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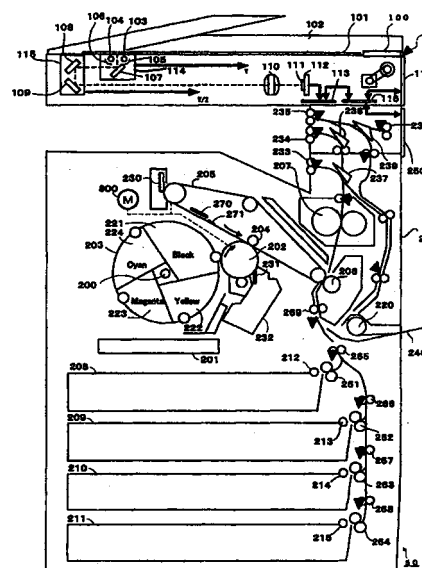
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(54) **IMAGE FORMING DEVICE**

(57) In an electrographic image forming device, the present invention can raise its productivity by reducing a period from a time when a primary transfer of a toner image on a photosensitive body onto an intermediate transfer body is finished to a time when a secondary transfer of the toner image on the intermediate transfer body to a sheet is started. In order to realize such raised productivity, when the sheet, on which the toner image is transferred from the intermediate transfer body 205, is a predetermined sheet, a rotating rate of the intermediate body 205 is changed from a first rate to a second rate after the primary transfer of the toner image on a photo-sensitive drum 202 to the intermediate transfer body 205 is finished, and further the rotating rate of the intermediate transfer body 205 is changed during its first round where the primary transfer is executed or during its second round followed by the first one where the primary transfer is executed in accordance with image forming modes.

FIG. 1



Description

Field of the Invention

[0001] The present invention relates to an image forming device which primarily transfers a toner image formed on a photosensitive body onto an intermediate transfer body, from which the primarily transferred toner image is secondarily transferred onto a recording sheet.

Background of the Invention

[0002] Recently an image forming device, which primarily transfers a toner image formed on a photosensitive body onto an intermediate transfer body and then secondarily transfers the primarily transferred toner image onto a recording sheet, has been gradually employed. In such an image forming device, when a distance between a secondary transfer part and a fixing part is short, a rotating rate of the intermediate transfer body and a rotating rate of the fixing part, namely a fixing rate should be harmonized each other, since sometimes the recording sheet extends over the secondary part to the fixing part.

[0003] When image is formed on special recording sheets such as a thick paper, an envelope, an OHP sheet and the like, fixing rates for such recording papers should be set slower than the fixing rate for a usual recording sheet, since a fixing time set for the usual recording sheet is not enough for the special recording sheets. When images are formed on such special sheets such as the thick paper, the envelope, the OHP sheet and the like, image forming rates have to be reduced, because the rotating rate of the intermediate transfer body has to be reduced in accordance with the fixing rate.

[0004] For example, Japanese laid open patent No.4-67174 proposes an image forming device where the intermediate transfer body is rotated at a predetermined rate during the primary transfer and immediately after the primary transfer is finished the secondary transfer is executed by reducing the rotating rate of the intermediate transfer body so as to harmonize with the fixing rate. The proposed image forming device can keep the image forming rate from reducing.

Disclosure of the Invention

Problems to be Solved by the Invention

[0005] In the above-mentioned conventional image forming devices, however, image forming productivity is prevented from improving, since the rotating rate of the intermediate transfer body is reduced immediately after the primary transfer is finished so that it takes a rather longer period to start the secondary transfer from a time when the rotating rate of the intermediate transfer body is reduced.

[0006] And Japanese laid open patent No.9-146434

discloses an image forming device where a rotating rate of an intermediate transfer body is start reducing when the top of image on the intermediate transfer body reaches at a position ahead of a secondary transfer position after a primary transfer is finished, and the reduced rotating rate of the intermediate transfer body is returned to the initial rate before the top of the image on the intermediate transfer body reaches a second transfer position by arranging a distance between a primary transfer part and a secondary transfer part on the intermediate transfer body which is constituted longer than image having a maximum length.

[0007] However, such image forming devices are designed on the assumption that the distance between the primary transfer part and the secondary transfer part on the intermediate transfer body is set more than a distance consisting of a maximum image length and a length required to reduce the rotating rate of the intermediate transfer body. In order to make it possible to form a longer image, a further longer distance between the primary transfer part and the secondary transfer part on the intermediate transfer body is proposed.

[0008] In some cases, however, the distance between the first transfer part and the secondary transfer part on the intermediate transfer body cannot be set so long due to structural restrictions of the image forming device. Recently, a plurality of images are formed around the whole surface of the intermediate transfer body in certain types of image forming devices. In such image forming devices, sometimes the rotating rate of the intermediate transfer body can be completely reduced before the top of the image reaches the secondary transfer part, but in some cases the rotating rate cannot be completely reduced, depending on the sizes of images and the number of the images formed on around the whole surface of the intermediate transfer body. Consequently, the secondary transfer is started whenever the top of the image on the intermediate transfer body reaches the secondary transfer part after completing the first transfer, the secondary transfer is started before completing to reduce the rotating rate of the intermediate transfer body, which sometimes causes a problem that the secondary transfer is executed in a state where the rotating rate of the intermediate transfer body is faster than a fixing rate.

[0009] The present invention is carried out in view of the above-mentioned problems in order to provide an image forming device capable of raising productivity by reducing a period from a time when the first transfer is finished to a time when the secondary transfer is started.

Means to Solve the Problems

[0010] The image forming devices constituted in the following manners can attain the above-mentioned purposes of the present invention.

(1) An image forming device comprising: a photosensitive body which carries a toner image on it; a

rotatable intermediate transfer body onto which the toner image on the photosensitive body is transferred; a primary transfer means which primarily transfers the toner image on the photosensitive body to the intermediate transfer body; a secondary transfer means which secondarily transfers the toner image on intermediate transfer body to a sheet, and a control means which controls the intermediate transfer body and the secondary transfer means, wherein: in case of a predetermined sheet, the control means changes a rotating rate of the intermediate body from a first rate to a second rate after the primary transfer is finished, and in accordance with image forming modes, further the control means determines whether the rotating rate of the intermediate transfer body is changed during its first round where the primary transfer is executed or during its second round followed by the first round where the primary transfer is executed.

(2) The image forming device according to (1), wherein: the sheet is either one of a thick paper, an envelope, a postcard, an OHP sheet, a label paper, a tab paper or a second draft of an original drawing.

(3) The image forming device according to (1), wherein: the image forming modes comprise the number of the toner images formed on one round of the surface of the intermediate transfer body.

(4) The image forming device according to (1), wherein: the image forming modes comprise the sizes of the toner images.

(5) The image forming device according to (1), wherein: the control means determines whether the rotating rate of the intermediate transfer body is changed during its first round where the primary transfer is executed or during its second round followed by the first round where the primary transfer is executed by judging whether a first distance between the top of the toner image and the secondary transfer means, is longer than a predetermined distance or not.

(6) The image forming device according to (5), wherein: when the first distance is longer than the predetermined distance, the control means changes the rotating rate of the intermediate transfer body during the first round where the primary transfer is executed.

(7) The image forming device according to (5), wherein: when the first distance is less than the predetermined distance, the control means changes the rotating rate of the intermediate transfer body during the second round followed by the first round where the primary transfer is executed.

(8) The image forming device according to (1), further comprising: a fixing means to fix the toner image on the sheet at a fixing rate after the secondary transfer is finished, wherein: the control means controls the rotating rate of the intermediate transfer body substantially at the same rate as the fixing rate.

(9) The image forming device according to (1), wherein: the first rate is faster than the second rate.

(10) The image forming device according to (1), wherein: the intermediate transfer body comprises a mark for detecting the top of the toner image on the intermediate transfer body, and the intermediate transfer body further comprises a detecting means to detect the mark on the intermediate transfer body.

(11) The image forming device according to (10), wherein: the control means changes the rotating rate of the intermediate transfer body immediately before the detecting means detects the mark on the intermediate transfer body.

Effects of the Invention

[0011] The present invention can provide the image forming device capable of raising productivity by reducing the period from the time when the primary transfer is finished to the time when the secondary transfer is started.

Brief Description of the Drawings

[0012]

FIG.1 is a cross-sectional view of a color image forming device by the present invention showing an out-lined whole arrangement.

FIG.2 is a block diagram showing a detailed constitution of the digital image processing unit.

FIG.3 is a block diagram showing an image information processing constitution.

FIG.4 is a block diagram showing a main constitution of the control unit.

FIG.5 is a perspective view showing an arrangement of an optical writing system.

FIG.6 is a timing chart showing image forming operations of a referential example in the case of two ordinary sheets.

FIG.7 is a timing chart showing image forming operations of another referential example in the case of two thick sheets.

FIG.8 is a flow chart showing a calculating procedure to determine a period from a time when the primary transfer is finished to a time when the rotating rate of the motor is reduced.

FIG.9 is a timing chart showing image forming operations in the case of two thick sheets.

FIG.10 is another timing chart showing image forming operations in the case of two thick sheets.

FIG.11 is a timing chart showing image forming operations in the case of one thick sheet.

FIG.12 is another timing chart showing image forming operations in the case of one thick sheet.

Detailed Description of the Preferred Embodiments

[0013] Hereinafter a color image forming device 50, as

one of the embodiments by the present invention, is explained as referring to the drawings.

[0014] In respective drawings, since components having the same reference characters indicate the same components, repeated explanations on the same components in different drawings are omitted.

[0015] FIG.1 is the rough cross-sectional view of the color image forming device 50.

[0016] In the drawing, a reference numeral "1" is a color image reader part (hereinafter referred as "reader part 1") and a reference numeral "2" is a color image printer part (hereinafter referred as "printer part").

[0017] A reference numeral "100" is a control unit, a reference numeral "101" is a draft mounting glass (platen), a reference numeral "102" is an automatic draft feeder (ADF), reference numerals "103", "104" are light sources to irradiate a draft and reference numerals "105", "106" are reflective umbrellas.

[0018] Reference numerals "107"-"109" are mirrors, a reference numeral "110" is a lens and a reference numeral "111" is a CCD.

[0019] A reference numeral "112" is a substrate and a reference numeral "113" is a digital image processing unit.

[0020] A reference numeral "114" is a carriage which accommodates the light sources 103, 104, the reflective umbrellas 105, 106 and the mirror 107, and a reference numeral "115" is a carriage which accommodates the mirrors 108, 109.

[0021] A reference numeral "116" is an external interface (I/F) to be connected with other devices.

[0022] Hereinafter, a constitution of the printer part 2 is explained.

