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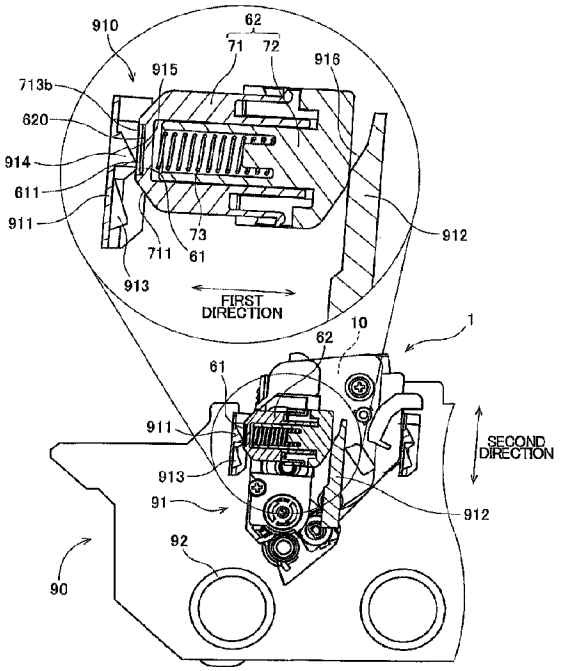
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(54) Titre : CARTOUCHE DE DEVELOPPEMENT
(54) Title: DEVELOPING CARTRIDGE



(57) Abrégé/Abstract:
A developing cartridge includes: a casing configured to accommodate developer therein; a storage medium including an electric contact surface; a holder holding the electric contact surface; and an elastic member. The elastic member is configured to be compressed or expanded in the first direction between a first state and a second state which is more compressed than the first state. The outer surface of the holder holding the electric contact surface is positioned at the first position when the elastic member is in the first state, and the outer surface is positioned at the second position when the elastic member is in the second state. Thus, a position of the outer surface of the holder holding the electric contact surface is changed in the first direction. Accordingly, friction of the electric contact surface can be reduced when the developing cartridge is attached.

Abstract

A developing cartridge includes: a casing configured to accommodate developer therein; a storage medium including an electric contact surface; a holder holding the electric contact surface; and an elastic member. The elastic member is configured to be compressed or expanded in the first direction between a first state and a second state which is more compressed than the first state. The outer surface of the holder holding the electric contact surface is positioned at the first position when the elastic member is in the first state, and the outer surface is positioned at the second position when the elastic member is in the second state. Thus, a position of the outer surface of the holder holding the electric contact surface is changed in the first direction. Accordingly, friction of the electric contact surface can be reduced when the developing cartridge is attached.

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DESCRIPTION

[Title of the Invention] DEVELOPING CARTRIDGE

[Technical Field]

[0001] The present invention relates to a developing cartridge.

[Description of Related Art]

[0002] An electro-photographic type image forming apparatus such as a laser printer and LED printer is known. A developing cartridge is used in the image forming apparatus. The developing cartridge includes a developing roller for supplying toner. Patent Literature 1 discloses a developing cartridge which is capable of being attached to a drawer unit. The drawer unit is positioned in an interior of the image forming apparatus and can be pulled from the image forming apparatus. The drawer unit includes a photosensitive drum. The photosensitive drum faces the developing roller when the developing cartridge is attached to the drawer unit.

[0003] Further, Patent Literature 2 discloses a developing cartridge which is capable of being attached to a drum cartridge. The drum cartridge includes a photosensitive drum. The photosensitive drum faces the developing roller when the developing cartridge is attached to the drum cartridge. The developing cartridge is attached to the image forming apparatus in a state where the developing cartridge is attached to the drum cartridge.

[Prior art document]

[Patent publication]

[0004]

[Patent Literature 1] Japanese Patent Application Publication No.2011-59510

[Patent Literature 2] Japanese Patent Application Publication No.2013-54058

[Summary of the Invention]

[Problems to be Solved by Invention]

[0005] Further, a developing cartridge including a storage medium is also known. An IC (Integrated Circuit) chip is an example of the storage medium. The storage medium has an electric contact surface. The electric contact surface is in contact with an electric connector of the image forming apparatus or the drawer unit. However, friction between the electric contact surface and a protrusion of the image forming apparatus or the drawer unit may occur when the developing cartridge is attached to the image forming apparatus or the drawer unit.

[0006] It is an object of the present invention to reduce friction of the electric contact surface when the developing cartridge is attached.

[Means for solving the problem]

[0007] In order to overcome the above-described problem, a first invention of the present application provides a developing cartridge comprising: a casing configured to accommodate developer therein; a storage medium including an electric contact surface; an elastic member extending in a first direction which crosses the electric contact surface, the elastic member configured to be compressed or expanded in the first direction between a first state and a second state; a holder including an outer surface positioned on a side of the holder in the first direction, the electric contact surface being positioned at the outer surface, the outer surface being movable between a first position and a second position in the first direction relative to the casing; wherein a length in the first direction of the elastic member in the first state is greater than a length in the first direction of the elastic member in the second state, wherein the holder is in the first position in a state where the elastic member is in the first state, and wherein the holder is in the second position in a state where the elastic member is in the second state.

[0008] A second invention of the present application is the developing cartridge according to the first invention, in which the holder includes a first end portion including the outer surface and a second end portion which is separated from the first end portion in the first direction, and the elastic member is positioned between the first end portion and the second end portion in the first direction.

[0009] A third invention is the developing cartridge according to the second invention, in which a distance in the first state between the first end portion and the second end portion in the first direction is greater than a distance in the second state between the first end portion and the second end portion in the first direction.

[0010] A fourth invention is the developing cartridge according to any one of the first through third inventions, in which a position of the outer surface relative to the casing is movable among the first position, the second position and a third position in the first direction, the elastic member is configured to be compressed or expanded in the first direction among the first state, the second state and a third state, a length in the first direction of the elastic member in the first state is greater than a length in the first direction of the elastic member in the second state, a length in the first direction of the elastic member in the third state is greater than the length in the first direction of the

elastic member in the second state, and the position of the holder is positioned at the third position in a state where the elastic member is in the third state.

[0011] A fifth invention is the developing cartridge according to the second invention, in which a position of the outer surface relative to the casing is movable among the first position, the second position and a third position, the elastic member is configured to be compressed or expanded in the first direction among the first state, the second state and a third state, a length in the first direction of the elastic member in the first state is greater than a length in the first direction of the elastic member in the second state, and a distance in the first state between the first end portion and the second end portion in the first direction is greater than a distance in the second state between the first end portion and the second end portion in the first direction, the length in the first direction of the elastic member in the third state is greater than a length in the first direction of the elastic member in the second state, and the distance in the third state between the first end portion and the second end portion in the first direction is greater than a distance in the second state between the first end portion and the second end portion in the first direction, and the outer surface is in the third position in a state where the elastic member is in the third state.

[0012] A sixth invention is the developing cartridge according to any one of the first through the fifth inventions, in which the position of the outer surface relative to the casing is movable from the first position to the second position according to attachment of the developing cartridge to an image forming apparatus, a portion of the holder and the electric contact surface are not in contact with a portion of the image forming apparatus at the first position, and one of a portion of the holder and the electric contact surface is in contact with the portion of the image forming apparatus at the second position.

[0013] A seventh invention is the developing cartridge according to one of the fourth and fifth inventions, in which the position of the outer surface relative to the casing is movable from the first position to the third position through the second position according to attachment of the developing cartridge to the image forming apparatus, a portion of the holder and the electric contact surface are not in contact with a portion of the image forming apparatus at the first position, one of a portion of the holder and the electric contact surface is in contact with a portion of the image forming apparatus at the second position, and the electric contact surface is in contact with an

electrical connector of the image forming apparatus at the third position.

[0014] An eighth invention is the developing cartridge according to any one of the fourth, fifth, and seventh inventions, in which a length in the first direction of the elastic member in the third state is shorter than a natural length of the elastic member.

[0015] A ninth invention is the developing cartridge according to any one of the first through eighth inventions, in which the first direction is perpendicular to the electric contact surface.

[0016] A tenth invention is the developing cartridge according to any one of the first through ninth inventions, in which the holder is movable with the storage medium.

[0017] An eleventh invention is the developing cartridge according to any one of the first through tenth invention, in which the holder holds the electric contact surface at the outer surface.

[0018] A twelfth invention is the developing cartridge according to any one of any one of the first to the eleventh inventions, in which the storage medium is positioned at the outer surface of the holder.

[0019] A thirteenth invention is the developing cartridge according to the twelfth invention, in which the holder holds the storage medium at the electric contact surface.

[0020] A fourteenth invention is the developing cartridge according to any one of the first to the thirteenth inventions, further comprising a developing roller rotatable about an axis extending in a direction which is different from the first direction.

[0021] A fifteenth invention is the developing cartridge according to any one of the first to the fourteenth inventions, in which the holder is positioned at a side of the casing.

[0022] A sixteenth invention is the developing cartridge according to any one of the first invention to the fifteenth invention, in which the outer surface includes: a first surface inclined relative to the electric contact surface, the first surface being positioned at one side of the electric contact surface in a second direction which is different from the first direction.

[0023] A seventeenth invention is the developing cartridge according to the sixteenth invention, further comprising a developing roller rotatable about an axis extending in a third direction which is different from the first direction, the developing

roller being positioned at one side of the casing in the second direction.

[0024] An eighteenth invention is the developing cartridge according to the sixteenth invention or the seventeenth invention, in which the first surface extends from a third position to a fourth position toward the electric contact surface, and the third position is farther from the electric contact surface in the first direction than the fourth position.

[0025] A nineteenth invention is the developing cartridge according to the eighteenth invention, in which a distance between the third position and the fourth position in the first direction is greater than a distance between the electric contact surface and the fourth position in the first direction.

[0026] A twentieth invention is the developing cartridge according to any one of the sixteenth invention to the nineteenth invention, in which the first surface is a first guide surface, the first guide surface is contactable with a portion of an image forming apparatus when the developing cartridge is attached to the image forming apparatus.

[0027] A twenty-first invention is the developing cartridge according to any one of the sixteenth invention to the twentieth invention, in which the outer surface includes: a second surface inclined relative to the electric contact surface, the second surface being positioned at another side of the electric contact surface in the second direction.

[0028] A twenty-second invention is the developing cartridge according to the twenty-first invention further comprising a developing roller rotatable about an axis extending in a third direction which is different from the first direction, the developing roller being positioned at one side of the casing in the second direction.

[0029] A twenty-third invention is the developing cartridge according to the twenty-first invention or the twenty-second invention, in which the second surface extends from a fifth position to a sixth position toward the electric contact surface, and the fifth position is farther from the electric contact surface in the first direction than the sixth position.

[0030] A twenty-fourth invention is the developing cartridge according to the twenty-third invention, in which a distance between the fifth position and the sixth position in the first direction is greater than a distance between the electric contact surface and the sixth position in the first direction.

[0031] A twenty-fifth invention is the developing cartridge according to any

one of the twenty-first invention to the twenty-fourth invention, in which the second surface is a second guide surface, the second guide surface is contactable with a portion of an image forming apparatus when the developing cartridge is attached to the image forming apparatus.

[0032] A twenty-sixth invention is the developing cartridge according to any one of the first invention to the twenty-fifth invention, in which the outer surface includes: a third surface positioned at both sides of the electric contact surface in a third direction which is different from the first direction respectively, and the third surface is farther from the elastic member in the first direction than the electric contact surface.

[0033] A twenty-seventh invention is the developing cartridge according to the twenty-sixth invention, in which the third surface is a third guide surface, the third guide surface is contactable with a portion of an image forming apparatus when the developing cartridge is attached to the image forming apparatus.

[0034] A twenty-eighth invention is the developing cartridge according to the twenty-sixth invention or the twenty-seventh invention, further comprising a developing roller rotatable about an axis extending in the third direction, the developing roller being positioned at one side of the casing in the second direction.

[0035] A twenty-ninth invention is the developing cartridge according to the first invention to the twenty-eighth invention, in which the elastic member is a spring.

[0036] A thirtieth invention is the developing cartridge according to the twenty-ninth invention, in which the spring is a coil spring.

[0037] A thirty-first invention is the developing cartridge according to the twelfth invention or the thirteenth invention, in which the storage medium includes the electric contact surface.

[Advantages of Invention]

[0038] According to the first to thirty-first inventions, friction of the electric contact surface can be reduced when a developing cartridge is attached.

[0039] According to the second invention, the first end portion including the outer surface is movable in the first direction, because an elastic member is provided between the first end portion and the second end portion of the holder. Accordingly, the friction of the electric contact surface can be reduced when the developing cartridge is attached to the image forming apparatus.

[0040] According to the third invention, a distance in the first state between the

first end portion and the second end portion in the first direction is greater than a distance in the second state between the first end portion and the second end portion in the first direction. Accordingly, the distance of the first end portion including the outer surface relative to the second end portion is changeable. Therefore, friction of the electric contact surface can be reduced when the developing cartridge is attached to the image forming apparatus.

[0041] According to the fourth invention, a position of the outer surface of the holder holding the electric contact surface can be further moved from the second position to the third position in the first direction. Accordingly, friction of the electric contact surface can be reduced when the developing cartridge is attached to the image forming apparatus.

[0042] According to the fifth invention, due to the elastic member provided between the first end portion and the second end portion of the holder, the first end portion including the outer surface is movable relative to the second end portion in the first direction. Additionally, the position of the outer surface of the holder holding the electric contact surface is further changed from the second position to the third position in the first direction. Accordingly, friction of the electric contact surface can be reduced when the developing cartridge is attached to the image forming apparatus.

[0043] According to the sixth invention, the holder is movable from the first position to the second position even when the holder is contactable with a portion of the image forming apparatus. Accordingly, friction of the electric contact surface can be reduced when the developing cartridge is attached to the image forming apparatus.

[0044] According to the seventh invention, the position of the outer surface of the holder holding the electric contact surface is further movable from the second position to the third position in the first direction. Additionally, the electric contact surface is contactable with an electric connector of the image forming apparatus at the third position. Accordingly, friction of the electric contact surface can be reduced when the developing cartridge is attached to the image forming apparatus. And, the electric contact is contactable with the electric connector of the image forming apparatus.

[0045] According to the eighth invention, a length in the third state of the elastic member in the first direction is shorter than a natural length of the elastic member. Accordingly, the electric contact surface can receive a repulsion force of the

elastic member at the third position.

[0046] According to the tenth invention, the storage medium can be moved together with the holder.

[0047] According to the eleventh invention, the holder can hold the electric contact surface at the outer surface.

[0048] According to the twelfth invention, the storage medium can be positioned at the outer surface.

[0049] According to the thirteenth invention, the holder can hold the storage medium at the outer surface.

[0050] According to the sixteenth invention, the developing cartridge includes the first surface inclined relative to the electric contact surface. The holder can be guided by the first surface when the developing cartridge is attached to or detached from the image forming apparatus.

[0051] According to the eighteenth invention, the developing cartridge includes the first surface inclined relative to the electric contact surface. The holder can be guided by the first surface when the developing cartridge is attached to or detached from the image forming apparatus.

[0052] According to the nineteenth invention, the developing cartridge includes the first surface inclined relative to the electric contact surface. The holder can be guided by the first surface when the developing cartridge is attached to or detached from the image forming apparatus.

[0053] According to the twentieth invention, the developing cartridge includes the first guide surface inclined relative to the electric contact surface. The holder can be guided by the first guide surface when the developing cartridge is attached to or detached from the image forming apparatus.

[0054] According to the twenty-first invention, the developing cartridge includes the second surface inclined relative to the electric contact surface. The holder can be guided by the second surface when the developing cartridge is attached to or detached from the image forming apparatus.

[0055] According to the twenty-third invention, the developing cartridge includes the second surface inclined relative to the electric contact surface. The holder can be guided by the second surface when the developing cartridge is attached to or detached from the image forming apparatus.

[0056] According to the twenty-fourth invention, the developing cartridge includes the second surface inclined relative to the electric contact surface. The holder can be guided by the second surface when the developing cartridge is attached to or detached from the image forming apparatus.

[0057] According to the twenty-fifth invention, the developing cartridge includes the second guide surface inclined relative to the electric contact surface. The holder can be guided by the second guide surface when the developing cartridge is attached to or detached from the image forming apparatus.

[0058] According to the twenty-sixth invention, the developing cartridge includes the third surface inclined relative to the electric contact surface. The friction of the electric contact surface can be reduced by the third surface when the developing cartridge is attached to or detached from the image forming apparatus.

[0059] According to the twenty-seventh invention, the developing cartridge includes the third guide surface inclined relative to the electric contact surface. The friction of the electric contact surface can be reduced by the third guide surface when the developing cartridge is attached to or detached from the image forming apparatus.

[0060] According to the twenty-eighth invention, a protrusion of the image forming apparatus is not contact with the electric contact surface when the developing cartridge is attached to the image forming apparatus. Accordingly, damage of the electric contact surface can be restricted.

[Brief description of the drawings]

[0061]

Fig. 1 is a perspective view of a developing cartridge;

Fig. 2 is a perspective view of the developing cartridge;

Fig. 3 is a perspective view of the developing cartridge;

Fig. 4 is a perspective view of the developing cartridge;

Fig. 5 is a perspective view of the developing cartridge;

Fig. 6 is an exploded perspective view of an IC (Integrated Circuit) chip assembly;

Fig. 7 is a cross-sectional view of the IC chip assembly;

Fig. 8 is a view for description of an attachment of the developing cartridge;

Fig. 9 is a view for description of the attachment of the developing cartridge;

Fig. 10 is a view for description of the attachment of the developing cartridge;

Fig. 11 is a view for description of the attachment of the developing cartridge;

Fig. 12 is a view for description of the attachment of the developing cartridge;

Fig. 13 is a view for description of the attachment of the developing cartridge;

Fig. 14 is a view for description of the attachment of the developing cartridge;

Fig. 15 is a view for description of a separating operation;

Fig. 16 is a partial exploded perspective view of a developing cartridge according to a first modification;

Fig. 17 is a cross-sectional view of an IC (Integrated Circuit) chip assembly according to the first modification;

Fig. 18 is a partial perspective view of a developing cartridge according to a second modification;

Fig. 19 is a view for description of operation of a columnar like elastic member and an IC chip assembly according to the second modification;

Fig. 20 is a view for description of operation of the columnar like elastic member and the IC chip assembly according to the second modification;

Fig. 21 is a view for description of an assembly of a developing cartridge according to the second modification;

Fig. 22 is a view for description of the assembly of the developing cartridge according to the second modification;

Fig. 23 is a view for description of a separating operation in the developing cartridge according to the second modification;

Fig. 24 is a perspective view of a developing cartridge according to a third modification;

Fig. 25 is a view of the developing cartridge according to the third embodiment as viewed from one side thereof in a first direction;

Fig. 26 is a view of the developing cartridge according to the third embodiment as viewed from the one side thereof in the first direction;

Fig. 27 is a view of the developing cartridge according to the third embodiment as viewed from the one side thereof in the first direction;

Fig. 28 is an exploded perspective view of a first cover and an IC (Integrated Circuit) chip assembly according to a fourth modification;

Fig. 29 is a cross-sectional view of the first cover and the IC chip assembly according to the fourth modification;

Fig. 30 is a perspective view of the IC chip assembly according to the fourth modification;

Fig. 31 is a partial perspective view of a developing cartridge according to a fifth modification;

Fig. 32 is an exploded perspective view of the first cover and the IC chip assembly according to the fifth modification;

Fig. 33 is a perspective view of a developing cartridge and a drum cartridge according to a sixth embodiment;

Fig. 34 is a view for description of attachment of the drum cartridge to an image forming apparatus according to the sixth embodiment; and

Fig. 35 is an exploded perspective view of the IC chip assembly and components ambient thereto according to the sixth embodiment.

[Embodiment]

[0062] A preferred embodiment of the present invention will be described with reference to drawings.

[0063] In the followings, a direction which crosses an electric contact surface (in the present embodiment, a direction which is perpendicular to the electric contact surface) will be referred to as "a first direction", and a moving direction of a casing in a separating operation described later will be referred to as "a second direction". And an extending direction of a rotation axis of a developing roller will be referred to as "a third direction".

[0064]

1. Overall Structure of Developing Cartridge

Figs. 1 to 5 are perspective views of a developing cartridge 1 as an example of the present invention. The developing cartridge 1 is used for an electro-photographic type image forming apparatus (for example, a laser printer or a LED printer), and is a unit for supplying developer (toner, for example) to a photosensitive drum. As shown in Fig. 1, the developing cartridge 1 according to the present embodiment is attached to a drawer unit 90 of the image forming apparatus. When the developing cartridge 1 is replaced, the drawer unit 90 is drawn out from a front surface of the image forming apparatus. The drawer unit 90 includes four cartridge holding portions 91, and the developing cartridge 1 is attached to four cartridge holding portions 91, respectively. Each of four cartridge holding portions 91 includes a photosensitive drum.

[0065] In the present embodiment, four developing cartridges 1 are attached to one drawer unit 90. Each of the four developing cartridges 1 is configured to accommodate developer therein, and the color of the developer is different colors (cyan, magenta, yellow, and black, for example) among the four developing cartridges respectively. However, the number of the developing cartridges 1 that can be attached to the drawer unit 90 may be 1 to 3 or be greater than or equal to 5.

[0066] As shown in Figs. 2 to 5, each developing cartridge 1 according to the present embodiment includes a casing 10, an agitator 20, a developing roller 30, a first gear portion 40, a second gear portion 50, and an IC (Integrated Circuit) chip assembly 60.

[0067] The developing roller 30 is a roller rotatable about a rotation axis extending in the third direction. The developing roller 30 according to the present embodiment includes a roller body 31 and a roller shaft 32. The roller body 31 is a cylindrical member extending in the third direction. The roller body 31 is made of a material such as an elastic rubber, for example. The roller shaft 32 is a cylindrical member penetrating through the roller body 31 in the third direction. The roller shaft 32 is made of a material such as a metal or conductive resin.

[0068] The roller shaft 32 may not penetrate through the roller body 31 in the third direction. For example, each of a pair of roller shafts 32 may extend from each end of the roller body 31 in the third direction.

[0069] The agitator 20 includes an agitator shaft 21 and an agitation blade 22. The agitator shaft 21 extends along the rotation axis extending in the third direction. The agitation blade 22 expands outward from the agitator shaft 21 in a radial direction. The agitation blade 22 is positioned inside a developing chamber 13 of the casing 10. A first agitator gear 44 and a second agitator gear 51 described later are connected to both end portions in the third direction of the agitator shaft 21, respectively. Accordingly, the agitator shaft 21 and the agitation blade 22 are rotatable along with the first agitator gear 44 and the second agitator gear 51. The developer which is accommodated in the developing chamber 13 is agitated by rotation of the agitation blade 22.

[0070] The casing 10 is a case configured to accommodate therein developer (toner, for example) for an electro-photographic printing. The casing 10 includes a first outer surface 11 and a second outer surface 12. The first outer surface 11 and the

second outer surface 12 are separated from each other in the third direction. The first gear portion 40 and the IC chip assembly 60 are positioned at the first outer surface 11. The second gear portion 50 is positioned at the second outer surface 12. The casing 10 extends in the third direction between the first outer surface 11 and the second outer surface 12. The developing chamber 13 for accommodating the developer is provided in the casing 10.

[0071] The casing 10 has an opening 14. The opening 14 communicates between an interior of the developing chamber 13 and an exterior of the developing chamber 13. The opening 14 is positioned at one end portion in the second direction of the casing 10. The developing roller 30 is positioned at the opening portion 14. That is, the developing roller 30 is positioned at a position closer to one side of the casing 10 than to the center of the casing 10 in the second direction. The roller body 31 is fixed to the roller shaft 32 so as to be incapable of rotating relative to the roller shaft 32. One end portion of the roller shaft 32 in the third direction is fixed to a developing gear 42 described later so as to be incapable of rotating relative to the developing gear 42. When the developing gear 42 rotates, the roller shaft 32 rotates along with the developing gear 42 and then the roller body 31 rotates together with the roller shaft 32.

[0072] When the developing cartridge 1 receives a driving force, the developer is supplied from the developing chamber 13 in the casing 10 onto an outer peripheral surface of the developing roller 30 via a supply roller which is omitted in the figure. At this time, the developer is tribocharged between the supply roller and the developing roller 30. On the other hand, bias voltage is applied to the roller shaft 32 of the developing roller 30. As a consequence, electrostatic force between the roller shaft 32 and the developer moves the developer toward the outer peripheral surface of the roller body 31.

[0073] The developing cartridge 1 further includes a layer thickness regulation blade which is omitted in the figure. The layer thickness regulation blade regulates a thin layer of the developer supplied onto the outer peripheral surface of the roller body 31 so that the thickness of the developer becomes constant. Then, the developer on the outer peripheral surface of the roller body 31 is supplied to the photosensitive drum of the drawer unit 90. At this time, the developer moves from the roller body 31 to the photosensitive drum in accordance with an electrostatic latent image formed on the

outer peripheral surface of the photosensitive drum. Accordingly, the electrostatic latent image is visualized on the outer peripheral surface of the photosensitive drum.

[0074] The first gear portion 40 is positioned at one end portion in the third direction of the casing 10. That is, the first gear portion 40 is positioned at the first outer surface 11. Fig. 4 is a perspective view of the developing cartridge 1 in a state in which the first gear portion 40 is disassembled. As shown in Fig. 4, the first gear portion 40 includes a coupling 41, a developing gear 42, an idle gear 43, a first agitator gear 44, and a first cover 45. A plurality of gear teeth of each gear are not illustrated in Fig. 4.

[0075] The coupling 41 is a gear for initially receiving the driving force applied from the image forming apparatus. The coupling 41 is rotatable about a rotation axis extending in the third direction. The coupling 41 includes a coupling portion 411 and a coupling gear 412. The coupling portion 411 and the coupling gear 412 are integral with each other and made of a resin, for example. The coupling portion 411 has a coupling hole 413 depressed in the third direction. The coupling gear 412 includes a plurality of gear teeth. The coupling gear 412 includes a plurality of gear teeth provided on an entire outer peripheral surface of the coupling gear 412 at equal intervals.

[0076] When the drawer unit 90 to which the developing cartridge 1 is attached is accommodated in the image forming apparatus, a drive shaft of the image forming apparatus is inserted into the coupling hole 413 of the coupling portion 411. Through this operation, the drive shaft and the coupling portion 411 are connected so as to be incapable of rotating relative to each other. Accordingly, the coupling portion 411 rotates when the drive shaft rotates, and the coupling gear 412 rotates together with the coupling portion 411.

