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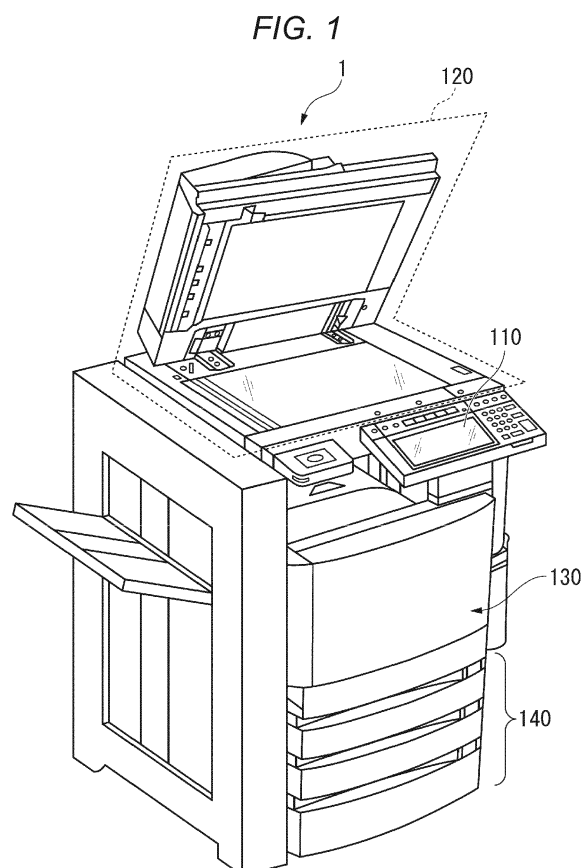
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(54) **IMAGE FORMING APPARATUS AND IMAGE FORMING METHOD INCLUDING DECORATIVE TONER**

(57) An image forming apparatus according to an embodiment includes a first developing unit that supplies color toner to form a color toner image on a first photoreceptor. A second developing unit supplies decorative toner to form a decorative toner image on a second photoreceptor. The decorative toner has a decorative property of at least one of glossiness, glitter or a stereoscopic effect. A transfer unit transfers the decorative toner image and the color toner image onto a recording medium with the decorative toner overlapping at least a part of the color toner image in an overlapping area so that the decorative property is visible in the overlapping area.



Description

FIELD

[0001] Embodiments described herein relate generally to an image forming apparatus and an image forming method including decorative toner.

BACKGROUND

[0002] In general, toners containing various color pigments such as yellow, magenta, cyan, and black (hereinafter, referred to as a "color toner") are used in an image forming apparatus. Recently, a package, a card, or the like is required to have decorative properties. For this reason, in the image forming apparatus, in addition to the four color toners, a toner containing a pigment having the decorative properties (hereinafter, referred to as a "decorative toner") is used.

[0003] However, when the color toner and the decorative toner are transferred onto paper, the color toner may be transferred onto the decorative toner so as to overlap. Accordingly, when a fixing process is performed after transferring, the color toner is fixed on top of the decorative toner. For this reason, in some cases, decorative properties of the decorative toner cannot be visually recognized because the decorative toner is hidden by the color toner.

DESCRIPTION OF THE DRAWINGS

[0004]

FIG. 1 is an exterior view illustrating an example image forming apparatus according to a first embodiment.

FIG. 2 is an example schematic configuration of the image forming apparatus.

FIG. 3 illustrates a case in which a color toner and a decorative toner have been transferred onto paper. FIG. 4 is a block diagram illustrating a control unit of the image forming apparatus.

FIG. 5 illustrates an example sequence of operations of a printing process in the image forming apparatus according to the first embodiment.

FIG. 6 is an example schematic configuration of an image forming apparatus according to a second embodiment.

FIG. 7 illustrates an example sequence of operations of a printing process in the image forming apparatus according to the second embodiment.

DETAILED DESCRIPTION

[0005] An image forming apparatus according to an embodiment includes a first developing unit that supplies color toner to form a color toner image on a first photoreceptor. A second developing unit supplies decorative ton-

er to form a decorative toner image on a second photoreceptor. The decorative toner has a decorative property of at least one of glossiness, glitter or a stereoscopic effect. A transfer unit transfers the decorative toner image and the color toner image onto a recording medium with the decorative toner overlapping at least a part of the color toner image in an overlapping area so that the decorative property is visible in the overlapping area. (First Embodiment)

[0006] Preferably, the apparatus further comprises: an intermediate transfer belt having a belt surface to which the decorative toner image and the color toner image are transferred; and a primary transfer unit configured to transfer the decorative toner image onto the belt surface and the color toner image onto at least a portion of the decorative toner image, wherein the transfer unit is a secondary transfer unit configured to transfer the color toner image and the decorative toner image from the intermediate transfer belt onto the recording medium.

[0007] Preferably, the primary transfer unit includes a second image forming unit configured to transfer the decorative toner image from the second photoreceptor onto the intermediate transfer belt, and a first image forming unit configured to transfer the color toner image from the first photoreceptor onto the intermediate transfer belt on top of at least the portion of the decorative toner image, and wherein the second image forming unit is disposed upstream of the first image forming unit in a rotation direction of the intermediate transfer belt.

[0008] Preferably, the transfer unit includes a first image forming unit configured to transfer the color toner image from the first photoreceptor onto the recording medium, and a second image forming unit configured to transfer the decorative toner image from the second photoreceptor onto the recording medium with at least the part of the color toner image in the overlapping area.

[0009] Preferably, the first image forming unit is disposed upstream of the second image forming unit in a transportation direction of the recording medium.

[0010] Preferably, the decorative toner contains a pigment having a decorative property of at least one of glossiness, glitter or a stereoscopic effect.

[0011] Preferably, an average particle diameter of the said pigment having the decorative property is comprised within 20 μm and 100 μm .

[0012] Preferably, the decorative toner contains at least one of: lame powder, metal powder, and natural mica coated with metal oxide.

[0013] Preferably, the color toner includes at least one of: cyan toner, magenta toner, yellow toner, and black toner.

[0014] The apparatus may further comprise: an acquisition unit configured to determine a desired luminance of the decorative toner image based on input image data; and an adjusting unit configured to adjust an amount of the decorative toner being supplied to form the decorative toner image based on the desired luminance.

[0015] The apparatus may further comprise a determi-

nation unit configured to determine a region where the decorative toner image and the color toner image are desired to be overlapped with each other based on input image data.

[0016] The transfer unit may be configured to transfer the decorative toner image so that the decorative toner image overlaps the color toner image in the determined region.

[0017] The present invention also relates to an image forming method comprising the steps of: supplying a decorative toner to form a decorative toner image on a first photoreceptor, the decorative toner having a decorative property of at least one of glossiness, glitter or a stereoscopic effect; supplying a color toner to form a color toner image on a second photoreceptor; and transferring the decorative toner image and the color toner image onto a recording medium with the decorative toner overlapping at least a part of the color toner image in an overlapping area so that the decorative property is visible in the overlapping area.

[0018] The method may further comprise: transferring the decorative toner image onto a surface of an intermediate transfer belt; transferring the color toner image onto at least a portion of the decorative toner image on the surface of the intermediate transfer belt.

[0019] Preferably, the step of transferring the decorative toner image and the color toner image onto the recording medium includes transferring the color toner image and the decorative toner image from the intermediate transfer belt onto the recording medium.

[0020] Preferably, the step of transferring the decorative toner image and the color toner image onto the recording medium includes: transferring the decorative toner image from the first photoreceptor onto a intermediate transfer belt with a first image forming unit, and transferring the color toner image from the second photoreceptor onto the intermediate transfer belt on top of at least the portion of the decorative toner image with a second image forming unit.

[0021] Preferably, the second image forming unit is disposed upstream of the first image forming unit in a rotation direction of the intermediate transfer belt.

[0022] Preferably, the step of transferring the decorative toner image and the color toner image onto the recording medium includes: transferring a the color toner image from the first photoreceptor onto the recording medium with a first image forming unit, and transferring the decorative toner image from the second photoreceptor onto the recording medium with at least the part of the color toner image in the overlapping area with a second image forming unit, and wherein the first image forming unit is disposed upstream of the second image forming unit in a transportation direction of the recording medium.

[0023] Preferably, the decorative toner contains at least one of: lame powder, metal powder, and natural mica coated with metal oxide.

