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(54) IMAGE PROCESSING DEVICE, IMAGE FORMATION SYSTEM, IMAGE PROCESSING METHOD, AND IMAGE PROCESSING PROGRAM

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(57) **ABSTRACT**

The present invention provides an image processing device capable of correcting an image formation position page by page. The image processing device has: an obtaining unit obtaining a print job corresponding to a plurality of pages; a determination unit obtaining a read image of a sheet in which an image is formed for at least two pages in the plurality of pages and determining a deviation amount in the at least two pages; a calculation unit calculating at least two correction values on the basis of the deviation amount in the at least two pages; and a correction unit performing image correction on each of the plurality of pages on the basis of a corresponding correction value in the at least two correction values.

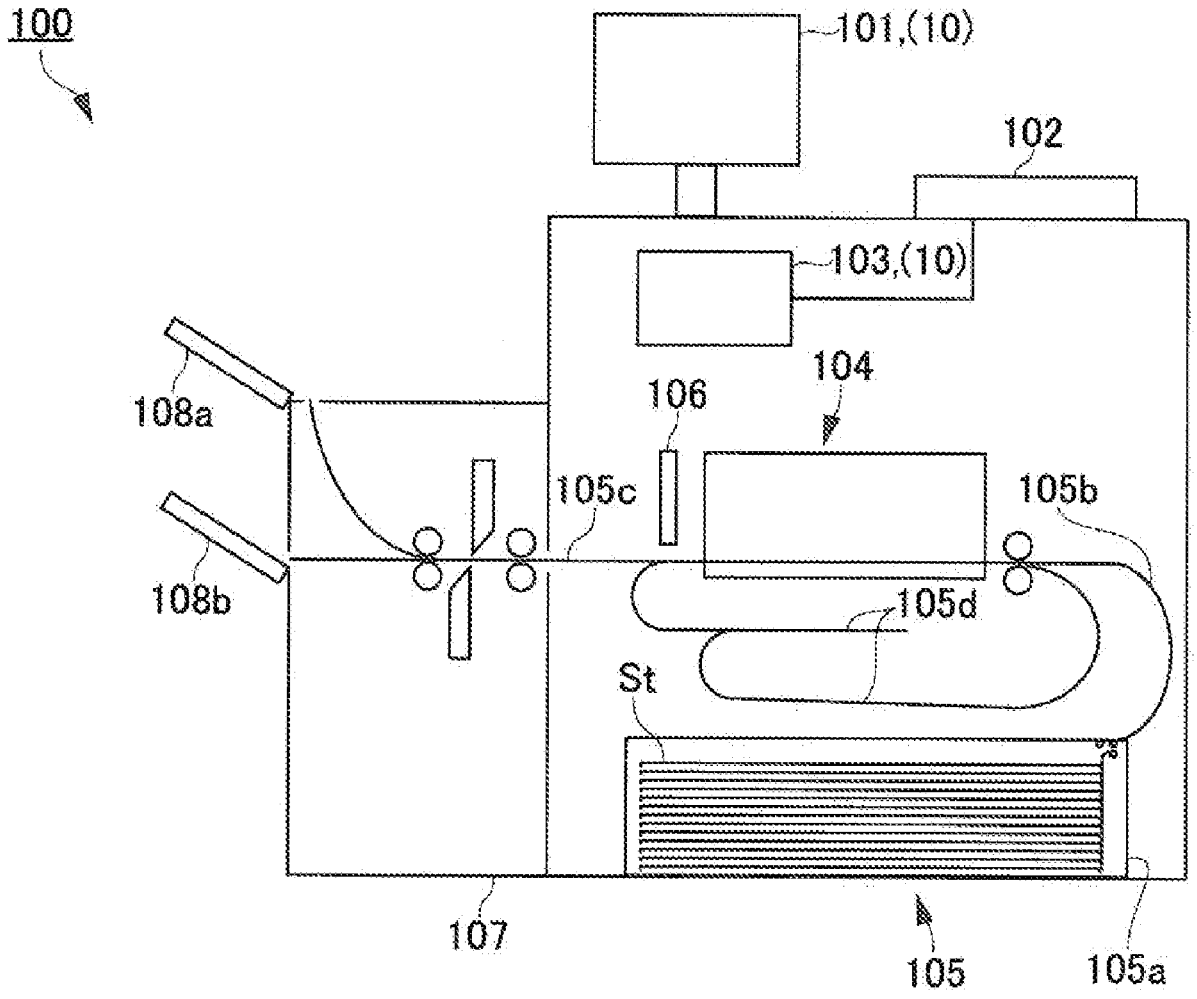


FIG. 1

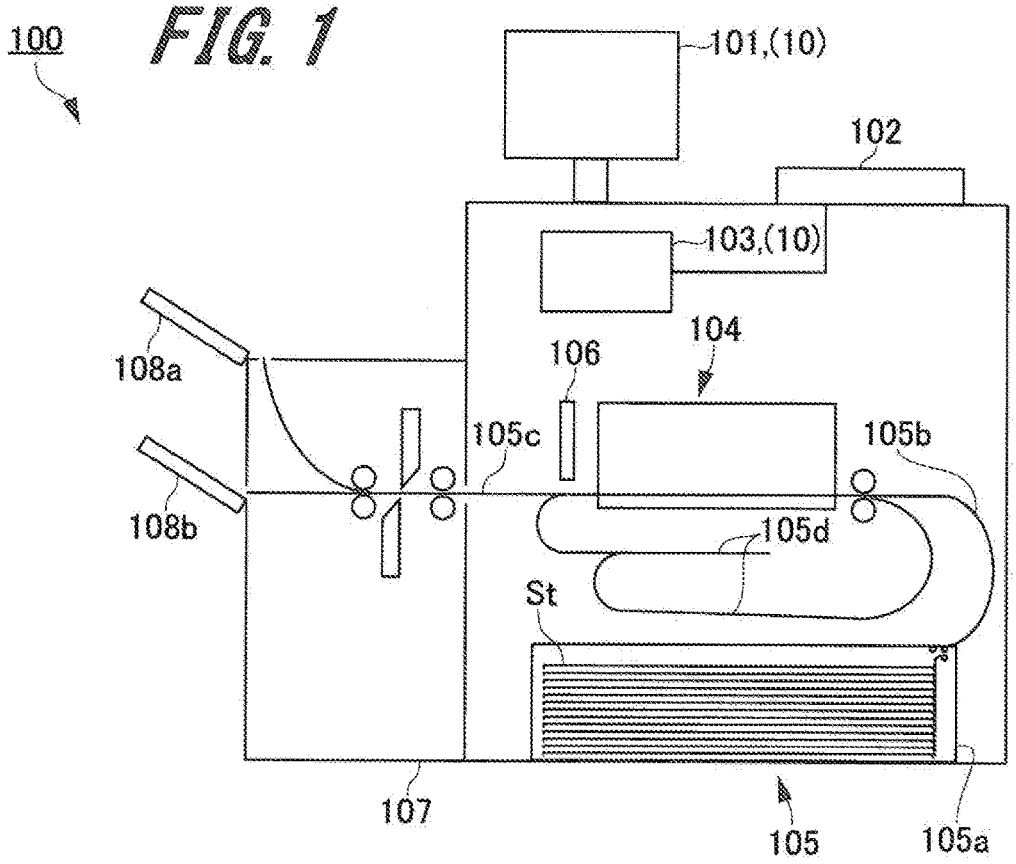

100
101,(10)
102
103,(10)
104
106
108a
108b
105c
105b
105d
St
107
105
105a

FIG. 2

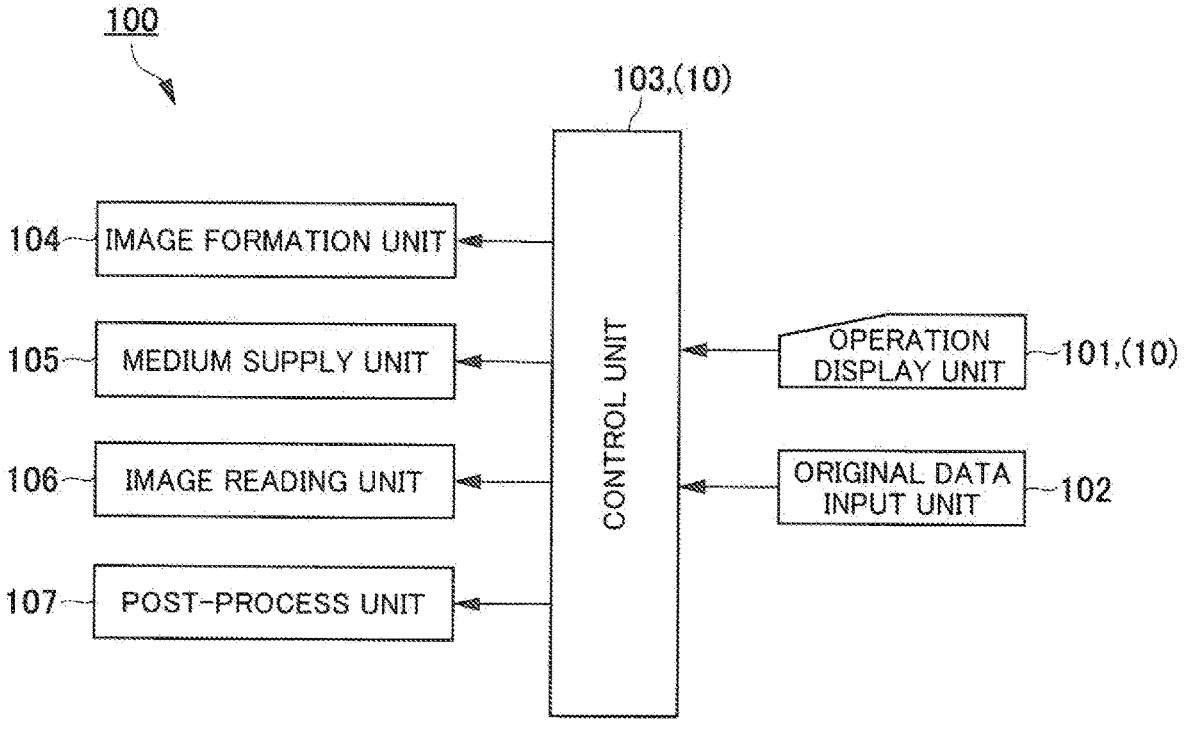

100
103,(10)
104
IMAGE FORMATION UNIT
105
MEDIUM SUPPLY UNIT
106
IMAGE READING UNIT
107
POST-PROCESS UNIT
CONTROL UNIT
OPERATION DISPLAY UNIT
101,(10)
ORIGINAL DATA INPUT UNIT
102

