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(54) IMAGE READING APPARATUS

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(57) **ABSTRACT**

Disclosed is an image reading apparatus that may include a scan data acquirer that acquires scan data obtained by reading from printed matter output by an image forming apparatus, a magnification acquirer that acquires a magnification used when the printed matter is imaged, a reverse scaling part that generates reverse-scaled data obtained by scaling the scan data at a reverse magnification that is the reciprocal of the magnification acquired by the magnification acquirer, and a determiner that determines whether a predetermined reference image is included in the reverse-scaled data by comparing with the predetermined reference image.

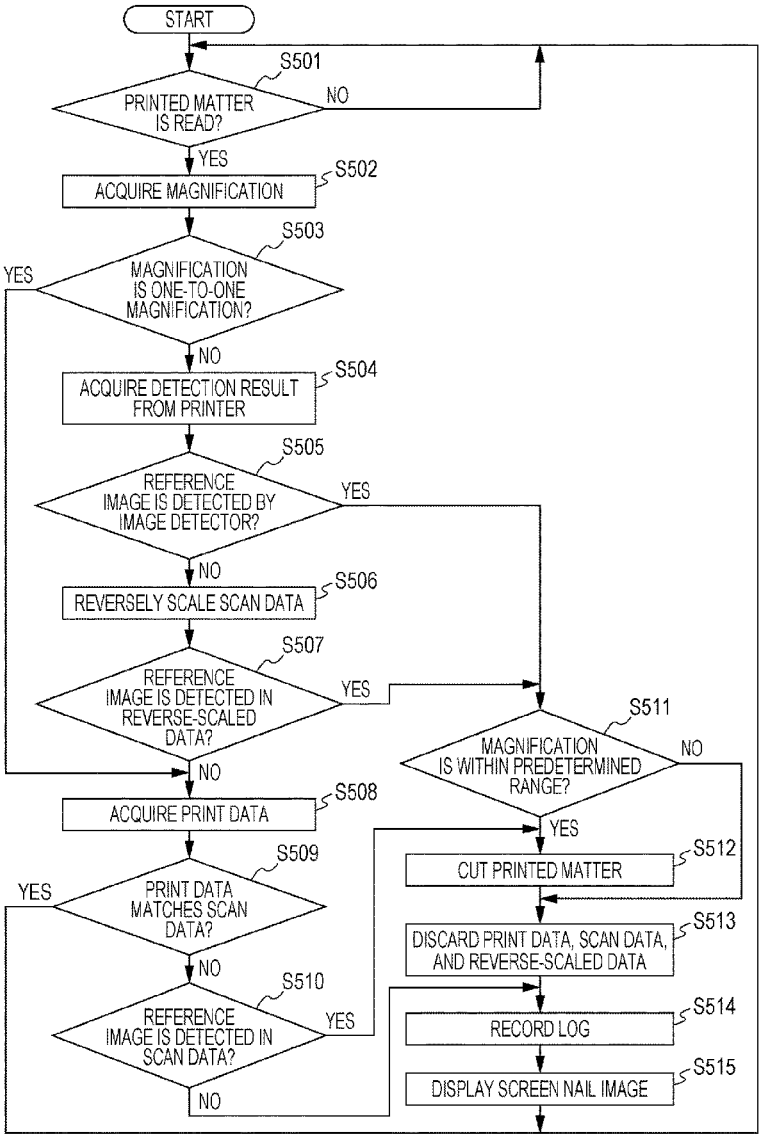

FIG. 1

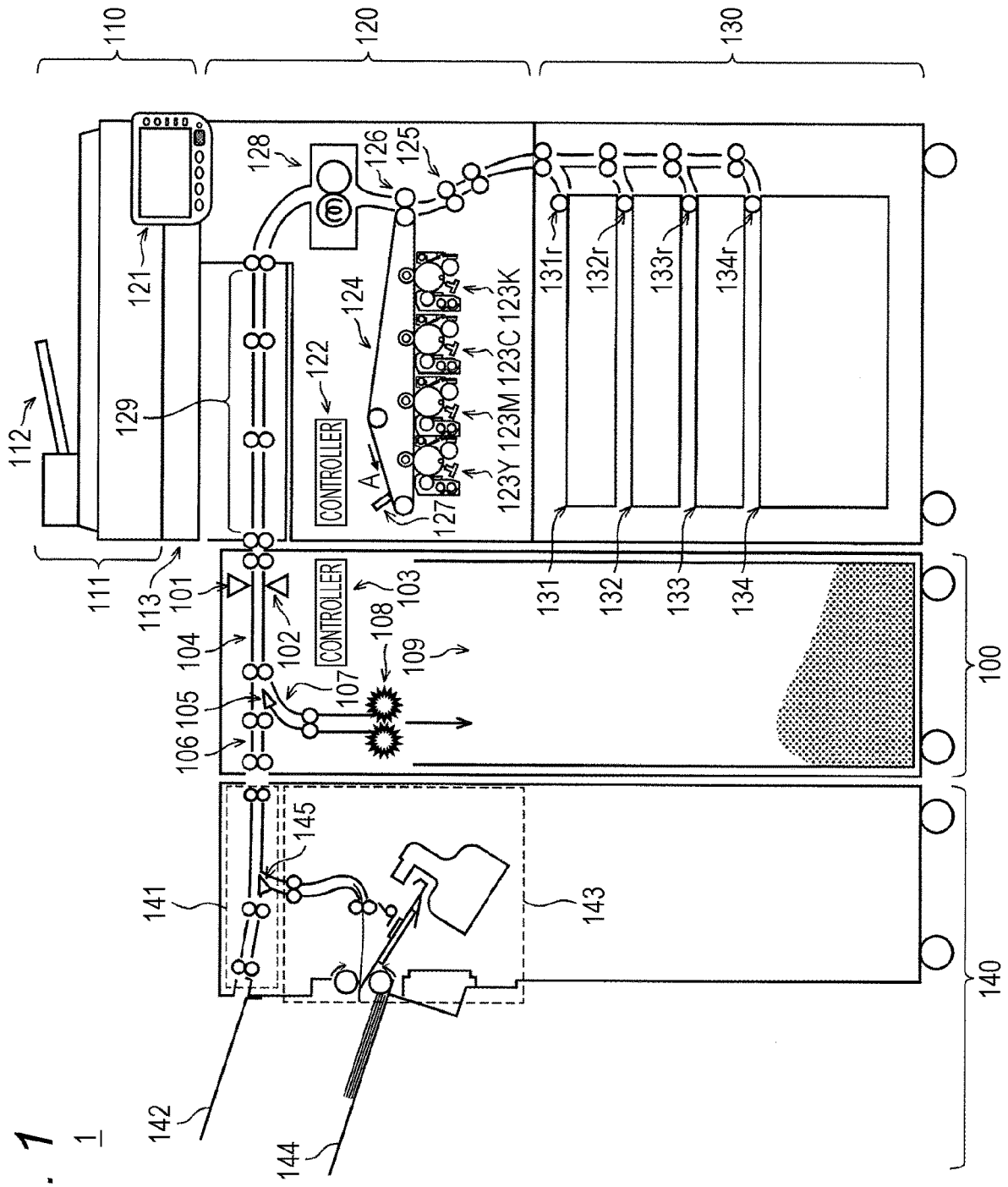
1
110
120
130
100
140
111
112
113
101
102
103
104
105
106
107
108
109
121
122
123Y
123M
123C
123K
124
125
126
127
128
129
131
132
133
134
131r
132r
133r
134r
141
142
143
144
145
CONTROLLER
CONTROLLER
A

