

(19)



(11)

EP 3 139 217 B1

(12)

EUROPEAN PATENT SPECIFICATION

(45) Date of publication and mention
of the grant of the patent:
21.10.2020 Bulletin 2020/43

(51) Int Cl.:
G03G 15/16 (2006.01) G03G 15/01 (2006.01)

(21) Application number: **16174559.1**

(22) Date of filing: **15.06.2016**

(54) IMAGE FORMING APPARATUS AND IMAGE FORMING METHOD

BILDERZEUGUNGSVORRICHTUNG UND BILDERZEUGUNGSVERFAHREN

APPAREIL DE FORMATION D'IMAGES ET PROCÉDÉ DE FORMATION D'IMAGES

(84) Designated Contracting States:
**AL AT BE BG CH CY CZ DE DK EE ES FI FR GB
GR HR HU IE IS IT LI LT LU LV MC MK MT NL NO
PL PT RO RS SE SI SK SM TR**

(30) Priority: **24.06.2015 JP 2015126906**
15.03.2016 JP 2016051421

(43) Date of publication of application:
08.03.2017 Bulletin 2017/10

(73) Proprietor: **Kyocera Document Solutions Inc.**
Osaka-shi, Osaka 540-8585 (JP)

(72) Inventor: **KIMURA, Ryosuke**
Osaka, 540-8585 (JP)

(74) Representative: **Becker & Kurig Partnerschaft**
Patentanwälte PartmbB
Bavariastrasse 7
80336 München (DE)

(56) References cited:
EP-A1- 2 397 912 US-A1- 2012 002 996
US-A1- 2012 099 907

EP 3 139 217 B1

Note: Within nine months of the publication of the mention of the grant of the European patent in the European Patent Bulletin, any person may give notice to the European Patent Office of opposition to that patent, in accordance with the Implementing Regulations. Notice of opposition shall not be deemed to have been filed until the opposition fee has been paid. (Art. 99(1) European Patent Convention).

Description

BACKGROUND

[0001] The present disclosure relates to an image forming apparatus and an image forming method, and in particular to an image forming apparatus having a secondary transfer manner and including an intermediate transfer body and an image forming method.

[0002] Conventionally, an image forming apparatus having a secondary transfer manner and including an intermediate transfer body is known.

[0003] For example, JP 2009-128481 A discloses an image forming apparatus having a secondary transfer manner and including a plurality of image carriers configured to carry a toner image, an intermediate transfer body configured to come into contact with a plurality of the image carriers, a plurality of primary transfer members configured to primarily transfer the toner image on a plurality of the image carriers to the intermediate transfer body, a secondary transfer member configured to secondarily transfer the toner image on the intermediate transfer body to a recording medium, and a guide member arranged at an upstream side of the secondary transfer member in a conveying direction of the recording medium and configured to guide the recording medium

SUMMARY

[0004] In accordance with an embodiment of the present disclosure, an image forming apparatus includes a plurality of image carriers, an intermediate transfer body, a plurality of primary transfer members, a secondary transfer member, a first guide member, and a controller. A plurality of the image carriers are configured to carry a toner image. The intermediate transfer body is configured to come into contact with a plurality of the image carriers. A plurality of the primary transfer members are configured to primarily transfer the toner image on a plurality of the image carriers to the intermediate transfer body. The secondary transfer member is configured to secondarily transfer the toner image on the intermediate transfer body to a recording medium. The first guide member is arranged at an upstream side of the secondary transfer member in a conveying direction of the recording medium and configured to guide the recording medium along the conveying direction. The controller is configured to control both of a primary transfer bias applied to a plurality of the primary transfer members when the toner image on a plurality of the image carriers is primarily transferred to the intermediate transfer body and a secondary transfer bias applied to the secondary transfer member when the toner image on the intermediate transfer body is secondarily transferred to the recording medium. A plurality of the primary transfer members include an upstream side primary transfer member and a downstream side primary transfer member arranged at a downstream side of the upstream side pri-

mary transfer member in a running direction of the intermediate transfer body. The controller makes an absolute value of the primary transfer bias applied to the downstream side primary transfer member larger than an absolute value of the primary transfer bias applied to the upstream side primary transfer member. The controller lowers an absolute value of the secondary transfer bias when an upstream a downstream end part of the recording medium in the conveying direction separates from the first guide member.

[0005] In accordance with an embodiment of the present disclosure, an image forming method includes a plurality of primary transfer steps, a secondary transfer step, and a guide step. In a plurality of the primary transfer steps, a toner image on a plurality of image carriers are primarily transferred to an intermediate transfer body. In the secondary transfer step, the toner image on the intermediate transfer body is secondarily transferred to a recording medium. In the guide step, the recording medium is guided by a first guide member along a conveying direction. The guide step is carried out so as to be finished during the secondary transfer step. A plurality of the primary transfer steps include an upstream side primary transfer step carried out by an upstream side primary transfer member, and a downstream side primary transfer step carried out after the upstream side primary transfer step and carried out by a downstream side primary transfer member arranged at a downstream side of the upstream side primary transfer member in a running direction of the intermediate transfer body. An absolute value of a transfer bias of the downstream side primary transfer step is larger than an absolute value of a transfer bias of the upstream side primary transfer step. An absolute value of a transfer bias of the secondary transfer step is lowered when an upstream end part of the recording medium in the conveying direction separates from the first guide member and the guide step is finished.

[0006] The above and other objects, features, and advantages of the present disclosure will become more apparent from the following description when taken in conjunction with the accompanying drawings in which a preferred embodiment of the present disclosure is shown by way of illustrative example.

BRIEF DESCRIPTION OF THE DRAWINGS

[0007]

FIG. 1 is a schematic view showing an outline of an MFP (multifunction peripheral) according to an embodiment of the present disclosure.

FIG. 2 is a sectional view showing a secondary transfer roller and its periphery, in the MFP according to the embodiment of the present disclosure.

FIG. 3 is a block diagram showing a control system of the MFP according to the embodiment of the

present disclosure.

FIG. 4 is a sectional view showing a state where a sheet passes through a fixing nip of a fixing device when an image is printed on a first face of the sheet, in the MFP according to the embodiment of the present disclosure.

FIG. 5 is a sectional view showing a state before the sheet enters a secondary transfer nip when the image is printed on a second face of the sheet, in the MFP according to the embodiment of the present disclosure.

FIG. 6 is a table showing a result of an experiment conducted to the first face of the sheet under a normal temperature and normal humidity environment.

FIG. 7 is a table showing a result of an experiment conducted to the second face of the sheet under the normal temperature and normal humidity environment.

FIG. 8 is a table showing a result of an experiment conducted to the first face of the sheet under a high temperature and high humidity environment.

FIG. 9 is a table showing a result of an experiment conducted to the second face of the sheet under the high temperature and high humidity environment.

FIG. 10 is a table showing a result of an experiment conducted to the first face of the sheet under a low temperature and low humidity environment.

FIG. 11 is a table showing a result of an experiment conducted to the second face of the sheet under the low temperature and low humidity environment.

DETAILED DESCRIPTION

[0008] Hereinafter, an MFP 1 (image forming apparatus) according to an embodiment of the present disclosure will be described with reference to the drawings. Arrows L, R, U and Lo optionally added to each drawing indicate a left side, a right side, an upper side and a lower side of the MFP 1, respectively.

[0009] Firstly, an outline of the configuration of the MFP 1 will be explained.

[0010] As shown in FIG. 1, the MFP 1 includes a box-formed MFP main body 2 (apparatus main body). In an upper end part of the MFP main body 2, an image reading device 3 to read an original image is arranged. In an upper part of the MFP main body 2, a sheet ejecting tray 4 is arranged below the image reading device 3. In the upper part of the MFP main body 2, four toner containers 5Y, 5C, 5M, 5K are housed below the sheet ejecting tray 4. Each toner container 5Y, 5C, 5M, 5K contains a toner

of yellow, cyan, magenta, and black, respectively.

[0011] In the roughly middle part of the MFP main body 2, four image forming parts 6Y, 6C, 6M, 6K are housed. Each image forming part 6Y, 6C, 6M, 6K corresponds to the toner of yellow, cyan, magenta, and black, respectively. Image forming parts 6Y, 6C, 6M, 6K include photosensitive drums 7Y, 7C, 7M, 7K (image carriers), respectively. Each image forming part 6Y, 6C, 6M, 6K is provided with a charger 8, a developing device 9, and a cleaning device 10 around each photosensitive drum 7Y, 7C, 7M, 7K.

[0012] In a roughly middle part of the MFP main body 2, an intermediate transfer belt 11 (intermediate transfer body) is arranged above the four image forming parts 6Y, 6C, 6M, 6K. The intermediate transfer belt 11 comes into contact with each photosensitive drum 7Y, 7C, 7M, 7K. The intermediate transfer belt 11 is configured to be runnable in a predetermined direction (see arrows X in FIG.1).

[0013] Inside the intermediate transfer belt 11, four primary transfer rollers 12Y, 12C, 12M, 12K (primary transfer members) are arranged along a lower face of the intermediate transfer belt 11. Each primary transfer roller 12Y, 12C, 12M, 12K corresponds to the toner of yellow, cyan, magenta, and black, respectively. Each primary transfer roller 12Y, 12C, 12M, 12K faces each photosensitive drum 7Y, 7C, 7M, 7K via the intermediate transfer belt 11 and sandwiches the intermediate transfer belt 11 with each photosensitive drum 7Y, 7C, 7M, 7K. According to this, a primary transfer nip N1 is formed between each photosensitive drum 7Y, 7C, 7M, 7K and the intermediate transfer belt 11, respectively. The primary transfer roller 12K (downstream side primary transfer member) is arranged at a downstream side of each primary transfer roller 12Y, 12C, 12M (each upstream side primary transfer member) in a running direction of the intermediate transfer belt 11 (see the arrows X in FIG.1).

[0014] At a left end side of the intermediate transfer belt 11, a cleaning unit 13 is arranged. The cleaning unit 13 includes a cleaning brush 14 configured to come into contact with a surface of the intermediate transfer belt 11, a collecting roller 15 configured to come into contact with the cleaning brush 14, and a cleaning blade 16 configured to come into contact with the collecting roller 15.

[0015] In a lower part of the MFP main body 2, a laser scanning device 17 is housed below the four image forming parts 6Y, 6C, 6M, 6K. In a lower end part of the MFP main body 2, a sheet feeding tray 18 is housed below the laser scanning device 17. In the sheet feeding tray 18, a sheet S (recording medium) is accommodated.