FIG. 3

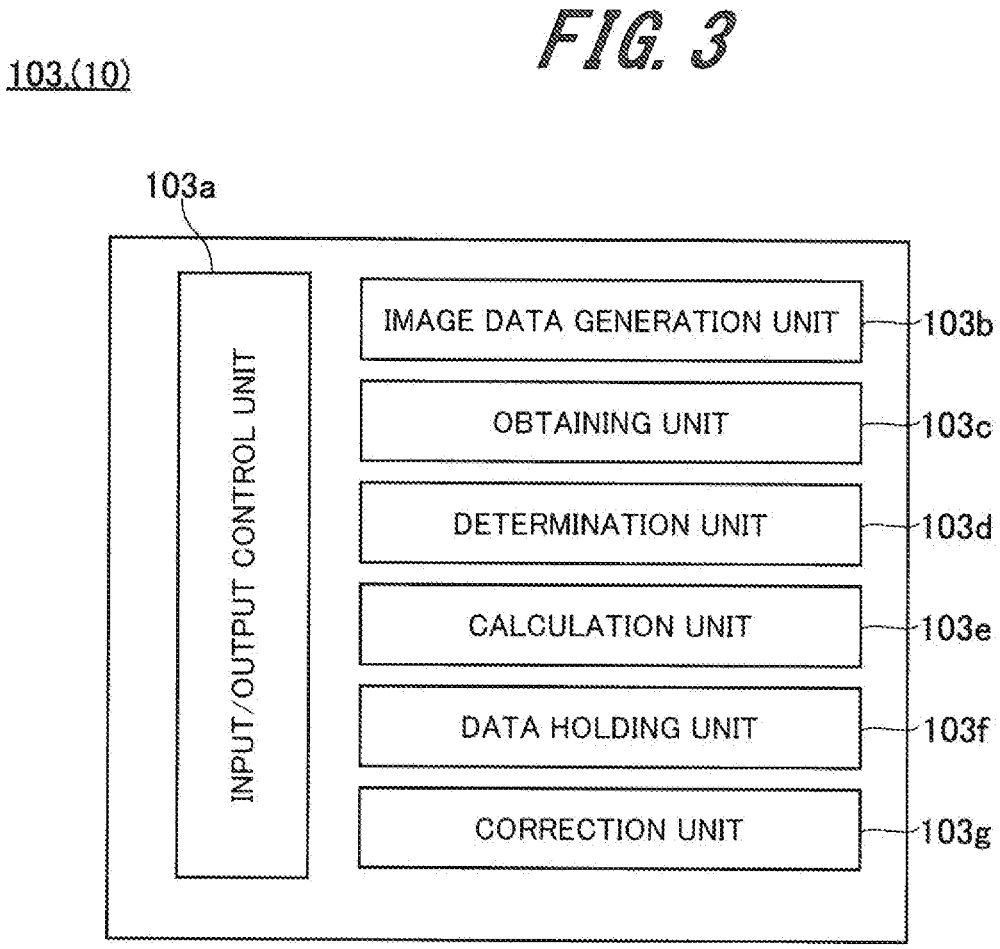

103(10)
103a
INPUT/OUTPUT CONTROL UNIT
IMAGE DATA GENERATION UNIT
103b
OBTAINING UNIT
103c
DETERMINATION UNIT
103d
CALCULATION UNIT
103e
DATA HOLDING UNIT
103f
CORRECTION UNIT
103g

FIG. 4

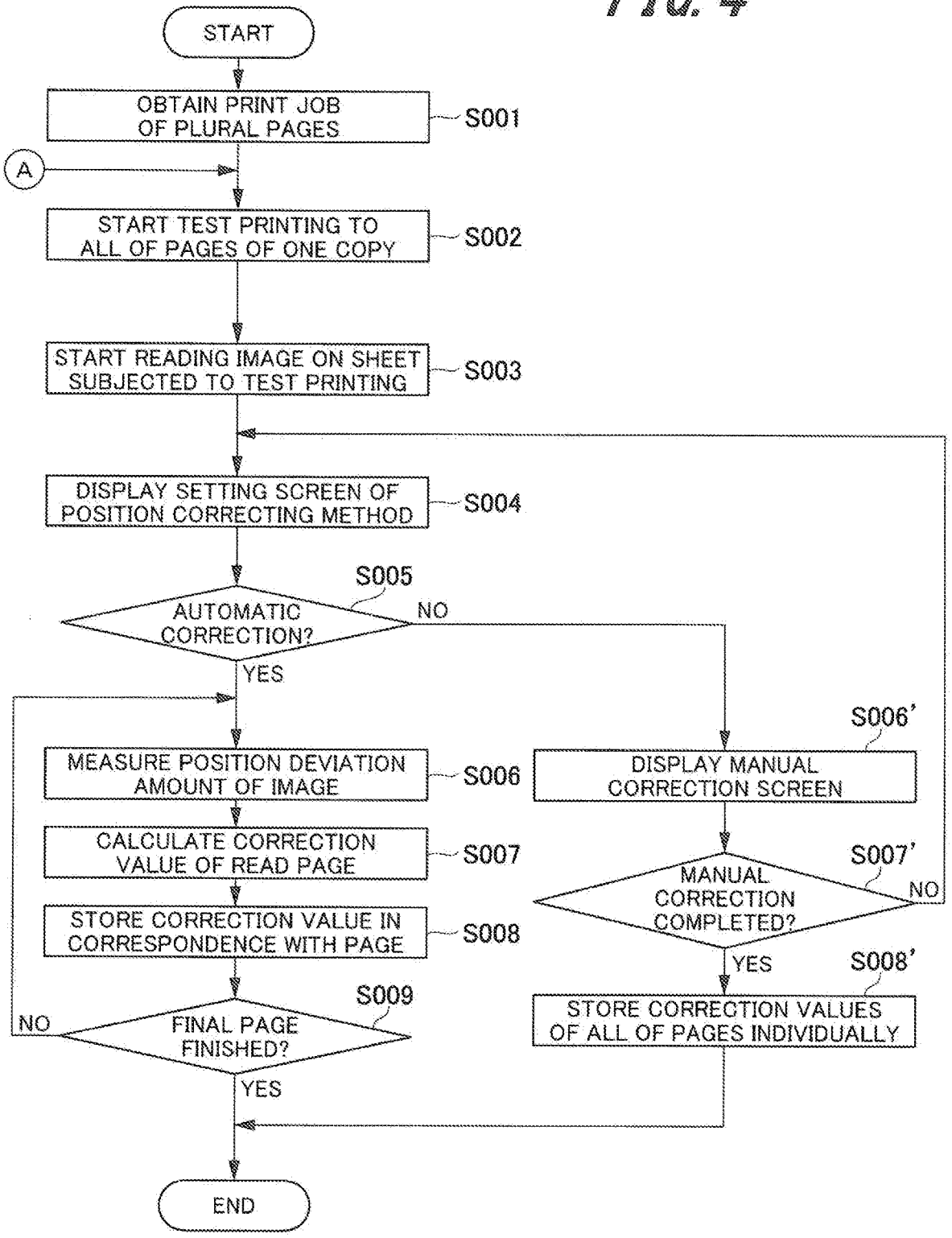

START
OBTAIN PRINT JOB OF PLURAL PAGES
S001
A
START TEST PRINTING TO ALL OF PAGES OF ONE COPY
S002
START READING IMAGE ON SHEET SUBJECTED TO TEST PRINTING
S003
DISPLAY SETTING SCREEN OF POSITION CORRECTING METHOD
S004
S005
AUTOMATIC CORRECTION?
NO
YES
MEASURE POSITION DEVIATION AMOUNT OF IMAGE
S006
CALCULATE CORRECTION VALUE OF READ PAGE
S007
STORE CORRECTION VALUE IN CORRESPONDENCE WITH PAGE
S008
S009
FINAL PAGE FINISHED?
NO
YES
S006'
DISPLAY MANUAL CORRECTION SCREEN
S007'
MANUAL CORRECTION COMPLETED?
NO
YES
S008'
STORE CORRECTION VALUES OF ALL OF PAGES INDIVIDUALLY
END

FIG. 5

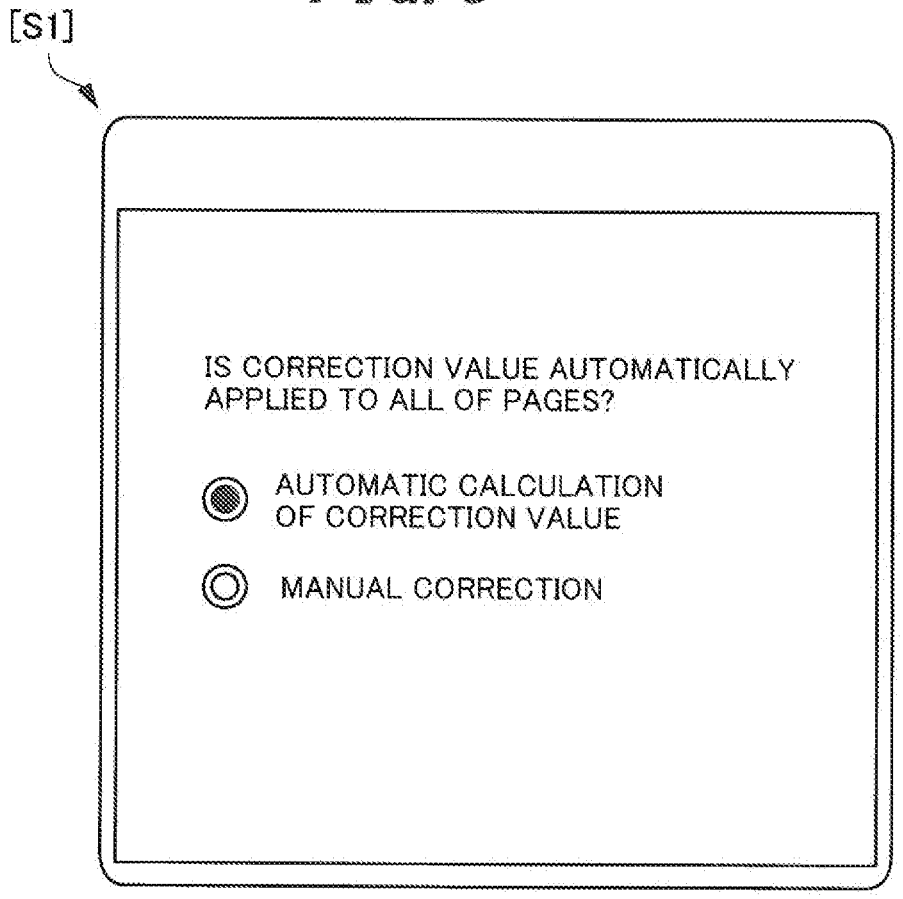


FIG. 6

PAGE	1	2	3	4	5	6	7	...
CORRECTION VALUE	+0.1	+1.275	+0.5	+0.5	+1.0	+0.5	+2.0	...

