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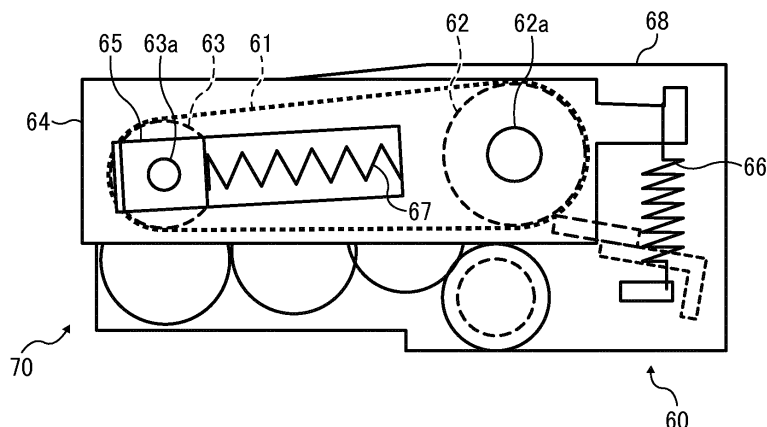
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(54) **BELT DEVICE, TRANSFER DEVICE, AND IMAGE FORMING APPARATUS**

(57) A belt device includes a belt (61) and a belt alignment unit (62, 63). The belt is stretched over a plurality of support rotators. The belt alignment unit (70) is configured to restrict a range of deviation of the belt in which the belt moves in a belt width direction. The belt alignment unit (70) includes a shaft displacement member (72), a shaft holder (64), and a shaft displacement corrector (66). The shaft displacement member (72) is configured to displace a position of at least one end of a rotary shaft (63a) of at least one support rotator (63) among the plurality of support rotators (62, 63) by a movement of the belt (61)

in the belt width direction. The shaft holder (64) is configured to tiltably hold the rotary shaft (63a). The shaft displacement corrector (66) is provided to the shaft holder (64). The shaft displacement corrector (66) is configured to return the position of the at least one end of the rotary shaft (63a) having been displaced by the shaft displacement member (72) to a position before the displacement. The shaft displacement corrector is positioned inside a projection area of the belt device (60) by a vertical light as viewed in an axial direction of one of the plurality of support rotators (62).

FIG. 2



Description

BACKGROUND

Technical Field

[0001] Aspects of this disclosure relate to a belt device, a transfer device, and an image forming apparatus.

Related Art

[0002] A belt device including a belt-shaped member stretched over a plurality of support rollers is used as, for example, a secondary transfer device to secondarily transfer toner images of different colors, which have been primarily transferred from latent image bearers onto an intermediate transferor, from the intermediate transferor onto a recording medium.

[0003] For such a belt device, a belt may deviate to one end of the belt (belt deviation) or meander, i.e., repeats deviation to both sides in a lateral width direction (belt width direction) of the belt.

[0004] As a belt device to restrict a range of movement (a range of deviation) of the belt due to such deviation within a certain restricted range, for example, JP-2010-0230958-A describes a belt device described below.

[0005] The belt device described in JP-2010-0230958-A includes an intermediate transfer belt stretched over a plurality of support rotators including a belt meandering correcting roll and a belt meandering correcting assembly (belt alignment unit) to restrict a range of deviation of the intermediate transfer belt within a certain restricted range.

[0006] The belt meandering correcting assembly includes a belt meandering correcting member and a roll shaft support portion at an end of a rotary shaft (hereinafter, simply referred to as "of the roll shaft") of the belt meandering correcting roll.

[0007] The belt meandering correcting member is a shaft displacement portion to displace a position of one end of the roll shaft by a movement in a belt width direction of the intermediate transfer belt, includes a slanted face approaching the center of the roll shaft toward an outer side in an axial direction of the roll shaft, and is disposed to be movable along the roll shaft.

[0008] The roll shaft support portion is a shaft holding portion to movably support the roll shaft and includes a tension spring having an end secured to a frame of the belt device.

[0009] The tension spring is a shaft displacement corrector to return the position of the end of the roll shaft displaced by the belt meandering correcting member to a position before the displacement.

[0010] The belt meandering correcting member described in JP-2010-0230958-A is proposed to restrict the range of deviation of the belt within a certain range.

[0011] In other words, when one end of the intermedi-

ate transfer belt deviates toward one end of the roll shaft, the belt meandering correcting member receives a pressure due to meandering of the intermediate transfer belt, moves along the roll shaft, and contacts a portion of the frame of the belt device.

[0012] With the movement of the belt meandering correcting member, the contact position in the slanted face of the belt meandering correcting member displaces and the position of the end of the roll shaft displaces in a direction perpendicular to the roll shaft, thus inclining the roll shaft.

[0013] According to JP-2010-0230958-A, the inclination allows the end of the intermediate transfer belt, which has deviated to one end of the belt meandering correcting roll, to be moved to a direction to correct the deviation. The position of the roll shaft displaced by the belt meandering correcting member can be corrected by the tension spring.

[0014] However, other components are typically disposed adjacent to a belt device, such as a secondary transfer device, and a space for a member to restrict the deviation of a belt is limited.

[0015] Accordingly, if the belt meandering correcting assembly as described in JP-2010-0230958-A is used in a belt device adjacent to other components, the following failure may arise.

[0016] For example, in correcting the deviation of the belt or modifying the position of the roll shaft after the correction of the deviation of the belt, a member, such as a tension spring, to restrict the deviation of the belt may interfere with adjacent other components.

SUMMARY

[0017] In an aspect of this disclosure, there is provided a belt device that includes a belt and a belt alignment unit. The belt is stretched over a plurality of support rotators. The belt alignment unit is configured to restrict a range of deviation of the belt in which the belt moves in a belt width direction. The belt alignment unit includes a shaft displacement member, a shaft holder, and a shaft displacement corrector. The shaft displacement member is configured to displace a position of at least one end of a rotary shaft of at least one support rotator among the plurality of support rotators by a movement of the belt in the belt width direction. The shaft holder is configured to tiltably hold the rotary shaft. The shaft displacement corrector is provided to the shaft holder. The shaft displacement corrector is configured to return the position of the at least one end of the rotary shaft having been displaced by the shaft displacement member to a position before the displacement. The shaft displacement corrector is positioned inside a projection area of the belt device by a vertical light as viewed in an axial direction of one of the plurality of support rotators.

[0018] In another aspect of this disclosure, there is provided a transfer device that includes the belt device including the belt stretched over the plurality of support

rotators. The transfer device is configured to transfer a toner image formed on an image bearer onto a transfer medium carried and conveyed on an outer circumferential surface of the belt. The at least one support rotator, the position of the rotary shaft of which is displaced by the shaft displacement member, is positioned most downstream in a conveyance direction of the transfer medium among the plurality of support rotators. The shaft displacement corrector is positioned upstream in the conveyance direction from a rotary shaft of a support rotator positioned most upstream in the conveyance direction among the plurality of support rotators.

[0019] In still another aspect of this disclosure, there is provided an image forming apparatus that includes a latent image bearer, a latent image forming member, a developing unit, and a recording medium conveyor. The latent image forming member is configured to form a latent image on the latent image bearer. The developing unit is configured to perform developing processing in which toner is adhered to the latent image on the latent image bearer. The recording medium conveyor is configured to convey a recording medium. The image forming apparatus is configured to form an image on the recording medium by ultimately transferring a toner image formed on the latent image bearer onto the recording medium in the developing processing. The recording medium conveyor is the belt device.

[0020] In still yet another aspect of this disclosure, there is provided an image forming apparatus that includes a latent image bearer, a latent image forming member, a developing unit, an intermediate transfer member, and the transfer device. The latent image forming member is configured to form a latent image on the latent image bearer. The developing unit is configured to perform developing processing in which toner is adhered to the latent image on the latent image bearer. A toner image formed on the latent image bearer is transferred onto the intermediate transfer member. The intermediate transfer member is configured to carry the toner image. The transfer device is configured to transfer the toner image on the intermediate transfer member onto a transfer medium.

[0021] According to the present invention, a belt alignment unit is unlikely to interfere with adjacent components in a belt device and allows control of the deviation of a belt over time.

BRIEF DESCRIPTION OF THE SEVERAL VIEWS OF THE DRAWINGS

[0022] The aforementioned and other aspects, features, and advantages of the present disclosure would be better understood by reference to the following detailed description when considered in connection with the accompanying drawings, wherein:

FIG. 1 is a schematic view of a printer as an example of an image forming apparatus according to an em-

bodiment of the present disclosure;

FIG. 2 is a schematic view of a shaft moving device of a secondary transfer device employed in the image forming apparatus of FIG. 1 immediately after assembly as viewed in an axial direction of a separation roller;

FIG. 3 is a schematic view of the shaft moving device after adjustment of deviation of a belt as viewed in the axial direction of the separation roller;

FIG. 4 is a cross-sectional view of the shaft moving device immediately after assembly, taken along a rotary shaft of the separation roller;

FIG. 5 is a cross-sectional view of the shaft moving device after adjustment of the deviation of the belt, taken along the rotary shaft of the separation roller;

FIG. 6 is an illustration of a belt deviation of a secondary transfer belt;

FIG. 7 is a perspective view schematically illustrating a shaft inclining member of the shaft moving device;

FIG. 8 is a schematic view of a positional relationship between the shaft moving device and adjacent members as viewed in the axial direction of the separation roller;

FIG. 9 is a schematic view of another configuration of the secondary transfer device employed in the image forming apparatus as viewed in the axial direction of the separation roller;

FIG. 10 is a schematic view of a configuration adjacent to a cleaning blade employed in the secondary transfer device of FIG. 2 as viewed in a vertical direction to an axial direction of the separation roller 64; and

FIG. 11 is a schematic view of a positional relationship between a conventional shaft moving device and adjacent members as viewed in the axial direction of the separation roller.

