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(71) Applicant: CANON KABUSHIKI KAISHA [JP/JP]; 30-2, Shimomaruko 3-chome, Ohta-ku, Tokyo 146-8501 (JP).

(72) Inventors: KAWAGUCHI, Hideshi; 13-32-303, Wakabacho, Numazu-shi, Shizuoka 410-0059 (JP). KUBOTA, Takeshi; 1-7-17, Fuyodai, Mishima-shi, Shizuoka 411-0046 (JP).

(74) Agent: YAMADA, Ryuichi; Toko International Patent Office, Hasegawa Bldg. 4F, 7-7, Toranomon 3-chome, Minato-ku, Tokyo 105-0001 (JP).

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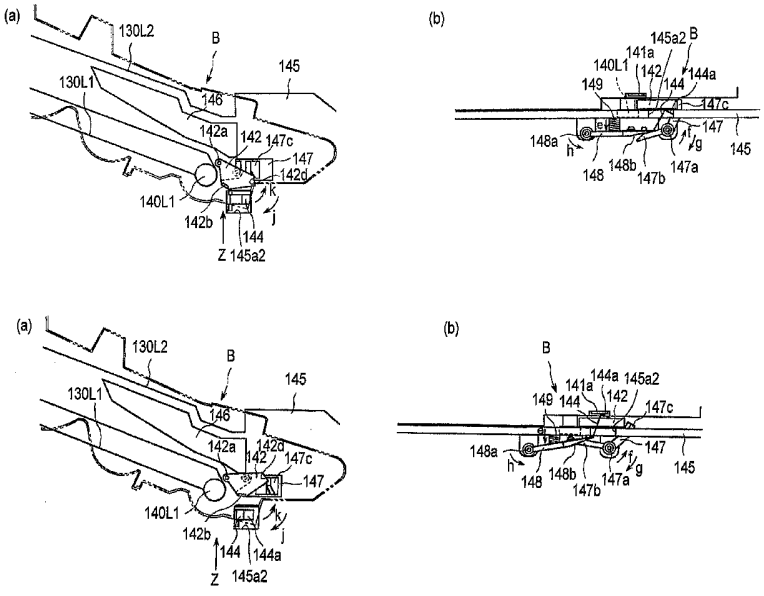
(54) Title: PROCESS CARTRIDGE AND ELECTROPHOTOGRAPHIC IMAGE FORMING APPARATUS



(57) Abstract: A process cartridge (B) detachably mountable to a main assembly (A) of an electrophotographic image forming apparatus (100), the main assembly (A) including an output contact (144a) movable between an electrical connecting position and a retracted position retracted from the electrical connecting position, displaceable member (147) for moving the output contact (144a), and an elastic function member (149) for elastically urging the displaceable member (147) to urge the output contact (144a) toward the retracted position away from the electrical connecting position, the process cartridge (B) includes an electrophotographic photosensitive drum (107); process means (108) actable on the electrophotographic photosensitive drum (107); a movable operation member (142) movable relative to a cartridge frame (B1), wherein after the process cartridge (B) is mounted to the main assembly (A) of the apparatus, the movable operation member (142) is displaced by a driving force transmitted from the main assembly (A) of the electrophotographic image forming apparatus (100) to the process cartridge (B), so that movable operation member (142) is engaged with the displaceable member (147) provided in the main assembly (A) of the electrophotographic image forming apparatus (100) to move the displaceable member (147), in interrelation with which the output contact (144a) is moved from the retracted position to the electrical connection position against an elastic force of the elastic function member (149); an input electrical contact (141a) for receiving a voltage for enabling the process means (108) by engagement with the output contact (144a) moved to the electrical connecting position.

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DESCRIPTION

PROCESS CARTRIDGE AND ELECTROPHOTOGRAPHIC IMAGE FORMING APPARATUS

[TECHNICAL FIELD]

The present invention relates to a process cartridge and an electrophotographic image forming apparatus usable with the process cartridge.

Here, the electrophotographic image forming apparatus is A apparatus for forming the image on a recording material (recording sheet, OHP sheet or the like) through an electrophotographic image forming process. It includes A electrophotographic copying machine, electrophotographic printer or the like.

The process cartridge is a cartridge containing as a unit an electrophotographic photosensitive member and process means including at least one of charging member and developing member, which cartridge is detachably mountable to a main assembly of the electrophotographic image forming apparatus.

[BACKGROUND ART]

With the electrophotographic image forming apparatus of the process cartridge type, the process cartridge can be mounted to or demounted from the main

assembly of the image forming apparatus by the user without an expert serviceman. Therefore, the operationality of the image forming apparatus is remarkably improved.

In such an electrophotographic image forming apparatus, it is necessary to supply electric voltages to a charging member for electrically charging the electrophotographic photosensitive member (photosensitive drum), a developing member for developing an electrostatic latent image formed on the photosensitive drum, and the like, which are contained in the process cartridge.

Heretofore, a provision of the cartridge is provided with an input electrical contact for electrical connection between the cartridge and the main assembly of the apparatus when the cartridge is mounted in place in the main assembly of the image forming apparatus. On the other hand, the main assembly of the apparatus is provided with an output contact. With this structure, when the cartridge is mounted to the main assembly of the apparatus, the input electrical contact is connected with the output contact. By doing so, the voltage can be supplied from the main assembly of the apparatus to the cartridge.

More particularly, the following structure is known.

A movable protection plate covering the contact

member (the output contact) is provided in the main assembly of the apparatus. When the printer (image forming apparatus) is subjected to a maintenance operation, the operator and/or a tool is prevented from touching the contact member. By inserting motion of the cartridge into the main assembly of the apparatus, the protection plate is retracted to a retracted position. By doing so, the electrical connection is permitted between the contact member in the main assembly of the apparatus Ad the contact member on the cartridge (input electrical contact) (paragraphs ([0012] -[0015], Figure 1 - Figure 3 of Japanese Laid-open Patent Application Hei 7 - 77921).

When the unit is dismounted from the main assembly of the apparatus, a connector pin (output contact) is hidden inside a partition wall. By doing so, the serviceman or user is prevented from touching the connector pin. By the insertion of the unit into the main assembly of the apparatus, the connector pin enters the unit insertion space. Thus, the connector pin and connector portion of the unit (input electrical contact) are electrically connected (Japanese Laid-open Patent Application Sho 62 - 215278).

In addition, the drum shutter is provided with a regulating portion. The regulating portion is effective to covering the electrical contact (input

electrical contact). By doing so, the contact defect which may be caused by deposition of foreign matter on the electrical contact, can be prevented. By the entering of the cartridge into the main assembly of the apparatus, the electrical contact of the cartridge and the electrical contact of the main assembly of the apparatus (output contact) are electrically connected. (Japanese Laid-open Patent Application Hei 10 - 74030).

A contact member (output contact) is provided and is movable between a retracted position and a regular position. By doing so, the contact portion of the cartridge (input electrical contact) and the contact member of the main assembly of the apparatus are contacted with each other in order. Before the cartridge is inserted into the main assembly of the apparatus, the contact member (output contact) is in the retracted position. When the cartridge is mounted to the main assembly of the apparatus, the contact member is moved to the regular position. By this, the contact portion and the contact portion are electrically connected with each other. (Japanese Laid-open Patent Application Hei 9 - 68833).

[DISCLOSURE OF THE INVENTION]

The present invention provides a further improvements in such structures.

Accordingly, it is a principal object of the

present invention to provide a process cartridge and an electrophotographic image forming apparatus wherein when a process cartridge is mounted to the main assembly of the electrophotographic image forming apparatus, the reliability of establishment of the electrical connection between an input electrical contact of the process cartridge and an output contact of the main assembly of the image forming apparatus.

It is Aother object of the present invention to provide a process cartridge and an electrophotographic image forming apparatus wherein damage of an electric circuit provided in the main assembly of the electrophotographic image forming apparatus can be prevented.

According to an aspect of the present invention, there is provided a process cartridge and an electrophotographic image forming apparatus which comprises a movable operation member movable relative to a cartridge frame, wherein after the process cartridge is mounted to the main assembly of the apparatus, the movable operation member is displaced by a driving force transmitted from the main assembly of the electrophotographic image forming apparatus to the process cartridge, so that movable operation member is engaged with a displaceable member provided in the main assembly of the electrophotographic image forming apparatus to move the displaceable member, in

interrelation with which an output contact of the main assembly is moved from the retracted position to an electrical connection position against an elastic force of the elastic function member, by which the assurance of establishment of electrical connection between the input electrical contact and the output contact is improved.

According to another aspect of the present invention, there is provided a process cartridge and an electrophotographic image forming apparatus which comprises a movable operation member movable relative to a cartridge frame, wherein after the process cartridge is mounted to the main assembly of the apparatus, the movable operation member is displaced by a driving force transmitted from the main assembly of the electrophotographic image forming apparatus to the process cartridge, so that movable operation member is engaged with a displaceable member provided in the main assembly of the electrophotographic image forming apparatus to move the displaceable member, in interrelation with which an output contact is moved from a retracted position to an electrical connection position against an elastic force of an elastic function member provided in the main assembly of the apparatus, by which the damage of the electric circuit provided in the main assembly of the image forming apparatus is prevented.

It is a further object of the present invention to provide a process cartridge and an electrophotographic image forming apparatus wherein an output contact is moved relative to a stationary input electrical contact to establish the electrical connection therebetween, by which the electrical connection therebetween is assured.

These and other objects, features Ad advantages of the present invention will become more apparent upon a consideration of the following description of the preferred embodiments of the present invention taken in conjunction with the accompanying drawings.

[BRIEF DESCRIPTION OF THE DRAWINGS]

Figure 1 is a sectional view of the process cartridge according to an embodiment of the present invention.

Figure 2 illustrates a structure of an image forming apparatus according to an embodiment of the present invention.

Figure 3 is a perspective view of the image forming apparatus according to the embodiment of the present invention.

Figure 4 shows a mounting portion of the main assembly of the apparatus to accept the process cartridge according to the embodiment of the present

invention.

Figure 5 shows a mounting portion of the main assembly of the apparatus to accept the process cartridge according to the embodiment of the present invention.

Figure 6 is a perspective view of a process cartridge according to the embodiment of the present invention.

Figure 7 is a perspective view of a process cartridge according to the embodiment of the present invention.

Figure 8 is a perspective view wherein the developing unit and the drum unit are shown as being separated to illustrate the structures of the process cartridge of the embodiment of the present invention.

Figure 9 is a perspective view wherein the developing unit and the drum unit are shown as being separated to illustrate the structures of the process cartridge of the embodiment of the present invention.

Figure 10 illustrates a structure of a drum unit of the process cartridge according to an embodiment of the present invention.

Figure 11 illustrates a structure of a drum unit of the process cartridge according to an embodiment of the present invention.

Figure 12 illustrates a structure of a movable operation member of the process cartridge according to

the embodiment of the present invention.

Figure 13 is a perspective view showing a structure of an electrical contact provided in main assembly of the image forming apparatus according to an embodiment of the present invention.

Figure 14 illustrates a structure of a mounting portion provided in the main assembly of the image forming apparatus according to the embodiment of the present invention.

Figure 15 illustrates structures of the movable operation member and the electrical contact of the image forming apparatus according to the embodiment of the present invention.

Figure 16 illustrates structures of the movable operation member and the electrical contact of the image forming apparatus according to the embodiment of the present invention.

Figure 17 illustrates structures of the movable operation member and the electrical contact of the image forming apparatus according to the embodiment of the present invention.

Figure 18 illustrates structures of the movable operation member and the electrical contact of the image forming apparatus according to the embodiment of the present invention.

Figure 19 is a side view illustrating a major part of a movable operation member of a process

cartridge according to an embodiment of the present invention.

Figure 20 is a partly broken top plan view illustrating a structure of a movable operation member of a process cartridge according to an embodiment of the present invention.

Figure 21 illustrates a structure of a circuit board in the image forming apparatus according to the embodiment of the present invention.

Figure 22 is a side view illustrating a major part of the movable operation member of a process cartridge according to another embodiment of the present invention.

Figure 23 illustrates structures of the movable operation member and the electrical contact of the image forming apparatus.

Figure 24 illustrates structures of the movable operation member and the electrical contact of the image forming apparatus.

Figure 25 illustrates structures of the movable operation member and the electrical contact of the image forming apparatus.

Figure 26 illustrates structures of the movable operation member and the electrical contact of the image forming apparatus.

Figure 27 illustrates a movable operation member and a contact of a process cartridge according

to a further embodiment.

Figure 28 illustrates a movable operation member and a contact of a process cartridge according to a further embodiment.

Figure 29 illustrates a movable operation member and a contact of a process cartridge according to a further embodiment.

Figure 30 illustrates a movable operation member and a contact of a process cartridge according to a further embodiment.

Figure 31 illustrates a movable operation member and a contact of a process cartridge according to a further embodiment.

Figure 32 is a side view of a major part of a movable operation member of a process cartridge according to a further embodiment of the present invention.

Figure 33 is a side view of a major part of a movable operation member of a process cartridge according to a further embodiment of the present invention.

Figure 34 is a perspective view showing a structure of an electrical contact of a main assembly of the image forming apparatus according to a further embodiment of the present invention.

Figure 35 illustrates structures of the movable operation member and the electrical contact of the

image forming apparatus.

Figure 36 illustrates structures of the movable operation member and the electrical contact of the image forming apparatus.

Figure 37 illustrates structures of the movable operation member and the electrical contact of the image forming apparatus.

Figure 38 is a perspective view showing a structure of a movable operation member of a process cartridge according to a further embodiment of the present invention.

Figure 39 is a perspective view showing a structure of a movable operation member of a process cartridge according to a further embodiment of the present invention.

Figure 40 is a perspective view showing a structure of a movable operation member of a process cartridge according to a further embodiment of the present invention.

Figure 41 is a side view of a structure of a movable operation member according to a further embodiment of the present invention.

Figure 42 is a side view of a structure of a movable operation member according to a further embodiment of the present invention.

Figure 43 is a perspective view showing a structure of an electrical contact of a main assembly

of the image forming apparatus according to a further embodiment of the present invention.

Figure 44 is a perspective view showing a structure of an electrical contact of a main assembly of the image forming apparatus according to a further embodiment of the present invention.

Figure 45 illustrates structures of the movable operation member and the electrical contact of the image forming apparatus.

Figure 46 illustrates structures of the movable operation member and the electrical contact of the image forming apparatus.

Figure 47 is a perspective view showing a structure of a movable operation member of a process cartridge according to a further embodiment of the present invention.

Figure 48 is a perspective view showing a structure of a movable operation member of a process cartridge according to a further embodiment of the present invention.

Figure 49 is a perspective view showing a structure of a movable operation member of a process cartridge according to a further embodiment of the present invention.

Figure 50 is a side view of a structure of a movable operation member according to a further embodiment of the present invention.

Figure 51 is a side view of a structure of a movable operation member according to a further embodiment of the present invention.

Figure 52 illustrates structures of the movable operation member and the electrical contact of the image forming apparatus.

Figure 53 is a perspective view showing a structure of a movable operation member of a process cartridge according to a further embodiment of the present invention.

Figure 54 illustrates structures of the movable operation member and the electrical contact of the image forming apparatus.

Figure 55 illustrates structures of the movable operation member and the electrical contact of the image forming apparatus.

Figure 56 illustrates structures of the movable operation member and the electrical contact of the image forming apparatus.

Figure 57 illustrates a structure of the movable operation member of the process cartridge according to the embodiment of the present invention.

Figure 58 illustrates a structure of an electrical contact portion in the main assembly of the image forming apparatus according to the embodiment of the present invention.

[BEST MODE FOR CARRING OUT THE INVENTION]

The process cartridge and electrophotographic image forming apparatus according to the present invention will be described in conjunction with the accompanying drawings.

EMBODIMENT 1:

(1) General Structure of Process Cartridge:

Referring to Figure 1, a process cartridge B (cartridge) according to a first embodiment of the present invention will be described. Figure 1 is a sectional view of the cartridge B.

In Figure 1, the cartridge B comprises A electrophotographic photosensitive drum (photosensitive drum) 107. As shown in Figure 2, when the cartridge B is mounted to the main assembly A of the electrophotographic image forming apparatus (main assembly of the apparatus), the photosensitive drum 107 is rotatable by receiving a driving force from the main assembly A.

Disposed opposed to an outer surface of the photosensitive drum 107 is a charging roller 108 functioning as a charging member. The charging roller 108 is supplied with a voltage from the main assembly A of the apparatus Ad electrically charges the

photosensitive drum 107. The charging roller 108 is contacted to the photosensitive drum 107 and is rotated by the photosensitive drum 107.

When the cartridge B is mounted to the main assembly A of the apparatus, the charging roller 108 is supplied with a voltage from the main assembly 100 of the apparatus through a charging output contact 144a (Figure 4) functioning as A output contact and a charging input electrical contact 141a (Figure 10) functioning as A input electrical contact. The charging roller 108 functions by the voltage to electrically charge the photosensitive drum 107.

The cartridge B includes a developing roller 110 functioning as a developing member. The developing roller 110 supplies the developer t into a developing zone adjacent a photosensitive drum 107. The developing roller 110 develops A electrostatic latent image formed on the photosensitive drum 107 with the developer t. The developing roller 110 contains a magnet roller (stationary magnet) 111.

When the cartridge B is mounted to the main assembly A of the apparatus, the developing roller 110 is supplied with a voltage from the main assembly 100 of the apparatus through a development output contact (unshown) functioning as A output contact and a development input electrical contact (unshown)functioning as A input electrical contact.

The developing roller 110 functions by the thus applied voltage to develop the electrostatic latent image.

To the peripheral surface of the developing roller 110, a developing blade 112 is contacted. The developing blade 112 functions to regulate an amount of the developer t deposited on the peripheral surface of the developing roller 110. The developing blade 112 also functions to triboelectrically charge the developer t.

The developer t accommodated in the developer accommodating container 114 is supplied out into the developer chamber 113a by rotation of the stirring members 115, 116. The developing roller 110 supplied with the voltage through the electrical contact 160a is rotated. By doing so, a layer of the developer having the triboelectric charge applied by the developing blade 112 is formed on the surface of the developing roller 110. The developer t is transferred onto the photosensitive drum 107 in accordance with the pattern of the latent image. Thus, the latent image developed.

The developed image on the photosensitive drum 107 is transferred onto a recording material 102 by a transfer roller 104.

Disposed opposed to the outer surface of the photosensitive drum 107 is A elastic cleaning blade

117a. The cleaning blade 117a has A edge which is contacted to the photosensitive drum 107. The blade 117a functions to remove the developer t remaining on the photosensitive drum 107 after transfer of the developed image onto the recording material 102. The developer t removed from the surface of the photosensitive drum 107 by the blade 117a is accommodated in a removed developer container 117b.

The cartridge B is constituted by the developing unit 119 and the drum unit 120.

The developing unit 119 is constituted by the developing device frame 113 which is a part of the cartridge frame B1. The developing unit 119 contains the developing roller 110, the developing blade 112, the developer chamber 113a, the developer accommodating container 114 and stirring members 115, 116. A development input electrical contact (unshown) is provided exposed from the developing device frame 113.

The drum unit 120 contains the photosensitive drum 107, the cleaning blade 117a, the removed developer container 117b and the charging roller 108. An electrical contact is provided on the drum frame 118 and is exposed.

One end of the photosensitive drum 107 is supported by the drum frame 118. An outer end of the drum shaft 139 functions as a cartridge guide 140L1

which will be described hereinafter referring to Figure 7.

As will be understood from Figure 6, cartridge guides 140R1, 140R2 are provided at one longitudinal end 120a of the drum unit 120. As shown in Figure 7, a cartridge guide 140L1 and another cartridge guide 140L2 are provided at the other longitudinal end 120b.

The developing unit 119 and the drum unit 120 are rotatably coupled with each other by pins P (Figure 1). The developing roller 110 is urged to the photosensitive drum 107 by A elastic member 121, 122 (Figure 8) which is provided between the units 119, 120. Designated by 119a is A arm which is provided in the developing unit 119. The arm 119a is engaged with the drum unit 120, too. A pin P is penetrated through holes formed in the units 119, 120.

Referring to Figures 8 and 9, more detailed description will be made. Free ends of arm portions 119a, 119b are provided adjacent longitudinally opposite end portions of the developing device frame 113, and are provided with circular rotation holes 119c, 119d extending parallel with developing roller 110. At two positions of the longitudinal ends of the drum frame 118, recesses 118a, 118b are provided to receive the arm portion 119a, 119b. The arm portions 119a, 119b are inserted into recesses 118a, 118b. Then, coupling members, namely, pins P are inserted into

mounting holes 118c, 118d of the drum frame 118. In addition, pins P are engaged into the rotation holes 119c, 119d of the arm portions 119a, 119b. Then, in the pins P are press-fitted into holes (unshown) formed inside of the drum frame 118. In this manner, the pins P are mounted. By doing so, the drum unit 120 and the developing unit 119 are rotatably coupled by the pins (coupling members) and therefore, they are rotatable about the pins. In this case, compression coil springs 121, 122 mounted to the base portions of the arm portion 119a, 119b abut to upper walls of the recesses 118a, 118b of the drum frame 118. By this, the developing unit 119 is urged downwardly by the elastic force provided by the springs 121, 122. In this manner, the developing roller 110 is assuredly press against the photosensitive drum 107.

(2) Electrophotographic Image Forming Apparatus.

Referring to Figure 2, the description will be made as to the electrophotographic image forming apparatus 100 with which the cartridge B is usable. Figure 2. Shows a general arrangement of an electrophotographic image forming apparatus (image forming apparatus) 100.

The description will be made as to a laser beam printer which is A exemplary image forming apparatus

100.

In the image forming operation, a surface of the photosensitive drum 107 is uniformly charged by the charging roller 108. A laser beam is emitted from a laser diode and is projected onto the photosensitive drum 107 in accordance with image information with optical means 101 including a polygonal mirror, lenses Ad deflection mirrors (unshown). By doing so, an electrostatic latent image is formed on the photosensitive drum 107 corresponding to the image information. The latent image is developed by the developing roller 110 which has been described hereinbefore.

On the other hand, in synchronism with the formation of the developed image, a recording material 102 in a cassette 103a is fed out by pick-up roller 103b and is fed to a transfer position by feeding rollers 103c, 103d, 103e. At the transfer position, a transfer roller 104 (transferring means) is provided. The transfer roller 104 is supplied with a voltage. By this, the developed image formed on the photosensitive drum 107 is transferred onto the recording material 102.

The recording material 102 now having the developed image transferred thereto is fed to fixing means 105 through a guide 103f. The fixing means 105 includes a driving roller 105c and a fixing roller

105b containing a heater 105a therein. The fixing means 105 applies heat and pressure to the recording material 102 passing therethrough to fix the developed image on the recording material 102. The recording material 102 is fed by a pair of rollers 103g and 103g onto a tray 106. The roller 103b, the pair of feeding rollers 103c, 103d, 103e, the guide 103f, the pair of rollers 103g, 103h and so on constitute feeding means 103 for the recording material 102.

The cartridge B is mounted into or demounted from the main assembly A of the apparatus in the following manner.

As shown in Figure 3, the operator opens a door 109 provided in the main assembly A of the apparatus. The cartridge B is demountably mounted to cartridge mounting means 130 provided in the main assembly A of the apparatus.

As shown in Figures 4 and 5, the mounting means 130 of this embodiment includes main assembly guides 130R1, 130R2, 130L1, 130L2 in the main assembly A of the apparatus. When the cartridge B is mounted to the main assembly A of the apparatus, it is inserted toward the cartridge mounting portion 130a such that cartridge guides 140R1, 140R2 (Figure 6) are guided by the main assembly guides 130R1, 130R2, and the cartridge guides 140L1, 140L2 (Figure 7) are guided by the main assembly guides 130L1, 130L2.

The cartridge guide 140R1 is engaged with the positioning portion 130R1a of the main assembly guide 130R1, and the cartridge guide 140R2 is abutted to the positioning portion 130R2a of the main assembly guide 130R2. The cartridge guide 140L1 is engaged with the positioning portion 130L1a of the main assembly guide 130L1, and the cartridge guide 140L2 is abutted to the positioning portion 130L2a of the main assembly guide 130L2. At this time, the cartridge B is demountably mounted to the cartridge mounting portion 130a by the mounting means 130. By the cartridge B mounted in place in the cartridge mounting portion 130a, the image forming operation is enabled. Here, the cartridge mounting portion 130a is the space occupied by the cartridge B which is mounted in place to the main assembly A of the apparatus by the mounting means 130.

When the cartridge B is mounted, a coupling 134 (Figure 5) functioning as a driving force transmitting portion is at a retracted position, so that it does not interfere with the cartridge B which is being inserted for mounting. When the cover 109 is closed, the coupling 134 provided in the main assembly A of the apparatus is brought into engagement with a coupling 107a (Figure 6) of the coupling 107a of the cartridge B functioning as a driving force receiving portion. Then, the process cartridge is capable of

receiving a driving force for rotating the photosensitive drum 107 from the main assembly A of the apparatus.

(3) Cartridge Charging Contact Member:

As shown in Figure 10, the drum unit 120 is provided with the input electrical contact member (input electrical contact member) 141 for receiving a charging voltage to be supplied to the charging roller 108 from the main assembly A of the apparatus. The cartridge charging contact member 141 is mounted to the drum frame 118. More particularly, the charging contact member 141 has a contact 141a on a side surface of the drum frame 118 to establish electrical connection with the output contact member in the main assembly of the apparatus A, that is, an electrical contact (output contact) 144a (Figure 13) of the main assembly charging contact member 144. The other end portion of the cartridge charging contact member 141 is electrically connected with the charging roller 108 inside the drum unit 120.

Figure 11 is a perspective view wherein a side of the drum frame 118 has been removed so that inside of the drum frame 118 can be seen. As shown in the Figure, the charging roller 108 has a metal shaft 108a which is is rotatably supported by charging roller

bearings 132 molded from electroconductive resin material. The charging roller 108 is mounted in the drum frame 118. Between the charging roller bearing 132 and the drum frame 108, there is provided a charging roller pressing spring 133. The spring 133 urges the charging roller 108 to the photosensitive drum 107 with a predetermined force.

The charging contact member 141 is in the form of a metal plate having an electrical contact 141a for electrical contact to the contact 144a provided in the main assembly of the apparatus, and a contact 141b for contact to said spring 133. The (charging contact member 141) is mounted to the drum frame 118. Therefore, the contact 141a is electrically connected with a charging roller 108 through the contact 141b, the spring 133, the charging roller bearing 132 and the metal shaft 108a.

The electrical contact 141a is surrounded by a rib 118g so as not to projects beyond the side surface of the drum frame 118.