[0024] Preferably, the color toner includes at least one of: cyan toner, magenta toner, yellow toner, and black

toner.

[0025] The method may further comprise: determining a desired luminance of the decorative toner image based on input image data; and adjusting an amount of the decorative toner being supplied to form the decorative toner image based on the desired luminance.

The method may further comprise: determining a region where the decorative toner image and the color toner image are desired to be overlapped with each other based on input image data.

[0026] Preferably, the decorative toner image is transferred so that the decorative toner image overlaps the color toner image in the determined region.

[0027] The present invention further relates to a non-transitory computer readable medium containing instructions that are executed in a processing unit to cause an image forming apparatus to perform the steps of: supplying a decorative toner to form a decorative toner image on a first photoreceptor, the decorative toner having a decorative property of at least one of glossiness, glitter or a stereoscopic effect; supplying a color toner to form a color toner image on a second photoreceptor; and transferring the decorative toner image and the color toner image onto a recording medium with the decorative toner overlapping at least a part of the color toner image in an overlapping area so that the decorative property is visible in the overlapping area.

[0028] Preferably, the step of transferring the decorative toner image and the color toner image onto the recording medium includes: transferring a the color toner image from the first photoreceptor onto the recording medium with a first image forming unit, and transferring the decorative toner image from the second photoreceptor onto the recording medium with at least the part of the color toner image in the overlapping area with a second image forming unit.

[0029] Preferably, the first image forming unit is disposed upstream of the second image forming unit in a transportation direction of the recording medium.

[0030] Preferably, the instructions, when executed in the processing unit, further cause the image forming apparatus to perform the steps of: determining a desired luminance of the decorative toner image based on input image data; and adjusting an amount of the decorative toner being supplied to form the decorative toner image based on the desired luminance.

[0031] Preferably, the instructions, when executed in the processing unit, further cause the image forming apparatus to perform the steps of: determining a region where the decorative toner image and the color toner image are desired to be overlapped with each other based on input image data.

[0032] Preferably, the decorative toner image is transferred so that the decorative toner image overlaps the color toner image in the determined region.

[0033] FIG. 1 is an exterior view illustrating an example of an image forming apparatus 1 according to an embodiment. For example, the image forming apparatus 1 may

be a multi-function peripheral (MFP). The image forming apparatus 1 generates digital data (image file) by reading an image formed on a sheet type recording medium such as paper. The image forming apparatus 1 forms the image on the paper, based on the digital data, using toner.

[0034] The image forming apparatus 1 includes a display unit 110, an image reading unit 120, an image forming unit 130, and a paper feeding unit 140.

[0035] The display unit 110 is operated as an output interface for displaying characters and images. The display unit 110 is also operated as an input interface for receiving an instruction from a user. For example, the display unit 110 may be a liquid crystal display including a touch panel.

[0036] The image reading unit 120 is a color scanner. The image reading unit 120 reads an image formed on the recording medium. The image reading unit 120 converts the read image on the recording medium to the digital data. For example, the image reading unit 120 includes a CIS (contact image sensor) or a CCD (charge coupled device). For example, the recording medium is a paper.

[0037] The image forming unit 130 forms the image on a recording medium using the toner. The image forming unit 130 forms the image on the recording medium based on the image data read by the image reading unit 120 or image data received from an external device.

[0038] The paper feeding unit 140 accommodates paper, which is a recording medium. For example, the paper may be unused paper or reuse paper. The paper feeding unit 140 supplies the recording medium to the image forming unit 130.

[0039] Next, the toner used in the image forming unit 130 according to the exemplary embodiment will be described. The image forming unit 130 uses at least color toner and decorative toner. The color toner is a toner containing a pigment of yellow (Y), magenta (M), cyan (C), or black (K). That is, the color toner is at least any one of a yellow toner, a magenta toner, a cyan toner, and a black toner. The decorative toner is a toner which is applied on the recording medium for decoration. In addition, "on the recording medium" may also include "on top of the color toner". The decorative toner is a toner containing a pigment having decorative properties. The decorative toner is used to decorate a surface of the recording medium. For example, the decorative properties mean glossiness, glitter, a stereoscopic effect of unevenness, or the like. For example, the decorative toner contains a fine solid substance for decorating such as lame powder. In addition, for example, the pigment having decorative properties may be an organic or inorganic pigment. Examples of organic or inorganic pigments includes: Fast Yellow G, Benzidine Yellow, India Fast Orange, Irgazin Red, Carmine FB, Permanent Bordeaux FRR, Pigment Orange R, Lithol Red 2G, Lake Red C, Rhodamine FB, Rhodamine B Lake, Phthalocyanine Blue, Pigment Blue, Brilliant Green B, Phthalocyanine Green, Quinacridone, Pearlescent Pigment, or the like.

The Pearlescent Pigment may be a metal powder such as aluminum, brass, bronze, nickel, stainless steel, or zinc; coated flake-like inorganic crystal substances such as mica coated with titanium oxide or yellow iron oxide, barium sulfate, a stacked silicate, or silicate stacked aluminum; single-crystal plate-like titanium oxide, basic carbonate, bismuth oxychloride, natural guanine, flake-like glass powder, or metal deposited flake-like glass powder. In addition, the pigment having the decorative properties may be an inorganic pearl pigment of a powder type in which a surface of natural mica is coated with a high-refractive index metal oxide. For example, the high-refractive index metal oxide may be titanium oxide and iron oxide. Accordingly, a multiple reflection generated because a refractive index difference between a metal oxide layer and the natural mica causes a pearl luster such as natural pearlescent luster. However, the pigment having the decorative properties is not particularly limited. An average particle diameter of the pigment having the decorative properties is approximately 20 μm to 100 μm . A shape of the pigment having the decorative properties may be scaly. The decorative toner is a toner in which particles of the pigment having the decorative properties are mainly coated with a resin.

[0040] FIG. 2 is an example schematic configuration of the image forming apparatus 1.

[0041] The image forming apparatus 1 is an intermediate transfer type image forming apparatus. The image forming apparatus 1 includes a paper discharge unit 11, a primary transfer unit 30, a secondary transfer unit 12 (a counter roller 122 and a secondary transfer roller 121), an intermediate transfer belt 13, a fixing unit 14, a control unit 15, and a paper feeding unit 140.

[0042] The paper discharge unit 11 discharges paper 40 subjected to a fixing process by the fixing unit 14 to a paper discharge tray (not illustrated).

[0043] The primary transfer unit 30 includes an image forming station 20N, an image forming station 20Y, an image forming station 20M, an image forming station 20C, an image forming station 20K, a primary transfer roller 30N, a primary transfer roller 30Y, a primary transfer roller 30M, a primary transfer roller 30C, and a primary transfer roller 30K.

[0044] The image forming station 20N is disposed upstream of a color toner station in a rotation direction of the intermediate transfer belt 13. The color toner station is a transfer station transferring the color toner. In the exemplary embodiment, the color toner station includes the image forming station 20Y, the image forming station 20M, the image forming station 20C, and the image forming station 20K.

[0045] The image forming station 20N is disposed upstream of the image forming station 20Y. The image forming station 20N includes a photoreceptor 21N, a photoreceptor cleaner 22N, an electrification device 23N, an exposure device 24N, and a developing device 25N.

[0046] The image forming station 20Y is disposed upstream of the image forming station 20M. The image

forming station 20Y includes a photoreceptor 21Y, a photoreceptor cleaner 22Y, an electrification device 23Y, an exposure device 24Y, and a developing device 25Y.

[0047] The image forming station 20M is disposed upstream of the image forming station 20C. The image forming station 20M includes a photoreceptor 21M, a photoreceptor cleaner 22M, an electrification device 23M, an exposure device 24M, and a developing device 25M.

[0048] The image forming station 20C is disposed upstream of the image forming station 20K. The image forming station 20C includes a photoreceptor 21C, a photoreceptor cleaner 22C, an electrification device 23C, an exposure device 24C, and a developing device 25C.

[0049] The image forming station 20K is disposed downstream of the image forming station 20C in the rotation direction of the intermediate transfer belt 13. The image forming station 20K includes a photoreceptor 21K, a photoreceptor cleaner 22K, an electrification device 23K, an exposure device 24K, and a developing device 25K.

[0050] Each of the photoreceptors 21N, 21Y, 21M, 21C, and 21K respectively include an organic photoconductor (OPC) thereon.

