

(c) a second frame connected with said first frame so as to close said first frame, thus constituting with said first frame said developer accommodating container for the developer, wherein said developing frame and said developer accommodating container connected with each other are rotatably connected with said drum frame;

(ix) a removable toner seal configured and positioned to seal said developer supply opening, wherein said toner seal is pulled out of said process cartridge before said process cartridge is mounted to the main assembly by which the developer supply opening is opened; and

(x) a gripping portion configured and positioned to permit said process cartridge to be gripped provided in said first frame and said second frame,

wherein said end opening and said developer filling opening are provided at the same side in the longitudinal direction of said first frame.

14. A process cartridge according to claim 13, wherein said first frame further includes a plurality of partition members, extending in a widthwise direction of said first frame, for preventing the developer in said developer accommodating container from moving in the longitudinal direction.

15. A process cartridge according to claim 14, wherein as seen from the longitudinal direction of said first frame, a part of each of said partition members partly blocks the view through said developer filling opening.



16. A process cartridge according to any one of claims 13 to 15, wherein said developing frame and said developer accommodating container are connected to each other by welding.

5 17. A process cartridge according to claim 16, wherein the welding is ultrasonic welding.

18. A process cartridge according to any one of claims 14 to 17, wherein the part of said first frame constituting said gripping portion is in the form of a recess.

10

19. A process cartridge according to any one of claims 13 to 18, wherein said second frame is provided on its outer surface with a plurality of ribs extending in the longitudinal direction, as the part of said second frame constituting said gripping portion.

15 20. A process cartridge according to any one of claims 13 to 19, wherein said end opening and said developer filling opening are covered by a side cover, and wherein said side cover is provided with a developing bias contact for receiving, from the main assembly, a developing bias voltage to be applied to said developing roller.

20 21. A process cartridge according to any one of claims 1 to 20, wherein said first and second frames are made of plastic resin material.

22. A process cartridge detachably mountable to a main assembly of an electrophotographic image forming apparatus, said process cartridge comprising:

25 (i) an electrophotographic photosensitive drum;
(ii) a first helical gear, provided at a longitudinal end of said photosensitive drum, configured and positioned to receive a driving force from the main assembly when said process cartridge is mounted to the main assembly;

(iii) a charging roller configured and positioned to electrically charge said
30 photosensitive drum, wherein said charging roller is contacted to said photosensitive drum;

(iv) a drum frame configured and positioned to support said photosensitive drum and said charging roller;

(v) a developing roller configured and positioned to develop a latent image
formed on said photosensitive drum, wherein said developing roller is provided at a



longitudinal end thereof with a second helical gear engaged with said first helical gear to receive a driving force for rotating said developing roller;

(vi) a developing frame configured and positioned to support said developing roller; and

5 (vii) a developer accommodating container configured and positioned to accommodate a developer to be used by said developing roller to develop the latent image, said developer accommodating container being connected with said developing frame;

10 (viii) a driving force transmission member, said developer accommodating container including:

(a) developer stirring member configured and positioned to stir the developer that is contained in said developer accommodating container and that is to be fed toward said developing roller, said developing stirring member being driven by said driving force transmission member;

15 (b) a first frame including:

a supporting portion, provided at a longitudinal end of said first frame, configured and positioned to support an end of said developer stirring member;

20 an end opening, provided at the other longitudinal end of said first frame, in which said driving force transmission member is supported, configured and positioned to permit transmission of a rotational driving force to said developer stirring member through said second helical gear;

a developer supply opening configured and positioned to permit the developer to pass toward said developing roller, the developer supply opening extending in a longitudinal direction; and

25 a developer filling opening configured and positioned to permit the developer accommodating container to be filled with developer; and

30 (c) a second frame connected with said first frame so as to close said first frame, thus constituting with said first frame the developer accommodating container, wherein said developing frame and said developer accommodating container connected with each other are rotatably connected with said drum frame;

(ix) a removable toner seal configured and positioned to seal said developer supply opening, wherein said toner seal is pulled out of said process cartridge before said process cartridge is mounted to the main assembly by which the developer supply opening is opened; and



(x) a gripping portion configured and positioned to permit said process cartridge to be gripped provided in said first frame and said second frame,

wherein said end opening and said developer filling opening are provided at the same side in the longitudinal direction of said first frame,

5 (xi) a side cover configured and positioned to cover said end opening and side developer filling opening, and wherein said side cover is provided with a developing bias contact for receiving, from the main assembly, a developing bias voltage to be applied to said developing roller when said process cartridge is mounted to the main assembly,

10 wherein said first and second frames are made of plastic resin material.

23. A process cartridge according to claim 22, wherein said first frame further includes a plurality of partition members, extending in a direction crossing with a longitudinal direction of said first frame, for preventing the developer in said developer
15 accommodating container from moving in the longitudinal direction.

24. A process cartridge according to claim 23, wherein as seen from the longitudinal direction of said first frame, a part of each of said partition members partly blocks the view through said developer filling opening.
20

25. A process cartridge according to any one of claims 22 to 24, wherein the part of said first frame constituting said gripping portion is in the form of a recess.

26. A process cartridge according to any one of claims 21 to 25, wherein said
25 developing frame and said developer accommodating container are connected to each other by welding.

27. A process cartridge according to claim 26, wherein the welding is ultrasonic welding.
30

28. A process cartridge according to any one of claims 22 to 27, wherein said second frame is provided on its outer surface with a plurality of ribs extending in the longitudinal direction, as the part of said second frame constituting said gripping portion.



29. A process cartridge according to any one of claims 22 to 27, wherein said side cover is provided with a detection contact, wherein said detection contact permits detection of mounting of said process cartridge to said main assembly and notification to said main assembly that said process cartridge is mounted to said main assembly.

5

30. A process cartridge according to claim 29, wherein said detection contact is also used for transmitting to said main assembly information indicating that a remaining amount of the toner reaches a predetermined level.

10 31. A developer accommodating container for accommodating a developer to be used by a developing member to develop a latent image formed on an electrophotographic photosensitive member in a process cartridge, said developer accommodating container comprising:

(a) a developer stirring member configured and positioned to stir the
15 developer which is contained in said developer accommodating container and which is to be fed toward said developing member, said developer stirring member being driven by a driving force transmission member;

(b) a first frame including:
a supporting portion, provided at a longitudinal end of said first frame,
20 configured and positioned to support an end of said developer stirring member;

an end opening, provided at the other longitudinal end of first frame, configured and positioned to permit transmission of a rotational driving force from a driving force transmission member to said developer stirring member;

a developer supply opening configured and positioned to permit the developer to
25 pass toward said developing member, the developer supply opening extending in a longitudinal direction; and

a developer filling opening configured and positioned to permit the developer accommodating container to be filled with developer; and

(c) a second frame connected with said first frame so as to close said first
30 frame, thus constituting with said first frame said developer accommodating container for the developer; and

(d) a gripping portion configured and positioned to permit said process cartridge to be gripped, said gripping portion being constituted by a part of said first frame and a part of said second frame.



32. A developer accommodating container for accommodating a developer to be used by a developing roller supported by a developing frame in a process cartridge to develop a latent image formed on an electrophotographic photosensitive drum having a helical gear at one end thereof for receiving a driving force a main assembly of an electrophotographic image forming apparatus, being charged by a charging member, and being supported by a drum frame that also supports the charging member, said developer accommodating container comprising:

(a) a developer stirring member configured and positioned to stir the developer that is contained in said developer accommodating container and that is to be fed toward the developing roller, said developer stirring member being driven by a driving force transmission member;

(b) a first frame including:

a supporting portion, provided at a longitudinal end of said first frame, configured and positioned to support an end of said developer stirring member;

an end opening, provided at the other longitudinal end of said first frame, configured and positioned to permit transmission of a rotational driving force from the driving force transmission member to said developer stirring member,

a developer supply opening configured and positioned to permit the developer to pass toward the developing roller, the developer supply opening extending in a longitudinal direction; and

(c) a second frame connected with said first frame so as to close said first frame, thus constituting with said first frame said developer accommodating container developer, wherein the developing frame and said developer accommodating container connected with each other are rotatably connected with the drum frame;

(d) a removable toner seal configured and positioned to seal said developer supply opening, wherein said toner seal is pulled out of said process cartridge before the process cartridge is mounted to the main assembly by which the developer supply opening is opened; and

(e) a gripping portion configured and positioned to permit said process cartridge to be gripped provided in said first frame and said second frame,

wherein said end opening and said developer filling opening are provided at the same side in the longitudinal direction of said first frame.

33. A developer accommodating container for accommodating a developer to be used by a developing roller supported by a developing frame in a process cartridge to



develop a latent image formed on an electrophotographic photosensitive drum having a first helical gear at one end thereof for receiving a driving force from a main assembly of an electrophotographic image forming apparatus and for transmitting a driving force to the developing roller by engaging a second helical gear at one longitudinal end of the developing roller, being charged by a charging roller, and being supported by a drum frame that also supports the charging roller, said developer accommodating container comprising:

(a) a developer stirring member configured and positioned to stir the developer that is contained in said developer accommodating container and that is to be fed toward the developing roller, said developing stirring member being driven by a driving force transmission member;

(b) a first frame including:
a supporting portion, provided at a longitudinal end of said first frame, configured and positioned to support an end of said developer stirring member;
an end opening, provided at the other longitudinal end of said first frame, in which the driving force transmission member is supported, configured and positioned to permit transmission of a rotational driving force to said developer stirring member through the second helical gear;

a developer supply opening configured and positioned to permit the developer to pass toward the developing roller, the developer supply opening extending in a longitudinal direction; and

a developer filling opening configured and positioned to permit the developer accommodating container to be filled with developer; and

(c) a second frame connected with said first frame so as to close said first frame thus constituting with said first frame the developer accommodating container connected with each said developing frame and said developer accommodating container connected with each other are rotatably connected with said drum frame;

(d) a removable toner seal configured and positioned to seal said developer supply opening, wherein said toner seal is pulled out of the process cartridge before the process cartridge is mounted to the main assembly by which the developer supply opening opened; and

(e) a gripping portion configured and positioned to permit the process cartridge to be gripped provided in said first frame and said second frame,

wherein said end opening and said developer filling opening are provided at the same side in the longitudinal direction of said first frame,



(f) a side cover configured and positioned to cover said end opening and said developer filling opening, and wherein said side cover is provided with a developing bias contact for receiving, from the main assembly, a developing bias voltage to be applied to the developing roller when said process cartridge is mounted to the main assembly,

wherein said first and second frames are made of plastic resin material.

34. An electrophotographic image forming apparatus, for forming an image on a recording material, having a main assembly to which a process cartridge is detachably mountable, said apparatus comprising:

a mounting member for mounting thereon a process cartridge including:

(i) an electrophotographic photosensitive member;

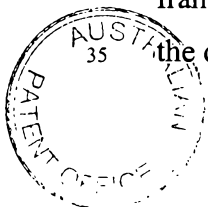
(ii) a developing member configured and positioned with respect to said electrophotographic photosensitive member to develop a latent image formed on said electrophotographic photosensitive member;

(iii) a developer accommodating container configured to accommodate a developer to be used by said developing member to develop the latent image; and a driving force transmission member, said developer accommodating container including:

(a) a developer stirring member configured and positioned to stir the developer which is contained in said developer accommodating container and which to be fed toward said developing member, said developer stirring member being driven by said driving force transmission member;

(b) a first frame including a supporting portion, provided at a longitudinal end of said first frame, configured and positioned to support an end of said developer stirring member; an end opening, providing at the other longitudinal end of said first frame, configured and positioned to permit transmission of a rotational driving force from said driving force transmission member to said developer stirring member; a developer supply opening configured and positioned to permit the developer to pass toward said developing member, the developer supply opening extending in a longitudinal direction; and a developer filling opening configured and positioned to permit the developer accommodating container to be filled with developer;

(c) a second frame connected with said first frame so as to close said first frame, thus constituting with said first frame said developer accommodating container for the developer; and



(d) a gripping portion configured and positioned to permit said process cartridge to be gripped, said gripping portion being constituted by a part of said first frame and a part of said second frame;

a gear engageable with said electrophotographic photosensitive member when said process cartridge is mounted to said mounting member to transmit a driving force to said electrophotographic member; and

a feeding member rotatable to feed the recording material through a path to receive the latent image developed by said developing member.

10 35. An electrophotographic image forming apparatus, for forming an image on a recording material, having a main assembly to which a process cartridge is detachably mountable, said apparatus comprising:

a mounting member for mounting thereon a process cartridge including:

(i) an electrophotographic photosensitive drum;

15 (ii) a helical gear, provided at a longitudinal end of said photosensitive drum, configured and positioned to receive a driving force from the main assembly when said process cartridge is mounted to the main assembly;

(iii) a charging member configured and positioned to electrically charge said photosensitive drum;

20 (iv) a drum frame configured and positioned to support said photosensitive drum and said charging member;

(v) a developing roller configured and positioned to develop a latent image formed on said photosensitive drum;

25 (vi) a developing frame configured and positioned to support said developing roller; and

(vii) a developer accommodating container configured and positioned to accommodate a developer to be used by said developing roller to develop the latent image, said developer accommodating container being connected with said developing frame;

30 (viii) a driving force transmission member said developer accommodating container including:

(a) a developer stirring member configured and positioned to stir the developer that is contained in said developer accommodating container and that is to be fed toward said developing roller, said developer stirring member being driven by said driving force transmission member;



(b) a first frame including: a supporting portion, provided at a longitudinal end of said first frame configured and positioned to support an end of said developer stirring member; an end opening, provided at the other longitudinal end of said first frame, configured and positioned to permit transmission of a rotational driving force from the driving force transmission member to said developer stirring member; a developer supply opening configured and positioned to permit the developer to pass toward said developing roller, the developer supply opening extending in a longitudinal direction; and

a developer filling opening configured and positioned to permit the developer accommodating container to be filled with developer; and

(c) a second frame connecting with said first frame so as to close said first frame, thus constituting with said first frame said developer accommodating container for the developer, wherein said developing frame and said developer accommodating container connected with each other are rotatably connected with said drum frame;

(ix) a removable toner seal configured and positioned to seal said developer supply opening, wherein said toner seal is pulled out of said process cartridge before said process cartridge is mounted to the main assembly by which the developer supply opening is opened; and

(x) a gripping portion configured and positioned to permit said process cartridge to be gripped provided in said first frame and said second frame,

wherein said end opening and said developer filling opening are provided at the same side in the longitudinal direction of said first frame;

a gear engageable with said helical gear when said process cartridge is mounted to said mounting member to transmit a driving force to the helical gear and said electrophotographic photosensitive drum; and

a feeding member rotatable to feed the recording material through a path to receive the latent image developed by said developing roller.

36. An electrophotographic image forming apparatus, for forming an image on a recording material, having a main assembly to which a process cartridge is detachably mountable, said apparatus comprising:

a mounting member for mounting thereon a process cartridge including:

(i) an electrophotographic photosensitive drum;



(ii) a first helical gear, provided at a longitudinal end of said photosensitive drum, configured and positioned to receive a driving force from the main assembly when said process cartridge is mounted to the main assembly;

(iii) a charging roller configured and positioned to electrically charge said photosensitive drum, wherein said charging roller is contacted to said photosensitive drum;

(iv) a drum frame configured and positioned to support said photosensitive drum and said charging roller;

(v) a developing roller configured and positioned to develop a latent image formed on said photosensitive drum, wherein said developing roller is provided at a longitudinal end thereof with a second helical gear engaged with said first helical gear to receive a driving force for rotating said developing roller;

(vi) a developing frame configured and positioned to support said developing roller; and

(vii) a developer accommodating container configured and positioned to accommodate a developer to be used by said developing roller to develop the latent image, said developer accommodating container being connected with said developing frame;

(viii) a driving force transmission member, said developer accommodating container including:

(a) a developer stirring member configured and positioned to stir the developer that is contained in said developer accommodating container and that is to be fed toward said developing roller, said developing stirring member being driven by said driving force transmission member;

(b) a first frame including: a supporting portion, provided at a longitudinal end of said first frame, configured and positioned to support an end of said developer stirring member; an end opening, provided at the other longitudinal end of said first frame, in which said driving force transmission member is supported, configured and positioned to permit transmission of a rotational driving force to said developer stirring member through said second helical gear; a developer supply opening configured and positioned to permit the developer to pass toward said developing roller, the developer supply opening extending in a longitudinal direction; and a developer filling opening configured and positioned to permit the developer accommodating container to be filled with developer; and



(c) a second frame connected with said first frame so as to close said first frame, thus constituting with said first frame the developer accommodating container wherein said developing frame and said developer accommodating container connected with each other are rotatably connected with said drum frame;

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(ix) a removable toner seal configured and positioned to seal said developer supply opening, wherein said toner seal is pulled out of said process cartridge before said process cartridge is mounted to the main assembly by which the developer supply opening is opened; and

10

(x) a gripping portion configured and positioned to permit said process cartridge to be gripped provided in said first frame and said second frame, wherein said end opening and said developer filling opening are provided at the same side in the longitudinal direction of said first frame,

15

(xi) a side cover configured and positioned to cover said end opening and said developer filling opening, and wherein said side cover is provided with a developing bias contact for receiving, from the main assembly, a developing bias voltage to be applied to said developing roller when said process cartridge is mounted to the main assembly, wherein said first and second frames are made of plastic resin material:

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a gear engageable with said first helical gear when said process cartridge is mounted to said mounting member to transmit a driving force to said electrophotographic photosensitive drum; and

a feeding member rotatable to feed the recording material through a path to receive the latent image developed by said developing roller.

