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PATENTS ACT 1990

PATENT REQUEST: STANDARD PATENT

I/We, the Applicant(s)/Nominated Person(s) specified below, request I/We be granted a patent for the invention disclosed in the accompanying standard complete specification.

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[54] Invention Title:

Process Cartridge Remanufacturing Method and Process Cartridge

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NOTICE OF ENTITLEMENT

I, Giichi MARUSHIMA
 of c/o CANON KABUSHIKI KAISHA
 3-30-2 Shimomaruko, Ohta-ku, Tokyo, Japan
 being authorised by the Applicant(s)/Nominated Person(s) in respect of an
 Application entitled:

Process Cartridge Remanufacturing Method and Process Cartridge.
 state the following:-

1. The Applicant(s)/Nominated Person(s) has/have, for the following reasons, gained entitlement from the actual inventor(s):-

Applicant is assignee of the actual inventors

2a.* The Applicant(s)/Nominated Person(s) is/are the applicant(s) of the basic application(s) listed* on the Patent Request/~~in the Declaration under Article 8 of the PCT.~~

~~2b.* The Applicant(s)/Nominated Person(s) is/are entitled to rely on the basic application(s) listed* on the Patent Request/^{*}in the Declaration under Article 8 of the PCT as follows:~~


3.* The basic application(s) listed* on the Patent Request/~~in the Declaration under Article 8 of the PCT~~ is/are the application(s) first made in a Convention Country in respect of the invention.

4a. ~~The Applicant(s)/Nominated Person(s) is/are the depositor(s) of the deposit(s) listed in the Schedule hereto.~~

4b.* The Applicant(s)/Nominated Person(s) has/have the consent of _____, of _____

~~the depositor(s) of the deposit(s) listed in the Schedule hereto, to rely on that/those deposit(s).~~

DATED this 12th day of May, 1995 at Tokyo, Japan


 CANON KABUSHIKI KAISHA
 Giichi MARUSHIMA
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* Delete if not applicable.

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- (57) Claim

1. A process cartridge remanufacturing method for a process cartridge detachably mountable to a main assembly of an image forming apparatus comprising the steps of:

providing a new photosensitive drum;

providing a new toner-development frame including a new toner frame having a toner containing portion for containing toner, a new development frame having roller mounting portion for mounting a developing roller for supplying toner from said toner containing portion to said photosensitive drum to develop a latent image formed on said photosensitive drum, wherein said toner frame and said development frame are welded with a new removable toner seal therebetween for preventing the toner in said toner containing portion from leaking out, wherein said toner seal is removed from between said toner frame and said

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development frame, prior to start of use of said process cartridge;

preparing a drum frame to be reused having a drum mounting portion for mounting the photosensitive drum;

supplying toner into said toner containing portion;

mounting the developing roller to said new development frame;

mounting the photosensitive drum to the drum frame to be reused;

rotatably engaging said new toner-development frame and said drum frame to be reused.

PROCESS CARTRIDGE REMANUFACTURING METHOD
AND PROCESS CARTRIDGE

FIELD OF THE INVENTION AND RELATED ART

5 The present invention relates to a process cartridge and an image forming apparatus, into or from which a process cartridge is installable or removable.

 This image forming apparatus includes electro-photographic copying machines, electro-
10 photographic printers (for example, LED printers, laser beam printers, or the like), electro-photographic facsimile apparatuses, electro-photographic word processors, or the like.

 As for the process cartridge, it is such a
15 cartridge that integrally comprises: a combination of charging means, developing means, cleaning means, and/or an electro-photographic photosensitive member; a combination of at least one of the charging means, developing means, and cleaning means, and the electro-
20 photographic photosensitive member; or a combination of at least the developing means and electro-photographic photosensitive member, and can be removably installed into the main assembly of the image forming apparatus.

25 In a conventional image forming apparatus employing the electro-photographic image forming process, a process cartridge system is used in which

the electro-photographic photosensitive member and the processing means that acts on the electro-photographic photosensitive member are integrated into a form of cartridge, which can be removably installed into the main assembly of the image forming apparatus.

5 According to this cartridge system, the apparatus can be maintained by a user him/herself without relying on professional maintenance personnel; therefore, the operational efficiency can be substantially increased.

10 Thus, this process cartridge system has been widely employed in image forming apparatus.

A remanufacturing method for such a process cartridge has been known to comprise a step for disassembling the process cartridge into a frame A and a frame B, and a step for uniting again the frames A and B (U.S. Patent No. 5,294,960), wherein the frame A comprises a photosensitive drum, and the frame B comprises developing means and developer storing means.

15 The method disclosed in the aforementioned patent is one of the effective remanufacturing methods for a process cartridge.

20 The present invention is an invention made by developing further the aforementioned prior technology.

25

SUMMARY OF THE INVENTION

In accordance with one aspect of the present invention there is disclosed a process cartridge remanufacturing method for a process cartridge detachably mountable to a main assembly of an image forming apparatus comprising the steps of:

providing a new photosensitive drum;

providing a new toner-development frame including a new toner frame having a toner containing portion for containing toner, a new development frame having roller mounting portion for mounting a developing roller for supplying toner to said photosensitive drum, wherein said toner frame and said development frame are welded with a new removable toner seal therebetween for preventing the toner in said toner containing portion from leaking out;

preparing a drum frame to be reused having a drum mounting portion for mounting the photosensitive drum;

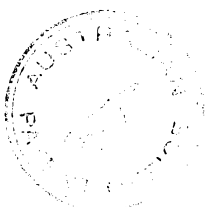
supplying toner into said toner containing portion of said new therefore;

mounting the developing roller to said new development frame;

mounting the photosensitive drum to the drum frame to be reused;

rotatably engaging said new toner-development frame and said drum frame to be reused.

In accordance with another aspect of the present invention there is disclosed a process cartridge detachably



mountable to a main assembly of an image forming apparatus,
comprising:

a toner-development frame including a new toner frame
having a toner containing portion for containing toner, a
5 new development frame having roller mounting portion for
mounting a developing roller for supplying toner to said
photosensitive drum, wherein said toner frame and said
development frame are welded with a new removable toner seal
therebetween for preventing the toner in said toner
10 containing portion from leaking out;

a reused drum frame to be reused having a drum
mounting portion for mounting the photosensitive drum;

a photosensitive drum mounted to said drum mounting
portion;

15 supplying toner into said toner containing portion of
said new therefore;

a developing roller mounted to said new development
frame.

In accordance with one aspect of the present
20 invention, there is provided a process cartridge
remanufacturing method for a process cartridge detachably
mountable to a main assembly of an image forming apparatus,
said method comprising the steps of:

providing a new photosensitive drum;

25 providing a new toner-development frame including a
new toner frame having a toner containing portion for
containing toner, said new toner-development frame including
a new development frame having roller mounting portion for

mounting a used and cleaned developing roller for supplying
toner from said toner containing portion to said
photosensitive drum to develop a latent image formed on said
photosensitive drum, wherein said toner frame and said
5 development frame are welded with a new removable toner seal
therebetween for preventing the toner in said toner
containing portion from leaking out, wherein said toner seal
is removed from between said toner frame and said
development frame, prior to start of use of said process
10 cartridge;

preparing a drum frame to be reused, said drum frame
having a drum mounting portion for mounting the
photosensitive drum and

a used and cleaned elastic cleaning blade for removing
15 residual toner deposited on the photosensitive drum during
image forming operation,

mounting a used and cleaned charging roller for
charging said photosensitive drum during image forming
operation to said drum frame to be reused after said drum
20 frame to be reused is cleaned,

supplying toner into said toner containing portion;

mounting the developing roller to said new development
frame;

mounting the photosensitive drum to the drum frame to
25 be reused;

rotatably engaging said new toner-development frame
and said drum frame to be reused.

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

5 a new toner-development frame, including a new toner frame having a toner containing portion for containing toner, a new development frame having a roller mounting portion for mounting a used and cleaned developing roller for supplying toner from said toner containing portion to
10 said photosensitive drum to develop a latent image formed on said photosensitive drum, wherein said toner frame and said development frame are welded with a new removable toner seal therebetween for preventing the toner in said toner containing portion from leaking out, wherein said toner seal
15 is removed from between said toner frame and said development frame, prior to start of use of said process cartridge;

a reused drum frame having a drum mounting portion for mounting the photosensitive drum, said drum being provided
20 with a used and cleaned elastic cleaning blade for removing residual toner deposited on the photosensitive drum during image forming operation;

a new photosensitive drum mounted to said drum mounting portion;

25 a toner containing portion having toner supplied therein;

a cleaned and used charging roller for charging said photosensitive drum during image forming operation, said

charging roller mounted to said drum frame to be reused,
after said drum frame to be reused is cleaned.

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BRIEF DESCRIPTION OF THE DRAWINGS

Figure 1 is a vertical sectional view of a process cartridge.

Figure 2 is a vertical section of a laser beam printer, in which the process cartridge has been installed.

Figure 3 is a perspective view of the process cartridge, from which pins have been removed.

Figure 4 is a perspective view of the process cartridge, with its top frame off.

Figure 5 is a perspective view of a cleaning unit, with the primary unit off.

Figure 6 is a perspective view of one of the longitudinal ends of the process cartridge, wherein a compression spring for pressing a developing roller toward the photosensitive drum has been removed.

Figure 7 is a perspective view of a developing unit and the cleaning unit, which have been separated from each other.

Figure 8(a) is a perspective view of a jig and a shield mounted thereon, and Figure 8(b) is a side view of the jig and the shield mounted thereon.

Figure 9 is a perspective drawing to describe how the shield deformation is checked.

Figure 10(a) is a perspective view describing how the grid surface is cleaned, and Figure 10(b) is a perspective view describing how the grid is placed

upside down.

Figure 11 is a perspective view showing how a discharge wire is cleaned.

Figure 12 is an exploded perspective view of the primary charging unit.

Figure 13 is a longitudinal vertical section of the insulating block portion of the shield.

Figure 14 is a vertical section of the same insulating block portion, in the direction perpendicular to the longitudinal direction.

Figure 15 is a vertical section of another insulating block portion, in the direction perpendicular to the longitudinal direction.

Figure 16 is an exploded perspective view of the developing unit, with the developing blade and arm off.

Figure 17 is an exploded view of the developing unit.

Figure 18 is an explanatory drawing describing how a sheet of sealing film is attached to the base member by heat-sealing.

Figure 19 is an explanatory drawing describing how the toner chamber frame and developing chamber frame are united by melt-welding.

Figures 20(a, b) are explanatory drawings describing how the sealing film is peeled to expose an opening.

Figure 21 is an explanatory drawing depicting the operation for replenishing the developing unit with the toner.

Figure 22 is a vertical sectional view of the
5 general structure of the cleaning apparatus of the cleaning unit.

Figure 23 is a perspective view for describing how the process cartridge is clamped.

Figure 24(a) is a perspective view of an
10 oscillating apparatus.

Figure 24(b) is a sectional view of the same, taken along a line A, and shows the operation of an oscillating table.

Figure 25(a) and 25(b) are explanatory
15 drawings depicting the operation of a tapping apparatus, and Figure 25(c) is a perspective view of the structures of a motor shaft and a cam shaft.

Figure 26 is a perspective view of a sucking apparatus, and describes the operation thereof.

Figure 27 is a flow chart showing the
20 cleaning flow of the cleaning unit.

Figure 28 is a perspective view of another embodiment of sucking apparatus according to ^{an} the ~~embodiment present invention.~~

Figure 29 is a perspective view of another
25 embodiment of cleaning apparatus of the cleaning unit ~~according to the present invention.~~

Figure 30 is a perspective view of a pressing apparatus employed for disassembling the photosensitive drum.

Figure 31 gives a front view and a side view of a screw devised for locking (locking screw).

DESCRIPTION OF THE PREFERRED EMBODIMENTS

Hereinafter, the preferable embodiments of the present invention will be described.

10 The process cartridge, which will be described hereinafter, comprises a given combination of: a toner chamber frame (T frame) provided with a toner storing portion; a developing chamber frame (D frame), on which a developing roller or the like is
15 mounted; and a drum frame, on which a photosensitive drum, a cleaning member, and the like are mounted. When a cartridge of this type is assembled, the openings of the toner chamber frame are sealed with sealing members so that the toner stored within the
20 toner chamber frame is prevented from leaking out, and then, the toner chamber frame and developing chamber frame are melt-welded to form a T chamber-D chamber combination frame (T-D frame). When it is put to use, an operator takes hold of the portion of the sealing
25 member exposed from the gap between the T frame and D frame, and pulls out the sealing member to allow the toner within the T frame to be supplied to the

developing roller.

In the first embodiment of the present invention, which will be described next, it will be described how a replaceable process cartridge for an
5 image forming apparatus is remanufactured.

This embodiment of the remanufacturing method involves: a new photosensitive drum; a recycled drum frame, on which the new photosensitive drum is mounted; a new T frame containing the toner storing
10 portion for storing the toner; a new D frame containing a roller mount portion for mounting a developing roller that supplies the toner to the photosensitive drum; and a new toner sealing member, and comprises: a step in which the toner is stored in
15 the toner storing portion provided in the new T frame; a step in which the developing roller is mounted in the new D frame; a step in which the photosensitive drum is mounted in the recycled drum frame, and a step in which two frames, that is, T and D frames, are
20 joined to form a new T-D frame, with the toner sealing member being removably interposed between two frames in such a manner that the toner stored in the toner storing portion is prevented from leaking; and a step in which the new T-D frame and recycled drum frame are
25 joined so as to be pivotal from each other.

"The recycled drum frame" mentioned above means a drum to be recycled.

In recycling the process cartridge, a new T-D frame is used; therefore, the T frame and D frame can be joined after the toner sealing member is attached to seal completely the opening of the T frame. As a result, the toner leak from the toner storing portion can be completely prevented.

Hereinafter, the preferable embodiments of the present invention will be more specifically described referring to the drawings.

10 {Overall Structures of Process Cartridge and Image Forming Apparatus}

Before beginning the detailed description of the present invention, descriptions will be given as to the general structure of the process cartridge in which a photosensitive drum and a cleaning blade are mounted, and the general structure of a laser beam printer (image forming apparatus) in which the process cartridge is installed.

Figure 1 is a vertical sectional view of a process cartridge C, and shows the general structure thereof. Generally speaking, the process cartridge C comprises four units separable from each other: a top unit (cartridge cover), a primary charging unit (charging means) 2, a developing unit (developing means) 3, a cleaning unit (cleaning means) 4. The developing unit 3 and cleaning unit 4 comprise, respectively, a T-D frame 3A and a drum frame 4A,

which store or support structural components to be described later. It should be noted that when the process cartridge C is disassembled into these four units, the photosensitive drum (electro-photographic photosensitive drum) 41 is contained in the cleaning unit 4.

The top frame 1 is constituted of a frame that covers from above the primary charging unit 2, developing unit 3, and cleaning unit 4, and is provided with light passing holes 11a and 11b for allowing exposure light and reflected exposure light. These light passing holes 11a and 11b are cut in the vertical direction, substantially at the middle of the top frame 1 in the front-to-rear direction (direction of an arrows K1 and K2 in Figure 1).

The primary charging unit 2 has a U-shaped section, and comprises: a shield 21, the opening of which faces the photosensitive drum 41; a discharge wire 22 disposed within the shield 21; and a grid 23 disposed at the opening of the shield 21.

The developing unit 3 comprises: a toner chamber frame (T frame) 31 provided with a toner (developer) storing portion; a developing chamber frame (D frame) 32 provided with a developing chamber, which is in communication with the T frame 31 through an opening 31a provided on the T frame 31 and an opening 32a provided on the D frame 32; and a

developing roller 33 mounted on the D frame 32 so as to face directly the photosensitive drum 41. Above the developing roller 33, a developing blade 35 for regulating the thickness of a layer of the toner
5 coated on the surface of the developing roller 33 is disposed. An alphanumerical reference 32f designates a mount where the developing roller 33 is disposed, and the developing roller 33 is mounted on this mount 32f, using left and right arms 36c and 36d. An
10 alphanumerical reference 32g designates an end seal, and 33a designates a gear.

The cleaning unit 4 supports the photosensitive drum 41 and cleaning apparatus 42. The photosensitive drum 41 is supported so as to be
15 rotatable in the direction of an arrow mark R2, and below it, a protective plate (drum shutter) for protecting the photosensitive drum 41 from unnecessary exposure or physical damage is disposed. This
protective plate 43 is retractively constructed, and
20 is automatically retracted to expose the bottom portion of the photosensitive drum 41 as the process cartridge C is installed into the apparatus main assembly to be described later. The cleaning
apparatus 42 comprises: an elastic cleaning blade (of
25 urethane, for example) 45, which rubs the surface of the photosensitive drum 41 to remove the residual toner adhering thereto; a scooping sheet 46 for

catching the residual toner scraped off by the
cleaning blade 45; a waste toner delivery member 47,
which moves toward the front (direction indicated by
the arrow mark K1) the residual toner caught by the
5 scooping sheet 46; and a waste toner storage 49 for
storing the delivered residual toner.

The process cartridge C constructed as
described in the foregoing is installed into a laser
beam printer 50 illustrated in Figure 2. The laser
10 beam printer 50 comprises an apparatus main assembly
51, and a cover 52 that is rotatable about a
rotational axis 51a provided on the apparatus main
assembly 51, at the bottom front (direction of the
arrow mark K1). This cover 52 is normally closed
15 (solid line in the drawing), and is opened (double dot
chain line) when the process cartridge C is replaced,
when a jam caused by a sheet of transfer medium P such
as paper, on which an image is formed, is handled, or
when a like situation occurs. When the process
20 cartridge C is installed, it is first held in the open
cover 52, and then, this cover holding the process
cartridge C is closed, whereby the process cartridge C
is disposed at a predetermined location (solid line in
the drawing) within the apparatus main assembly 51.
25 As the process cartridge C is disposed at the
predetermined location, the photosensitive drum 41,
developing roller 33, and the like are connected to

the driving means (unillustrated) provided on the apparatus main assembly 51 side, being thereby rotatively driven in the directions of arrow marks R2 and R1 (refer to drawing), respectively. At this
5 time, the discharge wire 22 of the primary charging unit 2, and the developing roller 33, are connected to the high voltage power source provided on the same apparatus main assembly 51 side.

Next, referring to Figures 1 and 2, an image
10 forming process of the laser beam printer 50 will be described. As a command to start the image formation is sent in through a start button (unillustrated), the photosensitive drum 41 is rotatively driven in the arrow mark R2 direction, being thereby uniformly
15 charged by the primary charging unit 2, on the surface thereof. The surface of the photosensitive drum 41 is exposed to an exposure light by an exposing means comprising a laser unit 53, a full-reflection mirror 55, and the like, whereby an electrostatic latent
20 image reflecting the imaging data is formed. The electrostatic latent image turns into a toner image as the toner is adhered thereto by the developing roller 33 of the developing unit 3. The toner image formed on the photosensitive drum 41 is transferred onto a
25 sheet of transfer medium P by a transferring apparatus 56. This transfer medium P is a sheet of transfer medium such as is stored in a sheet feeding cassette

57 installed in the rear side (direction of the arrow
mark K2) of the apparatus main assembly 51, is fed by
a sheet feeding roller 59, and then, is delivered by a
registration roller pair 60 in synchronism with the
5 rotation of the photosensitive drum 41. The transfer
medium P having received the toner image is further
conveyed along a delivery guide 61 to a fixing
apparatus 62. In the fixing apparatus 62, the
transfer medium P is subjected to heat and pressure by
10 a fixing roller 62a and a pressing roller 62b, whereby
the toner image is fixed to the surface of the
transfer medium P. Thereafter, the transfer medium P,
on which the toner image has been fixed, is discharged
by a discharge roller 63 into a discharge tray 65
15 formed on the top surface of the cover 52.

{Remanufacturing Process of Process Cartridge}

Next, a case in which a used process
cartridge C is recycled will be described. Generally,
the used process cartridge is recovered from the
20 market in cooperation with consumers. In this case,
some of the members in the recovered process cartridge
C must be replaced with new ones. The first member,
which can listed as such, is the photosensitive drum
41, the photosensitive surface layer of which has
25 deteriorated due to a long period of usage, and also,
there are other members which must be replaced, since
they have reached the ends of their service lives, or

have been damaged by certain factors.

