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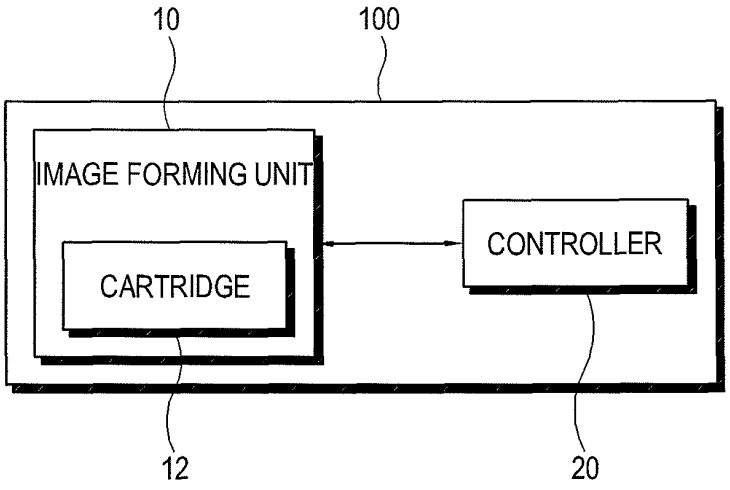
(54) Image Forming Apparatus and Image Forming method thereof

(57) An image forming apparatus including an image forming unit (10) which comprises a cartridge (12) having a toner therein to form an image and a controller (20) to control the image forming unit (10) to increase a density of the image to be formed, if it is determined that a standard of the cartridge (12) does not meet a usage requirement.

FIG. 1



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Description

[0001] The present invention relates to an image forming apparatus and an image forming method thereof.

[0002] An image forming apparatus forms an image based on printing data. An image forming unit of the image forming apparatus forms an image. The image forming unit includes a photosensitive body which forms an electrostatic latent image thereon, a light scanner which scans light to form the electrostatic latent image on the photosensitive body, a developing part which applies a developer to the electrostatic latent image formed on the photosensitive body, and a cartridge which stores toner therein.

[0003] A user may purchase a cheap unwarranted toner for the image forming apparatus. However, the unwarranted toner has characteristics different from a warranted toner. Since the durability of the photosensitive body and the developing part of the image forming unit is designed corresponding to an amount of the warranted toner which is provided initially, the frequent use of the unwarranted toner may cause unnecessary wear of the photosensitive body and the developing part. Also, the cleaning and charging operations of the photosensitive body is not performed properly, thereby deteriorating quality of an image formed by the image forming unit.

[0004] If the image is deteriorated as described above, a user may not perceive that the unwarranted toner is the cause. Instead, a user may ascribe the problem to the image forming apparatus itself. Also, an improper development to the photosensitive body due to the unwarranted toner may contaminate the image forming apparatus by scattering of the toner and carrier carrying the toner.

[0005] Thus, a conventional image forming apparatus adopts a method of not outputting an image when reaching a critical value in durability of the photosensitive body and to prevent the developing part from using the unwarranted toner. However, this method is against a law in some countries including Europe. Therefore, it is necessary to maintain a quality of an image at a certain level even if the unwarranted toner is used.

[0006] The present invention provides an image forming apparatus to maintain quality of an image at a certain level even if using an unwarranted toner, and an image forming method thereof.

[0007] The present invention also provides an image forming apparatus which is prevented from being contaminated, even if a developer is not properly developed to a photosensitive body due to an unwarranted toner, and a toner and a carrier carrying the toner are scattered, and an image forming method thereof.

[0008] The present invention provides an image forming apparatus, comprising an image forming unit to receive a cartridge having a toner therein to form an image; and means for determining the type of cartridge received by the image forming unit and, a controller to control the image forming unit to vary a density of an image to be formed, in dependence on the type of cartridge as determined by said means.

[0009] Preferably, the controller varies the density of an image by increasing the density of the image.

[0010] Preferably, the image forming unit further comprises a photosensitive body and a light scanner to scan light to the photosensitive body, and a developing unit to apply a developer to the photosensitive body, wherein the controller determines the density of the image based on a lifetime of at least one of the photosensitive body and the developing unit.

[0011] Preferably, the controller calculates the lifetime of the photosensitive body and the developing unit based on a number of recording media output by the image forming unit.