[0023] The accompanying drawings are intended to depict embodiments of the present disclosure and should not be interpreted to limit the scope thereof. The accompanying drawings are not to be considered as drawn to scale unless explicitly noted.

DETAILED DESCRIPTION

[0024] In describing embodiments illustrated in the drawings, specific terminology is employed for the sake of clarity. However, the disclosure of this patent specification is not intended to be limited to the specific terminology so selected and it is to be understood that each specific element includes all technical equivalents that operate in a similar manner and achieve similar results.

[0025] Although the embodiments are described with technical limitations with reference to the attached drawings, such description is not intended to limit the scope of the disclosure and all of the components or elements described in the embodiments of this disclosure are not necessarily indispensable.

[0026] Referring now to the drawings, embodiments of the present disclosure are described below. In the drawings for explaining the following embodiments, the same reference codes are allocated to elements (members or components) having the same function or shape and redundant descriptions thereof are omitted below.

[0027] With reference to FIG. 1, a description is provided of an electrophotographic printer as an example of an image forming apparatus according to an embodiment of the present disclosure.

[0028] FIG. 1 is a schematic view of an image forming apparatus 1000 according to an embodiment of the present disclosure.

[0029] The image forming apparatus 1000 includes four photoconductors 1a, 1b, 1c, and 1d as latent image bearers disposed inside a main body housing of the image forming apparatus 1000.

[0030] Toner images of different colors are formed on the respective photoconductors 1a, 1b, 1c, and 1d.

[0031] More specifically, a black toner image, a magenta toner image, a cyan toner image, and a yellow toner image are formed on the photoconductors 1a, 1b, 1c, and 1d, respectively.

[0032] According to the present embodiment, the photoconductors 1a, 1b, 1c, and 1d have a drum shape. Alternatively, the photoconductors 1a, 1b, 1c, and 1d may employ an endless looped belt wound about a plurality of rollers and driven to rotate.

[0033] The image forming apparatus 1000 includes an intermediate transfer belt 51 formed into an endless loop as an intermediate transfer member which serves as an image bearing member. The intermediate transfer belt 51 faces the four photoconductors 1a, 1b, 1c, and 1d.

[0034] The outer circumferential surface of each of the photoconductors 1a, 1b, 1c, and 1d contacts the outer circumferential surface of the intermediate transfer belt 51.

[0035] The intermediate transfer belt 51 is wound about and stretched taut over a plurality of support rollers: a tension roller 52, a drive roller 53, a repulsive roller 54, an entry roller 55, and so forth.

[0036] The drive roller 53, which is one of support rollers, is driven to rotate by a drive source, and rotation of the drive roller 53 causes the intermediate transfer belt 51 to travel in a direction indicated by arrow A in FIG. 1.

[0037] The intermediate transfer belt 51 may be a single-layer belt or a multi-layered belt.

[0038] In the case of the multi-layered belt, a base layer of the belt may be formed of a relatively inelastic fluorine resin such as a polyvinylidene fluoride (PVDF) sheet and polyimide resin, with a smooth coating layer of fluorine resin deposited on the outer surface of the belt.

[0039] In the case of a single-layer belt, the belt material may be selected from, for example, polyvinylidene difluoride (PVDF), polycarbonate (PC) and polyimide (PI).

[0040] The configuration and operation for forming toner images on each of the photoconductors 1a, 1b, 1c,

and 1d, all have a similar or the same configuration as all the others, differing only in the color of toner employed. Similarly, the configuration and operation for transferring primarily the toner images onto the intermediate transfer belt 51 have a similar or the same configuration as all the others, differing only the color of toner employed.

[0041] Thus, a description is provided only of the photoconductor 1a for forming a black toner image and its associated imaging equipment as a representative example of the photoconductors and associated imaging equipment. The description of the photoconductors 1b, 1c, and 1d, and associated imaging equipment are omitted herein, unless otherwise indicated.

[0042] The photoconductor 1a rotates in the counter-clockwise direction indicated by arrow in FIG. 1.

[0043] The outer circumferential surface of the photoconductor 1a is irradiated with light from a static eliminating device, thereby initializing the surface potential of the photoconductor 1a.

[0044] The initialized outer circumferential surface of the photoconductor 1a is charged uniformly by a charging device 8a to a predetermined polarity (in the present embodiment, a negative polarity). Similarly, the initialized outer circumferential surfaces of the photoconductors 1b, 1c, and 1d are charged uniformly by charging devices 8b, 8c, and 8d.

[0045] Subsequently, an exposure device 13 as a latent image forming device irradiates the charged surface of the photoconductor 1a with a modulated laser beam L, thereby forming an electrostatic latent image on the surface of the photoconductor 1a.

[0046] According to the present embodiment, the exposure device 13 that projects the laser beam L includes a laser writing device. Alternatively, the exposure device 13 may include a laser emitting diode (LED) array and an imaging device.

[0047] The electrostatic latent image formed on the photoconductor 1a is developed with a respective color of toner, i.e., black, by a developing device 10a into a visible image, known as a black toner image. Reference numerals 100b, 10c, and 10d also refer to developing devices.

[0048] Primary transfer rollers 11a, 11b, 11c, and 11d serving as primary transfer devices are disposed inside the looped intermediate transfer belt 51, facing the photoconductors 1a, 1b, 1c, and 1d, respectively.

[0049] The primary transfer roller 11a, hereinafter described as a representative example of the primary transfer rollers, contacts the inner circumferential surface of the intermediate transfer belt 51 to form a primary transfer nip between the photoconductor 1a and the intermediate transfer belt 51.

[0050] The primary transfer roller 11a is supplied with a primary transfer voltage having a polarity (in the present embodiment, a positive polarity) opposite a charge polarity of the toner image formed on the photoconductor 1a, thereby forming a primary transfer electric field between the photoconductor 1a and the intermediate trans-

fer belt 51 and transferring electrostatically the toner image onto the intermediate transfer belt 51.

[0051] After the toner image is primarily transferred onto the intermediate transfer belt 51, residual toner remaining on surface of the photoconductor 1a is removed by a cleaning device 12a. Similarly, the photoconductors 1b, 1c, and 1d are cleaned by cleaning devices 12b, 12c, and 12d, respectively.

[0052] In a full-color mode in which toner images of four different colors are formed, similar to the black toner image, a magenta toner image, a cyan toner image, and a yellow toner image are formed on the photoconductors 1b, 1c, and 1d, respectively.

[0053] As described above, the toner images in the colors magenta, cyan, and yellow are transferred onto the intermediate transfer belt 51, such that they are superimposed one atop the other on the black toner image which has been primarily transferred onto the intermediate transfer belt 51.

[0054] When forming a single color image of black color, such as in a monochrome mode, the primary transfer rollers 11b, 11c, and 11d, other than the primary transfer roller 11a for black, are separated from the photoconductors 1b, 1c, and 1d for the colors magenta, cyan, and yellow by a moving device.

[0055] In a state in which only the photoconductor 1a is in contact with the intermediate transfer belt 51, only the black toner image is transferred primarily onto the intermediate transfer belt 51.

[0056] As illustrated in FIG. 1, a paper feed device 14 is disposed substantially at the bottom of the main body of the image forming apparatus 1000.

[0057] The paper feed device 14 includes a feed roller 15 to pick up and send a recording medium P as a sheet-type medium as transfer medium in a direction indicated by arrow B in FIG. 1.

[0058] The recording medium P fed by the feed roller 15 is delivered in a predetermined timing to a secondary transfer nip at which the intermediate transfer belt 51 wound about the repulsive roller 54 contacts a secondary transfer belt 61 of a secondary transfer device 60. The recording medium P is fed to the secondary transfer nip in appropriate timing by a pair of registration rollers 16.

[0059] At this time, the repulsive roller 54 is supplied with a predetermined secondary transfer voltage to transfer secondarily the toner image from the intermediate transfer belt 51 onto the recording medium P.

[0060] In the secondary transfer device 60, the secondary transfer belt 61 is wound about and stretched taut between a secondary transfer roller 62 and a separation roller 63.

[0061] In the present embodiment, the secondary transfer roller 62 rotationally drives as a drive roller, thereby enabling the secondary transfer belt 61 to travel in a direction indicated by arrow C in FIG. 11.

[0062] The recording medium P, onto which the toner image is secondarily transferred, is carried on the outer circumferential surface of the secondary transfer belt 61

and transported while the recording medium P is attracted electrostatically to the outer circumferential surface of the secondary transfer belt 61.

