US012395596B2

(12) **United States Patent**
Suzuki

(10) **Patent No.: US 12,395,596 B2**
(45) **Date of Patent: Aug. 19, 2025**

(54) **IMAGE PROCESSING APPARATUS, NON-TRANSITORY COMPUTER READABLE MEDIUM, AND METHOD**

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(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 396 days.

(21) Appl. No.: **17/891,667**

(22) Filed: **Aug. 19, 2022**

(65) **Prior Publication Data**

US 2023/0308580 A1 Sep. 28, 2023

(51) **Int. Cl.**
H04N 1/23 (2006.01)
H04N 1/00 (2006.01)

(52) **U.S. Cl.**
CPC ***H04N 1/2384*** (2013.01); ***H04N 1/00679*** (2013.01); ***H04N 1/00931*** (2013.01); ***H04N 1/2323*** (2013.01); ***H04N 1/233*** (2013.01)

(58) **Field of Classification Search**
CPC H04N 1/2384; H04N 1/00679; H04N 1/00931
See application file for complete search history.

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(57) **ABSTRACT**

An image processing apparatus includes a processor configured to: acquire a read image of a document that is read by a document reading apparatus; and control an image output device such that the read image and an additional image are outputted to a medium with a significance portion and the additional image prevented from overlapping, and a length of the medium in a sub scanning direction is increased in a case where the significance portion of the read image and a specified region of the read image to which the additional image is decided to be added overlap.

14 Claims, 21 Drawing Sheets

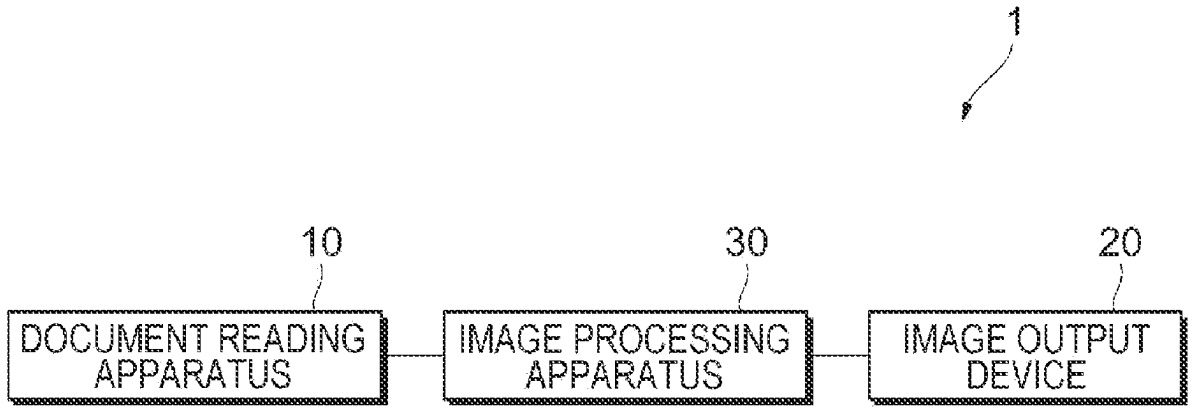


FIG. 1

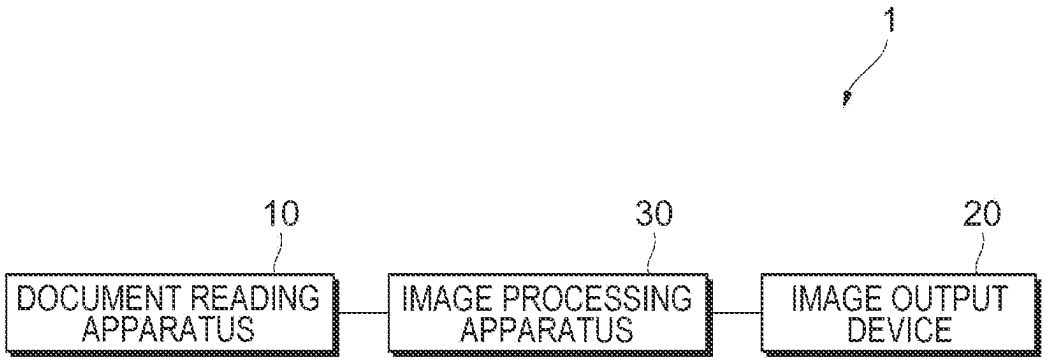

1
10
30
20
DOCUMENT READING APPARATUS
IMAGE PROCESSING APPARATUS
IMAGE OUTPUT DEVICE

FIG. 2

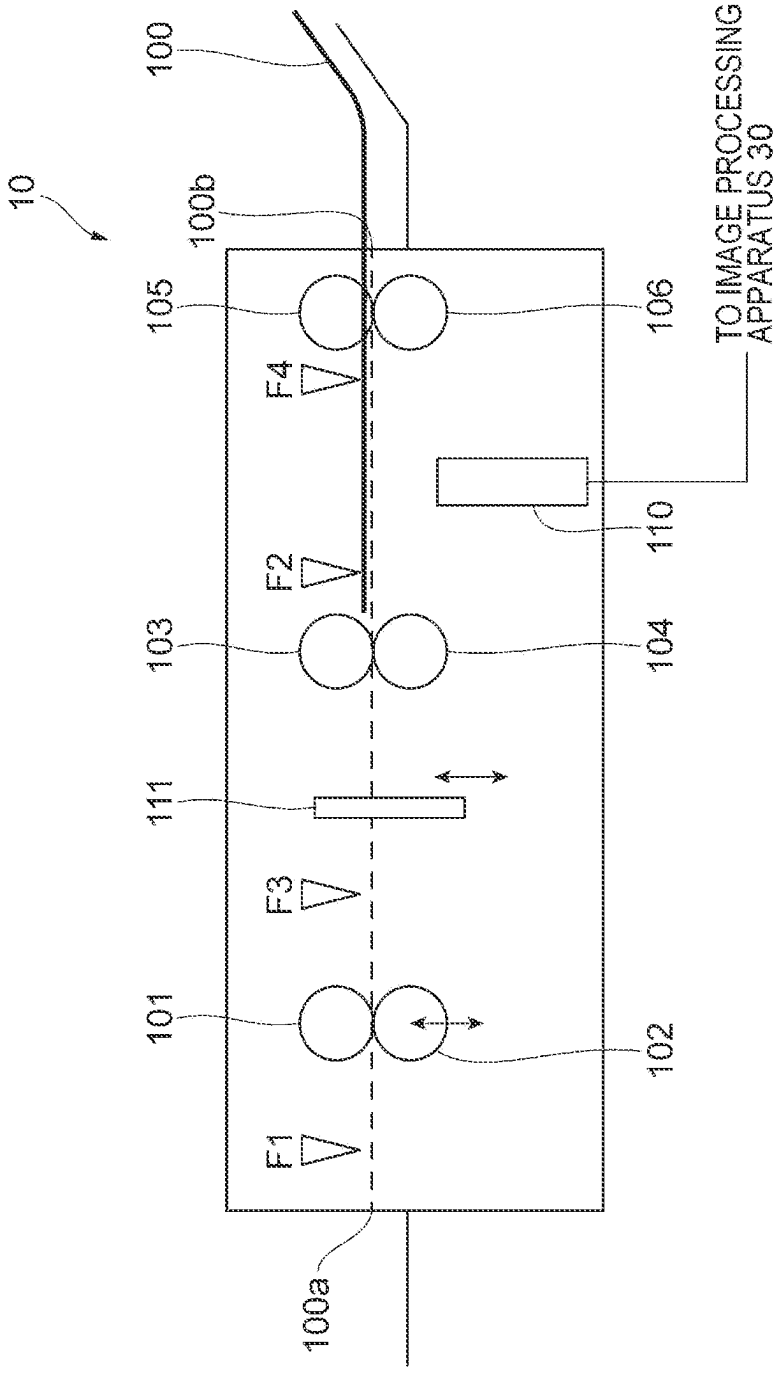

10
100
100b
105
106
F4
TO IMAGE PROCESSING APPARATUS 30
110
F2
103
104
111
F3
101
102
F1
100a

FIG. 3

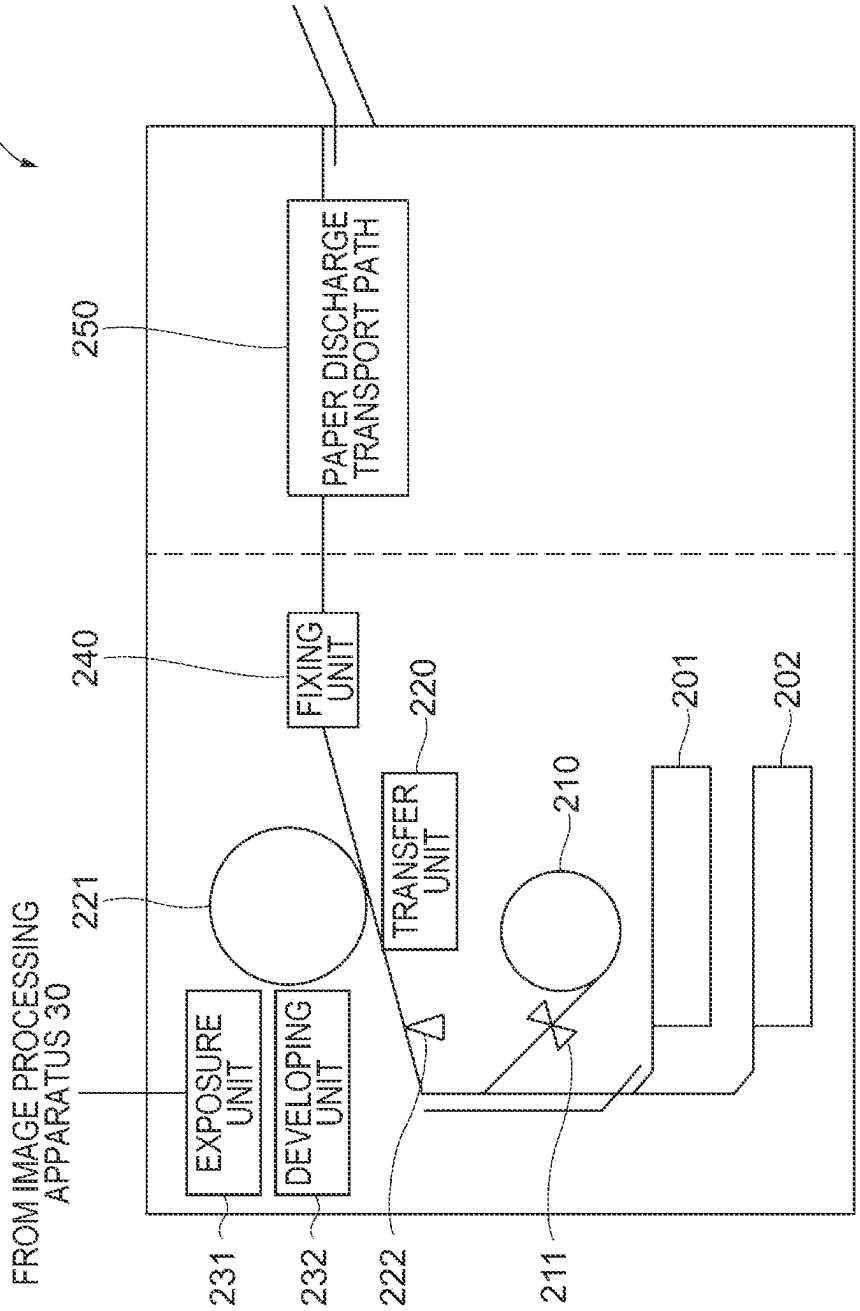
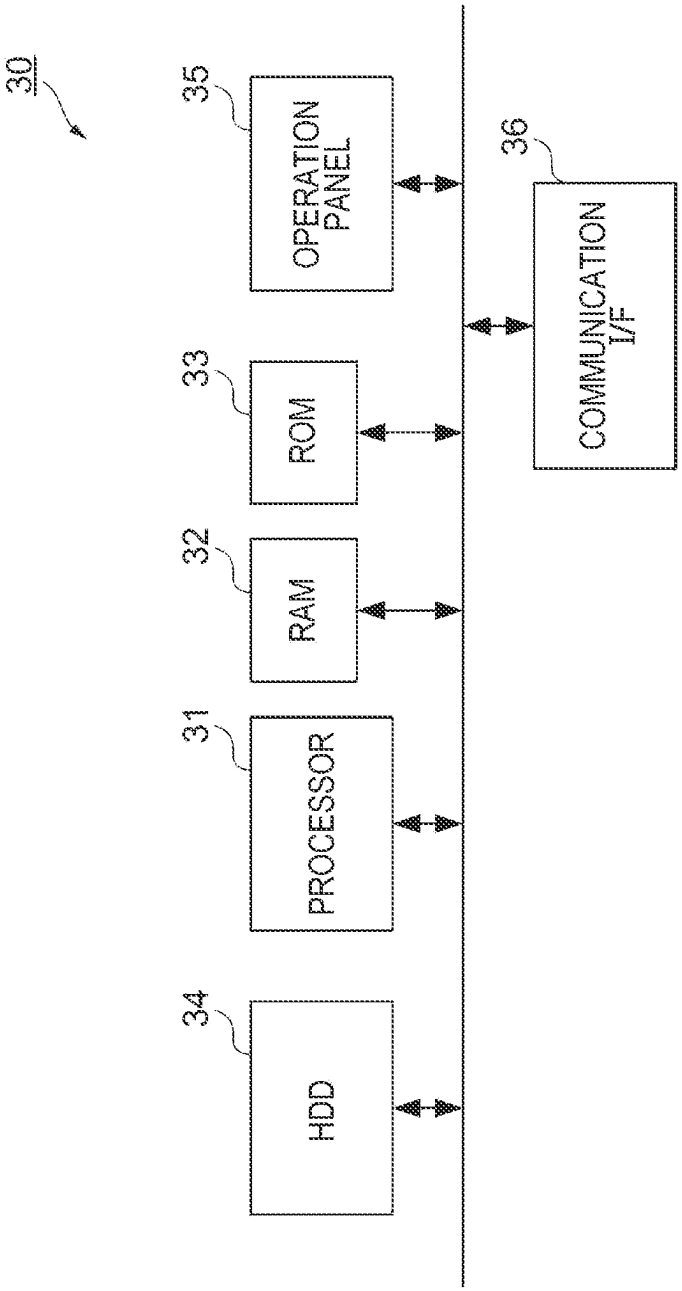

20
250
PAPER DISCHARGE TRANSPORT PATH
240
FIXING UNIT
220
TRANSFER UNIT
210
201
202
221
FROM IMAGE PROCESSING APPARATUS 30
EXPOSURE UNIT
DEVELOPING UNIT
231
232
222
211