[0051] The photoreceptor cleaners 22N, 22Y, 22M, 22C, and 22K respectively remove residual toner on the photoreceptors 21N, 21Y, 21M, 21C, and 21K. The residual toner is toner which remains on the surface of the photoreceptor after the primary transfer is performed.

[0052] Each of the electrification devices 23N, 23Y, 23M, 23C, and 23K respectively electrify uniformly the surfaces of the photoreceptors 21N, 21Y, 21M, 21C, and 21K. For example, the electrification devices 23N, 23Y, 23M, 23C, and 23K are a scorotron type corona charger.

[0053] Each of the exposure devices 24N, 24Y, 24M, 24C, and 24K respectively acquire the image data from a control unit 15. Each of the exposure devices 24N, 24Y, 24M, 24C, and 24K respectively apply laser light to the photoreceptors 21N, 21Y, 21M, 21C, and 21K in accordance with the acquired image data. Each of the exposure devices 24N, 24Y, 24M, 24C, and 24K respectively scan the photoreceptors 21N, 21Y, 21M, 21C, and 21K in an axial direction with the laser light. By a scanning exposure with the laser light, an electrostatic latent image is respectively formed on each of the photoreceptors 21N, 21Y, 21M, 21C, and 21K.

[0054] Each of the developing devices 25N, 25Y, 25M, 25C, and 25K respectively include a developing roller and a developing motor.

[0055] The developing device 25N accommodates a developer N. The developing device 25Y accommodates a developer Y. The developing device 25M accommodates a developer M. The developing device 25C accommodates a developer C. The developing device 25K accommodates a developer K.

[0056] The developer is a mixture of toner and a magnetic carrier. The developer N accommodated in the developing device 25N is a mixture of decorative toner and the magnetic carrier. The developer Y accommodated in

the developing device 25Y is a mixture of yellow toner and the magnetic carrier. The developer M accommodated in the developing device 25M is a mixture of magenta toner and the magnetic carrier. The developer C accommodated in the developing device 25C is a mixture of cyan toner and the magnetic carrier. The developer K accommodated in the developing device 25K is a mixture of black toner and the magnetic carrier.

[0057] In the developing device 25N, a developing bias is applied to the developing roller. The developer N is supplied to the photoreceptor 21N by the developing bias. Then, the electrostatic latent image formed on the photoreceptor 21N by the exposure device 24N is formed as a decorative toner image 41.

[0058] In the developing device 25Y, the developing bias is applied to the developing roller. The developer Y is supplied to the photoreceptor 21Y by the developing bias. Then, the electrostatic latent image formed on the photoreceptor 21Y by the exposure device 24Y is formed as a toner image 42 of the yellow toner.

[0059] In the developing device 25M, the developing bias is applied to the developing roller. The developer M is supplied to the photoreceptor 21M by the developing bias. Then, the electrostatic latent image formed on the photoreceptor 21M by the exposure device 24M is formed as a toner image 43 of the magenta toner.

[0060] In the developing device 25C, the developing bias is applied to the developing roller. The developer C is supplied to the photoreceptor 21C by the developing bias. Then, the electrostatic latent image formed on the photoreceptor 21C by the exposure device 24C is formed as a toner image 44 of the cyan toner.

[0061] In the developing device 25K, the developing bias is applied to the developing roller. The developer K is supplied to the photoreceptor 21K by the developing bias. Then, the electrostatic latent image formed on the photoreceptor 21K by the exposure device 24K is formed as toner image 45 of the black toner.

[0062] The intermediate transfer belt 13 is brought into contact with the primary transfer unit 30. The intermediate transfer belt 13 is supported by a backup roller 17, a driven roller 18, and a tension roller 19. The intermediate transfer belt 13 is rotated in a direction of an arrow m (in FIG. 2).

[0063] The primary transfer roller 30N, the primary transfer roller 30Y, the primary transfer roller 30M, the primary transfer roller 30C, and the primary transfer roller 30K are conductive rollers. The primary transfer roller 30N is in press-contact with the photoreceptor 21N through the intermediate transfer belt 13. In addition, a transfer bias is applied to the primary transfer roller 30N. Accordingly, the decorative toner image 41 is transferred (primary transfer) to the intermediate transfer belt 13.

[0064] The primary transfer roller 30Y is in press-contact with the photoreceptor 21Y through the intermediate transfer belt 13. In addition, the transfer bias is applied to the primary transfer roller 30Y. Accordingly, the toner image 42 is transferred (primary transfer) to the interme-

diate transfer belt 13.

[0065] The primary transfer roller 30M is in press-contact with the photoreceptor 21M through the intermediate transfer belt 13. In addition, the transfer bias is applied to the primary transfer roller 30M. Accordingly, the toner image 43 is transferred (primary transfer) to the intermediate transfer belt 13.

[0066] The primary transfer roller 30C is in press-contact with the photoreceptor 21C through the intermediate transfer belt 13. In addition, the transfer bias is applied to the primary transfer roller 30C. Accordingly, the toner image 44 is transferred (primary transfer) to the intermediate transfer belt 13.

[0067] The primary transfer roller 30K is in press-contact with the photoreceptor 21K through the intermediate transfer belt 13. In addition, the transfer bias is applied to the primary transfer roller 30K. Accordingly, the toner image 45 is transferred (primary transfer) to the intermediate transfer belt 13. Here, the transfer bias is applied to the primary transfer roller 30N, the primary transfer roller 30Y, the primary transfer roller 30M, the primary transfer roller 30C, and the primary transfer roller 30K, in this order. That is, a position on the intermediate transfer belt 13 to which the decorative toner image 41 is transferred is transported to the image forming stations 20Y, 20M, 20C, and 20K, in an order of transferring regions thereof.

[0068] The paper is supplied to the secondary transfer unit 12 from the paper feeding unit 140.

[0069] The secondary transfer unit 12 includes a secondary transfer roller 121 and a counter roller 122.

[0070] The secondary transfer unit 12 is disposed downstream of the image forming station 20K. The secondary transfer roller 121 is opposite to the counter roller 122. The intermediate transfer belt 13 is positioned between the secondary transfer roller 121 and the counter roller 122. The secondary transfer roller 121 is a conductive roller. A predetermined secondary transfer bias is applied to the secondary transfer roller 121. Accordingly, the secondary transfer roller 121 transfers (secondary transfer) the decorative toner image 41 and the toner images 42 to 45 formed on the intermediate transfer belt 13 onto the paper fed from the paper feeding unit 140. The toner images stacked on the intermediate transfer belt-13 in order of the decorative toner image 41, the toner image 42, the toner image 43, the toner image 44, and the toner image 45-are secondary transferred onto the paper 40. Accordingly, an image in which the toner image 45, the toner image 44, the toner image 43, the toner image 42, and the decorative toner image 41 are sequentially stacked is formed on the paper 40. FIG. 3 is a view illustrating a case where the decorative toner image 41 and the toner images 42 to 45 are transferred onto the paper 40 in the exemplary embodiment. As illustrated in FIG. 3, a toner layer of the uppermost layer is the decorative toner, and a lower side of the decorative toner is a toner layer of the color toner. That is, the decorative toner is stacked on the upper side of the entirety

or a part of the color toner. Therefore, the color toner overlaps the upper side of the decorative toner so that the decorative properties of the decorative toner are not hidden. Accordingly, the decorative properties of the decorative toner may be visually recognized. In addition, after the secondary transferring is performed, the intermediate transfer belt 13 is cleaned by a belt cleaner (not illustrated).

[0071] The fixing unit 14 heats and fixes the paper to which the toner image is transferred. For example, the fixing unit 14 may be a fixing device which heats the paper via electromagnetic induction heating.

[0072] FIG. 4 is a block diagram illustrating the control unit 15 of the image forming apparatus 1.

[0073] The image forming apparatus 1 includes the control unit 15, a memory 202, an auxiliary storage device 203, a display unit 110, an image reading unit 120, the paper feeding unit 140, and an image processing unit 204.

[0074] The control unit 15 executes an image forming program. For example, the image forming program is stored in the auxiliary storage device 203 in advance and is read out in the memory 202 by the control unit 15. The image forming apparatus 1 executes the image forming program to perform a printing process for forming the image on the recording medium.