[0012] Preferably, the controller controls the light scanner to increase an intensity of light scanned by the light scanner to a preset level, in dependence on the determined type of the cartridge.

[0013] Preferably, the controller blocks a toner saving mode, in dependence on the determined type of the cartridge.

[0014] Preferably, the determining means determines whether the cartridge conforms to a predetermined type requirement based on at least one of dot counting information and page counting information.

[0015] Preferably, the image forming apparatus further comprises a user interface (UI) generator to generate a user interface to display the lifetime of at least one of the photosensitive body and the developing unit, and a display unit to display the generated user interface thereon.

[0016] The present invention also provides an image forming method of an image forming apparatus comprising an image forming unit to receive a cartridge having a toner therein to form an image, and means for determining the type of cartridge received by the image forming unit, the method including determining a type of cartridge received by the image forming unit, and varying a density of the image to be formed, in dependence on the type of cartridge as determined by said means.

[0017] Preferably, the varying of the density of the image to be formed comprises raising the density of the image.

[0018] The image forming unit may further include a photosensitive body and a light scanner to scan light to the photosensitive body, and a developing unit to apply a developer to the photosensitive body, and the raising the density of the image includes determining the density of the image based on a lifetime of at least one of the photosensitive body and the developing unit.

[0019] The raising the density of the image may include calculating the lifetime of the photosensitive body and the developing unit based on a number of recording media output by the image forming unit.

[0020] The raising the density of the image may include increasing an intensity of light scanned by the light scanner to a preset level, in dependence on the determined type of cartridge.

[0021] The raising the density of the image may include blocking a toner saving mode, in dependence on the determined type of cartridge.

[0022] The image forming method may further include generating and displaying a user interface to inform the lifetime of at least one of the photosensitive body and the developing unit.

[0023] The present invention also provides a computer-readable recording medium having embodied thereon a computer program to execute a method, wherein the method comprises determining a type of cartridge of the image forming apparatus and varying, preferably raising, a density of the image to be formed based on the determined type of the cartridge.

[0024] Preferred embodiments of the present invention will now be described, by way of example only with reference to the accompany drawings, of which:

Figure 1 is a block diagram illustrating an image forming apparatus according to an exemplary embodiment of the present invention;

Figure 2 illustrates a configuration illustrating an image forming apparatus according to another exemplary embodiment of the present invention;

Figure 3 is a block diagram illustrating an operation of a controller of the image forming apparatus according to another exemplary embodiment of the present invention; and

Figure 4 is a flowchart which illustrates an image forming method of the image forming apparatus according to another exemplary embodiment of the present invention.

[0025] Figure 1 is a block diagram of an image forming apparatus 100 according to an exemplary embodiment of the present invention. As illustrated therein, the image forming apparatus 100 includes an image forming unit 10 and a controller 20.

[0026] The image forming unit 10 includes a cartridge 12 to store a toner therein to form an image, and to form an image based on printing data. The image forming unit 10 can further include a photosensitive body 14, a developing unit 16 and a light scanner 18.

[0027] The photosensitive body 14 forms a predetermined image thereon. If a charger (not illustrated) charges a surface of the photosensitive body 14 with a negative charge, the light scanner 18 which is described below scans light to the photosensitive body 14 to form an electrostatic latent image thereon. The developing unit 16 applies a developer to the photosensitive body 14 forming the electrostatic latent image thereon.

[0028] The light scanner 18 includes a light source module, a polygon mirror assembly and a reflection mirror, and scans a light including printing image information to the photosensitive body 14 to form the electrostatic latent image thereon. The controller 20 controls the light scanner 18 by adjusting an amount of light or a width of a light scanning section to adjust a density of the image.

[0029] If it is determined that a standard of the cartridge 12 does not meet a usage requirement, the controller 20 controls the image forming unit 10 to raise density of the image to be formed. The controller 20 according to the present embodiment includes a determiner 22 to determine whether the standard of the cartridge 12 meets the usage requirement. The controller 20 may be embodied by a microcomputer or software.