When the process cartridge C according to the present invention is replenished with the toner, or the aforementioned members thereof are replaced, it is first disassembled into the four major units, and then, each of the four major units is further disassembled into smaller portions as needed.

(Disassembling Steps)

First, a step in which the process cartridge C is disassembled into the aforementioned major units, that is, the top frame 1, primary charging unit 2, developing unit 3, and cleaning unit 4, will be described.

To begin with, the process cartridge C to be disassembled is set within an air duct (unillustrated), in which air is blown on the surface of the process cartridge C to remove the toner or dust adhering to the surface thereof.

Next, referring to Figure 3, a total of four pins 12 (two on the left and two on the right), with which the left and right wall portions 1a and 1b (direction indicated by the arrow mark K1 are fixed to the cleaning unit 4, are removed. More specifically, the head portion of the pin 12 is in the form of a flange having a recess at the center, and this flange portion is gripped with a radio pliers and rotatively pulled out. The pin 12 is of resin material, and an

engaging portion is provided at the end. However, when it is pulled out, the engaging portion and the flange portion gripped by the radio pliers are liable to be damaged; therefore, the pin 12 is replaced with
5 a new one during the remanufacturing. Further, before the process cartridge C is put to use, a seal film cover 13 protecting a seal film (unillustrated) that seals the T frame 31 and D frame 32 is pulled off by
10 the radio pliers, for example, in the same manner as the pin 12; therefore, the seal film cover 13 is also replaced with a new one during the remanufacturing.

Next, referring to Figure 3, the top frame 1 is grabbed by the left and right hands, on the left and right ends (double dot chain line), with the left
15 and right thumbs placed at a couple of hatched areas, respectively. While the hatched areas are pressed down, the left and right wall portions 1a and 1b of the top frame 1 are lift up with the fingers placed at other hatched areas (only one of the other hatched
20 areas is illustrated) as if the left and right wall portions 1a and 1b are opened outward from the bottom, respectively. As a result, claws 4a and 4b, which project from the top surface of the cleaning unit 4, and are engaged in the engagement holes 1c and 1d,
25 respectively, of the top frame 1 as shown in Figure 4, are disengaged therefrom, allowing the top frame 1 to be taken off the cleaning unit 4. As a result, the



top frame 1 among the four units is completely removed. The top frame 1 is recycled as is after it is cleaned of foreign matter such as the toner or dust clinging to the outer and inner surfaces thereof.

5 Next, the primary charging unit 2 fitted in the top portion of the cleaning unit 4 is taken off. Referring to Figures 4 and 5, the primary charging unit 2 is provided with a leg portion 25, at one end, and is in engagement with the cleaning unit 4, being
10 pressed toward the leg portion 25 by a pressing member (unillustrated) provided on the cleaning unit 4 on the side opposite to the leg portion. As the leg portion 25 is grabbed and pulled upward by a hand while being gently pushed sideways (arrow direction), the primary
15 charging unit 2 is completely removed.

 Referring to Figure 6, before disassembling the developing unit 3 and cleaning unit 4, a tension spring (spring member) 41a, which is stretched between, and anchored to, a projection 3c provided on
20 the D frame 3A side and a projection 4c provided on the drum frame 4A side, is removed. Another tension spring 41a, which is substantially the same spring, and is stretched between the other ends of the developing unit 3 and cleaning unit 4, is removed in
25 the same manner. These tension springs 41a or the like press the developing roller 33 of the developing unit 3 toward the photosensitive drum 41 of the

cleaning unit 4, whereby the spacer (unillustrated) fitted around the periphery of the developing roller 33, at each longitudinal end, makes contact with the non-image forming region provided at each longitudinal end of the photosensitive drum 41, keeping a predetermined gap between the directly facing surfaces of the photosensitive drum 41 and developing roller 33. The tension spring 41a is reused during the reassembly as long as it meets a predetermined standard when tested by an inspector.

Even after the removal of the tension spring 41a, the developing unit 3 and cleaning unit 4 are pivotally in contact with each other at the left and right ends, respectively. In order to break this engagement, a pin 4d connecting the developing unit 3 and cleaning unit 4 is pulled out with the radio pliers. Then, after the developing unit 3 is rotated approximately 80° in the direction indicated by an arrow mark in Figure 6, the developing unit 3 is slightly lifted by the right-hand end with reference to Figure 7, whereby the engagement on the right-hand side is broken, allowing the developing unit 3 and cleaning unit 4 to separate from each other.

Thus, the process cartridge C is disassembled into four major units: the top frame 1, primary charging unit 2, developing unit 3, and cleaning unit 4.

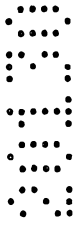
Next, it will be described how each unit is further disassembled into smaller structural components, how they are cleaned, how they are exchanged, and how the like procedure is carried out.

5 To begin with, the top frame 1 does not comprise a portion which is rubbed by the other structural members. In other words, it does not have a portion to wear out; therefore, it is recycled as is when no anomaly is detected thereon after it is
10 cleaned and inspected by the inspector.

(Remanufacture of Primary Charging Unit)

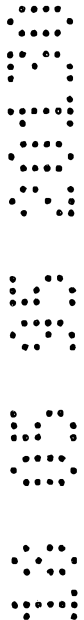
Next, the shield 21, discharge wire 22, and guide of the primary charging unit 2 are cleaned. First, the toner or dust adhering to the entire body
15 of the primary charging unit 2 is removed. This is accomplished using a cleaning apparatus (unillustrated), for example. More specifically, the primary charging unit 2 is positioned at a predetermined spot within the cleaning chamber of the
20 cleaning apparatus, and is entirely blown with air, while the air within the cleaning chamber is sucked out. Next, before starting to clean the individual members, a connecting spring (unillustrated) is removed to disengage the connected members, and then,
25 the grid 23 is removed from the shield 21. Then, the shield 21 is placed on the slanted surface B2 of a jig B1 as shown in Figure 8(a), and its position is fixed

by a stopper B3 as shown in Figure 8(b). Next, the shield 21 is cleaned with a sheet of Silbon paper soaked with IPA (isopropyl alcohol), on the outward facing surface of one of the wall portions 21a and the inward facing surface (hatched area) of the other wall portion 21b, and then, is flipped 180°, being thereby cleaned this time on the outward facing surface of the latter wall portion 21b and the inward facing surface (hatched area) of the first wall portion 21a in the same manner. This step must be very carefully performed so that no dust or fuzz of the Silbon paper adheres to the shield 21. After the cleaning, the shield 21 is checked for deformation. More specifically, referring to Figure 9, a gauge G1 provided with a maximum portion and a minimum portion is inserted into one end of the shield 21 in order to confirm that the minimum portion freely slides, but the maximum portion is gently rejected. The gauge G1 is inserted into also the central portion and the outer end of the shield 21 in order to confirm in the same manner the free passage of the minimum portion and the gentle rejection of the maximum portion. As for the grid portion 23, it is placed on the projection B5 of a jig B4 in such a manner that the grid portion 23 covers the projection B5 as shown in Figure 10(a), and its exposed surface is cleaned with the SIRUBON paper B7. Thereafter, the grid 23 is



reversely fixed on the jig B4 in such a manner that
the grid 23 is fitted into a recess portion B6 as
shown in Figure 10(b), and then, is cleaned with the
SIRUBON paper B7, this time on the inward facing
5 surface. The discharge wire 22 is blown with the air,
is dry-wiped with a piece of CR rubber, and then, is
cleaned with a cleaner pen B8 as shown in Figure 11.
The tip B9 of the cleaner pen B8 is fitted with a
piece of felt, which is cut to give a V-shaped notch
10 and is impregnated with alcohol. In order to clean
the discharge wire 22, the V-shaped tip of the cleaner
pen B9 is gently placed across the discharge wire 22,
and is moved from one end of the wire 22 to the other
end in the direction of an arrow mark, with no
15 downward pressure applied except for the self weight
of the pen itself. Next, the shield 21 is rotated
180°, and the same cleaning operation of the cleaner
pen B8 is repeated to finish cleaning the discharge
wire 22. The cleaned shield and discharge wire are
20 examined by the inspector, and when it is confirmed by
the inspector that their performances have been
recovered, they are recycled. When the performance of
the discharge wire 22, which is taken out of the
primary charging unit 2 and cleaned, does not meet a
25 predetermined standard, it is replaced in the
following manner. First, the structure of the primary
charging unit 2 will be briefly described. Referring

to the exploded perspective view in Figure 12,
insulating blocks 21c and 21d are fixed at the left
and right ends of the shield 21, respectively. On the
downward facing surfaces of the insulating blocks 21c
5 and 21d, pin-shaped projections 21c1 and 21c2
(unillustrated), and pin-shaped projection 21d1 and
21d2 are provided (refer to Figure 13, in which only
the portions belonging to the insulating block 21d are
shown). These projections are put through small holes
10 21e1 and 21e2 drilled at the left and right ends of
the shield 21, and one of the projections 21d2 is
welded with heat and pressure, whereby the insulating
blocks 21c and 21d are fixed to the left and right
ends of the shield 21, respectively. The insulating
15 blocks 21c and 21d are provided with engagement holes
21c4 (unillustrated) and 21d4 (refer to Figure 4), and
the discharge wire 22 is fixed at the left and right
ends with pins 22a and 22b, which engage with the
engagement holes 21c4 and 21d4, respectively. The
20 pins 22a and 22b are members formed of resin material
having less hardness than the insulating blocks 21c
and 21d. Referring to Figure 12, on the inward facing
surface of the insulating blocks 21c and 21d, vertical
guide portions 21c3 and 21d3 are provided, and
25 elements 21f and 21g are vertically guided by these
guide portions 21c3 and 21d4, respectively. These
chassis 21f and 21g have arm portions 21f1 and 21g1



with V-shaped cutaway portions 21f2 and 21g2,
respectively. On the arm portions 21f1 and 21g1,
roller 21f4 and 21g4 are rotatively supported with
pins 21f3 and 21g3, which are put through the arm
5 portions 21f1 and 21g1. As for the cutaway portions
21f2 and 21g2, they are placed across the discharge
wire 22, at the left and right ends of the discharge
wire 22, in such a manner as to press downward these
portions as shown in the drawing. Therefore, the
10 distance between the tips of the roller 21f4 and 21g4,
which are in contact with the photosensitive drum 41
surface, and the discharge wire 22, can be accurately
maintained. In other words, the distance between the
photosensitive drum 41 surface and discharge wire 22
15 is accurately regulated by the chassis 21f and 21g.
Referring to Figures 12 and 15, on one, 21c, of the
insulating blocks, an electrode 22c for applying a
voltage to the discharge wire 22 is attached with the
pin 22a.

20 Referring to Figure 12, on the left and right
insulating blocks 21c and 21d, covers 21h and 21i are
attached in an easily removeable manner. The covers
21h and 21i are provided with windows 21h1 and 21i1
and engagement holes 21h2, 21h2, 21i2 and 21i2.
25 Referring to Figure 14, the design of the cover 21i is
such that when it is put, from above, on the
insulating block 21d, the engagement holes 21i2 and

21i2 engage with the claws 21d5 and 21d5 of the
insulating block 21d. When they are engaged, the arm
portion 21g1 and roller 21g4 of the chassis 21g
project through the window 21i1, and the pin 22b is
5 pressed down into the engagement hole 21d4, whereby
the discharge wire 22 is securely held. The structure
of a cover 21h is the same as the cover 21i.

In order to replace the discharge wire 22,
first, the left and right covers 21h and 21i are
10 pulled by the bottom portions in a manner to open
them, whereby the engagement holes 21h2, 21h2, 21i2
and 21i2 are disengaged from the corresponding claws
21c5, 21c5, 21d5 and 21d5. Then, the covers are
lifted upward in the direction of the arrow marks,
15 exposing thereby the left and right chassis 21f and
21g, and pins 22a and 22b, which fix the discharge
wire 22 at the left and right ends, respectively.
Since nothing is holding the left and right chassis
21f and 21g at this time, they can be removed upward
20 following the guide portions 21c3 and 21d3. Next, the
pins 22a and 22b are pulled out from the insulating
blocks 21c and 21d, and the discharge wire 22, which
have been wound around these pins 22a and 22b, is
removed.

25 The discharge wire 22 and pins 22a and 22b
are replaced with new ones. More specifically, the
new discharge wire 22 is wound four times on the pins

22a and 22b at the left and right ends, respectively,
and then, the pins 22a and 22b are fitted into the
engagement holes 21c4 and 21d4 of the insulating
blocks 21c and 21d. Next, the chassis 21f and 21g are
5 placed at the left and right ends, in such a manner as
to straddle across the discharge wire 22 stretched
between the left and right pins 22a and 22b, and at
the same time, to be fitted into the guide portions
21c3 and 21d3, respectively. Finally, the covers 21h
10 and 21i are placed over the insulating blocks 21c and
21d, completing the process of exchanging the
discharge wire 22.

The primary charging unit 2, of which
performance has been recovered by the cleaning or
15 replacement of the shield 21 and/or discharge wire 22,
is remounted on the cleaning unit 4, which also has
been through the disassembly, cleaning, inspection,
and the like, which will be described later. At this
time, the seal member 21n (in Figure 9, only one of
20 them is illustrated), which has been pasted adjacent
to the left and right ends, is also recycled when no
anomaly is discovered thereon. This seal member 21n
is made of artificial leather, and it is disposed so
as to rub on the photosensitive drum 41 surface. As a
25 result, it usually suffers from severe wear, and often
becomes unsuitable for reuse; therefore, it is
replaced by a new one without being checked for its

suitability for recycling. Further, adjacent to the seal member 21n, a seal member 21m formed of foamed urethane is disposed. Since this seal member 21m is simply placed in contact with a stationary member, it is seldom damaged; therefore, when no anomaly is discovered thereon through the inspection, it is recycled as is, instead of being replaced.

(Remanufacture of Developing Unit)

Next, a remanufacturing method for the developing unit 3 will be described. First, the developing unit 3 separated from the cleaning unit 4 is disassembled into smaller portions in the following manner. Referring to Figure 16, a developing blade 35 is removed by removing screws 35a and 35b, and the left and right arms 36c and 36d are pulled out by removing the left and right end screws 36c and 36d; the developing roller 33 having been fixed to the D frame 32 by the left and right arms 36c and 36d, and a magnet 33a having been placed in the developing roller 33, are removed in the frontward direction (direction of an arrow mark K1). The developing roller 33 is further disassembled into smaller parts: a magnet 33a, a roller gear 33b, a bearing (front) 33c, a developing roller base member 33e, a couple of rollers 33d and 33d, a bearing (rear) 33h, and a roller electrode (unillustrated), which are separated into recyclable and non-recyclable groups. Those recyclable are

cleaned with the high pressure air or the like. When
found with no anomaly through inspection, the
developing blade 35, roller gear 33b, and the like are
reused, whereas those revealed by the inspection that
5 their performance does not meet a predetermined
standard are replaced by new ones as needed.

In this embodiment, the members such as
developing roller 33, developing blade 35, or the like
are recycled when it is revealed by the inspection
10 that their performance satisfies a predetermined
standard, but the T frame 31 and D frame 32 are always
replaced with new ones. This is because the T frame
31 and D frame 32 of the developing unit 3 are welded
together, making it impossible to separate them, which
15 in turn makes it impossible to reseal perfectly the
opening 31a of the T frame 31 during the
remanufacture. Therefore, a new T frame 31 and a new
D frame 32 are separately prepared, and before two
frames are joined, the opening 31a of the T frame 31
20 is airtightly sealed with the sealing film (toner
seal) by heat sealing, and then, the two are welded
together. The T frame 31, D frame 32, drum frame, and
the like are formed of highly impact resistant
styrene, polyphenylene oxide, or the like.

25 More specifically, referring to Figure 17,
before the sealing film 91 is placed over the opening
31a, the T frame 31 and D frame are separate members,

and they are united after the sealing film 91 is attached; therefore, it is easy to seal perfectly the opening 31a with the sealing film 91. Also referring to Figure 17, the T frame 31 comprises a picture
5 frame-like flange portion 31b extending outward from the entire perimeter of the rectangular opening 31a, and also, the D frame comprises a flange portion 32b having substantially the same shape. The sealing film 91 is mounted on a plastic base member, which is a
10 plate member having the same picture frame-like configuration as the flange portions 31b and 32b. In other words, the sealing film 91 and base member 92 are separably united by means of heat sealing or the like. The reason why the sealing film 91 is separably
15 mounted on the base member 92 is to allow the operator to peel off the sealing film 91 before the process cartridge is put to use, so that the toner within the T frame 31 is supplied to the developing roller 33. Next, the T frame 31 and D frame 32 are joined in such
20 a manner that the base member 92 is pinched between the flange portion 31b of the T frame 31 and the flange portion 32b of the D frame 32. It should be noted here that a slit 32c (refer to Figure 20) is provided on the D frame 32, on the surface portion
25 facing the sealing film 91, so that the sealing film 91 is not hindered from being separated. In order to uncover the opening 31a, a tip 91a of the sealing film

91 projecting from one of the slits 32c is pulled in the direction of an arrow mark K3, moving thereby the doubling back point 91b of the sealing film 91 as shown in Figure 20(b) till the sealing film 91 is
5 completely pulled out to uncover fully the opening 31a.

Next, the sealing process using the sealing member 91 will be described. To begin with, the sealing film 91 is attached to the base member 92 with
10 an opening 92, by heat sealing. As for the base member 92, an approximately 0.3 mm to 2.0 mm thick plate of plastic material such as polyester, polystyrene, nylon, ABS, or the like is formed into sheet, and then, the opening 92a is punched out, or
15 the picture frame-shaped base member 92 is molded in an ordinary method.

Next, the sealing film 91 is heat-sealed to the thus made base member 92, by applying heat and pressure as shown in Figure 18. As for an example of
20 the sealing conditions, the temperature of the sealing bar 98a of the horn 92 is approximately 110°C to 130°C; the pressure, approximately 1.5 kgf/cm² to 5 kgf/cm²; and the time is approximately 1 second to 3 seconds.

25 During the heat-pressure sealing by this sealing bar 98a, a certain caution must be taken so that the base member 92 and the sealing bar 98a make

uniform and parallel contact. When the contact is non-uniform, the sealing film 92 is subjected to excessive stress, which is liable to cause the sealing film 91 to break from inside the sealed surface when
5 the process cartridge is subjected to an impact or is dropped.

Next, the base member 92, to which the sealing film 92 has been heat-sealed, is welded to the flange portion 31b of the T frame 31. For this
10 reason, a rib 31e is provided on the flange portion 31b, on the surface that makes contact with the base member 92, in such a manner as to surround the opening 31a. This rib 31e melts and welds itself to the base member 92 during the ultrasonic welding.

As the rib 31e melts, the opening 31a of the T frame 31 is completely sealed by the base member 92, to which the sealing film 91 has been attached.
15

Next, the T frame and D frame are welded together using ultrasonic waves. This is accomplished
20 by using a jig as shown in Figure 19. More specifically, the T frame 31 is set in the recess 99a of a holding jig 99a, and the sealing film 91 having been heat-sealed to the base member 92 is folded back. This sealing film 91 is given more than twice the
25 length of the opening 92a of the base member 92 so that when folded back, the tip 91a thereof sticks out from one longitudinal end of the T frame 31.

Next, the D frame 32 is placed on top of the T frame 31, and the D frame 32 is pressed from above with a pressing jig 99b. At this time, the free end of the sealing film 91 is placed so as to stick out of the slit 32c (Figure 20(a)). In this state, the ultrasonic waves are applied to the T frame 31 and D frame 32, whereby the rib 32e (Figure 17) extended on the welding surface of the D frame 32 in the longitudinal direction of the D frame 32 melts and welds itself to the welding surface of the D frame 31, uniting thereby two frames 31 and 32.

Referring to Figure 17, the D frame 32 comprises a positioning boss 32d disposed at a predetermined location on the joining surface, and correspondingly, the D frame comprises a positioning hole 31f disposed so as to accommodate the boss 32d. Thus, when the frames 31 and 32 are placed on top of each other, the boss 32d is fitted into the hole 31f to fix the positional relationship between two frames, which can prevent the frames 31 and 32 from being displaced from each other, or from becoming deformed.

