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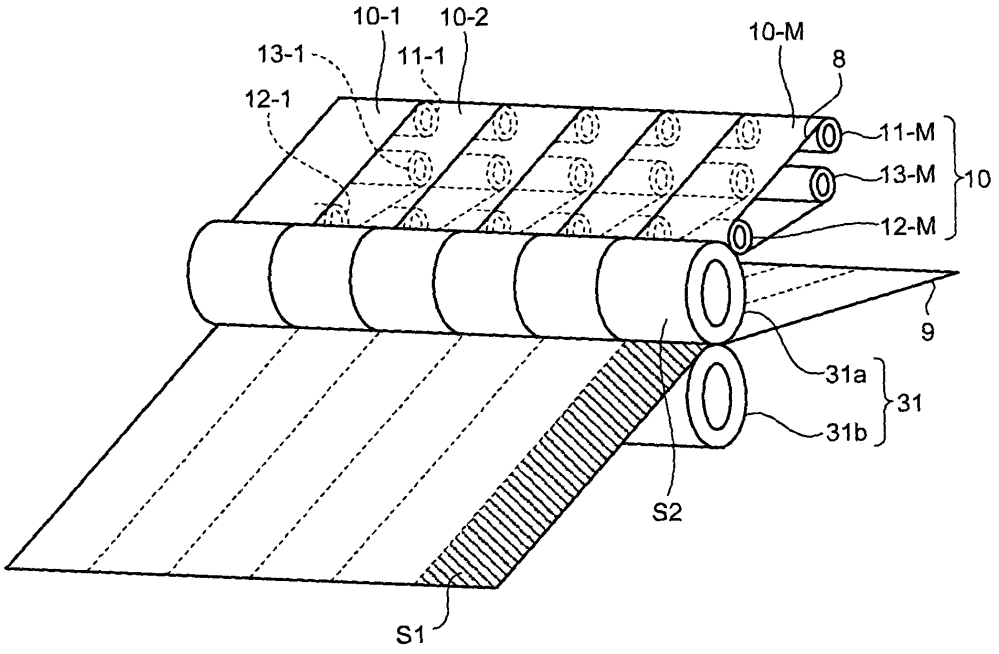
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(54) **Image forming apparatus and cleaning unit**

(57) A fixing unit (31) fixes a toner image transferred onto a recording sheet. A plurality of cleaning units (7) is provided for a plurality of areas on an outer surface of the fixing unit (31) divided in a direction perpendicular to a rotating axis, respectively, and independently removes unwanted substances adhered to the fixing unit (31) by making contact with the fixing unit (31). An image-data-amount calculating unit (5, 520) divides a recording sheet into a plurality of sections, and calculates image data amount of the toner image transferred onto the recording sheet for each of the sections. A drive control unit (6) brings a cleaning unit (7) corresponding to an area of the fixing unit (31) used to fix the toner image into contact with the fixing unit (31) based on the image data amount calculated by the image-data-amount calculating unit (5).

FIG.1



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Description

CROSS-REFERENCE TO RELATED APPLICATIONS

[0001] The present application claims priority to and incorporates by reference the entire contents of Japanese priority document 2008-176034 filed in Japan on July 4, 2008 and Japanese priority document 2009-119828 filed in Japan on May 18, 2009.

BACKGROUND OF THE INVENTION

1. Field of the Invention

[0002] An image forming apparatus, such as a copier, forms an image in such a manner that an electrostatic latent image is formed on a photosensitive drum, and the electrostatic latent image is developed into a toner image. The toner image on the photosensitive drum is transferred onto a sheet, and a fixing unit fixes the toner image on the sheet by the application of heat. As types of the fixing unit, for example, there are a heat roller type and a belt type. The heat roller type of the fixing unit includes a fixing roller (also called "a heat roller") and a pressure roller. The pressure roller presses against the fixing roller. While a sheet onto which a toner image is transferred passes between the fixing roller and the pressure roller, the toner image is fixed on the sheet by the application of heat and pressure.

[0003] An outer circumferential surface of a fixing roller (or a fixing belt) has contact with a toner image transferred onto a sheet. Therefore, to prevent the fixing roller from adhesion of foreign substances such as toner, the fixing roller is generally coated with a fluorine resin layer or the like having high releasablity. However, in fact, such a coating is not enough to prevent the fixing roller from the adhesion of foreign substances perfectly. Namely, toner is adhered to the fixing roller by the repetition of heat fixing. Toner accumulated on the fixing roller comes to be attached to a sheet, and makes a spot on the sheet, resulting in image degradation.

[0004] To prevent such a problem, for example, a so-called web-type cleaning unit may be used. The web-type cleaning unit includes a belt-like cleaning member that is provided to be in contact with the fixing roller. By reeling in the cleaning member, the cleaning unit removes unwanted substance on the fixing roller. As other types of cleaning units, a roller-type cleaning unit and a felt-type cleaning unit are commonly used. In the roller-type cleaning unit, a roller is used as the cleaning member, and provided to be in contact with the outer circumferential surface of the fixing roller. In the felt-type cleaning unit, felt is used as the cleaning member, and provided to be in sliding contact with the fixing roller.

[0005] However, such conventional cleaning units have the following problems from the viewpoint of an efficiency of cleaning member consumption. For example, even when the fixing roller is clean, the web-type cleaning unit is configured to clean the fixing roller, and the cleaning member constantly has contact with the fixing roller. Therefore, a web rapidly deteriorates due to the friction. Furthermore, in a case where the cleaning unit is configured to count a rotation time of the fixing roller, and reels in the cleaning member if the rotation time exceeds a certain value, even when the fixing roller is clean, the cleaning member is wastefully consumed.

[0006] For example, Japanese Patent No. 3834899 discloses a technique for consuming a cleaning member efficiently with the aim of improving a performance in cleaning a fixing roller included in a heat fixing unit thereby preventing a transfer medium from being stained at the time of fixing a toner image thereon. In this technique, an amount of toner passing through the fixing unit is estimated based on pixel counts, and the cleaning member is reeled in only when the fixing roller needs to be cleaned.

[0007] In the technique disclosed in Japanese Patent No. 3834899, the cleaning member is reeled in based on the toner amount estimated from the pixel count. However, when toner is fixed on a portion of the transfer medium (for example, a central portion of the transfer medium in a main scanning direction or a central portion of the transfer medium in a sub-scanning direction), although a portion of the fixing roller corresponding to the portion of the transfer medium needs to be cleaned, the other area of the fixing roller need not to be cleaned. Therefore, the cleaning member is wastefully consumed. Namely, the technique disclosed in Japanese Patent No. 3834899 does not consider which part of the fixing roller is used to fix toner. Thus, in this technique, also, it is not possible to consume the cleaning member efficiently.

SUMMARY OF THE INVENTION

[0008] It is an object of the present invention to at least partially solve the problems in the conventional technology.

[0009] According to one aspect of the present invention, there is provided an image forming apparatus including a fixing unit that fixes a toner image transferred onto a recording sheet; a plurality of cleaning units provided for a plurality of areas on an outer surface of the fixing unit divided in a direction perpendicular to a rotating axis, respectively, which independently removing unwanted substances adhered to the fixing unit by making contact with the fixing unit; an image-

data-amount calculating unit that divides a recording sheet into a plurality of sections, and calculates image data amount of the toner image transferred onto the recording sheet for each of the sections; and a drive control unit that brings a cleaning unit corresponding to an area of the fixing unit used to fix the toner image into contact with the fixing unit based on the image data amount calculated by the image-data-amount calculating unit.

[0010] Furthermore, according to another aspect of the present invention, there is provided a cleaning device including a plurality of cleaning units provided for a plurality of areas on an outer surface of a fixing unit divided in a direction perpendicular to a rotating axis, respectively, each independently removing unwanted substances adhered to the fixing unit by making contact with the fixing unit; an image-data-amount calculating unit divides a recording sheet into a plurality of sections, and calculates image data amount of the toner image transferred onto the recording sheet for each of the sections; and a drive control unit that brings a cleaning unit corresponding to an area of the fixing unit used to fix the toner image into contact with the fixing unit based on the image data amount calculated by the image-data-amount calculating unit.

[0011] The above and other objects, features, advantages and technical and industrial significance of this invention will be better understood by reading the following detailed description of presently preferred embodiments of the invention, when considered in connection with the accompanying drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

[0012]

Fig. 1 is a schematic diagram for explaining a cleaning unit according to a first embodiment of the present invention;
Fig. 2 is a cross-sectional view for explaining a configuration of the cleaning unit according to the first embodiment;
Fig. 3 is a schematic diagram for explaining the configuration of the cleaning unit according to the first embodiment;
Fig. 4 is a block diagram of an image forming apparatus including the cleaning unit according to the first embodiment;
Fig. 5 is a block diagram of an image-data-amount calculating unit included in the image forming apparatus shown in Fig. 4;
Fig. 6 is a block diagram of a drive control unit included in the cleaning unit shown in Fig. 4;
Fig. 7 is a flowchart of an image forming process performed by the image forming apparatus shown in Fig. 4;
Fig. 8 is a flowchart of a cleaning process performed by the cleaning unit shown in Fig. 4;
Fig. 9 is a schematic diagram illustrating a cleaning unit according to a second embodiment of the present invention;
Fig. 10 is a schematic diagram for explaining a distance from a fixing inlet sensor to a fixing nip and an outer circumferential distance of a fixing roller from the fixing nip to a contact point between the fixing roller and a fixing cleaning roller;
Fig. 11 is a schematic diagram illustrating a recording sheet and a section on the recording sheet;
Fig. 12 is a block diagram of an image forming apparatus including the cleaning unit according to the second embodiment;
Fig. 13 is a block diagram of a drive control unit included in the cleaning unit shown in Fig. 12;
Fig. 14 is a flowchart of a cleaning process performed by the cleaning unit shown in Fig. 12;
Fig. 15 is a schematic diagram illustrating a reference mark put on the fixing roller;
Fig. 16 is a schematic diagram for explaining a position of a mark detecting sensor provided in a fixing unit to detect the reference mark;
Fig. 17 is an expansion plan of the fixing roller cut along the reference mark;
Fig. 18 is a block diagram of an image forming apparatus including a cleaning unit according to a third embodiment of the present invention;
Fig. 19 is a block diagram of an image-data-amount calculating unit included in the image forming apparatus shown in Fig. 18;
Fig. 20 is a block diagram of a drive control unit included in the cleaning unit shown in Fig. 18;
Fig. 21 is a flowchart of a cleaning process performed by the cleaning unit according to the third embodiment;
Fig. 22 is a block diagram of an image-data-amount calculating unit as a modified example of the image-data-amount calculating unit shown in Fig. 19; and
Fig. 23 is a block diagram illustrating a hardware configuration of an MFP as an example of the image forming apparatuses according to the first to third embodiments.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

[0013] Exemplary embodiments of an image forming apparatus including a cleaning unit according to the present invention are explained in detail below with reference to the accompanying drawings.

[0014] Fig. 1 is a schematic diagram for explaining a cleaning unit 10 according to a first embodiment of the present

invention. As shown in Fig. 1, a plurality of the cleaning units 10-1 to 10-M (hereinafter, unless otherwise specified, referred to as simply "the cleaning unit(s) 10"). Each of the cleaning units 10 (10-1 to 10-M) is composed of a feed shaft 11 (11-1 to 11-M), a fixing cleaning roller 12 (12-1 to 12-M), and a take-up shaft 13 (13-1 to 13-M). The cleaning units 10 are arranged to be parallel to a rotating shaft of a fixing roller 31a included in a fixing unit 31. The fixing unit 31 includes the fixing roller 31a containing a heater and a pressure roller 31b.

[0015] A cleaning member 8 is wound on the feed shaft 11, and one end of the cleaning member 8 is tied to the take-up shaft 13 through the fixing cleaning roller 12. The fixing roller 31a is divided in a direction perpendicular to the rotating shaft into a plurality (M-numbers) of areas (areas continuing in a direction parallel to the rotating shaft) (hereinafter, referred to as "the area(s) on the fixing roller 31a"). The fixing cleaning rollers 12 are provided to be opposed to the areas on the fixing roller 31a, respectively. Each of the fixing cleaning rollers 12 is independently brought into contact with the fixing roller 31a across the cleaning member 8, and cleans the corresponding area on the fixing roller 31a with the cleaning member 8.

[0016] Incidentally, in most cases, an image is formed on the center part of a copy sheet. Therefore, a larger amount of the cleaning member 8 is preferably wound on the feed shaft 11 of the cleaning unit 10 opposed to the center part of the fixing roller 31a in a main scanning direction because the area on the center part of the fixing roller 31a may need to be cleaned frequently. Fig. 3 is a schematic diagram for explaining a configuration of the cleaning units 10 viewed from a sub-scanning direction (a sheet conveying direction). As shown in Fig. 3, the feed shafts 11-1 to 11-M are opposed to the fixing cleaning rollers 12-1 to 12-M, respectively. As described above, the closer to the center the feed shaft 11 is located, the larger amount of the cleaning member 8 is wound on the feed shaft 11. In this manner, an arbitrary amount of the cleaning member 8 can be wound on each of the feed shafts 11 depending on a toner amount of a toner image fixed by the corresponding area on the fixing roller 31a.

