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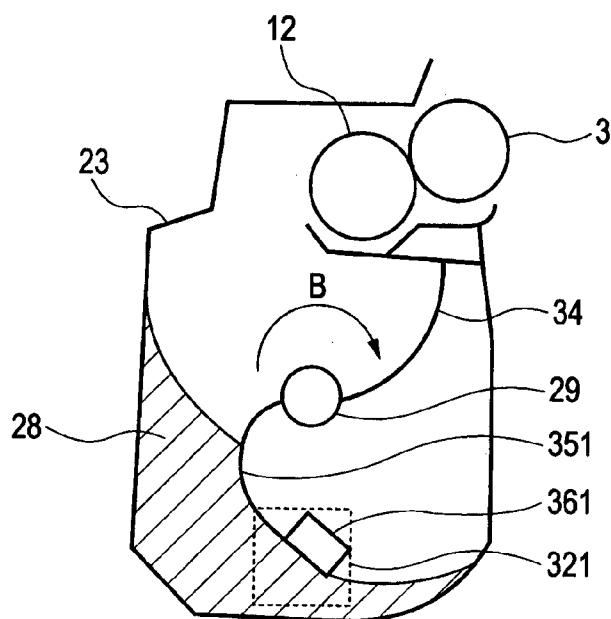
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(54) Title: IMAGE FORMING APPARATUS

FIG. 2

(57) Abstract: The image forming apparatus includes a developing unit that contains developer and that is detachable; a detection member that includes a detected electrode and that moves around a rotation shaft in the developing unit, an electrostatic capacitance sensor electrode that is provided on an outer side of the developing unit, an electrostatic capacitance sensor that detects an electrostatic capacitance between the detected electrode and the electrostatic capacitance sensor electrode and that outputs data related to the detected electrostatic capacitance, and a CPU that determines an amount of the developer in the developing unit based on the data output from the electrostatic capacitance sensor.



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AMENDED CLAIMS

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- [1] (Amended) An image forming apparatus comprising:
a developing unit that contains developer and that is detachable;
a member including a first electrode, said member performing a rotation around a rotation shaft in the developing unit;
a second electrode provided on an outer side of the developing unit, wherein said member bends by the rotation;
an output unit that detects an electrostatic capacitance between the first electrode and the second electrode and that outputs data related to the detected electrostatic capacitance; and
a determination unit that determines an amount of the developer in the developing unit based on the data output from the output unit.
- [2] An image forming apparatus according to claim 1, wherein the first electrode is provided on an edge on a side of a wall of the developing unit in an axial direction of the member, and near a leading edge in a circumferential direction of the member.
- [3] An image forming apparatus according to claim 1, wherein the first electrode has a length from near the rotation shaft of the member to near the leading edge in the circumferential direction, and a predetermined width.
- [4] An image forming apparatus according to any one of claims 1 to 3, wherein the determination unit determines the amount of the developer in the developing unit based on a time width in which the data output from the output unit indicates equal to or more than a predetermined value.
- [5] An image forming apparatus according to claim 1 or 2, wherein the determination unit determines the amount of the developer in the developing unit based on an

average value of the data in a time in which the data output from the output unit is equal to or more than the predetermined value.

- [6] An image forming apparatus comprising a developing unit that contains developer and that is detachable, the image forming apparatus comprising:
- a rotation member that comprises a first electrode and that moves around a rotation shaft in the developing unit, the rotation member being provided on the rotation shaft having flexibility in which the rotation shaft is deformed by resistance of the developer;
 - a second electrode that is provided at a position where the first electrode is not affected by the resistance of the developer even if the developer is full and that is provided near an outer surface of the developing unit;
 - a third electrode that is provided at a position where the first electrode is affected by the resistance of the developer even if an amount of the developer is smaller than when the developer is full and that is provided near the outer surface of the developing unit;
 - a detection unit that detects an electrostatic capacitance between the first electrode and the second electrode or between the first electrode and the third electrode;
 - a measurement unit that measures a first time at which the detection unit has detected the electrostatic capacitance between the first electrode and the second electrode and a second time at which the detection unit has detected the electrostatic capacitance between the first electrode and the third electrode; and
 - a determination unit that determines an amount of the developer based on a time difference between the first time and the second time measured by the measurement unit.
- [7] An image forming apparatus according to claim 6,

wherein the first electrode is provided on a leading edge section of the rotation member in a radial direction around the rotation shaft and provided parallel to a side that is a wall of the developing unit perpendicular to the rotation shaft, and the second electrode and the third electrode are provided near the side.