FIG. 2

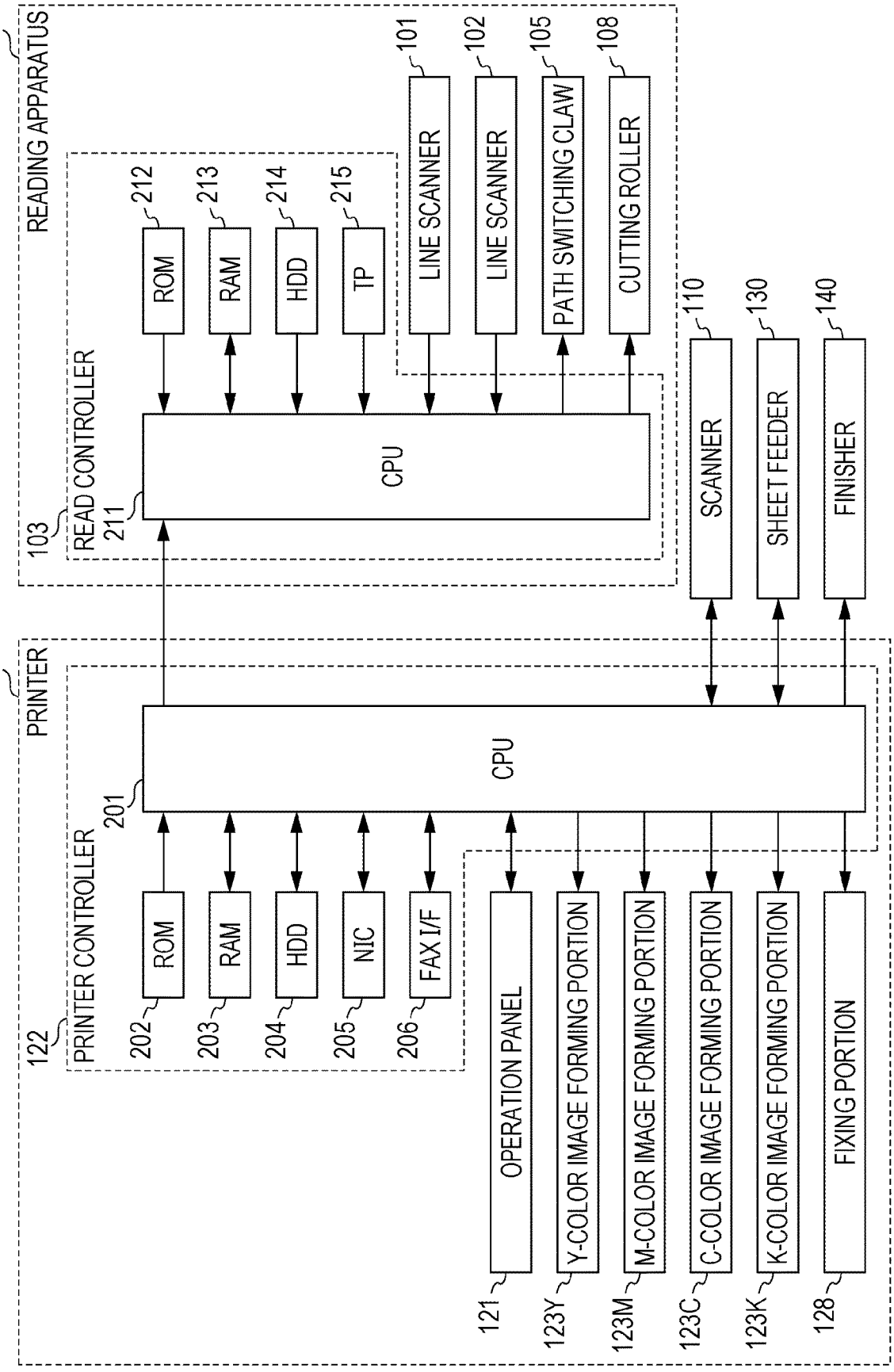
100
READING APPARATUS
101
LINE SCANNER
102
LINE SCANNER
105
PATH SWITCHING CLAW
108
CUTTING ROLLER
212
ROM
213
RAM
214
HDD
215
TP
103
READ CONTROLLER
211
CPU
110
SCANNER
130
SHEET FEEDER
140
FINISHER
120
PRINTER
201
CPU
122
PRINTER CONTROLLER
202
ROM
203
RAM
204
HDD
205
NIC
206
FAX I/F
121
OPERATION PANEL
123Y
Y-COLOR IMAGE FORMING PORTION
123M
M-COLOR IMAGE FORMING PORTION
123C
C-COLOR IMAGE FORMING PORTION
123K
K-COLOR IMAGE FORMING PORTION
128
FIXING PORTION

FIG. 3

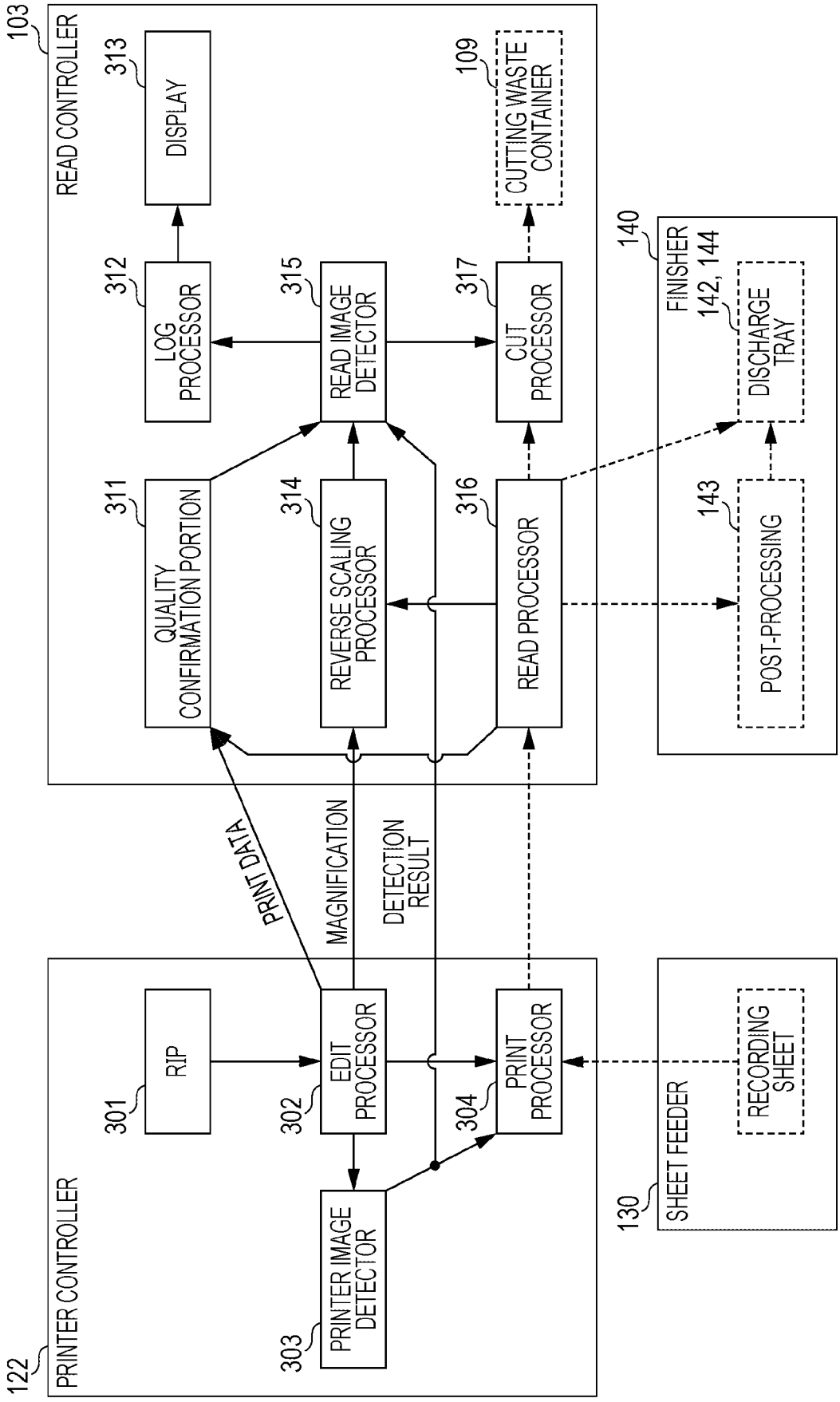
103
READ CONTROLLER
313
DISPLAY
109
CUTTING WASTE CONTAINER
140
FINISHER
142, 144
DISCHARGE TRAY
312
LOG PROCESSOR
315
READ IMAGE DETECTOR
317
CUT PROCESSOR
311
QUALITY CONFIRMATION PORTION
314
REVERSE SCALING PROCESSOR
316
READ PROCESSOR
143
POST-PROCESSING
PRINT DATA
MAGNIFICATION
DETECTION RESULT
122
PRINTER CONTROLLER
301
RIP
302
EDIT PROCESSOR
304
PRINT PROCESSOR
303
PRINTER IMAGE DETECTOR
130
SHEET FEEDER
RECORDING SHEET

FIG. 4

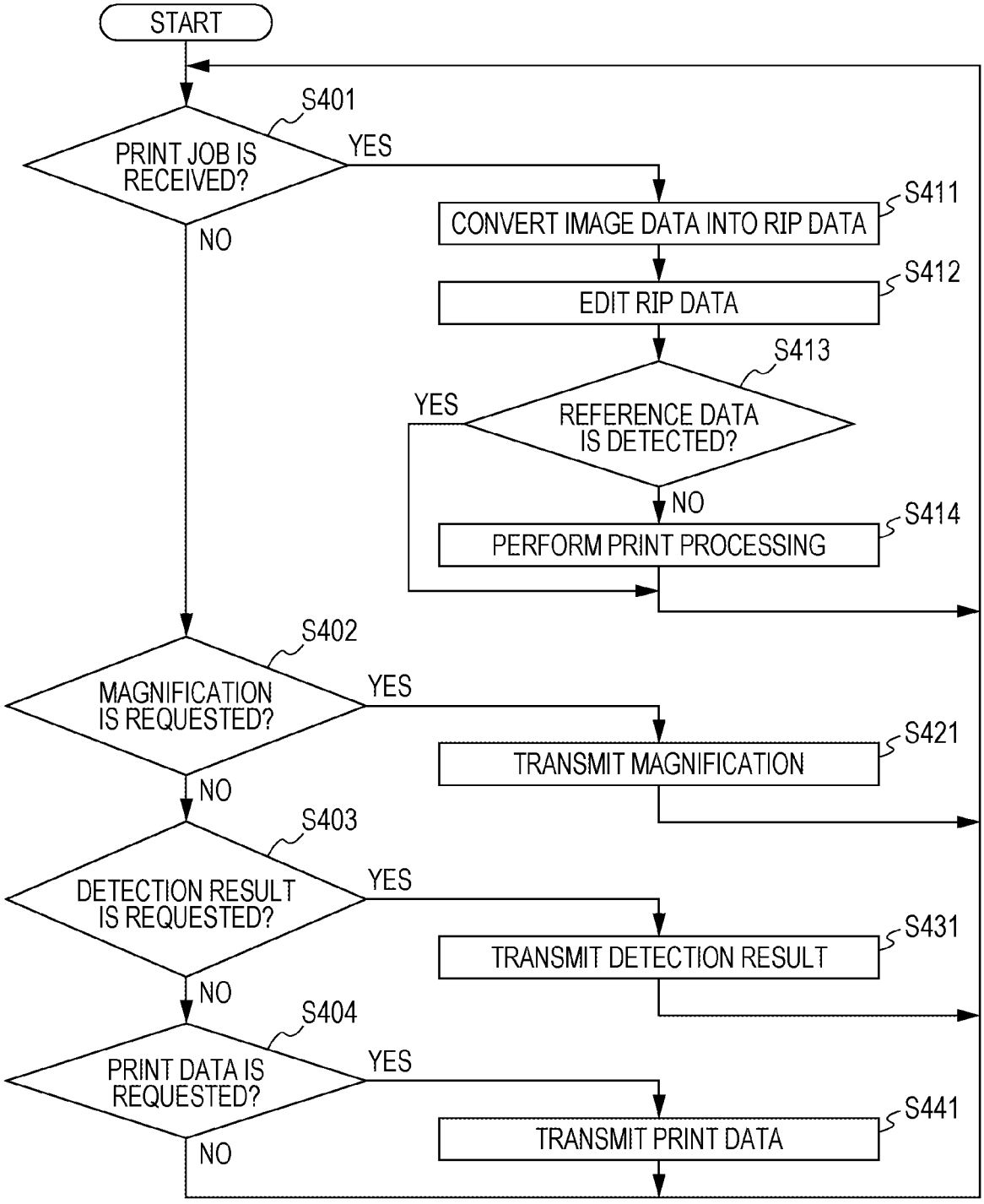
START
S401
PRINT JOB IS RECEIVED?
YES
NO
S411
CONVERT IMAGE DATA INTO RIP DATA
S412
EDIT RIP DATA
S413
YES
REFERENCE DATA IS DETECTED?
NO
S414
PERFORM PRINT PROCESSING
S402
MAGNIFICATION IS REQUESTED?
YES
NO
S421
TRANSMIT MAGNIFICATION
S403
DETECTION RESULT IS REQUESTED?
YES
NO
S431
TRANSMIT DETECTION RESULT
S404
PRINT DATA IS REQUESTED?
YES
NO
S441
TRANSMIT PRINT DATA

