SPECIFICATION

Process cartridge, recording apparatus, and method for assembling process cartridge

TECHNICAL FIELD

The present invention relates to a process cartridge, a recording apparatus and a method for assembling process cartridge.

The process cartridge means an integral unit including at least an image bearing member (for example an electrophotographic photosensitive member) and developing means, rendered attachable to and detachable from a recording apparatus.

The recording apparatus can be, for example, an electrophotographic copying apparatus, a laser beam printer (LBP), a facsimile apparatus, a word processor or the like.

BACKGROUND ART

In the following there will be explained the background art of the present invention.

Figs. 1(a) and 1(b) are views showing the background art of the present invention, wherein Fig. 1(a) is a schematic lateral cross-sectional view of a process cartridge not mounted on the recording apparatus, and Fig. 1(b) is a perspective view in which the process cartridge is divided into a developing unit

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and a cleaner unit.

As shown in Figs. 1(a) and 1(b), a photosensitive drum unit 7 is provided with a photosensitive drum 4, and a cleaning blade 7a and a used toner reservoir 7b constituting a cleaner 7e for cleaning the periphery of said photosensitive drum 4.

Also a developing unit 6 is provided with a developing sleeve 6a and a toner reservoir 6b constituting a developer 6i. (In these drawings, the toner in the toner reservoir 6b and in the used toner reservoir 7b is omitted.)

Pins 6d formed on arms 6c of the unit 6 are fitted in holes 7c of the unit 7, and are then prevented from displacement in the thrust direction by a thrust stopper 6f such as a ring, fitted on a groove 6e of the pin 6d. Thus the units 6, 7 are mutually rotatable about said pins 6d. Subsequently tension springs 9 are applied between pins 6g provided on both sides of the unit 6 and pins 7d provided on both sides of the unit 7, thereby generating a tensile force between the units 6 and 7. Thus the units 6, 7 are integrated in a state in which the photosensitive drum 4 and the developing sleeve 6a are mutually contacted with a predetermined pressure in a direction A.

When the process cartridge 1 is mounted on a laser beam printer (not shown), the photosensitive

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drum 4 is driven by a driving gear (not shown) of the main body of the apparatus, while the developing sleeve 6a is rotated by a developing roller gear 6h meshing with a photosensitive drum gear 4a. In general, the pins 6d and the holes 7c are positioned in the angular direction of meshing pressure of said gears, in order not to receive the force in the rotational direction.

However, the above-explained process cartridge requires a cumbersome operation in the assembling, as the tension springs 9 cannot be placed between the pins 6g and 7d unless they are once extended with a force exceeding the necessary tensile force. Also in case of disassembling the process cartridge into the cleaner 7 and the developer unit 6 for maintenance or the like, there have to be detached the springs 9 and then the thrust stopper 6f. In this manner cumbersome operations are involved in the assembling and disassembling of such conventional process cartridge.

On the other hand, the present applicant made an invention enabling to compactize the process cartridge by the use of compression coil springs in contacting the developing sleeve with the photosensitive drum with a predetermined pressure, and applied for a patent in Japan on this invention (Japanese Patent Application No. 63-69735, filed March

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25, 1988; Japanese Patent Laid-open Application No. 1-244472, laid open Sept. 28, 1989).

The present invention is an extension of the above-mentioned background art and of the above-explained invention of the present applicant.

DISCLOSURE OF INVENTION

An object of the present invention is to provide a process cartridge enabling further compactization, an image forming apparatus adapted therefor, and a method for assembling such process cartridge.

Another object of the present invention is to provide a process cartridge capable of reducing the assembling process, an image forming apparatus adapted therefor, and a method for assembling such process cartridge.

Still another object of the present invention is to provide a process cartridge capable of reducing the disassembling process, an image forming apparatus adapted therefor, and a method for assembling such process cartridge.

Still another object of the present invention is to provide a process cartridge with improved assembling and disassembling property, an image forming apparatus adapted therefor, and a method of assembling such process cartridge.

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In a principal aspect of the present invention, there is provided a process cartridge capable of being attached to and detached from a recording apparatus, comprising:

a first support member supporting an image bearing member;

a second support member supporting developing means for acting on said image bearing member thereby developing an image on said image bearing member; and

coupling means including a limiting member for limiting rotary axis between said first and second support members and a compression spring for generating an elastic force between said image bearing member and said developing means, thereby being used for coupling said first and second support members.

In another principal aspect of the present invention, there is provided a recording apparatus for effecting a recording operation on a recording medium, comprising:

mounting means for mounting a process cartridge including:

a first support member supporting an image bearing member;

a second support member supporting developing means for acting on said image bearing member thereby developing an image on said image bearing

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member; and

coupling means including a limiting member for limiting the rotary axis between said first and second support members and a compression spring for generating an elastic force between said image bearing member and said developing means, thereby being used for coupling said first and second support members and

transport means for transporting said recording medium;

In still another principal aspect of the present invention, there is provided a method for assembling a process cartridge including:

a first support member supporting an image bearing member;

a second support member supporting developing means for acting on said image bearing member thereby developing an image on said image bearing member; and

coupling means including a limiting member for limiting the rotary axis between said first and second support members and a compression spring for generating an elastic force between said image bearing member and said developing means, thereby being used for coupling said first and second support members;

said method comprising to integrally couple said first

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and second support members in mutually rotatable manner about said rotary axis by means of said coupling means.

In still another principal aspect of the present invention, there is provided a process cartridge capable of being attached to and detached from a recording apparatus, comprising:

a first frame supporting an image bearing member; and

a second frame supporting developing means for acting on said image bearing member thereby developing an image on said image bearing member;

wherein said first and second frames mutually cooperate to form an aperture when they are coupled.

Owing to the above-mentioned characteristic configurations, the present invention achieves the reduction of assembling process of the process cartridge, since, because of said characteristic configurations, the present invention allows to assemble the process cartridge without the use of a tension spring. Also because of said characteristic configurations, the present invention allows to mount the compression spring in an easy manner at the assembly of the process cartridge.

Also owing to said characteristic configurations, the present invention allows to form an aperture (for example aperture for exposure) without sacrificing

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the strength of the casing of the process cartridge. Because of said characteristic configurations, the present invention allows to form the aperture, without forming a hole in the casing.

BRIEF DESCRIPTION OF THE DRAWINGS

Figs. 1(a) and 1(b) are respectively a lateral cross-sectional view and a perspective view, showing the background art of the present invention;

Figs. 2(a), 2(b) and 2(c) are respectively a perspective view, a lateral cross-sectional view and a perspective view showing a combined state, of a preferred embodiment of the process cartridge of the present invention;

Fig. 3 is an external perspective view of a preferred embodiment of the process cartridge of the present invention;

Fig. 4 is an external perspective view, seen from below, of the process cartridge shown in Fig. 3;

Fig. 5 is a lateral cross-sectional view of the process cartridge shown in Fig. 3;

Figs. 6(a) and 6(b) are respectively a plan view and a lateral view of an embodiment of coupling means adapted in the present invention;

Figs. 7(a) and 7(b) are perspective views respectively of a photosensitive drum unit and a developing unit, constituting the process cartridge

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shown in Fig. 3; and

Fig. 8 is a lateral cross-sectional view of a laser beam printer in which the present invention is applicable.

BEST MODE FOR EXPLOITING THE INVENTION

Now the present invention will be clarified in detail by preferred embodiments thereof shown in the accompanying drawings.

Figs. 2(a) and 2(b) are respectively a schematic perspective view and a schematic cross-sectional view of a preferred embodiment of the process cartridge of the present invention. Fig. 2(a) illustrates a state in which a photosensitive drum unit 100 and a developing unit 200 are mutually disassembled.

In the present embodiment, a process cartridge 300 is constructed by coupling the photosensitive drum unit 100 and the developing unit 200. The photosensitive drum unit 100 rotatably supports an electrophotographic photosensitive drum 104 in a frame 100a, by means of bearings. It also is provided with a cleaning blade 107a and a used toner reservoir 107b, constituting a cleaner 107 for cleaning the periphery of the photosensitive drum 104. On the other hand, the developing unit 200 supports, in a frame 200a, a developing sleeve 106a and a toner reservoir 106b,

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constituting a developing device 106, wherein the developing sleeve 106a serves to transport the toner in the toner reservoir 106b to a developed area of the photosensitive drum 104.

In the following there will be explained a procedure for coupling the photosensitive drum unit 100 and the developing unit 200.

In the present embodiment, cylindrical projections 106d, formed on arms 200b of the developing unit 200 are fitted in U-shaped grooves 107d provided in the drum unit 100, and, after the fitting of the units 100, 200 in this manner, a stopper unit 123 in which a pressurizing spring (compression spring in this case) 124 is integrated (for example by snap fitting of an end of the compression spring) is fitted in a fixing part 107e, positioned above each of the U-shaped grooves 107d. Then the stopper unit 123 is fixed to the unit 100 by a screw 305 inserted in a direction c. In this operation, a face 123a of the stopper unit 123 and the U-shaped groove 107d define the position of the projection 106d of the developing unit 200, thereby limiting the position thereof. Also the pressure springs 124 press spring seats 106e of the developing unit 200, thereby applying a biasing force in a direction B of mutual impingement of the photosensitive drum 104 and the developing sleeve 106a.

The stopper unit 123 is integrally provided

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with a base platc 123b, a fixing screw hole 123c provided therein, a perpendicular plate 123a formed on said base plate 123b, and a compression spring 124.

On the other hand, the fixing part 107e formed in the drum unit 100 is provided with a hole 107e1 into which said perpendicular plate 123a is to be fitted, a female thread part 107e2 for fixing the screw 305, and a hole 107e3 for passing the spring 124.

Thus, after the projections (pins) 106d of the unit 200 are fitted in the deepest parts of the grooves 107d of the unit 100, the stopper units 123 are fixed on the fixed parts 107e. More specifically, the perpendicular plate 123a of the stopper unit 123 is fitted in the hole 107e1, while the spring 124 is made to pass through the hole 107e and to be received in a compressed state by the spring seat 106e of the unit 200, and the screw 305 is fixed, through the screw hole 123c, into the female thread part 1007e2.

In this manner the units 100 and 200 are coupled so as to be mutually rotatable about the pins 106d, thereby completing the process cartridge 250. The positional relationship between the periphery of the photosensitive drum 104 and that of the developing sleeve 106a is defined in thus coupled state of the units 100, 200, and the developing sleeve 106a is pressed toward the photosensitive drum 104 by the elastic force of the compression springs 124. (In

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the present embodiment, the elastic force of the compression springs is selected at about 2 kg, whereby a pressing force of about 1 kg is applied to the developing sleeve.)

A drum gear 104a, provided at a side of the photosensitive drum 104, meshes with a developing sleeve gear 106b, provided at a side of the developing sleeve 106a, thereby transmitting the rotating force, received from the main body of the printer, to the developing sleeve.

In the above-explained configuration, the developing unit 106 can be attached or detached in the direction of the U-shaped grooves 107d. Consequently the projections (pins) 106d can both be constructed outwards (or inwards), so that of the thrust stopper can be dispensed with.

Also as the stopper unit 123 is inserted in the direction C and fixed in said direction, the pressurizing of the developing device can be realized simultaneously with the mounting of the stopper unit 123, and there is no longer required the conventional cumbersome operation of mounting the tension springs.

Also at the disassembling, the pressure is gradually released by loosening the stopper units, and the disassembling operation is extremely easy because of the absence of the thrust stopper.

Thus, the above-explained embodiment realizes

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the positioning of the developing device relative to the image bearing member, by means of a unit provided with compression springs, thereby improving the assembling and disassembling property of the process cartridge.

In the present embodiment, the photosensitive drum unit supports the cleaner, but such configuration is not essential. The process cartridge of the present invention needs only to be attachable to and detachable from the main apparatus in a state in which at least the photosensitive drum and the developing unit are integrally supported.

In the following, there will be explained another preferred embodiment of the present invention, with reference to Figs. 3 to 7.

Fig. 3 is an external perspective view, seen from above, of a preferred embodiment of the process cartridge of the present invention, Fig. 4 is an external perspective view thereof seen from below, Fig. 5 is a lateral cross-sectional view of the process cartridge shown in Fig. 3, Figs. 6(a) and 6(b) are respectively a plan view and a lateral view of an embodiment of the coupling means, and Figs. 7(a) and 7(b) are perspective views respectively of a photosensitive drum unit and a developing unit, constituting the process cartridge shown in Fig. 3.

At first the photosensitive drum unit 300 will

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be explained with reference to Fig. 7(a).

A unit frame 301 is provided with attach/detaching guides 301a1 provided on the external faces of lateral plates 301a, upper arms 301b extending diagonally upwards, and an exposure aperture 301c positioned between said arms 301b. Said lateral plates 301a, guides 301a1, arms 301b and exposure aperture are integrally molded. Under said frame 301 there is openably provided a photosensitive drum protecting cover 301d. Said guides 301a1 serve to guide the process cartridge 500 in attaching to or detaching from the printer (to be explained later). Said exposure aperture 301b constitutes an exposure aperture in cooperation with a frame of a developing unit 400, when the process cartridge 500 is composed by coupling the photosensitive drum unit 300 and the developing unit 400. The protective cover 301d is mounted on an arm 301d2 rotatable about a shaft 301d1. It is retracted from a protecting position (illustrated) for protecting the periphery of the photosensitive drum to a retracted position, when an engaging part 301d3 integral with the arm 301d2 engages with an engaging part of the main body, and returns to said protecting position when said engaging parts are disengaged upon detachment of the cartridge 500 from the main body. In this manner the protective cover 301d is opened and closed, in response to the

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attachment and detachment of the cartridge.

Between the lateral plates 301a, a photosensitive drum 302 is rotatably supported by bearings. Said drum 302 is provided with a helical gear 302a at an end, a flat-tooth gear 302b at the other end, and an electrophotographic photosensitive member 302c (for example an amorphous photosensitive member of an organic photoconductor (OPC)) on the periphery. Upon attachment of the cartridge in the main body, said helical gear 302a meshes with a helical gear (not shown) of the main body, thereby receiving the drum driving force. Also when the units are coupled, said gear meshes with a developing sleeve gear of the developing unit 400, thereby transmitting the sleeve driving force. A conductive bearing 302d engages with a conductive part (not shown) of the main body, thereby grounding the drum 104.

A charging roller 303 is pressed, with a predetermined pressure, to the periphery of the drum 302, by means of springs 303a. An electrical contact spring 303b elastically contacts the shaft 303c of the charging roller 303, thereby applying a predetermined voltage from the main body to said charging roller 303.

In the present embodiment, in each of the arms 301b there is provided an elongated recess 304, including therein apertures 304b, 304c on both sides of a female thread part 304a. The front aperture

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304b serves to pass a compression spring provided in a stopper unit to be explained later, while the rear aperture 304c serves to accept a perpendicular plate also provided in the stopper unit.

Below said recess 304, there is provided a rectangular groove 307, for accepting a pin of the developing unit 400 to be explained later.

Legs 305 serve to support the process cartridge 500 when it is detached from the main body. A conductive metal plate 305 is mounted on the lateral plate 301a, in contact with the bearing 302d, by means of a screw 306a.

In the following, explained is the developing unit 400, with reference to Fig. 7(b).

A unit frame 401 is provided, at upper lateral positions, with externally extending cylindrical pins 402, between which formed is an exposure aperture 403. There are also provided a light shield plate 403a for limiting the light other than from the exposure aperture 403, a rear light shield plate 403b for further limiting the light entering from the exposure aperture, with notches 403c at the center and at both ends in order not to hinder the image exposure, and a vertical light shield plate 403e. Said rear light shield plate 403b protrudes toward the photosensitive drum 302, beyond the light shield plate 403a.

Rectangular grooves 408 are provided for

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receiving compression springs, to be positioned in the vicinity of the pins 402 as will be explained later.

A developing roller 404, constituting the developing means, transports by rotation the toner from a toner reservoir 405 to a developed portion of the photosensitive drum 302. A magnet roller is incorporated in said developing sleeve 404. A helical gear 404a receives the driving force by meshing with the drum gear 302a of the photosensitive drum unit 300 when the units 300, 400 are coupled to constitute the cartridge 500.