[0023] A reference numeral "200" is a rotation axis, a reference numeral "201" is a laser scanner used as a latent image forming means, a reference numeral "202" is a photosensitive drum used as a photosensitive body and a reference numeral "203" is developers for various colors having developing means and a switching means to switch a color to be developed.

[0024] The above-mentioned laser scanner 201, the photosensitive drum 202 and the developers 203 for respective colors constitute a color forming means.

[0025] A reference numeral "204" is a primary transfer roller.

[0026] A reference numeral "205" is an intermediate transfer body, a reference numeral "206" is a secondary transfer roller, a reference numeral "207" is a fixing and pressure roller, reference numerals "208", "209", "210", "211" are cassettes, reference numerals "212", "213", "214", "215" are pick-up rollers, a reference numeral "220" is a manually fed paper pick-up roller, reference numerals "221", "222", "223", "224" are developers, a reference numeral "230" is a cleaning blade, a reference numeral "231" is a blade, a reference numeral "232" is a wasted toner box, a reference numeral "233" is a first paper delivery roller, a reference numeral "234" is a second paper delivery roller, a reference numeral "235" is a

reverse roller, a reference numeral "236" is a third paper delivery roller, a reference numeral "237" is a first paper delivery flapper, a reference numeral "238" is a second paper delivery flapper, a reference numeral "239" is a third paper delivery flapper, a reference numeral "240" is a sheet tray for manually fed sheet, reference numerals "261", "262", "263", "264" are paper pick-up rollers, reference numerals "265", "266", "267", "268" are paper feed rollers to feed in a longitudinal direction, a reference numeral "269" is a registration roller, a reference numeral "270" is an HP detection sensor and reference numeral "271" is a home position (HP) seal.

[0027] The image forming device 50 has the reader part 1 in its upper part and the printer part 2 in its lower part.

[0028] Hereinafter a constitution of the reader part 1 is explained.

[0029] The reader part 1 has the draft mounting glass (platen) 101 and the automatic draft feeder (ADF) 102. In place of the automatic draft feeder, a mirror pressure plate or a white pressure plate (not shown in the drawing) can be used in this constitution.

[0030] Halogen lamps, fluorescent lamps, xenon lamps and the like are used as the light sources 103 and 104 to irradiate drafts.

[0031] Light from the light sources 103 and 104 is collected onto the draft mounting glass 101 by the reflective umbrellas 105 and 106.

[0032] Reflected light or projected light from a draft on the draft mounting glass 101 is collected onto the CCD (Charge Coupled Device) image sensor (hereinafter referred as CCD) 111 via the lens 110.

[0033] The CCD 111 is mounted on the substrate 112. The control unit 100 controls the whole image forming device. Except the CCD 111 and the external I/F 116, the digital image processing unit 113 contains processing parts from a cramp & Amp & S/H & A/D part 502 to a black-letter identifying part 115 as shown in FIG.2 as well as a binary conversion part 401 a delay processing part 402 as shown in FIG.3.

[0034] The carriage 114 accommodates the light sources 103, 104, the reflective umbrellas 105, 106 and the mirror 107. The carriage 115 accommodates the mirrors 108, 109.

[0035] The carriage 114 scans the whole surface of the draft on the draft mounting glass 101 at a rate of V by mechanically moving in a sub-scanning direction Y perpendicular to an electrically scanning direction (a main-scanning direction X) of the CCD 111, and the carriage 115 moves in the same direction at a rate of 1/2*V as the carriage 114 moves.

[0036] The external interface (I/F) 116 is used as an interface connected with other devices such as personal computers and networks.

[0037] FIG.2 is the block diagram showing the detailed constitution of the digital image processing unit 113.

[0038] In the drawing, a reference numeral "502" is the cramp & Amp & S/H & A/D part, a reference numeral

"503" is a shading part, a reference numeral "504" is a parting line joint & MTF correction & draft detecting part, a reference numeral "505" is a inputting image masking part, a reference numeral "506" is a selector, a reference numeral "507" is a color space compressing & background removing & LOG conversion part, a reference numeral "508" is a delay processing part, a reference numeral "509" is a moiré removing part, a reference numeral "510" is a variable sizing part, a reference numeral "511" is a UCR & masking & black-letter reflecting part, a reference numeral "512" is a γ correction part, a reference numeral "513" is a filtering part, a reference numeral "514" is a background removing part and a reference numeral "515" is the black-letter identifying part.

[0039] Light from the light sources 103, 104 is reflected by the draft on the draft mounting glass 101 and led to the CCD 111 where the led light is converted into electrical signals (when the CCD is a color sensor, either a one-lined sensor where RGB color filters are mounted on the CCD in the order of RGB or three-lined CCDs where an R filter, a G filter and a B filter are mounted on respective three CCDs can be used, and either built-in filters in a CCD chip or separately arranged filters from the CCD chip can be used).

[0040] The above-mentioned electrical signals (analog image signals) are inputted in the digital image processing part 113 and are sampled/held (S/H) by the clamp & Amp & S/H & A/D part 502 where a dark level of the analog signals is cramped at a reference voltage and converted into digital signals, for example, into respective RGB 8 bit signals after amplified at a predetermined rate (the above-mentioned processing steps are not always execute in the explained order).

[0041] When the CCD 111 is, for example, the three-lined CCDs, since original reading positions among three lines do not match each other in a step to join the parting lines, delayed values of the respective lines are adjusted in accordance with a reading rate and timings of the signals are corrected by the joining & MTF correction & draft detecting part 504 so as to match reading positions of the three lines, after shading corrections and black corrections on the RGB signals are executed by the shading part 503.

[0042] Since read MTF values vary in accordance with reading rates and variable sizing rates, varied values are corrected in the MTF correction step and the size of the draft is recognized by scanning the draft on the draft mounting glass 101.

[0043] The digital signals with corrected read positions are also corrected in their spectral characteristics of the CCD 111, the light sources 103, 104 and the reflective umbrellas 105, 106 by the inputted image masking part 504.

[0044] Outputted signals from the inputted image masking part 505 are inputted to the selector 506 which can be switched to signals from the external I/F.

[0045] Outputted signals from the selector 506 are inputted to the color space compressing & background re-

moving & LOG conversion part 507 and the background removing part 514.

[0046] Background signals of the inputted signals are removed by the background removing part 514 and inputted to the black-letter identifying part 515 where inputted signals are decided whether the signals correspond to black letters in the draft or not, and black-letter signals are generated from the draft.

[0047] In the color space compressing step of the color space compressing & background removing & LOG conversion part 507 to which another outputted signals from the selector 506 is inputted, inputted signals are judged whether they are in a reproducible range by the printer part or not. If they are in the range, the signals are left as they are. If not in the range, the signals are corrected so as to go into the range.

[0048] Then background signals are removed from the signals processed in the previous step, and the signals are converted from the RGB signals to YMC signals by a LOG conversion part.

[0049] Then, in order to match the timings of the generated signals by the black-letter identifying part 515, the outputted signals from the color space compressing & background removing & LOG conversion part 507 are adjusted in their timings by the delay processing part 508.

[0050] Moiré are removed from these two types of the signals by the moiré removing part 509 and the processed signals are varied their sizes in the main scanning direction by the variable sizing part 510.

[0051] YMCK signals are generated from YMC signals among the signals processed by the variable sizing part 510 in a UCR processing part of the UCR & masking & black-letter reflecting part 511 and the generated signals are corrected so as to match outputting performance of the printer unit by a masking part, and at the same time judged signals generated from the black-letter identifying part 515 are fed back to the YMCK signals.

[0052] The signals processed by the UCR & masking & black-letter reflecting part 511 are adjusted their densities by the γ correction part 512, and then treated for smoothing or edging by the filtering part 513.

[0053] The signals processed in the above-mentioned manners are transmitted to the printer unit 2.

[0054] FIG.3 is a block diagram showing a signal receiving part in the printer unit 2 which receives transmitted data from the digital signal processing unit.

[0055] 8 bit multi-valued signals are converted into binary signals by the binary conversion part 401.

[0056] Either one of methods among a dithering method, an error-diffusion method, a modified error-diffusion method and the like can be employed as the converting method.

[0057] The converted binary signals are transmitted to the external I/F 116 and the delay processing part 402.

[0058] The external I/F 116 transmits the binary signals to external output devices such as a facsimile machine (not shown) and the like, if required.

[0059] The delay processing part 402 adjusts timings

of the binary signals to transmit to the laser scanner 201, in order to correct emitting timings of the laser scanners 201.

[0060] Then the binary signals are transmitted to the laser scanner 201.

[0061] The binary conversion part 401 and the delay processing part 402 can be included in the digital image processing part 113 as another constitution.

[0062] FIG.4 is the block diagram explaining the main constitution of the control unit 100.

[0063] A reference numeral "218" is a printer controlling I/F, a reference numeral "301" is a CPU to reduce the rotating rate of the intermediate transfer body 205 and a feeding rate of a recording sheet before the secondary transfer in accordance with type of the sheet, a reference numeral "302" is a memory for storing the size of the recording sheet, a reference numeral "303" is an operational part (operation panel), a reference numeral "304" is a ROM and a reference numeral "305" is a RAM.

[0064] The control unit 100 is constituted by the CPU 301 which exchanges information with and controls the digital image processing part 113, the printer controlling I/F 218 and the external I/F 116, the operational part 303 and the memory 302.

[0065] The memory 302 is constituted by the RAM 305 which provides operational areas to the CPU 301 and the ROM 304 which stores a control program of the CPU 301.

[0066] The operational part 303 is constituted by a liquid crystal display equipped with a touch panel for inputting processing steps to be executed and notifying information on the processing steps, warnings to an operator and the like.

[0067] Hereinafter a constitution of the color printer unit 2 is explained as referring to FIGs.1 and 5.

[0068] Control signals from the control unit 100 are received by the printer control I/F 218 and the printer unit 2 is operated based on the control signals from the printer control I/F 218.

[0069] FIG.5 is the perspective view showing the rough arrangement of the laser scanner 201.

[0070] A reference numeral "601" is a laser driver circuit board, a reference numeral "602" is a collimator lens, a reference numeral "603" is a cylindrical lens, a reference numeral "604" is a polygon mirror, a reference numeral "605" is a polygon mirror driving motor, a reference numeral "606" is an image forming lens, a reference numeral "607" is a reflective mirror and a reference numeral "608" is a BD (beam detector) circuit board.

[0071] Laser light corresponding to image data signals is radiated from the laser driver circuit board 601, converted into collimated light by the collimator lens 602 and the cylindrical lens 603, and reaches the polygon mirror 604 rotated at a predetermined rate by the polygon mirror driving motor 605.