FIG. 5

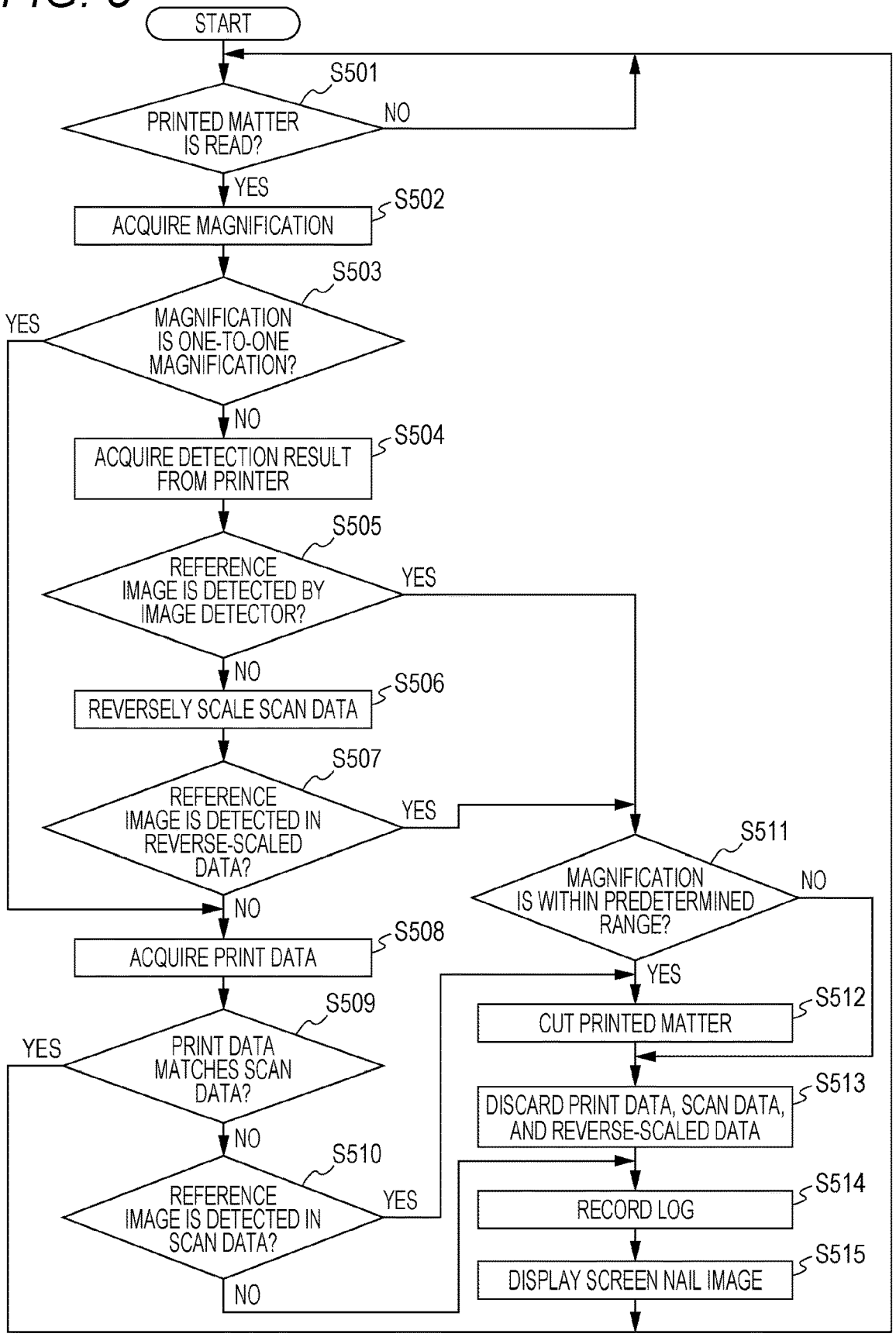
START
S501
PRINTED MATTER IS READ?
NO
YES
S502
ACQUIRE MAGNIFICATION
S503
MAGNIFICATION IS ONE-TO-ONE MAGNIFICATION?
YES
NO
S504
ACQUIRE DETECTION RESULT FROM PRINTER
S505
REFERENCE IMAGE IS DETECTED BY IMAGE DETECTOR?
YES
NO
S506
REVERSELY SCALE SCAN DATA
S507
REFERENCE IMAGE IS DETECTED IN REVERSE-SCALED DATA?
YES
NO
S508
ACQUIRE PRINT DATA
S509
PRINT DATA MATCHES SCAN DATA?
YES
NO
S510
REFERENCE IMAGE IS DETECTED IN SCAN DATA?
YES
NO
S511
MAGNIFICATION IS WITHIN PREDETERMINED RANGE?
NO
YES
S512
CUT PRINTED MATTER
S513
DISCARD PRINT DATA, SCAN DATA, AND REVERSE-SCALED DATA
S514
RECORD LOG
S515
DISPLAY SCREEN NAIL IMAGE

FIG. 6A

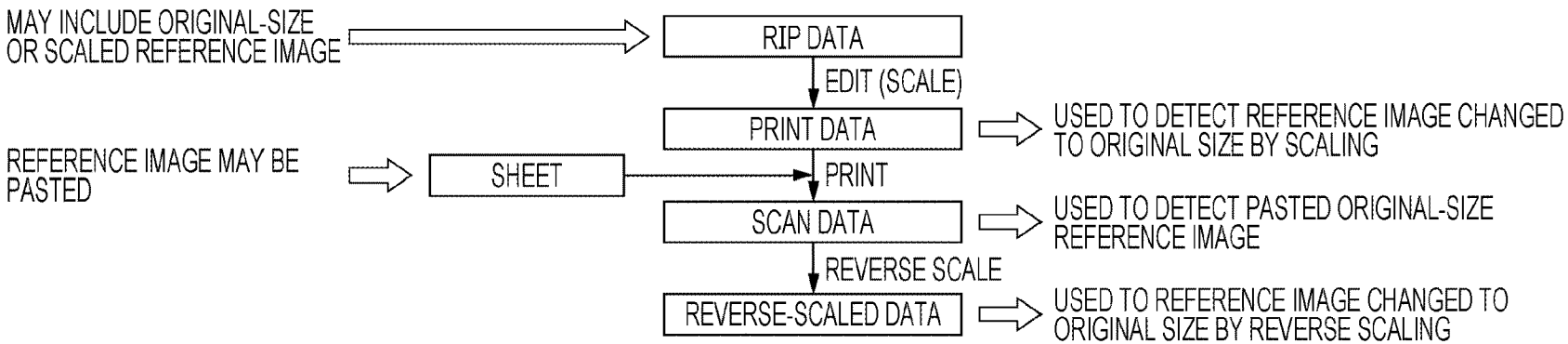

FIG. 6B

NUMBER	RECORDING SHEET	RIP DATA	EDIT	PRINT DATA	SCAN DATA	REVERSE-SCALED DATA	DETECTION ENTITY	DATA	PRINTED MATTER
#1	BLANK	REFERENCE IMAGE	ONE-TO-ONE MAGNIFICATION	DETECTABLE	NONE	NONE	IMAGE DETECTOR (S413)	NONE	NOT PRINTED
#2	BLANK	REFERENCE IMAGE	HIGH MAGNIFICATION	UNDETECTABLE	UNDETECTABLE	DETECTABLE	READING APPARATUS (S507)	DISCARD	OUTPUT
#3	BLANK	REFERENCE IMAGE	LOW MAGNIFICATION	UNDETECTABLE	UNDETECTABLE	DETECTABLE	READING APPARATUS (S507)	DISCARD	CUT
#4	REFERENCE IMAGE PASTED	NO REFERENCE IMAGE	ONE-TO-ONE MAGNIFICATION	UNDETECTABLE	DETECTABLE	NONE	READING APPARATUS (S510)	DISCARD	CUT
#5	REFERENCE IMAGE PASTED	NO REFERENCE IMAGE	HIGH MAGNIFICATION	UNDETECTABLE	DETECTABLE	UNDETECTABLE	READING APPARATUS (S510)	DISCARD	CUT
#6	REFERENCE IMAGE PASTED	NO REFERENCE IMAGE	LOW MAGNIFICATION	UNDETECTABLE	DETECTABLE	UNDETECTABLE	READING APPARATUS (S510)	DISCARD	CUT