[0063] Subsequently, the recording medium P separates from the surface of the secondary transfer belt 61 by a curvature of a portion of the secondary transfer belt 61 wound about the separation roller 63, and is transported further downstream from the secondary transfer belt 61 in a conveyance direction of the recording medium P by a conveyor belt 17 disposed downstream from the secondary transfer belt 61.

[0064] The conveyor belt 17 is wound about and stretched taut between a first roller 17A and a second roller 17B. The entry roller 17A serves as a drive roller. The second roller 17B serves as a driven roller.

[0065] When the recording medium P passes through a fixing device 18 which applies heat and pressure to the toner image on the recording medium P, the toner image is fixed to the recording medium P.

[0066] After the recording medium P passes through the fixing device 18, the recording medium P is discharged outside the main body through a pair of output rollers 19 of a discharge unit.

[0067] The conveyor belt 17 according to this embodiment is made of, for example, ethylene propylene diene monomer (EPDM) rubber and has a thickness of, e.g., 1 mm.

[0068] Residual toner remaining on the intermediate transfer belt 51 after the toner image is secondarily transferred therefrom is removed by a belt cleaning device 20.

[0069] In the present embodiment, the belt cleaning device 20 includes an intermediate cleaning blade 21 made of suitable material, such as urethane, held against the intermediate transfer belt 51 to mechanically remove or scrape toner residues from the belt surface.

[0070] Alternatively, instead of or in combination with a cleaning blade, any suitable cleaning device may be used to clean the intermediate transfer belt 51, including, for example, an electrostatic cleaning device for electrostatically removing toner residues from the belt surface.

[0071] Next, a description is provided of a shaft moving device 70 as a belt alignment unit employed in the secondary transfer device 60 equipped with the secondary transfer belt 61.

[0072] FIG. 2 is a schematic view of the shaft moving device 70 immediately after assembly, as viewed in an axial direction of the separation roller 63.

[0073] FIG. 3 is a schematic view of the shaft moving device 70 after adjustment of deviation of the secondary transfer belt 61, as viewed in the axial direction of the separation roller 63.

[0074] According to the present embodiment, the belt alignment unit employed in the secondary transfer device 60 is of a shaft-inclining type, and a shaft moving device 70 serves as the belt alignment unit of the secondary transfer device 60 to tilt a rotary shaft 63a of the separation roller 63 about which the secondary transfer belt 61 is wound so as to regulate the range of deviation of the

secondary transfer belt 61 within a predetermined permissible range. The separation roller 63 is one of support rollers over which the secondary transfer belt 61 is stretched.

[0075] Each end of the rotary shaft 63a of the separation roller 63 is supported individually by different support arms 64 as separate shaft holders.

[0076] Each shaft support arm 64 is rotatably attached to each end of the rotary shaft 62a of the secondary transfer roller 62 and is biased in a clockwise direction in FIG. 2 by an arm spring 66 with one end thereof fixed to a frame 68 of the secondary transfer device 60.

[0077] The arm spring 66 is a shaft displacement corrector to return a position of one end of the separation roller 63, which has been displaced by the shaft inclining member 72 as a shaft displacement member, to a position before the displacement.

[0078] Note that the setting position of the arm spring 66 in the secondary transfer device 60 is described later.

[0079] In a state in which there is no deviation of the secondary transfer belt 61 immediately after assembly, a rotation position of the shaft support arms 64 is maintained at a position at which the shaft support arms 64 contact the frames 68 due to a bias force of the arm spring 66 as illustrated in FIG. 2.

[0080] As illustrated in FIGS. 2 and 3, each shaft support arm 64 slidably supports a shaft bearing 65 that bears the rotary shaft 63a of the separation roller 63 such that the shaft bearing 65 is slidable in a radial direction from the center of rotation of the support arm 64.

[0081] The shaft bearing 65 is biased outward by a tension spring 67 in the radial direction from the center of rotation of the support arms 64.

[0082] With this configuration, the separation roller 63 is always biased in such a direction that the separation roller 63 separates from the secondary transfer roller 62. Accordingly, a certain tension is applied to the secondary transfer belt 61 looped around the separation roller 63 and the secondary transfer roller 62.

[0083] FIG. 4 is a cross-sectional view of the shaft moving device 70 of the secondary transfer device 60, cut along the rotary shaft 63a of the separation roller 63.

[0084] FIG. 5 is a cross-sectional view of the shaft moving device 70 after adjustment of the deviation of the belt, taken along the rotary shaft of the separation roller.

[0085] As illustrated in FIG. 4, a belt deviation detector 71 and a shaft inclining member 72 as an angle adjuster are disposed on the rotary shaft 63a between the separation roller 63 and the shaft bearing 65. The belt deviation detector 71 and the shaft inclining member 72 constitute an axial-direction displacement device.

[0086] The belt deviation detector 71 includes a flange 71a that contacts an end portion of the secondary transfer belt 61.

[0087] As the secondary transfer belt 61 moves in the direction of the belt width and the end portion of the secondary transfer belt 61 contacts the flange 71a, exerting a force on the belt deviation detector 71, the belt deviation

detector 71 moves outward in the axial direction along the rotary shaft 63a of the separation roller 63.

[0088] As the belt deviation detector 71 moves outward in the axial direction along the rotary shaft 63a, the shaft inclining member 72 which is disposed outside the belt deviation detector 71 on the rotary shaft 63a moves outward in the axial direction along the rotary shaft 63a.

[0089] A contact portion 68a of the frame 68 contacts a slanted face 72a of the shaft inclining member 72 from outside the rotary shaft 63a in the axial direction.

[0090] The end portion of the rotary shaft 63a of the separation roller 63 on which the shaft inclining member 72 is disposed is supported, via the shaft bearing 65, by the shaft support arm 64 which is biased by the arm spring 66. Thus, the end portion of the rotary shaft 63a of the separation roller 63 is biased upward in FIG. 4.

[0091] Accordingly, in a state in which the end portion of the secondary transfer belt 61 is not in contact with the flange 71a of the belt deviation detector 71, the spring force of the arm spring 66 adjusts the contact position at which the contact portion 68a of the frame 68 and the slanted face 72a of the shaft inclining member 72 contact to a position at which a first stopper surface 68b of the frame 68 contacts a contact face 72b of the shaft inclining member 72. The contact face 72b of the shaft inclining member 72 is continuously formed at the lower end of the slanted face 72a.

[0092] That is, the contact portion 68a of the frame 68 is held in a state in which the contact portion 68a contacts the lower end portion of the slanted face 72a of the shaft inclining member 72.

[0093] In this state, the secondary transfer belt 61 receives a force causing the secondary transfer belt 61 to move in the direction of the belt width, thereby moving the belt deviation detector 71 and the shaft inclining member 72 outward in the axial direction along the rotary shaft 63a. As a result, the contact portion 68a of the frame 68 relatively moves along the slanted face 72a of the shaft inclining member 72.

[0094] The contact position at which the slanted face 72a of the shaft inclining member 72 contacts the contact portion 68a of the frame 68 moves up towards the upper portion of the slanted face 72a.

[0095] As a result, the axial end portion of the rotary shaft 63a of the separation roller 63 in the moving direction of the secondary transfer belt 61 is pressed down against the biasing force of the arm spring 66 as illustrated in FIG. 5.

[0096] At this time, the end portion of the secondary transfer belt 61 is not in contact with the flange 71a of the belt deviation detector 71. Accordingly, as illustrated in FIG. 4, the contact portion 68a of the frame 68 is held in a state in which the contact portion 68a of the frame 68 contacts the lower end portion of the slanted face 72a of the shaft inclining member 72.

[0097] The opposite end of the rotary shaft 63a of the separation roller 63, which is the opposite end in the moving direction of the secondary transfer belt 61, is pressed

down relative to the other end, causing the rotary shaft 63a to tilt.

[0098] As the rotary shaft 63a of the separation roller 63 tilts further, the moving speed of the secondary transfer belt 61 in the direction of the belt width slows down gradually, and ultimately the secondary transfer belt 61 moves in the direction opposite to the direction of the belt width.

[0099] As a result, the position of the secondary transfer belt 61 in the width direction returns gradually, thereby running the secondary transfer belt 61 on track and enabling the secondary transfer belt 61 to travel reliably.

[0100] The same is true for the case in which the direction of deviation of the secondary transfer belt 61 is in the direction opposite to the direction described above.

[0101] With reference to FIG. 6, a description is provided of a principle of correction of belt deviation by tilting the rotary shaft 63a of the separation roller 63.

[0102] FIG. 6 is an illustration of deviation of the secondary transfer belt 61.

[0103] Here, it is assumed that the secondary transfer belt 61 has a rigid body, and an arbitrary point (i.e., a point E on the belt end portion) on the secondary transfer belt 61 before advancing to the separation roller 63 is observed.

[0104] As long as the secondary transfer belt 61 stretched over two rollers, i.e., the secondary transfer roller 62 and the separation roller 63, is completely horizontal or parallel, the position of the secondary transfer belt 61 in the axial direction of the separation roller 63 does not change between the point E on the secondary transfer belt 61 immediately before advancing to the separation roller 63 and a point E' corresponding to the point E immediately after exiting the separation roller 63.

[0105] In this case, the secondary transfer belt 61 does not travel out of alignment.