25

DATED this Seventh Day of May, 2002

Canon Kabushiki Kaisha

Patent Attorneys for the Applicant

SPRUSON & FERGUSON



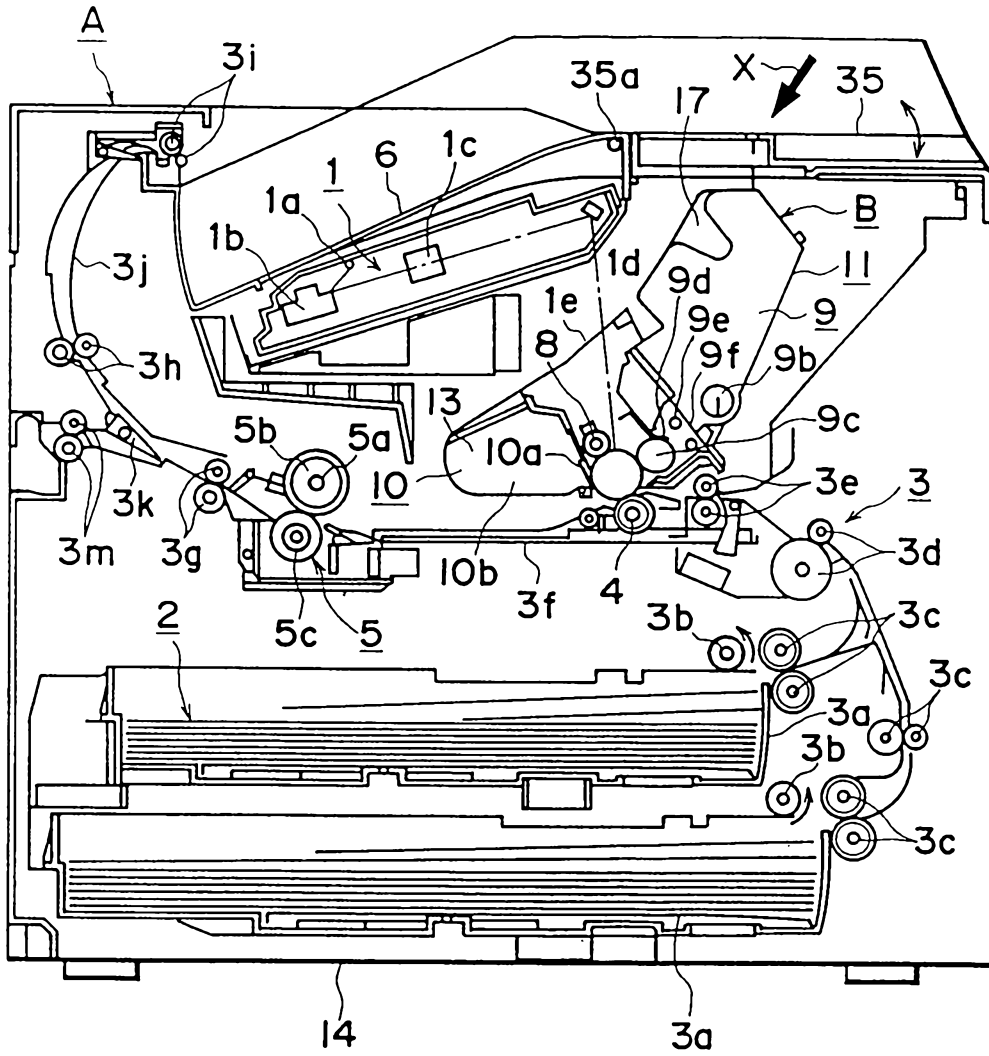


FIG. 1

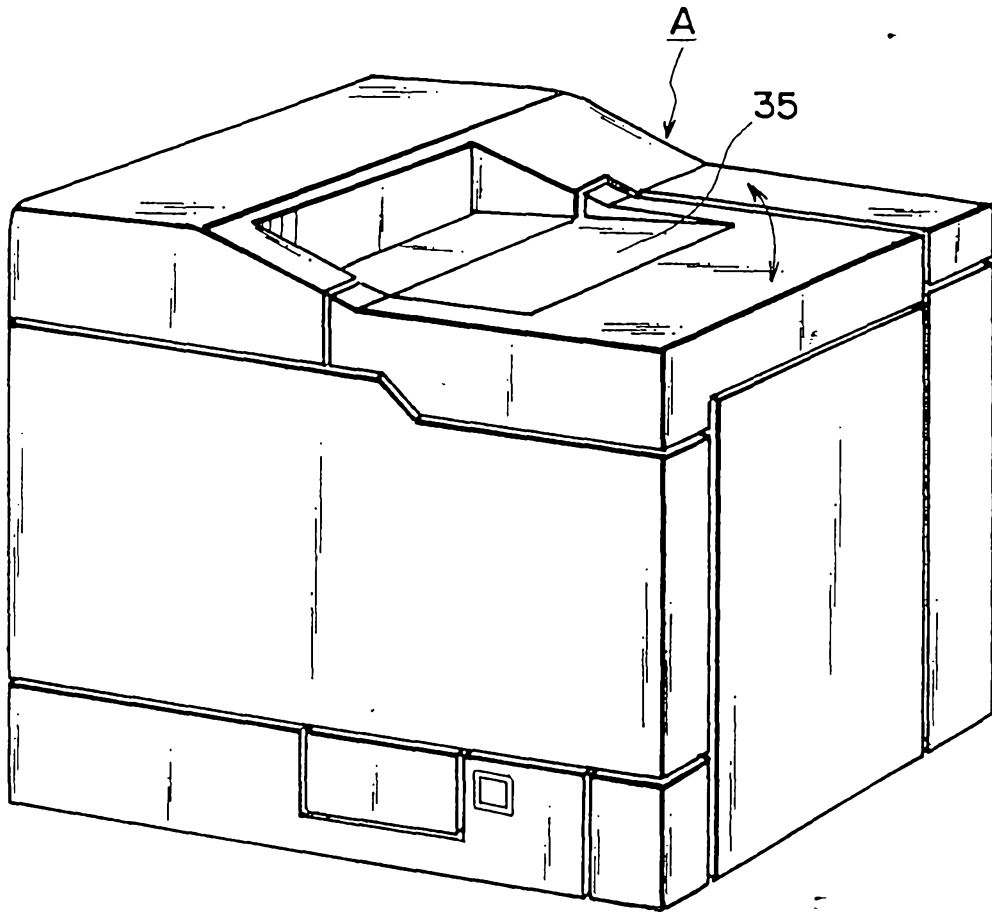


FIG. 2

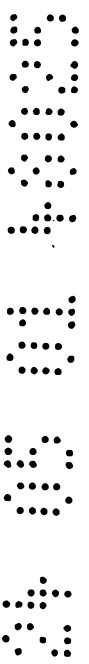
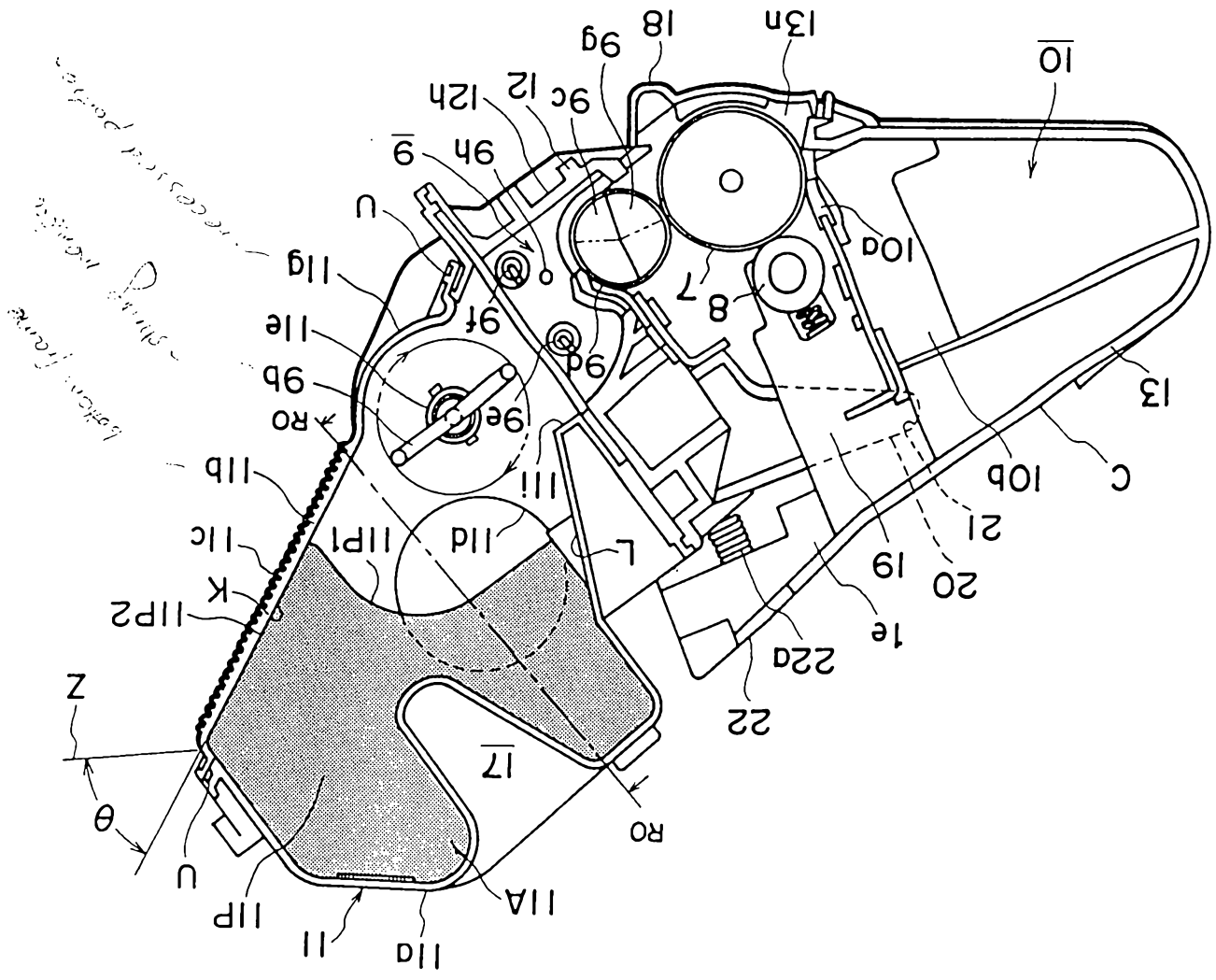