A doctor blade 406 is provided for limiting the thickness of toner on the periphery of the sleeve 404. On both ends, there are provided felt members 406a for preventing lateral leak of the toner. Outside areas 406b are free from toner deposition.

Plastic rollers 407 are provided on both ends of the sleeve 404, and have a diameter slightly larger than that of the sleeve 404. Consequently in the present embodiment, when the units 300, 400 are coupled to constitute the process cartridge 500, the periphery of the photosensitive drum 302 comes into contact with those of the rollers 407, thereby defining a small gap (for example 200 - 500 μ in the present embodiment) between the surfaces of the drum 302 and the sleeve 404. However such configuration is not essential, and said surfaces may be in direct contact.

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Screw 406b fix the blade 406 onto the frame 401.

In the following, there will be explained a stopper unit 600, serving as coupling means for coupling the units 300 and 400, with reference to Figs. 6(a) and 6(b), which are respectively a plan view and a lateral view.

A screw hole 602, penetrating through a base member 601, accepts the male screw 700 (Fig. 3). A perpendicular plate 603 extends downwards from the lower face 601a of the base member 601, and serves to define the position of the pin 402 of the developing unit 400 by a lower lateral end 603a. A spring seat 604 is provided parallel to the perpendicular plate 603, and supports, at the end thereof, a compression spring 605 extending further downwards beyond the perpendicular plate 603. There are also provided hollow parts 606, 607.

The process cartridge 500 is assembled by coupling the units 300 and 400 in the following manner.

At first the photosensitive drum 302 of the unit 300 and the developing sleeve 404 of the unit 400 are positioned in mutually opposed manner, and the pins 402 on both sides of the unit 400 are inserted deeply into the rectangular grooves 307 on both sides of the unit 300, whereby the units 300 and 400 are mutually combined in such a manner that the arms 301b of the unit 300 cover the frame 401 of the unit 400.

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Then, the stopper unit 600 is fitted into each of the recess 304. In this state, the front aperture 304c of the unit 300 faces the rectangular groove 408 of the unit 400, while the rear aperture 304c faces the rectangular groove 307. Thus the stopper unit 600 is fitted into the recess 304, by fitting the compression spring 605 through the front aperture 304b into the rectangular groove 408, and fitting the perpendicular plate 603 through the rear aperture 304c.

Subsequently, the male screw 700 is fixed to the female thread 304a through the screw hole 602 of the stopper unit 600, thereby fixing the stopper unit 600 to the unit 300. The assembly of the process cartridge 500 is thus completed (Figs. 3 to 5).

Thus the pins 402 of the unit 400 are limited from movement by the lower lateral ends 603a of the perpendicular plates 603, whereby the units 300 and 400 are integrally coupled, with the pins 402 as the center of rotation. At the same time with the mounting of the stopper unit 600, the developing sleeve 404 is pressed by the elastic force of the compression springs 605, toward the periphery of the photosensitive drum 302. In the present embodiment, the peripheries of the drum 302 and the rollers 407 come into mutual contact, thereby defining the positions thereof. (In

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the present embodiment, a gap (for example about 200 - 500 μ) is formed between the peripheries of the drum 302 and the sleeve 404 in order to enable so-called jumping development, but these members may be in direct contact.)

Thus, the present embodiment can achieve the coupling of the photosensitive drum unit 300 and the developing unit 400 and the positioning of the photosensitive drum 302 and the developing sleeve 404 in a same assembling step, thereby shortening the assembling process.

Also in the present embodiment, when the units 300 and 400 are mutually coupled, the exposure aperture 301c of the unit 300 becomes positioned above the exposure aperture 403 of the unit 400, thereby defining an exposure aperture of a predetermined size (for introducing the image light from the main body of the printer). Thus, in the coupled state of the units 300 and 400, the frames 301, 401 cooperate each other to form the exposure aperture. The present embodiment can therefore improve the strength of the frames, as a large hole for image exposure need not be formed in one of the frames. Also the present embodiment can minimize the intrusion of unnecessary light from the exposure aperture, because of the presence of the light shield plate 403a, rear light shield plate 403b and vertical light shield plate 403c in the process cartridge 500.

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In Fig. 3, an arrow A indicates the image exposing light. Parallel recesses 409, formed on the external surface of the frame 401 of the unit 400 serve as grips in the transportation of the cartridge 500 (said recesses 409 being omitted from illustration in Fig. 7(b)). Arms 310 support the protective cover 301d, at a side opposite to the side supported by the arms 301d2. Fig. 5 illustrates a new process cartridge 500 prior to use. In Fig. 5, there is provided a rotary blade 411, rotated in a direction B to feed the toner 412 toward the sleeve 404. An elastic cleaning blade 311, serving as the cleaner, is in contact with the periphery of the photosensitive drum 302, thereby removing the toner remaining thereon after the image transfer. A used toner reservoir 312 stores the toner scraped by the blade 311. C indicates the protecting position of the protective cover 301d, while D indicates the retracted position thereof. In this drawing, for facilitating the understanding, the protective cover 301d is illustrated in solid lines both in the protecting position C and in the retracted position D.

Now reference is made to Fig. 8, for explaining a laser beam printer, in which the afore-mentioned process cartridge 250, 500 is detachably mounted. It is to be noted that, in Fig. 8, said process cartridge 250, 500 is only schematically illustrated.

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As shown in Fig. 8, a laser beam printer 1 includes a process cartridge 250 (500) detachably mounted in a main body 2, and said process cartridge 250 (500) includes a photosensitive drum 104 (320) serving as the image bearing member, and process means such as a charger 303, a developing device 106 (404, 405 etc.), a cleaner 107 (311, 132) etc. positioned around said drum. In the upper part of the main body 2 there are provided a scanner unit 8 and a mirror 9 for emitting and guiding a laser beam.

The photosensitive drum 104 (302) uniformly charged by the charger 303 is irradiated by the laser beam, corresponding to the image information, from the unit 8 (indicated by arrow A), whereby a latent image corresponding to the image information is formed on the photosensitive drum 104 (302). Said latent image is developed into a toner image by the developing device 106 (404, 405 etc.). In the lower part of the main body 2, there is provided a sheet cassette 10 containing a plurality of sheets S servig as the recording medium (for example recording paper or overhead projector sheet). Next to the sheet cassette 10, there is provided a feed roller 11, which feeds the sheets S, one by one, from the cassette 10 to registration rollers 12. With a timing adjusted by the registration rollers 12, the sheet S is advanced to an image transfer position between the

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photosensitive drum 104 (302) and a transfer charger 13, and the toner image on said photosensitive drum 104 (302) is transferred, in said transfer position, onto the sheet S. After the toner image transfer, the sheet S is transported by a conveyor belt unit 14 to a fixing unit 15 for fixation of said toner image, and is discharged from the main body 2.

The laser beam printer of the present embodiment can select two methods in the discharge of the sheet S.

In the first face-up discharge method in which the sheets S are discharged with the image bearing faces thereof upwards, the sheet is discharged from face-up discharge rollers 16 onto a face-up discharge tray 17. In the second face-down discharge method in which the sheets S are discharged with the image bearing faces thereof downwards and in the order of pages, the sheet S is guided from said face-up discharge rollers 16 upwards through a transport direction switching mechanism such as a flapper 20 and a sheet guide member 21, thereby being inverted, and is discharged from face-down discharge rollers 18 onto a face-down discharge tray 19.

The maintenance works of the laser beam printer 1, such as the disposal of jammed sheet or replacement of the process cartridge 250 (500), are conducted by exposing the interior of the apparatus by rotating

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the upper part 2a of the main body 2 upwards about a shaft P, as indicated by chain lines, relative to the lower part 2b, and inserting a hand in a direction E.

Also, the attaching and detaching of the process cartridge 250 (500) are conducted in a direction F. More specifically, the cartridge 250 (500) is introduced into the main body 1 along the direction F, then is guided toward the mounting position, with the guides 301a1 of the cartridge guided by guide members (not shown) of the main body, and is supported in the mounting position by mounting means 22, 23. Subsequently the upper part 2a is rotated clockwise about the shaft P, whereby the apparatus becomes capable of image formation. With said clockwise rotation of the upper part 2a, an engaging part 301d3 of the protective cover 301d engages with an engaging part (not shown) of the main body, whereby the arms 301d2 are rotated anticlockwise to move the protective cover 301d to the retracted positon D. On the other hand, when the upper part 2a is opened by anticlockwise rotation, said engaging parts are disengaged whereby the protective cover 301d moves to the protecting position C by the elastic force of the springs 301d4.

24 indicates guide members. The sheet cassette 10 can be attached and detached in a direction G. The foregoing embodiments are not limitative, and

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the photosensitive drum unit needs only to contain at least the photosensitive drum, while the developing unit needs only to contain at least the developing device.

As explained in the foregoing, the present invention realizes to shorten the assembling process.

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CLAIMS

1. A process cartridge detachably attachable to the main body of a recording or image forming apparatus, comprising:

a first support member supporting an image bearing member;

a second support member supporting development means for acting on said image bearing member to thereby develop an image of said image bearing member; and

coupling means including a member defining a rotary pivot between said first and second support members, and a compression spring for generating an elastic force between said image bearing member and said development means, to be adapted for coupling said first and second support members.

2. A process cartridge according to claim 1, wherein the positions of the periphery of a photo-sensitive drum serving as said image bearing member and of the periphery of a developing sleeve in said development means are mutually defined so as to protect said image bearing member.

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3. A process cartridge according to claim 1, wherein said first support member is provided with a protective cover, which can be opened and closed, for protecting said image bearing member.

4. A process cartridge according to claim 3, wherein said protective cover is adapted to protect an image transfer area of said image bearing member.

5. A process cartridge according to claim 1, wherein said pivot comprises a cylindrical member fixed on said first support member.

6. A process cartridge according to claim 1, wherein the developing sleeve of said development means is pressed toward the electrophotographic photosensitive drum of said image bearing member, by the elastic force of said compression spring.

7. A process cartridge according to claim 1, wherein the developing sleeve of said development means and the electrophotographic photosensitive drum of said image bearing member are arranged with a gap therebetween.

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8. A recording apparatus for recording on a recording medium, comprising:

mounting means for mounting a process cartridge including:

a first support member supporting an image bearing member;

a second support member supporting development means for acting on said image bearing member to thereby develop an image of said image bearing member; and

coupling means including a member defining a pivot between said first and second support members, and a compression spring for generating an elastic force between said image bearing member and said development means, to be adapted for coupling said first and second support members; and transport means for transporting said recording medium.

9. An assembling method for a process cartridge detachably attachable to the main body of a recording apparatus and including:

a first support member supporting an image bearing member;

a second support member supporting development means for acting on said image bearing member to

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thereby develop an image of said image bearing member; and

coupling means including a defining member defining a pivot between said first and second support members, and a compression spring for generating an elastic force between said image bearing member and said development means, to be adapted for coupling said first and second support members, comprising a step of:

coupling said first and second support members in mutually rotatable manner about said pivot by means of said coupling means.

10. An assembling method according to claim 9, wherein said coupling means is fixed by a screw to said first support member, and said first and second support members are coupled in mutually rotatable manner about said pivot.

11. An assembling method according to claim 10, wherein said coupling means includes a base member, a screw hole for fixing, provided in said base member, a perpendicular plate formed as said defining member on said base member, and said compression spring provided on said base member.

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12. An assembling method according to claim 10, wherein said pivot comprises cylindrical member fixed on said first support member.

13. A process cartridge detachably attachable to the main body of a recording apparatus, comprising:

a first frame supporting an image bearing member; and

a second frame supporting development means for acting on said image bearing member to thereby develop an image of said image bearing member;

wherein said first and second frames mutually cooperate to form an aperture when they are coupled.

14. A process cartridge according to claim 13, wherein said aperture is an exposure aperture through which said image bearing member can be irradiated with image information when said process cartridge is mounted in the main body of the recording apparatus.

15. A process cartridge according to either of claims 1 or 13, wherein said first and second frames are coupled by coupling means including a member defining a pivot and a compression spring for generating an

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elastic force between said image bearing member and said development means.

16. A process cartridge according to either claim 1 or claim 15, wherein said coupling means is fixed by a screw to said first frame, and said first and second frames are coupled in mutually rotatable manner about said pivot.

17. A process cartridge according to claim 15, wherein said pivot is composed of a cylindrical member fixed on said first frame.

18. A process cartridge according to claim 13, wherein said image bearing member is composed of an electrophotographic photosensitive drum, having a drum gear at a lateral end thereof.

19. A process cartridge according to claim 18, wherein said drum gear meshes with a developing sleeve gear provided at a lateral end of the developing sleeve in said development means, to thereby transmit rotary driving force to said developing sleeve.

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20. A process cartridge according to claim 15, wherein the developing sleeve of said development means is pressed toward the electrophotographic photosensitive drum of said image bearing member, by the elastic force of said compression spring.

21. A process cartridge according to claim 15, wherein the developing sleeve of said development means and the electrophotographic photosensitive drum of said image bearing member are mutually pressed by the elastic force of said compression spring.

22. A process cartridge according to claim 15, wherein the developing sleeve of said development means and the electrophotographic photosensitive drum of said image bearing member are arranged with a gap therebetween by the elastic force of said compression spring.

23. A recording apparatus for recording on a recording medium, comprising:

mounting means for mounting a process cartridge including:

a first frame supporting an image bearing member; and

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a second frame supporting development means for acting on said image bearing member to develop an image of said image bearing member;

wherein said first and second frames mutually cooperate to form an aperture when they are coupled; and

transport means for transporting said recording medium.

24. A recording apparatus according to either of claims 8 or 23 wherein said recording apparatus is either a laser beam printer or an electrophotographic copying apparatus.

25. A process cartridge including at least an image bearing member and development means and detachably attachable to an image forming apparatus,

wherein a member for defining the position of said development means relative to the image bearing member and a compression spring for biasing said development means toward the image bearing member are constructed as an integral unit, and said unit is utilized in positioning the development means in a support member for the image bearing member.

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26. A process cartridge according to claim 25, wherein the support member for said image bearing member is provided with cleaning means.

27. A process cartridge for a recording apparatus comprising a pair of support members pivotally interconnected in an easily detachable manner.

28. A process cartridge as claimed in claim 27, in which one support member has a pivot detachably held in a slot in the other member.



