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Ishido et al.

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(54) **IMAGE FORMING APPARATUS**

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B65H 7/10 (2006.01)
G03G 15/00 (2006.01)

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CPC ***B65H 7/14*** (2013.01); ***B65H 7/10*** (2013.01); ***G03G 15/5062*** (2013.01); ***G03G 15/6567*** (2013.01); *B65H 2301/531* (2013.01); *B65H 2511/521* (2013.01); *B65H 2553/45* (2013.01); *B65H 2601/2611* (2013.01); *G03G 2215/00616* (2013.01)

(58) **Field of Classification Search**
CPC ... B65H 7/06; B65H 7/08; B65H 7/10; B65H 7/14; B65H 2301/531; B65H 2511/521; B65H 2553/45; B65H 2601/2611; G03G 15/5062; G03G 15/6567; G03G 2215/00616
See application file for complete search history.

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(57) **ABSTRACT**

An image forming apparatus is capable of correcting a lateral deviation and/or a skew of a sheet. A pair of conveying rollers convey the sheet to a transfer position of an image. An image sensor reads the sheet on an upstream side of the transfer position in a sheet conveying direction. A control device senses a foreign substance on a reading surface of the image sensor as well as calculate a lateral deviation amount and/or a skew amount of the sheet based on an output signal of the image sensor.