[0077] The developing gear 42 is a gear for rotating the developing roller 30. The developing gear 42 is rotatable about a rotation axis extending in the third direction. The developing gear 42 includes a plurality of gear teeth provided on an entire outer peripheral surface of the developing gear 42 at equal intervals. At least a portion of the plurality of gear teeth of the coupling gear 412 meshes with at least a portion of the plurality of gear teeth of the developing gear 42. Further, the developing gear 42 is fixed to the end portion of the roller shaft 32 in the third direction so as to be incapable of rotating relative to the roller shaft 32. With this construction, when the coupling

gear 412 rotates, the developing gear 42 rotates, and the developing roller 30 also rotates together with the developing gear 42.

[0078] The idle gear 43 is a gear for transmitting rotational driving force of the coupling gear 412 to the first agitator gear 44. The idle gear 43 is rotatable about a rotation axis extending in the third direction. The idle gear 43 includes a large diameter gear portion 431 and a small diameter gear portion 432. The large diameter gear portion 431 and the small diameter gear portion 432 are arranged in the third direction. The small diameter gear portion 432 is positioned between the large diameter gear portion 431 and the first outer surface 11 of the casing 10. In other words, the large diameter gear portion 431 is farther away from the first outer surface 11 than the small diameter gear portion 432 is. A diameter of the small diameter gear portion 432 is smaller than a diameter of the large diameter gear portion 431. In other words, a diameter of an addendum circle of the small diameter gear portion 432 is smaller than a diameter of an addendum circle of the large diameter gear portion 431. The large diameter gear portion 431 and the small diameter gear portion 432 are integral with each other and are made of a resin, for example.

[0079] The large diameter gear portion 431 includes a plurality of gear teeth provided on an entire outer peripheral surface of the large diameter gear portion 431 at equal intervals. The small diameter gear portion 432 includes a plurality of gear teeth provided on an entire outer peripheral surface of the small diameter gear portion 432 at equal intervals. The number of gear teeth of the small diameter gear portion 432 is less than the number of gear teeth of the large diameter gear portion 431. At least a portion of the plurality of gear teeth of the coupling gear 412 meshes with at least a portion of the plurality of gear teeth of the large diameter gear portion 431. Further, at least a portion of the plurality of gear teeth of the small diameter gear portion 432 meshes with at least a portion of the plurality of gear teeth of the first agitator gear 44. When the coupling gear 412 rotates, the large diameter gear portion 431 rotates, and the small diameter gear portion 432 rotates together with the large diameter gear portion 431. Also, the first agitator gear 44 rotates with the rotation of the small diameter gear portion 432.

[0080] The first agitator gear 44 is a gear for rotating the agitator 20 in the developing chamber 13. The first agitator gear 44 is rotatable about a rotation axis extending in the third direction. The first agitator gear 44 includes a plurality of gear

teeth provided on an entire outer peripheral surface of the first agitator gear 44 at equal intervals. As described above, at least a portion of the plurality of gear teeth of the small diameter gear portion 432 meshes with the at least a portion of the plurality of gear teeth of the first agitator gear 44. Further, the first agitator gear 44 is fixed to one end portion of the agitator shaft 21 in the third direction so as to be incapable of rotating relative to the agitator shaft 21. With the configuration, when the driving force is transmitted from the coupling 41 to the first agitator gear 44 via the idle gear 43, the first agitator gear 44 rotates and the agitator 20 rotates together with the first agitator gear 44.

[0081] The first cover 45 is fixed to the first outer surface 11 of the casing 10 by screws, for example. The coupling gear 412, the developing gear 42, the idle gear 43, and the first agitator gear 44 are accommodated in a space between the first outer surface 11 and the first cover 45. The coupling hole 413 of the coupling portion 411 is exposed to an outside of the first cover 45. The first cover 45 according to the present embodiment also serves as a holder cover for holding the holder 62 of the IC chip assembly 60 described later. A structure of the first cover 45 as the holder cover will be described later in detail.

[0082] The second gear portion 50 is positioned at the other end portion of the casing 10 in the third direction. In other words, the second gear portion 50 is positioned at the second outer surface 12. Fig. 5 is a perspective view of the developing cartridge 1 in which the second gear portion 50 is exploded. As illustrated in Fig. 5, the second gear portion 50 includes a second agitator gear 51, a detection gear 52, an electrically conductive member 53, and a second cover 54. Note that, in Fig. 5, gear teeth are not illustrated in the second agitator gear 51 and the detection gear 52.

[0083] The second agitator gear 51 is a gear for transmitting rotation of the agitator shaft 21 to the detection gear 52. The second agitator gear 51 is rotatable about a rotation axis extending in the third direction. The second agitator gear 51 includes a plurality of gear teeth provided on an entire outer peripheral surface of the second agitator gear 51 at equal intervals. At least a portion of the plurality of gear teeth of the second agitator gear 51 meshes with at least a portion of a plurality of gear teeth of the detection gear 52. The second agitator gear 51 is fixed to the other end portion of the agitator shaft 21 in the third direction so as to be incapable of rotating relative to the agitator shaft 21. With this configuration, the second agitator gear 51

rotates as the agitator shaft 21 rotates.

[0084] The detection gear 52 is a gear for providing information on the developing cartridge 1 for the image forming apparatus. The information on the developing cartridge 1 includes, for example, information as to whether the developing cartridge 1 is a new (unused) developing cartridge or a used developing cartridge. The information on the developing cartridge 1 also includes, for example, a product specification of the developing cartridge 1. The product specification of the developing cartridge 1 includes, for example, the number of sheets that can be printed with the developer accommodated in the developing cartridge 1 (i.e. sheet-yield number).

[0085] The detection gear 52 is rotatable about a rotation axis extending in the third direction. The detection gear 52 includes a plurality of gear teeth, and the plurality of gear teeth are provide on a portion of an outer peripheral surface of the detection gear 52. When the drawer unit 90 to which an unused developing cartridge 1 is attached is accommodated in the image forming apparatus, the detection gear 52 can rotate by meshing with the second agitator gear 51. When the detection gear 52 is disengaged from the second agitator gear 51, rotation of the detection gear 52 is stopped.

[0086] When the drawer unit 90 to which a used developing cartridge 1 is attached is accommodated in the image forming apparatus, the detection gear 52 does not mesh with the second agitator gear 51. Thus, the detection gear 52 does not rotate.

[0087] A gear may be provided between the second agitator gear 51 and the detection gear 52. For example, the second gear portion 50 may further include a second idle gear meshing with both the second agitator gear 51 and the detection gear 52. In this case, rotation of the second agitator gear 51 may be transmitted to the detection gear 52 via the second idle gear.

[0088] As illustrated in Fig. 5, the detection gear 52 includes a detecting protrusion 521. The detecting protrusion 521 protrudes in the third direction. The detecting protrusion 521 has a tubular shape with a center thereof positioned at the rotation axis of the detection gear 52, and a cross section of the protrusion 521 perpendicular to the protruding direction has a circular arc shape.

[0089] The electrically conductive member 53 is electrically conductive. The electrically conductive member 53 is formed of a material such as electrically

conductive metal or electrically conductive resin. The electrically conductive member 53 is positioned at the second outer surface 12 of the casing 10. The electrically conductive member 53 includes a gear shaft 531 protruding in the third direction. The detection gear 52 rotates about the gear shaft 531 in a state where the detection gear 52 is supported by the gear shaft 531. The electrically conductive member 53 further includes a bearing portion 532. The bearing portion 532 is in contact with the roller shaft 32 of the developing roller 30.

[0090] The drawer unit 90 includes an electrically conductive lever (not illustrated) that is in contact with the gear shaft 531 When the lever contacts the gear shaft 531, electrical connection between the lever, and the electrically conductive member 53 and the roller shaft 32 is established. When the image forming apparatus is in operation, electric power is supplied to the roller shaft 32 through the lever, and the roller shaft 32 is maintained at a prescribed bias voltage. Note that the detecting protrusion 521 covers a portion of an outer peripheral surface of the gear shaft 531. Hence, when the detection gear 52 rotates after a new developing cartridge 1 is inserted in the drawer unit 90, the contact state between the lever and the gear shaft 531 is changed according to the shape of the detection gear 52. The image forming apparatus recognizes the change in the contact state between the lever and the gear shaft 531 to identify whether the mounted developing cartridge 1 is new or used and the product specification of the mounted developing cartridge 1.

[0091] However, the method for detecting the information on the developing cartridge 1 using the detection gear 52 is not limited to detection of electrical conduction. For example, movement of the lever may be optically detected. Further, the detecting protrusion 521 may be formed to have different circumferential position and length from those in the present embodiment. Further, the detection gear 52 may have a plurality of detecting protrusions 521. The shape of the detection gear 52 may vary according to the product specification of the developing cartridge 1 such as the number of printable sheets. More specifically, the number of the detecting protrusions 521, circumferential intervals between the plurality of detecting projections 521, a circumferential length of each detecting projection 521 and/or a radial length of each detecting projection 521 may be differentiated based on the product specification of the developing cartridges. In this way, variations in the number of the detecting protrusions 521 and/or circumferential positions of the each of the detecting projections

521 enables the image forming apparatus to identify the product specification regarding each of the developing cartridges 1.

[0092] The detection gear 52 may be configured of a plurality of components. For example, the detecting protrusion 521 and the detection gear 52 may be different components. Further, the detection gear 52 may include a detection gear body and a supplemental member that shifts its position relative to the detection gear body in accordance with rotation of the detection gear body. And, the supplemental member may change the position of the lever.

[0093] Further, the detection gear 52 may be configured of a movable gear that can move in the third direction. The movable gear may not be limited to a partially toothless gear. In other words, the movable gear may includes a plurality of gear teeth, and the plurality of gear teeth are provided on an outer peripheral surface of the movable gear along the circumference of the movable gear. In this case, the movable gear moves in the third direction in accordance with rotation of the movable gear, so that the movable gear is disengaged from the second agitator gear 51. The movable gear may be moved in the third direction away from the second outer surface 12 or toward the second outer surface 12 in the third direction.

[0094] Further, the detection gear 52 may include a cam, and the cam may contact the detecting protrusion 521. In this case, the cam rotates together with rotation of the detection gear 52, and the rotating cam contacts the detecting projection 521. This causes the detecting projection 521 to move. The detecting protrusion 521 may be rotatably attached to a shaft provided at the second outer surface 12 or the second cover 54. Alternatively, the detecting protrusion 521 may have a shaft, and the shaft of the detecting projection 521 may be inserted into a hole formed in the second outer surface 12 or the second cover 54 so that the detecting protrusion 521 is rotatably supported.

[0095] Further, in the present embodiment, the gear shaft 531 extends in the third direction from the second outer surface 12. However, the gear shaft 531 does not need to be in direct contact with the second outer surface 12. For example, the casing 10 may have a through-hole penetrating the second outer surface 12 and a cap fitted with the through-hole, and a gear shaft may extend from the cap in the third direction. In this case, the cap includes the gear shaft protruding in the third direction toward the detection gear 52, and the detection gear 52 rotates about the gear shaft 531 in a state

where the detection gear is supported by the gear shaft.

[0096] The second cover 54 is fixed to the second outer surface 12 of the casing 10 by a screw, for example. The second agitator gear 51, the detection gear 52, and the electrically conductive member 53 are accommodated in a space between the second outer surface 12 and the second cover 54. The second cover 54 has an opening 541. A portion of the detection gear 52 and a portion of the gear shaft 531 are exposed to an outside through the opening 541. The lever described-above contacts the detection gear 52 or the gear shaft 531 through the opening 541.

[0097]

2. IC Chip assembly

The IC chip assembly 60 is positioned at the first outer surface 11 of the casing 10. Fig. 6 is an exploded perspective view of the IC chip assembly 60. Fig. 7 is a cross-sectional view of the IC chip assembly 60 taken along a plane perpendicular to the third direction. As shown in Figs. 2 through 7, the IC chip assembly 60 includes an IC (Integrated Circuit) chip 61 as a storage medium and a holder 62 for holding the IC chip 61. The holder 62 is held to the first cover 45 at one end of the casing 10 in the third direction. The IC chip 61 stores various information on the developing cartridge 1. The IC chip 61 includes an electric contact surface 611. The electric contact surface 611 is made of electrically conductive metal. The IC chip 61 is fixed to an outer surface of the holder 62 in the third direction.

[0098] The drawer unit 90 includes an electric connector. The electric connector is made of metal, for example. The electric connector of the drawer unit 90 contacts the electric contact surface 611 when the developing cartridge 1 is attached to the drawer unit 90. At this time, the image forming apparatus can perform at least one of reading information from the IC chip 61 and writing information in the IC chip 61.

[0099] At least a portion of the holder 62 is covered by the first cover 45. The holder 62 includes a boss 621a, a boss 621b, and a boss 621c. Each of the boss 621a and boss 621b extends in the third direction toward the first cover 45 from a surface of the holder 62 opposite to a surface thereof facing the casing 10. The boss 621a and boss 621b are aligned in the second direction. As shown in Figs. 2 and 4, the first cover 45 has a through-hole 451a and a through-hole 451b. The through-hole 451a and through-hole 451b penetrate the first cover 45 in the third direction, respectively. The through-hole 451a and through-hole 451b are aligned in the second direction. The

boss 621a is inserted into the through-hole 451a. The boss 621b is inserted into the through-hole 451b.

[0100] The boss 621c extends in the third direction toward the casing 10 from the surface of the holder 62 facing the casing 10. On the other hand, the casing 10 includes a recessed portion 15. The recessed portion 15 is recessed in the third direction on the first outer surface 11 of the casing 10. The boss 621c is inserted into the recessed portion 15. The bosses 621a, 621b and 621c may have a circular columnar shape or a rectangular columnar shape, respectively.

[0101] The through-hole 451a has a dimension (inner dimension) in the second direction larger than a dimension (outside dimension) of the boss 621a in the second direction. The through-hole 451b has a dimension (inner dimension) in the second direction larger than a dimension (outside dimension) of the boss 621b in the second direction. Further, the recessed portion 15 has a dimension (inner dimension) in the second direction larger than a dimension (outer dimension) of the boss 621c in the second direction. Hence, the holder 62 can move along with the bosses 621a, 621b and 621c in the second direction relative to the casing 10 and the first cover 45. As the holder 62 moves in the second direction, the IC chip 61 having the electric contact surface 611 also moves in the second direction together with the holder 62.

[0102] The through-hole 451a has a dimension (inner dimension) in the first direction larger than a dimension (outer dimension) of the boss 621a in the first direction. The through-hole 451b has a dimension (inner dimension) in the first direction larger than a dimension (outer dimension) of the boss 621b in the first direction. Further, the recessed portion 15 has a dimension (inner dimension) in the first direction larger than a dimension (outer dimension) of the boss 621c in the first direction. Hence, the holder 62 can move along with the bosses 621a, 621b and 621c in the first direction relative to the casing 10 and the first cover 45. As the holder 62 moves in the first direction, the IC chip 61 having the electric contact surface 611 also moves in the first direction together with the holder 62. Further, the holder 62 may be movable in the third direction between the first cover 45 and the first outer surface 11.

[0103] Alternatively, the holder 62 may include a single boss, or equal to or more than three bosses. Likewise, the first cover 45 may have a single through-hole, or equal to or more than three through-holes. Or, instead of the through-holes 451a and 451b, the first cover 45 may include recesses to have the bosses 621a and/or 621b

inserted thereinto.

[0104] As shown in Figs. 6 and 7, the holder 62 includes a first end portion 710 and a second end portion 720. The first end portion 710 is one end portion of the holder 62 in the first direction. The second end portion 720 is another end portion of the holder 62 in the first direction. The first end portion 710 is movable relative to the second end portion 720 in the first direction. More specifically, the holder 62 of the present embodiment includes a first holder member 71, a second holder member 72, and a coil spring 73 positioned between the first holder member 71 and the second holder member 72. The first holder member 71 is made of resin, for example. The second holder member 72 is made of resin, for example. The first holder member 71 includes the first end portion 710. The IC chip 61 is fixed to the holding surface 620 included in the outer surface at the first end portion 710. The second holder member 72 includes the second end portion 720. In the assembled holder 62, the first end portion 710 and the second end portion 720 are separated from each other in the first direction.

[0105] The coil spring 73 is an elastic member extending in the first direction. The coil spring 73 is positioned between the first end portion 710 and the second end portion 720 in the first direction. The coil spring 73 can be expanded or compressed in the first direction at least between a first state and a second state which is more compressed than the first state. The coil spring 73 in the first state has a length in the first direction longer than a length of the coil spring 73 in the second state in the first direction. Therefore, a distance between the first end portion 710 and the second end portion 720 in the first direction in the first state is longer than a distance between the first end portion 710 and the second end portion 720 in the first direction in the second state. At least, the coil spring 73 in the second state has a length in the first direction shorter than a natural length of the coil spring 73.

[0106] As shown in Figs. 6 and 7, the first holder member 71 includes a pawl 714a and a pawl 714b. The pawl 714a and the pawl 714b respectively protrude from the first holder member 71 in a direction crossing the first direction. The second holder member 72 has an opening 721a and an opening 721b. The pawl 714a is inserted into the opening 721a. The pawl 714b is inserted into the opening 721b. In the first state, the pawl 714a is in contact with the second holder member 72 at a periphery of the opening 721a on a side of the first end portion 710. Also, in the first state, the pawl 714b is in contact with the second holder member 72 at a periphery of

the opening 721b on a side of the first end portion 710. With this structure, the length of the coil spring 73 in the first direction is prevented from getting further longer than the length of the coil spring 73 in the first state. Further, the first holder member 71 is prevented from coming off the second holder member 72. On the other hand, in the second state, the pawl 714a and pawl 714b are separated from the periphery of the opening 721b of the second holder member 72 on the side of the first end portion 710.

[0107] Instead of openings, recesses or steps which are capable of contacting the pawls may be provided. Alternatively, the first holder member 71 may have openings, recesses, or steps, whereas the second holder member 72 may include pawls.

[0108] Due to the difference in dimension between the through-hole 451 and boss 621 and expansion and compression of the coil spring 73 described above, the holding surface 620 of the holder 62 can move in the first direction relative to the casing 10. Hereinafter, the position of the holding surface 620 in the first direction relative to the casing 10 prior to mounting of the developing cartridge 1 on the drawer unit 90 will be referred to as "an initial position (a first position)." Further, the position of the holding surface 620 in the first direction relative to the casing 10 at a moment when the coil spring 73 is most compressed during attaching the developing cartridge 1 to the drawer unit 90 will be referred to as "an intermediate position (a second position)." Further, the position of the holding surface 620 in the first direction relative to the casing 10 when the electric contact surface 611 makes contact with an electric connector 913 described later will be referred to as "a contact position (a third position)." And the position of the holding surface 620 in the first direction relative to the casing 10 after attaching the developing cartridge 1 to the drawer unit 90 has been completed will be referred to as "a final position (a fourth position)."

[0109] The outer surface of the first end portion 710 further includes a first guide surface 711 (an example of a first surface), a second guide surface 712 (an example of second surface), and third guide surfaces 713a and 713b (an example of a third surface), in addition to the holding surface 620 described above.

[0110] The first guide surface 711 is positioned at one side of the holding surface 620 in the second direction which is closer to the developing roller 30 than another side of the holding surface 620 in the second direction. The first guide surface 711 is inclined relative to the electric contact surface 611 of the IC chip 61 held by the holding surface 620. Specifically, the first guide surface 711 is inclined at an acute

angle relative to the relative to the electric contact surface 611.

[0111] Here, one end of the first end portion 710 in the second direction will be defined as a first outer end position 711a (a third position). One end of the holding surface 620 in the second direction is defined as a first inner end position 711b (a fourth position). As illustrated in Fig. 7, the first guide surface 711 extends from the first outer end position 711a to the first inner end position 711b toward the electric contact surface 611. The first outer end position 711a is farther away from the electric contact surface 611 than the first inner end position 711b both in the first direction and the second direction. In addition, as illustrated in Fig. 7, the distance d1 between the first outer end position 711a and first inner end position 711b in the first direction is greater than the distance d2 between the electric contact surface 611 and first inner end position711b in the first direction.

[0112] The second guide surface 712 is positioned at one side of the holding surface 620 in the second direction which is farther from the developing roller 30 than another side of the holding surface 620 in the second direction. The second guide surface 712 is inclined relative to the electric contact surface 611 of the IC chip 61 held by the holding surface 620. Specifically, the second guide surface 712 is inclined at an acute angle relative to the electric contact surface 611.

[0113] Here, another end of the first end portion 710 in the second direction will be defined as a second outer end position 712a (a fifth position). Another end of the holding surface 620 in the second direction is defined as a second inner end position 712b (a sixth position). As illustrated in Fig 7, the second guide surface 712 extends from the second outer end position 712a to the second inner end position 712b toward the electric contact surface 611. The second outer end position 712a is farther away from the electric contact surface 611 than the second inner end position 712b both in the first direction and the second direction. In addition, as illustrated in Fig. 7, the distance d3 between the second outer end position 712a and second inner end position 712b in the first direction is greater than the distance d4 between the electric contact surface 611 and second inner end position 712b in the first direction.

[0114] The third guide surface 713a is positioned at one side of the electric contact surface 611 in the third direction. The third guide surface 713b is positioned at another side of the electric contact surface 611 in the third direction. The third guide surfaces 713a, 713b extend in the second direction, respectively. Each of the third

guide surfaces 713a, 713b is farther away from the coil spring 73 than the electric contact surface 611 in the first direction. Therefore, the electric contact surface 611 is positioned at a recessed area which is recessed toward the coil spring 73 side relative to the third guide surfaces 713a, 713b.

[0115] Each of the first guide surface 711, second guide surface 712, and third guide surfaces 713a, 713b may be planar or curved. However, it is preferable that each of the first guide surface 711, second guide surface 712, and third guide surfaces 713a, 713b is smooth surface without steps so that each of the first guide surface 711, second guide surface 712, and third guide surfaces 713a, 713b does not hook a portion of the drawer unit 90 when the developing cartridge 1 is attached to the drawer unit 90.

[0116]

3. Attaching Operation

Subsequently, operation when each developing cartridge 1 is attached to the drawer unit 90 will be described. Figs. 8 through 14 respectively illustrate how the developing cartridge 1 is attached to one of the cartridge holding portions 91 of the drawer unit 90.

[0117] When the developing cartridge 1 is attached to the cartridge holding portion 91, as illustrated in Fig. 8, the developing roller 30 of the developing cartridge 1 first faces an insertion opening 910 of the cartridge holding portion 91. At this time, the first end portion 710 and second end portion 720 of the holder 62 are not in contact with the drawer unit 90 yet. Thus, the coil spring 73 is in the first state described above. The position of the holding surface 620 with respect to the casing 10 in the first direction is the initial position described above. The developing cartridge 1 is inserted into the cartridge holding portion 91 in the second direction, as shown by a dashed arrow illustrated in Fig. 8.

[0118] The cartridge holding portion 91 includes a first guide plate 911 and a second guide plate 912. The first guide plate 911 is spaced apart from the second guide plate 912 in the first direction and the first guide plate 91 and the second guide plate 912 face each other. Each of the first guide plate 911 and second guide plate 912 extends along both the second direction and the third direction. The first guide plate 911 includes an electric connector 913 made of metal. The electric connector 913 is contactable with the electric contact surface 611 of the IC chip 61. The electric connector 913 protrudes from the surface of the first guide plate 911 toward the second

guide plate 912 in the first direction.

[0119] When the developing cartridge 1 is inserted into the cartridge holding portion 91, the first guide surface 711 of the holder 62 contacts the end of the first guide plate 911 in the second direction, as illustrated in Fig. 9. Then, the first guide plate 911 presses the first guide surface 711, so that the holder 62 moves in the first direction. At this time, the movement of the holder 62 is relative movement with respect to the casing 10. As a result, the holder 62 is positioned between the first guide plate 911 and second guide plate 912 in the first direction, as illustrated in Fig. 10.

[0120] The first end portion 710 of the first holder member 71 then contacts the first guide plate 911. The second end portion 720 of the second holder member 72 also contacts the second guide plate 912. The coil spring 73 is more compressed in the first direction than the first state.

[0121] As illustrated in Fig. 11, the first guide plate 911 includes a guide protrusion 914 protruding toward the second guide plate 912. The guide protrusion 914 is positioned closer to the insertion opening 910 than the electric connector 913. The guide protrusion 914 includes a first inclined surface 915. The second guide plate 912 also includes a second inclined surface 916. The distance between the first inclined surface 915 and second inclined surface 916 in the first direction becomes gradually smaller toward the inserting direction of the developing cartridge 1.

[0122] When the developing cartridge 1 is further inserted in the second direction, the first holder member 71 contacts the first inclined surface 915 and the second holder member 72 contacts the second inclined surface 916. As a result, the first holder member 71 and second holder member 72 become closer to each other in the first direction and the length of the coil spring 73 in the first direction becomes shorter gradually. When each of the third guide surfaces 713a, 713b of the first holder member 71 contacts the top portion of the guide protrusion 914, the length of the coil spring 73 in the first direction becomes shortest. That is, the coil spring 73 becomes in the second state described above. The position of the holding surface 620 relative to the casing 10 in the first direction is the intermediate position described above.

[0123] As described above, the IC chip assembly 60 can change the position of the holding surface 620 holding the IC chip 61 in the first direction when the developing cartridge 1 is inserted into the drawer unit 90. As a result, the developing cartridge 1 can be inserted into the drawer unit 90 by changing the position of the holding surface

620 in the first direction along the guide protrusion 914. A pressure applied from the guide protrusion 914 to the first holder member 71 in the first direction is reduced, compared with the pressure in the case in which the guide protrusion 914 is passed with the position of the holding surface 620 in the first direction being fixed. Therefore, the developing cartridge 1 can be inserted into the drawer unit 90 with suppressing friction of the electric contact surface 611 of the IC chip 61. In addition, as illustrated Figs. 10, 11, and 12, the electric contact surface 611 directly contacts the electric connector 913 after the first guide surface 711 moves over the guide protrusion 914. As a result, friction of the electric connector 913 can be reduced.

[0124] In particular, in the developing cartridge 1 according to the present embodiment, the electric contact surface 611 of the IC chip 61 is positioned at a recessed area which is recessed relative to the third guide surfaces 713a, 713b. As a result, the top portion of the guide protrusion 914 contacts only the third guide surfaces 713a, 713b and does not contact the electric contact surface 611 in the state illustrated in Fig. 11. Therefore, friction of the guide protrusion 914 against the electric contact surface 611 can be prevented.