FIG. 7

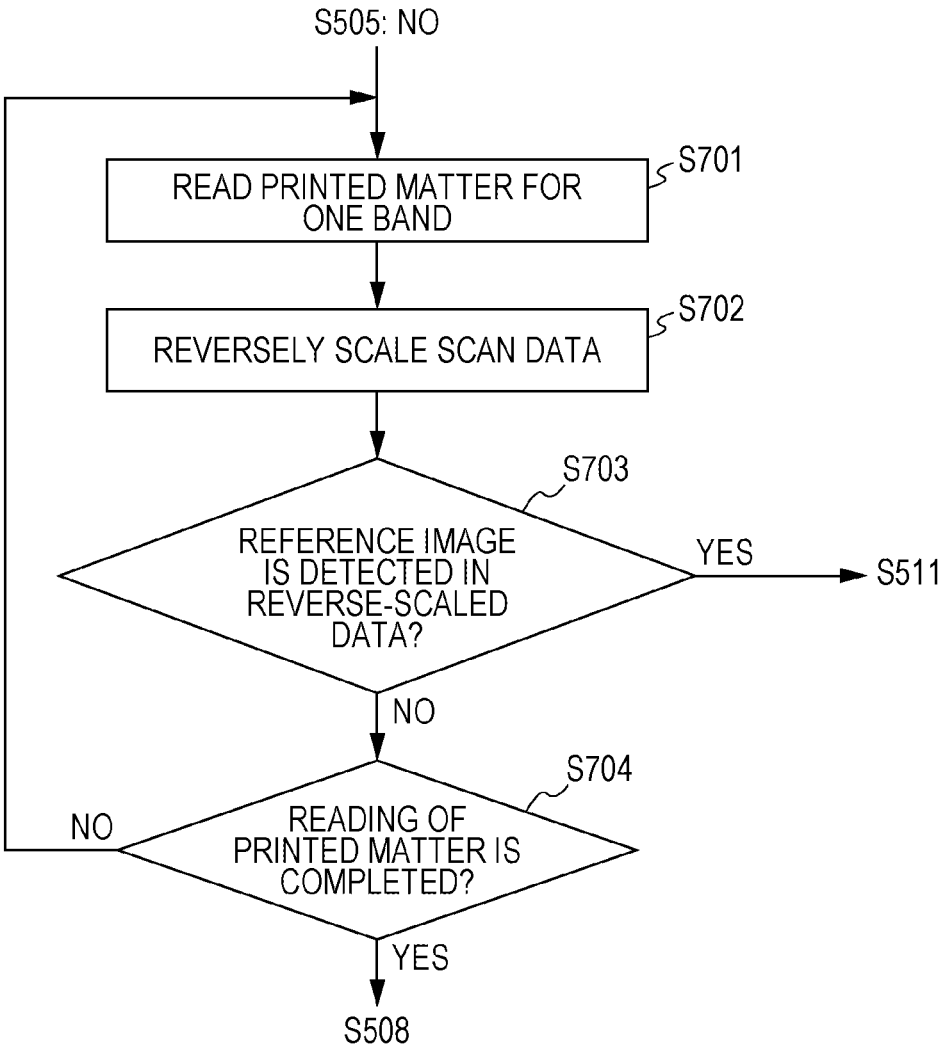
S505: NO
READ PRINTED MATTER FOR ONE BAND
S701
REVERSELY SCALE SCAN DATA
S702
REFERENCE IMAGE IS DETECTED IN REVERSE-SCALED DATA?
S703
YES
S511
NO
READING OF PRINTED MATTER IS COMPLETED?
S704
NO
YES
S508

FIG. 8

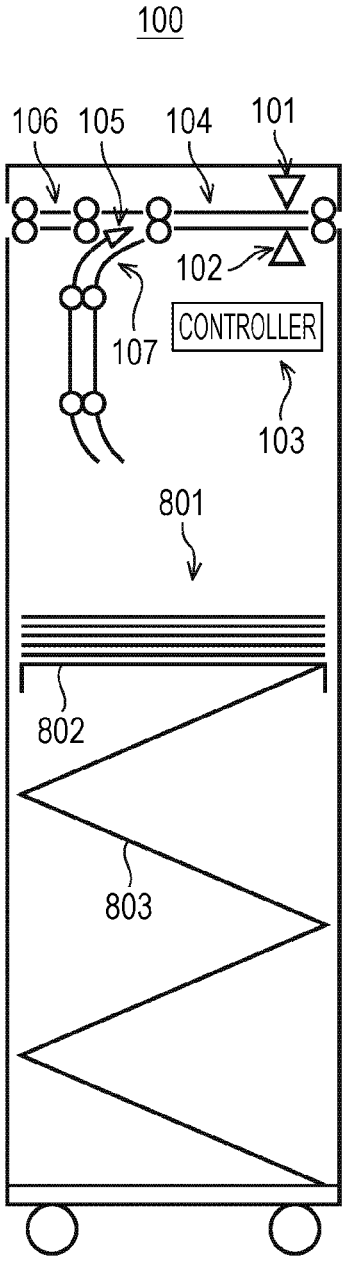

FIG. 9

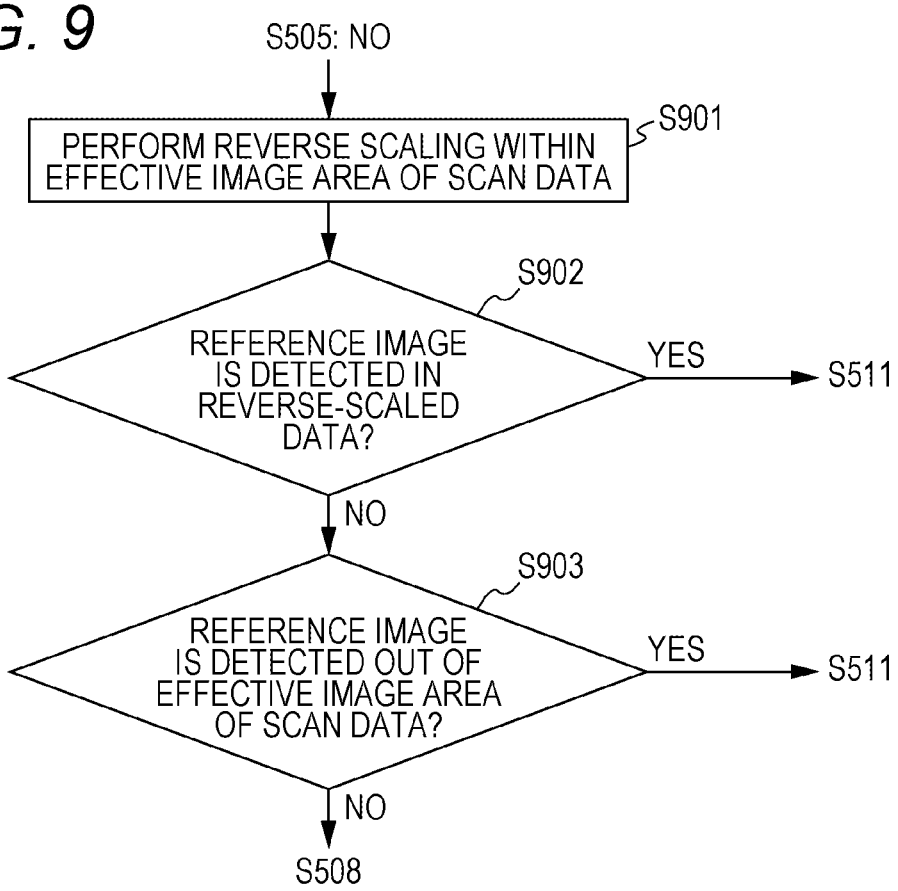
S505: NO
PERFORM REVERSE SCALING WITHIN EFFECTIVE IMAGE AREA OF SCAN DATA
S901
S902
REFERENCE IMAGE IS DETECTED IN REVERSE-SCALED DATA?
YES
S511
NO
S903
REFERENCE IMAGE IS DETECTED OUT OF EFFECTIVE IMAGE AREA OF SCAN DATA?
YES
S511
NO
S508

FIG. 10

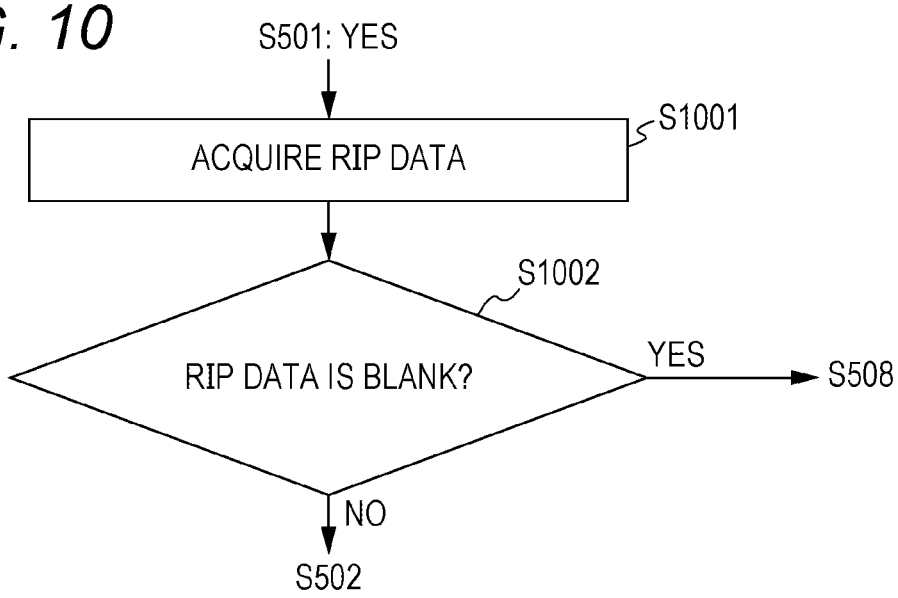
S501: YES
ACQUIRE RIP DATA
S1001
S1002
RIP DATA IS BLANK?
YES
S508
NO
S502

IMAGE READING APPARATUS

CROSS REFERENCE TO RELATED APPLICATIONS

[0001] This application claims priority to Japanese Patent Application No. 2018-225907, filed on Nov. 30, 2018, which is incorporated herein by reference in its entirety.