[0016] At a right side part of the MFP main body 2, a conveying path 19 for the sheet S is arranged. At a lower end part (upstream end part) of the conveying path 19, a sheet feeding part 20 is arranged. At an intermediate stream part of the conveying path 19, a secondary transfer roller 21 (secondary transfer member) is arranged. Between the secondary transfer roller 21 and the intermediate transfer belt 11, a secondary transfer nip N2 is

formed. At an upper part (downstream part) of the conveying path 19, a fixing device 22 is arranged. The fixing device 22 includes a fixing belt 23 (fixing member) and a pressuring roller 24 (pressuring member). Between the fixing belt 23 and the pressuring roller 24, a fixing nip N is formed. At an upper end part (a downstream end part) of the conveying path 19, a sheet ejecting unit 25 is arranged. At the right side of the conveying path 19, an inversion path 26 for duplex printing is arranged.

[0017] Next, the operation of the MFP 1 will be explained.

[0018] When an instruction to start printing is given to the MFP 1, firstly, a surface of each photosensitive drum 7Y, 7C, 7M, 7K is electrically charged by the charger 8 of each image forming part 6Y, 6C, 6M, 6K. Then, an electrostatic latent image is formed on the surface of each photosensitive drum 7Y, 7C, 7M, 7K by a laser light (refer to an arrow P in FIG. 1) from the laser scanning device 17. Then, the electrostatic latent image is developed by the developing device 9 of each image forming part 6Y, 6C, 6M, 6K by using the toner supplied from each toner container 5Y, 5C, 5M, 5K, so that a toner image is formed on each photosensitive drum 7Y, 7C, 7M, 7K. The toner image (color toner image) formed on each photosensitive drum 7Y, 7C, 7M is primarily transferred to the intermediate transfer belt 11 by each primary transfer roller 12Y, 12C, 12M, respectively (these are "upstream side primary transfer steps"). The toner image (black toner image) formed on the photosensitive drum 7K is primarily transferred to the intermediate transfer belt 11 by the primary transfer roller 12K (this is a "downstream side primary transfer step"). The downstream side primary transfer step is carried out after each upstream side primary transfer step. According to this, a full-color toner image is formed on the intermediate transfer belt 11. Incidentally, the toner remained on each photosensitive drum 7Y, 7C, 7M, 7K is removed by the cleaning device 10 of each image forming part 6Y, 6C, 6M, 6K.

[0019] On the other hand, the sheet S picked from the sheet feeding tray 18 by the sheet feeding part 20 is conveyed to a downstream side of the conveying path 19 and enters the secondary transfer nip N2. In the secondary transfer nip N2, the full-color toner image formed on the intermediate transfer belt 11 is secondarily transferred to the sheet S by the secondary transfer roller 21 (This is a "secondary transfer step"). Incidentally, the toner remained on the intermediate transfer belt 11 is removed by the cleaning unit 13. Concretely, the toner remained on the intermediate transfer belt 11 is removed by the cleaning brush 14, collected from the cleaning brush 14 by the collecting roller 15, and scraped from the collecting roller 15 by the cleaning blade 16.

[0020] The sheet S to which the toner image is secondarily transferred is further conveyed to the downstream side of the conveying path 19 and enters the fixing device 22. In the fixing nip N of the fixing device 22, the toner image is fixed on the sheet S. The sheet S on which the toner image is fixed is ejected on the sheet ejecting

tray 4 by the sheet ejecting unit 25.

[0021] Next, the secondary transfer roller 21 and its periphery will be explained in detail. Incidentally, an arrow Z in FIG. 2 indicates a conveying direction of the sheet S.

[0022] As shown in FIG. 2, the secondary transfer roller 21 faces a driving roller 30 via the intermediate transfer belt 11. Around the driving roller 30, a right end part of the intermediate transfer belt 11 is wound.

[0023] At a lower left side of the secondary transfer roller 21 (an upstream side in the conveying direction of the sheet S), first and second guide members 31 and 32 are arranged. The first and second guide members 31 and 32 face each other via the conveying path 19. The first guide member 31 is arranged at a left side (a side of the intermediate transfer belt 11) of the conveying path 19. On a right face (inner face) of the first guide member 31, a first guide face 33 is formed. The first guide face 33 is curved in a shape of an arc toward a left side (a side remote from the conveying path 19). The second guide member 32 is arranged at a right side (a side of the secondary transfer roller 21) of the conveying path 19. On a left face (inner face) of the second guide member 32, a second guide face 34 is formed. The second guide face 34 is curved in a shape of an arc toward the left side (a side approaching the conveying path 19). A curvature of the arc formed by the second guide face 34 is larger than a curvature of the arc formed by the first guide face 33.

[0024] At a lower side (an upstream side in the conveying direction of the sheet S) of the first and second guide members 31 and 32, a sheet sensor 35 is arranged. The sheet sensor 35 is composed of an optical sensor, for example, and has a function of detecting the sheet S.

[0025] Next, a control system of the MFP 1 will be explained.

[0026] As shown in FIG. 3, the MFP 1 includes a controller 40. The controller 40 is connected to a storage part 41, and the controller 40 is configured to control each part of the MFP 1 based on a control program or control data stored in the storage part 41.

[0027] The controller 40 is connected to a driving source 42 composed of a motor or the like, and the driving source 42 is connected to the driving roller 30. When the driving source 42 rotates the driving roller 30 based on a signal from the controller 40, the intermediate transfer belt 11 whose right end part is wound around the driving roller 30 runs.

[0028] The controller 40 is connected to the sheet sensor 35 and a detecting result is outputted to the controller 40 when the sheet sensor 35 detects the sheet S.

[0029] The controller 40 is connected to primary transfer bias applying parts 43Y, 43C, 43M, 43K, and each primary transfer bias applying part 43Y, 43C, 43M, 43K is connected to each primary transfer roller 12Y, 12C, 12M, 12K, respectively. When the toner image on each photosensitive drum 7Y, 7C, 7M, 7K is primarily transferred to the intermediate transfer belt 11, the controller 40 controls a primary transfer bias applied from each

primary transfer bias applying part 43Y, 43C, 43M, 43K to each primary transfer roller 12Y, 12C, 12M, 12K.

[0030] The controller 40 is connected to a secondary transfer bias applying part 44, and the secondary transfer bias applying part 44 is connected to the secondary transfer roller 21. When the toner image on the intermediate transfer belt 11 is secondarily transferred to the sheet S, the controller 40 controls a secondary transfer bias applied from the secondary transfer bias applying part 44 to the secondary transfer roller 21.

[0031] When the sheet S passes through the secondary transfer nip N2 in the MFP 1 applying the above-mentioned configuration, as shown in FIG. 2, the first and second guide members 31 and 32 guide the sheet S along the conveying direction (this is a "guide step"). At this time, a lower end part (an end part at an upstream a downstream side in the conveying direction) of the sheet S moves in a state of coming into contact with the first guide face 33 of the first guide member 31.

[0032] Incidentally, a start timing of the above-mentioned guide step is earlier than a start timing of the above-mentioned secondary transfer step. Further, an end timing of the above-mentioned guide step is later than the start timing of the secondary transfer step and is earlier than an end timing of the above-mentioned secondary transfer step. That is, the above-mentioned guide step is carried out so as to be finished during the above-mentioned secondary transfer step.

[0033] Meanwhile, when the lower end part of the sheet S passes through the first guide face 33 of the first guide member 31, the lower end part of the sheet S separates from the first guide face 33 of the first guide member 31 (see a dotted line in FIG. 2). According to this, a posture of the lower end part of the sheet S becomes unstable and the lower end part of the sheet S is significantly displaced in some cases. When such a phenomenon occurs, there is a concern that electric discharge occurs in a surrounding area of the secondary transfer roller 21, and a transfer failure (so-called "void"), which brings about loss of a part of an image, occurs. Such a transfer failure occurs in particular when the image is printed on a relatively stiff sheet S, such as a cardboard or an OHP sheet (Overhead Projector sheet).

[0034] Hence, the controller 40 lowers an absolute value of the secondary transfer bias when the lower end part of the sheet S separates from the first guide face 33 of the first guide member 31 (when the guide step is finished). In other words, the controller 40 makes the absolute value of the secondary transfer bias after the lower end part of the sheet S separates from the first guide face 33 of the first guide member 31 smaller than the absolute value of the secondary transfer bias when the lower end part of the sheet S comes into contact with the first guide face 33 of the first guide member 31. By performing such control, it is possible to prevent occurrence of the electric discharge in the surrounding area of the secondary transfer roller 21 when the guide step is finished, so that, even when the image is printed on the relatively stiff sheet S,

such as the cardboard or the OHP sheet, the transfer failure hardly occurs.

[0035] Incidentally, for example, the controller 40 calculates a time at which the lower end part of the sheet S separates from the first guide face 33 of the first guide member 31, by adding a time the lower end part of the sheet S takes to move from a detecting position of the sheet sensor 35 to an upper end part of the first guide face 33 of the first guide member 31 to a time at which the sheet sensor 35 detects the lower end part of the sheet S. Incidentally, the controller 40 may lower the absolute value of the secondary transfer bias simultaneously with the separation of the lower end part of the sheet S from the first guide face 33 of the first guide member 31, or may lower the absolute value of the secondary transfer bias immediately before or immediately after the lower end part of the sheet S separates from the first guide face 33 of the first guide member 31.

[0036] By the way, in the present embodiment, at the downstream side of each primary transfer roller 12Y, 12C, 12M (each color primary transfer roller) in the running direction of the intermediate transfer belt 11 (see the arrows X in FIG. 1), the primary transfer roller 12K (black primary transfer roller) is arranged. According to this relationship, when a color toner image is primarily transferred to the intermediate transfer belt 11 by each primary transfer roller 12Y, 12C, 12M, and then passes through the primary transfer roller 12K, a charging amount of the color toner image increases. Meanwhile, a black toner image is primarily transferred to the intermediate transfer belt 11 by the primary transfer roller 12K and then does not pass through another primary transfer roller, and therefore a charging amount of the black toner image does not increase. Hence, the charging amount of the color toner image is likely to be higher than the charging amount of the black toner image, and the charging amount of the toner image on the intermediate transfer belt 11 is likely to be uneven.

[0037] When the charging amount of the toner image on the intermediate transfer belt 11 becomes uneven as mentioned above, a range of the secondary transfer bias which causes the electric discharge becomes different by each color, and it becomes difficult to prevent the transfer failure due to the electric discharge during secondary transfer for all colors. Hence, it is necessary to make the charging amount of the toner image on the intermediate transfer belt 11 uniform.