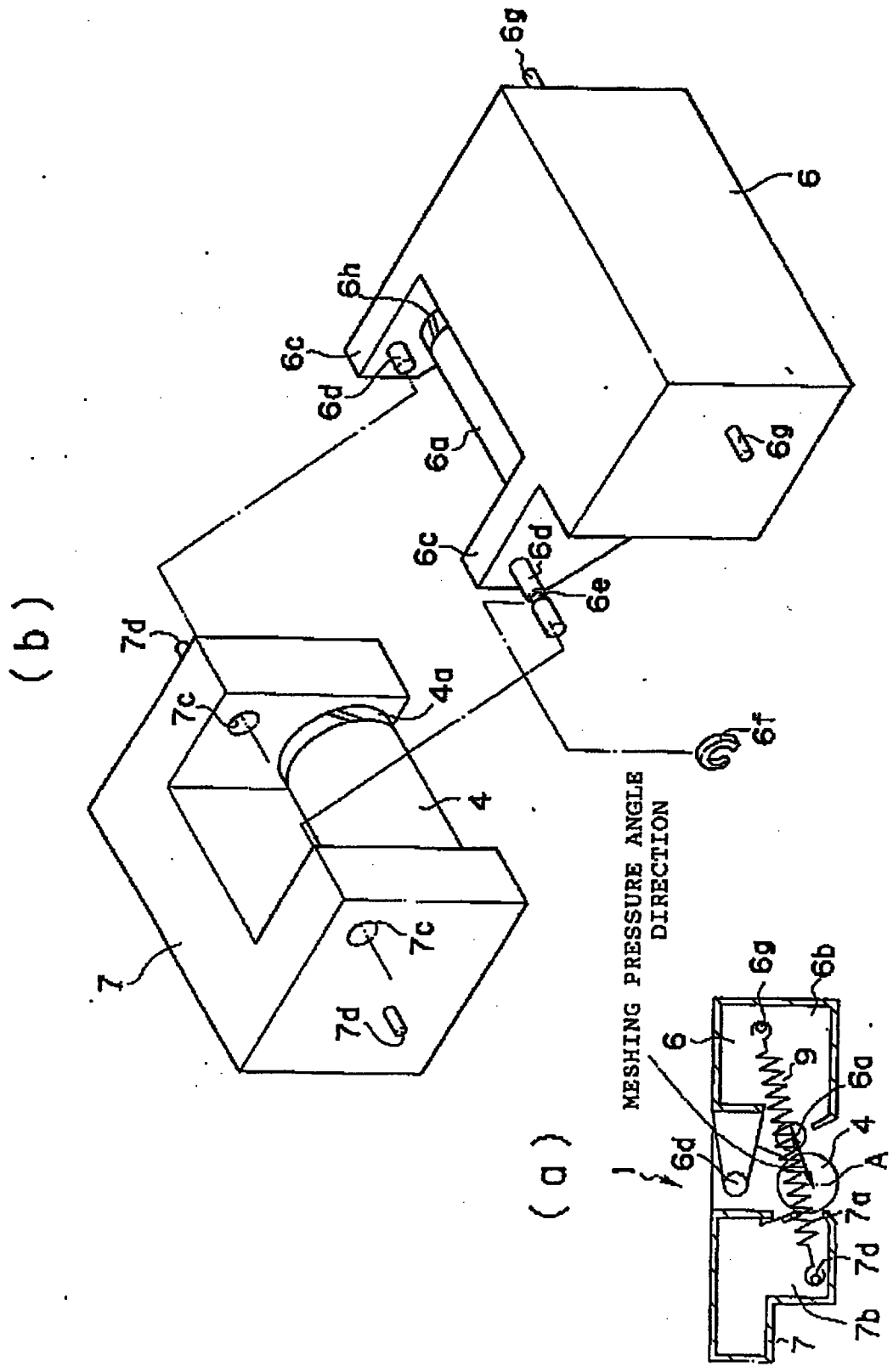
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PROCESS CARTRIDGE, RECORINDG APPARATUS, AND METHOD FOR ASSEMBLING PROCESS CARTRIDGE

The present invention realizes to shorten the assembling process of a process cartridge, by employing a first support member supporting an image bearing member, a second support member supporting a development unit for acting on the image bearing member to thereby develope an image of the image bearing member, a defining member for defining the rotary shaft between the first and second support members, and a compression spring for generating an elastic force between the image bearing member and the development unit.

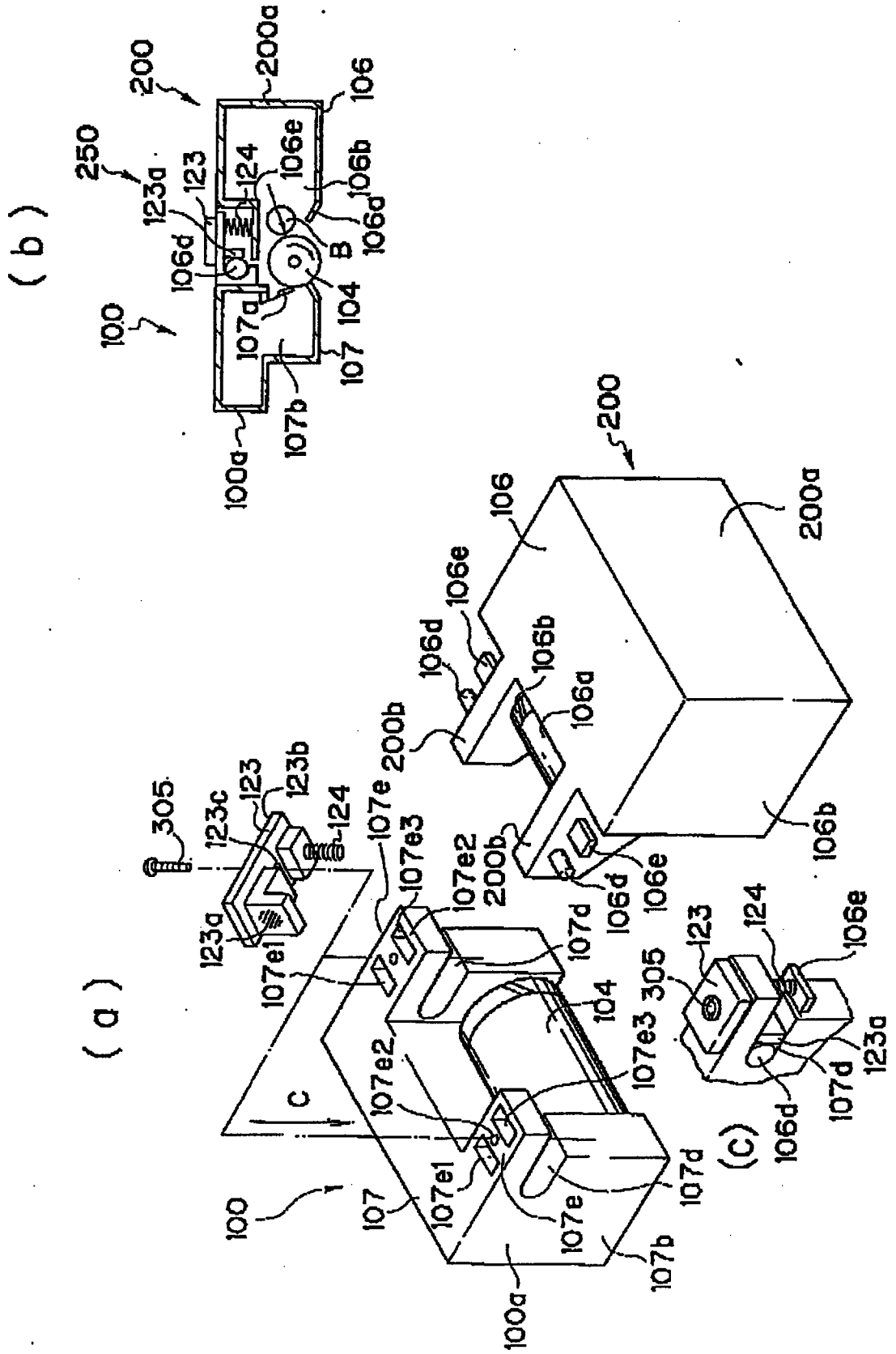
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Fig. 1



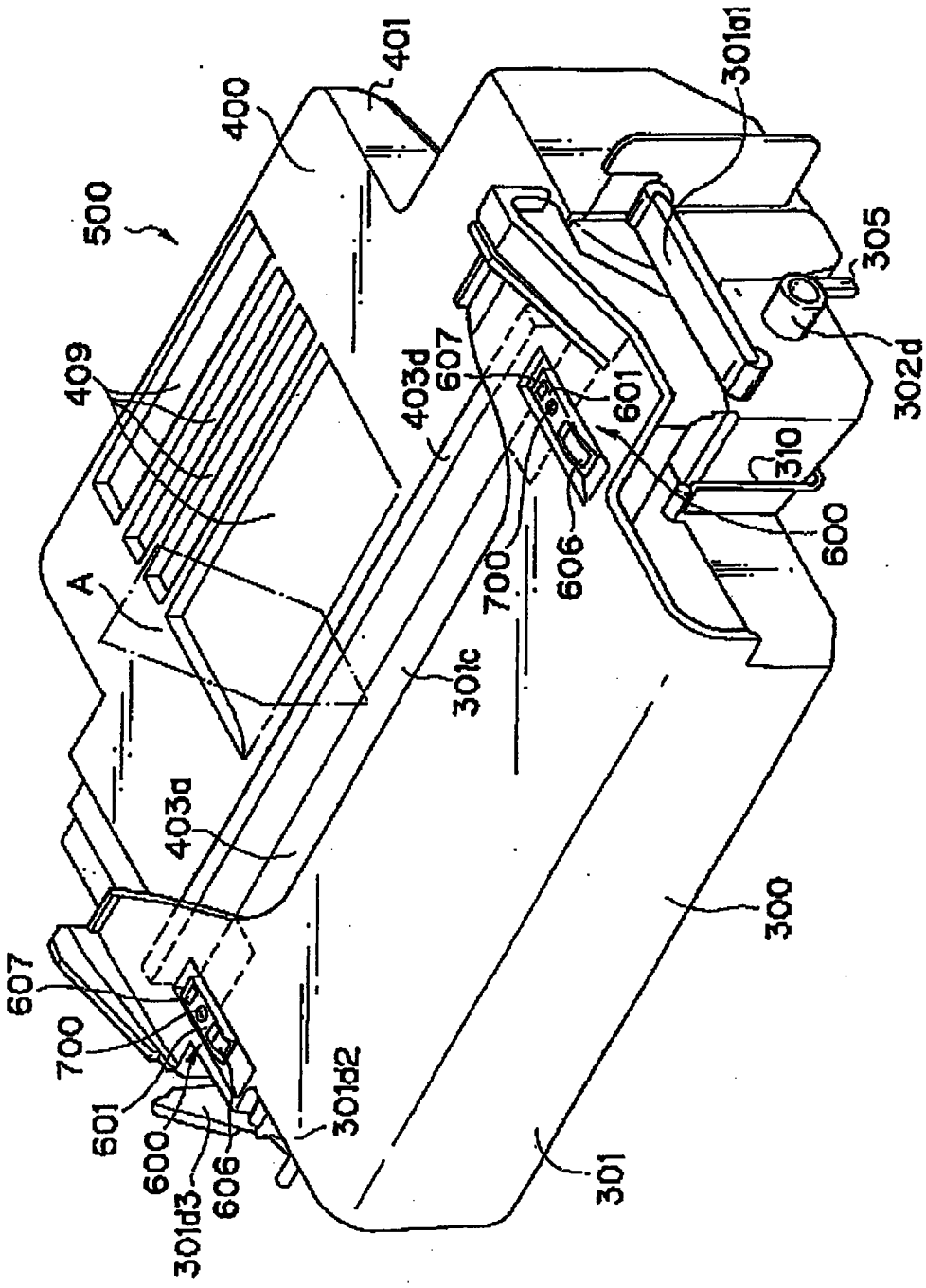
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Fig. 2



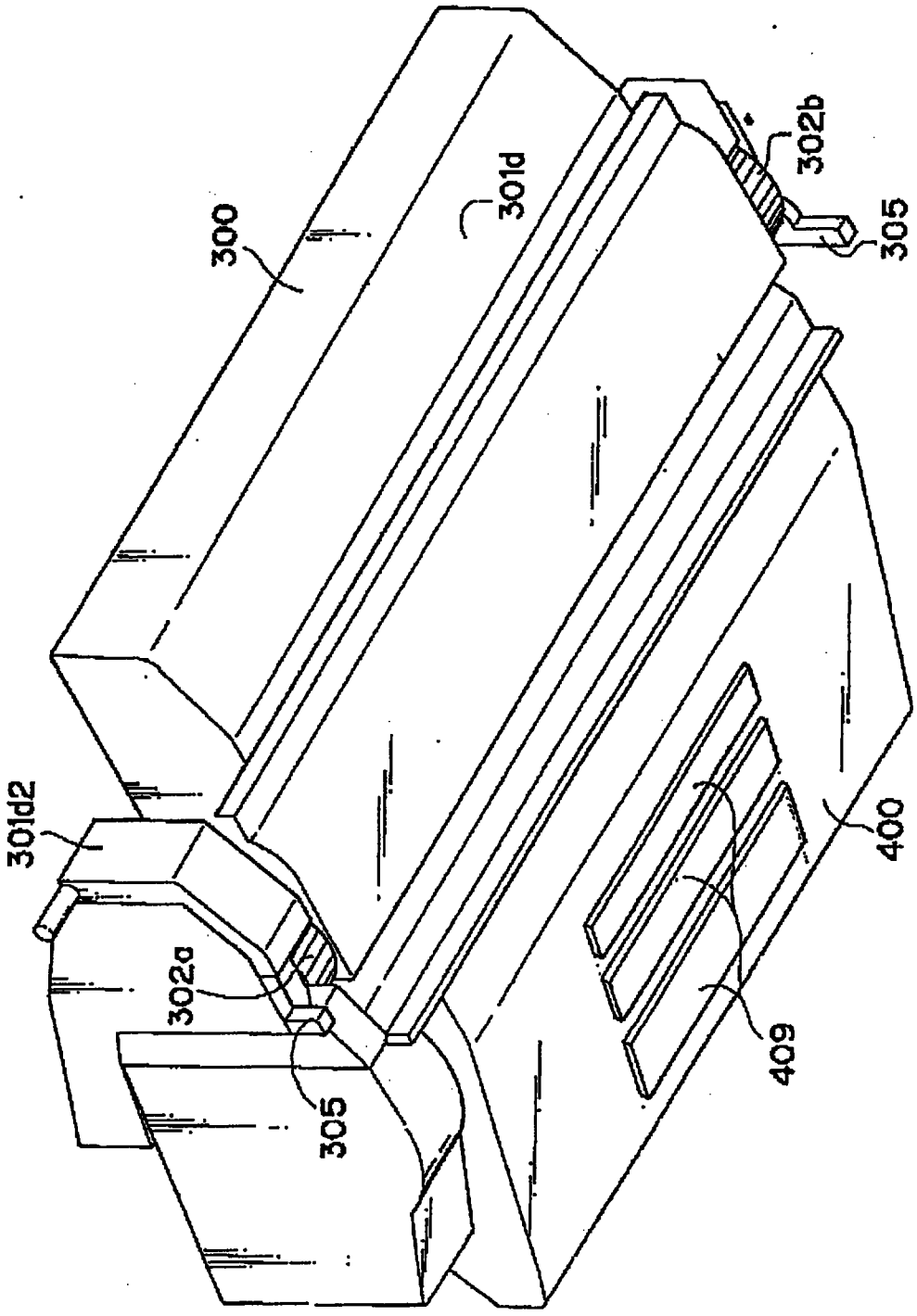
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Fig. 3



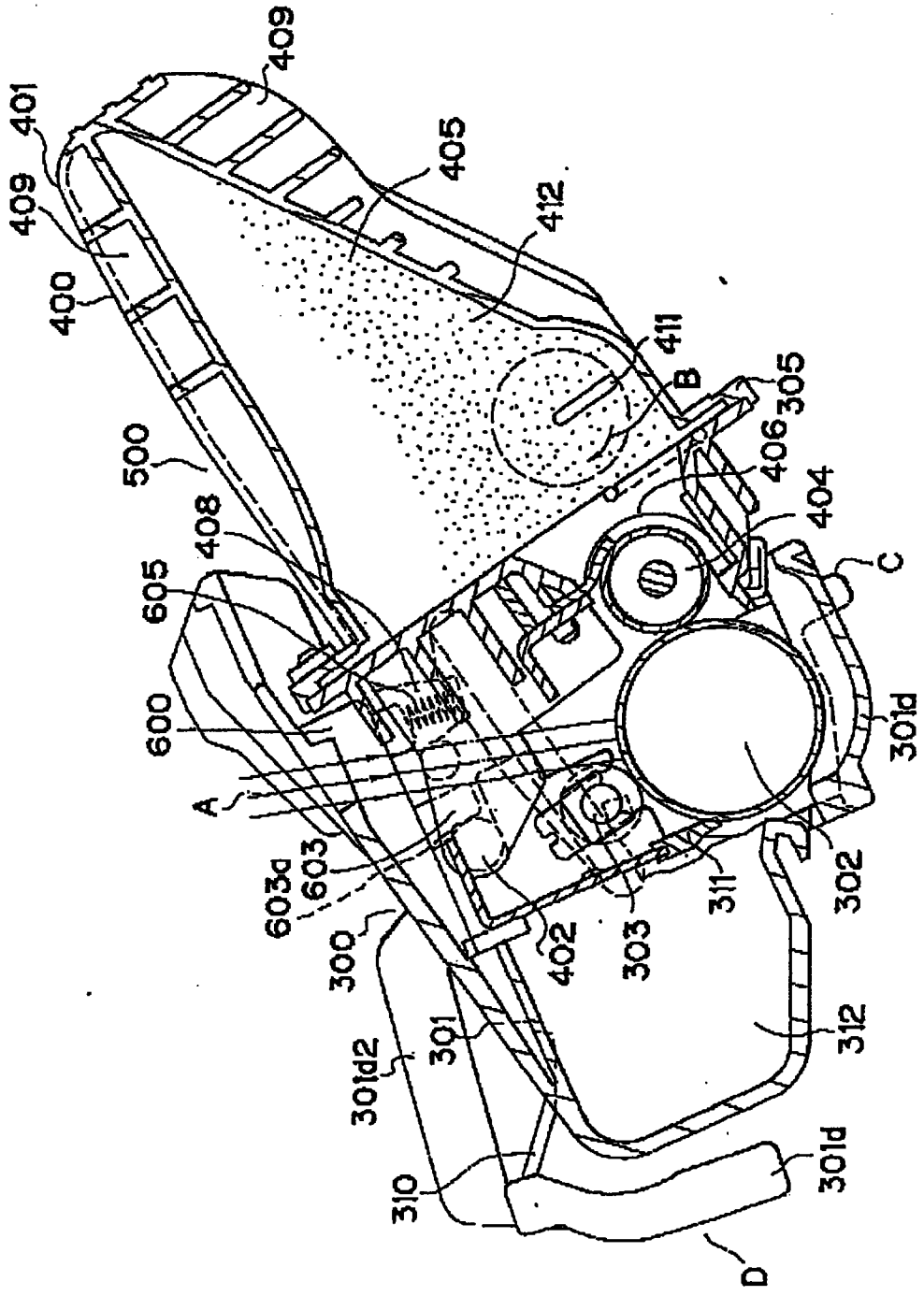
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Fig. 4