[0106] By contrast, in a case in which the rotary shaft 63a of the separation roller 63 is inclined at an inclination angle α relative to the rotary shaft 62a of the secondary transfer roller 62, the point E on the secondary transfer belt 61 shifts by an amount of $\tan \alpha$ in the axial direction of the separation roller 63 while moving along the peripheral surface of the separation roller 63 as illustrated in FIG. 6.

[0107] Therefore, by tilting the rotary shaft 63a of the separation roller 63 at the inclination angle α relative to the rotary shaft 62a of the secondary transfer roller 62, the position of the secondary transfer belt 61 in the width direction of the belt can be moved approximately by the amount of $\tan \alpha$ in accordance with the rotation of the separation roller 63.

[0108] The amount of belt deviation (moving speed in the width direction of the belt) of the secondary transfer belt 61 is proportional to the inclination angle α .

[0109] That is, the greater is the inclination angle α , the greater is the amount of deviation of the secondary transfer belt 61. The smaller is the inclination angle α , the smaller is the amount of deviation of the secondary

transfer belt 61.

[0110] For example, in a case in which the secondary transfer belt 61 drifts to the right side as illustrated in FIG. 5, this belt deviation causes the shaft inclining member 72 to move in the axial direction of the separation roller 63, thereby moving the rotary shaft 63a of the separation roller 63 down in FIG. 5 and thus bringing the secondary transfer belt 61 back to the left in FIG. 5.

[0111] With this configuration, the rotary shaft 63a of the separation roller 63 is inclined, hence moving the secondary transfer belt 61 in the opposite direction to the direction of the initial belt deviation and thus compensating the initial belt deviation of the secondary transfer belt 61. In other words, the secondary transfer belt 61 is moved to a place at which the initial belt deviation and the deviation of the secondary transfer belt 61 caused by the inclination of the rotary shaft 63a are balanced, thereby correcting the deviation of the secondary transfer belt 61.

[0112] In the event in which the secondary transfer belt 61 traveling at the balanced position starts to drift toward either side, the inclination of the rotary shaft 63a of the separation roller 63 in accordance with the deviation of the secondary transfer belt 61 brings the secondary transfer belt 61 to the balanced position again.

[0113] According to the present embodiment, the shaft moving device 70 of the secondary transfer device 60 tilts the rotary shaft 63a of the separation roller 63 at an inclination angle corresponding to the amount of deviation of the secondary transfer belt 61 in the direction of the belt width. Accordingly, deviation of the secondary transfer belt 61 is corrected fast.

[0114] Furthermore, in order to tilt the rotary shaft 63a of the separation roller 63, the moving force of the secondary transfer belt 61 moving in the direction of the belt width is used so that an additional drive source such as a motor is not necessary, and hence no extra space is needed to accommodate the drive source. The rotary shaft 63a of the separation roller 63 can be tilted with a simple configuration without a dedicated drive source.

[0115] Next, with reference to FIG. 7, a description is provided of the shaft inclining member 72.

[0116] FIG. 7 is a perspective view of a shaft inclining member 72 of the shaft moving device 70.

[0117] According to the present embodiment, the shaft inclining member 72 includes a cylindrical main body, and the outer circumferential surface of the cylindrical main body includes the slanted face 72a.

[0118] The slanted face 72a is formed of a curved surface that constitutes a part of the circumference of a conical shape, the center of which coincides with the center axis of the cylindrical main body.

[0119] There are two reasons for forming the slanted face 72a with a curved surface.

[0120] The first reason is that even when the shaft inclining member 72 rotates slightly around the rotary shaft 63a of the separation roller 63, the angle of inclination of the separation roller 63 does not change.

[0121] The second reason is that the curved surface of the slanted face 72a allows the slanted face 72a and the contact portion 68a of the frame 68 to make a point contact, thereby reducing friction at the contact place. With this configuration, the contact pressure at the end portion of the secondary transfer belt 61 contacting the belt deviation detector 71 is reduced, thereby reducing damage to the end portion of the secondary transfer belt 61 and hence achieving extended belt life expectancy.

[0122] According to the present embodiment, the slanted face 72a is tilted at an inclination angle β of approximately 30° relative to the rotary shaft 63a. Preferred material of the shaft inclining member 72 includes, but is not limited to, polyacetal (POM).

[0123] In a case in which the rotary shaft of the separation roller 63 is not tilted and the range of deviation of the belt is not restricted, since an end face of the secondary transfer belt 61 is directly pressed with the belt deviation detector 71 provided to an end portion of the separation roller 63, the end face of the secondary transfer belt 61 is in a constantly-stressed state.

[0124] The end face of a belt is the weakest part of the belt, and it has been observed that allowing the secondary transfer belt 61 to travel in the state where the end face of the secondary transfer belt 61 is constantly stressed may sometimes result in the end portion of the secondary transfer belt 61 being folded.

[0125] By tilting the separation roller 63, the belt alignment unit according to the present embodiment is capable of reducing a load on the end face of the secondary transfer belt 61 while controlling the deviation of the belt.

[0126] A bending stress acts repeatedly on the end portion of the secondary transfer belt 61 due to contact with the belt deviation detector 71. Accordingly, damage or breakage of the secondary transfer belt 61 might occur.

[0127] Hence,, a reinforcing tape may be adhered around edges of the inner and outer circumferential surfaces of the secondary transfer belt 61.

[0128] Next, a description is provided of an example of the separation roller 63 and the secondary transfer belt 61.

[0129] The outer diameter of the separation roller 63 is $\phi 15$.

[0130] Material for the separation roller 63 is aluminum.

[0131] Material for the secondary transfer belt 61 is polyimide.

[0132] Young's modulus of the secondary transfer belt 61 is 3000Mpa.

[0133] Folding endurance of the secondary transfer belt 61 using MIT-type folding endurance tester is 6000 times.

[0134] The thickness of the secondary transfer belt 61 is 80 μ m.

[0135] The linear velocity of the secondary transfer belt 61 is 352 mm/s.

[0136] The belt tension is 0.9 N/cm.

[0137] The measuring method of the MIT-type folding endurance test conforms to Japanese Industrial Stand-

ard (JIS)-P8115.

[0138] More specifically, the measuring conditions of the folding endurance testing are as follows: Testing load: 1 kgf, Flexion angle: 135 degrees, Flexion speed 175 times per minute. A sample belt has a width of 15 mm.

[0139] Next, a detailed description is provided of the arm spring 66, which is a shaft displacement corrector. In general, there are many components existing closely around a secondary transfer device, whereby a space for disposing the belt alignment unit is small.

[0140] Accordingly, depending on disposition of the shaft displacement corrector such as a tension spring employed in the belt alignment unit, the following malfunction may occur to the secondary transfer device having the belt alignment unit.

[0141] That is, when a correction of the deviation of the belt is made or when a modification of a roller shaft position is made after the correction of the deviation of the belt, the tension spring may come in contact with the components around the secondary transfer device, and the deviation of the belt is no longer corrected.

[0142] FIG. 11 is a schematic view of a positional relationship between a conventional shaft moving device 270 and adjacent members as viewed in the axial direction of the separation roller.

[0143] Note that a secondary transfer device 260 illustrated in FIG. 11 has an identical configuration as the secondary transfer device 60 described based on FIG. 2 other than that disposition of an arm spring 266 employed in the shaft moving device 270 is different.

[0144] For this reason, a part identical to the secondary transfer device 60 of FIG. 2 is denoted with the same reference numeral, and a description thereof is omitted herein.

[0145] For example, as illustrated in FIG. 11, the following malfunction may occur to the secondary transfer device in a case where the components such as the conveyor belt 17, the intermediate transfer belt 51, and the belt cleaning device 20 exist closely around the secondary transfer device 260.

[0146] That is, when the correction of the deviation of the belt is made or the modification of a roller shaft position is made after the correction of the deviation of the belt, the arm spring 266 may come in contact with the components around the secondary transfer device 260, and the deviation of the belt is not corrected.

[0147] Thus, in the secondary transfer device 60 according to the present embodiment, a position of the arm spring 66 relative to the secondary transfer device 60 is set as the following.

[0148] FIG. 8 is a schematic view of the positional relationship between the shaft moving device and the adjacent members of FIG. 2 as viewed in the axial direction of the separation roller 63.

[0149] Around the secondary transfer device 60 according to the present embodiment, the conveyor belt 17 is disposed downstream from of the secondary transfer device 60 in a conveyance direction of a recording me-

dium, and the intermediate transfer belt 51 and the belt cleaning device 20 are disposed above the secondary transfer device 60.

[0150] Below the secondary transfer device 60, from a viewpoint of paper jam processing and the like between the intermediate transfer belt 51 and the secondary transfer belt 61, there is disposed a contact-separation mechanism that separates the secondary transfer belt 61 from the intermediate transfer belt 51 by rotating the secondary transfer device 60 around a contact-separation shaft 90 relative to the intermediate transfer belt 51.

[0151] Furthermore, around the shaft moving device 70, there are disposed a secondary transfer cleaning blade 81 for removing residual toner remaining on an outer circumferential surface of the secondary transfer belt 61 after a toner image is secondarily transferred onto a transfer medium as well as a waste toner conveyance mechanism.