6 Claims, 10 Drawing Sheets

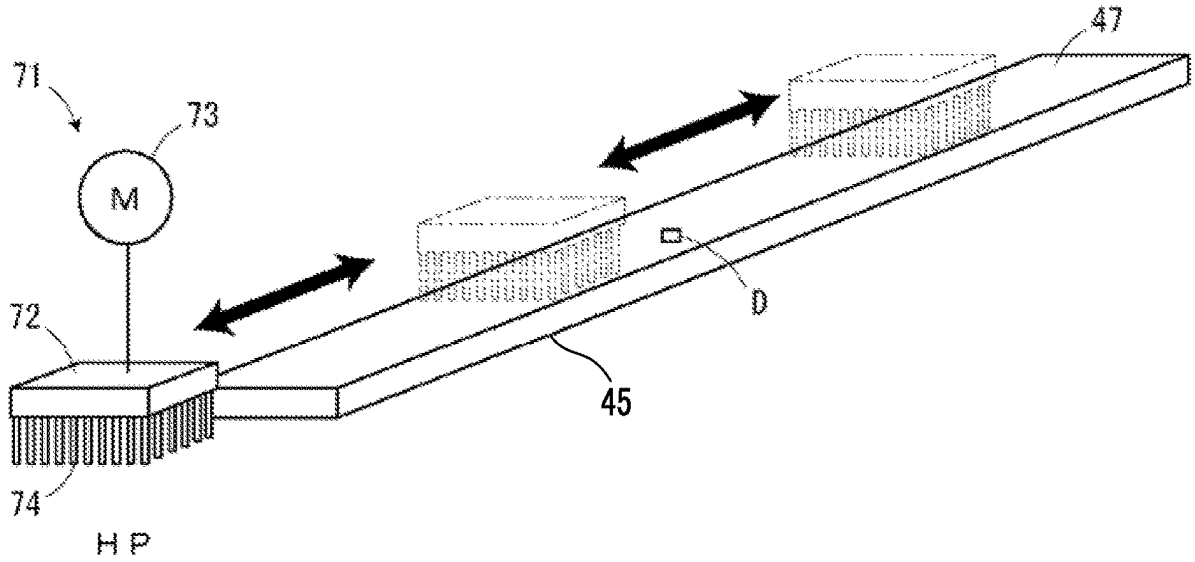


FIG.1

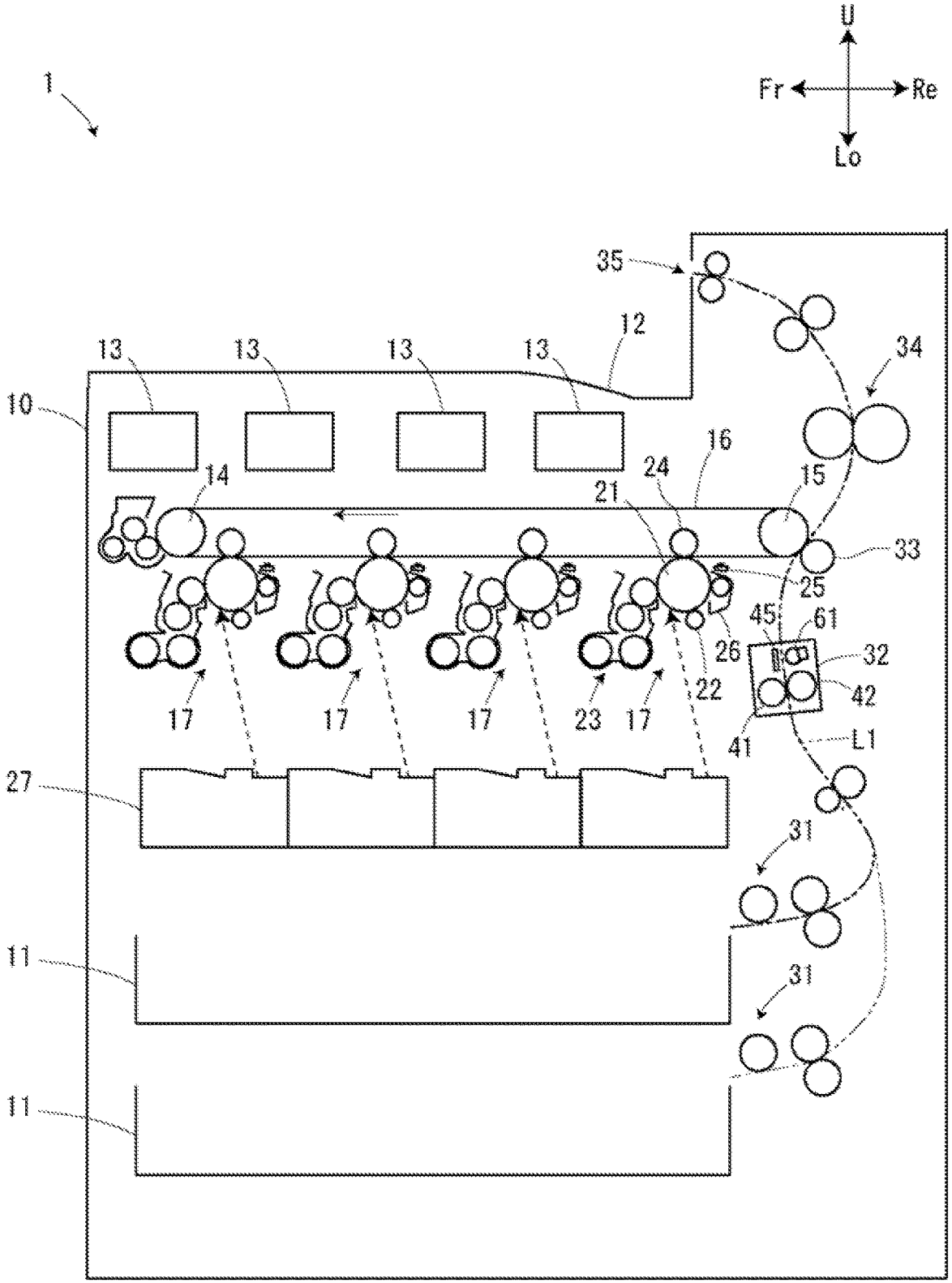

1
U
Fr
Re
Lo
35
12
13
13
13
13
34
10
16
14
24
15
21
33
25
45
61
26
32
42
17
17
17
23
17
22
41
L1
27
31
11
31
11

FIG.2

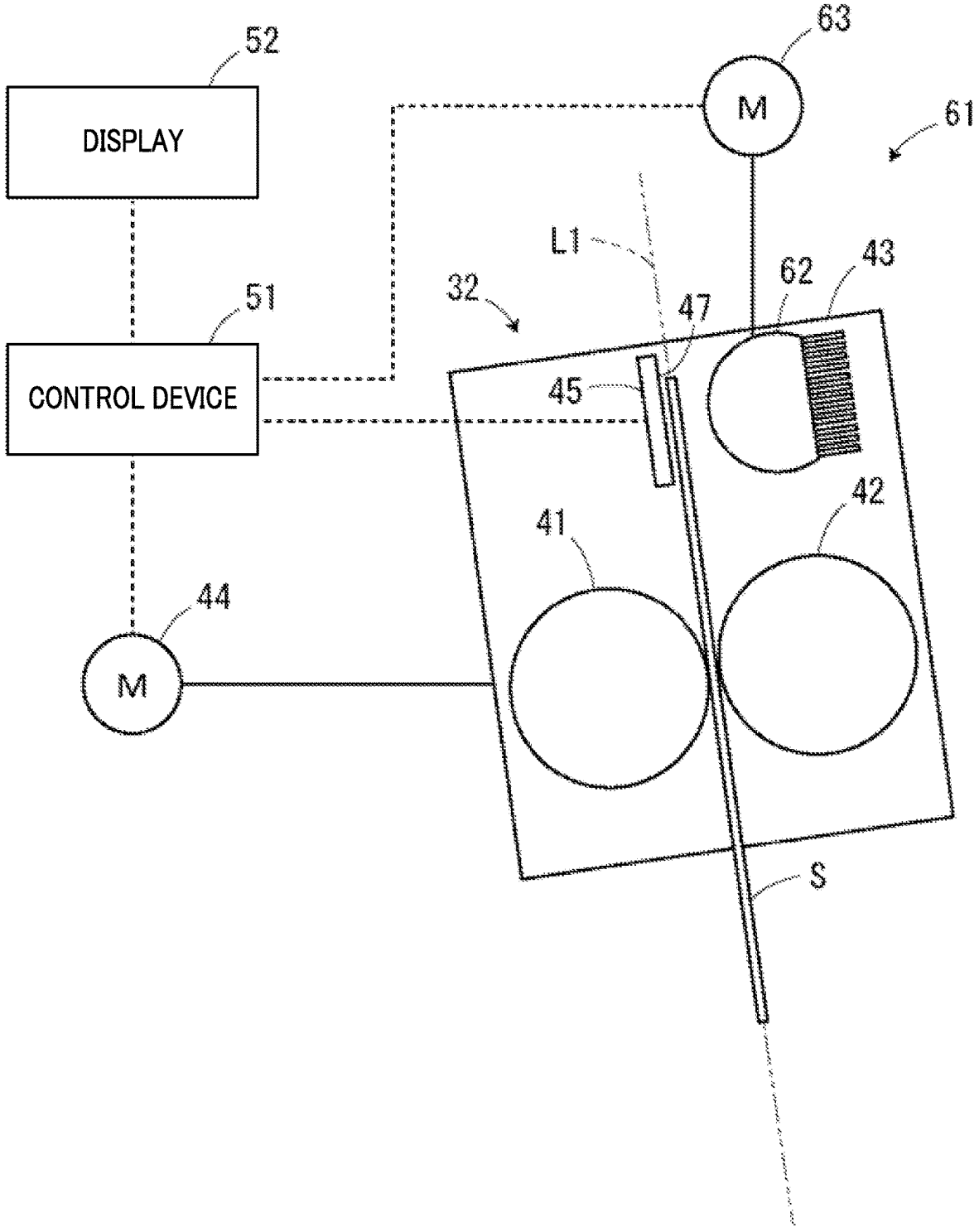


FIG.3

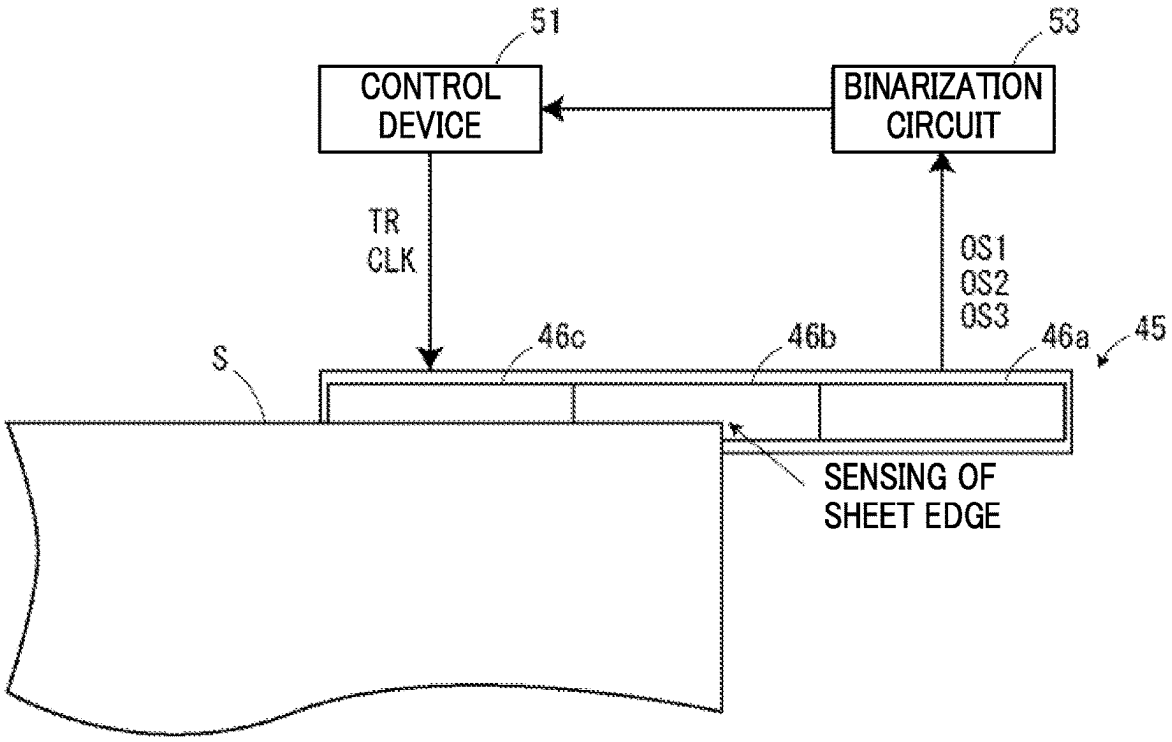
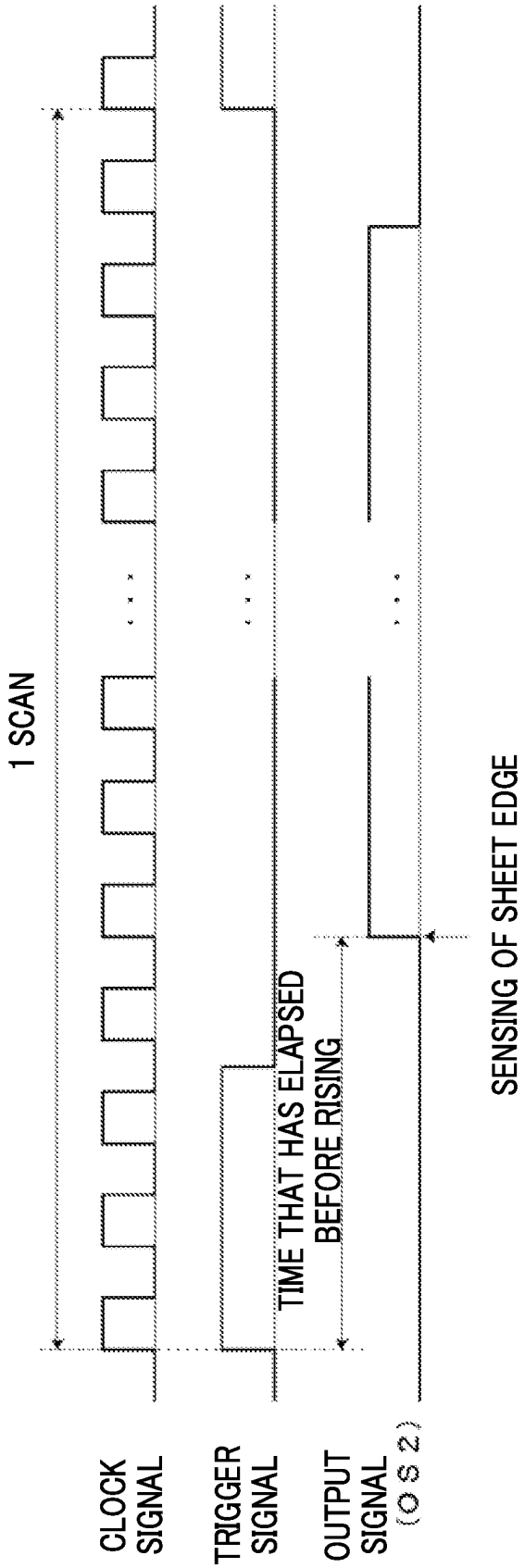

51
CONTROL DEVICE
53
BINARIZATION CIRCUIT
TR
CLK
OS1
OS2
OS3
S
46c
46b
46a
45
SENSING OF SHEET EDGE

FIG.4


1 SCAN
CLOCK SIGNAL
TRIGGER SIGNAL
OUTPUT SIGNAL (OS2)
TIME THAT HAS ELAPSED BEFORE RISING
SENSING OF SHEET EDGE

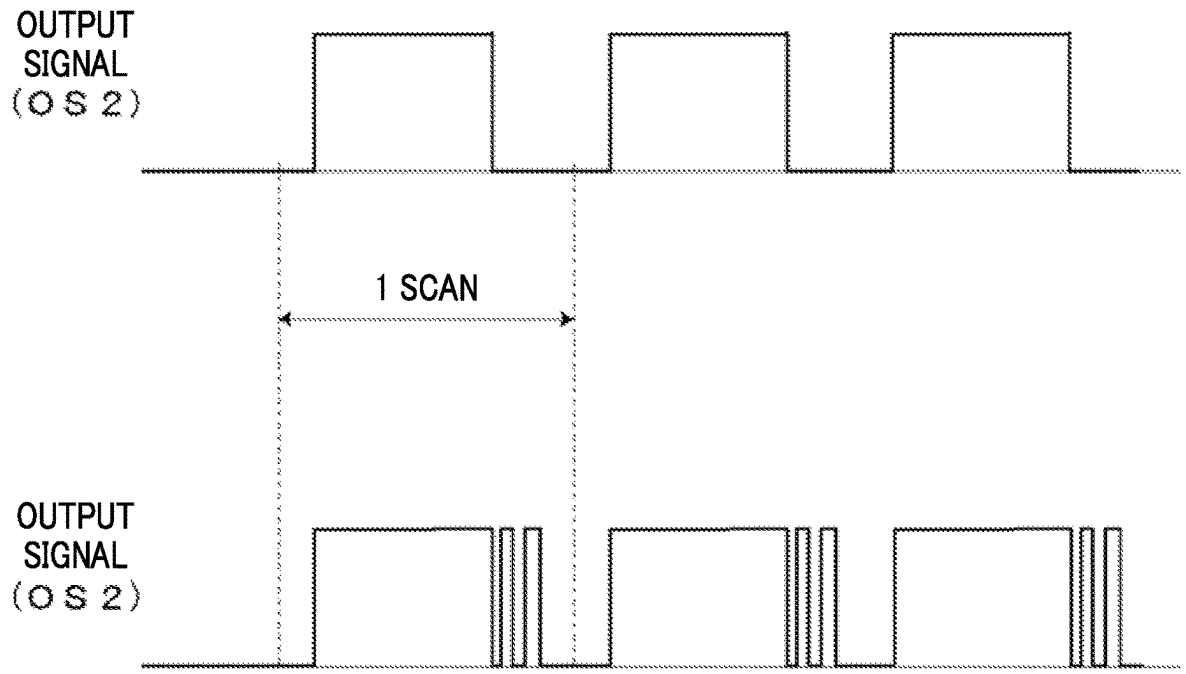

OUTPUT SIGNAL (OS2)
1 SCAN
OUTPUT SIGNAL (OS2)

FIG.5

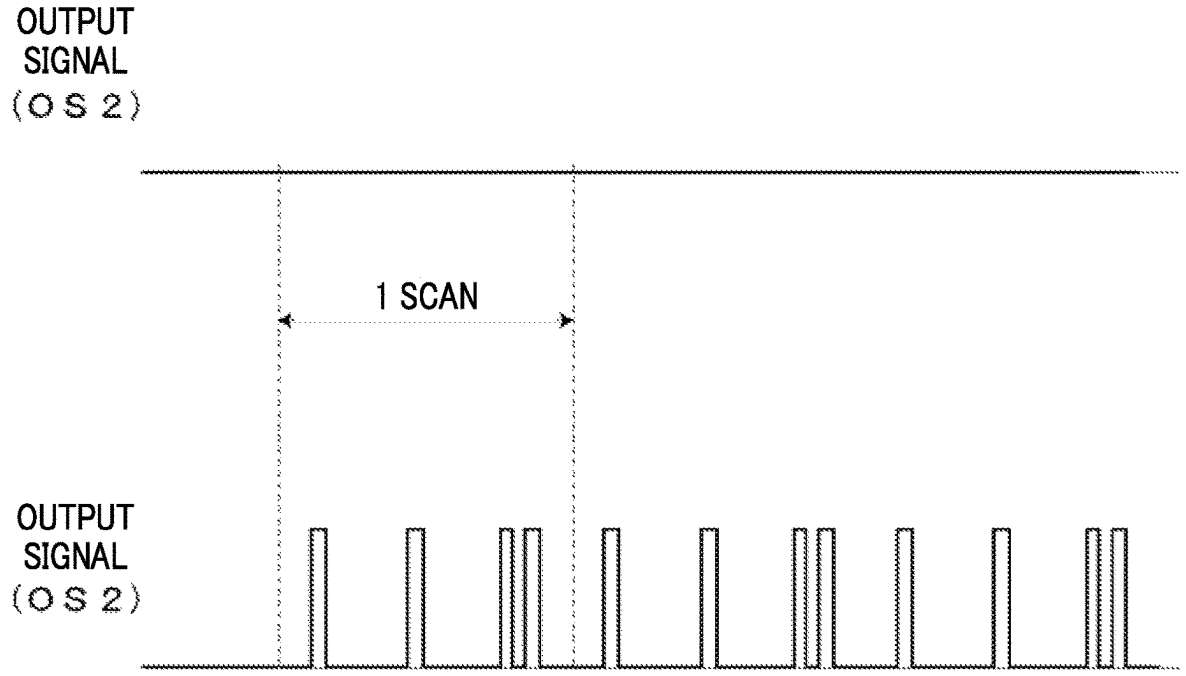

OUTPUT SIGNAL (OS2)
1 SCAN
OUTPUT SIGNAL (OS2)