Next, the toner is filled into the T-D frame formed through the integration of the T frame and D frame by the aforementioned welding. More specifically, referring to Figure 21, the toner T is refilled through a toner supply opening 31c using a developer hopper 97 or the like. At the top end of

the funnel-shaped main body 97a, a supply opening 97b is provided for supplying the toner T, and at the bottom end, an adaptor 97c that fits into a toner supply opening 31c of the T frame 31 is provided.

5 Further, within the main body 97a, a rotatable auger 97d is disposed. The toner refilling speed is adjusted by controlling the revolution of this auger 97d as needed. The internal surface or the like of the main body 97a may be treated with fluororesin or
10 the like to reduce the coefficient of friction. Such a treatment enables the toner to be refilled from the developer hopper 97 into the T frame with higher efficiency.

After the toner is refilled, a cap 31d is put
15 on the toner supply opening 31c of the T frame 31 (refer to Figure 17). Then, the developing blade 35, developing roller 33, and the like, which have been cleaned with the high pressure air or the like, are mounted on the T frame in the reverse order to the
20 disassembling order, reconstructing thereby the developing unit 3. It should be noted here that normally, a new cap 31d is used during this reconstruction. This is to prevent the cap 31d from coming off unexpectedly.

25 When the T frame 31 and D frame 32 are welded together, the force holding together the frames 31 and 32 becomes very strong, preventing thereby the

occurrence of the toner leak. As for the welding method, ultrasonic welding, vibration welding, or the like can be listed. The ultrasonic welding takes a relatively short time to provide a stronger holding
5 force.

Further, the use of the base member 92 allows the sealing film 91 to be mounted between two frames 31 and 32, with a proper strength (suitable for an operator to pull out). Further, the amount of the
10 toner to be supplied from the T frame 31 to the D frame 32 can be adjusted by varying the size of the opening 92a of the base member 92.

(Remanufacture of Cleaning Unit)

Next, the remanufacture of the cleaning unit
15 4 will be described. The cleaning unit 4 is recycled after the drum frame 4A is cleaned. First, a cleaning apparatus for disassembling and cleaning the cleaning unit 4 will be described. To begin with, the protective plate 43 (Figure 1) and photosensitive drum
20 41 are removed from the cleaning unit 4, and in this state, the waste toner is extracted (cleaning operation), which will be described later. In the descriptions given above, a terminology "cleaning unit 4" meant a cleaning unit 4 comprising the
25 photosensitive drum 41 and protective plate 43, but in the description to be given hereinafter, it will be designated as the cleaning unit 4 as needed even when

it does not includes these components.

Referring to Figure 22, the structure of the cleaning apparatus will be described. A cleaning apparatus 170 comprises a housing 170a, which covers the entire structure of the apparatus. At the top front portion of the housing 170a, a transparent cover 170b with a knob 170c is mounted. It can be opened or closed as needed, and its state, that is, whether it is open or closed, is detected by a detection sensor 170d. On the top rear portion (top right portion in the drawing) of the housing 170a, an exhaust vent 170e is provided, and it is connected to the suck end opening of an auxiliary sucking apparatus.

Within the housing 170a, a stopper table 171 is disposed at the bottom front so as for its flat top surface to be level. The surface of its rear lateral wall is slanted with a steep angle. On these level and slanted surfaces, a stopper 171a and 171b made of rubber material are fixed to regulate the oscillating range of an oscillating apparatus, which will be described later.

On the level surface of the stopper table 171, a receptacle table 172, which is movable in the backward and forward direction, is disposed. The receptacle table 172 is moved between a home position M1 (double dot chain line in Figure 22) and a cleaning position M2 (solid line in the same drawing) by an air

cylinder 175 connected to the backside thereof. The top surface of the receptacle table 172 is give a shape that matches the bottom surface of the cleaning unit 4. As indicated by the double dot chain line in Figure 22, the cleaning unit 4 is placed on the top surface of the receptacle table 172 located at the home position M1, being oriented in such a manner that its cleaning blade 45 and scooping sheet 46 are disposed at the top and bottom rear portions, respectively. Therefore, a gap G formed between the tips of the cleaning blade 45 and scooping sheet 46 is located at the rear. The receptacle table 172 is provided with a clamping apparatus 172c comprising a movable block 172a and a fixed block 172b as shown in Figure 23. It should be noted here that the perspective view in Figure 23 depicts the cleaning unit 4 on the receptacle table (unillustrated) located at the home position M1, being oriented as described above. The structure of the clamping apparatus 172c is such that when the cover 170b (double dot chain line in Figure 22), which has been opened before the cleaning unit 4 is mounted on the receptacle table 172 located at the home position M1, is closed (solid line in the same drawing) after the cleaning unit 4 is mounted, this closing action detected by the aforementioned detection sensor 170d triggers the clamping apparatus 172c to grip the cleaning unit 4 on

the receptacle table, and thereby, fixes the position of the cleaning unit 4. In other words, the initiation of the clamping operation of the clamping apparatus 172 is linked to the closing of the cover 5 170b. More specifically, after the cover 170b is closed, a positioning block 172a illustrated in Figure 23 is extended, by the unillustrated air cylinder, to be placed in contact with an engagement portion 4b provided on the lateral surface of the cleaning unit 10 4, and then, it is further extended, sliding the cleaning unit 4 till the opposite lateral surface of the cleaning unit 4 comes in contact with a fixing block 172b.

When the receptacle table 172 is at the 15 cleaning position M2, at which its bottom rear portion is regulated by the stopper 173c (refer to Figure 22), it is mounted on an oscillating apparatus (moving apparatus) 173. The oscillating apparatus 173 comprises an oscillating table 173a provided with left 20 and right side plates 173b and 173b erected from the left and right edges of the bottom plate as shown in Figure 24(a). This oscillating table 173a is pivotally supported with a rotational axis 173d fixed to the outward facing surface of one of the side 25 plates 173b. On the other side plate 173b, an oscillating axis 176b is supported at a position correspondent to the rotational axis 173d, with the

interposition of a key 176c. The oscillating axis
176b is caused to alternate backward and forward
rotations within a predetermined angle α by a
combination of a rotary actuator 176 and an air
5 cylinder 176a. Referring to Figures 24(b) (section of
Figure (a) at a plane A), as this oscillating axis
176a alternates the backward and forward rotations,
the oscillating table 173a is oscillated by the angle
of α between a level position N1 (solid line in the
10 same drawing) and an upright position N2 (double dot
chain line in the same drawing). The level position
N1 and upright position N2 of the oscillating table
173a are fixed by the stopper 171a and 171b of the
aforementioned stopper table 171. In this embodiment,
15 the oscillating angle α is set at 80° .

At the top rear portion of the oscillating
table 173a at the level position N1 (solid line in
Figure 22), a tapping apparatus 177 is disposed, which
taps the cleaning unit 4 as it is driven by a motor
20 177a. Referring to Figure 25(a) (depicting the
tapping apparatus 177 as seen from the opposite side
of Figure 22), the tapping apparatus 177 comprises: a
cam shaft 177c (Figure 25(c)) projecting eccentrically
from one end of a motor shaft 177b; a tapping table
25 177d, which has an oscillating center 177e on the base
side, and a guide groove 177h that engages with the
aforementioned cam shaft 177c in a sliding manner, on

the free end side; a tapping plate 177f screwed on the top surface of the free end of the tapping table 177d; and a projecting member 177g fixed at the free end of the tapping plate 177f so as to face downward. The tapping plate 177f is a plate of elastic material having a proper amount of elasticity. The projecting member 177g is made of resin material having a hardness slightly less than that of the waste toner storage 49 of the cleaning unit 4, which is where the cleaning unit 4 is tapped, so that the cleaning unit 4 is not damaged. In the tapping apparatus 177, the tapping table 177d is oscillated in the substantially vertical direction by the rotation of the cam shaft 177c, which is integral with the motor shaft 177b, in the direction of an arrow mark. With this oscillation, the projecting member 177g is alternately moved away from the cleaning unit 4 (Figure 25(a)) and caused to strike the top surface of the cleaning unit 4 (Figure 25(b)). In these drawings, only one set of the tapping table 177, tapping plate 177f, and projecting member 177g is illustrated, but a pair of such sets may be provided. In such a case, two pair of such sets are to be connected with a shaft, for example, and the cleaning unit 4 is to be tapped on the top surface, at points P and P indicated in Figure 26.

Referring to Figure 22, at the aforementioned

cleaning position M2, the receptacle table 172, air
cylinder 175, and tapping apparatus 177 are all
mounted on the oscillating table 173a of the
oscillating apparatus 173. In other words, these
5 components are moved together with the oscillating
table 173a.

Referring to Figure 22, the gap G located on
the rear side of the cleaning unit 4 sitting on the
receptacle table having been moved to the cleaning
10 position M2 is covered with the air block 179a of a
sucking apparatus 179. Figure 26 is a detailed
drawing of the air block 179a. The air block 179a is
basically hollow, and a contact surface 179g facing
the gap G of the cleaning unit 4 is mostly covered
15 with a rubber-like sealing member 179b, except for a
blowing opening 179d and a sucking opening 179e.
Within the air block 179a, an air sending duct 179c
for blowing the air into the cleaning unit 4 is
disposed, and the blowing opening 179d of this air
20 duct 179c opens near one end of the contact surface
179g. In addition, within the air block 179a, an air
sucking duct 179f is disposed, and the sucking end
opening 179e of the sucking duct 179f is disposed near
the other end of the contact surface 179g. The
25 contact surface 179g, at which this blowing opening
179d and sucking opening 179e open up, is moved in the
direction of an arrow mark K3 by the aforementioned



receptacle table 172, being thereby placed in contact with the cleaning blade 45 and scooping sheet 46 of the cleaning unit 4 having been moved to the cleaning position M2, so as to cover completely the gap G
5 formed between the aforementioned two tips. The way the gap G is covered by the contact surface 179g is indicated by double dot lines A1, A2 and A3 in Figure 26, wherein these double dot lines correspond to the contact surface 179g, blowing opening 179d, and
10 sucking opening 179e. As is evident from the above description, the sucking apparatus 179 sends (Q2) compressed air supplied (Q1) from the base end side of the air sending duct 179c, into the cleaning unit 4 held air-tightly against the air block 179a, through
15 blowing opening 179d placed air-tightly against A2 and the gap G, causing thereby the waste toner within the cleaning unit 4 to be air borne, and then, sucks out (Q3) the waste toner together with the air within the cleaning unit 4, through the sucking side opening 179e
20 placed air-tightly against A3. The sucked out waste toner is sent out (Q4) toward the base side.

It should be noted here that the waste toner that leaks out of the cleaning unit 4 and air block 179a during this operation is sucked up together with
25 the internal ambient air of the cleaning apparatus, by the auxiliary sucking apparatus (unillustrated) through the ventilating opening 178.

Next, referring mainly to Figure 22, which depicts the structure of the cleaning apparatus 170, and a flow chart in Figure 27, which shows the operational flow thereof, and also, to the other
5 drawings as needed, a method for cleaning the cleaning unit 4 and the operation of the cleaning apparatus 170 will be described in detail.

At first, the cleaning apparatus 170 (cleaner) is started (S1). Then, the cleaning unit 4
10 as the object to be cleaned is placed on the top surface of the receptacle table 172 located at the home position M1 (S2). The cover 170b is closed (S3), which is detected by the detection sensor (door switch) 170d (S4), whereby the air cylinder is turned
15 on (S5), and the cleaning unit 4 is clamped so as to be fixed at a predetermined location on the receptacle table 172 (S6). The air cylinder 175 is turned on (S7), whereby the receptacle table 172 is moved from the home position M1 to the cleaning position M2 (S8),
20 placing thereby the gap G of the cleaning unit 4 airtightly against the contact surface 179g of the sucking apparatus 179 (see Figure 26). The motor 177a is turned on (S9), whereby the tapping apparatus 177 is activated to begin tapping the cleaning unit 4 by
25 the projecting member 177g (S10). As a result, the waste toner clinging to the internal walls of the cleaning unit 4 is forced to fall so that the waste

toner can be easily moved. The rotary actuator 176 is started (S11), whereby the oscillating table 173a of the oscillating apparatus 173 is oscillated once by 80° (S12). A compression air valve (unillustrated) of the sucking apparatus 179 is opened (S13, S14),
5 whereby the air is blown into the cleaning unit 4 through the blowing opening 179d (Figure 26) and gap G, and at the same time, the air within the cleaning unit 4 is sucked out together with the waste toner,
10 through the gap G and sucking opening 179e. This is continued as needed to suck out completely the waste toner within the cleaning unit 4.

The oscillating table 173a is oscillated once more (S15). After the rotary actuator 176 is turned
15 off (S16), and it is confirmed that the oscillating table 173a has been returned to the level position N1 (S17), the motor 177a is turned off (S18, S19), ending thereby the tapping of the cleaning unit 4 by the tapping apparatus 177. As the compression air valve
20 is closed (S20, S21), and the air cylinder is turned on (S22), the receptacle table 172 having been at the cleaning position M2 is returned to the home position M1 (S23). Then, the air cylinder is turned off (S24), whereby the cleaning unit 4 having been clamped on the
25 receptacle table is released (S25). Next, the cover 170b is opened (S26), and the cleaning unit 4 is taken out of the housing 170a (S27), ending the operation

for cleaning the cleaning unit 4.

When the cleaning operation is continued to clean the next cleaning unit 4 (S28), the sequence goes back to S2, whereas when the cleaning operation
5 is ended, the cleaning apparatus 170 is turned off (S29).

During the cleaning process described in the foregoing, the tapping of the cleaning unit 4 by the tapping apparatus 177 is continued from S9 to S18 of
10 the flow chart given in Figure 27, and the oscillating movement of the cleaning unit 4 and the waste toner suction are carried out in parallel with this continuous tapping. Therefore, the waste toner adhering to the internal walls or the like of the
15 cleaning unit 4 is continuously tapped down, moved smoothly toward the gap G, blown by the compressed air blowing out of the blowing opening 179d, becoming thereby airborne, and sucked through the sucking opening 179e. In other words, these sequential
20 operations can reliably extract the waste toner within the cleaning unit 4, leaving no toner therein.

Also during the cleaning operation described above, the number of oscillating operations of the oscillating table 173a, the duration of the sucking
25 operation by the sucking apparatus 179, or the like may be optionally set based on the amount of the remaining waste toner, performance of the sucking

apparatus, or the like factors.

In the cleaning operation represented by the flow chart given in Figure 27, the steps S1 - S4 are manually done by an operator, leaving the step S5 -
5 S25 to an automatic operation, and then, the rear end steps S26 - S29 are again manually done. In other words, in the beginning portion, the operational sequence to be manually performed by the operator are those in the sequence from the first step to the step
10 in which the cleaning unit 4 is mounted on the receptacle table 172 located at the home position M1, and, in the ending portion, the normal operation sequence are those in the sequence from the step in which the cleaned cleaning unit 4 is removed from the
15 receptacle table located at the home positioned, to the last step.

There are no strict rules concerning, for example, which of the sequence of the cleaning steps shown in Figure 27 are to be manually or automatically
20 carried out during the cleaning of the cleaning unit 4. For example, all the steps may be manually carried out as depicted by the perspective view in Figure 28. In this case, the cleaning unit 4 is fixed on an appropriate table, and then, the sucking nozzle 180 of
25 a sucking apparatus (unillustrated) is held by a hand so as for the sucking opening 180a thereof to be pressed against the gap G of the cleaning unit 4.

Then, the toner within the cleaning unit 4 is sucked
as the sucking opening 180a is horizontally moved
along the gap G while tapping the top surface of the
cleaning unit 4, at the portions indicated by arrow
5 marks P and P.

At this time, when the sucking operation is
carried out while rotating the gear 47a exposed near
the one end of cleaning unit 4, in the direction of an
arrow mark R3 (while carrying out the toner moving
10 step), the waste toner can be extracted with a higher
efficiency. More specifically, the gear 47a is
engaged with a gear (unillustrated) fixed on the waste
toner delivery member designated by a reference
numeral 47; therefore, as the gear 47a is rotated in
15 the arrow mark R3 direction, the waste toner delivery
member 47 illustrated in Figure 1 is rotated in the
counterclockwise direction of the same drawing,
whereby the waste toner having settled at the bottom
of the waste toner storage can be consecutively moved
20 toward the gap G.

In the case of a partially manual, that is,
the so-called semi-automatic cleaning apparatus such
as the one 170 illustrated in Figure 22, it is
unnecessary to rotate manually the gear 47a
25 illustrated in Figure 28. This is because the
cleaning apparatus 170 comprises, as described before,
the built-in oscillating apparatus 173 as the

replacement of the gear 47a, and as the cleaning unit 4 is oscillated by the oscillating apparatus 173, the waste toner is moved toward the gap G with a better efficiency than as the waste toner delivery member 47.

5 Also, such a cleaning apparatus 181 as shown in Figure 29 may be employed. The cleaning apparatus 181 comprises a housing 70a and a cover 170b, and its basic structure is substantially similar to that of the cleaning apparatus 170 illustrated in Figure 22.
10 The difference is in that in the case of the cleaning apparatus 181 of Figure 29, the sucking opening (unillustrated) for sucking the waste toner within the cleaning unit 4 is manually moved. As a shifter knob 181a is horizontally moved, the sucking opening
15 integral with the shifter knob 181a is moved along the gap G of the cleaning unit 4, sucking up the waste toner therein.

 After the toner is extracted from the cleaning unit 4, the cleaning blade 45 and scooping sheet 46 are removed from the cleaning unit 4. Then,
20 the interior of the waste toner storage 49 is cleaned by air or the like, and the used cleaning blade 45 and used scooping sheet 46 are replaced with new ones.

 On the other hand, the photosensitive drum 41
25 is disassembled into a smaller components using a pressing apparatus 182 illustrated in Figure 30. More specifically, the drum cylinder 41d is set on jigs

182a and 182a of the pressing apparatus 182 in such a manner that the driving gear 41b (in this embodiment, a helical gear is used as the driving gear so that the position of the photosensitive drum 41 is easily and reliably fixed by being pressed in the thrust direction as the driving force is transmitted to the photosensitive drum 41) mounted at one end and the flange gear 41c mounted at the other end stick out leftward and rightward, respectively. Next, the driving gear 41b and flange gear 41c are held between vertically movable members 182b and 182b, and jigs 182a and 182a of the pressing apparatus 182, and these gears are disengaged from the drum cylinder 41d. These gears are not recycled as is, but are recycled as production material after they are separated into a group of metallic members such as the drum cylinder 41 and a group of resin material members such as the driving gear 41b and flange gear 41c.

After the waste toner extraction, cleaning, replacement of the cleaning blade 45 and scooping sheet 46, a new photosensitive drum 41 and a cleaned protective plate 43 are attached to the waste toner storage 49 to reconstruct the cleaning unit 4. At this time, it is necessary to attach the cleaning blade 45 to the photosensitive drum 41 with a predetermined degree of accuracy. Since both components are mounted on the common frame

constituting the waste toner storage 49, that is, their positions are fixed by the common frame, it is easier to assure the positional accuracy. It should be noted here that even the basically recyclable members such as the protective plate, to begin with, are replaced with new members as needed when their performances and specifications do not meet the predetermined standards after the cleaning or the like procedure.

10 Next, following in reverse order of the disassembling steps for the process cartridge C, which were described with reference to Figures 3 - 7, the process cartridge C is reconstructed by mounting the developing unit 3, primary charging unit 2, and top frame 1, on the cleaning unit 4. More specifically, 15 the developing unit 3 is joined with the cleaning unit 4 (Figure 7); the tension spring 41a for pressing the developing roller 33 toward the photosensitive drum 41 is attached (Figure 6); the primary charging unit 2 is 20 mounted on the top surface of the cleaning unit 4 (Figure 5); and lastly, the top frame 1 is lowered from above to cover the cleaning unit 4, developing unit 3, and primary charging unit 2, which have been united through the assembly sequence described above, 25 and is fixed with pins 12 (Figure 3). During this assembly, the positions of the charge wire 22 of the primary charging unit 2, and the developing roller 33

of the developing unit 3, which must be mounted with a predetermined degree of the positional accuracy relative to the photosensitive drum 41, are fixed by the spacer, which makes contact with the

5 photosensitive drum 41, on the peripheral surface, outside the image forming region; therefore, the required positional accuracy can be simply secured just by reconstructing the process cartridge C

10 With the use of the reconstructing method described in the foregoing, a process cartridge C (Figure 1) can be remanufactured to display substantially the same performance as a brand new process cartridge C constructed using nothing but new

15 components; therefore, the remanufacturing method according to the present invention can contribute to the preservation of natural resources.