FIG. 4


30
35
OPERATION PANEL
36
COMMUNICATION I/F
33
ROM
32
RAM
31
PROCESSOR
34
HDD

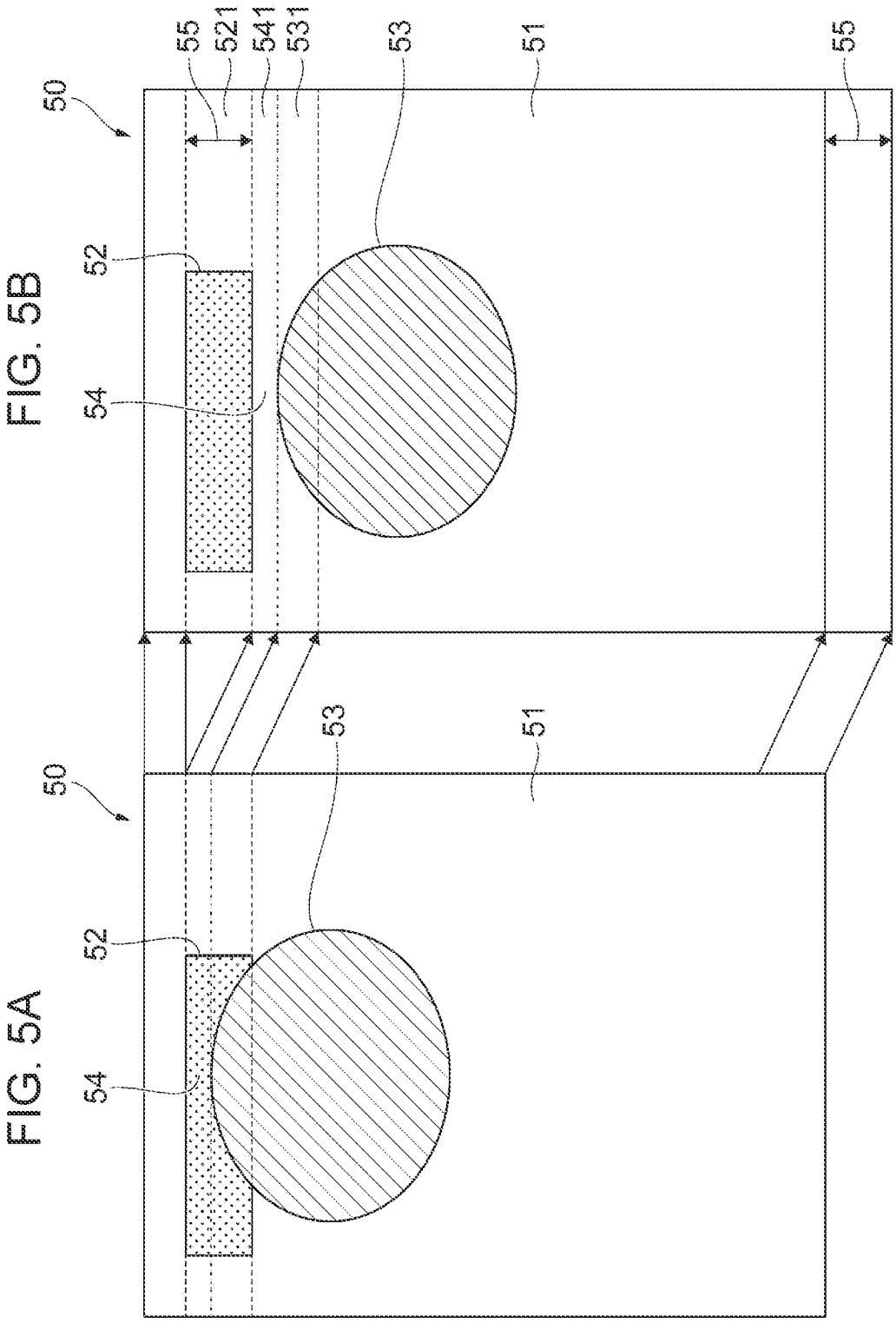


FIG. 5B

FIG. 5A

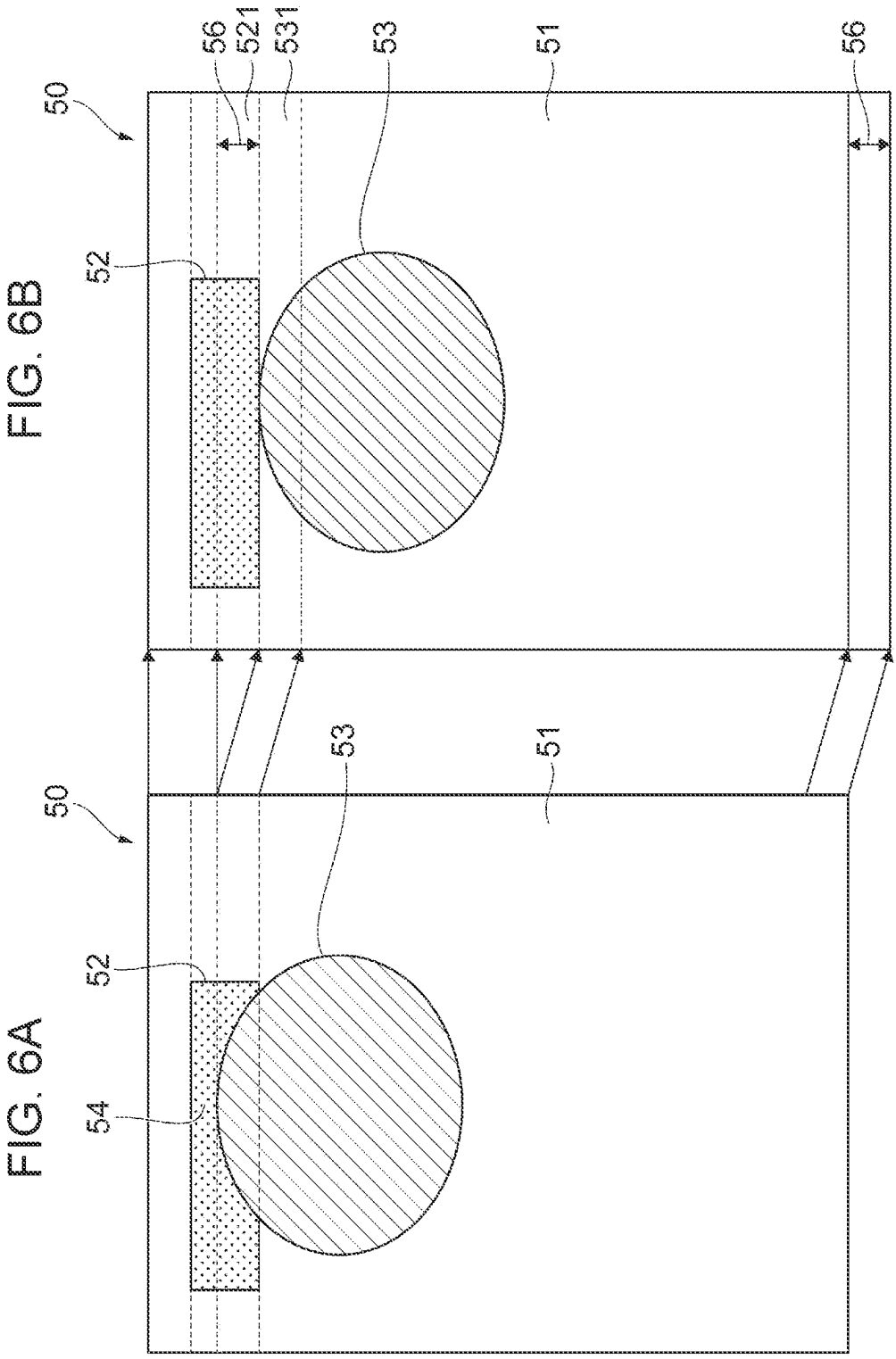


FIG. 6B

FIG. 6A

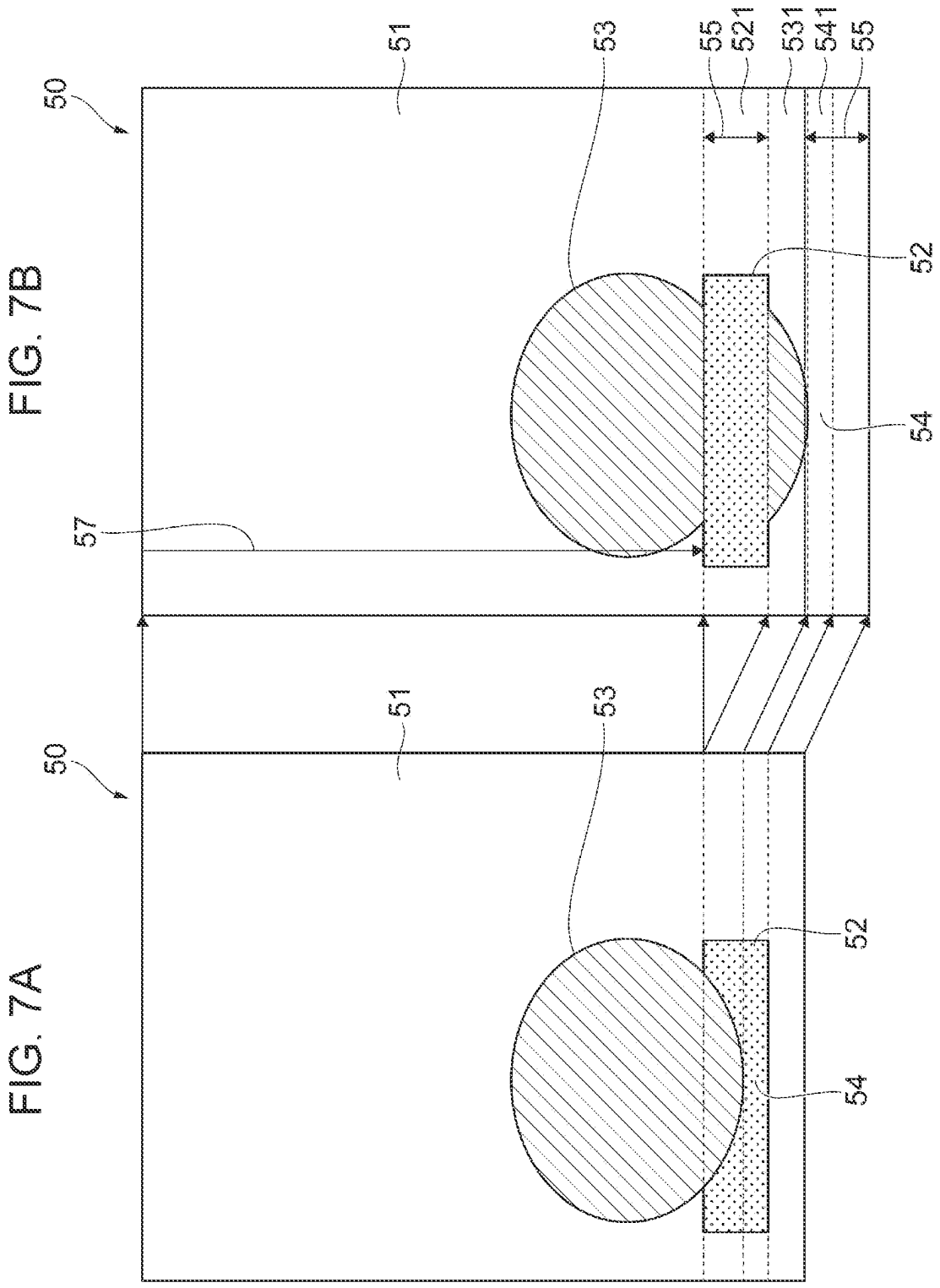


FIG. 7B

FIG. 7A

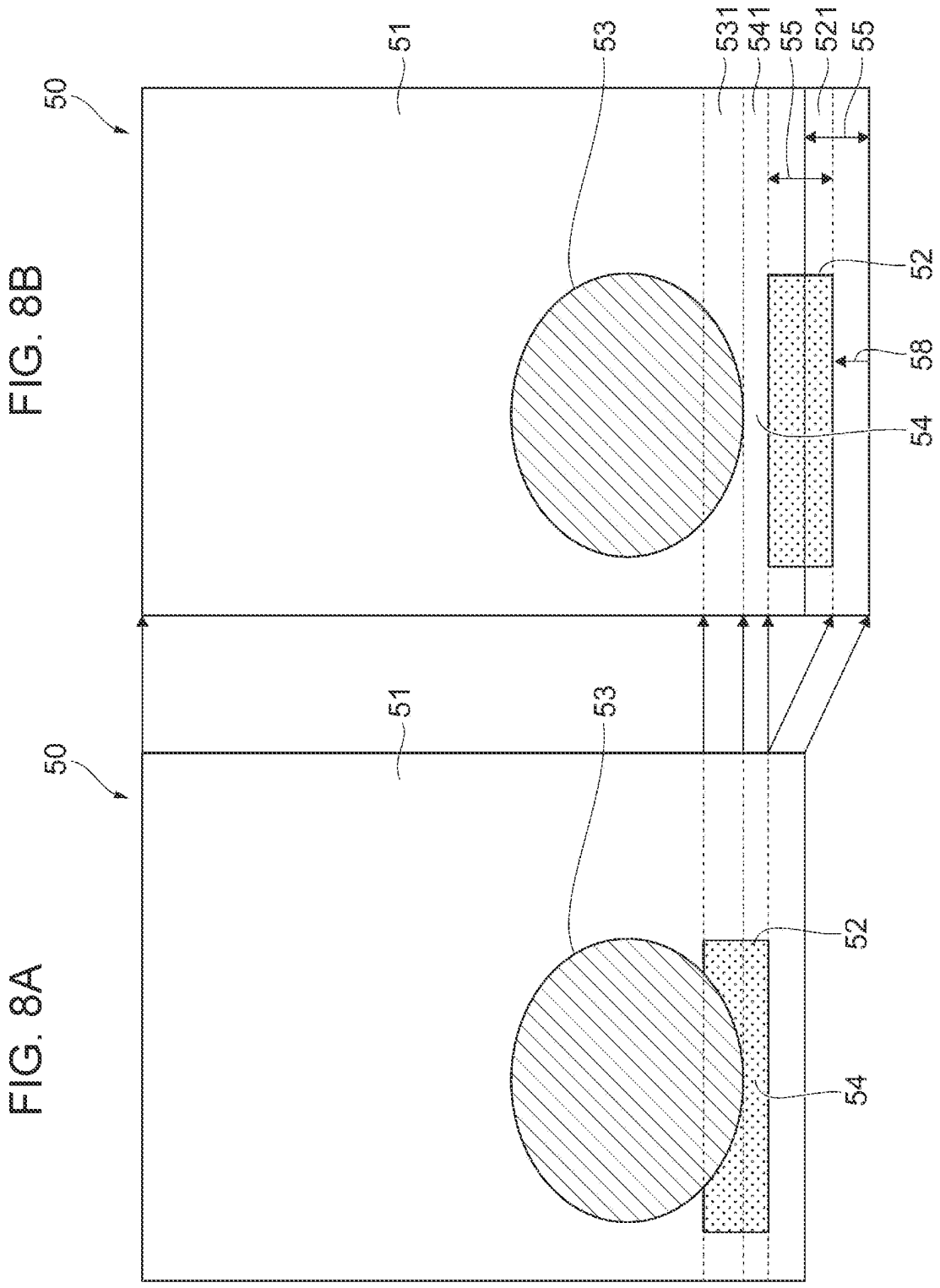


FIG. 8B

FIG. 8A

FIG. 9

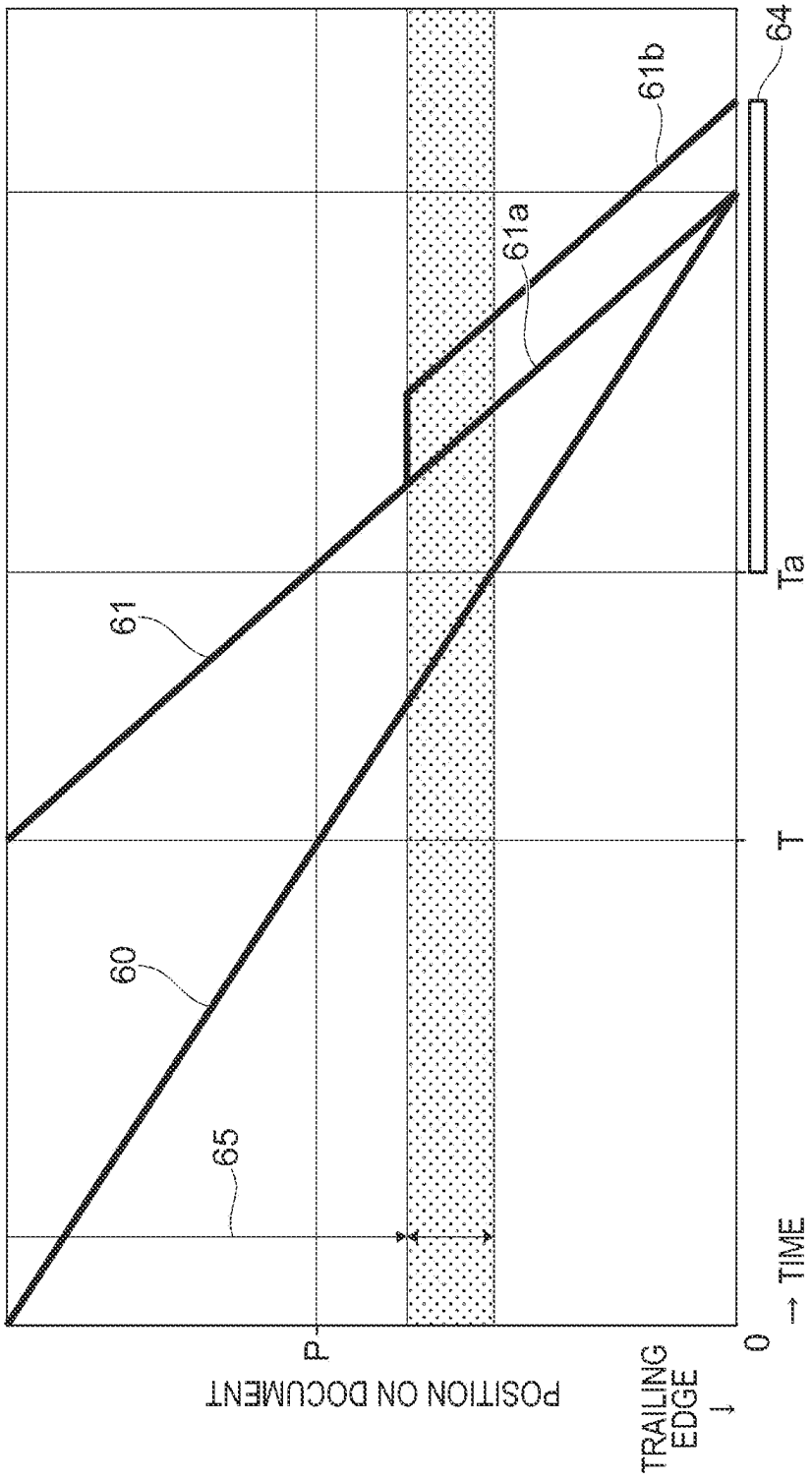

64
61b
61a
61
60
65
Ta
T
0
→ TIME
TRAILING EDGE
↓
d
POSITION ON DOCUMENT

FIG. 10

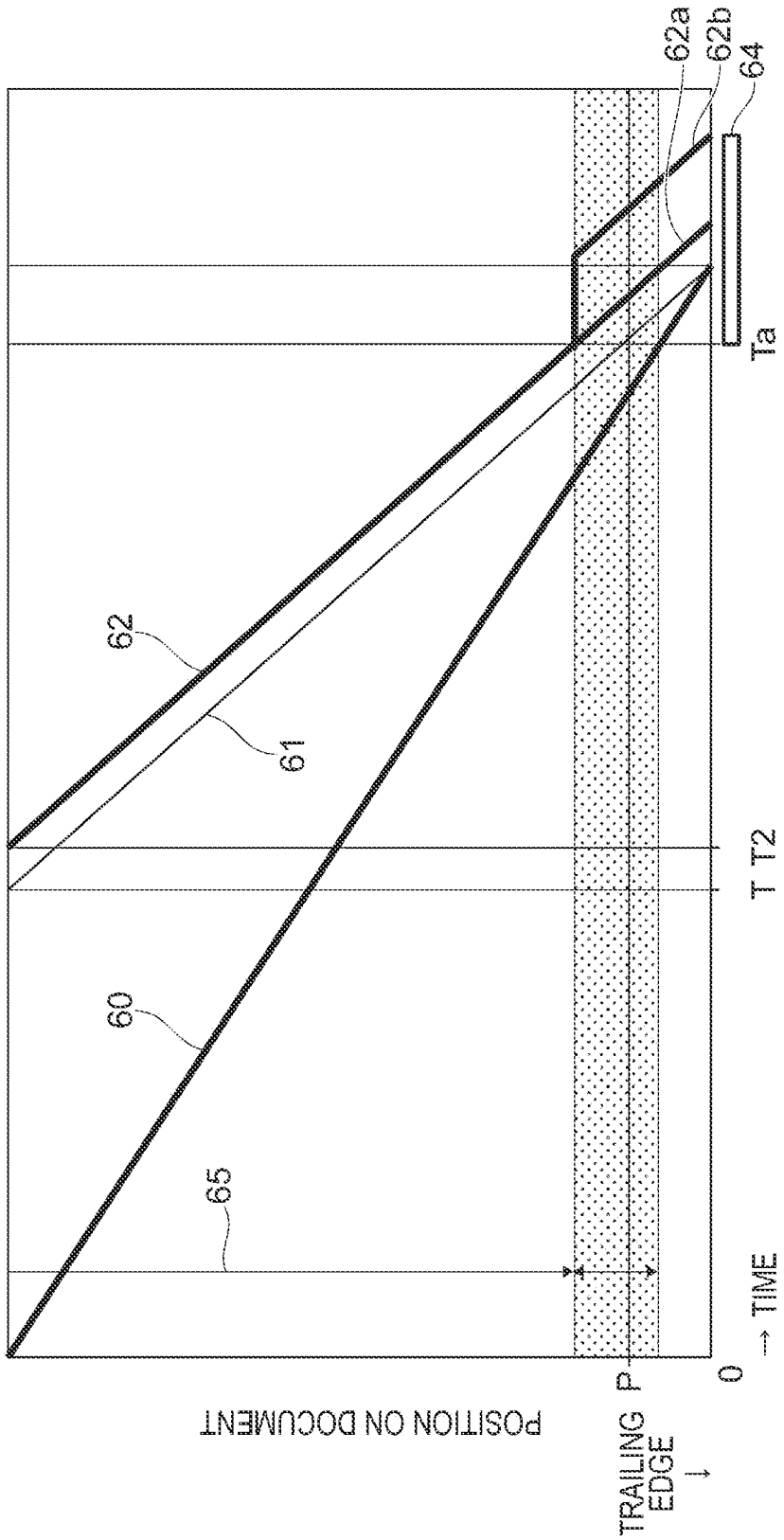

62a
62b
64
Ta
62
61
T T2
60
65
→ TIME
0
P
TRAILING EDGE →
POSITION ON DOCUMENT

FIG. 11

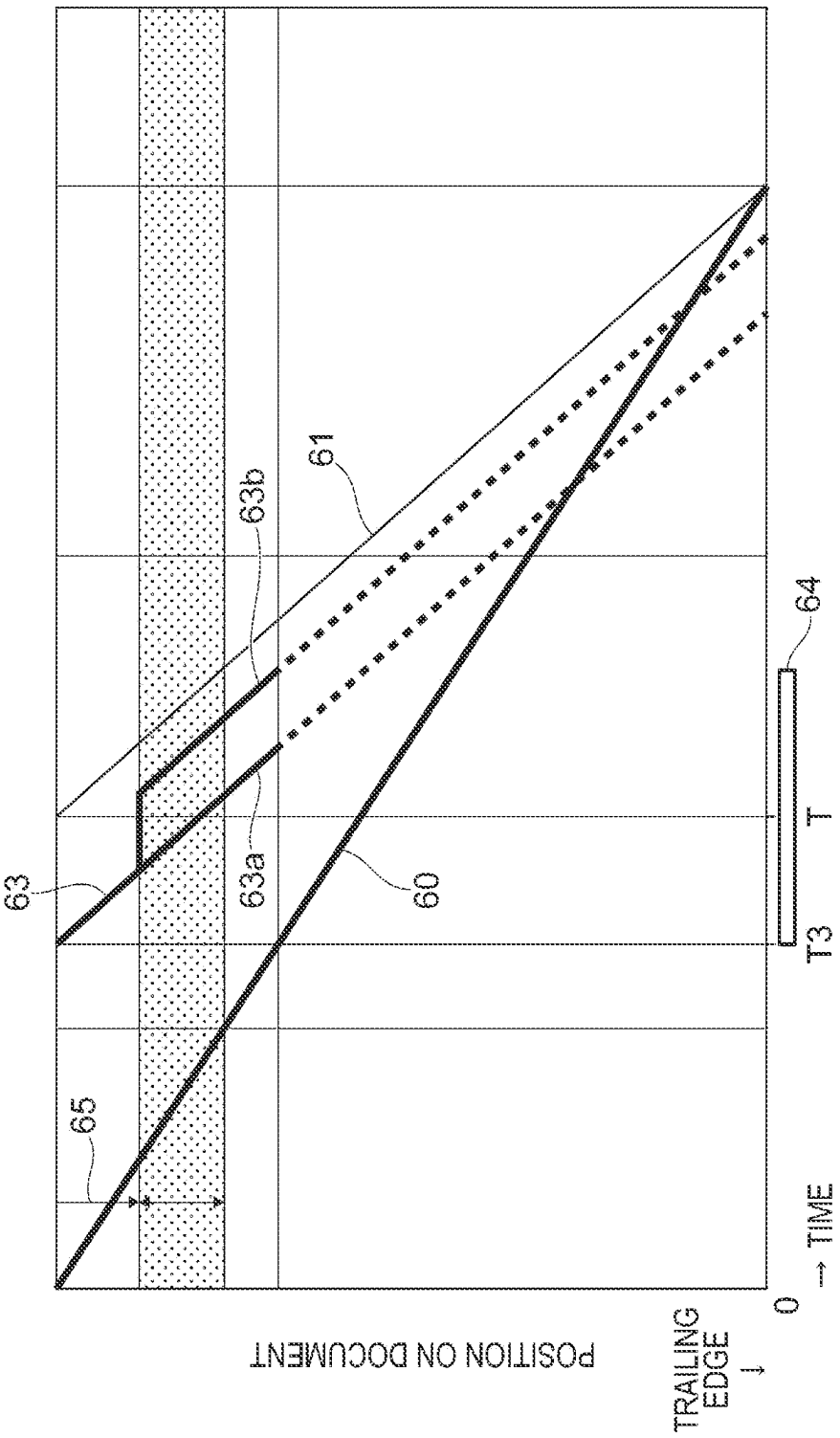

63
63a
63b
61
60
64
T
T3
65
0
→ TIME
TRAILING EDGE
↓
POSITION ON DOCUMENT

FIG. 12

