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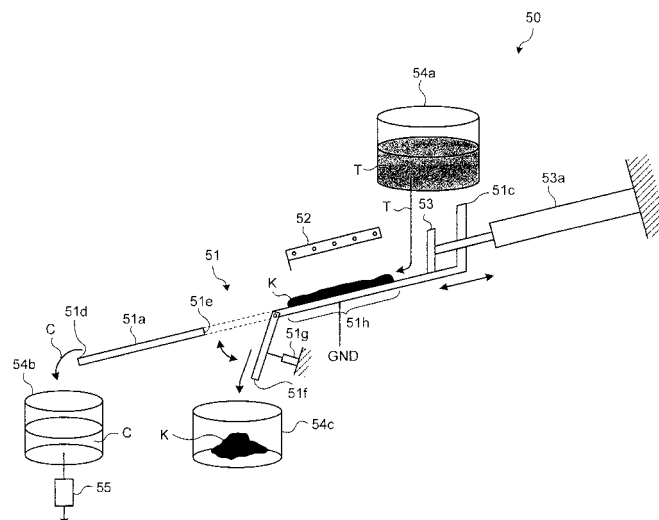
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(54) **SOLID CONTENT SEPARATION DEVICE FOR LIQUID TONER**

(57) A solid content separation device 50 includes a tray 51, a pushing blade 53, a cylinder device 53a, a used liquid toner tank 54a, a recycled carrier tank 54b, and a solid content tank 54c. In the solid content separation device 50, a liquid toner T is introduced from the used liquid toner tank 54a to the tray 51. Solid contents K contained in the liquid toner T introduced to the tray 51 are

aggregated on the tray 51. In the solid content separation device 50, when the cylinder device 53a is actuated, the pushing blade 53 introduces the aggregated solid contents to the solid content tank 54c. In the solid content separation device 50, a liquid C (mainly composed of a carrier) reduced in the amount of the solid contents K is introduced to the recycled carrier tank 54b.

FIG.2



Description

Field

[0001] The present invention relates to a solid content separation device for a liquid toner that is used to facilitate separation of solid contents and a carrier that are contained in the liquid toner.

Background

[0002] Electrophotographic printing presses using a liquid toner have been proposed. The liquid toner is configured such that a toner composed of a thermoplastic resin, a pigment, etc. to serve as a solid content is dispersed in a carrier. In such an electrophotographic printing press, there is a demand to recycle the carrier. For example, Patent Literature 1 discloses a device including a conductive pipe and a conductive roller disposed inside the conductive pipe. In this device, a bias voltage is applied between the conductive pipe and the conductive roller, and solid contents contained in a liquid toner introduced to a gap between the conductive pipe and conductive roller are thereby accumulated on the surface of the conductive roller.

Citation List

Patent Literature

[0003] Patent Literature 1: Japanese Patent Application Laid-Open No. 2003-270957

Summary

Technical Problem

[0004] In the device disclosed in Patent Literature 1, both of its two electrodes come into contact with the liquid toner. Therefore, in the device disclosed in Patent Literature 1, the solid contents may adhere to the two electrodes, causing a reduction in the amount of charge on the solid contents. Particularly, since no means for cleaning the inner circumferential surface of the conductive pipe is provided in the device disclosed in Patent Literature 1, the solid contents can easily accumulate on the inner circumferential surface of the conductive pipe. Therefore, the frequency of maintenance (cleaning) is high in the device disclosed in Patent Literature 1. The accumulation of the solid contents on the electrodes causes a reduction in the amount of charge on the solid contents. Therefore, in the device disclosed in Patent Literature 1, the separation of the solid contents and the carrier cannot be facilitated sufficiently.

[0005] When a bias voltage is applied between the two electrode surfaces, the distance between the electrode surfaces must be very small. Therefore, in the device disclosed in Patent Literature 1, a flow passage for the

liquid toner is narrow. As described above, in the device disclosed in Patent Literature 1, the solid contents easily accumulate between the electrodes. Therefore, in the device disclosed in Patent Literature 1, the flow passage is easily clogged with the solid contents. This further increases the frequency of maintenance (cleaning) in the device disclosed in Patent Literature 1.

[0006] The present invention has been made in view of the above circumstances, and it is an object to reduce the time and effort required for maintenance.

Solution to Problem

[0007] According to an aspect of the present invention, a solid content separation device for a liquid toner, includes: a flow passage along which a liquid toner containing a carrier and a solid content dispersed in the carrier can flow; and aggregating means for aggregating the solid content, the aggregating means being disposed so as not to be in contact with the liquid toner flowing along the flow passage.

[0008] In the above-configured solid content separation device for a liquid toner according to the present invention, the aggregating means does not come into contact with the liquid toner. Therefore, in the solid content separation device for a liquid toner according to the present invention, the possibility that the solid content adheres to the aggregating means can be reduced. Accordingly, in the solid content separation device for a liquid toner according to the present invention, the time and effort required for maintenance can be reduced. If the aggregating means were to come into contact with the liquid toner, the solid content contained in the liquid toner could adhere to the aggregating means. If the solid content were to adhere to the aggregating means, the aggregation of the solid content on the aggregating means could be insufficient. However, in the solid content separation device for a liquid toner according to the present invention, the possibility that the solid content adheres to the aggregating means can be reduced. Therefore, the solid content separation device for a liquid toner according to the present invention can facilitate the aggregation of the solid content. Accordingly, the solid content separation device for a liquid toner according to the present invention can facilitate the separation of the carrier and the solid content.

[0009] Advantageously, in the solid content separation device for a liquid toner, the flow passage includes a negative electrode section electrically connected to a ground, and the aggregating means includes a positive electrode member that is disposed to face the negative electrode section and is capable of generating corona discharge between the positive electrode member and the negative electrode section.

[0010] In the above-configured solid content separation device for a liquid toner according to the present invention, the solid content can be charged by corona discharge. The solid content negatively charged by co-

rona discharge is aggregated on the negative electrode section. Therefore, the solid content separation device for a liquid toner according to the present invention can facilitate the separation of the carrier and the solid content. Accordingly, the solid content separation device for a liquid toner according to the present invention can reduce the amount of the solid content contained in the liquid toner.

[0011] In the solid content separation device for a liquid toner according to the present invention, the positive electrode member does not come into contact with the liquid toner. Therefore, in the solid content separation device for a liquid toner according to the present invention, the possibility that the solid content adheres to the positive electrode member can be reduced. Accordingly, in the solid content separation device for a liquid toner according to the present invention, the time and effort required for maintenance can be reduced.

[0012] In the solid content separation device for a liquid toner according to the present invention, the solid content is charged using corona discharge. The corona discharge is local discharge. Therefore, in the solid content separation device for a liquid toner according to the present invention, the distance between the electrodes can be ensured longer than that when, for example, a bias voltage is applied between two mutually facing electrode surfaces. In the solid content separation device for a liquid toner according to the present invention, a large flow passage along which the liquid toner flows can be ensured, and the possibility that the flow passage between the electrodes is clogged with the solid content can thereby be reduced. Accordingly, in the solid content separation device for a liquid toner according to the present invention, the time and effort required for maintenance can be preferably reduced.