[0075] The control unit 15 includes a developing device control unit 151, a transportation control unit 152, a transferring control unit 153, and a fixing control unit 154.

[0076] The developing device control unit 151 controls the developing roller and the developing motor of each of the developing devices 25N, 25Y, 25M, 25C, and 25K. That is, the developing device control unit 151 applies the developing bias to the developing rollers. In addition, the developing device control unit 151 drives the developing motor.

[0077] The developing device control unit 151 controls the developing roller and the developing motor of the developing device 25N so that the decorative toner image 41 is formed on the photoreceptor 21N. The developing device control unit 151 controls the developing roller and the developing motor of the developing device 25Y so that the toner image 42 is formed on the photoreceptor 21Y. The developing device control unit 151 controls the developing roller and the developing motor of the developing device 25M so that the toner image 43 is formed on the photoreceptor 21M. The developing device control unit 151 controls the developing roller and the developing motor of the developing device 25C so that the toner image 44 is formed on the photoreceptor 21C. The developing device control unit 151 controls the developing roller and the developing motor of the developing device 25K so that the toner image 45 is formed on the photoreceptor 21K.

[0078] The transportation control unit 152 controls a plurality of transportation rollers (hereinafter, singly or collectively referred to as a "transportation device") such as the intermediate transfer belt 13.

[0079] The transferring control unit 153 applies the transfer bias to the primary transfer rollers 30N, 30Y, 30M, 30C, and 30K, in that order. Accordingly, the toner images are stacked on the intermediate transfer belt 13 in the order of the decorative toner image 41, the toner image 42, the toner image 43, the toner image 44, and the toner image 45.

[0080] The transferring control unit 153 applies the secondary transfer bias to the secondary transfer roller 121. Accordingly, the toner images (decorative toner image 41 and toner images 42 to 45) stacked on the intermediate transfer belt 13 are secondary transferred to the paper 40.

[0081] The fixing control unit 154 controls driving of the fixing unit 14.

[0082] Hereinafter, an operation of the printing process in the image forming apparatus 1 according to the exemplary embodiment will be described, as non-limiting examples, with reference to the drawings. FIG. 5 illustrates an example sequence of operations of the printing process in the image forming apparatus 1.

[0083] A user inputs an execution instruction of the printing process using the decorative toner to the display unit 110. The process indicated by the input execution instruction is a job. The control unit 15 receives of the execution instruction of the job based on the input information (ACT 601).

[0084] The developing device control unit 151 drives the developing motor so as to rotate the photoreceptors 21N, 21Y, 21M, 21C, and 21K. The surface of the photoreceptor 21N is uniformly electrified by the electrification device 23N. The surface of the photoreceptor 21Y is uniformly electrified by the electrification device 23Y. The surface of the photoreceptor 21M is uniformly electrified by the electrification device 23M. The surface of the photoreceptor 21C is uniformly electrified by the electrification device 23C. The surface of the photoreceptor 21K is uniformly electrified by the electrification device 23K.

[0085] Next, the photoreceptor 21N is irradiated with the laser light in accordance with the image data by the exposure device 24N. Then, the electrostatic latent image is formed on the photoreceptor 21N. The photoreceptor 21Y is irradiated with the laser light in accordance with the image data by the exposure device 24Y. Then, the electrostatic latent image is formed on the photoreceptor 21Y. The photoreceptor 21M is irradiated with the laser light in accordance with the image data by the exposure device 24M. Then, the electrostatic latent image is formed on the photoreceptor 21M. The photoreceptor 21C is irradiated with the laser light in accordance with the image data by the exposure device 24C. Then, the electrostatic latent image is formed on the photoreceptor 21C. The photoreceptor 21K is irradiated with the laser light in accordance with the image data by the exposure device 24K. Then, the electrostatic latent image is formed on the photoreceptor 21K (ACT 602).

[0086] When the electrostatic latent image is formed

on the photoreceptor 21N, the developing device control unit 151 applies the developing bias to the developing roller of the developing device 25N. Accordingly, the electrostatic latent image of the photoreceptor 21N is developed using decorative toner. Then, the decorative toner image 41 formed of decorative toner is formed on the photoreceptor 21N (toner image is developed).

[0087] When the electrostatic latent image is formed on the photoreceptor 21Y, the developing device control unit 151 applies the developing bias to the developing roller of the developing device 25Y. Accordingly, the electrostatic latent image of the photoreceptor 21Y is developed using yellow toner. Then, the toner image 42 is formed of yellow toner on the photoreceptor 21N.

[0088] When the electrostatic latent image is formed on the photoreceptor 21M, the developing device control unit 151 applies the developing bias to the developing roller of the developing device 25M. Accordingly, the electrostatic latent image of the photoreceptor 21M is developed using magenta toner. Then, the toner image 43 is formed of magenta toner on the photoreceptor 21M.

[0089] When the electrostatic latent image is formed on the photoreceptor 21C, the developing device control unit 151 applies the developing bias to the developing roller of the developing device 25C. Accordingly, the electrostatic latent image of the photoreceptor 21C is developed using cyan toner. Then, the toner image 44 is formed of the toner on the photoreceptor 21C.

[0090] When the electrostatic latent image is formed on the photoreceptor 21K, the developing device control unit 151 applies the developing bias to the developing roller of the developing device 25K. Accordingly, the electrostatic latent image of the photoreceptor 21K is developed using black toner. Then, the toner image 45 is formed of black toner on the photoreceptor 21K (ACT 603).

[0091] The transferring control unit 153 applies the transfer bias to the primary transfer roller 30N. That is, the transferring control unit 153 performs the primary transfer of the decorative toner image 41 to the intermediate transfer belt 13 (ACT 604).

[0092] When the primary transfer of the decorative toner image 41 is finished, the transferring control unit 153 applies the transfer bias in the order of the primary transfer rollers 30Y, 30M, 30C, and 30K. That is, the transferring control unit 153 performs the primary transfer of the color toner to the intermediate transfer belt 13 (ACT 605). Accordingly, the transferring control unit 153 sequentially transfers the decorative toner image 41 and the color toner to the intermediate transfer belt 13 so that the color toner is overlapped on the decorative toner.

[0093] The transportation control unit 152 synchronizes the paper 40 fed from the paper feeding unit 140 with the toner image transferred to the intermediate transfer belt 13 and transports the paper to the secondary transfer unit 12 (ACT 606).

[0094] The transferring control unit 153 applies the secondary transfer bias to the secondary transfer roller

121. Accordingly, the decorative toner image 41 and the color toner stacked on the intermediate transfer belt 13 are secondary transferred to the paper 40 (ACT 607). Accordingly, the image in which the color toner and the decorative toner are sequentially stacked is formed on the paper 40. That is, the decorative toner image is stacked on the paper 40 so as to overlap a part or the entirety of the color toner. Accordingly, the decorative toner is transferred onto the paper 40 without the color toner overlapping the decorative toner.

[0095] When the secondary transfer is finished, the transportation control unit 152 transports the paper 40 subjected to secondary transfer to the fixing unit 14.

[0096] The fixing control unit 154 drives the pressure roller 51. Accordingly, the fixing unit 14 applies heat and pressure to the paper 40 so that the decorative toner image 41 and the color toner is melted and fixed (ACT 608). After the decorative toner image 41 and the color toner are fixed, the paper 40 is discharged to the paper discharge tray (not illustrated) by the paper discharge unit 11.

(Second Embodiment)

[0097] Hereinafter, the image forming apparatus 1a according to a second embodiment will be described. FIG. 6 is an example schematic configuration of the image forming apparatus 1a according to the second embodiment. In addition, in a configuration same as that of the first embodiment, the same numerals are given and a description thereof will be omitted. The image forming apparatus 1a according to the second embodiment is a direct transfer type image forming apparatus. The image forming apparatus 1a includes the paper discharge unit 11, the primary transfer unit 30, the fixing unit 14, the control unit 15, and the paper feeding unit 140.

[0098] The image forming station 20N is disposed downstream of a color toner station in a transportation direction of the recording medium (or in a rotation direction of a transportation belt 10a) than.

[0099] The image forming station 20N is disposed downstream of the image forming station 20K. The image forming station 20K is disposed downstream of the image forming station 20C. The image forming station 20C is disposed downstream of the image forming station 20M. The image forming station 20M is disposed downstream of the image forming station 20Y.