[0038] However, by controlling the secondary transfer bias as described above, it is not possible to make the charging amount of the toner image on the intermediate transfer belt 11 uniform. Hence, by controlling the secondary transfer bias as described above, it is not possible to reliably prevent occurrence of the transfer failure for all of the color toner image, the black toner image, and a secondary color toner image (toner image obtained by overlaying color toner images).

[0039] Hence, the controller 40 makes an absolute value of the primary transfer bias applied to the primary

transfer roller 12K larger than an absolute value of the primary transfer bias applied to each primary transfer roller 12Y, 12C, 12M. By performing such control, it is possible to increase the charging amount of the black toner image, to prevent the charging amount of the color toner image from getting larger than the charging amount of the black toner image and to make the charging amount of the toner image on the intermediate transfer belt 11 uniform. Consequently, it is possible to reliably prevent the occurrence of the transfer failure for all of the color toner image, the black toner image and the secondary color toner image.

[0040] By the way, when the MFP 1 applying the above-mentioned configuration performs the duplex printing, the secondary transfer roller 21 secondarily transfers the toner image to a first face of the sheet S, and the toner image is fixed to the first face of the sheet S in the fixing nip N of the fixing device 22. Thus, the image is printed on the first face of the sheet S. Next, the sheet S is conveyed to the inversion path 26 to invert the sheet S having the first face and a second face. Further, the secondary transfer roller 21 secondarily transfers the toner image to the second face (a face at a side opposite to the first face) of the sheet S, the toner image is fixed to the second face of the sheet S in the fixing nip N of the fixing device 22. Thus, the image is printed on the second face of the sheet S, and the duplex printing is finished.

[0041] When the image is printed on the first face of the sheet as mentioned above, and when the sheet passes through the fixing nip N of the fixing device 22, as shown in FIG. 4, the sheet S is curled leftward (a side of the fixing belt 23). When the sheet S curved leftward in this way is inverted in the inversion path 26, as shown in FIG. 5, the sheet S is curled rightward. According to this relationship, it is more likely that the lower end part of the sheet S is significantly displaced when the lower end part of the sheet S separates from the first guide face 33 of the first guide member 31, and the transfer failure is more likely to occur in a case where the image is printed on the second face of the sheet than in a case where the image is printed on the first face of the sheet S.

[0042] Hence, the controller 40 makes a separating absolute value (an absolute value of the secondary transfer bias after the lower end part of the sheet S separates from the first guide face 33 of the first guide member 31) smaller and makes a downstream side absolute value (an absolute value of the primary transfer bias applied to the primary transfer roller 12K) smaller in the case where the image is printed on the second face of the sheet S than in the case where the image is printed on the first face of the sheet S. By performing such control, it is possible to reliably prevent the occurrence of the transfer failure both in the case where the image is printed on the first face of the sheet S and in the case where the image is printed on the second face of the sheet S.

[0043] Further, values of the primary transfer bias and the secondary transfer bias to be needed are different in

a case where temperature and humidity inside the MFP 1 are relatively high and in a case where the temperature and the humidity inside the MFP 1 are relatively low. Hence, there is a concern that the transfer failure occurs if the values of the primary transfer bias and the secondary transfer bias are the same in the case where the temperature and the humidity inside the MFP 1 are relatively high and in the case where the temperature and the humidity inside the MFP 1 are relatively low.

[0044] Hence, the controller 40 increases the absolute values of the primary transfer bias and the secondary transfer bias according to an increase of the temperature and the humidity inside the MFP 1. By performing such control, it is possible to optimize the absolute values of the primary transfer bias and the secondary transfer bias according to the temperature and the humidity inside the MFP 1.

[0045] Further, in the present embodiment, the primary transfer rollers 12Y, 12C, 12M primarily transfer the color toner image to the intermediate transfer belt 11 and the primary transfer roller 12K primarily transfers the black toner image to the intermediate transfer belt 11. By applying such a configuration, it is possible to reliably transfer both of the color and black toner images to the sheet.

[0046] In the present embodiment, the absolute values of the primary transfer bias and the secondary transfer bias are increased according to the increase of the temperature and the humidity inside the MFP 1. In other embodiments, the absolute values of the primary transfer bias and the secondary transfer bias may be increased according to the increase of one of the temperature and the humidity inside the MFP 1.

[0047] In the present embodiment, the time at which the lower end part of the sheet S separates from the first guide face 33 of the first guide member 31 is calculated by adding the time the lower end part of the sheet S takes to move from the detecting position of the sheet sensor 35 to the upper end part of the first guide face 33 of the first guide member 31 to the time at which the sheet sensor 35 detects the lower end part of the sheet S. In other embodiments, the time at which the lower end part of the sheet S separates from the first guide face 33 of the first guide member 31 may be calculated by adding the time the lower end part of the sheet S takes to move from a starting position of conveyance to the upper end part of the first guide face 33 of the first guide member 31 to the time at which the conveyance of the sheet S is started. That is, the detecting result of the sheet sensor 35 may or may not be used when the time at which the lower end part of the sheet S separates from the first guide face 33 of the first guide member 31 is calculated.

[0048] Control of the secondary transfer bias (control of lowering the absolute value of the secondary transfer bias when the lower end part of the sheet S separates from the first guide face 33 of the first guide member 31) and control of the primary transfer bias (control of making the absolute value of the primary transfer bias applied to the primary transfer roller 12K larger than the absolute

value of the primary transfer bias applied to the primary transfer rollers 12Y, 12C, 12M) according to the present embodiment may be applied to the case where the image is printed on the sheet S of all sorts, or may be applied to only the case where the image is printed on the relatively stiff sheet, such as the cardboard or the OHP sheet. Especially, the control of the primary and secondary transfer biases according to the present embodiment may preferably be applied to a case where the image is printed on the cardboard which has a basis weight of not less than 200 g/m².

[0049] In the present embodiment, the configuration of the present disclosure is applied to the MFP 1. In other embodiments, the configuration of the present disclosure may be applied to an image forming apparatus other than the MFP 1, such as a copying machine, a scanner, or a facsimile.

<Experiment>

[0050] Experiments were conducted to prove an effect of the present disclosure by performing control according to examples of the present disclosure and control according to comparative examples.

(Experiment Conditions)

[0051] Under a normal temperature and normal humidity environment (an environment in which temperature is 23°C and humidity is 50%), a high temperature and high humidity environment (an environment in which temperature is 32.5°C and humidity is 80%) and a low temperature and low humidity environment (an environment in which temperature is 10°C and humidity is 10%), the experiments to transfer the toner image to the first face and the second face of the sheet S were conducted. For these experiments, a tandem-type MFP 1 including the intermediate transfer belt 11 was used. The configuration of the MFP 1 used for the experiments is the same as the configuration of the MFP 1 according to the present embodiment (see FIGS. 1 and 2), and therefore an explanation will be omitted. A linear velocity of the MFP 1 was 109 mm/sec. A cardboard of 200 g was used as the sheet S.

(Experiment Result)

[0052] FIGS. 6 to 11 show results of the experiments under each experiment condition.

[0053] In FIGS. 6 to 11, each number written below each letter of Y, C, M, and K in a field of "PRIMARY TRANSFER BIAS (-μA)" indicates the value of the primary transfer bias applied to each primary transfer roller 12Y, 12C, 12M, 12K. Each number written below "DURING CONTACT" in a field of "SECONDARY TRANSFER BIAS (-μA)" indicates a value of the secondary transfer bias when the lower end part of the sheet S comes into contact with the first guide face 33 of the first guide mem-

ber 31. Each number written below characters of "AFTER SEPARATION" in the field of "SECONDARY TRANSFER BIAS (-μA)" indicates a value of the secondary transfer bias after the lower end part of the sheet S separates from the first guide face 33 of the first guide member 31. ○ or × written below each letter of Y, C, M, K and Blue in a field of "TRANSFER RESULT" indicates a result, which is obtained by visually checking, as to whether or not the transfer failure of the toner image of yellow, cyan, magenta, black and blue occurred. Incidentally, a 100% solid toner image of primary colors of yellow, cyan, magenta and black was transferred to the sheet, and a 200% solid toner image of a secondary color of blue obtained by overlaying a 100% solid toner image of magenta and a 100% solid toner image of cyan was transferred to the sheet.

[0054] In FIGS. 6 to 11, comparative example 1 is an example where both of the control to lower the absolute value of the secondary transfer bias when the lower end part of the sheet S separates from the first guide face 33 of the first guide member 31 and the control to make the absolute value of the primary transfer bias applied to the primary transfer roller 12K larger than the absolute value of the primary transfer bias applied to each primary transfer roller 12Y, 12C, 12M were not performed. Comparative examples 2 and 3 are examples where the control to lower the absolute value of the secondary transfer bias when the lower end part of the sheet S separates from the first guide face 33 of the first guide member 31 was performed, but the control to make the absolute value of the primary transfer bias applied to the primary transfer roller 12K larger than the absolute value of the primary transfer bias applied to each primary transfer roller 12Y, 12C, 12M was not performed. The examples 1 and 2 are examples where both of the control to lower the absolute value of the secondary transfer bias when the lower end part of the sheet S separates from the first guide face 33 of the first guide member 31 and the control to make the absolute value of the primary transfer bias applied to the primary transfer roller 12K larger than the absolute value of the primary transfer bias applied to each primary transfer roller 12Y, 12C, 12M were performed. Incidentally, according to the examples 1 and 2, the secondary transfer bias was lowered when a lower part of the sheet S (a part which is 7 mm above the lower end part of the sheet S) passed through the secondary transfer nip N2, and the secondary transfer bias was switched to an inverse polarity when the lower end part of the sheet S passed through the secondary transfer nip N2.

[0055] As shown in FIGS. 6 to 11, under all experiment conditions, the transfer failure occurred in a part of colors or all of the colors with regard to comparative examples 1 to 3. This shows that it is not possible to sufficiently prevent the transfer failure by performing the control according to comparative examples 1 to 3. By contrast with this, under all experiment conditions, the transfer failure of the image of any color did not occur in the examples 1 and 2. This shows that, by performing the control ac-

according to the examples 1 and 2 of the present disclosure, it is possible to reliably prevent the transfer failure.

[0056] Further, as shown in FIGS. 6 and 7, it is possible to reliably prevent the transfer failure by making the absolute value of the secondary transfer bias after the lower end part of the sheet S separates from the first guide face 33 of the first guide member 31 smaller in the case where the image is printed on the second face of the sheet S than in the case where the image is printed on the first face of the sheet S.

