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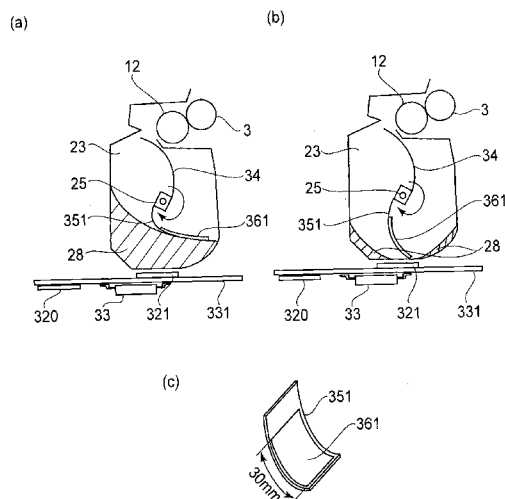
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(54) Title: IMAGE FORMING APPARATUS

**FIG. 2**

(57) Abstract: An image forming apparatus includes a rotatable member which is provided on and rotatable about a rotation shaft in a detachably mountable developing unit containing a developer and has flexibility so that it is flexed depending on a resistance of the developer; an electroconductive member to be detected which is provided on the rotatable member; a detecting electrode provided in a neighborhood of an outer wall surface of a bottom of the developing unit; a converting portion for detecting an electrostatic capacity between the member to be detected and the detecting electrode and for converting the electrostatic capacity into an electric signal; a measuring portion for measuring a time duration in which the electric signal converted by the converting portion exceeds a predetermined threshold; and a discriminating portion for discriminating an amount of the developer on the basis of the time duration measured by the measuring portion.



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AMENDED CLAIMS**received by the International Bureau on 26 October 2012**

1. (Amended) An image forming apparatus
comprising:

5 a rotatable member which is provided on and
rotatable about a rotation shaft in a detachably
mountable developing unit containing a developer and
has flexibility so that it is flexed depending on a
resistance of the developer;

10 an electroconductive member to be detected
which is provided on said rotatable member;

 a detecting electrode provided in a
neighborhood of an outer wall surface of a bottom of
the developing unit;

15 converting means for detecting an
electrostatic capacity between said member to be
detected and said detecting electrode and for
converting the electrostatic capacity into an electric
signal;

20 measuring means for measuring a time duration
in which the electric signal converted by said
converting means exceeds a predetermined threshold;
and

 discriminating means for discriminating an
25 amount of the developer on the basis of the time
duration measured by said measuring means,

 wherein said predetermined threshold is

changeable.

2. (Amended) An image forming apparatus comprising:

5 a rotatable member which is provided on and rotatable about a rotation shaft in a detachably mountable developing unit containing a developer and has flexibility so that it is flexed depending on a resistance of the developer;

10 an electroconductive member to be detected which is provided on said rotatable member;

 a detecting electrode provided in a neighborhood of an outer wall surface of a bottom of the developing unit;

15 converting means for detecting an electrostatic capacity between said member to be detected and said detecting electrode and for converting the electrostatic capacity into an electric signal;

20 measuring means for measuring a detection level of the electric signal converted by said converting means; and

 discriminating means for discriminating an amount of the developer on the basis of the detection
25 level measured by said measuring means,

 wherein said detection level is changeable.

3. (Amended) An image forming apparatus
comprising:

a rotatable member which is provided on and
rotatable about a rotation shaft in a detachably
5 mountable developing unit containing a developer and
has flexibility so that it is flexed depending on a
resistance of the developer;

an electroconductive member to be detected
which is provided on said rotatable member;

10 a detecting electrode provided in a
neighborhood of an outer wall surface of a bottom of
the developing unit;

converting means for detecting an
electrostatic capacity between said member to be
15 detected and said detecting electrode and for
converting the electrostatic capacity into an electric
signal;

first measuring means for measuring a time
duration in which the electric signal converted by
20 said converting means exceeds a predetermined
threshold;

second measuring means for measuring a
detection level of the electric signal converted by
said converting means;

25 discriminating means for discriminating an
amount of the developer on the basis of the time
duration measured by said first measuring means or the

detection level measured by said second measuring means; and

control means for effecting control so that said discriminating means discriminates, when said
5 discriminating means discriminates that the amount of the developer is less than a predetermined amount on the basis of the time duration measured by said first measuring means, the amount of the developer on the basis of the detection level measured by said second
10 measuring means and so that said discriminating means discriminates, when said discriminates that the amount of the developer is not less than the predetermined amount on the basis of the time duration measured by said first measuring means, the amount of the
15 developer on the basis of the time duration measured by said first measuring means

wherein said predetermined threshold or said detection level is changeable.

20 4. An image forming apparatus according to any one of Claims 1 - 3, wherein said member is provided in a neighborhood of the rotation shaft of said rotatable member and in a neighborhood of an end of said rotatable member.

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5. An image forming apparatus according to any one of Claims 1 - 3, wherein said member is a single

member provided in a region ranging from a neighborhood of the rotation shaft of said rotatable member to a neighborhood of an end of said rotatable member.

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6. An image forming apparatus according to any one of Claims 1 - 5, further comprising a stirring member, rotatable about the rotation shaft in the developing unit, for stirring the developer.