- [8] The image forming apparatus according to claim 6, wherein
the first electrode is provided on a surface of the leading edge section of the rotation member in the radial direction around the rotation shaft, and the second electrode and the third electrode are provided in a circumferential direction of the rotation of the first electrode.
- [9] An image forming apparatus according to any one of claims 6 to 8, wherein the rotation member performs an agitating operation of the developer.
- [10] An image forming apparatus according to any one of claims 6 to 9, wherein the determination unit determines whether the detection unit is abnormal based on a result of the detection by the detection unit.
- [11] (Amended) An image forming apparatus comprising:
a developing unit that contains developer and that is detachable;
a first member including a first electrode, said member performing a rotation around a rotation shaft in the developing unit;
a second member that comprises a second electrode and that is provided on the rotation shaft of the first member to form a predetermined angle with the first member;
a third electrode provided on an outer side of the developing unit;
an output unit that detects an electrostatic capacitance between the first electrode and the third

electrode or between the second electrode and the third electrode and that outputs information related to the detected electrostatic capacitance; and

a determination unit that determines an amount of the developer based on a difference between a time at which the output unit has started detecting the electrostatic capacitance between the first electrode and the third electrode and a time at which the output unit has started detecting the electrostatic capacitance between the second electrode and the third electrode.

[12] (Amended) An image forming apparatus comprising:

a developing unit that contains developer and that is detachable;

a first member including a first electrode, said member performing a rotation around a rotation shaft in the developing unit, wherein said first member bends by the rotation;

a second member that comprises a second electrode and that is provided on the rotation shaft of the first member to form a predetermined angle with the first member, wherein second member bends by the rotation;

a third electrode provided on an outer side of the developing unit;

an output unit that detects an electrostatic capacitance between the first electrode and the third electrode or between the second electrode and the third electrode and that outputs information related to the detected electrostatic capacitance; and

a determination unit that determines an amount of the developer based on a difference between information related to the electrostatic capacitance between the first electrode and the third electrode output by the output unit and information related to the electrostatic capacitance between the second electrode and the third electrode output by the output unit.

[13] An image forming apparatus according to claim 11 or 12,

wherein the first member has flexibility, and the second member has flexibility different from the flexibility of the first member.

- [14] An image forming apparatus according to any one of claims 11 to 13, wherein
a length in a direction orthogonal to the rotation shaft of the first member is a length that does not cause the first member to reach a bottom of the developing unit when the first member rotates around the rotation shaft, a length in a direction orthogonal to the rotation shaft of the second member is a length that causes the second member to slide the bottom of the developing unit when the second member rotates around the rotation shaft, the first electrode is provided on a leading edge of the first member, and the second electrode is provided on a leading edge of the second member.

- [15] An image forming apparatus comprising:
a developing unit that contains developer and that is detachable;
a first member that does not have an electrode and moves around a rotation shaft in the developing unit;
a second member that comprises a second electrode and that is provided on a rotation shaft of the first member to form a predetermined angle with the first member;
a third electrode provided on an outer side of the developing unit;
an output unit that detects an electrostatic capacitance between the first electrode and the third electrode or between the second electrode and the third electrode and that outputs information related to the detected electrostatic capacitance; and
a determination unit that determines an amount of the developer based on a difference between a time at which the output unit has started detecting the electrostatic

capacitance between the first electrode and the third electrode and a time at which the output unit has started detecting the electrostatic capacitance between the second electrode and the third electrode, wherein the first electrode includes a conductivity and the second electrode includes a flexibility.

- [16] An image forming apparatus comprising:
a developing unit that contains developer and that is detachable;
a first member that does not have an electrode and that moves around a rotation shaft in the developing unit;
a second member that comprises a second electrode and that is provided on a rotation shaft of the first member to form a predetermined angle with the first member;
a third electrode provided on an outer side of the developing unit;
an output unit that detects an electrostatic capacitance between the first electrode and the third electrode or between the second electrode and the third electrode and that outputs information related to the detected electrostatic capacitance; and
a determination unit that determines an amount of the developer based on a difference between information related to the electrostatic capacitance between the first electrode and the third electrode output by the output unit and information related to the electrostatic capacitance between the second electrode and the third electrode output by the output unit.
wherein the first electrode includes a conductivity and the second electrode includes a flexibility.
- [17] An image forming apparatus according to any one of claims 11 to 15, wherein
the first member or the second member agitates the developer in the developing unit.