[0017] Furthermore, as shown in Fig. 1, a recording sheet 9 onto which a toner image is transferred, i.e., a copy sheet is divided into a plurality of sections continuing in the main scanning direction (a direction perpendicular to the sheet conveying direction) (hereinafter, referred to as "the section(s) on the recording sheet 9"). The areas on the fixing roller 31a are preliminarily associated with the sections on the recording sheet 9, respectively. For example, as shown in Fig. 1, a section S1 on the recording sheet 9 is associated with an area S2 on the fixing roller 31a. An image area ratio of each of the sections on the recording sheet 9 is calculated (for example, based on pixel counts). A contact/separation timing of the cleaning unit 10 with respect to the fixing unit 31 is determined based on the image area ratio.

[0018] Fig. 2 is a cross-sectional view for explaining an outline of the configuration of the cleaning unit 10 according to the present embodiment. As shown in Fig. 2, when the recording sheet 9 on which a toner image is transferred is conveyed to the fixing unit 31, toner T of the toner image is fixed on the recording sheet 9 by the application of heat and pressure by the fixing roller 31a and the pressure roller 31b. Specifically, when the recording sheet 9 enters in the fixing unit 31, the recording sheet 9 is conveyed by the rotation of the fixing roller 31a and the pressure roller 31b. While the recording sheet 9 passes through the fixing roller 31a and the pressure roller 31b, the toner T is fixed on the recording sheet 9. After the recording sheet 9 passes through the fixing unit 31, unwanted substances (toner, paper dust, and the like) remaining on the surface of the fixing roller 31a are wiped off by the cleaning unit 10.

[0019] Fig. 4 is a block diagram of an image forming apparatus 100 including the cleaning unit 10 according to the first embodiment. As shown in Fig. 4, the image forming apparatus 100 includes an image input unit 1, an external input unit 2, an image processing unit 3, an image output unit 4, an image-data-amount calculating unit 5, and the cleaning unit 10. The cleaning unit 10 includes a drive control unit 6 and a plurality of cleaning units 7.

[0020] The image input unit 1 reads an original image, and converts the read image into an electrical signal. The external input unit 2 receives image data transmitted from an external device such as a personal computer (PC) connected to the image forming apparatus 100 via a network or reads image data stored in a recording medium. The image processing unit 3 performs predetermined image processing on the image data from the image input unit 1 or the external input unit 2. The image output unit 4 converts an electrical signal from the image processing unit 3 into an optical signal, and emits a light corresponding to the optical signal to a photosensitive element, and thereby forming an electrostatic latent image on the photosensitive element.

[0021] The image-data-amount calculating unit 5 calculates an image data amount of a copy image based on information from the image processing unit 3. In the present embodiment, the image-data-amount calculating unit 5 calculates an image area ratio as the image data amount. Fig. 5 is a block diagram of the image-data-amount calculating unit 5. The image-data-amount calculating unit 5 includes an image-area pixel counter 51, a non-image-area pixel counter 52, and an image-area-ratio calculating unit 53.

[0022] The image-area pixel counter 51 counts the number of pixels of an image area of the copy image (i.e., a black-color portion of the copy image if the copy image is a black-and-white image, or a portion other than a white-color portion of the copy image if the copy image is a color image). The non-image-area pixel counter 52 counts the number of pixels in a non-image area of the copy image (i.e., a white-color portion of the copy image). The image-area-ratio calculating unit 53 calculates a ratio of the image area based on the pixel counts of the image area and the pixel counts of the non-image area.

[0023] The drive control unit 6 drives the corresponding cleaning unit 7 based on the image area ratio calculated by the image-data-amount calculating unit 5. Fig. 6 is a block diagram of the drive control unit 6. The drive control unit 6 includes an image-data-amount acquiring unit 61, an image-data-amount determining unit 62, an area determining unit 63, and a drive executing unit 64.

[0024] The image-data-amount acquiring unit 61 acquires the image area ratio calculated by the image-data-amount calculating unit 5. The image-data-amount determining unit 62 determines whether the acquired image area ratio exceeds a predetermined threshold. When the image-data-amount determining unit 62 determines that the image area ratio exceeds the threshold, the area determining unit 63 determines which one of the areas on the fixing roller 31a is used to fix the toner image on the section of the recording sheet 9 determined that the image area ratio exceeds the threshold. The drive executing unit 64 drives the cleaning unit 7 opposed to the determined area on the fixing roller 31a. Specifically, the drive executing unit 64 causes the corresponding fixing cleaning roller 12 to bring into contact with the fixing roller 31a and to separate from the fixing roller 31a, and causes the corresponding take-up shaft 13 to rotate thereby reeling in the cleaning member 8.

[0025] The drive control unit 6 and the cleaning units 7 compose the cleaning unit 10 according to the present embodiment. The image forming apparatus 100 includes the cleaning unit 10 having the configuration described above.

[0026] Subsequently, an image forming process performed by the image forming apparatus 100 is explained below with reference to a flowchart shown in Fig. 7.

[0027] First, the image input unit 1 reads an original image from a scanner unit (not shown) and converts the read image into an electrical signal, or the external input unit 2 receives image data transmitted from a PC or reads image data stored in a recording medium (Step S10). The image-data-amount calculating unit 5 calculates an image area ratio of the received image data (Step S11). Specifically, the image-data-amount calculating unit 5 calculates the image area ratio based on pixel counts. Then, the image processing unit 3 performs predetermined image processing on the image data. The image output unit 4 converts an electrical signal from the image processing unit 3 into an optical signal, and emits a light corresponding to the optical signal to the photosensitive element thereby forming an electrostatic latent image on the photosensitive element. The electrostatic latent image is developed into a toner image, and the toner image is transferred onto a recording sheet. The toner image is fixed on the recording sheet by the fixing unit 31. In this manner, an image of the original is formed on the recording sheet (Step S12). After that, based on the image area ratio calculated by the image-data-amount calculating unit 5, the drive control unit 6 drives the corresponding cleaning unit 7 (Step S13).

[0028] A cleaning process performed by the cleaning unit 10 is explained in detail below with reference to a flowchart shown in Fig. 8.

[0029] The image-data-amount acquiring unit 61 acquires an image area ratio of the section S1 on the recording sheet 9 calculated by the image-data-amount calculating unit 5 (Step S20). The image-data-amount determining unit 62 determines whether the acquired image area ratio exceeds a predetermined threshold (Step S21). When the image-data-amount determining unit 62 determines that the image area ratio exceeds the threshold (YES at Step S21), the area determining unit 63 determines which one of the fixing cleaning rollers 12 is opposed to the area S2 on the fixing roller 31a used to fix the toner image on the section S1 on the recording sheet 9 (Step S22). After the fixing cleaning roller 12 is determined, the drive executing unit 64 brings the determined fixing cleaning roller 12 into contact with the fixing roller 31a (Step S23).

[0030] On the other hand, when the image-data-amount determining unit 62 determines that the image area ratio does not exceed the threshold (NO at Step S21), it is not necessary to clean the area on the fixing roller 31a, so that the processes at Steps S22 and S23 are skipped.

[0031] In the present embodiment, the contact/separation of each of the fixing cleaning rollers 12 with respect to the fixing roller 31a is switched by the drive control unit 6. By passing through a portion where the fixing roller 31a has contact with the fixing cleaning roller 12, unwanted substances adhered onto the fixing roller 31a are wiped off by the cleaning member 8, and removed from the fixing roller 31a.

[0032] As described above, in the image forming apparatus 100, when a toner image is transferred onto a recording sheet, pixel counts of an image area and pixel counts of a non-image area of a whole copy image can be obtained. The recording sheet is divided into M-numbers of sections continuing in the main scanning direction (the direction perpendicular to the sheet conveying direction), and pixel counts of an image area and pixel counts of a non-image area with respect to each of the sections are calculated. Based on these two values (the pixel counts of the image area and the pixel counts of the non-image area), an image area ratio of each of the sections is obtained. The image area ratio is calculated, for example, by dividing pixel counts by total pixel counts. The image area ratio can be calculated by other calculating formulas as long as an efficiency of cleaning-member consumption can be improved.

[0033] In this manner, in the present embodiment, a recording sheet on which a toner image is transferred is divided into M-numbers of sections continuing in the main scanning direction (the direction perpendicular to the sheet conveying direction), and an image area ratio of each of the sections is obtained. Based on the obtained image area ratio, after the toner image is fixed on the recording sheet, the cleaning unit 10 opposed to the area on the fixing roller 31a used to fix the toner image on the section is brought into contact with the fixing roller 31a across the cleaning member 8. For

example, when an image area ratio of a section S1 on the recording sheet exceeds a threshold C, after the fixing unit 31 fixes the toner image on the recording sheet, the cleaning unit 10 opposed to an area S2 on the fixing roller 31a corresponding to the section S1 is brought into contact with the area S2 on the fixing roller 31a across the cleaning member 8. A timing of bringing the cleaning unit 10 into contact with the fixing roller 31a can be arbitrarily set, for example, immediately after the toner image is fixed on the recording sheet or predetermined numbers of sheets pass through the fixing unit 31. Furthermore, the threshold C can be changed, for example, depending on whether the toner image is a single-color toner image or a multi-color toner image, or how many colors of toner images are superimposed if the toner image is a multi-color toner image.

[0034] In the present embodiment, the cleaning unit is provided to the roller type of the fixing unit. The fixing roller of the fixing unit is divided into a plurality of areas continuing in the direction perpendicular to the rotating shaft of the fixing roller, and the cleaning unit is brought into contact with only the area on the fixing roller needs to be cleaned across a web as the cleaning member. Therefore, only a portion of the fixing roller having a stain can be cleaned efficiently, and thus it is possible to avoid wasting the web.

[0035] In the first embodiment, a copy sheet on which a toner image is transferred is divided into a plurality of sections continuing in the main scanning direction (the direction perpendicular to the sheet conveying direction), and an image area ratio of each of the sections is calculated. If the image area ratio of any of the sections exceeds a predetermined threshold, the cleaning process is performed on the area of the fixing roller used to fix the toner image on the section on the copy sheet. In an image forming apparatus 200 according to a second embodiment, a copy sheet is divided into a plurality of sections continuing in the sub-scanning direction (the sheet conveying direction) in addition to the main scanning direction, and an image area ratio of each of the sections is calculated. A contact/separation timing of the cleaning member 8 is determined based on the image area ratio and a timing when a toner image transferred onto the copy sheet passes through a fixing nip formed between the fixing roller 31a and the pressure roller 31b.

[0036] Fig. 9 is a schematic diagram for explaining a cleaning unit 80 according to the second embodiment of the present invention. The portions identical to those in Fig. 1 for the first embodiment are denoted with the same reference numerals, and the description of those portions is omitted. In the second embodiment, a section on the recording sheet 9 that an image area ratio exceeds a predetermined threshold shall be referred to as a section S1', and an area on the fixing roller 31a corresponding to the section S1' on the recording sheet 9 shall be referred to as an area S2'.

[0037] As shown in Fig. 9, the recording sheet 9 is divided into a plurality of sections continuing not only in the main scanning direction but also in the sub-scanning direction. The fixing cleaning rollers 12 are individually brought into contact with the different area on the fixing roller 31a from one another in the sub-scanning direction (the sheet conveying direction) across the cleaning member 8. While passing through a contact point where the fixing roller 31a has contact with the fixing cleaning roller 12, unwanted substances adhered onto the fixing roller 31a are wiped off and removed by the cleaning member 8.

[0038] In the present embodiment, to prevent wear of the cleaning member 8 caused by bringing the fixing cleaning roller 12 into contact with the corresponding area on the fixing roller 31a even when no unwanted substances are adhered onto the area, it is controlled so that only the fixing cleaning roller 12 corresponding to the area on the fixing roller 31a onto which unwanted substances are adhered is brought into contact with the area, and separated from the fixing roller 31a just after the area on the fixing roller 31a passes through the fixing cleaning roller 12.

[0039] To execute such a contact/separation control, the areas on the fixing roller 31a are preliminarily associated with the sections on the recording sheet 9, respectively. For example, as shown in Fig. 9, the area S2' on the fixing roller 31a is associated with the section S1' on the recording sheet 9. The contact of the fixing cleaning rollers 12 with the different area on the fixing roller 31a from one another in the sub-scanning direction is made based on a timing when a toner image on the recording sheet 9 passes through the fixing nip. Details of the contact/separation control will be described later.

[0040] Furthermore, in the same manner as in the first embodiment, the cleaning unit 80 according to the second embodiment can be configured to bring the fixing cleaning roller 12 into contact with the fixing roller 31a across the cleaning member 8 with respect to each section that the recording sheet 9 is divided into a plurality of sections continuing in the main scanning direction. Moreover, the cleaning unit 80 can be configured to bring the fixing cleaning roller 12 into contact with the fixing roller 31a across the cleaning member 8 with respect to each section that the recording sheet 9 is divided into a plurality of sections continuing in the sub-scanning direction. Incidentally, when the contact/separation control of the fixing cleaning roller 12 is made with respect to each of the sections on the recording sheet 9 continuing in the sub-scanning direction (the sheet conveying direction), as shown in Fig. 9, it is controlled that all the fixing cleaning rollers 12 are integrally brought into contact with and separated from the fixing roller 31a.

[0041] Subsequently, there is explained details of the contact/separation control of the fixing cleaning roller 12 in the present embodiment based on an image area ratio and a timing when a toner image passes through the fixing nip.