[0013] Advantageously, the solid content separation device for a liquid toner, further includes: a solid content storage unit capable of storing the solid content aggregated by the aggregating means; and solid content moving means capable of moving the aggregated solid content to the solid content storage unit.

[0014] In the above-configured solid content separation device for a liquid toner according to the present invention, the aggregated solid content can be collected in the solid content storage unit. The solid content collected in the solid content storage unit is removed when maintenance is performed. The removal of the solid content collected in the solid content storage unit is easier than, for example, replacement of a cartridge type filter. Therefore, in the solid content separation device for a liquid toner according to the present invention, the time and effort required for maintenance can be reduced.

[0015] Advantageously, the solid content separation device for a liquid toner, further includes a solid content discharge section that is disposed in the flow passage and is capable of introducing the aggregated solid content to the solid content storage unit. The solid content moving means includes a blade, and blade moving

means capable of moving the blade along the flow passage to the solid content discharge section.

[0016] In the above-configured solid content separation device for a liquid toner according to the present invention, the aggregated solid content can be introduced from the solid content discharge section to the solid content storage unit. Therefore, in the solid content separation device for a liquid toner according to the present invention, the aggregated solid content can be collected in the solid content storage unit.

[0017] Advantageously, in the solid content separation device for a liquid toner, the solid content discharge section is an opening; and the solid content separation device includes an open-close member that is disposed in the flow passage and is capable of opening and closing the opening.

[0018] In the above-configured solid content separation device for a liquid toner according to the present invention, the open-close member opens to introduce the aggregated solid content to the solid content storage unit, and the open-close member closes when the aggregated solid content is not introduced to the solid content storage unit. Therefore, in the solid content separation device for a liquid toner according to the present invention, the solid content and the liquid toner (composed mainly of the carrier) reduced in the amount of the solid content can be handled separately. Accordingly, the solid content separation device for a liquid toner according to the present invention can facilitate the separation of the carrier and the solid content more preferably.

[0019] Advantageously, in the solid content separation device for a liquid toner, the solid content storage unit includes a filter section capable of collecting the aggregated solid content and allowing the carrier to pass there-through, and the aggregated solid content and the liquid toner that has passed between the positive electrode member and the negative electrode section can be introduced to the solid content storage unit.

[0020] The solid content storage unit is, for example, a bag filter. In the above-configured solid content separation device for a liquid toner according to the present invention, the solid content storage unit separates the aggregated solid content and the liquid toner (composed mainly of the carrier) reduced in the amount of the solid content. More specifically, the solid content storage unit allows the liquid toner (composed mainly of the carrier) reduced in the amount of the solid content to pass there-through and stores the aggregated solid content. Therefore, the solid content separation device for a liquid toner according to the present invention can facilitate the separation of the carrier and the solid content.

[0021] Advantageously, in the solid content separation device for a liquid toner, the solid content moving means is a belt conveyor device having a belt including the negative electrode section and is disposed such that the liquid toner can be supplied to the belt.

[0022] In the above-configured solid content separation device for a liquid toner according to the present

invention, the aggregated solid content can be introduced to the solid content storage unit. In a carrier collecting device, as the amount of accumulation of the aggregated solid content increases, the amount of charge on the solid content charged by corona discharge decreases. However, in the solid content separation device for a liquid toner according to the present invention, the solid content contained in the liquid toner additionally introduced can be aggregated while the previously aggregated solid content is moved. Therefore, in the solid content separation device for a liquid toner according to the present invention, the amount of accumulation of the aggregated solid content can be reduced. In the solid content separation device for a liquid toner according to the present invention, a reduction in the amount of charge on the solid content can thereby be reduced. Accordingly, the solid content separation device for a liquid toner according to the present invention can facilitate the separation of the carrier and the solid content.

[0023] Advantageously, in the solid content separation device for a liquid toner, the solid content moving means is a roller having an outer circumference including the negative electrode section, and the roller is disposed rotatably with at least part of the outer circumference of the roller being in contact with the liquid toner.

[0024] In the above-configured solid content separation device for a liquid toner according to the present invention, the aggregated solid content can be introduced to the solid content storage unit. In the solid content separation device for a liquid toner according to the present invention, the solid content contained in the liquid toner additionally introduced can be aggregated while the previously aggregated solid content is moved. Therefore, in the solid content separation device for a liquid toner according to the present invention, the amount of accumulation of the aggregated solid content can be reduced. In the solid content separation device for a liquid toner according to the present invention, a reduction in the amount of charge on the solid content can thereby be suppressed. Accordingly, the solid content separation device for a liquid toner according to the present invention can facilitate the separation of the carrier and the solid content.

[0025] Advantageously, the solid content separation device for a liquid toner, further includes a heater capable of heating the liquid toner.

[0026] The solid content contains a dispersing member. The function of the dispersing member deteriorates when its temperature exceeds its glass transition temperature. This function is to suppress the aggregation of the solid content to allow the solid content to be dispersed in the carrier. In the above-configured solid content separation device for a liquid toner according to the present invention, the function can be reduced by heating the liquid toner. Therefore, the solid content separation device for a liquid toner according to the present invention can facilitate the aggregation of the solid content contained in the liquid toner.

[0027] Advantageously, in the solid content separation device for a liquid toner, the aggregating means includes a heater capable of heating the liquid toner.

[0028] In the above-configured solid content separation device for a liquid toner according to the present invention, the above-described function can be reduced by heating the liquid toner. Therefore, in the solid content separation device for a liquid toner according to the present invention, the solid content contained in the liquid toner can be aggregated.

[0029] Advantageously, in the solid content separation device for a liquid toner, the flow passage is part of an outer circumferential surface of a roller. The solid content separation device further includes supplying means for supplying the liquid toner to the outer circumference, scraping means for scraping the solid content, the scraping means being disposed on a downstream side of the supplying means in a rotation direction of the roller and being in contact with the outer circumferential surface to scrape the solid content, carrier separating means for separating the carrier from the solid content scraped with the scraping means, and circulating means for returning the carrier separated by the carrier separating means to an upstream side of the aggregating means in the rotation direction of the roller. The aggregating means is disposed between the supplying means and the scraping means.

[0030] In the solid content separation device according to the present invention, the liquid toner on the roller is separated into the solid content and the carrier. Then the carrier remaining in the solid content is further separated from the solid content, and the separated carrier is returned to the upstream side of the aggregating means in the rotation direction of the roller. In this manner, the concentration factor of the waste solid content is improved, and the volume of the waste solid content can be reduced.

[0031] Advantageously, in the solid content separation device for a liquid toner, further includes carrier collecting means for separating the carrier from the liquid toner adhering to the outer circumferential surface while being in contact with the outer circumferential surfaces, the carrier collecting means being disposed on a downstream side of the aggregating means in the rotation direction of the roller. The above-configured solid content separation device according to the present invention can collect a high purity carrier in which the amount of the solid content mixed therein has been suppressed.