BACKGROUND

Technological Field

[0002] The present disclosure relates to an image reading apparatus, and more particularly to a technique for reducing a processing load for detecting an image for which image formation is prohibited.

Description of the Related Art

[0003] Conventionally, in order to manage the quality of printed matter output from an image forming apparatus, a reading apparatus that checks print quality using scan data obtained by reading a printing part has been used. When the reading apparatus detects printed matter that may have a problem with print quality, the reading apparatus notifies the user to that effect. The user who receives the notification refers to scan data stored in the reading apparatus to check whether there is a problem with the print quality, and if there is a problem, check what kind the problem is. As a result, the user can redo the printing, or identify and eliminate the cause so that no problem occurs in the print quality of the subsequent printed matter.

[0004] Incidentally, some printed matter output by the image forming apparatus should be managed so that they cannot be viewed or copied without permission.

[0005] To deal with such a problem, a technique has been proposed (see JP 2014-113775 A, for example) in which it is checked whether scan data includes a specific mark (image as indicator) or a pattern every time printed matter is read, and if the mark or pattern is included, the printed matter is crushed, marked to prevent use, or discharged to a dedicated tray, for example. According to this conventional technique, it is possible to prevent direct output of printed matter whose viewing and copying should be restricted.

[0006] Additionally, an image forming apparatus has multiple types of pattern data of images of special copies such as banknotes registered in advance. In a case where an input image is enlarged or reduced, the image forming apparatus performs reverse scaling processing for restoring one-to-one magnification, compares the image restored to one-to-one magnification with the pattern data of each registered special original, and determines whether or not the image is an image of a special original. There has also been proposed a technique for performing anti-counterfeit processing such as not adding color to an output image when it is determined that the image is an image of a special original (see JP 2000-232578 A).

[0007] However, an image forming apparatus has a scaling function for enlarging or reducing an image, and the above-mentioned specific mark or pattern is also scaled in scaled printed matter. Hence, output of printed matter cannot be managed sufficiently only by detecting a mark or pattern of one-to-one magnification.

[0008] Additionally, in view of such problems, it is conceivable to prepare marks or patterns with various magnifications and detect whether such marks or patterns are included in a round-robin manner. However, when there are many types of marks or patterns to be detected, the detection processing takes too much time and it becomes impossible to follow the output speed of the image forming apparatus, or the productivity of the image forming apparatus has to be reduced, and therefore the method is not realistic.

[0009] Additionally, the latter of the above two conventional techniques relates to prevention of counterfeit when an original is set and read on a copying machine or the like and the original is scaled at a specified magnification. If the input image is enlarged or reduced, reverse scaling processing is performed to restore one-to-one magnification.

[0010] Since the magnification at this time is specified by the image forming apparatus, it is possible to specify the magnification to be used. However, when a sheet once discharged from the image forming apparatus is read by a reading apparatus that checks print quality, the reading apparatus does not edit the image data, nor parameters for editing (including magnification) are specified. Hence, when a sheet including an enlarged or reduced prohibited image is discharged, it cannot be determined whether the image is a prohibited image by using pattern data of one-to-one magnification.

SUMMARY

[0011] The present disclosure has been made in view of the above-described problems, and aims to provide an image reading apparatus capable of efficiently detecting a reference image that may be included in printed matter output from an image forming apparatus.

[0012] To achieve the abovementioned object, according to an aspect of the present disclosure, an image reading apparatus reflecting one aspect of the present disclosure may comprise a scan data acquirer that acquires scan data obtained by reading from printed matter output by an image forming apparatus, a magnification acquirer that acquires a magnification used when the printed matter is imaged, a reverse scaling part that generates reverse-scaled data obtained by scaling the scan data at a reverse magnification that is the reciprocal of the magnification acquired by the magnification acquirer, and a determiner that determines whether or not a predetermined reference image is included in the reverse-scaled data by comparing with the predetermined reference image.

BRIEF DESCRIPTION OF THE DRAWINGS

[0013] The advantages and features provided by one or more embodiments of the disclosure 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 the limits of the present disclosure:

[0014] FIG. **1** is a diagram showing a main configuration of a multi-function peripheral according to an embodiment of the present disclosure;

[0015] FIG. **2** is a block diagram showing main hardware configurations of a read controller and a printer controller;

[0016] FIG. **3** is a block diagram showing main functional configurations of the read controller and the printer controller;

[0017] FIG. **4** is a flowchart showing an operation of the printer controller;

[0018] FIG. **5** is a flowchart showing an operation of the read controller;

[0019] FIG. **6**A is a diagram showing a flow of print processing, and FIG. **6**B is a table for describing a relationship between the form of reference images and detection processing;

[0020] FIG. **7** is a flowchart for describing a modification in which a reference image is detected every time one band of printed matter is read;

[0021] FIG. **8** is a diagram showing a configuration of a reading apparatus according to a modification of the present disclosure;

[0022] FIG. **9** is a flowchart for describing an operation of a read controller according to a modification of the present disclosure; and

[0023] FIG. **10** is a flowchart for describing an operation of a read controller according to a modification of the present disclosure.

DETAILED DESCRIPTION OF EMBODIMENTS

[0024] Hereinafter, one or more embodiments of an image reading apparatus according to the present disclosure will be described with reference to the drawings, taking a multifunction peripheral (MFP) as an example. However, the scope of the disclosure is not limited to the disclosed embodiments.

[1] CONFIGURATION OF MFP

[0025] First, a configuration of the MFP according to the embodiment will be described.

[0026] As shown in FIG. **1**, an MFP **1** includes a reading apparatus **100**, a scanner **110**, a printer **120**, a sheet feeder **130**, and a finisher **140**, and performs functions such as a printer function, a scanner function, a copy function, a facsimile function, and a document server function.

[0027] When the scanner **110** receives an original reading instruction from the user through an operation panel **121** included in the printer **120**, the scanner **110** uses an automatic document feeder (ADF) **111** to convey originals one by one to an image reading portion **113** from a bundle of originals placed on an original tray **112**, and uses the image reading portion **113** to read the originals and generate image data.

[0028] The printer **120** is a so-called tandem color printer. When a print job is received by a controller (hereinafter referred to as "printer controller") **122**, in a case of forming a color image, toner images of each color of YMCK are formed by using image forming portions **123**Y, **123**M, **123**C, and **123**K, and the toner images are electrostatically transferred (primary transfer) onto an intermediate transfer belt **124** so that the toner images overlap one another, thereby forming a color toner image. In a case of forming a monochrome image, a K-color toner image is formed by using only the image forming portion **123**K, and the toner image is electrostatically transferred (primary transfer) onto the intermediate transfer belt **124**.

[0029] The intermediate transfer belt **124** rotates in the direction of arrow A to convey the toner image to a secondary transfer roller pair **126**.

[0030] The sheet feeder **130** feeds recording sheets stored in feeding trays **131**, **132**, **133**, and **134** one by one by using pickup rollers **131***r*, **132***r*, **133***r*, and **134***r*. The fed recording sheet is conveyed by a conveyance roller, gets its skew corrected and conveyance timing adjusted by a timing roller **125**, and is then conveyed to the secondary transfer roller pair **126**.

[0031] A secondary transfer bias voltage is applied to the secondary transfer roller pair **126**, whereby the toner image on the intermediate transfer belt **124** is electrostatically transferred (secondary transfer) to the recording sheet. The toner remaining on the intermediate transfer belt **124** after the secondary transfer is scraped off by a cleaning blade **127** and discarded. After the toner image is thermally fixed onto the recording sheet by a fixing portion **128**, the recording sheet is conveyed toward the reading apparatus **100** through a conveyance path **129**.

[0032] When receiving the recording sheet from a conveyor **129**, the reading apparatus **100** reads front and back surfaces of the recording sheet using line scanners **101** and **102**, and generates color image data. A controller (hereinafter referred to as "read controller") **103** controls the posture of a path switching claw **105** depending on whether or not a prestored reference image is included in the image data.

[0033] When the recording sheet that passed through the conveyance path **104** includes a reference image, the recording sheet is guided to a conveyance path **107** by the path switching claw **105**, cut by a cutting roller **108**, and is then stored in a cutting waste container **109**. On the other hand, when a reference image is not included, the recording sheet is guided to a conveyance path **106** by the path switching claw **105** and is output to the finisher **140**.

[0034] The finisher **140** controls the posture of a path switching claw **145** depending on whether or not post-processing is instructed in the print job. When post-processing is not instructed, the recording sheet is guided to a discharge tray **142** by the path switching claw **145** through a conveyance path **141**. Meanwhile, when post-processing is instructed, the path switching claw **145** guides the recording sheet to a post-processing device **143**.

[0035] The post-processing device **143** performs post-processing such as alignment of the recording sheet bundle, punching, stapling, and folding on the recording sheet in accordance with instructions in the print job. The post-processed recording sheet is discharged onto a discharge tray **144**.