FIG. 7

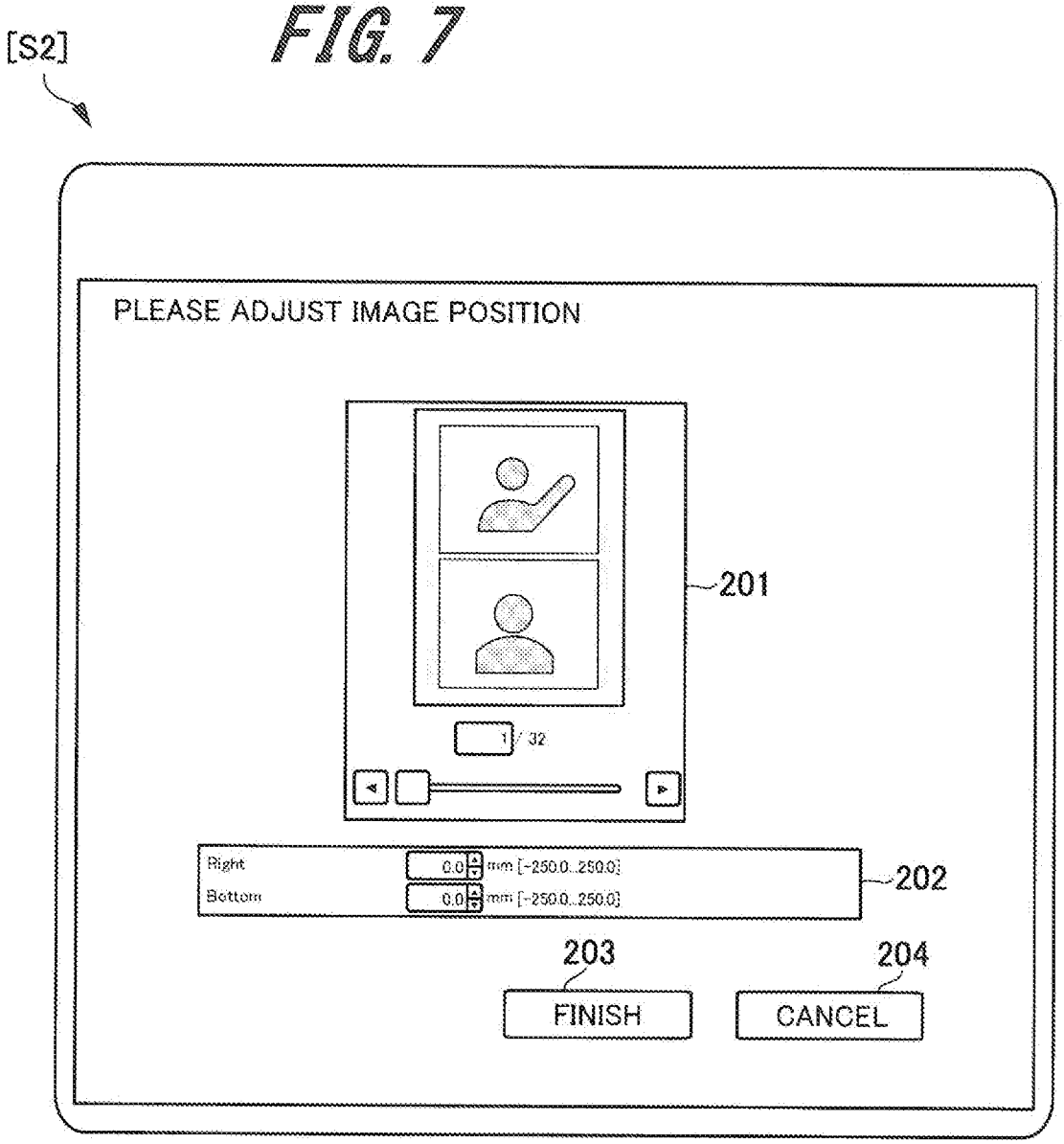

[S2]
PLEASE ADJUST IMAGE POSITION
1 / 32
201
Right
0.0
mm [-250.0..250.0]
Bottom
0.0
mm [-250.0..250.0]
202
203
204
FINISH
CANCEL

FIG. 8

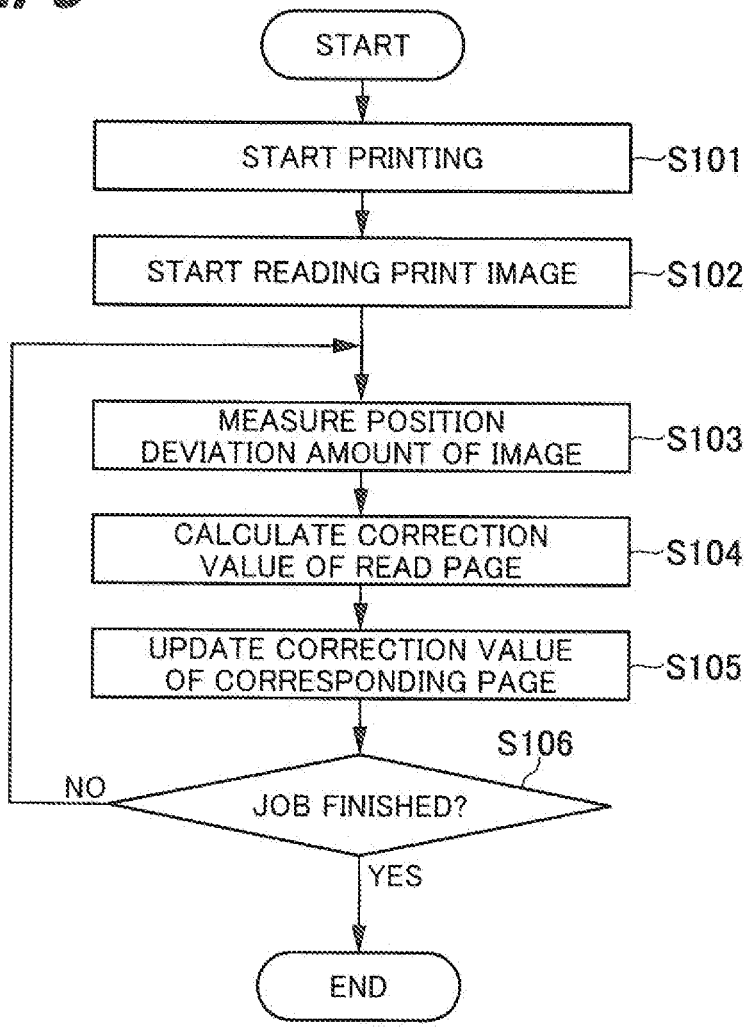

START
START PRINTING
S101
START READING PRINT IMAGE
S102
MEASURE POSITION DEVIATION AMOUNT OF IMAGE
S103
CALCULATE CORRECTION VALUE OF READ PAGE
S104
UPDATE CORRECTION VALUE OF CORRESPONDING PAGE
S105
S106
JOB FINISHED?
NO
YES
END