[0057] Furthermore, as shown in FIGS. 6 and 7, it is possible to reliably prevent the transfer failure by making the absolute value of the primary transfer bias applied to the primary transfer roller 12K smaller in the case where the image is printed on the second face of the sheet S than in the case where the image is printed on the first face of the sheet S.

[0058] Still further, as shown in FIGS. 6 and 8, by increasing the absolute values of the primary transfer bias and the secondary transfer bias according to the increase of the temperature and the humidity inside the MFP 1, it is possible to reliably prevent the transfer failure.

[0059] As shown in FIG. 6, when the toner image is transferred to the first face of the sheet S under the normal temperature and normal humidity environment, the primary transfer bias applied to the primary transfer roller 12K is preferably 7 to 10 ($-\mu\text{A}$). As shown in FIG. 7, when the toner image is transferred to the second face of the sheet S under the normal temperature and normal humidity environment, the primary transfer bias applied to the primary transfer roller 12K is preferably 6 to 9 ($-\mu\text{A}$). As shown in FIGS. 8 and 9, when the toner image is transferred to one of the first and second faces of the sheet S under the high temperature and high humidity environment, the primary transfer bias applied to the primary transfer roller 12K is preferably 10 to 14 ($-\mu\text{A}$). As shown in FIGS. 10 and 11, when the toner image is transferred to one of the first and second faces of the sheet S under the low temperature and low humidity environment, the primary transfer bias applied to the primary transfer roller 12K is preferably 7 to 11 ($-\mu\text{A}$). When the primary transfer bias applied to the primary transfer roller 12K exceeds each of the above-mentioned upper limit values, there is a concern that the color toner image is excessively charged and the transfer failure occurs during the secondary transfer of the color toner image. Meanwhile, when the primary transfer bias applied to the primary transfer roller 12K is less than each of the above-mentioned lower limit values, there is a concern that the charging amount of one or both of color and black toner images becomes insufficient and the transfer failure occurs during the secondary transfer.

[0060] Further, as described above, the sheet S is more likely to be curled rightward and therefore the electric discharge is more likely to occur during the secondary transfer, in the case where the image is printed on the second face of the sheet S than in the case where the image is printed on the first face of the sheet S. Hence,

it is preferable to make a proportion of the secondary transfer bias after the separation (the secondary transfer bias after the lower end part of the sheet S separates from the first guide face 33 of the first guide member 31) to the secondary transfer bias during contact (the secondary transfer bias when the lower end part of the sheet S comes into contact with the first guide face 33 of the first guide member 31) smaller in the case where the toner image is transferred to the second face of the sheet S than in the case where the toner image is transferred to the first face of the sheet S.

[0061] For example, under the normal temperature and normal humidity environment, when the toner image is transferred to the first face of the sheet S, the proportion of the secondary transfer bias after the separation to the secondary transfer bias during the contact is 55 to 70%, and, when the toner image is transferred to the second face of the sheet S, the proportion of the secondary transfer bias after the separation to the secondary transfer bias during the contact is 30 to 50%. Further, for example, under the high temperature and high humidity environment or the low temperature and low humidity environment, when the toner image is transferred to the first face of the sheet S, the proportion of the secondary transfer bias after the separation to the secondary transfer bias during the contact is 80 to 90%, and, when the toner image is transferred to the second face of the sheet S, the proportion of the secondary transfer bias after the separation to the secondary transfer bias during the contact is 60 to 70%.

[0062] Incidentally, in the above-mentioned numerical example, the controller 40 makes the proportion (80 to 90%) of the secondary transfer bias after the separation to the secondary transfer bias during the contact in the case where the toner image is transferred to the first face of the sheet S under the high temperature and high humidity environment or the low temperature and low humidity environment larger than the proportion (55 to 70%) of the secondary transfer bias after the separation to the secondary transfer bias during the contact in the case where the toner image is transferred to the first face of the sheet S under the normal temperature and normal humidity environment. Similarly, the controller 40 makes the proportion (60 to 70%) of the secondary transfer bias after the separation to the secondary transfer bias during the contact in the case where the toner image is transferred to the second face of the sheet S in the high temperature and high humidity environment or the low temperature and low humidity environment larger than the proportion (30 to 50%) of the secondary transfer bias after the separation to the secondary transfer bias during the contact in the case where the toner image is transferred to the second face of the sheet S in the normal temperature and normal humidity environment. That is, the controller 40 makes a secondary transfer proportion (a proportion of the secondary transfer bias after the lower end part of the sheet S separates from the first guide face 33 of the first guide member 31 to the secondary

transfer bias when the lower end part of the sheet S comes into contact with the first guide face 33 of the first guide member 31) larger in the case where the image is printed on the sheet S in the high temperature and high humidity environment or the low temperature and low humidity environment than in the case where the image is printed on the sheet S in the normal temperature and normal humidity environment.

Claims

1. An image forming apparatus (1) comprising:

a plurality of image carriers (7Y, 7C, 7M, 7K) configured to carry a toner image;
 an intermediate transfer body (11) configured to come into contact with a plurality of the image carriers (7Y, 7C, 7M, 7K);
 a plurality of primary transfer members (12Y, 12C, 12M, 12K) configured to primarily transfer the toner image on a plurality of the image carriers (7Y, 7C, 7M, 7K) to the intermediate transfer body (11);
 a secondary transfer member (21) configured to secondarily transfer the toner image on the intermediate transfer body (11) to a recording medium (S); and
 a first guide member (31) arranged at an upstream side of the secondary transfer member (21) in a conveying direction of the recording medium (S) and configured to guide the recording medium (S) along the conveying direction,
characterized in that
 the image forming apparatus (1) further comprises a controller (40) configured to control both of a primary transfer bias applied to a plurality of the primary transfer members (12Y, 12C, 12M, 12K) when the toner image on a plurality of the image carriers (7Y, 7C, 7M, 7K) is primarily transferred to the intermediate transfer body (11) and a secondary transfer bias applied to the secondary transfer member (21) when the toner image on the intermediate transfer body (11) is secondarily transferred to the recording medium (S),
 wherein a plurality of the primary transfer members (12Y, 12C, 12M, 12K) include:

an upstream side primary transfer member (12Y, 12C, 12M); and
 a downstream side primary transfer member (12K) arranged at a downstream side of the upstream side primary transfer member (12Y, 12C, 12M) in a running direction of the intermediate transfer body (11), and the controller (40) makes an absolute value of the primary transfer bias applied to the

downstream side primary transfer member (12K) larger than an absolute value of the primary transfer bias applied to the upstream side primary transfer member (12Y, 12C, 12M), and
 the controller (40) lowers an absolute value of the secondary transfer bias when an upstream end part of the recording medium (S) in the conveying direction separates from the first guide member (31).

2. The image forming apparatus (1) according to claim 1, further comprising an inversion path (26) configured to invert the recording medium (S) having a first face and a second face so as to print an image on the second face of the recording medium (S) after an image is printed on the first face of the recording medium (S),
 wherein the controller (40) makes a separating absolute value smaller in a case where the image is printed on the second face of the recording medium (S) than in a case where the image is printed on the first face of the recording medium (S), the separating absolute value being an absolute value of the secondary transfer bias after the upstream end part of the recording medium (S) in the conveying direction separates from the first guide member (31).
3. The image forming apparatus (1) according to claim 1 or 2, further comprising an inversion path (26) configured to invert the recording medium (S) having a first face and a second face so as to print an image on the second face of the recording medium (S) after an image is printed on the first face of the recording medium (S),
 wherein the controller (40) makes a downstream side absolute value smaller in a case where the image is printed on the second face of the recording medium (S) than in a case where the image is printed on the first face of the recording medium (S), the downstream side absolute value being an absolute value of the primary transfer bias applied to the downstream side primary transfer member (12K).
4. The image forming apparatus (1) according to any one of claims 1-3,
 wherein the controller (40) increases absolute values of the primary transfer bias and the secondary transfer bias according to an increase of at least one of temperature or humidity inside the image forming apparatus (1).
5. The image forming apparatus (1) according to any one of claims 1-4,
 wherein the upstream side primary transfer member (12Y, 12C, 12M) is configured to primarily transfer a color toner image to the intermediate transfer body (11), and

the downstream side primary transfer member (12K) is configured to primarily transfer a black toner image to the intermediate transfer body (11).

6. The image forming apparatus (1) according to any one of claims 1-5,
wherein the controller (40) makes a secondary transfer proportion larger in a case where an image is printed on the recording medium (S) under a high temperature and high humidity environment or a low temperature and low humidity environment than in a case where the image is printed on the recording medium (S) under a normal temperature and normal humidity environment, the secondary transfer proportion being a proportion of the secondary transfer bias after the upstream end part of the recording medium (S) in the conveying direction separates from the first guide member (31) to the secondary transfer bias when the upstream end part of the recording medium (S) in the conveying direction comes into contact with the first guide member (31). 5
7. The image forming apparatus (1) according to any one of claims 1-6,
wherein a first guide face (33) curved in a shape of an arc toward a side remote from a conveying path (19) of the recording medium (S) is arranged on an inner face of the first guide member (31), and the upstream end part of the recording medium (S) in the conveying direction moves in a state of coming into contact with the first guide face (33). 10
8. The image forming apparatus (1) according to claim 7, further comprising a second guide member (32) configured to face the first guide member (31) via the conveying path (19),
wherein a second guide face (34) curved in a shape of an arc toward a side approaching the conveying path (19) is arranged on an inner face of the second guide member (32). 15
9. The image forming apparatus (1) according to claim 8, wherein a curvature of the arc formed by the second guide face (34) is larger than a curvature of the arc formed by the first guide face (33). 20
10. An image forming method comprising:
a plurality of primary transfer steps of primarily transferring a toner image on a plurality of image carriers (7Y, 7C, 7M, 7K) to an intermediate transfer body (11);
a secondary transfer step of secondarily transferring the toner image on the intermediate transfer body (11) to a recording medium (S); and
a guide step of guiding the recording medium (S) by a first guide member (31) along a con- 25

veying direction and being carried out so as to be finished during the secondary transfer step, **characterized in that**
a plurality of the primary transfer steps include:

an upstream side primary transfer step carried out by an upstream side primary transfer member (12Y, 12C, 12M); and
a downstream side primary transfer step carried out after the upstream side primary transfer step and carried out by a downstream side primary transfer member (12K) arranged at a downstream side of the upstream side primary transfer member (12Y, 12C, 12M) in a running direction of the intermediate transfer body (11), and
an absolute value of a transfer bias of the downstream side primary transfer step is larger than an absolute value of a transfer bias of the upstream side primary transfer step, and
an absolute value of a transfer bias of the secondary transfer step is lowered when an upstream end part of the recording medium (S) in the conveying direction separates from the first guide member (31) and the guide step is finished.