FIG.6

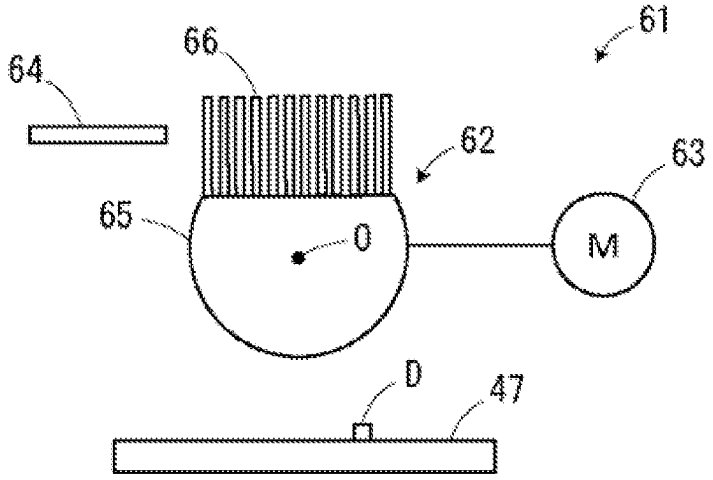


FIG.7A

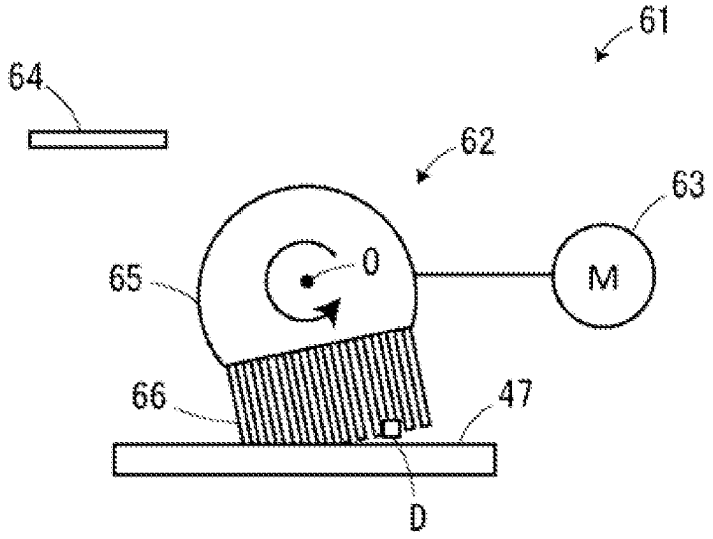


FIG.7B

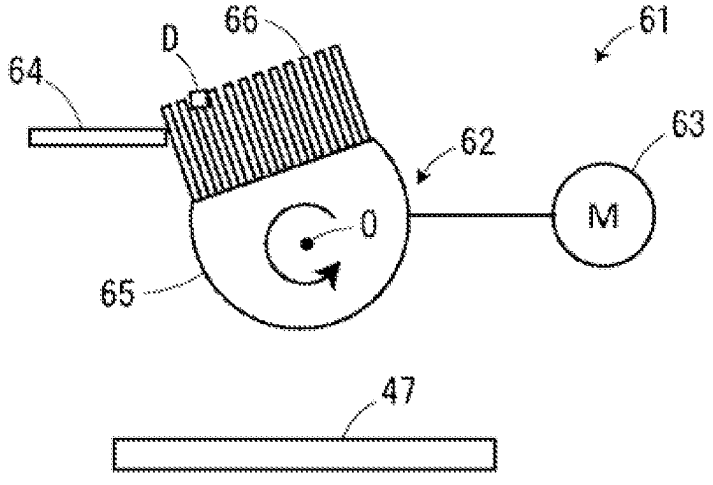


FIG.7C

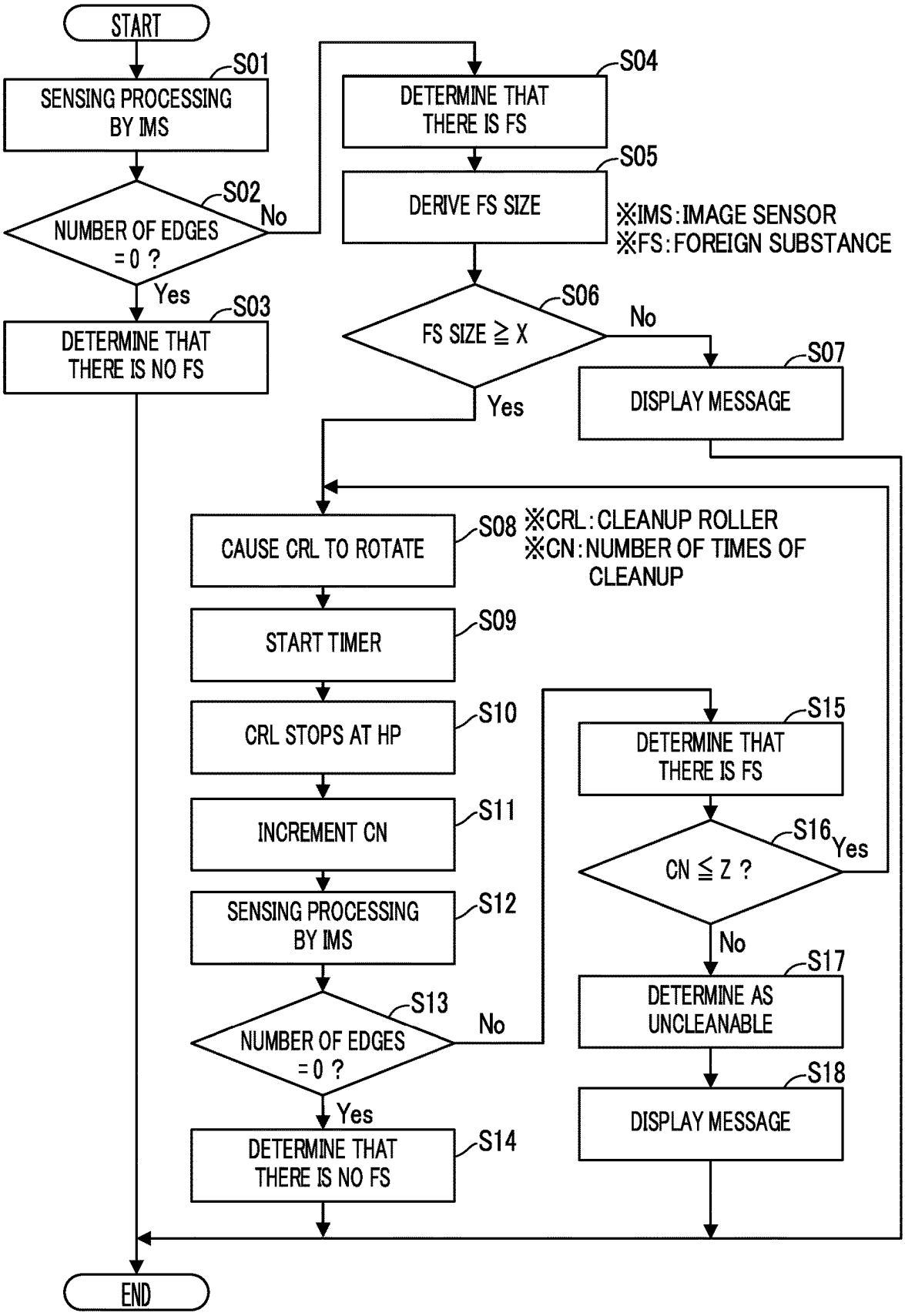
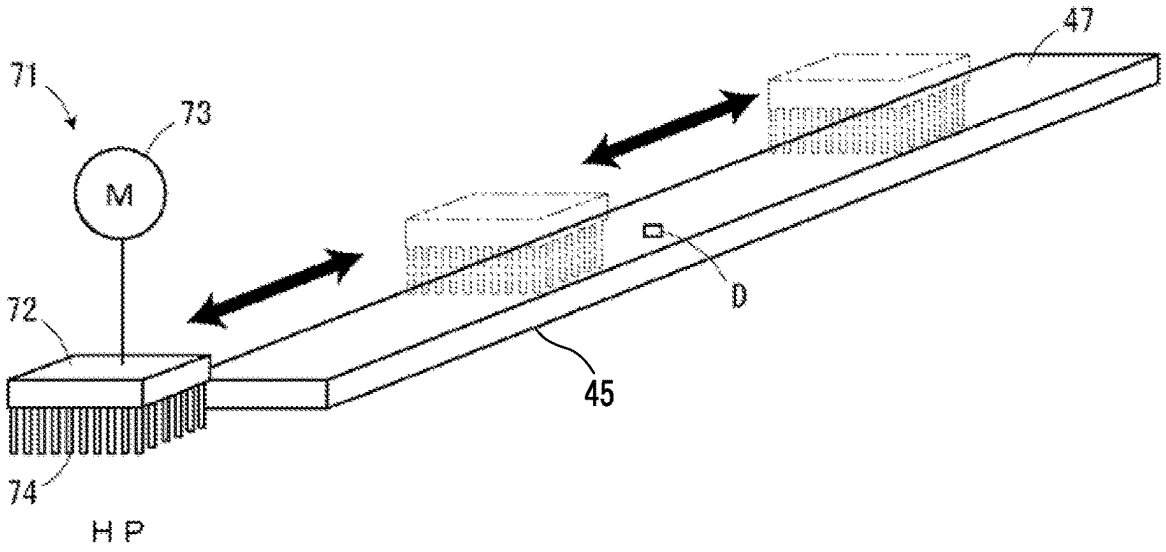

START
S01
SENSING PROCESSING BY IMS
S02
NUMBER OF EDGES = 0 ?
No
Yes
S03
DETERMINE THAT THERE IS NO FS
S04
DETERMINE THAT THERE IS FS
S05
DERIVE FS SIZE
※IMS:IMAGE SENSOR
※FS:FOREIGN SUBSTANCE
S06
FS SIZE ≧ X
No
Yes
S07
DISPLAY MESSAGE
S08
CAUSE CRL TO ROTATE
※CRL:CLEANUP ROLLER
※CN:NUMBER OF TIMES OF CLEANUP
S09
START TIMER
S10
CRL STOPS AT HP
S11
INCREMENT CN
S12
SENSING PROCESSING BY IMS
S13
NUMBER OF EDGES = 0 ?
No
Yes
S14
DETERMINE THAT THERE IS NO FS
S15
DETERMINE THAT THERE IS FS
S16
CN ≦ Z ?
Yes
No
S17
DETERMINE AS UNCLEANABLE
S18
DISPLAY MESSAGE
END