[0030] The controller 20 may raise intensity of the light scanned by the light scanner 18, i.e. raise an amount of light to a preset level, or increase a width of an image forming section, thereby raising the density of the image. The controller 20 may control the density of the image so that a lifetime of the photosensitive body 14 and the developing unit 16 of the image forming unit 10 corresponds to remaining toner of the cartridge 12. That is, the toner of the cartridge 12 is fully consumed before the lifetime of the photosensitive body 14 and the developing unit 16 reaches a critical value, thereby preventing quality deterioration of the image due to wear of the photosensitive body 14 and the developing unit 16.

[0031] If the determiner 22 determines that the standard of the cartridge 12 does not meet the usage requirement, the controller 20 forcibly blocks a toner saving mode even if a user chooses the toner saving mode to save the toner, thereby maintaining the density of the image formed by the image forming unit 10 above a certain level. The operation of the controller 20 according to another embodiment of the present invention will be described in detail with reference to Figure 3.

[0032] As described above, the image forming apparatus 100 according to the present embodiment increases the usage amount of the toner if the toner of the cartridge 12 is not a warranted toner, and consumes the toner before the lifetime of the photosensitive body 14 and the developing unit 16 reaches the critical value, thereby minimizing deterioration of the image formed by the image forming unit 10.

[0033] Figure 2 is a block diagram of an image forming apparatus 200 according to another exemplary embodiment of the present invention. As illustrated therein, the image forming apparatus 200 according to the present embodiment includes a user interface (UI) generator 30 and a display unit 40.

[0034] The UI generator 30 generates a UI to display the lifetime of at least one of a photosensitive body 14 and a developing unit 16. The display unit 40 displays the UI generated by the UI generator 30. The display unit 40 according to the present embodiment, for example, includes a liquid crystal display (LCD) which is provided at one side of the image forming apparatus 200. The UI generator 30 and the display unit 40 according to the present embodiment may be provided in an external host device (not illustrated) connected with the image forming apparatus 200.

[0035] The UI generator 30 may generate a UI to display the lifetime per stage calculated by the control of the controller 20, and may generate a UI to inform, for example, a user that the calculated lifetime reaches a predetermined critical value.

[0036] Hereinafter, the operation of the controller 20 of the image forming apparatuses 100 and 200 according to another embodiment of the present invention will be described in detail with reference to Figure 3. As illustrated therein, the cartridge 12 of the image forming unit 10 according to the present embodiment includes a customer replacement unit monitor (CRUM) 12a, and a dot count register 12b and a page count register 12c which are included in the CRUM 12a.

[0037] The dot count register 12b counts a number of dots formed in a recording medium while the page count register 12c counts a number of recording media output by the image forming unit 10.

[0038] The determiner 22 of the controller 20 determines whether the standard of the cartridge 12 meets the usage requirement, based on dot counting information and page counting information of the cartridge 12. More specifically, the determiner 22 determines that the cartridge 12 is recharged and does not meet the usage requirement, based on a number of pages counted by the page count register 12c, if a residual amount of the toner in the cartridge 12 is larger than a durability critical value of the photosensitive body 14 and the developing unit 16 of the image forming unit 10.

[0039] If the determiner 22 determines that the cartridge 12 does not meet the usage requirement, the controller 20 increases the intensity of light scanned by the light scanner 18 to the preset level to raise the density of the image formed on the photosensitive body 14. The controller 20 may control the light scanner 18 to increase the width of the image forming section of the photosensitive body 14 to the preset level, thereby increasing the density of the image.

[0040] The controller 20 may control the UI generator 30 to generate the UI to be displayed on the display unit 40 if the toner of the cartridge 12 is an unwarranted product. If the durability of the photosensitive body 14 and the developing unit 16 decreases due to the unwarranted toner, the controller 20 may control to display the UI on the display unit 40 periodically. If the durability of the photosensitive body 14 and the developing unit 16 reaches the critical value, the controller 20 may inform a user through the UI.

[0041] Hereinafter, the image forming method of the image forming apparatuses 100 and 200 according to another embodiment of the present invention will be described with reference to Figure 4.

[0042] First, the controller 20 determines whether the standard of the cartridge 12 meets the usage requirement (operation S10). If the standard of the cartridge 12 does not meet the usage requirement, the controller 20 raises the density of the image formed by the image forming unit 10 (operation S20).