[0125] When the developing cartridge 1 is further inserted into the second direction, the third guide surfaces 713a, 713b pass the guide protrusion 914. The second guide surface 712 then contacts the guide protrusion 914 as illustrated in Fig. 12. With such contact, the coil spring 73 expands again from the second state to the third state described above. As a result, the electric contact surface 611 of the IC chip 61 contacts the electric connector 913 as illustrated in Fig. 13. The length in the first direction of the coil spring 73 in the third state is shorter than the length in the first direction of the coil spring 73 in the first state, and longer than the length in the first direction of the coil spring 73 in the second state. In addition, the length in the first direction of the coil spring 73 in the third state is shorter than the natural length of the coil spring 73. The relative position of the holding surface 620 with respect to the casing 10 in the first direction corresponds to the contact position described above.

[0126] Consequently, the IC chip assembly 60 is fixed in a state where the IC chip assembly 60 is nipped between the electric connector 913 and second guide plate 912. In the present embodiment, the casing 10 is then inclined in the first direction as shown by a dashed arrow illustrated in Fig. 14. As a result, the developing roller 30 contacts the photosensitive drum 92 in the drawer unit 90. At this time, the position of

the holding surface 620 relative to the casing 10 in the first direction changes from the contact position to the final position described above. The boss 621 moves inside of the through-hole 451 in the first direction. As a result, the boss 621 is not in contact with the edge of the through-hole 451 of the first cover 45. Thus, the IC chip assembly 60 and first cover 45 are not in contact with each other. Accordingly, oscillation of the drive unit such as the first gear portion 40 and the like is difficult to be transmitted to the IC chip assembly 60 when the image forming apparatus executes the print process. Therefore, the contact state of the electric contact surface 611 and electric connector 913 can be sufficiently maintained.

[0127]

4. Separating operation

After the developing cartridge 1 is attached, the drawer unit 90 can perform a "separating operation" in which the developing roller 30 is temporarily separated from the photosensitive drum 92. As illustrated in Fig. 2, the first cover 45 of the developing cartridge 1 includes a first columnar protrusion 46 extending in the third direction. As illustrated in Fig. 3, the second cover 54 of the developing cartridge 1 includes a second columnar protrusion 55 extending in the third direction. As illustrated in Fig. 1, the drawer unit 90 includes a plurality of pressure members 93. The pressure members 93 are positioned at respective side portions of the cartridge holding portion 91 in the third direction.

[0128] In the motion indicated by the dashed arrow in Fig. 14, the pressure member 93 presses the first columnar protrusion 46 and the second columnar protrusion 55, and the casing 10 is thus inclined in the first direction. Accordingly, the position of the holding surface 620 in the first direction relative to the casing 10 is changed from the contact position to the final position, described above.

[0129] Fig.15 illustrates the developing cartridge 1 in the separating operation. During the separating operation, the driving force from the image forming apparatus changes the positions of the first columnar protrusion 46 and the second columnar protrusion 55. Specifically, the lever of the drawer unit 90 (not illustrated) presses each of the first columnar protrusion 46 and the second columnar protrusion 55, and each of the first columnar protrusion 46 and the second columnar protrusion 55 thus moves against the pressing force of the pressure member 93. Consequently, as shown by a dashed arrow illustrated in Fig. 15, the casing 10 and the developing roller 30 of

the developing cartridge 1 move in the second direction so as to separate away from the photosensitive drum 92.

[0130] Meanwhile, the IC chip assembly 60 is fixed in a state where the IC chip assembly 60 is nipped between the electric connector 913 and the second guide plate 912. Accordingly, the position of the IC chip assembly 60 is not changed relative to the drawer unit 90, even while the casing 10 and the developing roller 30 move in the second direction. Further, the state of the coil spring 73 does not change from the third state. As a result, the position of the holder 62 relative to the casing 10 in the second direction changes from a standard position (the first position) to a separation position (the second position). The boss 621 then moves inside of the through-hole 451 in the second direction.

[0131] As described above, the developing cartridge 1 can change the position of the casing 10 relative to the drawer unit 90 in the second direction, without changing the position of the electric contact surface 611 in the second direction relative to the drawer unit 90. Accordingly, the developing cartridge 1 can maintain the contacting state between the electric contact surface 611 and the electric connector 913 during the separating operation. The contacting state between the electric contact surface 611 and the electric connector 913 can also be maintained during the shipment of the image forming apparatus in which the developing cartridge 1 is attached to the drawer unit 90. Accordingly, abrasion or wear of the electric contact surface 611 can be suppressed.

[0132]

5. Modifications

While the description has been made in detail with reference to specific embodiment thereof, it would be apparent to those skilled in the art that various changes and modifications may be made therein without departing from the spirit and scope of the above described embodiment. In the following description, differences between the above embodiment and the modifications are mainly explained.

[0133]

5-1. First Modification

Fig. 16 is a partial exploded perspective view of the developing cartridge 1A according to a first modification. In the first modification illustrated in Fig. 16, at least a portion of the holder 62A holding the IC chip 61A is covered by the first cover 45A, in the similar manner to that of the above embodiment. It is noted that the first cover

45A includes a boss 451aA and a boss 451bA in the first modification illustrated in Fig. 16. The boss 451aA and the boss 451bA are arrayed in the second direction. Each of the boss 451aA and the boss 451bA extends from the first cover 45A toward the casing 10A in the third direction. The holder 62A has a through-hole 621A that penetrates the holder 62A in the third direction. Both of the boss 451aA and the boss 451bA are inserted in the through-hole 621A.

[0134] The through-hole 621A has a dimension in the second direction greater than the distance between the one edge of the boss 451aA in the second direction and the another edge of the boss 451bA in the second direction. Specifically, the distance between the one edge of the boss 451aA and the another edge of the boss 451bA in the second direction which are most separated from each other is the longest distance of the boss 451aA and the boss 451bA in the second direction, and the dimension of the through-hole 621A in the second direction is greater than the longest distance. The holder 62A can move together with the through-hole 621A in the second direction relative to both the casing 10A and the first cover 45A. When the holder 62A moves in the second direction, the IC chip 61A having the electric contact surface 611A moves in the second direction together with the holder 62A.

[0135] The dimension of the through-hole 621A in the first direction is greater than each dimension of the boss 451aA and the boss 451bA in the first direction. Accordingly, the holder 62A can move together with the through-hole 621A in the first direction relative to both the casing 10A and the first cover 45A. When the holder 62A moves in the first direction, the IC chip 61A having the electric contact surface 611A moves in the first direction together with the holder 62A. The holder 62A may be movable in the third direction between the first cover 45A and the first outer surface 11A.

[0136] As described above, the first cover 45A may include the boss 451A and the holder 62A may have the through-hole 621A, so that the electric contact surface 611 can move relative to the casing 10A in the first and second directions. In accordance with the configuration, the boss 451A can be moved in the first direction inside of the through-hole 621A when the casing 10A is inclined in the first direction during the attachment of the developing cartridge 1A to the drawer unit 90. When the separating operation is performed after the developing cartridge 1A is attached, the boss 451A can move in the second direction inside of the through-hole 621A. As a result, the position

of the casing 10A can be changed in a state where the contact state of the electric contact surface 611A and the electric connecter is satisfactorily maintained.

[0137] The number of the bosses 451A may be one, or more than or equal to three. The number of the through-holes 621A formed on the holder 62A may be more than or equal to two. Instead of the through-hole 621A, the holder 62A may have a recessed portion in which the boss 451A can be inserted. Further, the first outer surface of the casing may have a boss and the holder has the through-hole or the recessed portion through which the boss of the casing is inserted. The boss 451A may have either a cylindrical shape or a prism shape.

[0138] Fig. 17 is a cross-sectional view of the IC chip assembly 60A indicated in Fig. 16 taken along a plane orthogonal to the third direction. As illustrated in Fig. 17, the holder 62A of the IC chip assembly 60A includes a holder member 74A made of resin, and a leaf spring 75A fixed to the holder member 74A. The holder member 74A includes a first end portion 740A that is one end portion of the holder 62A in the first direction. The IC chip 61A is fixed to the holding surface 620A that is portion of the outer surface of the first end portion 740A. The leaf spring 75A includes a second end portion 750A that is the another end portion of the holder 62A in the first direction. The first end portion 740A and the second end portion 750A are separated from each other in the first direction in the assembled holder 62A.

[0139] The leaf spring 75A is made of a bent metal plate having flexibility, for example. The leaf spring 75A can be expanded or compressed in the first direction between a first state, and a second state in which the leaf spring 75A is bent more than in the first state. The length in the first direction of the leaf spring 75A in the first state is larger than the length in the first direction of the leaf spring 75A in the second state. That is, the distance in the first direction between the first end portion 740A and the second end portion 750A in the first state is longer than the distance in the first direction between the first end portion 740A and the second end portion 750A in the second state. The length in the first direction of the leaf spring 75A in the second state is smaller than the natural length of the leaf spring 75A.

[0140] As described above, instead of the coil spring, the leaf spring 75A may be used so that the IC chip assembly 60A can be expanded or compressed in the first direction. Further, as described above, the dimensional difference between the boss 451A and the through-hole 621A and expansion and compression of the leaf spring 75A

enable the electric contact surface 611A of the IC chip 61A to be moved in the first direction relative to the casing 10A, when the developing cartridge 1A is being attached to the drawer unit.

[0141]

5-2. Second Modification

Fig. 18 is a partial perspective view illustrating a developing cartridge 1B according to a second modification. In the second modification depicted in Fig. 18, the electric contact surface 611B of an IC chip 61B is oriented to face in the third direction. Accordingly, the first direction orthogonal to the electric contact surface 611B is the same direction as the third direction. In the second modification depicted in Fig. 18, a columnar elastic body 63B is positioned between a casing 10B and an IC chip assembly 60B. As the columnar elastic body 63B, for example, a coil spring extending in the first direction may be used. The columnar elastic body 63B includes one end portion in the third direction, and the one end portion is fixed to a holder 62B of the IC chip assembly 60B. The columnar elastic body 63B includes another end portion in the third direction, and the another end portion is fixed to a first outer surface of the casing 10B. That is, the casing 10B and the IC chip assembly 60B are connected to each other by the columnar elastic body 63B.

[0142] Figs. 19 and 20 are explanatory diagrams illustrating movement of the IC chip assembly 60B in accordance with deformation of the columnar elastic body 63B. As illustrated in Fig. 19, the columnar elastic body 63B is capable of being expanded or compressed in the first direction. As the columnar elastic body 63B is expanded or compressed, the position of the electric contact surface 611B relative to the casing 10B in the first direction also changes. Further, as illustrated in Fig. 20, the columnar elastic body 63B can deform in a direction diagonal to the first direction. As the columnar elastic body 63B diagonally deforms, the position of the one end of the columnar elastic body 63B also changes relative to another end of the columnar elastic body 63B in a direction crossing the first direction or a direction perpendicular to the first direction.

[0143] Figs. 21 and 22 are explanatory diagrams illustrating how the developing cartridge 1B according to the second modification is attached to a drawer unit 90B. As illustrated in Figs. 21 and 22, a first cover 45B includes a first frame portion 456B and a second frame portion 457B, and the first frame portion 456B and

the second frame portion 457B are arranged with a gap between the first frame portion 456B and the second frame portion 457B in the second direction. The IC chip assembly 60B and the columnar elastic body 63B are accommodated in an accommodating portion 452B which corresponds to a space between the first frame portion 456B and the second frame portion 457B. The first cover 45B further includes a pawl 453B protruding from the first frame portion 456B toward the accommodating portion 452B. As illustrated in Fig. 21, before the developing cartridge 1B is attached to the drawer unit 90B, a portion of the IC chip assembly 60 is in contact with the pawl 453B. Hence, the columnar elastic body 63B is maintained in a more compressed state than the natural length of the columnar elastic body 63B in the first direction.

[0144] When the developing cartridge 1B has been attached to the drawer unit 90B, as illustrated in Fig. 22, the electric contact surface 611B of the IC chip 61B contacts an electric connector 913B. In this state, a length of the columnar elastic body 63B in the first direction is shorter than that in the state illustrated in Fig. 21. Thus, due to a repulsion force of the columnar elastic body 63B, a contact state between the electric contact surface 611B and the electric connector 913B is maintained.

[0145] Fig. 23 is an explanatory diagram illustrating a state where the separating operation is performed after the developing cartridge 1B is attached to the drawer unit 90B. When the separating operation is performed, as illustrated in Fig. 23, the columnar elastic body 63B is deformed diagonally with respect to the first direction. Thus, the IC chip assembly 60B connected to the one end of the columnar elastic body 63B moves in the second direction relative to the casing 10B connected to the another end of the columnar elastic body 63B. Thus, the position of the casing 10B in the second direction can be changed without changing the position of the electric contact surface 611B in the second direction relative to the drawer unit 90B. That is, the separating operation can be performed in a state where the contact state between the electric contact surface 611B and the electric connector 913B is maintained.

[0146]

5-3. Third Modification

Fig. 24 is a perspective view of a developing cartridge 1C according to a third modification. In the third modification depicted in Fig. 24, an IC chip assembly 60C includes an IC chip 61C, a holder 62C, a shaft portion 66C, and a lever 67C. The shaft portion 66C extends in the second direction within a first cover 45C. The shaft portion

66C includes one end portion in the second direction, and the one end portion of the shaft portion 66C is connected to the holder 62C so as to be incapable of rotating relative to the holder 62C. The shaft portion 66C includes another end portion in the second direction, and the another end portion is connected to the lever 67C positioned outside the first cover 45C so as to be incapable of rotating relative to the lever 67C. Accordingly, as the lever 67C pivots about the shaft portion 66C as indicated by a dashed line arrow depicted in Fig. 24, the shaft portion 66C and the holder 62C also pivots about the shaft portion 66C. Accordingly, a position of the holder 62C in the first direction is changed.

[0147] Figs. 25 through 27 are views of the developing cartridge 1C according to the third modification as viewed in the third direction. Before the developing cartridge 1C is attached to the drawer unit, as illustrated in Figs. 24 and 25, the IC chip 61C and the holder 62C are accommodated inside the first cover 45C. When the developing cartridge 1C is attached to the drawer unit and then the drawer unit is accommodated in the image forming apparatus, the lever 67C pivots about the shaft portion 66C. As a result, a portion of the holder 62C and the IC chip 61C protrude from the first cover 45C. Further, as illustrated in Fig. 27, the electric contact surfaces 611C of the IC chip 61C are in contact with an electric connector 913C of the drawer unit.

[0148] The lever 67C may be manually operated by a user after the developing cartridge 1C is attached to the drawer unit. Alternatively, the lever 67C may be pivoted by a guide surface provided at a main body of the image forming apparatus when the drawer unit is accommodated into the main body of the image forming apparatus.

[0149] The first cover 45C includes a support surface 454C that contact the lever 67C before the lever 67C pivots. In a state depicted in Fig. 25, one surface of the lever 67C in the second direction is in contact with the support surface 454C. Accordingly, the lever 67C, the shaft portion 66C, the holder 62C and the IC chip 61C as a whole are supported by the first cover 45C in the second direction. However, as illustrated in Fig. 26, as the lever 67C pivots, the lever 67C moves outside the support surface 454C. Accordingly, the one surface of the lever 67C in the second direction and the support surface 454C are not in contact with each other. Further, the holder 62C is fixed at a position depicted in Fig. 26, by a positioning member of the drawer

unit. As a result, a state in which the electric contact surface 611C of the IC chip 61C and the electric connector 913C are in contact with each other is maintained.

[0150] Further, in the state depicted in Fig. 26, the one surface of the holder 62C in the second direction is not in contact with the first cover 45C. Accordingly, the lever 67C, the shaft portion 66C, the holder 62C and the IC chip 61C as a whole can move relative to the first cover 45C in the second direction. Consequently, as illustrated in Fig. 27, when the separating operation is performed, the casing 10C and the first cover 45C can move in the second direction in a state where the contact state between the electric contact surface 611C of the IC chip 61C and the electric connector 913C is maintained.

[0151]

5-4. Fourth Modification

Fig. 28 is an exploded perspective view illustrating a first cover 45D and an IC chip assembly 60D of the developing cartridge according to a fourth modification. Fig. 29 is a cross-sectional view illustrating the first cover 45D and the IC chip assembly 60D. In the fourth modification depicted in Figs. 28 and 29, the electric contact surfaces 611D of the IC chip 61D are oriented to face in the third direction. Accordingly, the first direction orthogonal to the electric contact surfaces 611D is the same direction as the third direction.

[0152] As illustrated in Figs. 28 and 29, the IC chip assembly 60D according to the fourth modification includes the IC chip 61D, the holder 62D holding the IC chip 61D, and a joint member 63D. The holder 62D includes a plurality of pawls 622D, and each of the plurality of pawls 622D extends in a direction away from the electric contact surfaces 611D in the first direction. In the fourth modification depicted in Fig. 28, the holder 62D has four pawls 622D. The joint member 63D includes a fixing portion 631D fixed to the first cover 45D, and an arm 632D extending from the fixing portion 631D toward the holder 62D in the first direction.

[0153] The arm 632D includes a distal end in the first direction, and a spherical portion 633D whose diameter is larger than a thickness of the arm 632D. The spherical portion 633D is positioned at the distal end of the arm 632D. The spherical portion 633D is held at a position inside of the holder 62D by the plurality of pawls 622D. With this configuration, as illustrated in Fig. 30, the arm 632D and the holder 62D are connected to each other so as to be rotatable relative to each other. That is,

the IC chip 61D and the holder 62D are rotatable relative to each other about the spherical portion 633D. Accordingly, the position of the electric contact surfaces 611D of the IC chip 61D relative to the fixing portion 631D can be moved in the second direction. Therefore, when the separating operation of the developing cartridge is performed, the casing and the first cover 45D can move in the second direction in a state where the contact state between the electric contact surfaces 611D of the IC chip 61D and the electric connector is maintained.

[0154] Further, with the configuration depicted in Figs. 28 through 30, the pawls 622D of the holder 62D and the arm 632D of the joint member 63D are movable relative to each other in the first direction. Thus, when the developing cartridge is inserted into the drawer unit, the IC chip 61D and the holder 62D can move relative to the fixing portion 631D in the first direction. Accordingly, the developing cartridge can be inserted, while the electric contact surfaces 611D of the IC chip 61D can be suppressed from being rubbed.

[0155] An elastic member such as a coil spring which is expanded or compressed in the first direction may be positioned between the fixing portion 631D of the joint member 63D and the plurality pawls 622D. An elastic member such as a coil spring which is expanded or compressed in the first direction may be positioned between the first cover 45D and the plurality pawls 622D. Accordingly, a repulsion force by the elastic member allows the electric contact surface 611D to reliably contact to the electric connector.

[0156] Further, the arm 632D may be rotatably connected to the fixing portion 631D or the first cover 45D. For example, the arm 632D includes one spherical portion at one end of the arm 632D and another spherical portion at another end of the arm 632D. Either the one spherical portion or the another spherical portion may be rotatably held by a plurality of pawls of the first cover 45D. In this manner, when both ends of the arm 632D are rotatably connected, the position of the electric contact surface 611D in the second direction may be changed more flexibly.

[0157]

5-5. Fifth Modification

Fig. 31 is a partial perspective view of a developing cartridge 1E of the fifth modification. In the embodiment shown in Fig. 31, the holder 62E holding the IC chip 61E is formed from a plate member which has been deformed in a circular manner and

whose ends are connected to each other. The holder 62E is made of a flexible resin, for example. Accordingly, in the embodiment shown in Fig. 31, the holder 62E itself is an elastic member which is expanded or compressed in the first direction. With this structure, a distance between both ends of the holder 62E in the first direction is changeable. Accordingly, when the developing cartridge 1E is inserted into the drawer unit, abrasion or wear of the electric contact surface 611E of the IC chip 61E can be suppressed.

[0158] In the embodiment shown in Fig. 31, the holder 62E is not necessary to be configured by a plurality of members due to expansion and compression of the holder 62E in the first direction. The holder 62E is not necessary to be formed from an elastic member which is different from the member for holding the IC chip 61E.

[0159] Fig. 32 is an exploded perspective view showing a first cover 45E and an IC chip assembly 60E of the fifth modification. As shown in Fig. 32, the first cover 45E includes a boss 451aE extending in the third direction and a boss 451bE extending in the third direction. The boss 451aE and the boss 451bE are aligned in the second direction. And, the first cover 45E includes a connecting portion 455E which connects a top of the boss 451aE and a top of the boss 451bE to each other.

[0160] The holder 62E extends in a ring shape surrounding the boss 451aE and the boss 451bE. And one pawl 623E positioned at one end of the holder 62E and another pawl 623E positioned at another end of the holder 62E are engaged with each other. Accordingly, a through-hole 621E is formed at the inside of the holder 62E and the through-hole 621E penetrates through the holder 62E in the third direction. The boss 451aE and the boss 451bE are positioned inside of the through-hole 621E. The holder 62E further includes a plate portion 624E protruding from an inner surface of the holder 62E toward the through-hole 621E. The plate portion 624E is inserted between the boss 451aE and the boss 451bE.

[0161] The spacing between the boss 451aE and the boss 451bE in the second direction is greater than the thickness of the plate portion 624E in the second direction. Therefore, the holder 62E is able to relatively move together with the plate portion 624E with respect to the casing 10E and the first cover 45E in the second direction. When the holder 62E moves in the second direction, the IC chip 61E having the electric contact surface 611E moves together with the holder 62E in the second direction.

[0162] The size of the through-hole 621E in the first direction is greater than

the sizes of each of the boss 451aE and the boss 451bE in the first direction. Therefore, the holder 62E is movable with respect to the casing 10E and the first cover 45E in the first direction. When the holder 62E moves in the first direction, the IC chip 61E having the electric contact surface 611E moves together with the holder 62E in the first direction.

[0163] When the developing cartridge 1E is attached to the drawer unit, the holder 62E is nipped by the guide plates of the drawer unit, and the holder 62E is compressed in the first direction. Specifically, by approaching both of the one pawl 623E and the another pawl 623 E to each other, an urging force exerting in the direction to separate the both of the one pawl 623E and the another pawl 623 E from each other is generated. The electric contact surface 611E of the IC chip 61E is in contact with the electric connector in a state where the holder 62E is elastically deformed. The electric contact surface 611E is fixed to the electric connector due to the urging force in a state where the electric contact surface 611E is in contact with the electric connector. And, in the separating operation, the casing 10E moves in the second direction in a state where the contact between the electric contact surface 611E and the electric connector is maintained.

[0164] With the above configuration, when the developing cartridge 1E is attached to the drawer unit and the casing 10E is inclined in the first direction, the boss 451aE and the boss 451bE are able to move in the first direction inside the through-hole 621E. After the developing cartridge 1E is attached to the drawer unit and the separating operation is performed, the boss 451aE and the boss 451bE are able to move in the second direction inside the through-hole 621E. As a result, the position of the casing 10E can be changed in a state where the contact condition between the electric contact surface 611E and the electric connector is maintained in a good manner.

[0165] The number of the bosses provided at the first cover 45E may be single or more than or equal to three.

[0166]

5-6. Sixth Modification

Fig. 33 is a perspective view showing a developing cartridge 1F and a drum cartridge 80F of the sixth modification. The developing cartridge 1F shown in Fig. 33 includes a casing 10F, a developing roller 30F, an IC chip assembly 60F, and a first cover 45F. In the embodiment shown in Fig. 33, the developing cartridge 1F is

attached to the drum cartridge 80F instead of the drawer unit. The drum cartridge 80F includes one developing cartridge holding portion 81F holding the developing cartridge 1F. The developing cartridge holding portion 81F includes a photosensitive drum 82F. When the developing cartridge 1F is attached to the drum cartridge 80F, the developing roller 30F of the developing cartridge 1F is in contact with the photosensitive drum 82F.

[0167] Fig. 34 is a view showing how to attach the drum cartridge 80F to an image forming apparatus 100F in a state where the developing cartridge 1F is attached to the drum cartridge 80F. As shown in Fig. 34, the drum cartridge 80F attached with the developing cartridge 1F is attached to a drum cartridge holding portion 101F provided in the image forming apparatus 100F.

[0168] In the above manner, the similar structure to that of the IC chip assemblies according to the above embodiment or the first to fifth modifications respectively can be applied to the developing cartridge 1F to be attached to the drum cartridge 80F. Fig. 35 is an exploded perspective view showing a detail of the IC chip assembly 60F of the developing cartridge 1F. As shown in Fig. 35, the IC chip assembly 60F of the developing cartridge 1F includes an IC chip 61F as a storage medium and a holder 62F holding the IC chip 61F. The first cover holds the holder 62F at a side of the casing 10F in the third direction.

[0169] The holder 62F includes a first holder member 71F, a second holder member 72F, and a coil spring 73F. The coil spring 73F is an elastic member that can be expanded or compressed in the first direction.

[0170] The first holder member 71F includes a boss 621aF, a boss 621bF, and a boss 621cF. The boss 621aF extends in the third direction toward the first cover 45F from the surface of the first holder member 71F facing the first cover 45F. On the other hand, the first cover 45F has a through-hole 451F. The through-hole 451F penetrates through the first cover 45F in the third direction. The boss 621aF is inserted through the through-hole 451F.

[0171] Each of the boss 621bF and the boss 621cF extends in the third direction toward the casing 10F from the surface of the first holder member 71F facing casing 10F. On the other hand, the casing 10F includes a recessed portion 15aF and a recessed portion 15bF. Each of the recessed portion 15aF and the recessed portion 15bF is recessed from the first outer surface 11F of the casing 10F in the third direction. The boss 621bF is inserted through the recessed portion 15aF. The boss 621cF is

inserted through the recessed portion 15bF.

[0172] The through-hole 451F has a size (inner dimension) in the second direction greater than a size (outer dimension) of the boss 621aF in the second direction. The recessed portion 15aF has a size (inner dimension) in the second direction greater than a size (outer dimension) of the boss 621bF in the second direction. Further, the recessed portion 15bF has a size (inner dimension) in the second direction greater than a size (outer dimension) of the boss 621cF in the second direction. Hence, the holder 62F can move in the second direction relative to the casing 10F and the first cover 45F, together with the bosses 621aF, 621bF, and 621cF. As the holder 62F moves in the second direction, the IC chip 61F including the electric contact surfaces 611F also moves in the second direction, together with the holder 62F.

[0173] The through-hole 451F has a size (inner dimension) in the first direction greater than a size (outer dimension) of the boss 621aF in the first direction. The recessed portion 15aF has a size (inner dimension) in the first direction greater than a size (outer dimension) of the boss 621bF in the first direction. Further, the recessed portion 15bF has a size (inner dimension) in the first direction greater than a size (outer dimension) of the boss 621cF in the first direction. Hence, the holder 62F can move in the first direction relative to the casing 10F and the first cover 45F, together with the boss 621aF, boss 621bF, and boss 621cF. As the holder 62F moves in the first direction, the IC chip 61F including the electric contact surfaces 611F also moves in the first direction, together with the holder 62F.