FIG.8

FIG.9



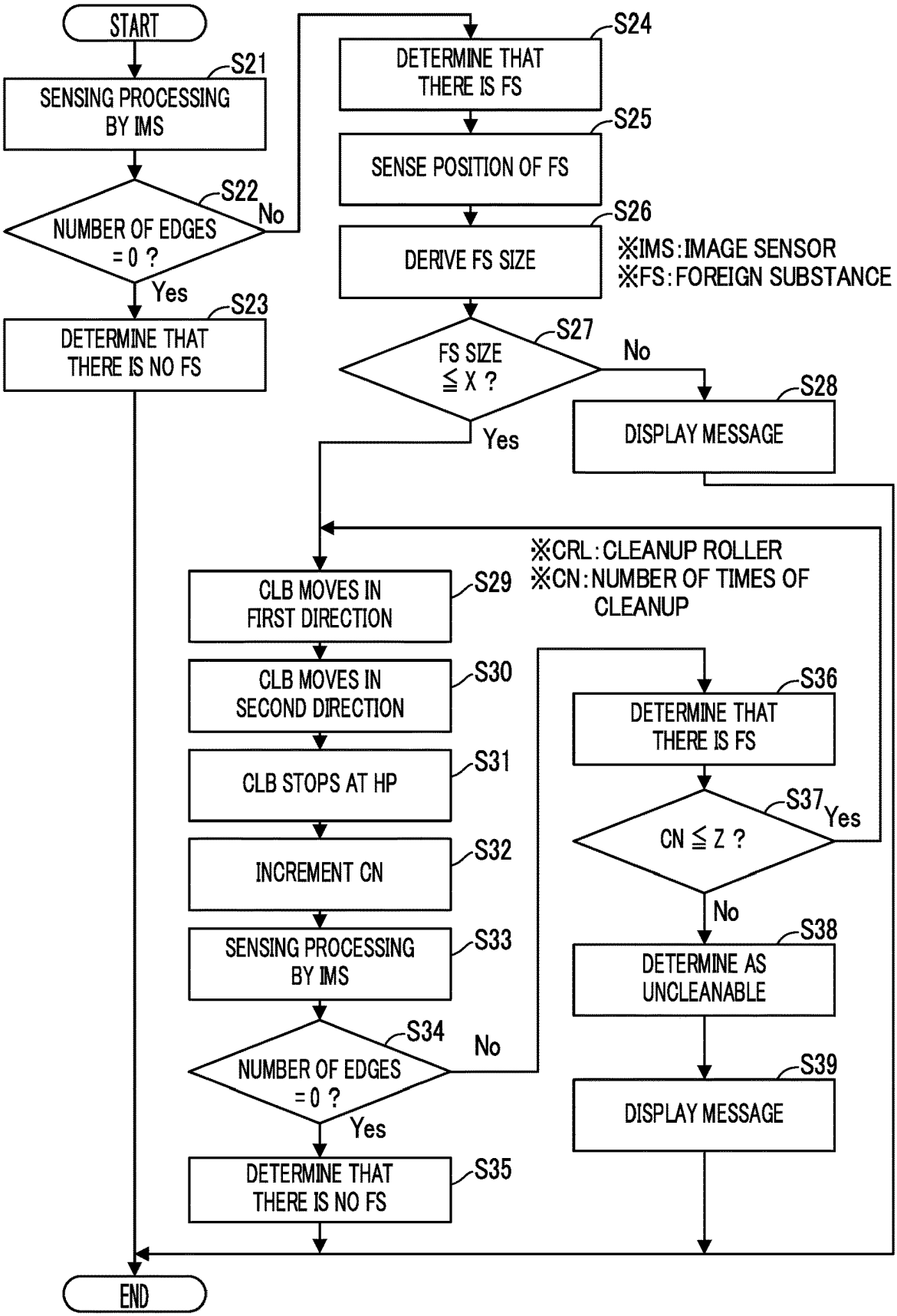

START
S21
SENSING PROCESSING BY IMS
S22
NUMBER OF EDGES = 0 ?
No
Yes
S23
DETERMINE THAT THERE IS NO FS
S24
DETERMINE THAT THERE IS FS
S25
SENSE POSITION OF FS
S26
DERIVE FS SIZE
※IMS:IMAGE SENSOR
※FS:FOREIGN SUBSTANCE
S27
FS SIZE ≦ X ?
No
Yes
S28
DISPLAY MESSAGE
※CRL:CLEANUP ROLLER
※CN:NUMBER OF TIMES OF CLEANUP
S29
CLB MOVES IN FIRST DIRECTION
S30
CLB MOVES IN SECOND DIRECTION
S31
CLB STOPS AT HP
S32
INCREMENT CN
S33
SENSING PROCESSING BY IMS
S34
NUMBER OF EDGES = 0 ?
No
Yes
S35
DETERMINE THAT THERE IS NO FS
S36
DETERMINE THAT THERE IS FS
S37
CN ≦ Z ?
Yes
No
S38
DETERMINE AS UNCLEANABLE
S39
DISPLAY MESSAGE
END

FIG.10

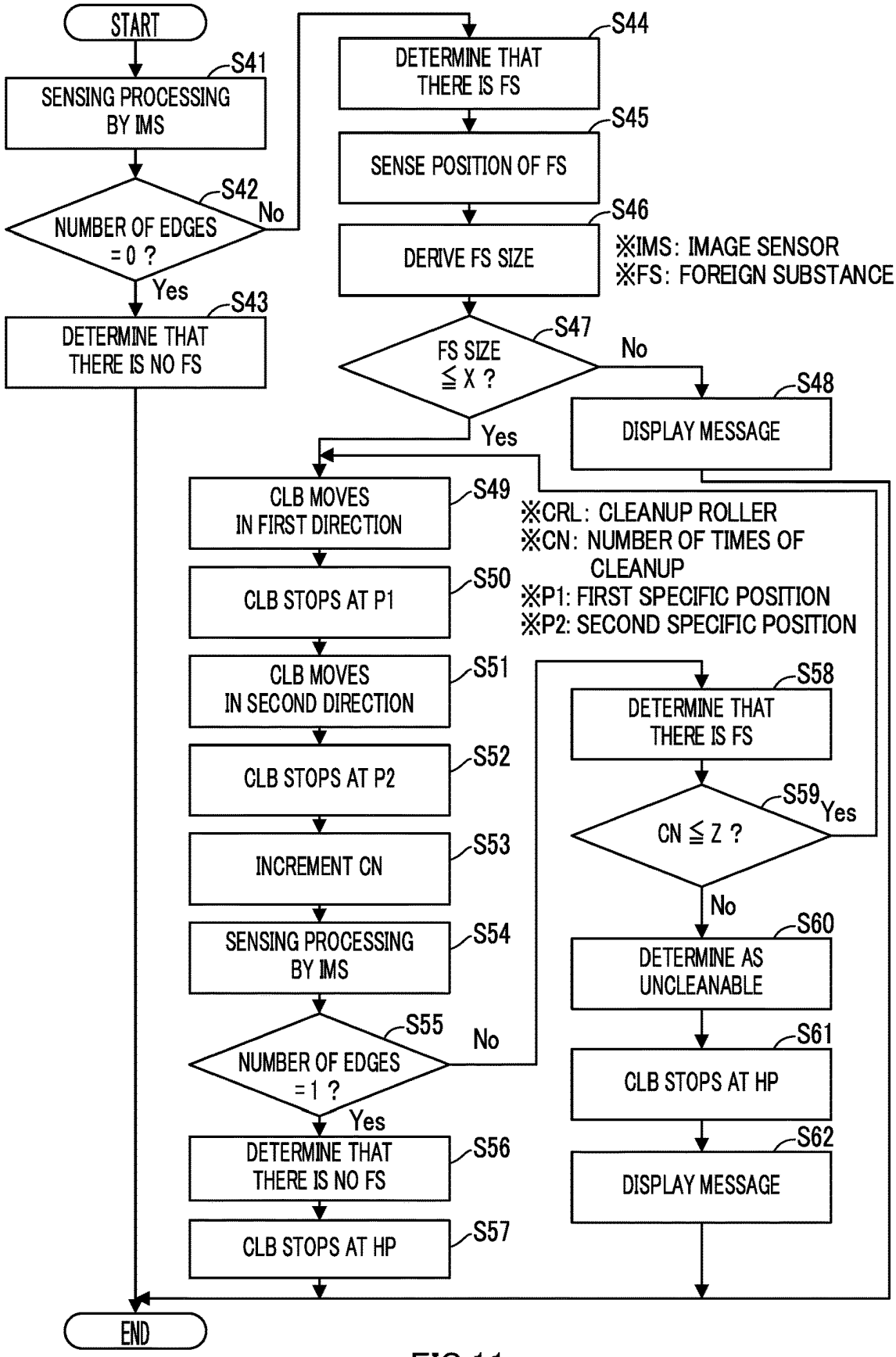

START
S41
SENSING PROCESSING BY IMS
S42
NUMBER OF EDGES = 0 ?
No
Yes
S43
DETERMINE THAT THERE IS NO FS
END
S44
DETERMINE THAT THERE IS FS
S45
SENSE POSITION OF FS
S46
DERIVE FS SIZE
※IMS: IMAGE SENSOR
※FS: FOREIGN SUBSTANCE
S47
FS SIZE ≦ X ?
No
Yes
S48
DISPLAY MESSAGE
S49
CLB MOVES IN FIRST DIRECTION
※CRL: CLEANUP ROLLER
※CN: NUMBER OF TIMES OF CLEANUP
※P1: FIRST SPECIFIC POSITION
※P2: SECOND SPECIFIC POSITION
S50
CLB STOPS AT P1
S51
CLB MOVES IN SECOND DIRECTION
S52
CLB STOPS AT P2
S53
INCREMENT CN
S54
SENSING PROCESSING BY IMS
S55
NUMBER OF EDGES = 1 ?
No
Yes
S56
DETERMINE THAT THERE IS NO FS
S57
CLB STOPS AT HP
S58
DETERMINE THAT THERE IS FS
S59
CN ≦ Z ?
Yes
No
S60
DETERMINE AS UNCLEANABLE
S61
CLB STOPS AT HP
S62
DISPLAY MESSAGE

FIG.11

IMAGE FORMING APPARATUS

INCORPORATION BY REFERENCE

This application is based upon and claims the benefit of priority from the corresponding Japanese Patent Application No. 2022-114806 filed on Jul. 19, 2022, the entire contents of which are incorporated herein by reference.

BACKGROUND

The present disclosure relates to an image forming apparatus.

An image forming apparatus is known to include a registration unit arranged in the middle of a sheet conveying path. The registration unit includes a pair of registration rollers arranged so as to sandwich the conveying path. The registration unit further includes an image sensor which senses a skew or a positional deviation of a sheet.