[0100] The image forming apparatus 1a directly transfers the toner image formed on the photoreceptor onto the recording medium without using an intermediate transfer belt. That is, the transportation belt 10a conveys the paper 40 supplied from the paper feeding unit 140 on the surface thereof. The transportation belt 10a conveys the paper 40 in a direction of an arrow n (in FIG. 6). At this time, the primary transfer roller 30Y transfers the toner image 42 of yellow toner on the photoreceptor 21Y onto the paper 40. Next, the primary transfer roller 30M transfers the toner image 43 of magenta toner on the

photoreceptor 21M onto the paper 40. Next, the primary transfer roller 30C transfers the toner image 44 of cyan toner on the photoreceptor 21C onto the paper 40. Next, the primary transfer roller 30K transfers the toner image 45 of black toner on the photoreceptor 21K onto the paper 40. Next, the primary transfer roller 30N transfers the toner image 41 of decorative toner on the photoreceptor 21N onto the paper 40. After transferring, the paper 40 is subjected to the fixing process by the fixing unit 14. Accordingly, the image in which the color toner and decorative toner are sequentially stacked is formed on the paper 40. That is, the decorative toner image is stacked on the paper 40 so as to be overlapped with a part or the entirety of the color toner.

[0101] Hereinafter, an operation of a printing process in the image forming apparatus 1a according to the second embodiment will be described. FIG. 7 illustrates an example sequence of operations of the printing process in the image forming apparatus 1a according to the second embodiment.

[0102] The user inputs an execution instruction of the printing process using the decorative toner to the display unit 110. The process indicated by the input execution information is a job. The control unit 15 receives the execution instruction of the job based on the input information (ACT 701).

[0103] The developing device control unit 151 drives a developing motor so as to rotate the photoreceptors 21N, 21Y, 21M, 21C, and 21K. The surface of the photoreceptor 21N is uniformly electrified by the electrification device 23N. The surface of the photoreceptor 21Y is uniformly electrified by the electrification device 23Y. The surface of the photoreceptor 21M is uniformly electrified by the electrification device 23M. The surface of the photoreceptor 21C is uniformly electrified by the electrification device 23C. The surface of the photoreceptor 21K is uniformly electrified by the electrification device 23K.

[0104] Next, the photoreceptor 21N is irradiated with the laser light in accordance with the image data by the exposure device 24N. Then, the electrostatic latent image is formed on the photoreceptor 21N. The photoreceptor 21Y is irradiated with the laser light in accordance with the image data by the exposure device 24Y. Then, the electrostatic latent image is formed on the photoreceptor 21Y. The photoreceptor 21M is irradiated with the laser light in accordance with the image data by the exposure device 24M. Then, the electrostatic latent image is formed on the photoreceptor 21M. The photoreceptor 21C is irradiated with the laser light in accordance with the image data by the exposure device 24C. Then, the electrostatic latent image is formed on the photoreceptor 21C. The photoreceptor 21K is irradiated with the laser light in accordance with the image data by the exposure device 24K. Then, the electrostatic latent image is formed on the photoreceptor 21K (ACT 702).

[0105] When the electrostatic latent image is formed on the photoreceptor 21N, the developing device control

unit 151 applies the developing bias to the developing roller of the developing device 25N. Accordingly, the electrostatic latent image of the photoreceptor 21N is developed using decorative toner. Then, the decorative toner image 41 formed of decorative toner is formed on the photoreceptor 21N (toner image is developed).

[0106] When the electrostatic latent image is formed on the photoreceptor 21Y, the developing device control unit 151 applies the developing bias to the developing roller of the developing device 25Y. Accordingly, the electrostatic latent image of the photoreceptor 21Y is developed using yellow toner. Then, the toner image 42 formed of yellow toner is formed on the photoreceptor 21Y.

[0107] When the electrostatic latent image is formed on the photoreceptor 21M, the developing device control unit 151 applies the developing bias to the developing roller of the developing device 25M. Accordingly, the electrostatic latent image of the photoreceptor 21M is developed using magenta toner. Then, the toner image 43 formed of magenta toner is formed on the photoreceptor 21M.

[0108] When the electrostatic latent image is formed on the photoreceptor 21C, the developing device control unit 151 applies the developing bias to the developing roller of the developing device 25C. Accordingly, the electrostatic latent image of the photoreceptor 21C is developed using cyan toner. Then, the toner image 44 formed of cyan toner is formed on the photoreceptor 21C.

[0109] When the electrostatic latent image is formed on the photoreceptor 21K, the developing device control unit 151 applies the developing bias to the developing roller of the developing device 25K. Accordingly, the electrostatic latent image of the photoreceptor 21K is developed using black toner. Then, the toner image 45 formed of black toner is formed on the photoreceptor 21K (ACT 703).

[0110] The transportation control unit 152 transports the paper 40 in the arrow n direction by operating the transportation belt 10a (ACT 704).

[0111] The transferring control unit 153 sequentially applies the transfer bias to the primary transfer rollers 30Y, 30M, 30C, and 30K. That is, the transferring control unit 153 transfers the toner image of color toner (toner images 42 to 45) to the paper 40 (ACT 705).

[0112] When the transferring of the color toner is finished, the transferring control unit 153 applies the transfer bias to the primary transfer roller 30N. That is, the transferring control unit 153 transfers the decorative toner image 41 of decorative toner to the paper 40 (ACT 706). Accordingly, the transferring control unit 153 sequentially transfers color toner and decorative toner to the paper 40 so that the decorative toner may be overlapped on the color toner. Therefore, decorative toner is transferred onto the paper 40 without the color toner overlapping the decorative toner.

[0113] The fixing unit 14 applies heat and pressure onto the paper 40 so that the decorative toner image 41 and the color toner are melted and fixed (ACT 707). After

fixing of the decorative toner image 41 and the color toner is finished, the paper 40 is discharged to the paper discharge tray (not illustrated) by the paper discharge unit 11.

[0114] According to at least one of the embodiments as described above, the image forming apparatus includes the color toner, the decorative toner, and the transfer unit. The recording medium is decorated with the decorative toner. The transfer unit transfers the decorative toner onto the recording medium so that the decorative toner overlaps the entirety or a part of the color toner. Accordingly, when the color toner and the decorative toner are simultaneously printed, the decorative toner is transferred onto the recording medium without the color toner overlapping the decorative toner. Therefore, the above described image forming apparatus may prevent the decorative properties of the decorative toner from being hidden by the color toner and likewise ensure a visibility of the decorative toner on the recording medium.

[0115] In the above described exemplary embodiments, the number of the developing devices in the image forming apparatus is not limited. That is, as long as the image forming apparatus includes a developing device using at least one color toner (e.g., yellow, magenta, cyan or black) and a developing device using decorative toner, the apparatus may be used.

[0116] In the above described exemplary embodiments, the image forming unit 130 may acquire the image data from an external device instead of the image reading unit 120.

[0117] In addition, in the above described exemplary embodiments, the control unit 15 may include a determination unit that determines an overlapping region based on the input image data. When there the executing instruction of the printing process using the decorative toner is received, the determination unit determines the overlapping region based on the image data. The overlapping region indicates a region in which the decorative toner and the color toner are desired to be overlapped with each other. The control unit 15 may transfer the decorative toner to the determined overlapping region so that the decorative toner is overlapped on the entirety or a part of the color toner.

[0118] In the above described exemplary embodiments, the image forming apparatus may include an acquisition unit that acquires a luminance of the decorative toner being transferred and an adjusting unit that adjusts an amount of the decorative toner to be used in forming the decorative toner image 41.

[0119] For example, the acquisition unit acquires a desired luminance of the decorative toner image based on the input image data. The adjusting unit adjusts the amount of the decorative toner which is transferred to the recording medium based on the acquired desired luminance.

[0120] In addition, the entirety or a part of functions of the control unit 15 is recorded as a program for realizing such a function (image forming program) on a recording

medium which is readable by a computer. Then, the program recorded on the recording medium may be executed by operating a CPU.

[0121] Here, the "recording medium readable by the computer" means a portable medium and a storage unit. For example, the portable medium may be a flexible disk, a magneto-optical disk, a ROM, a CD-ROM, a flash memory, or the like. For example, the storage unit is a hard disk or the like mounted in a computer system. The image forming program may be transferred to the CPU via a network such as the internet, for example. In addition, the program may be a program for realizing a part of the above described function. Further, the above described functions may be realized by combining with a program already recorded in the computer system.