[0174] As shown in Fig. 34, the second holder member 72 includes a recess portion 625F. On the other hand, the drum cartridge 80F includes a convex portion 83F. The recess portion 625F and the convex portion 83F face each other in the first direction. The size of the recess portion 625F gradually enlarges while progressing away from the IC chip 61F in the first direction. The size of the convex portion 83F gradually diminishes while progressing toward a top of the convex portion 83F in the first direction.

[0175] As shown in Fig. 34, the image forming apparatus 100F includes an electric connector 102F. When the drum cartridge 80F is inserted into the image forming apparatus 100F in a state where the developing cartridge 1F is attached to the drum cartridge 80F, the first holder member 71F is brought into contact with a component of the image forming apparatus 100F. Further, the convex portion 83F of

the drum cartridge 80F is fitted in the recess portion 625F of the second holder member 72F. Therefore, the position of the second holder member 72F relative to the drum cartridge 80f is fixed. As a result, the holder 62F is nipped between the component of the image forming apparatus 100F and the drum cartridge 80, so that the coil spring 73F is compressed in the first direction. When the drum cartridge 80F is further inserted into the image forming apparatus 100F, the electric contact surfaces 611F of the IC chip 61F are brought into contact with the electric connectors 102F.

[0176] The IC chip 61F is brought into contact with the electric connector 102F, while receiving a repulsion force from the coil spring 73F. The holder 62F is nipped between the electric connector 102F and the convex portion 83F. In this way, the holder 62F is positioned relative to the image forming apparatus 100F and the drum cartridge 80F.

[0177] As shown in Fig. 35, the second holder member 72F includes a pawl 714F. The pawl 714F protrudes from the second holder member 72F in a direction that crosses the first direction. In the example of Fig. 35, the pawl 714F protrudes in the third direction from the second holder member 72F. The first holder member 71F has an opening 721F. The pawl 714F is inserted through the opening 721F. This prevents the first holder member 71F from being detached from the second holder member 72F.

[0178] The casing 10F of the developing cartridge 1F includes a first rib 46F and a second rib 55F. The first rib 46F protrudes from the first outer surface 11F in the third direction. The second rib 55F protrudes from the second outer surface 12F in the first and third directions. The drum cartridge 80F includes a first lever 84F and a second lever 85F. During the separating operation, the first lever 84F and second lever 85F are operated by a driving force supplied from the image forming apparatus, so that the first rib 46F is pushed by the first lever 84F and the second rib 55F is pushed by the second lever 85F. This operation changes the positions of the first rib 46F and second rib 55F. As a result, the casing 10F and the developing roller 30F of the developing cartridge 1F move in the second direction and then move away from the photosensitive drum 92.

[0179] As described above, also in the developing cartridge 1F, the position of the holder 62F can be changed in the second direction relative to the casing 10F. Accordingly, the position of the casing 10F in the second direction can be changed,

while the positions of the electric contact surfaces 611F relative to the electric connector 102F in the second direction being unchanged. Therefore, it is possible to perform the separating operation, while maintaining the electric contact surfaces 611F and electric connector 102F in contact with each other. Accordingly, abrasion or wear of the electric contact surfaces 611F can be suppressed.

[0180] Also in the developing cartridge 1F, the electric contact surfaces 611F are movable relative to the casing 10F in the first direction. Accordingly, when the drum cartridge 80F is attached to the image forming apparatus 100F, abrasion or wear of the electric contact surfaces 611F can be suppressed.

[0181]

5-7. Other Modifications

In the above-described embodiments, the IC chip including the electric contact surfaces is fixed to the outer surface of the holder. However, only the electric contact surfaces that serve to contact the electric connectors may be fixed to the outer surface of the holder, and portions of the IC chip other than the electric contact surfaces may be positioned at other portions of the developing cartridge.

[0182] According to the above-described embodiments, the plural gears provided within each of the first gear portion and the second gear portion are engaged with one another through meshing engagement of the gear teeth. However, the plural gears provided within each of the first gear portion and the second gear portion may be engaged with one another through a frictional force. For example, instead of the plural gear teeth, frictional members such as rubber members may be provided to the outer circumferences of two gears that engage with each other.

[0183] According to the above-described embodiments, the developing cartridge 1 can be attached to the drawer unit of the image forming apparatus. However, the developing cartridge may be attached to the image forming apparatus which does not include the drawer unit.

[0184] Shapes of the details in the developing cartridge may differ from those shown in the drawings attached to this application. The respective components employed in the above-described embodiment and modifications can be selectively combined together within an appropriate range so that no inconsistency will arise.

[Explanation of Reference numerals]

[0185]

1, 1A 1B, 1C, 1E, 1F developing cartridge
10, 10A 10B, 10C, 10E, 10F casing
11 first outer surface
12 second outer surface
13 developing chamber
14 opening portion
20 agitator
21 agitator shaft
22 agitation blade
30, 30F developing roller
31 roller body
32 roller shaft
40 first gear portion
41 coupling
42 developing gear
43 idle gear
44 first agitator gear
45, 45A, 45B, 45C, 45D, 45E, 45F first cover
50 second gear portion
51 second agitator gear
52 detection gear
53 electrically conductive member
54 second cover
60, 60A, 60B, 60C, 60D, 60E, 60F IC chip assembly
61, 61A, 61B, 61C, 61D, 61E, 61F IC chip
62, 62A, 62B, 62C, 62D, 62E, 62F holder
63B columnar resilient body
63D joint member
66C shaft portion
67D lever
71, 71F first holder member
72, 72F second holder member
73, 73F coil spring

74A holder member
75A leaf spring
80F drum cartridge
81F developing cartridge holding portion
82F photosensitive drum
90, 90B drawer unit
91 cartridge holding portion
92 photosensitive drum
100F image forming apparatus
101F drum cartridge holding portion
102F electric connector
451, 451F through-hole
451aA, 451bA, 451aE, 451bE through-hole
611, 611A, 611B, 611C, 611D, 611E, 611F electric contact surface
620, 620A holding surface
621, 621F boss
621A, 621E through-hole
631D fixing portion
632D arm
633D spherical portion
710, 740A first end portion
711 first guide surface
712 second guide surface
713a, 713b third guide surface
720, 750A second end portion
910 insertion opening
911 first guide plate
912 second guide plate
913, 913B, 913C electric connector
914 guide protrusion

CLAIMS

1. A developing cartridge comprising:

a casing configured to accommodate developer therein;

a storage medium including an electric contact surface;

an elastic member extending in a first direction which crosses the electric contact surface, the elastic member configured to be compressed or expanded in the first direction between a first state and a second state; and

a holder including an outer surface positioned on a side of the holder in the first direction, the electric contact surface being positioned at the outer surface, the outer surface being movable between a first position and a second position in the first direction relative to the casing, wherein

a length in the first direction of the elastic member in the first state is greater than a length in the first direction of the elastic member in the second state, wherein

the holder is positioned at the first position in a state where the elastic member is in the first state, wherein

the holder is positioned at the second position in a state where the elastic member is in the second state, wherein

the holder includes a first end portion including the outer surface and a second end portion separate from the first end portion in the first direction, and wherein

the elastic member is positioned between the first end portion and the second end portion in the first direction.

2. The developing cartridge according to claim 1, wherein a distance in the first state between the first end portion and the second end portion in the first direction is greater than a distance in the second state between the first end portion and the second end portion in the first direction.

3. The developing cartridge according to claim 1 or 2, wherein a position of the outer surface relative to the casing is movable among any one of the first position, the second position and a third position in the first direction, wherein

the elastic member is configured to be compressed or expanded in the first direction among the first state, the second state and a third state, wherein

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a length in the first direction of the elastic member in the first state is greater than a length in the first direction of the elastic member in the second state, wherein

the length in the first direction of the elastic member in the third state is greater than the length in the first direction of the elastic member in the second state, and wherein

the holder is positioned in the third position in a state where the elastic member is in the third state.

4. The developing cartridge according to claim 1, wherein a position of the outer surface relative to the casing is movable among the first position, the second position and a third position, wherein

the elastic member is configured to be compressed or expanded in the first direction among the first state, the second state and a third state, wherein

a length in the first direction of the elastic member in the first state is greater than a length in the first direction of the elastic member in the second state, and a distance in the first state between the first end portion and the second end portion in the first direction is greater than a distance in the second state between the first end portion and the second end portion in the first direction, wherein

a length in the first direction of the elastic member in the third state is greater than a length in the first direction of the elastic member in the second state, and a distance in the third state between the first end portion and the second end portion in the first direction is greater than a distance in the second state between the first end portion and the second end portion in the first direction, and wherein

the holder is positioned at the third position in a state where the elastic member is in the third state.

5. The developing cartridge according to any one of claims 1 to 4, wherein the position of the outer surface relative to the casing is movable from the first position to the second position according to attachment of the developing cartridge to an image forming apparatus, wherein

a portion of the holder and the electric contact surface is not in contact with a portion of the image forming apparatus at the first position, and wherein

at least one of a portion of the holder and the electric contact surface is in contact with the portion of the image forming apparatus at the second position.

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6. The developing cartridge according to claim 3 or 4, wherein the position of the outer surface relative to the casing is movable from the first position to the third position through the second position according to attachment of the developing cartridge to an image forming apparatus, wherein

a portion of the holder and the electric contact surface is not in contact with a portion of the image forming apparatus at the first position, wherein

at least one of a portion of the holder and the electric contact surface is in contact with a portion of the image forming apparatus at the second position, and wherein

the electric contact surface is in contact with an electrical connector of the image forming apparatus at the third position.

7. The developing cartridge according to any one of claim 3, claim 4, and claim 6, wherein the length in the first direction of the elastic member in the third state is shorter than a natural length of the elastic member.

8. The developing cartridge according to any one of claims 1 to 7, wherein the first direction is perpendicular to the electric contact surface.

9. The developing cartridge according to any one of claims 1 to 8, wherein the holder is movable with the storage medium.

10. The developing cartridge according to any one of claims 1 to 9, wherein the holder holds the electric contact surface at the outer surface.

11. The developing cartridge according to any one of claims 1 to 10, wherein the storage medium is positioned at the outer surface of the holder.

12. The developing cartridge according to claim 11, wherein the holder holds the storage medium at the electric contact surface.

13. The developing cartridge according to any one of claims 1 to 12, further comprising: a developing roller rotatable about an axis extending in a direction which is different from the first direction.

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14. The developing cartridge according to any one of claims 1 to 13, wherein the holder is positioned at a side of the casing.

15. The developing cartridge according to claim 5 or 6, wherein the outer surface includes:

a first surface inclined relative to the electric contact surface, the first surface being positioned at one side of the electric contact surface in a second direction which is different from the first direction.

16. The developing cartridge according to claim 15, further comprising: a developing roller rotatable about an axis extending in a third direction which is different from the first direction, the developing roller being positioned at one side of the casing in the second direction.

17. The developing cartridge according to claim 15 or 16, wherein the first surface extends from a third position to a fourth position toward the electric contact surface, and wherein

the third position is farther from the electric contact surface in the first direction than the fourth position.

18. The developing cartridge according to claim 17, wherein a distance between the third position and the fourth position in the first direction is greater than a distance between the electric contact surface and the fourth position in the first direction.

19. The developing cartridge according to any one of claims 15 to 18, wherein the first surface is a first guide surface, the first guide surface is contactable with a portion of the image forming apparatus when the developing cartridge is attached to the image forming apparatus.

20. The developing cartridge according to claim 19, wherein the outer surface includes: a second surface inclined relative to the electric contact surface, the second surface being positioned at another side of the electric contact surface in the second direction.

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21. The developing cartridge according to claim 20, wherein the second surface extends from a fifth position to a sixth position toward the electric contact surface, and wherein

the fifth position is farther from the electric contact surface in the first direction than the sixth position.

22. The developing cartridge according to claim 21, wherein a distance between the fifth position and the sixth position in the first direction is greater than a distance between the electric contact surface and the sixth position in the first direction.

23. The developing cartridge according to any one of claims 20 to 22, wherein the second surface is a second guide surface, and the second guide surface is contactable with the portion of the image forming apparatus when the developing cartridge is attached to the image forming apparatus.

24. The developing cartridge according to any one of claims 1 to 23, wherein the outer surface includes:

third surfaces positioned at both sides of the electric contact surface in a third direction which is different from the first direction, and wherein

the third surfaces are farther from the elastic member in the first direction than the electric contact surface.

25. The developing cartridge according to claim 23, wherein the outer surface includes:

third surfaces positioned at both sides of the electric contact surface in a third direction which is different from the first direction, wherein

the third surfaces are farther from the elastic member in the first direction than the electric contact surface, and

wherein the third surfaces are third guide surfaces, and each of the third guide surfaces is contactable with the portion of the image forming apparatus when the developing cartridge is attached to the image forming apparatus.

26. The developing cartridge according to any one of claims 1 to 25, wherein the elastic member is a spring.

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27. The developing cartridge according to claim 26, wherein the spring is a coil spring.

28. The developing cartridge according to claim 11 or claim 12, wherein the storage medium includes the electric contact surface.

29. A developing cartridge comprising:

a casing configured to accommodate developer therein;

an elastic member extending in a first direction, the elastic member configured to be compressed or stretched in the first direction between a first state and a second state; and

a holder including an outer surface being positioned toward a side of the holder in the first direction, the outer surface including a chip mount being positioned at the outer surface and oriented in the first direction, the holder being movable between a first position and a second position in the first direction relative to the casing,

wherein a length of the elastic member in the first direction is greater in the first state than in the second state,

wherein the chip mount is in the first position in a state where the elastic member is in the first state,

wherein the chip mount is in the second position in a state where the elastic member is in the second state, and

wherein the outer surface includes a first surface inclined relative to the chip mount, and positioned at one side of the chip mount in a second direction different from the first direction.

30. The developing cartridge of claim 29, further comprising an IC chip having an electric contact surface, the IC chip being held by the chip mount of the holder to position the electric contact surface at the outer surface.

31. The developing cartridge of claim 30, wherein the chip mount comprises a holding surface configured to hold the IC chip at the outer surface of the holder.

32. The developing cartridge according to claim 31, wherein the holder is movable with the IC chip.

33. The developing cartridge according to claim 29,

wherein the holder includes a first end portion including the outer surface and a second end portion being separated from the first end portion in the first direction, and

wherein the elastic member is positioned between the first end portion and the second end portion.

34. The developing cartridge according to claim 33, wherein a distance between the first end portion and the second end portion in the first direction is greater in the first state than in the second state.

35. The developing cartridge according to claim 33,

wherein the chip mount is movable relative to the casing to any one of the first position, the second position and a third position,

wherein the elastic member is configured to be compressed or stretched in the first direction to be in any one of the first state, the second state and a third state,

wherein the length of the elastic member in the first direction is greater in the third state than in the second state, and distance between the first end portion and the second end portion in the first direction is greater in the third state than in the second state, and

wherein the chip mount is in the third position in a state where the elastic member is in the third state.

36. The developing cartridge according to claim 29,

wherein the chip mount is movable relative to the casing to any one of the first position, the second position and a third position in the first direction,

wherein the elastic member is configured to be compressed or stretched in the first direction to be in any one of the first state, the second state and a third state,

wherein the length of the elastic member in the first direction is greater in the third state than in the second state, and

wherein the chip mount is in the third position in a state where the elastic member is in the third state.

37. The developing cartridge according to claim 36, wherein the length of the elastic member in the first direction in the third state is shorter than a natural length of the elastic member.

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38. The developing cartridge according to claim 29, further comprising:

a developing roller rotatable about an axis extending in a third direction which is different from the first direction, and positioned at one side of the casing in the second direction.

39. The developing cartridge according to claim 29,

wherein the first surface extends from a third position to a fourth position toward the chip mount, and

wherein the third position is farther from the chip mount in the first direction than the fourth position.

40. The developing cartridge according to claim 39, wherein a distance between the third position and the fourth position in the first direction is greater than a distance between the chip mount and the fourth position in the first direction.

41. The developing cartridge according to claim 40,

wherein the second surface extends from a fifth position to a sixth position toward the chip mount, and

wherein the fifth position is farther from the chip mount in the first direction than the sixth position.

42. The developing cartridge according to claim 41, wherein a distance between the fifth position and sixth position in the first direction is greater than a distance between the chip mount and sixth position in the first direction.

43. The developing cartridge according to claim 29, wherein the first surface is a first guide surface, which is contactable with a portion of an image forming apparatus when the developing cartridge is attached to the image forming apparatus.

44. The developing cartridge according to claim 29, wherein the outer surface includes a second surface inclined relative to the chip mount, and being positioned at another side of the chip mount in the second direction.

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45. The developing cartridge according to claim 44, further comprising:

a developing roller rotatable about an axis extending in a third direction which is different from the first direction, and being positioned at one side of the casing in the second direction.

46. The developing cartridge according to claim 44, wherein the second surface is a second guide surface, which is contactable with a portion of an image forming apparatus when the developing cartridge is attached to the image forming apparatus.

47. The developing cartridge according to claim 44, wherein the second surface is inclined at an acute angle relative to the chip mount.

48. The developing cartridge according to claim 29,

wherein the outer surface includes third surfaces positioned on opposite sides of the chip mount in a third direction different from the first direction; and

wherein the third surfaces are farther from the elastic member in the first direction than the chip mount.

49. The developing cartridge according to claim 48, wherein the third surfaces are third guide surfaces, each of the third guide surfaces being contactable with a portion of an image forming apparatus when the developing cartridge is attached to the image forming apparatus.

50. The developing cartridge according to claim 48, further comprising:

a developing roller rotatable about an axis extending in the third direction, the developing roller being positioned at one side of the casing in the second direction.

51. The developing cartridge according to claim 29, wherein the first direction is perpendicular to the chip mount.

52. The developing cartridge according to claim 29, further comprising:

a developing roller rotatable about an axis extending in a direction different from the first direction.

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53. The developing cartridge according to claim 29, wherein the holder is positioned at a side of the casing.

54. The developing cartridge according to claim 29, wherein the elastic member is a spring.

55. The developing cartridge according to claim 54, wherein the spring is a coil spring.

56. The developing cartridge according to claim 29, wherein the first surface is inclined at an acute angle relative to the chip mount.

57. A developing cartridge comprising:

a casing configured to accommodate developer therein, the casing including a developing roller mounted therein and extending along an axis, the casing having first and second ends at opposing ends of the casing along the axis, the first end including a first outer surface and the second end including a second outer surface, the first and second outer surfaces being perpendicular to the axis; and

a cover removably attached to the casing at the first end of the casing;

wherein, when the cover is affixed to the casing, the cover and casing cooperatively forming a cavity for receiving a holder including an IC chip mount,

wherein the first outer surface includes one or more recesses sized to receive a first boss of the holder extending in a direction parallel to the axis; and

wherein the cover including a through-hole extending through a portion of the cover in a direction parallel to the axis and sized to receive a second boss of the holder extending in a direction parallel to the axis, the portion of the cover being spaced apart from the first outer surface in the direction parallel to the axis to form the cavity between the portion of the cover and the first outer surface;

wherein the cavity has an opening oriented in a first direction that is perpendicular to the axis, the opening being sized to allow at least a portion of the holder to extend therethrough, thereby allowing the IC chip mount and an inclined surface of the holder positioned at a side of the IC chip mount to be movable in the first direction between a first position and a second position relative to the casing, the first position comprising an extended position exposing the IC chip mount and inclined surface through the opening.

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58. The developing cartridge of claim 57, wherein the through hole is sized to accommodate movement of the holder.

59. The developing cartridge of claim 57, further comprising:

the holder, wherein the holder is positioned between the outer surface of the first end and the portion of the cover in the direction parallel to the axis, the holder being positioned within the cavity and having a portion extending through the opening.

60. The developing cartridge of claim 59, wherein the IC chip mount and the inclined surface of the holder are included in an outer surface of the holder.

61. The developing cartridge of claim 59, wherein the first position comprises an extended position and the second position comprises a retracted position of the holder in which more of the holder is positioned within the cavity relative to the extended position.

62. The developing cartridge of claim 59, wherein at least a portion of the holder is movable within the cavity with the IC chip mount.

63. The developing cartridge of claim 59, further comprising an IC chip received in the IC chip mount.

64. The developing cartridge of claim 57, wherein the cover is attached to the casing using at least one screw.

65. The developing cartridge of claim 64, wherein the casing includes a screw hole positioned in the first end of the casing.

66. The developing cartridge of claim 57, wherein, when the cover is affixed to the casing, at least a portion of the cover is retained by the casing.

67. The developing cartridge of claim 57, wherein the inclined surface is positioned at a side of the IC chip mount in a second direction different from the first direction.

68. The developing cartridge of claim 57, wherein, when the developing cartridge is

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attached to an image forming apparatus, the opening is positioned to align the holder with an electrical connector of the image forming apparatus.

69. The developing cartridge of claim 67, wherein the through-hole is formed through the cover in a direction parallel with the axis.

70. The developing cartridge of claim 57, wherein the portion of the cover is disposed further outward from the casing in the direction parallel to the axis relative to the first outer surface.

71. A developing cartridge comprising:

a casing configured to accommodate developer therein, the casing including a developing roller extending in an axial direction and having first and second ends spaced apart in the axial direction, the first end having a first outer surface and the second end having a second outer surface, the first and second outer surfaces being perpendicular to the axial direction, the first outer surface defining a first opening in the outer surface extending in a direction parallel to the axial direction;

a cover removably attached to the casing at the first end of the casing, the cover including a side end extending parallel to the first outer surface at the first end of the casing in a first direction and defining a second opening aligned with the first opening in the direction parallel to the axial direction,

wherein the cover and the casing cooperatively form a cavity having an opening oriented in the first direction that is perpendicular to the axial direction, and

wherein the side end of the cover is positioned further outward from the casing in the axial direction relative to the first outer surface to form the cavity.

72. The developing cartridge of claim 71, wherein the cover is attached to the casing using at least one screw.

73. The developing cartridge of claim 71, further comprising a holder positioned within the cavity and having a portion extending through the opening, the portion including an IC chip mount movable in the first direction between a first position and a second position relative to the casing.

74. The developing cartridge of claim 73, wherein the first position comprises an extended position and the second position comprises a retracted position of the IC chip mount in which more of the holder is positioned within the cavity relative to the extended position.