The registration unit is disposed on an upstream side of a transfer position. The registration unit causes the sheet to stand by using the pair of registration rollers, and corrects the skew or positional deviation of the sheet.

In addition, the registration unit feeds the sheet from the pair of registration rollers toward the transfer position in accordance with a timing of an image forming operation.

SUMMARY

An image forming apparatus according to one aspect of the present disclosure is an image forming apparatus capable of correcting a lateral deviation and/or a skew of a sheet. The image forming apparatus includes a pair of conveying rollers, an image sensor, and a control device. The pair of conveying rollers convey the sheet to a transfer position of an image. The image sensor reads the sheet on an upstream side of the transfer position in a sheet conveying direction. The control device processes an output signal of the image sensor. The control device senses a foreign substance on a reading surface of the image sensor as well as calculate a lateral deviation amount and/or a skew amount of the sheet based on the output signal of the image sensor.

In the image forming apparatus, in a case where the output signal obtained during one scan of the image sensor includes a plurality of rising edges or falling edges while the sheet is being conveyed, the control device may sense the foreign substance on the reading surface of the image sensor.

In the image forming apparatus, in a case where the output signal obtained during one scan of the image sensor includes at least one rising edge or falling edge when the sheet is not conveyed, the control device may sense the foreign substance on the reading surface of the image sensor.

The image forming apparatus may further include a cleanup device which cleans the reading surface of the image sensor.

In the image forming apparatus, in a case where the control device senses the foreign substance on the reading surface of the image sensor after the cleanup device has cleaned the reading surface of the image sensor, the cleanup device may re-clean the reading surface of the image sensor.

In the image forming apparatus, the image sensor may include a plurality of light-receiving elements arranged along a main scanning direction, and the cleanup device may include a cleanup roller which rotates about a rotation shaft arranged along the main scanning direction. In this case, the cleanup device causes the cleanup roller to rotate, to clean the reading surface of the image sensor.

In the image forming apparatus, the image sensor may include a plurality of light-receiving elements arranged along a main scanning direction, and the cleanup device may include a cleanup body movable in the main scanning direction. In this case, the cleanup device causes the cleanup body to reciprocate, to clean the reading surface of the image sensor.

In the image forming apparatus, the control device may sense a position of the foreign substance on the reading surface of the image sensor based on the output signal of the image sensor. In this case, the cleanup device causes the cleanup body to reciprocate in a partial region including the position of the foreign substance on the reading surface of the image sensor.

The image forming apparatus may further include a notification device which notifies information related to an image forming operation. In this case, the control device may derive a size of the foreign substance based on the output signal of the image sensor. Further, the control device may notify, in a case where the size of the foreign substance exceeds a predetermined size, information that prompts to check the reading surface of the image sensor via the notification device.

This Summary is provided to introduce a selection of concepts in a simplified form that are further described below in the Detailed Description with reference where appropriate to the accompanying drawings. This Summary is not intended to identify key features or essential features of the claimed subject matter, nor is it intended to be used to limit the scope of the claimed subject matter. Furthermore, the claimed subject matter is not limited to implementations that solve any or all disadvantages noted in any part of this disclosure.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. **1** is a schematic diagram of a printer according to a first embodiment;

FIG. **2** is a schematic diagram showing a configuration of equipment related to cleanup processing in the printer according to the first embodiment;

FIG. **3** is a schematic diagram showing a configuration of equipment related to control of an image sensor in the printer according to the first embodiment;

FIG. **4** is an example of a time chart of various signals obtained when a sheet edge is sensed in the printer according to the first embodiment;

FIG. **5** is an example of a time chart of an output signal of the image sensor obtained when a sheet is conveyed in the printer according to the first embodiment;

FIG. **6** is an example of a time chart of the output signal of the image sensor obtained when a sheet is not conveyed in the printer according to the first embodiment;

FIG. **7**A is a diagram showing a first state of a cleanup device in the printer according to the first embodiment;

FIG. **7**B is a diagram showing a second state of the cleanup device in the printer according to the first embodiment;

FIG. **7**C is a diagram showing a third state of the cleanup device in the printer according to the first embodiment;

FIG. **8** is a flowchart showing an example of procedures of the cleanup processing in the printer according to the first embodiment;

FIG. **9** is a perspective view of a cleanup device in a printer according to a second embodiment;

FIG. **10** is a flowchart showing an example of procedures of the cleanup processing in the printer according to the second embodiment; and

FIG. **11** is a flowchart showing an example of procedures of priority cleanup processing in the printer according to the second embodiment.

DETAILED DESCRIPTION

First Embodiment

Hereinafter, the present embodiment will be described with reference to the drawings. It is noted that in descriptions below, a printer **1** is an example of an image forming apparatus.

FIG. **1** is a schematic diagram of a printer according to the present embodiment. It is noted that in FIG. **1**, arrows Fr, Re, U, and Lo respectively indicate a front side, rear side, upper side, and lower side of the printer.

As shown in FIG. **1**, the printer **1** includes a box-like housing **10** that houses various types of equipment. A plurality of sheet feed cassettes **11** in each of which a stack of sheets are set are housed at a lower portion of the housing **10**. A sheet discharge tray **12** is provided at an upper portion of the housing **10**. A sheet formed with an image is stacked on the sheet discharge tray **12**.

A plurality of toner containers **13** are detachably attached at a portion below the sheet discharge tray **12** in the housing **10**. The plurality of toner containers **13** respectively store different colors of toner.

For example, the colors of toner are four colors including magenta, cyan, yellow, and black. An intermediate transfer belt **16** is bridged across a pair of rollers **14** and **15** below the plurality of toner containers **13**.

On a lower side of the intermediate transfer belt **16**, a plurality of image forming units **17** are arranged next to one another along a moving direction of a lower surface portion of the intermediate transfer belt **16**. Each of the image forming units **17** includes a photoconductor drum **21** that is rotatably supported while being in contact with the intermediate transfer belt **16**.

Each of the image forming units **17** includes a charging device **22**, a developing device **23**, a primary transfer roller **24**, a neutralization portion **25**, and a cleaning device **26** that are arranged in a periphery of the photoconductor drum **21**. A waste toner box (not shown) is connected to the cleaning device **26**.

An exposure unit **27** is arranged below the plurality of image forming units **17**. The exposure unit **27** is a laser scanning unit (LSU).

A conveying path L**1** is formed at a side portion inside the housing **10**. The conveying path L**1** is a path on which a sheet is conveyed by a plurality of rollers from the sheet feed cassettes **11** to the sheet discharge tray **12**.

Sheet feed portions **31** are provided on an upstream side of the conveying path L**1** in a sheet conveying direction. In the example shown in FIG. **1**, the sheet feed portions **31** are provided on a lower side of the conveying path L**1**.

A registration unit **32** is provided at a position on a downstream side of the sheet feed portions **31** on the conveying path L**1** in the sheet conveying direction. A secondary transfer roller **33** is provided at a position on a downstream side of the registration unit **32** on the conveying path L**1** in the sheet conveying direction. The secondary transfer roller **33** is in contact with a side end of the intermediate transfer belt **16**.

A fixing device **34** is provided at a position on a downstream side of the secondary transfer roller **33** on the conveying path L**1** in the sheet conveying direction. Further, a sheet discharge port **35** is provided at an end of the conveying path L**1** on a downstream end side in the sheet conveying direction.

In image forming processing by the printer **1**, the charging device **22** charges a surface of the photoconductor drum **21**. Further, the exposure unit **27** scans laser light to thus form an electrostatic latent image on the surface of the photoconductor drum **21**.

Next, the developing device **23** supplies toner to the surface of the photoconductor drum **21**. Thus, the toner adheres onto the electrostatic latent image, and a toner image is thus formed on the surface of the photoconductor drum **21**.

Furthermore, the toner image is primarily transferred onto a surface of the intermediate transfer belt **16** from the surface of the photoconductor drum **21**. By the toner images of the respective colors being primarily transferred onto the intermediate transfer belt **16** in the respective image forming units **17**, a full-color toner image is formed on the surface of the intermediate transfer belt **16**.

Charges and waste toner remaining on the photoconductor drum **21** are removed by the neutralization portion **25** and the cleaning device **26**.

Meanwhile, the sheet feed portion **31** feeds a sheet from the sheet feed cassette **11**, and the registration unit **32** feeds the sheet toward the secondary transfer roller **33**. Further, the secondary transfer roller **33** secondarily transfers the full-color toner image onto a surface of the sheet from the surface of the intermediate transfer belt **16**. The sheet onto which the toner image has been transferred is conveyed toward the fixing device **34** on the downstream side by the secondary transfer roller **33**.

The fixing device **34** fixes the toner image onto the sheet. The sheet onto which the toner image has been fixed is discharged onto the sheet discharge tray **12** from the sheet discharge port **35**. In this manner, the sheet onto which the toner image has been transferred is passed through the fixing device **34** so that an image is formed on the surface of the sheet.

Incidentally, the registration unit **32** includes a pair of registration rollers **41** and **42**, an image sensor **45**, and a cleanup device **61**. The image sensor **45** senses a sheet edge for sensing a lateral deviation of a sheet. The pair of registration rollers **41** and **42** are a pair of conveying rollers.

The cleanup device **61** cleans a reading surface **47** of the image sensor **45** (see FIG. **2**). The reading surface **47** is a glass surface. A foreign substance adhered onto the reading surface **47** of the image sensor **45** becomes a cause of false sensing of a sheet edge.

In the present embodiment, the printer **1** uses a reading function of the image sensor **45** to sense a foreign substance on the reading surface **47** of the image sensor **45**. In addition, the printer **1** removes the foreign substance from the reading surface **47** of the image sensor **45** by the cleanup device **61**.

Cleanup processing for cleaning the image sensor **45**, that is executed in the printer **1** will be described with reference to FIG. **2** to FIG. **7**.

FIG. **2** is a schematic diagram showing a configuration of equipment related to the cleanup processing. FIG. **3** is a schematic diagram showing a configuration of equipment related to control of the image sensor **45**. FIG. **4** is an example of a time chart of various signals obtained when a sheet edge is sensed. FIG. **5** is an example of a time chart of an output signal of the image sensor **45** obtained when a

sheet is being conveyed. FIG. **6** is an example of a time chart of the output signal of the image sensor **45** obtained when a sheet is not conveyed. FIG. **7**A to FIG. **7**C are transition diagrams of a cleaning operation of the cleanup device **61**.

As shown in FIG. **2**, the registration unit **32** includes the pair of registration rollers **41** and **42** arranged so as to sandwich the conveying path L**1** of a sheet S. By a tip end of the sheet S coming into contact with the pair of registration rollers **41** and **42**, a skew of the sheet S is corrected.

By a movement of a unit case **43** in a lateral direction, the pair of registration rollers **41** and **42** supported by the unit case **43** correct a lateral deviation of the sheet S.