Patentansprüche

1. Bilderzeugungsvorrichtung (1), umfassend:

eine Vielzahl Bildträger (7Y, 7C, 7M, 7K), die konfiguriert ist, ein Tonerbild zu tragen;
einen Zwischenübertragungskörper (11), der konfiguriert ist, mit einer Vielzahl der Bildträger (7Y, 7C, 7M, 7K) in Kontakt zu kommen;
eine Vielzahl primäre Übertragungselemente (12Y, 12C, 12M, 12K), die konfiguriert ist, primär das Tonerbild auf einer Vielzahl der Bildträger (7Y, 7C, 7M, 7K) auf den Zwischenübertragungskörper (11) zu übertragen;
ein sekundäres Übertragungselement (21), das konfiguriert ist, sekundär das Tonerbild auf dem Zwischenübertragungskörper (11) auf ein Aufzeichnungsmedium (S) zu übertragen; und
ein erstes Führungselement (31), das an einer stromaufwärtigen Seite des sekundären Übertragungselements (21) in einer Förderrichtung des Aufzeichnungsmediums (S) angeordnet ist, und konfiguriert ist, das Aufzeichnungsmedium (S) entlang der Förderrichtung zu führen;
gekennzeichnet dadurch, dass
die Bilderzeugungsvorrichtung (1) ferner eine Steuerung (40) umfasst, die konfiguriert ist, zu steuern sowohl eine primäre Übertragungsvorrichtung, die an eine Vielzahl primärer Über-

tragungselemente (12Y, 12C, 12M, 12K) angelegt ist, wenn das Tonerbild auf einer Vielzahl der Bildträger (7Y, 7C, 7M, 7K) primär auf den Zwischenübertragungskörper (11) übertragen wird, als auch eine sekundäre Übertragungsvorspannung, die an das sekundäre Übertragungselement (21) angelegt ist, wenn das Tonerbild auf dem Zwischenübertragungskörper (11) sekundär auf das Aufzeichnungsmedium (S) übertragen wird, wobei eine Vielzahl der primären Übertragungselemente (12Y, 12C, 12M, 12K) einschließt:

ein stromaufwärtiges primäres Übertragungselement (12Y, 12C, 12M); und
 ein stromabwärtiges primäres Übertragungselement (12K), das an einer stromabwärtigen Seite des stromaufwärtigen primären Übertragungselements (12Y, 12C, 12M) in einer Laufrichtung des Zwischenübertragungskörpers (11) angeordnet ist, und
 die Steuerung (40) einen Absolutwert der primären Übertragungsvorspannung erstellt, der an das stromabwärtige primäre Übertragungselement (12K) angelegt wird, der größer ist als ein Absolutwert der primären Übertragungsvorspannung, die an das stromaufwärtige primäre Übertragungselement (12Y, 12C, 12M) angelegt wird, und
 die Steuerung (40) einen Absolutwert der sekundären Übertragungsvorspannung senkt, wenn sich ein stromaufwärtiger Endteil des Aufzeichnungsmediums (S) in der Förderrichtung von dem ersten Führungselement (31) trennt.

2. Bilderzeugungsvorrichtung (1) nach Anspruch 1, ferner umfassend einen Inversionspfad (26), der konfiguriert ist, das Aufzeichnungsmedium (S) mit einer ersten Fläche und einer zweiten Fläche zu invertieren, um ein Bild auf die zweite Fläche des Aufzeichnungsmediums (S) zu drucken, nachdem ein Bild auf die erste Fläche des Aufzeichnungsmediums (S) gedruckt wurde, wobei die Steuerung (40) einen Trennungsabsolutwert kleiner macht in einem Fall, in dem das Bild auf die zweite Fläche des Aufzeichnungsmediums (S) gedruckt wird, als in einem Fall, in dem das Bild auf die erste Fläche des Aufzeichnungsmediums (S) gedruckt wird, wobei der trennende Absolutwert ein Absolutwert der sekundären Übertragungsvorspannung ist, nachdem sich der stromabwärtige Endteil des Aufzeichnungsmediums (S) in der Förderrichtung von dem ersten Führungselement (31) trennt.
3. Bilderzeugungsvorrichtung (1) nach Anspruch 1 oder 2, ferner umfassend einen Inversionspfad (26),

der konfiguriert ist, das Aufzeichnungsmedium (S) mit einer ersten Fläche und einer zweiten Fläche zu invertieren, um ein Bild auf die zweite Fläche des Aufzeichnungsmediums (S) zu drucken, nachdem ein Bild auf die erste Fläche des Aufzeichnungsmediums (S) gedruckt wurde, wobei die Steuerung (40) einen stromabwärtigen Absolutwert kleiner macht in einem Fall, in dem das Bild auf die zweite Fläche des Aufzeichnungsmediums (S) gedruckt wird, als in einem Fall, in dem das Bild auf die erste Fläche des Aufzeichnungsmediums (S) gedruckt wird, wobei der stromabwärtige Absolutwert ein Absolutwert der primären Übertragungsvorspannung ist, die an das stromabwärtige primäre Übertragungselement (12K) angelegt wird.

4. Bilderzeugungsvorrichtung (1) nach einem der Ansprüche 1-3, wobei die Steuerung (40) Absolutwerte der primären Übertragungsvorspannung und der sekundären Übertragungsvorspannung gemäß einer Erhöhung von wenigstens einem von Temperatur oder Feuchtigkeit innerhalb der Bilderzeugungsvorrichtung (1) erhöht.
5. Bilderzeugungsvorrichtung (1) nach einem der Ansprüche 1-4, wobei das stromaufwärtige primäre Übertragungselement (12Y, 12C, 12M) konfiguriert ist, primär ein Farbtonerbild auf den Zwischenübertragungskörper (11) zu übertragen, und das stromabwärtige primäre Übertragungselement (12K) konfiguriert ist, primär ein schwarzes Tonerbild auf den Zwischenübertragungskörper (11) zu übertragen.
6. Bilderzeugungsvorrichtung (1) nach einem der Ansprüche 1-5, wobei die Steuerung (40) ein sekundäres Übertragungsverhältnis größer macht in einem Fall, in dem ein Bild bei einer hohen Temperatur und hohem Feuchtigkeitsmilieu oder einer niedrigen Temperatur und niedrigem Feuchtigkeitsmilieu auf das Aufzeichnungsmedium (S) gedruckt wird, als in einem Fall, in dem das Bild bei einer normalen Temperatur und normalem Feuchtigkeitsmilieu auf das Aufzeichnungsmedium (S) gedruckt wird, wobei das sekundäre Übertragungsverhältnis ein Verhältnis der sekundären Übertragungsvorspannung, nachdem sich der stromaufwärtige Endteil des Aufzeichnungsmediums (S) in der Förderrichtung von dem ersten Führungselement (31) trennt, zu der sekundären Übertragungsvorspannung ist, wenn der stromaufwärtige Endteil des Aufzeichnungsmediums (S) in der Förderrichtung mit dem ersten Führungselement (31) in Kontakt kommt.
7. Bilderzeugungsvorrichtung (1) nach einem der An-

sprüche 1-6,

wobei eine erste Führungsfläche (33), die in einer Form eines Bogens in Richtung einer Seite, die von einem Förderweg (19) des Aufzeichnungsmediums (S) entfernt ist, auf einer inneren Fläche des ersten Führungselements (31) angeordnet ist, und sich der stromaufwärtige Endteil des Aufzeichnungsmediums (S) in der Förderrichtung bewegt in einem Zustand des in Kontakt kommens mit der ersten Führungsfläche (33).

8. Bilderzeugungsvorrichtung (1) nach Anspruch 7, ferner umfassend ein zweites Führungselement (32), das konfiguriert ist, dem ersten Führungselement (31) über den Förderweg (19) zugewandt zu sein, wobei eine zweite Führungsfläche (34), die in einer Form eines Bogens in Richtung einer Seite gekrümmt ist, die sich dem Förderweg (19) nähert, auf einer inneren Fläche des zweiten Führungselements (32) angeordnet ist.

9. Bilderzeugungsvorrichtung (1) nach Anspruch 8, wobei eine Krümmung des durch die zweite Führungsfläche (34) erzeugten Bogens größer ist als eine Krümmung des durch die erste Führungsfläche (33) erzeugten Bogens.

10. Bilderzeugungsverfahren, umfassend:

eine Vielzahl primärer Übertragungsschritte zum primären Übertragen eines Tonerbildes auf einer Vielzahl Bildträger (7Y, 7C, 7M, 7K) auf einen Zwischenübertragungskörper (11);

einen sekundären Übertragungsschritt zum sekundären Übertragen des Tonerbildes auf dem Zwischenübertragungskörper (11) auf ein Aufzeichnungsmedium (S); und

einen Führungsschritt zum Führen des Aufzeichnungsmediums (S) durch ein erstes Führungselement (31) entlang einer Förderrichtung und durchgeführt wird, um während des sekundären Übertragungsschrittes beendet zu werden,

gekennzeichnet dadurch, dass

eine Vielzahl der primären Übertragungsschritte einschließt:

einen stromaufwärtigen primären Übertragungsschritt, der durch ein stromaufwärtiges primäres Übertragungselement (12Y, 12C, 12M) durchgeführt wird; und

ein stromabwärtiger primärer Übertragungsschritt, der nach dem stromaufwärtigen primären Übertragungsschritt durchgeführt wird und durchgeführt wird durch ein stromabwärtiges primäres Übertragungselement (12K), das an einer stromabwärtigen Seite des stromaufwärtigen primären Über-

tragungselements (12Y, 12C, 12M) in einer Laufrichtung des Zwischenübertragungskörpers (11) angeordnet ist, und ein Absolutwert einer Übertragungsvorspannung des stromabwärtigen primären Übertragungsschritts größer ist als ein Absolutwert einer Übertragungsvorspannung des stromaufwärtigen primären Übertragungsschritts, und ein Absolutwert einer Übertragungsvorspannung des sekundären Übertragungsschritts verringert wird, wenn sich ein stromaufwärtiger Endteil des Aufzeichnungsmediums (S) in der Förderrichtung von dem ersten Führungselement (31) trennt und der Führungsschritt beendet ist.