The reconstructed process cartridge C is installed in the laser beam printer 50 illustrated in

20 Figure 2, in the same manner as a brand new one, to be used for image formation just like when it was a brand new one.

The T frame 31, waste toner storage 49, and the like are made of resin material, and when a

25 process cartridge C is constructed, the cleaning blade 45, for example, is attached to this waste toner storage 49 using a self-tapping screw. If the

original self-tapping screw is removed and reused when
the cleaning blade 34 is replaced, it is liable to
loosen itself. Therefore, the original self-tapping
screw is replaced with a new screw 185 called "nylon
5 lock" (commercial name), such as the one illustrated
in Figure 31, which has a resin portion 185a located
in the middle of the threaded portion. With this
screw replacement, even when the screw 185 is screwed
into the original screw hole with female threads cut
10 by the self-tapping screw, the screw 185 can be
effectively prevented from loosening itself.

{Other Structures of Processing Means}

As for the developing method for the
aforementioned process cartridge according to, the
15 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 may be employed.

20 As for the image bearing member to which the
present invention is applicable, it is not limited to
the aforementioned photosensitive drum. The present
invention is also applicable to The following can be
included. To begin with, the photoconductive material
25 is usable as the photosensitive material. As for the
photoconductive material, amorphous silicon, amorphous
selenium, zinc oxide, titanium oxide, organic

photoconductor, or the like, is usable. Further, as for the configuration of a base member on which the photosensitive material is placed, it may be in the form of a rotary member such as a drum, or may be in the form of a sheet such as a belt or the like.

Generally speaking, 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.

Further, as to the structure of the charging means, a so-called corona type charger is employed in the aforementioned embodiment, but the so-called contact charging method, for example, which has a different structure, may be employed. This type of charging roller comprises: a metallic roller shaft; an electrically conductive elastic layer laminated on the roller shaft; an electrically highly resistive elastic layer laminated on the first elastic layer; and a protective film laminated on the second elastic layer. The electrically conductive elastic layer functions to lead the bias voltage to be supplied to the roller shaft. The highly resistive elastic layer regulates the leakage current to the photosensitive drum, and thereby prevents the bias voltage from dropping suddenly. The protective layer prevents the plastic material of the electrically conductive elastic layer

or highly resistive layer from coming in contact with the photosensitive drum and changing the surface properties thereof. The charging roller is rotatively mounted in contact with the photosensitive drum so as
5 to be rotated by the rotation of the photosensitive drum, the surface of which is uniformly charged as the charge bias is applied to this charging roller.

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

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
15 brush, or the like.

{Various Combinations between New and Recycled Components for Cartridge Remanufacture}

According to the present invention, at least the T-D frame and photosensitive drum are replaced
20 with new ones during the process cartridge remanufacture, but the other components are reused when they meet the predetermined standards through the inspections after cleaning, and are replaced with the new ones when not. At this time, even normally
25 reusable components might be replaced with the new ones depending on the type of component combinations among the reusable components.

(1) During the process cartridge remanufacture, the T-D frame and photosensitive drum are replaced with new ones without inspecting the used ones. More specifically, when a process cartridge is remanufactured, a recycled developing roller is mounted on a new T-D frame, and a new photosensitive drum, a recycled elastic cleaning blade, and a recycled charging roller are mounted on a recycled drum frame.

10 In this case, the use of a new T-D frame makes it easier and more reliable to seal the T frame as described before, and the use of a new photosensitive drum enables even a reconstructed process cartridge to produce an image with exactly the same quality as a brand new cartridge. As for the other components, the use of recycled components contributes to the preservation of natural resources.

(2) In addition to the T-D frame and photosensitive drum, the cleaning blade is also replaced with a new one without inspecting the used one during the process cartridge remanufacture. More specifically, a recycled developing roller is mounted on a new T-D frame, and a new photosensitive drum, a new elastic cleaning blade, and a recycled corona charger are mounted on a recycled drum frame during the process cartridge remanufacture.

The cleaning blade is constantly in contact

with the photosensitive drum, being liable to be worn as it rubs against the rotating photosensitive drum. Therefore, a cleaning blade, which has been found out, through the inspection during the research and
5 development process, to display a high probability that it must be replaced during the remanufacture, may be replaced with a new one without being inspected during the remanufacture. Such an arrangement allows a process for inspecting the cleaning blade to be
10 omitted, improving thereby the cartridge remanufacture efficiency. It is needless to say that when there is a high probability that a cleaning blade will be found out to be reusable after the inspection, a policy to reuse it is preferable, and such a policy will further
15 contribute to the preservation of natural resources.

(3) In addition to the T-D frame and photosensitive drum, the cleaning blade and developing roller also are replaced with new ones during the process cartridge remanufacture. More specifically, a
20 new developing roller is mounted on a new T-D frame, and a new photosensitive drum, a new elastic cleaning blade, and a recycled charging roller are mounted on a recycled drum frame during the process cartridge manufacture.

25 The developing roller also is liable to be worn as it rubs against the developing blade. Therefore, when it is found out, through the

inspection conducted during the research and development process, that a developing roller displays a high probability that it will need replacement, replacing it with a new one without inspection during the process cartridge remanufacture improves the operational efficiency.

As for the type of the aforementioned process cartridge, the following can be listed in addition to the one described in the preceding embodiment.

10 To begin with, there are those in which charging means, developing means, and/or cleaning means, as processing means, and an electro-photographic photosensitive member as an image bearing member, are integrated into a form of cartridge, which
15 can be removably installed in an image forming apparatus.

Also, there are those in which at least one of the charging means, developing means, and cleaning means, as processing means, and an electro-
20 photographic photosensitive member as the image bearing member, are integrated into a form of cartridge, which is removably installed into the image forming apparatus.

Further, there are those in which at least
25 the developing means as the processing means and the electro-photographic photosensitive member as the image bearing member are integrated into a form of

cartridge, which is removably installed into the image forming apparatus.

As for the types of the aforementioned image forming apparatus, there are the laser beam printer, to begin with, illustrated in Figure 2, and the other ones, such as electro-photographic copying machines and facsimiles.

In this specification, a terminology "new component" (for example, photosensitive drum, T frame, D frame, and the like) includes those molded of the recycled material produced by melting the recovered components, in addition to brand new ones.

The "recycled components" means such components that are taken out of used cartridges recovered from the market or the like, and repeatedly put to use as they are. Further, they are those which are cleaned, inspected and assured for satisfactory performance before reuse. In addition, they include those which have been re-processed (for example, cutting, polishing, grinding, coating with solvent), as needed, to recover their original performance.

As for the inspection, it includes visual inspection by an inspector, and also, inspection using apparatuses as needed.

As described hereinbefore, according to the present invention, reusable members are recycled to remanufacture the process cartridge; therefore, it can

contribute to the preservation of natural resources.
During this remanufacture, at least the T-D frame and
photosensitive drum are replaced with new ones;
therefore, the opening of the T frame, which comprises
5 the toner storing portion, can be easily and reliably
sealed. Further, since the T-D frame is replaced with
a new one produced by joining new components by
welding, its seam is strong enough to prevent the
occurrence of toner leak.

10 Further, a reconstructed process cartridge
can also provide the same image quality as a brand new
cartridge.

Depending on the types of combinations among
the components, the cleaning blade or developing
15 roller, or both of them, may be replaced during the
cartridge remanufacture. Such replacement allows the
elimination of the inspection thereof; therefore, the
operational efficiency in the remanufacture can be
improved.

20 While the invention has been described with
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
25 improvements or the scope of the following claims.

The claims defining the invention are as follows:-

1. A process cartridge remanufacturing method for a process cartridge detachably mountable to a main assembly of an image forming apparatus comprising the steps of:

5 providing a new photosensitive drum;

providing a new toner-development frame including a new toner frame having a toner containing portion for containing toner, a new development frame having roller mounting portion for mounting a developing roller for

10 supplying toner from said toner containing portion to said photosensitive drum to develop a latent image formed on said photosensitive drum, wherein said toner frame and said development frame are welded with a new removable toner seal therebetween for preventing the toner in said toner
15 containing portion from leaking out, wherein said toner seal is removed from between said toner frame and said development frame, prior to start of use of said process cartridge;

20 preparing a drum frame to be reused having a drum mounting portion for mounting the photosensitive drum;

supplying toner into said toner containing portion;

mounting the developing roller to said new development frame;

25 mounting the photosensitive drum to the drum frame to be reused;

rotatably engaging said new toner-development frame and said drum frame to be reused.



2. A method according to Claim 1, wherein said drum frame to be reused is provided with an elastic cleaning blade for removing residual toner deposited on the photosensitive drum during image forming operation.

5

3. A method according to Claim 2, wherein said elastic cleaning blade is new.

4. A method according to Claim 2, wherein said
10 elastic cleaning blade is a used and cleaned one.

5. A method according to Claim 1, wherein said developing roller is a new one.

6. A method according to Claim 1, wherein said
15 developing roller is a used and cleaned one.

7. A method according to Claim 1, wherein a used and cleaned charging means for charging said photosensitive
20 drum during image forming operation is mounted to said drum frame to be reused after said drum frame to be reused is cleaned.

8. A method according to Claim 7, wherein said
25 charging means includes a corona charger having corona wire.

9. A method according to Claim 7, wherein said charging means includes a charging roller.

10. A method according to Claim 1, wherein a used and cleaned developing roller is mounted to said new development frame; and a new photosensitive drum, a new elastic cleaning blade and used and cleaned corona charger are mounted to said drum frame to be reused after said drum frame to be reused is cleaned.

11. A method according to Claim 1, wherein a new developing roller is mounted to said new development frame; and a new photosensitive drum, a new elastic cleaning blade and used and cleaned charging roller are mounted to said drum frame to be reused after said drum frame to be reused is cleaned.

12. A method according to Claim 1, wherein a used and cleaned developing roller is mounted to said new development frame; and a new photosensitive drum, a used and cleaned elastic cleaning blade and a used and cleaned charging roller are mounted to said drum frame to be reused after said drum frame to be reused is cleaned.

13. A method according to Claim 1, wherein said new photosensitive drum has an organic photosensitive layer on an outer surface thereof, and a helical gear at an end thereof.

14. A method according to any one of Claims 1, 2, 5-7, 10-13, wherein said new toner-development frame includes a new toner frame and a new development frame with a new toner seal therebetween, wherein said toner frame and
5 said development frame are welded by ultrasonic wave.

15. A method according to Claim 14, wherein said new toner seal is provided on a plate of plastic material having an opening for permitting toner in said toner containing
10 portion to pass so as to close the opening, and wherein said toner seal is removable.

16. A method according to Claim 15, wherein said toner seal is mounted to said plate by heat sealing, and
15 said plate is mounted to said toner frame by ultrasonic wave welding.

17. A process cartridge detachably mountable to a main assembly of an image forming apparatus, comprising:
20 a new toner-development frame including a new toner frame having a toner containing portion for containing toner, a new development frame having roller mounting portion for mounting a developing roller for supplying toner from said toner containing portion to said photosensitive
25 drum to develop a latent image formed on said photosensitive drum, wherein said toner frame and said development frame are welded with a new removable toner seal therebetween for preventing the toner in said toner containing portion from

leaking out, wherein said toner seal is removed from between said toner frame and said development frame, prior to start of use of said process cartridge;

a reused drum frame having a drum mounting portion for mounting the photosensitive drum;

a new photosensitive drum mounted to said drum mounting portion;

supplying toner into said toner containing portion;

a developing roller mounted to said new development frame.

18. A process cartridge according to Claim 17, wherein said drum frame to be reused is provided with an elastic cleaning blade for removing residual toner deposited on the photosensitive drum during image forming operation.

19. A process cartridge according to Claim 18, wherein said elastic cleaning blade is new.

20. A process cartridge according to Claim 18, wherein said elastic cleaning blade is a used and cleaned one.

21. A process cartridge according to Claim 17, wherein said developing roller is a new one.

22. A process cartridge according to Claim 21, wherein said developing roller is a used and cleaned one.

23. A process cartridge according to Claim 17, wherein a cleaned used charging means for charging said photosensitive drum during image forming operation is
5 mounted to said drum frame to be reused after said drum frame to be reused is cleaned.

24. A process cartridge according to Claim 23,
10 wherein said charging means includes a corona charger having corona wire.

25. A process cartridge according to Claim 23, wherein said charging means includes a charging roller.

26. A process cartridge according to Claim 17,
15 wherein a used and cleaned developing roller is mounted to said new development frame; and a new photosensitive drum, a new elastic cleaning blade and used and cleaned corona charger are mounted to said drum frame to be reused after
20 said drum frame to be reused is cleaned.

27. A process cartridge according to Claim 17, wherein a new developing roller is mounted to said new development frame; and a new photosensitive drum, a new
25 elastic cleaning blade and used and cleaned charging roller are mounted to said drum frame to be reused after said drum frame to be reused is cleaned.



28. A process cartridge according to Claim 17, wherein a used and cleaned developing roller is mounted to said new development frame; and a new photosensitive drum, a used and cleaned elastic cleaning blade and a used and cleaned charging roller are mounted to said drum frame to be reused after said drum frame to be reused is cleaned.

29. A process cartridge according to Claim 17, wherein said new photosensitive drum has an organic photosensitive layer on an outer surface thereof, and a helical gear at an end thereof.

30. A process cartridge according to any one of Claims 17, 18, 21-23, 26-29, wherein said new toner-development frame includes a new toner frame and a new development frame with a new toner seal therebetween, wherein said toner frame and said development frame are welded by ultrasonic wave.

31. A process cartridge according to Claim 30, wherein said new toner seal is provided on a plate of plastic material having an opening for permitting toner in said toner containing portion to pass so as to close the opening, and wherein said toner seal is removable.

32. A process cartridge according to Claim 31, wherein said toner seal is mounted to said plate by heat

sealing, and said plate is mounted to said toner frame by ultrasonic wave welding.

33. A process cartridge remanufacturing method for a process cartridge detachably mountable to a main assembly of an image forming apparatus, said method comprising the steps of:

providing a new photosensitive drum;

providing a new toner-development frame including a new toner frame having a toner containing portion for containing toner, said new toner-development frame including a new development frame having roller mounting portion for mounting a used and cleaned developing roller for supplying toner from said toner containing portion to said photosensitive drum to develop a latent image formed on said photosensitive drum, wherein said toner frame and said development frame are welded with a new removable toner seal therebetween for preventing the toner in said toner containing portion from leaking out, wherein said toner seal is removed from between said toner frame and said development frame, prior to start of use of said process cartridge;

preparing a drum frame to be reused, said drum frame having a drum mounting portion for mounting the photosensitive drum and a used and cleaned elastic cleaning blade for removing residual toner deposited on the photosensitive drum during image forming operation,

mounting a used and cleaned charging roller for charging said photosensitive drum during image forming operation to said drum frame to be reused after said drum frame to be reused is cleaned,

5 supplying toner into said toner containing portion; mounting the developing roller to said new development frame;

mounting the photosensitive drum to the drum frame to be reused;

10 rotatably engaging said new toner-development frame and said drum frame to be reused.

34. A method according to Claim 33, wherein said charging roller includes a corona charger having corona
15 wire.

35. A method according to Claim 33 or 34, wherein said new photosensitive drum has an organic photosensitive layer on an outer surface thereof, and a helical gear at an
20 end thereof.

36. A method according to any one of Claims 33 - 35, wherein said new toner-development frame includes a new toner seal between said new toner frame and said new
25 development frame, wherein said toner frame and said development frame are welded by ultrasonic wave.

37. A method according to Claim 36, wherein said new toner seal is provided on a plate of plastic material having an opening for permitting toner in said toner containing portion to pass so as to close the opening, and wherein said
5 toner seal is removable.

38. A method according to Claim 37, wherein said toner seal is mounted to said plate by heat sealing, and said plate is mounted to said toner frame by ultrasonic wave
10 welding.

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

15 a new toner-development frame, including a new toner frame having a toner containing portion for containing toner, a new development frame having a roller mounting portion for mounting a used and cleaned developing roller for supplying toner from said toner containing portion to
20 said photosensitive drum to develop a latent image formed on said photosensitive drum, wherein said toner frame and said development frame are welded with a new removable toner seal therebetween for preventing the toner in said toner containing portion from leaking out, wherein said toner seal
25 is removed from between said toner frame and said development frame, prior to start of use of said process cartridge;

a reused drum frame having a drum mounting portion for mounting the photosensitive drum, said drum being provided with a used and cleaned elastic cleaning blade for removing residual toner deposited on the photosensitive drum during
5 image forming operation;

a new photosensitive drum mounted to said drum mounting portion;

a toner containing portion having toner supplied therein;

10 a cleaned and used charging roller for charging said photosensitive drum during image forming operation, said charging roller mounted to said drum frame to be reused, after said drum frame to be reused is cleaned.

15 40. A process cartridge according to Claim 39, wherein said charging roller includes a corona charger having corona wire.

20 41. A process cartridge according to Claim 39 or 40, wherein said new photosensitive drum has an organic photosensitive layer on an outer surface thereof, and a helical gear at an end thereof.

25 42. A process cartridge according to any one of Claims 39-41, wherein said new toner-development frame includes a new toner seal between said new toner frame and said new development frame, wherein said toner frame and said development frame are welded by ultrasonic wave.

43. A process cartridge according to Claim 42, wherein said new toner seal is provided on a plate of plastic material having an opening for permitting toner in
5 said toner containing portion to pass so as to close the opening, and wherein said toner seal is removable.

44. A process cartridge according to Claim 43,
10 wherein said toner seal is mounted to said plate by heat sealing, and said plate is mounted to said toner frame by ultrasonic wave welding.

45. A process cartridge remanufacturing method,
15 substantially as herein described with reference to Figs. 1, 7, 16 and 19.

46. A process cartridge substantially as herein described with reference to Figs. 1, 7, 16 and 19.

DATED this Twentieth Day of November 1996

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Canon Kabushiki Kaisha
Patent Attorneys for the Applicant
SPRUSON & FERGUSON

Process Cartridge Remanufacturing Method and Process Cartridge

ABSTRACT

A process cartridge remanufacturing method for a process cartridge (C) detachably mountable to a main assembly (51) of an image forming apparatus (50) includes the steps of providing a new photosensitive drum (41); providing a new toner-development frame (3A) including a new toner frame (3) having a toner containing portion (31) for containing toner, a new development frame (32) having roller mounting portion for mounting a developing roller (33) for supplying toner to said photosensitive drum, 10 (41) wherein said toner frame (3) and said development frame (32) are welded with a new removable toner seal (91) therebetween for preventing the toner in said toner containing portion from leaking out; preparing a drum frame (4A) to be reused having a drum mounting portion for mounting the photosensitive drum (41); supplying toner into said toner containing 15 portion (31); mounting the developing roller (33) to said new development frame (32); mounting the photosensitive drum (41) to the drum frame (4A) to be reused; rotatably engaging said new toner-development frame (3A) and said drum frame (4A) to be reused.