[0072] The reflected laser light by the polygon mirror 604 irradiates the photosensitive drum 202 so as to scan in the main scanning direction via the image forming lens

606 and the reflective mirror which are arranged ahead of the polygon mirror 604.

[0073] While the photosensitive drum 202 is rotating counterclockwise, electrostatic latent image is formed on the photosensitive drum 202 by the laser scanner 201.

[0074] The rotatable color developer 203 is constituted such that the developers 221, 222, 223, 224 respectively corresponding to black, yellow, magenta, cyan are arranged clockwise around the rotation axis 200. The developers 221, 222, 223, 224 develop the photosensitive drum 202 by sticking respective toners on the latent image formed on the photosensitive drum 202. Developing agents are not limited to the toners, but other developing agents can be employed.

[0075] In the present embodiments, the developers 221, 222, 223, 224 for respective colors are arranged easily detachable from the rotatable color developer 203 and attached to predetermined positions on the color developer 203.

[0076] When black image is formed on the photosensitive drum 202 by the toner, only the black developer 221 is used for developing monochrome black image. The rotatable color developer 203 is rotated to a position where a developing sleeve of the black developer 221 faces against the photosensitive drum 202. Some amount of the black toner in proportion to a voltage between the surface of the photosensitive drum 202 on which the latent image is formed and the surface of the developing sleeve on which a bias voltage is applied, is shot from the developer 221 onto the surface of the photosensitive drum 202 so that the electrostatic latent image on the photosensitive drum 202 is developed.

[0077] When color image is formed, after the rotatable color developer 203 is rotated around the rotation axis 200 by a stepping motor (not shown in the drawings) up to a developing position where one of the desired color developers 221 to 224 is rotated closely (or contacted) to the photosensitive drum 202, the desired color is developed.

[0078] Some amount of toner in proportion to electric charge on the photoelectric drum 202 is supplied from one of the color developers 221 to 224 to the photosensitive drum 202, so that the electrostatic latent image on the photosensitive drum 202 is developed.

[0079] The photosensitive drum 202 on which toner image is formed, is rotated clockwise, and the toner image on the photosensitive drum 202 is primarily transferred onto the intermediate transfer body 205 rotated counterclockwise by the primary transfer roller 204. The primary transfer is executed under the bias voltage on the primary transfer roller 204 controlled by the CPU 301.

[0080] In case of a full-color image, since the primary transfer onto the intermediate transfer body 205 is executed in respective colors one by one, the primary transfer steps for the full-color image are completed by executing the primary transfer onto the intermediate transfer 205 four times.

[0081] When image has a special size, for example,

smaller than A4 size by the Japanese standard, two images (two pages) can be formed on the intermediate transfer body 205.

[0082] Sheets picked up from the respective cassettes (the cassette 208 on a first stage, the cassette 209 on a second stage, the cassette 210 on a third stage, the cassette 211 on the fourth stage) by respective pick-up rollers 212, 213, 214, 215 and fed by the respective paper pick-up rollers 261, 262, 263, 264 of the respective cassettes, are fed to the registration roller 269 by the paper feed rollers 265, 266, 267, 268 in a longitudinal direction.

[0083] In case of the manual pick-up, sheets mounted on the sheet tray 240 are fed to the registration roller 269 by the manual pick-up roller 220.

[0084] Then the sheet is fed to a nipping position between the intermediate transfer body 205 and the secondary transfer roller 206, at a timing when the primary transfer onto the intermediate transfer body 205 is finished.

[0085] Thereafter, while the sheet is fed toward the fixing and pressing roller 207 as being pinched between the secondary transfer roller 206 and the intermediate transfer body 205, at the same time the sheet is pressed against the intermediate transfer body 205, so that the toner image on the intermediate transfer roller 205 is secondarily transferred on the sheet by the secondary transfer roller 206. The secondary transfer is executed under the bias voltage on the secondary transfer roller 206 controlled by the CPU 301.

[0086] The toner image transferred on the sheet is fixed on the sheet as being heated and pressed by the fixing and pressing roller 207.

[0087] A portion of toner which is not transferred on sheet and is remaining on the intermediate transfer body 205, is scraped off from the surface of the intermediated transfer body 205 by pressing the cleaning blade 230, which can be detachably pressed, against the surface of the intermediate transfer body 205, so that the remaining toner is cleaned by an after-treatment operation in the latter part of an image forming sequence.

[0088] A portion of toner remaining on the photosensitive drum is scraped off from the surface of the photosensitive drum and sent to the waste toner box 232 which is monolithically formed as a photosensitive drum unit.

[0089] Toner with positive or negative polarity probably adsorbed on the surface of the secondary transfer roller by unexpected causes, is made to be adsorbed onto the intermediate transfer body 205 by applying alternately a secondary positive bias voltage and a secondary negative bias voltage, and then the adsorbed toner on the intermediate transfer body is scraped off by cleaning blade 230 for the intermediate transfer, so that the after-treatment operation is finished by cleaning the remaining toner completely.

[0090] When the fixed sheet is a first type of paper, the fixed sheet is delivered toward the first paper delivery roller 23-3 by switching the first paper delivery flapper 237 to the first delivery roller 233.

[0091] When the fixed sheet is a second type of paper, the fixed sheet is delivered toward the second paper delivery roller 234 by switching the second paper delivery flapper 238 to the second delivery roller 234.

[0092] When the fixed sheet is a third type of sheet, the fixed sheet is delivered toward the reverse roller 235 by switching the first paper delivery flapper 237 and the second delivery flapper 238 to the reverse roller 235 so that the fixed paper is reversed.

[0093] After the fixed sheet is reversed by the reverse roller 235, the fixed sheet is delivered toward the third paper delivery roller 236 by switching the third paper delivery flapper 239 to the third paper delivery roller 236.

[0094] When the fixed sheet is a double-sided paper, the fixed paper is reversed by the reverse roller 235 as in the case of the third type of the paper, and then the fixed sheet is delivered to a double-side processing unit by switching the third paper delivery flapper 239 to the double-side processing unit.

[0095] The fixed sheet is stopped for a predetermined period after the sheet is detected by a double-sided sensor, then the fixed sheet is fed again and another image is formed on the rear surface of the fixed sheet.

[0096] Hereinafter, image forming controlling procedures capable of raising productivity of image forming, which is one of the features the embodiment of the present invention, are explained together with referential examples as referring to FIGs.6 to 12.

[0097] To begin with, image forming controlling procedures of the referential examples are explained.

(Image Forming Controlling Procedure of Referential Example 1)

[0098] FIG.6 is a chart illustrating timings of respective steps of image forming controlling procedure of referential example 1 when images are formed on two ordinary sheets.

[0099] A reference numeral "701" is a timing chart showing change of rotating rate of a DC brush-less motor 800 which drives the photosensitive drum 202 and the intermediate transfer body 205. When image is formed on the ordinary paper, the photosensitive drum is rotated at a rate of V1, which is a rate for the ordinary paper.

[0100] A reference numeral "702" is a timing chart showing HP signal generating timings to determine the top of image. The HP signals are outputted whenever the HP sensor 270 detects the home position (HP) seal 271 arranged in the intermediate transfer body 205.

[0101] A reference numeral "703" is a timing chart showing laser light emitting timings based on image data to be reproduced, and the laser light is emitted when a predetermined time elapsed after the HP signal 702 generated. A color image with less color-shears can be formed by emitting laser light for respective colors in the same manner. In the present referential example, A4 sized (by the Japanese standard) two images are formed simultaneously on two sheets, so that Y-A, M-A, C-A,

K-A indicate laser light emitting timings for image on the first sheet and Y-B, M-B, C-B, K-B indicate laser light emitting timings for image on the second sheet. Here, the two sheets means that image having its size corresponding to two pages can be transferred on one round surface of the intermediate transfer body 205.

[0102] A reference numeral "704" is a timing chart showing primary transfer timings of the toner image on the photosensitive drum 202 to the intermediated transfer body 205.

[0103] A reference numeral "705" is a timing chart showing rotating timings of the rotatable color developer (hereinafter referred as "developing rotary") 203 in order to move another color developer closely to the photosensitive drum 202.

[0104] A reference numeral "706" is a timing chart showing secondary transfer timings of the toner image transferred on the intermediate transfer body 205 to the sheet, and the transfer timings are determined based on the HP signals 702.

[0105] A reference numeral "707" indicates one cycle of the image forming procedure from a time when the latent image is formed to a time when the secondary transfer is finished.

[0106] When the image is formed on one sheet, laser light emitting timings and the primary transfer timings only for Y-A, M-A, C-A, K-A and only the secondary transfer timing A in the timing chart 706 are controlled. When the cycle 707 is repeated, image can be formed on three sheets or more.

[0107] Reference numerals "710", "711", "712", "713" indicate periods from the respective timings of the HP signals 730, 731, 732, 733 to the timings to start the respective laser light emission.

[0108] A reference numeral "714" indicates a period from the timing of the HP signal to the timing to start the secondary transfer.

[0109] Reference numerals "720", "721", "722", "723" indicate periods from the respective timings of the HP signals 730, 731, 732, 733 to the timings to start the respective laser light emission for the second sheet in the case of two-sheet transfer.

[0110] A reference numeral "724" indicates a period from the timing of the HP signal to the timing to start the secondary transfer on the second sheet.

[0111] Reference numerals 730-734 are the respective HP signals.

(Image Forming Controlling Procedure of Referential Example 2)

[0112] A chart shown in FIG.7 is a timing chart, when images are formed on a thick paper, an envelope and the like.

[0113] FIG.7 is the chart illustrating timings of respective steps of image forming control of referential example 2 when images are formed on the thick two sheets, and the rotating rate of the motor is reduced to V_2 ($<V_1$) im-

mediately after the primary transfer is finished.

[0114] Reference numerals "735", "736" are respective HP signals after the rotating rate is reduced.

[0115] Up to the timing when the primary transfer is finished, respective timings are the same as in the case of the ordinary paper.

[0116] When the types of the sheets are the thick paper, the envelope and the like, taking a transfer efficiency of the secondary transfer and fixed quality of the fixing into consideration, the CPU 301 controls the feeding rate of the sheet and the rotating rate of the intermediate transfer body 205 at $1/2 \cdot V_1$; where V_1 is the rate for the ordinary sheet.

[0117] In of case FIG.7, the rotating rate of the motor is reduced to the rate of $V_2 = V_1/2$ as an image forming rate on the thick paper immediately after the primary transfer K-B is finished.