[0043] At operation S20, the density of the image may be determined by the lifetime of at least one of the photosensitive body 14 and the developing unit 16. The lifetime of the photosensitive body 14 and the developing unit 16 may be calculated based on the number of the recording media output by the image forming unit 10.

[0044] If it is determined at operation S10 that the standard of the cartridge 12 does not meet the usage requirement, the controller 20 may block the toner saving mode. In another exemplary embodiment of the present invention, the blocking of the toner saving mode may be performed between the operation S10 and the operation S20. The present invention can also be embodied as computer-readable codes on a computer-readable medium. The computer-readable medium can include a computer-readable recording medium and a computer-readable transmission medium. The computer-readable recording medium is any data storage device that can store data that can be thereafter read by a computer system. Examples of the computer-readable recording medium include read-only memory (ROM), random-access memory (RAM), CD-ROMs, magnetic tapes, floppy disks, and optical data storage devices. The computer-readable recording medium can also be distributed over network coupled computer systems so that the computer-readable code is stored and executed in a distributed fashion. The computer-readable transmission medium can transmit carrier waves or signals (e.g., wired or wireless data transmission through the Internet). Also, functional programs, codes, and code segments to accomplish the present invention can be easily construed by programmers skilled in the art to which the present invention pertains.

[0045] As described above, various embodiments of the present invention provide an image forming apparatus to maintain quality of an image at a predetermined level even if using an unwarranted toner, and an image forming method thereof.

[0046] Also, various embodiments of the present invention provide an image forming apparatus to increase an amount of a toner usage if an unwarranted toner is used.

[0047] The present invention provides an image forming apparatus to increase an amount of an unwarranted toner usage of an image forming unit and to prevent a decrease in durability of a photosensitive body and a developing unit of the image forming unit, and an image forming method thereof.

[0048] Further, various embodiments of the present invention provide an image forming apparatus which is prevented from being contaminated by scattered toner and carrier carrying the toner from an improper development to a photosensitive body due to an warranted toner, and an image forming method thereof.

[0049] Although various exemplary embodiments of the present invention have been illustrated and described, it will be appreciated by those skilled in the art that changes may be made in these exemplary embod-

iments without departing from the principles of the invention, the scope of which is defined in the appended claims.

Claims

1. An image forming apparatus, comprising:

   an image forming unit to receive a cartridge having a toner therein to form an image; and
   means for determining the type of cartridge received by the image forming unit and, a controller to control the image forming unit to vary a density of an image to be formed, in dependence on the type of cartridge as determined by said means.

2. The image forming apparatus according to claim 1, wherein the controller varies the density of an image by increasing the density of the image.

3. The image forming apparatus according to claim 1 or 2, wherein the image forming unit further comprises:

   a photosensitive body and a light scanner to scan light to the photosensitive body, and a developing unit to apply a developer to the photosensitive body, wherein
   the controller determines the density of the image based on a lifetime of at least one of the photosensitive body and the developing unit.

4. The image forming apparatus according to claim 3, wherein the controller calculates the lifetime of the photosensitive body and the developing unit based on a number of recording media output by the image forming unit.

5. The image forming apparatus according to claim 5 or claim 6, wherein the controller controls the light scanner to increase an intensity of light scanned by the light scanner to a preset level, in dependence on the determined type of the cartridge.

6. The image forming apparatus according to any preceding claim, wherein the controller blocks a toner saving mode, in dependence on the determined type of the cartridge.

7. The image forming apparatus according to any preceding claim wherein the determining means determines whether the cartridge conforms to a predetermined type requirement based on at least one of dot counting information and page counting information.

8. The image forming apparatus according to claim 3 or any of claims 4-7 when dependent of claim 3, further comprising:

   a user interface (UI) generator to generate a user interface to display the lifetime of at least one of the photosensitive body and the developing unit, and
   a display unit to display the generated user interface thereon.

9. An image forming method of an image forming apparatus comprising an image forming unit to receive a cartridge having toner therein to form an image, and means for determining the type of cartridge received by the image forming unit, the method comprising:

   determining a type of cartridge received by the image forming unit; and
   varying a density of an image to be formed, in dependence on the type of cartridge as determined by said means.

10. The image forming method according to claim 9 wherein varying a density of the image to be formed comprises raising the density of the image to be formed.