[0032] Advantageously, in the solid content separation device for a liquid toner, the scraping means is secured to a securing means with a distance between the scraping means and the roller being maintained constant. The scraping means may be always in contact with the outer circumference of the roller. Therefore, since the scraping means is secured, a support structure for the scraping means can be simplified.

Advantageous Effects of Invention

[0033] According to the present invention, the time and effort required for maintenance can be reduced.

Brief Description of Drawings

[0034]

FIG. 1 is a schematic diagram illustrating an electrophotographic printing press in a first embodiment.
 FIG. 2 is a schematic diagram illustrating a solid content separation device in the first embodiment.
 FIG. 3 is a schematic perspective view illustrating a tray in the present embodiment.
 FIG. 4 is a schematic diagram illustrating solid contents.
 FIG. 5 is a schematic diagram illustrating a plurality of solid contents before aggregation.
 FIG. 6 is a schematic diagram illustrating the plurality of solid contents after aggregation.
 FIG. 7 is a schematic diagram illustrating a solid content separation device in a second embodiment.
 FIG. 8 is a schematic diagram illustrating a solid content separation device in a third embodiment.
 FIG. 9 is a schematic diagram illustrating a solid content separation device in a fourth embodiment.
 FIG. 10 is a schematic diagram illustrating a solid content separation device in a fifth embodiment.
 FIG. 11 is a schematic diagram illustrating a solid content separation device in a sixth embodiment.
 FIG. 12 is a schematic diagram illustrating a solid content separation device in a modification of the sixth embodiment.
 FIG. 13 is a schematic diagram illustrating a solid content separation device in a seventh embodiment.
 FIG. 14 is an enlarged view of the solid content separation device in the seventh embodiment.

Description of Embodiments

[0035] The present invention will next be described in detail with reference to the drawings. However, the present invention is not limited to the following description. Components in the following description include those easily contemplated by a person skilled in the art and those substantially similar thereto, i.e., those equivalent thereto.

(First Embodiment)

[0036] An electrophotographic printing press in the present embodiment is a printing press of the liquid development electrophotographic type. The electrophotographic printing press includes a feeder unit, a printing unit, and a delivery unit. The feeder unit can feed printing sheets, for example, flat sheets of paper, from a feeder tray to the printing unit one by one. The printing unit can

perform printing on one side or both sides of each supplied printing sheet. The delivery unit can deliver the printing sheets simplex- or duplex-printed by the printing unit to an output tray.

[0037] FIG. 1 is a schematic diagram illustrating the electrophotographic printing press in a first embodiment. The electrophotographic printing press 10 in the present embodiment will next be described in detail. As shown in FIG. 1, the printing unit 11 includes an intermediate transfer member 12, a backup roller 13, a plurality of (4 in the present embodiment) developing units 14a, 14b, 14c, and 14d, a liquid toner supplying device 20, a cleaning device 30, a liquid toner collecting device 40, and a solid content separation device 50 used as a solid content separation device for a liquid toner. Although not shown in the figure, the printing unit 11 further includes a printing sheet conveying device, a toner fixing device, a heating device, etc. In this case, the printing unit 11 is designed to be capable of performing process color printing. The developing units 14a, 14b, 14c, and 14d are used for respective process colors C (cyan), M (magenta), Y (yellow), and K (black).

[0038] The printing unit 11 performs printing using a liquid toner T. The liquid toner T is prepared by dispersing a toner in a carrier. The toner is in the form of particles formed from a thermoplastic material and a coloring material (a pigment of a dye). The carrier is a petroleum-based solvent (such as a nonpolar paraffin-based solvent, for example, mineral oil). In the liquid toner T, the particle-shaped toner having an average diameter of about 1 to about 2 μm is contained in the carrier in a concentration of about 20 to about 40 percent by weight.

[0039] The intermediate transfer member 12 faces the backup roller 13 and is in contact therewith. The intermediate transfer member 12 forms a nip portion (transfer portion) N1 at the contact portion. The intermediate transfer member 12 has a circumferential side surface wound with a blanket 12a. The blanket 12a is formed of urethane-based conductive rubber. For example, a bias voltage of about -200 to about -300 V is applied to the intermediate transfer member 12.

[0040] The backup roller 13 is disposed such that a prescribed pressure, for example, about 1 to about 13 kg/cm, is applied to the intermediate transfer member 12. The backup roller 13 forms the above-described nip portion. N1 at the contact portion with the intermediate transfer member 12. Therefore, a printing sheet S is conveyed between the intermediate transfer member 12 and the backup roller 13, and a prescribed nip pressure is applied to the printing sheet S. For example, a transfer bias of about -800 V is applied to the backup roller 13. Therefore, the printing unit 11 applies to the liquid toner T a force that attracts the liquid toner T from the intermediate transfer member 12 toward the backup roller 13. This force is generated by the difference between the bias voltage applied to the intermediate transfer member 12 (-200 to -300 V) and the bias voltage applied to the backup roller 13 (about -800 V). In the printing unit 11,

electrostatic transfer of the liquid toner T from the intermediate transfer member 12 to the printing sheet S is thereby facilitated.

[0041] The respective developing units 14a, 14b, 14c, and 14d are arranged along the circumference of the intermediate transfer member 12 in the rotation direction thereof. In the respective developing units 14a, 14b, 14c, and 14d, the colors of the liquid toner T used therefor and introduced to the intermediate transfer member 12 are different from each other. However, the structures of the developing units 14a, 14b, 14c, and 14d are the same. Therefore, only the developing unit 14a will be described in detail.

[0042] The developing unit 14a includes a photosensitive drum 15, a bowl 16a, and liquid toner conveying rollers 16b. The photosensitive drum 15 has a photosensitive layer formed on its side circumferential surface. The photosensitive layer formed contains a photosensitizer such as amorphous silicon (a-Si) or a photosensitive polymer. The photosensitive drum 15 faces the intermediate transfer member 12 and is in contact therewith at a nip portion N2. The bowl 16a is a container for storing the liquid toner T. The liquid toner conveying rollers 16b convey the liquid toner T from the bowl 16a to the photosensitive drum 15. With the developing unit 14a configured as above, the liquid toner T introduced from the bowl 16a to the outer circumference of the photosensitive drum 15 by the liquid toner conveying rollers 16b can be transferred to the intermediate transfer member 12.

[0043] The liquid toner supplying device 20 includes a concentrated toner tank 21, a carrier tank 22, a liquid toner tank 23, a stirring tank 24, a concentrated toner pump 25a, a carrier pump 25b, a liquid toner pump 25c, a collecting pump 25d, a collecting pump 25e, collecting blades 26, and a concentration sensor 27. The concentrated toner tank 21 is a container for storing a liquid toner having a concentration higher than that of the liquid toner T introduced to the photosensitive drum 15. When the volume of the high concentration liquid toner in the concentrated toner tank 21 becomes short, the high concentration liquid toner is supplied from a toner bottle 21a.