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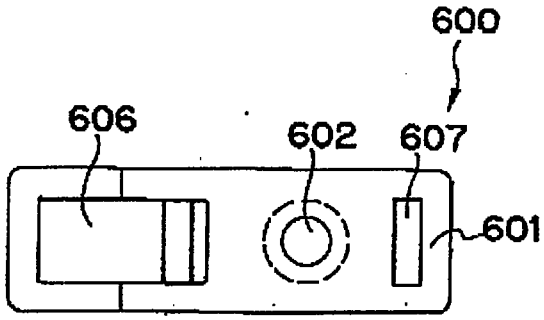
Fig. 5



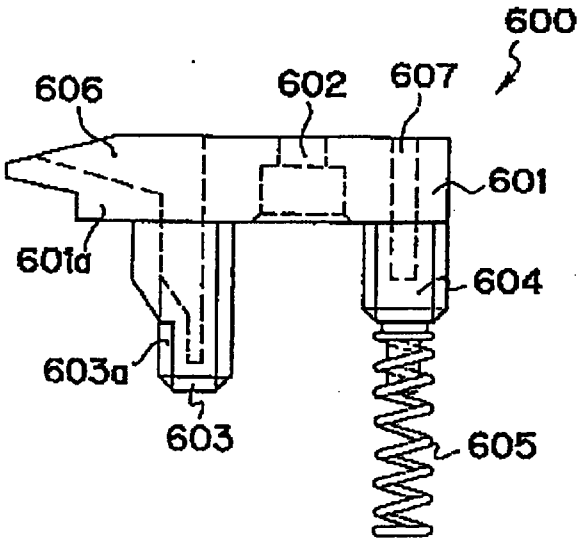
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Fig. 6

(a)



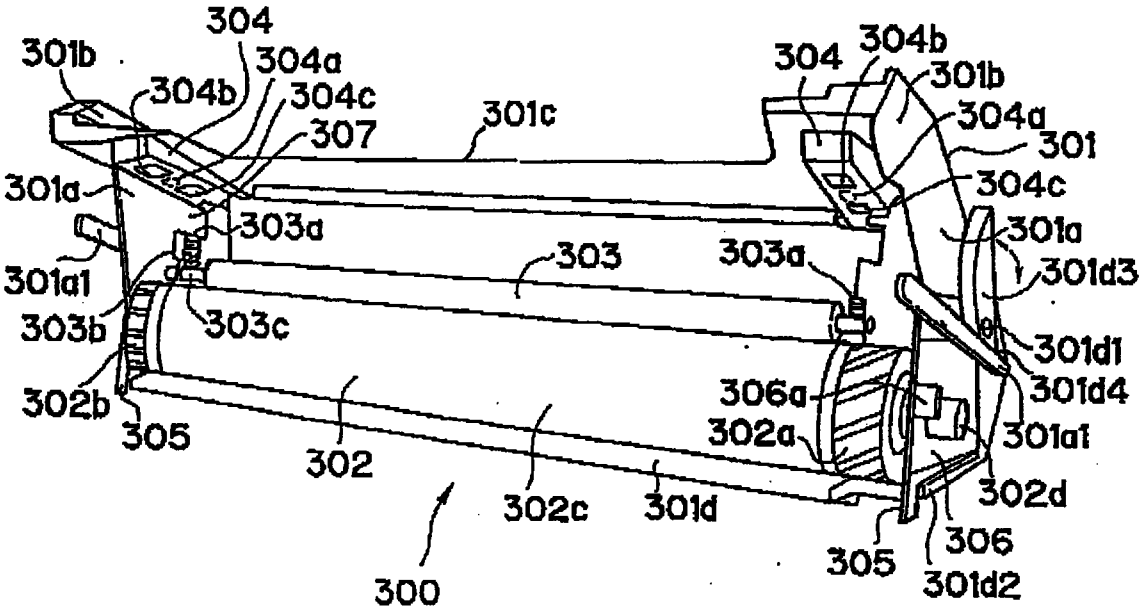
(b)



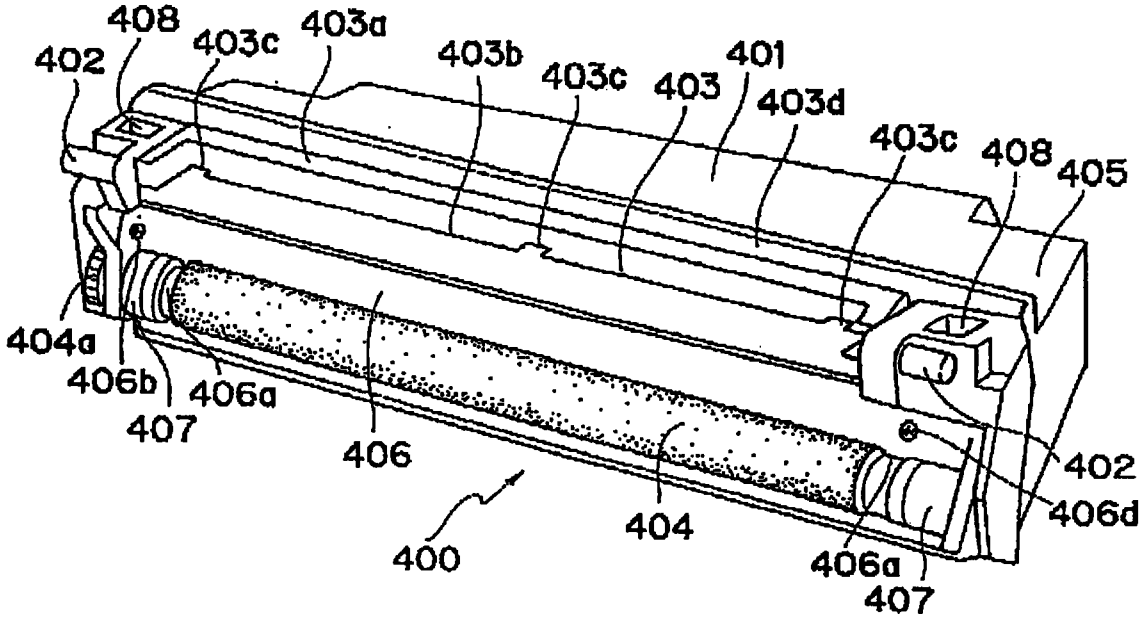
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Fig. 7

(a)

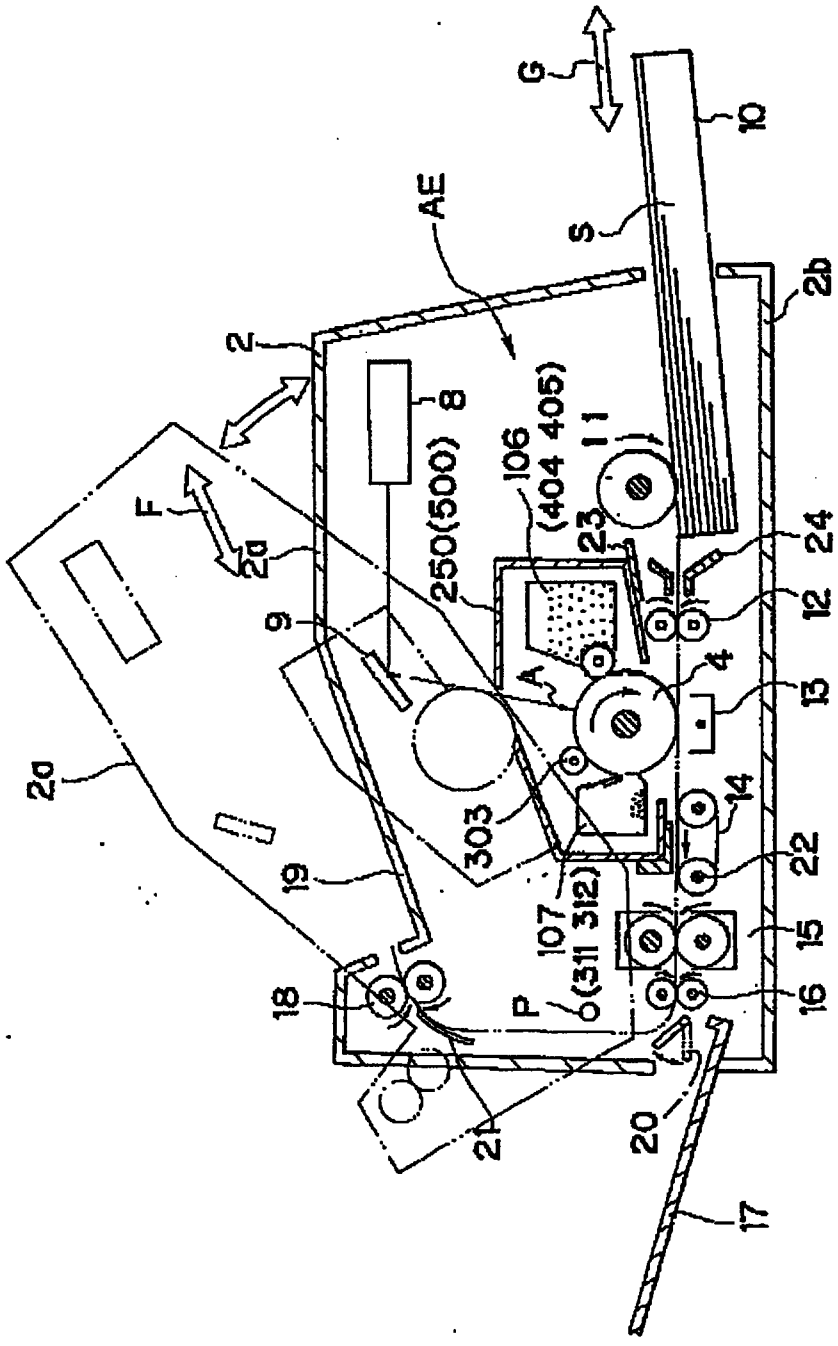


(b)



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Fig. 8



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REPLACED SHEETS SG
☐ Description : paged ..... to paged .....
☑ Claim(s) : paged 26 to paged 34
☐ Drawing(s) : paged ..... to paged .....
☑ Abstract : paged 35 to paged —
DATE OF RECEIPT .....

REPLACEMENT SHEETS SG
☑ Description : paged 1 to paged —
☑ Claim(s) : paged 26 to paged 34
☑ Drawing(s) : paged 1/8 to paged 2/8
☑ Abstract : paged 35 to paged —
DATE OF RECEIPT 24/12/96

S P E C I F I C A T I O N

Process cartridge, recording apparatus, and method for assembling process cartridge

TECHNICAL FIELD

The present invention relates to a process cartridge, a recording apparatus and a method for assembling process cartridge.

The process cartridge means an integral unit including at least an image bearing member (for example an electrophotographic photosensitive member) and developing means, rendered attachable to and detachable from a recording apparatus.

The recording apparatus can be, for example, an electrophotographic copying apparatus, a laser beam printer (LBP), a facsimile apparatus, a word processor or the like.

BACKGROUND ART

In the following there will be explained the background art of the present invention.

Figs. 1(a) and 1(b) are views showing the background art of the present invention, wherein Fig. 1(a) is a schematic lateral cross-sectional view of a process cartridge not mounted on the recording apparatus, and Fig. 1(b) is a perspective view in which the process cartridge is divided into a developing unit

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and a cleaner unit.

As shown in Figs. 1(a) and 1(b), a photosensitive drum unit 7 is provided with a photosensitive drum 4, and a cleaning blade 7a and a used toner reservoir 7b constituting a cleaner 7e for cleaning the periphery of said photosensitive drum 4.

Also a developing unit 6 is provided with a developing sleeve 6a and a toner reservoir 6b constituting a developer 6i. (In these drawings, the toner in the toner reservoir 6b and in the used toner reservoir 7b is omitted.)

Pins 6d formed on arms 6c of the unit 6 are fitted in holes 7c of the unit 7, and are then prevented from displacement in the thrust direction by a thrust stopper 6f such as a ring, fitted on a groove 6e of the pin 6d. Thus the units 6, 7 are mutually rotatable about said pins 6d. Subsequently tension springs 9 are applied between pins 6g provided on both sides of the unit 6 and pins 7d provided on both sides of the unit 7, thereby generating a tensile force between the units 6 and 7. Thus the units 6, 7 are integrated in a state in which the photosensitive drum 4 and the developing sleeve 6a are mutually contacted with a predetermined pressure in a direction A.

When the process cartridge 1 is mounted on a laser beam printer (not shown), the photosensitive

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drum 4 is driven by a driving gear (not shown) of the main body of the apparatus, while the developing sleeve 6a is rotated by a developing roller gear 6h meshing with a photosensitive drum gear 4a. In general, the pins 6d and the holes 7c are positioned in the angular direction of meshing pressure of said gears, in order not to receive the force in the rotational direction.

However, the above-explained process cartridge requires a cumbersome operation in the assembling, as the tension springs 9 cannot be placed between the pins 6g and 7d unless they are once extended with a force exceeding the necessary tensile force. Also in case of disassembling the process cartridge into the cleaner 7 and the developer unit 6 for maintenance or the like, there have to be detached the springs 9 and then the thrust stopper 6f. In this manner cumbersome operations are involved in the assembling and disassembling of such conventional process cartridge.

On the other hand, the present applicant made an invention enabling to compactize the process cartridge by the use of compression coil springs in contacting the developing sleeve with the photosensitive drum with a predetermined pressure, and applied for a patent in Japan on this invention (Japanese Patent Application No. 63-69735, filed March

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25, 1988; Japanese Patent Laid-open Application No. 1-244472, laid open Sept. 28, 1989).

The present invention is an extension of the above-mentioned background art and of the above-explained invention of the present applicant.

DISCLOSURE OF INVENTION

An object of the present invention is to provide a process cartridge enabling further compactization, an image forming apparatus adapted therefor, and a method for assembling such process cartridge.

Another object of the present invention is to provide a process cartridge capable of reducing the assembling process, an image forming apparatus adapted therefor, and a method for assembling such process cartridge.

Still another object of the present invention is to provide a process cartridge capable of reducing the disassembling process, an image forming apparatus adapted therefor, and a method for assembling such process cartridge.

Still another object of the present invention is to provide a process cartridge with improved assembling and disassembling property, an image forming apparatus adapted therefor, and a method of assembling such process cartridge.

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In a principal aspect of the present invention, there is provided a process cartridge capable of being attached to and detached from a recording apparatus, comprising:

a first support member supporting an image bearing member;

a second support member supporting developing means for acting on said image bearing member thereby developing an image on said image bearing member; and

coupling means including a limiting member for limiting rotary axis between said first and second support members and a compression spring for generating an elastic force between said image bearing member and said developing means, thereby being used for coupling said first and second support members.