FIG. 9

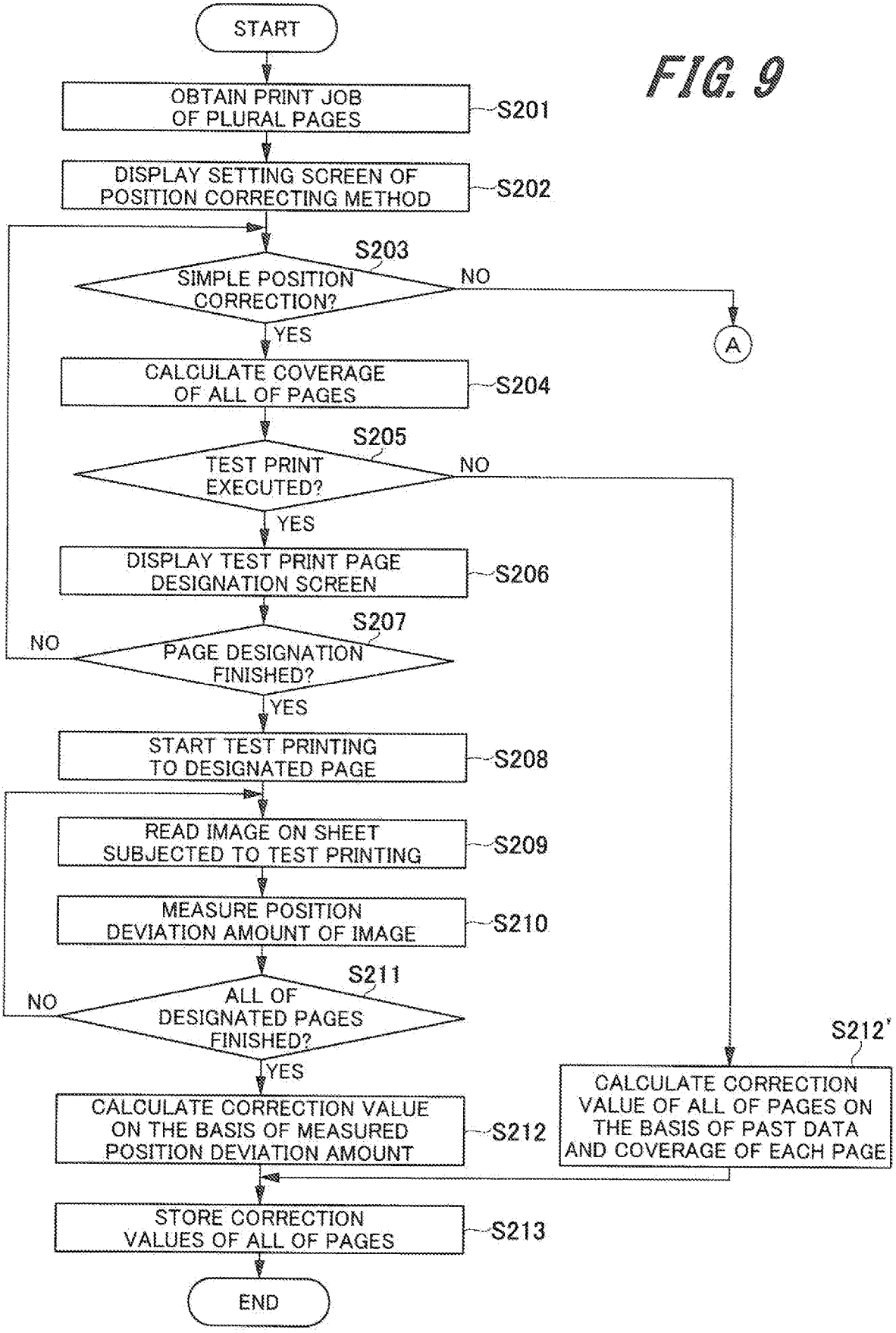
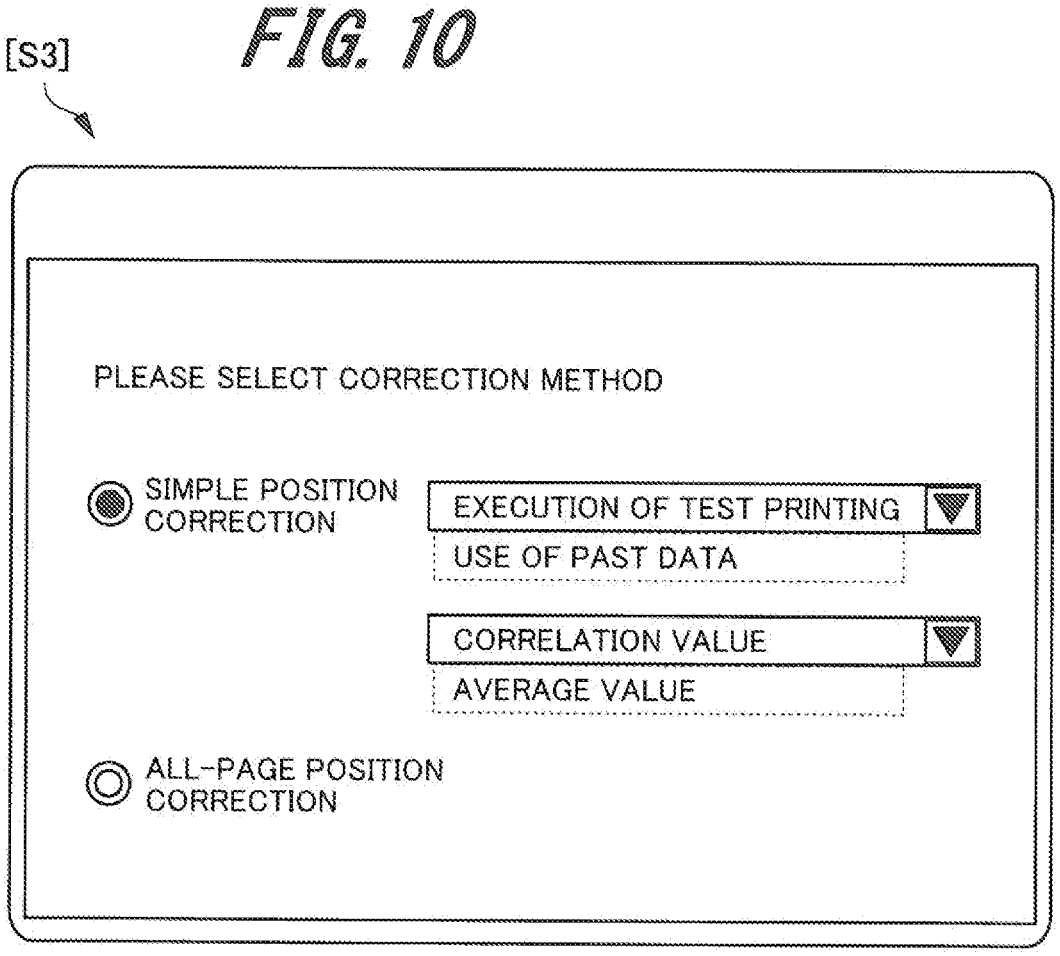

START
OBTAIN PRINT JOB OF PLURAL PAGES
S201
DISPLAY SETTING SCREEN OF POSITION CORRECTING METHOD
S202
S203
SIMPLE POSITION CORRECTION?
NO
YES
A
CALCULATE COVERAGE OF ALL OF PAGES
S204
S205
TEST PRINT EXECUTED?
NO
YES
DISPLAY TEST PRINT PAGE DESIGNATION SCREEN
S206
S207
NO
PAGE DESIGNATION FINISHED?
YES
START TEST PRINTING TO DESIGNATED PAGE
S208
READ IMAGE ON SHEET SUBJECTED TO TEST PRINTING
S209
MEASURE POSITION DEVIATION AMOUNT OF IMAGE
S210
S211
NO
ALL OF DESIGNATED PAGES FINISHED?
YES
S212'
CALCULATE CORRECTION VALUE OF ALL OF PAGES ON THE BASIS OF PAST DATA AND COVERAGE OF EACH PAGE
CALCULATE CORRECTION VALUE ON THE BASIS OF MEASURED POSITION DEVIATION AMOUNT
S212
STORE CORRECTION VALUES OF ALL OF PAGES
S213
END

FIG. 10


[S3]
PLEASE SELECT CORRECTION METHOD
SIMPLE POSITION CORRECTION
EXECUTION OF TEST PRINTING
USE OF PAST DATA
CORRELATION VALUE
AVERAGE VALUE
ALL-PAGE POSITION CORRECTION

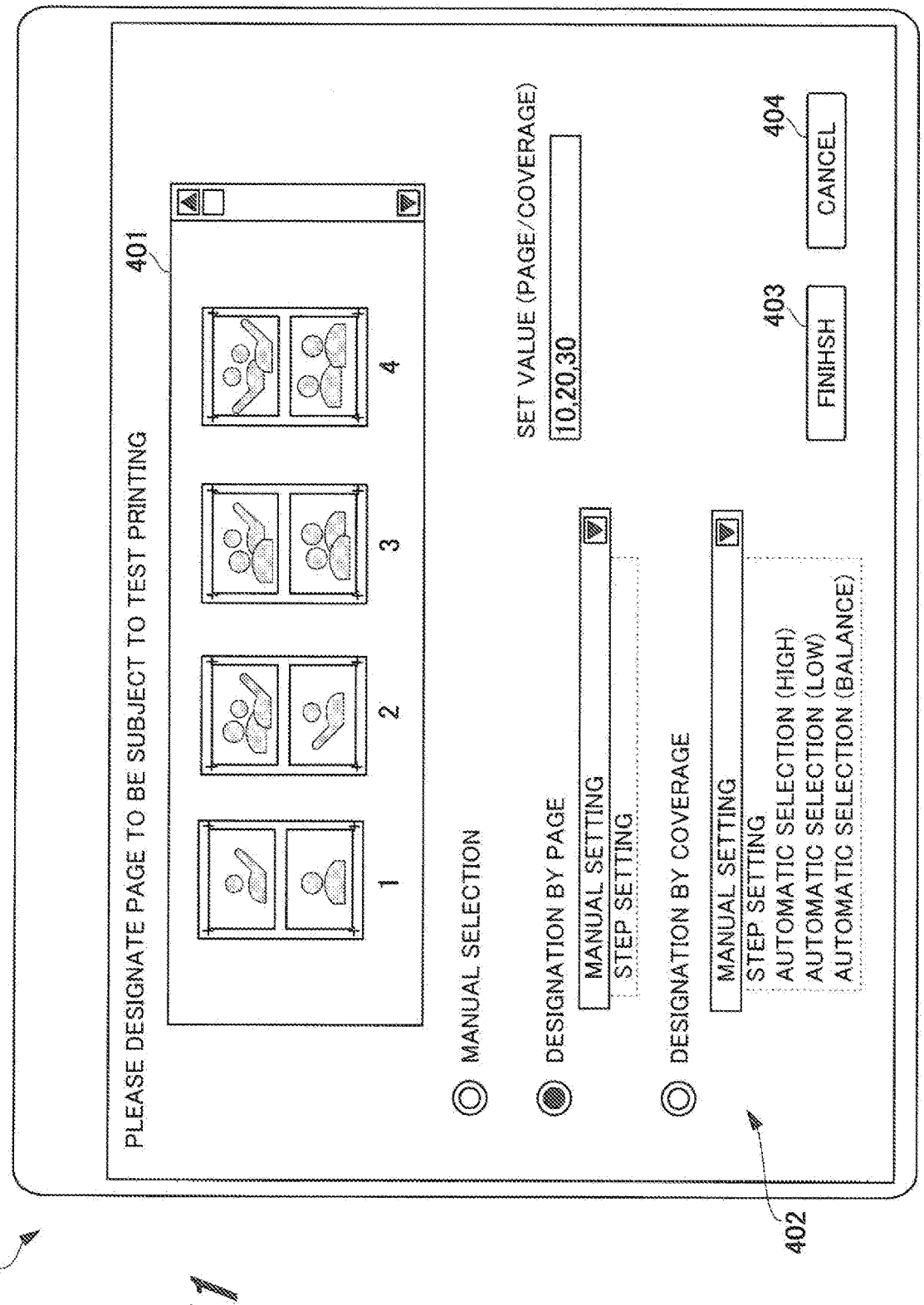

[S4]
PLEASE DESIGNATE PAGE TO BE SUBJECT TO TEST PRINTING
401
1
2
3
4
MANUAL SELECTION
DESIGNATION BY PAGE
MANUAL SETTING
STEP SETTING
DESIGNATION BY COVERAGE
MANUAL SETTING
STEP SETTING
AUTOMATIC SELECTION (HIGH)
AUTOMATIC SELECTION (LOW)
AUTOMATIC SELECTION (BALANCE)
SET VALUE (PAGE/COVERAGE)
10,20,30
403
FINIHSH
404
CANCEL
402

FIG. 11

FIG. 12

PAGE	1	2	3	...	10	...	20	...	30	...
COVERAGE	10%	40%	20%	...	30%	...	30%	...	50%	...
DESIGNATION PAGE		√	√						√	...
ACTUAL MEASUREMENT CORRECTION VALUE										...
CORRECTION VALUE				...		...		...		...

FIG. 13

PAGE	1	2	3	...	10	...	20	...	30	...
COVERAGE	10%	40%	20%	...	30%	...	30%	...	50%	...
DESIGNATION PAGE					√		√		√	...
ACTUAL MEASUREMENT CORRECTION VALUE										...
CORRECTION VALUE				...		...		...		...

FIG. 14

PAGE	1	2	3	...	10	...	20	...	30	...
COVERAGE	10%	40%	20%	...	30%	...	30%	...	50%	...
DESIGNATION PAGE	√				√		√		√	...
ACTUAL MEASUREMENT CORRECTION VALUE										...
CORRECTION VALUE				...		...		...		...