[0042] In the image forming apparatus 200, when a toner image is transferred onto a recording sheet, pixel counts of an image area and pixel counts of a non-image area of the whole recording sheet can be obtained. The recording sheet is divided into N-numbers of sections continuing in the main scanning direction, and further divided into M-numbers of

sections continuing in the sub-scanning direction. Pixel counts of an image area and pixel counts of a non-image area of each of the sections on the recording sheet are calculated. Based on these two values, an image area ratio of each of the sections is calculated, for example, by dividing pixel counts by total pixel counts. The image area ratio can be calculated by other calculating formulas as long as an efficiency of consumption of the cleaning member 8 can be improved.

[0043] For example, when an image area ratio of the section S1' on the recording sheet 9 exceeds the threshold C, the area S2' on the fixing roller 31a, which is used to fix the toner image on the section S1' of the recording sheet 9, is determined as a portion to be cleaned. After the fixing unit 31 fixes a portion of the toner image corresponding to the section S1' on the recording sheet 9, when the area S2' on the fixing roller 31a used to fix the portion of the toner image passes through a point close to the cleaning unit 10, the corresponding fixing cleaning roller 12 is brought into contact with the fixing roller 31a across the cleaning member 8. Then, after the area S2' on the fixing roller 31a passes through a contact point where the fixing roller 31a has contact with the fixing cleaning roller 12 across the cleaning member 8, the fixing cleaning roller 12 is separated from the fixing roller 31a. Namely, after the toner image is fixed on the recording sheet 9, the fixing cleaning roller 12 is brought into contact with only the area S2' on the fixing roller 31a across the cleaning member 8 in synchronization with the approaching area S2' on the fixing roller 31a in accordance with the rotation of the fixing roller 31a. After the area S2' on the fixing roller 31a passes through the fixing cleaning roller 12, the fixing cleaning roller 12 is separated from the fixing roller 31a.

[0044] The timing of bringing the fixing cleaning roller 12 into contact with the fixing roller 31a can be set based on an elapsed time since the area S2' on the fixing roller 31a has passed through the fixing nip between the fixing roller 31a and the pressure roller 31b. Furthermore, a sensor can be provided to the cleaning unit 10 so as to bring the fixing cleaning roller 12 into contact with the fixing roller 31a when the sensor detects the approaching area S2' on the fixing roller 31a. Alternatively, when the sensor detects the approaching area S2' on the fixing roller 31a, it can be configured to cause the fixing roller 31a to stop rotating so as to wait for the fixing cleaning roller 12 to come in contact with the fixing roller 31a.

[0045] Subsequently, a concrete method for determining the contact/separation timing of the fixing cleaning roller 12 is explained below. Fig. 10 is a schematic diagram illustrating a distance from a fixing inlet sensor 36 to a fixing nip 37 and a distance from the fixing nip 37 to a contact point between the fixing roller 31a and the fixing cleaning roller 12. Fig. 11 is a schematic diagram illustrating the recording sheet 9 and the section S1' on the recording sheet 9.

[0046] As shown in Fig. 10, a pair of registration rollers 40a and 40b bring the recording sheet 9 conveyed from a sheet feed unit (not shown) to a stop temporarily, and convey the recording sheet 9 in synchronization with a toner image formed on a photosensitive element 21a. While the recording sheet 9 conveyed from the registration rollers 40a and 40b passes through a transfer nip formed between the photosensitive element 21a and a transfer roller 21b, the toner image on the photosensitive element 21a is transferred onto the recording sheet 9.

[0047] The recording sheet 9 passing through the transfer nip is conveyed to the fixing nip 37 via the fixing inlet sensor 36. A distance from the fixing inlet sensor 36 to the fixing nip 37 shall be referred to as I1, and an outer circumferential distance of the fixing roller 31a from the fixing nip 37 to the contact point between the fixing roller 31a and the fixing cleaning roller 12 shall be referred to as I2.

[0048] Incidentally, the top of the recording sheet 9 shown in Fig. 11 corresponds to a leading edge of the recording sheet 9 conveyed to the fixing unit 31. As shown in Fig. 11, a distance from the leading edge of the recording sheet 9 up to an upper end of the section S1' shall be referred to as I3. A conveying speed of the recording sheet 9 shall be referred to as v1.

[0049] A time t1 from when the leading edge of the recording sheet 9 comes to the fixing inlet sensor 36 till when an upper end of the area S2' on the fixing roller 31a corresponding to the section S1' on the recording sheet 9 comes to the contact point between the fixing roller 31a and the fixing cleaning roller 12 is calculated by

$$t1=(I1+I2+I3)/v1 \qquad (1)$$

[0050] Based on the time t1 obtained by Equation (1) and the timing when the leading edge of the recording sheet 9 comes to the fixing inlet sensor 36, a timing when the upper end of the area S2' on the fixing roller 31a comes to the contact point between the fixing roller 31a and the fixing cleaning roller 12 can be determined. Therefore, based on the timing when the upper end of the area S2' on the fixing roller 31a comes to the contact point between the fixing roller 31a and the fixing cleaning roller 12, the fixing cleaning roller 12 is brought into contact with the fixing roller 31a.

[0051] Incidentally, the threshold C can be changed, for example, depending on whether the toner image is a single-color toner image or a multi-color toner image, or how many colors of toner images are superimposed if the toner image is a multi-color toner image. Furthermore, the number of contact movement of the fixing cleaning roller 12 is not limited

to once. The contact/separation movement of the fixing cleaning roller 12 can be repeated while the area S2' on the fixing roller 31a further makes 1 to n revolutions. In this case, the cleaning effect can be improved, for example, when the one-time contact movement of the fixing cleaning roller 12 is insufficient to clean the fixing roller 31a.

[0052] Subsequently, a configuration and functions of the image forming apparatus 200 are explained below. Fig. 12 is a block diagram of the image forming apparatus 200 including the cleaning unit 80 according to the second embodiment. As shown in Fig. 12, the image forming apparatus 200 includes the image input unit 1, the external input unit 2, the image processing unit 3, the image output unit 4, the image-data-amount calculating unit 5, and the cleaning unit 80. The portions identical to those in Fig. 4 for the first embodiment are denoted with the same reference numerals, and the description of those portions is omitted. The cleaning unit 80 includes a drive control unit 600 and the cleaning units 7.

[0053] A configuration and functions of the drive control unit 600 is explained below. Fig. 13 is a block diagram of the drive control unit 600. As shown in Fig. 13, the drive control unit 600 includes the image-data-amount acquiring unit 61, the image-data-amount determining unit 62, the area determining unit 63, a drive executing unit 604, and a contact/separation control unit 601. The portions identical to those in Fig. 6 for the first embodiment are denoted with the same reference numerals, and the description of those portions is omitted.

[0054] The contact/separation control unit 601 controls a timing of causing the drive executing unit 604 to bring the fixing cleaning roller 12 into contact with the fixing roller 31a and a timing of causing the drive executing unit 604 to separate the fixing cleaning roller 12 from the fixing roller 31a. Specifically, after a lapse of a predetermined time since the corresponding section on the recording sheet 9 has passed through the fixing inlet sensor 36, the contact/separation control unit 601 causes the drive executing unit 604 to bring the fixing cleaning roller 12 into contact with the fixing roller 31a. Then, after a lapse of a predetermined time since the fixing cleaning roller 12 has been brought into contact with the fixing roller 31a, the contact/separation control unit 601 causes the drive executing unit 604 to separate the fixing cleaning roller 12 from the fixing roller 31a. Under the control of the contact/separation control unit 601, the drive executing unit 604 brings the fixing cleaning roller 12 into contact with the area on the fixing roller 31a to be cleaned, and separates the fixing cleaning roller 12 from the fixing roller 31a.

[0055] Subsequently, a cleaning process performed by the cleaning unit 80 is explained in detail below with reference to a flowchart shown in Fig. 14.

[0056] The image-data-amount acquiring unit 61 acquires an image area ratio of the section S1' on the recording sheet 9 (Step S30). The image-data-amount determining unit 62 determines whether the acquired image area ratio exceeds a predetermined threshold (Step S31). When the image-data-amount determining unit 62 determines that the image area ratio exceeds the threshold (YES at Step S31), the area determining unit 63 determines the area on the fixing roller 31a corresponding to the section S1' on the recording sheet 9 (in this case, the area S2' on the fixing roller 31a) (Step S32).

[0057] The contact/separation control unit 601 determines whether the section S1' on the recording sheet 9 passes through the fixing inlet sensor 36, i.e., whether the fixing inlet sensor 36 detects the section S1' on the recording sheet 9 (Step S33). When the passage of the section S1' on the recording sheet 9 is detected (YES at Step S33), the contact/separation control unit 601 determines whether a predetermined time t1 has passed since the section S1' on the recording sheet 9 has passed through the fixing inlet sensor 36 (Step S34). When determining that the time t1 has passed (YES at Step S34), the contact/separation control unit 601 gives the drive executing unit 604 an instruction to bring the fixing cleaning roller 12 into contact with the fixing roller 31a.

[0058] In accordance with the instruction, the drive executing unit 604 brings the fixing cleaning roller 12 into contact with the determined area S2' on the fixing roller 31a (Step S35). The contact/separation control unit 601 determines whether a time t2 taken to convey the recording sheet 9 for a distance equivalent to one area on the fixing roller 31a has passed (Step S36). When determining that the time t2 has passed (YES at Step S36), the contact/separation control unit 601 gives the drive executing unit 604 an instruction to separate the fixing cleaning roller 12 from the fixing roller 31a. In accordance with the instruction, the drive executing unit 604 separates the fixing cleaning roller 12 from the fixing roller 31a (Step S37).

[0059] As described above, in the present embodiment, a recording sheet on which a toner image is transferred is divided into a plurality of sections continuing both in the main scanning direction (the direction perpendicular to the sheet conveying direction) and in the sub-scanning direction (the sheet conveying direction), and a ratio of an image area to a non-image area of each of the sections on the recording sheet is obtained. As for the division of the recording sheet in the main scanning direction, which one of the areas on the fixing roller to be cleaned is determined based on the image area ratio of each of the sections on the recording sheet, and the fixing cleaning roller opposed to the determined area on the fixing roller is selected. As for the division of the recording sheet in the sub-scanning direction, a contact/separation timing of the fixing cleaning roller is controlled based on a timing when the toner image on the recording sheet passes through the fixing nip. Therefore, the cleaning member can be consumed efficiently.

[0060] In the first embodiment, the image-data-amount calculating unit 5 calculates an image area ratio as the image data amount. In an image forming apparatus 300 including a cleaning unit 110 according to a third embodiment of the present invention, the image-data-amount calculating unit shall calculate a cumulative toner amount as the image data

amount. Specifically, each time a toner image is fixed on a recording sheet, a toner amount of the toner image fixed by each of the areas on the fixing roller is obtained, and a cumulative toner amount with respect to each area on the fixing roller is held. When the cumulative toner amount exceeds a predetermined threshold, the fixing cleaning roller opposed to the corresponding area on the fixing roller is brought into contact with the area on the fixing roller.

[0061] The portions identical to those in the first and second embodiments are denoted with the same reference numerals, and the description of those portions is omitted. In the third embodiment, a section on the recording sheet 9 where a portion of the toner image causing the corresponding area on the fixing roller 31a to be subject to a cleaning process is transferred shall be referred to as a section S1'', and the area on the fixing roller 31a corresponding to the section S1'' on the recording sheet 9 shall be referred to as an area S2''.

[0062] A concrete method of cleaning the area S2'' on the fixing roller 31a subject to the cleaning process is explained below with reference to Figs. 15 to 17. Fig. 15 is a schematic diagram illustrating a reference mark 32 put on the fixing roller 31a. Fig. 16 is a schematic diagram illustrating a position of a mark detecting sensor 33 provided in the fixing unit 31 to detect the reference mark 32. Fig. 17 is an expansion plan of the fixing roller 31a cut along the reference mark 32.

[0063] As shown in Fig. 15, the reference mark 32 is put on an end portion of the surface of the fixing roller 31a where the recording sheet 9 does not come in contact. Furthermore, the mark detecting sensor 33 for detecting the reference mark 32 is provided above the fixing roller 31a.

[0064] Fig. 16 depicts the cleaning unit 110 and the fixing unit 31 viewed from the main scanning direction (the direction perpendicular to the sheet conveying direction). As shown in Fig. 16, an outer circumferential distance of the fixing roller 31a from the mark detecting sensor 33 to the contact point between the fixing cleaning roller 12 and the fixing roller 31a shall be referred to as I4.

[0065] Fig. 17 depicts the fixing roller 31a expanded in the sub-scanning direction (the sheet conveying direction) with the reference mark 32 placed on the top edge. As shown in Fig. 17, a distance from the reference mark 32 to an upper end of the area S2'' on the fixing roller 31a in the sheet conveying direction shall be referred to as I5. A sheet conveying speed shall be referred to as v2.

[0066] When the fixing roller 31a rotates in the direction of conveying the recording sheet 9 at the sheet conveying speed v2, a time t2 from when the mark detecting sensor 33 detects the reference mark 32 till when the upper end of the area S2'' on the fixing roller 31a comes to the contact point between the fixing roller 31a and the fixing cleaning roller 12 is calculated by

$$t2=(I4+I5)/v2 \qquad (2)$$

[0067] Based on the time t2 and the timing when the mark detecting sensor 33 detects the reference mark 32 put on the fixing roller 31a that rotates in the sheet conveying direction at the sheet conveying speed v2, a timing when the area S2'' on the fixing roller 31a comes to the contact point between the fixing roller 31a and the fixing cleaning roller 12 can be determined. Therefore, a drive control unit 620 included in the cleaning unit 110 brings the fixing cleaning roller 12 into contact with the area S2'' on the fixing roller 31a at the determined timing.