11. The image forming method according to claim 10, wherein:

    the image forming unit further comprises:

    an image forming unit including a photosensitive body and a light scanner to scan light to the photosensitive body; and
    a developing unit to apply a developer to the photosensitive body; and
    the raising the density of the image comprises:

    determining the density of the image based on a lifetime of at least one of the photosensitive body and the developing unit.

12. The image forming method according to claim 11, wherein the raising the density of the image comprises:

    calculating the lifetime of the photosensitive body and the developing unit based on a number of recording media output by the image forming unit.

13. The image forming method according to claim 11 or 12, wherein the raising the density of the image comprises:

increasing an intensity of light scanned by the light scanner to a preset level, in dependence on the determined type of cartridge.

14. The image forming method according to any of claims 11-13, wherein the raising the density of the image comprises:

blocking a toner saving mode, in dependence on the determined type of cartridge.

15. The image forming method according to any of claims 13-16, further comprising:

generating and displaying a user interface to inform the lifetime of at least one of the photosensitive body and the developing unit.

16. A computer-readable recording medium having embodied thereon a computer program to execute a method, wherein the method comprises:

determining a type of a cartridge of the image forming apparatus; and
varying a density of the image to be formed based on the determined type of cartridge.

FIG. 1

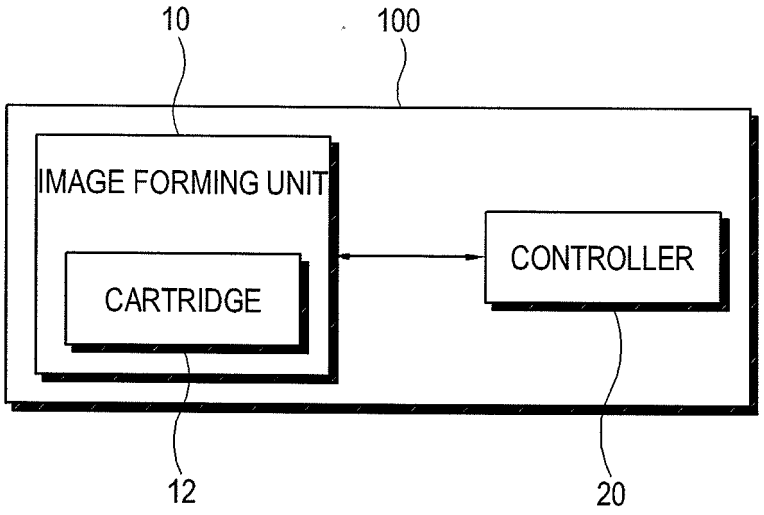


FIG. 2

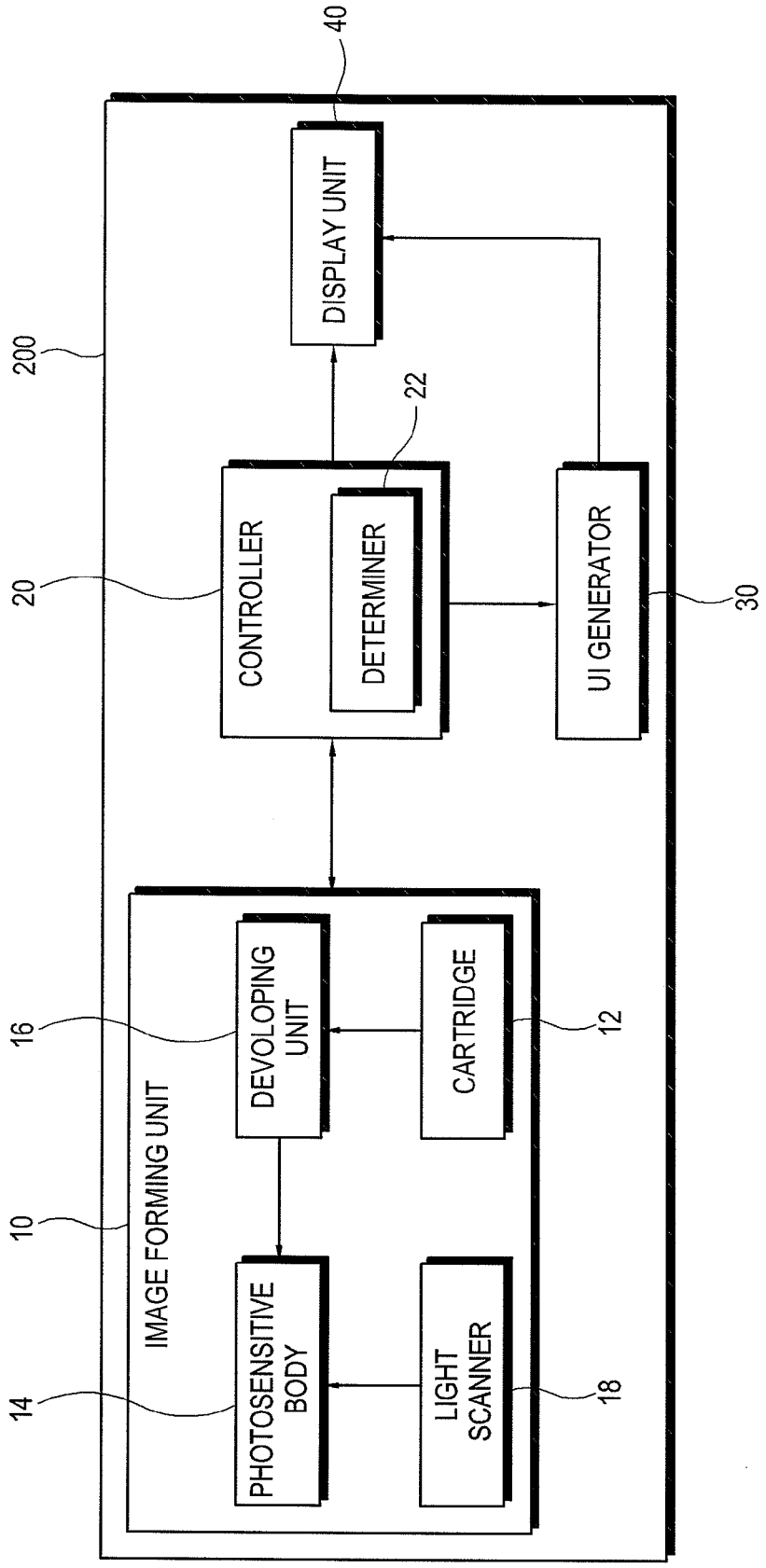

40
DISPLAY UNIT
200
22
CONTROLLER
DETERMINER
20
UI GENERATOR
30
IMAGE FORMING UNIT
DEVOLOPING UNIT
CARTRIDGE
16
12
10
PHOTOSENSITIVE BODY
LIGHT SCANNER
14
18