[0044] The carrier tank 22 is a container for storing the carrier. When the volume of the carrier in the carrier tank 22 becomes short, the carrier is supplied from a carrier can 22a. The liquid toner tank 23 is a container for storing a mixture of the high concentration liquid toner and the carrier, i.e., the liquid toner T. The stirring tank 24 is a container for storing the liquid toner T collected from the liquid toner conveying rollers 16b. The liquid toner tank 23 and the stirring tank 24 are equipped with stirrers that can stir the liquid toner T. The liquid toner T in the stirring tank 24 is stirred and then introduced to the liquid toner tank 23.

[0045] The concentrated toner pump 25a is disposed in a passage connecting the concentrated toner tank 21 to the liquid toner tank 23. The concentrated toner pump 25a introduces the high concentration liquid toner in the concentrated toner tank 21 to the liquid toner tank 23.

The carrier pump 25b is disposed in a passage connecting the carrier tank 22 to the liquid toner tank 23. The carrier pump 25b introduces the carrier in the carrier tank 22 to the liquid toner tank 23. The liquid toner pump 25c is disposed in a passage connecting the liquid toner tank 23 to the bowl 16a. The liquid toner pump 25c introduces the liquid toner T in the liquid toner tank 23 to the bowl 16a. The collecting pump 25d is disposed in a passage connecting the bowl 16a to the liquid toner tank 23. The collecting pump 25d returns an excess of the liquid toner T in the bowl 16a to the liquid toner tank 23.

[0046] The collecting blades 26 are in contact with the outer circumferences of the liquid toner conveying rollers 16b. The collecting blades 26 collect an excess of the liquid toner T on the outer circumferences of the liquid toner conveying rollers 16b. The excess of the liquid toner T is the remaining liquid toner T that has failed to be supplied to the outer circumference of the photosensitive drum 15. The collecting pump 25e is disposed in a passage connecting the collecting blades 26 to the stirring tank 24. The collecting pump 25e returns the liquid toner T collected by the collecting blades 26 to the stirring tank 24.

[0047] The concentration sensor 27 is disposed, for example, in a passage connecting the liquid toner tank 23 to the bowl 16a. The concentration sensor 27 detects the concentration of the liquid toner T to be introduced to the bowl 16a. A not-shown control device acquires a signal indicating the concentration of the liquid toner T from the concentration sensor 27. Then the control device causes the high concentration liquid toner and the carrier to be mixed such that the concentration of the liquid toner T becomes a prescribed concentration (the weight ratio of the toner to the carrier is, for example, 20 to 40%). More specifically, the control device controls the operation of the concentrated toner pump 25a and the operation of the carrier pump 25b.

[0048] One concentrated toner tank 21, one liquid toner tank 23, one stirring tank 24, one concentrated toner pump 25a, one liquid toner pump 25c, one collecting pump 25d, one collecting pump 25e, one set of collecting blades 26, and one concentration sensor 27 are provided for each of the developing units 14a, 14b, 14c, and 14d. The carrier tank 22 and the carrier pump 25b are used for all the developing units. The carrier pump 25b introduces the carrier from the carrier tank 22 to the liquid toner tank 23 for each of the developing units. One carrier tank 22 and one carrier pump 25b may be provided for each of the developing units. In the above configuration, the liquid toner supplying device 20 supplies the liquid toner T to the outer circumference of the photosensitive drum 15.

[0049] The cleaning device 30 includes a carrier nozzle 31, a carrier pump 32, a first cleaning roller 33a, a second cleaning roller 33b, a collecting blade 34a, a collecting blade 34b, and a collecting blade 34c. The carrier nozzle 31 is disposed to face the outer circumference of the intermediate transfer member 12. More specifically, the

carrier nozzle 31 is disposed between the nip portion N1 between the intermediate transfer member 12 and the backup roller 13 and the nip portion N2 between the intermediate transfer member 12 and the photosensitive drum 15 for the first color. The carrier nozzle 31 ejects the carrier to introduce the carrier to the outer circumference of the intermediate transfer member 12.

[0050] The carrier pump 32 is disposed in a passage connecting the carrier tank 22 to the carrier nozzle 31. The carrier pump 32 introduces the carrier in the carrier tank 22 to the carrier nozzle 31. The first cleaning roller 33a and the second cleaning roller 33b are disposed to face the outer circumference of the intermediate transfer member 12 and in contact therewith. The first cleaning roller 33a is disposed between the photosensitive drum 15 of the developing unit 14b and the photosensitive drum 15 of the developing unit 14c. The second cleaning roller 33b is disposed between the photosensitive drum 15 of the developing unit 14d and the backup roller 13. The first cleaning roller 33a and the second cleaning roller 33b come into contact with the intermediate transfer member 12 when printing is performed on a printing sheet S and collect part of the liquid toner T on the outer circumference of the intermediate transfer member 12. In this manner, the first cleaning roller 33a and the second cleaning roller 33b make the liquid toner T on the outer circumference of the intermediate transfer member 12 uniform.

[0051] The collecting blade 34a is disposed to face the outer circumference of the first cleaning roller 33a. The collecting blade 34a collects the liquid toner T on the outer circumference of the first cleaning roller 33a. The collecting blade 34b is disposed to face the outer circumference of the second cleaning roller 33b. The collecting blade 34b collects the liquid toner T on the outer circumference of the second cleaning roller 33b. The collecting blade 34c is disposed to face the outer circumference of the intermediate transfer member 12. More specifically, the collecting blade 34c is disposed between the carrier nozzle 31 and the photosensitive drum 15 of the developing unit 14a. The collecting blade 34c collects the liquid toner T diluted with the carrier ejected from the carrier nozzle 31.

[0052] The liquid toner collecting device 40 includes a liquid toner collecting pump 41a, a liquid toner collecting pump 41b, and a liquid toner collecting pump 41c. The liquid toner collecting pump 41a is disposed in a passage connecting the collecting blade 34c to the solid content separation device 50 described later. The liquid toner collecting pump 41a introduces the liquid toner T collected by the collecting blade 34c to the solid content separation device 50. The liquid toner collecting pump 41b is disposed in a passage connecting the collecting blade 34a to the solid content separation device 50. The liquid toner collecting pump 41b introduces the liquid toner T collected by the collecting blade 34a to the solid content separation device 50. The liquid toner collecting pump 41c is disposed in a passage connecting the collecting

blade 34b to the solid content separation device 50. The liquid toner collecting pump 41c introduces the liquid toner T collected by the collecting blade 34b to the solid content separation device 50.

[0053] FIG. 2 is a schematic diagram illustrating the solid content separation device in the first embodiment. FIG. 3 is a schematic perspective view illustrating a tray in the present embodiment. The solid content separation device 50 is a device that can facilitate the separation of the toner as the solid contents and the carrier contained in the liquid toner T. Hereinafter, the toner will be referred to as solid contents. As shown in FIG. 2, the solid content separation device 50 includes a tray 51 used as a flow passage, an electric actuator 51g, a positive electrode member 52 used as aggregating means, a pushing blade 53 and a cylinder device 53a that are used as solid content moving means, a used liquid toner tank 54a, a recycled carrier tank 54b, a solid content tank 54c used as a solid content storage unit, and a cartridge-type filter 55.