The pair of registration rollers **41** and **42** correct a skew of the sheet S before the sheet S reaches a secondary transfer position. The secondary transfer position is a position of the secondary transfer roller **33** (see FIG. **1**). In addition, the pair of registration rollers **41** and **42** convey the sheet S to the secondary transfer position while correcting the lateral deviation of the sheet S.

The cleanup device **61** includes a cleanup roller **62**. The image sensor **45** and the cleanup roller **62** are arranged so as to sandwich the conveying path L**1** at positions on a downstream side of the pair of registration rollers **41** and **42** and also on an upstream side of the secondary transfer position.

For example, a CIS (Contact Image Sensor) is used as the image sensor **45**. A back surface of the cleanup roller **62** is black. The cleanup roller **62** is held such that the back surface thereof faces the image sensor **45** when the cleanup processing is not carried out.

When the sheet S is not conveyed, sensing light emitted from the image sensor **45** is absorbed by the back surface of the cleanup roller **62** and black surfaces around the cleanup roller **62**.

When the sheet S passes between the image sensor **45** and the cleanup roller **62**, the sensing light is reflected by a white surface of the sheet S, and the image sensor **45** receives the reflected light to read a state of the sheet S.

A foreign substance D such as paper dust and a smudge (see FIG. **7**) may adhere onto the reading surface **47** of the image sensor **45**.

The sensing light emitted from the image sensor **45** is absorbed by the black back surface of the cleanup roller **62** and the like in regions excluding a position at which the foreign substance D has adhered on the reading surface **47**. On the other hand, the sensing light is reflected at the position at which the foreign substance D has adhered on the reading surface **47**.

When the sheet S is being conveyed and when the sheet S is not conveyed, the image sensor **45** receives the reflected light that has been reflected by the foreign substance D. Thus, the image sensor **45** outputs a signal of a level corresponding to an amount of the reflected light. The output signal of the image sensor **45** is used for sensing the foreign substance D on the reading surface **47** of the image sensor **45**.

The output signal of the image sensor **45** is processed by a control device **51**. The control device **51** senses coordinates of a sheet edge based on the output signal of the image sensor **45**. The control device **51** further calculates a difference between the sensed coordinates of the sheet edge and reference coordinates of the sheet edge, to thus calculate a lateral deviation amount of the sheet S.

Coordinates that have been sensed in a state where there is no lateral deviation of the sheet S are preset as the reference coordinates of the sheet edge. Moreover, the control device **51** senses a foreign substance D on the reading surface **47** of the image sensor **45** based on a signal waveform of the output signal of the image sensor **45**. Furthermore, when the foreign substance D is sensed, the control device **51** causes the cleanup device **61** to execute the cleanup processing. The cleanup processing is processing of cleaning the reading surface **47** of the image sensor **45**.

The control device **51** is connected to a registration motor **44** that causes the unit case **43** to move in the lateral direction. When the lateral deviation amount of the sheet S is calculated, the control device **51** causes the registration motor **44** to execute an operation of moving the unit case **43** in a direction of correcting the lateral deviation.

Further, the control device **51** is also connected to a cleanup motor **63** that causes the cleanup roller **62** to rotate. When the foreign substance D on the reading surface **47** is sensed, the control device **51** operates the cleanup motor **63** to cause the cleanup roller **62** to rotate. Thus, the foreign substance D on the reading surface **47** is removed. By removing the foreign substance D on the reading surface **47**, false sensing of the lateral deviation amount of the sheet S is prevented from occurring.

The control device **51** is also connected to a display **52** that displays and notifies various types of information related to the image forming operation of the sheet S. The display **52** is an example of a notification device which notifies information. When an uncleanable foreign substance D is on the reading surface **47** of the image sensor **45**, the control device **51** outputs a notification signal to the display **52**.

Based on the notification signal, the display **52** displays a message expressing information that prompts to check the reading surface **47**. A worker checks the reading surface **47** of the image sensor **45** according to the message, and removes the foreign substance D that cannot be removed by the cleanup device **61**.

It is noted that the control device **51** may be realized by software using a processor, or may be realized by hardware such as a logic circuit formed in an integrated circuit or the like.

When the processor is used, the processor reads programs stored in a memory and executes the programs, to thus execute various types of processing. For example, a CPU (Central Processing Unit) is used as the processor. The memory is constituted by one or a plurality of storage devices selected from a ROM (Read Only Memory), a RAM (Random Access Memory), and the like according to the intended use.

As shown in FIG. **3**, the image sensor **45** is arranged at a position biased with respect to the position of the sheet S in the lateral direction. The sensing surface of the image sensor **45** is sectioned into first to third sensing blocks **46***a* to **46***c*. Each of the first to third sensing blocks **46***a* to **46***c* includes a plurality of photoelectric conversion elements arranged in line in a main scanning direction.

A trigger signal and a clock signal output from the control device **51** are input to the image sensor **45**. The first to third sensing blocks **46***a* to **46***c* start reading a state of the sheet S in sync with the trigger signal. In addition, the first to third sensing blocks **46***a* to **46***c* each output a pixel signal per element to a binarization circuit **53** in sync with the clock signal.

A light source of the image sensor **45** emits the sensing light, and the sensing light is reflected by the sheet S or the foreign substance D. The plurality of photoelectric conversion elements of the first to third sensing blocks **46***a* to **46***c* receive the reflected light.

The plurality of photoelectric conversion elements of the first to third sensing blocks **46***a* to **46***c* each output an analog sensing signal to the binarization circuit **53**. The binarization circuit **53** converts the analog sensing signal into a digital signal, and outputs the digital signal to the control device **51** as the output signal of the image sensor **45**. As described above, the image sensor **45** reads the state of the sheet S and the foreign substance D, and the output signal of the image sensor **45** is output to the control device **51** via the binarization circuit **53**.

As shown in FIG. **4**, an input time interval of the trigger signal is a one-scan period. The output signal of the image sensor **45** is output in sync with the clock signal. The output signal of the sensing block corresponding to a position that the sheet edge passes through out of the first to third sensing blocks **46***a* to **46***c* is used for sensing the lateral deviation of the sheet S.

For example, when a size of the sheet S is an A4 size, a second output signal OS**2** as an output signal of the second sensing block **46***b* is used for sensing the lateral deviation of the sheet S. The control device **51** counts the number of clocks of the clock signal between a rising edge of the trigger signal and a rising edge of the output signal, to thus sense the coordinates of the sheet edge.

In addition, the control device **51** calculates a difference of the sensed coordinates of the sheet edge from the reference coordinates of the sheet edge corresponding to the size of the sheet S, to thus calculate the lateral deviation amount.

As shown in FIG. **5**, when the sheet S is being conveyed, the image sensor **45** outputs a signal corresponding to the reflected light that has been reflected by the sheet S and the foreign substance D.

The time chart on an upper side of FIG. **5** shows an output signal obtained when the sheet S is conveyed in a state where no foreign substance D is adhered onto the reading surface **47** of the image sensor **45**. When no foreign substance D is adhered, the output signal obtained during one scan includes one rising edge or falling edge.

The time chart on a lower side of FIG. **5** shows an output signal obtained when the sheet S is conveyed in a state where the foreign substance D is adhered onto the reading surface **47** of the image sensor **45**. When the foreign substance D is adhered, the output signal obtained during one scan includes a plurality of rising edges or a plurality falling edges.

As shown in FIG. **6**, when the sheet S is not conveyed, the image sensor **45** outputs a signal corresponding to the reflected light that has been reflected by the foreign substance D. For example, the sheet S is not conveyed when power is turned on, when the printer **1** resumes from a sleep state, when the printer **1** is in a standby state, right after a cover of the printer **1** is opened/closed, and the like.

The time chart on an upper side of FIG. **6** shows an output signal obtained when the sheet S is not conveyed in a state where no foreign substance D is adhered onto the reading surface **47** of the image sensor **45**. When no foreign substance D is adhered, the output signal obtained during one scan does not include a rising edge nor a falling edge.

The time chart on a lower side of FIG. **6** shows an output signal obtained when the sheet S is not conveyed in a state where the foreign substance D is adhered onto the reading surface **47** of the image sensor **45**. When the foreign substance D is adhered, the output signal obtained during one scan includes at least one rising edge or falling edge.

When the output signal obtained during one scan includes one rising edge or falling edge while the sheet S is being conveyed, the control device **51** does not sense a foreign substance D on the reading surface **47**.

When the output signal obtained during one scan includes a plurality of rising edges or falling edges while the sheet S is being conveyed, the control device **51** senses a foreign substance D on the reading surface **47**.

When the output signal obtained during one scan does not include a rising edge nor a falling edge while the sheet S is being conveyed, the control device **51** senses a foreign substance D on the reading surface **47**.

When the output signal obtained during one scan includes at least one rising edge or falling edge while the sheet S is being conveyed, the control device **51** senses a foreign substance D on the reading surface **47**.

Furthermore, the control device **51** derives a foreign substance size based on the number of clocks between the rising edge and the falling edge in the output signal.

When the foreign substance D is sensed while the sheet S is being conveyed, the control device **51** causes the cleanup device **61** to execute the cleanup processing after a printing job is ended or at other timings at which the printing job stops. The timing at which the printing job stops is a timing at which calibration or the like is executed, for example.

When the foreign substance D is sensed while the sheet S is being conveyed, the control device **51** causes the cleanup device **61** to execute the cleanup processing before the next printing job is executed.

However, when the derived foreign substance size is equal to or larger than a predetermined size, the control device **51** does not cause the cleanup device **61** to execute the cleanup processing. In this case, the control device **51** causes the display **52** to display a message that prompts a user to check the reading surface **47** of the image sensor **45**. This situation is a situation where it is determined by the control device **51** that the sensed foreign substance D is an uncleanable foreign substance D.

As shown in FIG. **7**A, the cleanup device **61** includes the cleanup roller **62**, the cleanup motor **63**, and a cleanup blade **64**. A rotation shaft O of the cleanup roller **62** is arranged along the main scanning direction. The cleanup motor **63** causes the cleanup roller **62** to rotate. The cleanup blade **64** is a long blade arranged along the cleanup roller **62**.

A roller shaft **65** of the cleanup roller **62** has a D-cut shape in which a part of a circular outer circumferential surface is cut out in a planar shape. A cleanup brush **66** having a plurality of bristles is planted at a planar portion of the roller shaft **65**.

Power from the cleanup motor **63** is transmitted to the cleanup roller **62**. It is noted that a configuration in which the registration motor **44** usually rotates in a forward direction, and when the registration motor **44** rotates in an opposite direction, power of the registration motor **44** is transmitted to the cleanup roller **62**, is also possible. A tip end of the cleanup blade **64** is arranged on a movement locus of a tip end of the cleanup brush **66**.

When the cleanup roller **62** is at a home position, the cleanup brush **66** faces a side opposite to the reading surface **47** of the image sensor **45**. Thus, the black back surface of the cleanup roller **62** faces the reading surface **47** of the image sensor **45**.

When the cleanup roller **62** is at the home position, a situation where the sheet S being conveyed gets caught in the cleanup brush **66** and a situation where the cleanup brush **66** is sensed by the image sensor **45** are avoided.