[0122] While certain embodiments have been described, these embodiments have been presented by way of example only, and are not intended to limit the scope of the inventions. Indeed, the novel embodiments described herein may be embodied in a variety of other forms; furthermore, various omissions, substitutions and changes in the form of the embodiments described herein may be made without departing from the framework of the inventions. The accompanying claims and their equivalents are intended to cover such forms or modifications as would fall within the scope of the inventions.

Claims

1. An image forming apparatus (1) comprising:

a first developing unit (25Y, 25M, 25C, 25K) configured to supply color toner to form a color toner image on a first photoreceptor;
a second developing unit (25N) configured to supply decorative toner to form a decorative toner image on a second photoreceptor, the decorative toner having a decorative property of at least one of glossiness, glitter or a stereoscopic effect; and
a transfer unit (12) configured to transfer the decorative toner image and the color toner image onto a recording medium with the decorative toner overlapping at least a part of the color toner image in an overlapping area so that the decorative property is visible in the overlapping area.

2. The apparatus according to claim 1, further comprising:

an intermediate transfer belt (13) having a belt surface to which the decorative toner image and the color toner image are transferred; and
a primary transfer unit (30) configured to transfer the decorative toner image onto the belt surface and the color toner image onto at least a portion of the decorative toner image,

wherein the transfer unit is a secondary transfer unit (12) configured to transfer the color toner image and the decorative toner image from the intermediate transfer belt onto the recording medium.

3. The apparatus according to claim 2, wherein the primary transfer unit (30) includes a second image forming unit (20N) configured to transfer the decorative toner image from the second photoreceptor (21N) onto the intermediate transfer belt, and a first image forming unit (20Y, 20M, 20C, 20K) configured to transfer the color toner image from the first photoreceptor (21Y, 21M, 21C, 21K) onto the intermediate transfer belt on top of at least the portion of the decorative toner image, and wherein the second image forming unit is disposed upstream of the first image forming unit in a rotation direction of the intermediate transfer belt.

4. The apparatus according to claim 1, wherein the transfer unit includes a first image forming unit configured to transfer the color toner image from the first photoreceptor onto the recording medium, and a second image forming unit configured to transfer the decorative toner image from the second photoreceptor onto the recording medium with at least the part of the color toner image in the overlapping area, and wherein the first image forming unit (20Y, 20M, 20C, 20K) is disposed upstream of the second image forming unit (20N) in a transportation direction of the recording medium.

5. The apparatus according to any one of claims 1 to 4, wherein the decorative toner contains a pigment having a decorative property of at least one of glossiness, glitter or a stereoscopic effect.

6. The apparatus according to claim 5, wherein an average particle diameter of the said pigment having the decorative property is comprised within 20 μm and 100 μm .

7. The apparatus according to any one of claims 1 to 6, wherein the decorative toner contains at least one of: lame powder, metal powder, and natural mica coated with metal oxide.

8. The apparatus according to any one of claims 1 to 7, wherein the color toner includes at least one of: cyan toner, magenta toner, yellow toner, and black toner.

9. The apparatus according to any one of claims 1 to 8, further comprising:

an acquisition unit configured to determine a de-

sired luminance of the decorative toner image based on input image data; and
 an adjusting unit configured to adjust an amount of the decorative toner being supplied to form the decorative toner image based on the desired luminance.

10. The apparatus according to any one of claims 1 to 9, further comprising:

a determination unit configured to determine a region where the decorative toner image and the color toner image are desired to be overlapped with each other based on input image data,
 wherein the transfer unit is configured to transfer the decorative toner image so that the decorative toner image overlaps the color toner image in the determined region.

11. An image forming method comprising the steps of:

supplying a decorative toner to form a decorative toner image on a first photoreceptor, the decorative toner having a decorative property of at least one of glossiness, glitter or a stereoscopic effect;
 supplying a color toner to form a color toner image on a second photoreceptor; and
 transferring the decorative toner image and the color toner image onto a recording medium with the decorative toner overlapping at least a part of the color toner image in an overlapping area so that the decorative property is visible in the overlapping area.

12. The method according to claim 11, further comprising:

transferring the decorative toner image onto a surface of an intermediate transfer belt;
 transferring the color toner image onto at least a portion of the decorative toner image on the surface of the intermediate transfer belt,
 wherein the step of transferring the decorative toner image and the color toner image onto the recording medium includes transferring the color toner image and the decorative toner image from the intermediate transfer belt onto the recording medium.

13. The method according to claim 11 or 12, wherein the step of transferring the decorative toner image and the color toner image onto the recording medium includes:

transferring the decorative toner image from the first photoreceptor onto a intermediate transfer

belt with a first image forming unit, and
 transferring the color toner image from the second photoreceptor onto the intermediate transfer belt on top of at least the portion of the decorative toner image with a second image forming unit,
 wherein the second image forming unit is disposed upstream of the first image forming unit in a rotation direction of the intermediate transfer belt.

14. The method according to any one of claims 11 to 13, wherein the step of transferring the decorative toner image and the color toner image onto the recording medium includes:

transferring a the color toner image from the first photoreceptor onto the recording medium with a first image forming unit, and
 transferring the decorative toner image from the second photoreceptor onto the recording medium with at least the part of the color toner image in the overlapping area with a second image forming unit, and
 wherein the first image forming unit is disposed upstream of the second image forming unit in a transportation direction of the recording medium.

15. A non-transitory computer readable medium containing instructions that are executed in a processing unit to cause an image forming apparatus to perform the steps according to any one of claims 11 to 14.