[0054] As shown in FIG. 3, the tray 51 has, for example, a bottom 51a, side surfaces 51b, a rear surface 51c, an open section 51d, an opening 51e used as a solid content discharge section, and an open-close member 51f. In the tray 51, the two side surfaces 51b facing each other and the one rear surface 51c extend from the bottom 51a in the same direction. The rear surface 51c is disposed between the two side surfaces 51b so as to be, for example, orthogonal to the side surfaces 51b. Therefore, the tray 51 is formed into a shape with the open section 51d being provided in a region that is along the bottom 51a and opposed to the rear surface 51c in a direction parallel to the side surfaces 51b. The opening 51e is formed in the bottom 51a. The opening 51e allows two spaces divided by the bottom 51a to be in communication with each other. The bottom 51a is disposed inclined with respect to the horizontal with the open section 51d being located vertically lower than the rear surface 51c.

[0055] The open-close member 51f is a plate-shaped member. The open-close member 51f is attached to the tray 51 so as to be capable of covering the opening 51e. The open-close member 51f rotates, for example, about a rotation axis Zr parallel to the bottom 51a and thereby opens/closes. The open-close member 51f may open/close when, for example, the plate-shaped member slides in a direction parallel to the bottom 51a. The open-close member 51f is operated by, for example, the electric actuator 51g.

[0056] The positive electrode member 52 shown in FIG. 2 is disposed to face a portion of the bottom 51a other than the opening 51e. The positive electrode member 52 is disposed with sufficient spacing from the bottom 51a so as not to come into contact with the liquid toner T flowing on the bottom 51a. The spacing is, for example, 10 mm. The positive electrode member 52 is, for example, a conductive wire. The positive electrode member 52 is disposed in the width direction of the tray 51 (a direction connecting the two side surfaces 51b). The positive electrode member 52 shown in FIG. 2 is formed by

arranging a plurality of conductive wires arranged in the longitudinal direction of the tray 51 (a direction connecting the rear surface 51c and the open section 51d). The positive electrode member 52 may be composed of one conductive wire. The positive electrode member 52 may be composed of, for example, a plurality of needles protruding toward the bottom 51a.

[0057] In the bottom 51a, a section thereof facing the positive electrode member 52 functions as an aggregation section 51h. In the tray 51, at least the aggregation section 51h is formed from a conductive member, and at least the aggregation section 51h is electrically connected to a ground (earth). Therefore, the aggregation section 51h functions as a negative electrode section in association with the positive electrode member 52. In the present embodiment, the entire portion of the tray 51 is formed from a conductive member and connected to a ground (earth). Therefore, in the solid content separation device 50, corona discharge can occur between the positive electrode member 52 and the aggregation section 51h.

[0058] The pushing blade 53 is a plate-shaped member. The pushing blade 53 is disposed in parallel to the rear surface 51c. The pushing blade 53 is disposed so as to be movable along the bottom 51a from the rear surface 51c toward the opening 51e shown in FIG. 3. The cylinder device 53a shown in FIG. 2 and used as blade moving means is, for example, an air cylinder device or a hydraulic cylinder device. The cylinder device 53a is a device that expands and contracts between the rear surface 51c and the opening 51e. The cylinder device 53a can move the pushing blade 53.

[0059] The used liquid toner tank 54a shown in FIG. 1 is a container for storing the used liquid toner T introduced by the respective liquid toner collecting pumps 41a to 41c. The used liquid toner tank 54a is disposed such that the used liquid toner T can be supplied to the bottom 51a between the positive electrode member 52 and the rear surface 51c. In the used liquid toner tank 54a, a section thereof from which the used liquid toner T is ejected (a section from which the used liquid toner T is supplied to the bottom 51a) includes, for example, a passage extending in the width direction of the bottom 51a and a plurality of holes formed in the passage and arranged in the width direction. The width direction herein is a direction connecting the two side surfaces 51b shown in FIG. 3. Therefore, the used liquid toner tank 54a can supply the liquid toner T to the bottom 51a more uniformly in the width direction.

[0060] The recycled carrier tank 54b is a container for storing liquid C contained in the liquid toner T in the used liquid toner tank 54a. The recycled carrier tank 54b is disposed so as to be capable of receiving the liquid C introduced to the open section 51d. In the present embodiment, the recycled carrier tank 54b is disposed vertically below the open section 51d and opposed to the open section 51d in the vertical direction. The liquid C introduced to the open section 51d is composed mainly

of the carrier but may contain a small amount of solid contents. The solid content tank 54c is a container for storing solid contents K contained in the liquid toner T in the used liquid toner tank 54a. The solid content tank 54c is disposed so as to be capable of receiving the solid contents K introduced to the opening 51e. In the present embodiment, the solid content tank 54c is disposed vertically below the opening 51e and opposed to the opening 51e in the vertical direction.

[0061] The cartridge-type filter 55 is disposed downstream of the recycled carrier tank 54b in the flow direction of the liquid C (composed mainly of the carrier). In the present embodiment, the cartridge-type filter 55 is disposed in a passage connecting the recycled carrier tank 54b to the carrier tank 22 as shown in FIG. 1. The cartridge-type filter 55 facilitates the separation of the solid contents K and the carrier contained in the introduced liquid C (composed mainly of the carrier). Next, a description will be given of a mechanism used in the solid content separation device 50 to separate the carrier and the solid contents K contained in the liquid toner T.

[0062] FIG. 4 is a schematic diagram illustrating the solid contents. The solid contents K will be described first using FIG. 4. The solid contents K include capsules K1, dispersing members K2, and a coloring material K3. The capsules K1 and the dispersing members K2 are formed from thermoplastic materials, for example, synthetic resin materials. The dispersing members K2 are needle-shaped members. The dispersing members K2 are disposed radially on the circumferences of the capsules K1. The coloring material K3 is contained in the capsules K1. Generally, the solid contents K are positively charged.

[0063] The solid content separation device 50 shown in FIG. 2 introduces the used liquid toner T collected in the used liquid toner tank 54a to the bottom 51a between the positive electrode member 52 and the rear surface 51c. The used liquid toner T introduced to the bottom 51a is introduced between the positive electrode member 52 and the aggregation section 51h. Then positive voltage is applied to the positive electrode member 52. Therefore, in the solid content separation device 50, corona discharge occurs between the positive electrode member 52 and the aggregation section 51h.

[0064] FIG. 5 is a schematic diagram illustrating a plurality of solid contents before aggregation. FIG. 6 is a schematic diagram illustrating the plurality of solid contents after aggregation. In the used liquid toner T that passes between the positive electrode member 52 and the aggregation section 51h, the solid contents K are positively charged by corona discharge, as shown in FIG. 5. Therefore, the solid contents K contained in the used liquid toner T are moved toward the aggregation section 51h on a negative side, as shown in FIG. 6. The plurality of solid contents K thereby come close to each other and aggregate on the aggregation section 51h. The carrier contained in the used liquid toner T is separated as the liquid C and gathers toward the positive electrode member 52.