(4) Cartridge Movable Member:

Referring to Figure 10, 12, 19 and 20, the description will be made as to. The movable operation member (cartridge movable member 142) of the cartridge B. Figure 12 illustrates a mounting method of the

cartridge movable member 142 or the like to the drum frame 118, and Figure 10 shows the state after the mounting through the method illustrated in Figure 10. Figure 19 is a side view of a major part of the movable member 142. Figure 20 is a partly sectional view of a major part of the movable member 142.

First, the structure will be described briefly.

The movable member 142 uses a so-called toggle action. More particularly, when even a small degree of deviation occurs from a balanced position determined by a spring, the member is urged in the direction of increasing the deviation. The motion for movement from the stable position beyond the balanced position is effected by A eccentricity shaft 151b provided on a flange 151 which is movable integrally with the photosensitive drum 107 (Figure 12).

As shown in Figure 12, the flange 151 is fixed to the end of the photosensitive drum 107. The flange 151 is provided with a hole portion 151a. A small diameter portion 140L1a of a cartridge guide cylindrical portion 140L1 is penetrated through a drum supporting hole 118j provided in the drum frame 118. Then, the small diameter portion 140L1a is engaged into the hole portion 151a of the flange 151. The dimensions of the small diameter portion 140L1a and the drum supporting hole 118j are determined so as to provide press-fitting therebetween. By doing so, the

cylindrical portion 140L1 is securedly fixed to the drum frame 118. In addition, the flange 151 is provided with an eccentricity shaft 151b. Therefore, the flange 151 is rotatable about the small diameter portion 140L1a together with rotation of the photosensitive drum 107.

As shown in Figure 12, a hole 142a of the movable member 142 is penetrated by a retaining shaft 150 in the form of axially connected circular columns having different diameters (stepped shaft). The retaining shaft 150 is press-fitted into a retaining hole 118i formed in a side surface of the drum frame 118. Thus, the movable member 142 mounted for rotation about the retaining shaft 150. The retaining shaft 150 has a large diameter portion 150a for retaining the movable member 142. When the movable member 142 is assembled, the abutting portion 142b is inserted into the opening 118h provided in the side surface of the drum frame 118. Therefore, the rotation range of the movable member 142 is defined by abutment of the abutting portion 142b to the abutting portion 118e in the direction of arrow an and by abutment of the abutting portion 142b to the abutting portion 118f in the direction of arrow b. In this manner, the rotation range of the movable member 142 is limited. The abutting portions 118e, 118f are provided on the drum frame 118.

The abutting portion 142b is extended through the opening 118h further inwardly. As shown in Figure 20, the degree of the projection thereof is such that it is overlapped with the eccentricity shaft 151b of the flange 151 in the axial direction of the photosensitive drum 107. The eccentricity shaft 150b and the movable member 142 move while engaging with each other, and the movement will be described hereinafter.

One end 143a of a tension coil spring 143 (elastic function member) is hooked with a spring supporting pin portion 142e of the movable member 142, and the other end 143b thereof is mounted to a projected shaft 118k on the side surface of the drum frame 118. As shown in Figure 20, the spring supporting pin portion 142e and the projected shaft 118k has a large diameter portion 118k1 having a diameter larger than the outer diameter of the spring 143 at the outside of the portion where the spring 143 is hooked. By this, the spring 143 is securedly retained. When the movable member 142 moves within the movable range, the spring 143 always produces a force in a direction of compression by maintaining the spring 143 in a sufficiently expanded state.

(5) Operation of Cartridge Movable Member 142.

Referring to Figures 19 and 20, the description will be made as to motions of the movable member 142 and the flange 151 after they are assembled.

First, the toggle function will be described.

In Figure 19, (a) and (b), the center of rotation of the movable member 142 (the center of the retaining shaft 150) is disposed above a line connecting the center of the portion 142e and the center of the projected shaft 118k. Therefore, in this state, the movable member 142 is urged in the direction of arrow a by the moment provided by the spring force of the spring 143. The abutting portion 142b indicated by broken lines in Figure 19, Figure 19 (a) - (d), abuts to the abutting portion 118e of the drum frame 118. By this, the position of the movable member 142 in the rotational direction is determined. Figure 19, (a) shows the same state as Figure 10.

In Figure 19, (c), the center of rotation of the movable member 142 (the center of the supporting shaft 150) is on a line connecting the center of the spring supporting portion 142e and the center of the projected shaft 118k. Therefore, in the state, no moment is produced by the spring force in the direction of rotating the movable member 142 about the center of rotation (the center of the shaft 150). This is the balanced state position. In the state, the abutting portion 142b is not contacted to any of said

abutting portions 118e, 118f.

In Figure 19, (d), the center of rotation of the movable member 142 (the center of the shaft 150) is below a line connecting the center of the spring supporting portion 142e and the center of the projected shaft 118k. Therefore, the movable member 142 is urged in the direction of arrow b by the moment provided by the spring force. The abutting portion 142b abuts to the abutting portion 118f of the drum frame 118. By doing so, the movable member 142 is determined in the position in the rotational direction.

The description will be made as to the motion of the movable member 142 by the rotation of the photosensitive drum 107.

As shown in Figure 19, (a), the eccentricity shaft (projection) 151b (indicated by broken lines in Figure 19, (a) and (b)) of the flange 151 positioned away from the abutting portion 142b, is rotated in interrelation with the clockwise rotation, in the Figure, of the photosensitive drum 107 by a driving force supplied from the main assembly of the apparatus A. In this manner, the eccentricity shaft 151b rotates together with the photosensitive drum 107. As shown in Figure 19, (b), the eccentricity shaft 151b moves to a position where it is contacted to the abutting portion 142b. The eccentricity shaft 151b in the form of a projection is projected in the direction of the drum

shaft line from the flange 151 which is integral with the photosensitive drum 107.

When the photosensitive drum 107 rotates further, the movable member 142 is pushed by the eccentricity shaft 151b to rotate in the direction of arrow b. As described hereinbefore, the movable member 142 reaches the balanced position shown in Figure 19, (c). When the photosensitive drum 107 rotates further, the movable member 142 is pushed by the eccentricity shaft 151b and rides over the balanced position (Figure 19, (d)). The movable member 142 which has come beyond the balanced position, the movable member 142 rotates in the direction of arrow b by the elastic force of the spring 143 until the abutting portion 142b abuts to the abutting portion 118f to stop there (Figure 19, (d)). In the state, even if the photosensitive drum 107 rotates further, the abutting portion 142b is outside the region although the passing of the eccentricity shaft 151b, therefore, it is not brought into contact. For this reason, the movable member 142 maintains the state shown in Figure 19, (d).

In other words, the operation member 142 is movable about the center of the shaft 150 relative to the drum frame 118 as the cartridge frame. By the driving force transmitted from the main assembly of the apparatus A to the cartridge B, the photosensitive

drum 107 is rotated. The driving force is transmitted to the operation member 142 by the rotation of the photosensitive drum 107. By doing so, the operation member 142 is rotated relative to the drum frame 118. In addition, the spring 143 is provided to apply the elastic force to the operation member 142. The elastic force is contributable to the rotation of the operation member 142. More particularly, the operation member 142 is rotated by being pushed by the eccentricity shaft 151b in the form of a projection provided on the photosensitive drum 107 which is rotated by the driving force. The operation member 142 is pushed by the eccentricity shaft 151b and rotated beyond the balanced position, and then, it goes away from the eccentricity shaft 151b (Figure 19, (d)). Then, the spring 143 starts rotating by the elastic force of the spring 143. By the series of rotating operation of the operation member 142, the electrical contact 144a is moved from the retracted position to the electrical connection position.

(6) Charging Contact Provided in Main Assembly of Apparatus A:

The description will be made as to the main assembly charging contact member 144 (output contact member) provided in the main assembly of the apparatus

A.

As shown in Figure 13, inside the main assembly of the apparatus A, there is provided a main assembly charging contact member 144 for applying the charging bias voltage by contact to the contact 141a of the cartridge charging contact member 141 (input electrical contact member of the cartridge B). When the cartridge B is not mounted to the main assembly of the apparatus A, the contact 144a of the main assembly charging contact member 144 is in a retracted position where it is not projected from the inner side plate 145 of the main assembly of the apparatus A. The main assembly charging contact member 144 is electrically connected to high voltage electric circuit which will be described hereinafter and which is provided in the main assembly of the apparatus A by lead or the like.

Inside the main assembly of the apparatus A, a fixed member 146 is projected from the inner side plate 145. The fixed member 146 is abuted by the movable member 142 when the cartridge B use the move from the main assembly of the apparatus A. Thus, the fixed member 146 functions as A abutting portion for rotating the movable member 142 beyond the balanced position to the original position. One end portion 147c of the main assembly movable member 147 is projected it a position downstream of the fixed member 146 with respect to the mounting direction of the

cartridge B. The fixed member 146 is not contacted by the movable member 142 when the cartridge B is mounted to the main assembly of the apparatus A. Therefore, the fixed member 146 does not rotation the movable member 142 at that time.

The main assembly movable member 147 moves in the directions of the arrows c, d in interrelation with the rotating operation of the cartridge movable member 142. As shown in Figure 13, (b), when the photosensitive drum 107 rotates, after the cartridge B is mounted into the main assembly of the apparatus A and the apparatus is ready for the image forming operation, the main assembly movable member 147 is pushed in the direction of the main assembly of the apparatus A by the movable member 142. In interrelation with the operation of the main assembly movable member 147, the charging contact 144a rotationally moves out of the inner side plate 145 toward the mounting portion 130a. The contact 144a is brought into contact to the contact 141a of the cartridge B. In this manner, the charging roller 108 is able to receive a voltage from the main assembly of the apparatus A. More particularly, while the contact 144a is making a rotational motion, it is contacted to said contact 141 which is in stand-by state and is stationary at the electrical contact position. The contact 144a is contacted to the contact 141a, and

thereafter, it slides on the contact 141a. Therefore, foreign matter such as dust, developer or the like can be removed by the wiping action by the sliding. For this reason, the establishment of the electrical connection between the contacts is improved.

(7) Internal Structure of Main Assembly A of Apparatus.

Referring to Figure 14, the description will be made as to the internal structure of the main assembly A of the apparatus. Figure 14 is a front view of the inside of the main assembly A of the apparatus as seen from the front side D, that is, in the direction of mounting the cartridge B (Figure 3).

At the bottom surface of the main assembly of the apparatus A, that is, below the cartridge mounting portion 130a there is provided an apparatus controller circuit board EC (Figure 21). At one lateral side of the mounting portion 130a with respect to the mounting direction, there is disposed a motor M and a driving gear train (driving force transmitting means) M1 for transmitting the driving force from the motor M to the coupling 134 or the like, outside the inside side surface 145e of the inner side plate 145.

At the opposite lateral side of the mounting portion 130a, the displaceable engaging portion 147c is disposed downstream of the fixed engageable member 146 with respect to the inserting direction X of the

cartridge B relative to the main assembly A of the apparatus. In addition, at least a part of the engaging portion 147c is overlapped with the fixed engageable member 146 as seen in the inserting direction X. In other words, a part of the engaging portion 147c is behind the fixed engageable member 146 as seen in the inserting direction X.

For this reason, even if the operator inserts his or her hand form the front side side D into the main assembly A of the apparatus for the purpose of maintenance (jam clearance operation or the like) after the cartridge B is dismounted, the hand is blocked by the fixed engageable member 146. Therefore, the displaceable engaging portion 147c is protected from inadvertently accessed by the operator. The output contact 144a (not shown in Figure 12) placed in the retracted position is prevented from moving unintentionally to the electrical connection position.

(8) Operations of Movable Member and Charging Contact Member:

Referring to Figure 15 - Figure 18, the description will be made as to the operations of the cartridge movable member 142 and the main assembly charging contact member 144 which is provided in the main assembly of the apparatus A. Figure 15

illustrates the operation in the process of mounting the cartridge B to the apparatus A, and Figure 16 - Figure 18 is a schematic view for illustrating an operation after the mounting.

(A) of Figure 15; (a) of Figure 16; (a) of Figure 17 and (a) of Figure 18, are views of the inner side plate 145 of the main assembly of the apparatus A as seen from an inside of the main assembly of the apparatus (in the direction of the arrow Y in Figure 13). (b) of Figure 15; (b) of Figure 16; (b) of Figure 17; (b) of Figure 18 are the views as seen in the direction of arrow Z.

As will be understood from these Figures, the main assembly movable member 147 is rotatably supported on the outside of the inner side plate 145 for rotation about the shaft portion 147a. The main assembly charging contact member 144 is mounted on a contact supporting member 148. The contact supporting member 148 is rotatably supported for rotation about the center of the shaft portion 148a, and is urged in the direction of the arrow e by the compression spring 149. The main assembly movable member 147 and the contact supporting member 148 are abutted to each other at the abutting portions 147b and 148b to move interrelatedly.

When the contact supporting member 148 is urged in the direction of the arrow e, the main assembly

movable member 147 rotates in the direction of the arrow f. The main assembly movable member 147 is positioned, by the abutting portion (unshown) abuts to an edge portion of an opening 145a1 of the inner side plate 145. At this time, the contact 144a is at such a position that it does not project into the main assembly of the apparatus A through the opening 145a2, and therefore, it is at a retracted position where it is retracted from the electrical connection position relative to the cartridge B.

Figure 15 shows the state in the process of mounting the cartridge B into the main assembly of the apparatus A. The cartridge B is mounted in the direction of the arrow X along guide portions 130L1, 130L2. In the process of mounting, the movable member 142 is a position shown in Figure 19, (a) described hereinbefore. The contact 144a is at a position where it does not project through the opening 145a2 of the inner side plate 145. After the mounting operation of the cartridge B into the main assembly of the apparatus A, as shown in Figure 16, the movable member 142 is not yet contacted to the main assembly movable member 147.

After the mounting of the cartridge B is completed, the cartridge door 109 (Figure 3) is closed, by which the image forming apparatus 100 starts preparation for the image forming operation.

Then, the main assembly of the apparatus A starts to operate, and the driving force is transmitted to rotate the photosensitive drum 107. Then, as shown in Figure 19, (a), the eccentricity shaft 151b located at the position away from the abutting portion 142b rotates together with the photosensitive drum 107. As shown in Figure 19, (b), the eccentricity shaft 151b is brought into contact to the abutting portion 142b. Thereafter, as described hereinbefore, the movable member 142 passes over the position shown in Figure 19, (c) and rotates to the position shown in Figure 19, (d).

Referring to Figure 17 and 18, the description will be made as to the operation of the movable member 142. The movable member 142 rotates in the direction of the arrow k from the position shown in Figure 16. Then, as shown in Figure 17, the engaging portion 142d of the movable member 142 is contacted to one end 147c of the main assembly movable member. When the movable member 142 rotates further in the direction of the arrow k, the engaging portion 142d of the movable member 142 pushes the main assembly movable member 147. By this, the main assembly movable member 147 rotates in the direction of the arrow g. Thus, the contact supporting member 148 is rotated in the direction of the arrow h. By doing so, the contact 144a is projected into the main assembly of the apparatus A

through the opening 145a2 of the inner side plate 145. During the rotation of the movable member 142 to the position shown in Figure 18 (the same as the position shown in Figure 19, (d)), the engaging portion 142d further rotates the main assembly movable member 147 in the direction of the arrow g.

In interrelation therewith, the main assembly charging contact 144a further projects through the inner side plate 145 until it is contacted to the contact 141a of the cartridge B.

As described hereinbefore, according to this embodiment of the present invention the contact 141a and the contact 144a are contacted to each other in the state that cartridge B is mounted to the mounting portion 130, and the cartridge B is stopped there. Therefore, these contacts can be assuredly electrically connected to each other.

As described hereinbefore, in this embodiment, when the mounting of the cartridge B into the main assembly of the apparatus A is completed, and the photosensitive drum 107 starts to rotate, the electrical contact 144a enters the mounting portion of the main assembly of the apparatus A to contact to the electrical contact 141a by the operations of the cartridge movable member 142, main assembly movable member 147 and the contact supporting member 148. In accordance with the control of the CPU200 (Figure 21),

a voltage is supplied to the charging roller 108 through the electrical contact 144a and the electrical contact 141a from the voltage source S (Figure 21). As described hereinbefore, the output contact 144a is movable between the electrical connection position and the retracted position where it is retracted from the electrical connection position and is outside the cartridge mounting portion 130. The output contact 144a is electrically connected with the voltage source S through the voltage source circuit E. The input electrical contact 141a is engaged with the output contact 144a located at the electrical connection position. Then, it receives a voltage for operating the developing roller 110 and the charging roller 108 which are said process means.

Thus, according to this embodiment, the electrical contact 144a moves Ad contact to the electrical contact 141a stationarily positioned at the electrical connection position. Therefore, the electrical contacts are assuredly contacted to each other. In this manner, the voltage for operating the charging roller 108 as the process means is received form the apparatus A.

By this, the charging roller 108 can receive the charging bias from the main assembly of the apparatus A.

When the cartridge B is to be removed from the

main assembly of the apparatus A, the movable member 142 is engaged with the fixed member (abutting portion) 146. By this, the movable member 142 is engaged with the fixed member 146 and is rotated so that it returns to the original position (the position shown in said fixed member 146, (a)) beyond the balanced position described hereinbefore. As shown in Figure 13, in interrelation with the motion of the movable member 142, the main assembly movable member 147 moves in the direction of the arrow d. Therefore, the main assembly charging electrical contact 144a returns to the retracted position shown in Figure 13, (a), Figure 15, (a) and (b) from the projected position.

(9) Apparatus Controller Circuit Board (Voltage Source Circuit).

Referring to Figure 21, the description will be made as to apparatus controller circuit board EC including voltage source circuits in the main assembly of the apparatus A usable with this embodiment. The circuit board EC is disposed below the cartridge mounting portion 130a. The circuit board EC comprises the CPU200 and the electric circuit E.

The circuit board EC comprises the CPU200 and the electric circuit E (voltage source circuit). The

electric circuit E is constituted by a charging bias circuit E1, a developing bias circuit E2 and a transfer/charging bias circuit E3.

The charging bias circuit E1 generates a negative DC voltage and an AC voltage. It applies a voltage in the form of a sum of these voltages to the charging roller 108. The charging roller 108 which receives the voltage and charges the photosensitive drum 107.

The charging bias circuit E1 applies the negative DC voltage also to the fixing roller 105b through a driving roller 105c. The developing bias circuit E2 generates a negative DC voltage and an AC voltage. The developing roller 110 is supplied with a voltage in the form of a sum of these voltages. The developing roller 110 receives the voltage to develop the electrostatic latent image with the developer. The transfer bias circuit E3 generate a positive or negative DC voltage. It applies positive or negative DC voltage to the transfer roller 104.

Thus, the charging roller 108 is supplied with the voltage from the voltage source S through the charging bias circuit E1. The fixing roller 105b and the driving roller 105c are supplied with the voltage from the voltage source S through the charging bias circuit E1. The developing roller 110 is supplied with the voltage from the voltage source S through the

developing bias circuit E2. The transfer roller 104 is supplied with the voltage from the voltage source S through the transfer/charging bias circuit E3.

These circuits E1, E2, E3 are on-off-controlled or subjected to the controls in response to instructions from the CPU200 provided on the circuit board EC.

As described in the foregoing, according to this embodiment, even if the operator inserts his or her hand into the main assembly A of the apparatus for the purpose of jam clearance (removal of the recording material 102 from the main assembly A when the recording material 102 is jammed in the main assembly A) or for the purpose of the maintenance operation, the output contact 144a is not easily touched by the hand. This is because the output contact 144a is retracted to the retracted position. Therefore, (1) the output contact 144a is protected from deposition of foreign matter (developer, grease, sweat or the like deposited on the hand). It is possible that grease or the developer on parts in the main assembly A of the apparatus contaminates the operators hand, and if this occurs, the they are liable to contaminate the output contact 144a. (2) Or, the output contact 144a is not damaged. This is because static electricity of the human body may be applied on the output contact 144a. This is A electrostatic noise,

which, however, can be avoided according to this embodiment. (3) thus, elements in the electric circuit E in the main assembly of the apparatus can be prevented from the damage which may be caused by the electrostatic noise or the like. newpa (4) More particularly, while the contact 144a is making a rotational motion, it is contacted to said contact 141 which is in stand-by state and is stationary at the electrical contact position. The contact 144a is contacted to the contact 141a, and thereafter, it slides on the contact 141a. Therefore, foreign matter such as dust, developer or the like can be removed by the wiping action by the sliding. For this reason, the establishment of the electrical connection between the contacts is improved.

Accordingly, electrical conduction defect from the voltage source S (Figure 16) to the charging roller 108 can be suppressed by (1) - (4).

As described in the foregoing, the engaging portion 147c of the displaceable member 147 (main assembly movable member) is disposed downstream of the fixed member 146 with respect to the inserting direction X, and at least a part of the engaging portion 147c as seen in the direction of the inserting direction X. Namely, as seen in the direction of the inserting direction X, at least part of the engaging portion 147c is positioned behind the fixed member 146.

Therefore, even if the operator inserts his or her hand into the main assembly A of the apparatus for the purpose of maintenance operation such as jam clearance or the like, the fixed member 146 is effective to prevent the hand from touching the engaging portion 147c.

Thus, unintentional movement of the output contact 144a placed in the retracted position to the electrical connection position can be avoided.

In other words, according to the foregoing embodiment, the following advantageous effects can be provided.

(1) even if the user inserts the hand into the main assembly of the image forming apparatus for maintenance such as jam clearance with the process cartridge being removed from the main assembly of the image forming apparatus, the electrical contact is not easily contacted by the user, since the electrical contact is not projected out of the inner side surface. As seen in the direction of mounting the cartridge into the main assembly of the image forming apparatus, the main assembly movable member for projecting the electrical contact out, is disposed behind the fixed member, so that operator does not easily contacts the main assembly movable member. Therefore, the electrical contact is protected from the possibility of electrostatic noise, so that damage of the element

in the electric circuit of the main assembly of the apparatus can be prevented. In addition, the contact is protected from sweat of the user or grease, so that conduction defect can be prevented beforehand.

(2) when the operator mounts the cartridge into the image forming apparatus, there is no resistance caused by the electrical contacts. Therefore, the cartridge can be smoothly mounted into the image forming apparatus.

(3) with respect to the structure of the main assembly of the image forming apparatus, the contact member is disposed at a side opposite from the driving side. Therefore, a space in the main assembly of the image forming apparatus can be efficiently utilized, so that apparatus can be downsized.

(4) since the cartridge movable member is disposed on a side surface of the process cartridge, so that assembling property is good.

(5) the cartridge contact member of the process cartridge is disposed at a position where it does not project out of the surface of the frame of the process cartridge. Therefore, the operator is protected from contacting to the electrical contact during manipulation of the cartridge. Thus, the contact is protected from sweat of the user or grease, so that conduction defect can be prevented beforehand.

In this embodiment, the cartridge movable

member 142 is moved using the rotation of the photosensitive drum 107, but the present invention is not limited to such a structure. For example, the rotation of the developing roller 110 is usable in place of the rotation of the photosensitive member.

In the foregoing embodiments, when the cartridge B is mounted to the main assembly of the apparatus A, the charging member, more particularly, the charging roller 107 (process means) receives the voltage from the main assembly of the apparatus 100 through the charging output contact 144a as the output contact and the charging input electrical contact 141a as the input electrical contact. However, the present invention is not limited to such a structure. In an alternative, using structures similar to those described in the foregoing, when the cartridge B is mounted to the main assembly of the apparatus A, the developing roller 110 receives the voltage from the main assembly of the apparatus 100 through a development output contact (unshown) as the development output contact and the development input electrical contact (unshown) as the input electrical contact. In a further alternative, voltages may be supplied to the charging roller 108 and to the developing roller 110. Thus, the process means is enabled.

Therefore, the following embodiments will be

described with respect to the charging roller 108 and/or developing roller 110, but the present invention is not limited to such examples, and the present invention is applicable to voltage supply from the main assembly of the apparatus 100 to another process means.

EMBODIMENT 2:

Referring to Figure 22 - Figure 26, the second embodiment of the present invention will be described.

In this embodiment, the structure of the cartridge B and the image forming apparatus 100 are similar to those of Embodiment 1 (Figures 1 and 2). The same reference numerals as in Embodiment 1 are assigned to the elements having the corresponding functions in this embodiment, and the detailed description thereof is omitted for simplicity.

In the foregoing embodiment, the electrical contact 141a is protected by the use of the rib 118g provided in the drum frame. However, in this embodiment, the electrical contact 141a is protected by the cartridge movable member 142 not by the rib 118g provided in the drum frame. This embodiment is different from the foregoing embodiment in this respect. More particularly, the electrical contact 141a is disposed behind the cartridge movable member

142. By doing so, the movable member 142 can cover the contact 141a. This embodiment is the same as Embodiment 1 in the other respect except for particularly mentioned.

Figure 22, (a) - (d) is side views of major parts of the cartridge movable member 142 according to Embodiment 2. The states of (a), (b), (c) and (d) of Figure 22 correspond to the states of (a), (b), (c) and (d) of Figure 19, respectively. Figure 23, (a) and (b) show the states during the process of mounting the cartridge B into the apparatus A, and Figure 24, (a), (b) -26 (a), (b) show the states after the cartridge B is mounted to the apparatus.

(A) of Figure 23; (a) of Figure 24; (a) of Figure 25 and (a) of Figure 26, are views of the inner side plate 145 of the main assembly of the apparatus A as seen from an inside of the main assembly of the apparatus (in the direction of the arrow Y in Figure 13). (b) of Figure 23; (b) of Figure 24; (b) of Figure 25; and (b) of Figure 26 are the views as seen in the direction of arrow Z. In other words, the states of Figure 23, (a), (b) -26 (a) and (b) correspond to the states of Figure 15, (a), (b) -18 (a) and (b).

(1) Cartridge Charging Contact Member and Cartridge Movable Member.

The description will be made using Figure 22,

(a) corresponding to the state of Figure 19 (a) in Embodiment 1. The electrical contact 141a is disposed behind the movable member 142 so as not to be exposed from the movable member 142. By this arrangement, the movable member 142 functions to protect the contact 141a.

(2) Operation of Cartridge Movable Member 142.

The toggle function is used also in this embodiment, and the toggle motion of the cartridge movable member 142 is the same as with Embodiment 1.

By the rotation of the photosensitive drum 107, the movable member 142 rotates in the direction of the arrow b. It rotates from the position shown in Figure 22, (b) which corresponds to the position of Figure 19, (b) of Embodiment 1 to position shown in Figure 22 (c) which corresponds to the position of Figure 19, (c), and then to the position shown in Figure 22, (d) which corresponds to the position of Figure 19, (d).