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FIG. 1

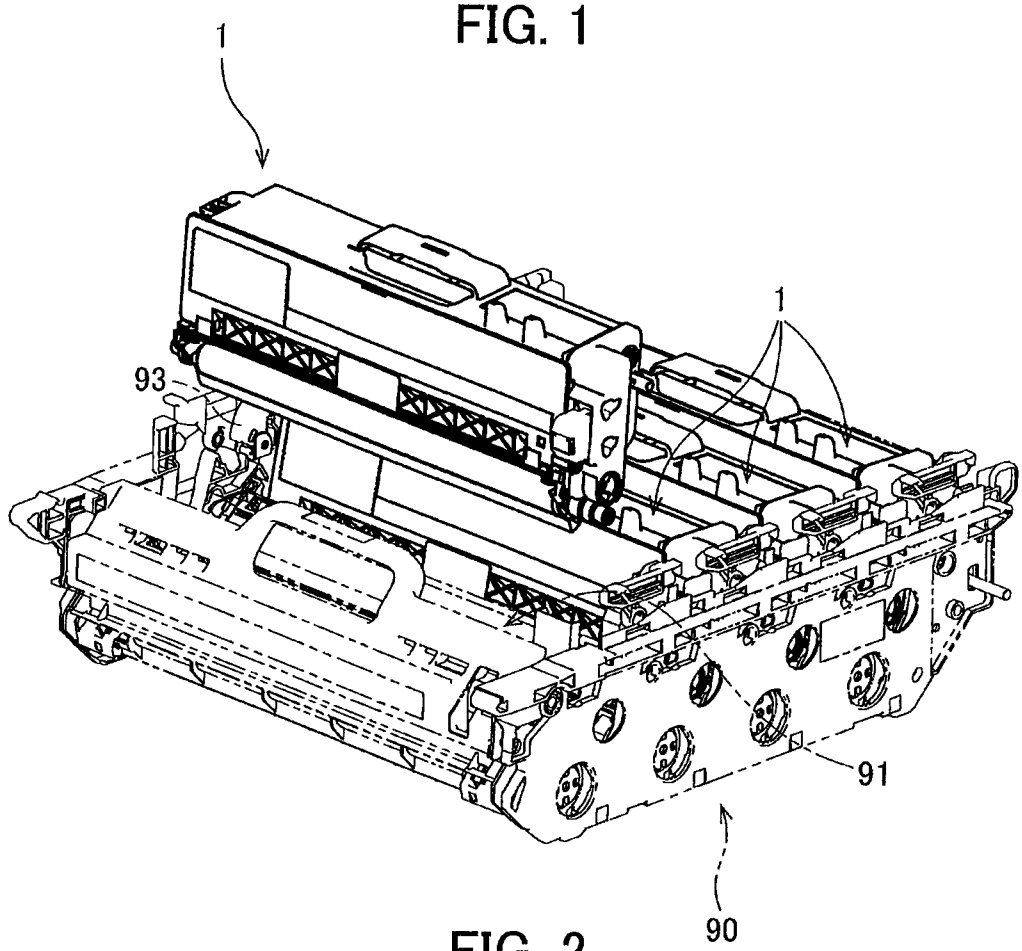

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FIG. 2

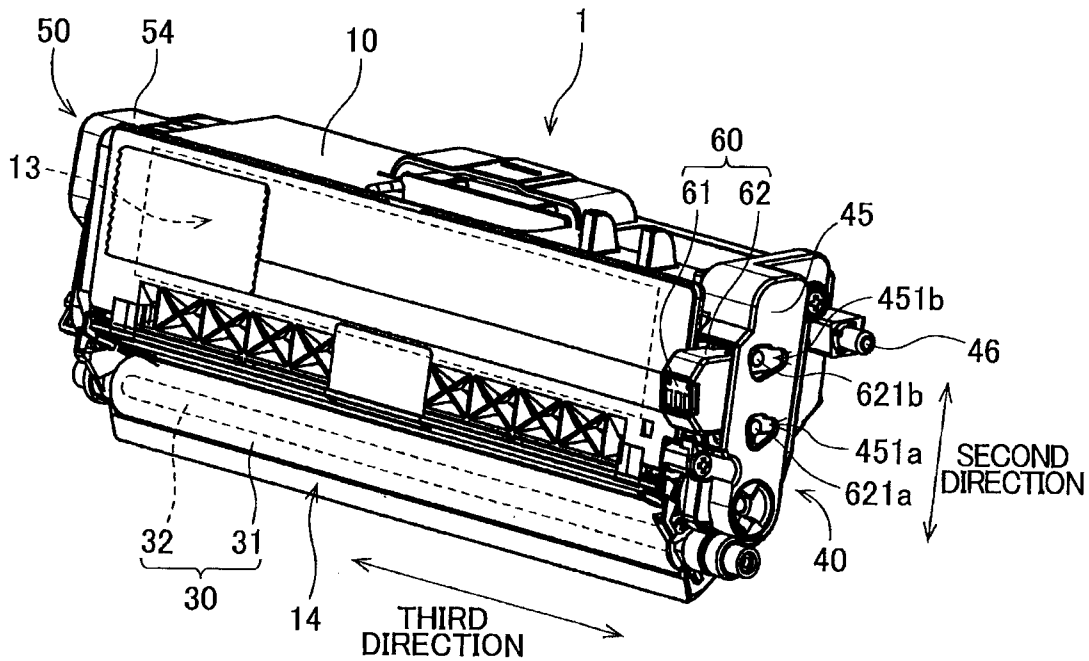

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THIRD DIRECTION

FIG. 3

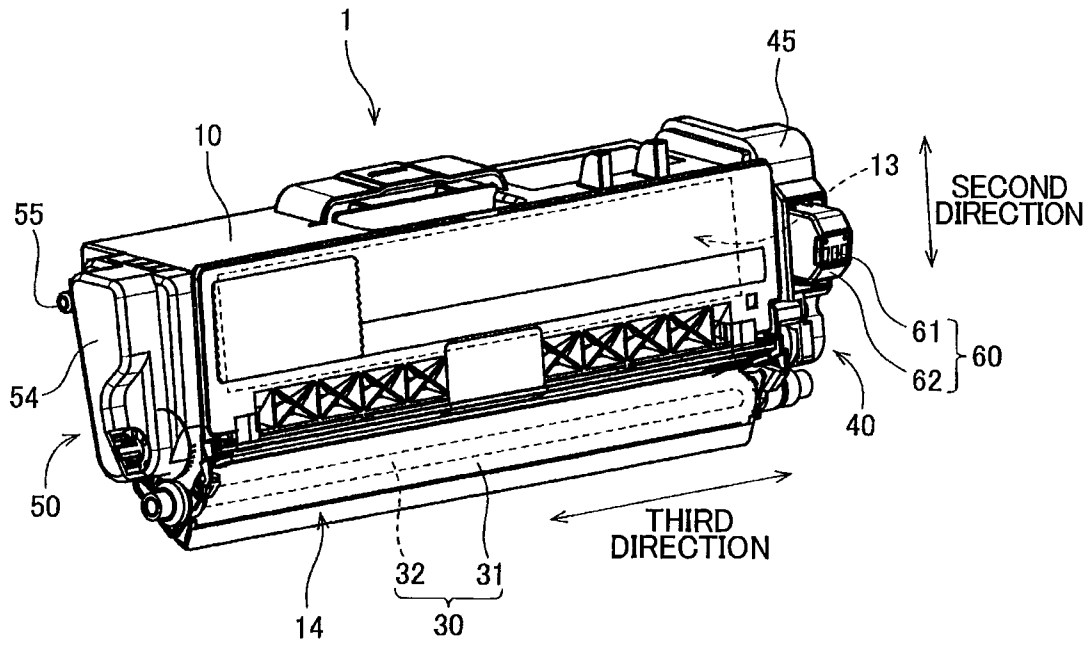

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FIG. 4

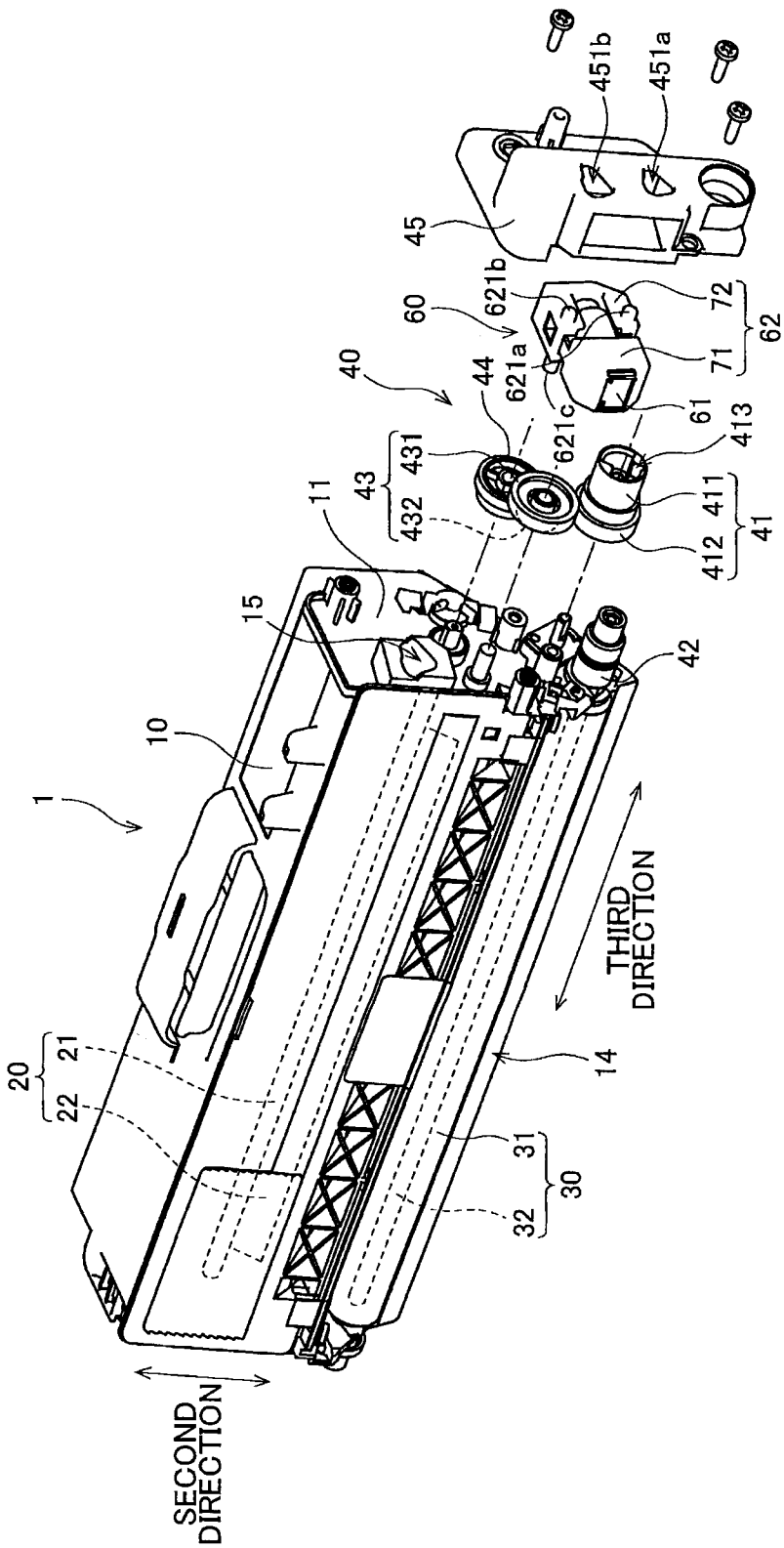

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SECOND DIRECTION

FIG. 5

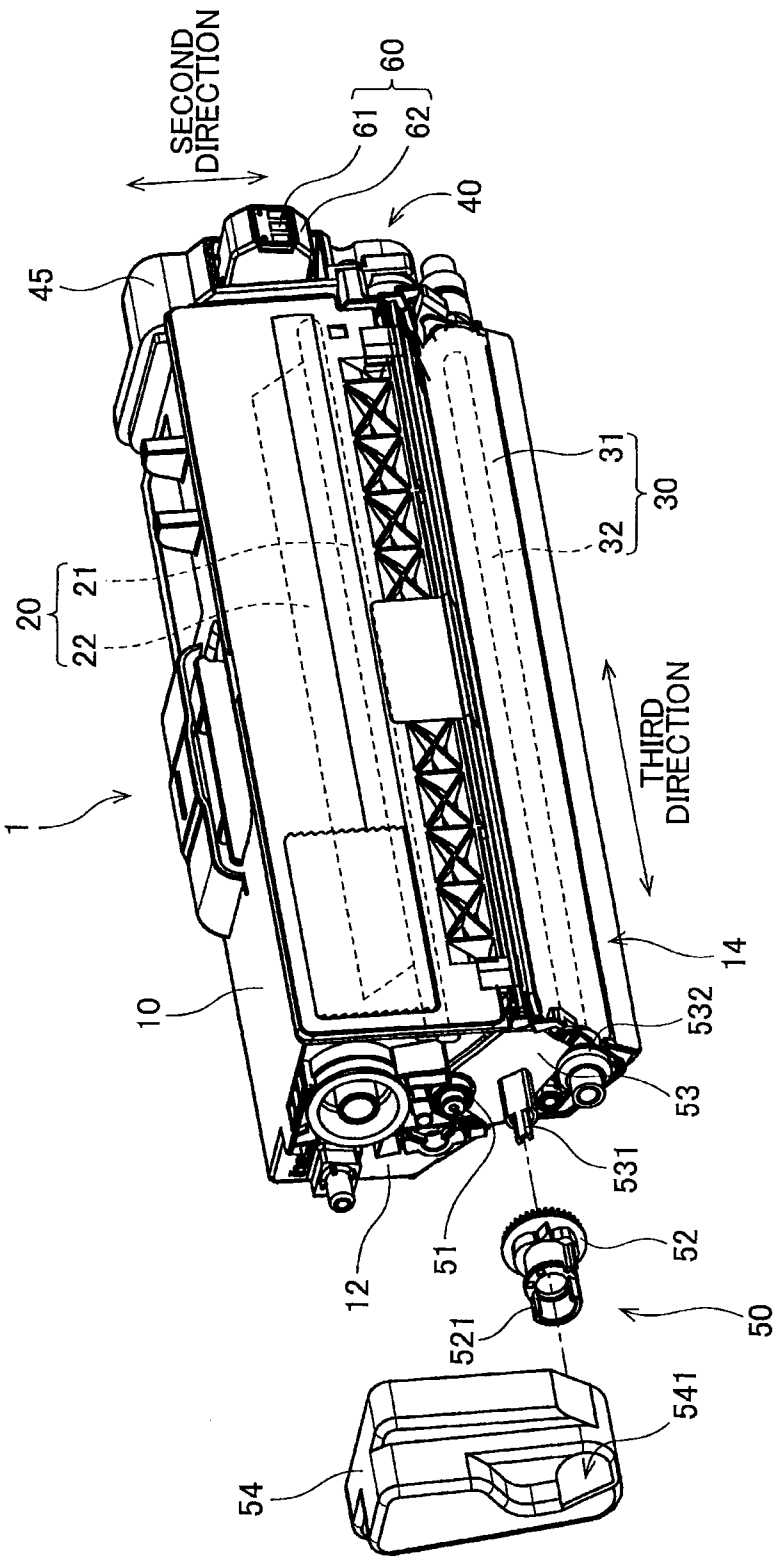

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FIG. 6

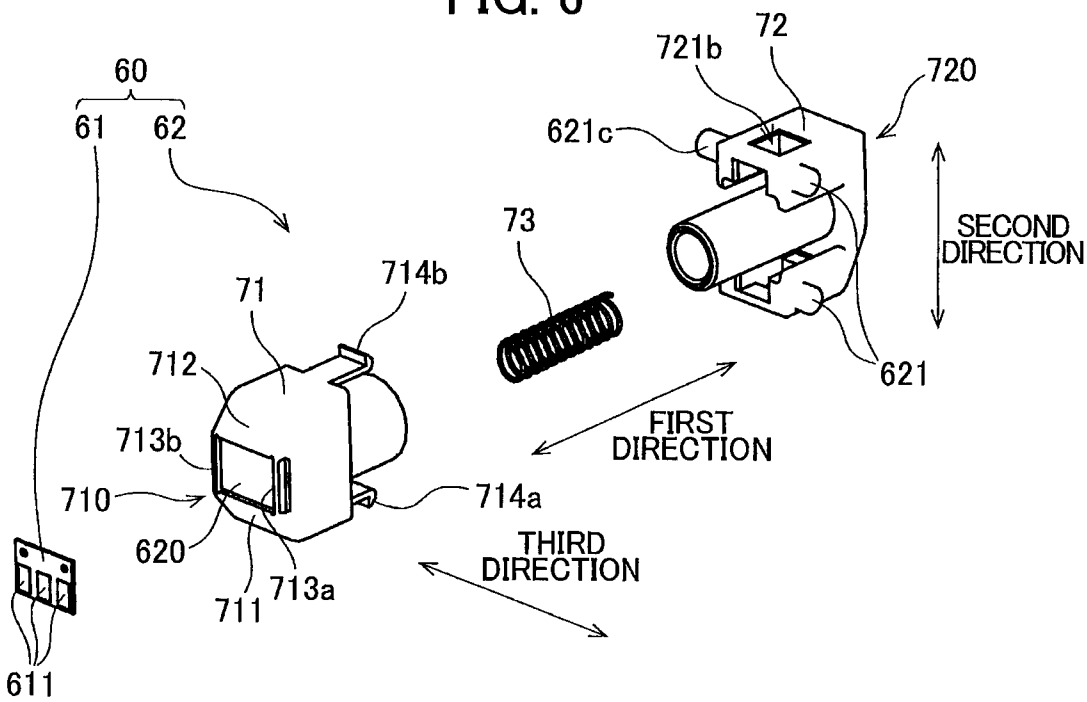

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FIRST DIRECTION
THIRD DIRECTION

FIG. 7

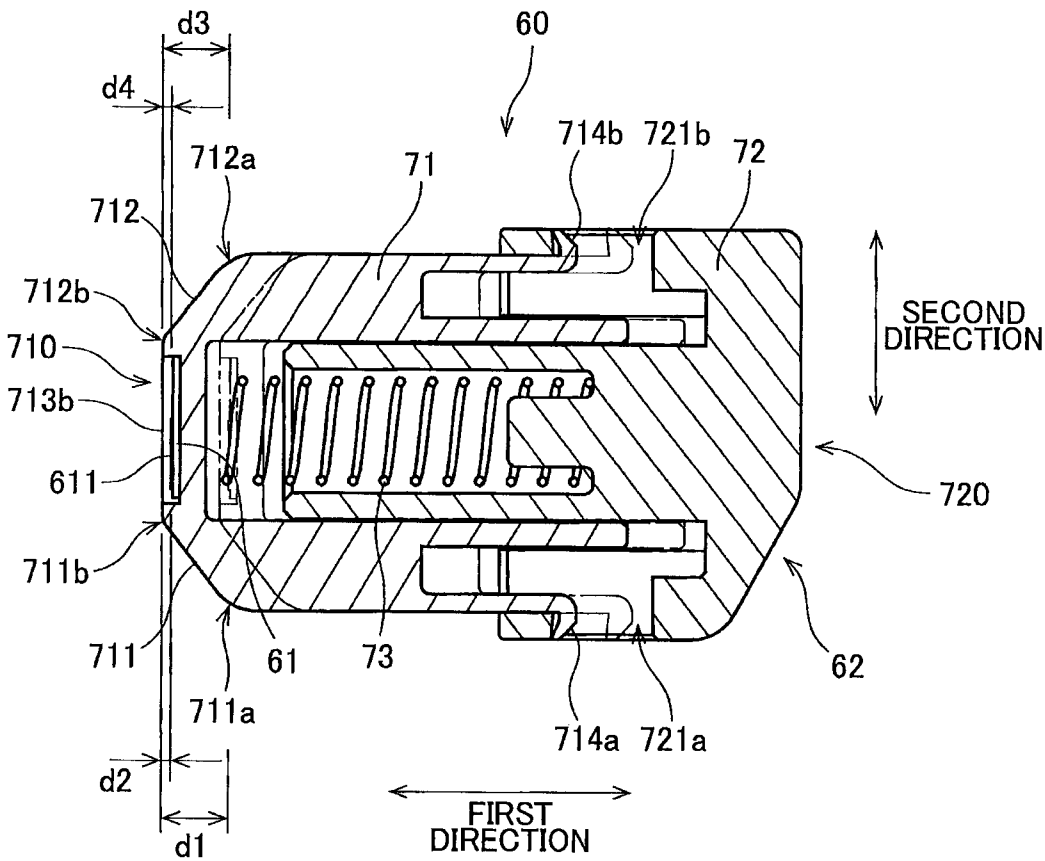

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SECOND DIRECTION
FIRST DIRECTION