[2] HARDWARE CONFIGURATION OF READ CONTROLLER **103** AND PRINTER CONTROLLER **122**

[0036] Next, hardware configurations of the read controller **103** and the printer controller **122** will be described.

[0037] (2-1) Hardware Configuration of Printer Controller **122**

[0038] As shown in FIG. **2**, the printer controller **122** includes a central processing unit (CPU) **201**, a read only memory (ROM) **202**, a random access memory (RAM) **203**, and the like. When the MFP **1** is powered on, the CPU **201** reads and activates a boot program from the ROM **202**, and executes an operating system (OS) and a control program read from a hard disk drive (HDD) **204** using the RAM **203** as a working storage area.

[0039] A network interface card (NIC) **205** performs communication processing when accepting print jobs from other devices or transmitting image data to other devices through a communication network such as a local area network

(LAN). A FAX interface **206** exchanges facsimile data with other facsimile devices through a facsimile line.

[0040] By controlling the operation of the operation panel **121**, the printer controller **122** presents information to the user of the MFP **1** and receives instructions from the user. The instructions include generation of image data by reading an original, copying using the image data, facsimile transmission using the image data, execution of a print job received from another device, and printed output of facsimile data received from another facsimile device, for example.

[0041] When forming an image, the printer controller **122** controls the image forming portions **123**Y, **123**M, **123**C, and **123**K to form toner images of each color of YMCK, and controls the fixing temperature of the fixing portion **128** to thermally fix the toner image on the recording sheet, for example. Similarly, the printer controller **122** controls the scanner **110** to read an original to generate image data, or controls the sheet feeder **130** to feed a recording sheet specified by a print job or specified by the user using the operation panel **121**.

[0042] (2-2) Hardware Configuration of Read Controller **103**

[0043] Similar to the printer controller **122**, the read controller **103** includes a central processing unit (CPU) **211**, a read only memory (ROM) **212**, a random access memory (RAM) **213**, and the like. When the MFP **1** is powered on, the CPU **211** reads and activates a boot program from the ROM **212**, and executes an operating system (OS) and a control program read from a hard disk drive (HDD) **214** using the RAM **213** as a working storage area.

[0044] As a result, the CPU **211** generates image data from the line-by-line image data output by the line scanners **101** and **102** reading the original, determines the presence or absence of a reference image, and controls the posture of the path switching claw **105** or controls the cutting roller **108** depending on the determination result.

[0045] Additionally, the read controller **103** includes a touch panel (TP) **215**, and can present information to the user of the MFP **1** or accept an instruction input from the user.

[3] FUNCTIONAL CONFIGURATION OF READ CONTROLLER **103** AND PRINTER CONTROLLER **122**

[0046] Next, functional configurations of the read controller **103** and the printer controller **122** will be described.

[0047] (3-1) Functional Configuration of Printer Controller **122**

[0048] As shown in FIG. **3**, the printer controller **122** includes a raster image processor (RIP: hereinafter referred to as "RIP") **301**, an edit processor **302**, a printer image detector **303**, and a print processor **304**. These functions are implemented by the CPU **201** executing the control program.

[0049] The RIP **301** generates raster image data (hereinafter referred to as "RIP data") by performing rasterization processing on image data specified by the print job. A print job is described using a page description language such as Postscript, portable document format (PDF), or XML, paper specification (XML: Extensible Markup Language) (XPS). Additionally, RIP data is bitmap data.

[0050] The edit processor **302** generates image data (hereinafter referred to as "print data") obtained by editing RIP data generated by the RIP **301**. In particular, when a magnification is specified in a print job, the RIP data is scaled by the magnification. Note that in a print job, there are a case where a magnification is specified by a numerical value and a case where a magnification is specified by specifying a layout such as 2 in 1.

[0051] The edit processor **302** transmits a magnification and print data in response to a request from the read controller **103**. The embodiment describes a case of transmitting a numerical value representing a magnification to the read controller **103** as an example, regardless of whether or not a magnification is specified using a numerical value in a print job. However, it goes without saying that the magnification may be displayed using data other than a numerical value.

[0052] The printer image detector **303** detects whether or not a reference image is included in print data. In the embodiment, a reference image refers to an image printed to specify the authenticity of securities on vouchers whose copying is prohibited, such as banknotes or securities, or a mark provided on a document containing secret that needs to be kept from being leaked. An example of such a mark or pattern is a mark or pattern including a character string such as "for internal use only" or "CONFIDENTIAL".

[0053] The printer image detector **303** prestores the reference image as described above, and compares the reference image with the print data for each reference image to detect whether the reference image is included in the print data. The printer image detector **303** transmits a detection result in response to a request from the read controller **103**. Additionally, the printer image detector **303** notifies the print processor **304** of the detection result.

[0054] The print processor **304** forms an image on a recording sheet supplied by the sheet feeder **130** using the print data generated by the edit processor **302**. Note that when the printer image detector **303** provides notification of a detection result that reference image is included in the print data, image formation is not performed. Additionally, in FIG. **3**, broken arrows indicate the flow of recording sheets and printed matter.

[0055] (3-2) Functional Configuration of Read Controller **103**

[0056] The read controller **103** includes a quality confirmation portion **311**, a log processor **312**, a display **313**, and the like. These functions are implemented by the CPU **211** executing the control program.

[0057] A read processor **316** controls the line scanners **101** and **102** to read printed matter output from the printer **120** and generate image data (hereinafter referred to as "scan data").

[0058] A reverse scaling processor **314** acquires a magnification M of print data corresponding to the scan data from the edit processor **302** of the printer controller **122**, and generates image data (hereinafter referred to as "reverse-scaled data") by reverse scaling scan data stored in an image storage unit **314**. Here, reverse scaling refers to processing for scaling scan data with a magnification that is the reciprocal (1/M) of the magnification M acquired from the edit processor **302**.

[0059] A read image detector **315** detects whether or not a reference image is included in image data by sequentially comparing prestored reference images with the image data. The image data is print data, scan data, and reverse-scaled

data. Note that in the embodiment, the read image detector **315** stores the same reference images as those stored in the printer image detector **303**.

[0060] The quality confirmation portion **311** acquires print data from the edit processor **302**, compares the print data with scan data, and determines whether or not the print data and the scan data match. If the print data and the scan data do not match, it can be estimated that there is a problem with print quality, such as the printed matter being torn.

[0061] The log processor **312** creates an image log and a display screen nail image for each piece of printed matter. An image log includes a quality confirmation result by the quality confirmation portion **311**, a detection result by the read image detector **315**, and scan data. Additionally, a display screen nail image is a thumbnail image obtained by reducing the image log.

[0062] The display **313** displays a list of display nail images generated by the log processor **312** on the touch panel **215**. When the user of the MFP **1** touches one of the display screen nail images, an image log corresponding to the display screen nail image is displayed on the touch panel **215**.

[0063] The cut processor **317** controls the posture of the path switching claw **105**, guides printed matter to the cutting roller **108**, cuts the printed matter, and discards the cutting waste into the cutting waste container **109**. When cutting is not performed, the cut processor **317** controls the posture of the path switching claw **105** and guides the printed matter to the finisher **140**. When post-processing is specified in the print job, the printed matter is post-processed by the post-processing device **143**, and is then discharged to the discharge tray **144**. When post-processing is not performed, the printed matter is discharged directly to the discharge tray **142**.

[4] OPERATION OF CONTROLLERS **103** AND **122**

[0064] Next, operations of the controllers **103** and **122** will be described.

[0065] (4-1) Operation of Printer Controller **122**

[0066] First, an operation of the printer controller **122** will be described.

[0067] As shown in FIG. **4**, when a print job is received (S**401**: YES), the printer controller **122** controls the RIP **301** to generate RIP data from image data included in the print job (S**411**), and controls the edit processor **302** to edit the RIP data to generate print data (S**412**). If the printer image detector **303** does not detect that the reference image is included in the print data (S**413**: NO), an image is formed using the print data (S**414**).

[0068] If the reverse scaling processor **314** of the read controller **103** requests a magnification that the edit processor **302** used to generate print data (S**402**: YES), the edit processor **302** transmits the magnification to the reverse scaling processor **314** (S**421**).

[0069] If the reverse scaling processor **314**, the log processor **312**, and the cut processor **317** of the read controller **103** request a detection result by the printer image detector **303** (S**403**: YES), the printer image detector **303** transmits the detection result to the reverse scaling processor **314**, the log processor **312**, or the cut processor **317** that is the request source (S**431**).

[0070] If the quality confirmation portion **311** of the read controller **103** requests print data (S**404**: YES), the edit processor **302** transmits the print data to the quality confirmation portion **311** (S**441**).

[0071] (4-2) Operation of Read Controller **103**

[0072] Next, an operation of the read controller **103** will be described.

[0073] As shown in FIG. **5**, when the read controller **103** controls the read processor **316** to read printed matter and generate scan data (S**501**: YES), the controller **103** controls the reverse scaling processor **314** to acquire a magnification from the edit processor **302** of the printer controller **122** (S**502**), and if the acquired magnification is one-to-one magnification (S**503**: YES), the processing proceeds to step S**508**. If the acquired magnification is not one-to-one magnification (S**503**: NO), the read image detector **315** acquires the detection result by the printer image detector **303** (S**504**).

[0074] If the detection result by the printer image detector **303** is positive, in other words, if the printer image detector **303** determines that the reference image is included in the print data (S**505**: YES), the processing proceeds to step S**511**. If the detection result by the printer image detector **303** is negative (S**505**: NO), the reverse scaling processor **314** reversely scales the scan data to generate reverse-scaled data (S**506**), and the read image detector **315** determines whether or not a reference image is included in the reverse-scaled data.