As shown in the Figure, with the rotation of the movable member 142 in the direction of the arrow b, the electrical contact 141a is gradually exposed by the movable member 142. In the state shown in Figure 22, (d), the electrical contact 141a is completely exposed.

(3) Charging Contact Member of Main Assembly of Apparatus A:

The main assembly charging contact member 144 provided in the main assembly of the apparatus A has a structure similar to Embodiment 1 (Figure 13).

(4) Operations of Movable Member and Charging Contact Member:

By the motion of the movable member 142, the electrical contact 144a is projected into the main assembly of the image forming apparatus A. The structures for contacting the electrical contact 144a to the electrical contact 141a are the same as with Embodiment 1.

The contact 141a is covered by the movable member 142 and is not exposed before the cartridge B is mounted into the apparatus A, during the process of cartridge mounting shown in (b) of Figure 23, and immediately after the mounting shown by (a) and (b) of Figure 24. Namely, the contact 141a is protected by the movable member 142.

After the completion of the cartridge B mounting to the mounting portion 130, the cartridge door 109 (Figure 3) is closed. By this, the main assembly of the apparatus A starts to prepare for the image forming operation.

Then, the main assembly of the apparatus A starts to operate, and the driving force is transmitted to rotate the photosensitive drum 107. Then, the movable member 142 rotates in the direction of the arrow k toward the position shown in (a) of Figure 25 from the position shown in (a) of Figure 24. By this, the contact 141a is gradually exposed from the movable member 142. Simultaneously, the movable member 142 is contacted to the main assembly movable member 147 (displaceable member). The main assembly movable member 147 moves the main assembly charging member 144 into the main assembly of the apparatus A by the mechanism having been described with Embodiment 1. After the contact 141a is completely exposed, the electrical contact 144a makes rotational movement to the stationary electrical contact 141a, thus starting contact thereto. The electrical contact 144a moves to the position shown in (a) of Figure 26 and stops there, finally. This enables to supply the charging bias to the charging roller 108 of the cartridge B from the main assembly A of the apparatus. More particularly, while the contact 144a is making a rotational motion, it is contacted to said contact 141 which is in stand-by state and is stationary at the electrical contact position. The contact 144a is contacted to the contact 141a, and thereafter, it slides on the contact 141a. Therefore, foreign matter such as dust,

developer or the like can be removed by the wiping action by the sliding. For this reason, the establishment of the electrical connection between the contacts is improved.

When the cartridge B is to be taken out of the main assembly of the apparatus A, the movable member 142 is engaged with the fixed member 146, similarly to Embodiment 1. The movable member 142 is returned to the position shown in (a) and (b) of Figure 23. In interrelation with the motion of the cartridge movable member 142, the main assembly movable member 147 moves in the direction of the arrow d. By doing so, the electrical contact 144a projected into the inside of the main assembly is returned to the retracted position shown in (a) and (b) of Figure 23.

When the cartridge B is removed out of the main assembly of the apparatus A, the electrical contact 141a is again covered by the cartridge movable member 142. Embodiment 2 provides the same advantageous effects as with Embodiment 1. In this embodiment, the movable member 142 does not necessarily completely cover the cartridge contact member 141. For example, it will suffice if it is projected beyond the contact surface or covers a part of the contact surface, since then the similar effects are provided. The description will be made as to various modifications of "protection" in the following Embodiment 3.

EMBODIMENT 3:

Referring to Figure 27 - Figure 31, the third embodiment of the present invention will be described.

In this embodiment, the structures of the cartridge B and the image forming apparatus 100 are similar to those of Embodiments 1 and 2 (Figures 1 and 2, and Figure 3 - Figure 26). The same reference numerals as with Embodiments 1 and 2 are assigned to the elements having the corresponding functions, and the detailed descriptions for such elements are omitted for simplicity.

In Embodiment 1, the electrical contact 141a, as shown in Figure 12, is such that 118g encloses the contact 141a. By doing so, the contact 141a is not projected beyond the side surface of the drum frame 118. And, the operator is prevented from touching the exposed contact 141a. In Embodiment 2, the contact 141a is completely covered by the cartridge movable member 142.

Another examples of structures of the movable member 142 effective to prevent the operator from inadvertently touching the contact 141a.

Figure 27 to Figure 31 show various type of structures of the cartridge movable member 142 (movable operation member).

In these examples, the side surface of the drum frame 118 is provided with the electrical contact 141a similarly to said Embodiments 1 and 2. The movable member 142 is supported and positioned similarly to the foregoing embodiments.

In the embodiment of Figure 27, the movable member 142 is positioned so as to cover the electrical contact 141a in the stand-by state similarly to Embodiment 2. However, the movable member 142 is provided with an opening 142p facing to the facing. Thus, the contact 141a is not covered by the movable member 142. However, the movable member 142 provides a portion higher than the surface of the contact 141a around the contact 141a, thus effectively protecting the contact 141a.

In the embodiment shown in Figure 28, the movable member 142 is provided with a rib 142q covering a part of the contact 141a in the stand-by position.

In the embodiment shown in Figure 29, 30 and 31, the movable member 142 is provided partly around the contact 141a with projected portions 142r, 142s, 142t at a level higher than the surface of the electrical contact 141a in the stand-by state.

In Figure 29, the projected portion 142r is disposed on the movable member 142 at a position below the contact 141a in the Figure. In Figure 30, the

projected portion 142s is provided on the movable member 142 at a lateral side of the contact 141a in the Figure. In Figure 31, the projected portion 142t is provided on the movable member 142 at a lower corner portion of the contact 141a in the Figure.

In these examples of this embodiment, similarly to Embodiments 1, 2, a projected portion higher than the surface of the contact 141a is provided adjacent the contact 141a. Therefore, the operator is effectively prevented from inadvertently touching the electrical contact during manipulation of the cartridge. Thus, the contact is protected from sweat of the user or grease, so that conduction defect can be prevented beforehand. In other words, the electrical contact 141a can be protected.

This embodiment provides the same advantageous effects as with Embodiments 1 and 2.

EMBODIMENT 4:

Referring to Figure 32 - Figure 35, the fourth embodiment will be described.

In this embodiment, the structure of the cartridge B and the image forming apparatus 100 are In this embodiment, the structure of the cartridge B and the image forming apparatus 100 are similar to those of Embodiment 1 which has been described in

conjunction with Figures 1 and 2. Similar to those of Embodiment 1 which has been described in conjunction with Figures 1 and 2. The same reference numerals as with the Embodiments 1 and 2 are assigned to the elements having the corresponding functions, and the detailed descriptions for such elements are omitted for simplicity.

In said Embodiment 1 and Embodiment 2, it is the charging electrical contact that is protected. In the following embodiments, a development electrical contact is protected. The different of this embodiment from Embodiment 1 and Embodiment 2 is in that movable member 142 protects not a charging electrical contact but a development electrical contact. And, the electrical contact which is projected by engagement with the movable member 142 is ot an electrical contact for applying the charging bias but an electrical contact for applying a developing bias.

More particularly, toggle mechanism similar to that used in Embodiment 2 is disposed at the center of rotation of the photosensitive drum 107. This embodiment is fundamentally the same as Embodiment 2. The same reference numerals as with the Embodiment 2 are assigned to the elements having the corresponding functions, and the detailed descriptions for such elements are omitted for simplicity.

Figures 32 and 33 are side views illustrating

major parts of the movable member 142. The states shown in Figures 32 and 33 correspond to the states shown in Figure 22, (a) and 22 (Embodiment 2), respectively. The states of Figure 34, (a) and Figure 34, (b) correspond to the states of Figure 13, (a) and Figure 13, (b).

Figure 35 illustrates the behavier during the process of mounting the cartridge B into the apparatus A, and Figures 36 and 37 illustrates the behavier after the mounting.

(A) of Figure 35; (a) of Figure 36; and (a) of Figure 37, are views of the inner side plate 145 of the main assembly of the apparatus A as seen from an inside of the main assembly of the apparatus (in the direction of the arrow Y in Figure 34). (b) of Figure 35; (b) of Figure 36; and (b) of Figure 37 are the views as seen in the direction of arrow Z. In other words, (a) and (b) of Figure 35; (a) and (b) 37 of Figure 36; and (a) and (b) of Figure 37 correspond to (a) and (b) of Figure 23; (a) and (b) of Figure 24 and (a) and (b) of Figure 26, respectively.

(1) Cartridge Developing Device Contact Member and Cartridge Movable Member:

In the state shown in (a) of Figure 32, the electrical contact (input electrical contact) 141a of

the cartridge development electrical contact member (input electrical contact member) 141 is disposed behind the movable member 142. The electrical contact 141a is so disposed that it is covered by the movable member 142 and not exposed. Thus, the contact 141a is protected by the movable member 142. The state shown in Figure 32, (a) correspond to the state shown in Figure 22, (a).

(2) Operation of Cartridge Movable Member 142.

The toggle operation of the movable member 142 is the same as with Embodiment 2. By the rotation of the photosensitive drum 107, cartridge movable member 142 rotates in the direction of the arrow b from the position of Figure 32 corresponding to (a) of Figure 22 to the position of Figure 33 corresponding to the (d) of Figure 22.

As shown in this Figure, the movable member 142 rotates in the direction of the arrow b. By this, the contact 141a is gradually exposed beside the movable member 142. Finally, the contact 141a is completely exposed.

(3) Developing Device Contact Member Provided in Main Assembly of Apparatus A:

The description will be made as to the main assembly developing device contact member (output contact member) 144 provided in the main assembly of the apparatus A.

As shown in Figure 34, on an inner side of the main assembly of the apparatus A, a main assembly developing device contact member 144 for applying the developing bias voltage by contact with the electrical contact 141a is provided. When the cartridge B is not mounted to the main assembly of the apparatus A, the electrical contact 144a (output contact) of the contact member 144 is retraction to such a position that it does not project into the inside (mounting portion 130 side) through the opening 145a1 of the inner side plate 145 of the main assembly of the apparatus A. The contact member 144 is connected with a voltage source circuit E provided in the main assembly of the apparatus A by lead lines or the like.

In the main assembly of the apparatus A, the above-described fixed member 146 is projected beyond the inner side plate 145. Downstream of the fixed member 146 with respect to the mounting direction of the cartridge B, a one 8end portion 147c of the main assembly movable member 147 is projected.

The main assembly movable member 147 moves in the direction of arrows c, d (b corresponds to c, and c, a corresponds to d) in interrelation with the

rotating operation of the cartridge movable member 142.

After the cartridge B is mounted to the main assembly of the apparatus A, and the preparation of the image formation is completed, the photosensitive drum 107 starts to rotate. Then, as shown in Figure 34, (b), the main assembly movable member 147 is pushed by the movable member 142 in the direction of the arrow c. By this, the contact 144a is projected through the opening 145a2 of the inner side plate 145 in interrelation with the operation of the main assembly movable member 147. The contact 144a then moves to contact the stationary contact 141a.

(4) Movable Member and Developing Device Contact Member:

By the movable member 142, the electrical contact 144a is projected into the main assembly of the apparatus A. The structure for contacting to the electrical contact 141a is the same as Embodiment 2.

The contact 141a is covered by the movable member 142, before the cartridge B is mounted to the main assembly of the apparatus A, during the process of the cartridge mounting, and immediately after the mounting shown in Figure 36. The contact 141a is not exposed, and protected by the movable member 142.

After the completion of mounting of the

cartridge B to the main assembly of the apparatus A, the cartridge door 109 (Figure 3) is closed. By this, the main assembly of the apparatus A starts to prepare for the image forming operation. Then, the main assembly of the apparatus A starts to operate, and the driving force is transmitted to rotate the photosensitive drum 107. Then, the movable member 142 rotates in the direction of the arrow k from the position shown in (a) of Figure 36 to the position shown in (a) of Figure 37. Then, it gradually permits the contact 141a to be exposed. Simultaneously, the movable member 142 is contacted to the main assembly movable member 147. By the mechanism described in Embodiment 2, the contact 144a is moved into the main assembly of the apparatus A. After the contact 141a is completely exposed, the contact 141a and the contact 144a start to contact to each other. The movable member 142, moves to the position shown in (a) of Figure 37 and stops there, finally.

Thus, the developing bias voltage becomes applicable to the developing roller 110 of the cartridge B from the main assembly of the apparatus A.

Similarly to Embodiment 2, the movable member 142 is engaged with the fixed member (abutting portion) 146. The movable member 142 is returned to the position shown in Figure 35, (a). The main assembly movable member 147 moves in the direction of

the arrow d in interrelation with the motion of the movable member 142. By this, the main assembly development electrical contact 144a is moved from the position in which it is projected into the main assembly to the position in which it is retracted ((a) of Figure 34, and (a) and (b) of Figure 35).

When the cartridge B is removed out of the main assembly A, the contact 141a is covered again by the movable member 142. Then, it is protected by the movable member 142.

This embodiment provides the same advantageous effects as with Embodiments 1 and 2.

Similarly to Embodiment 2, the movable member 142 is not necessarily completely covering the contact 141a, in this embodiment. For example, it will suffice if it is projected beyond the contact surface or covers a part of the surface of the contact. The types of the protection may be the same as Embodiment 3.

In Embodiment 2, the present invention is applied to a charging contact only, and in this embodiment, the present invention is applied only to the developing device contact. However, the present invention is applicable to both of the contacts to cover them with the movable member. By doing so, the operator is effectively prevented from inadvertently touch the charging electrical contact and the development electrical contact. Thus, the contact is

protected from sweat of the user or grease, so that conduction defect can be prevented beforehand. Here, it is not necessary for the movable member to completely covering the electrical contact. For example, it will suffice if it is projected beyond the contact surface or covers a part of the surface of the contact, similarly to Embodiments 2, 3 and 4.

EMBODIMENT 5:

Referring to Figure 38 - Figure 46, the fifth embodiment will be described.

In this embodiment, the structure of the cartridge B and the image forming apparatus 100 are In this embodiment, the structure of the cartridge B and the image forming apparatus 100 are similar to those of Embodiment 1 which has been described in conjunction with Figures 1 and 2. Similar to those of Embodiment 1 which has been described in conjunction with Figures 1 and 2. The same reference numerals as with the foregoing embodiments are assigned to the elements having the corresponding functions, and the detailed descriptions for such elements are omitted for simplicity.

The constituent elements of the structure of this embodiment will be described briefly.

The operation of the movable member 142 uses

so-called toggle operation. This is the same as with Embodiment 1, 2 and 4. The toggle operation is effected by the eccentric shaft 151b on the flange 151 which integrally rotates with the photosensitive drum 107, similarly to the foregoing embodiments.

The embodiment is different from said Embodiments 1, 2 and 4 in which the rotation center shaft of the movable member 142 extends substantially vertical direction (substantially perpendicular to the rotation center shaft of the photosensitive drum 107), but in this embodiment, the rotation center shaft of the movable member 142 extends substantially horizontal direction (parallel with the rotation center shaft of the photosensitive drum 107). This embodiment is also different in that movable member 142 is constituted by a plurality of elements, the movable member 142 being a single element in the foregoing embodiments. Moreover, in the foregoing embodiments, the electrical contact (input electrical contact) of the cartridge B is disposed on a side surface with respect to the mounting direction X, but in this embodiment, it is disposed on a front side.

(1) Movable Member Provision on Cartridge A:

Figures 38 and 39 show a cartridge B according to this embodiment. Figure 38 illustrates a state of

the movable member 142 before the cartridge B is mounted to the main assembly of the apparatus A. In this embodiment, the cartridge movable member is constituted by a first cartridge movable member 142, a second cartridge movable member 162 and a third cartridge movable member 182.

Figure 39 is a perspective view illustrating a method of mounting the first, second and third cartridge movable members 142, 162, 182 on the drum frame 118, and Figure 40 particularly shows the first movable member 142 and the cartridge charging electrical contact member 141 with the other members omitted for better understanding.

Figure 41 is a side view showing states of the first, second and third cartridge movable members 142, 162, 182 before the cartridge B is mounted to the main assembly of the apparatus A. Figure 42 is a side view of the state wherein by the rotation of the photosensitive drum 107 after the mounting, the movable member 142 is moved to abut to the abutting portion.

The cartridge B comprises a drum unit 120 and a developing unit 119 connected similarly to Embodiment 1. As shown in Figure 39, adjacent a front side at a longitudinal end of the cartridge B, an electrical contact 141a for applying the charging bias voltage to the charging roller 108 so as not to

project beyond the surface of the drum frame 118, and is surrounded by a rib 118g. A region of the charging electrical contact member 141 adjacent the corner portion is A electrical contact (input electrical contact) 141a for electrical contact with an electrical contact (output contact) 144a of the main assembly charging contact member 144 provided in the main assembly of the apparatus A.

The drum frame 118 is provided with a drum shutter 170 for protecting a photosensitive drum 107. The drum shutter 170 has a shutter portion 170a covering the photosensitive drum 107, supporting arms 170b at the opposite ends (only one end is shown), and a shaft portion 170c. It is rotatably supported by the drum frame 118 for rotation about the shaft portion 170c. The shutter 170 rotates in the direction of the arrows in interrelation with the mounting operation of the cartridge B to the main assembly of the apparatus A. It moves from the position (Figure 38) for protecting the photosensitive drum 107 to the position (Figure 39) for exposing the photosensitive drum 107.

As shown in Figure 39, to the drum frame 118, the first, second and third cartridge movable members 142, 162, 182 are mounted. This constitutes a quadric link.

The first cartridge movable member 142 is rotatably mounted on the shaft 118m. The second

cartridge movable member 162 makes the same motions as the cartridge movable member 142 (Embodiment 1 - Embodiment 4). A hole portion 162a of the second cartridge movable member 162 is penetrated by a retaining shaft 150 in the form of axially connected circular columns having different diameters (stepped shaft). The retaining shaft 150 is press-fitted into a retaining hole 118i of the drum frame 118. By doing so, the second cartridge movable member 162 is rotatably supported for rotation about the retaining shaft 150. The retaining shaft 150 has a large diameter portion 150a for retaining the second cartridge movable member 162. When the second cartridge movable member 162 is assembled, an abutting portion 162b for engagement with the eccentric shaft of the flange which will be described hereinafter enters A opening 118h provided in a side surface of the drum frame 118.

Holes of the third cartridge movable member 182 formed at the opposite end portions are rotatably connected with a projected shaft 142g of the first cartridge movable member 142 and a projected shaft 162g of the projected shaft. This constitutes a structure.

A motion of the quadric link is limited by rotation of the second cartridge movable member 162. More particularly, with respect to the direction of the arrow a (Figure 41), the movement range of the

first cartridge movable member 142 is limited by abutment of the abutting portion 162b of the second cartridge movable member 162 to the abutting portion 118e (position of Figure 41). With respect to the direction of the arrow b, the range of the first cartridge movable member 142 is limited by abutment of the abutting portion 142b of the second cartridge movable member 162 to the abutting portion 118f. Movable range of the quadric link is limited in this manner.

As shown in Figure 39, one end 143a of a tension coil spring 143 is hooked with a spring supporting portion 162e of the spring. The other end 143b of the spring 143 is mounting on a projected shaft 118k on the side surface of the drum frame 118. As shown in Figure 39, the spring supporting portion 142e and the projected shaft 118k has large diameter portions having a diameter larger than the outer diameter of the spring 143 to retain the spring 143. When the second cartridge movable member 162 moves within the movable range thereof, the spring 143 always produces a force in a direction of compression by maintaining the spring 143 in a sufficiently expanded state.

When the second cartridge movable member 162 is at a position closer to the position shown in Figure 41 then the balanced position of the toggle mechanism

(unshown), the spring force urges the first cartridge movable member 142 in the direction of the arrow a. As shown in Figure 41, the second cartridge movable member 162 urged by the coil spring 143, is determined in the rotational direction position by abutment of the abutting portion 162b to the abutting portion 118e of the drum frame 118. Therefore, the first cartridge movable member 142 moves to the position corresponding to the movement of the quadric link mechanism.

When the second cartridge movable member 162 is at a position closer to the position Figure 42 than the balanced position of the toggle mechanism, the spring force urges the first cartridge movable member 142 in the direction of the arrow b. As shown in Figure 42, the second cartridge movable member 162 urged by the coil spring 143 is determined in the rotational direction position by abutment of the abutting portion 162b to the abutting portion 118f of the drum frame 118. The first cartridge movable member 142 moves to the position corresponding to the quadric link mechanism.

A flange 151 is securedly fixed to one end of the photosensitive drum 107 in the same structure as with Figure 12 (Embodiment 1). The flange 151 has a hole portion 151a and an eccentric shaft 151b. The hole portion 151a is supported by a small diameter portion of the cylindrical portion 140L1. By doing so,

the eccentric shaft 151b rotates about the small diameter portion 140L1a together with the rotation of the photosensitive drum 107. This is the same as Embodiment 1.

The abutting portion 162b penetrates the opening 118h and projects further inwardly. The degree of projection is such that it overlies with the eccentric shaft 151b with respect to the direction of the rotational axis of the photosensitive drum 107 as shown in Figure 20 of Embodiment 1.

With this structure described above, similarly to Embodiment 1, when the photosensitive drum 107 rotates, the eccentric shaft 150b and abutting portion 162b of the second cartridge movable member 162 are engaged to each other, and then, they move together. Therefore, with the movement of the second cartridge movable member 162, the first cartridge movable member 142 moves from the position shown in Figure 41 to the position shown in Figure 42.

(2) Charging Electrical Contact Provided in Main Assembly of Apparatus A:

The description will be made as to the main assembly A of the apparatus to which the cartridge B is mountable.

As shown in Figure 43, inside the main assembly

of the apparatus A, there is provided a main assembly charging contact member 144 for applying the charging bias voltage to the charging roller 108 by contact to the contact 141a of the cartridge charging contact member 141.

When the cartridge B is not mounted to the main assembly of the apparatus A, the main assembly charging contact member 144 is in a retracted position where it is not projected from the cover 171 provided on an inner surface of the main assembly of the apparatus A. The main assembly charging contact member 144 is electrically connected to high voltage electric circuit which is provided in the main assembly of the apparatus A by lead or the like.

Similarly to Embodiment 1, inside the main assembly of the apparatus A, a fixed member 146 is projected from the inner side plate 145. Downstream of the fixed member 146 with respect to the mounting direction of the cartridge B, the one end portion 147c of the main assembly movable member 147 is projected.

The main assembly movable member 147 is rotatable about the shaft portion 147a. The main assembly movable member 147 rotates in the direction of the arrows c, d in interrelation with the rotating operation of the movable member 142. After completion of the mounting of the cartridge B to the main assembly of the apparatus A, and after the preparation

of the image forming operation, the photosensitive drum 107 is rotated. Then, as shown in Figure 44, the main assembly movable member 147 is pushed in the direction of the arrow c by the movable member 142 (Figures 38, 39). By this, in interrelation with the operation of the main assembly movable member 147, the charging electrical contact 144a is projected inwardly beyond the cover 171. And, the electrical contact 144a moves to contact the stationary electrical contact 141a. More particularly, while the contact 144a is making a rotational motion, it is contacted to said contact 141 which is in stand-by state and is stationary at the electrical contact position. The contact 144a is contacted to the contact 141a, and thereafter, it slides on the contact 141a. Therefore, foreign matter such as dust, developer or the like can be removed by the wiping action by the sliding. For this reason, the establishment of the electrical connection between the contacts is improved.

(3) Operations of Movable Member and Charging Contact member:

The description will be made as to the operations of the first cartridge movable member 142 and the main assembly charging contact member 144. Figure 45 is a schematic view illustrating an

operation when the cartridge B is inserted into the main assembly of the apparatus A.

Figure 45 is a view of an inner side plate 145 provided in the main assembly of the apparatus A as seen from an inside of the main assembly of the apparatus (in the direction of arrow Y in Figure 43). Figure 45 illustrates the behavier during the process of mounting the cartridge B into the apparatus A, and Figure 46 illustrates the behavier after the mounting, wherein the contact 141a and the contact 144a are contacted to each other.

As shown in Figure 45, the main assembly movable member 147 is rotatably supported by the inner side plate 145 for rotation about the shaft portion 147a. The main assembly charging contact member 144 is mounted to the main assembly movable member 147. The main assembly movable member 147 is urged in the direction of the arrow d by a compression spring (unshown). By this, the main assembly movable member 147 is position by the abutting portion 147d abutting the abutting portion 145d of the inner side plate 145. At this time, the electrical contact 144a is at such a position where it does not project into the main assembly of the apparatus A beyond the cover 171.

The cartridge B is inserted in the direction of arrow X along the guide portions 130L1, 130L2.

At the position shown in Figure 45, as

described hereinbefore, the second cartridge movable member 162 is urged in the direction of an arrow j by the function of the coil spring 143. By this, the movable member 162 is disposed at the position where the abutting portion 162b abuts to the abutting portion 118e of the drum frame 118. The contact 144a is at the position not projecting beyond the cover 171, as described hereinbefore.

After the completion of mounting of the cartridge B into the main assembly of the apparatus A, the cartridge door 109 (Figure 3) is closed. In response to this, the image forming apparatus 100 starts preparation for image formation.

Then, the main assembly of the apparatus A starts the operation, and the driving force is transmitted to rotate the photosensitive drum 107. As described hereinbefore, the first cartridge movable member 142 rotates in the direction of arrow k from the position shown in Figure 41. The movable member 142 rotates beyond the balanced position to the position shown information Figures 42 and 46.

At this time, the engaging portion 142d of the first cartridge movable member 142 first starts contacting to the one end 147c of the main assembly movable member 147. The movable member 142 rotates further in the direction of arrow k. Then, the engaging portion 142d of the movable member 142 pushes

the main assembly movable member 147. This rotates the main assembly movable member 147 in the direction of the arrow c. By this, the electrical contact 144a projects out to the outside of the cover 171 into the inside of the main assembly of the apparatus A from the position where it is retracted behind the cover 171 (Figure 45). During the rotation of the movable member 142 to the position shown in Figure 46, the engaging portion 142d rotates the main assembly movable member 147 further in the direction of the arrow c. In interrelation with this, the electrical contact 144a is further projected beyond the cover 171. By this, the electrical contact 144a moves to contact to the stationary electrical contact 141a.

This enables application of the charging bias to the charging roller 108 from the main assembly of the apparatus A.

When the cartridge B is to be taken out of the main assembly of the apparatus A, the movable member 142 is engaged with the fixed member 146, similarly to Embodiment 1. By this, the movable member 142 is rotated to the position shown in Figure 41. In interrelation with the motion of the movable member 142, the main assembly movable member 147 moves in the direction of the arrow d. Then, the electrical contact 144a returns to the retracted position from the projecting position.

When the cartridge B is removed out of the main assembly of the apparatus A, the electrical contact 141a is again covered by the cartridge movable member 142 and is protected thereby.

This embodiment provides the same advantageous effects as with Embodiment 1.