FIG. 8

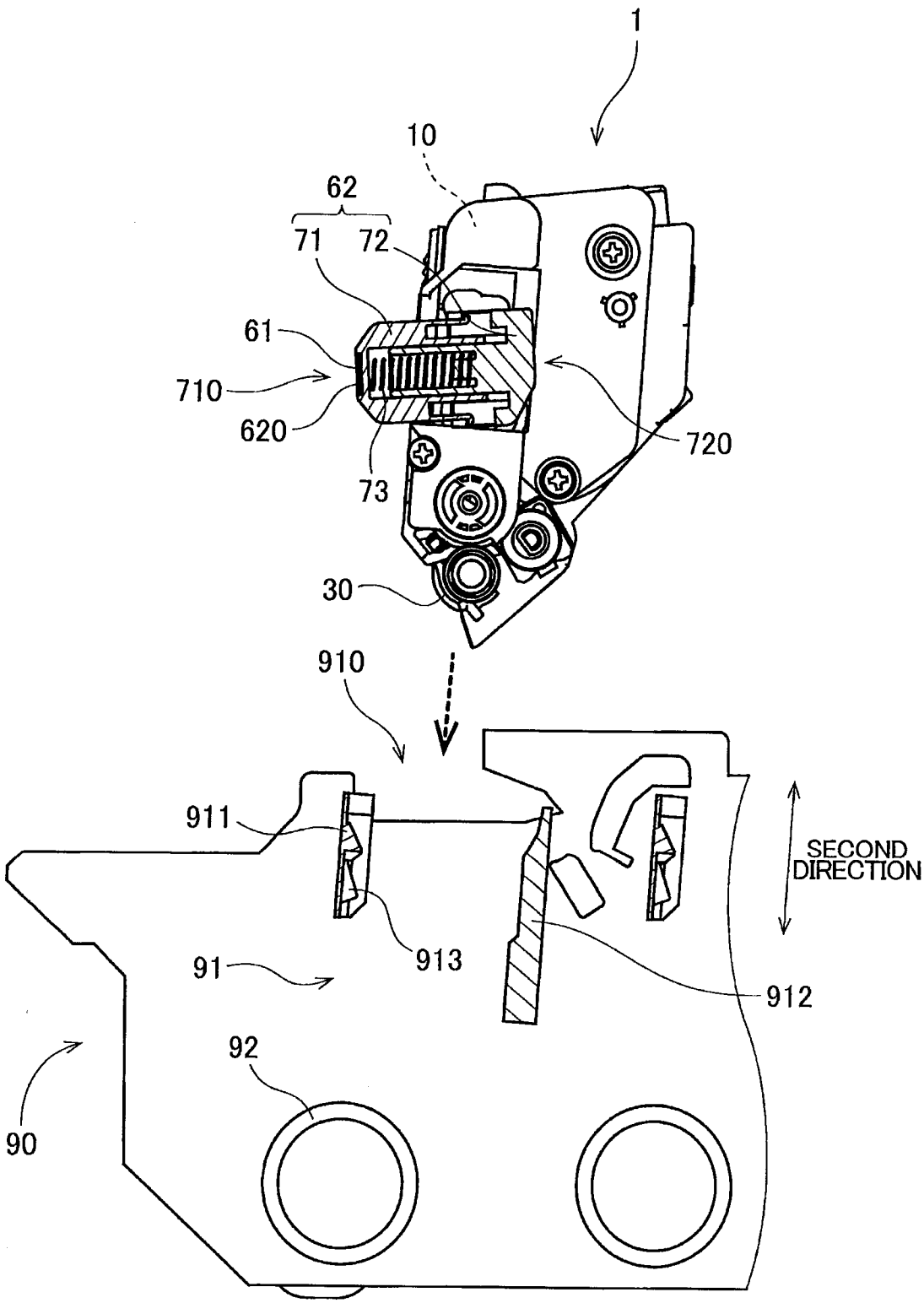

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SECOND DIRECTION

FIG. 9

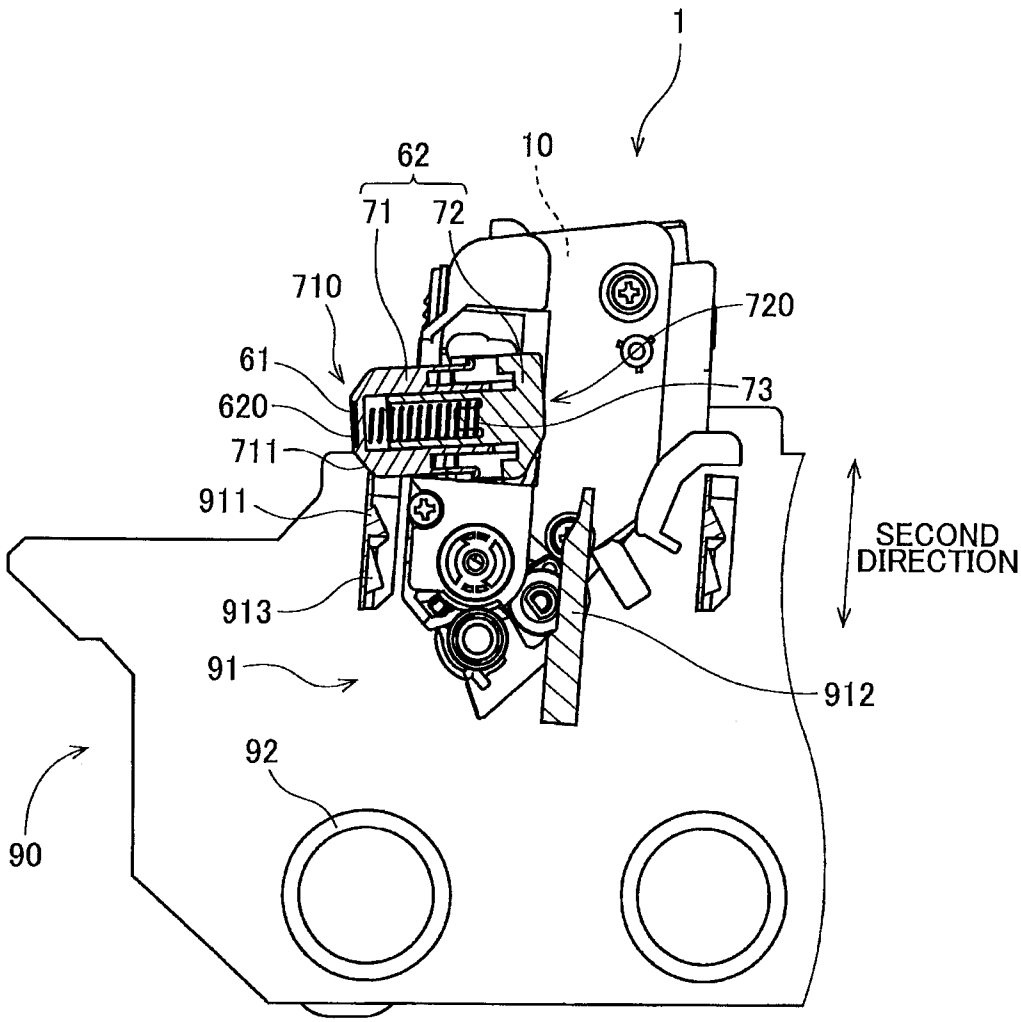

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FIG. 10

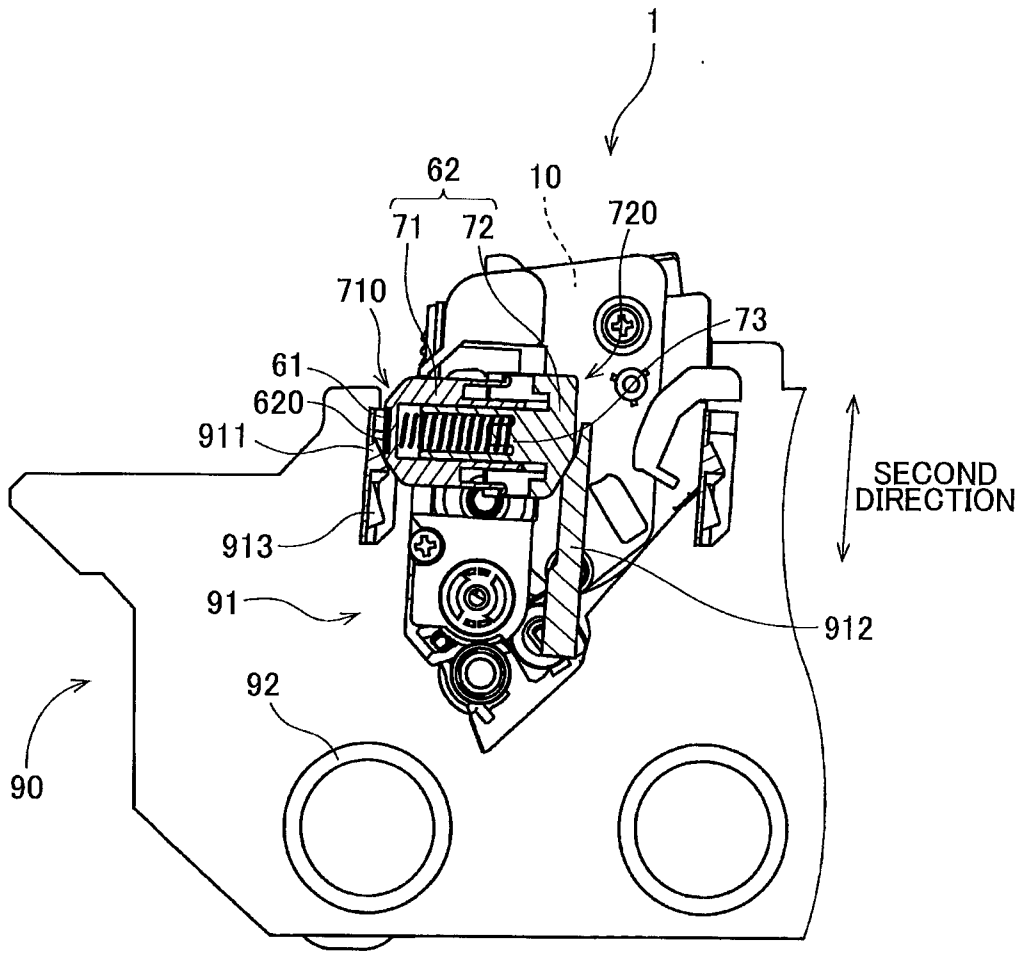

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FIG. 11

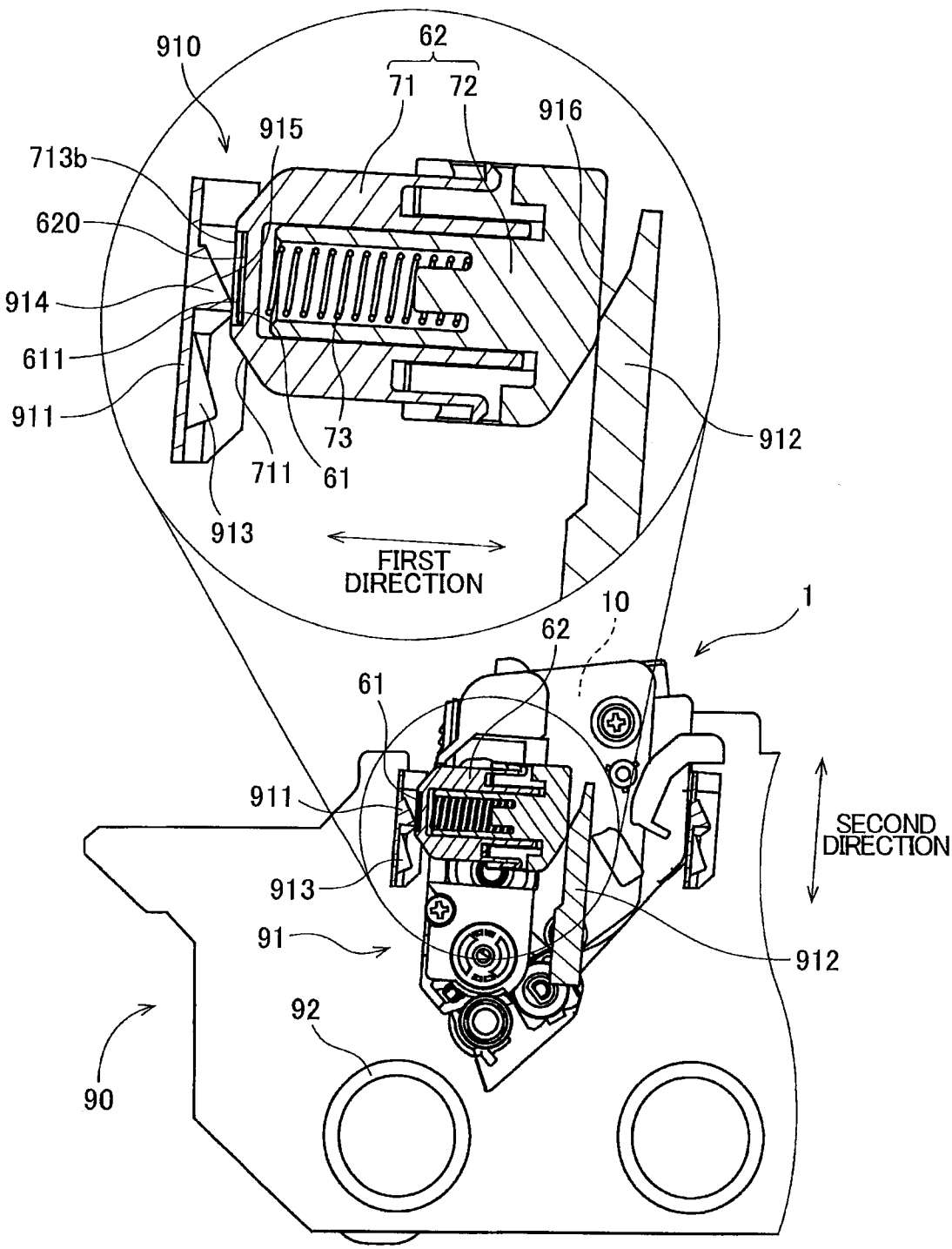

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FIG. 12

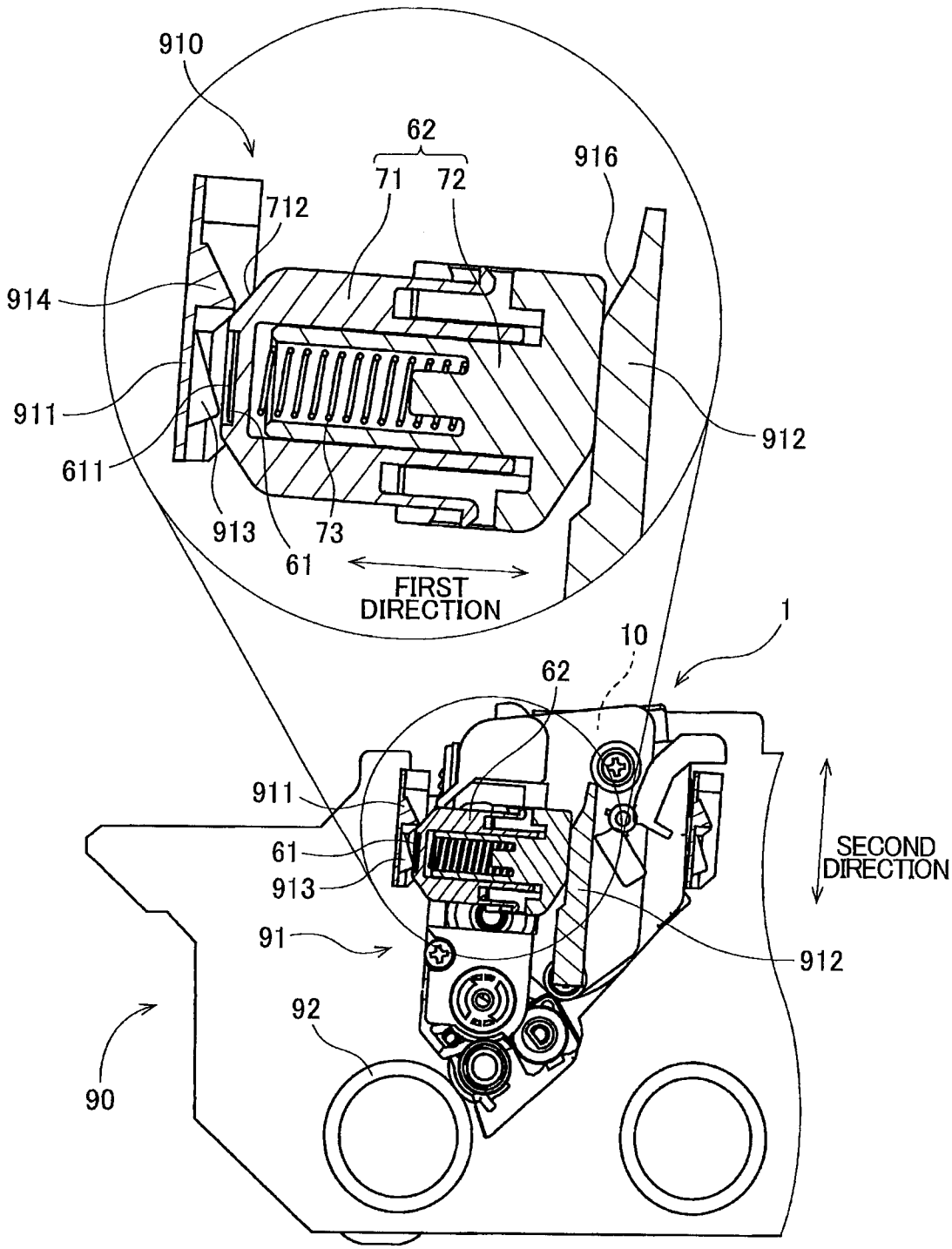

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FIG. 13

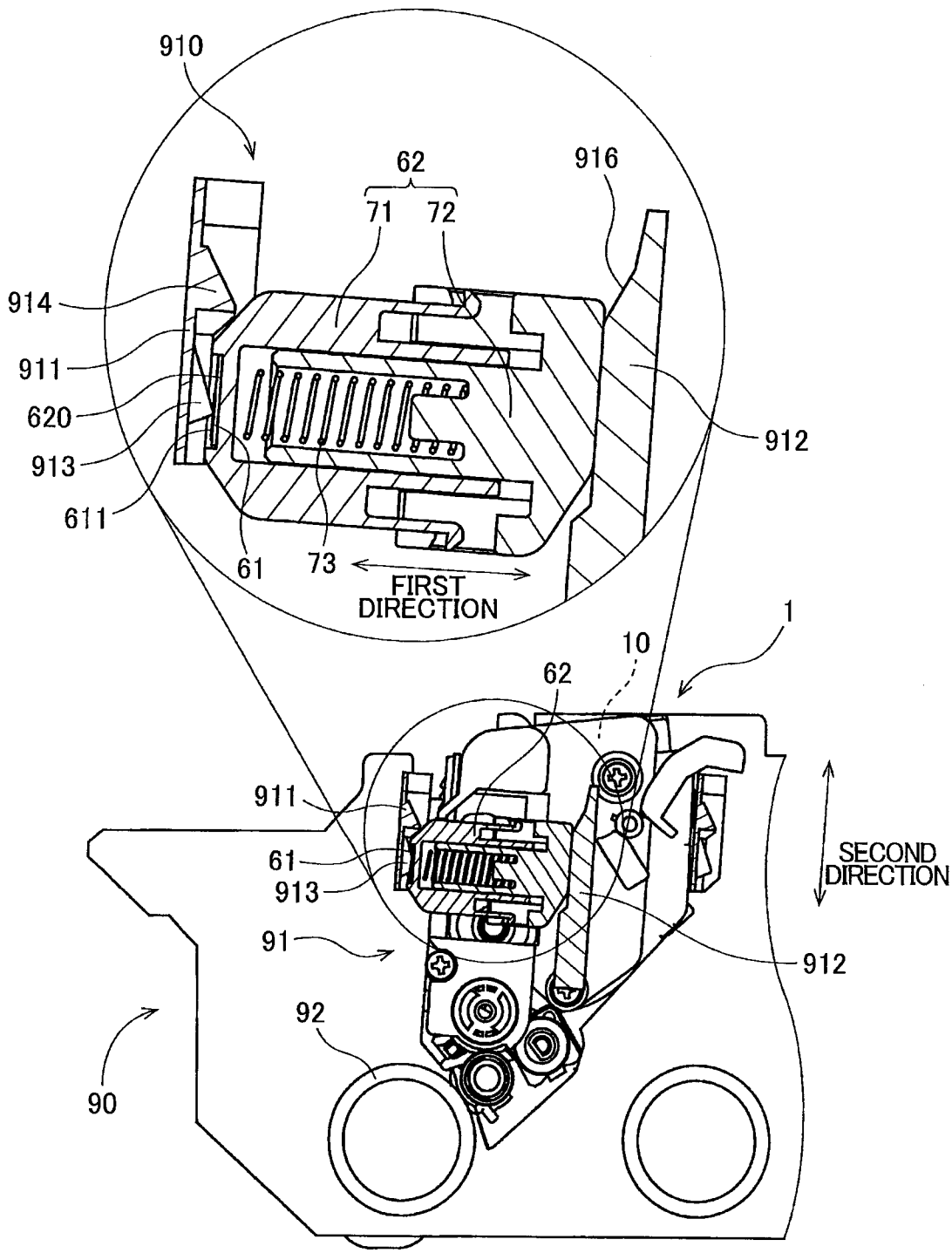

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FIG. 14

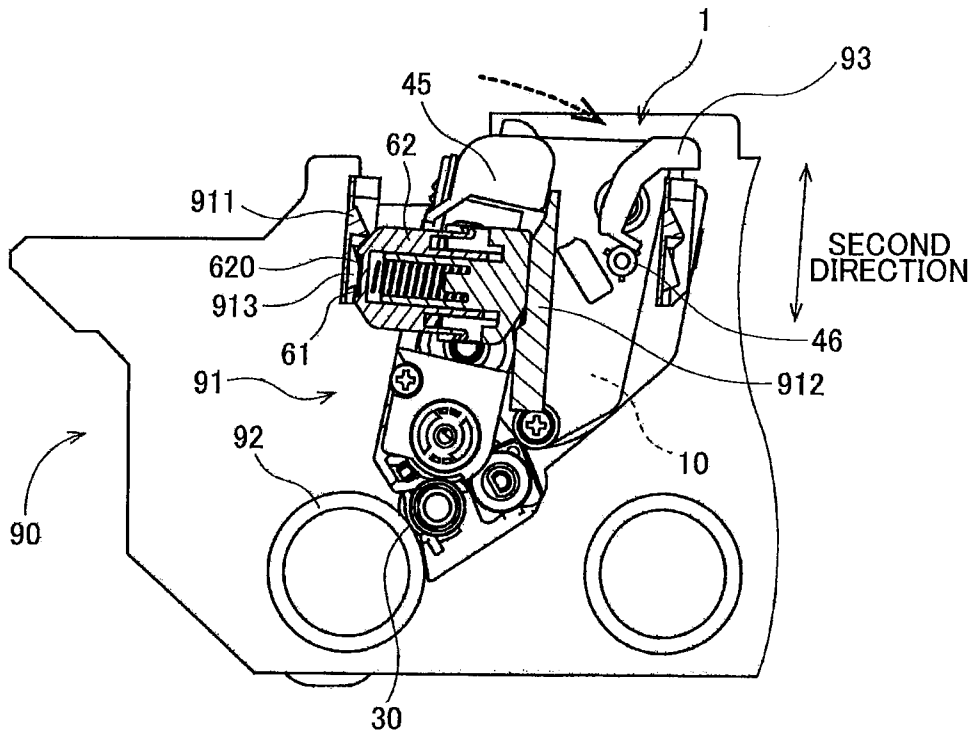

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FIG. 15

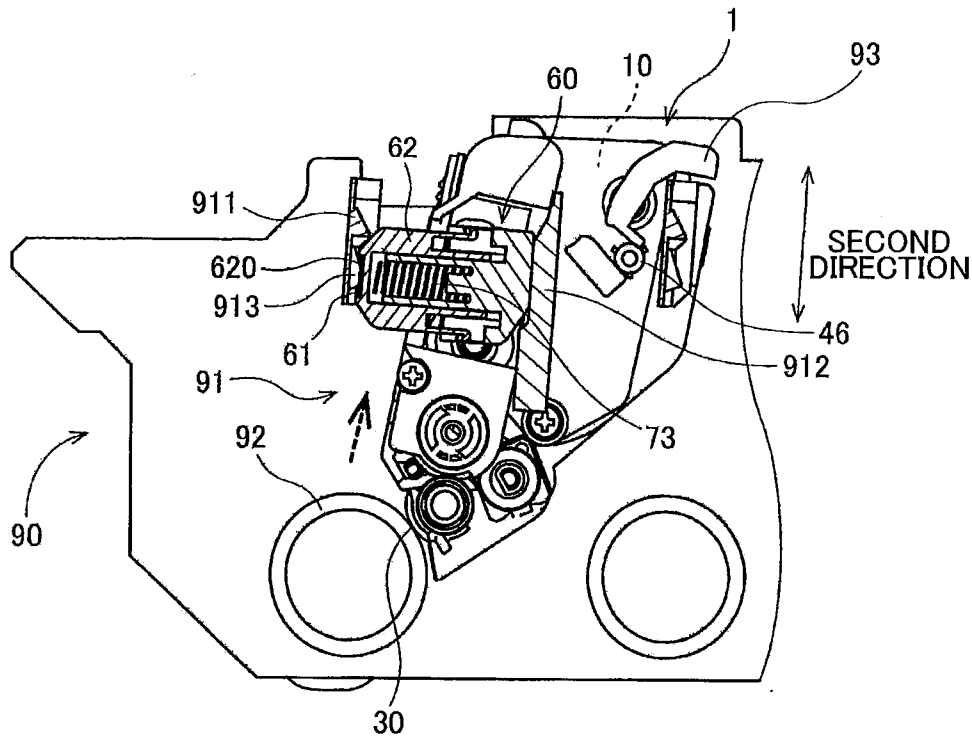

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FIG. 16

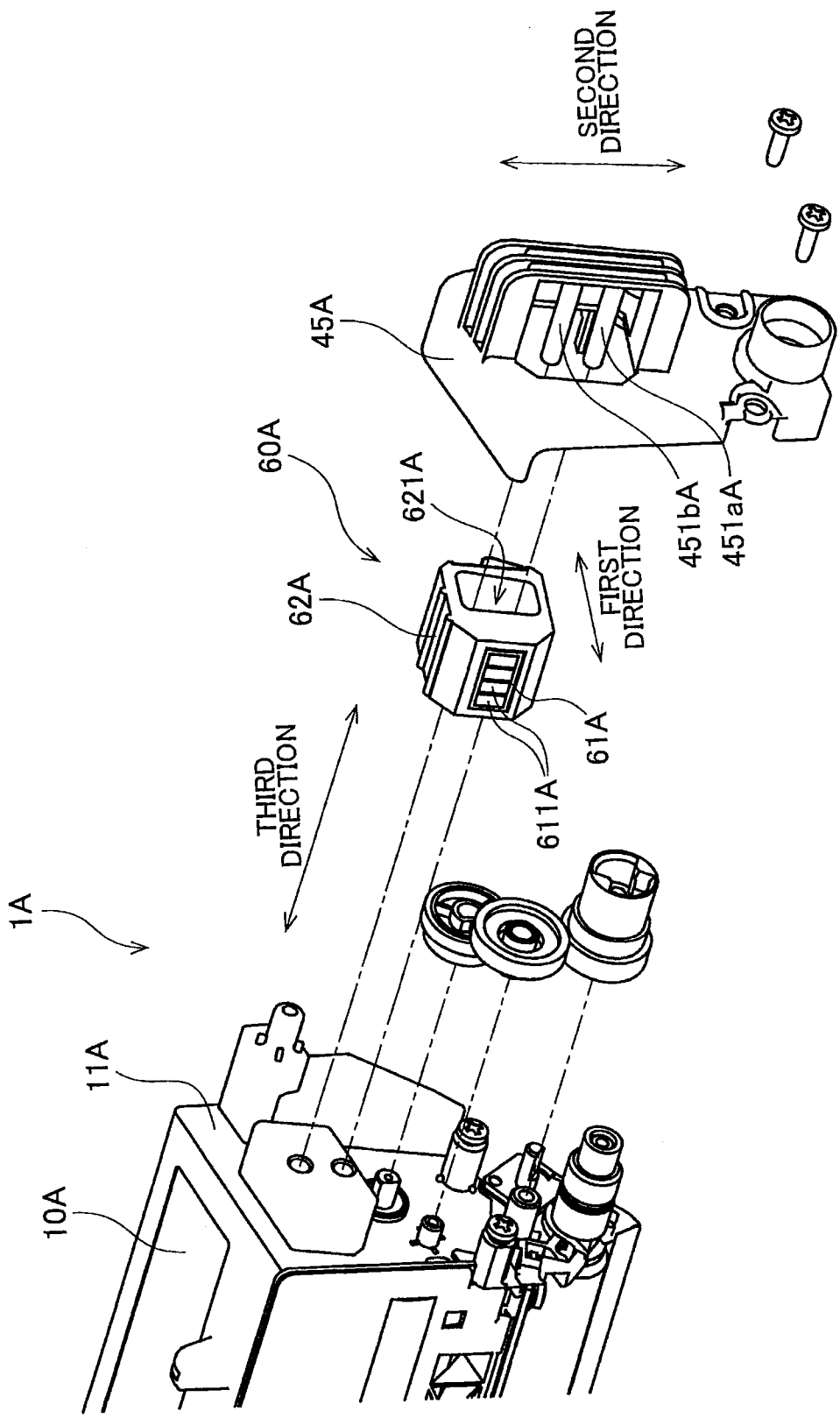

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THIRD DIRECTION
1A
11A
10A

FIG. 17

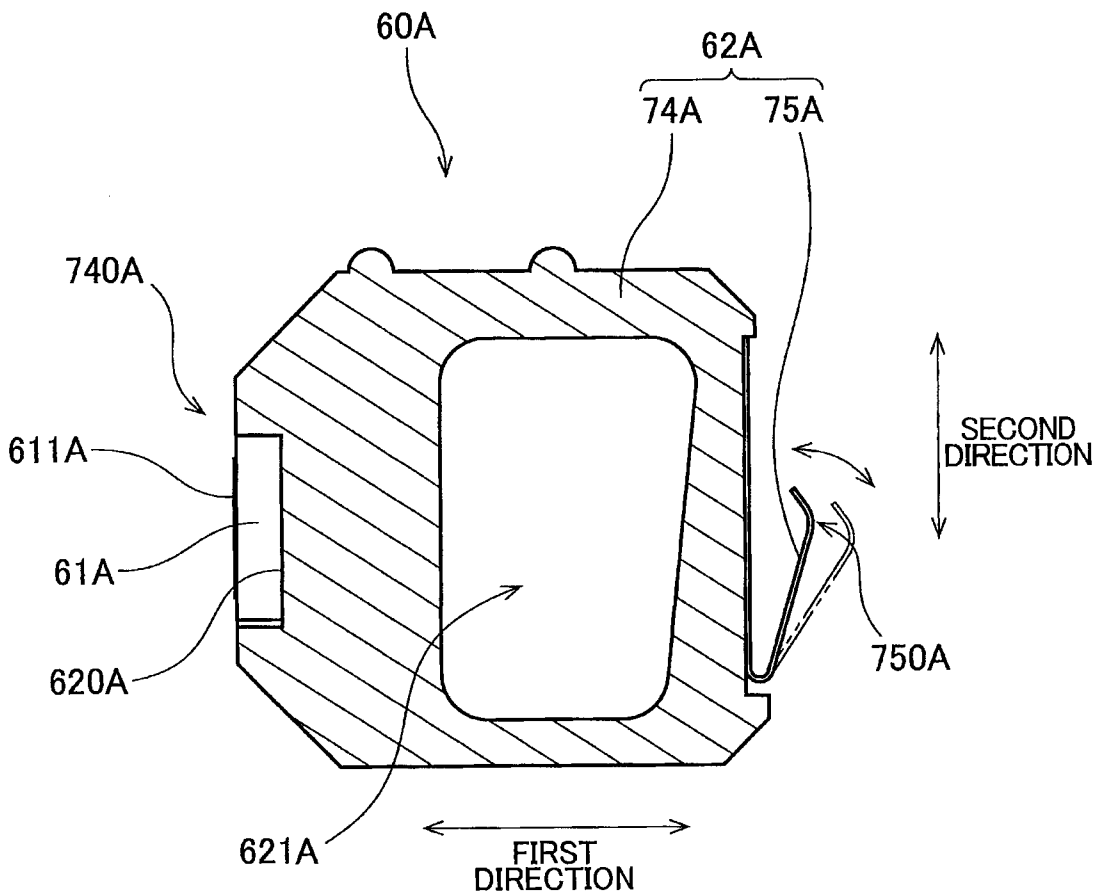

60A
62A
74A
75A
740A
611A
61A
620A
621A
750A
SECOND DIRECTION
FIRST DIRECTION

FIG. 18

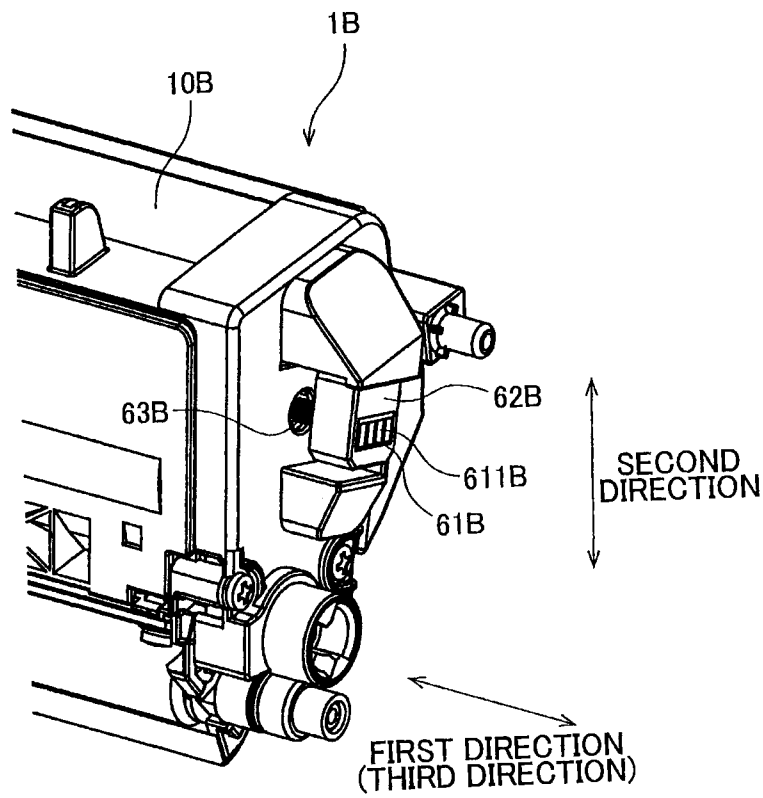

1B
10B
63B
62B
611B
61B
SECOND DIRECTION
FIRST DIRECTION (THIRD DIRECTION)