[0068] When cleaning of the fixing roller 31a is performed by using the above method, to make the section on the recording sheet 9 correspond to the area on the fixing roller 31a, also at the time of fixing the toner image on the recording sheet 9, it is necessary to rotate the fixing roller 31a, for example, so that the reference mark 32 on the fixing roller 31a is aligned with the leading edge of the recording sheet 9.

[0069] Subsequently, a configuration and functions of the image forming apparatus 300 are explained below. Fig. 18 is a block diagram of the image forming apparatus 300 including the cleaning unit 110 according to the third embodiment. As shown in Fig. 18, the image forming apparatus 300 includes the image input unit 1, the external input unit 2, the image processing unit 3, the image output unit 4, an image-data-amount calculating unit 520, and the cleaning unit 110. The portions identical to those in Fig. 4 for the first embodiment are denoted with the same reference numerals, and the description of those portions is omitted. The cleaning unit 110 includes the drive control unit 620 and the cleaning units 7.

[0070] Fig. 19 is a block diagram of the image-data-amount calculating unit 520. As shown in Fig. 19, the image-data-amount calculating unit 520 includes a fixed-toner-amount acquiring unit 521, a cumulative-toner-amount counter 522, and a cumulative-toner-amount calculating unit 523. The fixed-toner-amount acquiring unit 521 acquires a toner amount of a toner image fixed on each of the sections on the recording sheet 9 in image processing by the image processing unit 3. The cumulative-toner-amount counter 522 counts the fixed toner amount acquired by the fixed-toner-amount acquiring unit 521 each time a toner image is fixed. The cumulative-toner-amount calculating unit 523 calculates a cumulative toner amount based on the count by the cumulative-toner-amount counter 522.

[0071] Fig. 20 is a block diagram of the drive control unit 620. As shown in Fig. 20, the drive control unit 620 includes an image-data-amount acquiring unit 621, the image-data-amount determining unit 62, an area determining unit 623,

and the drive executing unit 64. The portions identical to those in Fig. 6 for the first embodiment are denoted with the same reference numerals, and the description of those portions is omitted.

[0072] The image-data-amount acquiring unit 621 acquires a cumulative toner amount calculated by the image-data-amount calculating unit 520. The area determining unit 623 determines a position on the fixing cleaning roller 12 where the area on the fixing roller 31a determined that a cumulative toner amount exceeds a predetermined threshold comes in contact based on a timing when the mark detecting sensor 33 detects the reference mark 32 put on the fixing roller 31a.

[0073] Subsequently, a cleaning process performed by the cleaning unit 110 is explained in detail below with reference to a flowchart shown in Fig. 21.

[0074] The image-data-amount acquiring unit 621 acquires a cumulative toner amount of the area S2'' on the fixing roller 31a (Step S40). The image-data-amount determining unit 62 determines whether the cumulative toner amount of the area S2'' on the fixing roller 31a exceeds a predetermined threshold (Step S41). When the image-data-amount determining unit 62 determines that the cumulative toner amount exceeds the threshold (YES at Step S41), the area determining unit 623 determines whether the mark detecting sensor 33 detects the reference mark 32 put on the fixing roller 31a (Step S42). When the mark detecting sensor 33 detects the reference mark 32 (YES at Step S42), the area determining unit 623 determines whether a predetermined time t3 has passed since the mark detecting sensor 33 has detected the reference mark 32 (Step S43). When determining that the time t3 has passed (YES at Step S43), the drive executing unit 64 brings the fixing cleaning roller 12 into contact with the area S2'' on the fixing roller 31a (Step S44).

[0075] In this manner, in the third embodiment, a cumulative toner amount of toner images fixed by each of the areas on the fixing roller 31a is used as the image data amount. Therefore, the cleaning member can be consumed efficiently.

[0076] As a modified example of the third embodiment, instead of the image-data-amount calculating unit 520, an image-data-amount calculating unit 530 is provided to the image forming apparatus 300. As the image data amount, the image-data-amount calculating unit 530 calculates either an image area ratio or a cumulative toner amount of fixed toner amounts, for example, by setting flag information, and thereby controlling the drive of the fixing cleaning roller based on the calculated image data amount. Namely, a user can select any of the image area ratio and the cumulative toner amount that makes it possible to consume the cleaning member with a higher degree of efficiency. Furthermore, as for the setting of the flag information, the flag information can be directly input to an input unit of the image forming apparatus, or the image forming apparatus can receive the flag information transmitted from, for example, a client terminal connected to the image forming apparatus via a network. In this case, a user can set the flag information remotely, and thus the usability can be improved.

[0077] A concrete configuration of the image-data-amount calculating unit 530 capable of controlling the image data amount to switch between the image area ratio and the cumulative toner amount is explained below. Fig. 22 is a block diagram of the image-data-amount calculating unit 530. As shown in Fig. 22, the image-data-amount calculating unit 530 includes a switching unit 531, the image-area-ratio calculating unit 53, and the cumulative-toner-amount calculating unit 523. The portions identical to those in Figs. 5 and 19 for the first and third embodiments are denoted with the same reference numerals, and the description of those portions is omitted.

[0078] The switching unit 531 switches between the image-area-ratio calculating unit 53 and the cumulative-toner-amount calculating unit 523 in accordance with a user's instruction input via an operation panel (not shown).

[0079] After any one of the image-area-ratio calculating unit 53 and the cumulative-toner-amount calculating unit 523 is selected by the switching unit 531, the image-data-amount acquiring unit 621 acquires an image data amount (either an image area ratio or a cumulative toner amount). In the same manner as described above, the image-data-amount determining unit 62 determines whether the acquired image data amount (either the image area ratio or the cumulative toner amount) exceeds the predetermined threshold. When the image data amount exceeds the threshold, the cleaning process is executed.

[0080] Incidentally, the above embodiments are preferred embodiments of the present invention. The present invention is not limited to the above embodiments. Various changes can be made without departing from the scope of the invention. For example, the image forming apparatus according to the present invention can be applied to any of a copier, a printer, a multifunction product (MFP), and the like. The fixing unit to be cleaned by the cleaning unit according to the present invention is not limited to the one employing the fixing roller. The cleaning unit according to the present invention can be applied to a fixing unit employing a fixing belt. Furthermore, in the above embodiments, the cleaning unit uses a web as the cleaning member. However, the cleaning unit can use other cleaning members, such as a roller or felt.

[0081] Incidentally, in the above embodiments, the image forming apparatus according to the present invention is applied to an MFP having at least any two of a copier function, a printer function, a scanner function, and a facsimile-machine function. However, the present invention is not limited to the MFP, and can be applied to other types of image forming apparatuses, such as a copier, a printer, a scanner, and a facsimile machine.

[0082] Fig. 23 is a block diagram illustrating a hardware configuration of an MFP 700 as an example of the image forming apparatuses 100, 200, and 300 according to the first to third embodiments. As shown in Fig. 23, in the MFP 700, a controller unit 710 is connected to an engine unit 760 via a peripheral component interface (PCI) bus. The controller unit 710 is a controller that controls the entire MFP 700, drawing, communication, and an input from an operating unit

(not shown). The engine unit 760 is, for example, a printer engine that can be connected to the PCI bus, and may be, for example, a black and white plotter, a 1-drum color plotter, a 4-drum color plotter, a scanner, and a facsimile machine. Incidentally, the engine unit 760 includes an image processing section that performs, for example, error diffusion or gamma conversion in addition to a so-called engine section such as the plotters.

[0083] The controller unit 710 includes a central processing unit (CPU) 711, a North Bridge (NB) 713, a system memory (MEM-P) 712, a South Bridge (SB) 714, a local memory (MEM-C) 717, an Application Specific Integrated Circuit (ASIC) 716, and a hard disk drive (HDD) 718. The NB 713 and the ASCI 716 are connected via an Accelerated Graphics Port (AGP) bus 715. The MEM-P 712 includes a read-only memory (ROM) 712a and a random access memory (RAM) 712b.

[0084] The CPU 711 controls the entire MFP 700, and has a chipset composed of the NB 713, the MEM-P 712, and the SB 714. The CPU 711 is connected to other devices via the chipset.

[0085] The NB 713 is a bridge for connecting the MEM-P 712, the SB 714, and the AGP bus 715 to the CPU 711. The NB 713 includes a memory controller that controls read/write with respect to the MEM-P 712 and the like, a PCI master, and an AGP target.

[0086] The MEM-P 712 is a system memory used for, for example, storing therein a computer program or data, developing a computer program or data, or drawing an image to be printed by a printer. The MEM-P 712 is composed of the ROM 712a and the RAM 712b. The ROM 712a is a read-only memory used for storing therein a computer program or data. The RAM 712b is a writable and readable memory used for developing a computer program or data or for drawing an image to be printed by a printer.

[0087] The SB 714 is a bridge for connecting the NB 713 and PCI devices to a peripheral device. The SB 714 is connected to the NB 713 via the PCI bus. An network interface (I/F) unit and the like are also connected to the PCI bus.

[0088] The ASIC 716 is an integrated circuit (IC) for image processing, and includes hardware components for image processing. The ASIC 716 serves as a bridge for connecting the AGP bus 715, the PCI bus, the HDD 718, and the MEM-C 717 to one another. The ASIC 716 is composed of a PCI target, an AGP master, an arbiter (ARB) constituting the core of the ASIC 716, a memory controller for controlling the MEM-C 717, a plurality of direct memory access controllers (DMACs) that performs, for example, image data rotation by using a hardware logic, and a PCI unit that performs data transfer to the engine unit 760 via the PCI bus. A facsimile control unit (FCU) 730, a universal serial bus (USB) 740, and the Institute of Electrical and Electronics Engineers 1394 (IEEE 1394) interface 750 are connected to the ASIC 716 via the PCI bus. Furthermore, an operation display unit 720 is directly connected to the ASIC 716.

[0089] The MEM-C 717 is a local memory used as a copy image buffer and a code buffer. The HDD 718 is a storage for storing therein image data, a computer program, font data, and a form.

[0090] The AGP bus 715 is a bus interface for a graphics accelerator card that is developed for accelerating a graphics operation. The AGP bus 715 directly accesses the MEM-P 712 with high throughput, and thereby accelerating the processing in the graphic accelerator card.

[0091] In this manner, the cleaning unit according to the present invention can improve the efficiency of cleaning-member consumption.

[0092] Although the invention has been described with respect to specific embodiments for a complete and clear disclosure, the appended claims are not to be thus limited but are to be construed as embodying all modifications and alternative constructions that may occur to one skilled in the art that fairly fall within the basic teaching herein set forth.

Claims

1. An image forming apparatus comprising :

a fixing unit (31) that fixes a toner image transferred onto a recording sheet;
a plurality of cleaning units (7) provided for a plurality of areas on an outer surface of the fixing unit (31) divided in a direction perpendicular to a rotating axis, respectively, each independently removing unwanted substances adhered to the fixing unit (31) by making contact with the fixing unit (31);
an image-data-amount calculating unit (5, 520) that divides a recording sheet into a plurality of sections, and calculates image data amount of the toner image transferred onto the recording sheet for each of the sections; and
a drive control unit (6, 600, 620) that brings a cleaning unit (7) corresponding to an area of the fixing unit (31) used to fix the toner image into contact with the fixing unit (31) based on the image data amount calculated by the image-data-amount calculating unit (5, 520).

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

the image-data-amount calculating unit (5) divides the recording sheet into the sections continuing in a direction perpendicular to a conveying direction of the recording sheet, and

the drive control unit (6) includes

an image-data-amount determining unit (62) that determines whether the image data amount exceeds a predetermined threshold for each of the sections,
an area determining unit (63) that determines, when it is determined that the image data amount exceeds the threshold, an area for which the image data amount exceeds the threshold as a first area used to fix the toner image on the recording sheet, and
a drive executing unit (64) that brings a cleaning unit (7) corresponding to the first area into contact with the fixing unit (31).

3. The image forming apparatus according to claim 2, wherein the image-data-amount calculating unit (5) divides the recording sheet into the sections continuing in the conveying direction of the recording sheet and the direction perpendicular to the conveying direction.

4. The image forming apparatus according to any one of claims 1 to 3, wherein the image-data-amount calculating unit (5) calculates a pixel ratio of each of the sections as the image data amount.

5. The image forming apparatus according to claim 3, wherein the drive control unit (600) further includes a contact control unit (601) that controls a start time of bringing the cleaning unit (7) into contact with the fixing unit (31).

6. The image forming apparatus according to claim 3, wherein the drive control unit (600) further includes a separation control unit (601) that controls a start time of separating the cleaning unit (7) from the fixing unit (31).

7. The image forming apparatus according to claim 5, wherein the contact control unit (601) calculates the start time based on a distance from a leading edge of the recording sheet to an area of the recording sheet with which the cleaning unit (7) makes contact and a conveyance speed of the recording sheet.

8. The image forming apparatus according to claim 6, wherein the separation control unit (601) calculates the start time based on a length of one section of the recording sheet and a conveyance speed of the recording sheet.

9. The image forming apparatus according to any one of claims 1 to 3, wherein the image-data-amount calculating unit (520) obtains fixed toner amount of the toner image fixed on each of the sections each time the fixing unit (31) fixes the toner image on the recording sheet, counts up cumulative toner amount of the fixed toner amount for each of the sections, and calculates the cumulative toner amount as the image data amount.