[0065] The liquid C flows from the space between the positive electrode member 52 and the aggregation section 51h toward the open section 51d shown in FIG. 2. In this case, the opening 51e is covered with the open-close member 51f. Therefore, the liquid C passes over the opening 51e covered with the open-close member 51f and is introduced to the open section 51d. Then the liquid C is introduced from the open section 51d to the recycled carrier tank 54b. The liquid C introduced to the recycled carrier tank 54b is further reduced in the amount of the contained solid contents K through the cartridge-type filter 55. In the present embodiment, the liquid C (composed substantially of the carrier) that has been reduced in the amount of the contained solid contents K through the cartridge-type filter 55 is introduced to the carrier tank 22 shown in FIG. 1.

[0066] The solid contents K contained in the liquid toner T are accumulated between the positive electrode member 52 and the aggregation section 51h. In the solid content separation device 50, the accumulated solid contents K are introduced to the solid content tank 54c by the pushing blade 53. More specifically, in the solid content separation device 50, first, the open-close member 51f is opened at prescribed timing. Then, in the solid content separation device 50, the cylinder device 53a is actuated to move the pushing blade 53 toward the opening 51e. In the solid content separation device 50, the solid contents K accumulated between the positive electrode member 52 and the aggregation section 51h are thereby introduced to the solid content tank 54c through the opening 51e.

[0067] The prescribed timing is, for example, the point in time when a prescribed time has elapsed since the last actuation of the electric actuator 51g or the last actuation of the cylinder device 53a. The prescribed time is determined, for example, by tests. An example of a method of setting the prescribed time will be described. As the amount of the solid contents K accumulated between the positive electrode member 52 and the aggregation section 51h increases, the amount of charge on the solid contents K additionally introduced decreases. Therefore, the amount of the solid contents K contained in the liquid C that has passed between the positive electrode member 52 and the aggregation section 51h increases. The prescribed time is set such that the amount of the solid contents K contained in the liquid C is within an allowable value.

[0068] In another embodiment, the solid content separation device 50 may include a concentration sensor. The concentration sensor detects the concentration of the liquid C (the weight ratio of the carrier contained to the weight of the solid contents K). The solid content separation device 50 includes a not-shown control device. The control device acquires a signal from the concentration sensor and controls the operation of the electric actuator 51g and the operation of the cylinder device 53a. When the concentration of the liquid C exceeds a threshold value, the control device actuates the electric actuator

51g to open the open-close member 51f. In addition, the control device actuates the cylinder device 53a to move the pushing blade 53 toward the opening 51e.

[0069] With the above-described configuration, the solid content separation device 50 can facilitate the separation of the carrier and the solid contents K contained in the used liquid toner T. Therefore, in the solid content separation device 50, the clogging of the cartridge-type filter 55 can be reduced as compared to a case where, for example, the used liquid toner T is directly introduced to the cartridge-type filter 55. More specifically, in the solid content separation device 50, a reduction in the service life of the cartridge-type filter 55 can be reduced. Therefore, in the solid content separation device 50, the frequency of maintenance can be reduced, and the time and effort required for maintenance can be reduced.

[0070] The electrophotographic printing press 10 in the present embodiment shown in FIG. 1 reuses the carrier that has been reduced in the amount of the solid contents K by the solid content separation device 50. Therefore, the electrophotographic printing press 10 includes a recycled carrier supply pump 17 used as a structure for recycling. The recycled carrier supply pump 17 is disposed in a passage connecting the recycled carrier tank 54b and the carrier tank 22. In the present embodiment, the recycled carrier supply pump 17 is disposed between the cartridge-type filter 55 and the carrier tank 22. The recycled carrier supply pump 17 may be disposed between the recycled carrier tank 54b and the cartridge-type filter 55. In the above configuration, the recycled carrier supply pump 17 introduces, to the carrier tank 22, the carrier that has been reduced in the amount of the solid contents K through the cartridge-type filter 55.

[0071] The carrier pump 32 in the present embodiment introduces the carrier from the carrier tank 22 to the carrier nozzle 31. However, the carrier pump 32 may introduce the carrier from the recycled carrier tank 54b to the carrier nozzle 31. In this case, it is preferable to dispose a cartridge-type filter 55 in a passage connecting the recycled carrier tank 54b to the carrier nozzle 31 of the cleaning device 30.

(Second Embodiment)

[0072] FIG. 7 is a schematic diagram illustrating a solid content separation device in the second embodiment. The solid content separation device 60 in the present embodiment shown in FIG. 7 includes, in addition to the components included in the solid content separation device 50 shown in FIG. 2, a bag-type filter 61 used as a solid content storage unit. The solid content separation device 60 further includes, instead of the cylinder device 53a shown in FIG. 2, a cylinder device 63a used as solid content moving means. In the solid content separation device 60, the opening 51e, the open-close member 51f, the electric actuator 51g, and the solid content tank 54c shown in FIG. 2 can be omitted. In the following description, the same components as those included in the solid

content separation device 50 shown in FIG. 2 are denoted by the same reference numerals.

[0073] At least part of the bag-type filter 61 is formed as a filter section that can reduce the amount of the solid contents K contained in the liquid toner T and allows the carrier contained in the liquid toner T to pass there-through. Almost the entire part of the bag-type filter 61 in the present embodiment is formed as a filter section. The bag-type filter 61 is larger than the cartridge-type filter 55. The separation ability of the bag-type filter 61 may be lower than that of the cartridge-type filter 55. The separation ability means the ratio between the concentration of a liquid before it passes through the filter and the concentration of the liquid after it passes through the filter. More specifically, the mesh of the bag-type filter 61 may be coarser than the mesh of the cartridge-type filter 55, and the thickness of the bag-type filter 61 may be smaller than the thickness of the cartridge-type filter 55. The bag-type filter 61 is disposed between the open section 51d and the recycled carrier tank 54b. The cylinder device 63a is a device that expands and contracts between the rear surface 51c and the open section 51d. The cylinder device 63a can move the pushing blade 53 from the rear surface 51c to the open section 51d.

[0074] Next, a description will be given of a mechanism used in the solid content separation device 60 to facilitate the separation of the carrier and the solid contents K contained in the liquid toner T. The solid content separation device 60 allows the solid contents K positively charged and present between the positive electrode member 52 and the aggregation section 51h to aggregate in the aggregation section 51h. The liquid C reduced in the amount of the solid contents K passes between the positive electrode member 52 and the aggregation section 51h and is introduced from the open section 51d to the bag-type filter 61. The amount of the solid contents K contained in the liquid C is further reduced through the bag-type filter 61. Then the liquid C is introduced to the recycled carrier tank 54b.