FIG. 19

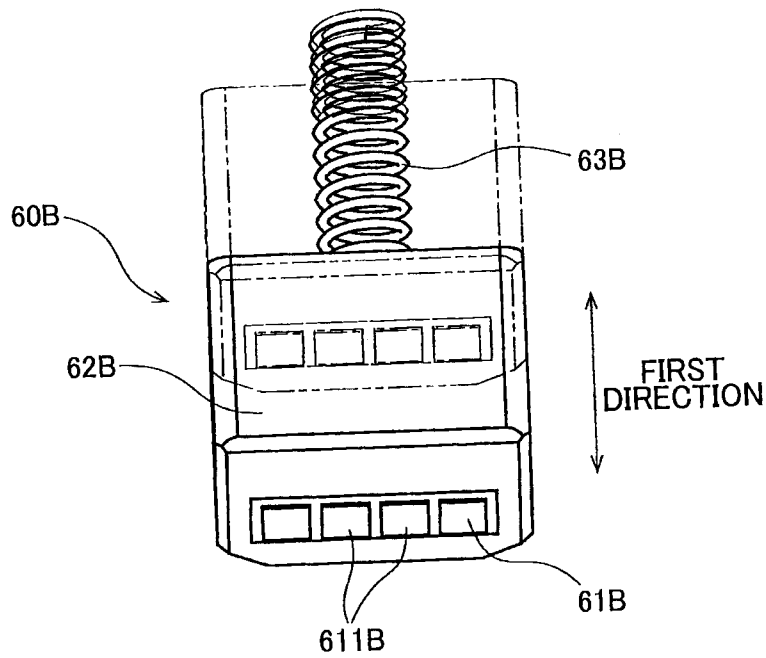

63B
60B
62B
FIRST DIRECTION
61B
611B

FIG. 20

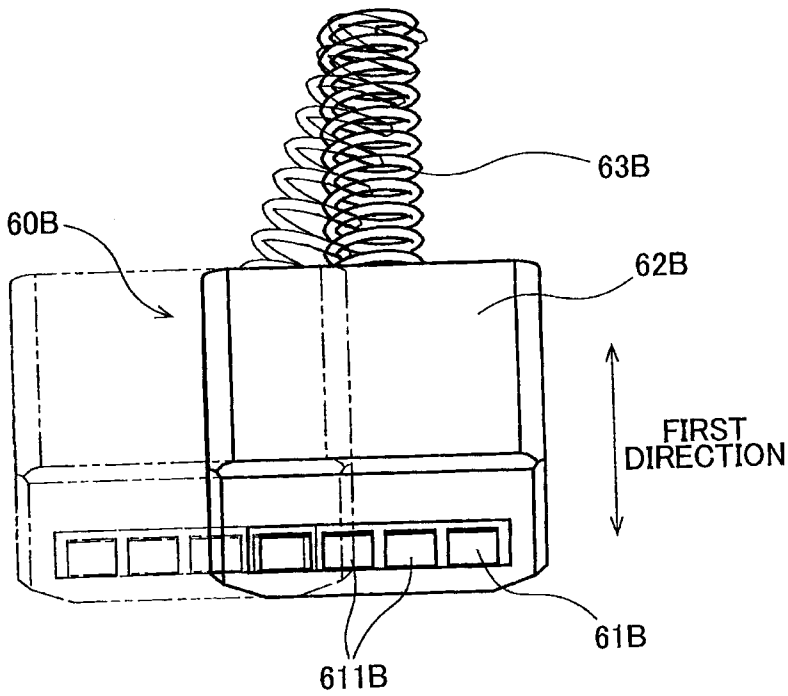

63B
60B
62B
FIRST
DIRECTION
61B
611B

FIG. 21

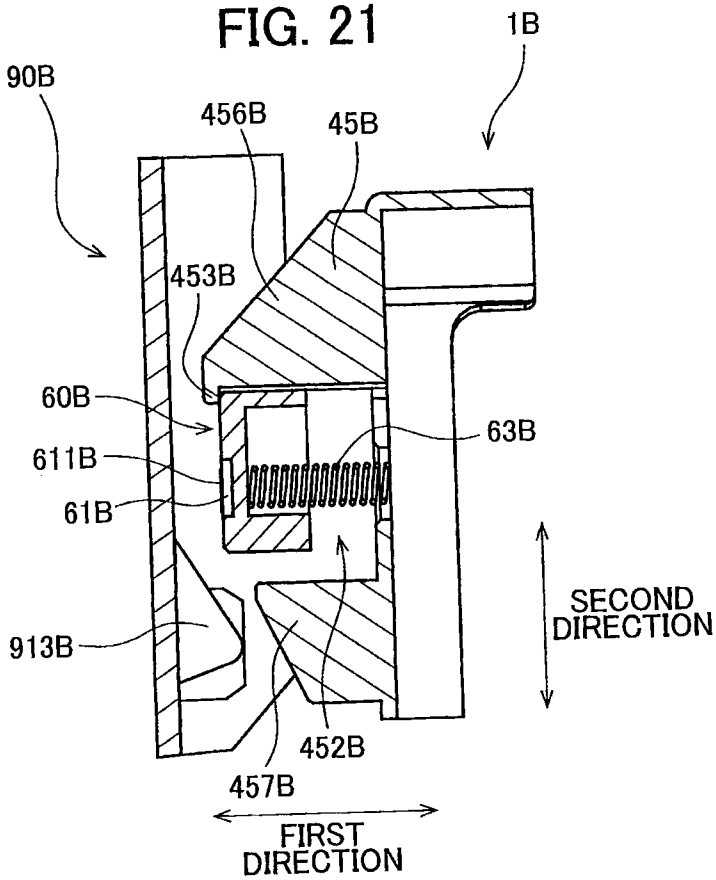

1B
90B
456B
45B
453B
60B
63B
611B
61B
913B
SECOND
DIRECTION
452B
457B
FIRST
DIRECTION

FIG. 22

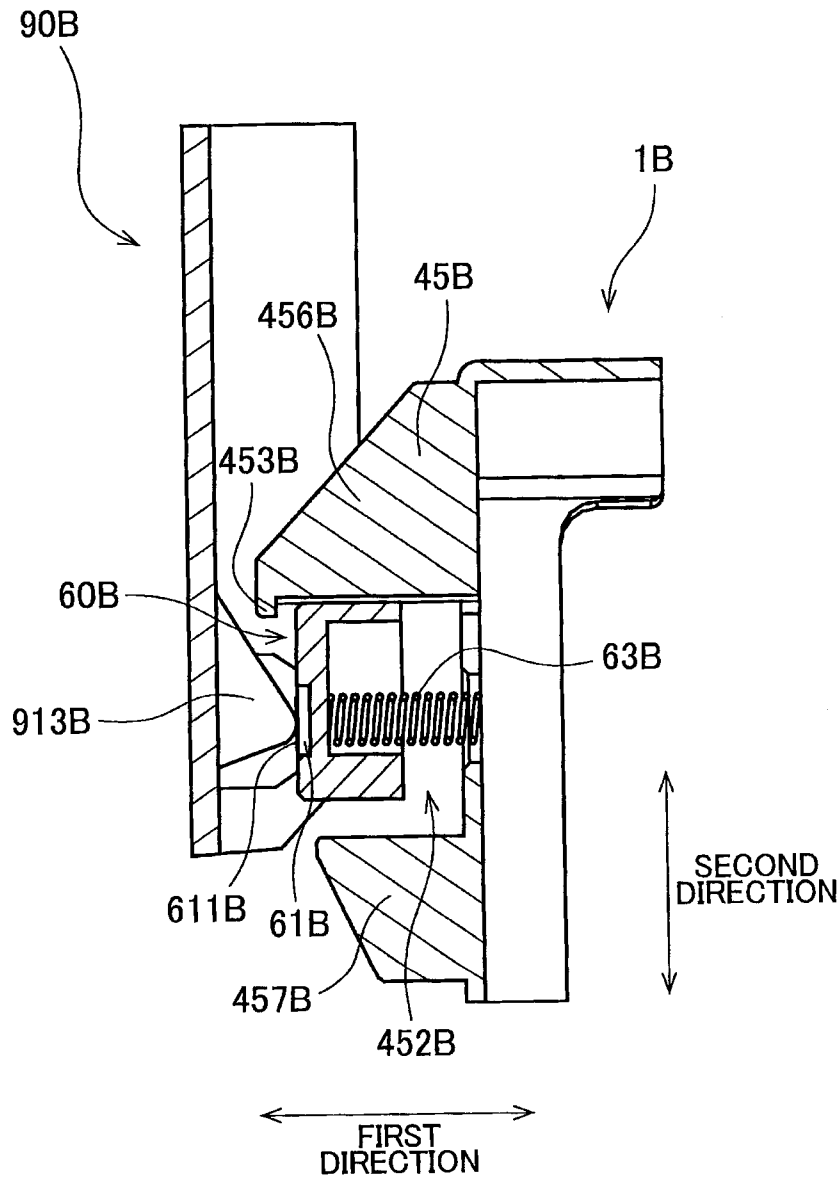

90B
1B
45B
456B
453B
60B
63B
913B
611B
61B
457B
452B
SECOND DIRECTION
FIRST DIRECTION

FIG. 23

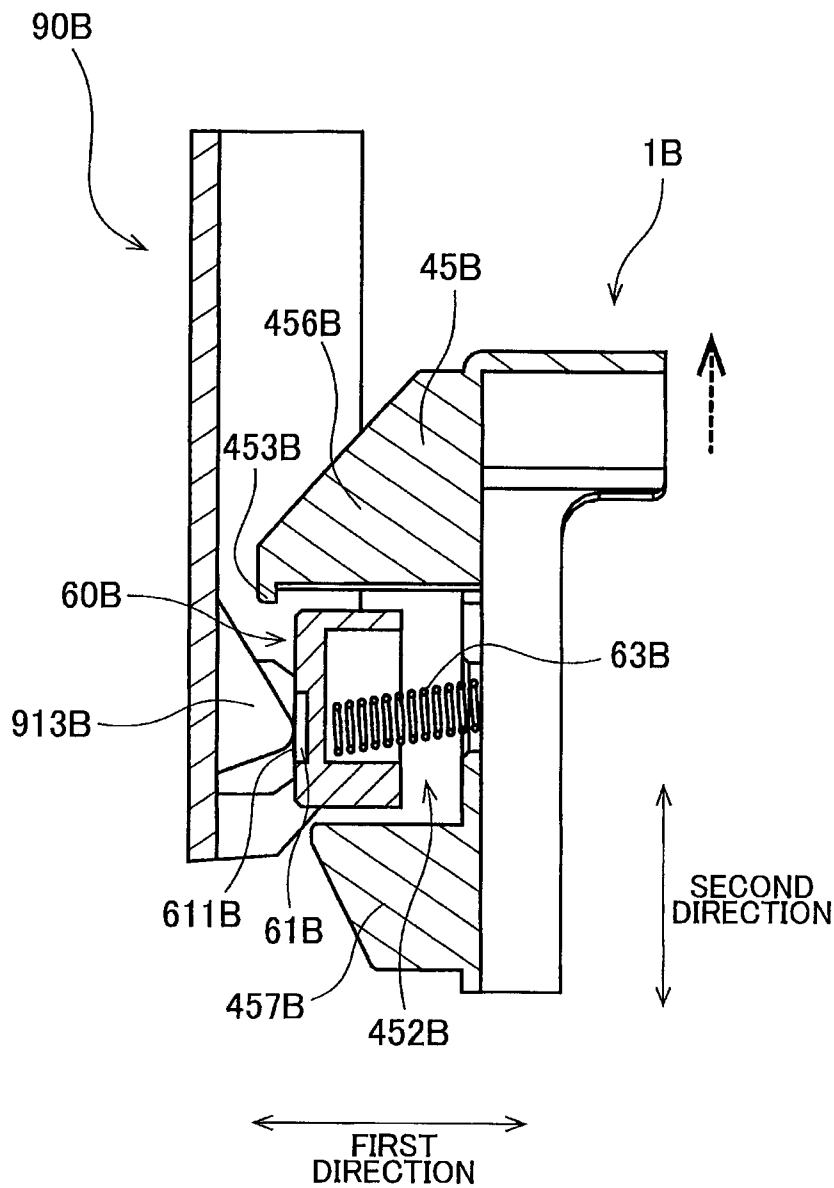

90B
1B
45B
456B
453B
60B
63B
913B
611B
61B
457B
452B
SECOND DIRECTION
FIRST DIRECTION

FIG. 24

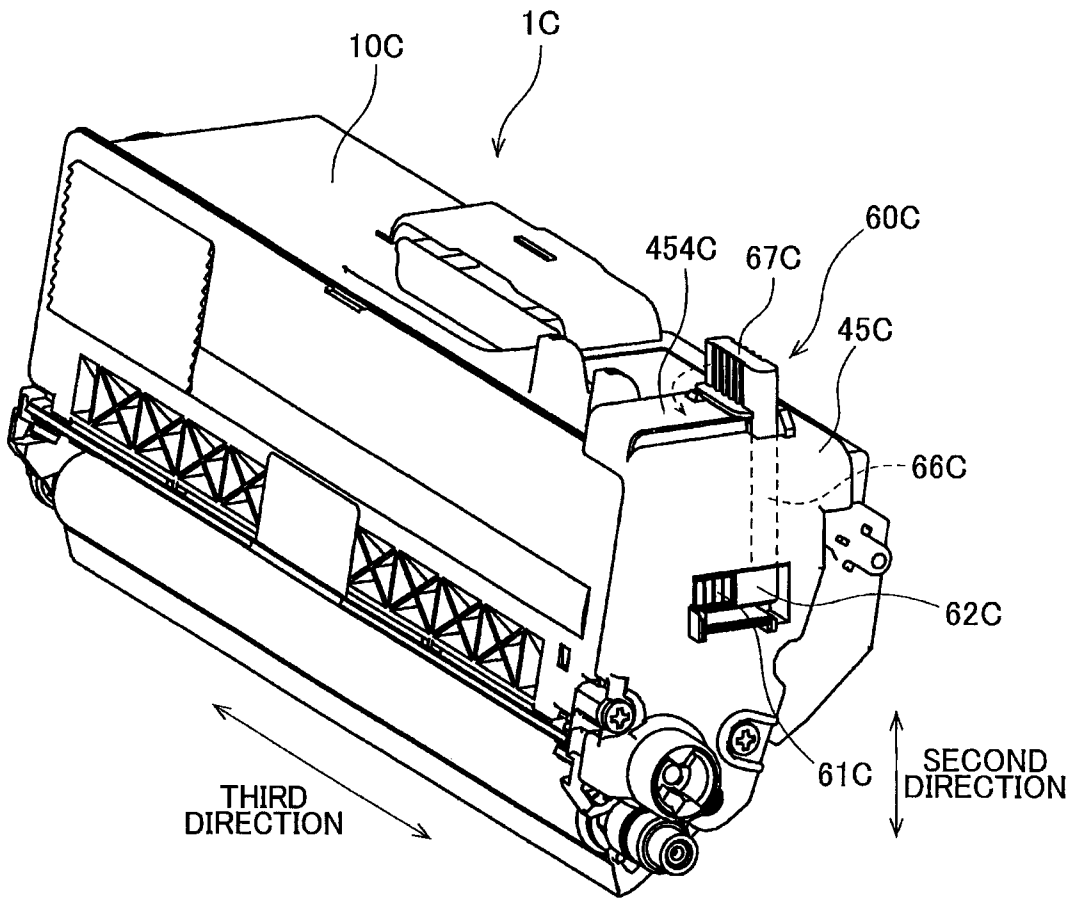

10C
1C
454C
67C
60C
45C
66C
62C
61C
SECOND DIRECTION
THIRD DIRECTION

FIG. 25

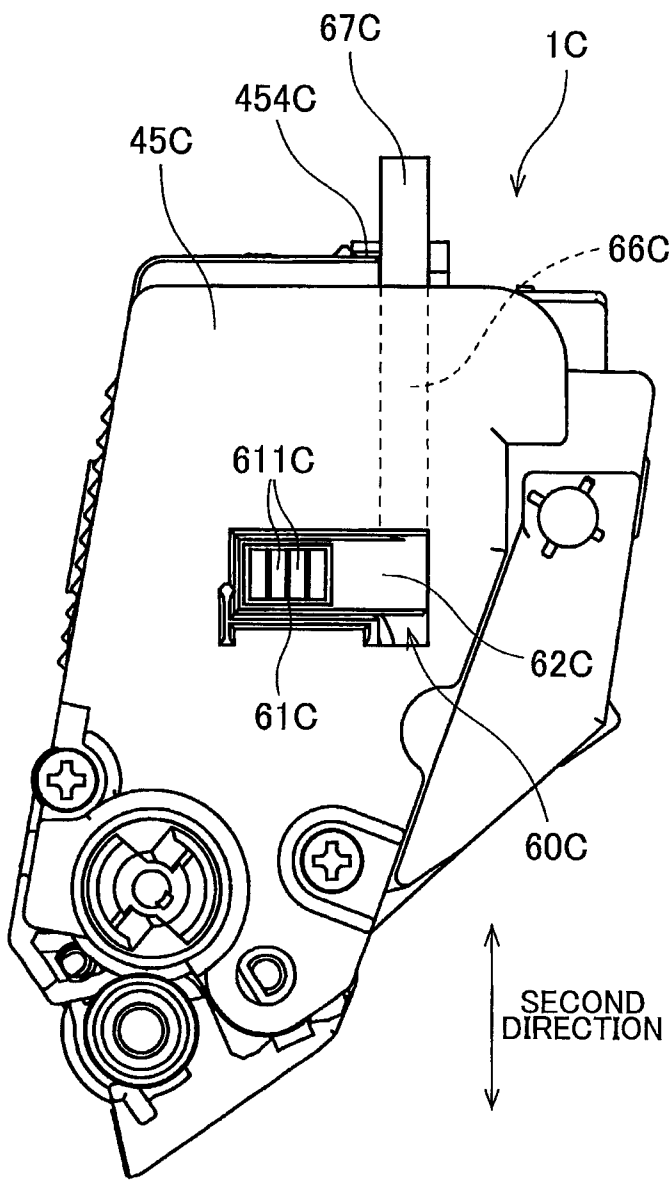


FIG. 26

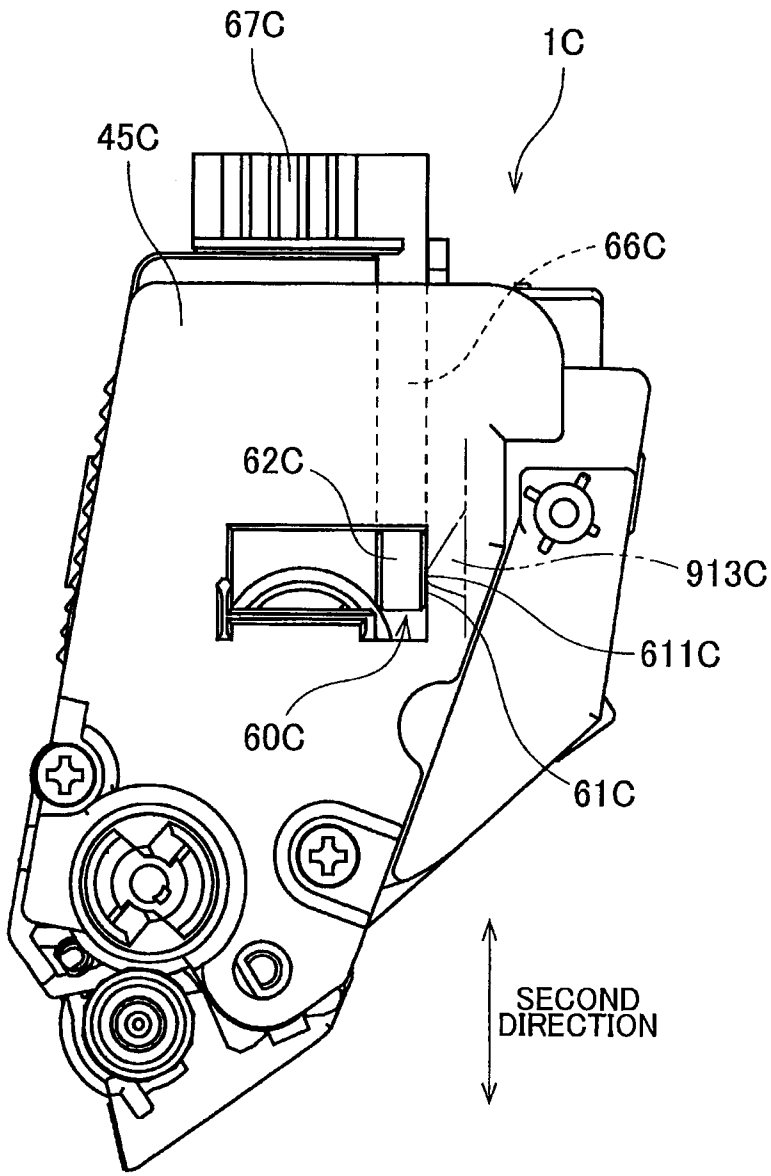


FIG. 27

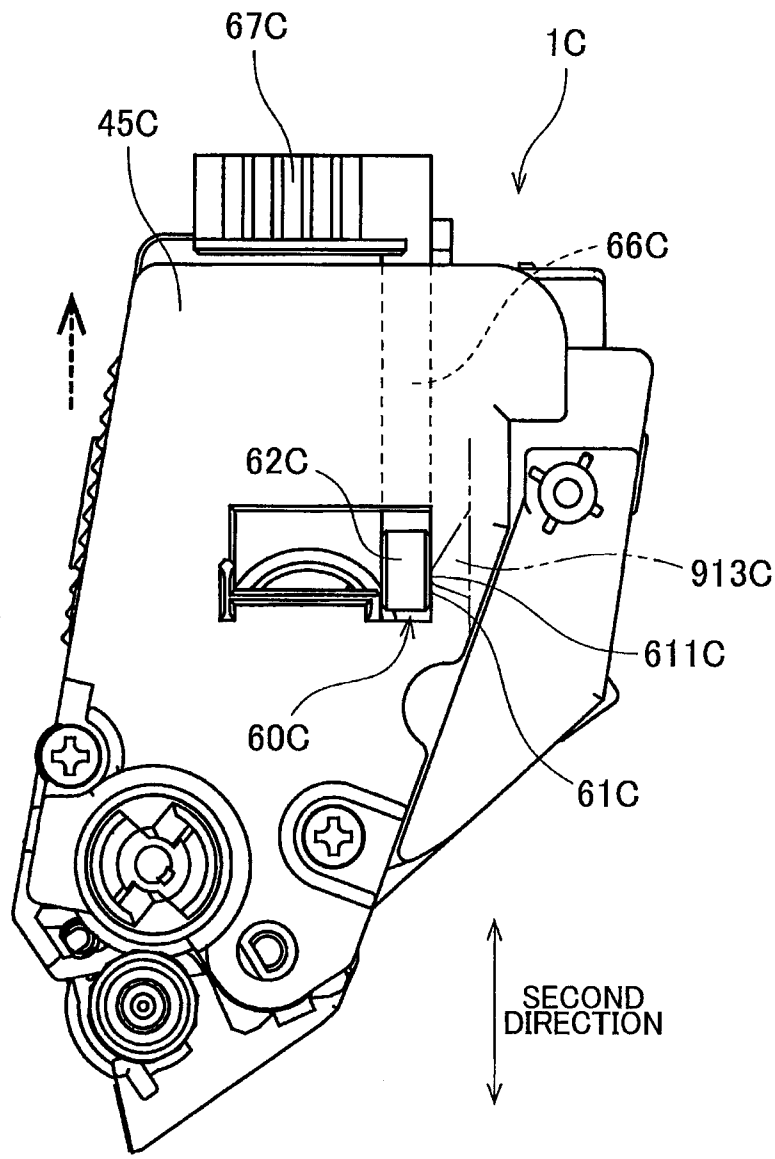


FIG. 28

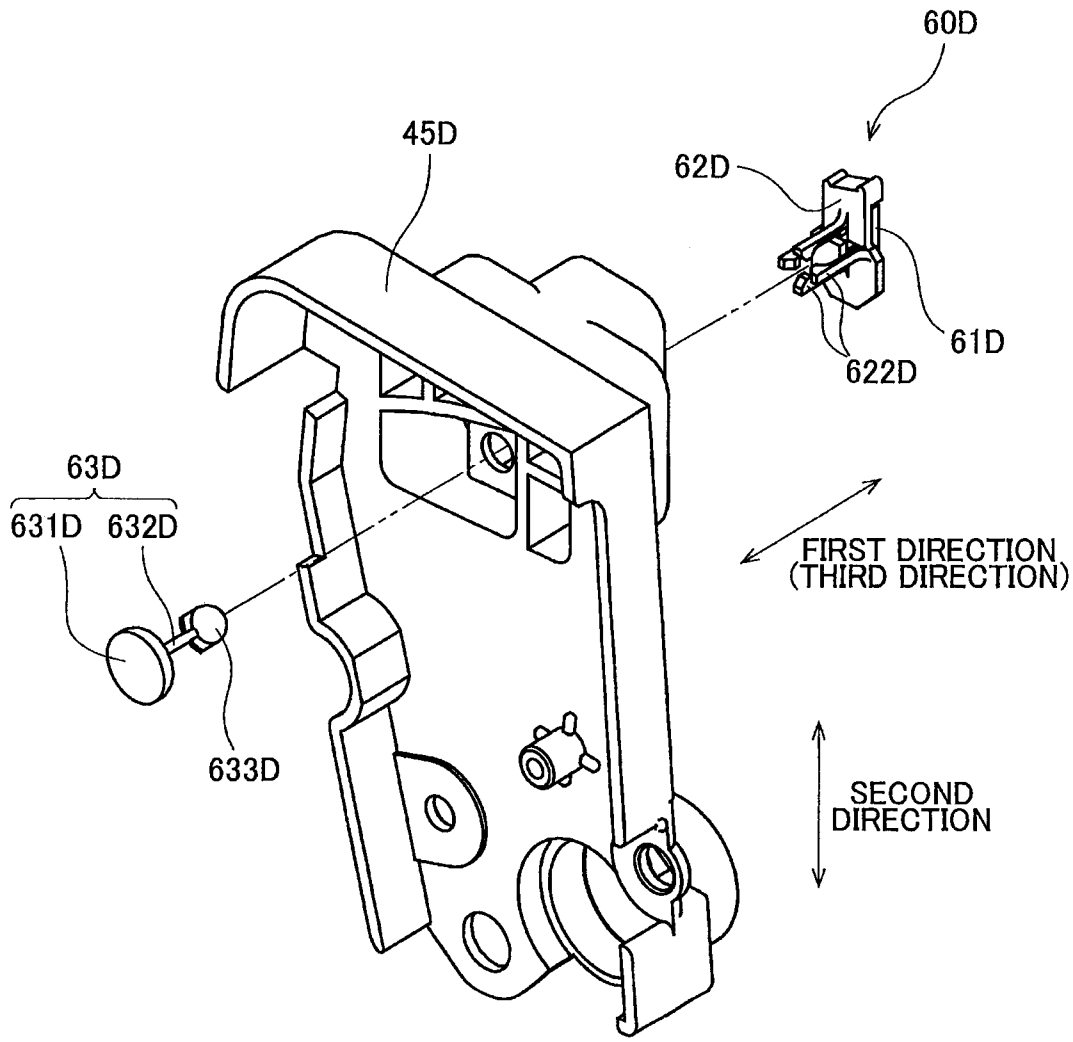

60D
45D
62D
61D
622D
63D
631D
632D
633D
FIRST DIRECTION
(THIRD DIRECTION)
SECOND
DIRECTION

FIG. 29