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7. (Amended) An image forming apparatus comprising:

a detachably mountable developing unit for accommodating a developer;

15

a first member which includes a first electrode and is rotatable about a rotation shaft in said developing unit;

a second member which performs a rotating operation about the rotation shaft in said developing

20

unit;

a second electrode provided on an outer casing of said developing unit;

outputting means for detecting an electrostatic capacity between said first electrode

25

and said second electrode and for outputting data

regarding the detected electrostatic capacity; and

discriminating means for discriminating an

amount of the developer in said developing unit on the basis of the data outputted from said outputting means,

wherein said outputting means includes setting means for setting an amplification factor of the data
5 and amplifying means for amplifying the data depending on the amplification factor set by said setting means.

8. An image forming apparatus according to Claim 7, wherein said first member is rotated by the
10 rotating operation of said second member until the developer falls freely by its own weight.

9. An image forming apparatus according to Claim 7 or 8, wherein said second member has a function of
15 stirring the developer in said developing unit.

10. An image forming apparatus according to any one of Claims 7 - 9, wherein said first electrode is provided in a neighborhood of a circumferential end of
20 said first member.

11. (Canceled)

12. (Amended) An image forming apparatus
25 according to Claim 7, wherein said outputting means changes the amplification factor of the data depending on a remaining amount of the developer.

13. (Amended) An image forming apparatus
according to Claim 7, wherein said outputting means
changes the amplification factor in a state in which
5 rotation of said first member is stopped.

14. An image forming apparatus comprising:
a detachably mountable developing unit for
accommodating a developer;
10 a first member which comprises a first
electrode and is rotatable about a rotation shaft in
said developing unit;
a second member which comprises a second
electrode and is provided at a predetermined angle
15 formed between itself and said first member with
respect to the rotation shaft of said first member;
a third electrode provided on an outer casing
of said developing unit;
outputting means for detecting an
20 electrostatic capacity between said first electrode
and said third electrode or between said second
electrode and said third electrode and for outputting
information on the detected electrostatic capacity;
and
25 discriminating means for discriminating an
amount of the developer in said developing unit on the
basis of the information outputted from said

outputting means,

wherein said discriminating means discriminates the amount of the developer on the basis of a difference between a time when said outputting means detects the electrostatic capacity between said first electrode and said third electrode and a time when said outputting means detects the electrostatic capacity between said second electrode and said third electrode.

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15. An image forming apparatus comprising:

a detachably mountable developing unit for accommodating a developer;

a first member which comprises a first electrode and is rotatable about a rotation shaft in said developing unit;

a second member which comprises a second electrode and is provided at a predetermined angle formed between itself and said first member with respect to the rotation shaft of said first member;

a third electrode provided on an outer casing of said developing unit;

outputting means for detecting an electrostatic capacity between said first electrode and said third electrode or between said second electrode and said third electrode and for outputting information on the detected electrostatic capacity;

and

discriminating means for discriminating an amount of the developer in said developing unit on the basis of the information outputted from said

5 outputting means,

wherein said discriminating means discriminates the amount of the developer on the basis of a difference between the information on the electrostatic capacity between said first electrode
10 and said third electrode outputted by said outputting means and the information on the electrostatic capacity between said second electrode and said third electrode outputted by said outputting means.

15 16. An image forming apparatus according to Claim 14 or 15, wherein said first member and said second member have flexibility, and

wherein an amount of flexure of said second member is larger than that of said first member.

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17. An image forming apparatus according to Claim 16, wherein said first electrode is provided at an end of said first member with respect to a circumferential direction perpendicular to the rotation shaft, and
25 said second electrode is provided at an end of said second member with respect to the circumferential direction.

18. An image forming apparatus according to Claim
16, wherein said first electrode is provided at a side
of the rotation shaft of said first member with
5 respect to a circumferential direction perpendicular
to the rotation shaft, and said second electrode is
provided at an end of said second member with respect
to the circumferential direction.

10 19. An image forming apparatus according to Claim
14 or 15, wherein said second member has flexibility,
wherein said second electrode is provided at
an end of said second member with respect to a
circumferential direction perpendicular to the
15 rotation shaft, and

wherein said first member is the first
electrode and has rigidity higher than that of said
second member, and has a function of stirring the
developer.

BRIEF STATEMENT UNDER ARTICLE 19 (1)

Claims 1, 2 and 3 are amended for more clearly define features of measuring means. Claim 7 is amended to recite the subject matter of the canceled Claim 11. Claims 12 and 13 are amended to correct dependency thereof.

In D1, a rotatable stirring rod provided with an antenna is provided in a toner container of a process cartridge of an image forming apparatus, and another antenna is provided outside the toner container. An electrostatic capacity between these antennas is detected to determine a toner amount in the toner container.

In D2, a stirring member is for stirring a toner is provided in a toner container of a process cartridge of an image forming apparatus. On the stirring member, a flexible member provided with an antenna is provided, and another antenna is provided outside the toner container. An electrostatic capacity between these antennas is detected to determine a toner amount in the toner container.

In D3, an electrostatic capacity between a developing roller for development using a toner on a photosensitive member in a process cartridge and an antenna (fixed metal plate) provided on a toner container is detected to determine a toner amount in the toner container.

In the present invention, an amount of the developer is discriminated on the basis of the changeable predetermined threshold (Claim 1), the changeable detection level (Claim 2), the changeable predetermined threshold or the changeable detection level (Claim 3), or the data outputted from said outputting means including setting means and amplifying means (Claim 7).