[0152] The waste toner conveyance mechanism is provided with a waste toner coil 82 to which drive is transmitted from a drive source 83 through a plurality of gears 84. Toner recovered by the secondary transfer cleaning blade 81 is conveyed to a waste toner conveyance path by the waste toner coil 82.

[0153] The secondary transfer device 60 according to the present embodiment is disposed such that the entire arm spring 66 is positioned within a projection area of the secondary transfer device 60 by a vertical light as viewed in an axial direction of the secondary transfer roller 62 (hereinafter, simply referred to as the "projection area").

[0154] Note that the projection area according to the present embodiment is a projection area of the shaft moving device 70 and the frame 68 excluding the arm spring 66 by the vertical light as viewed in the axial direction of the secondary transfer roller 62.

[0155] As a result, when the correction of the deviation of the belt is made or when the modification of the roller shaft position is made after the correction of the deviation of the belt, a major movable range of the arm spring is inside the projection area of the secondary transfer device 60.

[0156] Thus, even in a case where there is a limited space for providing a member to restrict the deviation of the belt since another component is adjacent to the secondary transfer device 60, the arm spring 66 does not interfere with the adjacent component, and it is possible to control the deviation of the belt over a long period of time.

[0157] In the secondary transfer device 60 according to the present embodiment, by disposing the arm spring 66 inside the projection area of the secondary transfer device 60 as viewed in the axial direction of the secondary transfer roller 62, it is possible to downsize the secondary transfer device 60.

[0158] More specifically, in the secondary transfer device 60 according to the present embodiment, the arm spring 66 is disposed further upstream in a paper con-

veyance direction from a rotary shaft of the secondary transfer roller 62 positioned most upstream in the paper conveyance direction among the support rollers of the secondary transfer device 60.

[0159] In the secondary transfer device, there is a relatively more space upstream in a paper passing direction.

[0160] For this reason, in the secondary transfer device 60 according to the present embodiment, it is possible to suppress interference between the arm spring 66 and the adjacent component without securing a large space for disposing the belt alignment unit to prevent the arm spring 66 from interfering with the adjacent component of the secondary transfer device.

[0161] Thus, it is possible to downsize a belt device having the belt alignment unit.

[0162] FIG. 9 is a schematic view of another configuration of the secondary transfer device employed in the image forming apparatus 1000 as viewed in the axial direction of the separation roller 63.

[0163] Note that a secondary transfer device 160 illustrated in FIG. 9 has an identical configuration as the secondary transfer device 60 described based on FIG. 2 other than that the secondary transfer device 60 is provided with a lubricant application brush roller 85.

[0164] For this reason, a part identical to the secondary transfer device 60 of FIG. 2 is denoted with the same reference numeral, and a description thereof is omitted herein.

[0165] In a common secondary transfer device, sometimes lubricant is applied to the belt to prevent filming on the belt or to prevent blade rolling-in.

[0166] For this reason, as illustrated in FIG. 9, the lubricant application brush roller 85 may be in contact with the secondary transfer belt 61 to apply the lubricant on the belt.

[0167] However, in a case where the lubricant application brush roller 85 is provided to the secondary transfer device, to rotate the lubricant application brush roller 85 for applying the lubricant to the secondary transfer belt 61, it is necessary to dispose a gear 86 to the secondary transfer device.

[0168] For this reason, a space for disposing the arm spring 66 is limited, and it is necessary to enlarge the space for disposing the belt alignment unit such that the gear 86 of the lubricant application brush roller 85 does not interfere with the arm spring 66, whereby the secondary transfer device becomes large.

[0169] For this reason, as illustrated in FIG. 8, the secondary transfer device 60 according to the present embodiment has a configuration without a lubricant application member.

[0170] That is, in the secondary transfer device 60 according to the present embodiment, members that come in contact with a part of the outer circumferential surface of the secondary transfer belt 61 that is wound about the secondary transfer roller 62 are the secondary transfer cleaning blade 81, a toner leak prevention seal member

87 that is a toner leak prevention member described below, and the intermediate transfer belt 51 only.

[0171] As a result, it is possible to secure the space for disposing a constituent component of a shaft moving device 170 as the belt alignment unit, whereby it is possible to suppress the secondary transfer device from becoming large.

[0172] FIG. 10 is a schematic view of a configuration adjacent to the secondary transfer cleaning blade 81 employed in the secondary transfer device 60 illustrated in FIG. 8 as viewed in a vertical direction relative to the axial direction of the separation roller 63.

[0173] In the axial direction of the secondary transfer roller 62, to each of both ends of the secondary transfer cleaning blade 81, the toner leak prevention seal member 87 is disposed.

[0174] This toner leak prevention seal member 87 is provided for preventing toner that has been cleaned by the secondary transfer cleaning blade 81 from scattering around.

[0175] In the present embodiment, material of the secondary transfer cleaning blade 81 is urethane rubber. One having rubber hardness (Shore A) of 90 is used in a contact portion with the secondary transfer belt 61; however, the rubber hardness of the secondary transfer cleaning blade 81 is not limited to this.

[0176] It is preferred that the rubber hardness of the secondary transfer cleaning blade 81 be high since the blade rolling-in relative to the secondary transfer belt is less likely to occur.

[0177] In a case where the rubber hardness is too high, however, the secondary transfer cleaning blade 81 is incapable of following a minute projection and recess of the secondary transfer belt, whereby cleaning failure may occur or the secondary transfer cleaning blade 81 may be easily chipped.

[0178] Accordingly, it is preferred that the rubber hardness suitable for a system be used each time.

[0179] The above-described embodiments and examples are limited examples, and the present disclosure includes, for example, the following aspects having advantages.

Aspect A

[0180] A belt device, such as the secondary transfer device 60, includes a belt, such as the secondary transfer belt 61, stretched over a plurality of support rotators, such as the secondary transfer roller 62 and the separation roller 63; and a belt alignment unit, such as the shaft moving device 70, to restrict a range of deviation of the belt in which the belt moves in a belt width direction. The belt alignment unit includes a shaft displacement member, such as the shaft inclining member 72, to displace a position of at least one end of a rotary shaft of at least one support rotator, such as the separation roller 63, among the plurality of support rotators by a movement of the belt in the belt width direction; a shaft holder, such

as the rotary shaft support arm 64, to tiltably hold the rotary shaft; and a shaft displacement corrector, such as the arm spring 66, provided to the shaft holder and to return the position of the at least one end of the rotary shaft having been displaced by the shaft displacement member to a position before the displacement. The shaft displacement corrector is positioned inside a projection area of the belt device by a vertical light as viewed in an axial direction of one of the plurality of support rotators.

[0181] In this aspect, as described in the above-described embodiment, at least a part of a movable range of the arm spring when a correction of the deviation of the belt is made or when a modification of a roller shaft position is made after the correction of the deviation of the belt is inside the projection area of the secondary transfer device.

[0182] Thus, even in a case where another component is adjacent to the secondary transfer device and where a space for providing a member to restrict the deviation of the belt is limited, the arm spring 66 is unlikely to interfere with the adjacent component, and it is possible to control the deviation of the belt over a long period of time.

Aspect B

[0183] In the Aspect A, there is provided a shaft holding member, such as the frame 68, to indirectly or directly hold the rotary shaft of the plurality of support rotators, such as the secondary transfer roller 62 and the separation roller 63. The shaft displacement corrector, such as the arm spring 66, is positioned inside the projection area of the belt alignment unit and the shaft holding member excluding the shaft displacement corrector by the vertical light as viewed in the axial direction of one of the plurality of support rotators.

[0184] As a result, the major movable range of the arm spring when a correction of the deviation of the belt is made or when a modification of a roller shaft position is made after the correction of the deviation of the belt is inside the projection area of the secondary transfer device.

[0185] Thus, even in a case where another component is adjacent to the secondary transfer device and where a space for providing a member to restrict the deviation of the belt is limited, the arm spring 66 is unlikely to interfere with the adjacent component, and it is possible to control the deviation of the belt over a long period of time.

Aspect C

[0186] A transfer device, such as the secondary transfer device 60, includes a belt device having a belt, such as the secondary transfer belt 61, stretched over a plurality of support rotators, such as the secondary transfer roller 62 and the separation roller 63. The transfer device transfers a toner image formed on an image bearer, such as the intermediate transfer belt 51, onto a transfer medium, such as the recording medium P, carried and con-

veyed on an outer circumferential surface of the belt. The belt device of Aspect A or Aspect B is used as the belt device. The at least one support rotator, such as the separation roller 63, the position of the rotary shaft of which is displaced by the shaft displacement member, such as the shaft inclining member 72, is positioned most downstream in a conveyance direction of the transfer medium among the plurality of support rotators. The shaft displacement corrector, such as the arm spring 66, is positioned upstream in the conveyance direction from a rotary shaft of a support rotator, such as the secondary transfer roller 62, positioned most upstream in the conveyance direction among the plurality of support rotators.

[0187] In general, in a transfer device, there is a relatively more space upstream in a paper pass direction.

[0188] For this reason, in this aspect, it is possible to suppress interference between the arm spring 66 and an adjacent component without securing a large space for disposing the belt alignment unit to prevent the arm spring 66 from interfering with the adjacent component of the secondary transfer device.

[0189] Thus, it is possible to downsize the belt device having the belt alignment unit.