10. The image forming apparatus according to claim 9, wherein the area determining unit determines the first area based on a distance from a reference point on the fixing unit (31) to a contact point between the fixing unit (31) and the cleaning unit (7), a distance from a leading edge of the recording sheet to the recording sheet, and a conveyance speed of the recording sheet.

11. The image forming apparatus according to any one of claims 1 to 3, wherein the image-data-amount calculating unit (520) calculates, as the image data amount, either one of a pixel ratio of each of the sections and cumulative toner amount of a fixed toner amount of the toner image fixed on each of the sections obtained each time the fixing unit (31) fixes the toner image on the recording sheet.

12. A cleaning device comprising:

a plurality of cleaning units (7) provided for a plurality of areas on an outer surface of a fixing unit (31) divided in a direction perpendicular to a rotating axis, respectively, each independently removing unwanted substances adhered to the fixing unit (31) by making contact with the fixing unit (31);
an image-data-amount calculating unit (5, 520) that divides a recording sheet into a plurality of sections, and calculates image data amount of the toner image transferred onto the recording sheet for each of the sections; and
a drive control unit (6, 600, 620) that brings a cleaning unit (7) corresponding to an area of the fixing unit (31) used to fix the toner image into contact with the fixing unit (31) based on the image data amount calculated by the image-data-amount calculating unit (5, 520).

FIG.1

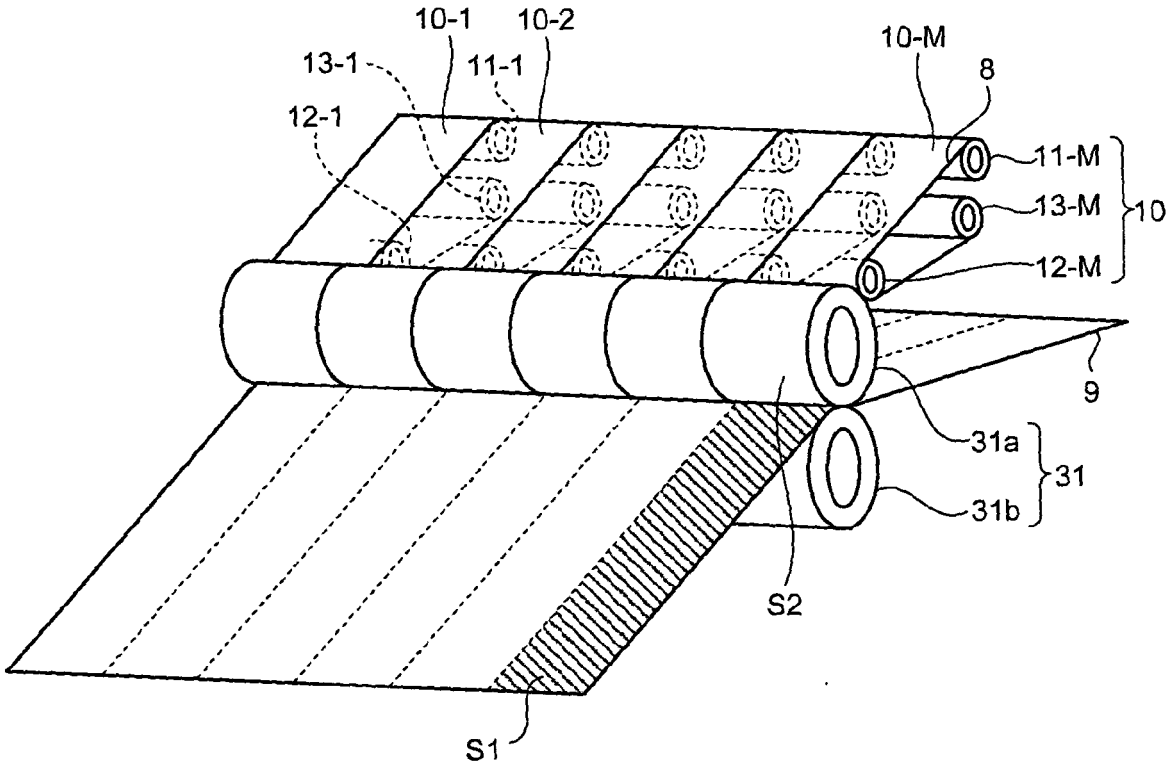


FIG.2

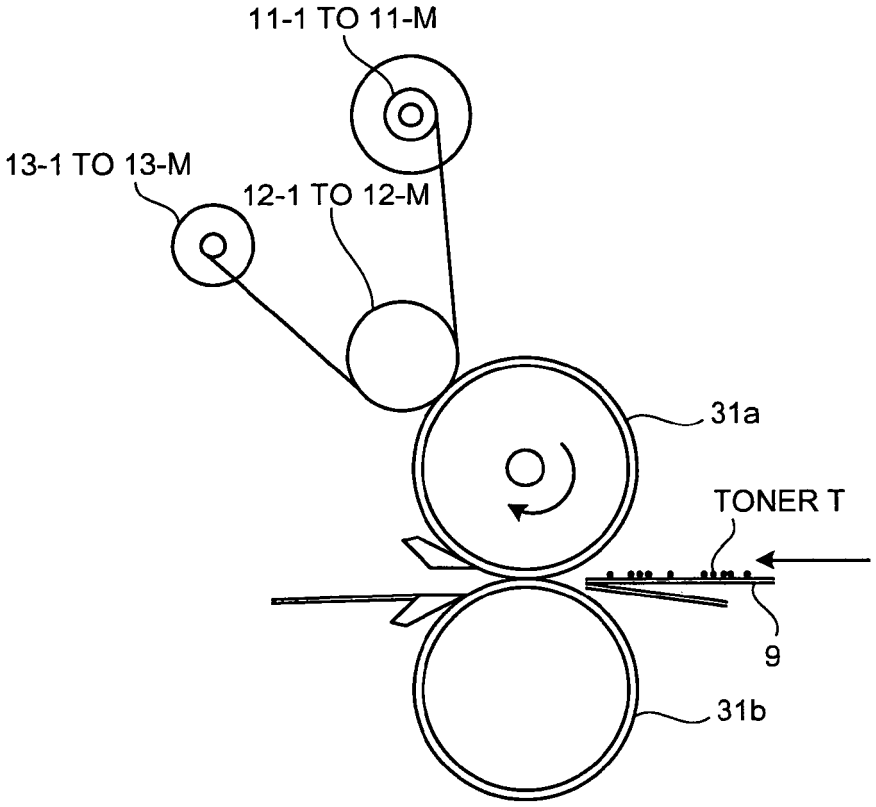

11-1 TO 11-M
13-1 TO 13-M
12-1 TO 12-M
31a
TONER T
9
31b

FIG.3

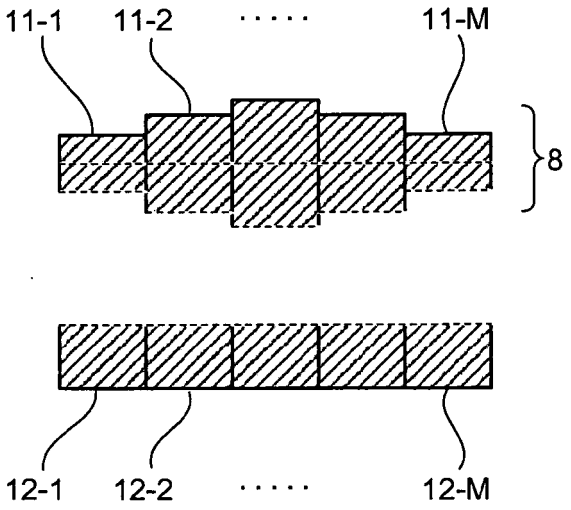

11-1
11-2
11-M
8
12-1
12-2
12-M

FIG.4

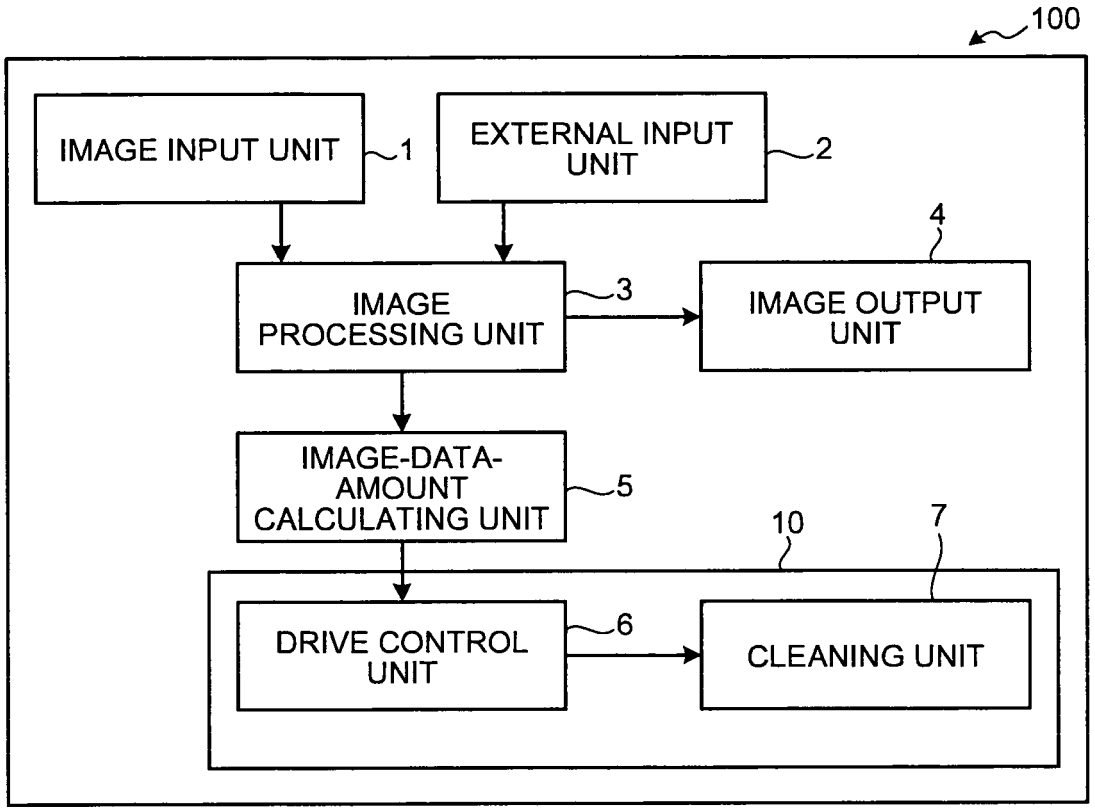

100
IMAGE INPUT UNIT
1
EXTERNAL INPUT UNIT
2
4
IMAGE PROCESSING UNIT
3
IMAGE OUTPUT UNIT
IMAGE-DATA-AMOUNT CALCULATING UNIT
5
10
7
DRIVE CONTROL UNIT
6
CLEANING UNIT

FIG.5

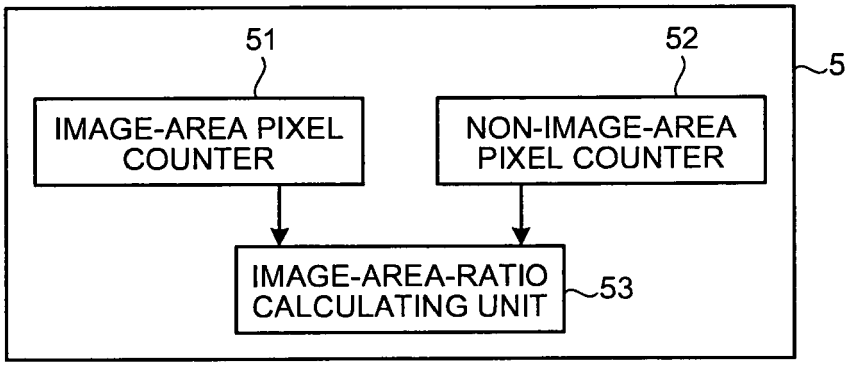

51
52
5
IMAGE-AREA PIXEL COUNTER
NON-IMAGE-AREA PIXEL COUNTER
IMAGE-AREA-RATIO CALCULATING UNIT
53

FIG.6

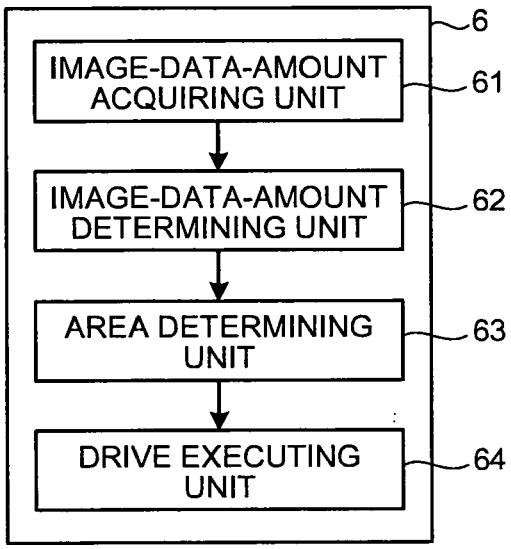

6
IMAGE-DATA-AMOUNT ACQUIRING UNIT
61
IMAGE-DATA-AMOUNT DETERMINING UNIT
62
AREA DETERMINING UNIT
63
DRIVE EXECUTING UNIT
64