[0118] Then after the rotating rate of the motor is stabilized at the rate V_2 and when the predetermined period 714 is elapsed after the HP signal is detected again, the toner image on the intermediate transfer body 205 is secondarily transferred on the fed sheet. In the example shown in FIG.7, the rotating rate of the intermediate transfer body 205 is changed in accordance with the size of the image and the numbers of images on one round of the intermediate transfer body 205. Although the CPU 301 controls the timing of the second transfer in response to the HP signal 735, it does not determine the rotating rate of the intermediate transfer body 205 prior to the secondary transfer.

[0119] In case of reproducing three or more images, after the image is transferred on the second sheet at timing B in the chart 706, the rotating rate of the motor is raised to V_1 again and the developing rotary 203 is rotated up to the developing position of yellow (corresponding to the first timing) in the chart 705.

[0120] In case of reproducing black mono-color image, only the laser light emitting timing K-A in the chart 703, the corresponding primary transfer timing in the chart 704 and the secondary transfer timing A in the chart 706 are controlled.

[0121] In case of reproducing full-color image, when only one image can be formed one round of the intermediate transfer body 205 for a longer sheet than A4 size (by the Japanese standard) or a letter size, only the laser emitting timings Y-A, M-A, C-A, K-A in the chart 703, the corresponding primary transfer timings in the chart 704 and the secondary transfer timing A in the chart 706 are controlled.

[0122] In the timing chart shown in FIG.7, the image forming rate per unit time is in inverse proportion to the cycle 707 from a time when the HP signal for the first yellow image is detected to a time when the HP signal for the third yellow signal is detected.

[0123] Since a period required for the primary and secondary transfers depends on the size of the sheet and the numbers of the sheets, it is difficult to reduce the cycle 707 in order to raise the image forming rate.

[0124] While a period from the time the primary transfer is finished to the time when the HP signal for the secondary transfer is detected can be reduced regardless of size of the sheet.

(Image Forming Control of the Present Embodiment)

[0125] Hereinafter the image forming control of the present embodiment is explained.

[0126] In the image forming control of the present embodiment, the same control as in referential example 1 shown in FIG.6 is employed when image is formed on the ordinary papers. However, when image is formed on the thick paper, the envelope or the OHP sheet (transparent sheet for an overhead projector) and when the rotating rate of the intermediate transfer body 205 is required to reduce during image forming procedure, the rotating rate of the intermediate transfer body is reduced not immediately after the time when the primary transfer is finished, but after a predetermined period t_{intvl} is elapsed by taking a period t_v required to reduce the rotating rate of the motor and size of the sheet into consideration.

[0127] FIG.8 is a flow chart showing a calculating procedure to determine the period t_{intvl} from the time when the primary transfer is finished to the time when the rotating rate of the motor is started to reduce down to V2. Based on this flow chart, the period t_{intvl} is calculated before the primary transfer.

[0128] At step S1001, the following periods are calculated or memorized beforehand. Period t_1 : from a time when the HP on the intermediate transfer body 205 is detected to a time when the primary transfer is started; period t_v : a time required to reduce the rotating rate of the intermediate transfer body 205 from V1 to V2; period t_{itb} : a time required to rotate the intermediate transfer body 205 one round at a rate of V1; period $t_{itb'}$: a time required to rotate the intermediate transfer body 205 one round during and after reducing the rate from V1 to V2; period t_{pap} : a time required to pass the sheet through a position at a rate of V1, and period t_x : from a time when the first image has just passed through to a time when the second image is started passing.

[0129] Since the period $t_{itb'}$ includes a transition period from rate V1 to V2, it is a little bit longer than the period t_{itb} .

[0130] Then the number of images simultaneously formed on the intermediate transfer body 205 is judged (step S1002). If the judged number corresponds to the two sheets, the procedure goes to step S1003 and if not (the single sheet), the procedure goes to step S1004.

[0131] Namely, the CPU 301 determines the rotating rate of the intermediate transfer body 205 up to the time when the secondary transfer is started and controls the timing to start reducing the rotating rate of the intermediate transfer body 205 in accordance with the timing of the secondary transfer after the primary transfer is finished. In other words, the CPU 301 determines and con-

trols whether the rotating rate of the intermediate transfer body 205 is changed within one round in which the primary transfer is executed or during the next round followed by the first round in which the primary transfer is executed.

[0132] At step S1003, period t_{img} is calculated by summing up $t_1 + t_{pap} \times 2 + t_x$ corresponding to a period from a time when the HP in the intermediate transfer body is detected to a time when the primary transfer for the two sheet is finished and period t_v required to reduce the rotating rate of the motor from V1 to V2, and calculated period t_{img} is compared with period t_{itb} which is a required time to rotate the intermediate transfer body one round at the rate of V1 (step S1005).

[0133] If $t_{img} < t_{itb'}$, namely, if period t_{img} is briefer than period $t_{itb'}$, the procedure goes to step S1007 and if $t_{img} \geq t_{itb'}$, namely, if period t_{img} is the same as or larger than period $t_{itb'}$, the procedure goes to step S1008.

[0134] FIG.9 is a chart illustrating timings of respective steps when images are formed on two sheets as well as when $t_{img} < t_{itb'}$, and FIG.10 is a chart illustrating timings of respective steps when images are formed on two sheets as well as when $t_{img} \geq t_{itb'}$.

[0135] At step S1007, if the rotating rate of the motor is reduced to V2 immediately after the primary transfer is finished, there is enough time for the intermediate transfer body to reach the home position (HP 734) so that signal HP 734 is employed as a timing signal to start the secondary transfer.

[0136] Period $t_{intvl} = t_{img} - t_{itb'}$ is calculated. The intermediate transfer body 205 is rotated at the rate of V1 during period t_{intvl} from the time when the primary transfer is finished to the time determined in accordance with the sheet size and the number of images formed on one round surface of the intermediate transfer body 205. After period t_{intvl} is elapsed, the rotating rate of the intermediate transfer body 205 is reduced to V2. Namely, the CPU 301 determines to execute the primary transfer of the last color (black) and the reduction of the rotating rate of the intermediate transfer body 205 within one rotation of the intermediate transfer body 205, and controls the timing to start the reduction of the rotating rate of the intermediate body 205 after the primary transfer is finished in order that the secondary transfer can start immediately after the reduction of the rotating rate is finished in accordance with the determination. In this manner, the reduction of the rotating rate of the intermediate transfer body 205 to V2, is finished before the home position signal HP 734 is detected. In other words, the CPU 301 sets the timing of the reduction of the rotating rate immediately before the secondary transfer is started within a period from the time when the primary transfer is finished to the time when the secondary transfer is started. A recording sheet is fed at the nipping position between the secondary transfer roller 206 and the intermediate transfer body 205 by driving the registration roller

269 by the CPU 301 in accordance with the detected signal HP 734. Then, the CPU 301 controls the bias voltage to be applied to the secondary transfer roller 206 so as to start the secondary transfer at a time when the top of the image on the intermediate transfer body 205 passes through a position where the secondary transfer is executed. Which reduces a period before the signal HP734 is detected, as a result a cycle time of the image forming procedure is reduced and the image forming productivity is raised.

[0137] On the other hand at step S1008, even if the rotating rate of the motor is reduced to V2 immediately after the primary transfer is finished, there is not enough time to detect the home position (signal HP 734) so that signal HP 735 is employed as a timing signal to start the secondary transfer as shown in FIG.10. In this case, the top of the image on the intermediate transfer body 205 passes through a position where the secondary transfer is executed during a period from the time when the primary transfer is finished to the time when the signal HP 735 is detected. However, the CPU 301 controls the bias voltage to be applied to the secondary voltage in order not to start the secondary transfer at this timing.

[0138] Period $t_{intvl} = t_{itb} + t_{itb}' - t_{img}$ is calculated. The intermediate transfer body 205 is rotated at the rate of V1 during period t_{intvl} from the time when the primary transfer is finished to the time determined in accordance with the sheet size and the like, and then the rotating rate of the intermediate transfer body 205 is reduced to V2. Namely, the CPU 301 determines to execute the primary transfer of the last color (black) and the reduction of the rotating rate of the intermediate transfer body 205 within two rotations of the intermediate transfer body 205, and controls the timing to start the reduction of the rotating rate of the intermediate body 205 after the primary transfer is finished in order that the secondary transfer can start immediately after the reduction of the rotating rate is finished in accordance with the determination. In other words, when the CPU 301 judges the reduction of the rotating rate of the intermediate transfer body 205 is not finished within one round during which the last color (black) is primarily transferred, the CPU 301 determines and controls the change of the rotating rate of the intermediate transfer body 205 and executes the next round followed by the first round during which the primary transfer is executed. In this manner, the reduction of the rotating rate of the intermediate transfer body 205 to V2 is finished before the home position signal HP 735 is detected. The recording sheet is fed at the nipping position between the secondary transfer roller 206 and the intermediate transfer body 205 by driving the registration roller 269 by the CPU 301 in accordance with the detected signal HP 735. Then, the CPU 301 controls the bias voltage to be applied to the secondary transfer roller 206 so as to start the secondary transfer at a time when the top of the image on the intermediate transfer body 205 passes through a position where the secondary transfer is executed. Which reduces a period before the signal

HP235 is detected, as a result a cycle time of the image forming procedure is reduced and the image forming productivity is raised.

[0139] Namely, the CPU 301 executes the primary transfer as rotating the intermediate transfer body 205 at a first rotating rate, and then executes the secondary transfer after reducing the rotating rate to a second rotating rate at a predetermined timing, when a distance between the top of the image and the position where the secondary transfer is executed, is equal to or more than a predetermined distance at the time when the primary transfer is finished. When the distance is less than the predetermined distance, the secondary transfer is not executed, even if the top of the image reaches to the point where the secondary transfer is executed, but the rotating rate of the intermediate transfer body is kept at the first rate and reduced to the second rate at a predetermined timing.

[0140] As explained above, in either step S1007 or S1008, since the CPU 301 determines the timing of the reduction of the rotating rate based on the sheet sizes stored in the memory 302 and rotates the intermediate transfer body 205 at the rate of V1 during period t_{intv} after the primary transfer is finished, the cycle time of the image forming procedure is reduced and the image forming productivity is raised compared with the conventional case where the rotating rate is reduced to V2 immediately after the timing when the primary transfer is finished.

[0141] Hereinafter, the case of "one sheet" is explained as referring to FIGs.11 and 12.

[0142] When the number of images simultaneously formed on the intermediate transfer body 205 is judged to be one sheet at step S1002 in FIG.8, period $t_{img} = t_1 + t_{pap} + t_v$ is calculated (step S1004): where t_1 is a period from a time when the HP on the intermediate transfer body 205 is detected to a time when the primary transfer of the one sheet image is started, t_{pap} is a period from a time when the primary transfer is started and t_v is a period required to reduce the rotating rate of the motor from V1 to V2.