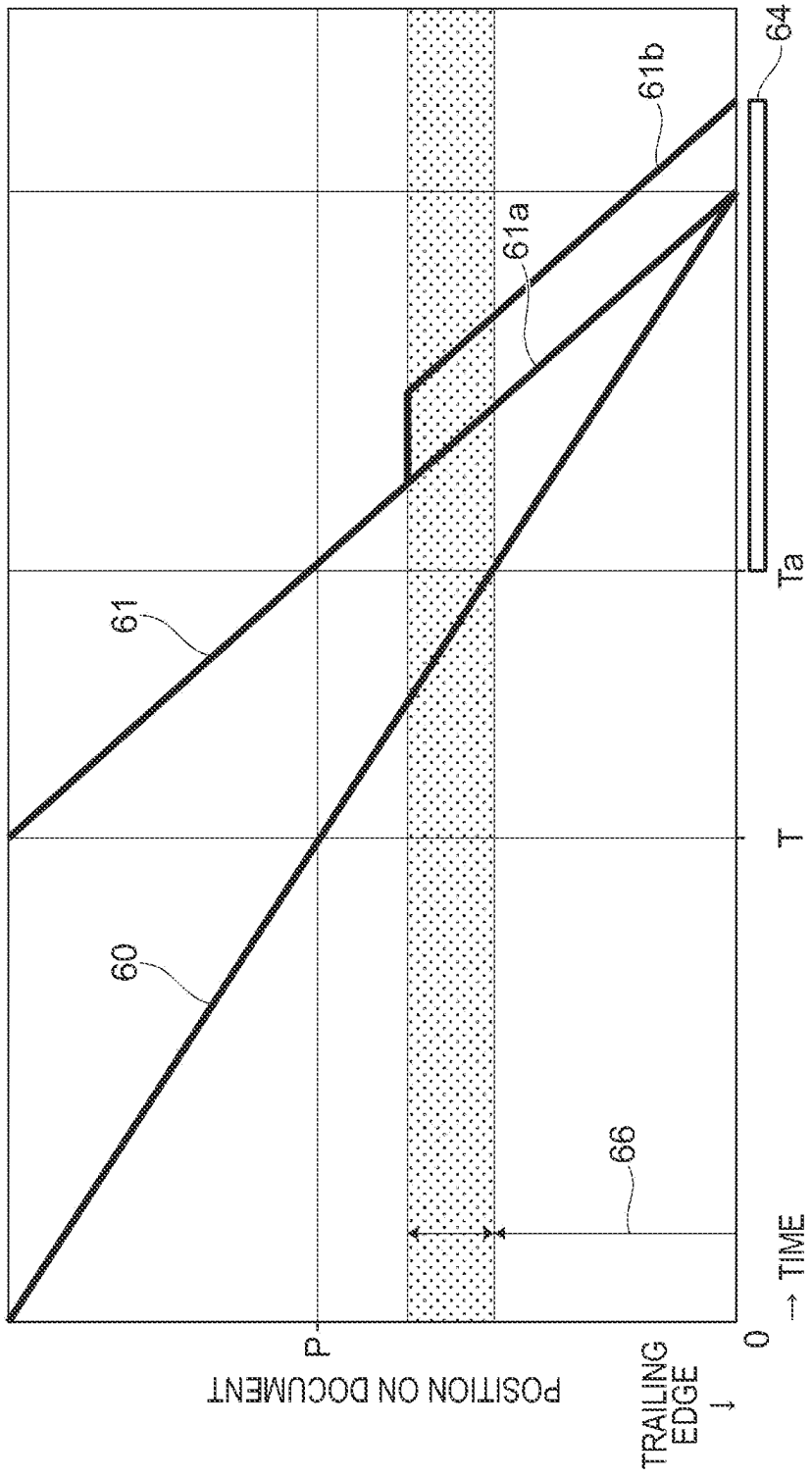

64
61b
61a
61
60
66
Ta
T
0
→ TIME
TRAILING EDGE
↓
d
POSITION ON DOCUMENT

FIG. 13

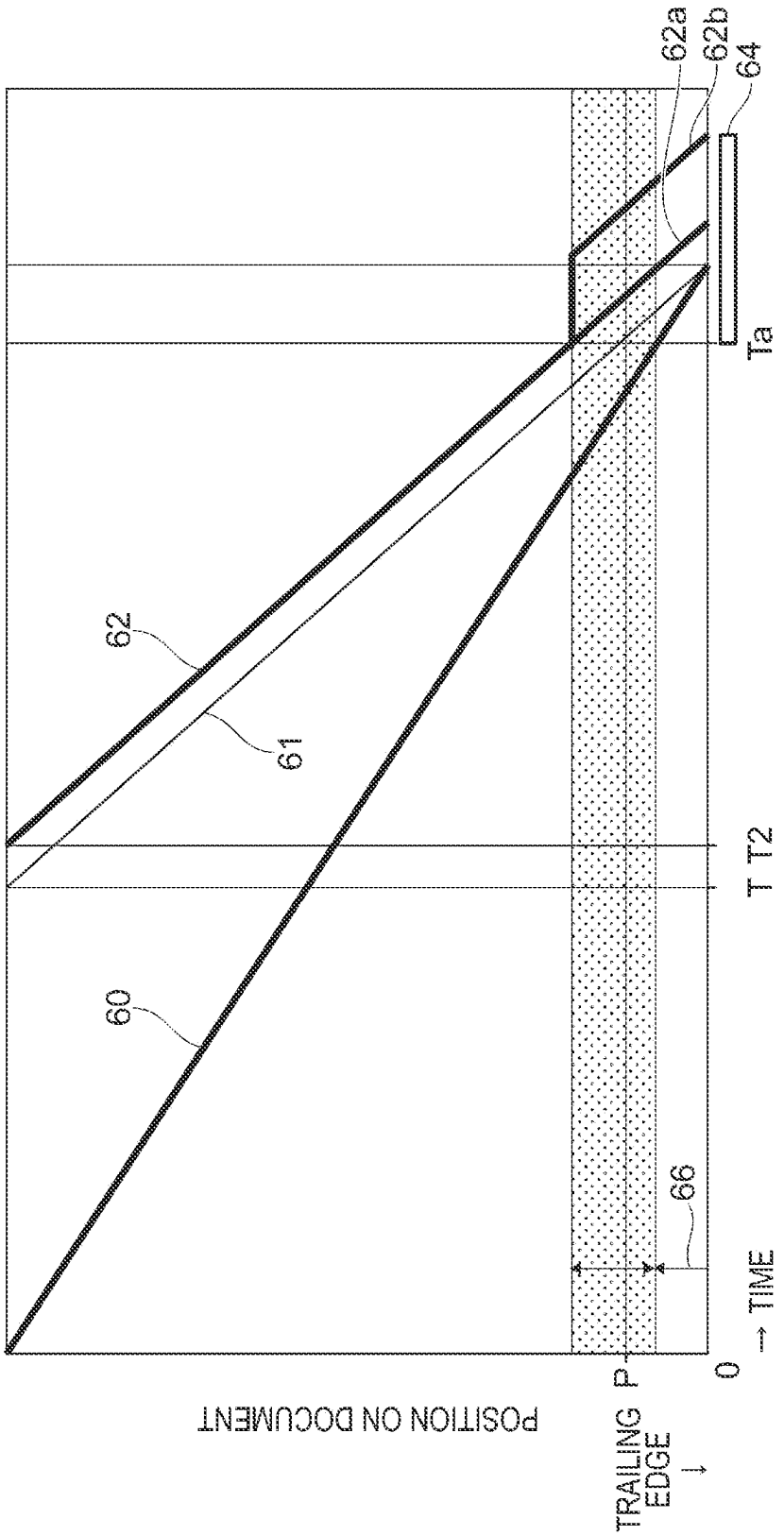

62a
62b
64
Ta
62
61
T T2
60
66
→ TIME
0
P
TRAILING EDGE →
POSITION ON DOCUMENT

FIG. 14

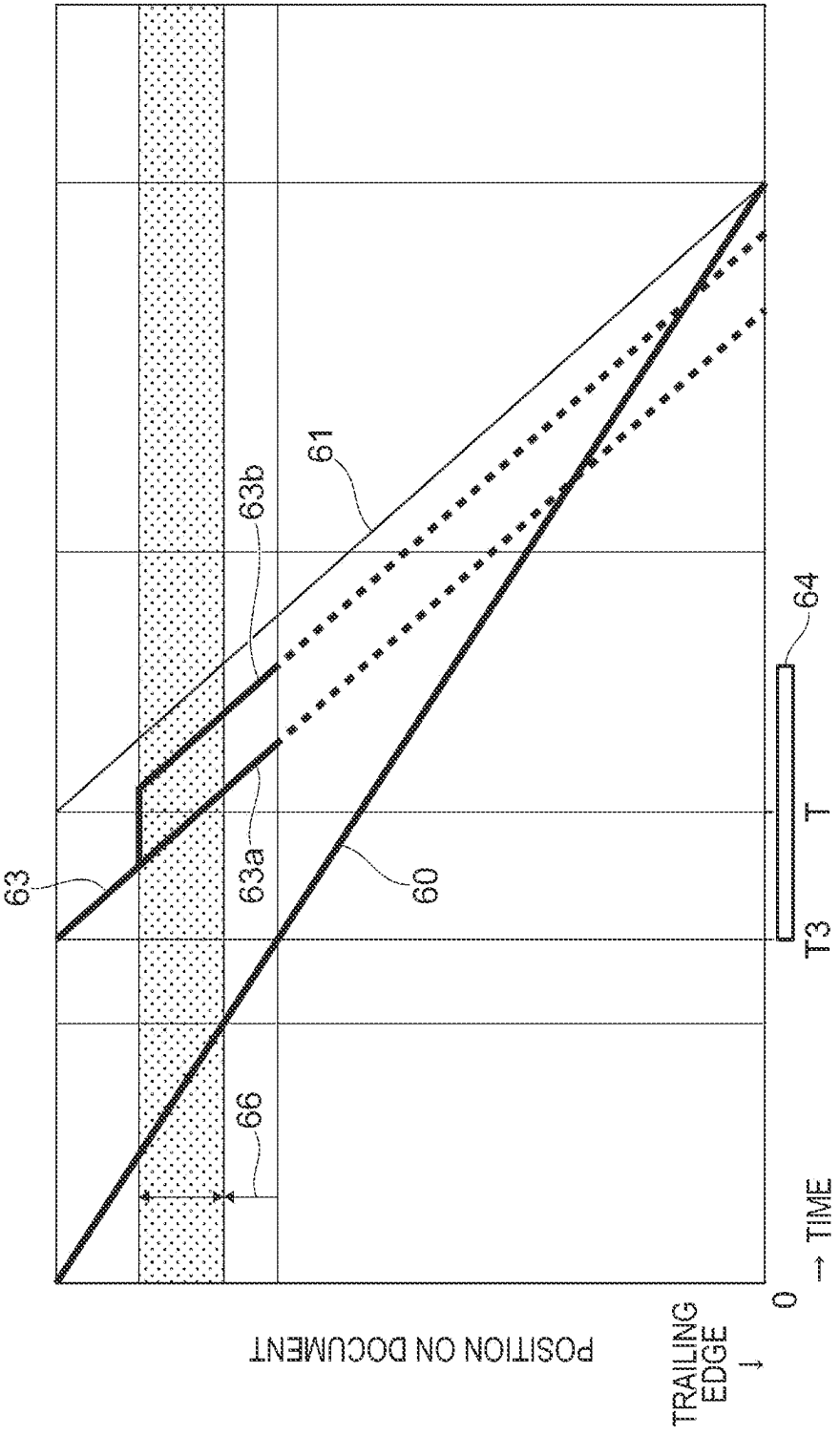

61
63b
64
63
63a
60
T
T3
66
0
→ TIME
TRAILING EDGE
↓
POSITION ON DOCUMENT

FIG. 15

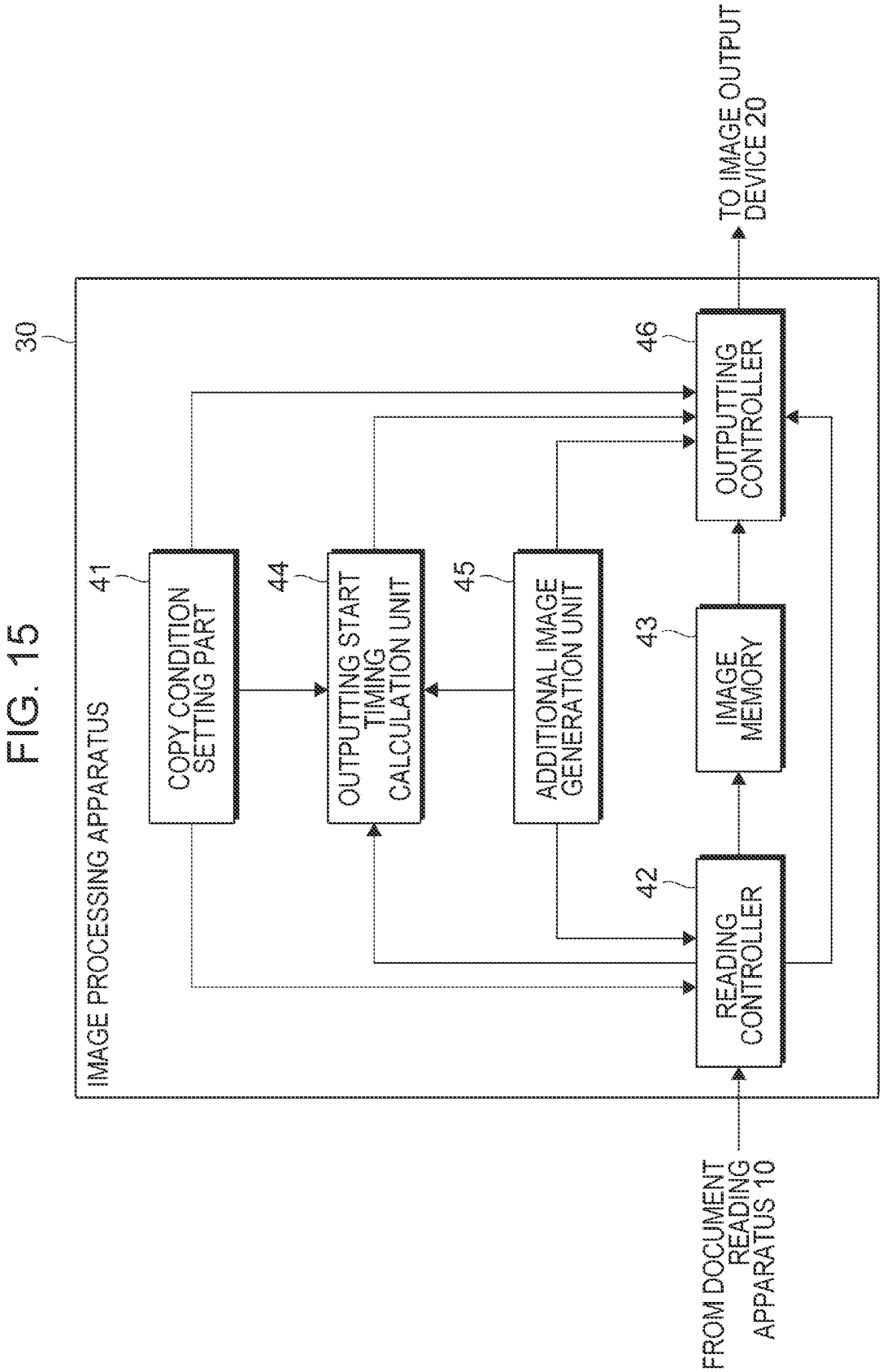

30
IMAGE PROCESSING APPARATUS
41
COPY CONDITION SETTING PART
44
OUTPUTTING START TIMING CALCULATION UNIT
45
ADDITIONAL IMAGE GENERATION UNIT
43
IMAGE MEMORY
46
OUTPUTTING CONTROLLER
42
READING CONTROLLER
TO IMAGE OUTPUT DEVICE 20
FROM DOCUMENT READING APPARATUS 10

FIG. 16A