Revendications

1. Un appareil (1) de formation d'images comprenant :

une pluralité de supports d'image (7Y, 7C, 7M, 7K) configurés pour porter une image de toner ;
un corps intermédiaire de transfert (11) configuré pour venir en contact avec une pluralité de supports d'image (7Y, 7C, 7M, 7K) ;

une pluralité d'organes de transfert primaires (12Y, 12C, 12M, 12K) configurés pour transférer de façon première, au corps intermédiaire de transfert (11), l'image de toner présente sur une pluralité de supports d'image (7Y, 7C, 7M, 7K) ;
un organe de transfert secondaire (21) configuré pour transférer de façon secondaire, à un support d'enregistrement (S), l'image de toner présente sur le corps intermédiaire de transfert (11) ; et

un premier organe de guidage (31) agencé sur un côté amont de l'organe de transfert secondaire (21) dans une direction de transport du support d'enregistrement (S) et configuré pour guider le support d'enregistrement (S) le long de la direction de transport,

caractérisé en ce que

l'appareil de formation d'image (1) comprend en outre un contrôleur (40) configuré pour contrôler à la fois une sollicitation de transfert primaire appliquée à une pluralité des organes de transfert primaires (12Y, 12C, 12M, 12K) lorsque l'image de toner présente sur une pluralité des supports d'image (7Y, 7C, 7M, 7K) est transférée de façon première au corps intermédiaire de transfert (11), et une sollicitation de transfert secondaire appliquée à l'organe de transfert secondaire (21) lorsque l'image de toner présente sur le corps intermédiaire de transfert (11) est transférée de façon secondaire au support d'enregistrement (S),

une pluralité des organes de transfert primaires (12Y, 12C, 12M, 12K) comprenant :

- un organe de transfert primaire (12Y, 12C, 12M) situé côté amont ; et
 - un organe de transfert primaire (12K) situé côté aval, agencé sur un côté aval de l'organe de transfert primaire (12Y, 12C, 12M) situé côté amont dans une direction de déplacement du corps intermédiaire de transfert (11), et
 - le contrôleur (40) établit une valeur absolue de la sollicitation de transfert primaire appliquée à l'organe de transfert primaire (12K) situé côté aval, qui est supérieure à une valeur absolue de la sollicitation de transfert primaire appliquée à l'organe de transfert primaire (12Y, 12C, 12M) situé côté amont, et
 - le contrôleur (40) abaisse une valeur absolue de la sollicitation de transfert secondaire lorsqu'une partie d'extrémité amont du support d'enregistrement (S) dans la direction de transport se sépare du premier organe de guidage (31).
2. L'appareil (1) de formation d'images selon la revendication 1, comprenant en outre un chemin d'inversion (26) configuré pour inverser le support d'enregistrement (S) ayant une première face et une deuxième face de manière à imprimer une image sur la deuxième face du support d'enregistrement (S) après l'impression d'une image sur la première face du support d'enregistrement (S), le contrôleur (40) rend une valeur absolue de séparation plus petite dans le cas où l'image est imprimée sur la deuxième face du support d'enregistrement (S) que dans le cas où l'image est imprimée sur la première face du support d'enregistrement (S), la valeur absolue de séparation étant une valeur absolue de la sollicitation de transfert secondaire après que la partie d'extrémité amont du support d'enregistrement (S) dans la direction de transport se sépare du premier organe de guidage (31).
3. L'appareil (1) de formation d'images selon la revendication 1 ou la revendication 2, comprenant en outre un chemin d'inversion (26) configuré pour inverser le support d'enregistrement (S) ayant une première face et une deuxième face de manière à imprimer une image sur la deuxième face du support d'enregistrement (S) après l'impression d'une image sur la première face du support d'enregistrement (S), le contrôleur (40) rend une valeur absolue côté aval plus petite dans le cas où l'image est imprimée sur la deuxième face du support d'enregistrement (S) que dans le cas où l'image est imprimée sur la première face du support d'enregistrement (S), la valeur

absolue côté aval étant une valeur absolue de la sollicitation de transfert primaire appliquée à l'organe de transfert primaire (12K) situé du côté aval.

- 4. L'appareil (1) de formation d'images selon l'une quelconque des revendications 1 à 3, dans lequel le contrôleur (40) augmente les valeurs absolues de la sollicitation de transfert primaire et de la sollicitation de transfert secondaire selon une augmentation d'au moins une parmi la température et l'humidité à l'intérieur de l'appareil (1) de formation d'images.
- 5. L'appareil (1) de formation d'images selon l'une quelconque des revendications 1 à 4, dans lequel l'organe de transfert primaire (12Y, 12C, 12M) situé côté amont est configuré pour transférer de façon première une image de toner couleur au corps intermédiaire de transfert (11), et l'organe de transfert primaire (12K) côté aval est configuré pour transférer de façon première, au corps intermédiaire de transfert (11), une image de toner noir.
- 6. L'appareil (1) de formation d'images selon l'une quelconque des revendications 1 à 5, dans lequel le contrôleur (40) rend une proportion de transfert secondaire plus grande dans le cas où une image est imprimée sur le support d'enregistrement (S) sous une température élevée et un environnement à humidité élevée ou un environnement à basse température et à faible humidité que dans le cas où l'image est imprimée sur le support d'enregistrement (S) dans un environnement à température et humidité normales, la proportion de transfert secondaire étant une proportion de la sollicitation de transfert secondaire après que la partie d'extrémité amont du support d'enregistrement (S) dans la direction de transport se sépare du premier organe de guidage (31) par rapport à la sollicitation de transfert secondaire lorsque la partie d'extrémité amont du support d'enregistrement (S) dans la direction de transport vient en contact avec le premier organe de guidage (31).
- 7. L'appareil (1) de formation d'images selon l'une quelconque des revendications 1 à 6, dans lequel une première face de guidage (33) incurvée selon une forme d'arc vers un côté éloigné d'un chemin de transport (19) du support d'enregistrement (S) est agencée sur une face intérieure du premier organe de guidage (31), et la partie d'extrémité amont du support d'enregistrement (S) dans la direction de transport se déplace dans un état de venue en contact avec la première face de guidage (33).
- 8. L'appareil (1) de formation d'images selon la reven-

dication 7, comprenant en outre un deuxième organe de guidage (32) configuré pour faire face au premier organe de guidage (31) via le chemin de transport (19),

une deuxième face de guidage (34) incurvée selon une forme d'arc vers un côté qui se rapproche du chemin de transport (19) étant agencée sur une face intérieure du deuxième organe de guidage (32). 5

9. L'appareil (1) de formation d'images selon la revendication 8, 10

dans lequel une courbure de l'arc formé par la deuxième face de guidage (34) est plus grande qu'une courbure de l'arc formé par la première face de guidage (33). 15

10. Un procédé de formation d'image comprenant :

une pluralité d'étapes de transfert primaires consistant à transférer de façon première, à un corps intermédiaire de transfert (11), une image de toner présente sur une pluralité de supports d'image (7Y, 7C, 7M, 7K) ; 20

une étape de transfert secondaire consistant à transférer de façon secondaire, à un support d'enregistrement (S), l'image de toner présente sur le corps intermédiaire de transfert (11) ; et 25

une étape de guidage consistant à guider le support d'enregistrement (S) par un premier organe de guidage (31) le long d'une direction de transport et qui est exécutée de manière à être terminée pendant l'étape de transfert secondaire, **caractérisé en ce que** 30

une pluralité d'étapes de transfert primaire comprend : 35

une étape de transfert primaire côté amont mise en œuvre par un organe de transfert primaire (12Y, 12C, 12M) situé côté amont ; et 40

une étape de transfert primaire côté aval mise en œuvre après l'étape de transfert primaire côté amont et mise en œuvre par un organe de transfert primaire (12K) situé du côté aval agencé sur un côté aval de l'organe de transfert primaire (12Y, 12C, 12M) situé côté amont selon une direction de fonctionnement du corps intermédiaire de transfert (11), et 45

une valeur absolue d'une sollicitation de transfert de l'étape de transfert primaire côté aval est supérieure à une valeur absolue d'une sollicitation de transfert de l'étape de transfert primaire côté amont, et 50

une valeur absolue d'une sollicitation de transfert de l'étape de transfert secondaire est abaissée lorsqu'une partie d'extrémité amont du support d'enregistrement (S) 55

dans la direction de transport se sépare du premier organe de guidage (31) et que l'étape de guidage est terminée.