FIG. 3



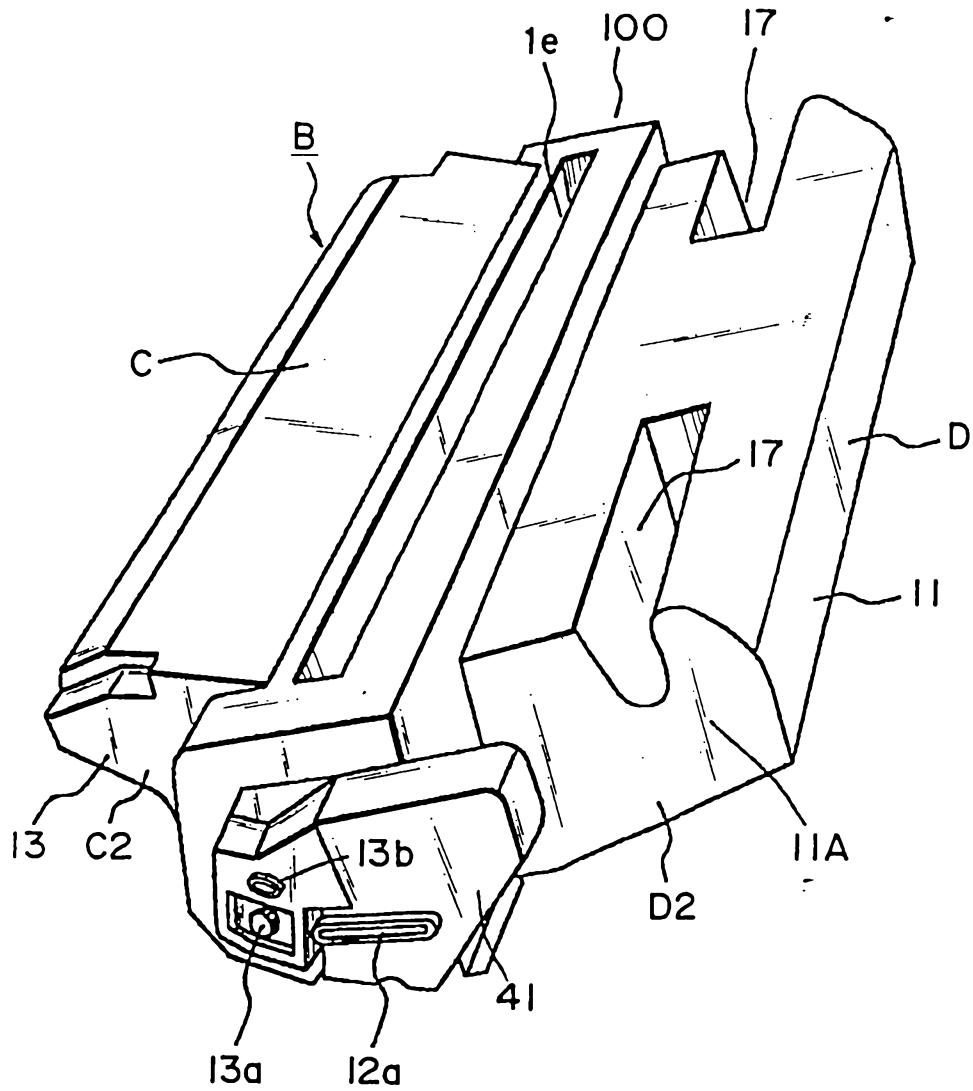


FIG. 4

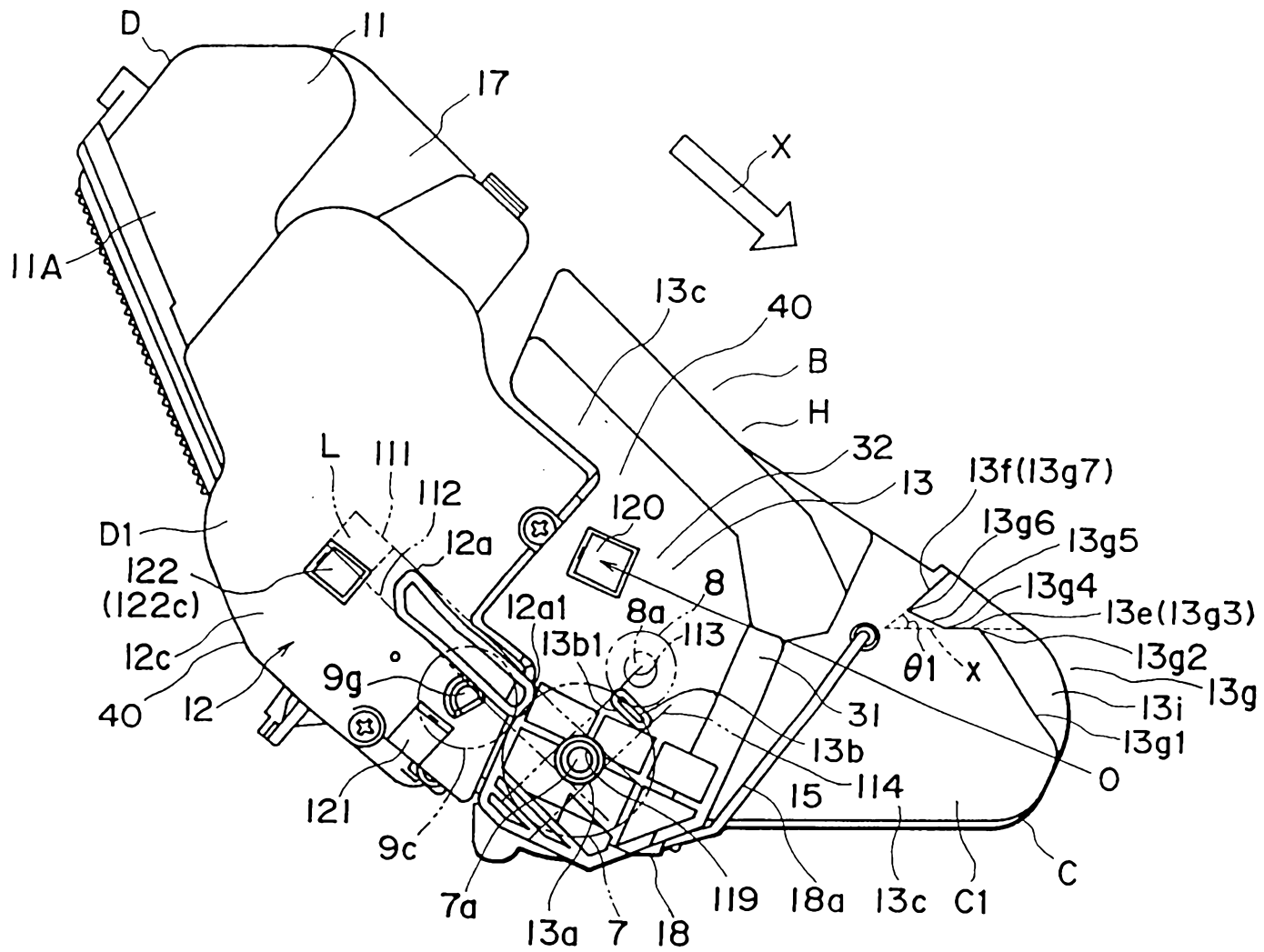


FIG. 5

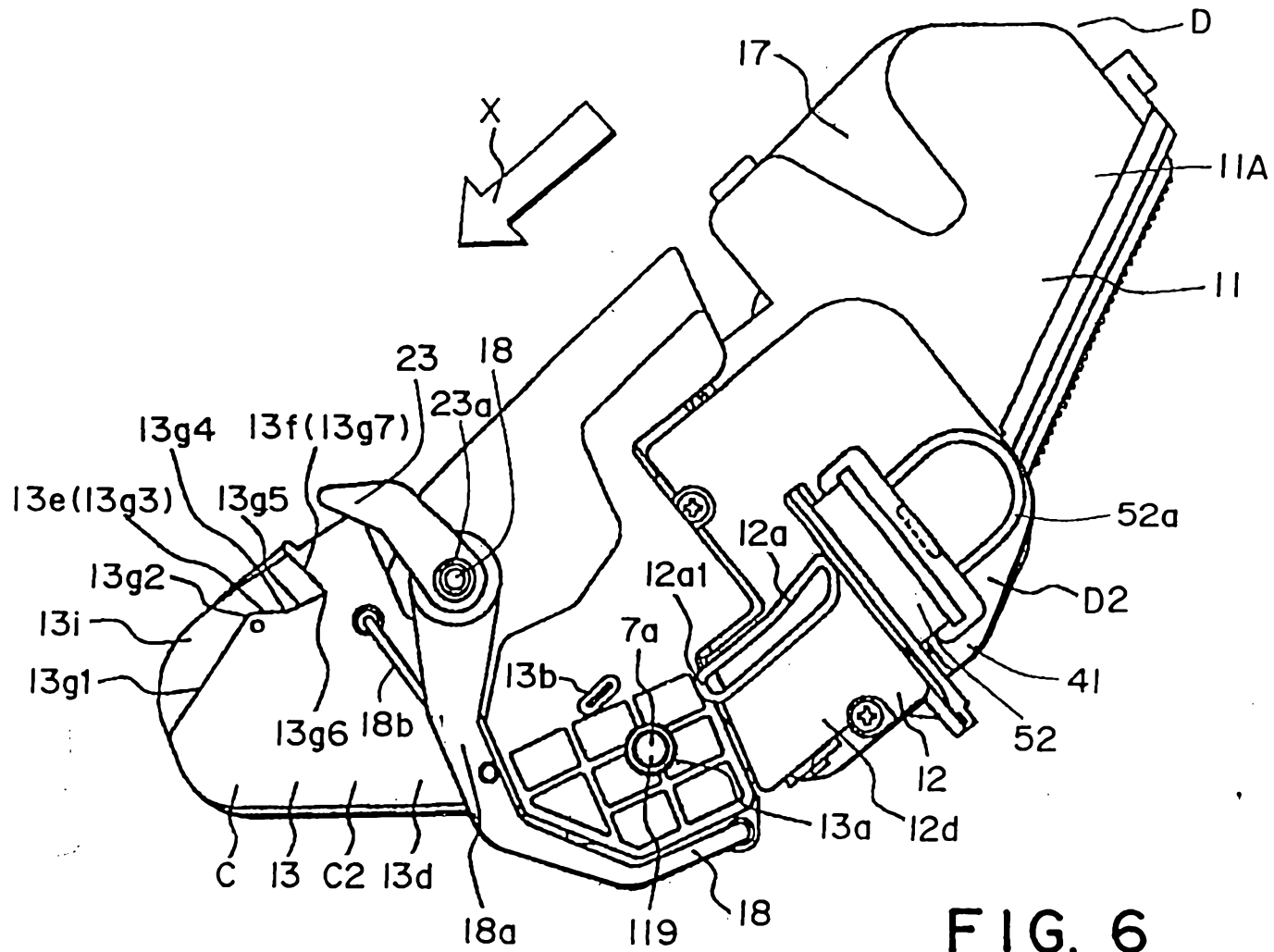


FIG. 6

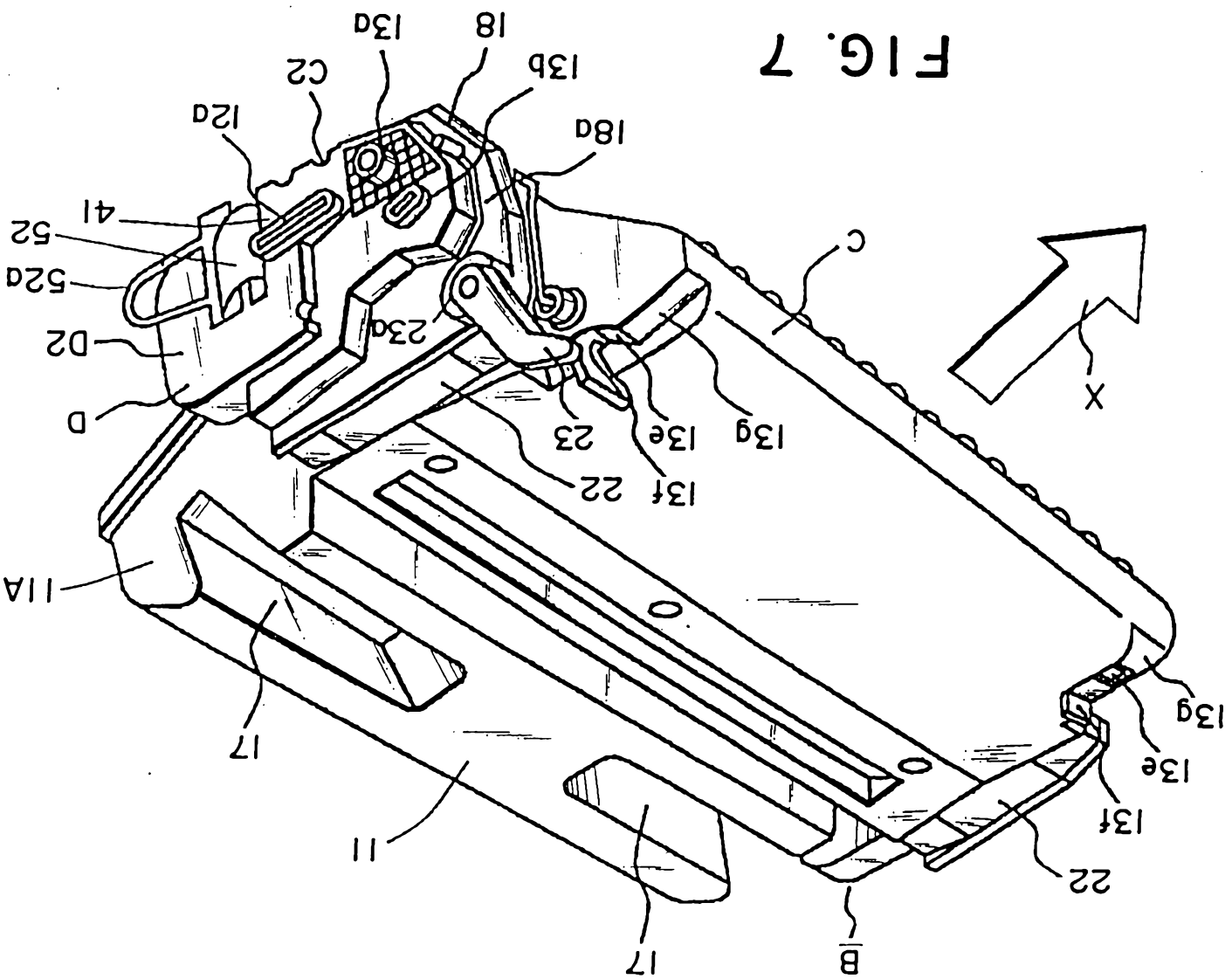


FIG. 7

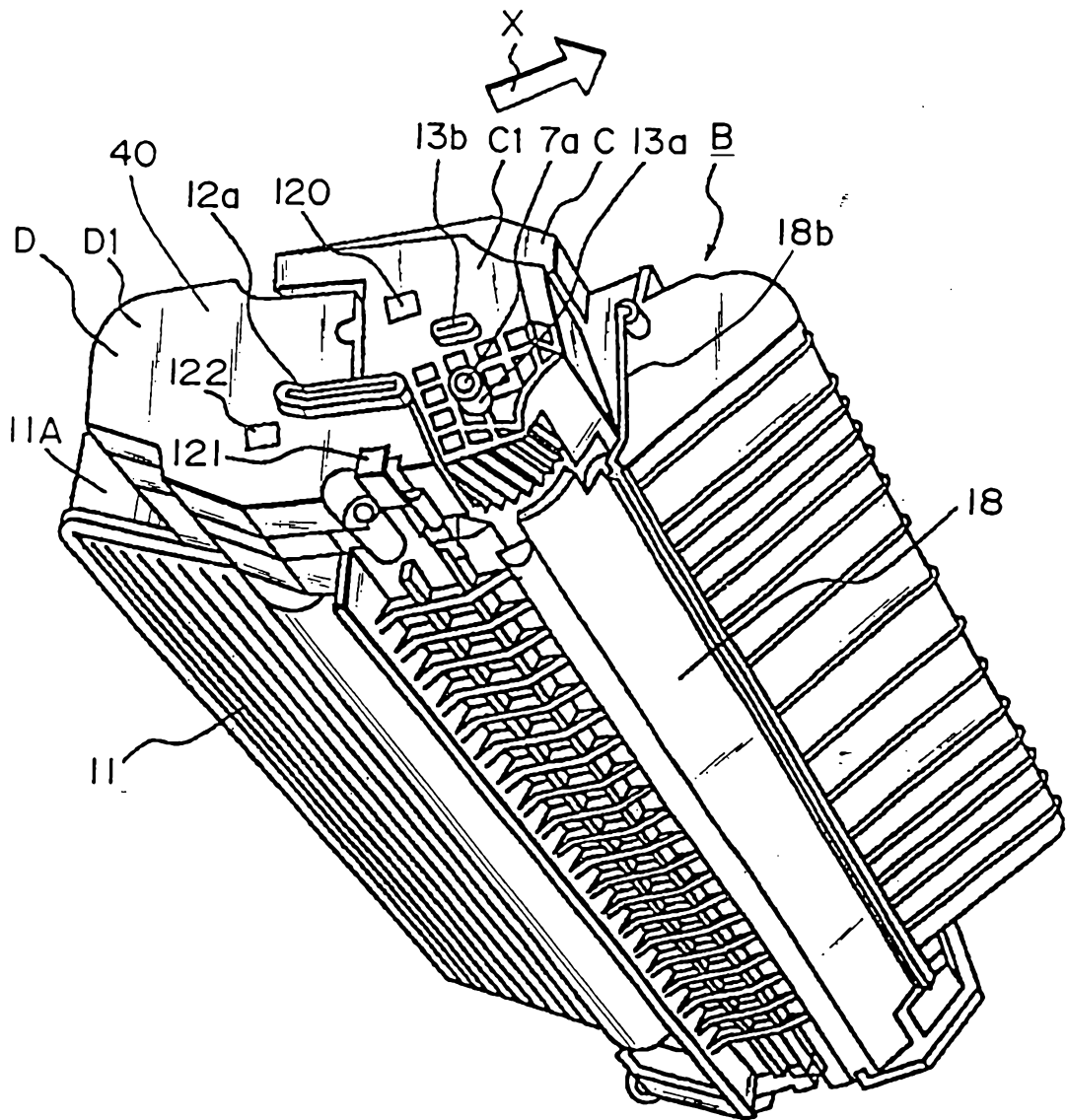
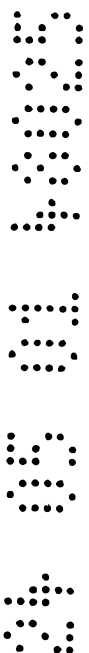
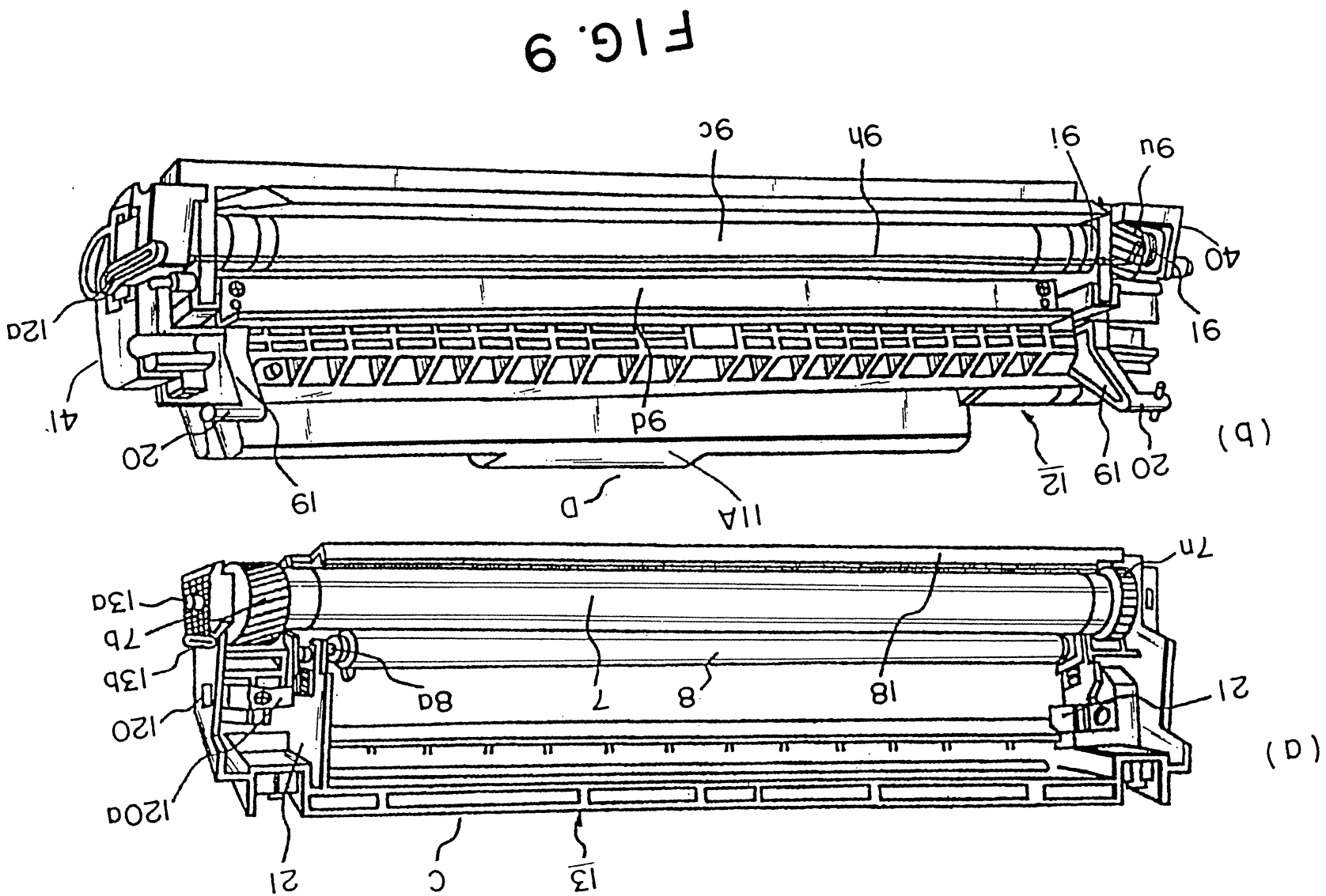


FIG. 8



9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35 36 37 38 39 40 41 42 43 44 45 46 47 48 49 50 51 52 53 54 55 56 57 58 59 60 61 62 63 64 65 66 67 68 69 70 71 72 73 74 75 76 77 78 79 80 81 82 83 84 85 86 87 88 89 90 91 92 93 94 95 96 97 98 99 100



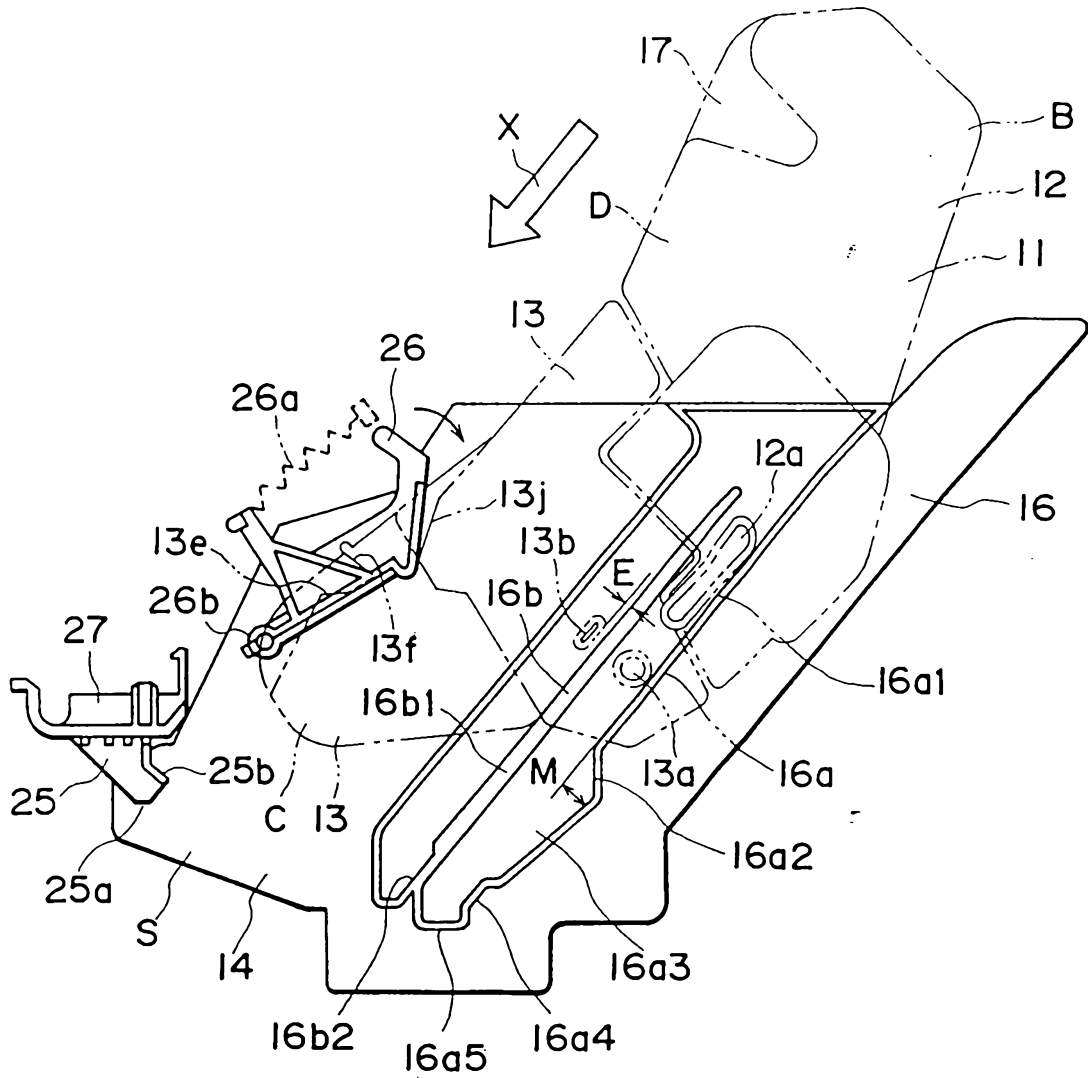


FIG. 10



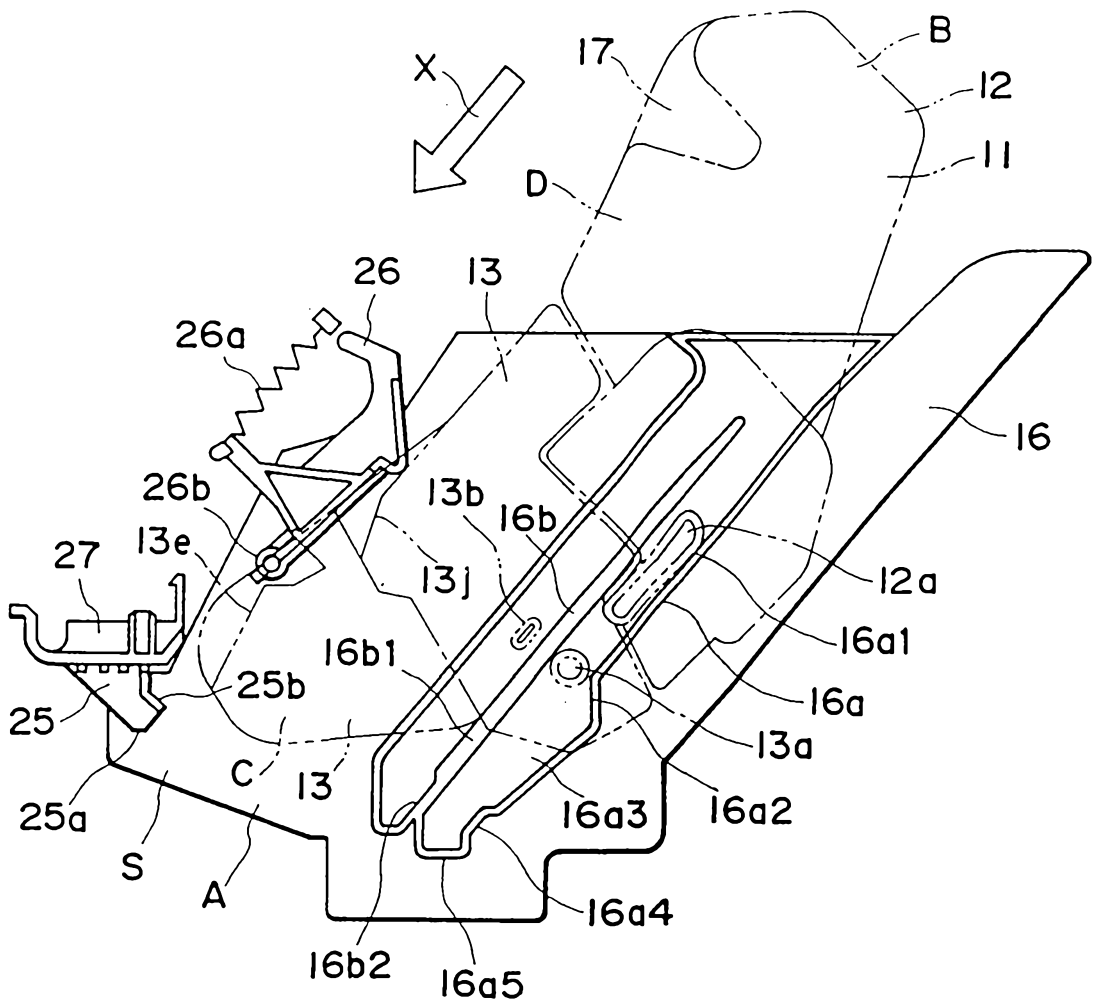
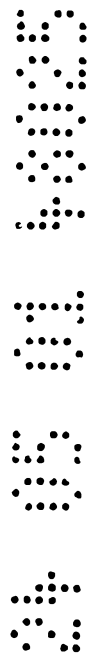