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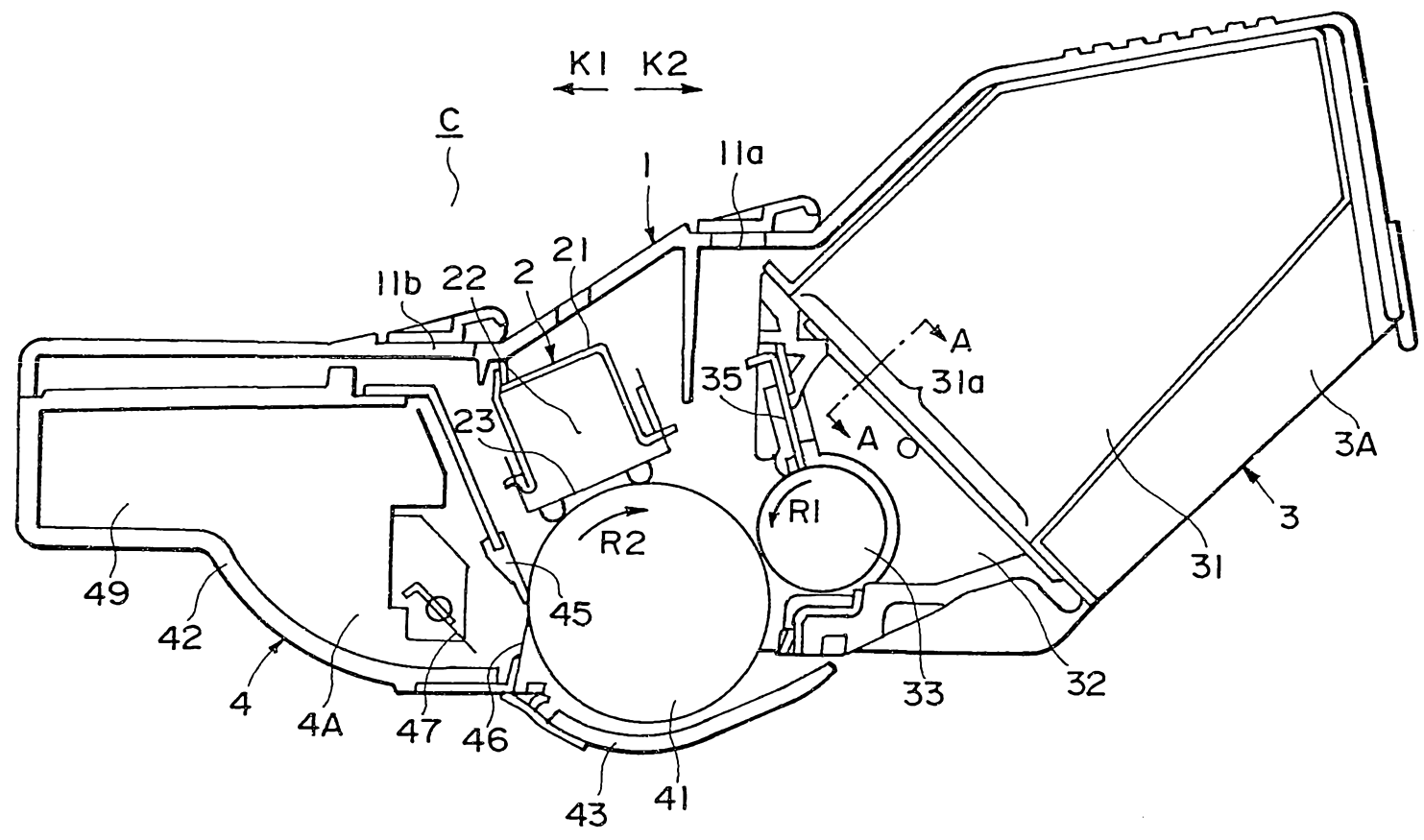


FIG. 1

20130195

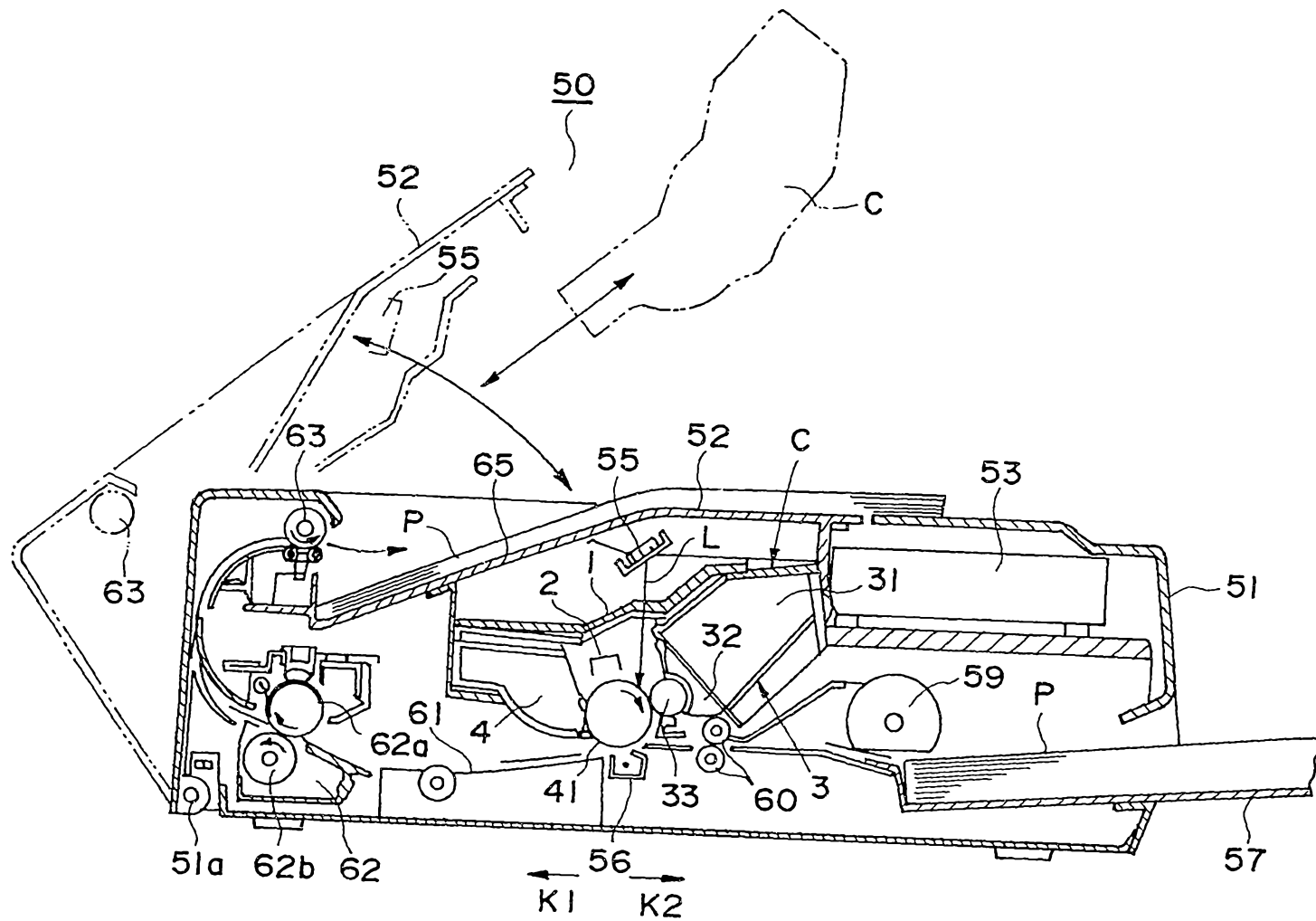


FIG. 2

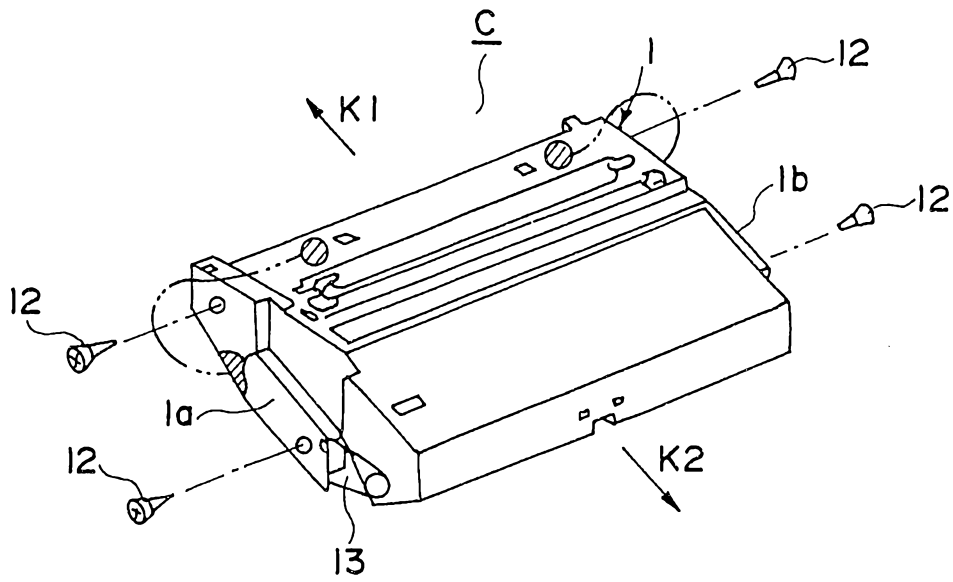


FIG. 3

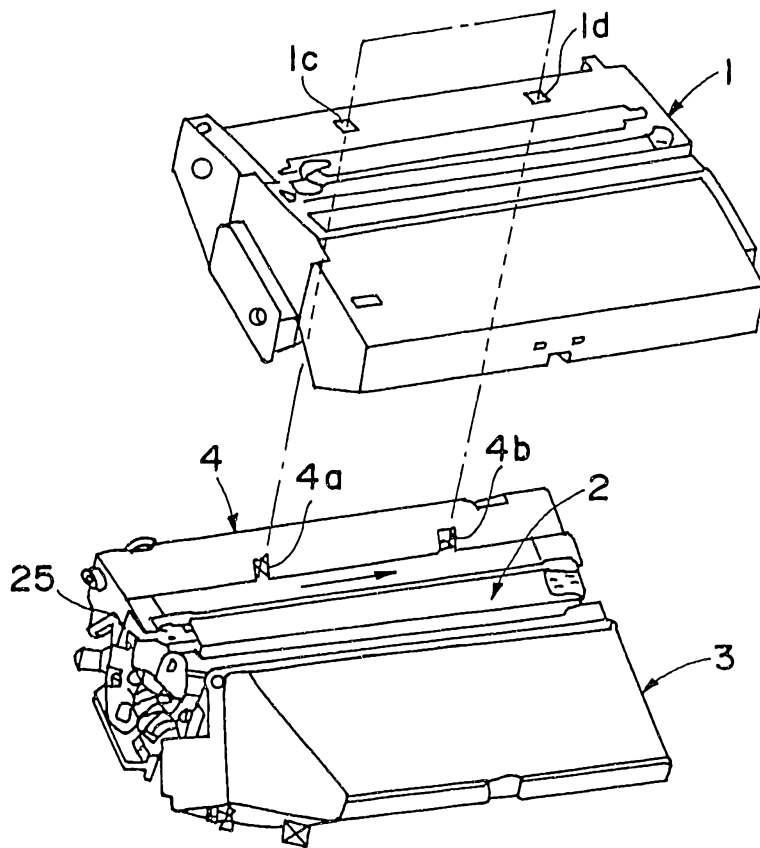


FIG. 4

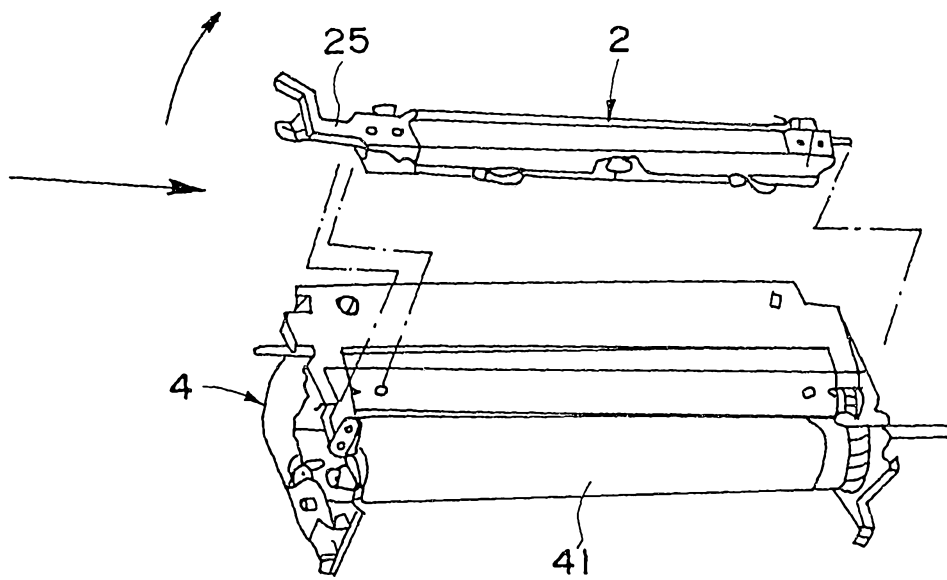


FIG. 5

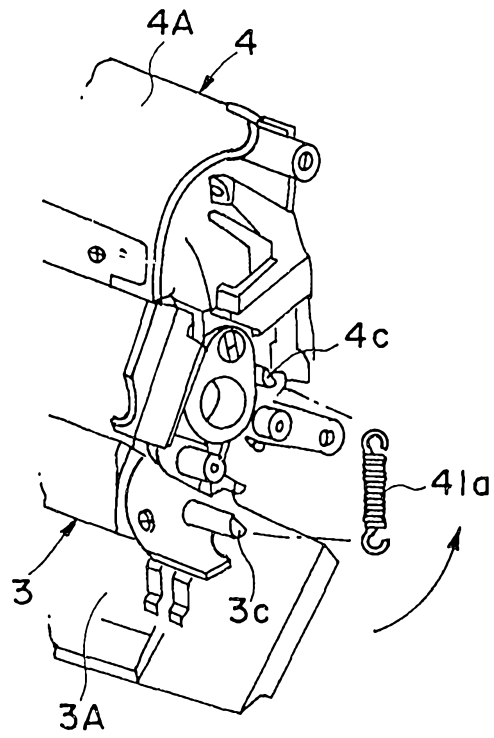


FIG. 6

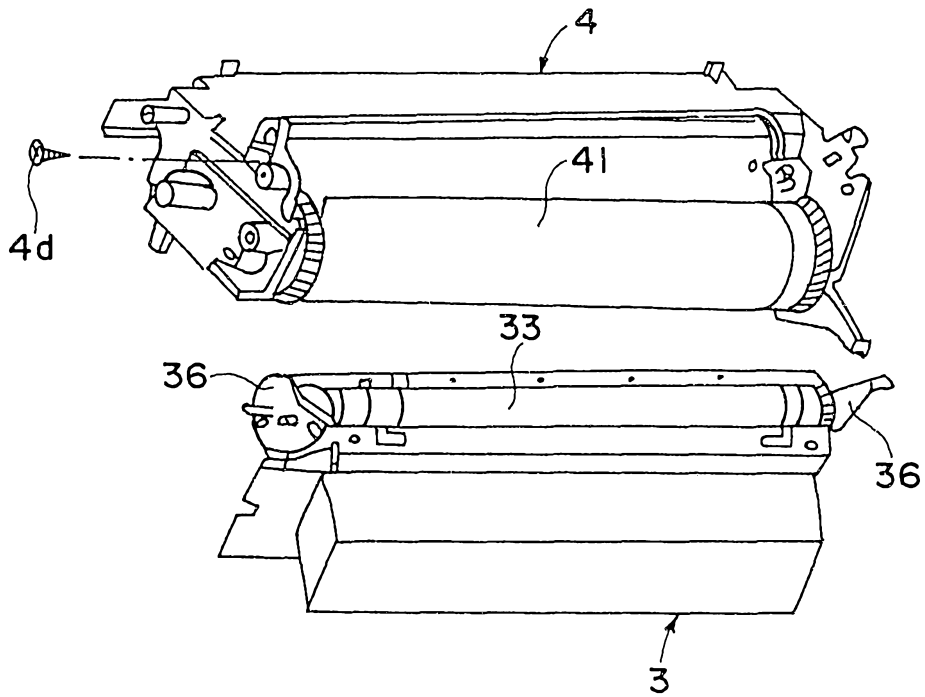
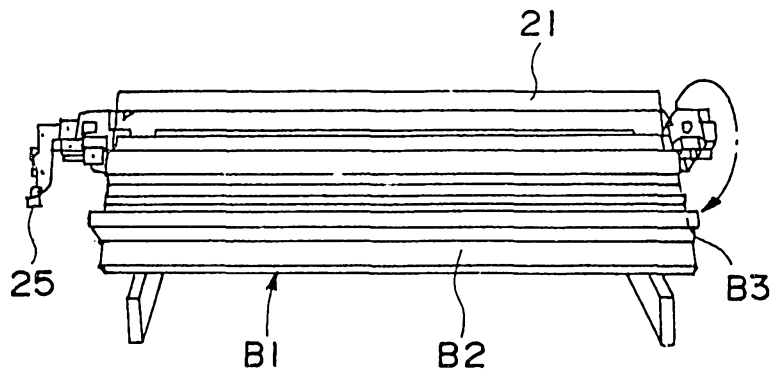


FIG. 7

(a)



(b)

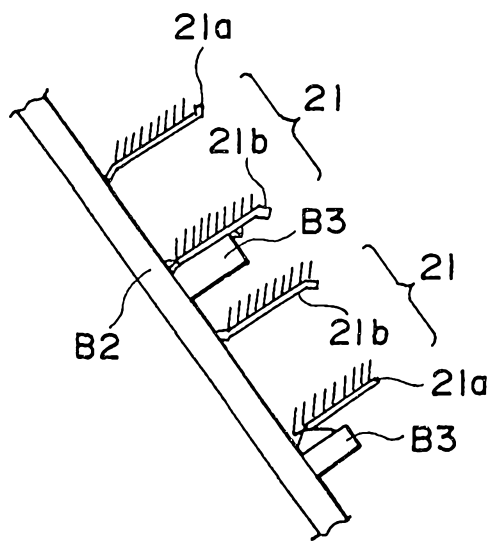


FIG. 8

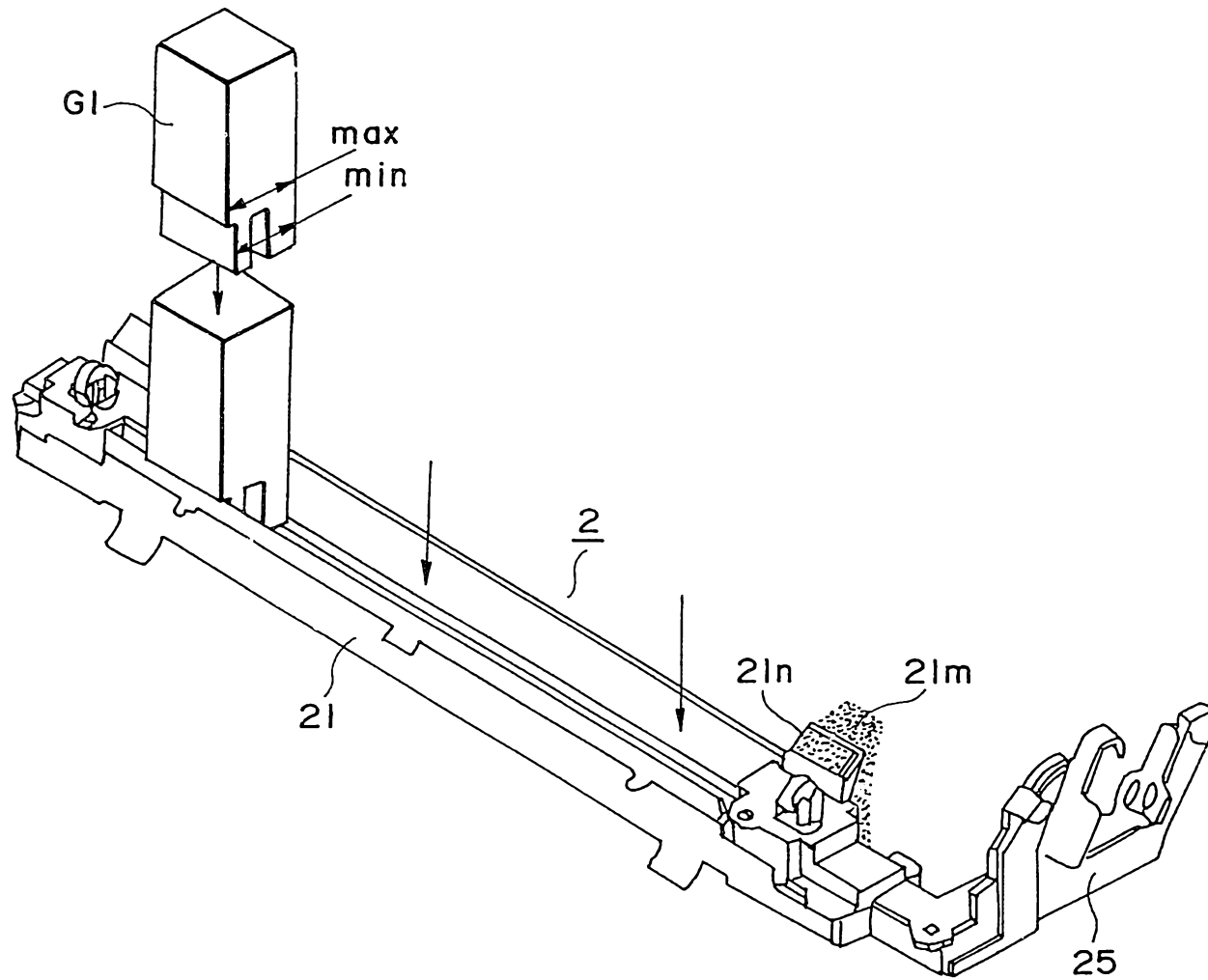
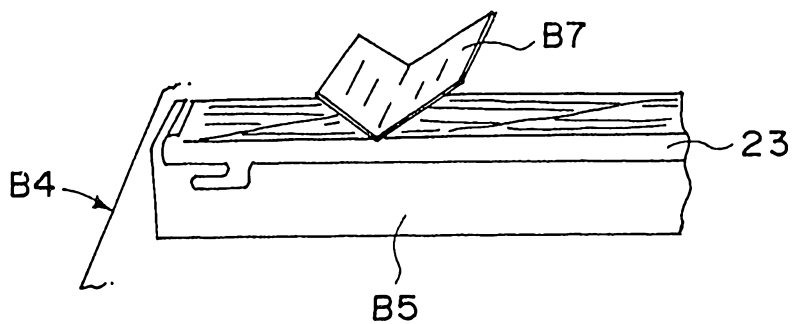