In another principal aspect of the present invention, there is provided a recording apparatus for effecting a recording operation on a recording medium, comprising:

mounting means for mounting a process cartridge including:

a first support member supporting an image bearing member;

a second support member supporting developing means for acting on said image bearing member thereby developing an image on said image bearing

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member; and

coupling means including a limiting member for limiting the rotary axis between said first and second support members and a compression spring for generating an elastic force between said image bearing member and said developing means, thereby being used for coupling said first and second support members and

transport means for transporting said recording medium;

In still another principal aspect of the present invention, there is provided a method for assembling a process cartridge including:

a first support member supporting an image bearing member;

a second support member supporting developing means for acting on said image bearing member thereby developing an image on said image bearing member; and

coupling means including a limiting member for limiting the rotary axis between said first and second support members and a compression spring for generating an elastic force between said image bearing member and said developing means, thereby being used for coupling said first and second support members;

said method comprising to integrally couple said first

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and second support members in mutually rotatable manner about said rotary axis by means of said coupling means.

In still another principal aspect of the present invention, there is provided a process cartridge capable of being attached to and detached from a recording apparatus, comprising:

a first frame supporting an image bearing member; and

a second frame supporting developing means for acting on said image bearing member thereby developing an image on said image bearing member;

wherein said first and second frames mutually cooperate to form an aperture when they are coupled.

Owing to the above-mentioned characteristic configurations, the present invention achieves the reduction of assembling process of the process cartridge, since, because of said characteristic configurations, the present invention allows to assemble the process cartridge without the use of a tension spring. Also because of said characteristic configurations, the present invention allows to mount the compression spring in an easy manner at the assembly of the process cartridge.

Also owing to said characteristic configurations, the present invention allows to form an aperture (for example aperture for exposure) without sacrificing

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the strength of the casing of the process cartridge. Because of said characteristic configurations, the present invention allows to form the aperture, without forming a hole in the casing.

BRIEF DESCRIPTION OF THE DRAWINGS

Figs. 1(a) and 1(b) are respectively a lateral cross-sectional view and a perspective view, showing the background art of the present invention;

Figs. 2(a), 2(b) and 2(c) are respectively a perspective view, a lateral cross-sectional view and a perspective view showing a combined state, of a preferred embodiment of the process cartridge of the present invention;

Fig. 3 is an external perspective view of a preferred embodiment of the process cartridge of the present invention;

Fig. 4 is an external perspective view, seen from below, of the process cartridge shown in Fig. 3;

Fig. 5 is a lateral cross-sectional view of the process cartridge shown in Fig. 3;

Figs. 6(a) and 6(b) are respectively a plan view and a lateral view of an embodiment of coupling means adapted in the present invention;

Figs. 7(a) and 7(b) are perspective views respectively of a photosensitive drum unit and a developing unit, constituting the process cartridge

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shown in Fig. 3; and

Fig. 8 is a lateral cross-sectional view of a laser beam printer in which the present invention is applicable.

BEST MODE FOR EXPLOITING THE INVENTION

Now the present invention will be clarified in detail by preferred embodiments thereof shown in the accompanying drawings.

Figs. 2(a) and 2(b) are respectively a schematic perspective view and a schematic cross-sectional view of a preferred embodiment of the process cartridge of the present invention. Fig. 2(a) illustrates a state in which a photosensitive drum unit 100 and a developing unit 200 are mutually disassembled.

In the present embodiment, a process cartridge 300 is constructed by coupling the photosensitive drum unit 100 and the developing unit 200. The photosensitive drum unit 100 rotatably supports an electrophotographic photosensitive drum 104 in a frame 100a, by means of bearings. It also is provided with a cleaning blade 107a and a used toner reservoir 107b, constituting a cleaner 107 for cleaning the periphery of the photosensitive drum 104. On the other hand, the developing unit 200 supports, in a frame 200a, a developing sleeve 106a and a toner reservoir 106b,

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constituting a developing device 106, wherein the developing sleeve 106a serves to transport the toner in the toner reservoir 106b to a developed area of the photosensitive drum 104.

In the following there will be explained a procedure for coupling the photosensitive drum unit 100 and the developing unit 200.

In the present embodiment, cylindrical projections 106d, formed on arms 200b of the developing unit 200 are fitted in U-shaped grooves 107d provided in the drum unit 100, and, after the fitting of the units 100, 200 in this manner, a stopper unit 123 in which a pressurizing spring (compression spring in this case) 124 is integrated (for example by snap fitting of an end of the compression spring) is fitted in a fixing part 107e, positioned above each of the U-shaped grooves 107d. Then the stopper unit 123 is fixed to the unit 100 by a screw 305 inserted in a direction c. In this operation, a face 123a of the stopper unit 123 and the U-shaped groove 107d define the position of the projection 106d of the developing unit 200, thereby limiting the position thereof. Also the pressure springs 124 press spring seats 106e of the developing unit 200, thereby applying a biasing force in a direction B of mutual impingement of the photosensitive drum 104 and the developing sleeve 106a.

The stopper unit 123 is integrally provided

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with a base plate 123b, a fixing screw hole 123c provided therein, a perpendicular plate 123a formed on said base plate 123b, and a compression spring 124.

On the other hand, the fixing part 107e formed in the drum unit 100 is provided with a hole 107e1 into which said perpendicular plate 123a is to be fitted, a female thread part 107e2 for fixing the screw 305, and a hole 107e3 for passing the spring 124.

Thus, after the projections (pins) 106d of the unit 200 are fitted in the deepest parts of the grooves 107d of the unit 100, the stopper units 123 are fixed on the fixed parts 107e. More specifically, the perpendicular plate 123a of the stopper unit 123 is fitted in the hole 107e1, while the spring 124 is made to pass through the hole 107e and to be received in a compressed state by the spring seat 106e of the unit 200, and the screw 305 is fixed, through the screw hole 123c, into the female thread part 1007e2.

In this manner the units 100 and 200 are coupled so as to be mutually rotatable about the pins 106d, thereby completing the process cartridge 250. The positional relationship between the periphery of the photosensitive drum 104 and that of the developing sleeve 106a is defined in thus coupled state of the units 100, 200, and the developing sleeve 106a is pressed toward the photosensitive drum 104 by the elastic force of the compression springs 124. (In

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the present embodiment, the elastic force of the compression springs is selected at about 2 kg, whereby a pressing force of about 1 kg is applied to the developing sleeve.)

A drum gear 104a, provided at a side of the photosensitive drum 104, meshes with a developing sleeve gear 106b, provided at a side of the developing sleeve 106a, thereby transmitting the rotating force, received from the main body of the printer, to the developing sleeve.

In the above-explained configuration, the developing unit 106 can be attached or detached in the direction of the U-shaped grooves 107d. Consequently the projections (pins) 106d can both be constructed outwards (or inwards), so that of the thrust stopper can be dispensed with.

Also as the stopper unit 123 is inserted in the direction C and fixed in said direction, the pressurizing of the developing device can be realized simultaneously with the mounting of the stopper unit 123, and there is no longer required the conventional cumbersome operation of mounting the tension springs.

Also at the disassembling, the pressure is gradually released by loosening the stopper units, and the disassembling operation is extremely easy because of the absence of the thrust stopper.

Thus, the above-explained embodiment realizes

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the positioning of the developing device relative to the image bearing member, by means of a unit provided with compression springs, thereby improving the assembling and disassembling property of the process cartridge.

In the present embodiment, the photosensitive drum unit supports the cleaner, but such configuration is not essential. The process cartridge of the present invention needs only to be attachable to and detachable from the main apparatus in a state in which at least the photosensitive drum and the developing unit are integrally supported.

In the following, there will be explained another preferred embodiment of the present invention, with reference to Figs. 3 to 7.

Fig. 3 is an external perspective view, seen from above, of a preferred embodiment of the process cartridge of the present invention, Fig. 4 is an external perspective view thereof seen from below, Fig. 5 is a lateral cross-sectional view of the process cartridge shown in Fig. 3, Figs. 6(a) and 6(b) are respectively a plan view and a lateral view of an embodiment of the coupling means, and Figs. 7(a) and 7(b) are perspective views respectively of a photosensitive drum unit and a developing unit, constituting the process cartridge shown in Fig. 3.

At first the photosensitive drum unit 300 will

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be explained with reference to Fig. 7(a).

A unit frame 301 is provided with attach/detaching guides 301a1 provided on the external faces of lateral plates 301a, upper arms 301b extending diagonally upwards, and an exposure aperture 301c positioned between said arms 301b. Said lateral plates 301a, guides 301a1, arms 301b and exposure aperture are integrally molded. Under said frame 301 there is openably provided a photosensitive drum protecting cover 301d. Said guides 301a1 serve to guide the process cartridge 500 in attaching to or detaching from the printer (to be explained later). Said exposure aperture 301b constitutes an exposure aperture in cooperation with a frame of a developing unit 400, when the process cartridge 500 is composed by coupling the photosensitive drum unit 300 and the developing unit 400. The protective cover 301d is mounted on an arm 301d2 rotatable about a shaft 301d1. It is retracted from a protecting position (illustrated) for protecting the periphery of the photosensitive drum to a retracted position, when an engaging part 301d3 integral with the arm 301d2 engages with an engaging part of the main body, and returns to said protecting position when said engaging parts are disengaged upon detachment of the cartridge 500 from the main body. In this manner the protective cover 301d is opened and closed, in response to the

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attachment and detachment of the cartridge.

Between the lateral plates 301a, a photosensitive drum 302 is rotatably supported by bearings. Said drum 302 is provided with a helical gear 302a at an end, a flat-tooth gear 302b at the other end, and an electrophotographic photosensitive member 302c (for example an amorphous photosensitive member of an organic photoconductor (OPC)) on the periphery. Upon attachment of the cartridge in the main body, said helical gear 302a meshes with a helical gear (not shown) of the main body, thereby receiving the drum driving force. Also when the units are coupled, said gear meshes with a developing sleeve gear of the developing unit 400, thereby transmitting the sleeve driving force. A conductive bearing 302d engages with a conductive part (not shown) of the main body, thereby grounding the drum 104.

A charging roller 303 is pressed, with a predetermined pressure, to the periphery of the drum 302, by means of springs 303a. An electrical contact spring 303b elastically contacts the shaft 303c of the charging roller 303, thereby applying a predetermined voltage from the main body to said charging roller 303.

In the present embodiment, in each of the arms 301b there is provided an elongated recess 304, including therein apertures 304b, 304c on both sides of a female thread part 304a. The front aperture

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304b serves to pass a compression spring provided in a stopper unit to be explained later, while the rear aperture 304c serves to accept a perpendicular plate also provided in the stopper unit.

Below said recess 304, there is provided a rectangular groove 307, for accepting a pin of the developing unit 400 to be explained later.

Legs 305 serve to support the process cartridge 500 when it is detached from the main body. A conductive metal plate 305 is mounted on the lateral plate 301a, in contact with the bearing 302d, by means of a screw 306a.

In the following, explained is the developing unit 400, with reference to Fig. 7(b).

A unit frame 401 is provided, at upper lateral positions, with externally extending cylindrical pins 402, between which formed is an exposure aperture 403. There are also provided a light shield plate 403a for limiting the light other than from the exposure aperture 403, a rear light shield plate 403b for further limiting the light entering from the exposure aperture, with notches 403c at the center and at both ends in order not to hinder the image exposure, and a vertical light shield plate 403e. Said rear light shield plate 403b protrudes toward the photosensitive drum 302, beyond the light shield plate 403a.

Rectangular grooves 408 are provided for

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receiving compression springs, to be positioned in the vicinity of the pins 402 as will be explained later.

A developing roller 404, constituting the developing means, transports by rotation the toner from a toner reservoir 405 to a developed portion of the photosensitive drum 302. A magnet roller is incorporated in said developing sleeve 404. A helical gear 404a receives the driving force by meshing with the drum gear 302a of the photosensitive drum unit 300 when the units 300, 400 are coupled to constitute the cartridge 500.

A doctor blade 406 is provided for limiting the thickness of toner on the periphery of the sleeve 404. On both ends, there are provided felt members 406a for preventing lateral leak of the toner. Outside areas 406b are free from toner deposition.

Plastic rollers 407 are provided on both ends of the sleeve 404, and have a diameter slightly larger than that of the sleeve 404. Consequently in the present embodiment, when the units 300, 400 are coupled to constitute the process cartridge 500, the periphery of the photosensitive drum 302 comes into contact with those of the rollers 407, thereby defining a small gap (for example 200 - 500 μ in the present embodiment) between the surfaces of the drum 302 and the sleeve 404. However such configuration is not essential, and said surfaces may be in direct contact.

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Screw 406b fix the blade 406 onto the frame 401.

In the following, there will be explained a stopper unit 600, serving as coupling means for coupling the units 300 and 400, with reference to Figs. 6(a) and 6(b), which are respectively a plan view and a lateral view.

A screw hole 602, penetrating through a base member 601, accepts the male screw 700 (Fig. 3). A perpendicular plate 603 extends downwards from the lower face 601a of the base member 601, and serves to define the position of the pin 402 of the developing unit 400 by a lower lateral end 603a. A spring seat 604 is provided parallel to the perpendicular plate 603, and supports, at the end thereof, a compression spring 605 extending further downwards beyond the perpendicular plate 603. There are also provided hollow parts 606, 607.

The process cartridge 500 is assembled by coupling the units 300 and 400 in the following manner.

At first the photosensitive drum 302 of the unit 300 and the developing sleeve 404 of the unit 400 are positioned in mutually opposed manner, and the pins 402 on both sides of the unit 400 are inserted deeply into the rectangular grooves 307 on both sides of the unit 300, whereby the units 300 and 400 are mutually combined in such a manner that the arms 301b of the unit 300 cover the frame 401 of the unit 400.

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Then, the stopper unit 600 is fitted into each of the recess 304. In this state, the front aperture 304c of the unit 300 faces the rectangular groove 408 of the unit 400, while the rear aperture 304c faces the rectangular groove 307. Thus the stopper unit 600 is fitted into the recess 304, by fitting the compression spring 605 through the front aperture 304b into the rectangular groove 408, and fitting the perpendicular plate 603 through the rear aperture 304c.

Subsequently, the male screw 700 is fixed to the female thread 304a through the screw hole 602 of the stopper unit 600, thereby fixing the stopper unit 600 to the unit 300. The assembly of the process cartridge 500 is thus completed (Figs. 3 to 5).

Thus the pins 402 of the unit 400 are limited from movement by the lower lateral ends 603a of the perpendicular plates 603, whereby the units 300 and 400 are integrally coupled, with the pins 402 as the center of rotation. At the same time with the mounting of the stopper unit 600, the developing sleeve 404 is pressed by the elastic force of the compression springs 605, toward the periphery of the photosensitive drum 302. In the present embodiment, the peripheries of the drum 302 and the rollers 407 come into mutual contact, thereby defining the positions thereof. (In

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the present embodiment, a gap (for example about 200 - 500 μ) is formed between the peripheries of the drum 302 and the sleeve 404 in order to enable so-called jumping development, but these members may be in direct contact.)

Thus, the present embodiment can achieve the coupling of the photosensitive drum unit 300 and the developing unit 400 and the positioning of the photosensitive drum 302 and the developing sleeve 404 in a same assembling step, thereby shortening the assembling process.

Also in the present embodiment, when the units 300 and 400 are mutually coupled, the exposure aperture 301c of the unit 300 becomes positioned above the exposure aperture 403 of the unit 400, thereby defining an exposure aperture of a predetermined size (for introducing the image light from the main body of the printer). Thus, in the coupled state of the units 300 and 400, the frames 301, 401 cooperate each other to form the exposure aperture. The present embodiment can therefore improve the strength of the frames, as a large hole for image exposure need not be formed in one of the frames. Also the present embodiment can minimize the intrusion of unnecessary light from the exposure aperture, because of the presence of the light shield plate 403a, rear light shield plate 403b and vertical light shield plate 403c in the process cartridge 500.

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In Fig. 3, an arrow A indicates the image exposing light. Parallel recesses 409, formed on the external surface of the frame 401 of the unit 400 serve as grips in the transportation of the cartridge 500 (said recesses 409 being omitted from illustration in Fig. 7(b)). Arms 310 support the protective cover 301d, at a side opposite to the side supported by the arms 301d2. Fig. 5 illustrates a new process cartridge 500 prior to use. In Fig. 5, there is provided a rotary blade 411, rotated in a direction B to feed the toner 412 toward the sleeve 404. An elastic cleaning blade 311, serving as the cleaner, is in contact with the periphery of the photosensitive drum 302, thereby removing the toner remaining thereon after the image transfer. A used toner reservoir 312 stores the toner scraped by the blade 311. C indicates the protecting position of the protective cover 301d, while D indicates the retracted position thereof. In this drawing, for facilitating the understanding, the protective cover 301d is illustrated in solid lines both in the protecting position C and in the retracted position D.