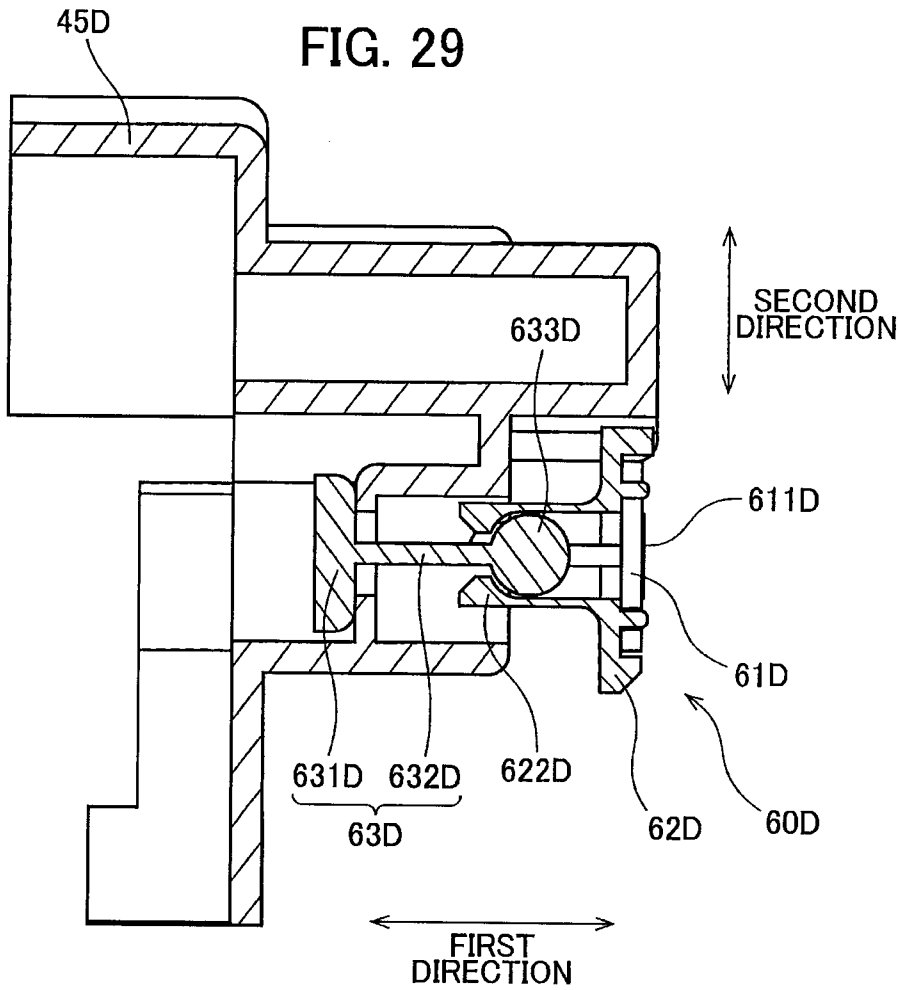

45D
633D
SECOND DIRECTION
611D
61D
631D
632D
622D
63D
62D
60D
FIRST DIRECTION

FIG. 30

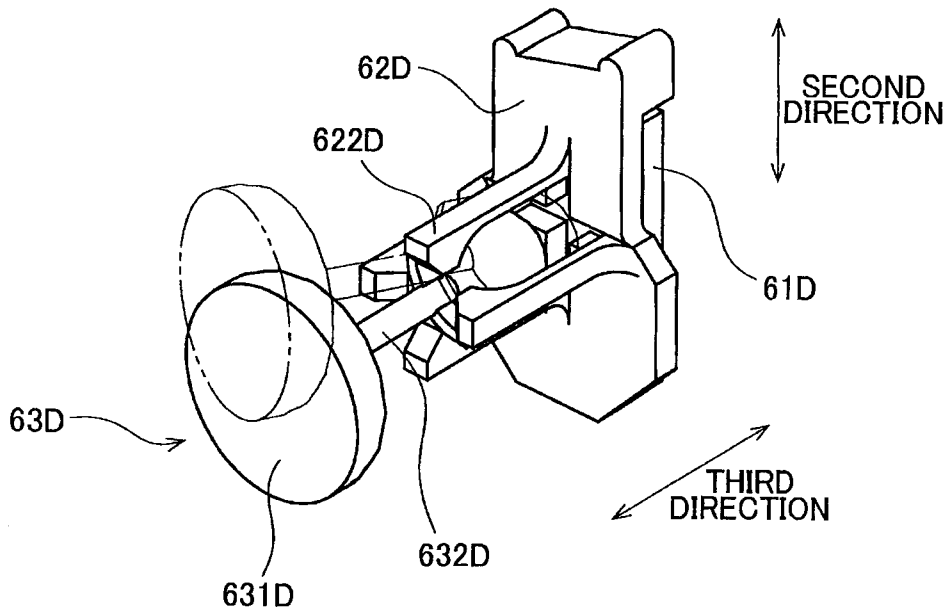

62D
622D
SECOND DIRECTION
61D
63D
THIRD DIRECTION
632D
631D

FIG. 31

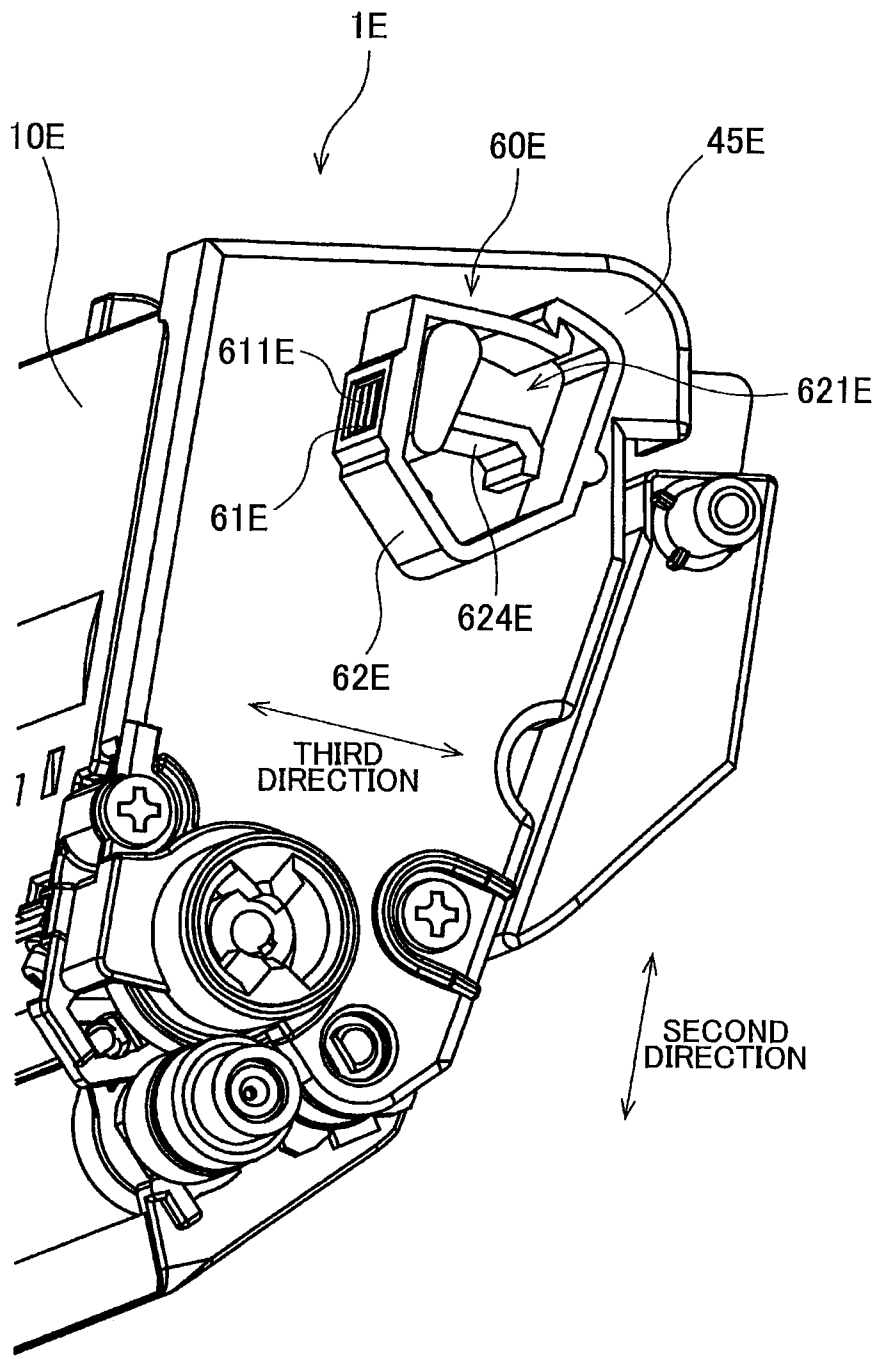

1E
10E
60E
45E
611E
621E
61E
624E
62E
THIRD
DIRECTION
SECOND
DIRECTION

FIG. 32

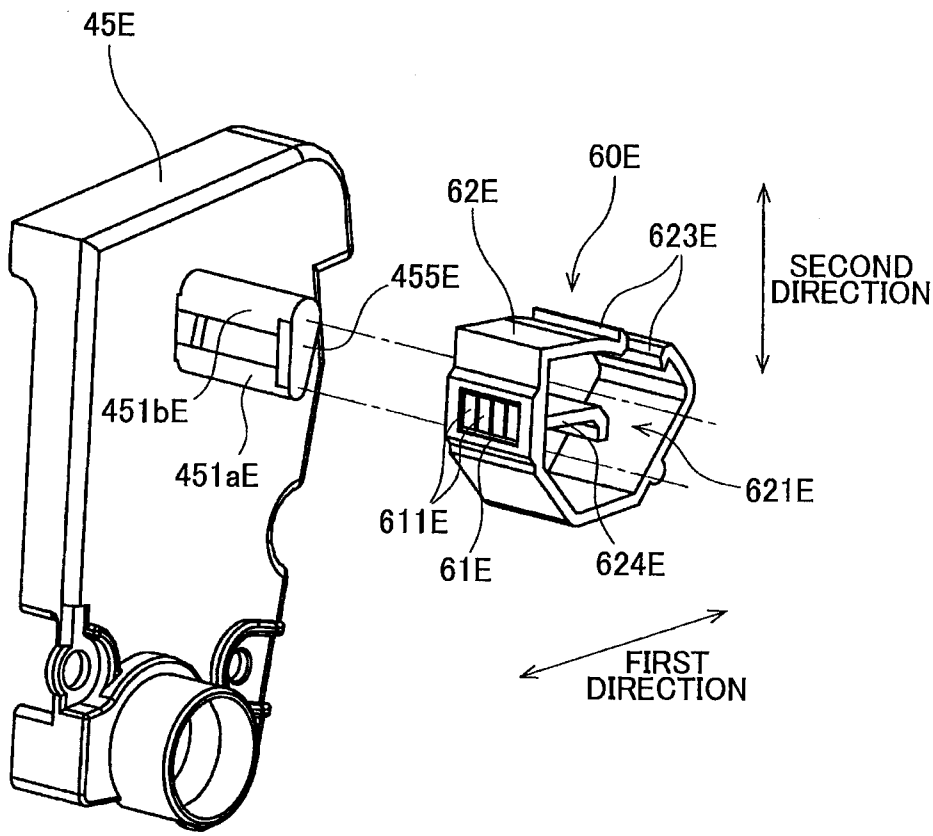

45E
60E
62E
623E
455E
SECOND DIRECTION
451bE
451aE
621E
611E
61E
624E
FIRST DIRECTION

FIG. 33

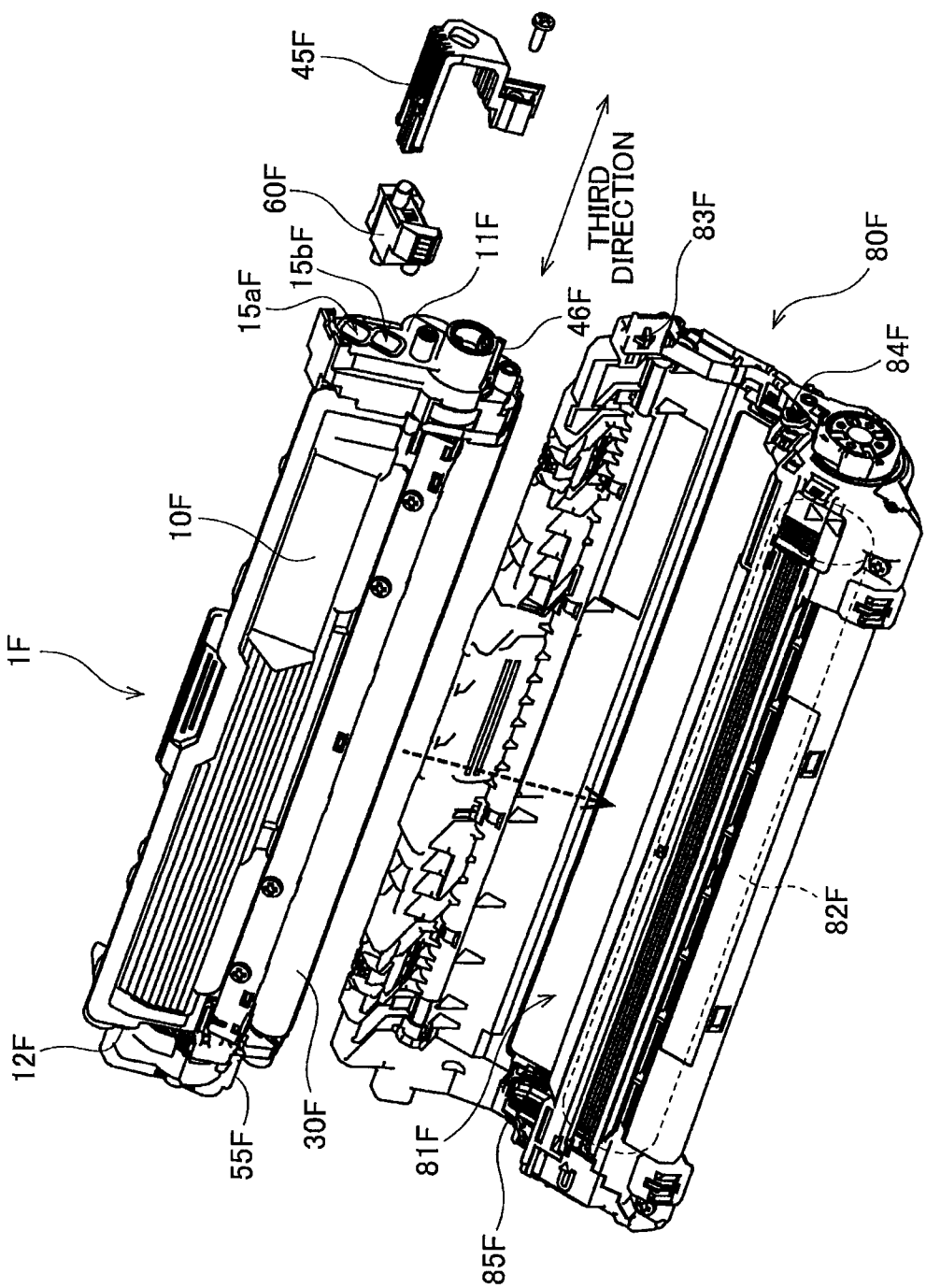

45F
60F
15bF
15aF
11F
THIRD DIRECTION
83F
80F
46F
84F
10F
1F
82F
12F
55F
30F
81F
85F

FIG. 34

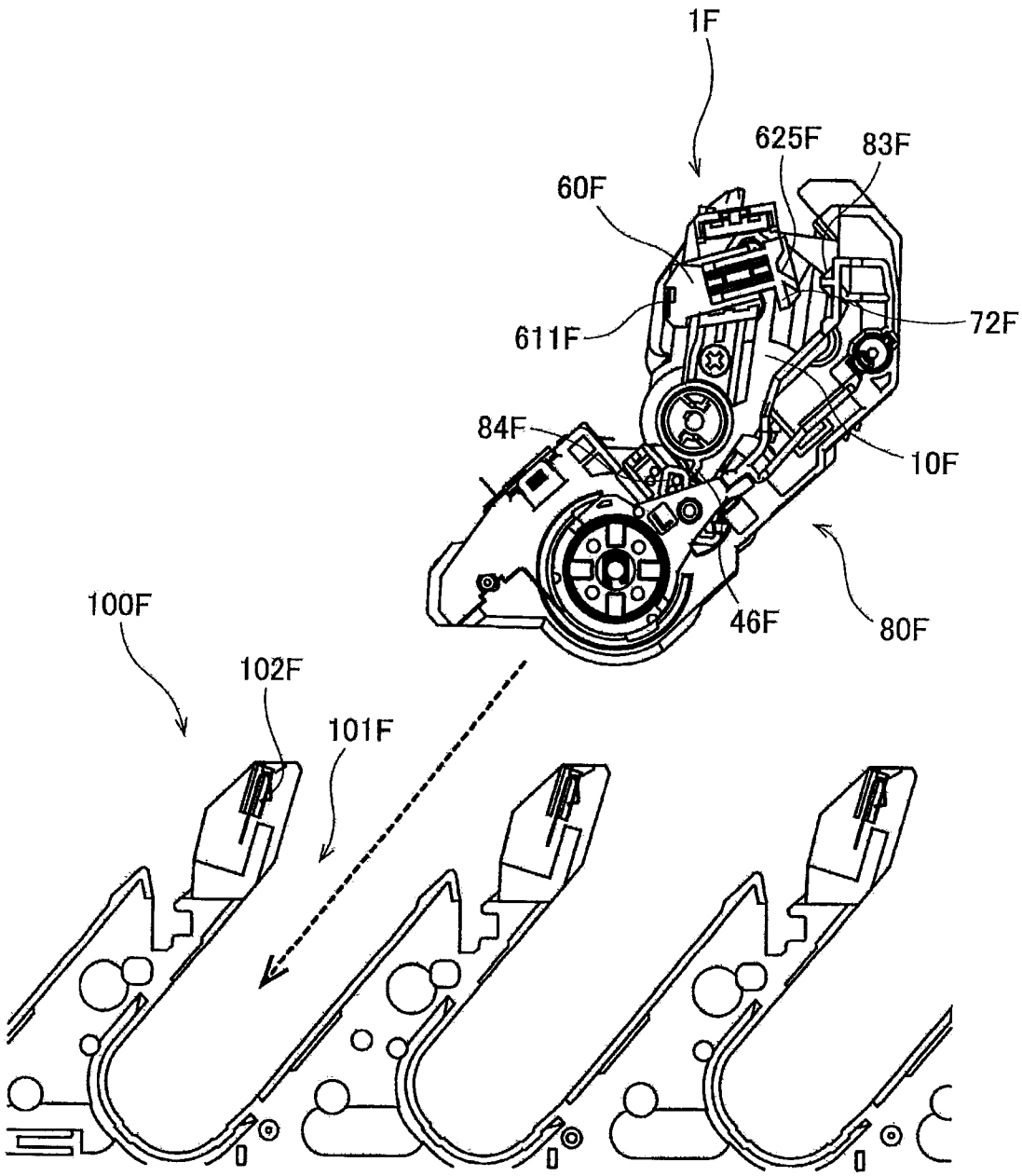
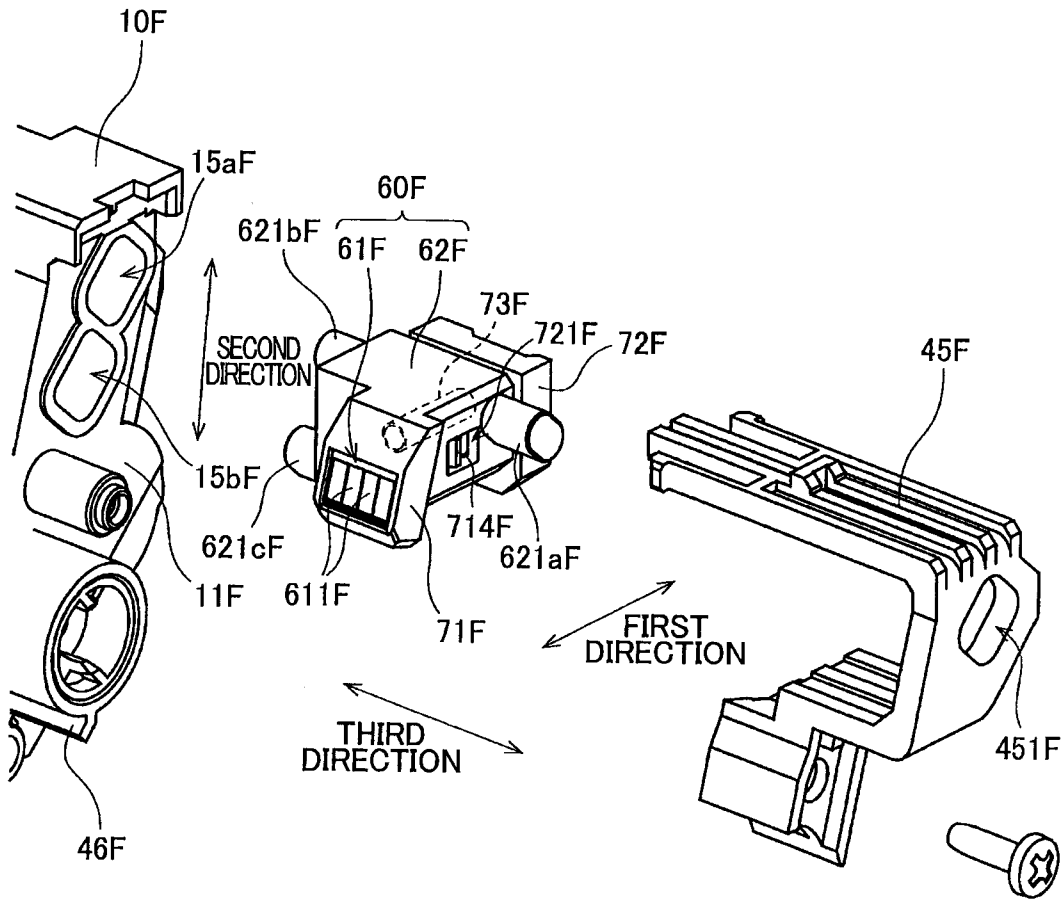
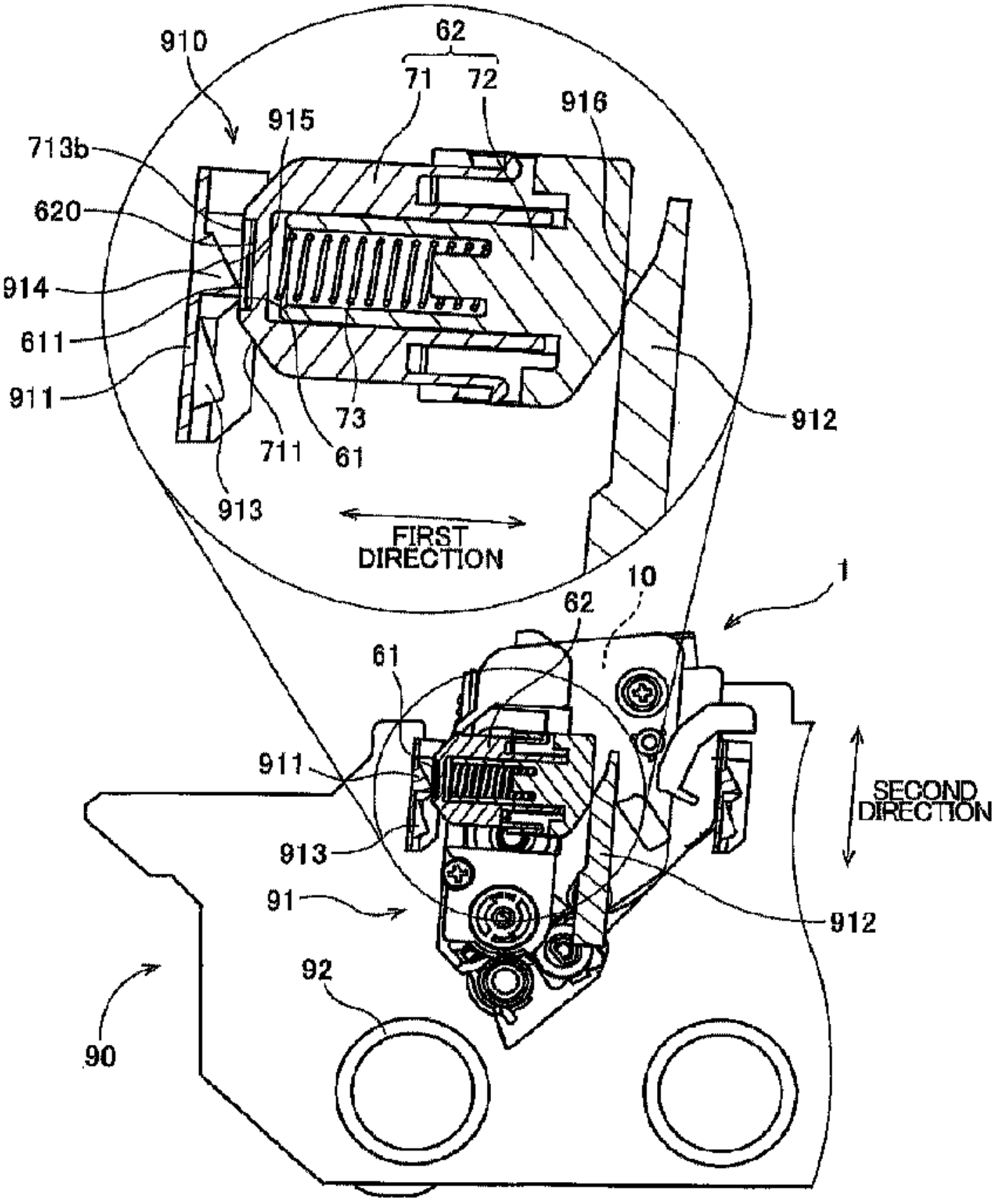


FIG. 35


10F
15aF
60F
621bF
61F
62F
73F
721F
72F
45F
SECOND DIRECTION
15bF
621cF
714F
621aF
11F
611F
71F
FIRST DIRECTION
THIRD DIRECTION
451F
46F


910
62
71
72
916
915
713b
620
914
611
911
912
73
711
61
913
FIRST DIRECTION
1
10
62
61
911
913
91
912
SECOND DIRECTION
92
90