FIG. 9

(a)



(b)

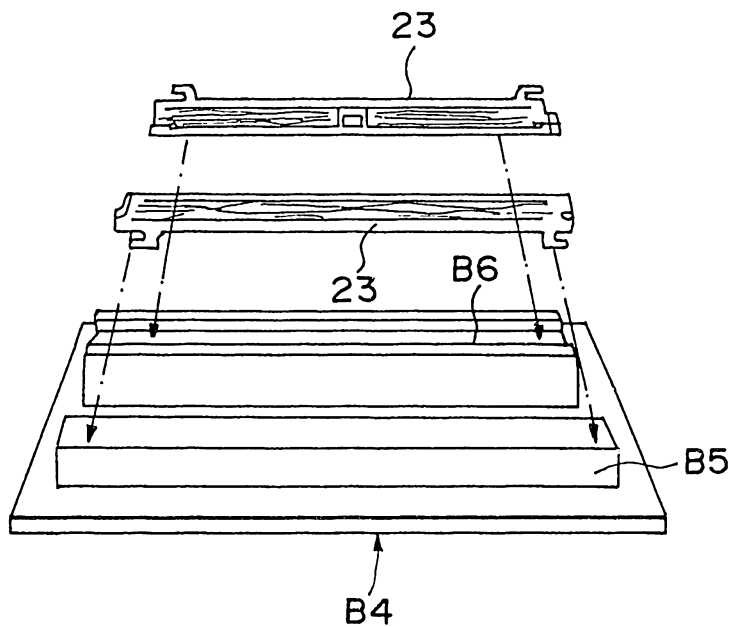


FIG. 10

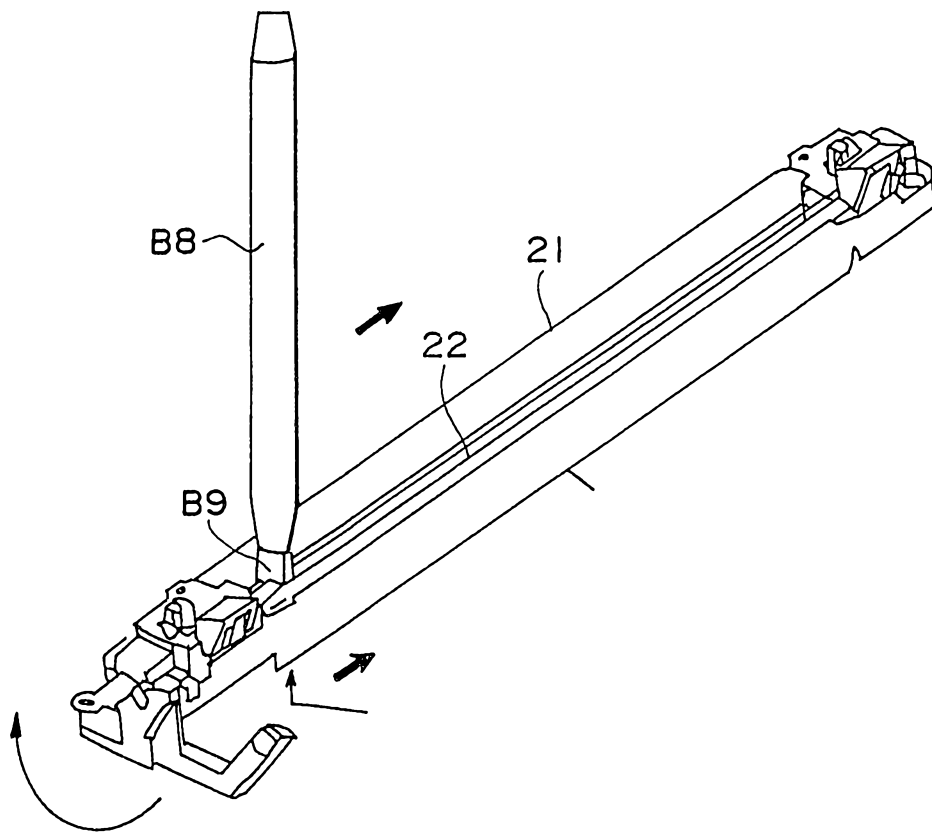


FIG. II

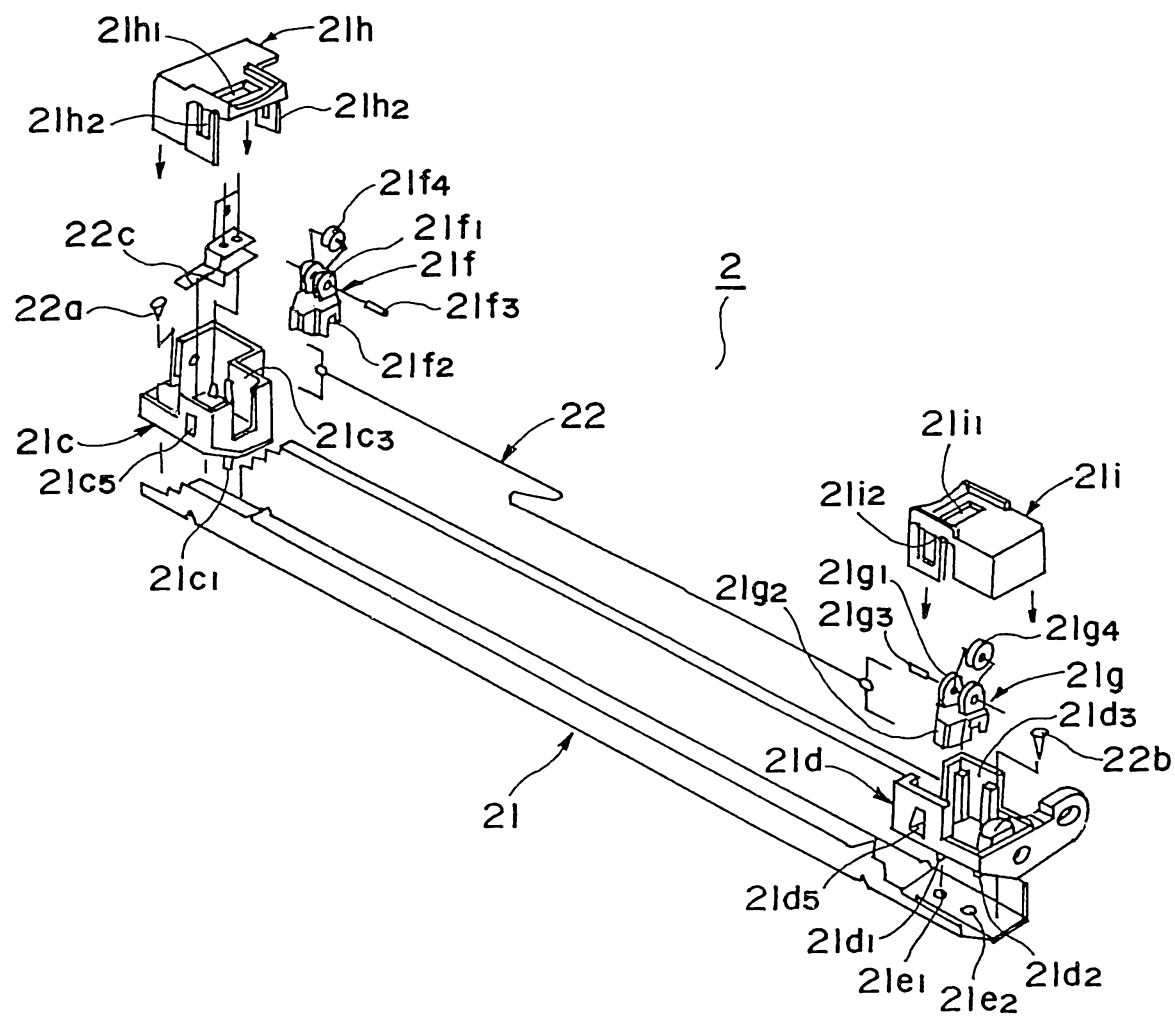


FIG. 12

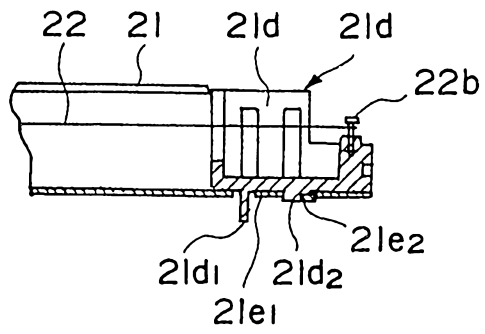


FIG. 13

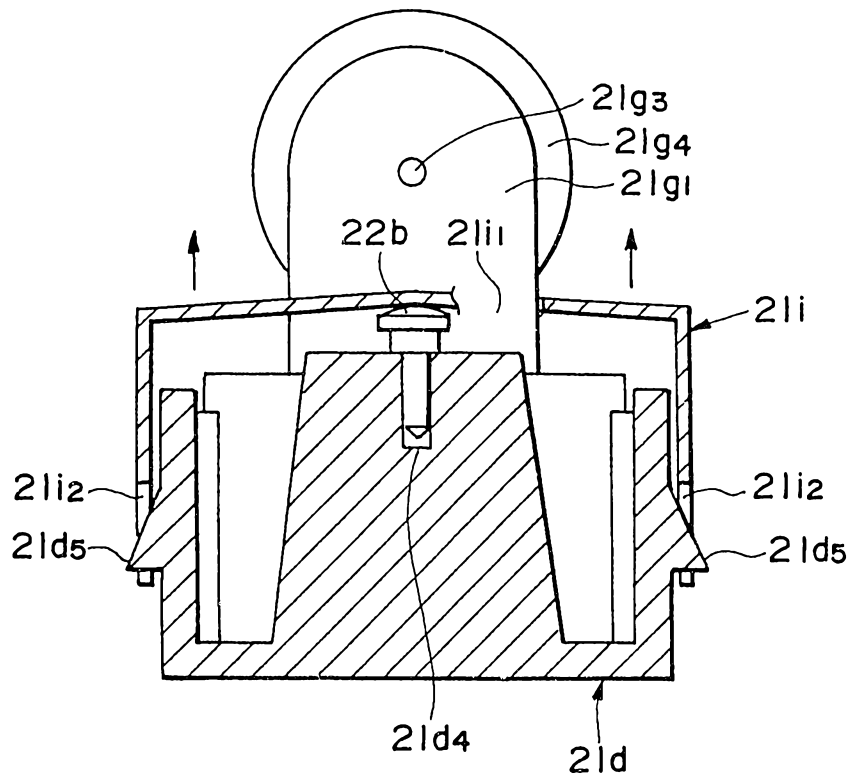


FIG. 14

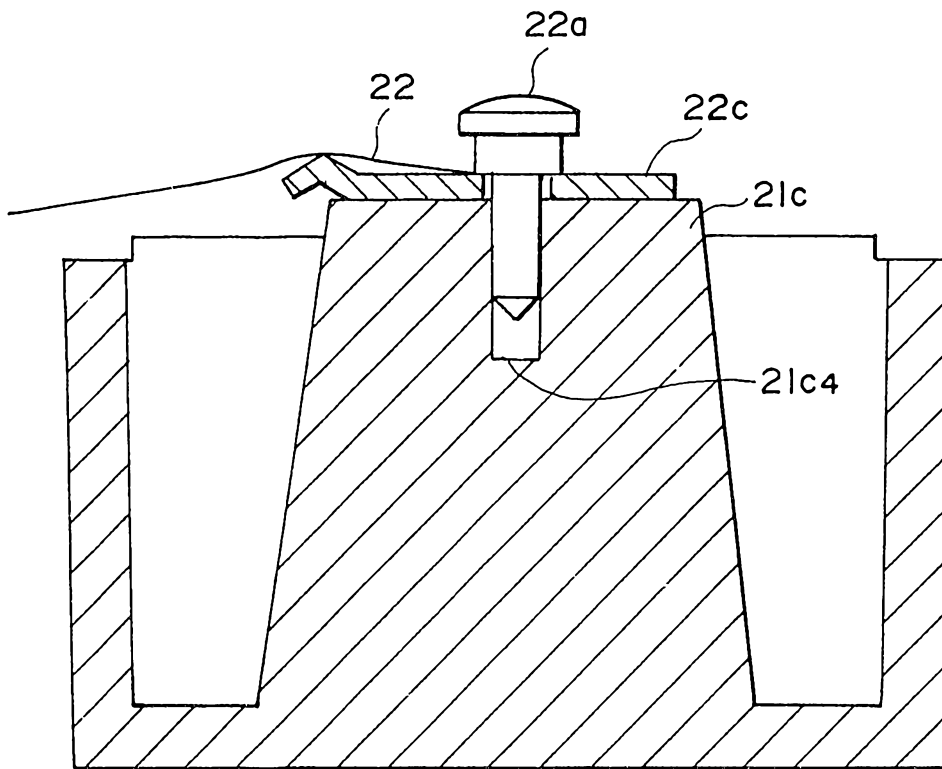


FIG. 15

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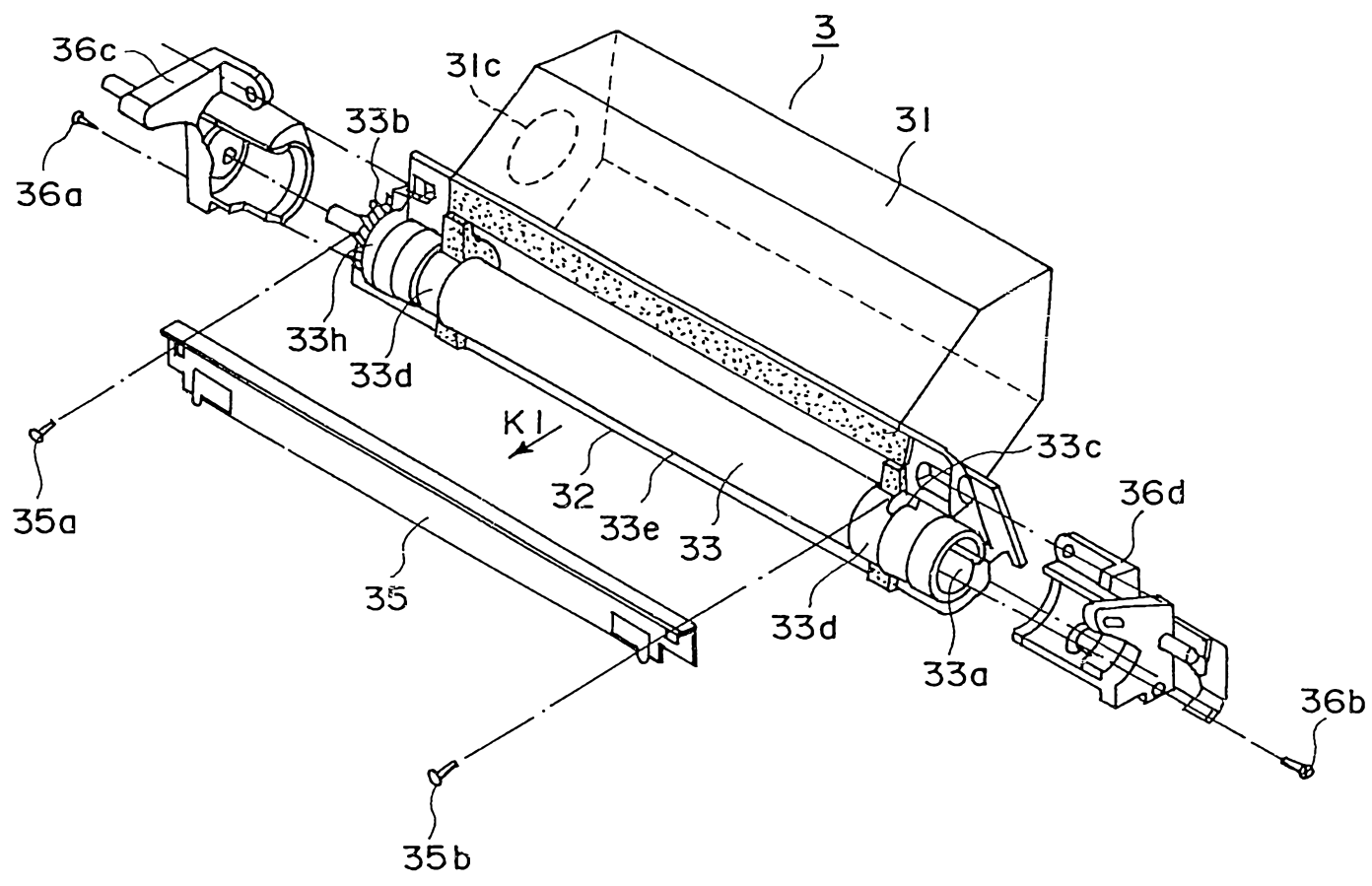


FIG. 16

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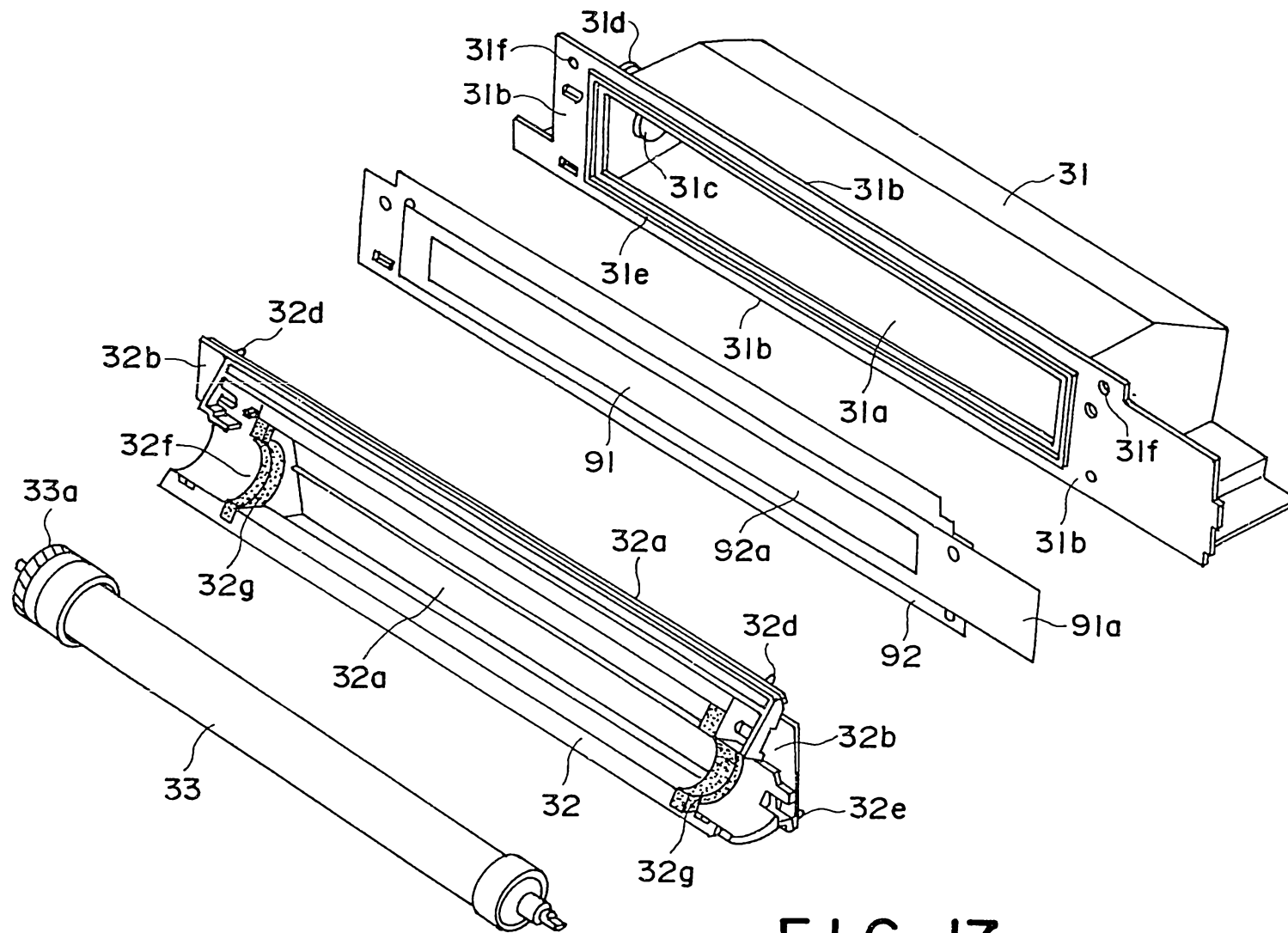