FIG. 15

PAGE	1	2	3	...	10	...	20	...	30	...
COVERAGE	10%	40%	20%	...	30%	...	30%	...	50%	...
DESIGNATION PAGE	√				√		√		√	...
ACTUAL MEASUREMENT CORRECTION VALUE	+1.0				+1.5		+1.5		+2.0	...
CORRECTION VALUE	+1.0	+1.7	+1.35	...	+1.5	...	+1.5	...	+2.0	...

FIG. 16

PAGE	1	2	3	...	10	...	20	...	30	...
COVERAGE	10%	40%	20%	...	30%	...	30%	...	50%	...
DESIGNATION PAGE	√				√		√		√	...
ACTUAL MEASUREMENT CORRECTION VALUE	+1.0				+1.5		+1.5		+2.0	...
CORRECTION VALUE	+1.0	+1.275	+1.275	...	+1.5	...	+1.5	...	+2.0	...

FIG. 17

PAGE	1	2	3	...	10	...	20	...	30	...
COVERAGE	10%	40%	20%	...	30%	...	30%	...	50%	...
DESIGNATION PAGE										...
ACTUAL MEASUREMENT CORRECTION VALUE										...
CORRECTION VALUE	+0.0	+1.5	+0.5	...	+1.2	...	+1.2	...	+2.2	...

IMAGE PROCESSING DEVICE, IMAGE FORMATION SYSTEM, IMAGE PROCESSING METHOD, AND IMAGE PROCESSING PROGRAM

CROSS-REFERENCE TO RELATED APPLICATIONS

[0001] The entire disclosure of Japanese Patent Application No. 2019-129369, filed on Jul. 11, 2019, is incorporated herein by reference in its entirety.

BACKGROUND

Technological Field

[0002] The present invention relates to an image processing device, an image formation system, an image processing method, and an image processing program.

[0003] There is an image forming device having a post-process device for performing cutting, folding, or the like to a sheet-shaped recording medium subjected to image formation. To such an image forming device, a technique to be described hereinafter is proposed for preventing occurrence of a position deviation and density variation in parts which are originally apart from each other but come adjacent by the folding of recording media subjected to image formation.

[0004] First, regions which come adjacent to each other after a post process are found out on the basis of sheet information and post-process information of a job and set as setting regions. Subsequently, a position in which a register mark is printed is determined in the regions which come adjacent after the prost process, and a chart for adjustment in which the register mark is printed is output. After printing, the chart for adjustment is read by an image reading unit, the register mark position is measured from the read chart for adjustment, a correction value is calculated and applied to control of an image formation unit, and the job is output (refer to patent literature 1).

Citation List

Patent Literature

[0005] Patent literature 1: Japanese Unexamined Patent Application Publication No. 2018-189728

SUMMARY

[0006] In image formation using ink or toner, the shrinkage ratio of a recording medium after image formation varies depending on the coverage. Consequently, in variable printing of forming images which are different among pages, the formation position of an image on a recording medium varies depending on the coverage of the image formed on the recording medium.

[0007] However, in the conventional art as described above, one correction value is calculated on the basis of reading of a chart for adjustment at the time of outputting a job, and the calculated one correction value is applied to the control of the image formation unit. Therefore, in the case of applying the above-described technique to, for example, execution of the variable printing in which the coverage varies among pages, image formation in which the formation position is corrected page by page cannot be executed, and a problem occurs such that, for example, a recording medium cannot be cut in a predetermined state in a post process based on the formation position of a register mark.

[0008] Therefore, an object of the present invention is to provide an image processing device, an image formation system, an image processing method, and an image processing program capable of correcting an image formation position page by page.

[0009] To achieve such an object, according to an aspect of the present invention, an image processing device reflecting one aspect of the present invention has: an obtaining unit obtaining a print job corresponding to a plurality of pages: a determination unit obtaining a read image of a sheet in which an image is formed for at least two pages in the plurality of pages and determining a deviation amount related to the at least two pages; a calculation unit calculating at least two correction values on the basis of the deviation amount related to the at least two pages; and a correction unit performing image correction on each of the plurality of pages on the basis of a corresponding correction value in the at least two correction values.

BRIEF DESCRIPTION OF THE DRAWINGS

[0010] The advantages and features provided by embodiments of the invention will become more fully understood from the detailed description given hereinbelow and the appended drawings which are given by way of illustration only, and thus are not intended as a definition of limits of the present invention:

[0011] FIG. **1** is a schematic diagram illustrating a general configuration of an image formation system having an image processing device according to embodiments of the present invention;

[0012] FIG. **2** is a block diagram of the image formation system according to the embodiments of the invention;

[0013] FIG. **3** is a functional configuration diagram of a control unit in the image formation system according to the embodiments of the invention;

[0014] FIG. **4** is a flowchart illustrating an image processing method according to a first embodiment of the invention;

[0015] FIG. **5** is a diagram illustrating an example of a setting screen of a position correcting method which is displayed in the image processing method according to the first embodiment of the invention;

[0016] FIG. **6** is a diagram illustrating storage of correction values in the first embodiment of the invention;

[0017] FIG. **7** is a diagram illustrating an example of a manual correction screen which is displayed in the image processing method according to the first embodiment of the invention;

[0018] FIG. **8** is a flowchart illustrating procedure of execution of a print job in the image processing method according to the first embodiment of the invention;

[0019] FIG. **9** is a flowchart illustrating an image processing method according to a second embodiment of the invention;

[0020] FIG. **10** is a diagram illustrating an example of a setting screen of a position correcting method which is displayed in the image processing method according to the second embodiment of the invention;

[0021] FIG. **11** is a diagram illustrating an example of a test print page designation screen which is displayed in the image processing method according to the second embodiment of the invention;

[0022] FIG. **12** is a diagram illustrating a designation example (No. 1) of a test print page in the second embodiment of the invention;

[0023] FIG. **13** is a diagram illustrating a designation example (No. 2) of the test print page in the second embodiment of the invention;

[0024] FIG. **14** is a diagram illustrating a designation example (No. 3) of the test print page in the second embodiment of the invention;

[0025] FIG. **15** is a diagram illustrating a storage example (No. 1) of correction values in the second embodiment of the invention;

[0026] FIG. **16** is a diagram illustrating a storage example (No. 2) of correction values in the second embodiment of the invention; and

[0027] FIG. **17** is a diagram illustrating a storage example (No. 3) of correction values in the second embodiment of the invention.

DETAILED DESCRIPTION OF EMBODIMENTS

[0028] Hereinafter, embodiments to which the present invention is applied will be described in detail with reference to the drawings. However, the scope of the invention is not limited to the embodiments. The same reference numerals are designated to components which are common in the embodiments and a part of repetitive explanation will be omitted.

Schematic Configuration of Image Forming Device in Embodiments

[0029] FIG. **1** is a schematic diagram illustrating a general configuration of an image formation system **100** having an image processing device according to an embodiment of the present invention. FIG. **2** is a block diagram of the image formation system according to the embodiment of the invention. The image formation system **100** illustrated in FIGS. **1** and **2** is a system for forming an image of a sheet St as a recording medium and has a configuration including an image processing device **10** for forming an image in a predetermined position on the sheet St. The image formation system **100** may further has a function of performing a post process such as cutting or folding to the sheet St on which an image is formed and outputting the resultant sheet. Such an image formation system **100** has an operation display unit **101**, an original data input unit **102**, a control unit **103**, an image formation unit **104**, a medium supply unit **105**, an image reading unit **106**, and a post-process unit **107**. The configuration of each of the members is as follows.

Operation Display Unit **101**

[0030] The operation display unit **101** is a part of inputting a setting of a print job and a setting of an image process executed by using the image formation system **100** and has a display panel and an operation button. The operation button may be a touch panel provided integral with a display panel. Settings of jobs are the size of the sheet St, the number of images intensively formed on one sheet St, one-side printing or duplex printing, the number of print copies, and the like. Settings of the image process are, as will be specifically described later in the image processing method, correction of the formation position of an image on the sheet St and the like.

[0031] The operation display unit **101** is a component of the image processing device **10** in the image formation system **100**. The operation display unit **101** may be a personal computer or another external device connected to the image formation system **100**. In the case where the image processing device **10** is connected as another member in the image formation system **100**, the image processing device **10** has an operation display unit for inputting a setting of the image process.

Original Data Input Unit **102**

[0032] The original data input unit **102** has an original stand and a reading device of reading an image in an original which is placed on the original stand. The original data input unit **102** may input, for example, original data of an image received from the personal computer or another external device connected to the image formation system **100** or may be an input/output interface.

Control Unit **103**

[0033] The control unit **103** controls operations of the units in the image formation system **100** in accordance with an operation in the operation display unit **101** or a reception signal from the external device such as the personal computer connected to the image formation system **100** and is configured by a computing machine. The computing machine is hardware used as a so-called computer. The computing machine has a CPU (Central Processing Unit), a ROM (Read Only Memory), and a RAM (Random Access Memory) and also has a nonvolatile storage and a network interface.

[0034] The control unit **103** executes a characteristic control which will be described later in the image processing method and a part of the function is a component of the image processing device **10** in the image formation system **100**. The procedure of the processes executed by the control unit **103** is loaded and stored, as an image processing program and an image forming program of controlling operations of the units of the image formation system **100**, from the ROM or the external device to the RAM or a nonvolatile storage.

[0035] FIG. **3** is a functional configuration diagram of the control unit **103** in the image formation system according to the embodiment of the invention. As illustrated in the diagram, the control unit **103** has an input/output control unit **103***a*, an image data generation unit **103***b*, an obtaining unit **103***c*, a determination unit **103***d*, a calculation unit **103***e*, a data holding unit **103***f*, and a correction unit **103***g*. Hereinafter, the configuration of each of the units will be described with reference to FIGS. **1** to **3**.

Input/Output Control Unit **103***a*

[0036] The input/output control unit **103***a* is connected to the units constructing the image formation system **100** such as the operation display unit **101**, the original data input unit **102**, the image formation unit **104**, the medium supply unit **105**, the image reading unit **106**, and the post-process unit **107**. The input/output control unit **103***a*controls the driving of the image formation unit **104**, the medium supply unit **105**, the image reading unit **106**, and the post-process unit **107** on the basis of inputs from the operation display unit **101**, the original data input unit **102**, and the external device and, further, the image formation program and the image

process program stored in the control unit **103**. The control of the driving of the units by the input/output control unit **103***a* will be described in detail later in the image processing method.