FIG. 1

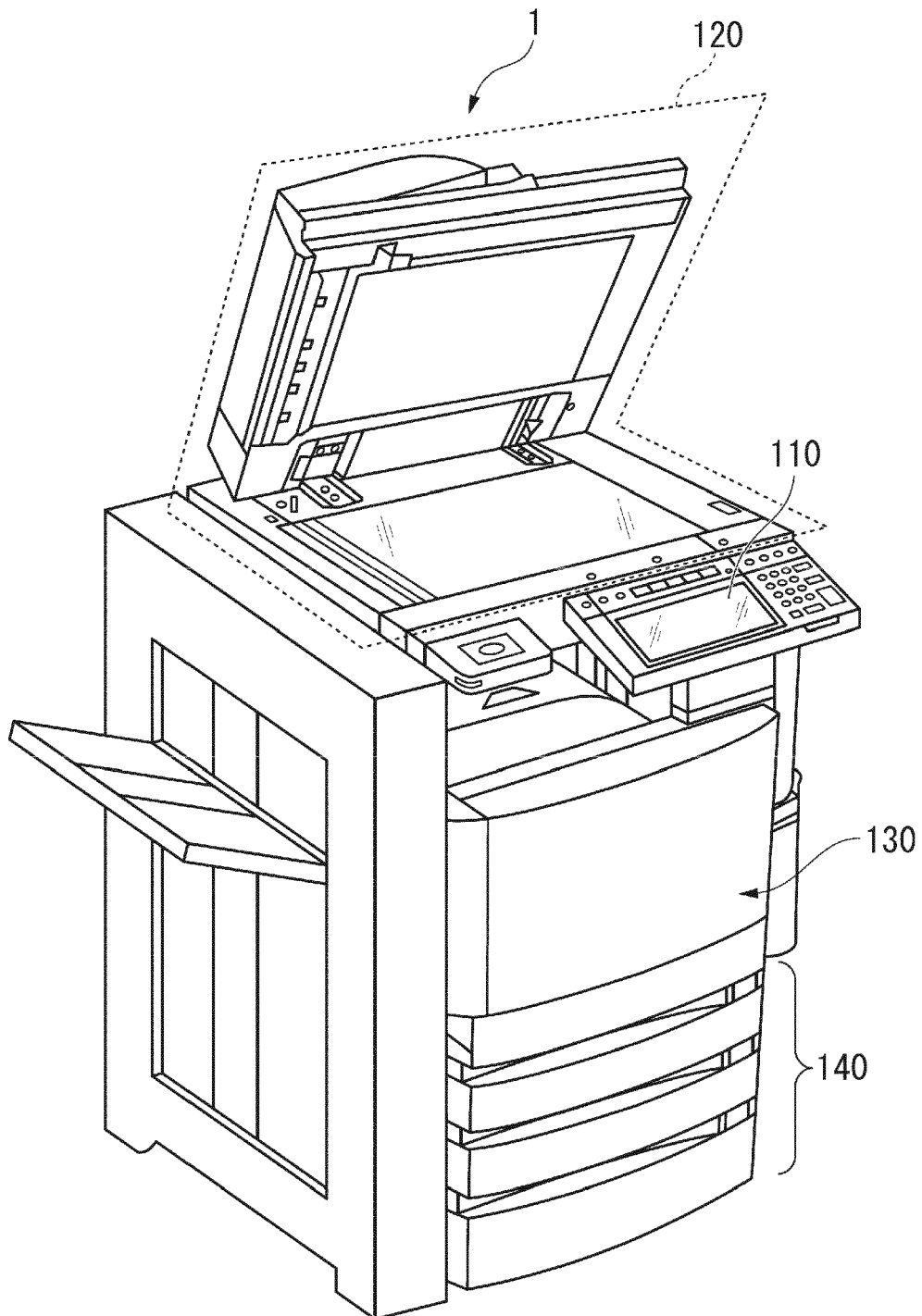


FIG. 2

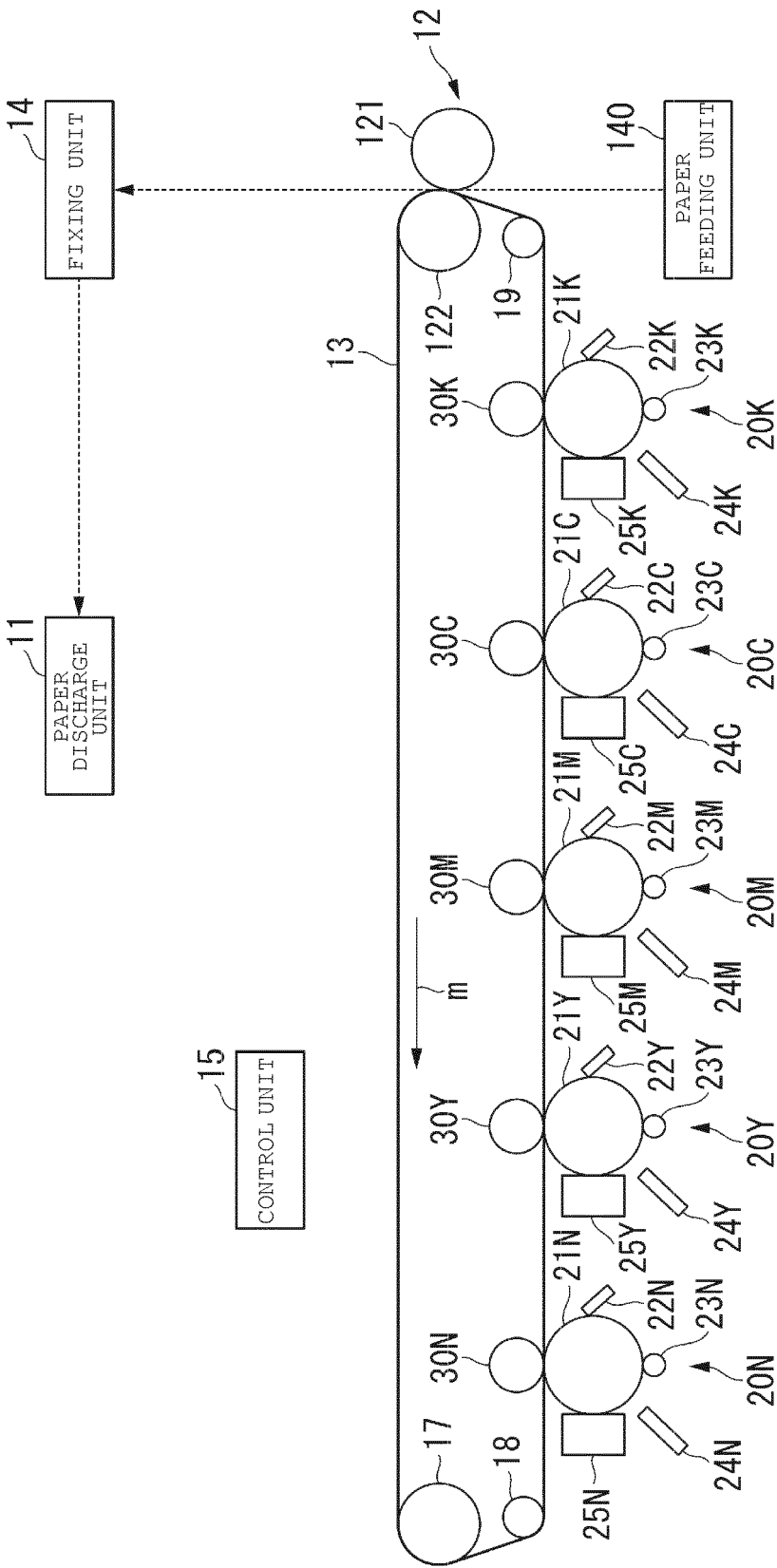


FIG. 3

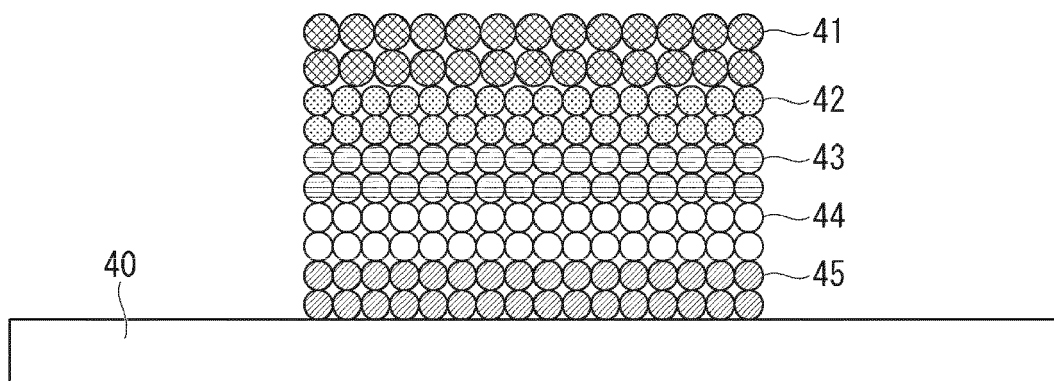


FIG. 4

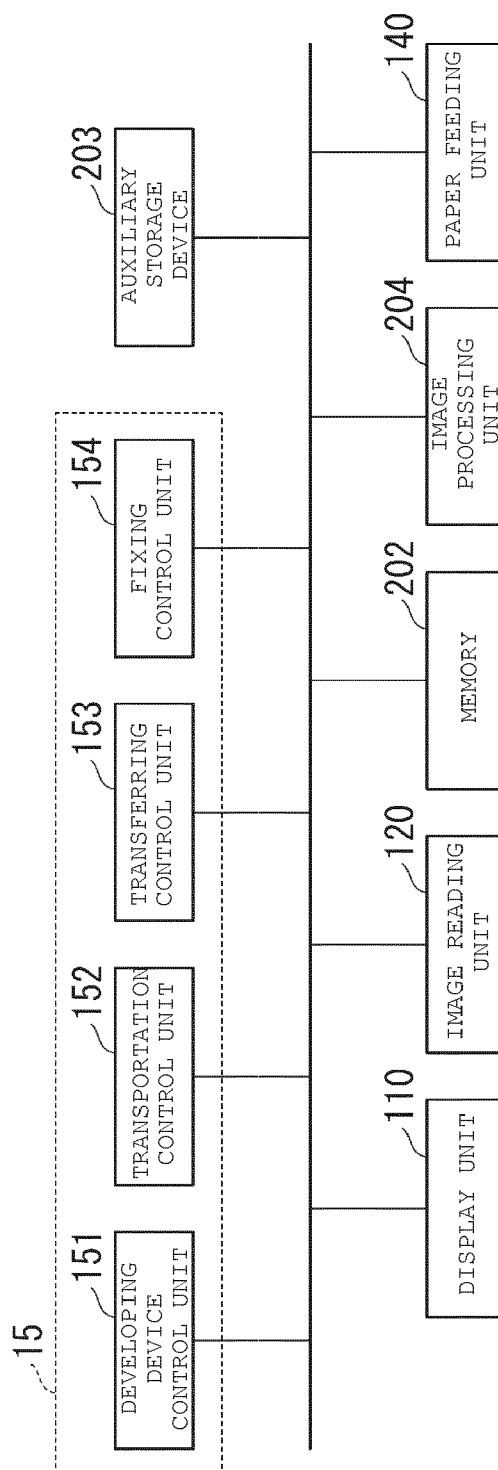