FIG. II



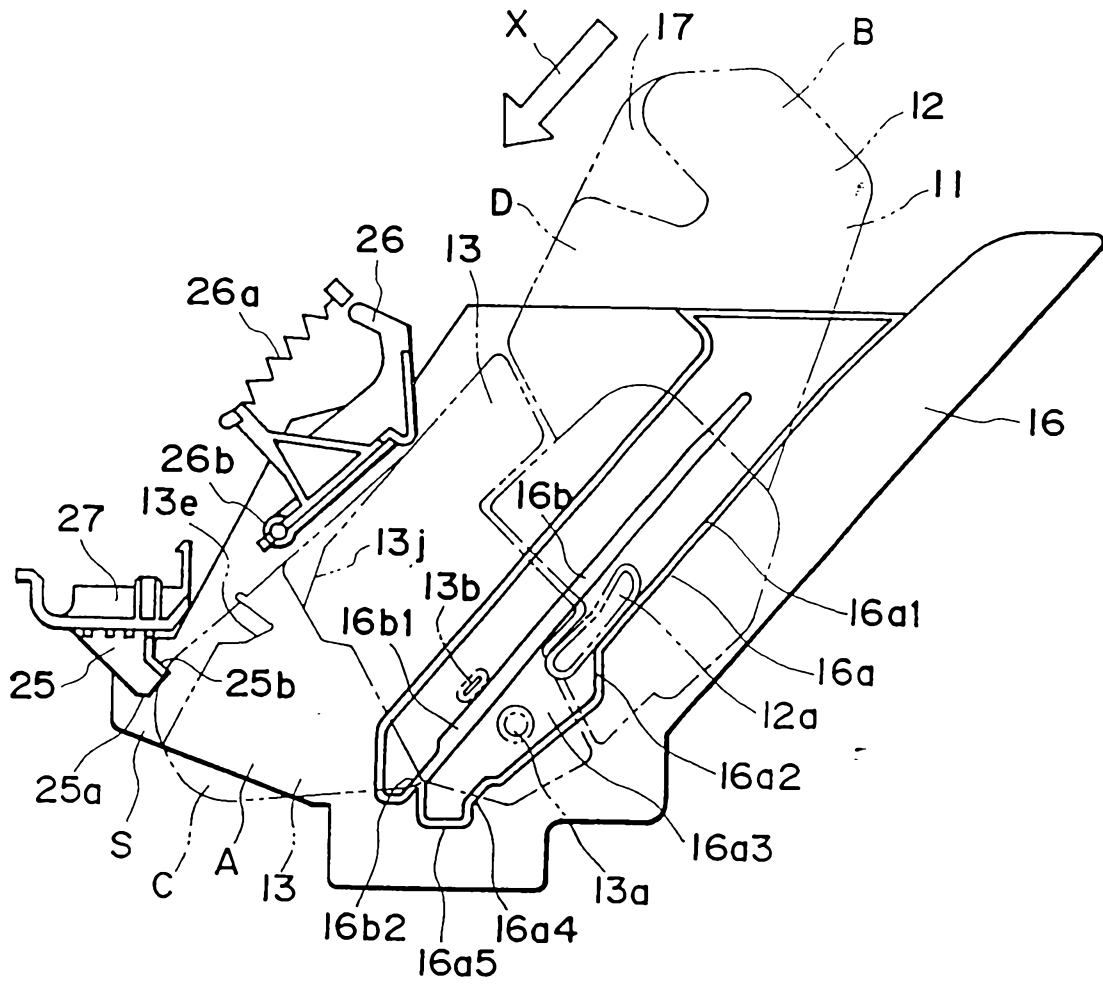


FIG. 12

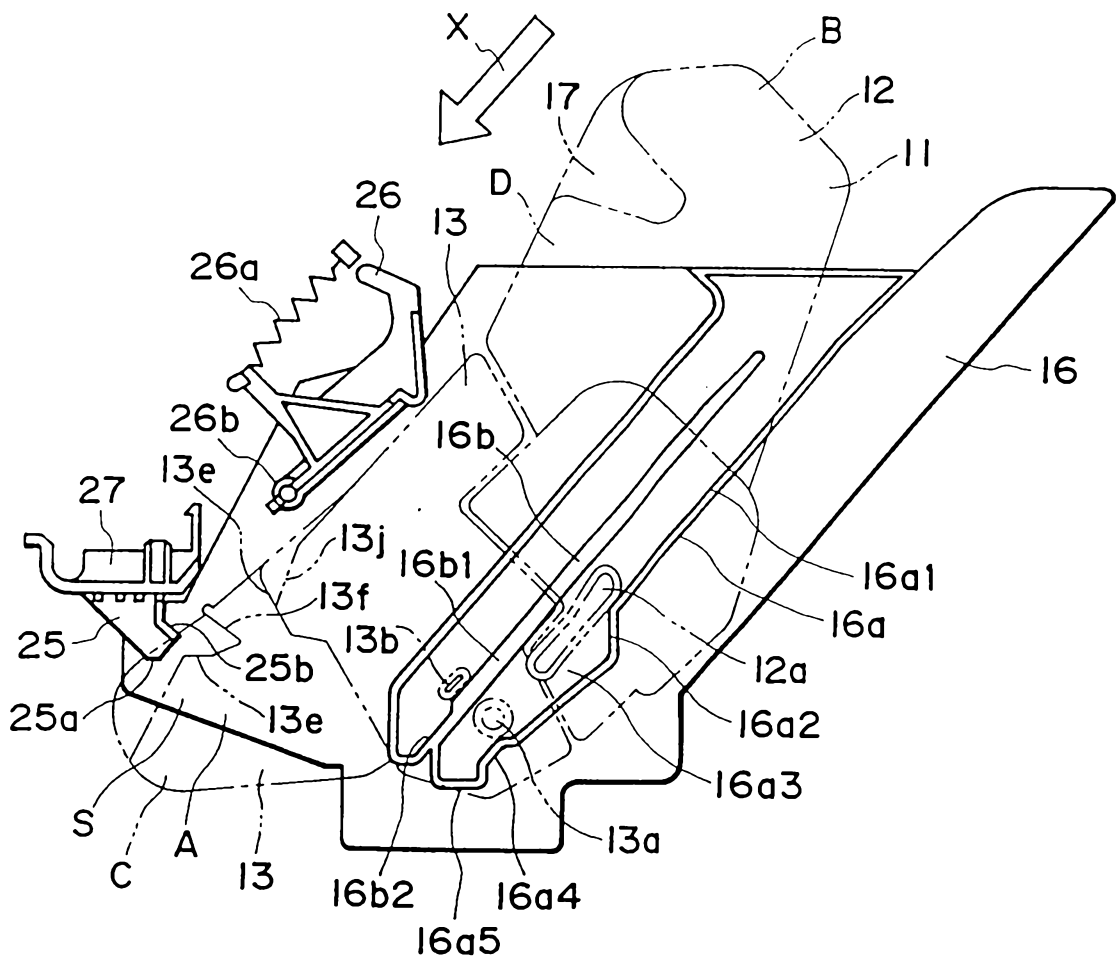


FIG. 13

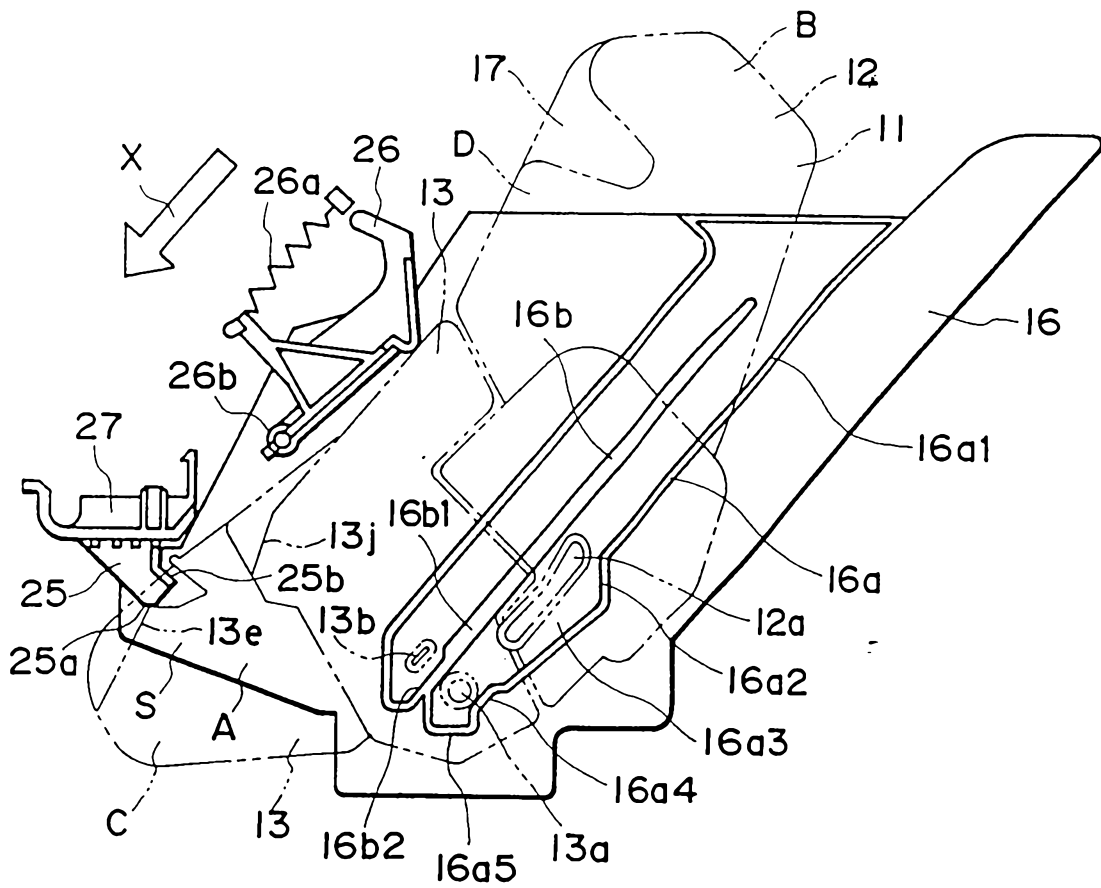


FIG. 14

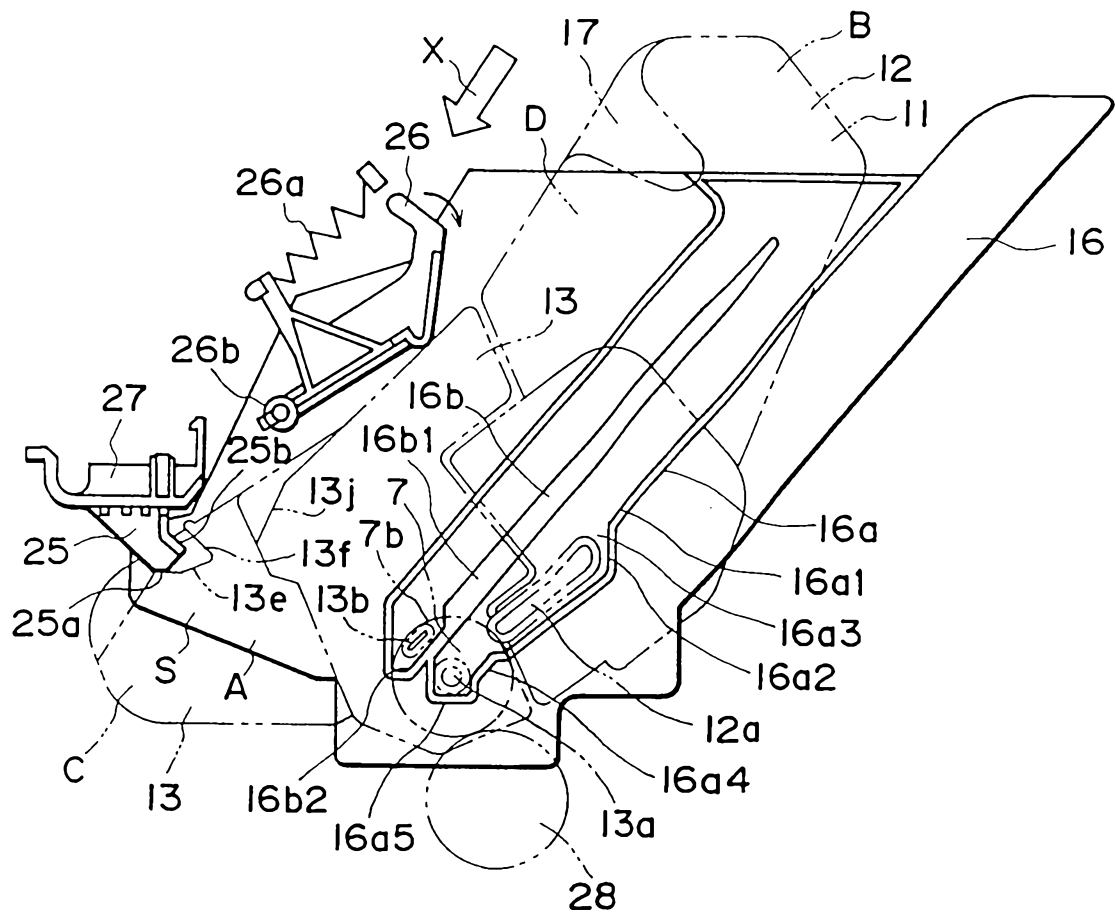


FIG. 15

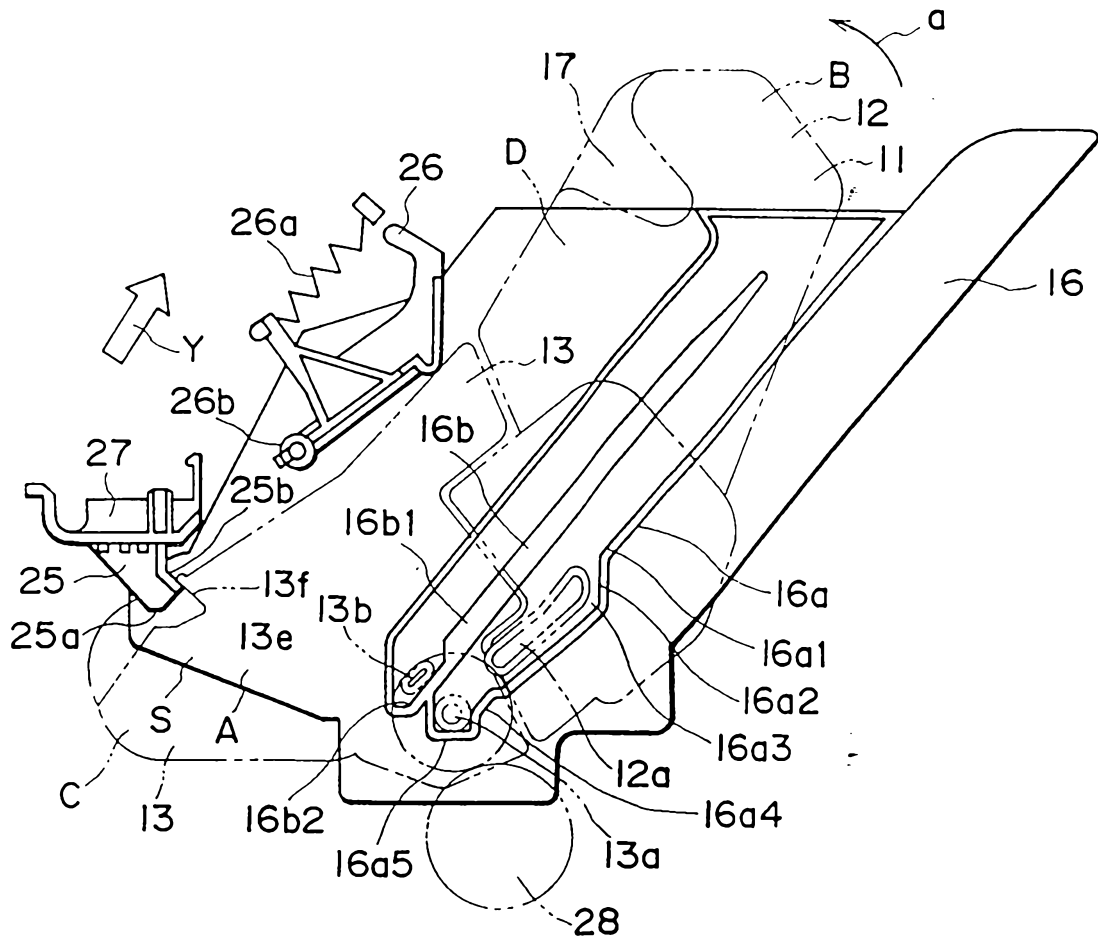


FIG. 16

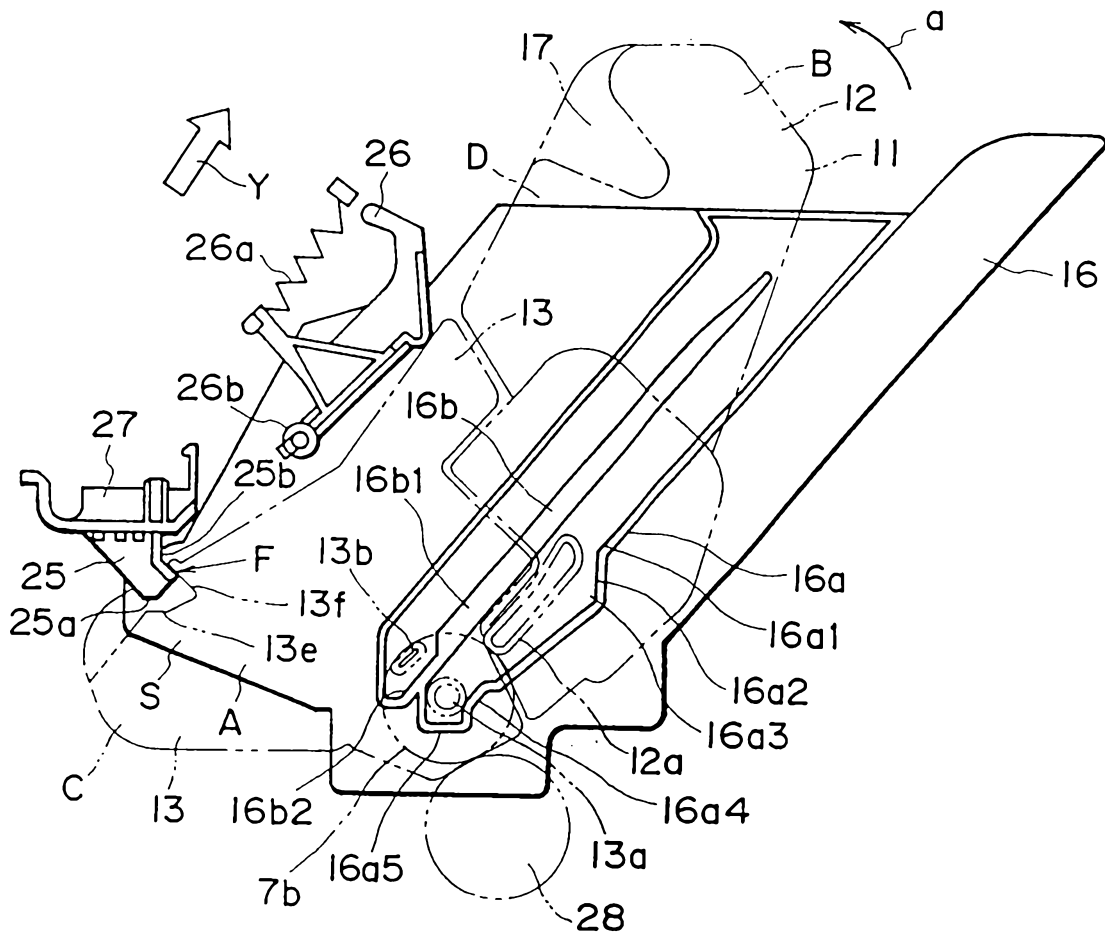