FIG. 17

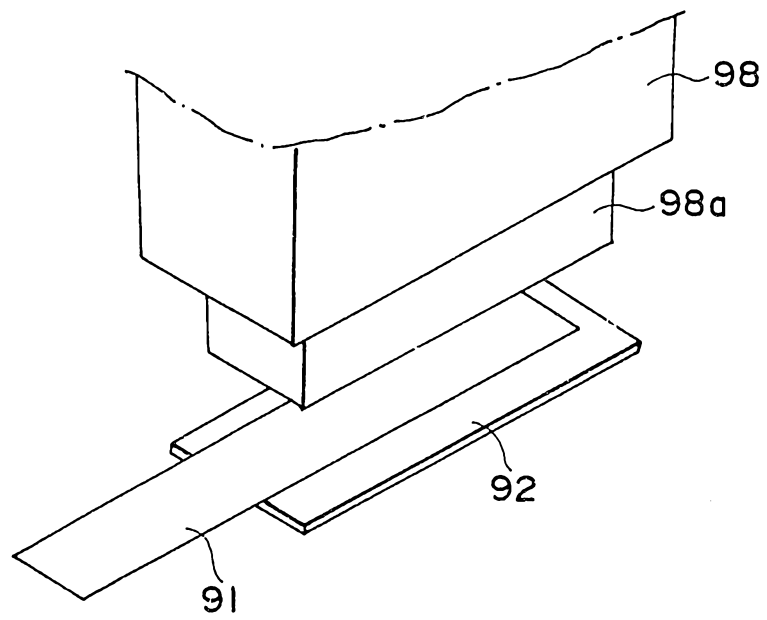


FIG. 18

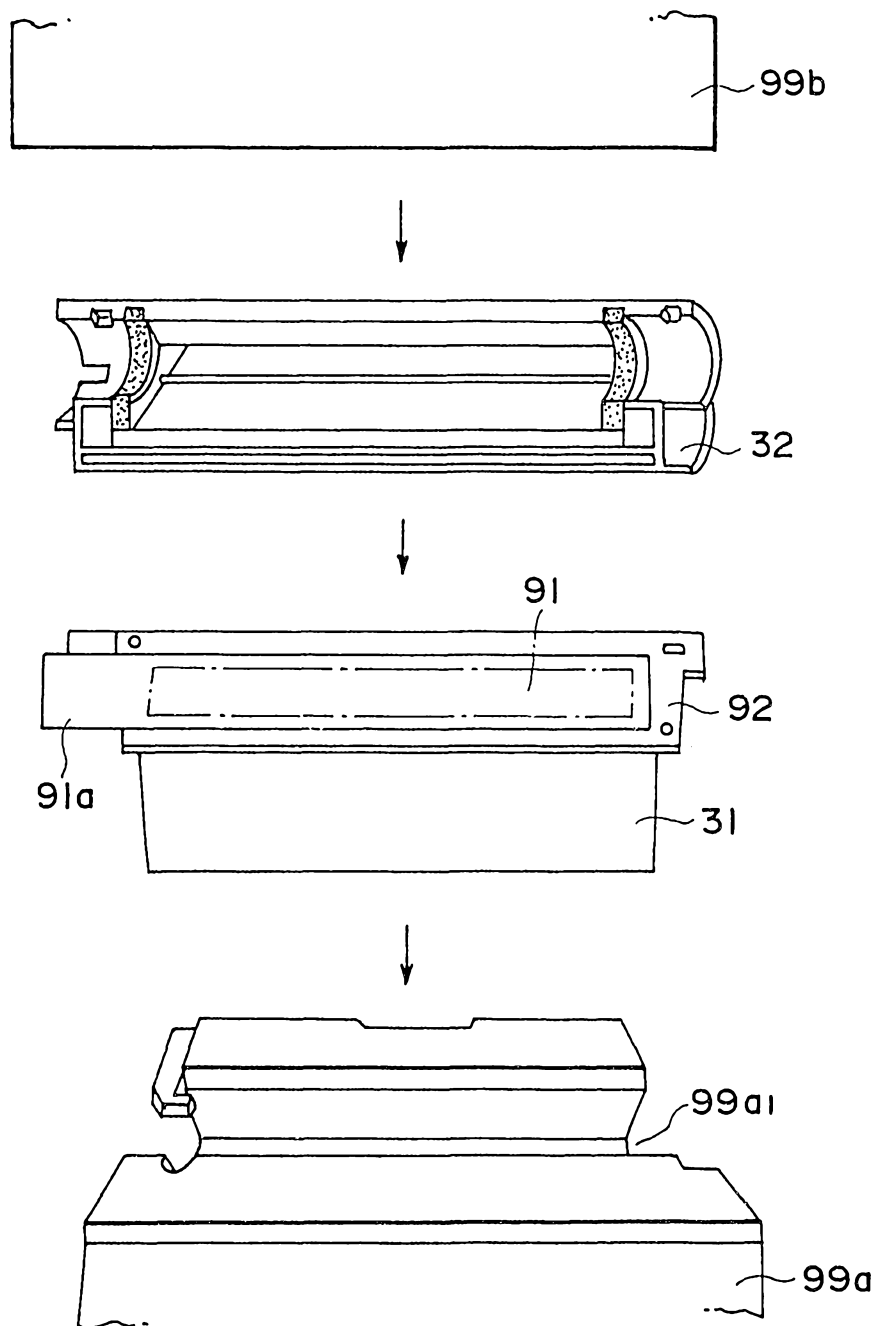


FIG. 19

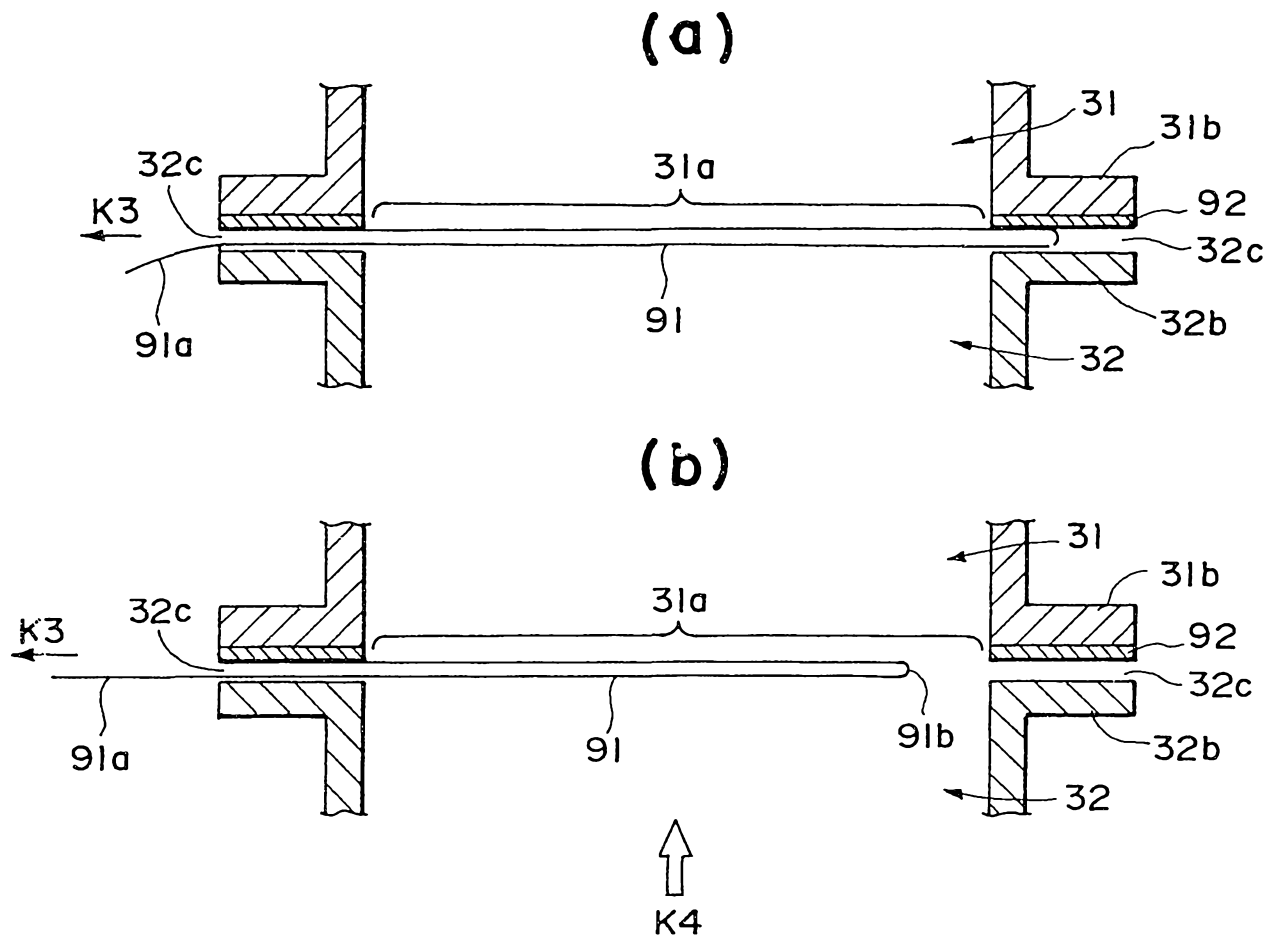


FIG. 20

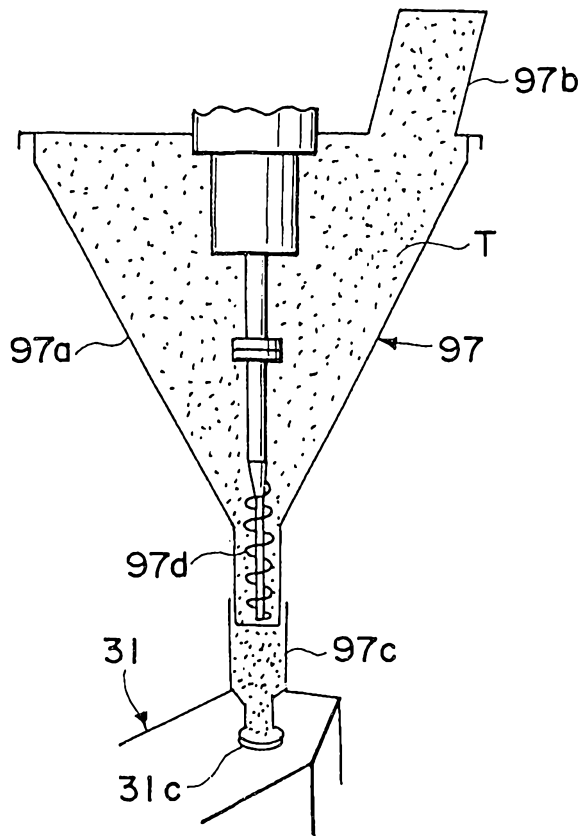


FIG. 21

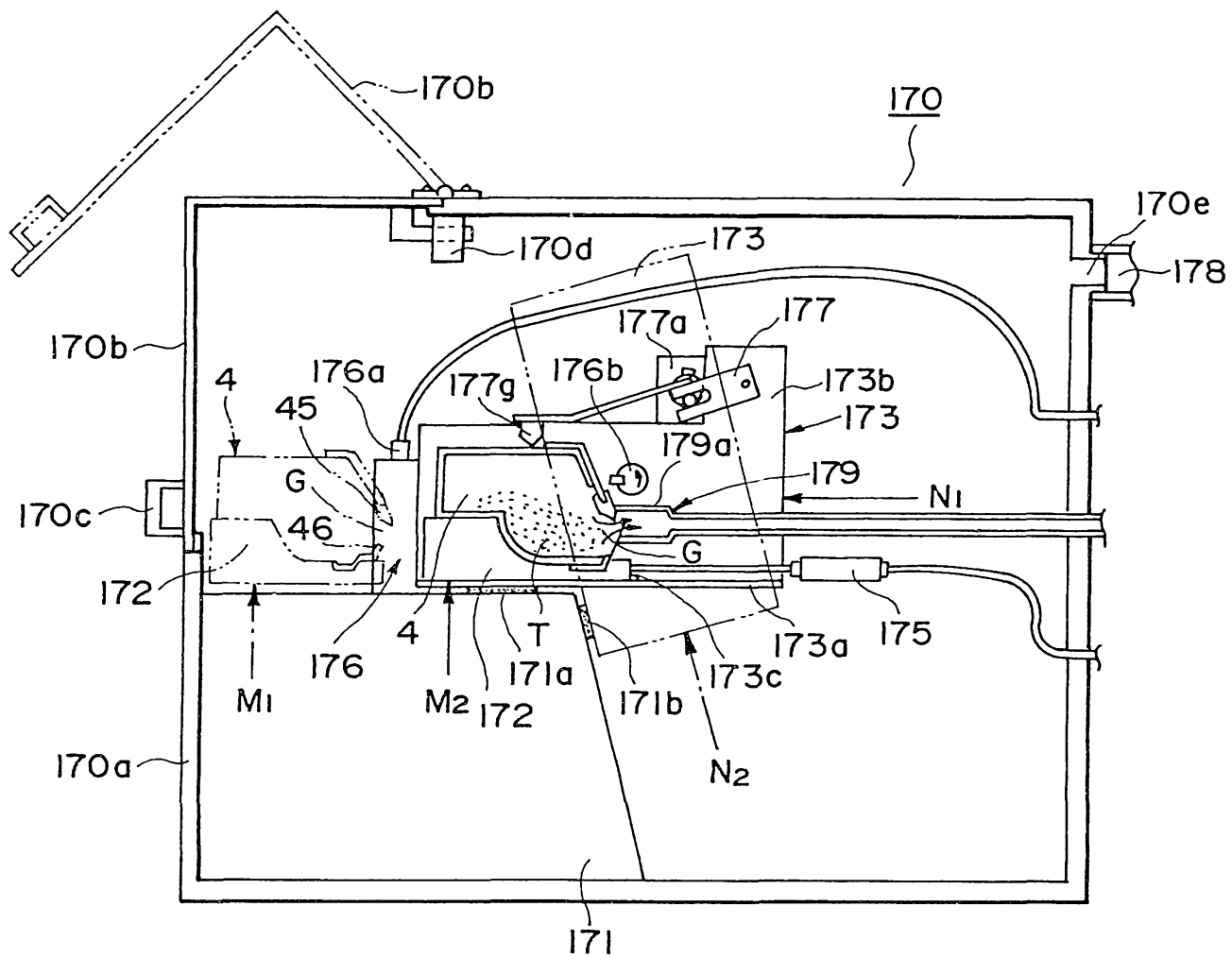


FIG. 22

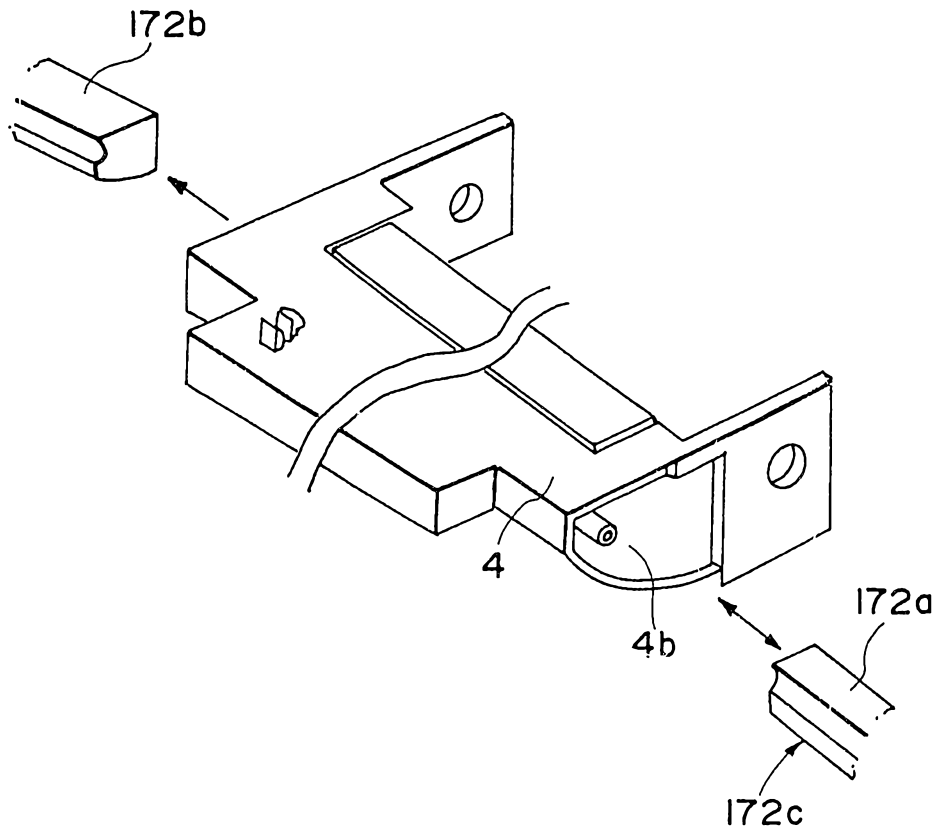
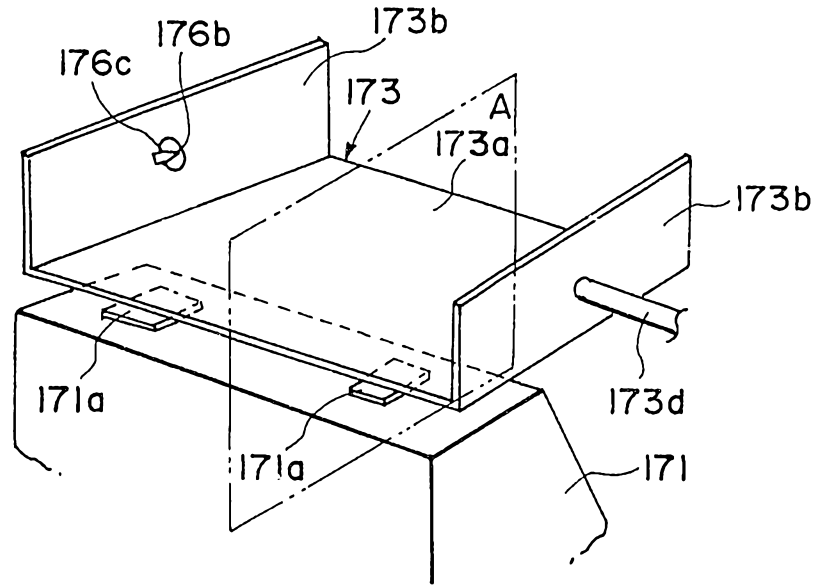


FIG. 23

(a)



(b)