In this embodiment, the cartridge movable members 142, 162, 182 are disposed outside a passing path of the supporting arm 170b with respect to the direction of the rotational axis of the drum shutter 170. By doing so, there is no need of paying consideration to timing of opening and closing of the cartridge movable members 142, 162, 182 and the drum shutter 170 when the cartridge B is mounted and dismounted. In addition, the image forming apparatus can be downsized.

This embodiment utilizes rotation of the photosensitive drum 107 the move the cartridge movable member 142. However, the present invention is not limited to such a structure. For example, the rotation of the developing roller 110 is usable in place of the rotation of the photosensitive member.

EMBODIMENT 6:

Referring to Figure 47 - Figure 53, sixth embodiment will be described.

The same reference numerals as with Embodiment 5 are assigned to the elements having the corresponding functions, and the detailed descriptions for such elements are omitted for simplicity. The difference from Embodiment 5 is in that said electrical contact 141a is protected not by the rib 118g of the drum frame 118 but by the first cartridge movable member 142.

More particularly, the contact 141a is disposed behind the first cartridge movable member 142. By doing so, the movable member 142 can cover the contact 141a. This embodiment is the same as Embodiment 5 in the other respect except for particularly mentioned. The description will be made as to the structural portions which are different from those of Embodiment 5. The same reference numerals as with Embodiment 5 are assigned to the elements having the corresponding functions, and the detailed descriptions for such elements are omitted for simplicity.

Figure47 - Figure 51 illustrate a cartridge B according to this embodiment. Figure47 - Figure 51 correspond to Figure38 - Figure 42 of Embodiment 5. Figure 47 is a perspective view showing the structures of first, second and third cartridge movable members 142, 162, 182 before the cartridge B is mounted to the main assembly of the apparatus A. Figure 48 illustrates a mounting method of the movable members

142, 162, 182 to the drum frame 118. Figure 49 particularly shows the first movable member 142 and the cartridge charging electrical contact member 141 with the other members omitted for better understanding.

Figure 50 is a side view showing states of the first, second and third cartridge movable members 142, 162, 182 before the cartridge B is mounted to the main assembly of the apparatus A. Figure 51 is a side view of the state wherein by the rotation of the photosensitive drum 107 after the mounting, the movable member 162 is moved to abut to the abutting portion 118e.

Figure 52 and Figure 53 correspond to Figure 45 and Figure 46 of Embodiment 5. Figure 52 is a view of an inner side plate 145 provided in the main assembly of the apparatus A as seen from an inside of the main assembly of the apparatus (in the direction of arrow Y in Figure 43). Figure 52 illustrates the behavier during the process of mounting the cartridge B into the apparatus A. Figure 54 illustrates the behavier after the mounting, wherein the contact 141a and the contact 144a are contacted to each other by movement of the first cartridge movable member 142.

(1) Cartridge Charging Contact Member and Cartridge

Movable Member:

As shown in Figure 48, adjacent a longitudinal end at a front side (leading side) with respect to the mounting direction X of the cartridge B, there is A electrical contact 141a for applying the charging bias voltage to the charging roller 108. A region of the charging electrical contact member 141 adjacent the corner portion is A electrical contact (input electrical contact) 141a for electrical contact with an electrical contact (output contact) 144a of the main assembly charging contact member 144 provided in the main assembly of the apparatus A. Figure 48 corresponds to Figure 39 of Embodiment 5.

In the state shown in Figure 49, the contact 141a is disposed behind the movable member 142 so as to prevent the contact 141a from being exposed. Thus, the contact 141a is protected by the movable member 142. Figure 49 corresponds to the state shown in Figure 40 of Embodiment 5.

(2) Operation of Cartridge Movable Member:

The toggle operation of the cartridge movable member 142 is the same as with Embodiment 5. The movable member 142 is rotated in the direction of the arrow b by rotation of the photosensitive drum 107. The movable member 142 rotates beyond the balanced

position to the position shown information Figure 51. Then, the movable member 142 rotates in the direction of the arrow b so that said electrical contact 141a is gradually exposed, until it is completely exposed. Figure 50 corresponds to Figure 41. Figure 51 corresponds to Figure 42.

(3) Main Assembly Charging Contact Member Provided in Main Assembly of Apparatus A:

The main assembly charging contact member 144 provided in the main assembly of the apparatus A has the structure similar to Embodiment 5. That is, the structure has been described in conjunction with Figure 43.

(4) Operations of Movable Member and Main Assembly Charging Contact Member:

The structure by which the contact 144a is contacted to the electrical contact 141a by the movement of the movable member 142 is the same as with Embodiment 5.

The electrical contact 141a is covered by the movable member 142 and is not exposed, before the cartridge B is mounted to the main assembly of the apparatus A, during the process of cartridge mounting (Figure 52), and immediately after the mounting. Namely, it is protected by the movable member 142.

After the completion of the mounting of the cartridge B, the cartridge door 109 (Figure 3) is closed. By this, the main assembly of the apparatus A starts preparation for image formation.

Then, the main assembly of the apparatus A starts to operate, and the driving force is transmitted to rotate the photosensitive drum 107. Then, said movable member 142 rotates from the position of Figure 52 to the position of Figure 51 in the direction of arrow b. By this, the electrical contact 141a is exposed gradually. Simultaneously, the movable member 142 is contacted to the main assembly movable member 147. By the mechanism described with respect to Embodiment 5, the charging member 144 of the main assembly is moved toward inside of the main assembly of the apparatus A. After the electrical contact 141a is completely kx said electrical contacted 141a, the contact between said electrical contact 141a and the electrical contact 144 starts.

Final, the movable member 142 is moved to the position shown in Figure 51 and Figure 53. It stops at the state in which the contact 141a and the electrical contact 144a are assuredly contacted. More particularly, the electrical contact 144a moves to the contact 141a to contact it. With this state, the movable member 142 stops.

This enables application of the charging bias

to the charging roller 108 from the main assembly of the apparatus A.

When the cartridge B is to be removed from the main assembly of the apparatus A, the movable member 142 is returned to the position shown in Figure 50 and Figure 52 through the operations similar to Embodiment 5.

When the cartridge B is taken out of the main assembly of the apparatus A, the movable member 142 is returned to the position of Figure 50 through the operations similar to Embodiment 5. In interrelation with the motion of the movable member 142, the main assembly movable member 147 moves in the direction of the arrow d (Figure 43), by which the contact 144a is returned to the retracted position from the projecting position (Figure 43 and Figure 52).

When the cartridge B is removed out of the main assembly of the apparatus A, the contact 141a is again covered by the movable member 142 and is protected thereby.

This embodiment provides the same advantageous effects as with Embodiments 1 and 2.

Similarly to Embodiment 2, the cartridge movable member 142, 162, 182 are disposed outside the passing path of the supporting arm in this embodiment. Therefore, by doing so, there is no need of paying consideration to timing of opening and closing of the

cartridge movable members 142, 162, 182 and the drum shutter 170 when the cartridge B is mounted and dismounted. In addition, the image forming apparatus can be downsized.

In this Embodiment 6, the charging contact is protected. However, the present invention is not limited to such a structure. For example, a developing device contact may be protected by the same structure.

In the foregoing embodiments, the rotating force of the photosensitive drum 107 and the elastic force of the spring 143 are used to rotate the movable member 142. However, the present invention is not limited to such a case. For example, the movable member may be moved only by the rotating force of the photosensitive drum. Or, in place of the rotational force of the photosensitive drum, a rotating force of a developing roller may be used.

This Embodiment 6 protects the charging contact only. However, the present invention is not limited to this example. For example, the structure for protecting the developing device contact shown in Embodiment 4 may be incorporated. In such a case, both of the electrical contacts are protected.

The movable member 142 does not necessarily completely covering the electrical contact 141a. For example, the movable member 142 or the projected portion or the like may be projection beyond the

surface of the electrical contact. Or, a part of the surface of the electrical contact is covered by the movable member 142 or projected portion or the like. By doing so, a similar effect can be provided. The description will be made as to various modifications of "cover" in the following Embodiment 7.

EMBODIMENT 7:

Referring to Figure 54 - Figure 58, seventh embodiment will be described.

In this embodiment, the description is made only as to the portion different from the Embodiments 1 - 6.

Figure54 - Figure 58 show examples of the movable member 142. In these Figures, the members other than the movable member 142 are omitted. The cartridge B of the embodiment has a contact 141a similarly to Embodiments 5 and 6. A region of the charging electrical contact member 141 adjacent the corner portion is A electrical contact (input electrical contact) 141a for electrical contact with an electrical contact (output contact) 144a of the main assembly charging contact member 144 provided in the main assembly of the apparatus A. The movable member 142 is supported and positioned similarly to Embodiment 5 and Embodiment 6.

In Figure 54, the movable member 142 encloses the contact 141a in the stand-by state. In this example, the surface of the contact 141a is surrounded by a skelton structure having a plurality of ribs 142u of the movable member 142.

In Figure 55, the movable member 142 is provided with a rib 142v covering a part of the contact 141a in the stand-by state.

In the examples shown in Figures 56, 57, 58, the movable member 142 is provided with projected portions (surfaces) 142w, 142x, 142y which is higher than the surface of the contact 141a in the stand-by state. The projected portions 142w, 142x, 142y are provided partly around the contacts 141a.

In the example of Figure 56, the projected portion 142w is provided on the movable member 142 so as to be positioned above the contact 141a in the Figure. In Figure 57, the projected portion 142x is provided on the movable member 142 so as to be positioned faced to the contact 141a in the Figure. In the example of Figure 58, the projected portion 142y is provided on the movable member 142 so as to be at the side surface portion of the contact 141a in the Figure.

According to this embodiment including the various examples, the cartridge movable member 142 has a rib 142u, rib 141v or projected portions (surfaces)

142w, 142x, 142y at a level higher than the contact 141a adjacent the contact 141a. Therefore, the operator is effectively prevented from inadvertently touching the electrical contact during manipulation of the cartridge. Thus, the electrical contact 141a can be protected.

This embodiment provides the same advantageous effects as with Embodiments 1 - 6.

The process cartridge B to which the present invention is applicable is not limited to a process cartridge for formation of the monochromatic image. But it may be a color cartridge for formation of multicolor image is (two-color images, three-color images, full-color images or the like) using a plurality of developing means. But, it is applicable to a color cartridge for formation of multicolor image is (two-color images, three-color images, full-color images or the like) using a plurality of developing means.

In the above-described, the electrophotographic photosensitive member has been described as photosensitive drum, but the electrophotographic photosensitive member is not limited to such a photosensitive drum, but the following is usable.

The photosensitive member may be a photoconductor which may be an amorphous silicon, amorphous selenium, zinc oxide, titanium oxide,

organic photoconductor (OPC) or the like. The photosensitive member may be in the form of a drum, a belt or another rotatable member, or a sheet, or the like. Generally, however, a drum or a belt is used, and in the case of a drum type photosensitive member, a cylinder of aluminum alloy or the like is coated with a photoconductor by evaporation or application or the like.

Also, the present invention is preferably usable with various known developing methods such as the magnetic brush developing method using two component toner, the cascade developing method, the touch-down developing method, the cloud developing method.

The structure of the charging means described in the foregoing is of a so- called contact type charging method, but a known charging means comprising a tungsten wire which is enclosed width metal shield of aluminum or the like at three sides, wherein positive or negative ions generated by application of a high voltage to said tungsten wire are directed to the surface of the photosensitive drum to uniformly charged the surface, is usable.

The charging means may be a roller type as described in the foregoing, a blade type (charging blade), a pad type, a block type, a rod type, a wire type or the like. As for a cleaning method for removing toner remaining on the photosensitive drum, a

blade, a furbrush, a magnetic brush or the like is usable.

[INDUSTRIAL APPLICABILITY]

As described in the foregoing, according to the present invention, the reliability of establishment of electrical connection between the output electrical contact of the main assembly of the electrophotographic image forming apparatus Ad the input electrical contact of the process cartridge when the process cartridge is mounted to the main assembly of the apparatus. In addition, the damage of the electric circuit of the main assembly of the image forming apparatus can be effectively prevented.

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

CLAIMES

1. A process cartridge detachably mountable to a main assembly of an electrophotographic image forming apparatus, said main assembly including an output contact movable between an electrical connecting position and a retracted position retracted from the electrical connecting position, a displaceable member for moving the output contact, and an elastic function member for elastically urging the displaceable member to urge the output contact toward the retracted position away from the electrical connecting position, said process cartridge comprising:

an electrophotographic photosensitive drum;

process means actable on said electrophotographic photosensitive drum;

a movable operation member movable relative to a cartridge frame, wherein after said process cartridge is mounted to the main assembly of the apparatus, said movable operation member is displaced by a driving force transmitted from the main assembly of the electrophotographic image forming apparatus to said process cartridge, so that movable operation member is engaged with the displaceable member provided in the main assembly of the electrophotographic image forming apparatus to move the displaceable member, in interrelation with which the output contact is moved from the retracted

position to the electrical connection position against an elastic force of the elastic function member;

an input electrical contact for receiving a voltage for enabling said process means by engagement with the output contact moved to the electrical connecting position.

2. A process cartridge according to Claim 1, further comprising a driving force receiving portion for receiving a driving force from said main assembly of the image forming apparatus when said process cartridge is mounted to said main assembly of the image forming apparatus, said driving force receiving portion being disposed at one end of said process cartridge with respect to a longitudinal direction of said electrophotographic photosensitive drum, and said movable operation member being disposed at the other end of said process cartridge with respect to the longitudinal direction.

3. A process cartridge according to Claim 1 or 2, wherein said movable operation member is supported on a cartridge frame for rotation about a shaft relative to said cartridge frame, and said electrophotographic photosensitive drum is rotated by a driving force

transmitted from the main assembly of the electrophotographic image forming apparatus to said process cartridge, wherein said driving force is transmitted to said movable operation member by rotation of said electrophotographic photosensitive drum to rotate said movable operation member relative to said cartridge frame.

4. A process cartridge according to Claim 1, 2 or 3, further comprising an elastic function member for applying an elastic force to said movable operation member, wherein said elastic force is contributable to rotation of said movable operation member.

5. A process cartridge according to Claim 1 or 2, further comprising an elastic function member for applying an elastic force to said movable operation member, wherein said movable operation member is rotated by being pushed by a projection provided on said electrophotographic photosensitive drum which is rotated by the driving force, and wherein when said movable operation member is rotated beyond a balanced position, said movable operation member becomes away from said projection, and said movable operation member starts rotating by the elastic force, thus

moving said output contact from said retracted position to said electrical connection position by movement of the movable operation member caused by said projection and said elastic function member.

6. A process cartridge according to any one of Claims 1 - 5, wherein said process means includes a charging member for electrically charging said electrophotographic photosensitive drum, and said input electrical contact receives from the output contact the voltage for charging said electrophotographic photosensitive drum.

7. A process cartridge according to any one of Claims 1 - 5, wherein said process means includes a developing member for developing the electrostatic latent image formed on said electrophotographic photosensitive drum, and said input electrical contact receives from the output contact a voltage for developing the electrostatic latent image.

8. A process cartridge detachably mountable to a main assembly of an electrophotographic image forming apparatus, wherein a main assembly of

electrophotographic image forming apparatus including,

a voltage source;

a voltage source circuit electrically connected with the voltage source;

a cartridge mounting portion for detachably mounting said process cartridge;

a fixed engageable member;

an output contact movable between an electrical connecting position and a retracted position which is retracted from the electrical connecting position and which is outside said cartridge mounting portion, said output contact electrically connected with said voltage source through said voltage source circuit; and.

a displaceable member having a displaceable engaging portion for moving the output contact, wherein the displaceable engaging portion is disposed downstream of the fixed engageable member, and at least a part of said displaceable engaging portion is overlapped with the fixed engageable member with respect to a direction in which said process cartridge is inserted; and.

an elastic function member for elastically urging the displaceable member to urge the output contact toward the retracted position away from the electrical connecting position;

said process cartridge including,

an electrophotographic photosensitive drum;

process means actable on said electrophotographic photosensitive drum;

a movable operation member movable relative to a cartridge frame, wherein after said process cartridge is mounted to the main assembly of the apparatus, said movable operation member is displaced by a driving force transmitted from the main assembly of the electrophotographic image forming apparatus to said process cartridge, so that movable operation member is engaged with the displaceable member provided in the main assembly of the electrophotographic image forming apparatus to move the displaceable member, in interrelation with which the output contact is moved from the retracted position to the electrical connection position against an elastic force of the elastic function member;

an input electrical contact for receiving a voltage for enabling said process means by engagement with the output contact moved to the electrical connecting position.

9. A process cartridge according to Claim 8, further comprising a driving force receiving portion for receiving a driving force from said main assembly of the image forming apparatus when said process

cartridge is mounted to said main assembly of the image forming apparatus, said driving force receiving portion being disposed at one end of said process cartridge with respect to a longitudinal direction of said electrophotographic photosensitive drum, and said movable operation member being disposed at the other end of said process cartridge with respect to the longitudinal direction.

10. A process cartridge according to Claim 8or 9, wherein said movable operation member is supported on a cartridge frame for rotation about a shaft relative to said cartridge frame, and said electrophotographic photosensitive drum is rotated by a driving force transmitted from the main assembly of the electrophotographic image forming apparatus to said process cartridge, wherein said driving force is transmitted to said movable operation member by rotation of said electrophotographic photosensitive drum to rotate said movable operation member relative to said cartridge frame.

11. A process cartridge according to Claim 8, 9 or 10, further comprising an elastic function member for applying an elastic force to said movable operation

member, wherein said elastic force is contributable to rotation of said movable operation member.

12. A process cartridge according to Claim 8 or 9, further comprising an elastic function member for applying an elastic force to said movable operation member, wherein said movable operation member is rotated by being pushed by a projection provided on said electrophotographic photosensitive drum which is rotated by the driving force, and wherein when said movable operation member is rotated beyond a balanced position, said movable operation member becomes away from said projection, and said movable operation member starts rotating by the elastic force, thus moving said output contact from said retracted position to said electrical connection position by movement of the movable operation member caused by said projection and said elastic function member.

13. A process cartridge according to any one of Claims 8 - 13, wherein said process means includes a charging member for electrically charging said electrophotographic photosensitive drum, and said input electrical contact receives from the output contact the voltage for charging said

electrophotographic photosensitive drum.

14. A process cartridge according to any one of Claims 8 - 13, wherein said process means includes a developing member for developing the electrostatic latent image formed on said electrophotographic photosensitive drum, and said input electrical contact receives from the output contact a voltage for developing the electrostatic latent image.

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

(i) an output contact movable between an electrical connecting position and a retracted position retracted from the electrical connecting position,

(ii) a main assembly displaceable member for moving the output contact,

(iii) a mounting portion for detachably mounting said process cartridge, said process cartridge including,

an electrophotographic photosensitive drum;

process means actable on said electrophotographic photosensitive drum;

a movable operation member, wherein after said process cartridge is mounted to the main assembly of the apparatus, said movable operation member is displaced by a driving force transmitted from the main assembly of the electrophotographic image forming apparatus to said process cartridge, so that movable operation member is engaged with the displaceable member provided in the main assembly of the electrophotographic image forming apparatus to move said displaceable member, in interrelation with which the output contact is moved from the retracted position to the electrical connection position;

an input electrical contact for receiving a voltage for enabling said process means by engagement with the output contact moved to the electrical connecting position, when said process cartridge is set in said mounting portion.

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

(i) voltage source;

(ii) a voltage source circuit connected with said voltage source;

a fixed member fixed in said

electrophotographic image forming apparatus;

an output contact movable between an electrical connecting position and a retracted position which is retracted from the electrical connecting position and which is outside said cartridge mounting portion, said output contact electrically connected with said voltage source through said voltage source circuit; and.

a displaceable member having a displaceable engaging portion for moving the output contact, wherein the displaceable engaging portion is disposed downstream of the fixed engageable member, and at least a part of said displaceable engaging portion is overlapped with the fixed engageable member with respect to a direction in which said process cartridge is mounted; and.

an elastic function member for elastically urging the displaceable member to urge the output contact toward the retracted position away from the electrical connecting position;

(vii) an electrophotographic photosensitive drum;

process means actable on said electrophotographic photosensitive drum;

a movable operation member movable relative to a cartridge frame, wherein after said process cartridge is mounted to the main assembly of the

apparatus, said movable operation member is displaced by a driving force transmitted from the main assembly of the electrophotographic image forming apparatus to said process cartridge, so that movable operation member is engaged with the displaceable member provided in the main assembly of the electrophotographic image forming apparatus to move the displaceable member, in interrelation with which the output contact is moved from the retracted position to the electrical connection position against an elastic force of the elastic function member;

an input electrical contact for receiving a voltage for enabling said process means by engagement with the output contact moved to the electrical connecting position.

17. An apparatus according to Claim 15or 16, wherein said movable operation member is supported on a cartridge frame for rotation about a shaft relative to said cartridge frame, and said electrophotographic photosensitive drum is rotated by a driving force transmitted from the main assembly of the electrophotographic image forming apparatus to said process cartridge, wherein said driving force is transmitted to said movable operation member by rotation of said electrophotographic photosensitive

drum to rotate said movable operation member relative to said cartridge frame.

18. An apparatus according to any one of Claims 15 - 17, further comprising an elastic function member for applying an elastic force to said movable operation member, wherein said elastic force is contributable to rotation of said movable operation member.

19. An apparatus according to Claim 15, 16 or 17, further comprising an elastic function member for applying an elastic force to said movable operation member, wherein said movable operation member is rotated by being pushed by a projection provided on said electrophotographic photosensitive drum which is rotated by the driving force, and wherein when said movable operation member is rotated beyond a balanced position, said movable operation member becomes away from said projection, and said movable operation member starts rotating by the elastic force, thus moving said output contact from said retracted position to said electrical connection position by movement of the movable operation member caused by said projection and said elastic function member.

20. An apparatus according to any one of Claims 15 - 19, wherein said process means includes a charging member for electrically charging said electrophotographic photosensitive drum, and said input electrical contact receives from the output contact the voltage for charging said electrophotographic photosensitive drum.

21. An apparatus Ay one of Claims 15 - 19, wherein said process means includes a developing member for developing the electrostatic latent image formed on said electrophotographic photosensitive drum, and said input electrical contact receives from the output contact a voltage for developing the electrostatic latent image.

22. A process cartridge according to Claim 1 or 8, wherein said input electrical contact is contacted to the output electrical contact, and then slides on the output electrical contact.

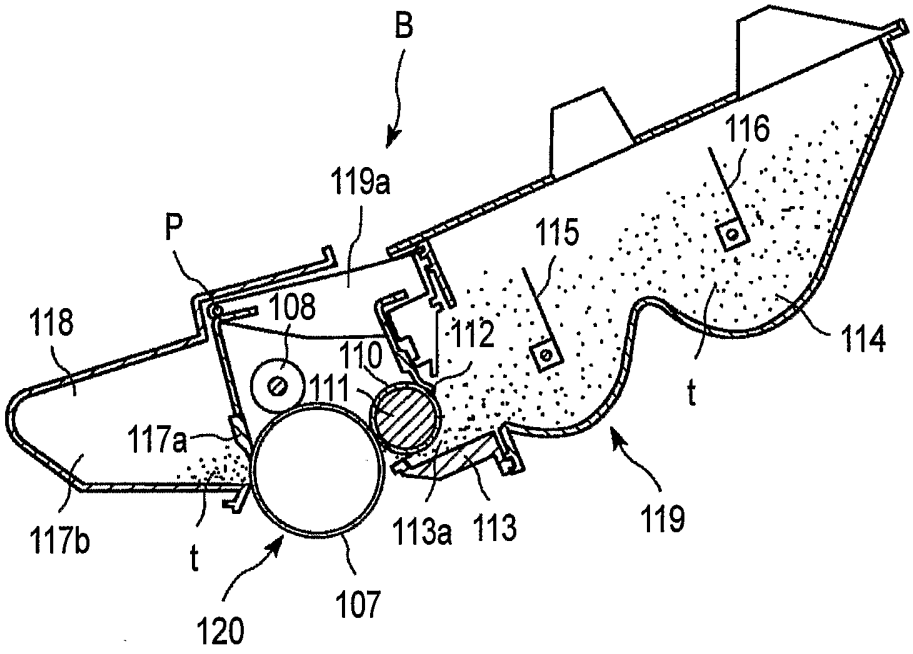

B
119a
P
108
118
110
112
111
117a
117b
t
113a
113
107
120
115
116
114
t
119

FIG.1

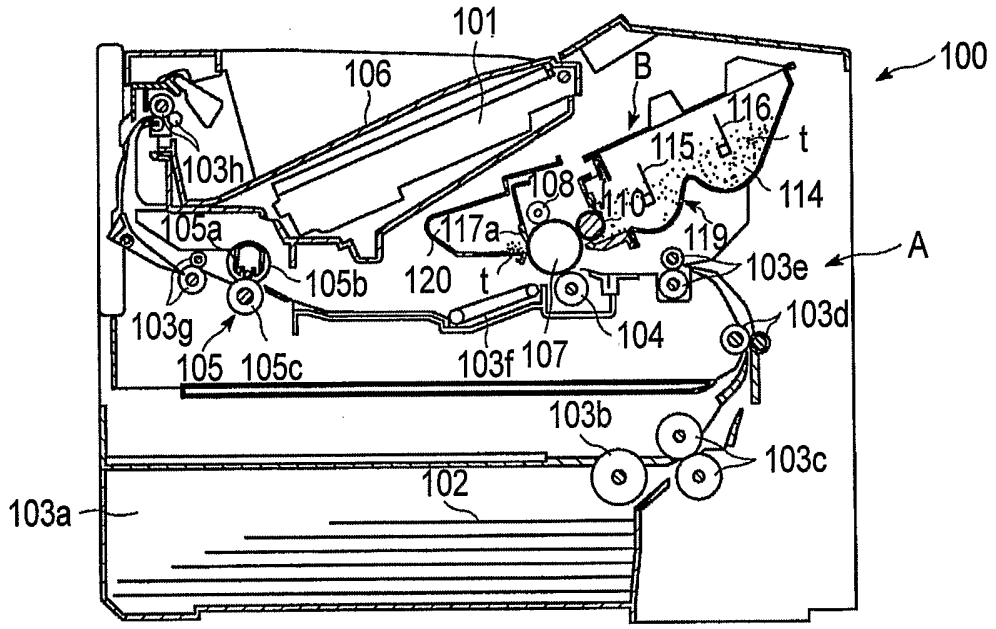

101
100
106
B
116
115
t
103h
108
114
110
105a
117a
119
A
105b
120
t
103e
103g
103d
105
105c
103f
107
104
103b
103c
102
103a