Image Data Generation Unit **103***b*

[0037] The image data generation unit **103***b* generates image data for printing by performing msterizing process on original data of an image formed on the sheet St by execution of a print job. The image data generation unit **103***b* may be, for example, a raster image processor (RIP). The original data of the image processed by the image data generation unit **103***b* may be an image input from the original data input unit **102** which is, for example, an image input from the external device via a network interface or, in the case where the original data input unit **102** has a reading device, original data read from the reading device.

[0038] The image data generation unit **103***b* generates image data obtained by imposing and laying out an image of image data generated on the basis of original data to the surface and the back face of the sheet St as a recording medium on the basis of the setting of the print job input from the operation display unit **101** or the external device. Further, the image data generation unit **103***b* adds a mark for recognizing the formation position of the image on the sheet St to the image data. Such a mark is, for example, a cross-shaped register-mark image formed at four corners of a maximum print region in the sheet St.

Obtaining Unit **103***c*

[0039] The obtaining unit **103***c* obtains a print job corresponding to a plurality of pages. It is assumed that the print job is, for example, input from the operation display unit **101** or the external device and held in the data holding unit **103***f* or stored in the external device. It is assumed here that a page is one of main surfaces of one sheet St. Consequently, also in the case of intensively forming a plurality of images on one of the main surfaces of one sheet St, it is assumed that one of the main surfaces of one sheet St on which the plurality of images are formed is one page.

Determination Unit **103***d*

[0040] The determination unit **103***d* determines a position deviation amount from a set position, of the formation position of an image formed on the sheet St. The determination of the position deviation amount in the determination unit **103***d* is performed on the basis of a read image which is read from the sheet St on which the image is formed. The determination unit **103***d* determines a position deviation amount from at least two pages designated in the image processing method to be described later, in a plurality of pages on which a print job is executed.

[0041] Reading of an image from the sheet St on which the image is formed is not limited to execution by the image reading unit **106** as an inline sensor provided on the inside of the image formation system **100** but an external image reading device such as a nearline sensor or an offline sensor may be used.

Calculation Unit **103***e*

[0042] The calculation unit **103***e* calculates a correction value of the formation position of the image formed on the sheet St on the basis of the position deviation amount determined by the determination unit **103***d*. The correction value may be a number obtained by inverting the direction of the position deviation amount. Such a calculation unit **103***e* calculates at least two correction values on the basis of the position deviation amount determined by the determination unit **103***d* as will be described later in the image processing method.

Data Holding Unit **103***f*

[0043] The data holding unit **103***f* holds a control program for the CPU as a component of the control unit **103** to control the units of the image formation system **100** and original data of an image input from the original data input unit **102**. The data holding unit **103***f* stores information related to a print job input from the operation display unit **101** and the external device and image data for printing which is generated by the image data generation unit **103***b*.

[0044] Particularly, the data holding unit **103***f* stores a correction value calculated by the calculation unit **103***e* every corresponding page. In the case of forming an image on both sides of one sheet St, a correction value is associated with each of both sides of one sheet St and stored.

Correction Unit **103***g*

[0045] The correction unit **103***g* performs image correction for correcting the formation position of an image to the sheet St on the basis of the correction value calculated by the calculation unit **103***e* for each of a plurality of pages on which a print job is executed. Such a correction unit **103***g* performs the image correction on the basis of a corresponding correction value out of at least two correction values calculated by the calculation unit for each of a plurality of pages on which a print job is executed.

Image Formation Unit **104**

[0046] Referring again to FIG. **1**, the image formation unit **104** is a part for forming an image by printing on the main surface of the sheet St as a recording medium in accordance with an instruction from the control unit **103**. The image forming method of the image formation unit **104** is not limited and, for example, an electrophotography type or an ink jet type is applied. As an example, the image formation unit **104** of the electrophotography type has a toner image formation unit, an intermediate transfer belt, a fixing unit, and the like and a toner image is formed on one main surface of the sheet St. The image formation unit **104** of the ink jet type has an ink jet head and an ink image is formed on one main surface of the sheet St.

Medium Supply Unit **105**

[0047] The medium supply unit **105** is a part of sequentially supplying the sheet St to the image formation unit **104** and the post-process unit **107** in accordance with an instruction from the control unit **103**. Such a medium supply unit **105** has a medium housing unit **105***a* housing a large amount of sheets St and a medium supply path **105***b* supplying the sheets St housed in the medium housing unit **105***a* one by one to the image formation unit **104**. The medium supply unit **105** has a medium discharging and carrying path **105***c* carrying the sheet St on which an image is printed by the image formation unit **104** to the following post-process unit **107**.

[0048] The medium supply unit **105** further has a medium inverting and carrying path **105***d* for inverting the sheet St on which the image is printed by the image formation unit **104** upside down with respect to the carrying direction and supplying the sheet St again to the image formation unit **104**. With the configuration, in the image formation unit **104**, an image can be printed on two main faces which are the surface and the back face of the sheet St.

Image Reading Unit **106**

[0049] The image reading unit **106** may be, for example, a general inline sensor made by a CCD and a CMOS sensor and reads an image formed on the sheet St by the image formation unit **104** and discharged from the image formation unit **104**. The image reading unit **106** is not limited to an inline sensor which is provided on the inside of the image formation system **100**. An external image reading device such as a nearline sensor or an offline sensor may be used.

Post-Process Unit **107**

[0050] The post-process unit **107** performs a post process such as cutting or folding to the sheet St carried from the image formation unit **104** in accordance with an instruction from the control unit **103**. Cutting of the sheet St in the post-process unit **107** is executed using a register mark image formed on the sheet St as a mark The sheet St subjected to the post process is sequentially discharged to trays **108***a* and **108***b*.

Image Processing Method of First Embodiment

[0051] Next, a first embodiment of the image processing method executed by the image formation system **100** having the units as described above will be described. The image processing method to be described hereinafter is realized by executing processes based on the image process program stored in a ROM or RAM by the CPU of each of the function units constructing the control unit **103** also as the image processing device **10**.

Setting of Correction Value of Image Formation Position

[0052] FIG. **4** is a flowchart illustrating an image processing method according to the first embodiment of the invention, and is a diagram illustrating the procedure of setting a correction value of an image formation position. Hereinafter, the procedure of setting a correction value of an image formation position in the image processing method of the first embodiment of the invention will be described in the order of the flowchart illustrated in FIG. **4** with reference to the above-described FIGS. **1** to **3**. The flow starts when a print job is input from the operation display unit **101** or the external device, or starts when an input of starting an image process is performed in the operation display unit **101**.

Step S**001**

[0053] In step S**001**, the obtaining unit **103**c obtains a print job of a plurality of pages as an object of an image process. A print job as an object of an image process may be, as an example, data of a print job which is input from the operation display unit **101** or an external device and held in the data holding unit **103**f or data which is input from an external device.

[0054] The print job obtained here is the number of print copies, the number of images intensively printed on one sheet St, selection of one-side printing or duplex printing, setting of a post process, and the like. The print job may include image data formed on each page. It is assumed that the image data is data generated by the image data generation unit **103***b*.

[0055] As a print job, it is assumed that, as an example, a setting of printing two images intensively on one of the faces of one sheet St which is one page, cutting the one sheet St which is one page to two sheets as a post process, and cutting the periphery of the sheet St is stored.

[0056] After this step S**001** and before the next step S**002**, a step in which the operator of the image formation system **100** can select whether position correction is executed or not may be performed and, in the case of selecting execution of position correction, the program may advance to the next step S**002**.

Step S**002**

[0057] In step S**002**, the input/output control unit **103***a* starts test printing based on the setting of the job for all of pages of the print job obtained. The input/output control unit **103***a* prints an image including a register-mark image in a setting position in each sheet St on the basis of the image data for printing generated by the image data generation unit **103***b*.

Step S**003**

[0058] In step S**003**, the input/output control unit **103***a* instructs the image reading unit **106** to read the image on the sheet St subjected to the test printing. In response to it, the image reading unit **106** starts sequentially reading the images in the entire region in the sheets St on which the images are formed by the image formation unit **104**.

Step S**004**

[0059] In step S**004**, the input/output control unit **103***a* instructs the operation display unit **101** to display the setting screen of the position correcting method. In response to it, the operation display unit **101** displays the setting screen of the position correcting method. FIG. **5** is a diagram illustrating an example of a setting screen [S**1**] of a position correcting method which is displayed in the image processing method according to the first embodiment of the invention. As illustrated in the diagram, as the setting screen [S**1**] of the position correcting method, a selection screen for making the operator of the image formation system **100** select either "automatic calculation of correction value" or "manual correction" is displayed.

Step S**005**

[0060] In step S**005**, the input/output control unit **103***a* determines whether automatic correction is performed or not as the position correcting method. In the case where "automatic calculation of correction value" is selected from the options displayed in the operation display unit **101** in step S**004**, the input/output control unit **103***a*determines "execution of automatic correction (YES)" and the program advances to step S**006**. On the other hand, in the case where "manual correction" is selected, "no execution of automatic

correction (NO)" is determined, and the program advances to step S**006'**. The case of advancing to step S**006** will be described first.

Step S**006**

[0061] In step S**006**, the determination unit **103***d* obtains the read image which is read by the image reading unit **106** and, on the basis of the obtained read image, determines a position deviation amount of the image formed on the sheet St with respect to the page on which the read image is formed. The position deviation amount is a value measured as a position deviation amount from the set position and, as an example, an amount of deviation from the set position, of the formation position of the register mark image for the periphery part of the sheet St.

Step S**007**

[0062] In step S**007**, the calculation unit **103***e* calculates a correction value of the print position of the image on the page from which the image is read, from the position deviation amount measured in step S**006**. The correction value may be the number obtained by inverting the direction of the position deviation amount.

Step S**008**

[0063] In step S**008**, the data holding unit **103***f* stores the correction value calculated in step S**007** in association with the page from which the image is read.

Step S**009**

[0064] In step S**009**, the input/output control unit **103***a* determines whether the process is finished to the final page or not and, until "finished (YES)" is determined, repeats the process from step S**006**. By the operation, the correction value is stored so as to be associated with the page with respect to all of the pages to which the test printing is performed. FIG. **6** is a diagram illustrating storage of correction values in the first embodiment of the invention. As illustrated in the diagram, in the data holding unit **103***f*, the correction value calculated in step S**007** is stored so as to be associated with each of the pages as one sheet St.

Step S**006'**

[0065] On the other hand, in step S**006'** advanced by the determination of "no automatic correction (NO)" in step S**005**, the input/output control unit **103***a* instructs the operation display unit **101** to display the manual correction screen. By the instruction, the operation display unit **101** displays a screen for manually correcting the print position.