[0143] Then, the calculated value of t_{img} is compared with a period t_{itb}' required to rotate the intermediate transfer body 205 one round where period t_{itb}' includes the period required to transfer the rotating rate of the motor from V1 to V2 (step S1007).

[0144] If $t_{img} < t_{itb}'$, namely, if period t_{img} is briefer than period t_{itb}' , the procedure goes to step S1007 and if $t_{img} \geq t_{itb}'$, namely, if period t_{img} is the same as or larger than period t_{itb}' , the procedure goes to step S1008.

[0145] At step S1007, if the rotating rate of the motor is reduced to V2 immediately after the primary transfer is finished, there is enough period for the intermediate transfer body to reach the home position (HP 734) so that signal HP 734 is employed as a timing signal to start the secondary transfer as shown in FIG.11.

[0146] Then by defining $t_{intvl} = t_{itb}' - t_{img}'$, the intermediate transfer body 205 is rotated at the rate of V1

during period t_{intvl} from the time when the primary transfer is finished to the time determined in accordance with the sheet size and the rotating rate is reduced to V2. Namely, the CPU 301 determines to start the reduction of the rotating rate immediately after the secondary transfer started within the period from the time when the primary transfer is finished to the time when the secondary transfer is started. In other words, the CPU 301 sets the timing of the reduction of the rotating rate immediately before the secondary transfer is started within a period from the time when the primary transfer is finished to the time when the secondary transfer is started. A recording sheet is fed at the nipping position between the secondary transfer roller 206 and the intermediate transfer body 205 by driving the registration roller 269 by the CPU 301 in accordance with the detected signal HP 734. Then, the CPU 301 controls the bias voltage to be applied to the secondary transfer roller 206 so as to start the secondary transfer at the time when the top of the image on the intermediate transfer body 205 passes through a position where the secondary transfer is executed. Which reduces a period before the signal HP734 is detected, as a result a cycle time 707 of the image forming procedure is reduced and the image forming productivity is raised.

[0147] On the other hand at step S1008, even if the rotating rate of the motor is reduced to V2 immediately after the primary transfer is finished, there is not enough period to detect the home position (signal HP 734) so that signal HP 735 is employed as a timing signal to start the secondary transfer as shown in FIG.12. In this case, the top of the image on the intermediate transfer body 205 passes through a position where the secondary transfer is executed, during a period from the time when the primary transfer is finished to the time the signal HP 735 is detected. However, the CPU 301 controls the bias voltage to be applied to the secondary voltage so as not to start the secondary transfer at this timing.

[0148] Then by defining $t_{\text{intvl}} = t_{\text{itb}} + t_{\text{itb}}' - t_{\text{img}}$, the intermediate transfer body 205 is rotated at the rate of V1 during period t_{intvl} from the time when the primary transfer is finished to the time determined in accordance with the sheet size and the rotating rate is reduced to V2. Namely, the CPU 301 determines to start the reduction of the rotating rate immediately after the secondary transfer started within the period from the time when the primary transfer finished to the time when the secondary transfer is started. In other words, the CPU 301 sets the timing of the reduction of the rotating rate immediately before the secondary transfer is started within a period from the time when the primary transfer is finished to the time when the secondary transfer is started. A recording sheet is fed at the nipping position between the secondary transfer roller 206 and the intermediate transfer body 205 by driving the registration roller 269 by the CPU 301 in accordance with the detected signal HP 735. Then, the CPU 301 controls the bias voltage to be applied to the secondary transfer roller 206 so as to start the sec-

ondary transfer at the time when the top of the image on the intermediate transfer body 205 passes through a position where the secondary transfer is executed. Which reduces a period before the signal HP734 is detected, as a result a cycle time 707 of the image forming procedure is reduced and the image forming productivity is raised.

[0149] Namely, the CPU 301 executes the primary transfer as rotating the intermediate transfer body 205 at a first rotating rate, and then executes the secondary transfer after reducing the rotating rate to a second rotating rate at a predetermined timing, when a distance between the top of the image and the position where the secondary transfer is executed, is equal to or more than a predetermined distance at the time when the primary transfer is finished. When the distance is less than the predetermined distance, the secondary transfer is not executed, even if the top of the image reaches to the point where the secondary transfer is executed, but the rotating rate of the intermediate transfer body is kept at the first rate and reduced to the second rate at a predetermined timing.

[0150] As explained above, in either step S1007 or S1008, since the CPU 301 determines the timing of the reduction of the rotating rate based on the sheet sizes stored in the memory 302 and rotates the intermediate transfer body 205 at the rate of V1 during period t_{intv} after the primary transfer is finished, the cycle time of the image forming procedure is reduced and the image forming productivity is raised compared with the conventional image forming devices where the rotating rate is reduced to V2 immediately after the time when the primary transfer is finished.

[0151] As explained above, in the image forming device capable of outputting image of good quality as transferring the toner image onto recording sheets at appropriate transfer rates for the various sheets by changing the rotating rate of the intermediate transfer body 205 during image forming procedure, image forming productivity is kept from being lowered by reducing the period required to detect HP at the rotating rate of V2 of the intermediate transfer body 205 as controlling the timing of the reduction of the rotating rate as late as possible when the rotating rate is reduced during the period from the time when the primary transfer is finished to the time when the secondary transfer is started.

[0152] If t_{v} is too small such that influence of the reduction of the rotating rate is resulted in being negligible, if a simplified calculating procedure is required or the like, instead of t_{itb}' shown in FIGs.8 to 12, t_{itb} can be employed.

[0153] In this case, at steps S1005, S1006 in FIG.8 t_{img} and t_{itb} are compared, at step S1007 t_{intvl} is approximated to $t_{\text{itb}} - t_{\text{img}}$ and at step S1008 t_{intvl} is approximated to $2 \times t_{\text{itb}} - t_{\text{img}}$.

(Other Embodiment)

[0154] In the above-mentioned embodiments, the image forming system where the rotating rate of the motor is reduced to V2 is explained, when the types of the sheets are the thick paper, the envelope and the OHP sheet. However, relations between the types of sheets and the rotating rate of the motor are not limited in embodiments explained above. Other image forming systems where various rotating rates of the motor are arranged in accordance with various types of sheets, can be also employed.

[0155] In the embodiments mentioned above, the image forming system where the rotating rate of the motor is reduced to V2 after the motor is rotated at V1 for a predetermined period from the time when the primary transfer is finished, is explained. However, the rotating rate of the motor is not limited to V1. Other image forming systems where re-detection of the HP 271 of the intermediate transfer body 205 is controlled faster than the above-mentioned embodiments by rotating the motor at a higher rate than V1 and then reducing to V2, can be also employed.

[0156] In this case, when the CPU 301 determines period t_{intv} , it employs a period t_{itb} (not shown in the drawings) required to rotate the intermediated transfer body 205 one round where periods required to raise and reduce the rotating rate are included, instead of period t_{itb} shown in FIG.8. Thus the CPU controls the intermediate transfer body 205 to raise the rotating rate for the predetermined period t_{intv} after the primary transfer is finished and then to reduce the rotating rate.

[0157] As explained above, by employing the present embodiments, the image forming device capable of raising its productivity can be provided by reducing the period from the time when the primary transfer is finished to the time when the secondary transfer is started.

Claims

1. An image forming device comprising:

a photosensitive body which carries a toner image on it;
a rotatable intermediate transfer body onto which the toner image on said photosensitive body is transferred;
a primary transfer means which primarily transfers the toner image on said photosensitive body to said intermediate transfer body;
a secondary transfer means which secondarily transfers the toner image on said intermediate transfer body to a sheet, and
a control means which controls said intermediate transfer body and said secondary transfer means, wherein:

in case of a predetermined sheet, said control means changes a rotating rate of said intermediate body from a first rate to a second rate after said primary transfer is finished, and

in accordance with image forming modes, further said control means determines whether the rotating rate of said intermediate transfer body is changed during its first round where said primary transfer is executed or during its second round followed by the first round where said primary transfer is executed.

2. The image forming device according to claim 1, wherein:

said sheet is either one of a thick paper, an envelope, a postcard, an OHP sheet, a label paper, a tab paper or a second draft of an original drawing.

3. The image forming device according to claim 1, wherein:

said image forming modes comprise the number of the toner images formed on one round of the surface of said intermediate transfer body.

4. The image forming device according to claim 1, wherein:

said image forming modes comprise the sizes of the toner images.

5. The image forming device according to claim 1, wherein:

said control means determines whether the rotating rate of said intermediate transfer body is changed during its first round where said primary transfer is executed or during its second round followed by the first round where said primary transfer is executed by judging whether a first distance between the top of the toner image and said secondary transfer means, is longer than a predetermined distance or not.

6. The image forming device according to claim 5, wherein:

when said first distance is longer than said predetermined distance, said control means changes the rotating rate of said intermediate transfer body during the first round where said primary transfer is executed.

7. The image forming device according to claim 5,

wherein:

when said first distance is less than said predetermined distance, said control means changes the rotating rate of said intermediate transfer body during the second round followed by the first round where said primary transfer is executed. 5

8. The image forming device according to claim 1, further comprising: 10

a fixing means to fix the toner image on the sheet at a fixing rate after said secondary transfer is finished, wherein: 15

said control means controls the rotating rate of said intermediate transfer body substantially at the same rate as said fixing rate. 20

9. The image forming device according claim 1, wherein: 25

said first rate is faster than said second rate. 25

10. The image forming device according to claim 1, wherein: 30

said intermediate transfer body comprises a mark for detecting the top of the toner image on said intermediate transfer body, and said intermediate transfer body further comprises a detecting means to detect said mark on said intermediate transfer body. 35

11. The image forming device according to claim 10, wherein: 40

said control means changes the rotating rate of said intermediate transfer body immediately before said detecting means detects the mark on said intermediate transfer body. 45