It is noted that an absorption sheet may be attached onto the back surface of the cleanup roller **62**. The absorption sheet prevents the sensing light emitted from the image

sensor **45** from being reflected. Similarly, black paint may be applied onto the back surface of the cleanup roller **62**.

As shown in FIG. **7**B, when the foreign substance D on the reading surface **47** is sensed based on the output signal of the image sensor **45**, the cleanup motor **63** operates, and power of the cleanup motor **63** is transmitted to the cleanup roller **62**. The cleanup roller **62** rotates counterclockwise about the rotation shaft O from the home position.

When the cleanup roller **62** rotates approximately 180 degrees from the home position, the tip end of the cleanup brush **66** comes into sliding contact with the reading surface **47** of the image sensor **45**. The foreign substance D is removed from the reading surface **47** by the tip end of the cleanup brush **66**. Further, in a state where the foreign substance D is adhered onto the tip end of the cleanup brush **66**, the cleanup roller **62** rotates toward the home position.

As shown in FIG. **7**C, when the cleanup roller **62** rotates beyond the home position, the tip end of the cleanup brush **66** comes into contact with the cleanup blade **64**. The cleanup blade **64** is arranged on a downstream side of the home position in a rotation direction of the cleanup brush **66**.

By the tip end of the cleanup brush **66** passing through the cleanup blade **64**, the foreign substance D is removed from the cleanup brush **66** by the cleanup blade **64**. The cleanup blade **64** recovers the foreign substance D from the cleanup brush **66**. Thus, a situation where the foreign substance D adheres onto the reading surface **47** of the image sensor **45** again from the cleanup brush **66** is suppressed. In this manner, when the foreign substance D is sensed on the reading surface **47** of the image sensor the reading surface **47** of the image sensor **45** is automatically cleaned.

The control device **51** may sense the foreign substance D on the reading surface **47** of the image sensor **45** again after the cleanup device **61** has cleaned the reading surface **47** of the image sensor **45**. In this case, the cleanup device **61** re-cleans the reading surface **47** of the image sensor **45**.

The foreign substance D is removed as the cleanup device **61** repeats the cleaning of the reading surface **47** of the image sensor **45**. The foreign substance D may be sensed even when the cleanup device **61** repeats the cleaning of the reading surface **47** of the image sensor **45**. In this case, the control device **51** causes the display **52** to display a message that prompts to check the reading surface **47**.

The cleanup processing will be described with reference to FIG. **8**. FIG. **8** is a flowchart showing an example of the cleanup processing in the first embodiment. Hereinafter, the reference symbols shown in FIG. **2** will be used in the descriptions as appropriate.

The flowchart shown in FIG. **8** is a mere example and can be changed as appropriate. FIG. **8** shows an example of sensing processing of a foreign substance D when the sheet S is not conveyed. The sensing processing of a foreign substance D may also be executed when the sheet S is being conveyed.

As shown in FIG. **8**, when the sheet S is being conveyed, sensing processing by the image sensor **45** is carried out (Step S**01**). Thus, the image sensor **45** outputs a signal to the control device **51**. In descriptions below, the number of rising edges included in the output signal obtained during one scan, that is output from the image sensor **45**, will be referred to as the number of edges.

When the number of edges in the output signal is 0 (Yes in Step S**02**), the control device **51** determines that there is no foreign substance, and ends the processing (Step S**03**). When the number of edges is one or more (No in Step S**02**), the control device **51** determines that there is a foreign substance (Step S**04**).

Next, the control device **51** derives a size of the foreign substance based on the number of clocks between the rising edge and the falling edge (Step S**05**). When the foreign substance size is larger than a predetermined size X (No in Step S**06**), the control device **51** causes the display **52** to display a message that prompts the user to check the reading surface **47** of the image sensor **45** (Step S**07**). Thus, the foreign substance D that cannot be cleaned by the cleanup roller **62** is manually removed from the reading surface **47**.

When the foreign substance size is equal to or smaller than the predetermined size X (Yes in Step S**06**), the control device **51** operates the cleanup motor **63** to cause the cleanup roller **62** to rotate (Step S**08**).

From a time point the cleanup roller **62** starts rotating, the control device **51** starts counting a cleanup time using a timer (Step S**09**). The reading surface **47** of the image sensor **45** is cleaned by the rotation of the cleanup roller **62**. When the cleanup time reaches a predetermined time Y, the control device **51** stops the cleanup roller **62** (Step S**10**). Thus, the cleanup roller **62** stops at the home position, and cleaning of the reading surface **47** by the cleanup roller **62** ends.

Next, the control device **51** increments the number of times of cleanup (Step S**11**). Further, the sensing processing by the image sensor **45** is carried out (Step S**12**). Thus, the image sensor **45** outputs a signal to the control device **51**.

When the number of edges in the output signal is 0 (Yes in Step S**13**), the control device **51** determines that there is no foreign substance, and ends the processing (Step S**14**). When the number of edges is one or more (No in Step S**13**), the control device **51** determines that there is a foreign substance (Step S**15**).

When the number of times of cleanup is equal to or smaller than a predetermined number of times of cleanup Z (Yes in Step S**16**), the control device **51** repeats the processing from Step S**08** to Step S**13**.

When the number of times of cleanup is larger than the predetermined number of times of cleanup Z (No in Step S**16**), the control device **51** determines that the foreign substance D is uncleanable (Step S**17**). In addition, the control device **51** causes the display **52** to display a message that prompts the user to check the reading surface **47** of the image sensor **45** (Step S**18**). Thus, the user is prompted to check a smudge or scratch on the reading surface **47** that cannot be removed by the cleanup roller **62**, to replace the image sensor **45** or the registration unit **32**, and the like. It is noted that in the printer **1**, arbitrary values can be set for the predetermined size X, the predetermined time Y, and the predetermined number of times of cleanup Z.

As described above, according to the first embodiment, the image sensor **45** can be used to sense the foreign substance D on the reading surface **47** based on the output signal of the image sensor **45**. By removing the foreign substance D on the reading surface **47** of the image sensor **45**, false sensing of a lateral deviation amount of the sheet S during the printing operation can be prevented from occurring.

Second Embodiment

Subsequently, a printer according to a second embodiment will be described. FIG. **9** is a perspective view of a cleanup device **71** in the printer according to the second embodiment. The cleanup device **71** differs from the cleanup device **61** in that a cleanup body **72** is provided in place of the cleanup roller **62**. Descriptions on configurations of the second embodiment that are similar to those of the first embodiment will be omitted.

As shown in FIG. **9**, the cleanup device **71** includes the cleanup body **72** and a cleanup motor **73**. The cleanup body **72** is movable in the main scanning direction. The cleanup motor **73** causes the cleanup body **72** to reciprocate.

The cleanup body **72** is formed in a square shape in a top view. A cleanup brush **74** having a plurality of bristles is planted on a lower surface of the cleanup body **72**. A conveying guide (not shown) that guides conveyance of the sheet S opposes the reading surface **47** of the image sensor **45**. A long hole (not shown) that guides a movement of the cleanup body **72** is formed in the conveying guide.

Power of the cleanup motor **73** is transmitted to the cleanup body **72**. It is noted that a configuration in which the registration motor **44** usually rotates in the forward direction, and when the registration motor **44** rotates in an opposite direction, power of the registration motor **44** is transmitted to the cleanup body **72**, is also possible.

A home position of the cleanup body **72** is set at one end side of the reading surface **47** of the image sensor **45** in the main scanning direction, on an outer side of the conveying path. At the home position, the cleanup body **72** is evacuated from above the reading surface **47** of the image sensor **45**.

When the cleanup body **72** is at the home position, a situation where the sheet S being conveyed gets caught in the cleanup brush **74** and a situation where the cleanup brush **74** is sensed by the image sensor **45** are avoided.

It is noted that an absorption sheet may be attached onto a surface of the conveying guide and a portion on an inner side of the guide hole. The absorption sheet prevents the sensing light emitted from the image sensor **45** from being reflected. Black paint may be applied onto the surface of the conveying guide and the portion on the inner side of the guide hole.

When the foreign substance D on the reading surface **47** is sensed based on the output signal of the image sensor **45**, the cleanup motor **73** operates, and power of the cleanup motor **73** is transmitted to the cleanup body **72**. Thus, the cleanup body **72** moves from the home position to the other end side in the main scanning direction.

A tip end of the cleanup brush **74** comes into sliding contact with the reading surface **47** of the image sensor **45**. The foreign substance D is removed from the reading surface **47** by the tip end of the cleanup brush **74**. In a state where the foreign substance D is adhered onto the tip end of the cleanup brush **74**, the cleanup motor **73** causes the cleanup body **72** to return to the home position on the one end side in the main scanning direction.

It is noted that a cleanup blade (not shown) may be provided near the home position. Moreover, an edge or the like of the reading surface **47** may shear off the foreign substance D from the cleanup brush **74**.

The control device **51** may sense the foreign substance D on the reading surface **47** of the image sensor **45** again after the cleanup device **71** has cleaned the reading surface **47** of the image sensor **45**. In this case, the cleanup device **71** re-cleans the reading surface **47** of the image sensor **45**.

The foreign substance D is removed as the cleanup device **71** repeats the cleaning of the reading surface **47** of the image sensor **45**. The foreign substance D may be sensed even when the cleanup device **71** repeats the cleaning of the reading surface **47** of the image sensor **45**. In this case, the control device **51** causes the display **52** to display a message indicating information that prompts to check the reading surface **47**.

The cleanup processing will be described with reference to FIG. **10**. FIG. **10** is a flowchart showing an example of the cleanup processing in the second embodiment. Hereinafter, the reference symbols shown in FIG. **2** and FIG. **9** will be used in the descriptions as appropriate.

Further, the flowchart shown in FIG. **10** is a mere example and can be changed as appropriate. FIG. **10** shows an example of the sensing processing of a foreign substance D when the sheet S is not conveyed. The sensing processing of a foreign substance D may also be executed when the sheet S is being conveyed.

As shown in FIG. **10**, when the sheet S is being conveyed, sensing processing by the image sensor **45** is carried out. Thus, the image sensor **45** outputs a signal to the control device **51** (Step S**21**).

When the number of edges in the output signal is 0 (Yes in Step S**22**), the control device **51** determines that there is no foreign substance, and ends the processing (Step S**23**).

When the number of edges is one or more (No in Step S**22**), the control device **51** determines that there is a foreign substance (Step S**24**).

Next, the control device **51** senses a position of the foreign substance D based on the number of clocks between the rising edge of the trigger signal and the rising edge of the output signal (Step S**25**).

Further, the control device **51** derives a size of the foreign substance based on the number of clocks between the rising edge and the falling edge in the output signal (Step S**26**). When the foreign substance size is larger than a predetermined size X (No in Step S**27**), the control device **51** causes the display **52** to display a message that prompts the user to check the reading surface **47** of the image sensor **45** (Step S**28**). Thus, the foreign substance D that cannot be cleaned by the cleanup body **72** is manually removed from the reading surface **47**.