Aspect D

[0190] In Aspect C, a part of the outer circumferential surface of the belt, such as the secondary transfer belt 61, wound about the support rotator such as the secondary transfer roller 62 positioned most upstream in the conveyance direction only contacts a cleaning blade, such as the secondary transfer cleaning blade 81, to remove toner on the surface of the belt, the image bearer, such as the intermediate transfer belt 51, and a toner leak prevention member, such as the toner leak prevention seal member 87.

[0191] In a case where the lubricant application brush roller 85 is provided to the secondary transfer device 60, to rotate the lubricant application brush roller 85 for applying the lubricant to the secondary transfer belt 61, it is necessary to dispose the gear 86 to the secondary transfer device.

[0192] For this reason, a space for disposing the arm spring 66 is limited, and it is necessary to enlarge the space for disposing the belt alignment unit such that the gear 86 of the lubricant application brush roller 85 does not interfere with the arm spring 66, whereby the secondary transfer device becomes large.

[0193] In this aspect, it is possible to secure the space for disposing the constituent component of the belt alignment unit, whereby it is possible to suppress the secondary transfer device from becoming large.

Aspect E

[0194] An image forming apparatus includes a latent image bearer such as the photoconductor 1a; a latent image forming member that forms a latent image on the

latent image bearer; a developing unit such as the developing device 10a that performs developing processing in which toner is adhered to the latent image on the latent image bearer; and a recording medium conveyor that conveys a recording medium. The image forming apparatus forms an image on the recording medium by ultimately transferring a toner image formed on the latent image bearer onto the recording medium in the developing processing. As the recording medium conveyor, the belt device according to Aspect A or Aspect B is used.

Aspect F

[0195] An image forming apparatus includes a latent image bearer, such as the photoconductor 1a; a latent image forming member, such as the exposure device 13, to form a latent image on the latent image bearer; a developing unit, such as the developing device 10a, to perform developing processing in which toner is adhered to the latent image on the latent image bearer; an intermediate transfer member, such as the intermediate transfer belt 51, onto which a toner image formed on the latent image bearer is transferred and that carries the toner image; and a transfer device, such as the secondary transfer device 60, to transfer the toner image on the intermediate transfer member onto a transfer medium, such as the recording medium P. As the transfer device, the transfer device according to Aspect C or Aspect D is used.

Claims

1. A belt device (60) comprising:

- a belt (61) stretched over a plurality of support rotators (62, 63); and
- a belt alignment unit (70) configured to restrict a range of deviation of the belt in which the belt moves in a belt width direction,

the belt alignment unit (70) including:

- a shaft displacement member (72) configured to displace a position of at least one end of a rotary shaft (63a) of at least one support rotator (63) among the plurality of support rotators (62, 63) by a movement of the belt (61) in the belt width direction;
- a shaft holder (64) configured to tiltably hold the rotary shaft (63a); and
- a shaft displacement corrector (66) provided to the shaft holder (64),
- the shaft displacement corrector (66) configured to return the position of the at least one end of the rotary shaft (63a) having been displaced by the shaft displacement member (72) to a position before the displacement,

the shaft displacement corrector positioned inside a projection area of the belt device (60) by a vertical light as viewed in an axial direction of one of the plurality of support rotators (62).

2. The belt device according to claim 1, further comprising a shaft holding member (68) configured to indirectly or directly hold the rotary shaft of each of the plurality of support rotators (62, 63), wherein the shaft displacement corrector (66) is positioned inside a projection area of the belt alignment unit and the shaft holding member excluding the shaft displacement corrector by the vertical light as viewed in the axial direction of one of the plurality of support rotators. 5

3. A transfer device comprising the belt device (60) according to claim 1 or 2 including the belt (61) stretched over the plurality of support rotators (62, 63), wherein the transfer device is configured to transfer a toner image formed on an image bearer onto a transfer medium carried and conveyed on an outer circumferential surface of the belt, wherein the at least one support rotator (63), the position of the rotary shaft (63a) of which is displaced by the shaft displacement member (72), is positioned most downstream in a conveyance direction of the transfer medium among the plurality of support rotators, and 10
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4. The transfer device according to claim 3, wherein a portion of the outer circumferential surface of the belt wound about the support rotator positioned most upstream in the conveyance direction only contacts a cleaning blade configured to remove toner on the surface of the belt, the image bearer, and a toner leak prevention member.

5. An image forming apparatus (1000) comprising:
 - a latent image bearer (1a);
 - a latent image forming member (13) configured to form a latent image on the latent image bearer (1a);
 - a developing unit (10a) configured to perform developing processing in which toner is adhered to the latent image on the latent image bearer (1a); and
 - a recording medium conveyor configured to convey a recording medium,
 - wherein the image forming apparatus is configured to form an image on the recording medium

by ultimately transferring a toner image formed on the latent image bearer onto the recording medium in the developing processing, and wherein the recording medium conveyor is the belt device (60) according to claim 1 or 2.

6. An image forming apparatus comprising:

- a latent image bearer (1a);
- a latent image forming member (13) configured to form a latent image on the latent image bearer;
- a developing unit (10a) configured to perform developing processing in which toner is adhered to the latent image on the latent image bearer;
- an intermediate transfer member (51) onto which a toner image formed on the latent image bearer is transferred, the intermediate transfer member configured to carry the toner image; and
- the transfer device (60) according to claim 3 or 4 configured to transfer the toner image on the intermediate transfer member (51) onto a transfer medium.