FIG. 17

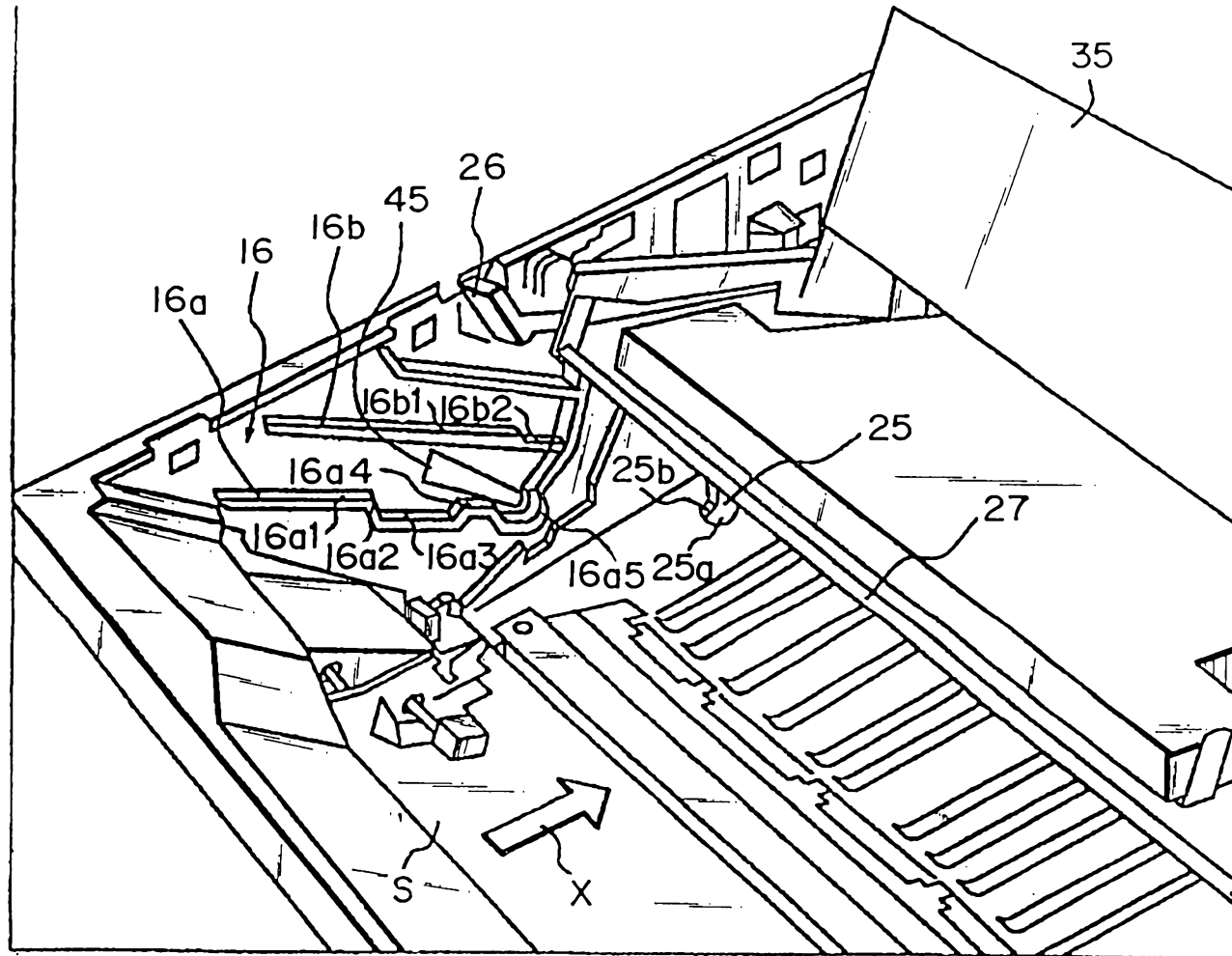


FIG. 18

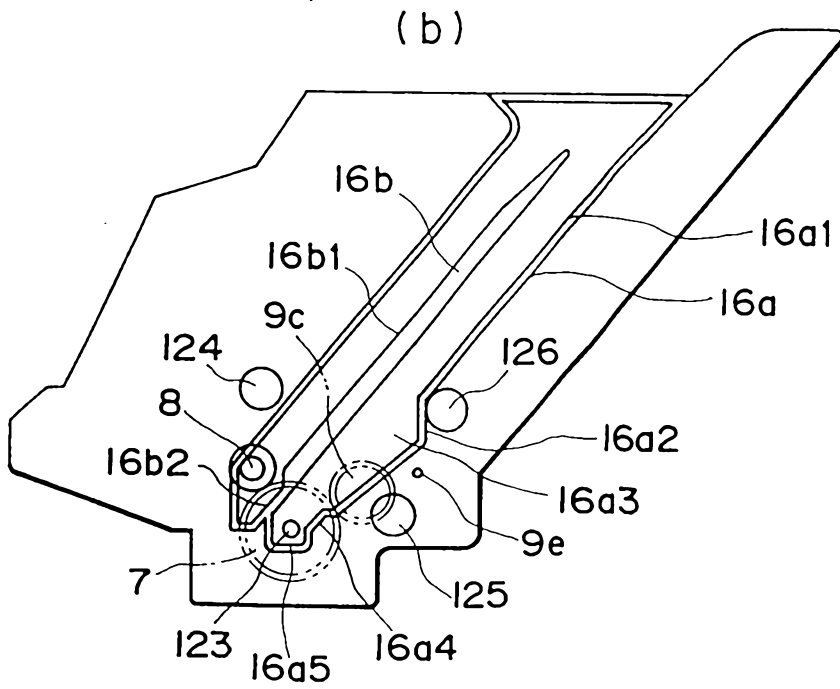
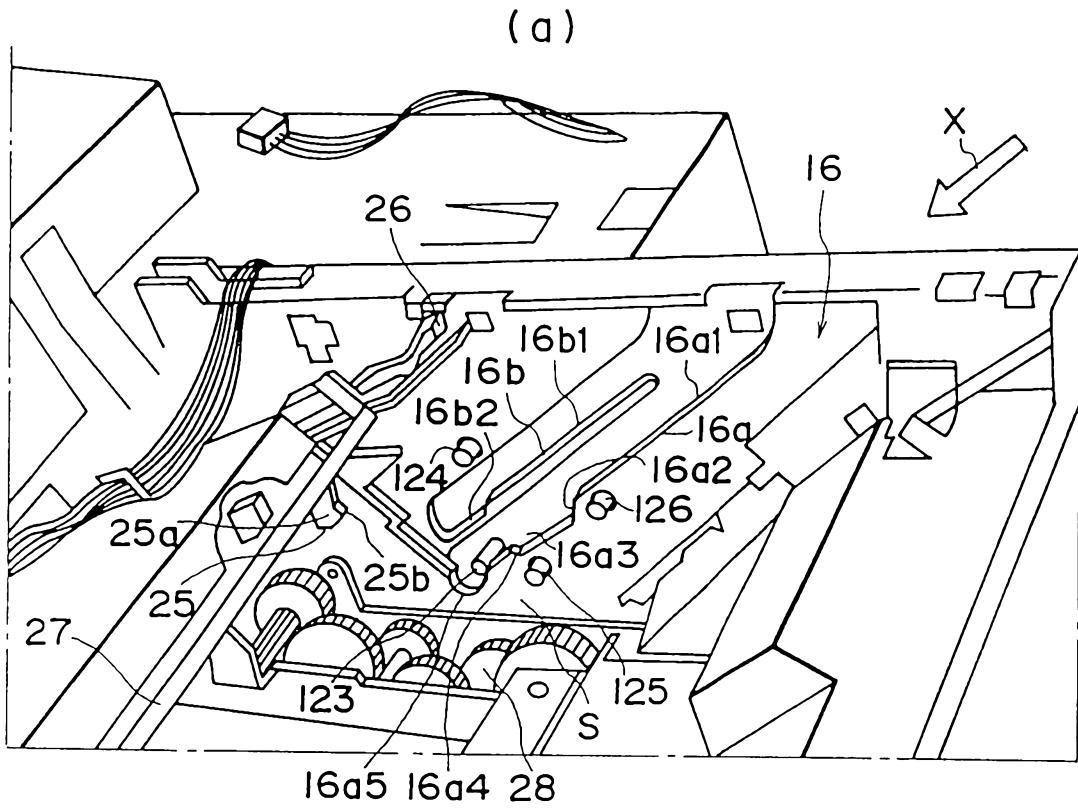


FIG. 19

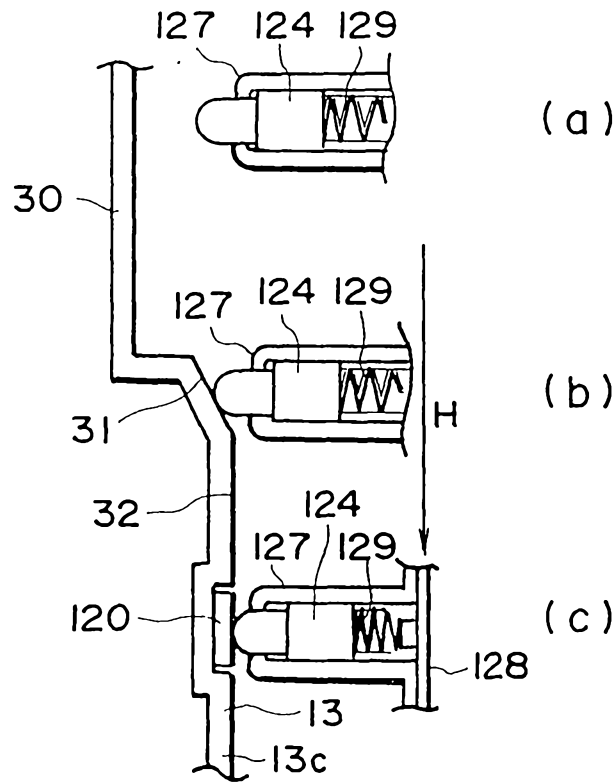
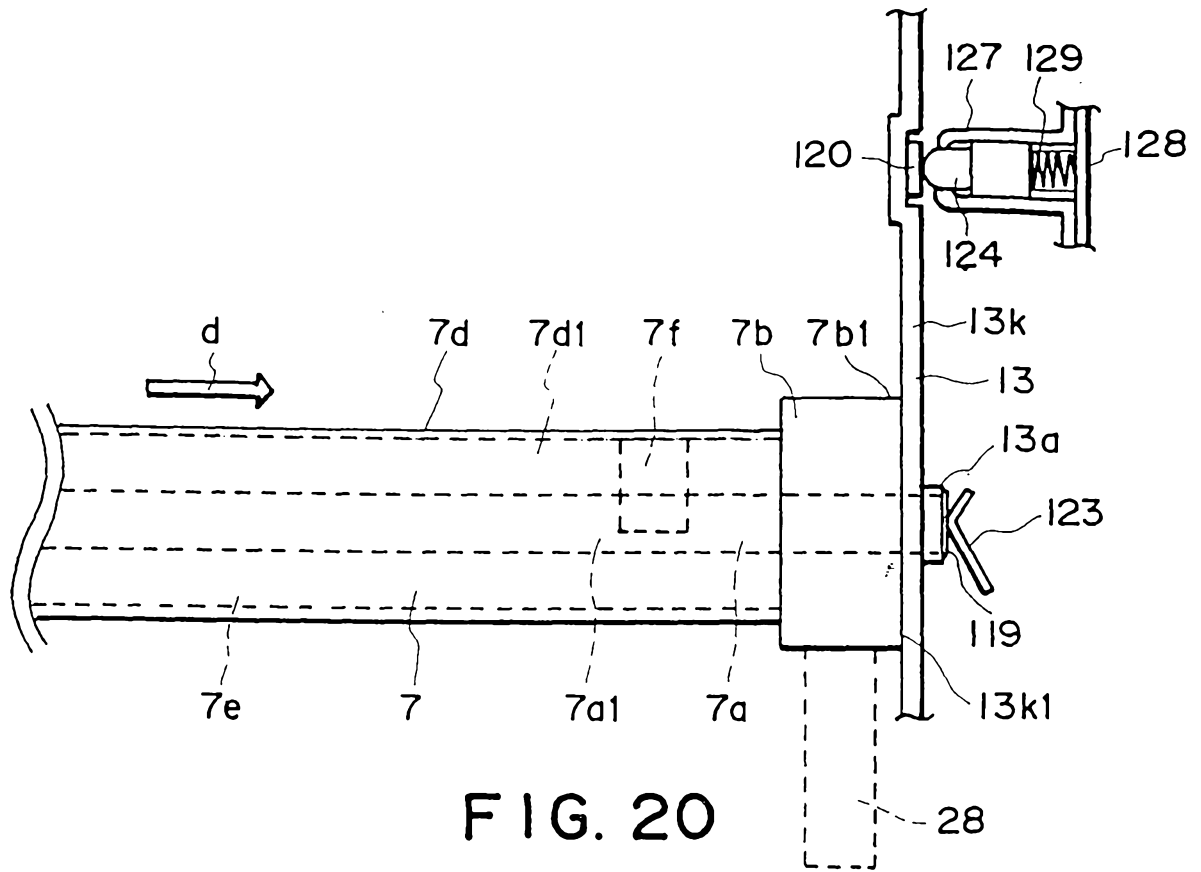
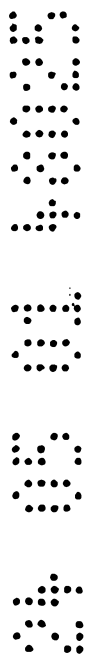