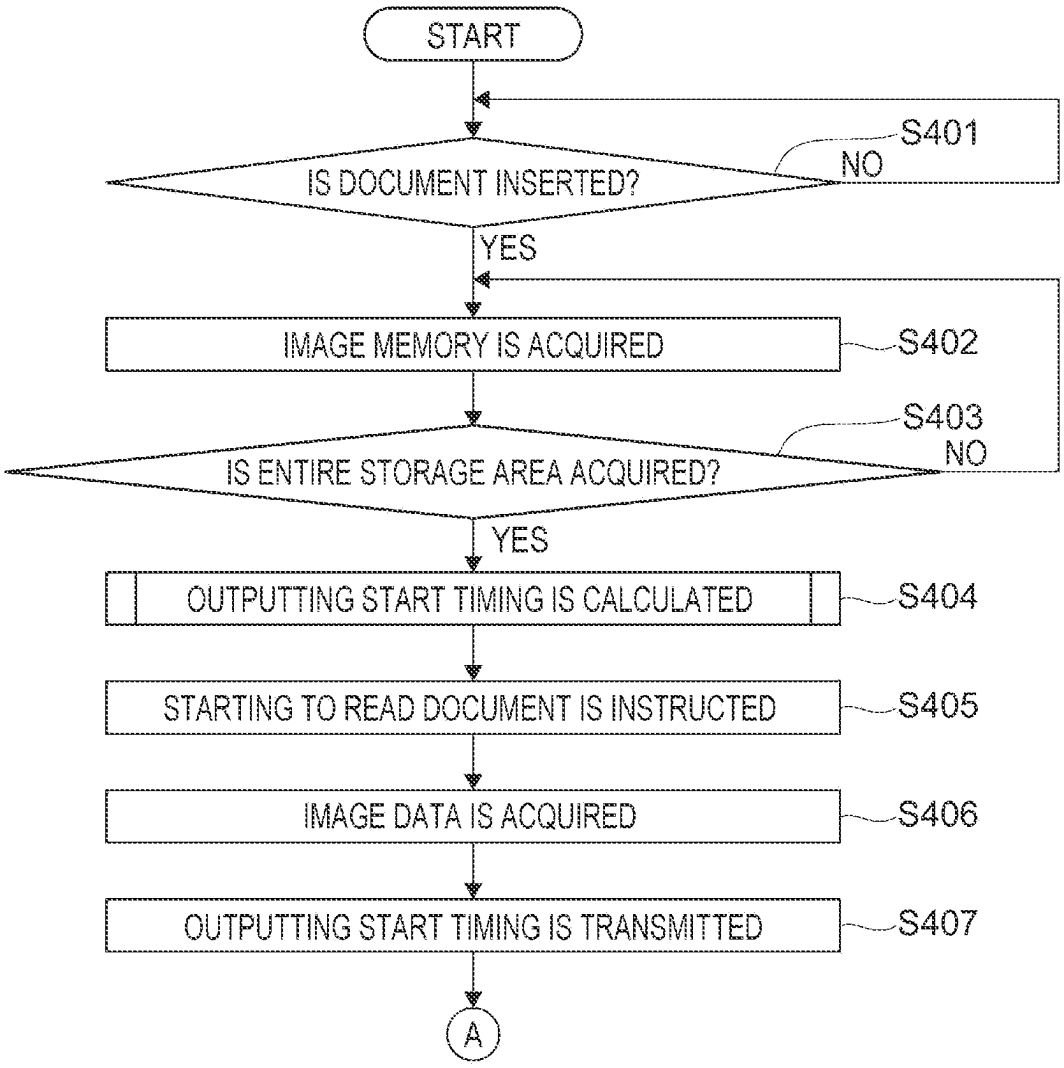

START
S401
IS DOCUMENT INSERTED?
NO
YES
IMAGE MEMORY IS ACQUIRED
S402
S403
IS ENTIRE STORAGE AREA ACQUIRED?
NO
YES
OUTPUTTING START TIMING IS CALCULATED
S404
STARTING TO READ DOCUMENT IS INSTRUCTED
S405
IMAGE DATA IS ACQUIRED
S406
OUTPUTTING START TIMING IS TRANSMITTED
S407
A

FIG. 16B

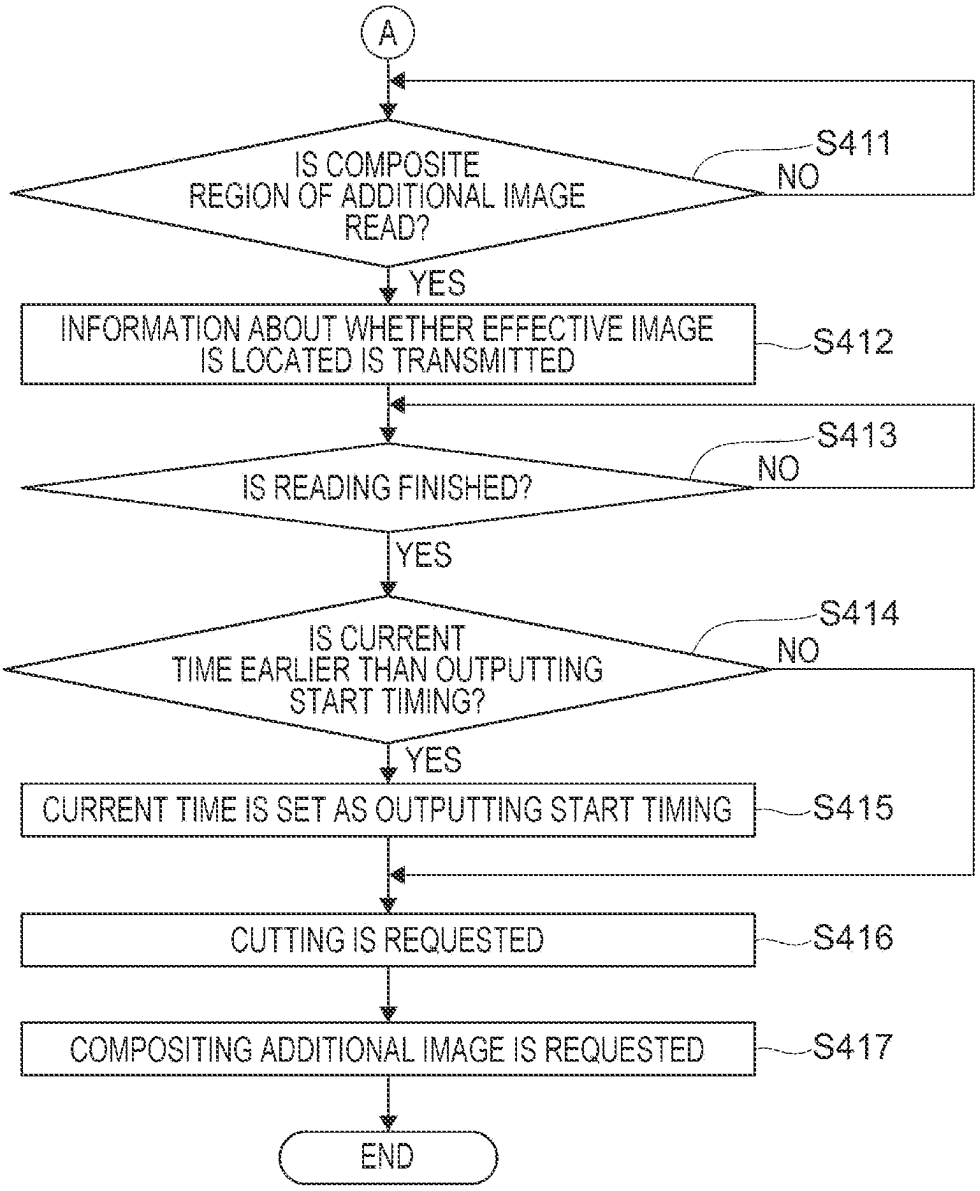

A
IS COMPOSITE REGION OF ADDITIONAL IMAGE READ?
S411
NO
YES
INFORMATION ABOUT WHETHER EFFECTIVE IMAGE IS LOCATED IS TRANSMITTED
S412
IS READING FINISHED?
S413
NO
YES
IS CURRENT TIME EARLIER THAN OUTPUTTING START TIMING?
S414
NO
YES
CURRENT TIME IS SET AS OUTPUTTING START TIMING
S415
CUTTING IS REQUESTED
S416
COMPOSITING ADDITIONAL IMAGE IS REQUESTED
S417
END