Now reference is made to Fig. 8, for explaining a laser beam printer, in which the afore-mentioned process cartridge 250, 500 is detachably mounted. It is to be noted that, in Fig. 8, said process cartridge 250, 500 is only schematically illustrated.

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As shown in Fig. 8, a laser beam printer 1 includes a process cartridge 250 (500) detachably mounted in a main body 2, and said process cartridge 250 (500) includes a photosensitive drum 104 (320) serving as the image bearing member, and process means such as a charger 303, a developing device 106 (404, 405 etc.), a cleaner 107 (311, 132) etc. positioned around said drum. In the upper part of the main body 2 there are provided a scanner unit 8 and a mirror 9 for emitting and guiding a laser beam.

The photosensitive drum 104 (302) uniformly charged by the charger 303 is irradiated by the laser beam, corresponding to the image information, from the unit 8 (indicated by arrow A), whereby a latent image corresponding to the image information is formed on the photosensitive drum 104 (302). Said latent image is developed into a toner image by the developing device 106 (404, 405 etc.). In the lower part of the main body 2, there is provided a sheet cassette 10 containing a plurality of sheets S servig as the recording medium (for example recording paper or overhead projector sheet). Next to the sheet cassette 10, there is provided a feed roller 11, which feeds the sheets S, one by one, from the cassette 10 to registration rollers 12. With a timing adjusted by the registration rollers 12, the sheet S is advanced to an image transfer position between the

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photosensitive drum 104 (302) and a transfer charger 13, and the toner image on said photosensitive drum 104 (302) is transferred, in said transfer position, onto the sheet S. After the toner image transfer, the sheet S is transported by a conveyor belt unit 14 to a fixing unit 15 for fixation of said toner image, and is discharged from the main body 2.

The laser beam printer of the present embodiment can select two methods in the discharge of the sheet S.

In the first face-up discharge method in which the sheets S are discharged with the image bearing faces thereof upwards, the sheet is discharged from face-up discharge rollers 16 onto a face-up discharge tray 17. In the second face-down discharge method in which the sheets S are discharged with the image bearing faces thereof downwards and in the order of pages, the sheet S is guided from said face-up discharge rollers 16 upwards through a transport direction switching mechanism such as a flapper 20 and a sheet guide member 21, thereby being inverted, and is discharged from face-down discharge rollers 18 onto a face-down discharge tray 19.

The maintenance works of the laser beam printer 1, such as the disposal of jammed sheet or replacement of the process cartridge 250 (500), are conducted by exposing the interior of the apparatus by rotating

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the upper part 2a of the main body 2 upwards about a shaft P, as indicated by chain lines, relative to the lower part 2b, and inserting a hand in a direction E.

Also, the attaching and detaching of the process cartridge 250 (500) are conducted in a direction F. More specifically, the cartridge 250 (500) is introduced into the main body 1 along the direction F, then is guided toward the mounting position, with the guides 301a1 of the cartridge guided by guide members (not shown) of the main body, and is supported in the mounting position by mounting means 22, 23. Subsequently the upper part 2a is rotated clockwise about the shaft P, whereby the apparatus becomes capable of image formation. With said clockwise rotation of the upper part 2a, an engaging part 301d3 of the protective cover 301d engages with an engaging part (not shown) of the main body, whereby the arms 301d2 are rotated anticlockwise to move the protective cover 301d to the retracted positon D. On the other hand, when the upper part 2a is opened by anticlockwise rotation, said engaging parts are disengaged whereby the protective cover 301d moves to the protecting position C by the elastic force of the springs 301d4.

24 indicates guide members. The sheet cassette 10 can be attached and detached in a direction G. The foregoing embodiments are not limitative, and

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the photosensitive drum unit needs only to contain at least the photosensitive drum, while the developing unit needs only to contain at least the developing device.

As explained in the foregoing, the present invention realizes to shorten the assembling process.

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CLAIMS

1. A process cartridge detachably attachable to the main body of a recording or image forming apparatus, comprising:

a first support member supporting an image bearing member;

a second support member supporting development means for acting on said image bearing member to thereby develop an image of said image bearing member; and

coupling means including a member defining a rotary pivot between said first and second support members, and a compression spring for generating an elastic force between said image bearing member and said development means, to be adapted for coupling said first and second support members.

2. A process cartridge according to claim 1, wherein the positions of the periphery of a photo-sensitive drum serving as said image bearing member and of the periphery of a developing sleeve in said development means are mutually defined so as to protect said image bearing member.

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3. A process cartridge according to claim 1, wherein said first support member is provided with a protective cover, which can be opened and closed, for protecting said image bearing member.

4. A process cartridge according to claim 3, wherein said protective cover is adapted to protect an image transfer area of said image bearing member.

5. A process cartridge according to claim 1, wherein said pivot comprises a cylindrical member fixed on said first support member.

6. A process cartridge according to claim 1, wherein the developing sleeve of said development means is pressed toward the electrophotographic photosensitive drum of said image bearing member, by the elastic force of said compression spring.

7. A process cartridge according to claim 1, wherein the developing sleeve of said development means and the electrophotographic photosensitive drum of said image bearing member are arranged with a gap therebetween.

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8. A recording apparatus for recording on a recording medium, comprising:

mounting means for mounting a process cartridge including:

a first support member supporting an image bearing member;

a second support member supporting development means for acting on said image bearing member to thereby develop an image of said image bearing member; and

coupling means including a member defining a pivot between said first and second support members, and a compression spring for generating an elastic force between said image bearing member and said development means, to be adapted for coupling said first and second support members; and transport means for transporting said recording medium.

9. An assembling method for a process cartridge detachably attachable to the main body of a recording apparatus and including:

a first support member supporting an image bearing member;

a second support member supporting development means for acting on said image bearing member to

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thereby develop an image of said image bearing member; and

coupling means including a defining member defining a pivot between said first and second support members, and a compression spring for generating an elastic force between said image bearing member and said development means, to be adapted for coupling said first and second support members, comprising a step of:

coupling said first and second support members in mutually rotatable manner about said pivot by means of said coupling means.

10. An assembling method according to claim 9, wherein said coupling means is fixed by a screw to said first support member, and said first and second support members are coupled in mutually rotatable manner about said pivot.

11. An assembling method according to claim 10, wherein said coupling means includes a base member, a screw hole for fixing, provided in said base member, a perpendicular plate formed as said defining member on said base member, and said compression spring provided on said base member.

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12. An assembling method according to claim 10, wherein said pivot comprises cylindrical member fixed on said first support member.

13. A process cartridge detachably attachable to the main body of a recording apparatus, comprising:

a first frame supporting an image bearing member; and

a second frame supporting development means for acting on said image bearing member to thereby develop an image of said image bearing member;

wherein said first and second frames mutually cooperate to form an aperture when they are coupled.

14. A process cartridge according to claim 13, wherein said aperture is an exposure aperture through which said image bearing member can be irradiated with image information when said process cartridge is mounted in the main body of the recording apparatus.

15. A process cartridge according to either of claims 1 or 13, wherein said first and second frames are coupled by coupling means including a member defining a pivot and a compression spring for generating an

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elastic force between said image bearing member and said development means.

16. A process cartridge according to either claim 1 or claim 15, wherein said coupling means is fixed by a screw to said first frame, and said first and second frames are coupled in mutually rotatable manner about said pivot.

17. A process cartridge according to claim 15, wherein said pivot is composed of a cylindrical member fixed on said first frame.

18. A process cartridge according to claim 13, wherein said image bearing member is composed of an electrophotographic photosensitive drum, having a drum gear at a lateral end thereof.

19. A process cartridge according to claim 18, wherein said drum gear meshes with a developing sleeve gear provided at a lateral end of the developing sleeve in said development means, to thereby transmit rotary driving force to said developing sleeve.

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20. A process cartridge according to claim 15, wherein the developing sleeve of said development means is pressed toward the electrophotographic photosensitive drum of said image bearing member, by the elastic force of said compression spring.

21. A process cartridge according to claim 15, wherein the developing sleeve of said development means and the electrophotographic photosensitive drum of said image bearing member are mutually pressed by the elastic force of said compression spring.

22. A process cartridge according to claim 15, wherein the developing sleeve of said development means and the electrophotographic photosensitive drum of said image bearing member are arranged with a gap therebetween by the elastic force of said compression spring.

23. A recording apparatus for recording on a recording medium, comprising:

mounting means for mounting a process cartridge including:

a first frame supporting an image bearing member; and

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a second frame supporting development means for acting on said image bearing member to develop an image of said image bearing member;

wherein said first and second frames mutually cooperate to form an aperture when they are coupled; and

transport means for transporting said recording medium.

24. A recording apparatus according to either of claims 8 or 23 wherein said recording apparatus is either a laser beam printer or an electrophotographic copying apparatus.

25. A process cartridge including at least an image bearing member and development means and detachably attachable to an image forming apparatus,

wherein a member for defining the position of said development means relative to the image bearing member and a compression spring for biasing said development means toward the image bearing member are constructed as an integral unit, and said unit is utilized in positioning the development means in a support member for the image bearing member.

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26. A process cartridge according to claim 25, wherein the support member for said image bearing member is provided with cleaning means.

27. A process cartridge for a recording apparatus comprising a pair of support members pivotally interconnected in an easily detachable manner.

28. A process cartridge as claimed in claim 27, in which one support member has a pivot detachably held in a slot in the other member.

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PROCESS CARTRIDGE, RECORINDG APPARATUS, AND METHOD FOR ASSEMBLING PROCESS CARTRIDGE

The present invention realizes to shorten the assembling process of a process cartridge, by employing a first support member supporting an image bearing member, a second support member supporting a development unit for acting on the image bearing member to thereby develope an image of the image bearing member, a defining member for defining the rotary shaft between the first and second support members, and a compression spring for generating an elastic force between the image bearing member and the development unit.

FIG 2A & B

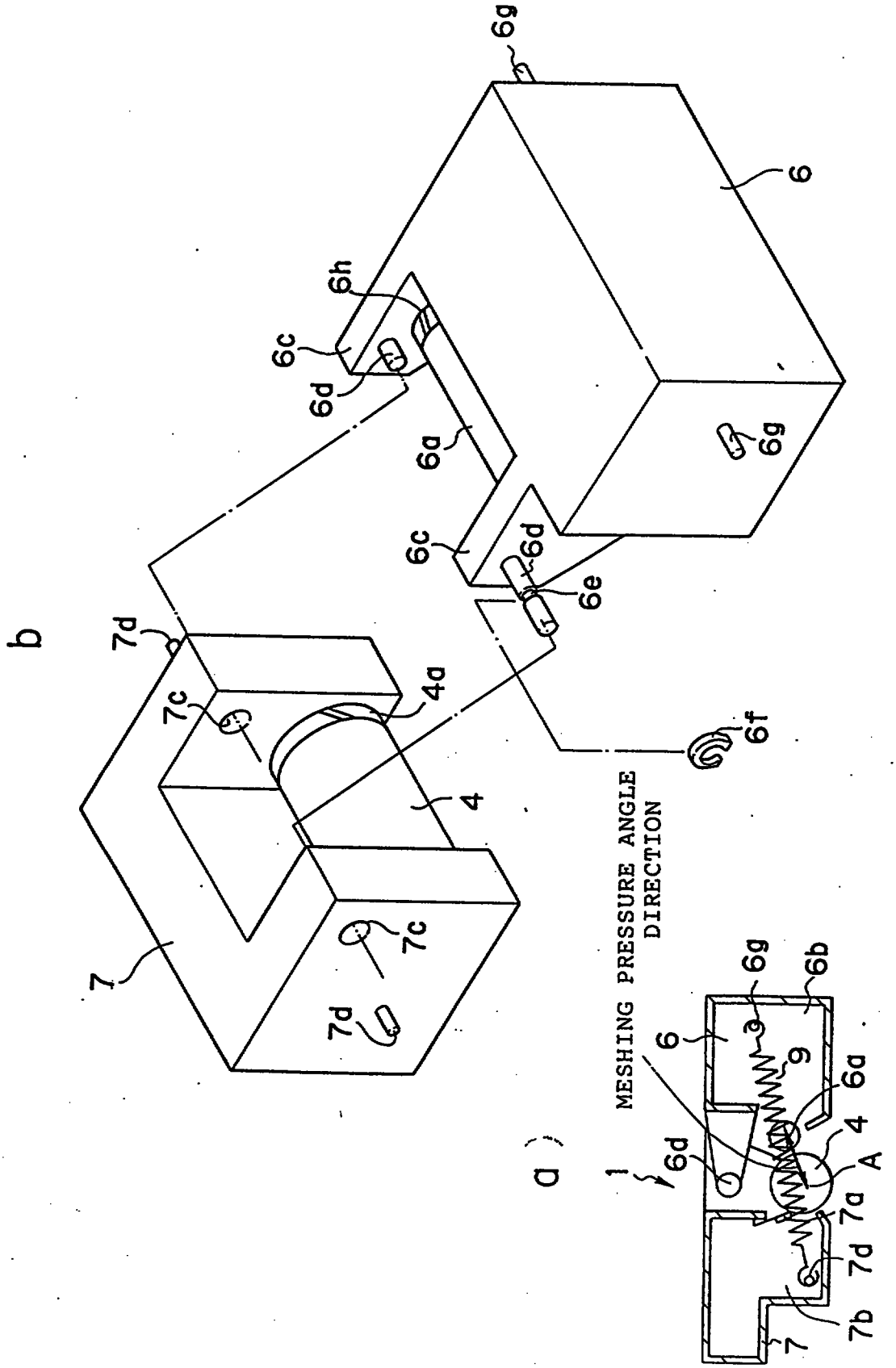
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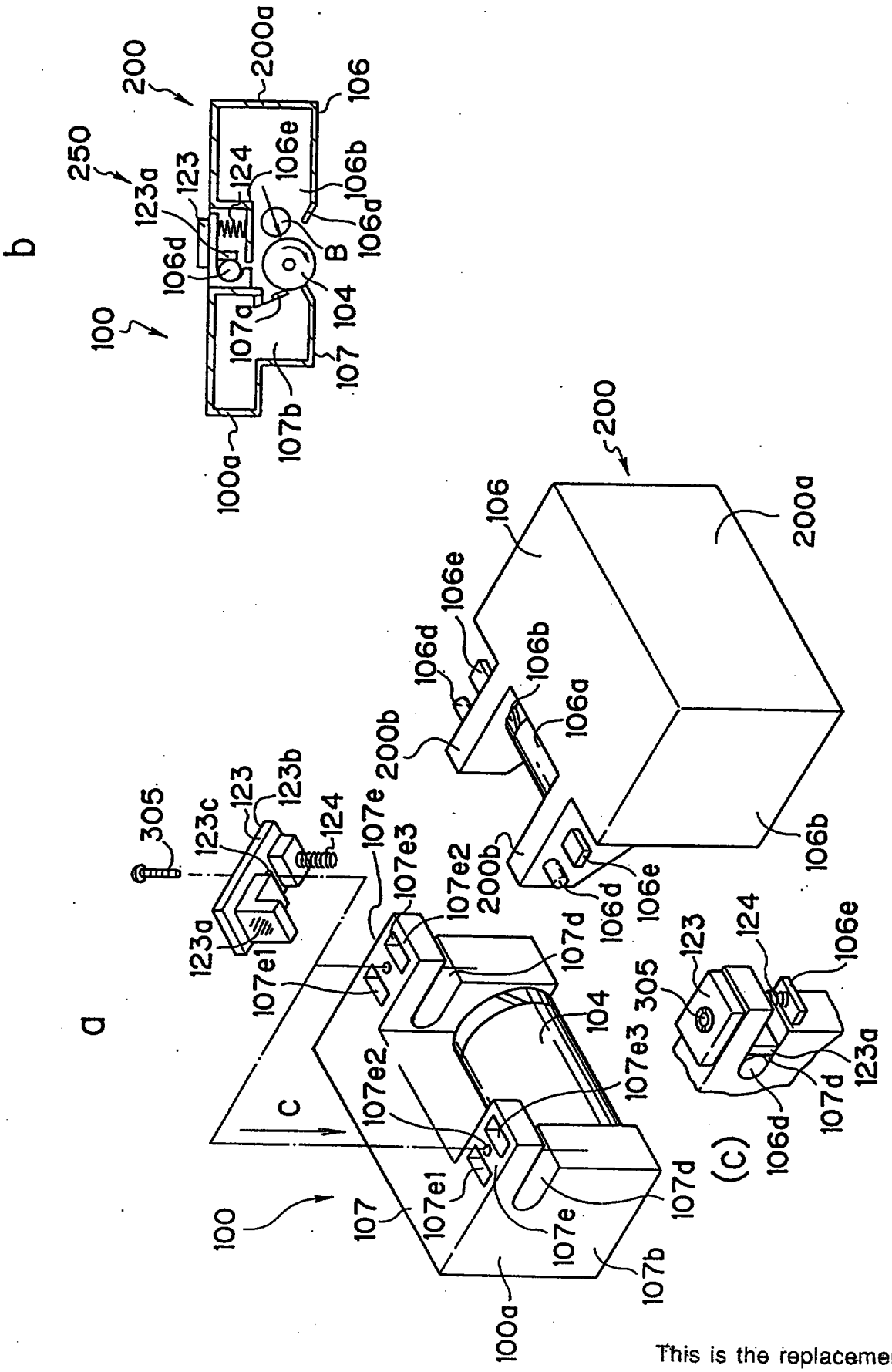
Fig. 1