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FIG. 1

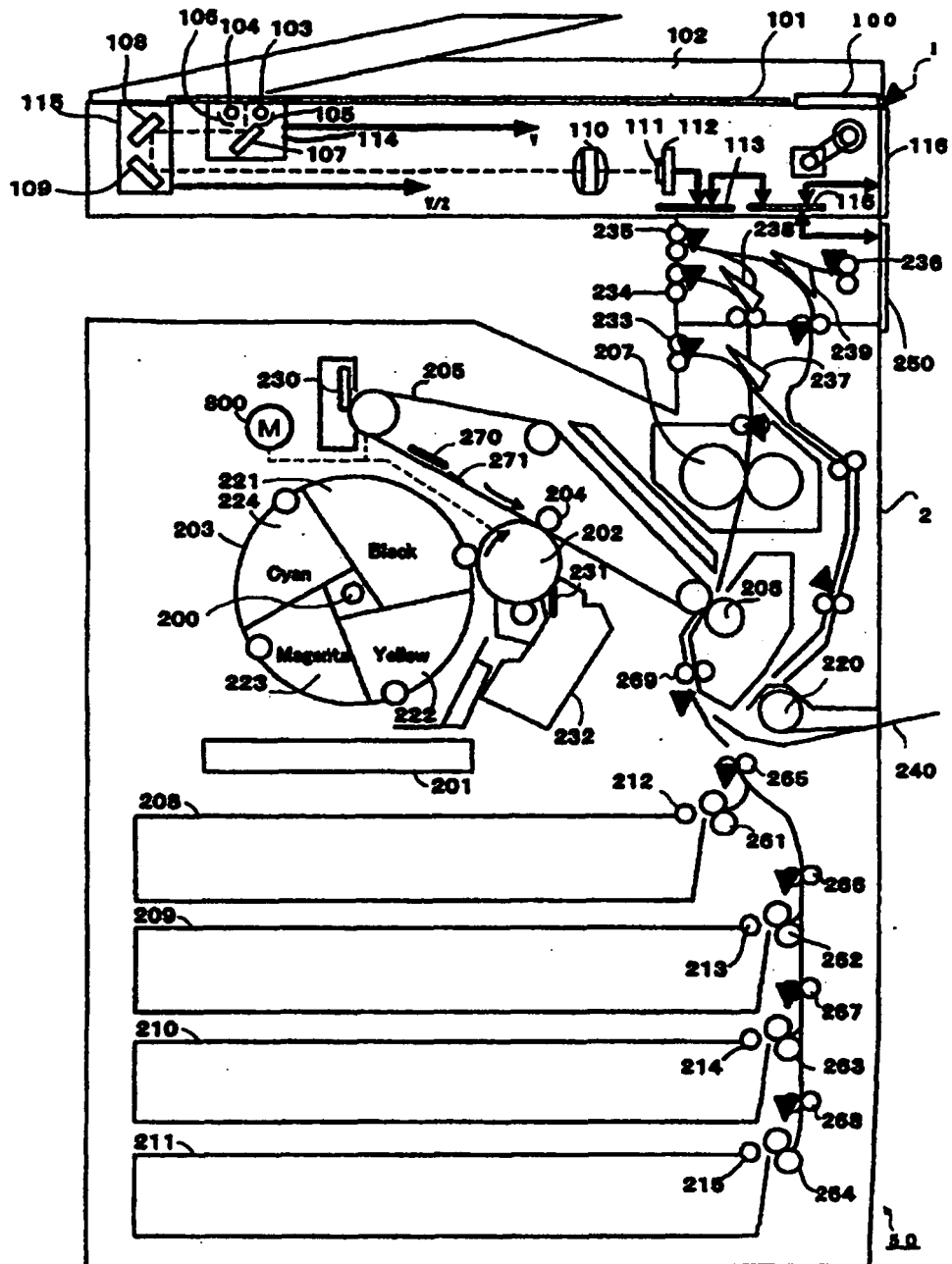


FIG. 2

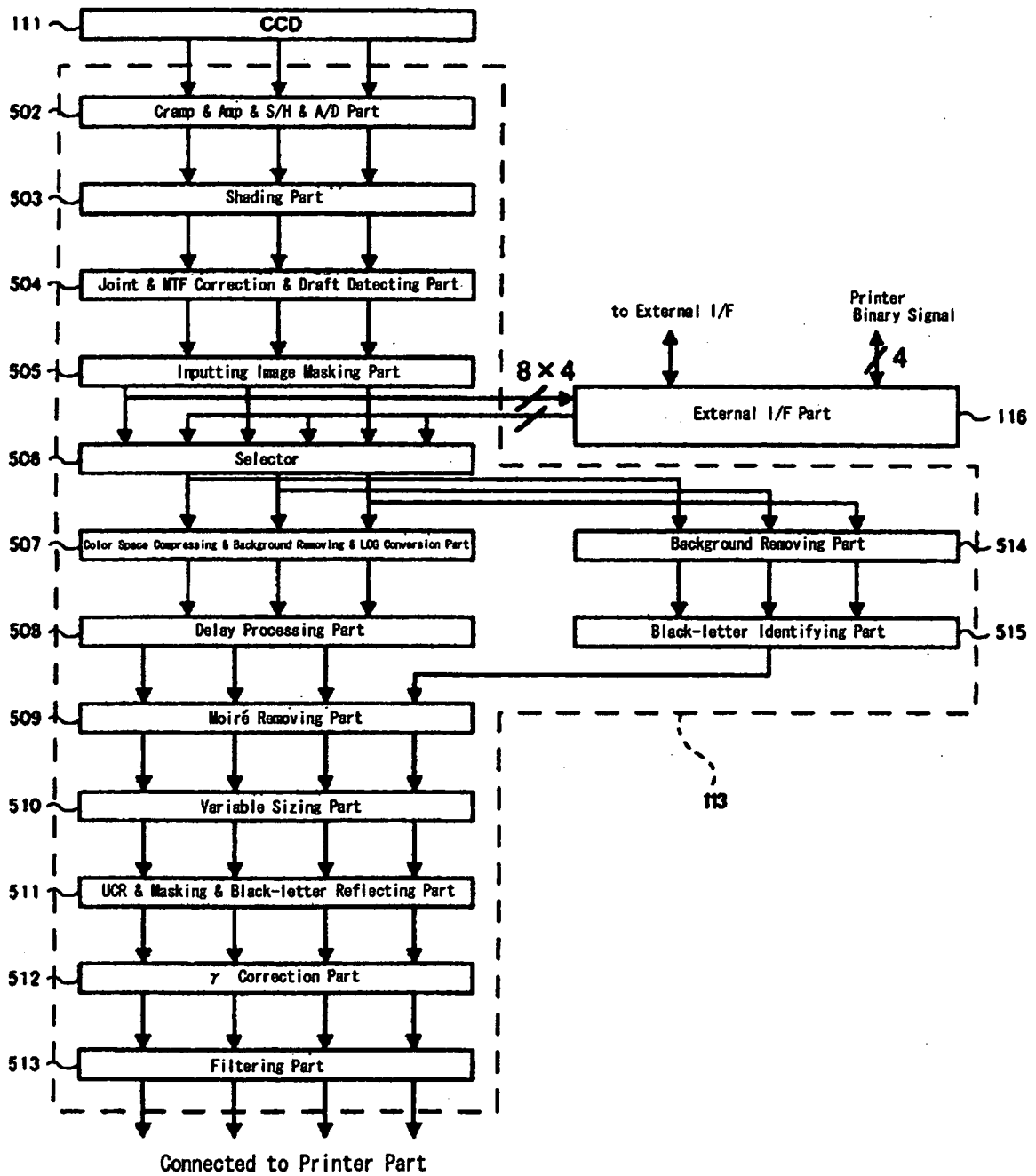


FIG. 3

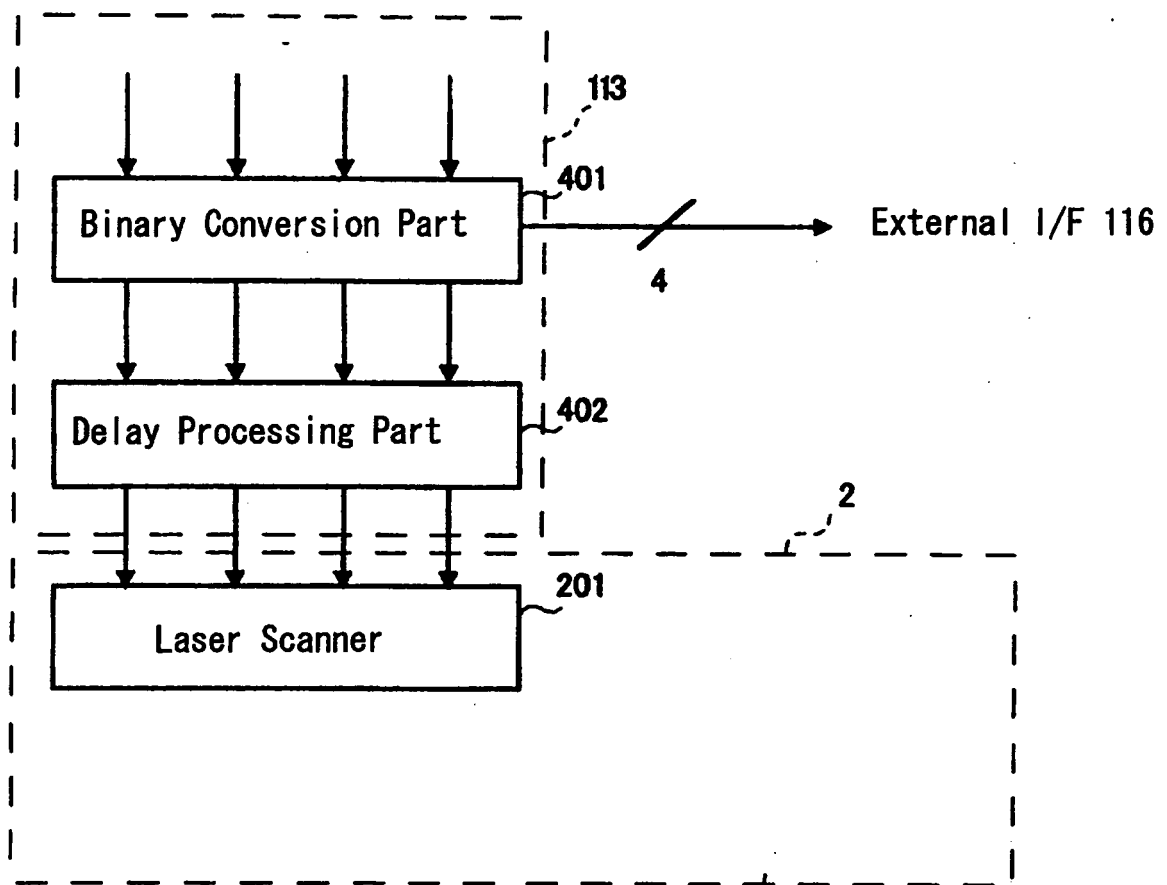


FIG. 4