FIG. 17

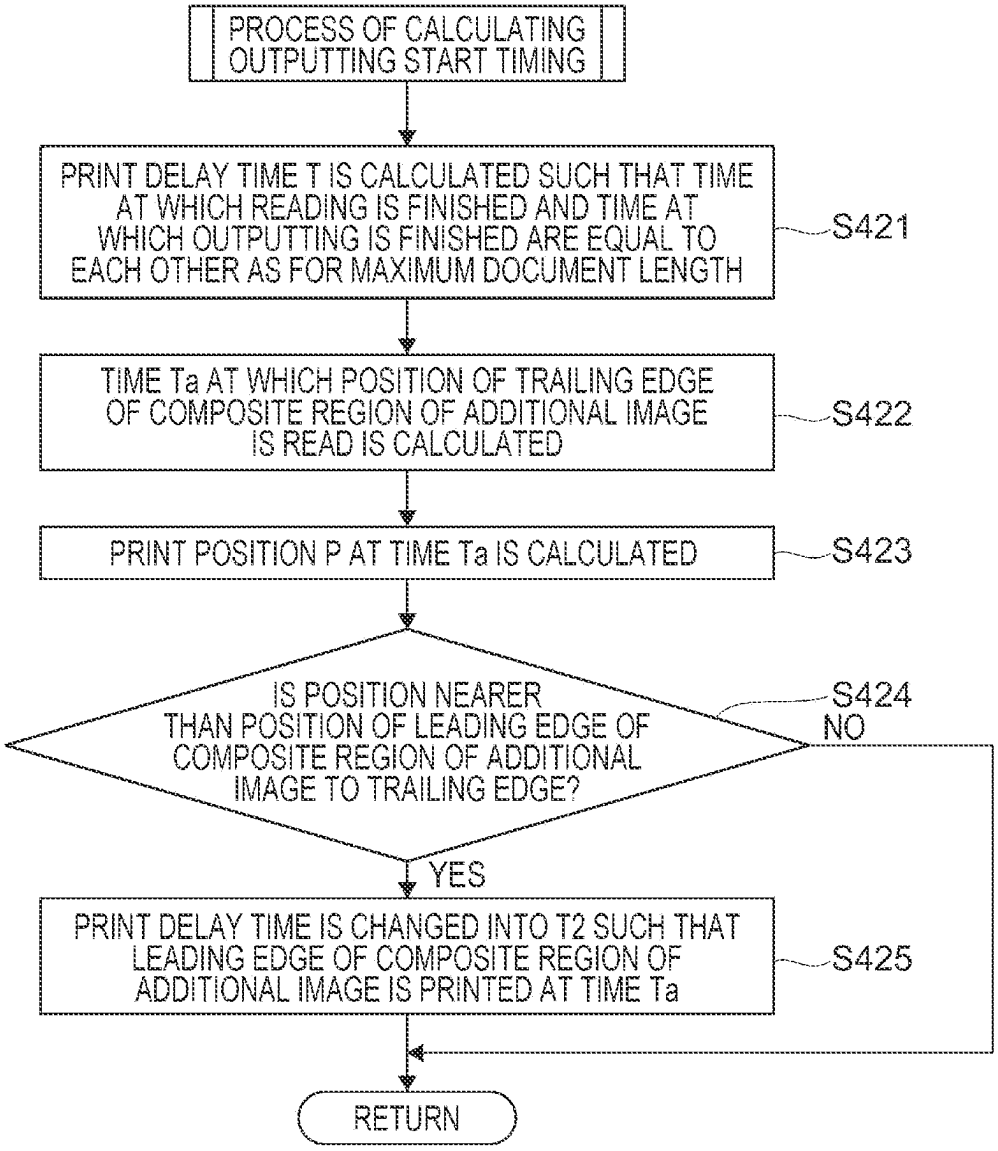

PROCESS OF CALCULATING OUTPUTTING START TIMING
PRINT DELAY TIME T IS CALCULATED SUCH THAT TIME AT WHICH READING IS FINISHED AND TIME AT WHICH OUTPUTTING IS FINISHED ARE EQUAL TO EACH OTHER AS FOR MAXIMUM DOCUMENT LENGTH
S421
TIME Ta AT WHICH POSITION OF TRAILING EDGE OF COMPOSITE REGION OF ADDITIONAL IMAGE IS READ IS CALCULATED
S422
PRINT POSITION P AT TIME Ta IS CALCULATED
S423
IS POSITION NEARER THAN POSITION OF LEADING EDGE OF COMPOSITE REGION OF ADDITIONAL IMAGE TO TRAILING EDGE?
S424
NO
YES
PRINT DELAY TIME IS CHANGED INTO T2 SUCH THAT LEADING EDGE OF COMPOSITE REGION OF ADDITIONAL IMAGE IS PRINTED AT TIME Ta
S425
RETURN

FIG. 18A

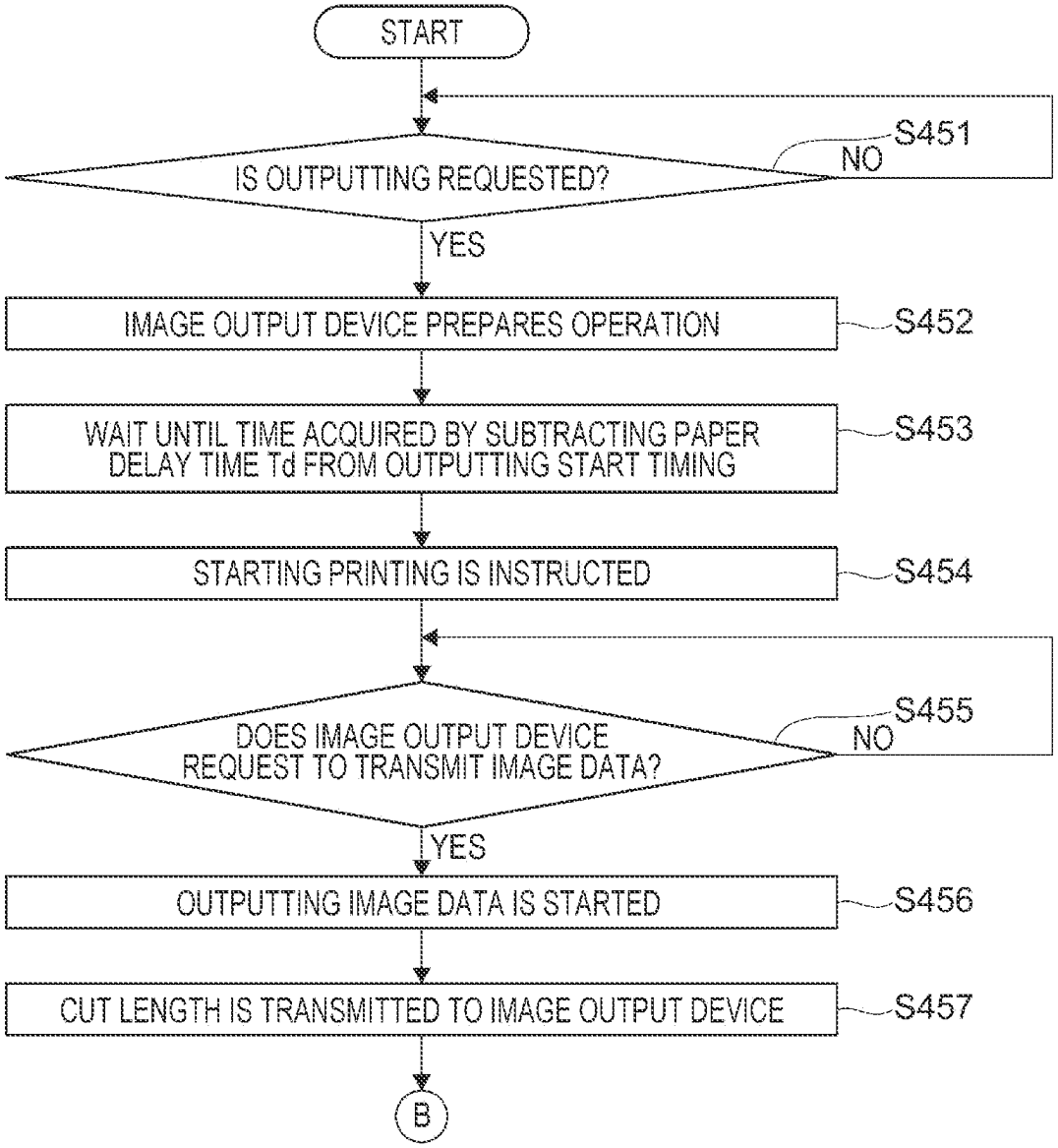

START
IS OUTPUTTING REQUESTED?
NO
S451
YES
IMAGE OUTPUT DEVICE PREPARES OPERATION
S452
WAIT UNTIL TIME ACQUIRED BY SUBTRACTING PAPER DELAY TIME Td FROM OUTPUTTING START TIMING
S453
STARTING PRINTING IS INSTRUCTED
S454
DOES IMAGE OUTPUT DEVICE REQUEST TO TRANSMIT IMAGE DATA?
NO
S455
YES
OUTPUTTING IMAGE DATA IS STARTED
S456
CUT LENGTH IS TRANSMITTED TO IMAGE OUTPUT DEVICE
S457
B

FIG. 18B

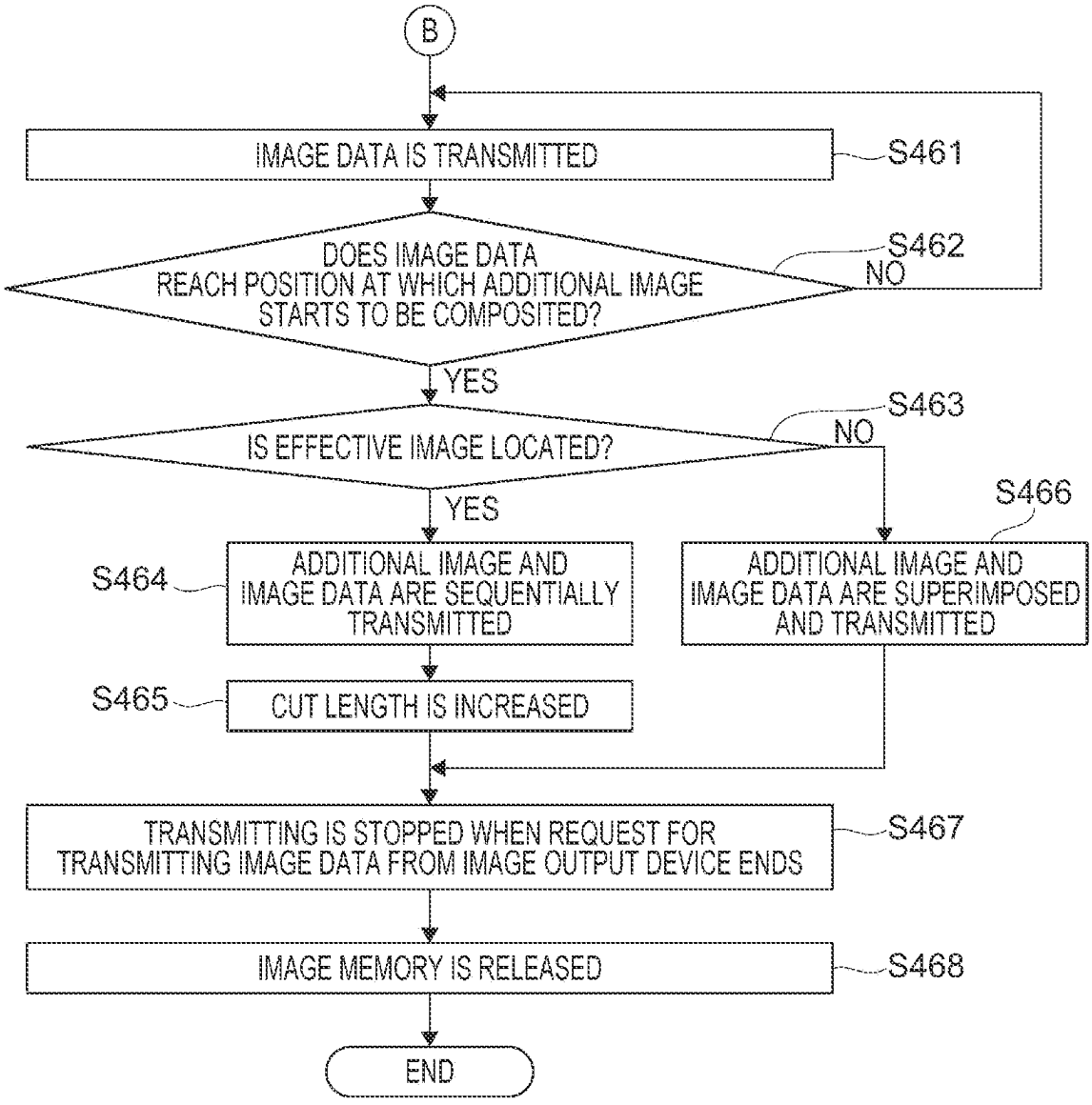

B
IMAGE DATA IS TRANSMITTED
S461
DOES IMAGE DATA REACH POSITION AT WHICH ADDITIONAL IMAGE STARTS TO BE COMPOSITED?
S462
NO
YES
IS EFFECTIVE IMAGE LOCATED?
S463
NO
YES
S466
S464
ADDITIONAL IMAGE AND IMAGE DATA ARE SEQUENTIALLY TRANSMITTED
ADDITIONAL IMAGE AND IMAGE DATA ARE SUPERIMPOSED AND TRANSMITTED
S465
CUT LENGTH IS INCREASED
TRANSMITTING IS STOPPED WHEN REQUEST FOR TRANSMITTING IMAGE DATA FROM IMAGE OUTPUT DEVICE ENDS
S467
IMAGE MEMORY IS RELEASED
S468
END

FIG. 19

70

71 72 73

PROCESS ID	PROCESS TYPE	PROCESS STATUS	START TIME	FINISH TIME	...	DATA WIDTH	DATA LENGTH	OUTPUT WIDTH	OUTPUT AMOUNT	OUTPUT TIME	ROLL LENGTH	ANNOTATION
20974	PRINT	FINISH	6/13/2021 3:40	6/13/2021 3:42		841	594	841	594	6/13/2021 3:42	594	PRESENT
20975	PRINT	FINISH	6/13/2021 3:40	6/13/2021 3:42		841	594	841	594	6/13/2021 3:42	594	PRESENT
20976	PRINT	FINISH	6/13/2021 3:40	6/13/2021 3:42		841	594	841	594	6/13/2021 3:42	594	ABSENT
20977	PRINT	FINISH	6/13/2021 3:40	6/13/2021 3:42		841	594	841	594	6/13/2021 3:42	594	ABSENT
20978	PRINT	FINISH	6/13/2021 3:40	6/13/2021 3:42		841	594	841	604	6/13/2021 3:42	604	PRESENT (EXTENDED)
20979	PRINT	FINISH	6/13/2021 3:40	6/13/2021 3:42		841	594	841	594	6/13/2021 3:42	594	PRESENT
20980	PRINT	FINISH	6/13/2021 3:40	6/13/2021 3:42		841	594	841	594	6/13/2021 3:42	594	PRESENT
20981	PRINT	FINISH	6/13/2021 3:40	6/13/2021 3:43		841	594	841	594	6/13/2021 3:43	594	ABSENT
20982	PRINT	FINISH	6/13/2021 3:40	6/13/2021 3:43		841	594	841	594	6/13/2021 3:43	594	ABSENT
20983	PRINT	FINISH	6/13/2021 3:40	6/13/2021 3:43		841	594	841	604	6/13/2021 3:43	604	PRESENT (EXTENDED)

IMAGE PROCESSING APPARATUS, NON-TRANSITORY COMPUTER READABLE MEDIUM, AND METHOD

CROSS-REFERENCE TO RELATED APPLICATIONS

This application is based on and claims priority under 35 USC 119 from Japanese Patent Application No. 2022-049026 filed Mar. 24, 2022.

BACKGROUND

(i) Technical Field

The present disclosure relates to an image processing apparatus, a non-transitory computer readable medium, and a method.

(ii) Related Art

Japanese Unexamined Patent Application Publication No. 2009-223696 discloses an information processing apparatus including a writer unit that writes information about a print paper size larger than the page size of document data as annotation information in the document data, a reader unit that reads the written information about the print paper size, and an instruction unit that specifies the paper size during printing, based on the read information about the print paper size and that instructs generation of the print image of the document data that contains the annotation information.

Japanese Unexamined Patent Application Publication No. 2009-223738 discloses an information processing apparatus including a storage unit that stores document data that includes a document data body that contains a described content and annotation paper data that contains annotation information about the described content, a paper information determination unit that determines whether the annotation paper data is present or absent, and a display processing unit that generates drawing data for a display corresponding to annotation paper from the annotation paper data, that generates drawing data for a display corresponding to document paper from the document data body if the paper information determination unit determines that the annotation paper data is present, that arranges the document paper in the annotation paper, and that causes a display unit to display the annotation paper and the document paper.

SUMMARY

In some cases where a read image of a document that is read by a document reading apparatus and an additional image that is added to the read image are outputted to a medium, the read image and the additional image overlap, and the readability of each image is consequently reduced. In these cases, if the medium is changed into a medium that is sized in advance such that the read image and the additional image are containable, and the read image and the additional image are outputted, each medium is not extended by a freely determined length in a sub scanning direction, and this results in a waste of the medium.

Aspects of non-limiting embodiments of the present disclosure relate to inhibition about the occurrence of a waste of a medium and inhibition about a reduction in the readability of images with the result that a read image and an additional image overlap when the read image of a document that is read by a document reading apparatus and the additional image that is added to the read image are outputted to the medium.