FIG. 21



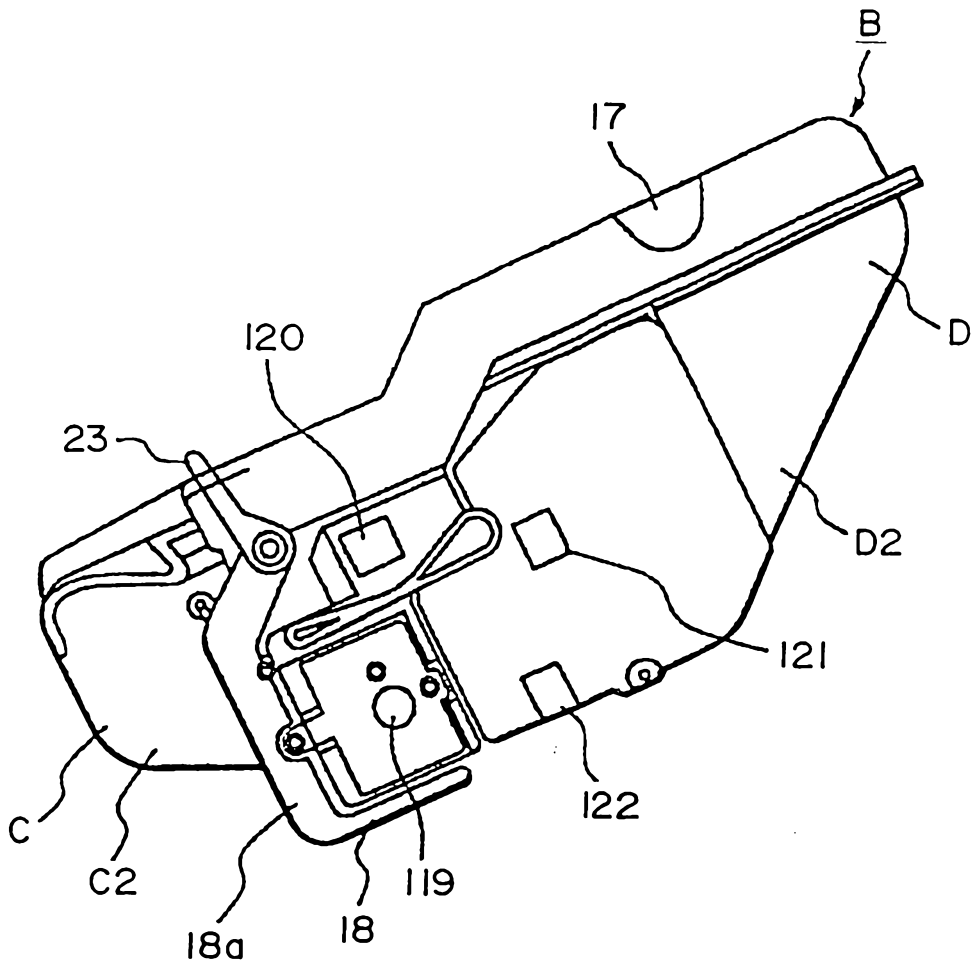


FIG. 22

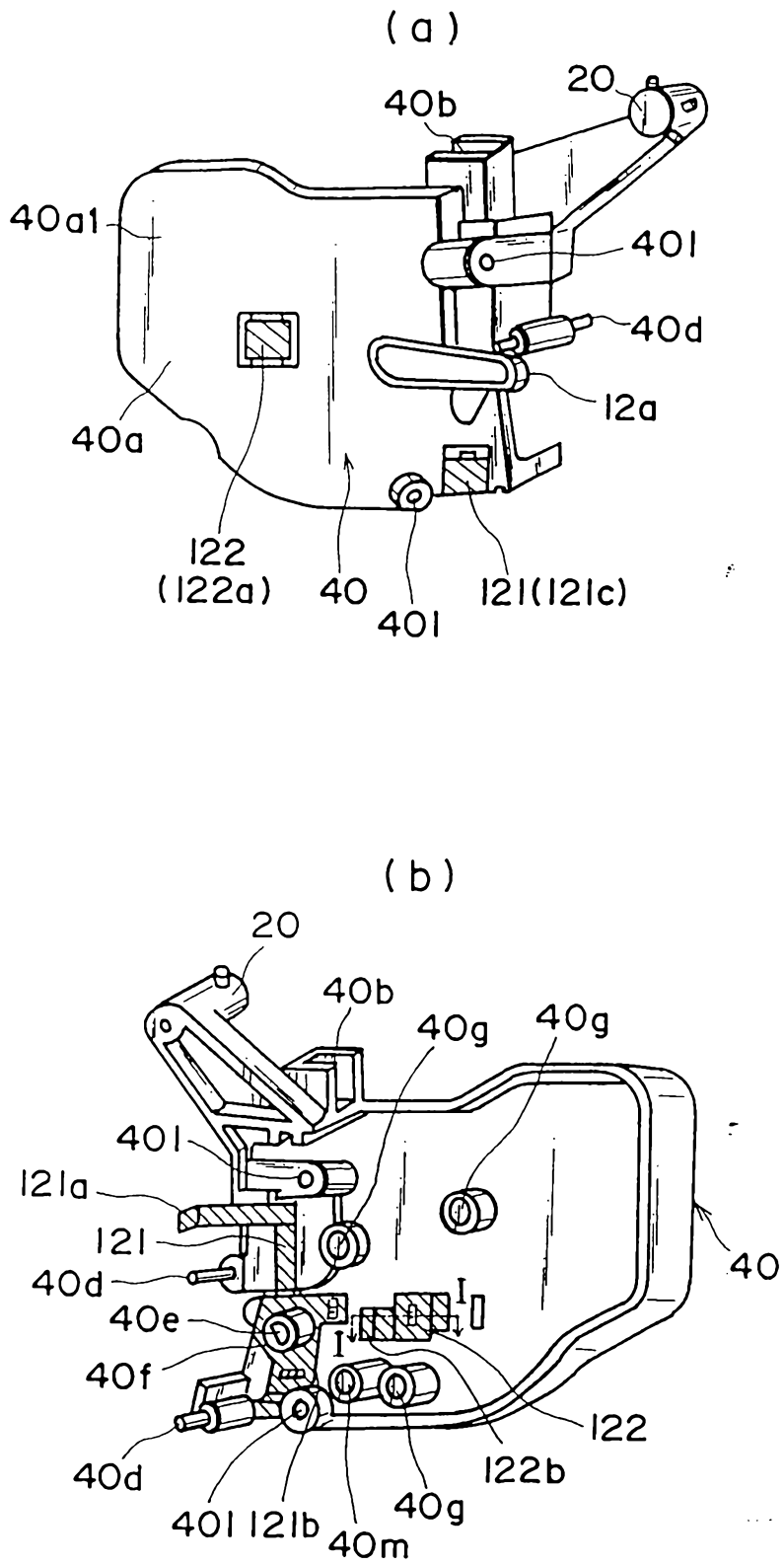


FIG. 23

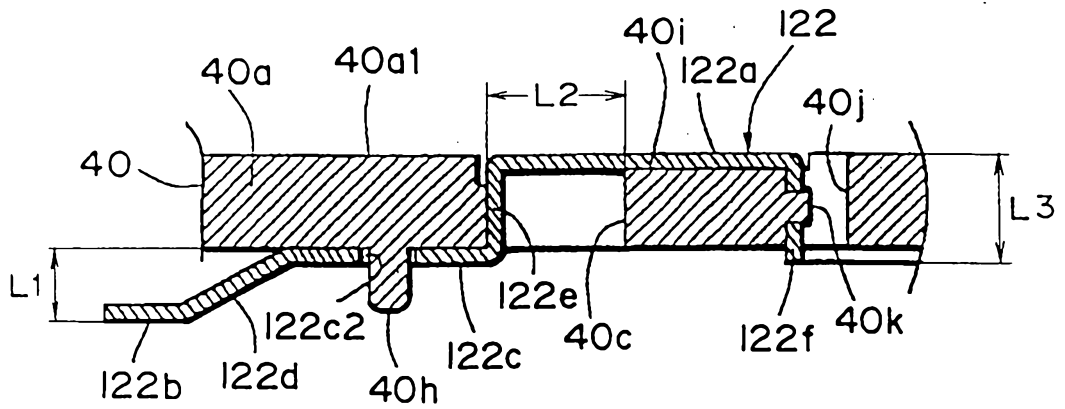


FIG. 24

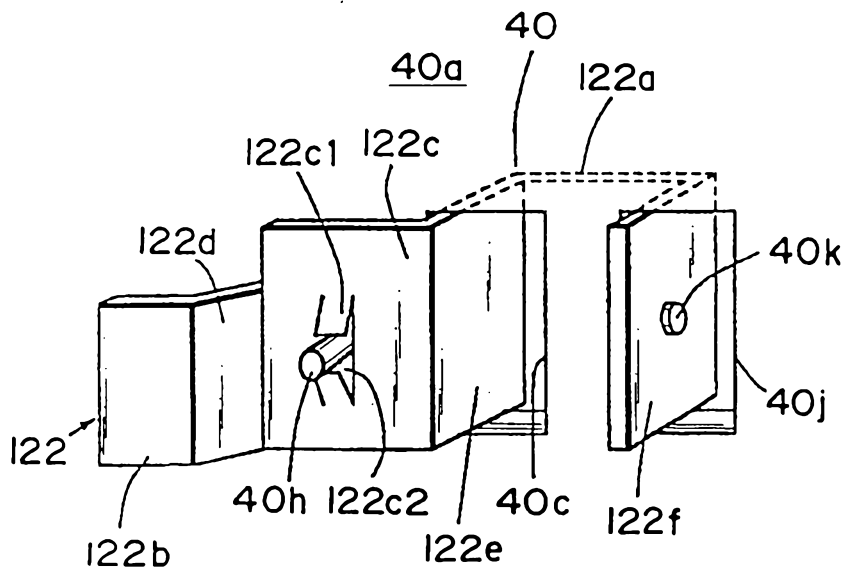


FIG. 25

FIG. 26

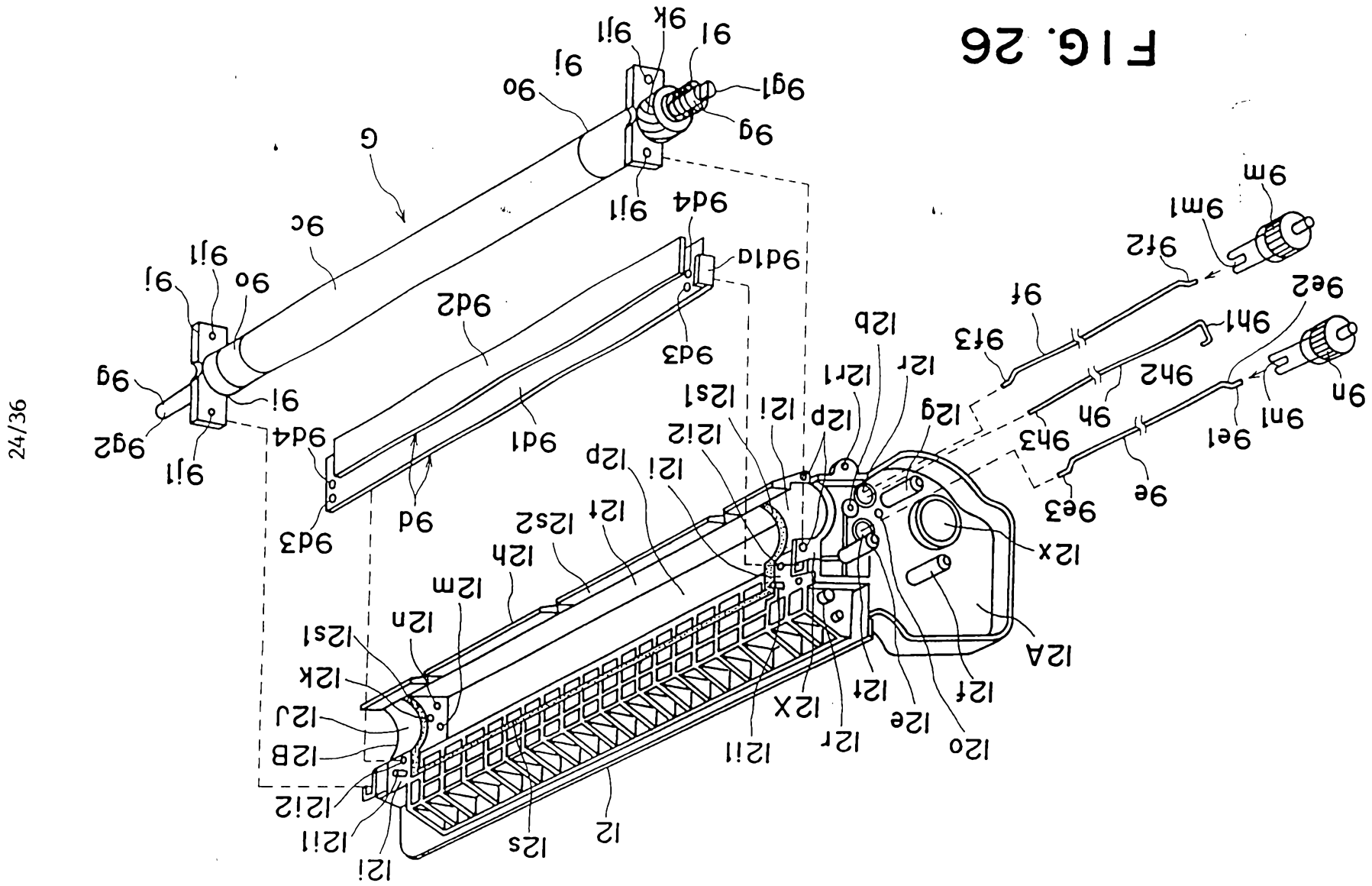


FIG. 27

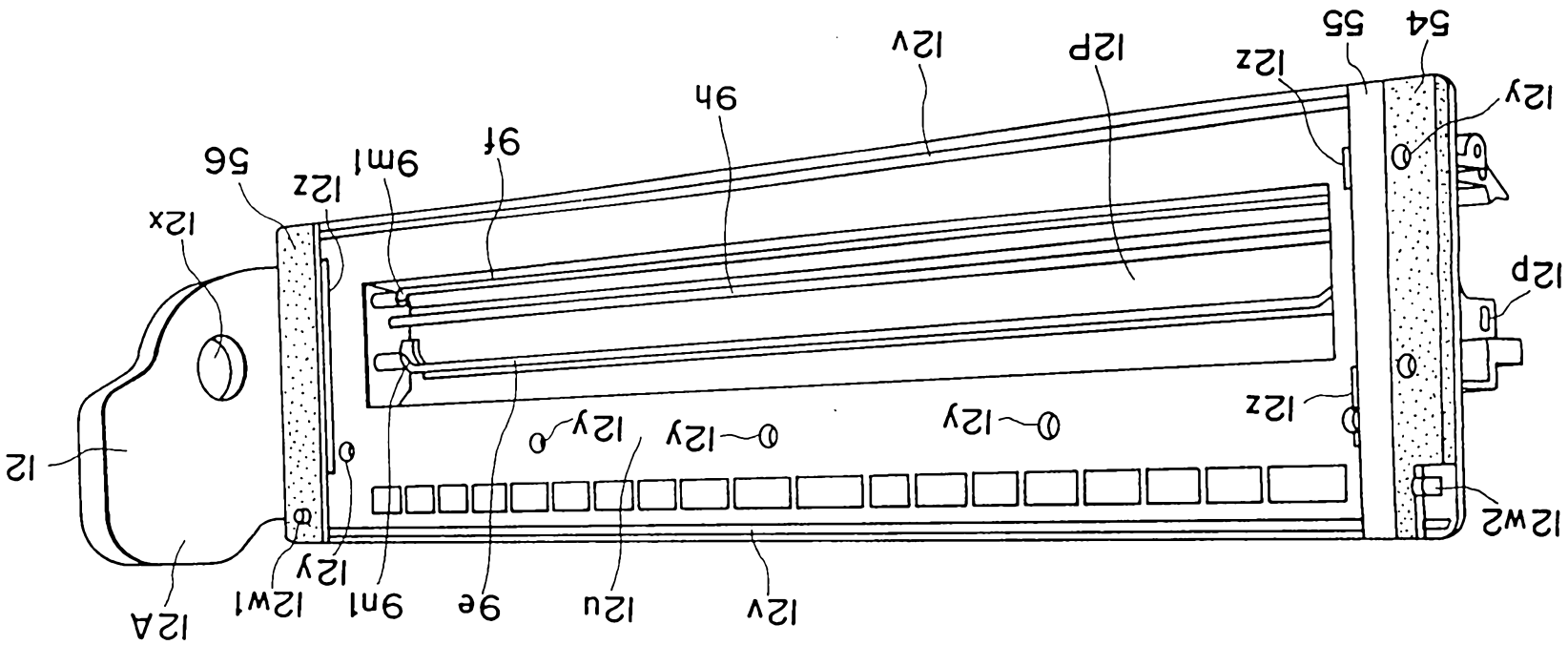
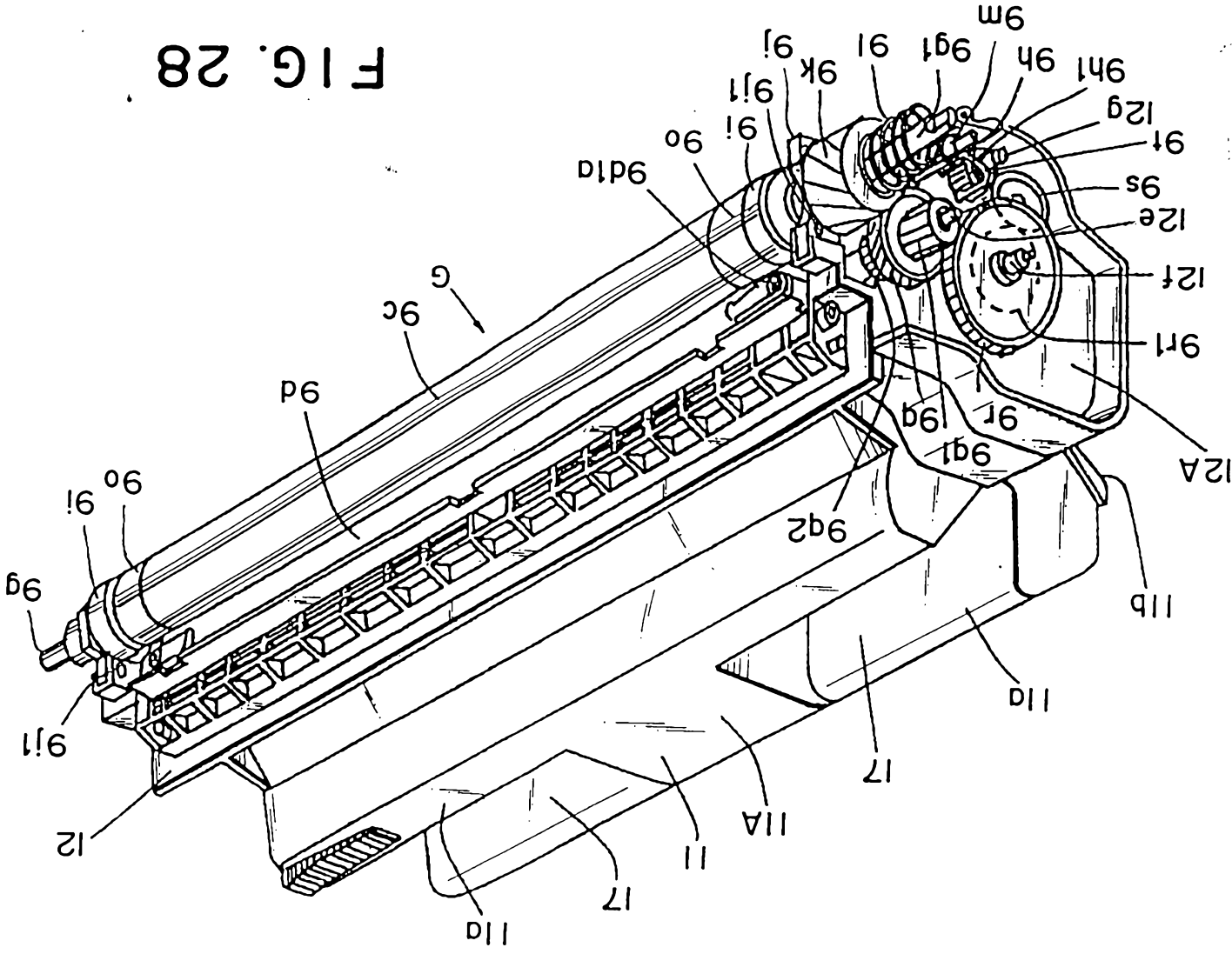