[0075] If the detection result by the read image detector **315** is affirmative, in other words, if the reference image is included in the reverse-scaled data (S**507**: YES), the processing proceeds to step S**511**. In step S**511**, the read image detector **315** determines whether or not the magnification by the edit processor **302** is within a predetermined range. While the predetermined range is 95% to 105% In the embodiment, it may be a different range, as long as it is a range including one-to-one magnification (100%).

[0076] If the magnification is within the predetermined range (S**511**: YES), the printed matter is cut by the cut processor **317** (S**512**) and discarded in the cutting waste container **109**. For example, if the print data is a banknote image and is close to the original size (one-to-one magnification), it may be mistaken as a banknote, and therefore may be misused as a fake bill. Hence, such misuse can be prevented by cutting the printed matter when the magnification is close to one-to-one magnification.

[0077] After the processing of step S**512** and if the magnification is out of the predetermined range (S**511**: NO), the print data, the scan data, and the reverse-scaled data are discarded (S**513**). Since this can prevent copying of printed matter using these types of data, it is possible to prevent unauthorized copying of printed matter whose copying is prohibited such as banknotes, and prevent leakage of confidential information by copying a document.

[0078] Thereafter, the log processor **312** generates an image log and a display nail image, records the image log (S**514**), the display **313** displays the display screen nail image on the touch panel **215** (S**514**), and the processing proceeds to step S**501**, to repeat the above processing. Note that when scan data is discarded, the log processor **312** generates an image log that does not include the scan data. It goes without saying that the display screen nail image generated from the image log not including the scan data does not include the scan data either.

[0079] If the reference image is not included in the reverse-scaled data (S**507**: NO), the quality confirmation portion **311** acquires print data from the edit processor **302** of the printer controller **122** (S**508**), and checks whether the acquired print data matches the scan data. If they match (S**509**: YES), it is considered that there is no problem with the quality of the printed matter, so the processing proceeds to step S**501** to repeat the above processing.

[0080] If the print data does not match the scan data (S**509**: NO), the read image detector **315** detects whether or not a reference image is included in the scan data. If the reference image is included in the scan data (S**510**: YES), the printed matter is cut by the cut processor **317** (S**512**), discarded in the cutting waste container **109**, and the processing proceeds to step S**513**.

[0081] If the reference image is not included in the scan image (S**510**: NO), the log processor **312** generates an image log and a display screen nail image, and records the image log (S**514**). The display **313** displays the display screen nail image on the touch panel **215** (S**514**), and the processing proceeds to step S**501** to repeat the above processing.

[5] EFFECT

[0082] The effect of the embodiment will be described.

[0083] As shown in FIG. **6**A, RIP data generated from a print job may include an original-size or scaled reference image. By comparing print data generated by editing the RIP data with the original-size reference image by the printer image detector **303**, it is possible to detect a prohibited image such as a banknote printed in the original size (case #1 of FIG. **6**B).

[0084] Additionally, when printing is performed by pasting a prohibited image on a recording sheet, even if the print data itself does not include the prohibited image, the reading apparatus **100** could generate and store scan data including the original-size prohibited image. In this case, by comparing the scan data with the original-size reference image by the read image detector **315**, it is possible to determine the presence or absence of the prohibited image (cases #4, #5, and #6 of FIG. **6**B).

[0085] Further, by acquiring a magnification from the edit processor **302**, generating reverse-scaled data from scan data, and comparing the reverse-scaled data with an original-size reference image, it is possible to determine the presence or absence of a prohibited image even with printed data obtained by scaling RIP data including the original-size reference image (cases #2 and #3 of FIG. **6**B).

[0086] Accordingly, since it is possible to determine the presence or absence of a prohibited image using only the original-size reference image, as compared to a case of preparing reference images with various magnifications other than the original size in consideration of the magnification and comparing them sequentially with image data, the processing load on the read controller **103** required for detection of a prohibited image can be reduced, and processing time can be shortened.

[0087] Additionally, when the magnification is within a predetermined range including one-to-one magnification, the printed matter could be mistaken as printed matter including an original-size prohibited image, and it is hard to distinguish between the two. Hence, there is a high risk of unauthorized use. In view of such a problem, since printed matter whose magnification is within the predetermined range is discarded, it is possible to prevent unauthorized use of printed matter including an original-size prohibited image and printed matter including a prohibited image that could be mistaken as the original size (case #3 of FIG. **6**B).

[0088] On the other hand, if the magnification is out of the predetermined range, the size is obviously different from the original-size prohibited image, so there is no possibility of being confused with the original-size prohibited image or being misused. Hence, printout is performed in consideration of user convenience (case #2 of FIG. **6**B).

[0089] Additionally, if the magnification is one-to-one magnification, the printer image detector **303** can detect the prohibited image using the original-size reference image. Hence, there is no need for the read image detector **315** to detect the prohibited image again. For this reason, by performing conditional branching as in step S**503** of FIG. **5**, the processing load on the read controller **103** can be reduced by omitting the processing in the read image detector **315** (case #1 of FIG. **6**B).

[0090] Additionally, since printed matter on which the prohibited image is printed is processed to be unusable by cutting the printed matter by the cut processor **317**, the printed matter cannot be output to the outside of the reading apparatus **100**. Thus, unauthorized use of printed matter on which a prohibited image is printed can be surely prevented (cases #3 to #6 of FIG. **6**B).

[0091] Additionally, when a prohibited image is pasted to a recording sheet, since the prohibited image is not included in the print data, the prohibited image cannot be detected by the printer image detector **303**. Additionally, when the magnification of the edit processor **302** is one-to-one magnification, the detection processing by the read image detector **315** is not performed.

[0092] Further, when the magnification by the edit processor **302** is not one-to-one magnification, reverse-scaled data is generated by reverse scaling scan data including an original-size prohibited image. Hence, the prohibited image included in the reverse-scaled data is not of original size. Accordingly, since the reference image included in the prohibited image is not the original size either, the read image detector **315** cannot detect the prohibited image using the original-size reference image. In view of such a problem, in the embodiment, if the scan data does not match the print data (S**509**: NO), there is a possibility that a prohibited image is pasted to the recording sheet.

[0093] In this case, focusing on to the fact that the prohibited image included in the scan data is of the original size, the read image detector **315** detects the prohibited image using the original-size reference image. Accordingly, even when a prohibited image is pasted to a recording sheet, it is possible to detect the prohibited image and discard the printed matter and the scan data. In this case, too, since only the original-size reference image needs to be used, the processing load on the read controller **103** can be reduced.

[6] MODIFICATION

[0094] While the present disclosure has been described on the basis of the embodiment, it is needless to say that the disclosure is not limited to the above-mentioned embodiment, and the following modifications can be implemented.

[0095] (6-1) While the above embodiment describes a case where the processing proceeds to step S**502** of FIG. **5** after the read processor **316** generates scan data by reading from the leading edge to the trailing edge of the printed matter

using the line scanners **101** and **102**, it is needless to say that the present disclosure is not limited to this, and the following may be performed instead.

[0096] FIG. **7** is a flowchart showing parts that replace the processing of steps S**506** and S**507** of the flowchart of FIG. **5**. As shown in FIG. **7**, every time the printed matter is read for one band using the line scanners **101** and **102** (S**701**), the read scan data for one band may be reversely scaled (S**702**), and the read image detector **315** may detect whether a reference image is included in the reverse-scaled data for one band. If the reference image is included (S**703**: YES), the read processing is omitted for the remaining part of the printed matter, and the processing immediately proceeds to step S**511**.

[0097] If the reference image is not included in the reverse-scaled data for one band (S**703**: NO), it is determined whether or not the one band is the final part. If not, the processing proceeds to step S**701**, and the above processing is repeated for the following one band. Meanwhile, if the processing is completed for the final part (S**704**: YES), it is determined that the reference image is not included in the reverse-scaled data of the printed matter, and the processing proceeds to step S**508**.

[0098] Thus, as compared with the case of detecting the reference image after reading the entire printed matter, the throughput of the reference image detection processing can be improved. Accordingly, the productivity of the printer **120** can be improved without being restricted by the processing performance of the reading apparatus **100**.

[0099] Note that adjacent bands on the printed matter may overlap one another, and in this way, it is possible to prevent decrease in the detection accuracy of the prohibited image due to division of the reference image at the boundary between bands.

[0100] (6-2) While the above embodiment describes a case where the recording sheet on which the prohibited image is printed is cut, it goes without saying that the present disclosure is not limited to this, and the following may be performed instead.

[0101] For example, as shown in FIG. **8**, by providing a recording sheet container **801** inside a reading apparatus **100**, the recording sheet may be stored instead of being cutting. The recording sheet container **801** is provided with a sheet tray **802** for placing recording sheet bundles, and a support member **803** for supporting the sheet tray **802**. The support member **803** supports the sheet tray **802** such that the position of the sheet tray **802** becomes lower as the number of recording sheets placed on the sheet tray **802** increases.

[0102] Additionally, when an unspecified number of persons access the recording sheet stored in the recording sheet container **801**, there is a risk of unauthorized use of the printed matter on which the prohibited image is printed. In order to prohibit such access, the recording sheet container **801** is locked so that a person other than the administrator of the MFP **1** cannot access the recording sheets stored in the recording sheet container **801**.

[0103] This, too, can prevent unauthorized use of printed matter on which a prohibited image is printed.

[0104] (6-3) While the above embodiment describes a case where the reverse scaling processor **314** generates reverse-scaled data by reversely scaling the entire scan data, it goes without saying that the present disclosure is not limited to this, and the following may be performed instead.

[0105] For example, the reverse scaling processor **314** may generate reverse-scaled data by reversely scaling only an effective image area of scan data that is an area where the print processor **304** performs printing. Then, the read image detector **315** detects whether or not a reference image is included outside the effective image area of the scan data, in addition to the reverse-scaled data.