Aspects of certain non-limiting embodiments of the present disclosure address the above advantages and/or other advantages not described above. However, aspects of the non-limiting embodiments are not required to address the advantages described above, and aspects of the non-limiting embodiments of the present disclosure may not address advantages described above.

According to an aspect of the present disclosure, there is provided an image processing apparatus including a processor configured to: acquire a read image of a document that is read by a document reading apparatus; and control an image output device such that the read image and an additional image are outputted to a medium with a significance portion and the additional image prevented from overlapping, and a length of the medium in a sub scanning direction is increased in a case where the significance portion of the read image and a specified region of the read image to which the additional image is decided to be added overlap.

BRIEF DESCRIPTION OF THE DRAWINGS

An exemplary embodiment of the present disclosure will be described in detail based on the following figures, wherein:

FIG. **1** is a block diagram illustrating an example of the entire configuration of a copy system according to the exemplary embodiment of the present disclosure;

FIG. **2** illustrates an example of the hardware configuration of a document reading apparatus according to the exemplary embodiment of the present disclosure;

FIG. **3** illustrates an example of the hardware configuration of an image output device according to the exemplary embodiment of the present disclosure;

FIG. **4** illustrates an example of the hardware configuration of an image processing apparatus according to the exemplary embodiment of the present disclosure;

FIG. **5**A and FIG. **5**B illustrate a first example of compositing in the case where an effective image in a read image of a document and an annotation image overlap;

FIG. **6**A and FIG. **6**B illustrate a second example of compositing in the case where the effective image in the read image of the document and the annotation image overlap;

FIG. **7**A and FIG. **7**B illustrate an example of compositing for maintaining an offset of the annotation image from a paper leading edge in the case where the effective image in the read image of the document and the annotation image overlap;

FIG. **8**A and FIG. **8**B illustrate an example of compositing for maintaining an offset of the annotation image from a paper trailing edge in the case where the effective image in the read image of the document and the annotation image overlap;

FIG. **9** is a graph illustrating a first example of an outputting start timing in the case of a paper leading edge base point specifying method;

FIG. **10** is a graph illustrating a second example of the outputting start timing in the case of the paper leading edge base point specifying method;

FIG. **11** is a graph illustrating a third example of the outputting start timing in the case of the paper leading edge base point specifying method;

FIG. **12** is a graph illustrating a first example of the outputting start timing in the case of a paper trailing edge base point specifying method;

FIG. **13** is a graph illustrating a second example of the outputting start timing in the case of the paper trailing edge base point specifying method;

FIG. **14** is a graph illustrating a third example of the outputting start timing in the case of the paper trailing edge base point specifying method;

FIG. **15** is a block diagram illustrating an example of the functional configuration of the image processing apparatus according to the exemplary embodiment of the present disclosure;

FIG. **16**A is a flowchart of a reading routine of the image processing apparatus according to the exemplary embodiment of the present disclosure;

FIG. **16**B is a flowchart of the reading routine of the image processing apparatus according to the exemplary embodiment of the present disclosure;

FIG. **17** is a flowchart illustrating the content of a process of calculating the outputting start timing;

FIG. **18**A is a flowchart of an outputting routine of the image processing apparatus according to the exemplary embodiment of the present disclosure;

FIG. **18**B is a flowchart of the outputting routine of the image processing apparatus according to the exemplary embodiment of the present disclosure; and

FIG. **19** illustrates an example of a process history in which it is recorded that copy paper is extended.

DETAILED DESCRIPTION

An exemplary embodiment of the present disclosure will hereinafter be described in detail with reference to the attached drawings.

Summary of Present Exemplary Embodiment

According to the present exemplary embodiment, an image processing apparatus acquires a read image of a document that is read by a document reading apparatus and controls an image output device such that the read image and an additional image are outputted to a medium with a significance portion and the additional image prevented from overlapping, and a length of the medium in a sub scanning direction is increased in a case where the significance portion of the read image and a specified region of the read image to which the additional image is decided to be added overlap.

The significance portion of the read image described herein is a portion of the read image for reporting meaningful information to a user. The portion for reporting the meaningful information may be the entire portion except for the color of a foundation or may be a portion that has a size equal to or more than a threshold with the result that pixels for colors other than the color of the foundation are coupled with each other. The portion for reporting the meaningful information may be a predetermined kind of part in such a portion. Examples of the predetermined kind of part include a part on which a character image is formed and a part on which a photographic image is formed. In the following description, the significance portion of the read image is an effective image.

The additional image is added to image data. In the following description, an annotation image is taken as an example of the additional image. However, this is not a limitation, and the image may contain any information.

The medium is an object that is used to report information, and the image data is outputted thereto. Examples of the medium include paper and a plastic sheet. In the following description, paper is taken as an example.

To increase the length of the medium is to increase the length of the medium by changing a position at which the medium is cut.

Entire Configuration of Copy System

FIG. **1** is a block diagram illustrating an example of the entire configuration of a copy system **1** according to the present exemplary embodiment. The copy system **1** includes a document reading apparatus **10**, an image output device **20**, and an image processing apparatus **30** as illustrated. The document reading apparatus **10** reads a document and outputs the image data thereof. The image output device **20** transfers an image to paper, based on the image data and discharges the paper. The image processing apparatus **30** acquires the image data from the document reading apparatus **10** and processes the image data for an output to the image output device **20**. The copy system **1** is capable of making a synchronous cutting copy. The synchronous cutting copy is a copy acquired in a manner in which copy paper is cut so as to be suitable for the length of the document.

Hardware Configuration of Document Reading Apparatus

FIG. **2** illustrates an example of the hardware configuration of the document reading apparatus **10** according to the present exemplary embodiment.

In the document reading apparatus **10**, transport rollers **101** to **106** for transporting a document **100** in a transport direction are disposed. As for the transport rollers **101** to **106**, two rollers that are arranged in the vertical direction in FIG. **2** are paired for three transport units in total. The document **100** enters via a document entrance **100***a*, is transported by the transport rollers **101** and **102** corresponding to the first transport units, the transport rollers **103** and **104** corresponding to the second transport units, and the transport rollers **105** and **106** corresponding to the third transport units in turn, and is discharged via a document exit **100***b*.

A reading sensor **110** is disposed between the transport rollers **103** and **104** corresponding to the second transport units and the transport rollers **105** and **106** corresponding to the third transport units. The reading sensor **110** is a one-dimensional sensor that is acquired by arranging a large number of light detection sensors in a direction perpendicular to the transport direction of the document **100**. The light detection sensors detect reflection light from a surface of the document **100**. The output signals of the light detection sensors are sequentially scanned in a predetermined period and sequentially converted into digital signals. Consequently, the image data of a straight portion that is included in the entire image on the surface of the document **100** and that faces the light detection sensors is generated. The image data is continuously generated while the document **100** is transported, and the image data that represents the image on the surface of the document **100** is consequently generated. The image data that is acquired by the reading sensor **110** is transmitted to the image processing apparatus **30**.

Sensors F**1** to F**4** for detecting edge portions of the document **100** that pass are disposed at points on a transport path for the document **100**. A gate **111** is disposed between the transport rollers **101** and **102** corresponding to the first

transport units and the transport rollers **103** and **104** corresponding to the second transport units. The gate **111** opens only while the reading sensor **110** reads the document **100** and allows the document **100** to pass toward the second transport units.

Hardware Configuration of Image Output Device

FIG. **3** illustrates an example of the hardware configuration of the image output device **20** according to the present exemplary embodiment.

The image output device **20** includes cut paper supplying units **201** and **202** and a roll paper supplying unit **210** as illustrated. The image output device **20** also includes a cutter **211** for cutting copy paper that is fed from the roll paper supplying unit **210**. Copy paper in the cut paper supplying units **201** and **202** or the copy paper that is wound around the roll paper supplying unit **210** is selected for copying, based on an operation of the user. The selected copy paper is transported to a transfer unit **220** in response to an instruction for outputting from the image processing apparatus **30**. A resist sensor **222** that detects the copy paper that comes is disposed in front of the transfer unit **220**. An exposure unit **231** exposes the surface of a transfer drum **221** that rotates at a predetermined speed to light, based on the image data that is supplied from the image processing apparatus **30** and forms a latent image depending on the image data. A developing unit **232** supplies toner to the surface of the transfer drum **221** on which the latent image is thus formed and forms a toner image depending on the image data on the surface of the transfer drum **221**. The transfer unit **220** presses the copy paper against the surface of the transfer drum **221** and transfers the toner image on the surface of the transfer drum **221** to the copy paper. The copy paper to which the toner image is thus transferred is subjected to a fixing process by a fixing unit **240** and is subsequently discharged via a paper discharge transport path **250**.

Hardware Configuration of Image Processing Apparatus

FIG. **4** illustrates an example of the hardware configuration of the image processing apparatus **30** according to the present exemplary embodiment. The image processing apparatus **30** includes a processor **31**, a random access memory (RAM) **32**, a read only memory (ROM) **33**, a hard disk drive (HDD) **34**, an operation panel **35**, and a communication interface (referred to below as a "communication I/F") **36** as illustrated.

The processor **31** loads various programs that are stored in, for example, the ROM **33** into the RAM **32** and runs the programs to perform the functions of the image processing apparatus **30** described later.

The RAM **32** is a memory that is used, for example, as a work memory for the processor **31**.

The ROM **33** is a memory that stores, for example, the various programs that are run by the processor **31**.

The HDD **34** stores, for example, the image data that is acquired by reading the document by using the document reading apparatus **10**, and an example thereof is a magnetic disk device.

The operation panel **35** displays various kinds of information and receives an operation input from the user, and an example thereof is a touch screen. The operation panel **35** includes a display that displays various kinds of information and a position detecting sheet that detects a position that is specified by a finger or an instruction unit such as a stylus pen. A display and a keyboard may be used instead of the touch screen.

The communication I/F **36** transmits and receives various kinds of information to and from another device via a communication line not illustrated.

Summary of Operation of Copy System

FIG. **5**A to FIG. **8**B illustrate examples of compositing a read image **51** of the document that is read by the document reading apparatus **10** and an annotation image **52** that is an example of the additional image on copy paper **50** that is outputted by the image output device **20**.

FIG. **5**A and FIG. **5**B illustrate a first example of compositing in the case where an effective image **53** in the read image **51** of the document and the annotation image **52** overlap. As illustrated in FIG. **5**A, a portion of the effective image **53** near a leading edge and the annotation image **52** overlap. In this case, as illustrated in FIG. **5**B, a white line **521** is first formed on the copy paper **50** and is composited with the annotation image **52**, and an image line that contains a portion of the read image **51** that overlaps the annotation image **52** is subsequently formed. The portion of the read image **51** that overlaps the annotation image **52** includes the portion of the effective image **53** near the leading edge and a white portion **54** that does not contain the effective image **53**. Accordingly, image lines that are formed in the first example include an image line **541** that contains the white portion **54** and an image line **531** that contains the portion of the effective image **53** near the leading edge. As a result, as illustrated by using arrows **55**, the copy paper **50** is extended not only by a length for the image line **531** that contains the portion of the effective image **53** near the leading edge but also by a length for the image line **541** that contains the white portion **54**.

FIG. **6**A and FIG. **6**B illustrate a second example of compositing in the case where the effective image **53** in the read image **51** of the document and the annotation image **52** overlap. As illustrated in FIG. **6**A, the portion of the effective image **53** near the leading edge and the annotation image **52** overlap. In this case, as illustrated in FIG. **6**B, the white line **521** is first formed on the copy paper **50** and is composited with the annotation image **52**, and the image line that contains the portion of the read image **51** that overlaps the annotation image **52** is subsequently formed. The portion of the read image **51** that overlaps the annotation image **52** includes the portion of the effective image **53** near the leading edge and the white portion **54** that does not contain the effective image **53**. An image line that is formed in the second example, however, is the image line **531** that contains the portion of the effective image **53** near the leading edge, but the image line that contains the white portion **54** is not formed. As a result, as illustrated by using arrows **56**, the copy paper **50** is extended only by a length for the image line **531** that contains the portion of the effective image **53** near the leading edge.

Examples of a method of specifying the position of the annotation image **52** when the read image **51** and the annotation image **52** are composited include a paper leading edge base point specifying method of specifying the position by using an offset from the paper leading edge and a paper trailing edge base point specifying method of specifying the position by using an offset from a paper trailing edge. In the paper leading edge base point specifying method, the annotation image **52** is composited while the offset from the paper leading edge is maintained, and this is convenient. In

the paper trailing edge base point specifying method, the annotation image **52** is composited while the offset from the paper trailing edge is maintained, and this is convenient. FIG. **5**A, FIG. **5**B, FIG. **6**A, and FIG. **6**B do not illustrate whether the annotation image **52** is composited while the offset from the paper leading edge is maintained or while the offset from the paper trailing edge is maintained. Accordingly, the case of extension by the length for the image line **541** that contains the white portion **54** as illustrated in FIG. **5**A and FIG. **5**B is taken as an example here, and the case where the annotation image **52** is composited while the offset from the paper leading edge is maintained and the case where the annotation image **52** is composited while the offset from the paper trailing edge is maintained will now be described.

FIG. **7**A and FIG. **7**B illustrate an example of compositing for maintaining the offset of the annotation image **52** from the paper leading edge in the case where the effective image **53** in the read image **51** of the document and the annotation image **52** overlap. As illustrated in FIG. **7**A, a portion of the effective image **53** near the trailing edge and the annotation image **52** overlap. In this case, as illustrated in FIG. **7**B, the white line **521** is first formed on the copy paper **50** and is composited with the annotation image **52**, and an image line that contains a portion of the read image **51** that overlaps the annotation image **52** is subsequently formed. As illustrated by an arrow **57**, the read image **51** and the annotation image **52** are formed in this order to maintain the offset of the annotation image **52** from the paper leading edge. The portion of the read image **51** that overlaps the annotation image **52** includes the portion of the effective image **53** near the trailing edge and the white portion **54** that does not contain the effective image **53**. Accordingly, image lines that are formed in this example include the image line **541** that contains the white portion **54** and the image line **531** that contains the portion of the effective image **53** near the trailing edge. As a result, as illustrated by the arrows **55**, the copy paper **50** is extended not only by a length for the image line **531** that contains the portion of the effective image **53** near the trailing edge but also by a length for the image line **541** that contains the white portion **54**.

FIG. **8**A and FIG. **8**B illustrate an example of compositing for maintaining the offset of the annotation image **52** from the paper trailing edge in the case where the effective image **53** in the read image **51** of the document and the annotation image **52** overlap. As illustrated in FIG. **8**A, the portion of the effective image **53** near the trailing edge and the annotation image **52** overlap. In this case, as illustrated in FIG. **8**B, the image line that contains the portion of the read image **51** that overlaps the annotation image **52** is first formed on the copy paper **50**, and the white line **521** is subsequently formed and is composited with the annotation image **52**. As illustrated in an arrow **58**, the read image **51** and the annotation image **52** are formed in this order to maintain the offset of the annotation image **52** from the paper trailing edge. The portion of the read image **51** that overlaps the annotation image **52** includes the portion of the effective image **53** near the trailing edge and the white portion **54** that does not contain the effective image **53**. Accordingly, image lines that are formed in this example include the image line **541** that contains the white portion **54** and the image line **531** that contains the portion of the effective image **53** near the trailing edge. As a result, as illustrated by the arrows **55**, the copy paper **50** is extended not only by the length for the image line **531** that contains the portion of the effective image **53** near the trailing edge but also by the length for the image line **541** that contains the white portion **54**.

In the case where the document reading apparatus **10** reads the document while the image output device **20** outputs the image according to the present exemplary embodiment, the image processing apparatus **30** reads the image data from the document reading apparatus **10** and calculates an outputting start timing with which the image is transferred to the copy paper.

FIG. **9** to FIG. **14** are graphs illustrating the outputting start timing. In these graphs, the horizontal axis represents a time, the vertical axis represents the position of the document, a straight line **60** represents reading, and a straight line **61** represents outputting. In the graphs, an annotation region near the paper trailing edge is illustrated by dot hatching. In the graphs, T, Ta, T**2**, and T**3** are used to represent the time but are also used to represent an elapsed time after a reading start timing because the reading start timing is set to 0.

FIG. **9** illustrates a first example of the outputting start timing in the case of the paper leading edge base point specifying method. An arrow **65** represents the paper leading edge base point specifying method.

In FIG. **9**, the image processing apparatus **30** delays the outputting start timing so as to finish reading a document that has a predetermined maximum document length and finish outputting at the same time in the case where reading and outputting are simultaneously progressed. Specifically, the image processing apparatus **30** transmits the outputting start timing to the image output device **20**. The outputting start timing is a timing after the reading start timing with which the document reading apparatus **10** starts to read the image data and after a print delay time T has elapsed. The print delay time T is a time in consideration of a difference between a reading speed corresponding to an example of a first speed of the document reading apparatus **10** and an outputting speed corresponding to an example of a second speed of the image output device **20**.