[0066] FIG. **7** is a diagram illustrating an example of a manual correction screen [S**2**] which is displayed in the image processing method according to the first embodiment of the invention. As illustrated in FIG. **7**, the manual correction screen [S**2**] displays a read image screen **201** displaying the image read in step S**003**, a print position adjustment part **202** for adjusting the print position of the image on the sheet St, a manual correction finish button **203**, and a manual correction cancel button **204**.

[0067] The operator sequentially selects read images of pages to be subject to position correction in the read image screen **201** displayed in the manual correction screen [S**2**] and adjusts the print position of the image in the selected read image in the print position adjustment part **202**. The read image screen **201** is displayed by moving the image to the position adjusted in the print position adjustment part **202**. In such a manner, the operator can adjust the print position while checking the image. The operator operates the finish button **203** in the case where the manual correction is completed and, operates the cancel button **204** in the case of cancelling the manual correction.

Step S**007'**

[0068] In step S**007'**, the input/output control unit **103***a* determines whether the manual correction is finished or not. In the case where the finish button **203** is operated in the manual correction screen [S**2**], the input/output control unit **103***a* determines that the manual correction is completed (YES) and advances to step S**008'**. On the other hand, in the case where the cancel button **204** is operated in the manual correction screen [S**2**], the input/output control unit **103***a* determines that the manual correction is not completed (NO) and the manual correction is cancelled, and returns to step S**004**.

Step S**008'**

[0069] In step S**008'**, the data holding unit **103***f* stores the correction value adjusted in step S**006'** so as to be associated with the page. The correction value for a page which is not selected in the manual correction screen [S**2**] is set to zero (0). As illustrated in FIG. **6** described above, the correction value adjusted on the basis of display in step S**006'** is stored in association with each page as one sheet St in the data holding unit **103***f*.

[0070] In the above-described series of procedure, after step S**009**, an image of each page to which the correction value stored in the data holding unit **103***f* is applied may be displayed in the operation display unit **101**. Consequently, the operator can recognize an image to which a correction value is applied. In this case, an automatic correction finish button and an automatic correction cancel button are displayed together with an image of each page and a step of determining whether the automatic correction may be finished or not is provided. A configuration may also be employed that, in the case where the cancel button is operated, the program returns to step S**005** and, based on an image to which a correction value obtained by automatic correction is applied, manual correction is further executed.

Execution of Print Job

[0071] FIG. **8** is a flowchart illustrating procedure of execution of a print job in the image processing method according to the first embodiment of the invention. Hereinafter, in order of the flowchart of FIG. **8**, referring to FIGS. **1** to **3**, the procedure of execution of a print job will be described. After the procedure described using the flowchart of FIG. **4** is finished, the following flow is automatically started or started by a predetermined input from the operation display unit **101** or an external device.

Step S**101**

[0072] In step S**101**, the input/output control unit **103***a* starts printing of an image to the sheet St by driving of the image formation unit **104** and the medium supply unit **105**. The correction unit **103***g* refers to a correction value of each of pages stored in the data holding unit **103***f* and performs

image correction on the image data generated by the image data generation unit **103***b*. The input/output control unit **103***a* prints an image in a corrected position in the sheet St by the driving of the image formation unit **104** and the medium supply unit **105**.

Step S**102**

[0073] In step S**102**, the input/output control unit **103***a* instructs the image reading unit **106** to read the image of the sheet St printed. By the instruction, the image reading unit **106** starts reading images sequentially in the entire region of the sheets St on which the image is formed by printing in the image formation unit **104**.

Step S**103**

[0074] In step S**103**, the determination unit **103***d* measures the position deviation amount of an image formed on the sheet St with respect to a page from which the image is read on the basis of read image data which is read by the image reading unit **106**. The position deviation amount is measured as a position deviation amount from a setting position and is, for example, an amount of deviation from the setting position, of the formation position of a register mark image at a periphery part of the sheet St.

Step S**104**

[0075] In step S**104**, the calculation unit **103***e* calculates a correction value of the print position of the image on the page from which the image is read, from the position deviation amount measured in step S**103**.

Step S**105**

[0076] In step S**105**, the data holding unit **103***f* updates the correction value stored in the data holding unit **103***f* in association with the page from which the image is read to the correction value calculated in step S**104**. When the job executed by the flow is a job of printing a plurality of copies, for printing of the next copy after the correction value is updated, the correction unit **103***g* performs image correction to which the updated correction value is applied and prints and forms an image in the image-corrected position.

Step S**106**

[0077] In step S**106**, the input/output control unit **103***a* performs determination of whether the job is finished or not and, when it is determined that the job is not finished (NO), returns to step S**103**, and repeats the following steps.

Effects of First Embodiment

[0078] According to the first embodiment described above, at the time of executing a print job of a plurality of pages, by making a correction value individually correspond to each of the plurality of pages, the formation position of an image can be corrected page by page in any of the case of forming the same image in the plurality of pages and the case of forming different images in the plurality of pages. Consequently, particularly, in variable printing of forming different images in a plurality of pages, even in the case where the deviation amount of the formation position of an image varies because images are different, image formation in which the position deviation is corrected in accordance with the position deviation amount of each page can be executed.

[0079] Further, by feeding back the position deviation amount obtained by reading from a sheet on which an image is formed by a print job, the more the number of print copies increases in one print job, the more the precision of the formation position of an image can be increased.

Image Processing Method of Second Embodiment

[0080] Next, a second embodiment of an image processing method executed by the above-described image formation system **100** will be described. The image processing method to be described hereinafter is realized when the CPU of each of function units constructing the control unit **103** also as the image processing device **10** executes a process based on an image processing program stored in a ROM or RAM.

Setting of Correction Value of Image Formation Position

[0081] FIG. **9** is a flowchart illustrating an image processing method according to the second embodiment of the invention and is a diagram illustrating a procedure of setting a correction value of an image formation position. Hereinafter, in order of the flowchart of FIG. **9**, referring to FIGS. **1** to **3**, the procedure of setting a correction value of an image formation position in the image processing method of the second embodiment of the invention will be described. The following flow is started when a print job is input from the operation display unit **101** or an external device or started when an input of starting an image process is made in the operation display unit **101**.

Step S**201**

[0082] In step S**201**, the obtaining unit **103***c* obtains a print job of a plurality of pages as an object of the image process. The print job as an object of the image process is, as an example, data of a print job which is input from the operation display unit **101** or an external device and held in the data holding unit **103***f* or data which is input from an external device like the first embodiment.

[0083] A configuration may be employed such that after step S**201** and before the next step S**202**, a step which can be selected by the operator of the image formation system **100** of determining whether position correction is executed or not is executed and, when execution of position correction is selected, the program advances to the next step S**202**.

Step S**202**

[0084] In step S**202**, the input/output control unit **103***a* instructs the operation display unit **101** to display the setting screen of the position correcting method. In response to it, the operation display unit **101** displays the setting screen of the position correcting method. FIG. **10** is a diagram illustrating an example of a setting screen [S**3**] of the display correcting method which is displayed in the image processing method according to the second embodiment of the invention. As illustrated in the diagram, as the setting screen [S**3**] of the position correcting method, a selection screen for making the operator of the image formation system **100** select either "simple position correction" or "all-page position correction" is displayed. As the setting screen [S**3**] of the position correcting method, when the simple position

correction is selected, a selection screen for making the operator of the image formation system **100** select either "execution of test printing" or "use of past data" is displayed.

[0085] Further, in the setting screen [S**3**] of the position correcting method, when "simple position correction" is selected, a selection screen for making the operator of the image formation system **100** select either calculation of "correlation value" or calculation of "average value" as the correction value calculating method is displayed.

Step S**203**

[0086] In step S**203**, the input/output control unit **103**a executes determination of whether "simple position correction" is selected or not in the options displayed in the setting screen [S**3**] of the position correcting method in step S**202**. When it is determined that "simple position correction" is selected (YES), the program advances to step S**204**.

[0087] On the other hand, when "all-page position correction" is selected in the options displayed in the setting screen [S**3**] of the position correcting method in step S**202**, the input/output control unit **103***a* determines that "simple position correction" is not selected (NO). The program advances to step S**002** in the flowchart of FIG. **4** in the first embodiment, and the following steps are executed.

Step S**204**

[0088] In step S**204**, the input/output control unit **103***a* calculates coverage with respect to all of the pages of the obtained print job. In this case, the input/output control unit **103***a* calculates the coverage of an image of each page on the basis of the image data for printing generated by the image data generation unit **103***b*. The input/output control unit **103***a* stores the calculated coverage in association with the page in the data holding unit **103***f*.

Step S**205**

[0089] In step S**205**, the input/output control unit **103***a* makes determination of whether a test print is executed or not. In the case where "simple position correction" is selected in the setting screen [S**3**] of the position correcting method in step S**202** and, further, in the case "execution of test print" is selected, the input/output control unit **103***a* determines to execute a test print (YES) and advances to step S**206**.

[0090] On the other hand, in the case where "simple position correction" is selected in the setting screen [S**3**] of the position correcting method in step S**202** and, further, in the case "use of past data" is selected, the input/output control unit **103***a* determines not to execute a test print (NO) and advances to step S**212**'.

Step S**206**

[0091] In step S**206**, the input/output control unit **103***a* instructs the operation display unit **101** to display a test print page designation screen. In response to it, the operation display unit **101** displays a screen for designating a page to be subjected to test printing.

[0092] FIG. **11** is a diagram illustrating an example of a test print page designation screen [S**4**] which is displayed in the image processing method according to the second embodiment of the invention. As illustrated in the diagram, in the test print page designation screen [S**4**], an image data screen **401**, a designation method setting screen **402**, a designation finish button **403**, and a designation cancel button **404** are displayed.

[0093] In the image data screen **401**, an image based on image data of all of pages generated by the image data generation unit **103***b* is displayed. The image is an image to which a register mark image is added. In the case where manual designation is selected in the designation method setting screen **402** which will be described later, the image data screen **401** displays so that an image in each page can be designated.

[0094] In the designation method setting screen **402**, any of "manual designation", "designation by page", and "designation by coverage" can be selected.

[0095] In the case where "manual designation" is selected, the designation method setting screen **402** may additionally display coverage of an image in each page as a reference of designation of a test print page.

[0096] In the designation method setting screen **402**, in the case where "designation by page" is selected, either "manual setting" or "step setting" can be selected and, further, a set value can be input. "Step setting" is a setting of designating pages which are set at predetermined intervals such as, for example, every five pages or 10 pages.

[0097] In the designation method setting screen **402**, in the case where "designate by coverage" is selected, any of "manual setting", "step setting", "automatic selection (high)", "automatic selection (low)", and "automatic selection (balance)" can be selected. "Step setting" is a setting of designating a page by setting the coverage at predetermined intervals such as, for example, every 10% or every 20%. In the case where "manual setting" or "step setting" is selected, a set value can also be input.