FIG.7

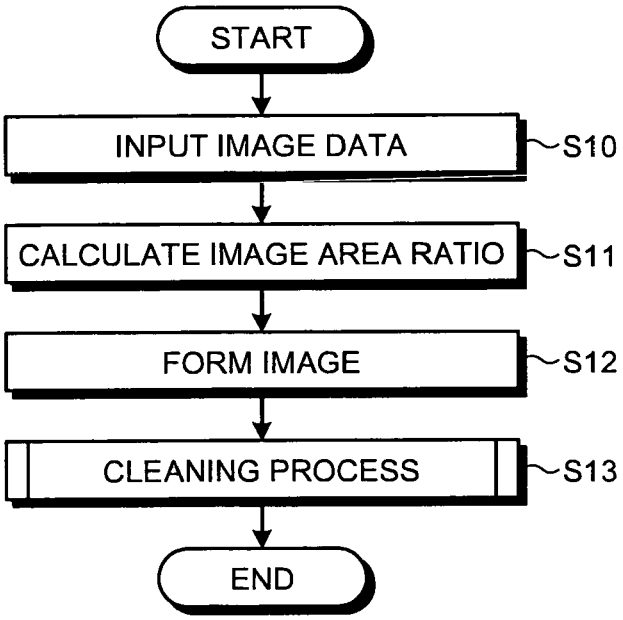

START
INPUT IMAGE DATA
S10
CALCULATE IMAGE AREA RATIO
S11
FORM IMAGE
S12
CLEANING PROCESS
S13
END

FIG.8

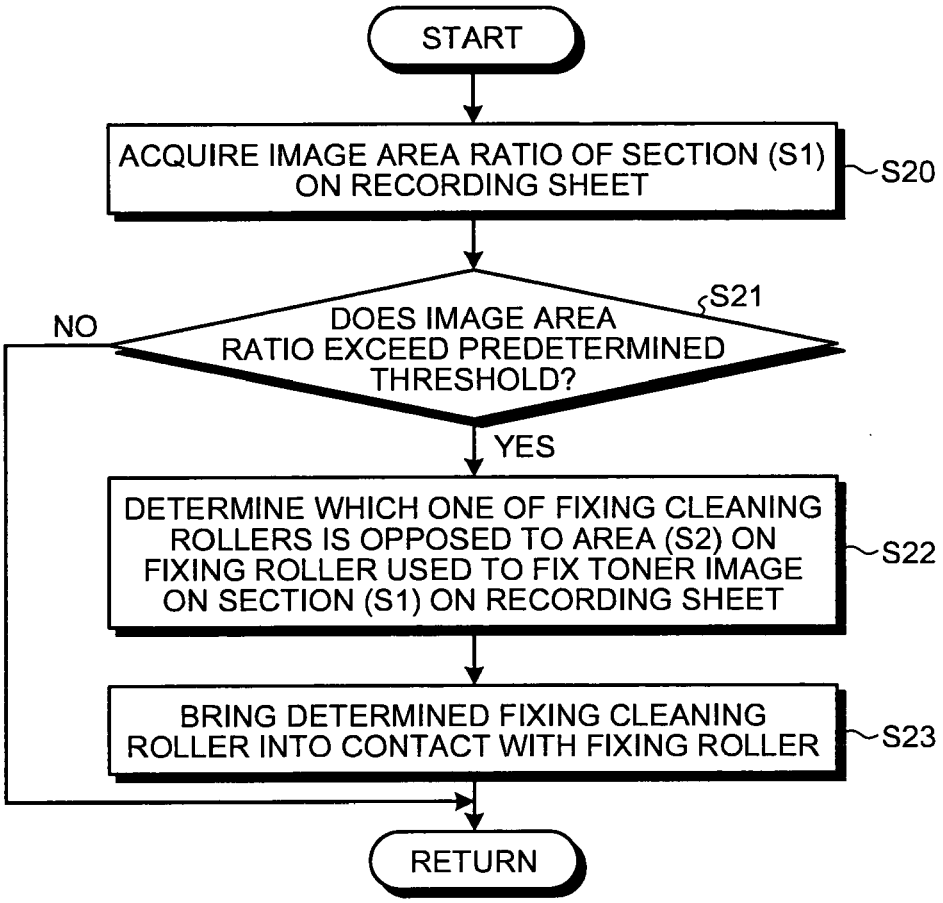

START
ACQUIRE IMAGE AREA RATIO OF SECTION (S1) ON RECORDING SHEET
S20
DOES IMAGE AREA RATIO EXCEED PREDETERMINED THRESHOLD?
S21
NO
YES
DETERMINE WHICH ONE OF FIXING CLEANING ROLLERS IS OPPOSED TO AREA (S2) ON FIXING ROLLER USED TO FIX TONER IMAGE ON SECTION (S1) ON RECORDING SHEET
S22
BRING DETERMINED FIXING CLEANING ROLLER INTO CONTACT WITH FIXING ROLLER
S23
RETURN

FIG.9

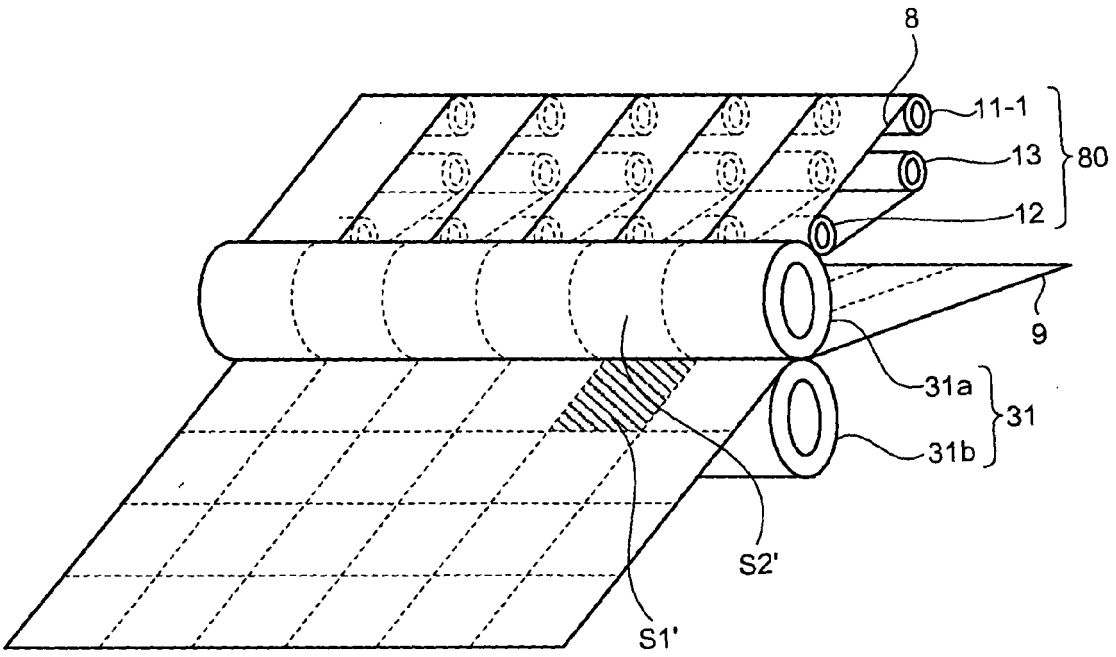


FIG.10

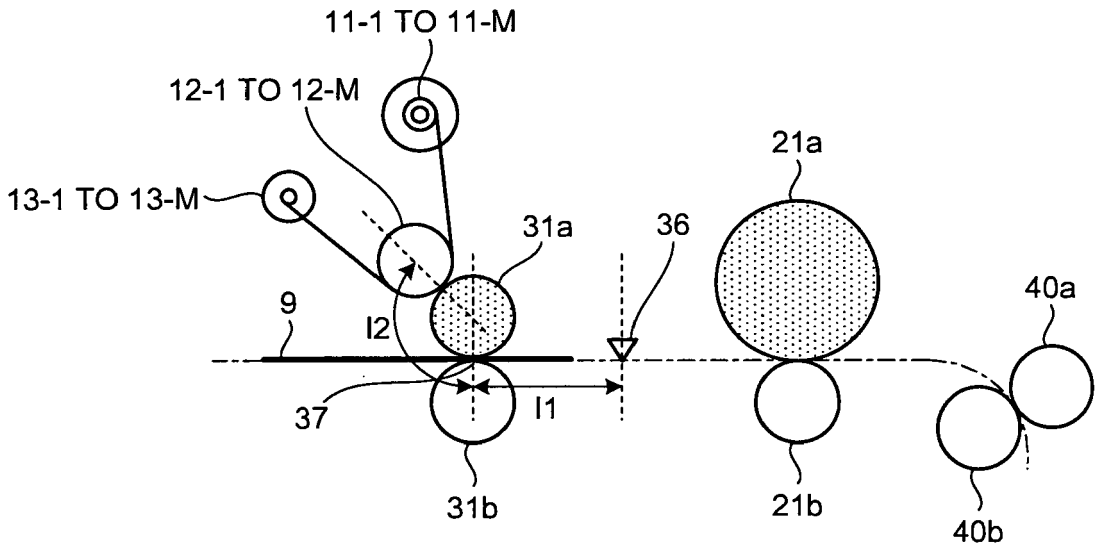

11-1 TO 11-M
12-1 TO 12-M
13-1 TO 13-M
31a
36
21a
40a
9
l2
37
l1
31b
21b
40b

FIG.11

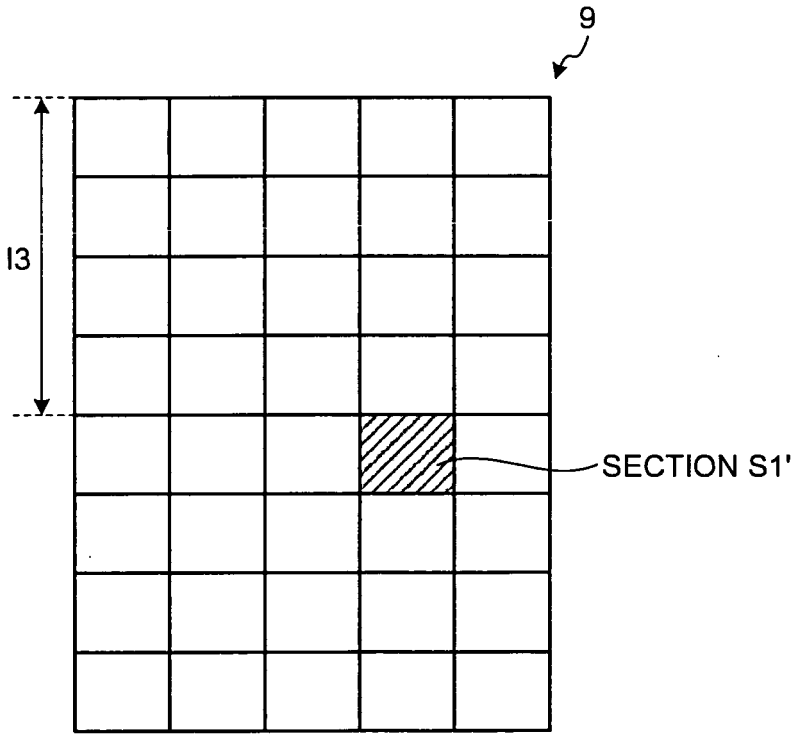

9
l3
SECTION S1'

FIG.12

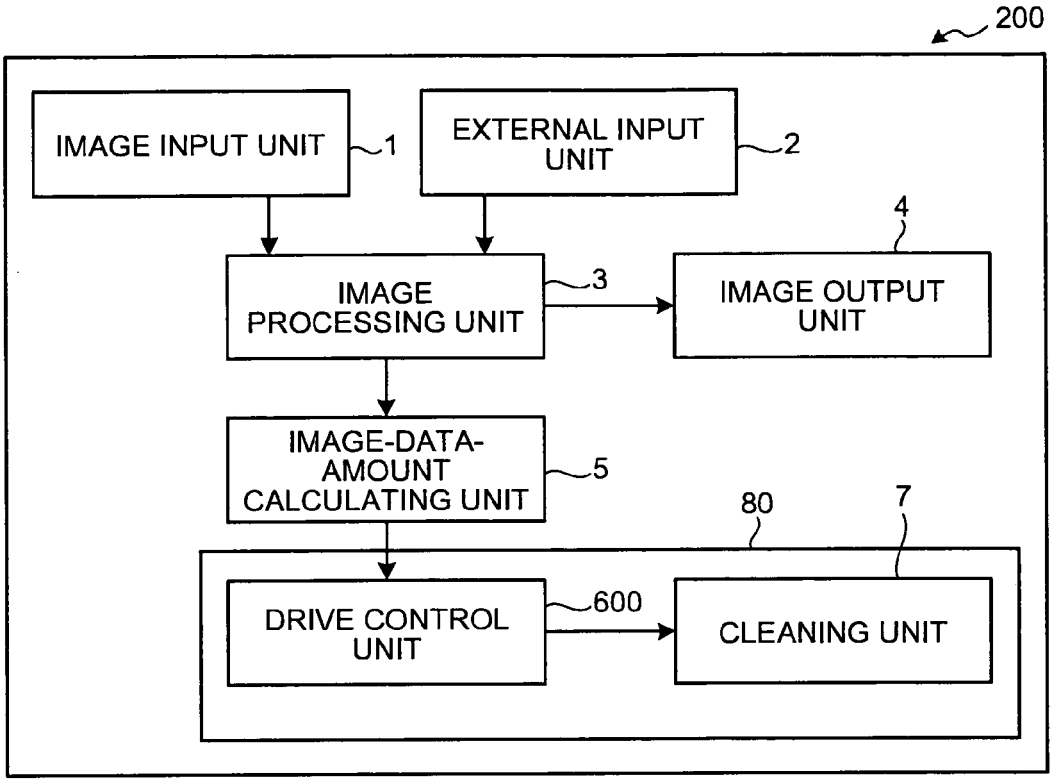

200
IMAGE INPUT UNIT
1
EXTERNAL INPUT UNIT
2
4
IMAGE PROCESSING UNIT
3
IMAGE OUTPUT UNIT
IMAGE-DATA-AMOUNT CALCULATING UNIT
5
80
7
DRIVE CONTROL UNIT
600
CLEANING UNIT