In the first example, a position P on the document to be printed does not reach the annotation region at a time Ta at which investigation of whether the annotation region overlaps the effective image is finished. That is, the annotation region does not start to be printed when the investigation of whether the annotation region overlaps the effective image is finished, and accordingly, it is not necessary to change the outputting start timing.

In FIG. **9**, a straight line **61***a* represents the trajectory of a print position in the case where whether the annotation region overlaps the effective image is investigated, and consequently, the paper is not extended because the annotation region does not overlap the effective image. A straight line **61***b* represents the trajectory of the print position in the case where whether the annotation region overlaps the effective image is investigated, and consequently, the paper is extended because the annotation region overlaps the effective image. A straight line **64** represents a period in which a UI for the user to determine whether the paper is extended is displayed.

FIG. **10** illustrates a second example of the outputting start timing in the case of the paper leading edge base point specifying method. The arrow **65** represents the paper leading edge base point specifying method.

In FIG. **10**, the image processing apparatus **30** delays the outputting start timing by the print delay time T so as to finish reading the document that has the predetermined maximum document length and finish outputting at the same time in the case where reading and outputting are simultaneously progressed as in FIG. **9**.

In the second example, however, the position P on the document reaches the annotation region at the time Ta at

which investigation of whether the annotation region overlaps the effective image is finished. That is, the annotation region starts to be printed before the investigation of whether the annotation region overlaps the effective image is finished. Accordingly, the straight line that represents outputting is changed into a straight line **62**, and the outputting start timing is delayed until a time T**2**.

In FIG. **10**, a straight line **62***a* represents the trajectory of the print position in the case where whether the annotation region overlaps the effective image is investigated, and consequently, the paper is not extended because the annotation region does not overlap the effective image. A straight line **62***b* represents the trajectory of the print position in the case where whether the annotation region overlaps the effective image is investigated, and consequently, the paper is extended because the annotation region overlaps the effective image. The straight line **64** represents the period in which the UI for the user to determine whether the paper is extended is displayed.

FIG. **11** illustrates a third example of the outputting start timing in the case of the paper leading edge base point specifying method. The arrow **65** represents the paper leading edge base point specifying method.

In FIG. **11**, the image processing apparatus **30** delays the outputting start timing by the print delay time T so as to finish reading the document that has the predetermined maximum document length and finish outputting at the same time in the case where reading and outputting are simultaneously progressed as in FIG. **9**.

In the third example, an actual document size is smaller than the maximum document size. In this case, when reading the document is finished, outputting may start because outputting is not finished earlier than reading. Accordingly, the straight line that represents outputting is changed into a straight line **63**, and the outputting start timing is advanced into a time T**3**.

In FIG. **11**, a straight line **63***a* represents the trajectory of the print position in the case where whether the annotation region overlaps the effective image is investigated, and consequently, the paper is not extended because the annotation region does not overlap the effective image. A straight line **63***b* represents the trajectory of the print position in the case where whether the annotation region overlaps the effective image is investigated, and consequently, the paper is extended because the annotation region overlaps the effective image. The straight line **64** represents the period in which the UI for the user to determine whether the paper is extended is displayed.

Even in some cases where the actual document size is smaller than the maximum document size, outputting starts when reading the document is finished. In these cases, the print delay time T is not advanced as in FIG. **9**.

FIG. **12** illustrates a first example of the outputting start timing in the case of the paper trailing edge base point specifying method. An arrow **66** represents the paper trailing edge base point specifying method. FIG. **12** is the same as FIG. **9**, and the description thereof is omitted here.

FIG. **13** illustrates a second example of the outputting start timing in the case of the paper trailing edge base point specifying method. The arrow **66** represents the paper trailing edge base point specifying method. FIG. **13** is the same as FIG. **10**, and the description thereof is omitted here.

FIG. **14** illustrates a third example of the outputting start timing in the case of the paper trailing edge base point specifying method. The arrow **66** represents the paper trailing edge base point specifying method. FIG. **14** is the same as FIG. **11**, and the description thereof is omitted here.

Even in some cases where the actual document size is smaller than the maximum document size, outputting starts when reading the document is finished. In these cases, the print delay time T is not advanced as in FIG. **12**. Functional Configuration of Image Processing Apparatus

FIG. **15** is a block diagram illustrating an example of the functional configuration of the image processing apparatus **30** according to the present exemplary embodiment. The image processing apparatus **30** includes a copy condition setting part **41**, a reading controller **42**, an image memory **43**, an outputting start timing calculation unit **44**, an additional image generation unit **45**, and an outputting controller **46** as illustrated.

The copy condition setting part **41** sets a copy condition that the user instructs on the operation panel **35**. Examples of the copy condition include a selection from a fixed form copy and a synchronous cutting copy, magnification, paper, and an operation mode for the synchronous cutting copy. Examples of the copy condition also include the position of a composite region of the additional image. The position of the composite region of the additional image may be specified by using a base point on the composite region and an offset from the base point.

The reading controller **42** controls the document reading apparatus **10** that reads the document.

Specifically, the reading controller **42** determines whether a document is inserted via the document entrance **100***a* and acquires the entire storage area in the image memory **43** if it is determined that the document is inserted.

The reading controller **42** instructs the document reading apparatus **10** to read the document and acquires the image data that is transmitted from the document reading apparatus **10** in response to the instruction. The reading controller **42** causes the image memory **43** to store the acquired image data.

The reading controller **42** sets the cut length of the copy paper and requests cutting or sets the position of the additional image and requests compositing the additional image.

The reading controller **42** determines whether the effective image is located in the composite region of the additional image of the image data and transmits information about whether the effective image is located therein to the outputting controller **46**.

According to the present exemplary embodiment, the reading controller **42** performs the process as an example of acquiring the read image of the document that is read by the document reading apparatus.

The image memory **43** stores the image data that the reading controller **42** reads from the document reading apparatus **10**. An example of the image memory **43** is the HDD **34**.

The outputting start timing calculation unit **44** acquires a print delay time T**2** from the reading start timing until the outputting start timing if it is determined that reading and outputting are simultaneously progressed depending on the copy condition that is set by the copy condition setting part **41**. Specifically, the outputting start timing calculation unit **44** acquires the print delay time T that is used to finish reading the document that has the predetermined maximum document length and finish outputting at the same time. When the position P on the document to be printed at the time Ta at which the trailing edge of the composite region of the additional image is read is nearer than the leading edge of the composite region of the additional image to the trailing edge, the outputting start timing calculation unit **44** changes the print delay time into T**2** such that the leading edge of the composite region of the additional image is

printed at the time Ta. The outputting start timing calculation unit **44** calculates the outputting start timing, based on the reading start timing and the print delay time T**2** and transmits the calculated outputting start timing to the outputting controller **46**.

According to the present exemplary embodiment, the print delay time T**2** is used as an example of a wait time depending on the position of a specified region in the sub scanning direction. According to the present exemplary embodiment, the outputting start timing calculation unit **44** performs this process as an example in which the image output device is controlled such that the read image starts to be outputted to the medium after the document reading apparatus starts to read the document and after the wait time has elapsed.

When reading the document is finished, the outputting start timing calculation unit **44** determines whether the current time is earlier than the calculated outputting start timing and transmits the current time as a new outputting start timing to the outputting controller **46** if the current time is earlier than the calculated outputting start timing.

According to the present exemplary embodiment, the outputting start timing calculation unit **44** performs this process as an example in which the image output device is controlled such that the read image starts to be outputted to the medium after reading is finished and before the wait time has elapsed in the case where reading is finished after the document reading apparatus starts to read the document and before the wait time has elapsed.

The additional image generation unit **45** generates the additional image. For example, the additional image generation unit **45** may generate the additional image, based on information about the user and information about date but is not limited thereto. The additional image generation unit **45** stores information about the height of the additional image, that is, the length of the additional image in the sub scanning direction.

The outputting controller **46** controls the image output device **20** that outputs the image data that is read from the image memory **43**.

Specifically, the outputting controller **46** determines whether the reading controller **42** requests outputting and causes the image output device **20** to prepare the operation thereof if outputting is requested. The outputting controller **46** instructs the image output device **20** to start printing at a time acquired by subtracting a paper delay time Td from the outputting start timing that is transmitted from the outputting start timing calculation unit **44**. The outputting controller **46** outputs the image data that is read from the image memory **43** to the image output device **20** after the instruction for starting printing in response to a request for transmitting the image data from the image output device **20**.

The outputting controller **46** determines whether the print position of the image data reaches the composite region of the additional image and outputs the image data to the image output device **20** while compositing the additional image that is generated by the additional image generation unit **45** if the print position reaches the composite region of the additional image. Since the image starts to be transferred to the copy paper with the outputting start timing that is transmitted from the outputting start timing calculation unit **44**, the print position of the image data reaches the composite region of the additional image after the reading controller **42** determines whether the effective image is located in the composite region of the additional image. That is, the outputting controller **46** outputs the data of the image with which the additional image is composited to the image output device **20** depending on the result of determination after the reading controller **42** determines whether the effective image is located in the composite region of the additional image.

If it is determined that the effective image is located in the composite region of the additional image, the outputting controller **46** outputs the image data that contains the additional image, a portion of the effective image that overlaps the composite region, and a portion of the effective image behind these in this order to the image output device **20**. Alternatively, the outputting controller **46** may output the image data that contains the portion of the effective image that overlaps the composite region, the additional image, and the portion of the effective image behind these in this order to the image output device **20**.

If it is determined that the effective image is not located in the composite region of the additional image, the outputting controller **46** outputs the image data that contains the additional image and a portion of the effective image behind the composite region in this order to the image output device **20**. Alternatively, the outputting controller **46** may output the image data that includes data acquired by superimposing the additional image and the portion of the effective image that overlaps the composite region and data of a portion of the effective image behind these in this order to the image output device **20**.

According to the present exemplary embodiment, the effective image is used as an example of the significance portion of the read image, and the composite region of the additional image is used as an example of the specified region of the read image to which the additional image is decided to be added. According to the present exemplary embodiment, the outputting controller **46** performs this process as an example in which the read image and the additional image are outputted to the medium such that the significance portion and the additional image do not overlap in the case where the significance portion and the specified region overlap.

According to the present exemplary embodiment, the outputting controller **46** performs this process as an example in which the image output device is controlled such that the additional image is outputted if the significance portion and the specified region overlap after the document reading apparatus finishes reading the specified region, and a part of the significance portion that overlaps the specified region is subsequently outputted.

According to the present exemplary embodiment, the outputting controller **46** performs this process as an example in which the image output device is controlled such that at least the additional image is outputted if the significance portion and the specified region do not overlap after the document reading apparatus finishes reading the specified region, and a part of the significance portion nearer than the specified region to the trailing edge in the sub scanning direction.

In some cases, the reading controller **42** determines whether the effective image is located in the composite region of the additional image, and consequently, it is revealed that a portion that overlaps the composite region of the additional image of the image data includes a white portion at which the effective image is not located.

In these cases, the outputting controller **46** may output the image data with which the additional image is composited to the image output device **20** together with the white portion.

For example, the outputting controller **46** may output an image line that contains the portion that overlaps the composite region of the additional image of the image data after

an image line acquired by compositing the additional image with a white line is outputted and may subsequently output an image line that contains a portion of the image data behind these.

According to the present exemplary embodiment, the outputting controller **46** performs this process as an example in which the image output device is controlled such that a portion that overlaps the specified region of the read image is outputted after the additional image is outputted.

Alternatively, the outputting controller **46** may output the image line acquired by compositing the additional image with the white line after the image line that contains the portion that overlaps the composite region of the additional image of the image data is outputted and may subsequently output the image line that contains the portion of the image data behind these.

According to the present exemplary embodiment, the outputting controller **46** performs this process as an example in which the image output device is controlled such that the additional image is outputted after the portion that overlaps the specified region of the read image is outputted.

In this case, the outputting controller **46** may output the image data with which the additional image is composited to the image output device **20** without a white portion.

For example, the outputting controller **46** may output an image line that contains the portion of the effective image that overlaps the composite region of the additional image after the image line acquired by compositing the additional image with the white line is outputted and may subsequently output the image line that contains the portion of the image data behind these.

According to the present exemplary embodiment, the outputting controller **46** performs this process as an example in which the image output device is controlled such that the part of the significance portion that overlaps the specified region is outputted after the additional image is outputted.

Alternatively, the outputting controller **46** may output the image line acquired by compositing the additional image with the white line after the image line that contains the portion of the effective image that overlaps the composite region of the additional image and may subsequently output the image line that contains the portion of the image data behind these.

According to the present exemplary embodiment, the outputting controller **46** performs this process as an example in which the image output device is controlled such that the additional image is outputted after the part of the significance portion that overlaps the specified region is outputted.

The outputting controller **46** reads the cut length that is set by the reading controller **42** and transmits the cut length to the image output device **20**. In the case where the portion that overlaps the composite region of the additional image of the image data is transmitted separately from the additional image, the outputting controller **46** transmits an instruction for increasing the cut length by the height of the portion that overlaps the composite region of the additional image of the image data to the image output device **20**.

According to the present exemplary embodiment, the outputting controller **46** performs this process as an example in which the image output device is controlled such that the length of the medium in the sub scanning direction is increased in the case where the significance portion and the specified region overlap.

Also, in this case, the process of the outputting controller **46** is changed depending on whether the white portion that is included in the portion that overlaps the composite region of the additional image of the image data is outputted to the image output device **20**.

In the case where the image data with which the additional image is composited is outputted to the image output device **20** together with the white portion, the outputting controller **46** transmits an instruction for increasing the cut length by the length of the portion that overlaps the composite region of the additional image of the image data to the image output device **20**.

According to the present exemplary embodiment, the outputting controller **46** performs this process as an example in which the image output device is controlled such that the length of the medium in the sub scanning direction is increased by the length of the specified region in the sub scanning direction.

In the case where the image data with which the additional image is composited is outputted to the image output device **20** without the white portion, the outputting controller **46** transmits an instruction for increasing the cut length by the length of the portion of the effective image that overlaps the composite region of the additional image to the image output device **20**.

According to the present exemplary embodiment, the outputting controller **46** performs this process as an example in which the image output device is controlled such that the length of the medium in the sub scanning direction is increased by the length of a part of the specified region that overlaps the significance portion in the sub scanning direction.

The outputting controller **46** transmits the image data from the image memory **43** to the image output device **20** only in a period in which a request for transmitting the image data is received and stops transmitting the image data when the request for transmitting ends. The outputting controller **46** releases the image memory **43**.

In the case where the cut length of the copy paper is increased, the outputting controller **46** outputs information that represents that the length of the copy paper is longer than the original length. The outputting controller **46** may display the information on the operation panel **35** or may cause the HDD **34** to store the information as a process history.

According to the present exemplary embodiment, the outputting controller **46** performs this process as an example in which information that represents that the length of the medium in the sub scanning direction is increased is outputted.

In the case where the document ends before the composite region of the additional image starts to be drawn, or in the case where the document ends before drawing the composite region of the additional image is finished, the outputting controller **46** may add a white line and may draw the entire additional image.

Example of Operation of Image Processing Apparatus

FIG. **16**A to FIG. **18**B are flowcharts illustrating an example of the operation of the image processing apparatus **30** according to the present exemplary embodiment. In the case described herein, the copy condition setting part **41** sets the synchronous cutting copy as the selection from the fixed form copy and the synchronous cutting copy, sets an equal size as the magnification, and sets roll paper as the paper.

FIG. **16**A and FIG. **16**B are flowcharts for the reading routine of the image processing apparatus **30**. After the copy

condition setting part **41** sets the various copy conditions, the image processing apparatus **30** performs the reading routine.

As for the image processing apparatus **30**, as illustrated in FIG. **16**A, the reading controller **42** first determines whether a document is inserted via the document entrance **100***a* (a step **401**) and waits as it is if no document is inserted. If the document is inserted, and the sensor F**1** detects the leading edge of the document, the reading controller **42** acquires the entire storage area in the image memory **43** as a storage area for storing the image data that is read from the document (a step **402**). The reading controller **42** subsequently determines whether the entire storage area is acquired at the step **402** (a step **403**) and performs a process at the step **402** again if the entire storage area is not acquired.

If the entire storage area is acquired at the step **402**, the outputting start timing calculation unit **44** calculates the outputting start timing (a step **404**). That is, the outputting start timing calculation unit **44** performs processes illustrated in FIG. **17** to acquire the print delay time T**2** from the reading start timing of the image data until the outputting start timing.

Subsequently, the reading controller **42** instructs the document reading apparatus **10** to start to read the document (a step **405**). As a result, the light detection sensors that are included in the reading sensor **110** start to scan the output signals and sequentially transmit the image data that is acquired every time scanning is repeated to the image processing apparatus **30**. Consequently, the reading controller **42** acquires the image data (a step **406**).