FIG.2

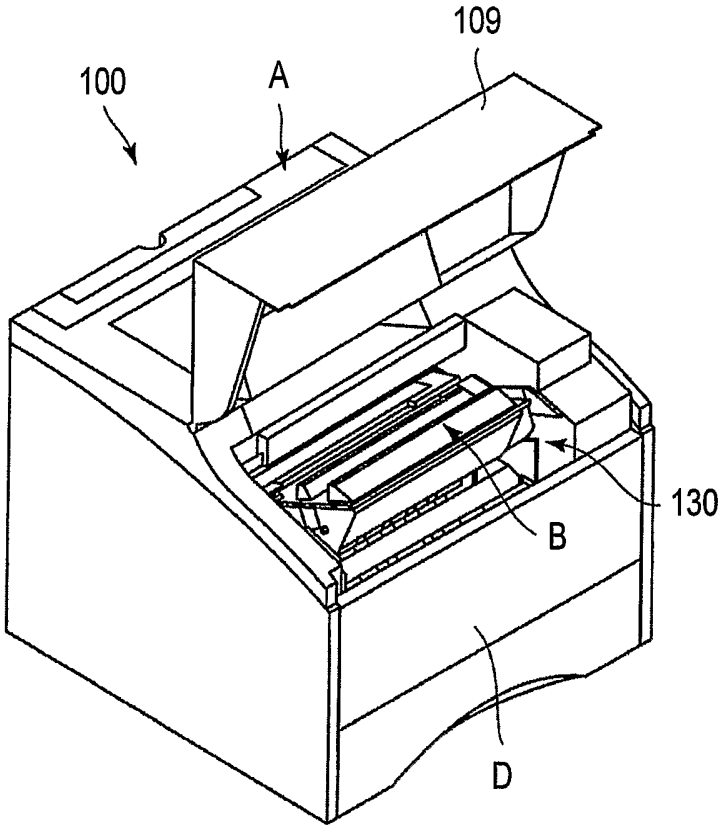


FIG.3

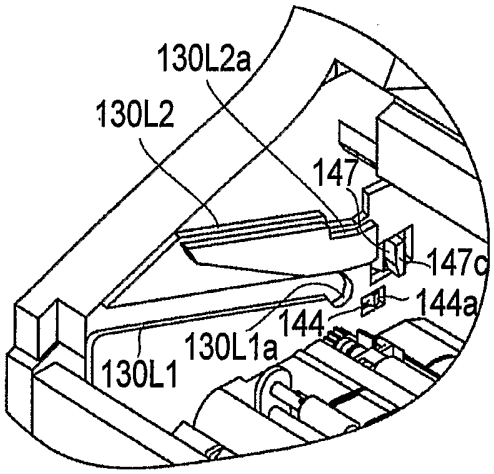


FIG.4

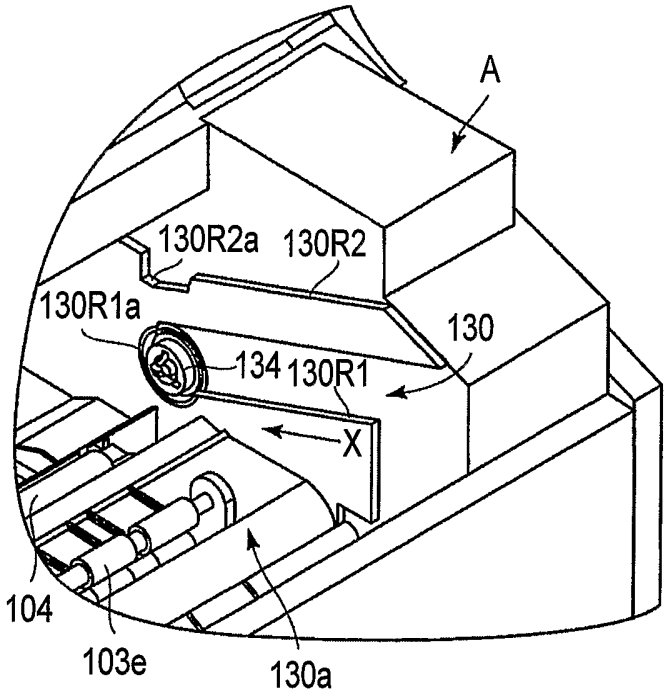

A
130R2a
130R2
130R1a
130
134
130R1
X
104
103e
130a

FIG.5

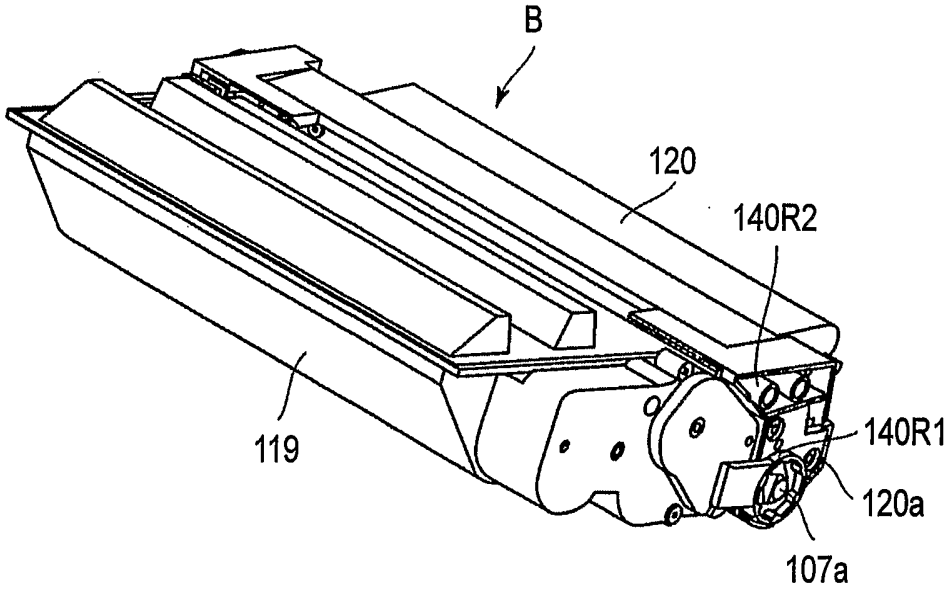

B
120
140R2
140R1
119
120a
107a

FIG.6

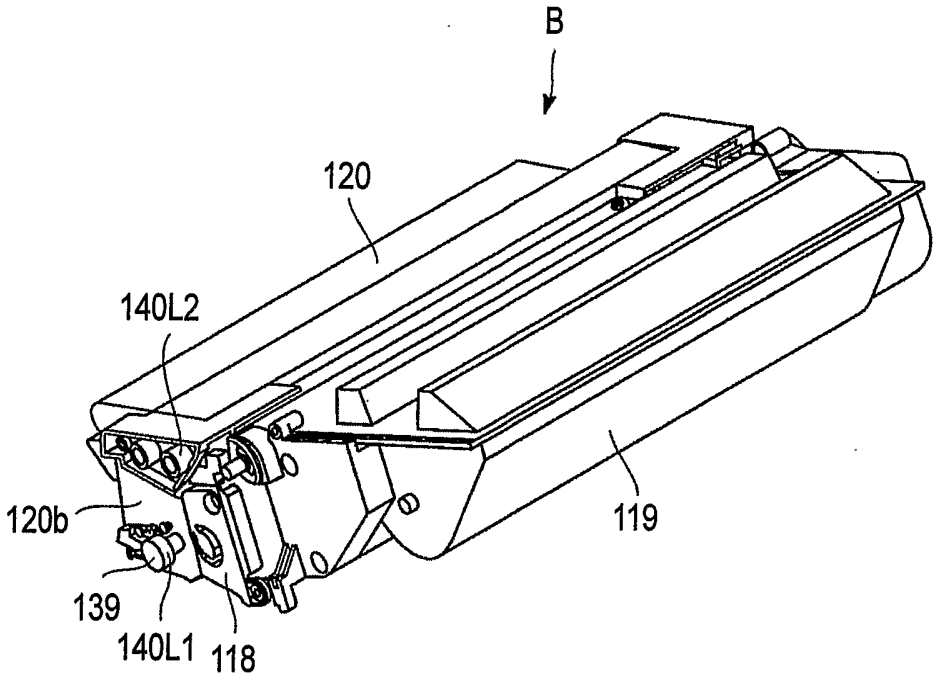


FIG.7

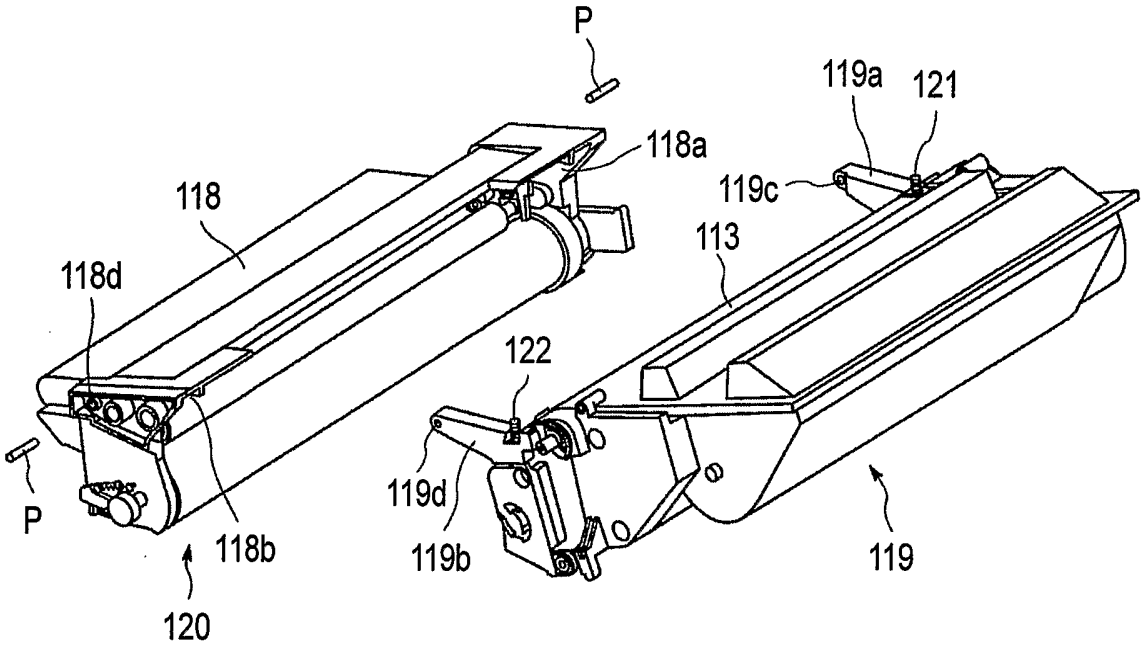


FIG.8

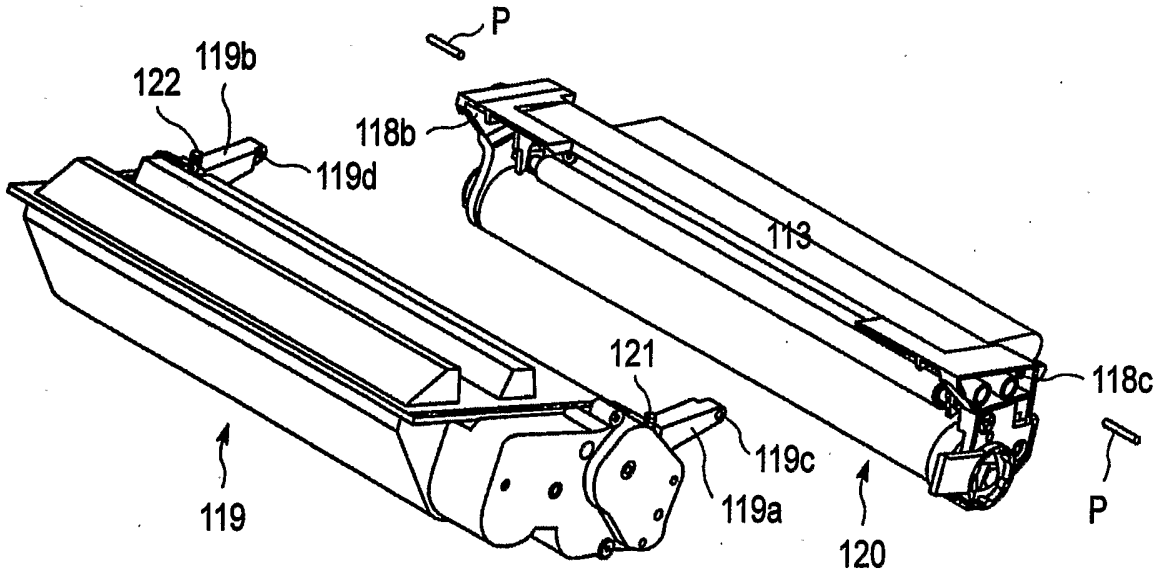


FIG.9

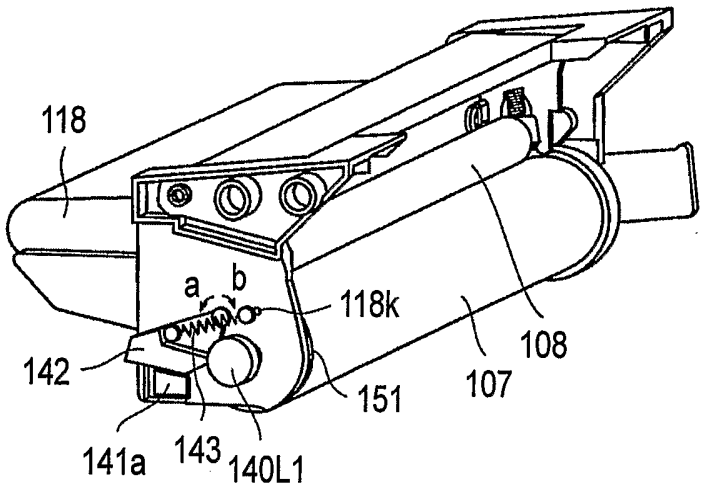

118
a
b
118k
142
151
107
108
141a
143
140L1

FIG.10

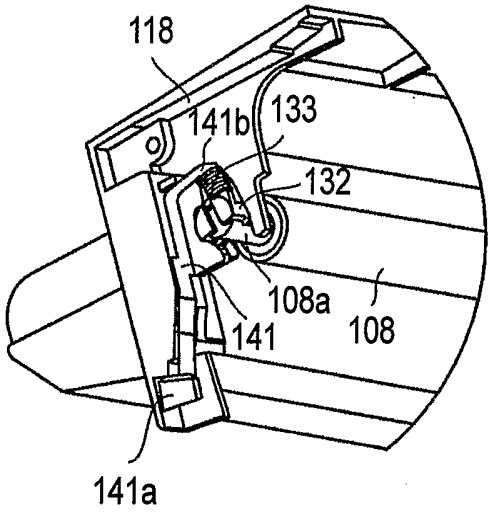

118
141b
133
132
108a
141
108
141a

FIG.11

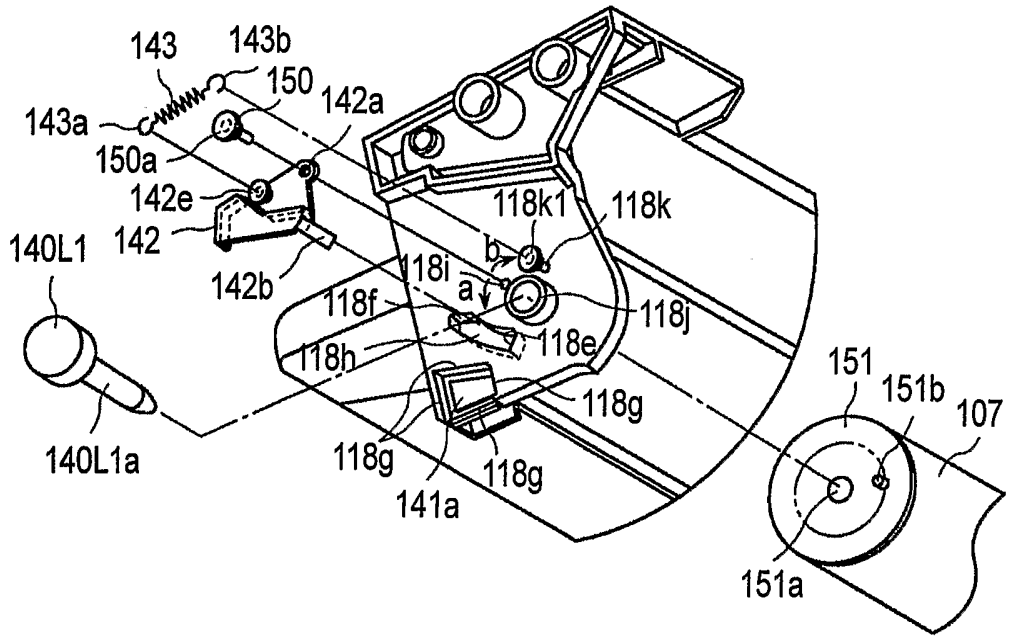
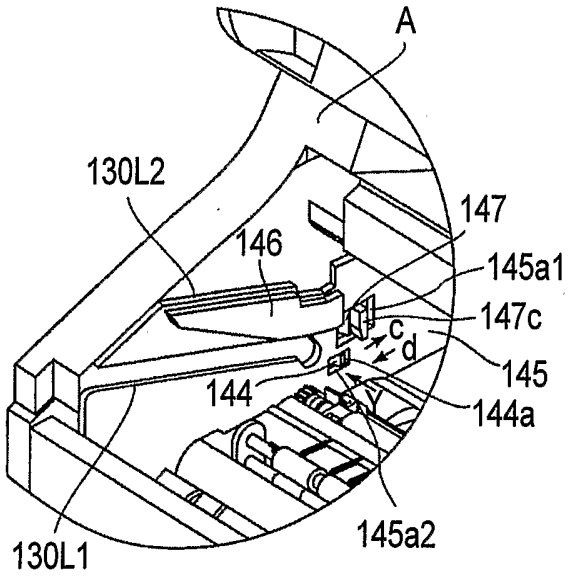

143
143b
150
142a
143a
150a
142e
142
140L1
142b
118k1
118k
b
118i
a
118f
118j
118h
118e
118g
151
151b
107
140L1a
118g
118g
141a
151a

FIG.12

(a)


A
130L2
147
146
145a1
147c
c
d
145
144
144a
145a2
130L1

(b)

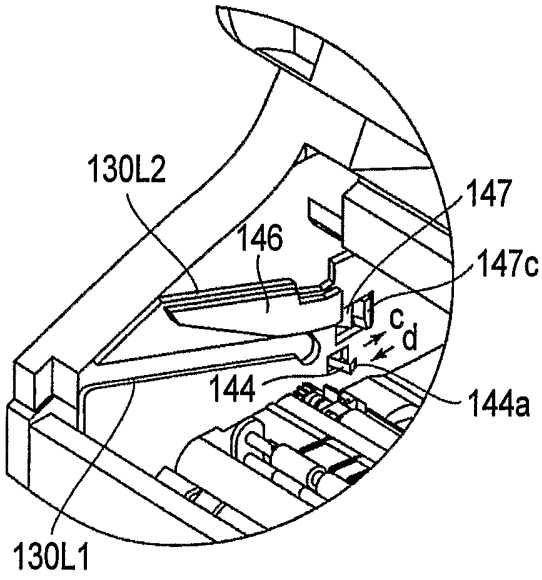

130L2
147
146
147c
c
d
144
144a
130L1

FIG.13

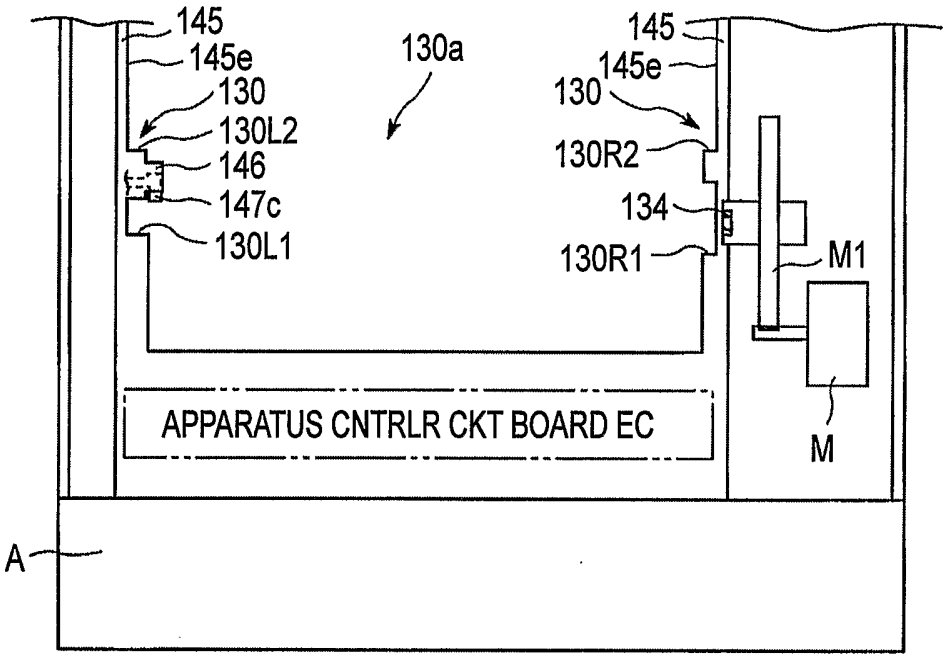

145
145e
130
130L2
146
147c
130L1
130a
145
145e
130
130R2
134
130R1
M1
M
APPARATUS CNTRLR CKT BOARD EC
A

FIG.14

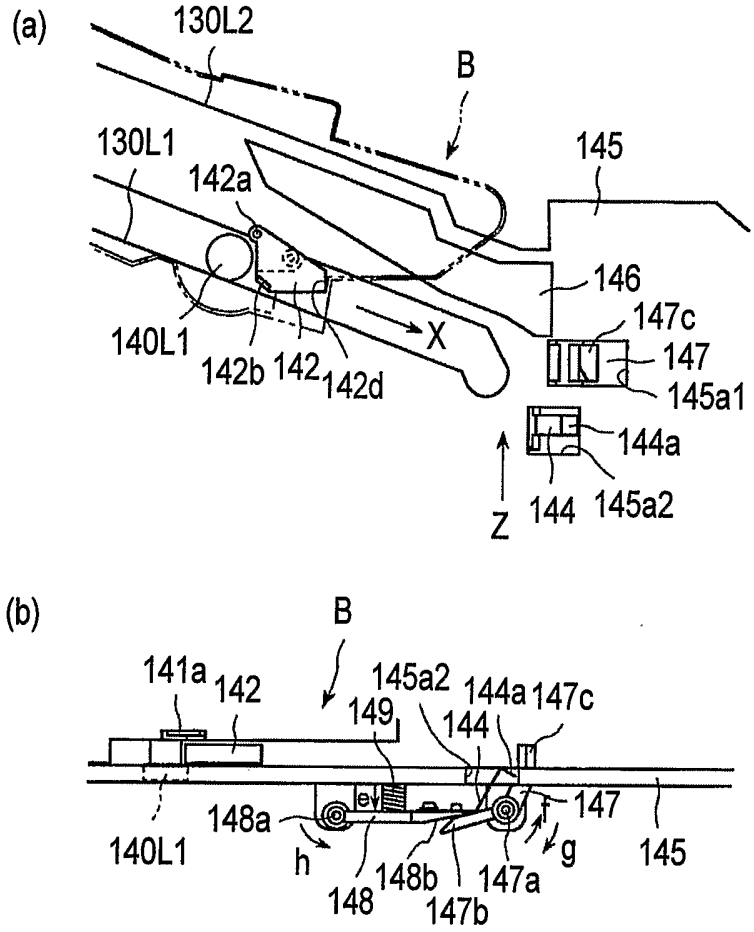

(a)
130L2
B
130L1
142a
145
146
147c
147
145a1
140L1
142b
142
142d
X
144a
144
145a2
Z
(b)
B
141a
142
145a2
144a
147c
149
144
147
148a
140L1
h
148
148b
147b
147a
g
145

FIG.15

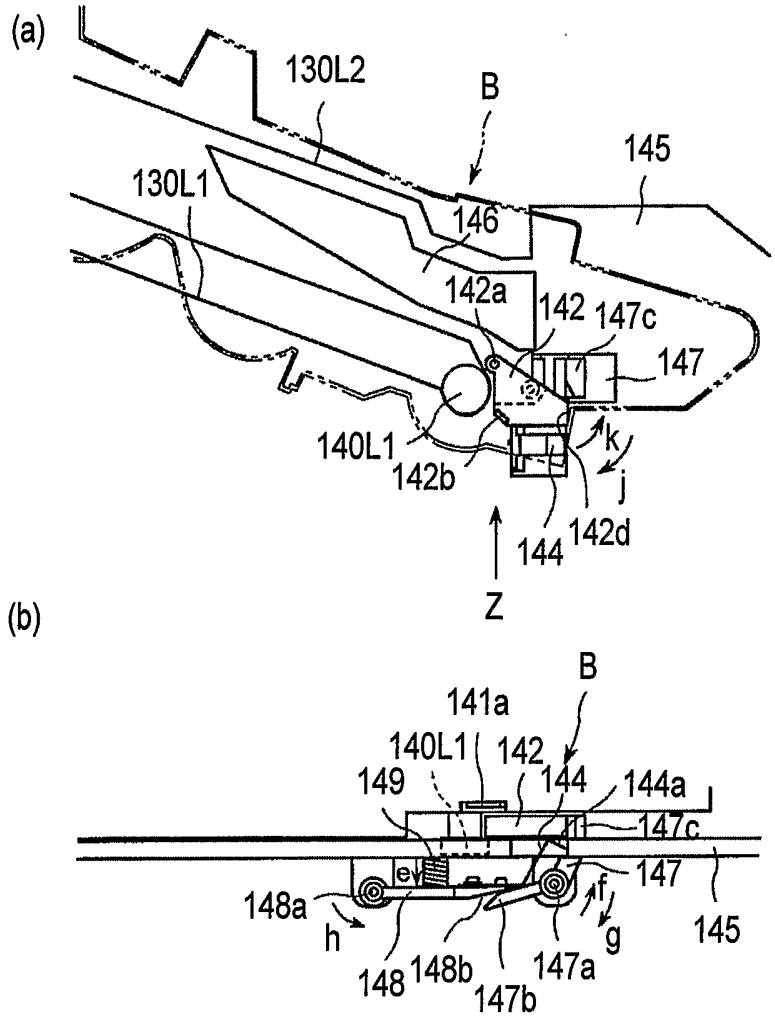

(a)
130L2
B
145
130L1
146
142a
142
147c
147
140L1
142b
k
j
144
142d
Z
(b)
B
141a
140L1
142
149
144
144a
147c
147
148a
h
148
148b
147b
147a
g
145