FIG.13

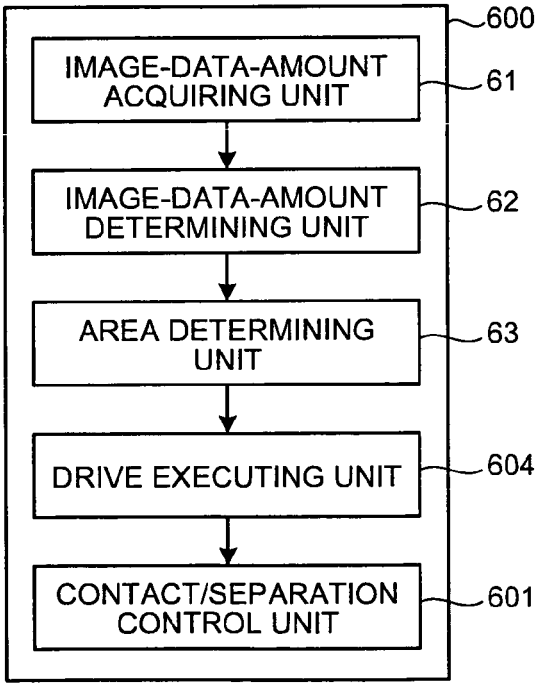

600
IMAGE-DATA-AMOUNT ACQUIRING UNIT
61
IMAGE-DATA-AMOUNT DETERMINING UNIT
62
AREA DETERMINING UNIT
63
DRIVE EXECUTING UNIT
604
CONTACT/SEPARATION CONTROL UNIT
601

FIG.14

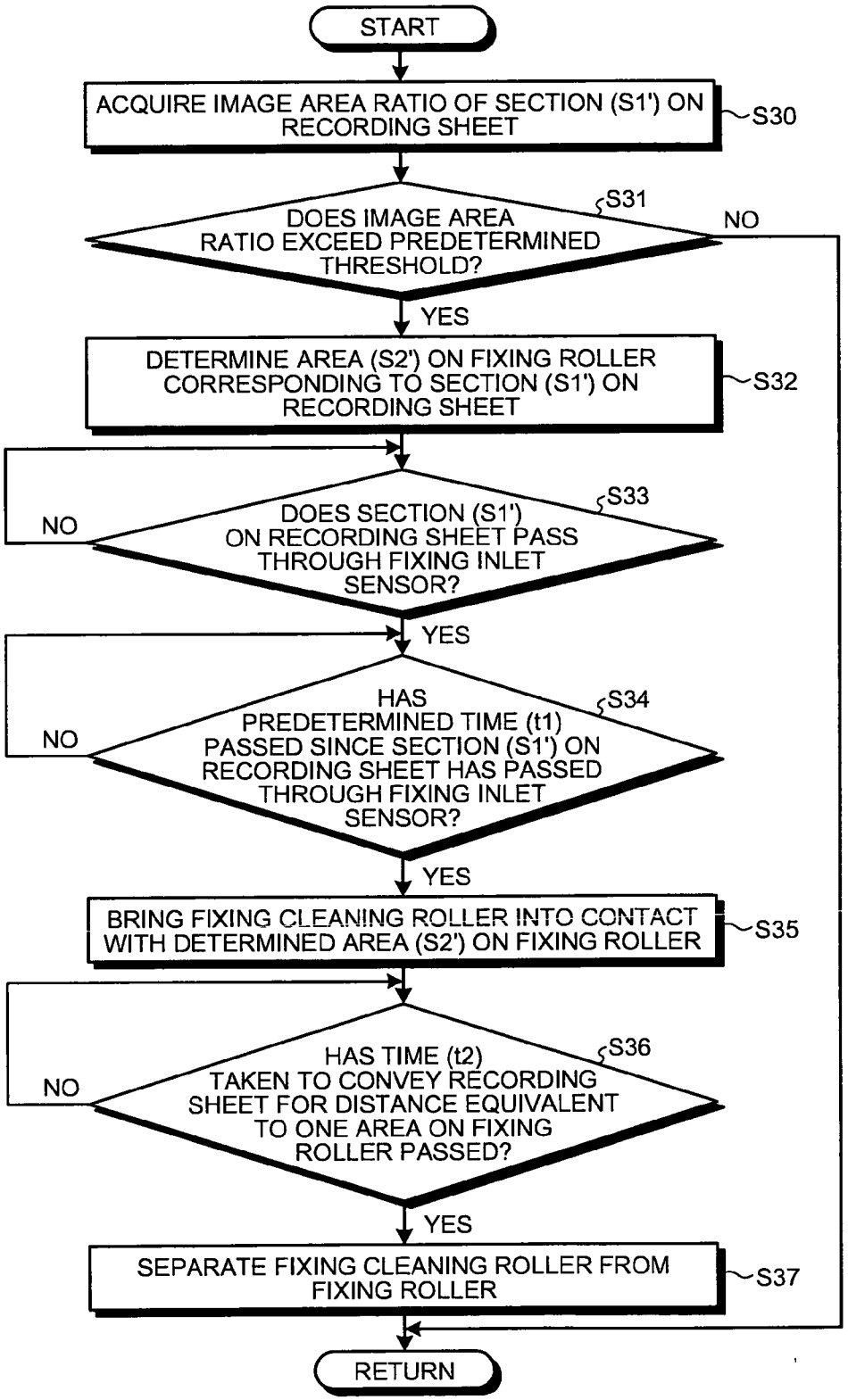

START
ACQUIRE IMAGE AREA RATIO OF SECTION (S1') ON RECORDING SHEET
S30
DOES IMAGE AREA RATIO EXCEED PREDETERMINED THRESHOLD?
S31
NO
YES
DETERMINE AREA (S2') ON FIXING ROLLER CORRESPONDING TO SECTION (S1') ON RECORDING SHEET
S32
DOES SECTION (S1') ON RECORDING SHEET PASS THROUGH FIXING INLET SENSOR?
S33
NO
YES
HAS PREDETERMINED TIME (t1) PASSED SINCE SECTION (S1') ON RECORDING SHEET HAS PASSED THROUGH FIXING INLET SENSOR?
S34
NO
YES
BRING FIXING CLEANING ROLLER INTO CONTACT WITH DETERMINED AREA (S2') ON FIXING ROLLER
S35
HAS TIME (t2) TAKEN TO CONVEY RECORDING SHEET FOR DISTANCE EQUIVALENT TO ONE AREA ON FIXING ROLLER PASSED?
S36
NO
YES
SEPARATE FIXING CLEANING ROLLER FROM FIXING ROLLER
S37
RETURN

FIG.15

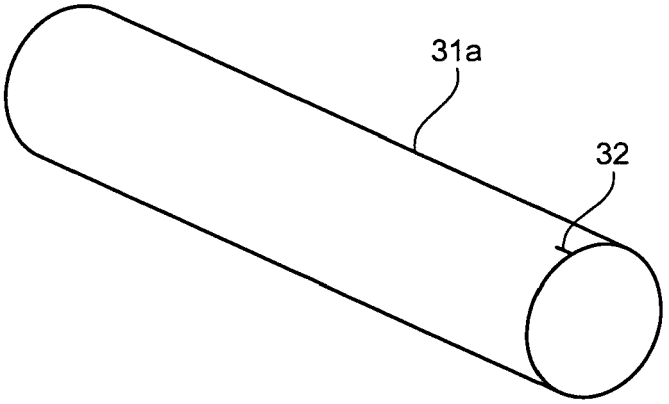


FIG.16

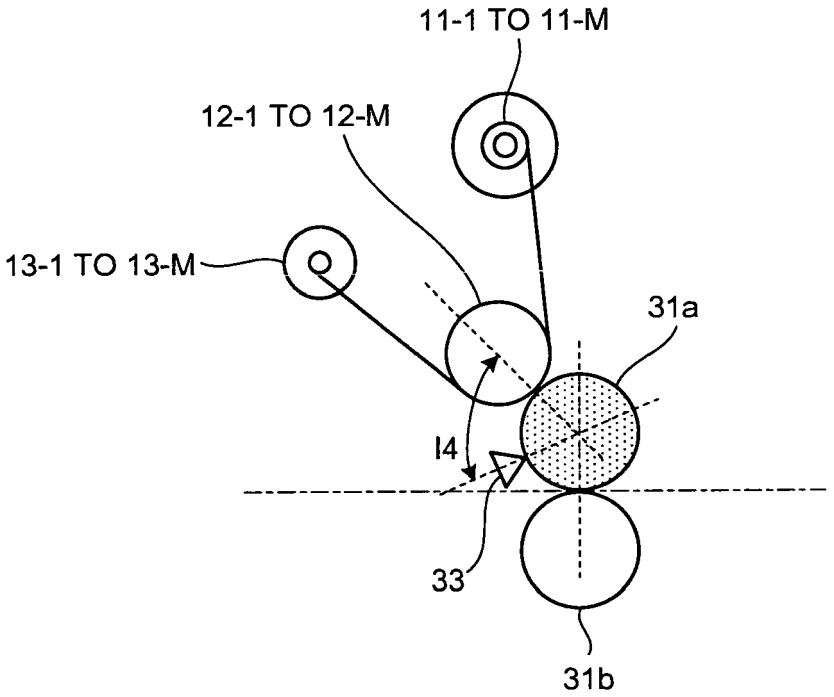


FIG.17

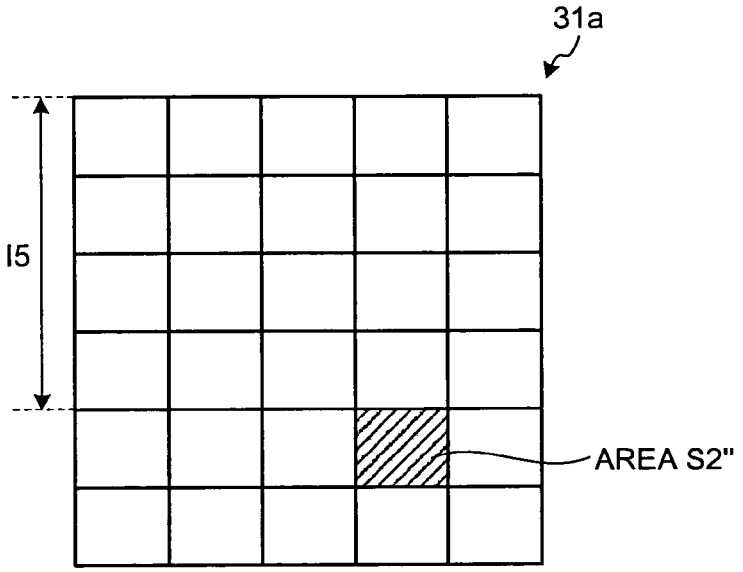

31a
l5
AREA S2"

FIG.18

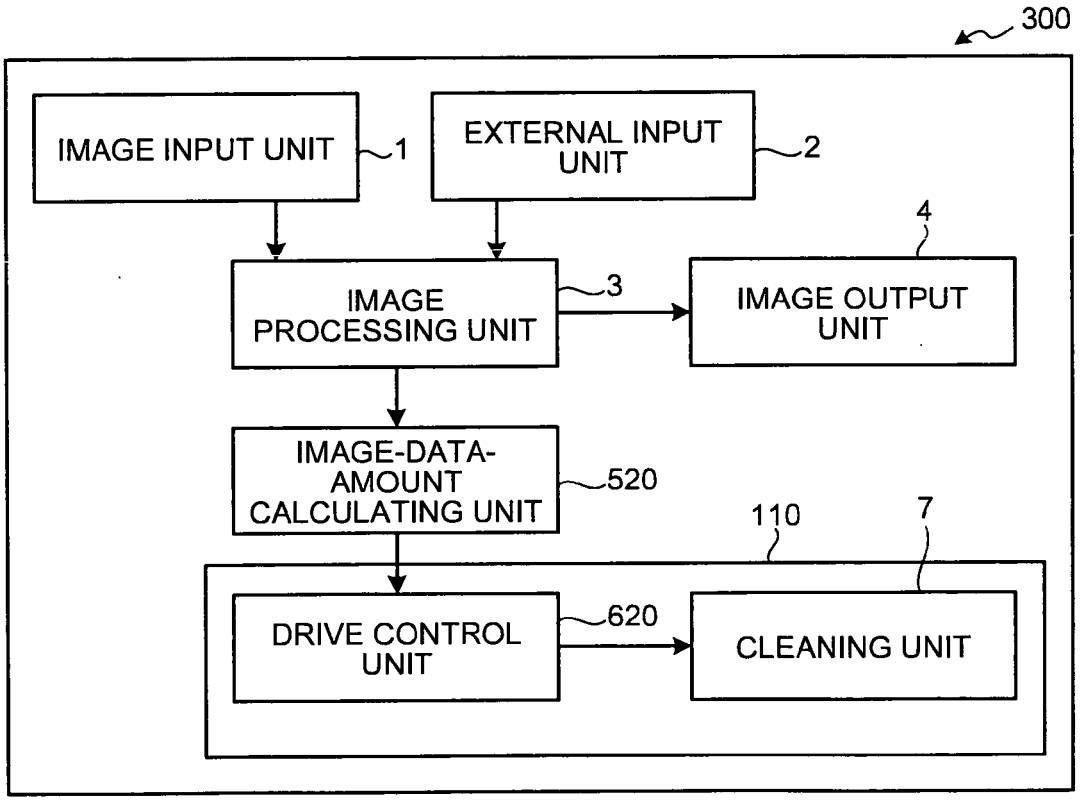

300
IMAGE INPUT UNIT
1
EXTERNAL INPUT UNIT
2
4
IMAGE PROCESSING UNIT
3
IMAGE OUTPUT UNIT
IMAGE-DATA-AMOUNT CALCULATING UNIT
520
110
7
DRIVE CONTROL UNIT
620
CLEANING UNIT