[0075] In the solid content separation device 60, the cylinder device 63a is actuated at prescribed timing. The prescribed timing is, for example, the point in time when a prescribed time has elapsed since the last actuation of the cylinder device 63a. The prescribed time is the same as the prescribed time described in the first embodiment. The pushing blade 53 thereby moves the solid contents K aggregated and accumulated between the positive electrode member 52 and the aggregation section 51h to the open section 51d. The solid contents K moved to the open section 51d are introduced to the bag-type filter 61 with the aggregated state being maintained. The most part of the solid contents K introduced to the bag-type filter 61 remain in the bag-type filter 61. Even when the solid contents K are present in the bag-type filter 61, the liquid C additionally introduced thereto passes through the bag-type filter 61 while avoiding the solid contents K. However, the separation ability of the bag-type filter 61 decreases as the amount of the solid contents K con-

tained therein increases. Therefore, the bag-type filter 61 is replaced at an appropriate time (before the separation ability of the bag-type filter 61 is out of an allowable range).

[0076] With the above-described configuration, the solid content separation device 60 can facilitate the separation of the carrier and the solid contents K contained in the used liquid toner T. In addition, the solid content separation device 60 can introduce the aggregated solid contents K to the bag-type filter 61. The aggregated solid contents K are less likely to pass through the bag-type filter 61 than the solid contents K dispersed in the carrier. Therefore, in the solid content separation device 60, the amount of the solid contents K passing through the bag-type filter 61 can be reduced. Accordingly, in the solid content separation device 60, a reduction in the service life of the cartridge-type filter 55 can be reduced. In the solid content separation device 60, the frequency of maintenance can thereby be reduced, and the time and effort required for maintenance can be reduced. In addition, the solid content separation device 60 can provide the same effects as those of the solid content separation device 50 shown in FIG. 2, while the number of components of the solid content separation device 60 is smaller than the number of components of the solid content separation device 50.

(Third Embodiment)

[0077] FIG. 8 is a schematic diagram illustrating a solid content separation device in the third embodiment. The solid content separation device 70 in the present embodiment shown in FIG. 8 includes: a tray 71 serving as a flow passage, instead of the tray 51 shown in FIG. 2; a cylinder device 73a used as solid content moving means, instead of the cylinder device 53a; and a solid content tank 74c used as solid content storing means, instead of the solid content tank 54c. In the solid content separation device 70, the electric actuator 51g shown in FIG. 2 can be omitted. In the following description, the same components as those included in the solid content separation device 50 shown in FIG. 2 are denoted by the same reference numerals.

[0078] The tray 71 is formed into a shape in which the rear surface 51c, the opening 51e, and the open-close member 51f shown in FIG. 3 have been omitted. In the tray 71, a section corresponding to the open section 51d is a first open section 71d, and a section corresponding to the rear surface 51c is a second open section 71j used as a solid content discharge section. The bottom 51a of the tray 71 is disposed inclined with respect to the horizontal with the first open section 71d being located vertically lower than the second open section 71j.

[0079] The solid content tank 74c is disposed so as to be capable of receiving the solid contents K introduced to the second open section 71j. In the present embodiment, the solid content tank 74c is disposed vertically below the second open section 71j and opposed to the

second open section 71j in the vertical direction. The recycled carrier tank 54b is disposed at the same position as that in the first embodiment (in the present embodiment, a position vertically below the first open section 71d and opposed to the first open section 71d in the vertical direction). The cylinder device 73a is a device that expands and contracts between the first open section 71d and the second open section 71j. The cylinder device 73a can move the pushing blade 53 from the first open section 71d to the second open section 71j.

[0080] Next, a description will be given of a mechanism used in the solid content separation device 70 to facilitate the separation of the carrier and the solid contents K contained in the liquid toner T. The solid content separation device 70 allows the solid contents K positively charged and present between the positive electrode member 52 and the aggregation section 51h to aggregate in the aggregation section 51h. The liquid C reduced in the amount of the solid contents K passes between the positive electrode member 52 and the aggregation section 51h. Then the liquid C is introduced to the first open section 71d through, for example, the gap between the pushing blade 53 and the bottom 51a and the gap between the pushing blade 53 and the side surfaces 51b. Also, the liquid C passes over, for example, the vertically upper edge of the pushing blade 53 and is then introduced to the first open section 71d. The liquid C introduced to the first open section 71d is introduced to the recycled carrier tank 54b.

[0081] In the solid content separation device 70, the cylinder device 73a is actuated at prescribed timing. The prescribed timing is, for example, the point in time when a prescribed time has elapsed since the last actuation of the cylinder device 73a. The prescribed time is the same as the prescribed time described in the first embodiment. Therefore, the pushing blade 53 moves the solid contents K aggregated and accumulated between the positive electrode member 52 and the aggregation section 51h to the second open section 71j. The solid contents K moved to the second open section 71j are introduced to the solid content tank 74c with the aggregated state being maintained.

[0082] With the above-described configuration, the solid content separation device 70 can facilitate the separation of the carrier and the solid contents K contained in the used liquid toner T. In the solid content separation device 70, the aggregated solid contents K and the liquid C are stored in separate tanks. Therefore, in the solid content separation device 70, the amount of the solid contents K introduced to the cartridge-type filter 55 can be made smaller than that in the solid content separation device 60 shown in FIG. 7. Accordingly, in the solid content separation device 70, a reduction in the service life of the cartridge-type filter 55 may be reduced. In addition, the solid content separation device 70 can provide the same effects as those of the solid content separation device 50 shown in FIG. 2, while the number of components of the solid content separation device 70 is smaller than the number of components of the solid content separation device 50.

aration device 50.

(Fourth Embodiment)

[0083] FIG. 9 is a schematic diagram illustrating a solid content separation device in the fourth embodiment. The solid content separation device 80 in the present embodiment shown in FIG. 9 includes a belt conveyor device 81 used as solid content moving means, a positive electrode member 82 used as aggregating means, a solid content collecting blade 83, a used liquid toner tank 84a, a recycled carrier tank 84b, a solid content tank 84c used as a solid content storage unit, and a cartridge-type filter 55. The belt conveyor device 81 includes a first roller 81a, a second roller 81b, a metal belt 81c used as a flow passage, and an aggregation section 81d used as a negative electrode section. The first roller 81a can rotate about a rotation axis Zr1. The second roller 81b can rotate about a rotation axis Zr2. The rotation axis Zr1 and the rotation axis Zr2 are parallel to each other.

[0084] The metal belt 81c is wound around the outer circumference of the first roller 81a and the outer circumference of the second roller 81b. The metal belt 81c is formed of a conductive member and electrically connected to a ground (earth). In the present embodiment, at least one of the first roller 81a and the second roller 81b is formed of a conductive member, and the at least one of them formed of the conductive member is electrically connected to the ground (earth). Therefore, the metal belt 81c in contact with the first roller 81a and the second roller 81b is electrically connected to the ground (earth).

[0085] The positive electrode member 82 is disposed vertically above the belt conveyor device 81. The positive electrode member 82 faces the metal belt 81c in the vertical direction. A portion of the metal belt 81c that faces the positive electrode member 82 functions as the aggregation section 81d. In the present embodiment, the first roller 81a and the second roller 81b rotate such that the solid contents K on the aggregation section 81d move from the side close to the first roller 81a toward the second roller 81b. The solid content collecting blade 83 is configured to be capable of collecting the solid contents K aggregated between the positive electrode member 82 and the aggregation section 81d. More specifically, the solid content collecting blade 83 is disposed to face part of the metal belt 81c that is located on the outer circumference of the second roller 81b. The used liquid toner tank 84a is configured to be capable of supplying the used liquid toner T to the aggregation section 81d.