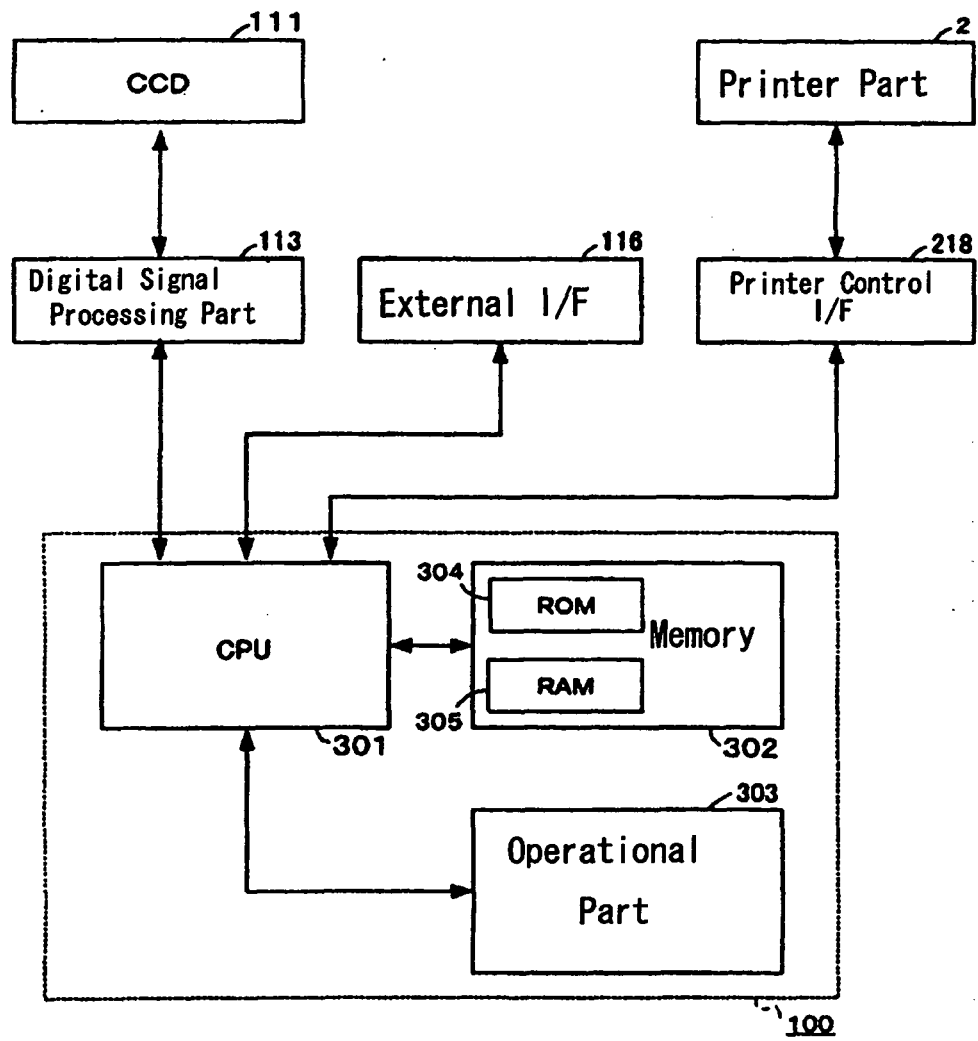


FIG. 5

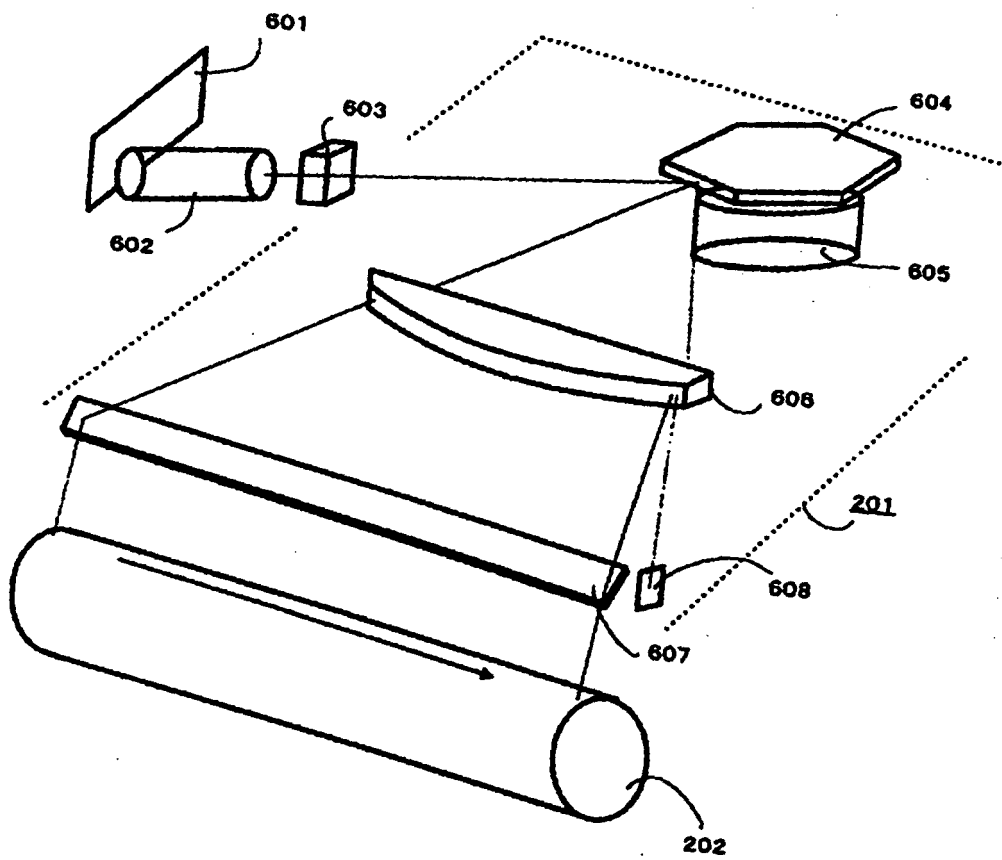


FIG. 6

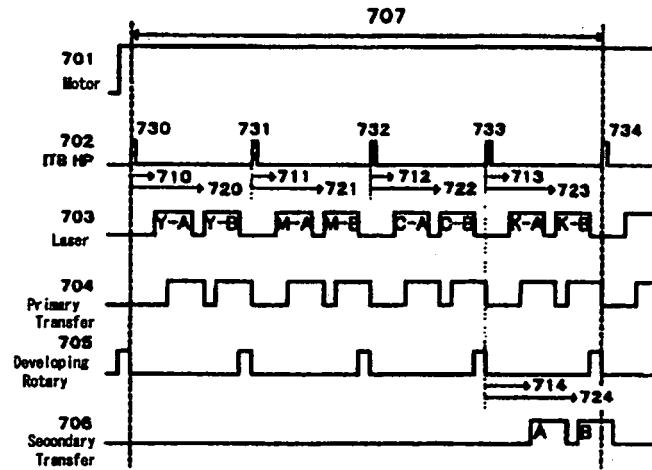


FIG. 7

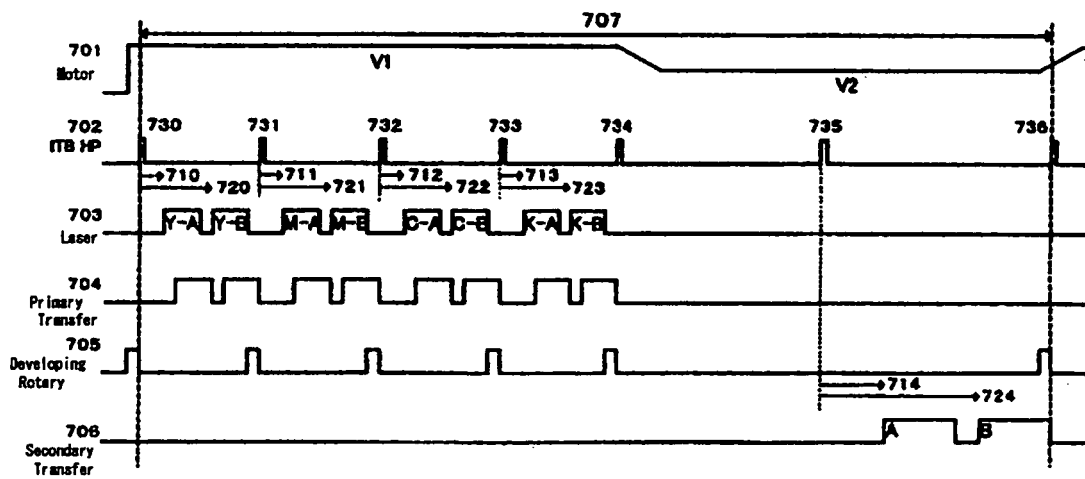
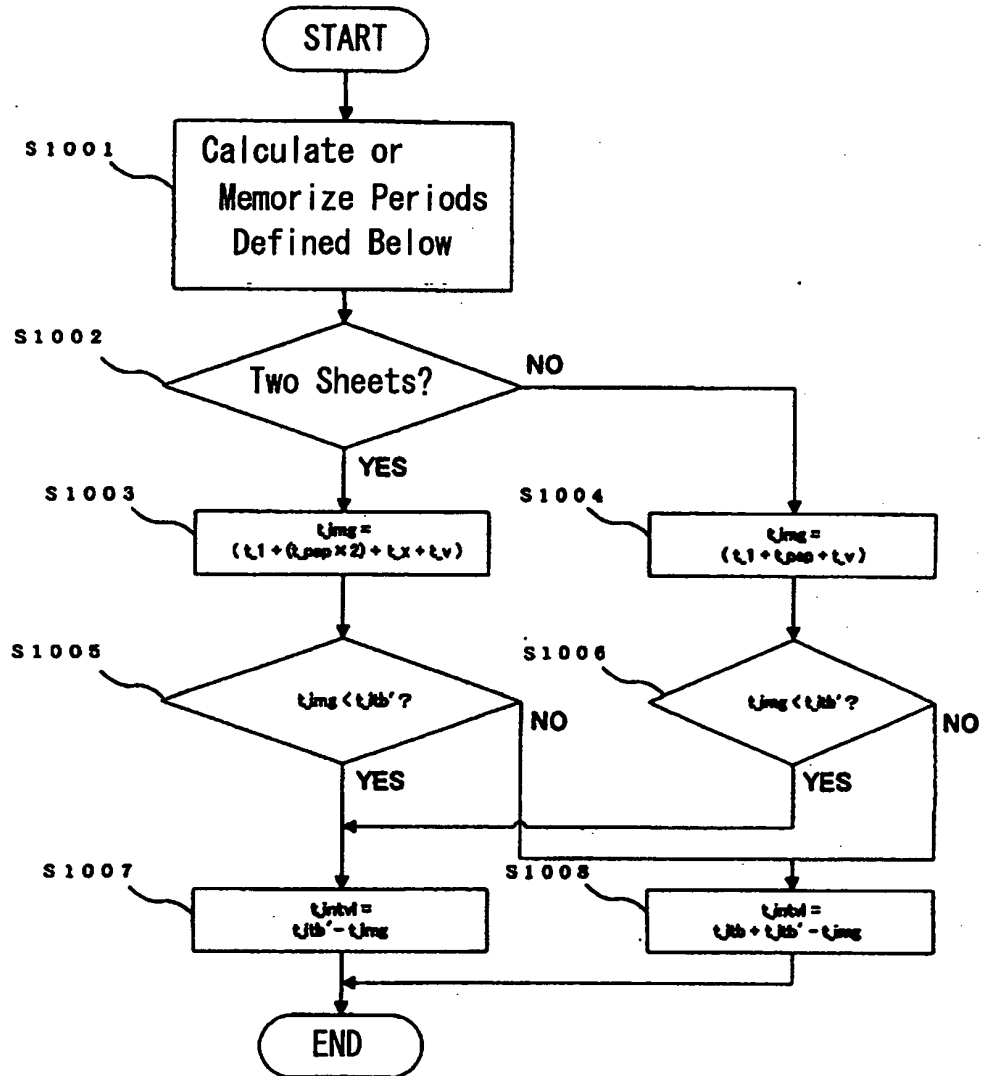