FIG. 28



3 0 0 1 8 0 2 5

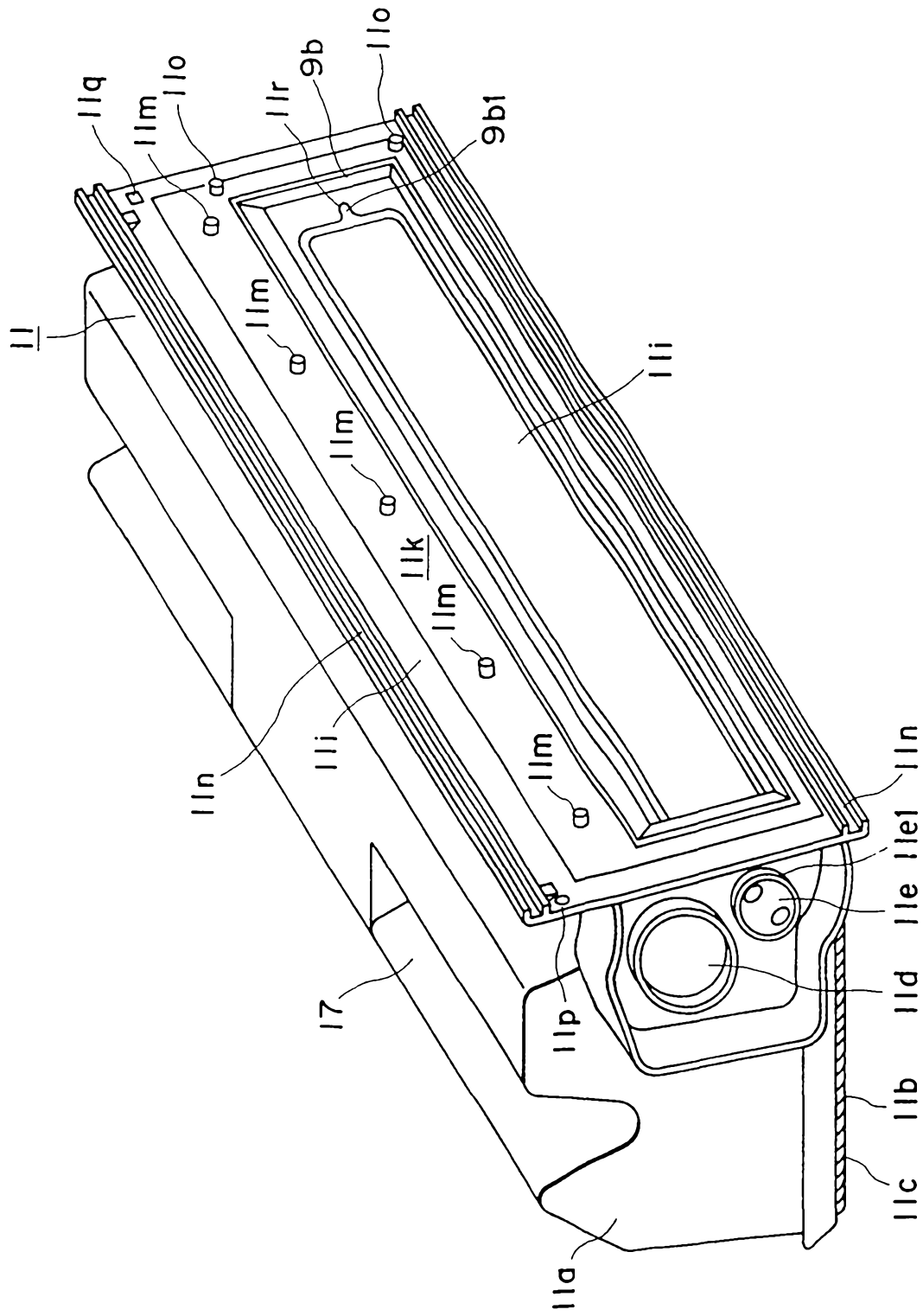
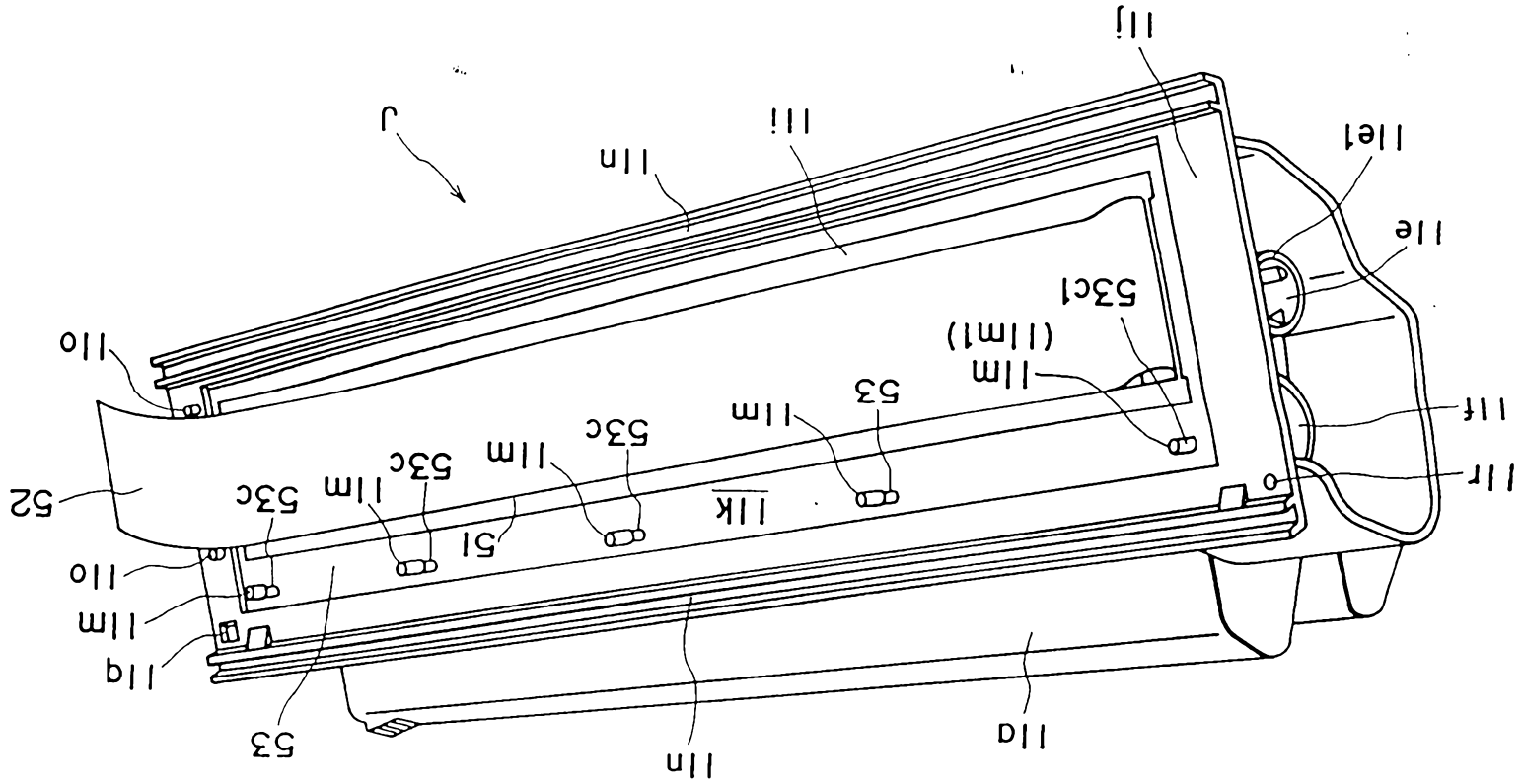


FIG. 29

FIG. 30



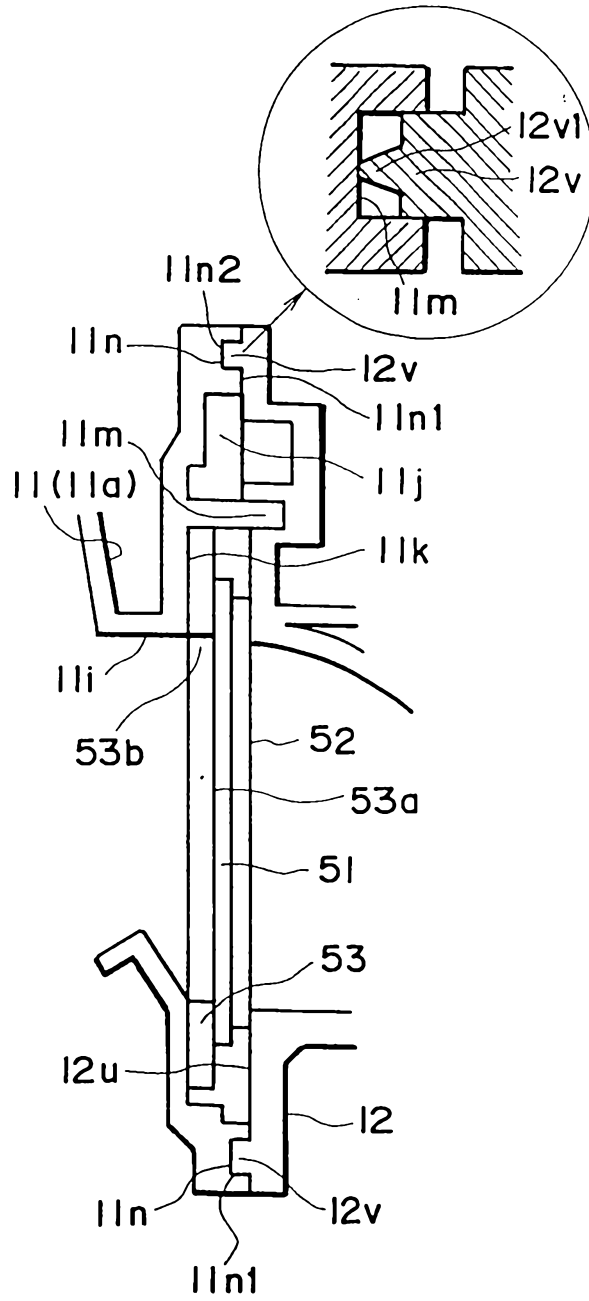


FIG. 31

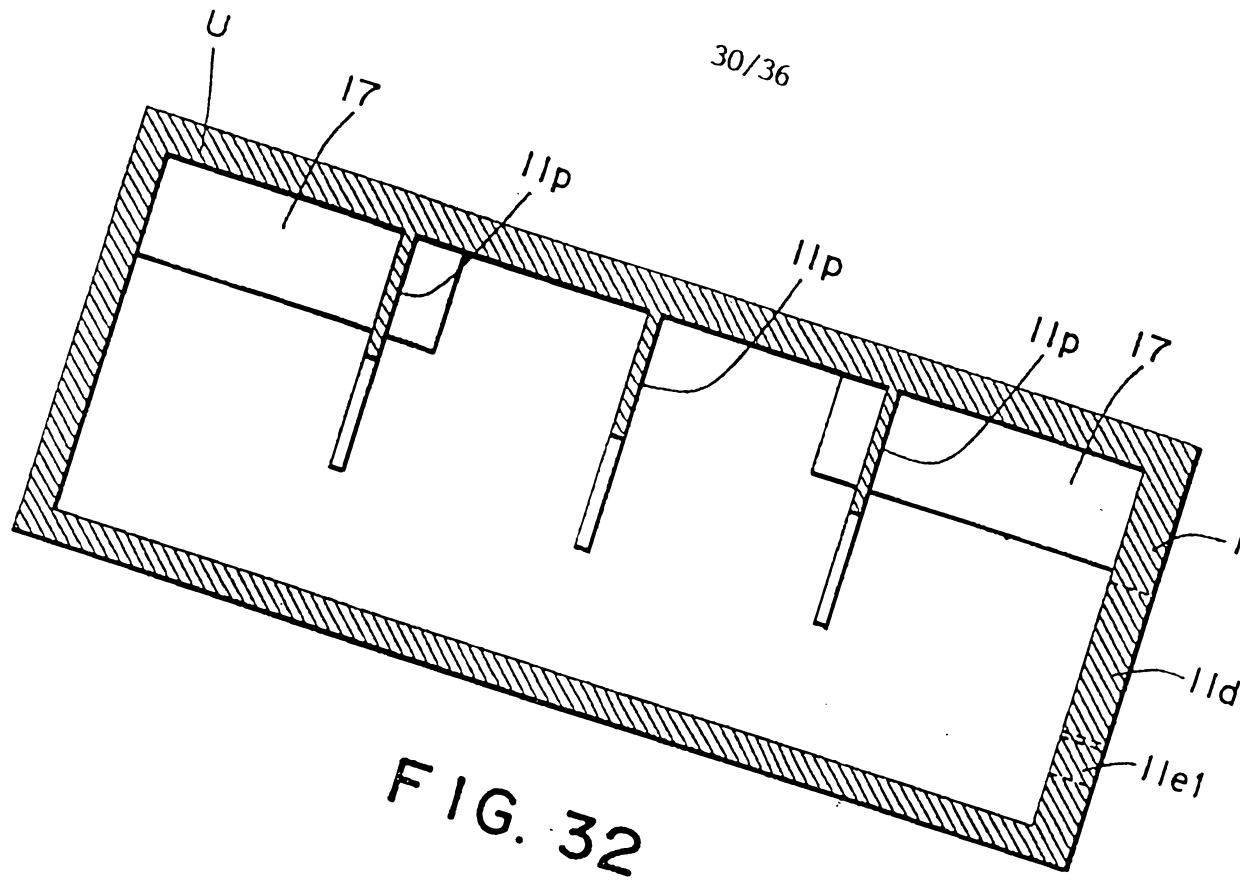


FIG. 32

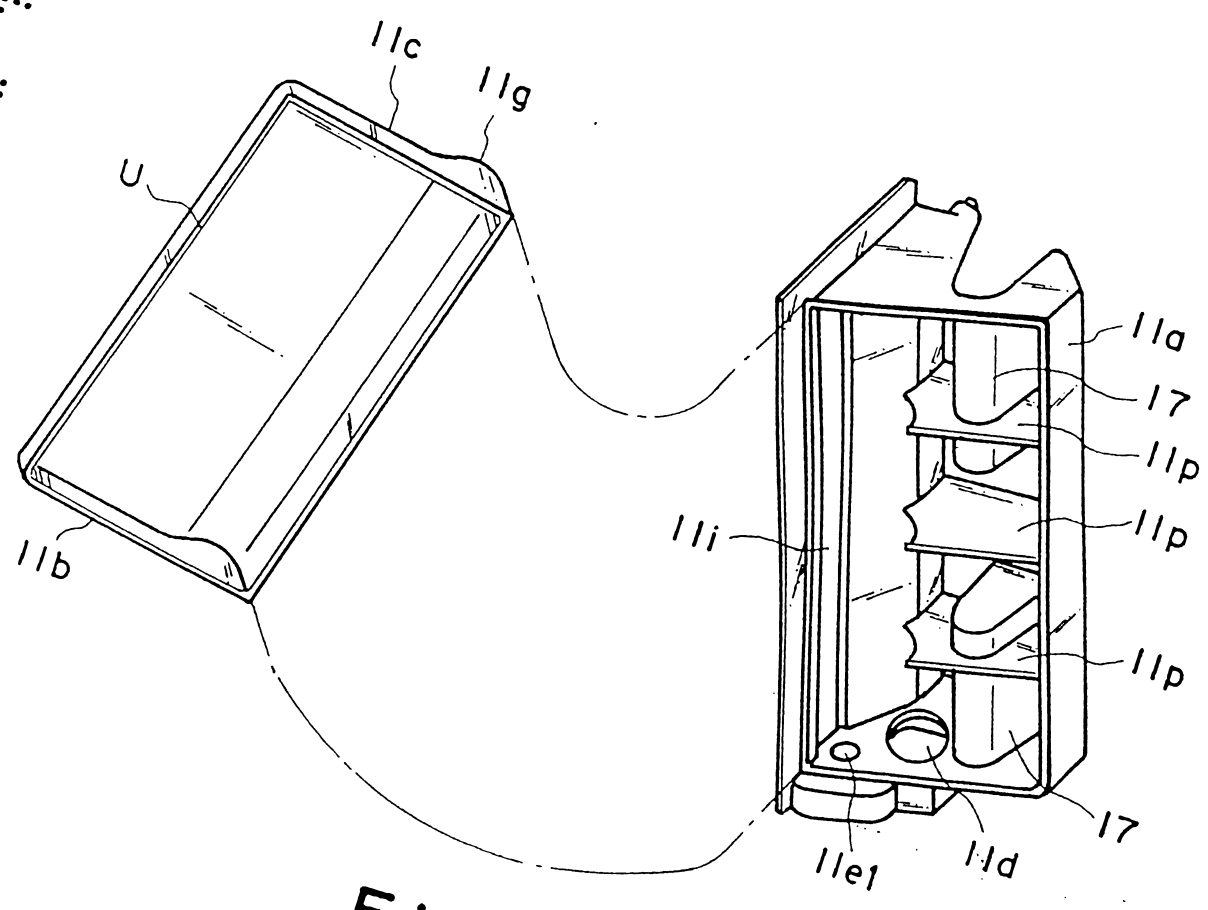


FIG. 33

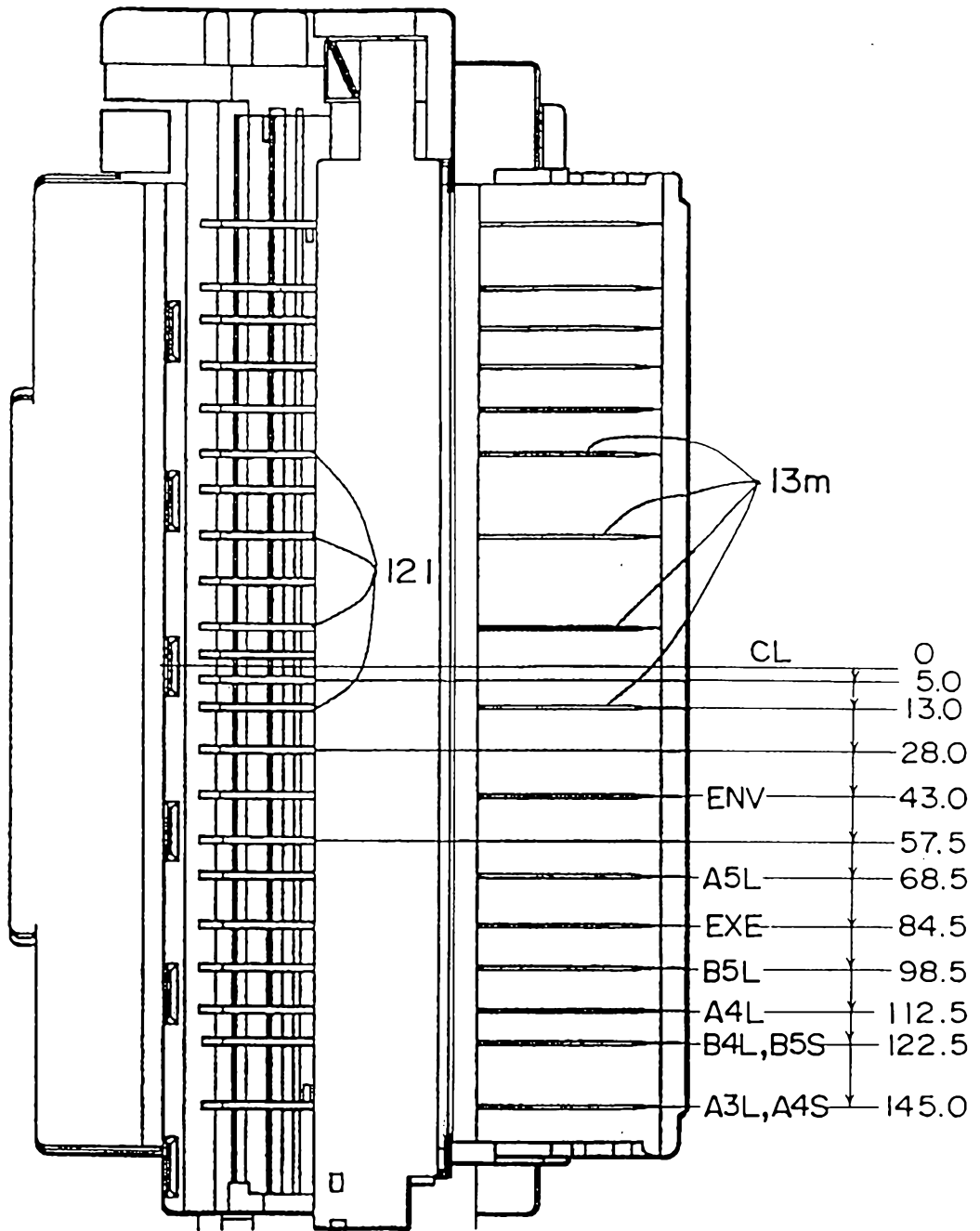
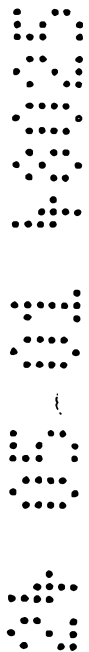