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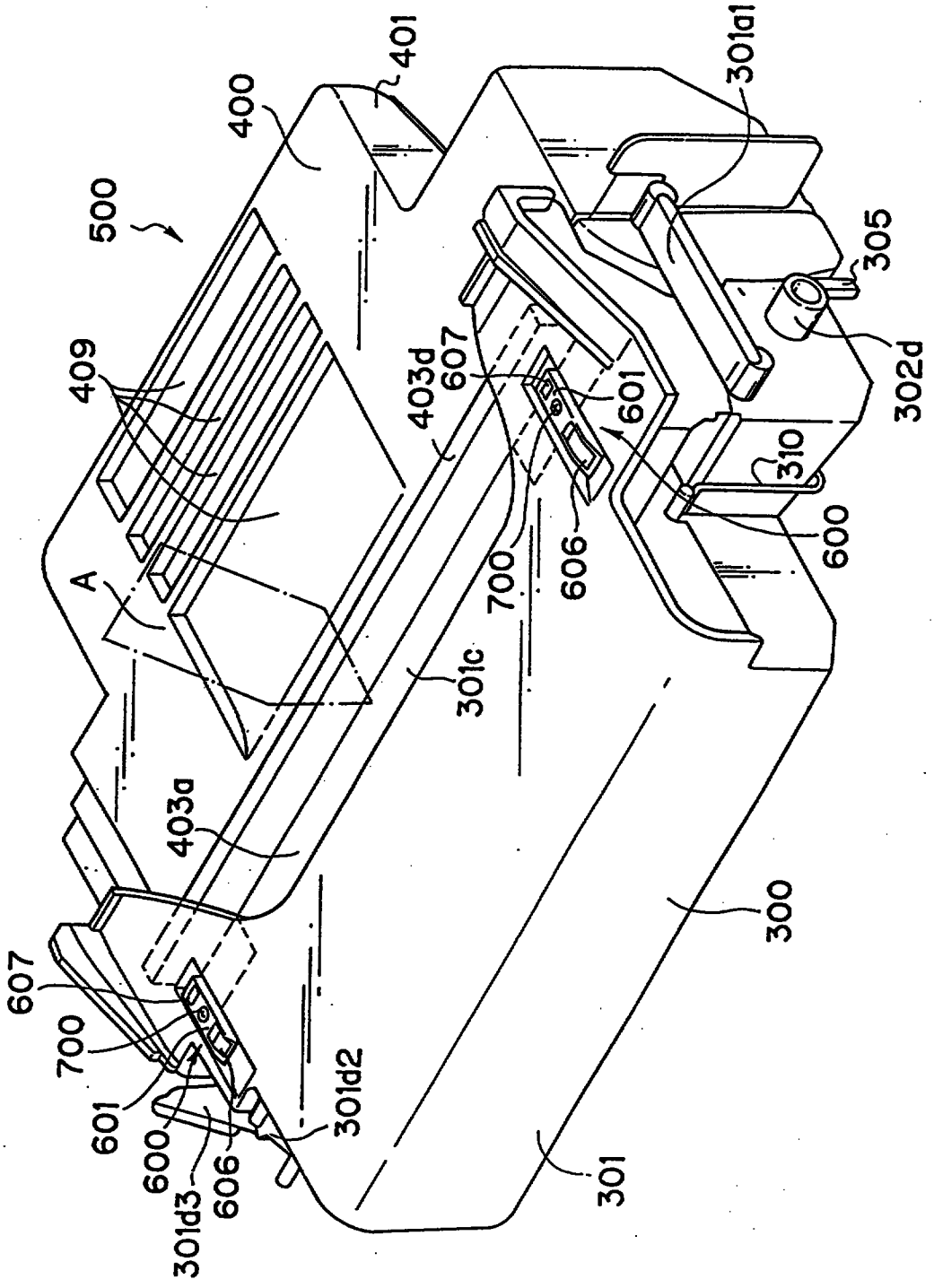
Fig. 2



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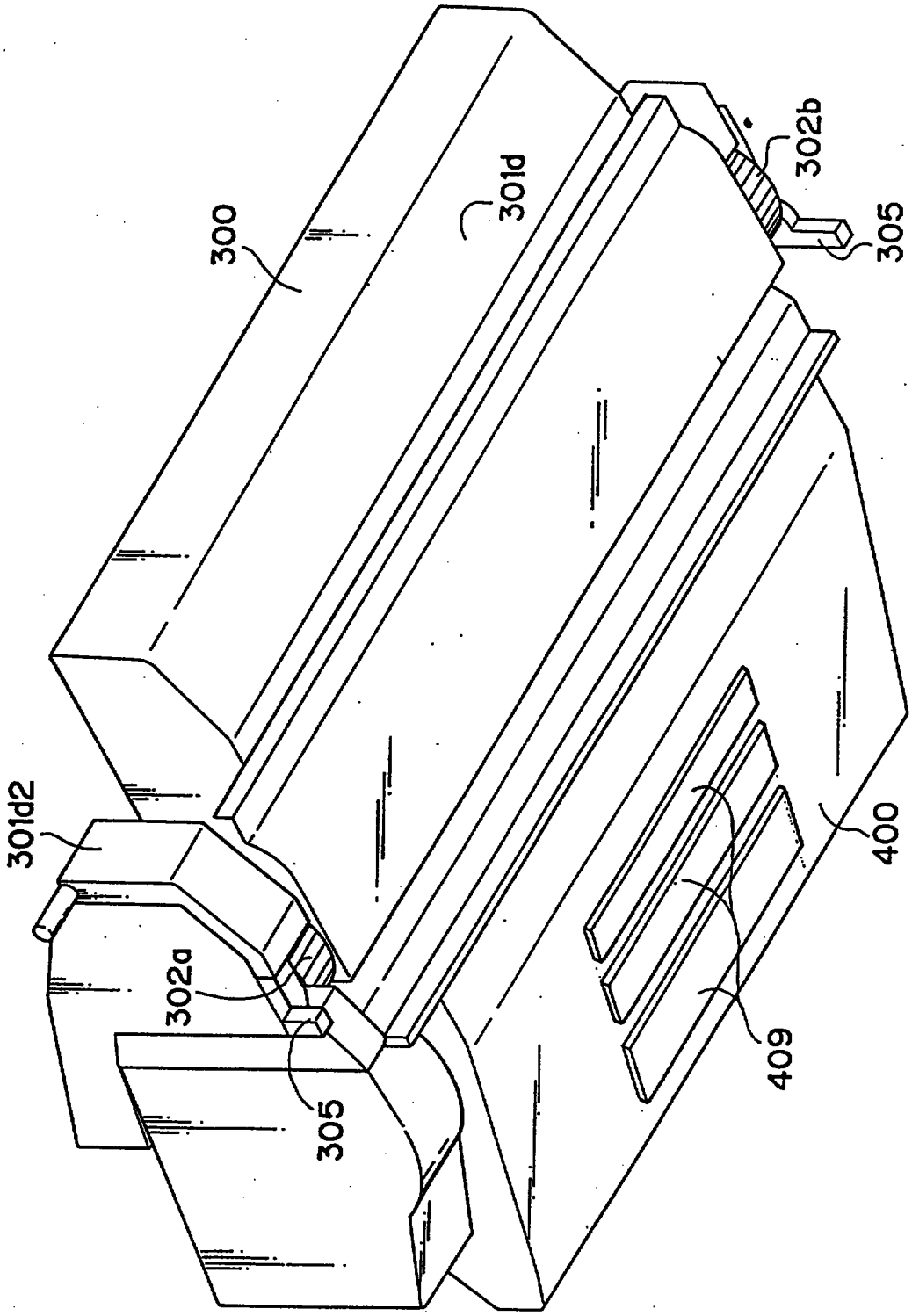
Fig. 3



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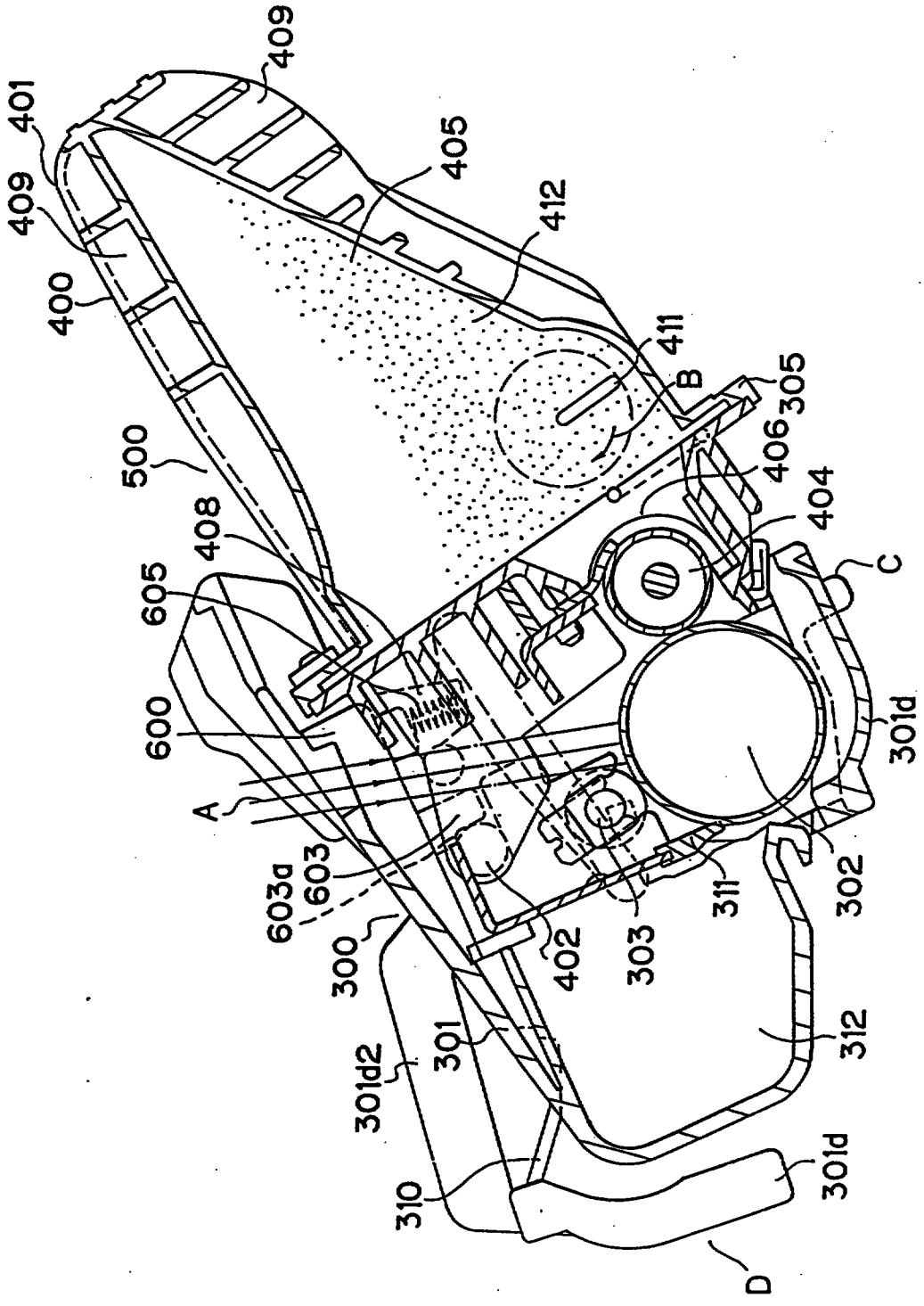
Fig. 4



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Fig. 5

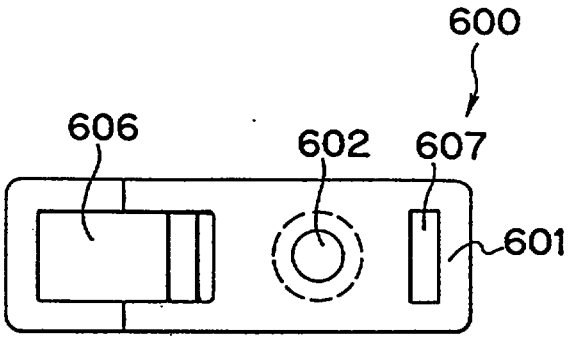


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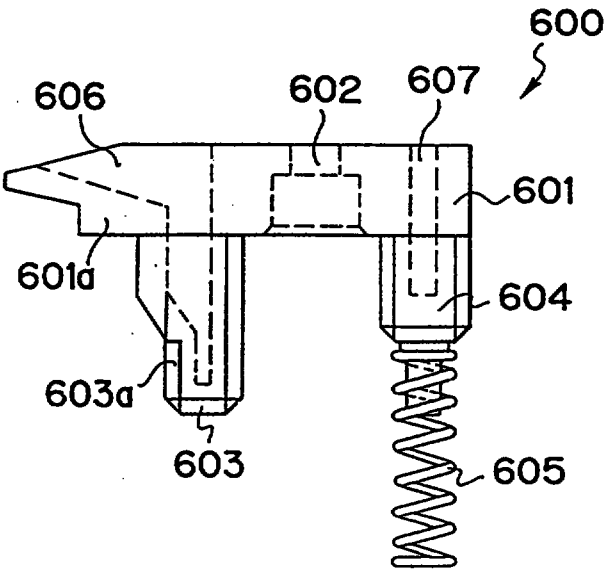
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Fig. 6