FIG.19

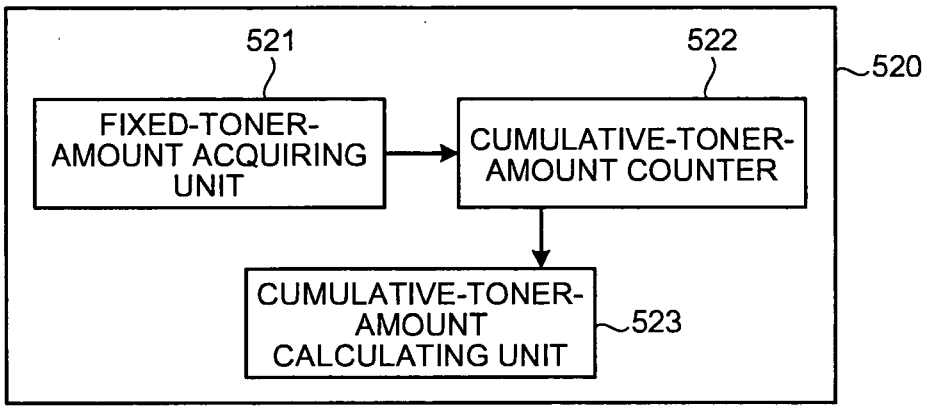

521
522
520
FIXED-TONER-AMOUNT ACQUIRING UNIT
CUMULATIVE-TONER-AMOUNT COUNTER
CUMULATIVE-TONER-AMOUNT CALCULATING UNIT
523

FIG.20

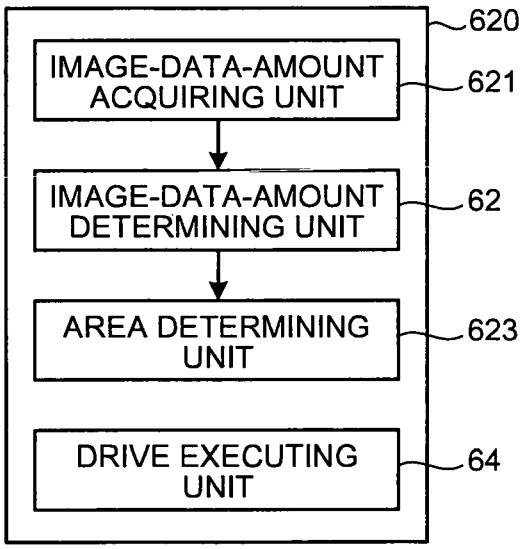

620
IMAGE-DATA-AMOUNT ACQUIRING UNIT
621
IMAGE-DATA-AMOUNT DETERMINING UNIT
62
AREA DETERMINING UNIT
623
DRIVE EXECUTING UNIT
64

FIG.21

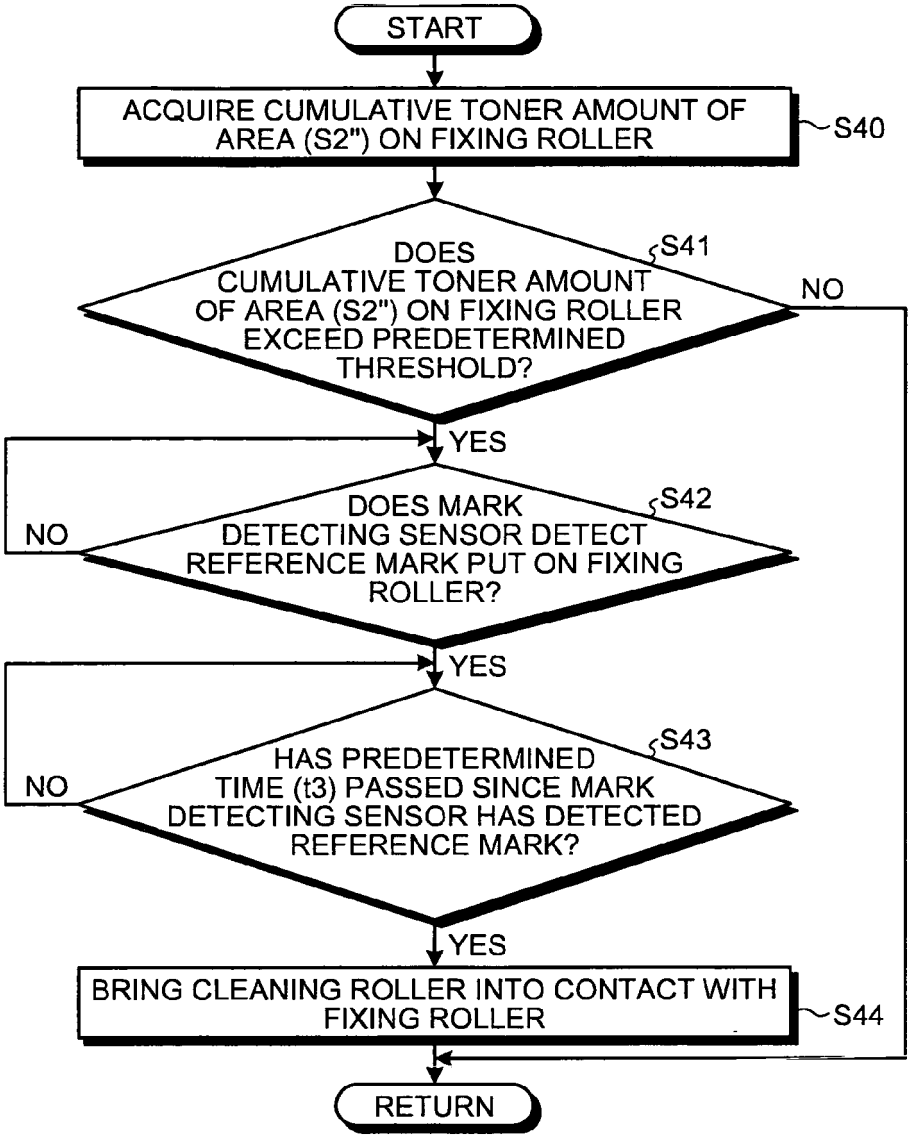

START
ACQUIRE CUMULATIVE TONER AMOUNT OF AREA (S2") ON FIXING ROLLER
S40
DOES CUMULATIVE TONER AMOUNT OF AREA (S2") ON FIXING ROLLER EXCEED PREDETERMINED THRESHOLD?
S41
NO
YES
DOES MARK DETECTING SENSOR DETECT REFERENCE MARK PUT ON FIXING ROLLER?
S42
NO
YES
HAS PREDETERMINED TIME (t3) PASSED SINCE MARK DETECTING SENSOR HAS DETECTED REFERENCE MARK?
S43
NO
YES
BRING CLEANING ROLLER INTO CONTACT WITH FIXING ROLLER
S44
RETURN

FIG.22

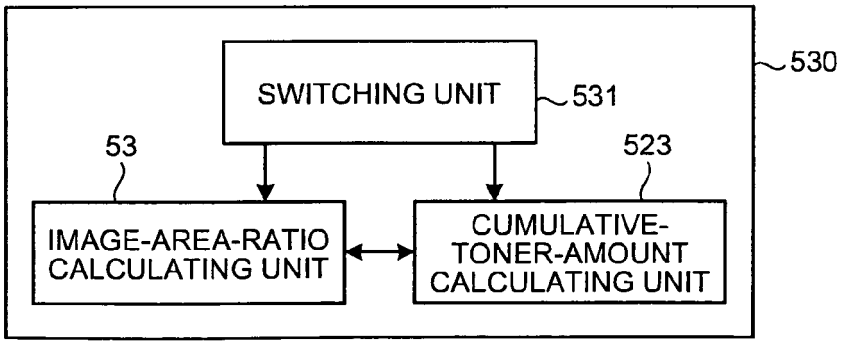
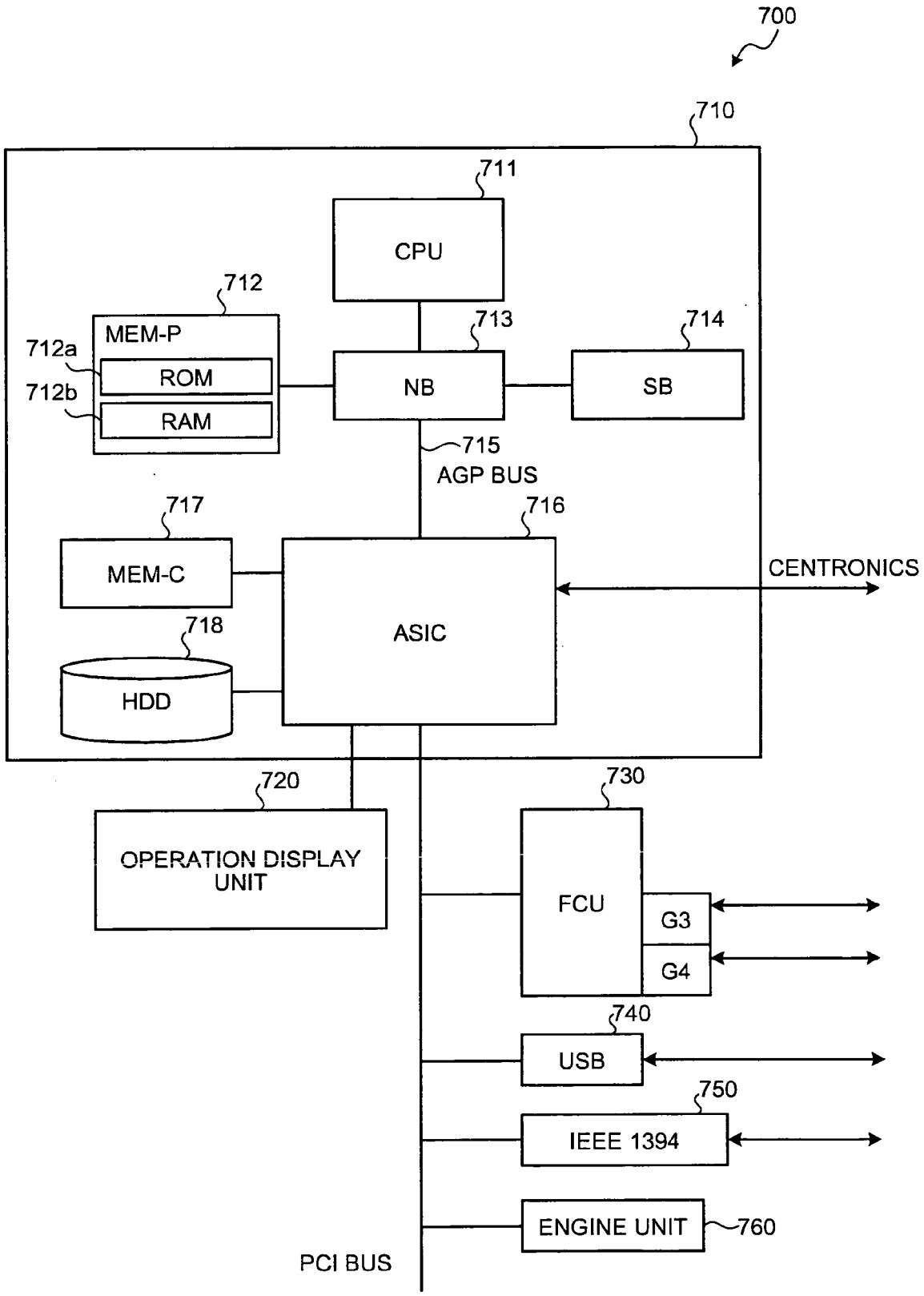

530
SWITCHING UNIT
531
53
523
IMAGE-AREA-RATIO CALCULATING UNIT
CUMULATIVE-TONER-AMOUNT CALCULATING UNIT

FIG.23


700
710
711
CPU
712
MEM-P
712a
ROM
712b
RAM
713
NB
714
SB
715
AGP BUS
716
ASIC
717
MEM-C
718
HDD
CENTRONICS
720
OPERATION DISPLAY UNIT
730
FCU
G3
G4
740
USB
750
IEEE 1394
ENGINE UNIT
760
PCI BUS

REFERENCES CITED IN THE DESCRIPTION

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- JP 3834899 B **[0006] [0007]**