FIG. 2

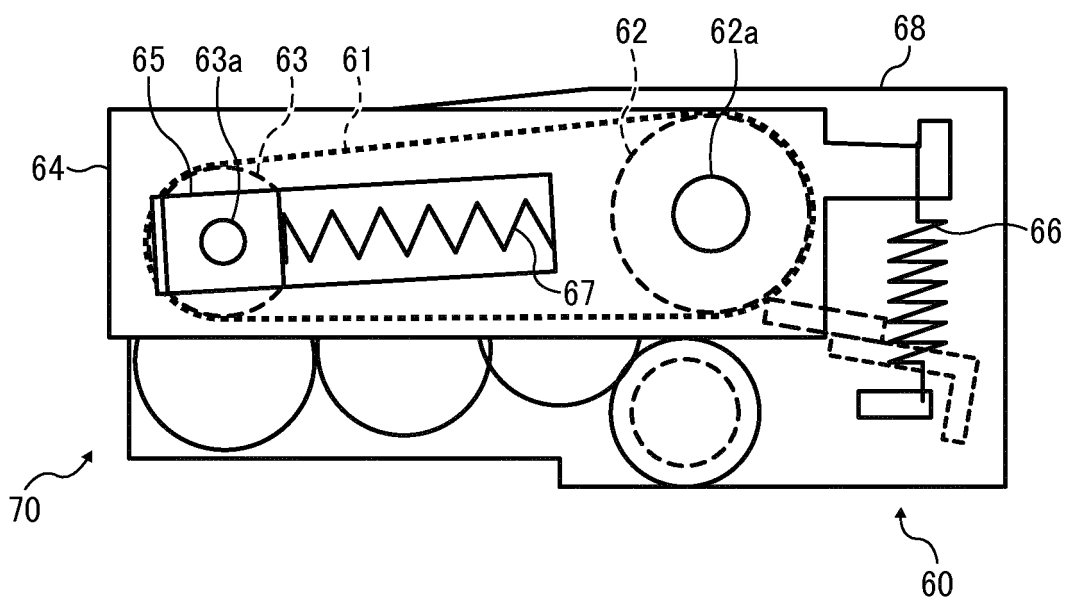


FIG. 3

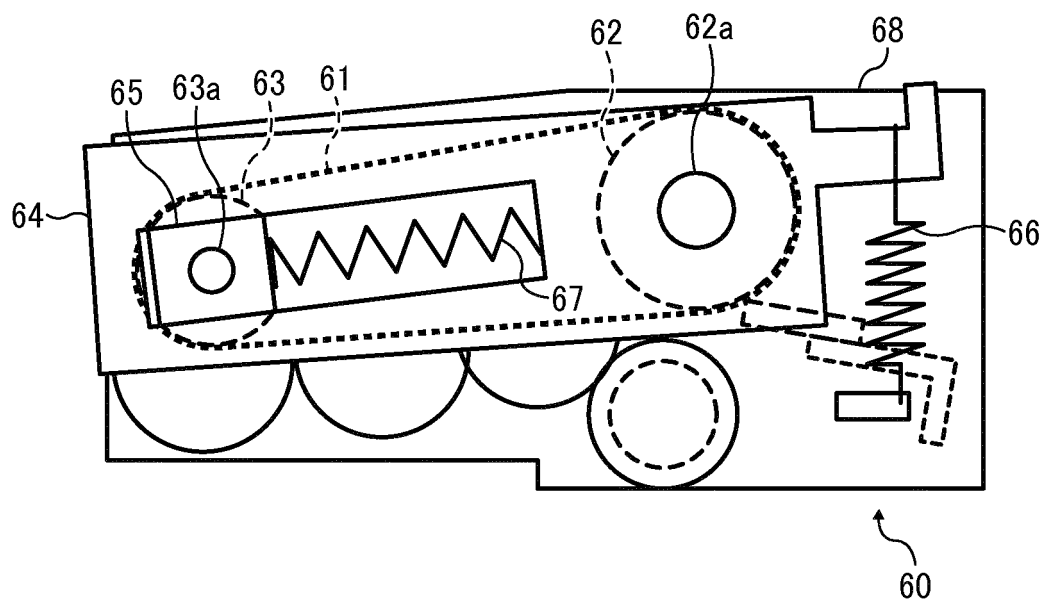


FIG. 4

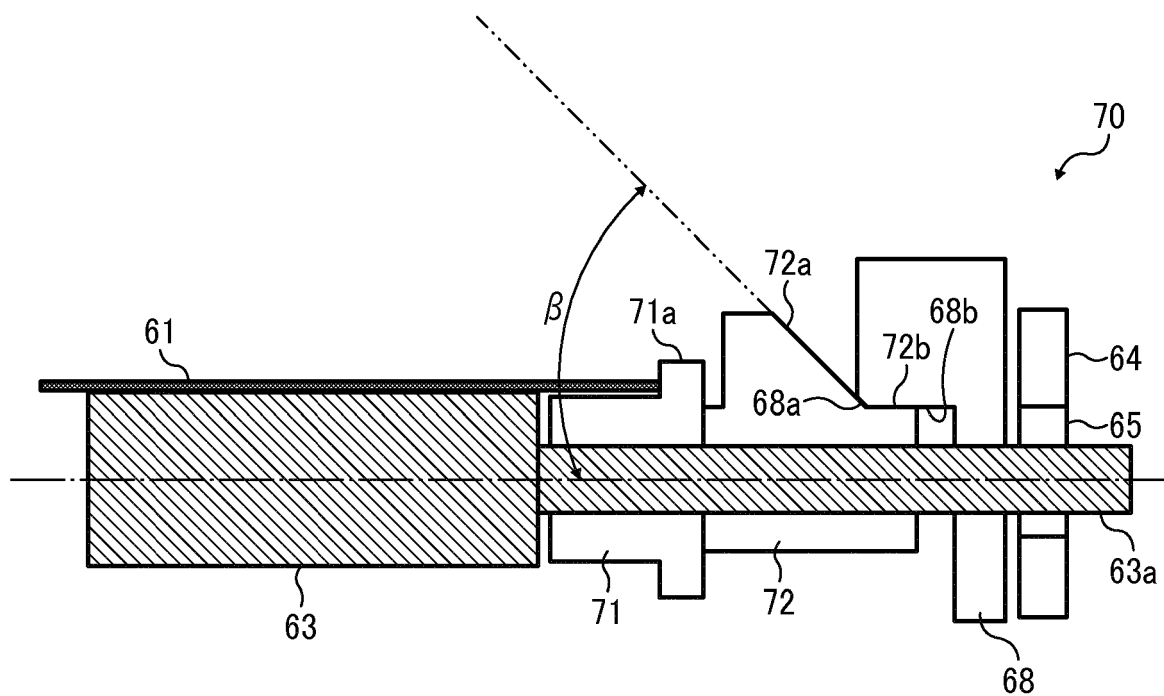


FIG. 5

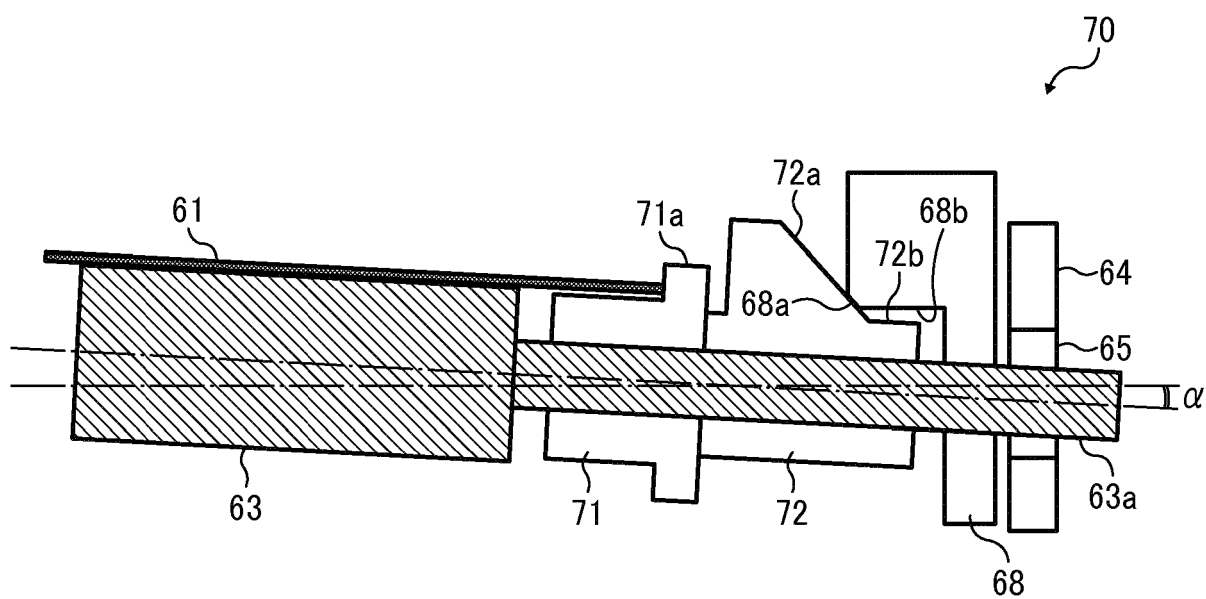


FIG. 6

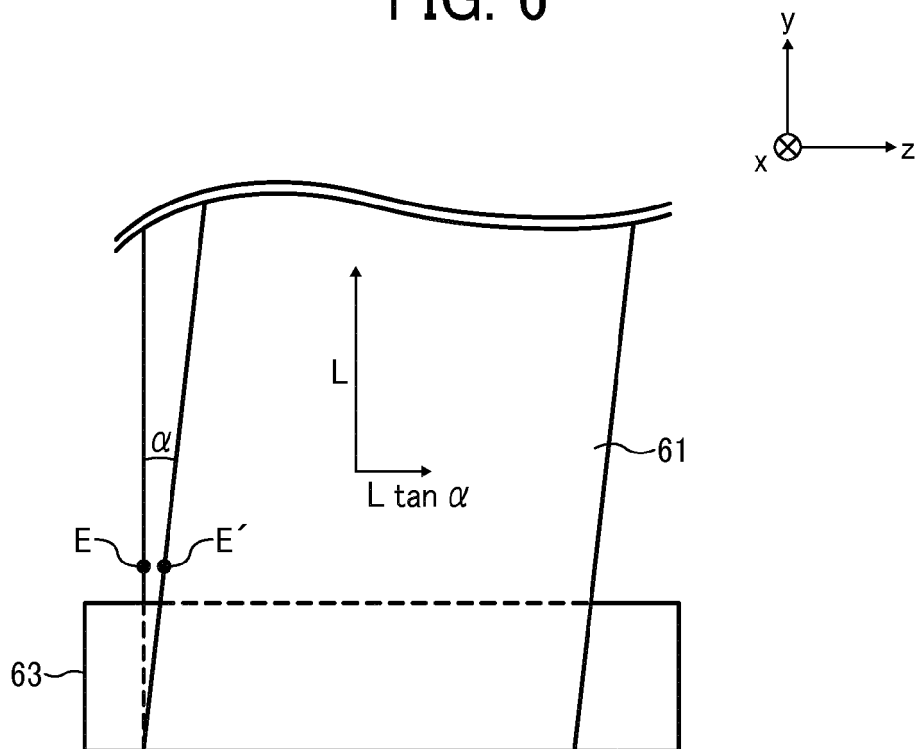


FIG. 7

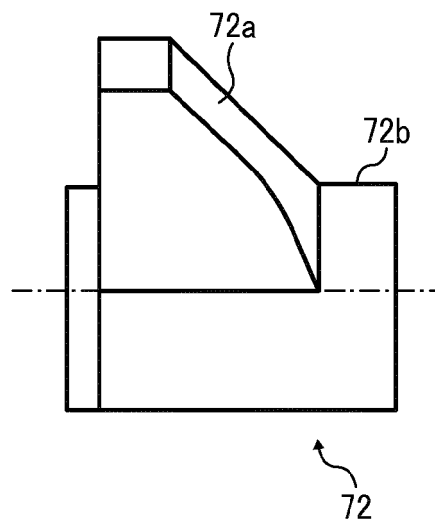


FIG. 8

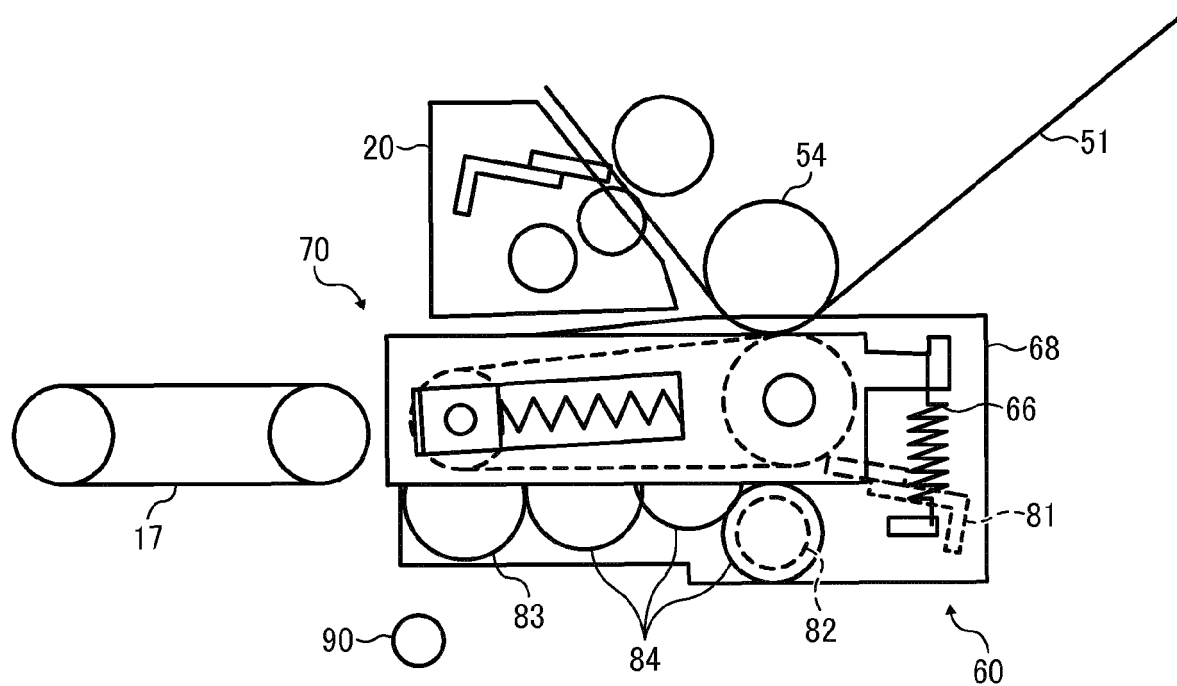


FIG. 9

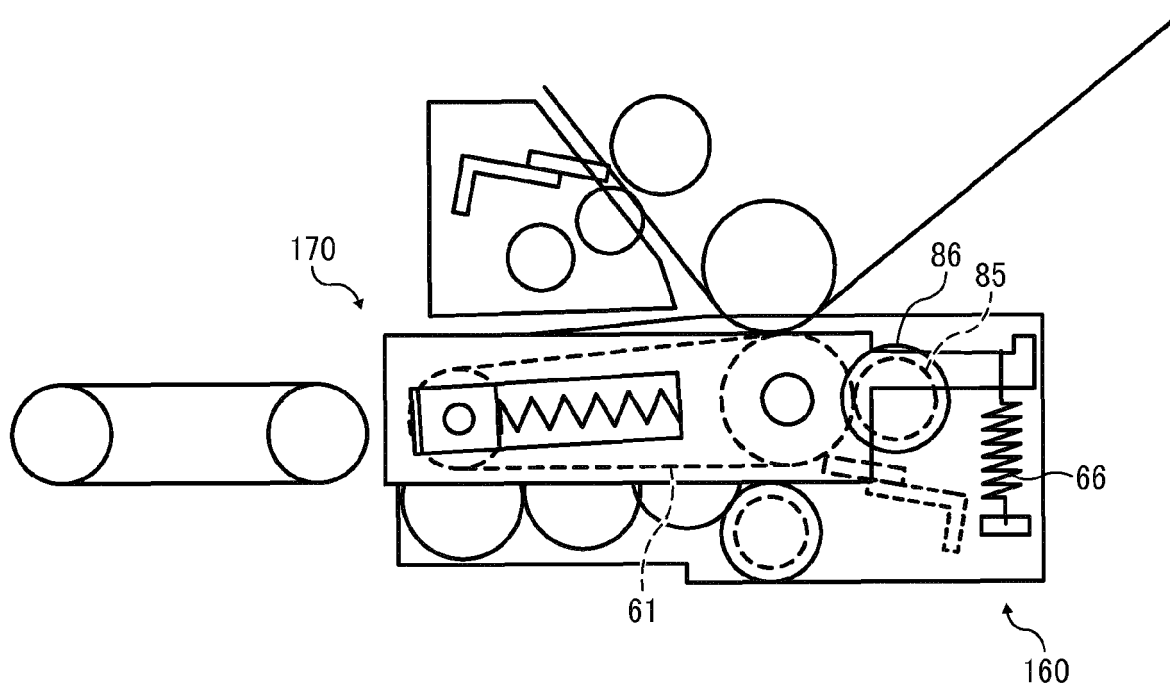


FIG. 10

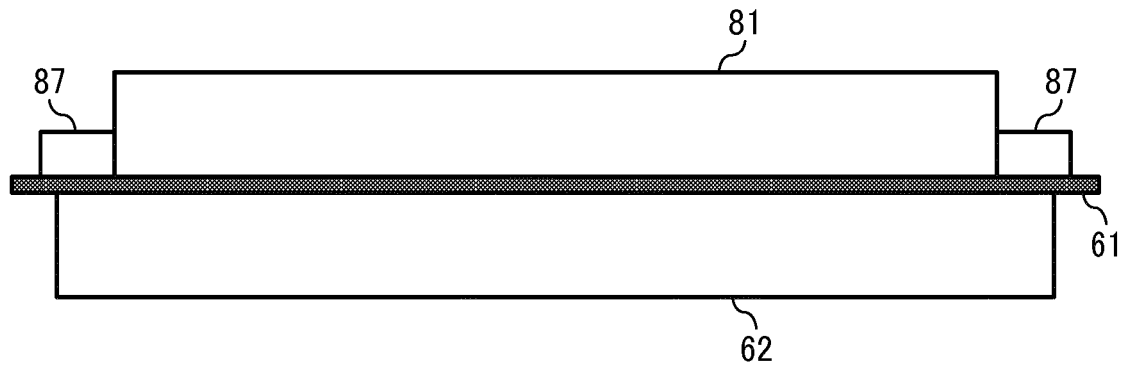