FIG. 1

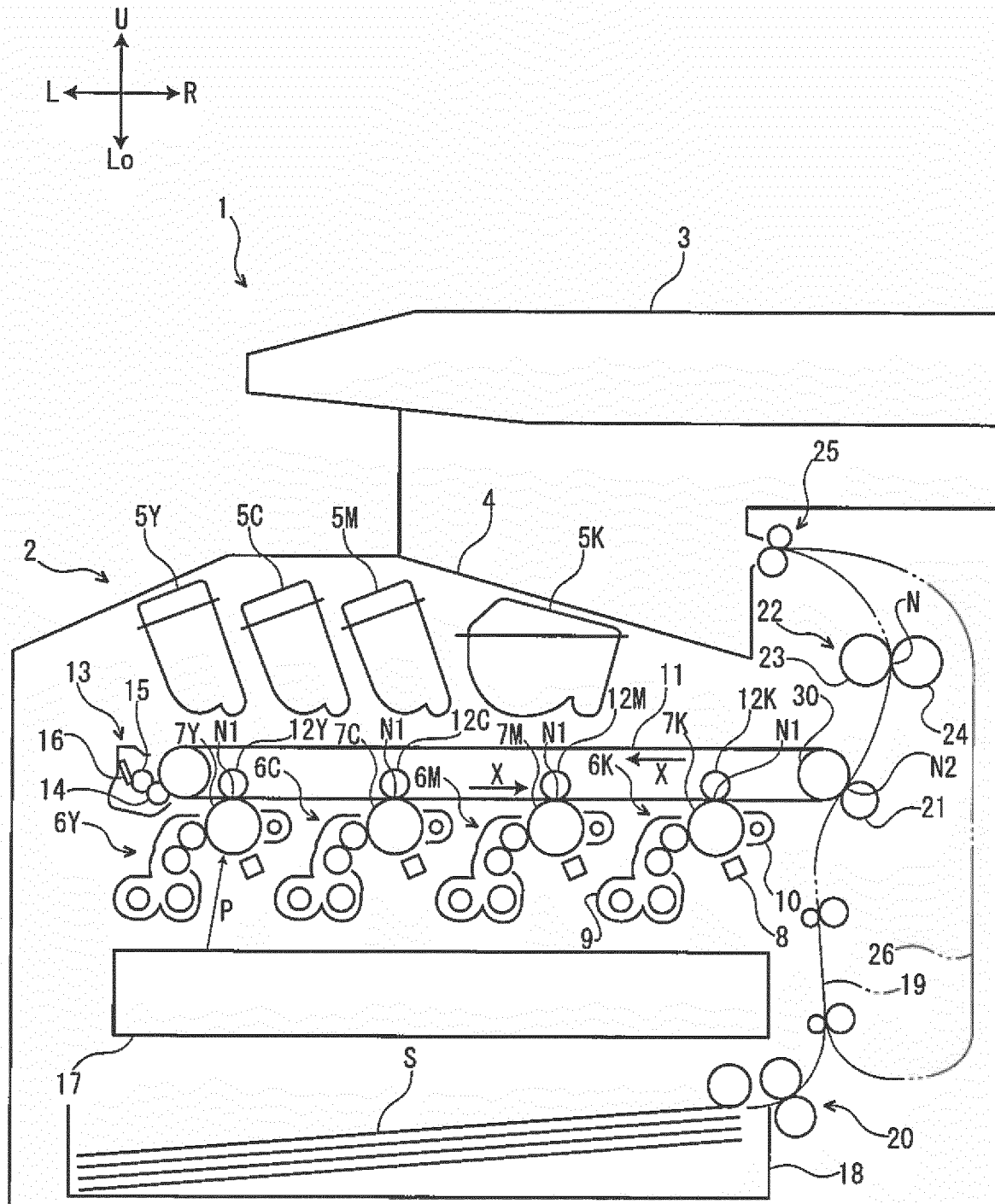


FIG. 2

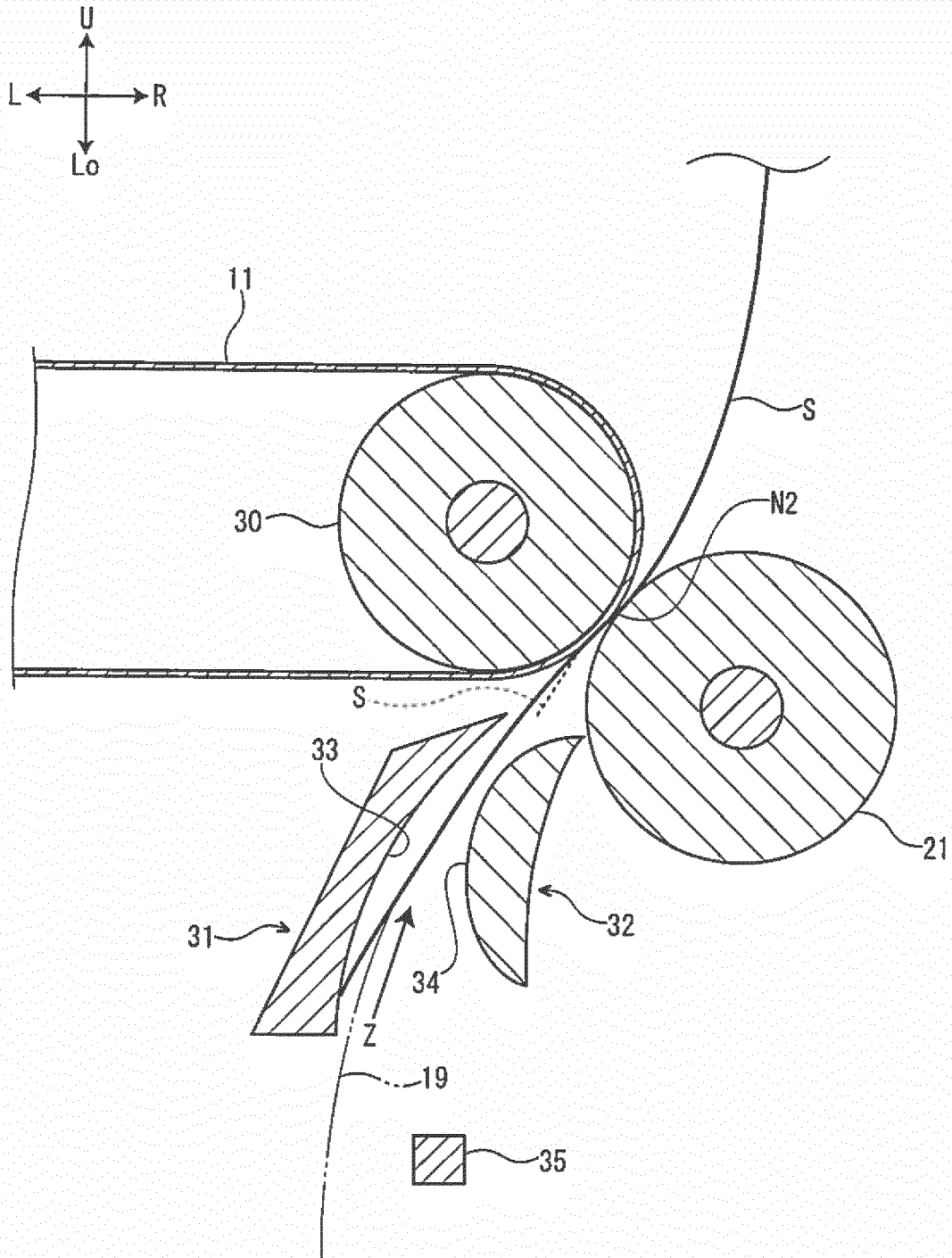


FIG. 3

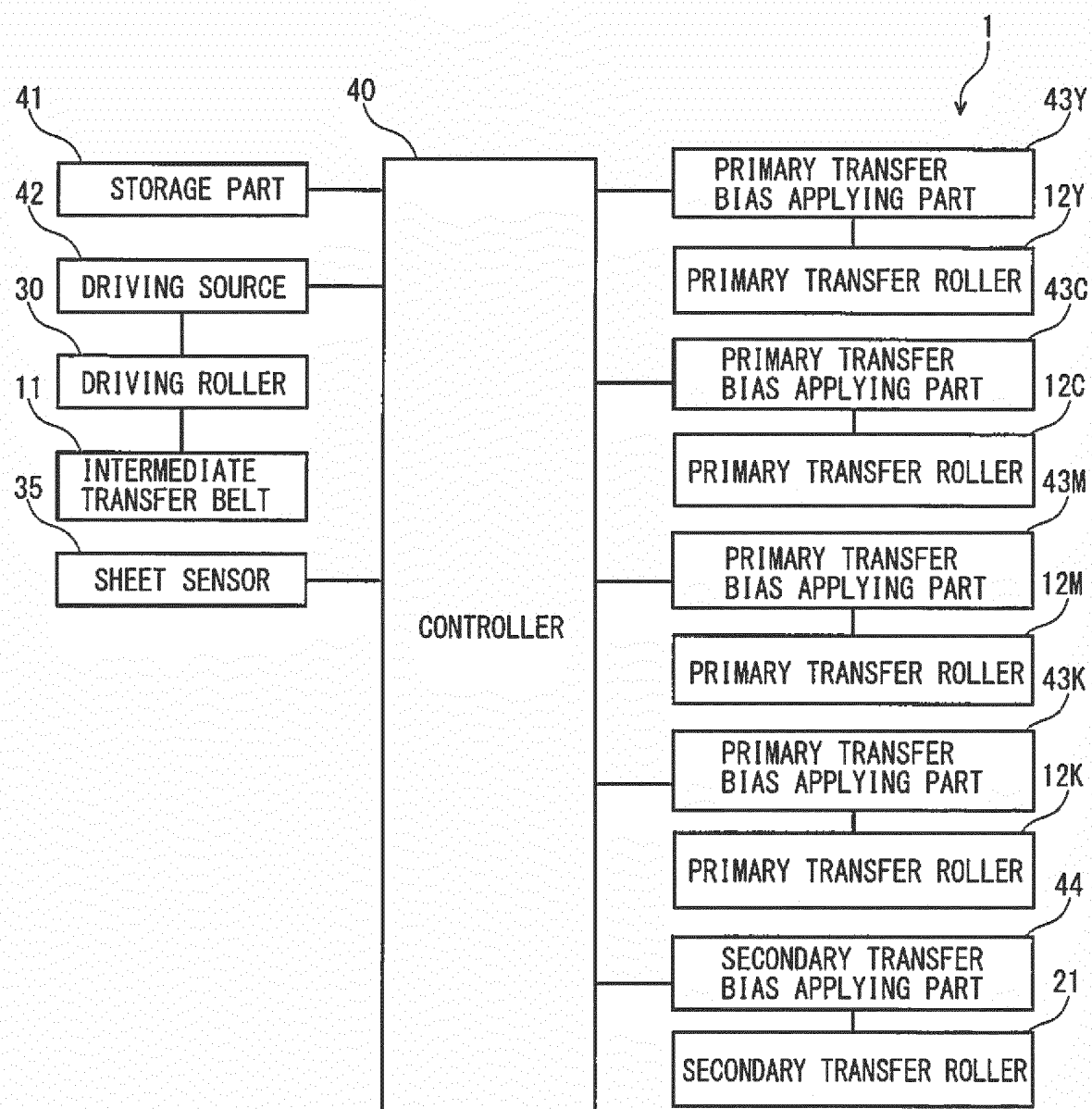


FIG. 4

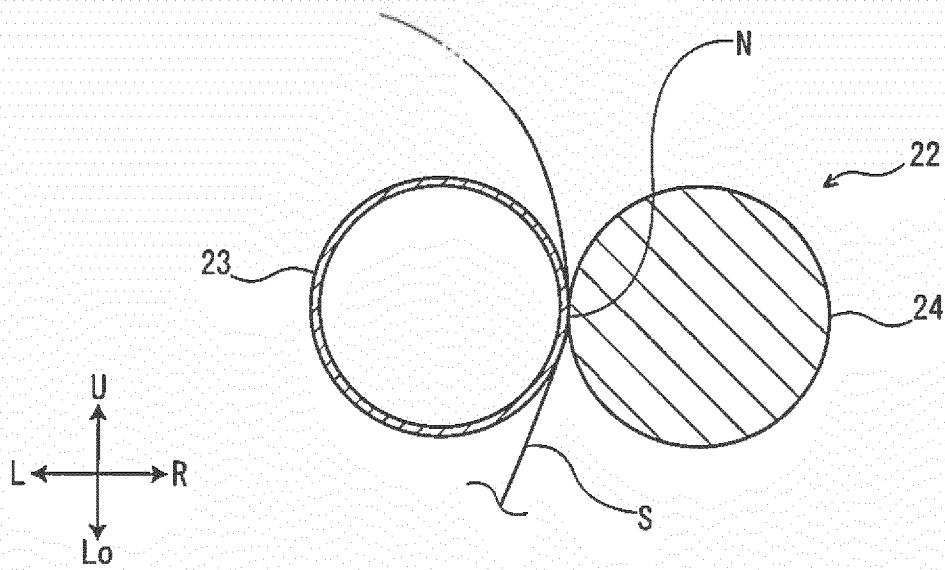


FIG. 5

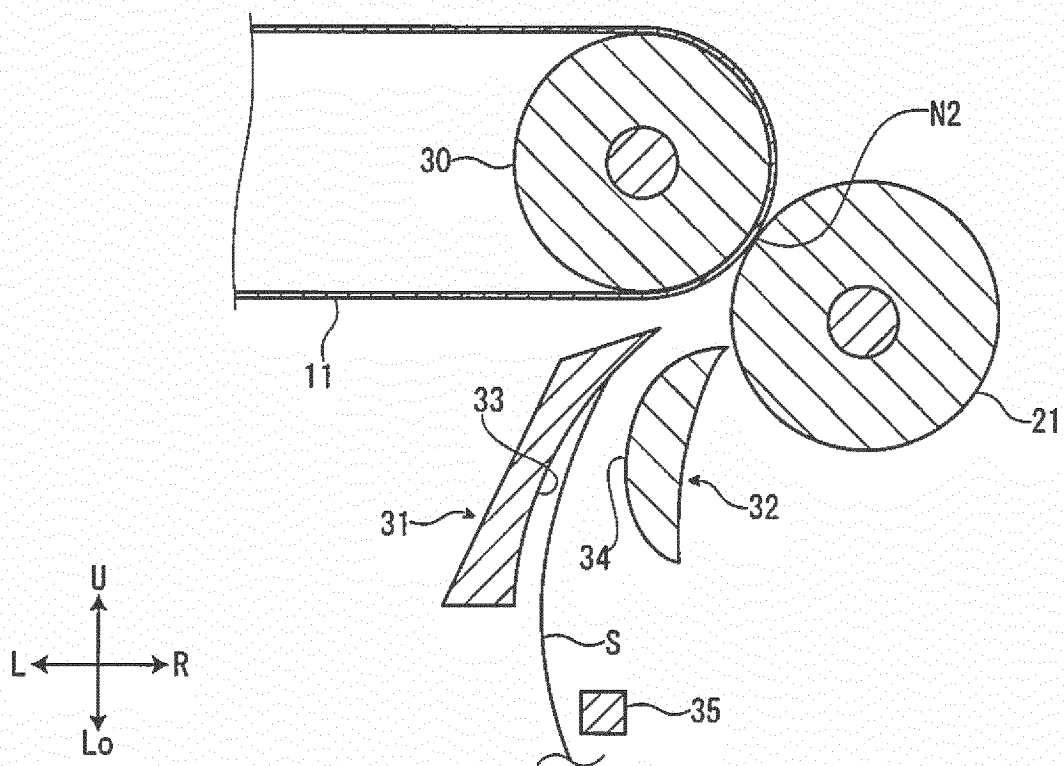


FIG. 6

RESULT OF EXPERIMENT CONDUCTED TO FIRST FACE OF SHEET
UNDER NORMAL TEMPERATURE AND NORMAL HUMIDITY ENVIRONMENT

	PRIMARY TRANSFER BIAS (-μA)				SECONDARY TRANSFER BIAS (-μA)		TRANSFER RESULT				
	Y	C	M	K	DURING CONTACT	AFTER SEPARATION	Y	C	M	K	Blue
COMPARATIVE EXAMPLE 1	4	4	4	4	40	40	x	x	x	x	x
COMPARATIVE EXAMPLE 2	4	4	4	4	40	25	O	O	O	x	O
COMPARATIVE EXAMPLE 3	4	4	4	4	40	15	x	x	x	O	x
COMPARATIVE EXAMPLE 4	4	4	4	7	40	40	x	x	x	x	x
EXAMPLE 1	4	4	4	7	40	25	O	O	O	O	O
EXAMPLE 2	4	4	4	10	40	25	O	O	O	O	O

TRANSFER RESULT O: TRANSFER FAILURE DID NOT OCCUR
TRANSFER RESULT x: TRANSFER FAILURE OCCURRED

FIG. 7

RESULT OF EXPERIMENT CONDUCTED TO SECOND FACE OF SHEET
UNDER NORMAL TEMPERATURE AND NORMAL HUMIDITY ENVIRONMENT

	PRIMARY TRANSFER BIAS (μA)				SECONDARY TRANSFER BIAS (μA)		TRANSFER RESULT				
	Y	C	M	K	DURING CONTACT	AFTER SEPARATION	Y	C	M	K	Blue
COMPARATIVE EXAMPLE 1	4	4	4	4	40	40	x	x	x	x	x
COMPARATIVE EXAMPLE 2	4	4	4	4	40	20	O	O	O	x	O
COMPARATIVE EXAMPLE 3	4	4	4	4	40	10	x	x	x	O	x
COMPARATIVE EXAMPLE 4	4	4	4	6	40	40	x	x	x	x	x
EXAMPLE 1	4	4	4	6	40	20	O	O	O	O	O
EXAMPLE 2	4	4	4	9	40	20	O	O	O	O	O

TRANSFER RESULT O: TRANSFER FAILURE DID NOT OCCUR
TRANSFER RESULT x: TRANSFER FAILURE OCCURRED

FIG. 8

RESULT OF EXPERIMENT CONDUCTED TO FIRST FACE OF SHEET
UNDER HIGH TEMPERATURE AND HIGH HUMIDITY ENVIRONMENT

	PRIMARY TRANSFER BIAS (μA)				SECONDARY TRANSFER BIAS (μA)		TRANSFER RESULT				
	Y	C	M	K	DURING CONTACT	AFTER SEPARATION	Y	C	M	K	Blue
COMPARATIVE EXAMPLE 1	8	8	8	8	60	60	x	x	x	x	x
COMPARATIVE EXAMPLE 2	8	8	8	8	60	50	O	O	O	x	O
COMPARATIVE EXAMPLE 3	8	8	8	8	60	20	x	x	x	O	x
COMPARATIVE EXAMPLE 4	8	8	8	10	60	60	x	x	x	x	x
EXAMPLE 1	8	8	8	10	60	50	O	O	O	O	O
EXAMPLE 2	8	8	8	14	60	50	O	O	O	O	O

TRANSFER RESULT O: TRANSFER FAILURE DID NOT OCCUR
TRANSFER RESULT x: TRANSFER FAILURE OCCURRED

FIG. 9

RESULT OF EXPERIMENT CONDUCTED TO SECOND FACE OF SHEET