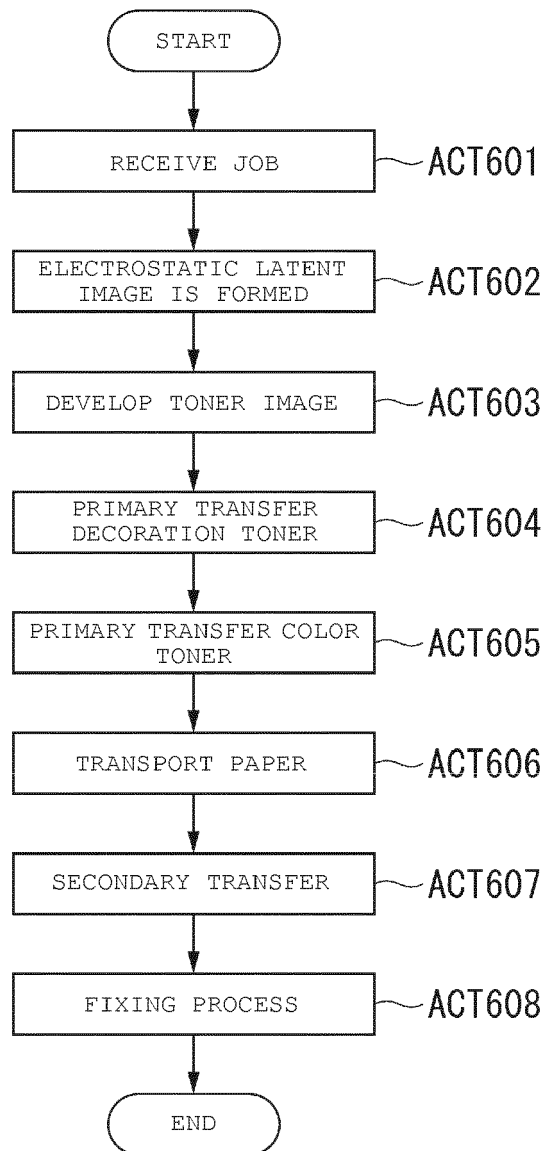
FIG. 5

FIG. 6

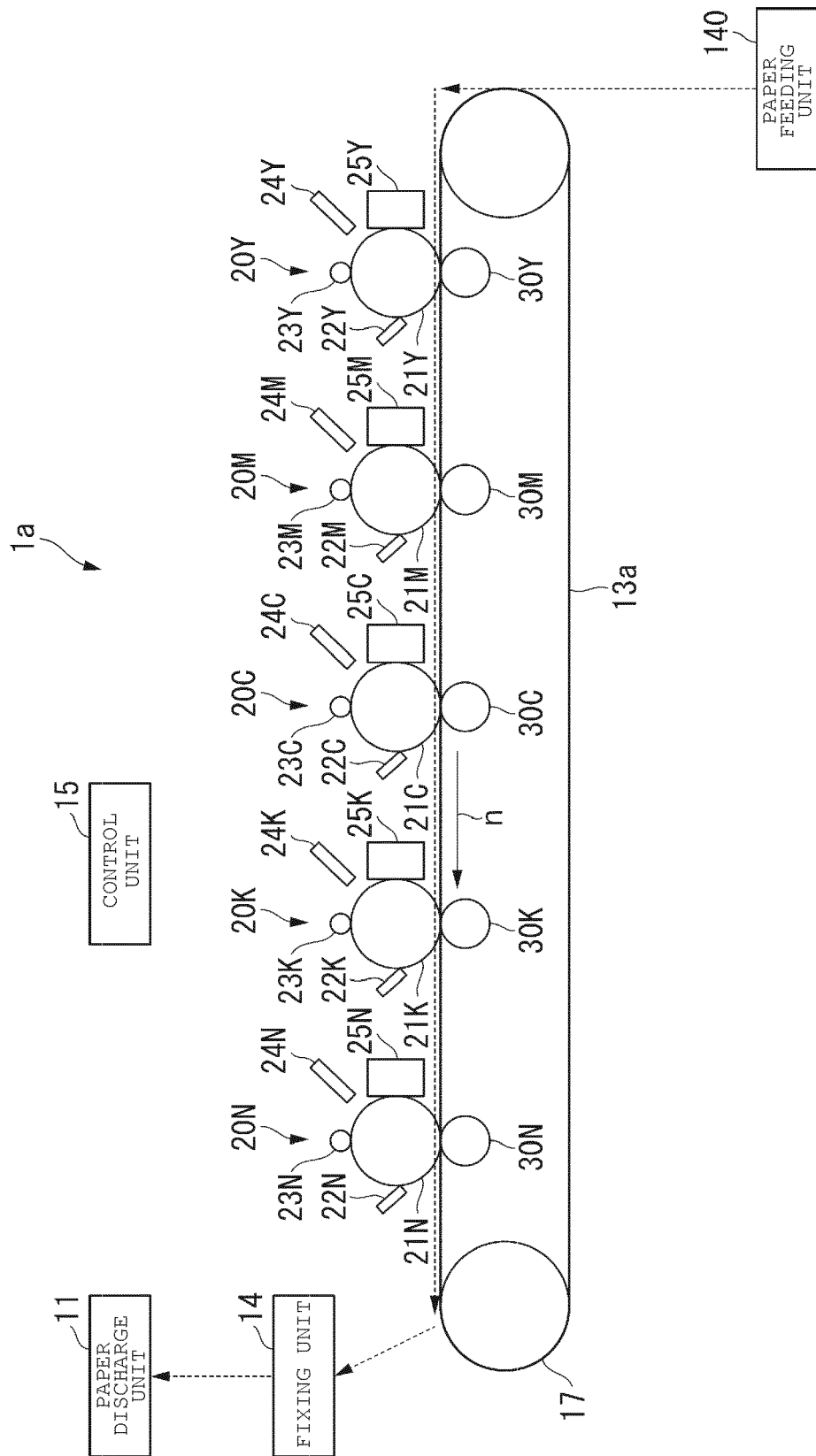
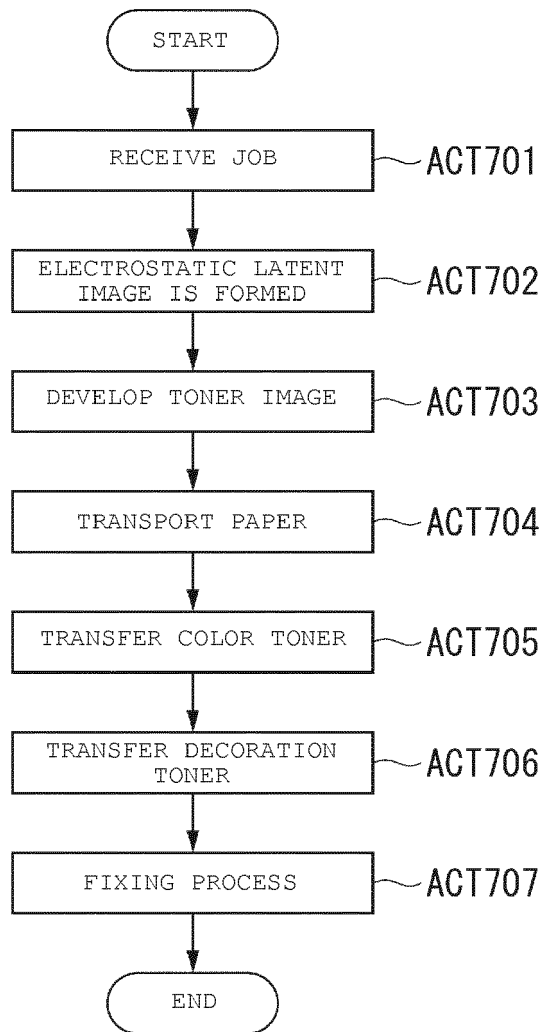


FIG. 7





EUROPEAN SEARCH REPORT

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