FIG. 3

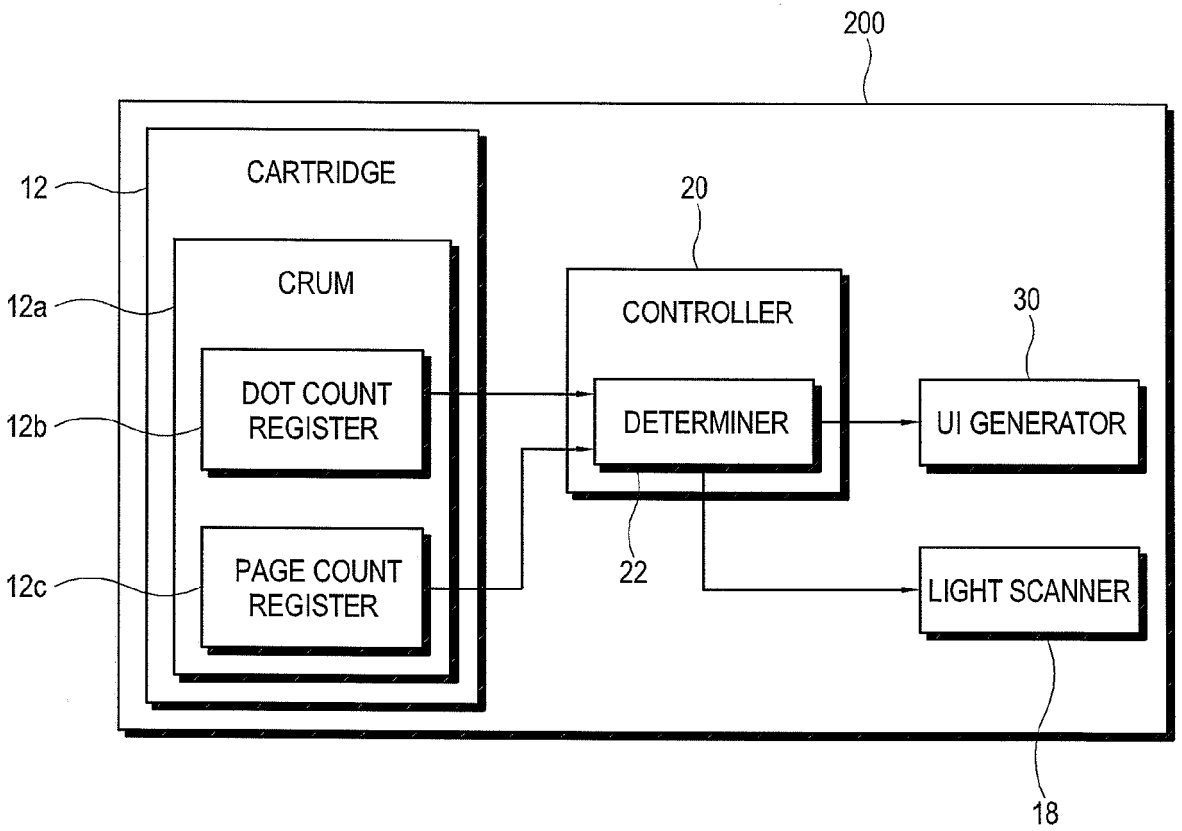
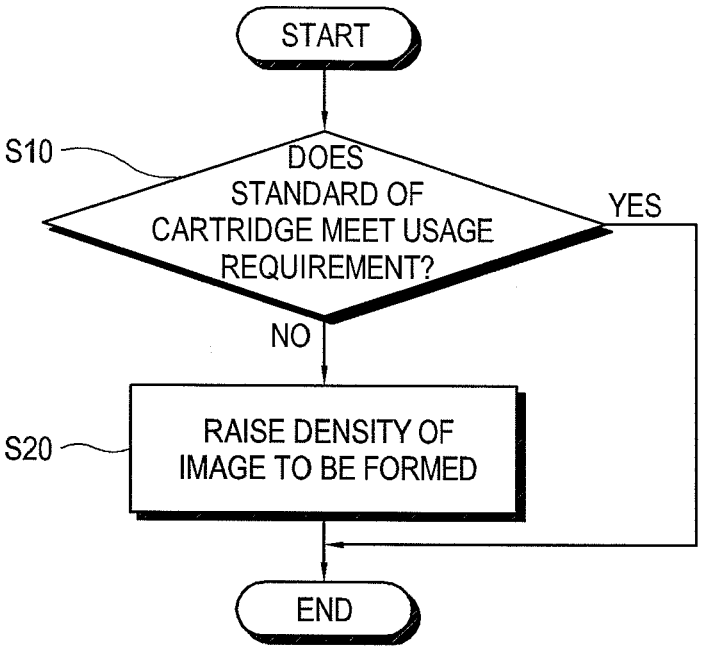

200
12
CARTRIDGE
20
CRUM
12a
CONTROLLER
30
DOT COUNT REGISTER
12b
DETERMINER
UI GENERATOR
PAGE COUNT REGISTER
12c
22
LIGHT SCANNER
18

FIG. 4


START
S10
DOES STANDARD OF CARTRIDGE MEET USAGE REQUIREMENT?
YES
NO
S20
RAISE DENSITY OF IMAGE TO BE FORMED
END

European Patent Office

EUROPEAN SEARCH REPORT

Application Number
EP 08 10 2181

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
X	EP 1 211 575 A (RICOH KK [JP]) 5 June 2002 (2002-06-05) * paragraph [0017] - paragraph [0043] * -----	1-16	INV. G03G15/00
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A	US 2002/188413 A1 (BORG MICHAEL JONAS [US]) 12 December 2002 (2002-12-12) * the whole document * -----	1-16	

TECHNICAL FIELDS SEARCHED (IPC)

G03G

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
Munich	17 September 2008	Götsch, Stefan

CATEGORY OF CITED DOCUMENTS

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17-09-2008

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