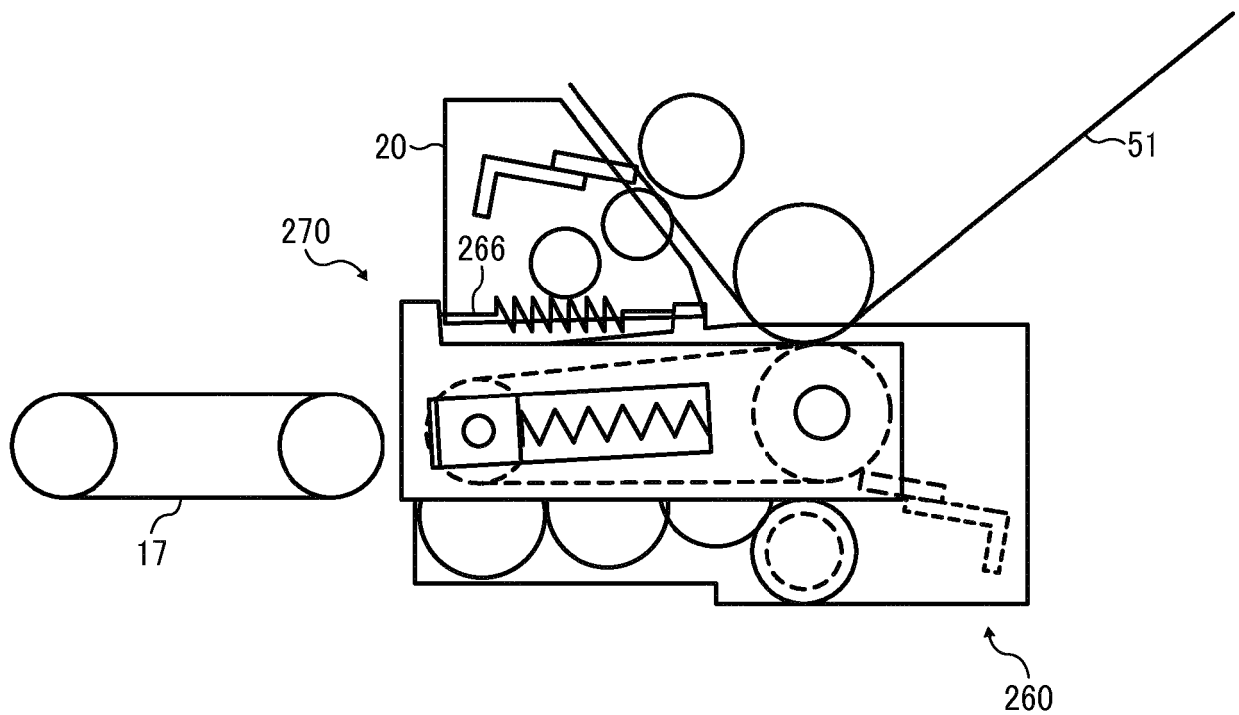


FIG. 11





EUROPEAN SEARCH REPORT

 Application Number
 EP 16 16 5381

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A	* figures 4-6 *	3,4,6	
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	* figures 1, 4, 8, 9 *		
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Place of search		Date of completion of the search	Examiner
Munich		18 August 2016	Guidet, Johanna
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