[0098] "Automatic selection (high)" is a setting of automatically designating a page in which the coverage is rather high among the coverages of the pages calculated in step S**204** (for example, pages corresponding to tens % from the highest coverage). "Automatic selection (low)" is a setting of automatically designating a page in which the coverage is rather low among the coverages of the pages calculated in step S**204** (for example, pages corresponding to tens % from the lowest coverage). "Automatic selection (balance)" is a setting of automatically designating a predetermined number of pages in accordance with a distribution of the coverages of the pages calculated in step S**204**.

[0099] FIGS. **12** to **14** are diagrams illustrating designation examples (No. 1) to (No. 3) of a test print page in the second embodiment of the invention. As indicated by check marks in FIGS. **12** to **14**, a page designated in the test print page designation screen [S**4**] is extracted as a designation page and held in the data holding unit **103***f*. For example, FIG. **12** illustrates the case where "manual designation" is selected in the designation method setting screen **402** and a test print page is manually designated. FIG. **13** illustrates the case where "step setting" in "designation by page" is selected in the designation method setting screen **402** and a step of every 10 pages is entered as a set value. Further, FIG. **14** illustrates the case where "manual setting" in "designation by coverage" is selected in the designation method setting screen **402** and 10, 30, and 50% are entered as setting values.

[0100] The designation (extraction) of a page to which test printing is performed is not limited to the above but a proper designation method may be used as an option.

Step S207

[0101] In step S207, the input/output control unit **103***a* determines whether the page designation is completed or not. In the case where the finish button **403** is operated in the test print page designation screen [S4], the input/output control unit **103***a* determines that the page designation has been completed (YES) and advances to step S208. On the other hand, in the case where the cancel button **404** is operated in the test print page designation screen [S4], the input/output control unit **103***a* determines that the page designation has not been completed (NO), determines that the page designation of test print is cancelled, and returns to step S203.

Step S208

[0102] In step S208, the input/output control unit **103***a* starts the test printing of the page designated in the test print page designation screen [S4]. The input/output control unit **103***a* prints an image including a register mark image in a set position in each sheet St on the basis of the image data for printing generated by the image data generation unit **103***b*.

Step S209

[0103] In step S209, the input/output control unit **103***a* instructs the image reading unit **106** to read the image on the sheet St subjected to the test printing. In response to it, the image reading unit **106** starts reading the image in the entire region of the sheet St sequentially in the sheets St on which images are formed by the image formation unit **104**.

Step S210

[0104] In step S210, the determination unit **103***d* obtains a read image which is read by the image reading unit **106** and, on the basis of the obtained read image, determines the position deviation amount of the image formed on the sheet St with respect to the page on which this read image is formed. The position deviation amount is a value measured as a position deviation amount from the setting position and is, for example, an amount of deviation of the formation position of a register mark image in the peripheral part of the sheet St from the setting position.

Step S211

[0105] In step S211, the input/output control unit **103**a determines whether measurement of a position deviation amount has been finished or not on all of pages designated in the test print page designation screen [S4] displayed in step S206. In the case where it is determined that the measurement is finished (YES), the program advances to step S212. In the case where it is determined that the measurement has not been finished (NO), the program returns to step S210.

Step S212

[0106] In step S212, the calculation unit **103***e* calculates correction values of all of pages on the basis of the coverage of a designation page and a position deviation amount. In this case, according to the calculating method which is set in the setting screen [S3] of the position correcting method (refer to FIG. **10**) in step S202, a correction value is calculated. That is, in the case where "correlation value" is selected in the setting screen [S3], the correlation between the coverage of each page in which the position deviation amount is measured in step S210 and the position deviation amount is derived, and the correction values (correlation correction values) of all of the pages are calculated on the basis of the derived correlation. In the case where "average value" is selected in the setting screen [S3], an average value of the position deviation amounts of the pages measured in step S210 is obtained, and a correction value (average correction value) is calculated from the average value.

Step S213

[0107] In step S213, the data holding unit **103***f* stores the calculated correction value in association with a page. At this time, with respect to the designation page, the correction value calculated on the basis of the measured position deviation amount may be stored as it is. Consequently, the most accurate correction value is stored in association with the designation page.

[0108] FIG. **15** is a diagram illustrating a storage example (No. 1) of correction values in the second embodiment of the invention, which is an example of the case where "correlation value" is selected in the setting screen [S3] of the position correcting method (refer to FIG. **10**) in step S202. With respect to the designation page, the correction value calculated on the basis of the measured position deviation amount is stored as it is, and the correlation correction value is stored in association with a page other than the designation page.

[0109] It is assumed that the data holding unit **103***f* accumulates the relation between the correction value (correlation correction value) calculated as described above and the coverage or the relation between the position deviation amount and the coverage.

[0110] FIG. **16** is a diagram illustrating a storage example (No. 2) of correction values in the second embodiment of the invention, which is an example of the case where "average value" is selected in the setting screen [S3] of the position correcting method (refer to FIG. **10**) in step S202. With respect to a designation page, a correction value calculated on the basis of the measured position deviation amount is stored as it is, and an average correction value is stored in association with a page other than the designation page.

Step S212'

[0111] On the other hand, in step S212' advanced by the determination of not executing test printing (NO) in step S205, the input/output control unit **103***a* calculates correction values of all of pages on the basis of past data stored in the data holding unit **103***f* and the coverages of all of the pages calculated in step S204. After that, the program advances to step S213. The correlation between the coverage and the position deviation amount or the correction value is obtained from the past data and, on the basis of the correlation and the coverages of all of the pages calculated in step S204, correction values of all of the pages are calculated.

[0112] FIG. **17** is a diagram illustrating a storage example (No. 3) of correction values in the second embodiment of the invention. As illustrated in the diagram, in the data holding unit **103***f*, the coverage of each page calculated in step S204 and the correction value of each page calculated on the basis of data between the past coverage and the position deviation amount of an image are stored in association with each page.

[0113] In the above-described procedure of steps **S201** to **S213**, the coverages of all of pages are calculated in step **S204**. However, the invention is not limited to the calculation of coverages of all of pages. For example, a flow that, after step **S203**, the program advances to step **S206** without executing step **S204** of calculating the coverage may also be employed. After executing steps **S206** to **S211**, in place of step **S212**, an average value of measured position deviation amounts may be calculated and one correction value may be calculated from the average value. Also in this case, the calculated one correction value is held in association with each page. To the page in which a position deviation amount is calculated in step **S210**, a correction value based on the calculated position deviation amount is applied and held.

Execution Method of Print Job

[0114] The print job obtained in step **S201** after setting the correction value of the image formation position for each page as described above is executed by the procedure described in the first embodiment in accordance with the flowchart described by using FIG. **8** in the first embodiment. In this case, the correction value updated in association with the page from which the image is read in step **S105** may be applied to image formation in a different page in which an image will be formed later and with which the same coverage is associated. The correction value, however, is not applied to a page in which the position deviation amount is measured. In a manner similar to the first embodiment, an updated correction value may be applied to a copy after the correction value is updated.

Effects of Second Embodiment

[0115] According to the second embodiment described above, at the time of executing a print job of a plurality of pages, by making a correction value individually correspond to each of the plurality of pages, effects similar to those of the first embodiment can be obtained. Since image formation in which a position deviation of an image is corrected can be performed on the basis of a result of image formation in the past including test printing, it is unnecessary to perform test printing on all of pages.

[0116] Although the embodiments of the present invention have been described and illustrated above, the disclosed embodiments are made for purposes of illustration and example only and not limitation. The scope of the present invention should be interpreted by the terms of the appended claims

DESCRIPTION OF REFERENCE NUMERALS

[0117] **1** . . . image formation system
10 . . . image processing device
103*c* . . . obtaining unit
103*d* . . . determination unit
103*e* . . . calculation unit
103*g* . . . correction unit
104 . . . image formation unit
St . . . sheet

What is claimed is:

1. An image processing device comprising:

an obtaining unit obtaining a print job corresponding to a plurality of pages:

a determination unit obtaining a read image of a sheet on which an image is formed for at least two pages in the plurality of pages and determining a deviation amount in the at least two pages;

a calculation unit calculating at least two correction values on the basis of the deviation amount in the at least two pages; and

a correction unit performing image correction on each of the plurality of pages on the basis of a corresponding correction value in the at least two correction values.

2. The image processing device according to claim **1**, wherein the at least two pages are all of the plurality of pages, and the image correction is performed to each of the plurality of pages on the basis of all of read images of the plurality of pages.

3. The image processing device according to claim **1**, wherein the at least two pages are pages extracted at predetermined intervals from the plurality of pages, and image correction is performed to each of the plurality of pages on the basis of read images of the pages extracted at the predetermined intervals.

4. The image processing device according to claim **1**, wherein the at least two pages are pages extracted from the plurality of pages on the basis of coverage, and image correction is performed to each of the plurality of pages on the basis of read images of the pages extracted on the basis of the coverage.

5. The image processing device according to claim **4**, wherein the calculation unit calculates the correction value for each of the plurality of pages on the basis of correlation between the coverage and the deviation amount of the at least two pages.

6. The image processing device according to claim **5**, wherein a correction value which is calculated directly from the deviation amount is applied as the correction value related to the at least two pages to which determination of the deviation amount is performed.

7. The image processing device according to claim **5**, wherein the calculation unit calculates a correction value which corresponds to each of the plurality of pages on the basis of the correlation and the coverage for each of the plurality of pages.

8. An image formation system comprising:

the image processing device according to claim **1**; and

an image formation unit forming an image on a sheet on the basis of correction in the correction unit.

9. The image formation system according to claim **8**, wherein a read image on a sheet on which an image is formed by the image formation unit on the basis of correction in the correction unit is fed back to the image processing device.

10. An image processing method comprising:

obtaining a print job corresponding to a plurality of pages;

obtaining a read image of a sheet in which an image is formed for at least two pages in the plurality of pages and determining a deviation amount in the at least two pages;

calculating at least two correction values on the basis of the deviation amount in the at least two pages; and

performing image correction on each of the plurality of pages on the basis of a corresponding correction value in the at least two correction values.

11. A non-transitory computer readable recording medium storing an image processing program making a computer to perform:

obtaining a print job corresponding to a plurality of pages;

obtaining a read image of a sheet in which an image is formed for at least two pages in the plurality of pages and determine a deviation amount in the at least two pages;

calculating at least two correction values on the basis of the deviation amount in the at least two pages; and

performing image correction on each of the plurality of pages on the basis of a corresponding correction value in the at least two correction values.

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