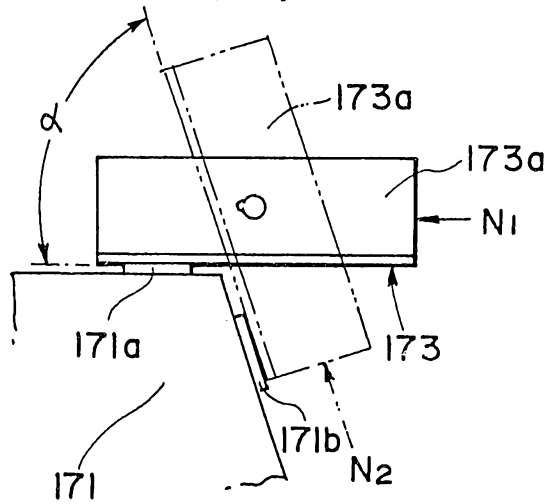


FIG. 24

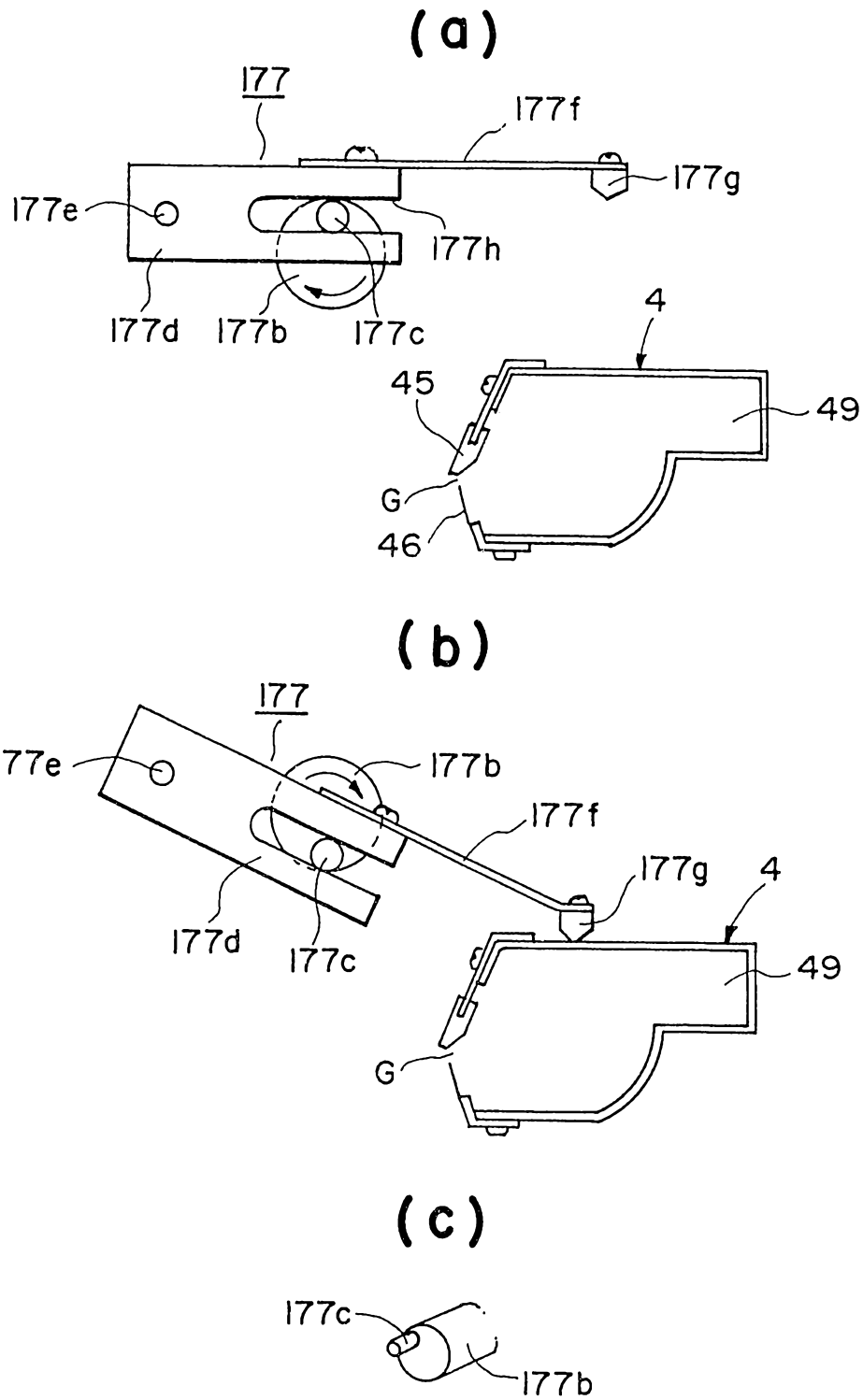


FIG. 25

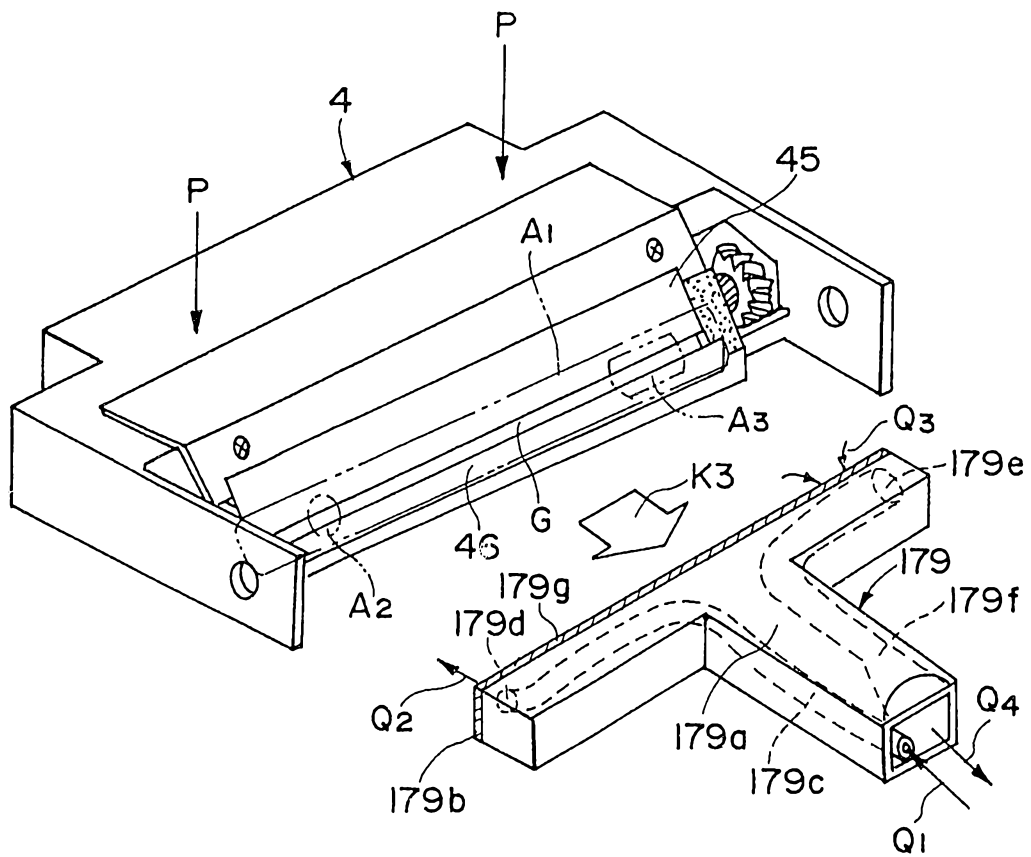


FIG. 26

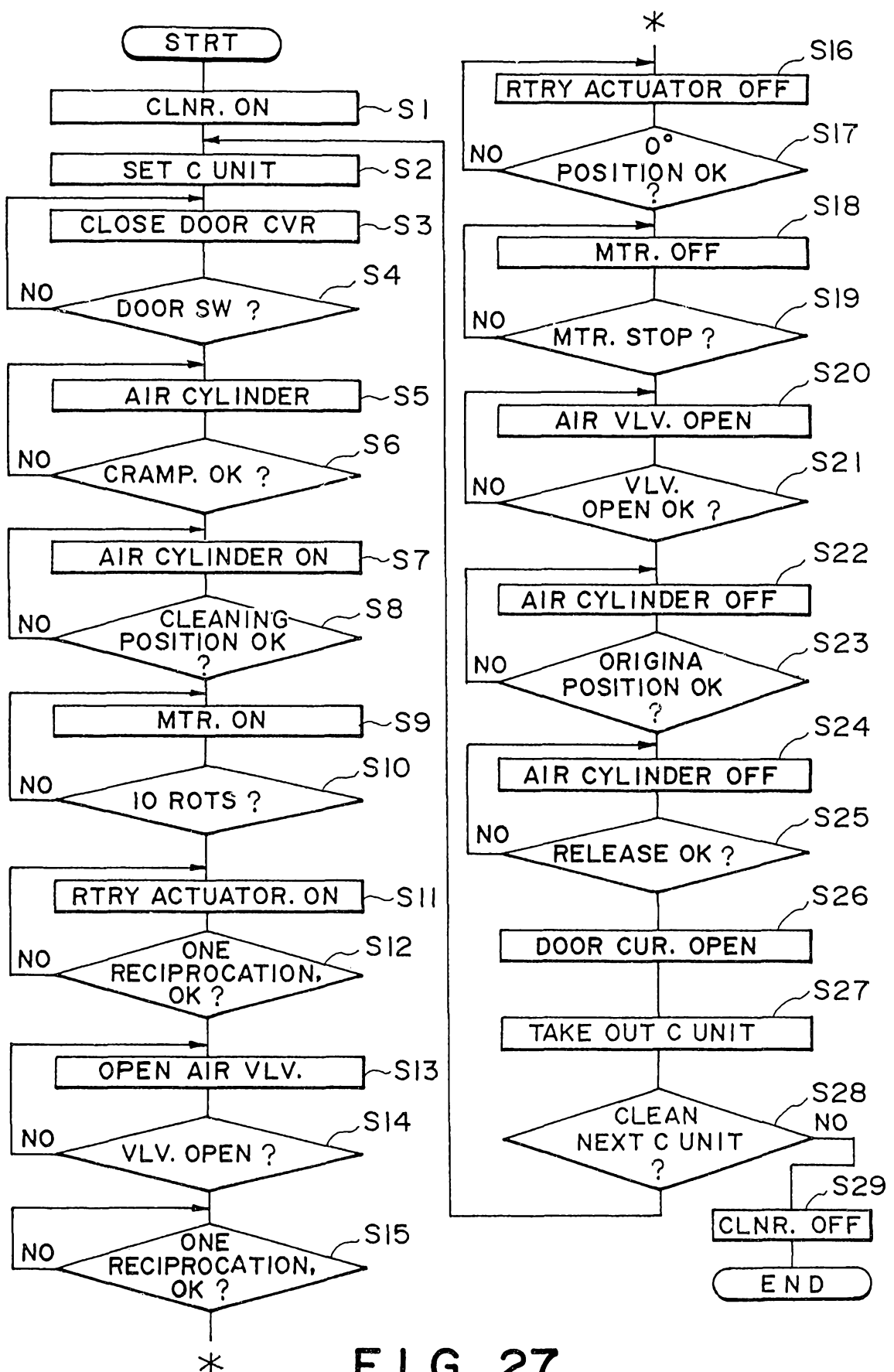


FIG. 27

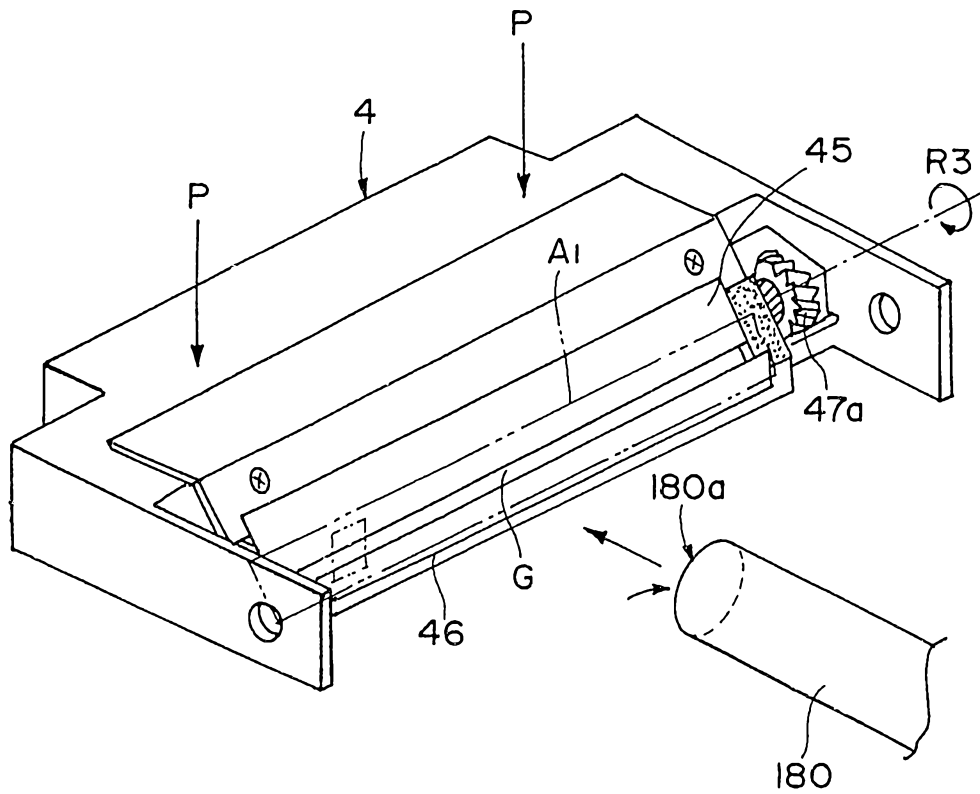


FIG. 28

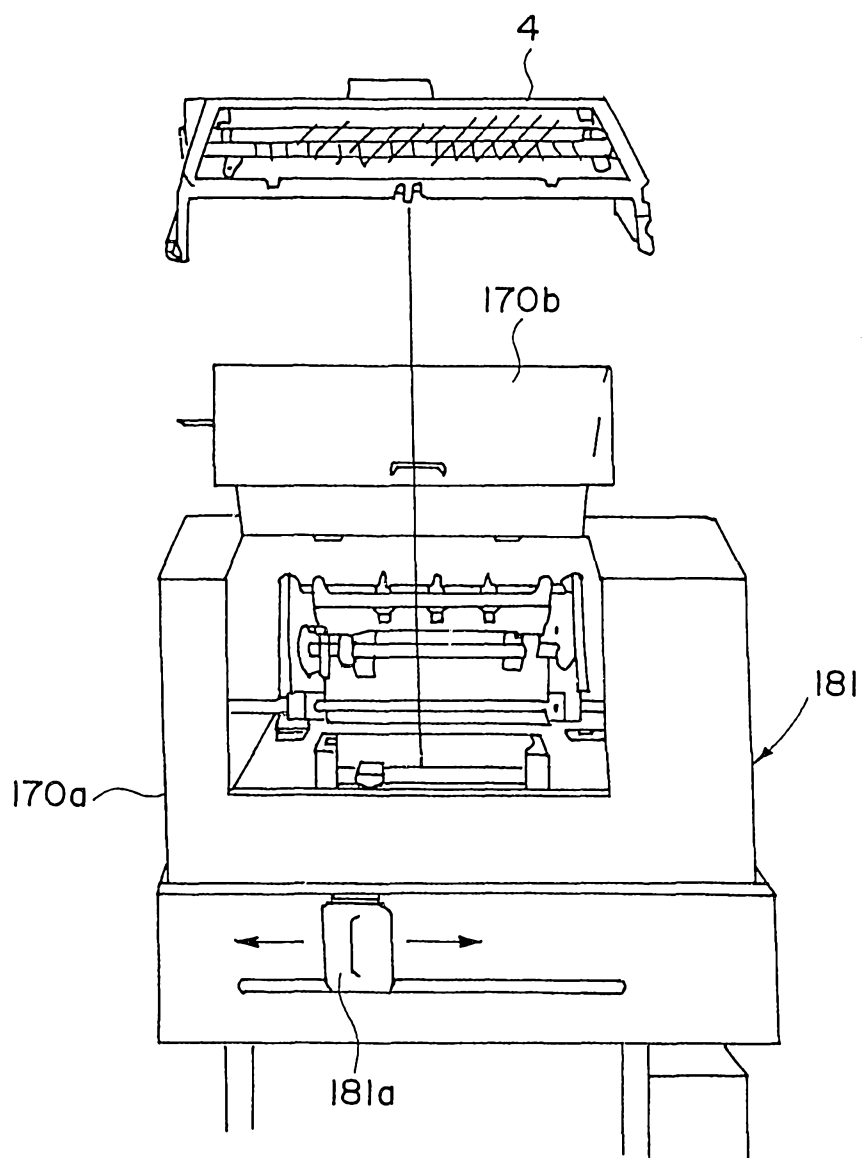


FIG. 29

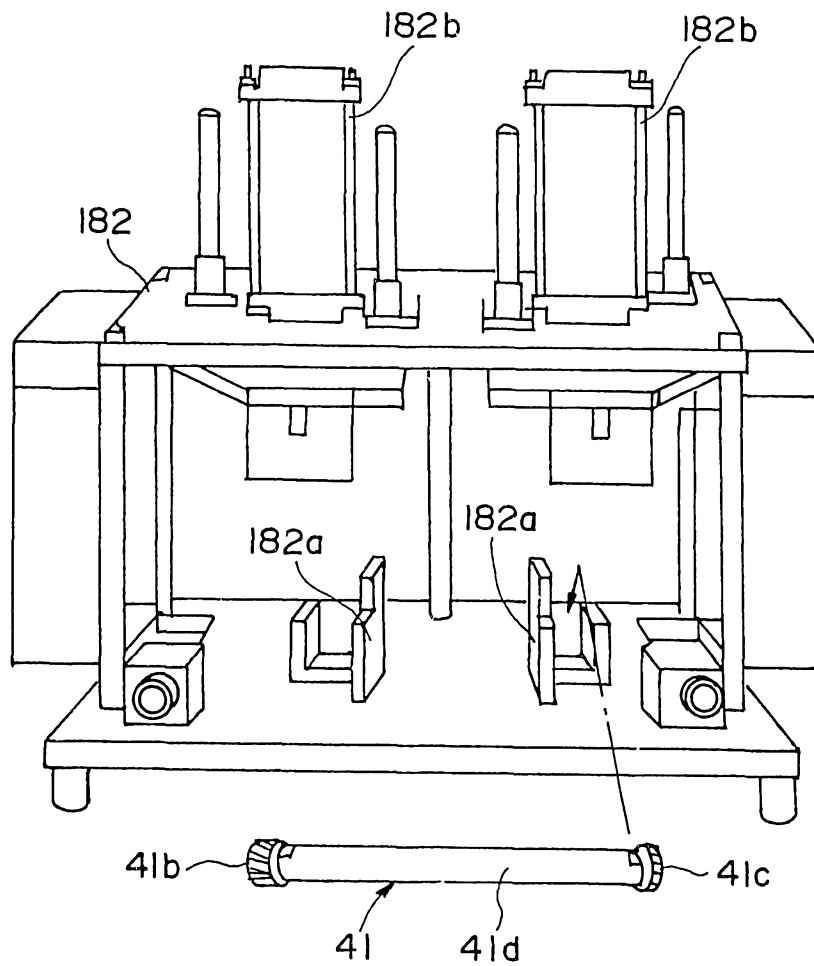


FIG. 30

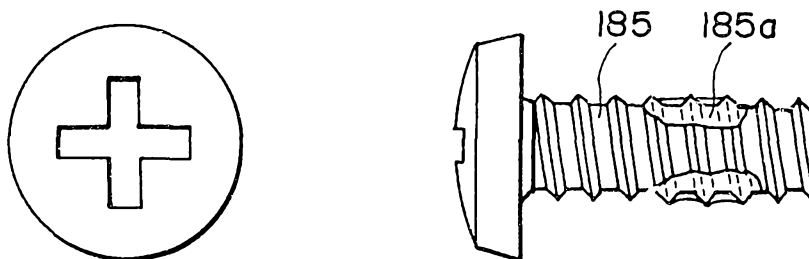


FIG. 31