Subsequently, the outputting start timing calculation unit **44** waits for the reading controller **42** to start to input the image data into the image memory **43** and sets the outputting start timing of the image data in response to the first input of the image data (a request for outputting) (a step **407**). That is, a time acquired by adding the print delay time T**2** that is acquired at the step **404** into the current time at which the image data is inputted at the first time is set as the outputting start timing of the image data.

Subsequently, as illustrated in FIG. **16**B, the reading controller **42** determines whether the composite region of the additional image is read (a step **411**). At this time, the reading controller **42** sets the position of the leading edge and the position of the trailing edge of the composite region of the additional image. The case where the copy condition setting part **41** sets a paper leading edge base point as the base point on the composite region of the additional image will now be described. In this case, the reading controller **42** sets the position of an offset from the paper leading edge base point as the position of the leading edge of the composite region of the additional image. The reading controller **42** sets a position away from the position of the leading edge toward the trailing edge by the height of the additional image that is acquired from the additional image generation unit **45** as the position of the trailing edge of the composite region of the additional image. The case where the copy condition setting part **41** sets a paper trailing edge base point as the base point on the composite region of the additional image will now be described. In this case, the reading controller **42** sets a position away from the position of the predetermined maximum document length toward the leading edge by an offset value from the paper trailing edge base point as the position of the trailing edge of the composite region of the additional image. The reading controller **42** sets a position away from the position of the trailing edge toward the leading edge by the height of the additional image that is acquired from the additional image generation unit **45** as the position of the leading edge of the composite region of the additional image. If the composite region of the additional image is not read, the reading controller **42** waits as it is. If the composite region of the additional image is read, the reading controller **42** determines whether the effective image is located in the composite region of the additional image and sets information about the result of determination (a step **412**).

Subsequently, the reading controller **42** determines whether the document reading apparatus **10** finishes reading the document while continuing a process of acquiring the image data and inputting the image data into the image memory **43** (a step **413**) and waits as it is if reading the document is not finished. When reading the document is finished, the outputting start timing calculation unit **44** determines whether the current time T**3** is earlier than the outputting start timing that is set at the step **407** in FIG. **16**A (a step **414**).

If the current time T**3** is earlier than the outputting start timing, the outputting start timing calculation unit **44** sets the current time T**3** as the new outputting start timing (a step **415**). Here, the time that is set as the new outputting start timing is the current time T**3** for convenience. In a strict sense, the time may be acquired by adding a time required for transmitting information about time to the outputting controller **46** into the current time T**3**. If the current time T**3** is not earlier than the outputting start timing, the outputting start timing calculation unit **44** does not perform the step **415**.

Subsequently, the reading controller **42** performs a process for transmitting a request for cutting (a step **416**). That is, the reading controller **42** detects the length of the document by using the sensor F**1** in the document reading apparatus **10** and sets the detected length of the document as the cut length of the copy paper.

Subsequently, the reading controller **42** performs a process for transmitting a request for compositing the additional image (a step **417**). That is, the reading controller **42** sets the position of the leading edge and the position of the trailing edge of the composite region of the additional image. In the case where the copy condition setting part **41** sets the paper leading edge base point as the base point on the composite region of the additional image, the reading controller **42** sets the position of the leading edge and the position of the trailing edge of the composite region of the additional image as described for the step **411**. In the case where the copy condition setting part **41** sets the paper trailing edge base point as the base point on the composite region of the additional image, the reading controller **42** uses the length of the document that is detected at the step **416** instead of the predetermined maximum document length and sets the position of the leading edge and the position of the trailing edge of the composite region of the additional image as described for the step **411**. In the case where the length of the document that is detected at the step **416** is shorter than the predetermined maximum document length, the outputting controller **46** may determine whether the effective image is located in the composite region of the additional image that is set at the step **417** and may replace the information that is set at the step **412** with information about the result of determination. Through the above processing, the reading routine ends.

FIG. **17** is a flowchart illustrating the content of a process of calculating the outputting start timing at the step **404** in FIG. **16**A.

The outputting start timing calculation unit **44** first calculates the print delay time T such that a time at which

reading is finished and a time at which outputting is finished are equal to each other as for the maximum document length (a step **421**) as illustrated.

Subsequently, the outputting start timing calculation unit **44** calculates the time Ta at which the position of the trailing edge of the composite region of the additional image is read (a step **422**). At this time, the outputting start timing calculation unit **44** specifies the position of the trailing edge of the composite region of the additional image as described for the step **411** in FIG. **16**B.

Subsequently, the outputting start timing calculation unit **44** calculates the position P on the document to be printed at the time Ta (a step **423**).

Subsequently, the outputting start timing calculation unit **44** determines whether the position P on the document to be printed is nearer than the position of the leading edge of the composite region of the additional image to the trailing edge (a step **424**). At this time, the outputting start timing calculation unit **44** specifies the position of the leading edge of the composite region of the additional image as described for the step **411** in FIG. **16**B. If the position P on the document to be printed is nearer than the position of the leading edge of the composite region of the additional image to the trailing edge, the outputting start timing calculation unit **44** changes the print delay time into T**2** such that the leading edge of the composite region of the additional image is printed at the time Ta (a step **425**). If the position P on the document to be printed is not nearer than the position of the leading edge of the composite region of the additional image to the trailing edge, the outputting start timing calculation unit **44** does not perform the step **425**.

FIG. **18**A and FIG. **18**B are flowcharts illustrating the outputting routine of the image processing apparatus **30**. The outputting routine is performed while the processes in FIG. **16**A and FIG. **16**B are performed.

As for the image processing apparatus **30**, as illustrated in FIG. **18**A, the outputting controller **46** first determines whether the reading controller **42** requests outputting (a step **451**) and waits as it is if outputting is not requested. When the outputting start timing is set at the step **407** in FIG. **16**A (the request for outputting), the result of determination at the step **451** is "YES", and the outputting controller **46** causes the image output device **20** to prepare the operation thereof (a step **452**).

Subsequently, the outputting controller **46** acquires a time by subtracting the paper delay time Td from the outputting start timing that is set at the step **407** in FIG. **16**A, waits until the time (a step **453**), and subsequently instructs the image output device **20** to start printing (a step **454**). The paper delay time Td is a time required for the copy paper to reach the resist sensor **222** in front of the transfer unit **220** from paper supplying units (the cut paper supplying units **201** and **202** and the roll paper supplying unit **210**). The paper delay time Td has a value that changes depending on a selection from the cut paper supplying units **201** and **202** and the roll paper supplying unit **210** among the paper supplying units. The roll paper supplying unit **210** is selected here. Accordingly, the paper delay time Td suitable for the roll paper supplying unit **210** is selected at the step **453**, and a time at which an instruction for starting printing is transmitted is calculated based on the selected Td. Subsequently, the outputting controller **46** determines whether the image output device **20** requests to start to output the image data (a step **455**).

As a result of an instruction for starting printing at the step **454**, the copy paper is supplied to the image output device **20** from the roll paper supplying unit **210**. When the copy paper reaches the position of the resist sensor **222**, a request for starting to output the image data is transmitted from the image output device **20** to the image processing apparatus **30**. In the case where the request for starting outputting is received before determination is made at the step **455**, the outputting controller **46** starts to output the image data from the image memory **43** (a step **456**).

Subsequently, the outputting controller **46** reads the cut length that is set at the step **416** in FIG. **16**B and transmits the cut length to the image output device **20** (a step **457**). As a result, the image output device **20** requests the image processing apparatus **30** to transmit the image data in a period in which the received cut length of the copy paper is fed from the roll paper supplying unit **210**. As illustrated in FIG. **18**B, the outputting controller **46** transmits the image data in response to this request (a step **461**), and the image output device **20** transfers an image in accordance with the transmitted image data.

Subsequently, the outputting controller **46** determines whether the image data that is outputted from the image memory **43** reaches the composite region of the additional image (a step **462**). The composite region of the additional image is determined by using the position of the leading edge and the position of the trailing edge that are set at the step **417** in FIG. **16**B. If the image data does not reach the composite region of the additional image, the outputting controller **46** performs a process at the step **461** again. If the image data reaches the composite region of the additional image, the outputting controller **46** determines whether the effective image is located in the composite region of the additional image (a step **463**). The outputting controller **46** makes the determination, based on the information that is set at the step **412** in FIG. **16**B.

If the effective image is located in the composite region of the additional image, the outputting controller **46** sequentially transmits the white line with which the additional image that is generated by the additional image generation unit **45** is composited and the image line that contains the portion that overlaps the composite region of the additional image of the image data to the image output device **20** (a step **464**). For example, the outputting controller **46** may transmit the image line after transmitting the white line as illustrated in FIG. **5**A to FIG. **7**B or may transmit the white line after transmitting the image line as illustrated in FIG. **8**A and FIG. **8**B. At this time, the outputting controller **46** may transmit the white line that contains the white portion at which the effective image is not located in the portion that overlaps the composite region of the additional image of the image data as illustrated in FIG. **5**A, FIG. **5**B, FIG. **7**A, FIG. **7**B, FIG. **8**A, and FIG. **8**B or as illustrated in FIG. **6**A and FIG. **6**B.

Subsequently, the outputting controller **46** transmits an instruction for increasing the cut length to the image output device **20** depending on the structure of the data that is transmitted at the step **464** (a step **465**). For example, in the case where the white line that contains the white portion at which the effective image is not located in the portion that overlaps the composite region of the additional image of the image data is transmitted at the step **464**, the outputting controller **46** increases the cut length by the height of the composite region of the additional image. In the case where the white line that contains the white portion at which the effective image is not located in the portion that overlaps the composite region of the additional image of the image data is not transmitted at the step **464**, the outputting controller **46** increases the cut length by the height of a portion at which the effective image is located in the composite region of the additional image.

If the effective image is not located in the composite region of the additional image, the outputting controller **46** transmits the image line that contains the image acquired by superimposing the additional image that is generated by the additional image generation unit **45** on the portion that overlaps the composite region of the additional image of the image data to the image output device **20** (a step **466**).

The outputting controller **46** transmits the image data from the image memory **43** to the image output device **20** only in a period in which a request for transmitting the image data is received after transmitting the cut length at the step **457** in FIG. **18**A and stops transmitting the image data when the request for transmitting ends (a step **467**). The outputting controller **46** releases the image memory **43** (a step **468**). Through the above processing, the outputting routine ends.

Finally, outputting for representing that the copy paper is extended by the outputting controller **46** will be described.

The case where the outputting controller **46** causes the operation panel **35** to display information that represents that the copy paper is extended will now be described.

According to the present exemplary embodiment, whether the effective image is located in the composite region of the additional image when reading the trailing edge of the composite region of the additional image is finished is determined. Whether the copy paper is extended is determined at this time, and accordingly, the outputting controller **46** causes the operation panel **35** to display the information that represents that the copy paper is extended at this time at the earliest.

The outputting controller **46** may cause the operation panel **35** to display a paper extension message such as the "paper is extended such that an annotation and a document image do not overlap". When copying is finished, the outputting controller **46** may change the display on the operation panel **35** into a copy finish message such as "copying is finished". In the case where a period in which the paper extension message is displayed is short, the outputting controller **46** may cause the operation panel **35** to display the paper extension message for a predetermined period, and the copy finish message may be subsequently displayed.

The case where the outputting controller **46** records the fact that the copy paper is extended as a process history in the HDD **34** will now be described.

In the case where the copy paper is extended, the outputting controller **46** may record information that represents this as the process history by using any one of methods described below.

In a first method, an output paper size in the process history is not fixed but is expressed by using the width and the length of the paper.

In a second method, an item for recording whether the additional image is outputted is added to the process history.

FIG. **19** illustrates an example of a process history **70** in this case. As for the process history **70**, for example, items **71** and **72** correspond to the width and the length of the paper in the first method. An item **73** corresponds to whether the additional image is outputted in the second method. In the case where the copy paper is extended, for example, "present (extended)" may be recorded in the item **73**.

Processor

In the embodiments above, the term "processor" refers to hardware in a broad sense. Examples of the processor include general processors (e.g., CPU: Central Processing Unit) and dedicated processors (e.g., GPU: Graphics Processing Unit, ASIC: Application Specific Integrated Circuit, FPGA: Field Programmable Gate Array, and programmable logic device).

In the embodiments above, the term "processor" is broad enough to encompass one processor or plural processors in collaboration which are located physically apart from each other but may work cooperatively. The order of operations of the processor is not limited to one described in the embodiments above, and may be changed.

Program

Processing that is performed by the image processing apparatus **30** according to the present exemplary embodiment is prepared, for example, as a program such as application software.

In this case, a program for carrying out the present exemplary embodiment causes a computer to perform a function of acquiring the read image of the document that is read by the document reading apparatus and a function of controlling the image output device such that the read image and the additional image are outputted to the medium with the significance portion and the additional image prevented from overlapping, and the length of the medium in the sub scanning direction is increased in the case where the significance portion of the read image and the specified region of the read image to which the additional image is decided to be added overlap.

The program for carrying out the present exemplary embodiment may be provided by using a communication unit or may be provided as a program that is stored in a recording medium such as a CD-ROM.

The foregoing description of the exemplary embodiments of the present disclosure has been provided for the purposes of illustration and description. It is not intended to be exhaustive or to limit the disclosure to the precise forms disclosed. Obviously, many modifications and variations will be apparent to practitioners skilled in the art. The embodiments were chosen and described in order to best explain the principles of the disclosure and its practical applications, thereby enabling others skilled in the art to understand the disclosure for various embodiments and with the various modifications as are suited to the particular use contemplated. It is intended that the scope of the disclosure be defined by the following claims and their equivalents.

What is claimed is:

1. An image processing apparatus comprising:

a processor configured to:

acquire a read image of a document that is read by a document reading apparatus; and

control an image output device such that the read image and an additional image are outputted to a medium with a significance portion and the additional image prevented from overlapping, and a length of the medium in a sub scanning direction is increased in a case where the significance portion of the read image and a specified region of the read image to which the additional image is decided to be added overlap.

2. The image processing apparatus according to claim **1**, wherein the processor is configured to control the image output device such that the length of the medium in the sub scanning direction is increased by a length of the specified region in the sub scanning direction.

3. The image processing apparatus according to claim **2**, wherein the processor is configured to control the image output device such that a portion that overlaps the

specified region of the read image is outputted after the additional image is outputted.

4. The image processing apparatus according to claim **2**, wherein the processor is configured to control the image output device such that the additional image is outputted after a portion that overlaps the specified region of the read image is outputted.

5. The image processing apparatus according to claim **1**, wherein the processor is configured to control the image output device such that the length of the medium in the sub scanning direction is increased by a length of a part of the specified region that overlaps the significance portion in the sub scanning direction.

6. The image processing apparatus according to claim **5**, wherein the processor is configured to control the image output device such that a part of the significance portion that overlaps the specified region is outputted after the additional image is outputted.

7. The image processing apparatus according to claim **5**, wherein the processor is configured to control the image output device such that the additional image is outputted after a part of the significance portion that overlaps the specified region is outputted.

8. The image processing apparatus according to claim **1**, wherein the document reading apparatus reads the document at a first speed,

wherein the image output device outputs the read image to the medium at a second speed higher than the first speed, and

wherein the processor is configured to control the image output device such that the read image starts to be outputted to the medium after the document reading apparatus starts to read the document and after a wait time depending on a position of the specified region in the sub scanning direction has elapsed.

9. The image processing apparatus according to claim **8**, wherein the processor is configured to control the image output device such that the additional image is outputted if the significance portion and the specified region overlap after the document reading apparatus finishes reading the specified region, and a part of the significance portion that overlaps the specified region is subsequently outputted.

10. The image processing apparatus according to claim **8**, wherein the processor is configured to control the image output device such that at least the additional image is outputted if the significance portion and the specified region do not overlap after the document reading apparatus finishes reading the specified region, and a part of the significance portion nearer than the specified region to a trailing edge in the sub scanning direction is subsequently outputted.

11. The image processing apparatus according to claim **8**, wherein the processor is configured to control the image output device such that the read image starts to be outputted to the medium after the document reading apparatus finishes reading and before the wait time has elapsed in a case where the document reading apparatus finishes reading after the document reading apparatus starts to read the document and before the wait time has elapsed.

12. The image processing apparatus according to claim **1**, wherein the processor is configured to output information that represents that the length of the medium in the sub scanning direction is increased.

13. A non-transitory computer readable medium storing a program causing a computer to execute a process comprising:

acquiring a read image of a document that is read by a document reading apparatus; and

controlling an image output device such that the read image and an additional image are outputted to a medium with a significance portion and the additional image prevented from overlapping, and a length of the medium in a sub scanning direction is increased in a case where the significance portion of the read image and a specified region of the read image to which the additional image is decided to be added overlap.

14. A method comprising:

acquiring a read image of a document that is read by a document reading apparatus; and

controlling an image output device such that the read image and an additional image are outputted to a medium with a significance portion and the additional image prevented from overlapping, and a length of the medium in a sub scanning direction is increased in a case where the significance portion of the read image and a specified region of the read image to which the additional image is decided to be added overlap.

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