FIG. 34



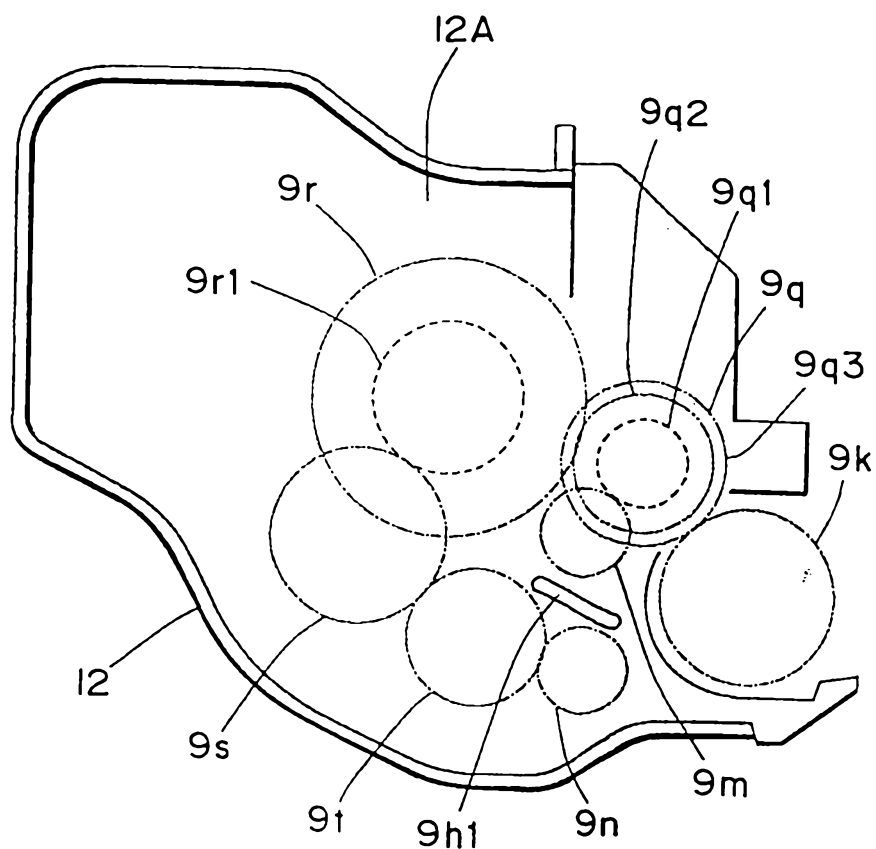


FIG. 35

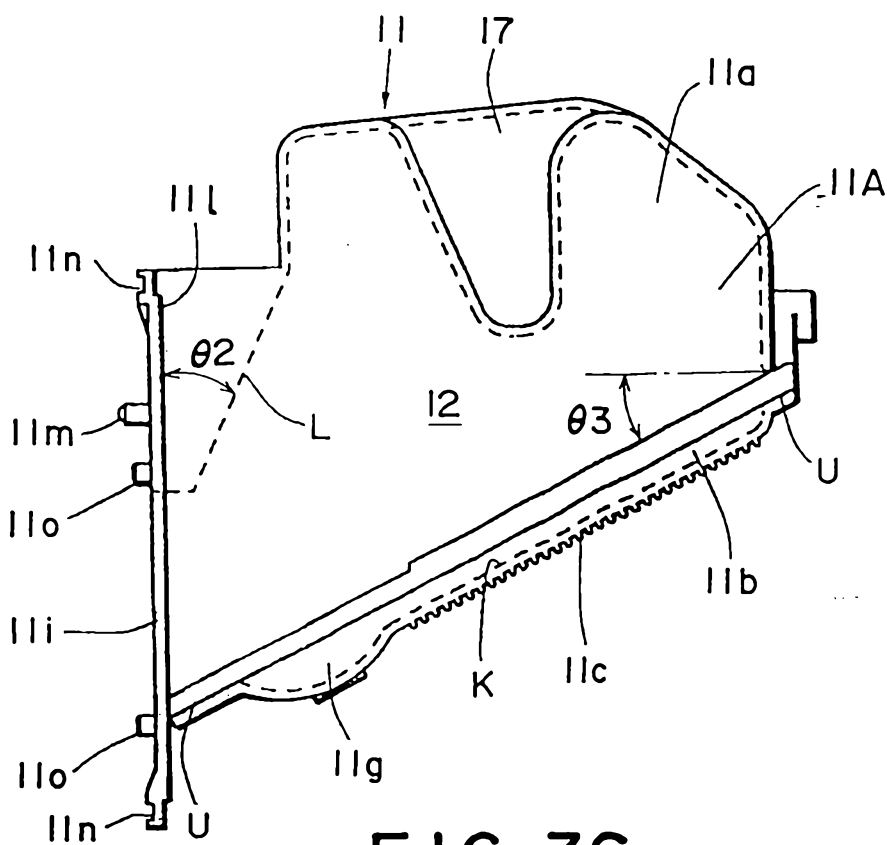


FIG. 36

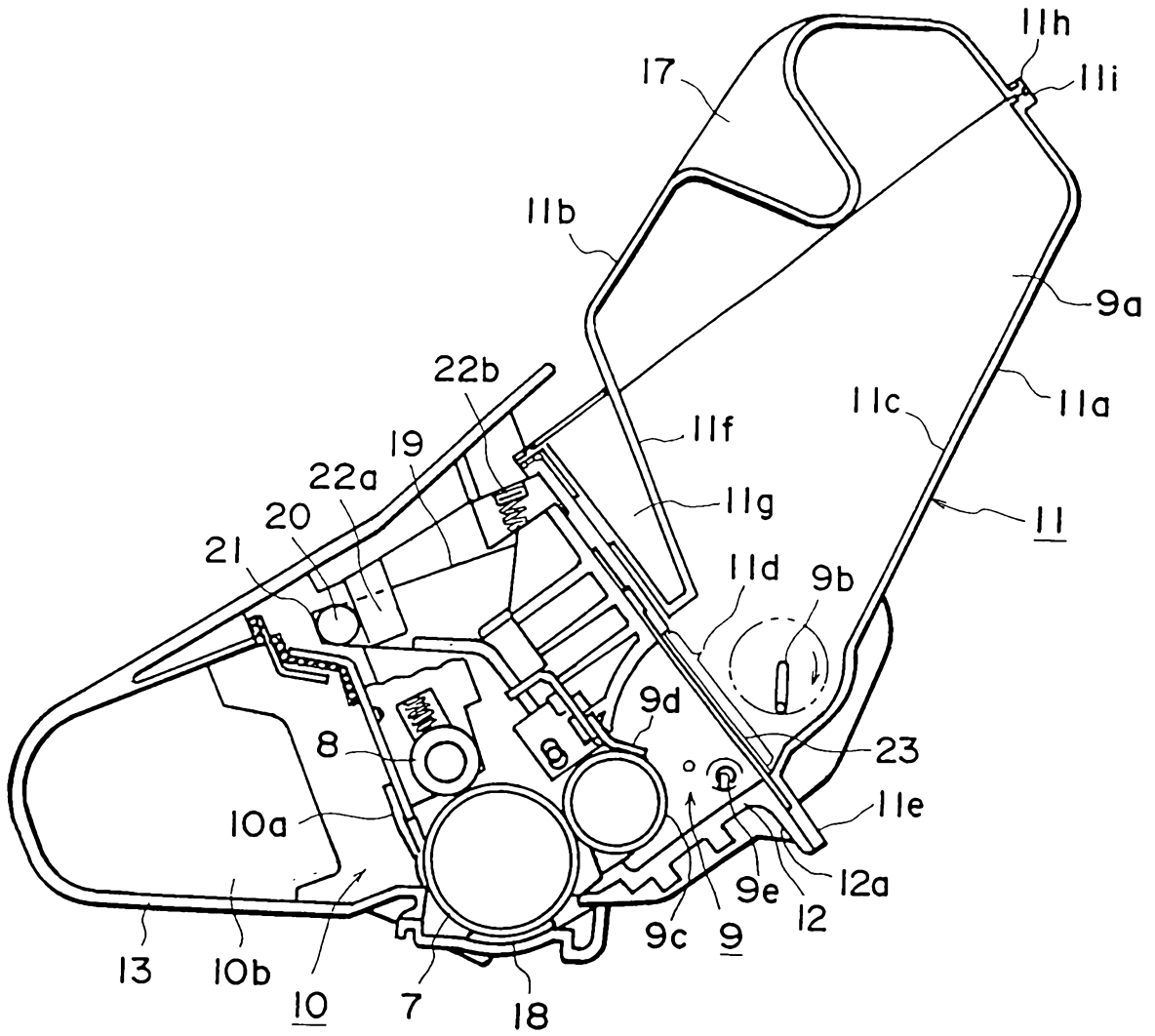
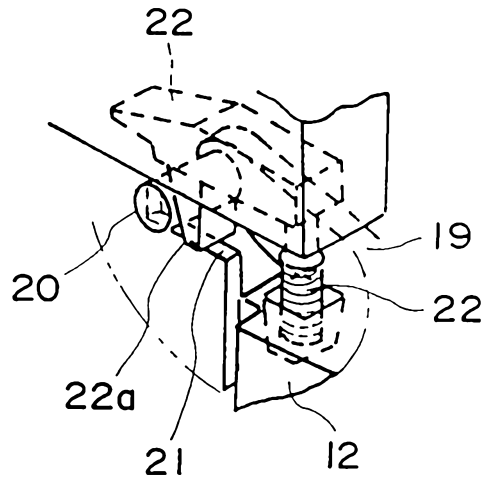


FIG. 37

(a)



(b)

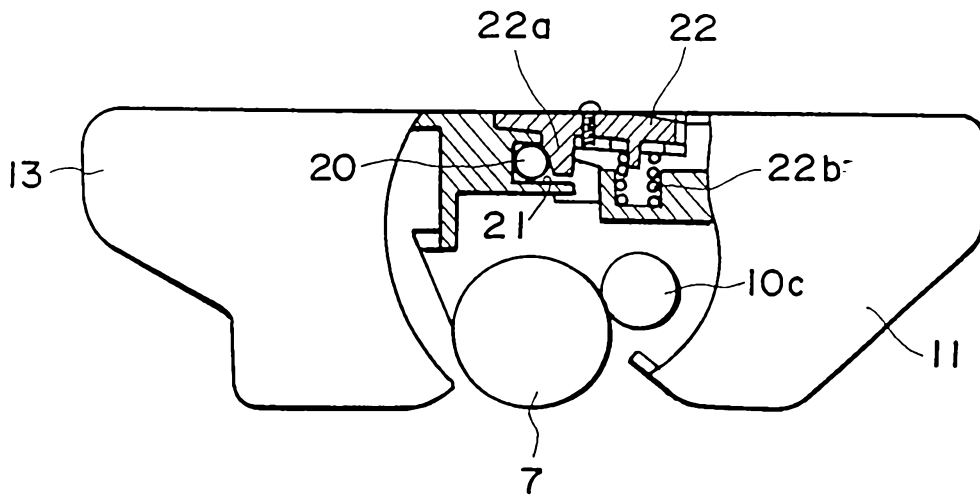
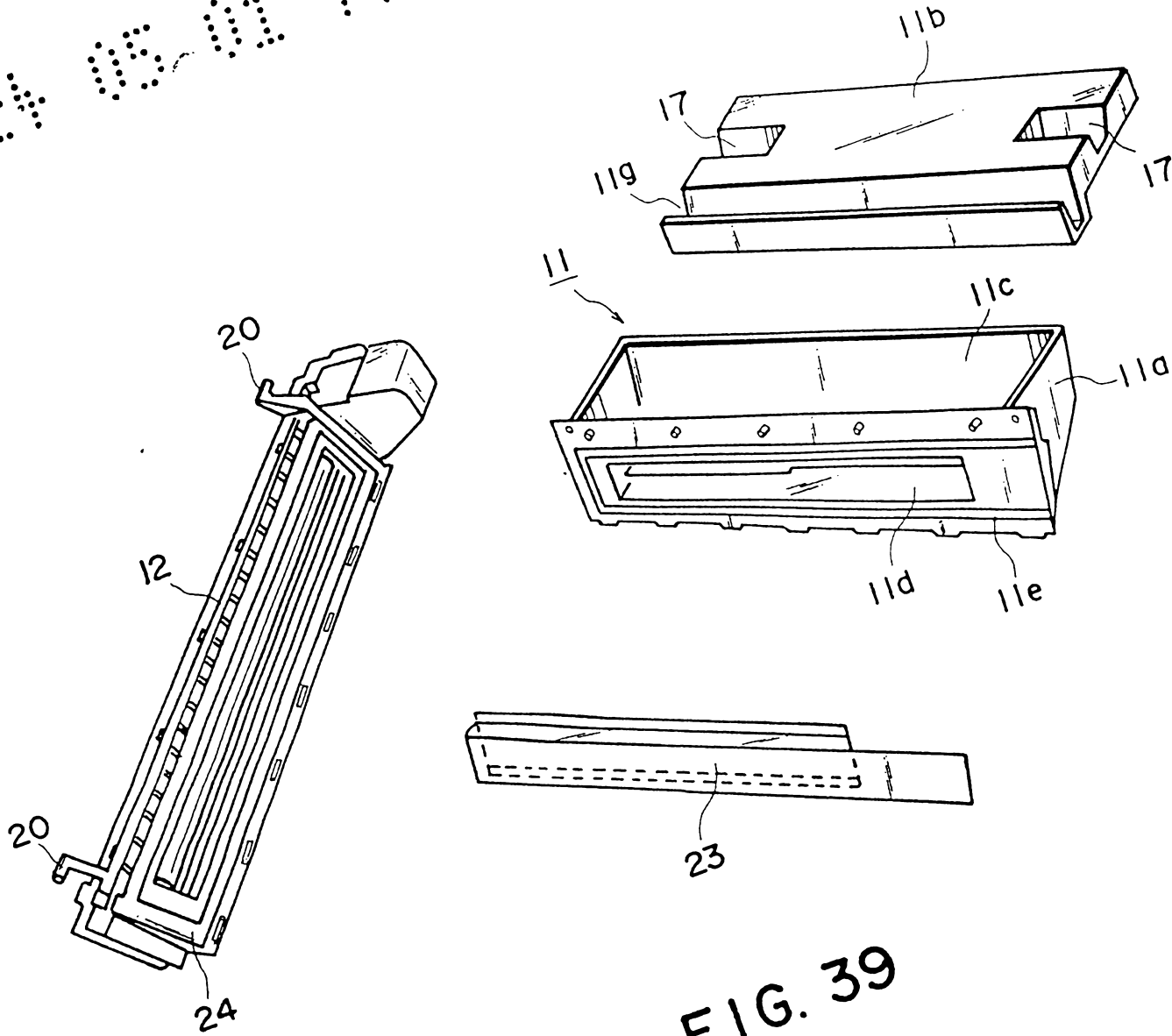


FIG. 38

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FIG. 39

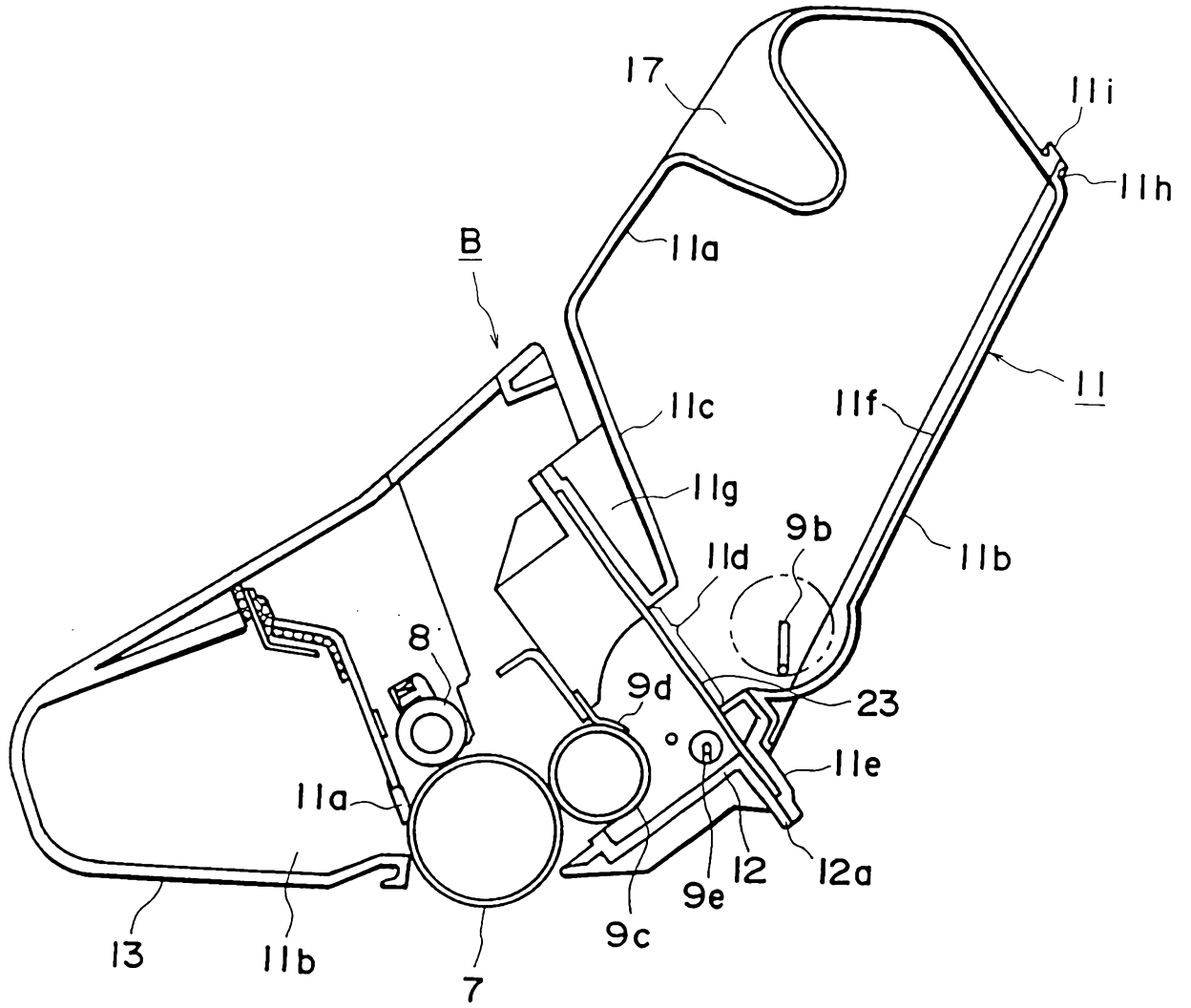


FIG. 40