[0106] Note that the range of the effective image area can be acquired from the edit processor **302**, for example. Additionally, the effective image area may be identified with reference to a register included in the scan data. A register is a mark for matching the finished size of printed matter or the finished dimension and the register of multicolored printing, and is also referred to as a register mark or a trim mark.

[0107] FIG. **9** is a flowchart showing parts that replace the processing of steps S**506** and S**507** of the flowchart of FIG. **5**. As shown in FIG. **9**, the reverse scaling processor **314** performs reverse scaling within the effective image area of the scan data to generate reverse-scaled data (S**901**). If the read image detector **315** detects that the reference image is included in the reverse-scaled data (S**902**: YES), the processing proceeds to step S**511**.

[0108] Additionally, if the read image detector **315** detects that a reference image is included outside the effective image area of the scan data (S**903**: YES), the processing proceeds to step S**511**. If the reference image is not included in reverse-scaled data or outside the effective image area of the scan data, the processing proceeds to step S**508**.

[0109] In this way, when a prohibited image is pasted in an area corresponding to the outside of the effective image area of the recording sheet, the prohibited image can be detected.

[0110] (6-4) While the above modification describes a case where the reference image is detected by reverse scaling within the effective image area and one-to-one magnification outside the effective image area, it goes without saying that the present disclosure is not limited to this, and the following may be performed instead.

[0111] For example, when RIP data is a blank sheet, the RIP data itself does not include a prohibited image, and therefore it is not necessary to generate reverse-scaled data. If a prohibited image is included in the scan data, that is because the prohibited image is pasted to the recording sheet.

[0112] For this reason, when the read controller **103** acquires RIP data from the printer controller **122** and determines whether or not the RIP data is blank and the RIP data is blank, it is only necessary for the read image detector **315** to detect whether or not a reference image is included in the scan data. In this way, it is possible to detect and prevent unauthorized copying that bypasses detection of a prohibited image by the printer controller **122** by pasting the prohibited image on the recording sheet.

[0113] FIG. **10** is a flowchart showing processing inserted between steps S**501** and S**502** in the flowchart of FIG. **5**. As shown in FIG. **10**, when the read processor **316** reads printed matter (S**501**: YES), the read controller **103** acquires RIP data from the RIP **301** of the printer controller **122** (S**1001**), and It is determined whether or not the RIP data is blank.

[0114] If the RIP data is not blank (S**1002**: NO), the processing proceeds to step S**502**, and the reverse scaling processor **314** acquires a magnification from the edit processor **302**. If the RIP data is blank (S**1002**: YES), the processing proceeds to step S**508**, and print data is acquired.

Note that instead of step S**508**, the processing may proceed to step S**509**. However, if there is no problem in print quality, the scan data is also blank, and therefore it is not necessary to detect the reference image by the read image detector **315**. Hence, in order to reduce the processing load on the read controller **103**, it is effective to proceed to step S**508**.

[0115] In this way, even if unauthorized copying that bypasses detection of a prohibited image by the printer controller **122** is performed, the reference image can be detected, so that such illegality can be prevented.

[0116] (6-5) While the above embodiment describes a case where the quality confirmation portion **311** determines whether or not there is a problem with print quality on the basis of whether or not the print data and the scan data match, it goes without saying that the present disclosure is not limited to this, and the print quality may be determined by another method instead of or in addition to this. The present disclosure can provide an effect regardless of the print quality determination method.

[0117] (6-6) While the above embodiment describes a case where the line scanners **101** and **102** included in the reading apparatus **100** are color scanners, it goes without saying that the present disclosure is not limited to this, and when printer **120** is a monochrome printer, the line scanners **101** and **102** may also be monochrome scanners. The present disclosure is applicable to this case, too, to obtain its effects.

[0118] (6-7) Although not specifically mentioned in the above embodiments, the MFP **1** may perform user authentication before the user starts use, and the log processor **312** of the reading apparatus **100** may acquire the login name of the user may from the printer **120**, and enter the login name in the image log. In this way, it becomes easy to identify the user who tried to illegally print the prohibited image, so that it is possible to prevent such unauthorized acts.

[0119] (6-8) While the above embodiment does not specifically mention the method by which the log processor **312** stores the image log and the display screen nail image, the image log and the display screen nail image may be stored in the HDD **214**, or the read controller **103** may be equipped with a card reading apparatus/writer and the image log and the display screen nail image may be stored in a memory card such as a compact flash (registered trademark) or smart media.

[0120] Even when an image log or the like is stored in a storage device that is insertable into the read controller **103**, according to the present disclosure, the prohibited image can be efficiently detected, and the scan data including the prohibited image can be detected from the image log or the like. Hence, unauthorized use of prohibited images can be reliably prevented.

[0121] (6-9) While the above embodiment describes a case of using the MFP **1** as an example, it goes without saying that the present disclosure is not limited to this, and it may be an MFP having a configuration excluding the scanner **110** and the finisher **140**, or the facsimile function may be excluded. Additionally, while the case where the printer **120** is a tandem color printer has been described as an example, the printer **120** may be a color printer other than a tandem printer or a monochrome printer.

[0122] As long as the apparatus includes at least the reading apparatus **100**, the printer **120**, and the sheet feeder **130**, the above-described effects can be obtained by applying the present disclosure.

[0123] (6-10) While the above embodiment describes a case where a print job is received by the network interface card (NIC) **205** through a communication network such as a local area network (LAN), it may be received by other communication means such as Bluetooth (registered trademark).

[0124] The image reading apparatus according to the present disclosure is useful as an apparatus for reducing a processing load for detecting an image for which image formation is prohibited.

[0125] Although embodiments of the present disclosure have been described and illustrated in detail, the disclosed embodiments are made for purposes of illustration and example only and not limitation. The scope of the present disclosure should be interpreted by terms of the appended claims.

[0126] As used herein, the words "can" and "may" are used in a permissive (i.e., meaning having the potential to), rather than mandatory sense (i.e., meaning must). The words "include," "includes," "including," and the like mean including, but not limited to. Similarly, the singular form of "a" and "the" include plural references unless the context clearly dictates otherwise. And the term "number" shall mean one or an integer greater than one (i.e., a plurality).

What is claimed is:

1. An image reading apparatus comprising:

a scan data acquirer that acquires scan data obtained by reading from printed matter output by an image forming apparatus;

a magnification acquirer that acquires a magnification used when the printed matter is imaged;

a reverse scaling part that generates reverse-scaled data obtained by scaling the scan data at a reverse magnification that is the reciprocal of the magnification acquired by the magnification acquirer; and

a determiner that determines whether a predetermined reference image is included in the reverse-scaled data by comparing with the predetermined reference image.

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

a discard part that discards the scan data and the reverse-scaled data when the determination result of the determiner is affirmative.

3. The image reading apparatus according to claim **1**, further comprising:

an output prohibitor that prohibits output of the printed matter to the outside of the apparatus when the determination result of the determiner is affirmative,

wherein the magnification acquired by the magnification acquirer is a magnification within a predetermined range including one-to-one magnification.

4. The image reading apparatus according to claim **1**, wherein the image forming apparatus includes a print data generator that generates print data by scaling raster image processor (RIP) data and a print data determiner that determines whether the predetermined reference image is included in the print data,

wherein the image reading apparatus further comprises a determination result acquirer that acquires a determination result by the print data determiner from the image forming apparatus, and

wherein the output prohibitor also prohibits output of the printed matter to the outside of the apparatus when the determination result acquired by the determination

result acquirer is affirmative and the magnification acquired by the magnification acquirer is within a predetermined range including one-to-one magnification.

5. The image reading apparatus according to claim **4**, further comprising:

a determination prohibitor that prohibits the determination by the determiner when the magnification acquired by the magnification acquirer is one-to-one magnification.

6. The image reading apparatus according to claim **3**, wherein the prohibitor prohibits the output by processing the printed matter to be unusable.

7. The image reading apparatus according to claim **1**, further comprising:

an effective image area identifier that identifies an effective image area in the scan data;

a determination controller that causes the determiner to make the determination only in the effective image area in the scan data; and

an out-of-effective image area determiner that determines whether a predetermined reference image is included in scan data before scaling by the reverse scaling part, for the outside of the effective image area in the scan data.

8. The image reading apparatus according to claim **1**, wherein the scan data is divided into a plurality of detection bands for each page,

wherein the reverse scaling part scales the scan data in units of detection bands whose recording by the scan data acquirer is completed, and

wherein the determiner makes the determination in units of the detection bands.

9. The image reading apparatus according to claim **1**, further comprising:

a quality confirmation part that confirms the quality of the scan data in units of pages when the determination result by the determiner is negative.

10. The image reading apparatus according to claim **1**, further comprising:

a blank sheet determiner that determines whether RIP data for imaging the printed matter is a blank sheet; and

a slip-through determiner that determines whether the predetermined reference image is included in the scan data when the determination result of the blank sheet determiner is affirmative.

11. The image reading apparatus according to claim **1**, wherein the predetermined reference image is a reference image of one-to-one magnification.

12. The image reading apparatus according to claim **1**, wherein the reference image includes a feature pattern having a predetermined feature.

13. The image reading apparatus according to claim **1**, wherein the magnification acquired by the magnification acquirer is a magnification specified in a print job.

14. The image reading apparatus according to claim **1**, wherein the magnification acquirer acquires the magnification from the image forming apparatus.

15. The image reading apparatus according to claim **13**, wherein the print job is a job received by the image forming apparatus from another apparatus.

16. The image reading apparatus according to claim **15**, wherein the image forming apparatus receives the job from the other apparatus through a communication network.

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