UNDER HIGH TEMPERATURE AND HIGH HUMIDITY ENVIRONMENT

	PRIMARY TRANSFER BIAS (μA)				SECONDARY TRANSFER BIAS (μA)		TRANSFER RESULT				
	Y	C	M	K	DURING CONTACT	AFTER SEPARATION	Y	C	M	K	Blue
COMPARATIVE EXAMPLE 1	8	8	8	8	60	60	x	x	x	x	x
COMPARATIVE EXAMPLE 2	8	8	8	8	60	50	O	O	x	x	x
COMPARATIVE EXAMPLE 3	8	8	8	8	60	20	x	x	O	O	O
COMPARATIVE EXAMPLE 4	8	8	8	10	60	60	x	x	x	x	x
EXAMPLE 1	8	8	8	10	60	40	O	O	O	O	O
EXAMPLE 2	8	8	8	14	60	40	O	O	O	O	O

TRANSFER RESULT O : TRANSFER FAILURE DID NOT OCCUR
TRANSFER RESULT x : TRANSFER FAILURE OCCURRED

FIG. 10

**RESULT OF EXPERIMENT CONDUCTED TO FIRST FACE OF SHEET
UNDER LOW TEMPERATURE AND LOW HUMIDITY ENVIRONMENT**

	PRIMARY TRANSFER BIAS (μA)				SECONDARY TRANSFER BIAS (μA)		TRANSFER RESULT				
	Y	C	M	K	DURING CONTACT	AFTER SEPARATION	Y	C	M	K	Blue
COMPARATIVE EXAMPLE 1	3	3	3	3	30	30	x	x	x	x	x
COMPARATIVE EXAMPLE 2	3	3	3	3	30	25	O	O	x	x	x
COMPARATIVE EXAMPLE 3	3	3	3	3	30	15	x	x	O	O	O
COMPARATIVE EXAMPLE 4	3	3	3	7	30	30	x	x	x	x	x
EXAMPLE 1	3	3	3	7	30	25	O	O	O	O	O
EXAMPLE 2	3	3	3	11	30	25	O	O	O	O	O

TRANSFER RESULT O: TRANSFER FAILURE DID NOT OCCUR
TRANSFER RESULT x: TRANSFER FAILURE OCCURRED

FIG. 11

RESULT OF EXPERIMENT CONDUCTED TO SECOND FACE OF SHEET
UNDER LOW TEMPERATURE AND LOW HUMIDITY ENVIRONMENT

	PRIMARY TRANSFER BIAS (- μ A)				SECONDARY TRANSFER BIAS (- μ A)		TRANSFER RESULT				
	Y	C	M	K	DURING CONTACT	AFTER SEPARATION	Y	C	M	K	Blue
COMPARATIVE EXAMPLE 1	3	3	3	3	30	30	x	x	x	x	x
COMPARATIVE EXAMPLE 2	3	3	3	3	30	25	O	O	x	x	x
COMPARATIVE EXAMPLE 3	3	3	3	3	30	15	x	x	x	O	x
COMPARATIVE EXAMPLE 4	3	3	3	7	30	30	x	x	x	x	x
EXAMPLE 1	3	3	3	7	30	20	O	O	O	O	O
EXAMPLE 2	3	3	3	11	30	20	O	O	O	O	O

TRANSFER RESULT O: TRANSFER FAILURE DID NOT OCCUR
TRANSFER RESULT x: TRANSFER FAILURE OCCURRED

REFERENCES CITED IN THE DESCRIPTION

This list of references cited by the applicant is for the reader's convenience only. It does not form part of the European patent document. Even though great care has been taken in compiling the references, errors or omissions cannot be excluded and the EPO disclaims all liability in this regard.

Patent documents cited in the description

- JP 2009128481 A [0003]