FIG.16

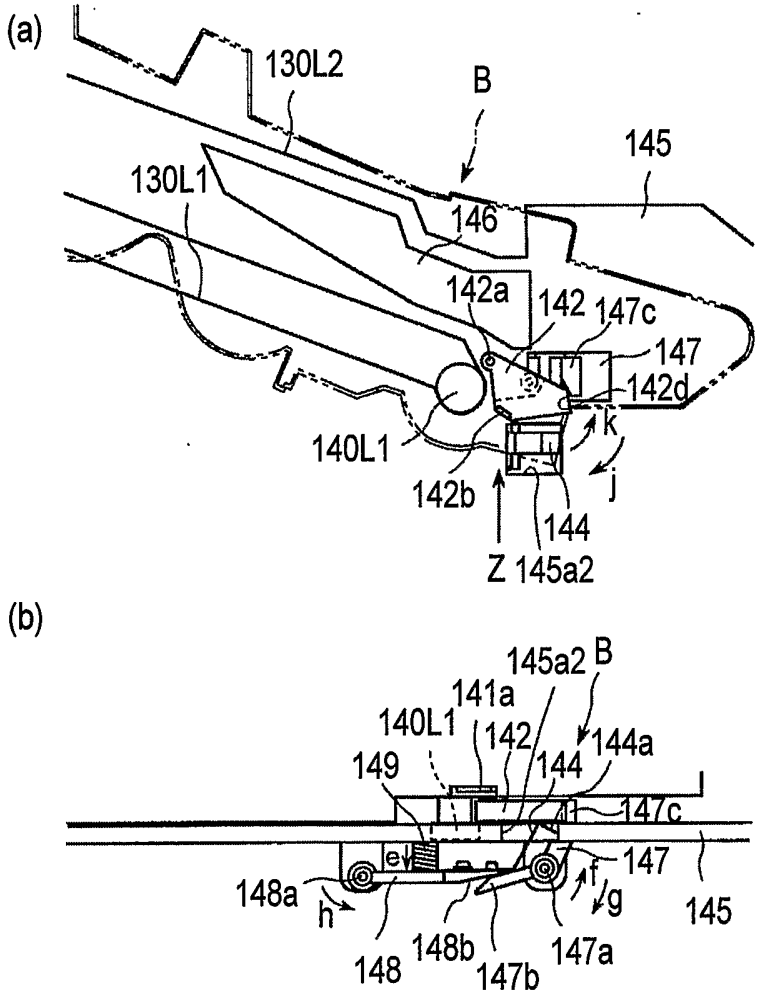

(a)
130L2
B
145
130L1
146
142a
142
147c
147
142d
k
140L1
j
142b
144
Z
145a2
(b)
145a2
B
141a
140L1
142
144a
149
144
147c
147
148a
h
f
g
145
148
148b
147b
147a

FIG.17

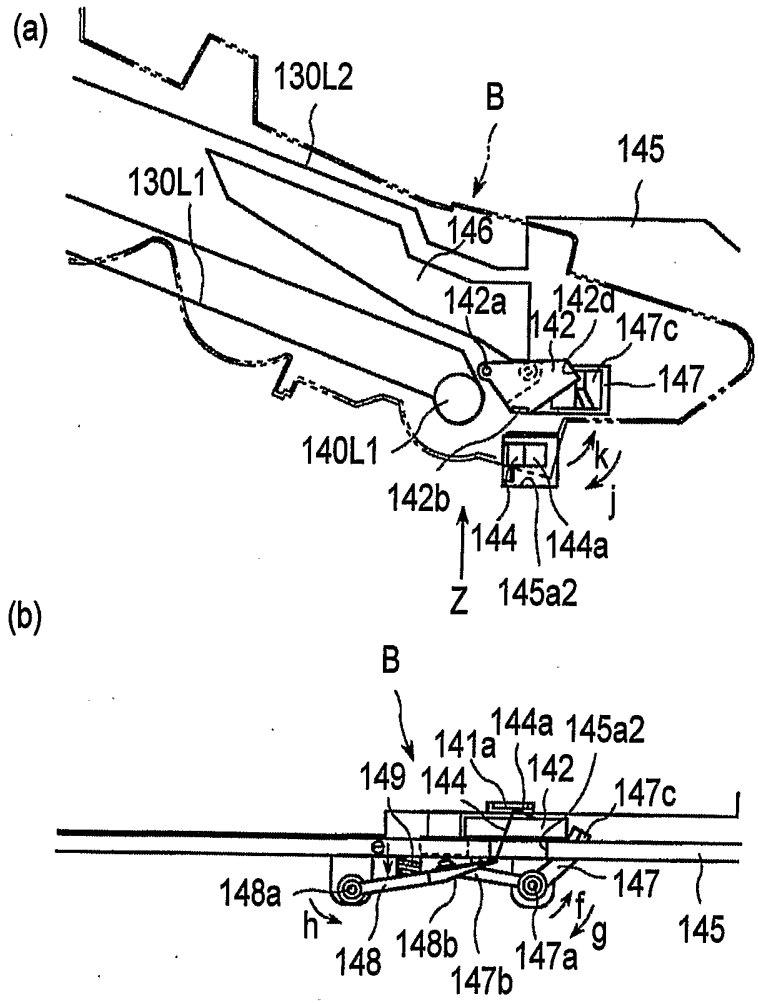
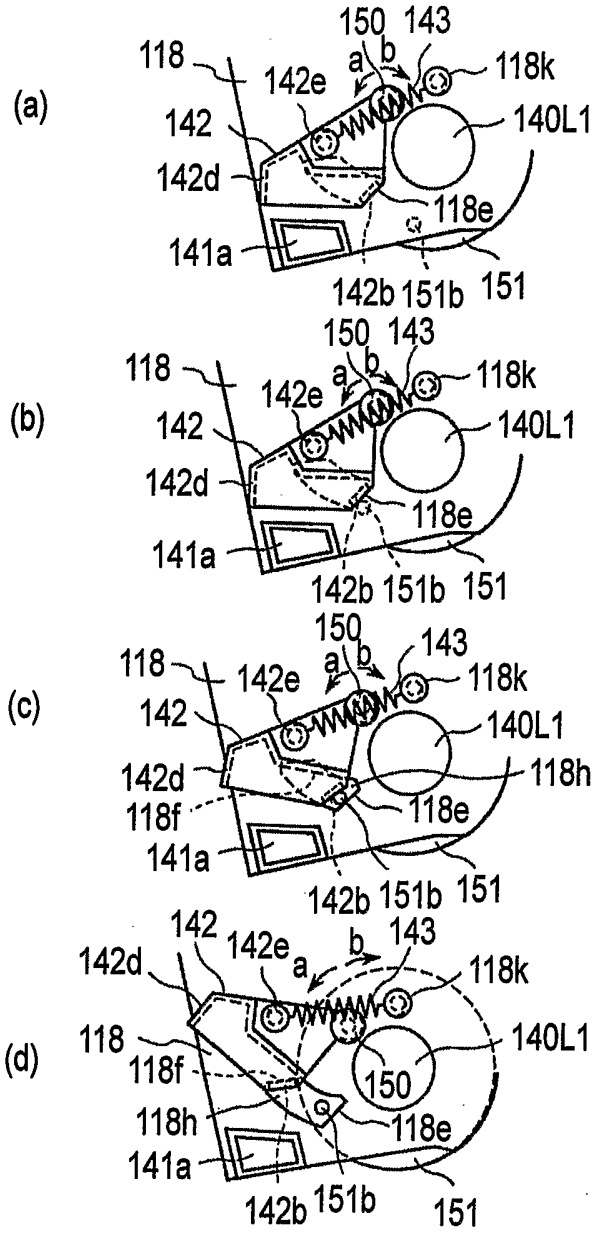

(a)
130L2
B
145
130L1
146
142a
142d
142
147c
147
140L1
k
j
142b
144
144a
Z
145a2
(b)
B
144a
145a2
141a
149
144
142
147c
148a
147
f
g
h
145
148
148b
147a
147b

FIG.18


(a)
150
143
118
a
b
142e
118k
142
140L1
142d
118e
141a
142b
151b
151
(b)
150
143
118
a
b
142e
118k
142
140L1
142d
118e
141a
142b
151b
151
(c)
150
143
118
a
b
142e
118k
142
140L1
142d
118h
118f
118e
141a
142b
151b
151
(d)
142
142e
142d
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118k
140L1
118
118f
150
118h
118e
141a
142b
151b
151

FIG.19

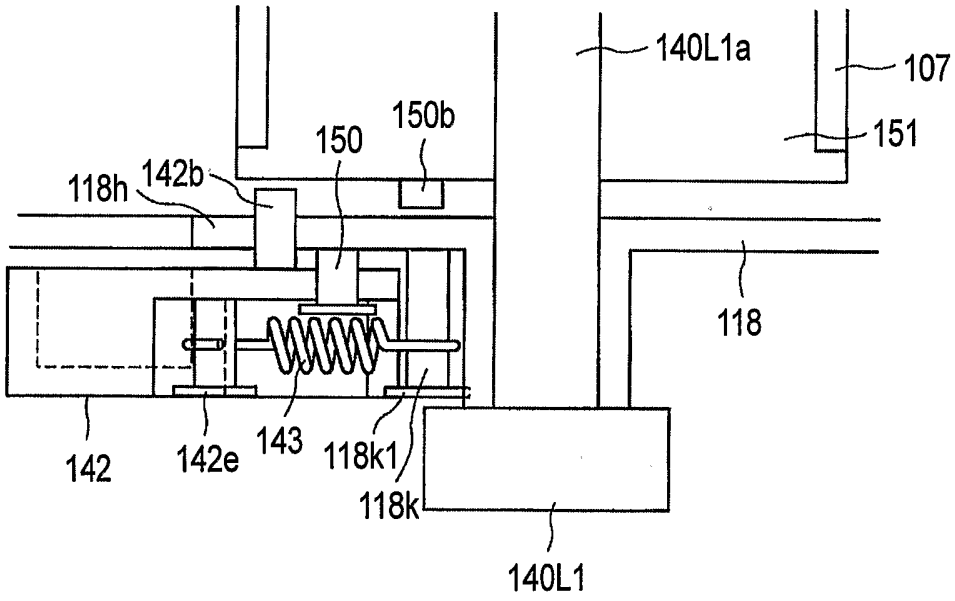

140L1a
107
150b
150
151
118h
142b
118
142
142e
143
118k1
118k
140L1

FIG.20

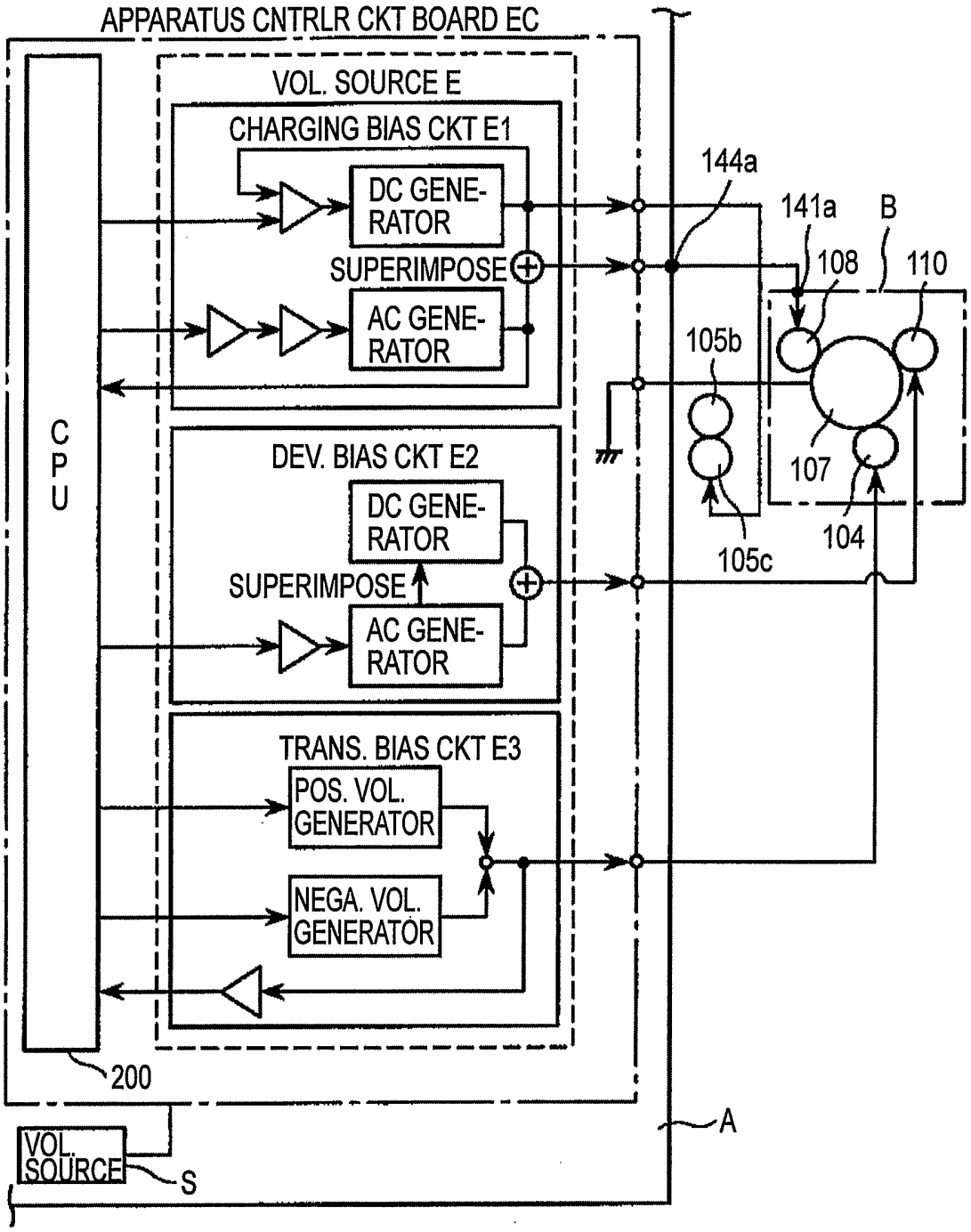

APPARATUS CNTRLR CKT BOARD EC
VOL. SOURCE E
CHARGING BIAS CKT E1
DC GENE-RATOR
SUPERIMPOSE
AC GENE-RATOR
DEV. BIAS CKT E2
DC GENE-RATOR
SUPERIMPOSE
AC GENE-RATOR
TRANS. BIAS CKT E3
POS. VOL. GENERATOR
NEGA. VOL. GENERATOR
CPU
200
VOL. SOURCE
S
144a
141a
B
108
110
105b
107
104
105c
A

FIG.21

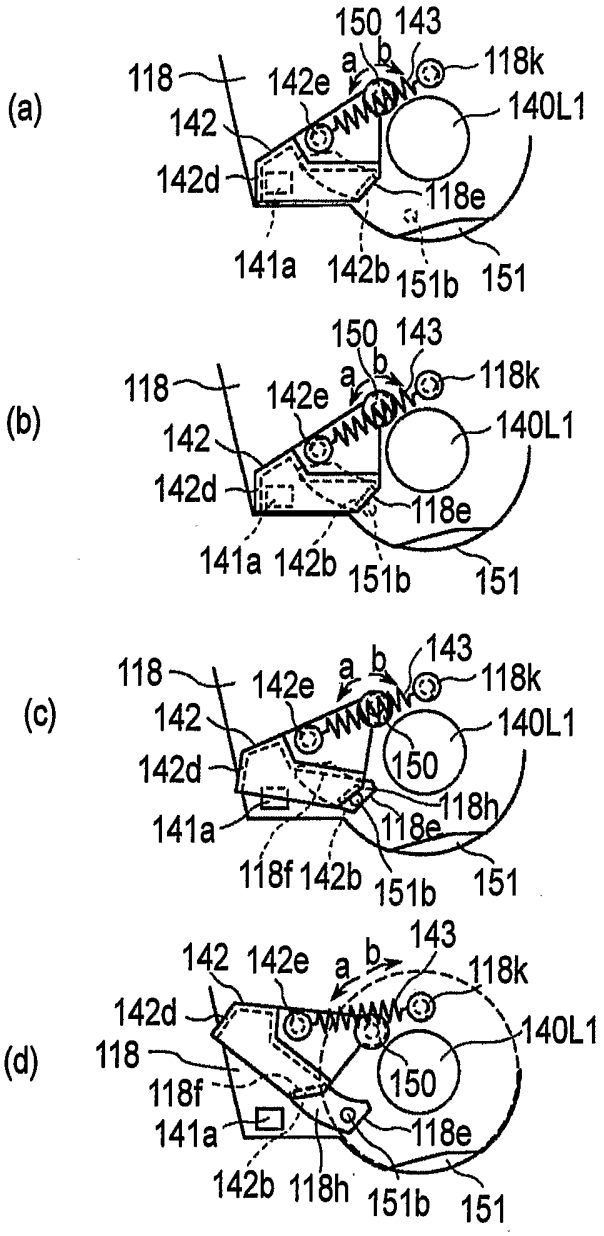

(a)
150
143
a
b
118
142e
118k
142
140L1
142d
118e
141a
142b
151b
151
(b)
150
143
a
b
118
142e
118k
142
140L1
142d
118e
141a
142b
151b
151
(c)
118
142e
a
b
143
118k
142
140L1
142d
150
118h
141a
118e
118f
142b
151b
151
(d)
142
142e
a
b
143
118k
142d
140L1
118
150
118f
141a
118e
142b
118h
151b
151

FIG.22

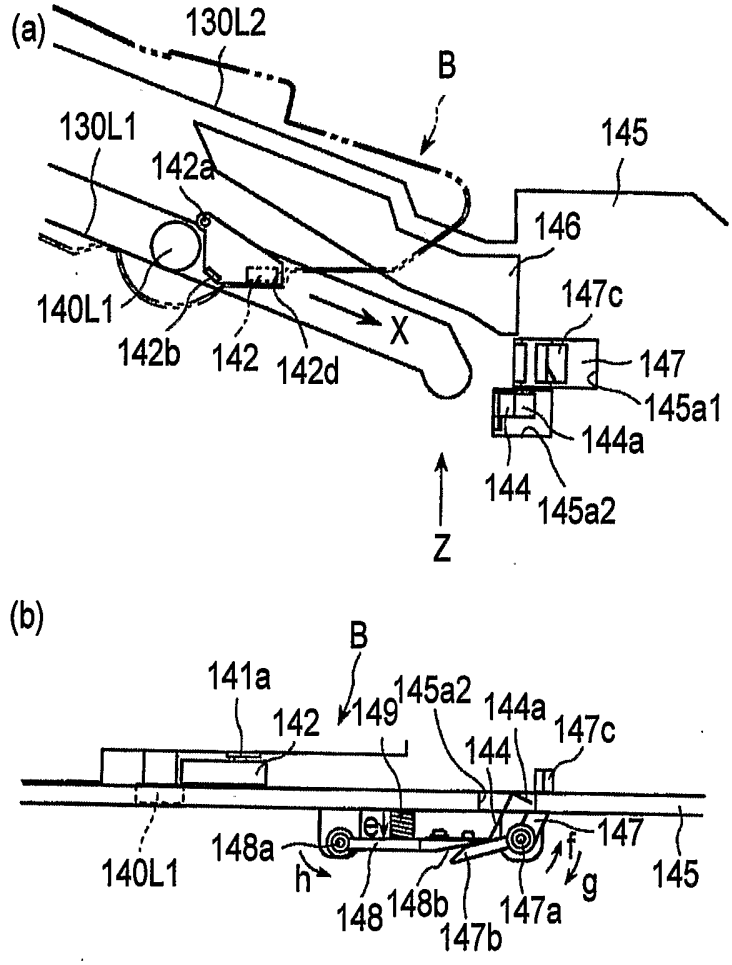

(a)
130L2
B
130L1
142a
145
146
147c
140L1
142b
142
142d
X
147
145a1
144a
144
145a2
Z
(b)
B
141a
142
149
145a2
144a
147c
144
147
140L1
148a
ev
f
g
145
h
148
148b
147b
147a

FIG.23

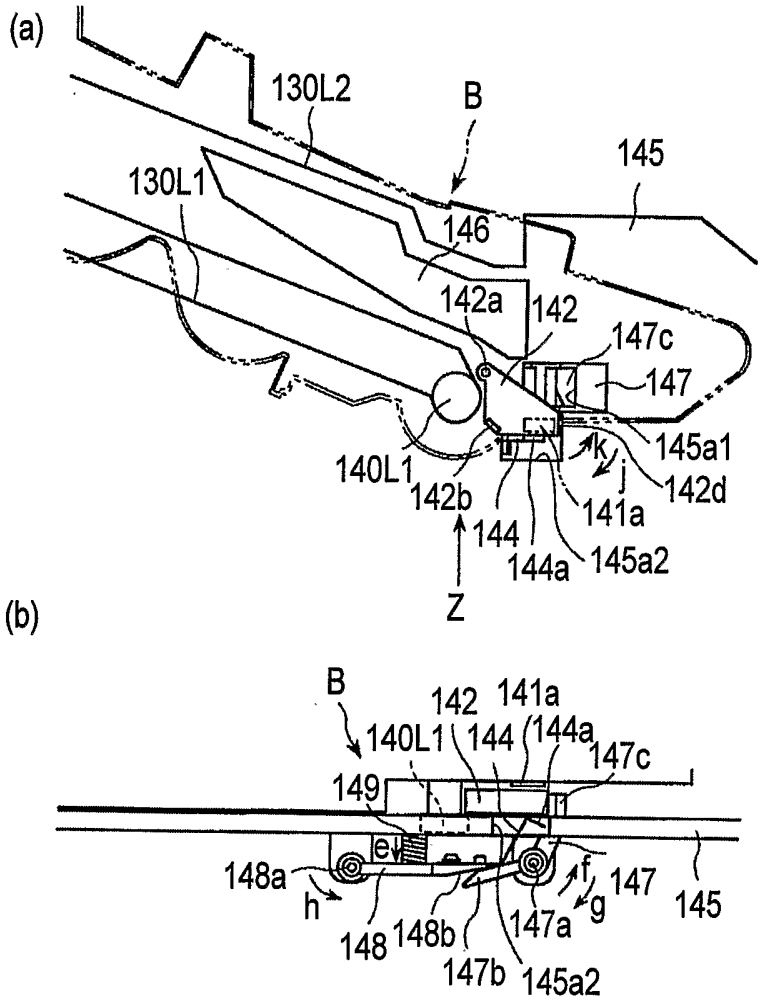

(a)
130L2
B
145
130L1
146
142a
142
147c
147
145a1
k
j
140L1
142b
144
141a
142d
144a
145a2
Z
(b)
B
142
141a
140L1
144
144a
147c
149
e
148a
h
148
148b
147b
145a2
f
g
147a
147
145

FIG.24

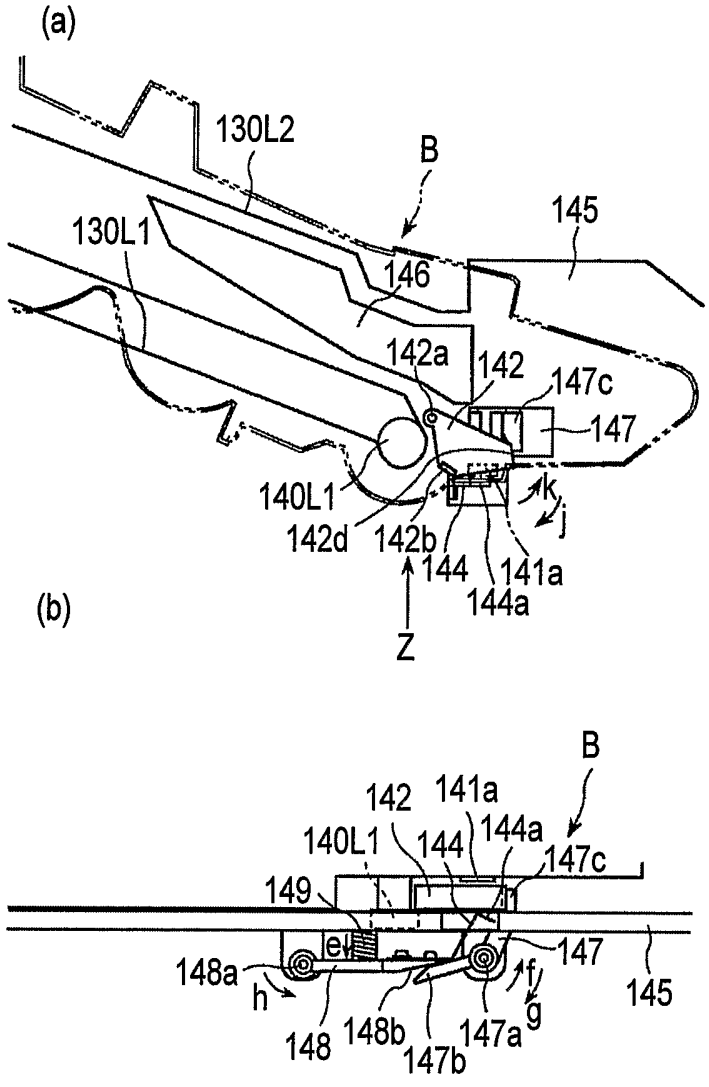

(a)
130L2
B
145
130L1
146
142a
142
147c
147
140L1
k
j
142d
142b
144
141a
144a
(b)
Z
B
142
141a
140L1
144
144a
147c
149
147
148a
e
f
g
h
145
148
148b
147a
147b