FIG. 8



t_1 = from a time when the HP is detected to a time when the primary transfer is started.

t_v = a time required to reduce the rotating rate of the intermediate transfer body from V1 to V2.

t_{itb} = a time required to rotate intermediate transfer body one round at a rate of V1.

t_{itb}' = a time required to rotate intermediate transfer body one round during/after reducing rate from V1 to V2.

t_{pap} = a time required to pass a sheet through a position at a rate of V1.

t_x = from a time when a first image has just passed through to a time when a second image is started passing.

FIG. 9

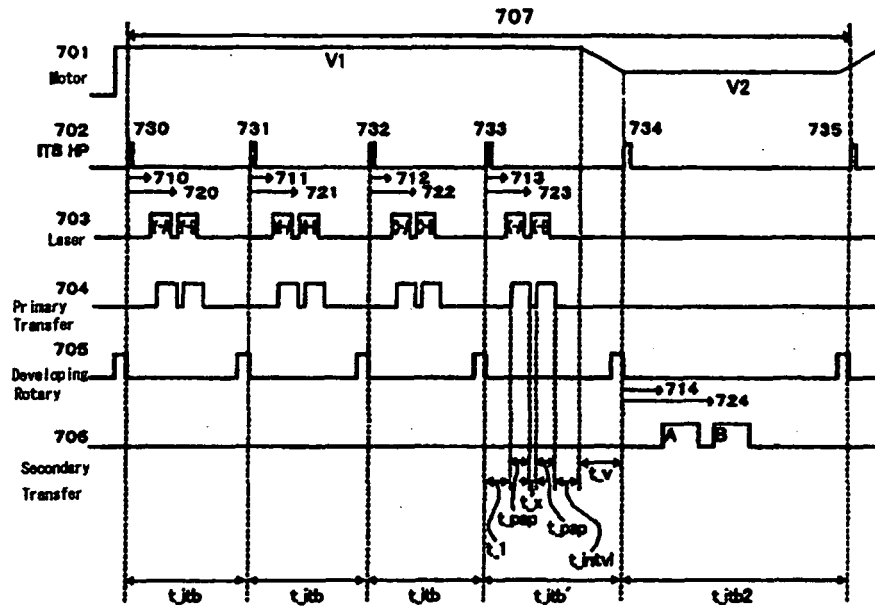


FIG. 10

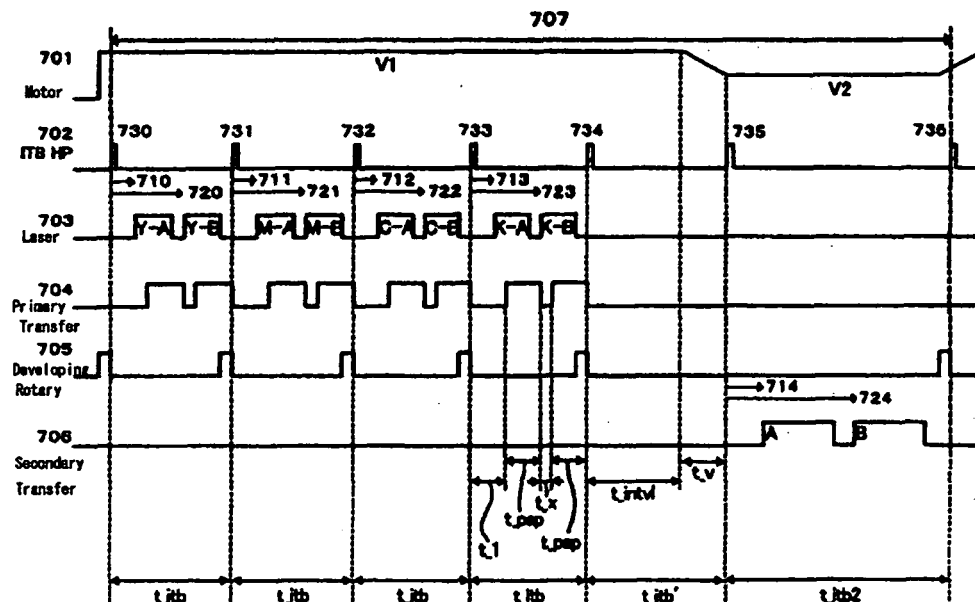


FIG. 11

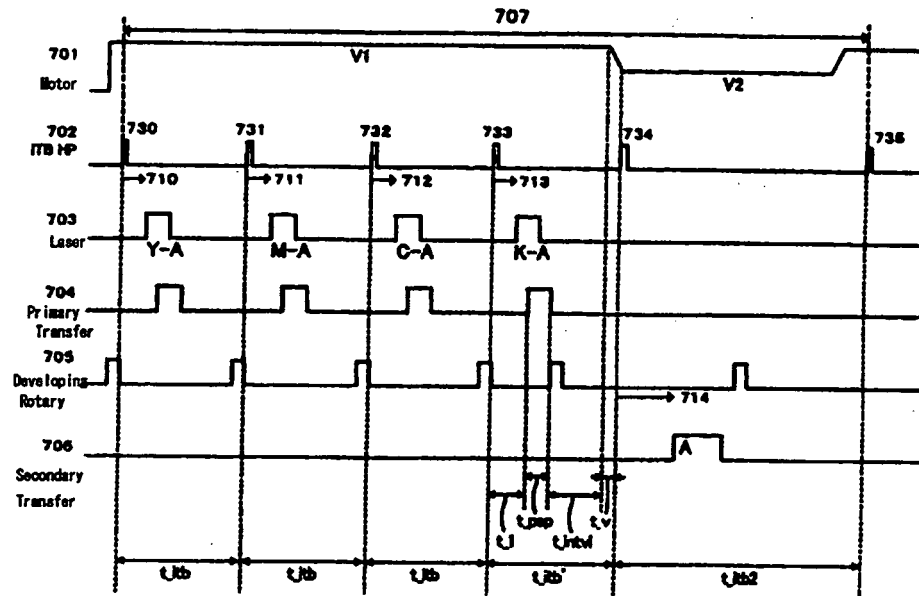
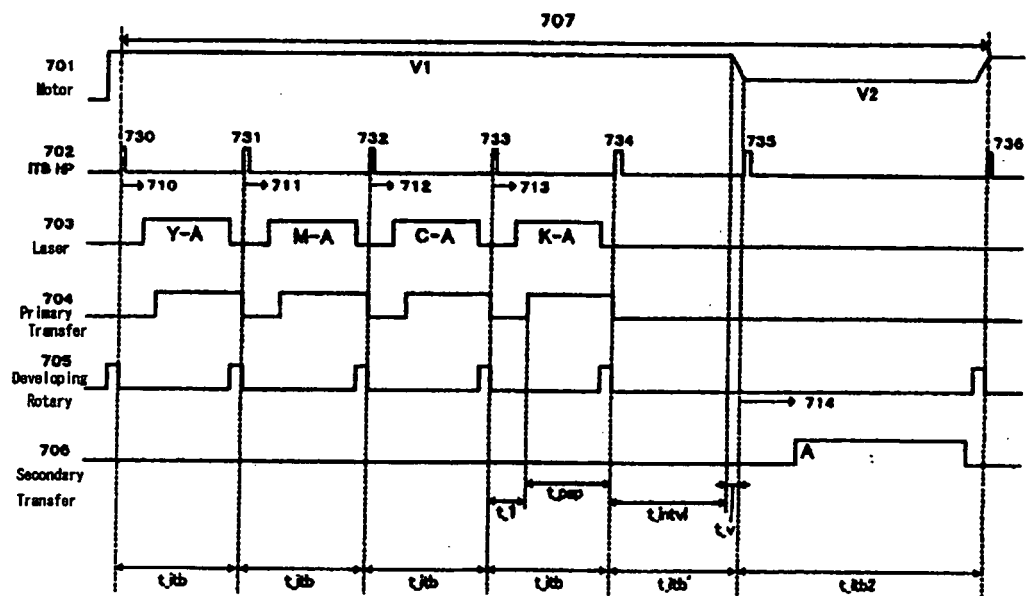


FIG. 12



INTERNATIONAL SEARCH REPORT

International application No.

PCT/JP2004/005840

A. CLASSIFICATION OF SUBJECT MATTER

Int.Cl⁷ G03G15/16, 21/00

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

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

Int.Cl⁷ G03G15/16, 21/00

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

Jitsuyo Shinan Koho 1926-1996 Jitsuyo Shinan Toroku Koho 1996-2004

Kokai Jitsuyo Shinan Koho 1971-2004 Toroku Jitsuyo Shinan Koho 1994-2004

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	JP 11-109767 A (Canon Inc.), 23 April, 1999 (23.04.99), Full text; all drawings & US 6088567 A	1-11
A	JP 9-171307 A (Fuji Xerox Co., Ltd.), 30 June, 1997 (30.06.97), Full text; all drawings & US 5765094 A	1-11
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☒ Further documents are listed in the continuation of Box C.☐ See patent family annex.

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C (Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	JP 11-52756 A (Ricoh Co., Ltd.), 26 February, 1999 (26.02.99), Full text; all drawings (Family: none)	1-11
A	JP 2000-338741 A (Canon Inc.), 08 December, 2000 (08.12.00), Full text; all drawings (Family: none)	1-11

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