When the foreign substance size is equal to or smaller than the predetermined size X (Yes in Step S**27**), the control device **51** causes the cleanup motor **73** to positively rotate, to thus cause the cleanup body **72** to move in a first direction along the main scanning direction (Step S**29**).

When the cleanup body **72** reaches the other end of the reading surface **47**, the control device **51** causes the cleanup motor **73** to rotate backwards, to thus cause the cleanup body **72** to move in a second direction along the main scanning direction (Step S**30**). By the reciprocation of the cleanup body **72**, the reading surface **47** of the image sensor **45** is cleaned.

Further the control device **51** causes the cleanup body **72** to stop at the home position (Step S**31**). Furthermore, the control device **51** increments the number of times of cleanup (Step S**32**). Moreover, the sensing processing by the image sensor **45** is carried out (Step S**33**). Thus, the image sensor **45** outputs a signal to the control device **51**.

When the number of edges in the output signal is 0 (Yes in Step S**34**), the control device **51** determines that there is no foreign substance, and ends the processing (Step S**35**).

When the number of edges is one or more (No in Step S**34**), the control device **51** determines that there is a foreign substance (Step S**36**).

When the number of times of cleanup is equal to or smaller than a predetermined number of times of cleanup Z (Yes in Step S**37**), the control device **51** repeats the processing from Step S**29** to Step S**34**.

When the number of times of cleanup is larger than the predetermined number of times of cleanup Z (No in Step S**37**), the control device **51** determines that the foreign substance D is uncleanable (Step S**38**). In addition, the control device **51** causes the display **52** to display a message that prompts the user to check the reading surface **47** of the image sensor **45** (Step S**39**). Thus, the user is prompted to

check a smudge or scratch on the reading surface **47** that cannot be removed by the cleanup body **72**, to replace the image sensor **45** or the registration unit **32**, and the like. It is noted that also in the second embodiment, arbitrary values can be set for the predetermined size X and the predetermined number of times of cleanup Z.

In the present embodiment, the position of the foreign substance D is sensed (Step S**25**). The control device **51** may execute priority cleanup processing in which the cleanup body **72** is caused to reciprocate in a partial region including the position of the foreign substance D on the reading surface **47**.

Hereinafter, the priority cleanup processing will be described with reference to FIG. **11**. FIG. **11** is a flowchart showing an example of procedures of the priority cleanup processing in the second embodiment.

It is noted that in descriptions of FIG. **11**, the reference symbols of FIG. **2** and FIG. **9** are used as appropriate. The flowchart shown in FIG. **11** is a mere example and can be changed as appropriate.

FIG. **11** shows an example of the sensing processing of a foreign substance D when the sheet S is not conveyed. The sensing processing of a foreign substance D may also be executed when the sheet S is being conveyed.

As shown in FIG. **11**, the processing of Step S**41** to Step S**48** in the priority cleanup processing is similar to the processing of Step S**21** to Step S**28** in FIG. **10**.

When the foreign substance size is equal to or smaller than the predetermined size X (Yes in Step S**47**), the control device **51** causes the cleanup motor **73** to positively rotate, to thus cause the cleanup body **72** to move in the first direction along the main scanning direction (Step S**49**). In addition, the control device **51** causes the cleanup body **72** to stop at a first specific position (Step S**50**). The first specific position is a position located beyond a sensing position of the foreign substance D that is farthest from the home position, in the first direction.

Next, the control device **51** causes the cleanup motor **73** to rotate backwards, to thus cause the cleanup body **72** to move in the second direction along the main scanning direction (Step S**51**). Further, the control device **51** causes the cleanup body **72** to stop at a second specific position (Step S**52**). The second specific position is a position located beyond a sensing position of the foreign substance D that is closest to the home position, in the second direction. Furthermore, the control device **51** increments the number of times of cleanup (Step S**53**).

After the cleanup body **72** reciprocates once, the sensing processing by the image sensor **45** is carried out (Step S**54**). Thus, the image sensor **45** outputs a signal to the control device **51** (Step S**54**).

In the present embodiment, the cleanup body **72** is positioned above the reading surface **47**. Therefore, the output signal of the image sensor **45** includes a rising edge that indicates a sensing position of the cleanup body **72**. Accordingly, when the number of edges is one (Yes in Step S**55**), the control device **51** determines that there is no foreign substance (Step S**56**).

Further, the control device **51** causes the cleanup motor **73** to rotate backwards to thus cause the cleanup body **72** to return to the home position, and ends the processing (Step S**57**).

On the other hand, when the number of edges is two or more (No in Step S**55**), the control device **51** determines that there is a foreign substance (Step S**58**).

Further, when the number of times of cleanup is equal to or smaller than the predetermined number of times of cleanup Z (Yes in Step S**59**), the control device **51** repeats the processing from Step S**49** to Step S**55**. In this manner, as long as the number of times of cleanup does not exceed the predetermined number of times of cleanup Z, the cleanup device **71** reciprocates in a partial region including the sensing position of the foreign substance D on the reading surface **47** until it is determined that there is no foreign substance. Thus, the position of the foreign substance D on the reading surface **47** of the image sensor **45** is preferentially cleaned by the cleanup body **72**.

When the number of times of cleanup exceeds the predetermined number of times of cleanup Z under the situation where it is determined that there is a foreign substance (No in Step S**59**), the control device **51** determines that the foreign substance D is uncleanable (Step S**60**). Further, the control device **51** causes the cleanup motor **73** to rotate backwards to thus cause the cleanup body **72** to return to the home position (Step S**61**).

In addition, the control device **51** causes the display **52** to display a message that prompts the user to check the reading surface **47** of the image sensor **45** (Step S**62**).

It is noted that when the cleanup body **72** returns to the home position after removing the foreign substance D, there is a fear that the foreign substance D on the cleanup brush **74** will adhere onto the reading surface **47** of the image sensor **45** again. To avoid this, all the steps may be repeated when it is determined that there is no foreign substance (Step S**56**).

According to the second embodiment, the foreign substance D on the reading surface **47** of the image sensor **45** is removed similar to the first embodiment. Thus, false sensing of the lateral deviation amount of the sheet S during the printing operation can be prevented from occurring. Moreover, the foreign substance D can be removed from the reading surface **47** of the image sensor **45** by the reciprocation of the cleanup body **72**.

It is noted that in the present embodiment, the image sensor **45** is disposed on the downstream side of the pair of registration rollers **41** and **42** in the sheet conveying direction (see FIG. **2**). However, the image sensor **45** may alternatively be disposed on the upstream side of the pair of registration rollers **41** and **42** in the sheet conveying direction. In this case, coordinates of a front end of the sheet S and a skew amount of the sheet S may be sensed based on the output signals of the image sensor **45**. For example, the skew amount is calculated based on a difference between timings at which the front end of the sheet S passes through two points on left and right sides of the image sensor **45**.

Also in the present embodiment, the CIS is exemplified as the image sensor **45**. However, other image sensors such as a CCD (Charge Coupled Device) sensor may be used as the image sensor.

Moreover, in the present embodiment, the pair of registration rollers **41** and **42** are exemplified as the pair of conveying rollers that convey the sheet to the image transfer position. A pair of non-registration rollers may alternatively be used as the pair of conveying rollers. In other words, in the image forming apparatus, a non-registration unit may be provided in place of the registration unit.

Also in the present embodiment, the lateral deviation of the sheet is corrected by the image forming apparatus. However, the lateral deviation and/or skew of the sheet may alternatively be corrected by the image forming apparatus.

Also in the present embodiment, the display **52** is exemplified as the notification device. However, the notification device is not limited to the display. The notification device may be any device as long as it notifies an error related to

the image forming operation of the sheet. For example, the error may be notified by audio or a beeping sound.

Moreover, a control device of an apparatus body may process the output signals of the image sensor **45**. Alternatively, a control device of a registration unit different from the control device of the apparatus body may process the output signals of the image sensor **45**.

Also in the present embodiment, the printer **1** is exemplified as the image forming apparatus. However, the image forming apparatus is not limited to the printer **1**. For example, the image forming apparatus may be a copying machine, a facsimile, or a multifunction peripheral. The multifunction peripheral compositely includes a printing function, a copying function, a facsimile function, and the like.

It is noted that embodiments in which the above-described embodiments and modified examples are wholly or partially combined may also be adopted as embodiments other than the embodiments described above.

Furthermore, the technique of the present disclosure is not limited to the embodiments described above and may be variously changed, substituted, or modified without departing from the gist of the technical idea of the present disclosure. In addition, the technique of the present disclosure may be realized by a different technique that is obtained by a progress of the technique or a different technique derived from the technique.

It is to be understood that the embodiments herein are illustrative and not restrictive, since the scope of the disclosure is defined by the appended claims rather than by the description preceding them, and all changes that fall within metes and bounds of the claims, or equivalence of such metes and bounds thereof are therefore intended to be embraced by the claims.

The invention claimed is:

1. An image forming apparatus capable of correcting a lateral deviation and/or a skew of a sheet, comprising:

a pair of conveying rollers which convey the sheet to a transfer position of an image;

an image sensor which reads the sheet on an upstream side of the transfer position in a sheet conveying direction;

a control device which processes an output signal of the image sensor; and

a cleanup device which cleans a reading surface of the image sensor, wherein

the image sensor includes a plurality of light-receiving elements arranged along a main scanning direction,

the cleanup device includes a cleanup body movable in the main scanning direction,

the cleanup device causes the cleanup body to reciprocate, to clean the reading surface of the image sensor,

the control device senses a position of a foreign substance on the reading surface of the image sensor as well as calculates a lateral deviation amount and/or a skew amount of the sheet based on the output signal of the image sensor,

the control device identifies a first position and a second position that are respective ends of a partial region including the position in the main scanning direction where the foreign substance was detected of an entire region of the reading surface of the imaging sensor, and

the control device causes the cleanup device to reciprocate between the first position and the second position.

2. The image forming apparatus according to claim **1**, wherein

in a case where the output signal obtained during one scan of the image sensor includes a plurality of rising edges or falling edges while the sheet is being conveyed, the control device senses the foreign substance on the reading surface of the image sensor.

3. The image forming apparatus according to claim **1**, wherein

in a case where the output signal obtained during one scan of the image sensor includes at least one rising edge or falling edge when the sheet is not conveyed, the control device senses the foreign substance on the reading surface of the image sensor.

4. The image forming apparatus according to claim **1**, wherein

in a case where the control device senses the foreign substance on the reading surface of the image sensor after the cleanup device has cleaned the reading surface of the image sensor, the cleanup device re-cleans the reading surface of the image sensor.

5. The image forming apparatus according to claim **1**, wherein

the cleanup device includes a cleanup roller which rotates about a rotation shaft arranged along the main scanning direction, and

the cleanup device causes the cleanup roller to rotate, to clean the reading surface of the image sensor.

6. The image forming apparatus according to claim **1**, further comprising

a notification device which notifies information related to an image forming operation, wherein

the control device derives a size of the foreign substance based on the output signal of the image sensor, and

the control device notifies, in a case where the size of the foreign substance exceeds a predetermined size, information that prompts to check the reading surface of the image sensor via the notification device.

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