FIG.25

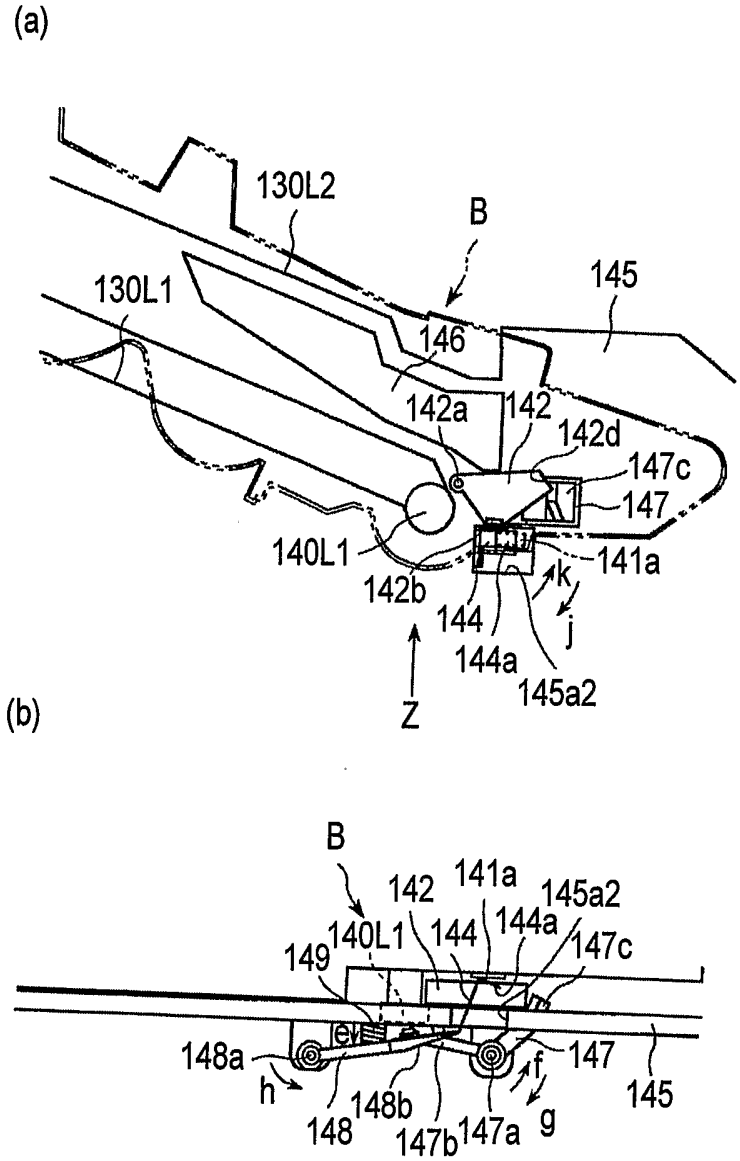

(a)
130L2
B
145
130L1
146
142a
142
142d
147c
147
140L1
141a
142b
144
k
j
144a
145a2
Z
(b)
B
142
141a
145a2
140L1
144
144a
147c
149
148a
147
145
h
148b
f
148
147b
147a
g

FIG.26

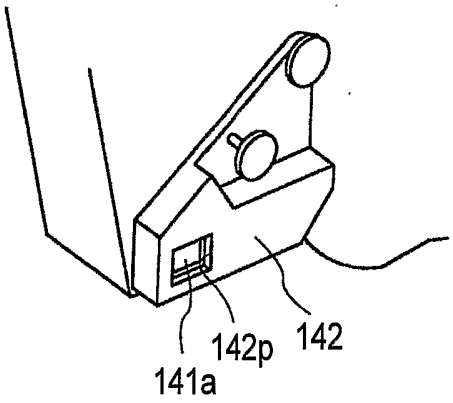


FIG.27

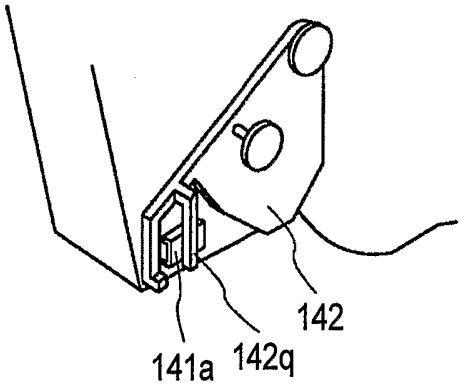


FIG.28

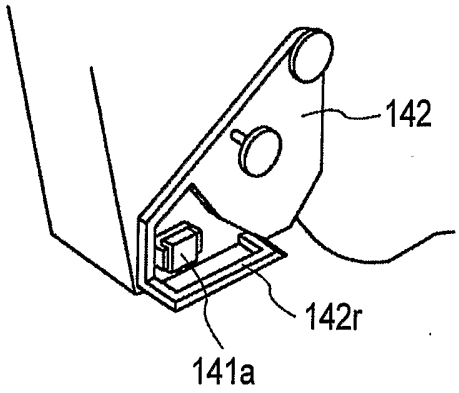


FIG.29

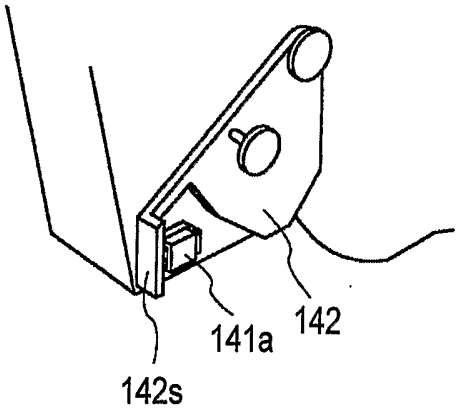


FIG.30

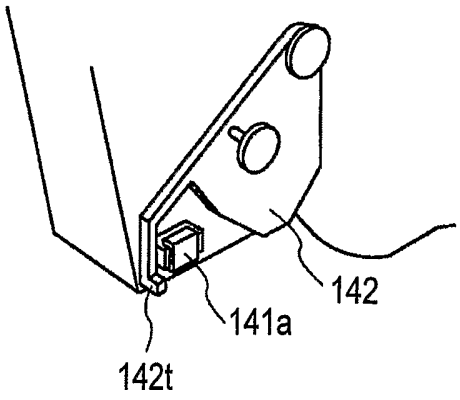

142
141a
142t

FIG.31

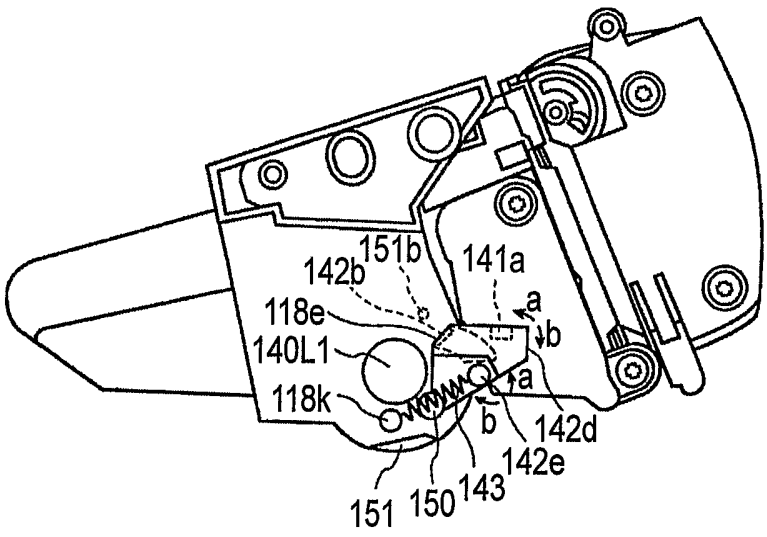

151b
142b
141a
a
118e
b
140L1
a
118k
b
142d
142e
151
150
143

FIG.32

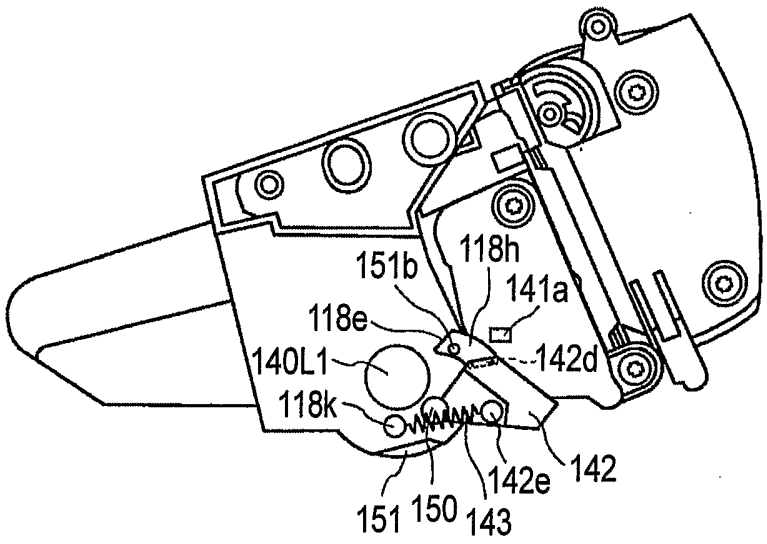
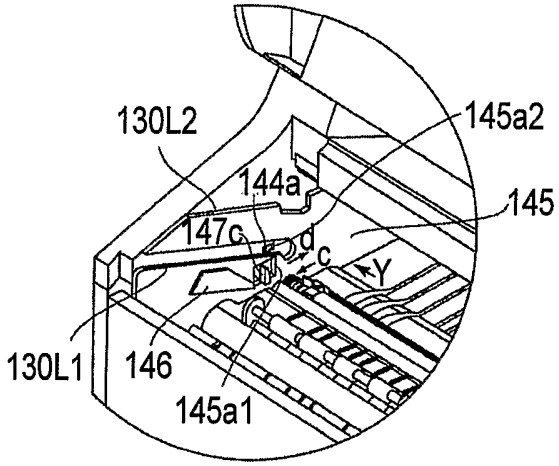


FIG.33

(a)


130L2
145a2
144a
145
147c
d
c
Y
130L1
146
145a1

(b)

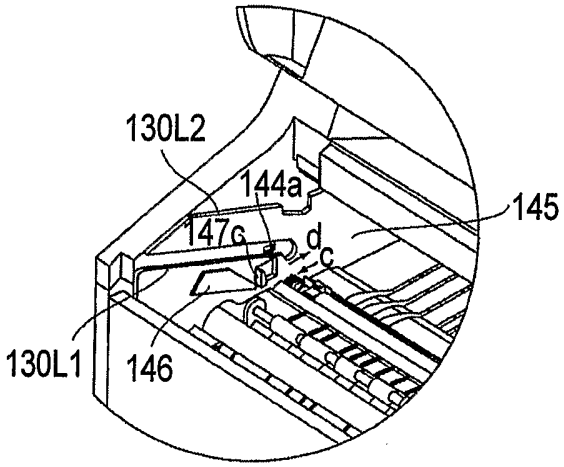

130L2
144a
145
147c
d
c
130L1
146

FIG.34

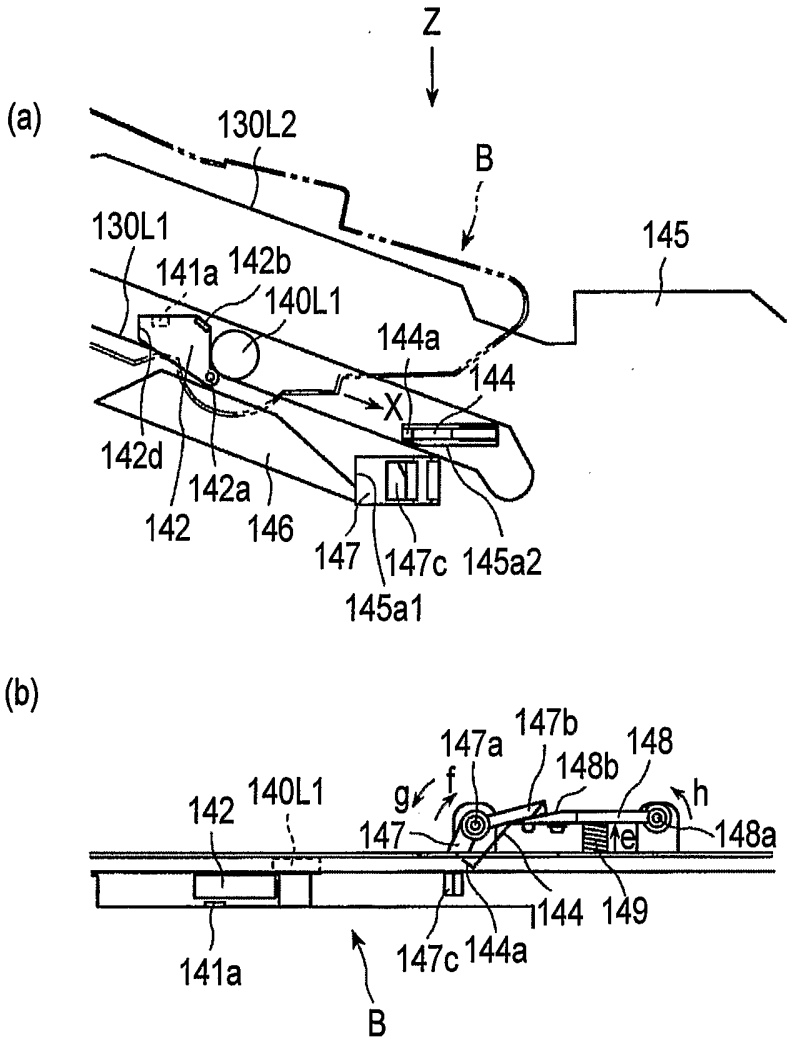

Z
(a)
130L2
B
130L1
145
141a
142b
140L1
144a
144
X
142d
142a
142
146
147
147c
145a2
145a1
(b)
147b
147a
148
148b
140L1
142
g
f
h
147
148a
144
149
141a
147c
144a
B

FIG.35

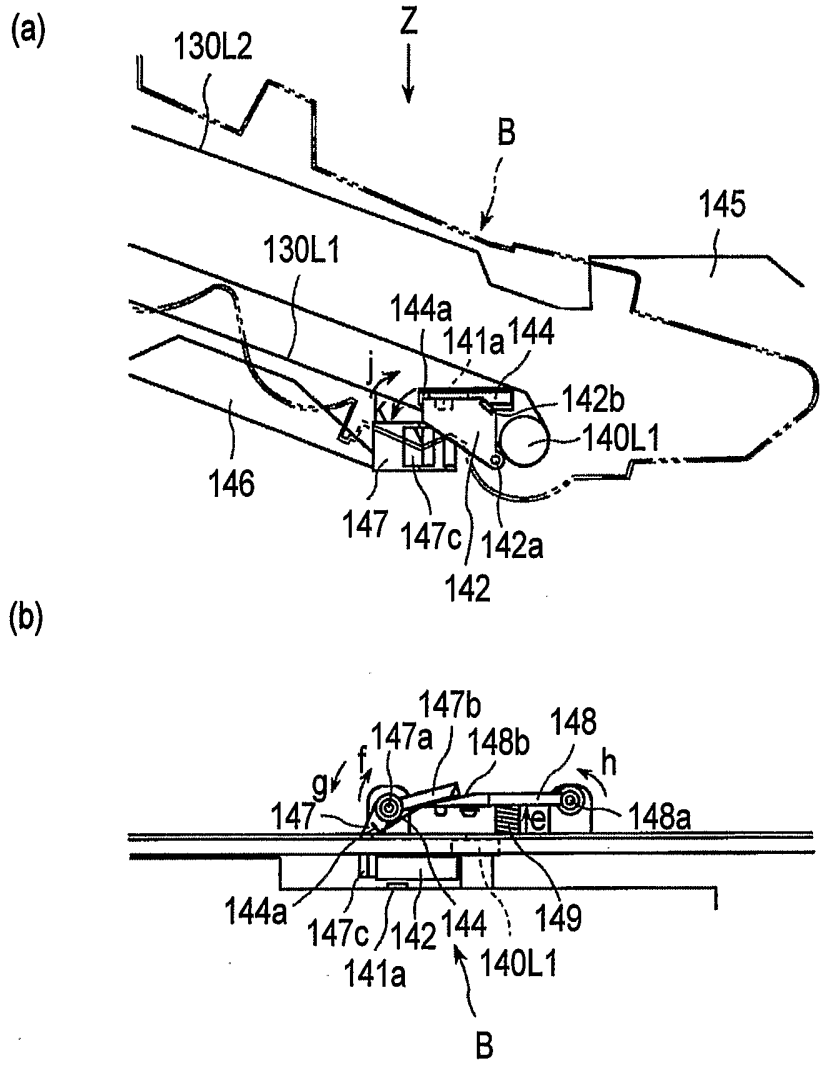

(a)
130L2
Z
B
145
130L1
144a
141a
144
j
k
142b
140L1
146
147
147c
142a
142
(b)
147b
147a
148b
148
f
g
h
147
148a
144a
147c
142
144
149
141a
140L1
B

FIG.36

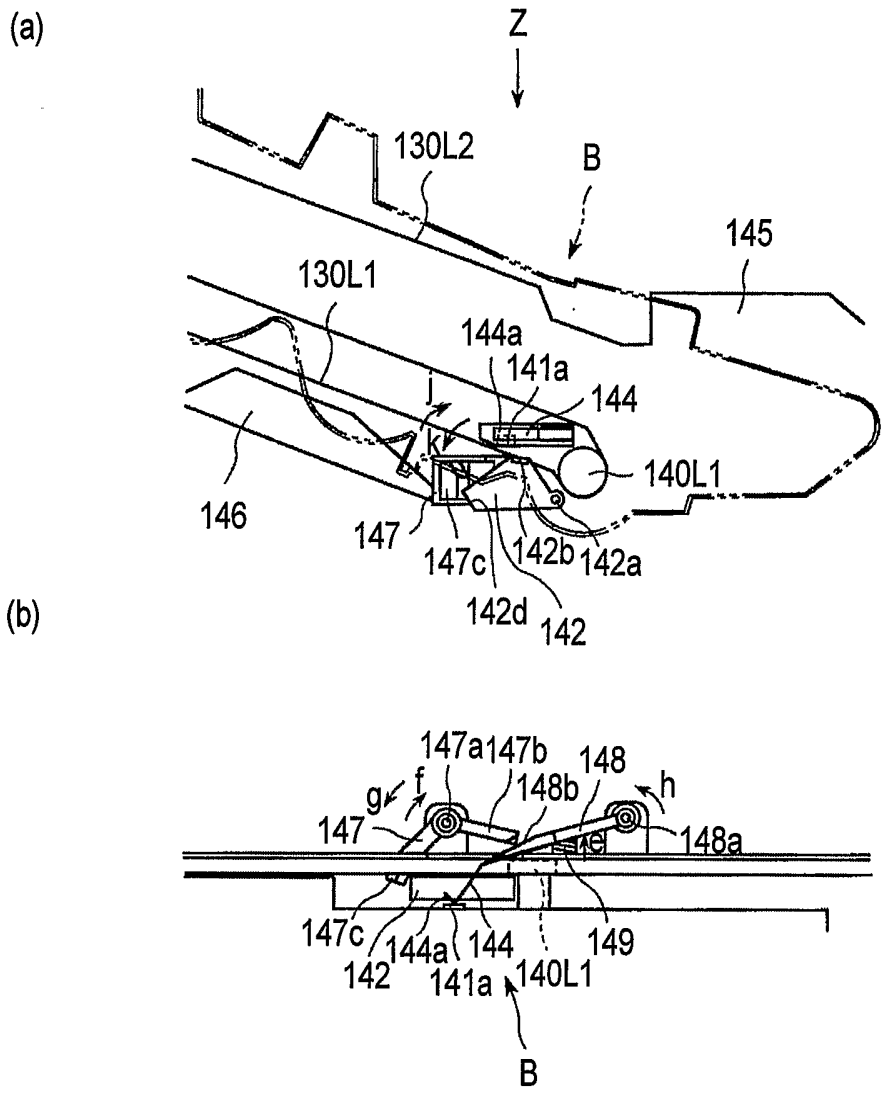

(a)
Z
130L2
B
145
130L1
144a
141a
144
J
K
140L1
146
147
147c
142b
142a
142d
142
(b)
147a
147b
148
148b
h
g
f
147
148a
147c
144a
144
149
142
141a
140L1
B

FIG.37

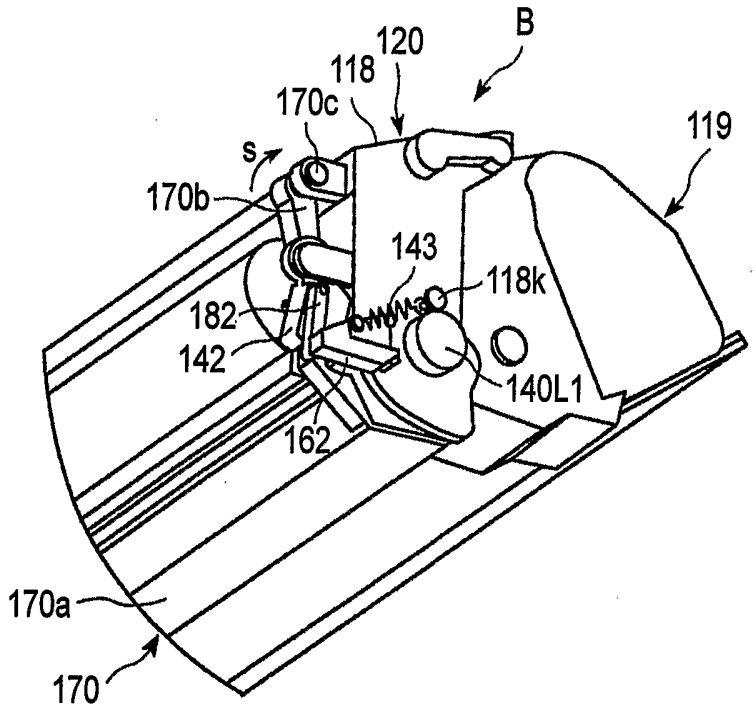


FIG.38

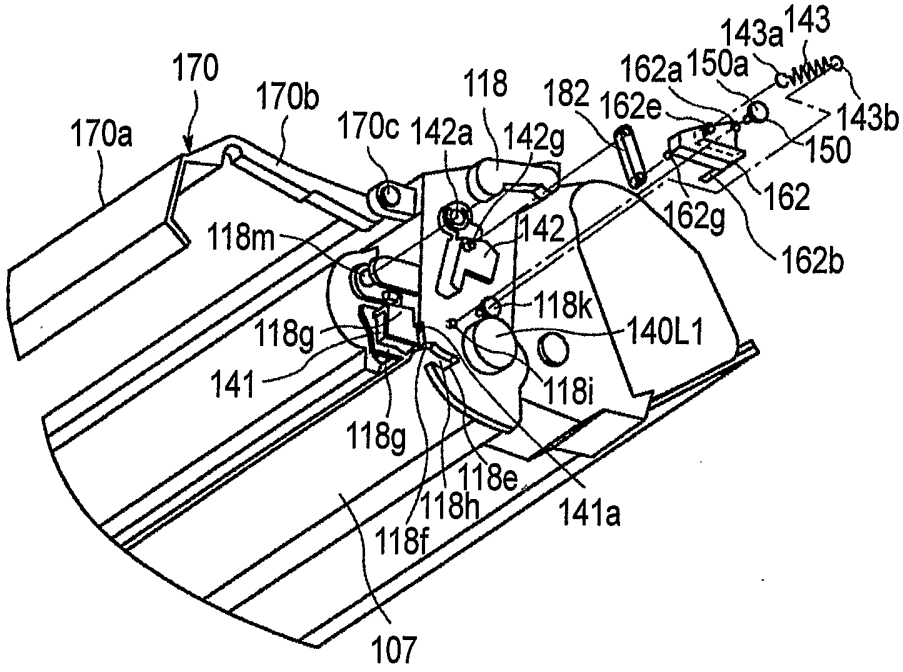

143a
143
170
162a
150a
170b
118
182
162e
143b
170a
170c
142a
142g
150
162
118m
142
162g
162b
118k
118g
140L1
141
118i
118g
118e
118h
141a
118f
107