a



b

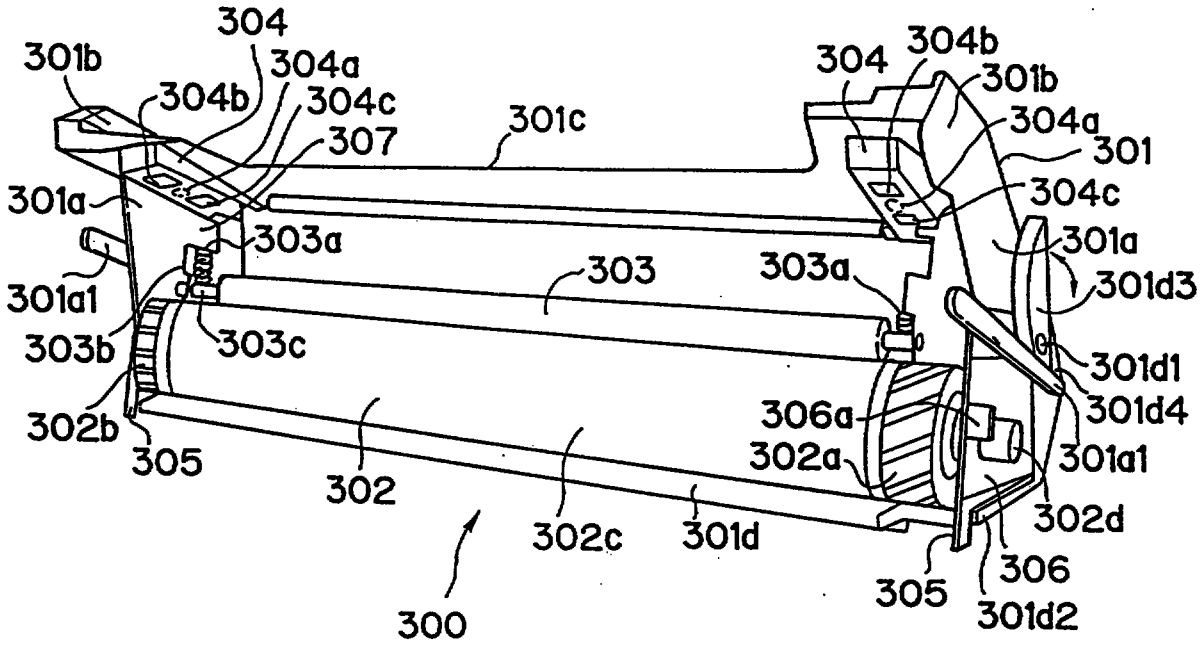


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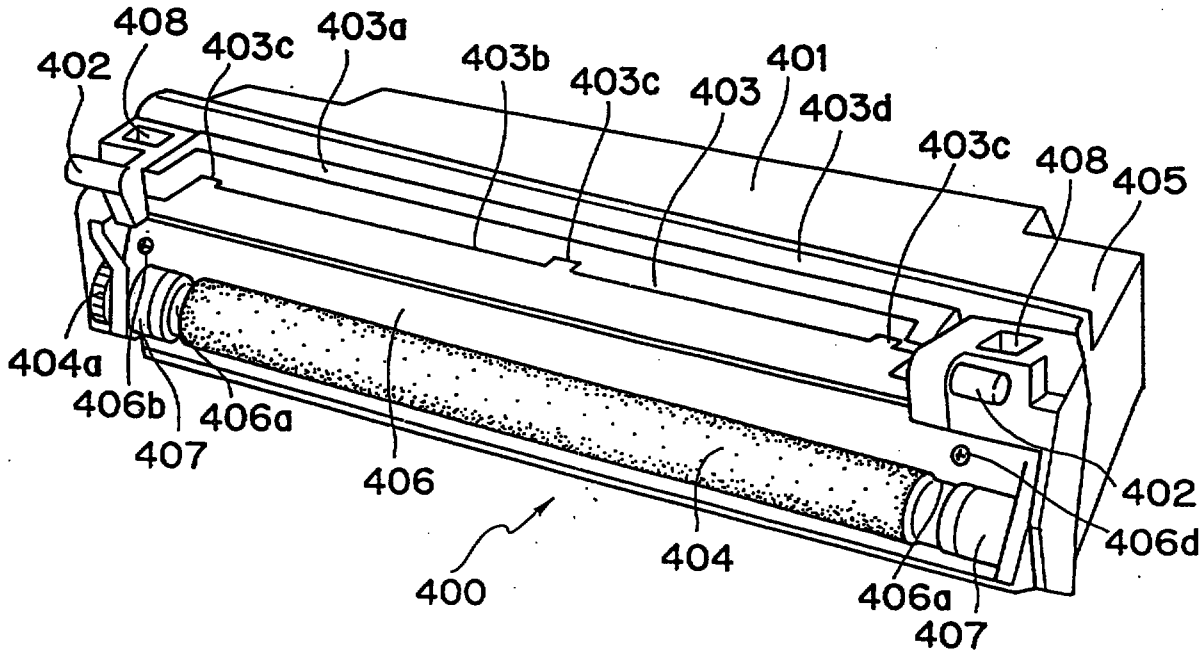
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Fig. 7

a



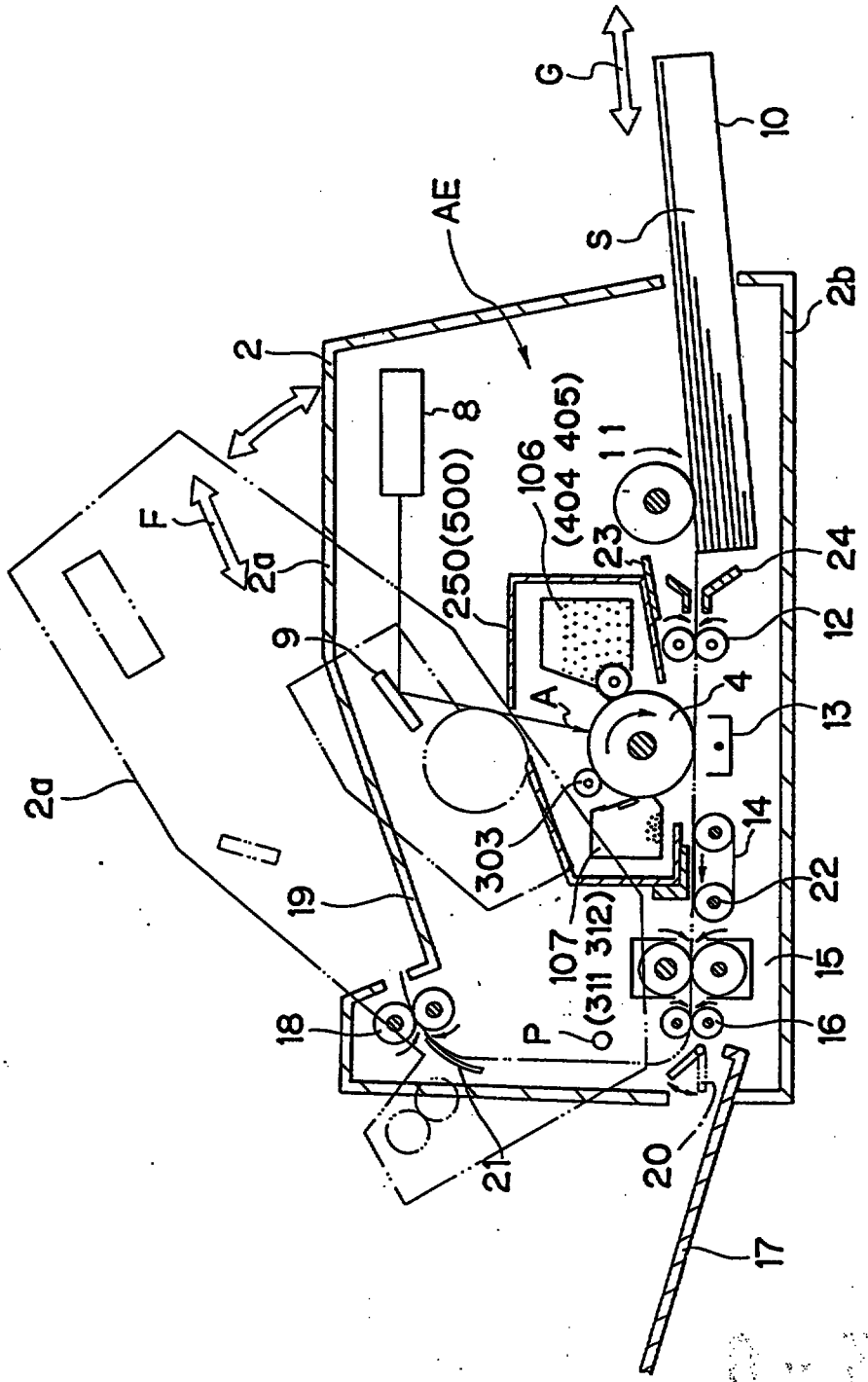
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Fig. 8



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☐ Drawing(s) : paged ..... to paged .....
☐ Abstract : paged ..... to paged .....

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Claims

1. An electrophotographic process cartridge (250, 500) adapted to be detachably mounted to the main body of a recording or image forming apparatus, comprising:

a) a first casing (100, 300) supporting an electrophotographic image bearing member (104, 302) for rotation about a first axis;
b) a second casing (200,400) supporting developing means (106a, 404) for acting on said image bearing member (104, 302) to develop images thereon;
c) first and second connecting means (106d, 107d, 123, 402, 307, 600) located at respective opposite sides of the cartridge and interconnecting the first and second casings (100, 200, 300, 400) for pivotal movement relative to each other about a second axis which is generally parallel to but spaced from said first axis;
d) first and second springs (124, 605) located at respective opposite sides of the cartridge and acting between said first and second casings (100, 200, 300, 400) for biassing them pivotally about said second axis towards each other for bringing the developing means (106a, 404) into a pre-determined position relative to the image bearing member (104, 302);

characterised in that:

(i) each connecting means (106d, 107d, 123, 402, 307, 600) comprises a pivot (106d, 402) on one of said casings (200, 400) engaged in a recess (107d, 307) on the other of said casings (100, 300) and a stopper (123, 600)

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received by and secured to said other casing (100, 300) at a position to retain the pivot (106d, 402) in the recess (107d, 307); and
(ii) each spring (124, 605) is a compression spring engaged with the stopper (123, 600) and arranged to act on said one casing (200, 400) to effect said biassing when the stopper (123, 600) is secured to said other casing (100, 300).

2. A cartridge (250, 500) according to claim 1, wherein each said stopper (123, 600) comprises a body (123b, 601) and a projection (123a, 603, 603a) on said body, the respective compression spring (124, 605) and said projection (123a, 603, 603a) being spaced apart from each other and extending away from said body (123b, 601) in substantially parallel directions, and wherein said projection (123a, 603, 603a) is arranged to engage the respective pivot (106d, 402) to retain the pivot (106d, 402) in the corresponding recess (107d, 307).

3. A cartridge (250, 500) according to claim 2, wherein said projection (123a, 603, 603a) and said respective compression spring (124, 605) are received in spaced apart first and second apertures (107e1, 107e3, 304b, 304c) provided in said other casing (100, 300).

4. A cartridge (250, 500) according to claim 2 or 3, wherein each said stopper (123, 600) includes a spring seat portion (604) attached to said body portion (123b, 601) at a position spaced from said projection (123a, 603, 603a) and extending therefrom in a direction parallel to said projection (123a, 603, 603a), said compression spring (124, 605) being secured to said spring seat portion (604).

5. A cartridge (250, 500) according to claim 4 as dependent upon claim 3, wherein said spring seat portion (604) is received in said second aperture (107e3, 304b).

6. A cartridge (250, 500) according to any preceding claim, wherein each said stopper (123, 600) is secured to said other casing (100, 300) by a removable screw (305, 700).

7. A cartridge (250, 500) according to claim 6 as dependent upon any of claims 2 to 5, wherein said screw (305, 700) passes through an opening (123c, 602) in said body portion (123b, 601) of said stopper (123, 600).

8. A cartridge (250, 500) according to any preceding claim, wherein said first casing (100, 300) includes a charger (303) for charging the electrophotographic image bearing member (104, 302); and a cleaner (107) for removing toner remaining on the electrophotographic image bearing member (104, 302).

9. A cartridge (250, 500) according to claim 8, wherein said charger (303) has a charging roller, and said cleaner (107) has a cleaning blade (107a, 311).

10. A process of assembling an electrophotographic process cartridge (250, 500) which comprises a first

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casing (100, 300) supporting an electrophotographic image bearing member (104, 302) for rotation about a first axis and a second casing (200, 400) supporting developing means (106a, 404) for acting on said image bearing member (104, 302) to develop images thereon, said second casing (200, 400) being connected to said first casing (100, 300) for pivotal movement relative thereto about a second axis which is generally parallel to but spaced from said first axis and said first and second casings (100, 200, 300, 400) being resiliently biassed for pivotal movement about said second axis towards each other for bringing the developing means (106a, 404) into a predetermined position relative to the image bearing member (104, 302);

said process being characterised by the steps of:

(i) engaging pivots (106d, 402) provided on one of said casings (200, 100, 400, 300) in recesses (107d, 307) provided on the other of said casings (100, 200, 300, 400), there being a said pivot (106d, 402) and corresponding recess (107d, 307) at each side of the cartridge (250, 500), and

(ii) securing to said other casing (100, 200, 300, 400) first and second stoppers (123, 600) at respective opposite sides of the cartridge with each stopper (123, 600) engaged with a respective compression spring (124, 605), so that the stopper (123, 600) retains the corresponding pivot (106d, 402) in the corresponding recess (107d, 307) to provide said interconnection for pivotal movement and each compression spring (124, 605) acts on said one casing (200, 100, 400, 300) to effect said resilient biassing.

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11. A process according to claim 10, including the step, in respect of each stopper (123, 600), of engaging a projection (123a, 603, 603a) thereof in a respective first aperture (107e1, 304c) in said other casing (100, 200, 300, 400) so that said projection (123a, 603, 603a) retains the corresponding pivot (106d, 402) in the corresponding recess (107d, 307) and disposing each compression spring (124, 605) in a corresponding second aperture (107e3, 304b) in said other casing (100, 20, 300, 400) spaced from said respective first aperture.

12. A process according to claim 11, including the step, in respect of each said stopper (123, 600), of inserting a spring seat portion (604) thereof, to which said respective compression spring (124, 605) is attached, in said respective second aperture (107e3, 304b).

13. A process according to any of claims 10 to 12, including the step of securing each said stopper (123, 600) to said other casing (100, 200, 300, 400) by a respective removable screw (305, 700).

14. A stopper unit (123, 600) for use in the cartridge (250, 500) of any of claims 1 to 9 or the assembly process of any of claims 10 to 13, the stopper unit (123, 600) comprising:

a) a body portion (123b, 601):
b) a projection carried by said body portion (123a, 603, 603a); and
c) a compression spring (124, 605) carried by said body portion (123b, 601) at a position spaced from said projection (123a, 603, 603a), said projection (123a, 603, 603a) and said compression spring (124, 605) being generally parallel to each other and extending away from said body portion (123b, 601) in the same direction.

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15. A stopper unit (123, 600) according to claim 14, wherein said body portion (123b, 601) includes a spring seat portion (604) projecting therefrom and to which said compression spring (124, 605) is attached.

16. An electrophotographic recording apparatus for recording on a recording medium comprising mounting means (22, 23) for removably receiving a process cartridge, a process cartridge (250, 500) in accordance with any of claims 1 to 9 mounted in said mounting means (22, 23), means (8, 9) for supplying light to the image bearing member (104, 302) for forming images thereon, transport means (24, 12, 14, 22, 16) for transporting a recording medium relative to the cartridge (250, 500), and transfer means (13) for transferring developed images from the image bearing member (4) to the recording medium.

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REPLACEMENT SHEET

PROCESS CARTRIDGE, RECORINDG APPARATUS, AND METHOD FOR ASSEMBLING PROCESS CARTRIDGE

The present invention realizes to shorten the assembling process of a process cartridge, by employing a first support member supporting an image bearing member, a second support member supporting a development unit for acting on the image bearing member to thereby develope an image of the image bearing member, a defining member for defining the rotary shaft between the first and second support members, and a compression spring for generating an elastic force between the image bearing member and the development unit.

FIG 2A & B

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15. A stopper unit (123, 600) according to claim 14, wherein said body portion (123b, 601) includes a spring seat portion (604) projecting therefrom and to which said compression spring (124, 605) is attached.

16. An electrophotographic recording apparatus for recording on a recording medium comprising mounting means (22, 23) for removably receiving a process cartridge, a process cartridge (250, 500) in accordance with any of claims 1 to 9 mounted in said mounting means (22, 23), means (8, 9) for supplying light to the image bearing member (104, 302) for forming images thereon, transport means (24, 12, 14, 22, 16) for transporting a recording medium relative to the cartridge (250, 500), and transfer means (13) for transferring developed images from the image bearing member (4) to the recording medium.

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☐ Drawing(s) : paged ..... to paged .....
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REPLACEMENT SHEET

PROCESS CARTRIDGE, RECORINDG APPARATUS, AND METHOD FOR ASSEMBLING PROCESS CARTRIDGE

The present invention realizes to shorten the assembling process of a process cartridge, by employing a first support member supporting an image bearing member, a second support member supporting a development unit for acting on the image bearing member to thereby develope an image of the image bearing member, a defining member for defining the rotary shaft between the first and second support members, and a compression spring for generating an elastic force between the image bearing member and the development unit.

FIG 2A & B

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