FIG.39

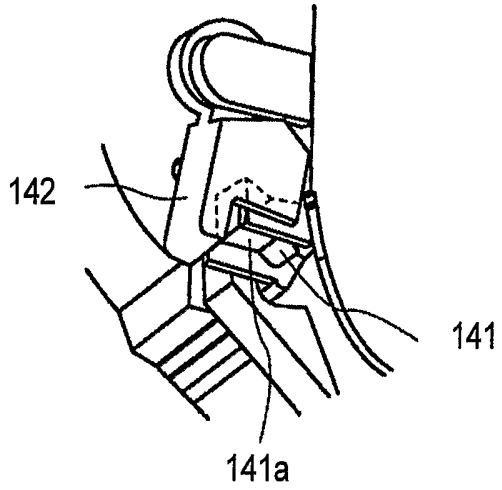

142
141
141a

FIG.40

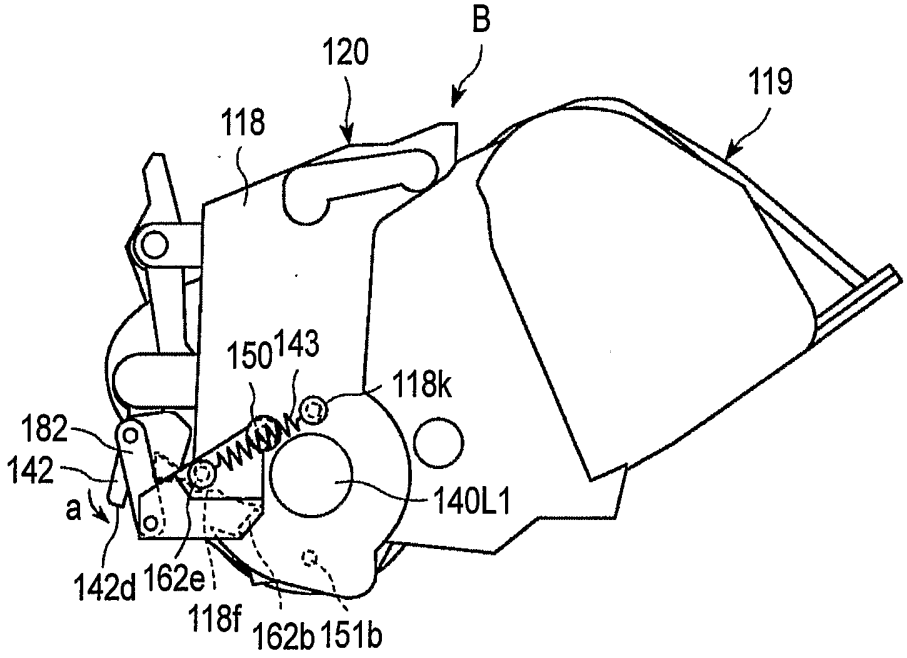

B
120
119
118
150
143
118k
182
142
a
140L1
142d
162e
118f
162b
151b

FIG.41

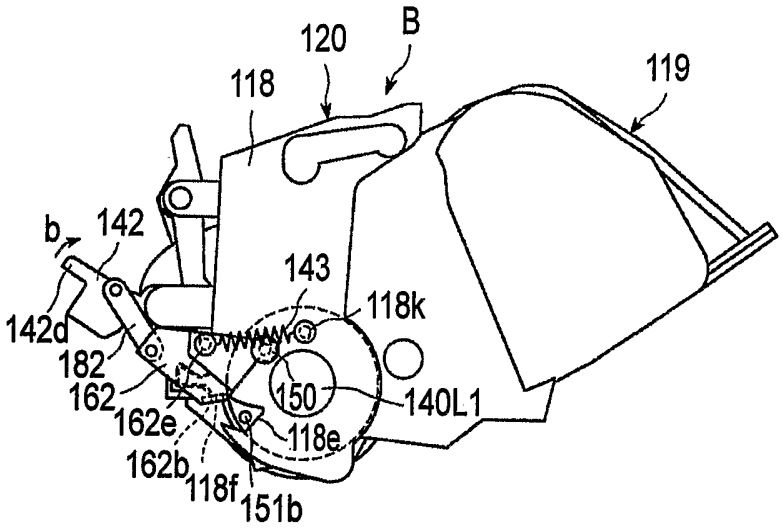

120
B
118
119
b
142
143
118k
142d
182
162
150
140L1
162e
118e
162b
118f
151b

FIG.42

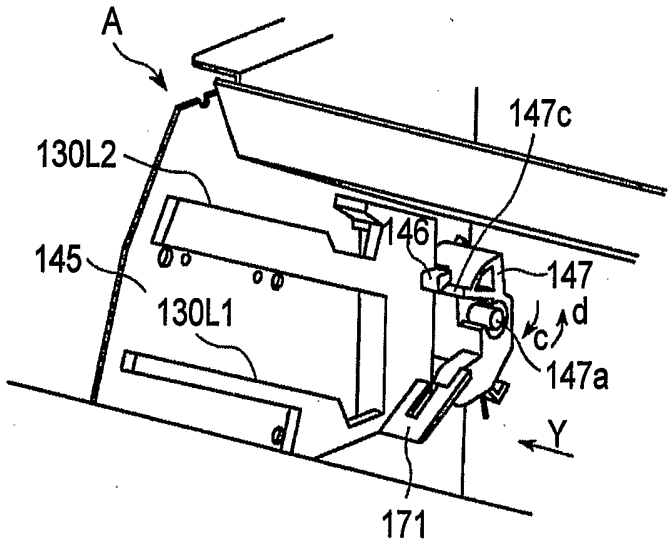

A
147c
130L2
146
145
147
130L1
d
c
147a
Y
171

FIG.43

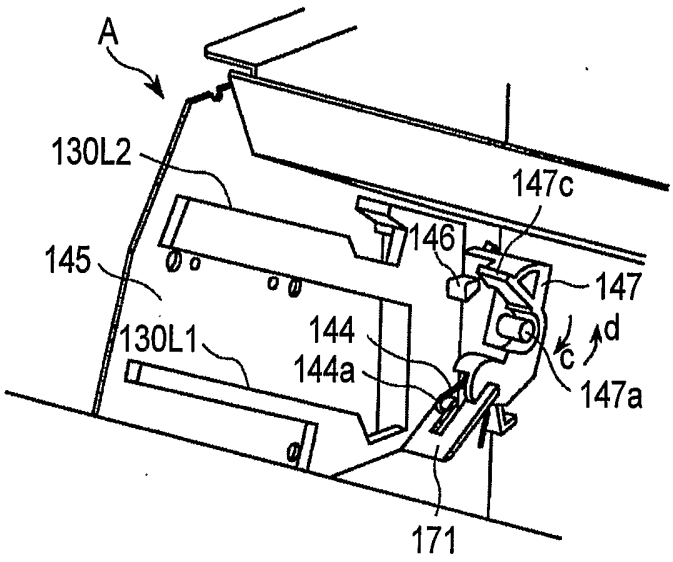


FIG.44

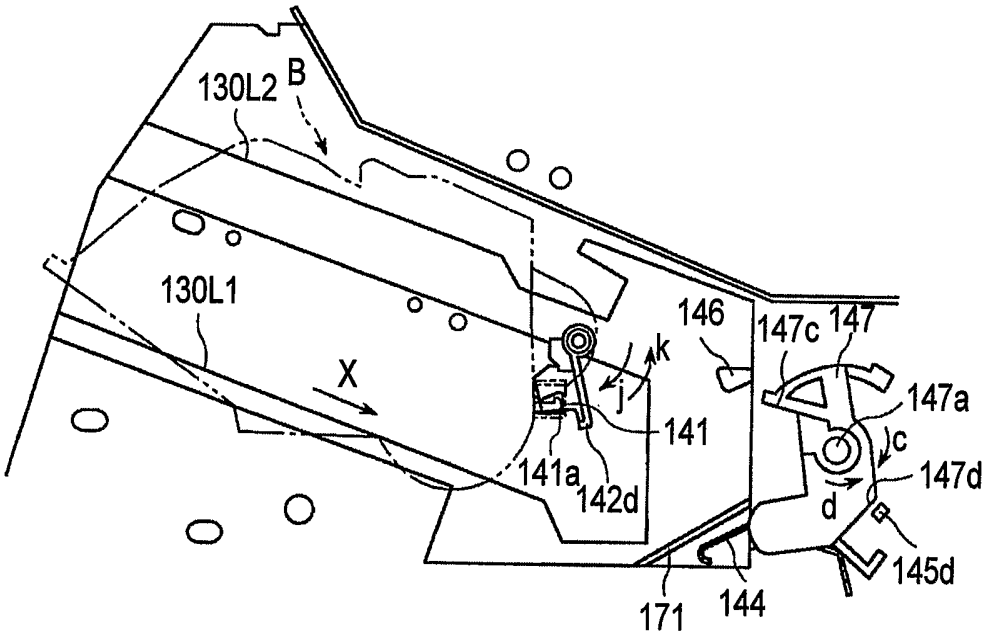

130L2
B
130L1
X
146
147c
147
k
j
141
147a
c
147d
141a
142d
d
145d
171
144

FIG.45

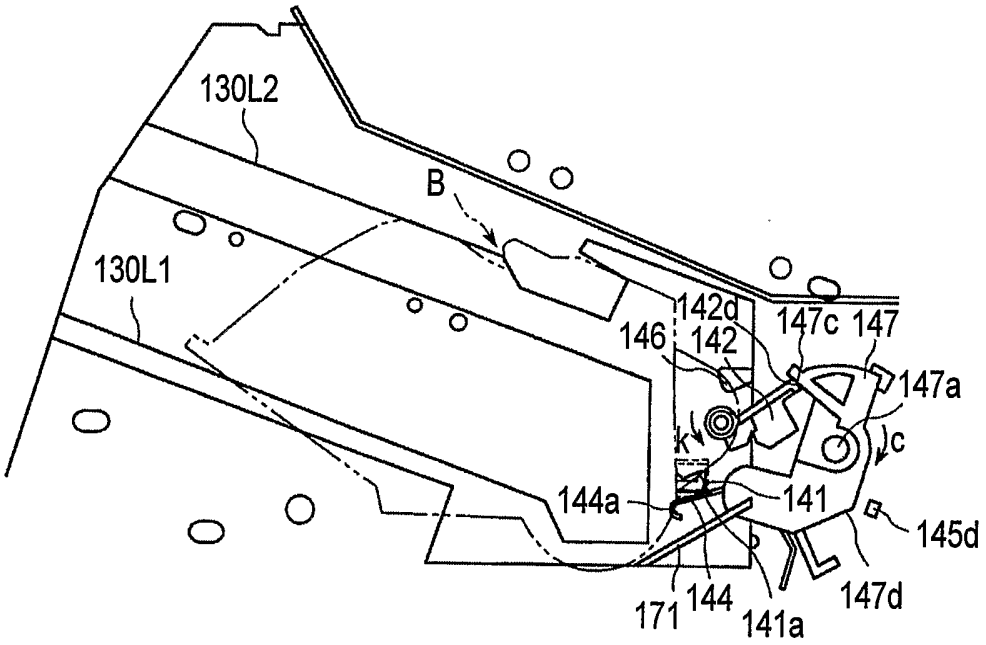

130L2
B
130L1
142d
146
142
147c
147
147a
c
K
144a
141
145d
171
144
141a
147d

FIG.46

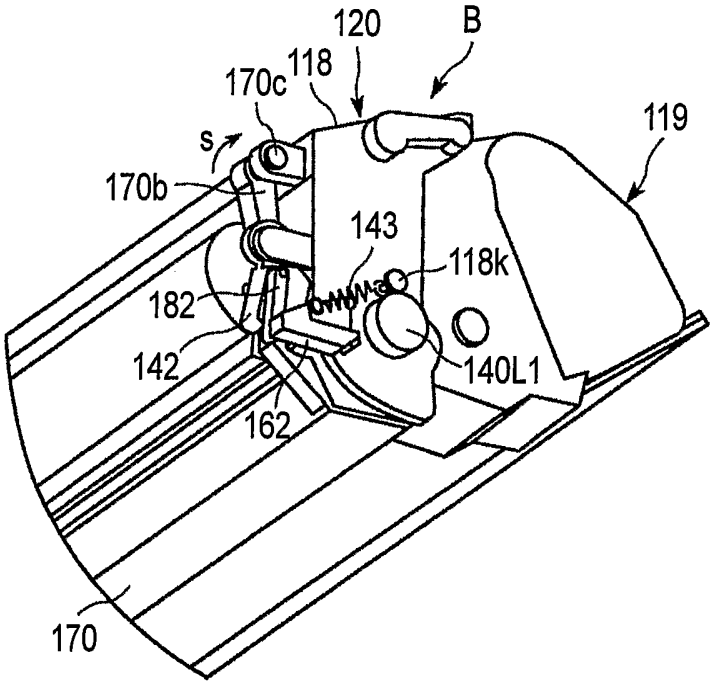


FIG.47

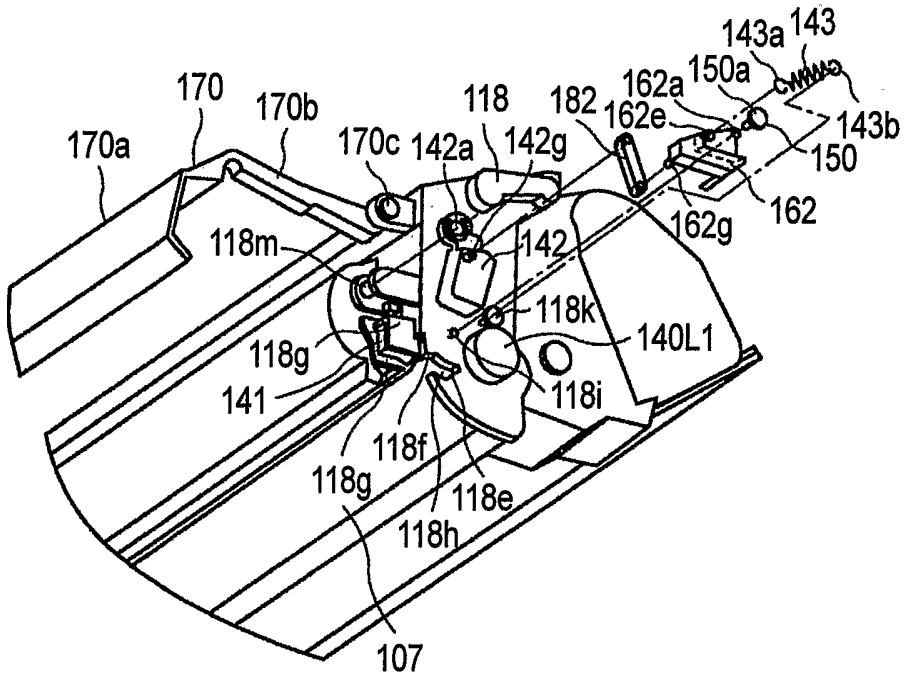

143a
143
150a
162a
182
118
170
170b
162e
143b
170a
170c
142a
142g
150
162
162g
118m
142
118k
140L1
118g
141
118i
118f
118g
118e
118h
107

FIG.48

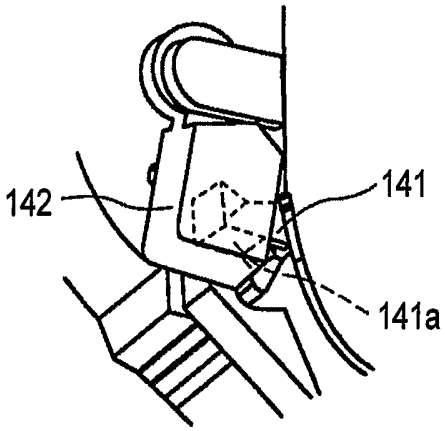

142
141
141a

FIG.49

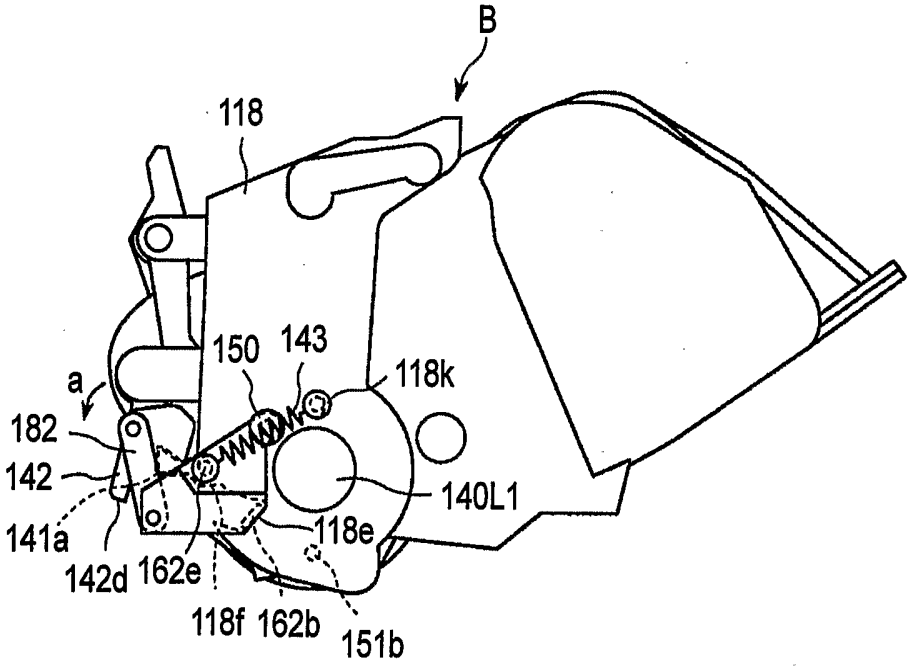

B
118
150
143
118k
a
182
142
140L1
141a
118e
142d
162e
118f
162b
151b

FIG.50

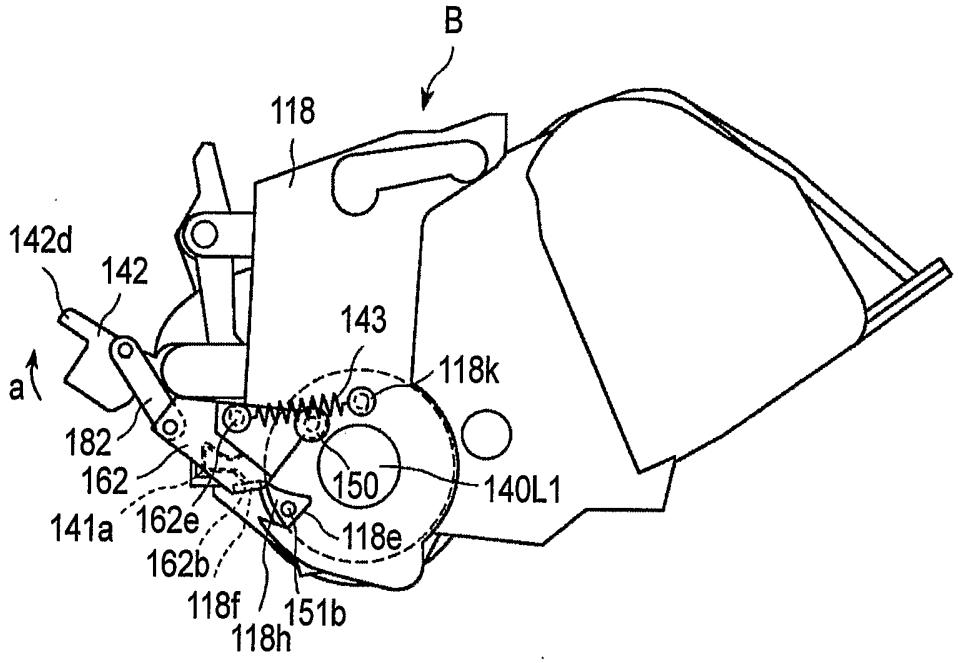

B
118
142d
142
143
118k
a
182
162
150
140L1
141a
162e
118e
162b
118f
151b
118h

FIG.51

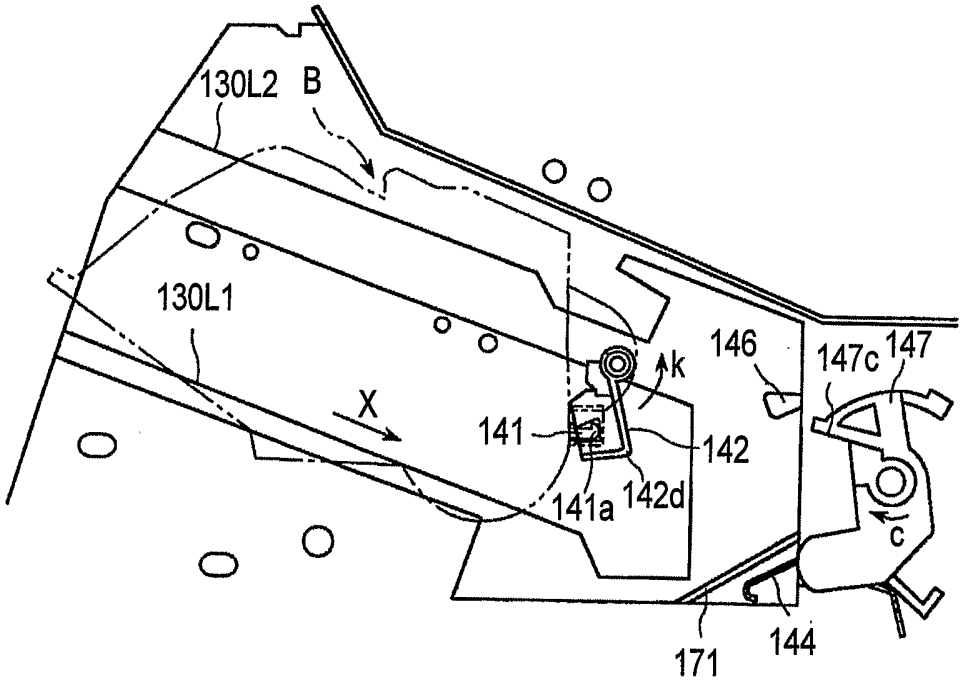


FIG.52

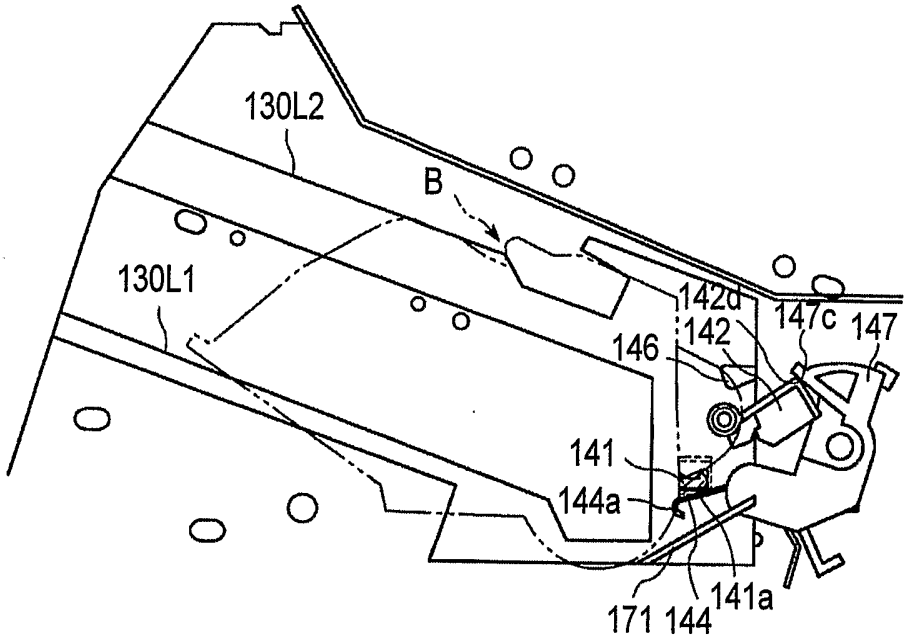

130L2
B
130L1
142d
142
147c
147
146
141
144a
171
144
141a

FIG.53

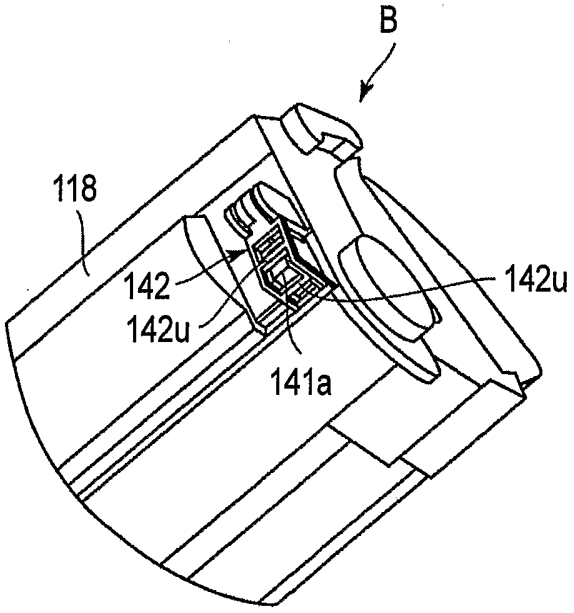

B
118
142
142u
142u
141a

FIG.54

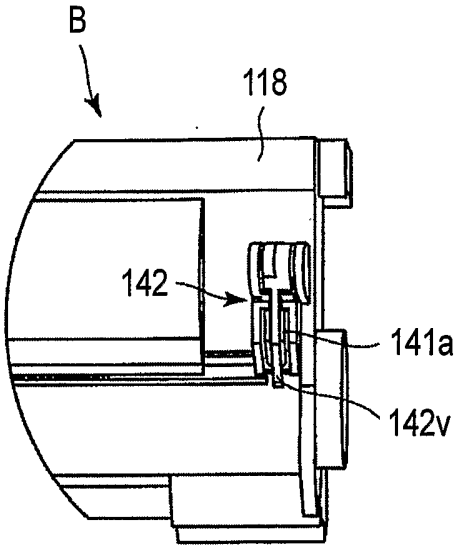


FIG.55

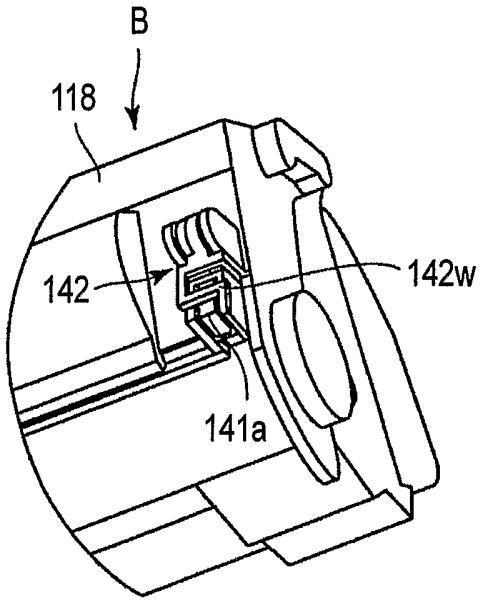


FIG.56

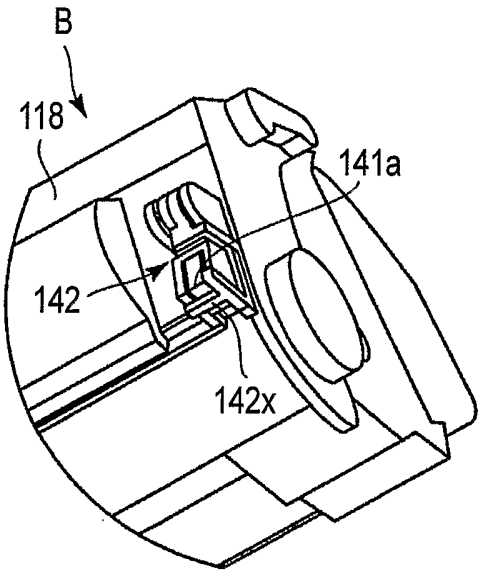


FIG.57

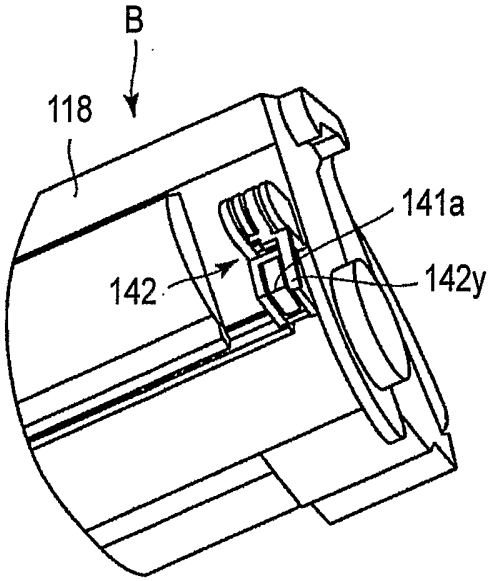


FIG.58

INTERNATIONAL SEARCH REPORT

ational Application No
/JP2004/018669

A. CLASSIFICATION OF SUBJECT MATTER
IPC 7 G03G21/18 G03G15/00

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
IPC 7 G03G

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)
EPO-Internal, PAJ

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category °	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	US 6 097 906 A (MATSUZAKI ET AL) 1 August 2000 (2000-08-01) column 11, line 19 - column 13, line 14 figures 14-25	1-22
Y	PATENT ABSTRACTS OF JAPAN vol. 1998, no. 08, 30 June 1998 (1998-06-30) -& JP 10 074030 A (CANON INC), 17 March 1998 (1998-03-17) cited in the application abstract; figures 16,17	1-22

☐ Further documents are listed in the continuation of box C.

☒ Patent family members are listed in annex.

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"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

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"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
3 March 2005	01/04/2005

Name and mailing address of the ISA	Authorized officer
European Patent Office, P.B. 5818 Patentlaan 2 NL - 2280 HV Rijswijk Tel. (+31-70) 340-2040, Tx. 31 651 epo nl, Fax: (+31-70) 340-3016	Götsch, S

INTERNATIONAL SEARCH REPORT

Information on patent family members

ational Application No
/JP2004/018669

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
US 6097906 A	01-08-2000	JP 10228223 A	25-08-1998
JP 10074030 A	17-03-1998	JP 3290597 B2	10-06-2002