[0086] The belt conveyor device 81, in the present embodiment is disposed such that the aggregation section 81d is inclined vertically downward from the first roller 81a toward the second roller 81b. More specifically, in the belt conveyor device 81, when the diameter of the first roller 81a is the same as the diameter of the second roller 81b, the rotation axis Zr2 is disposed vertically lower than the rotation axis Zr1. Alternatively, in the belt conveyor device 81, when the rotation axis Zr2 and the rotation axis Zr1 are parallel to each other, the rotation axis Zr2 is disposed vertically lower than the rotation axis Zr1.

tation axis Zr1 are disposed at the same level in the vertical direction, the second roller 81b is formed to have a diameter smaller than the diameter of the first roller 81a. The above-described inclination can reduce the possibility that the used liquid toner T introduced from the used liquid toner tank 84a to the metal belt 81c drops from its end on the first roller 81a side. However, the aggregation section 81d may be disposed horizontally.

[0087] The recycled carrier tank 84b is disposed so as to be capable of receiving the liquid C that has passed between the positive electrode member 82 and the aggregation section 81d. More specifically, the recycled carrier tank 84b is disposed vertically below the belt conveyor device 81 and faces the belt conveyor device 81 in the vertical direction. The solid content tank 84c is disposed so as to be capable of receiving the solid contents K collected by the solid content collecting blade 83. More specifically, the solid content tank 84c is disposed vertically below the solid content collecting blade 83 and faces the solid content collecting blade 83 in the vertical direction.

[0088] Next, a description will be given of a mechanism used in the solid content separation device 80 to facilitate the separation of the carrier and the solid contents K contained in the liquid toner T. In the solid content separation device 80, the first roller 81a and the second roller 81b rotate in the same direction. The used liquid toner T supplied from the used liquid toner tank 84a to the metal belt 81c is thereby introduced between the positive electrode member 82 and the aggregation section 81d. In the present embodiment, since the aggregation section 81d is inclined, the used liquid toner T is also attracted by the gravity and moves toward the second roller 81b.

[0089] In the used liquid toner T introduced between the positive electrode member 82 and the aggregation section 81d, the solid contents K are positively charged. In the solid content separation device 80, the solid contents K are thereby aggregated on the aggregation section 81d. The liquid C reduced in the amount of the solid contents K passes between the positive electrode member 82 and the aggregation section 81d. Then the liquid C is introduced to the used liquid toner tank 84a through, for example, the gap between the metal belt 81c and the solid content collecting blade 83. The liquid C introduced to the used liquid toner tank 84a is then introduced to the cartridge-type filter 55. The solid contents K aggregated on the aggregation section 81d are collected by the solid content collecting blade 83 with the aggregated state being maintained. The solid contents K collected by the solid content collecting blade 83 are introduced to the solid content tank 84c.

[0090] With the above-described configuration, the solid content separation device 80 can facilitate the separation of the carrier and the solid contents K contained in the used liquid toner T. In the solid content separation device 80, the aggregated solid contents K and the liquid C are stored in separate tanks. Therefore, in the solid content separation device 80, the amount of the solid

contents K introduced to the cartridge-type filter 55 can be reduced. Accordingly, in the solid content separation device 80, a reduction in the service life of the cartridge-type filter 55 can be reduced. This allows a reduction in the frequency of maintenance of the solid content separation device 80 and also allows a reduction in the time and effort required for maintenance.

(Fifth Embodiment)

[0091] FIG. 10 is a schematic diagram illustrating a solid content separation device in the fifth embodiment. The solid content separation device 85 in the present embodiment shown in FIG. 10 includes a metal roller 86 used as solid content moving means, a dual purpose tank 87a, a solid content tank 87c used as a solid content storage unit, a positive electrode member 88 used as aggregating means, and a solid content collecting blade 89. The metal roller 86 can rotate about a rotation axis Zr3. The metal roller 86 is a conductive member and electrically connected to a ground (earth). The dual purpose tank 87a has the function of the used liquid toner tank 84a and the function of the recycled carrier tank 84b in the fourth embodiment shown in FIG. 9. More specifically, the dual purpose tank 87a is a container for storing liquid C1 containing the used liquid toner T and the liquid C reduced in the amount of the solid contents K. The dual purpose tank 87a is disposed such that part of the outer circumference 86a of the metal roller 86 can be immersed in the liquid C1 stored in the dual purpose tank 87a. The outer circumference 86a of the metal roller 86 functions as a flow passage.

[0092] The positive electrode member 88 is disposed to face the outer circumference 86a of the metal roller 86. In the positive electrode member 88, a plurality of conductive wires, for example, are disposed along the outer circumference 86a of the metal roller 86. In the metal roller 86, a portion of the outer circumference 86a that faces the positive electrode member 88 functions as a negative electrode section and also as an aggregation section 86d. The solid content collecting blade 89 is configured to be capable of collecting the solid contents K aggregated on the outer circumference 86a of the metal roller 86. More specifically, the solid content collecting blade 89 is disposed to face the outer circumference 86a of the metal roller 86. The solid content tank 87c is disposed so as to be capable of receiving the solid contents K collected by the solid content collecting blade 89. More specifically, the solid content tank 87c is disposed vertically below the solid content collecting blade 89 and faces the solid content collecting blade 89 in the vertical direction.

[0093] Next, a description will be given of a mechanism used in the solid content separation device 85 to facilitate the separation of the carrier and the solid contents K contained in the liquid toner T. In the solid content separation device 85, the metal roller 86 rotates. Therefore, the liquid C1 in the dual purpose tank 87a is conveyed by the ro-

tating metal roller 86 while adhering to the outer circumference 86a thereof. The liquid C1 adhering to the rotating metal roller 86 is introduced between the positive electrode member 88 and the aggregation section 86d. In the liquid C introduced between the positive electrode member 88 and the aggregation section 86d, the solid contents K are positively charged. In the solid content separation device 85, the solid contents K are thereby aggregated on the aggregation section 86d. The liquid C reduced in the amount of the solid contents K passes between the positive electrode member 88 and the aggregation section 86d. Then the liquid C is introduced to the dual purpose tank 87a through, for example, the gap between the outer circumference 86a of the metal roller 86 and the solid content collecting blade 89.

[0094] The solid contents K aggregated on the aggregation section 86d are collected by the solid content collecting blade 89 with the aggregated state being maintained. The solid contents K collected by the solid content collecting blade 89 are introduced to the solid content tank 87c. The liquid C introduced to the dual purpose tank 87a is mixed with the liquid C1 and will be again introduced between the positive electrode member 88 and the aggregation section 86d. In the solid content separation device 85, the amount of the solid contents K contained in the liquid C1 can thereby be reduced. The liquid C in the dual purpose tank 87a is introduced to the cartridge-type filter 55 by the recycled carrier supply pump 17 shown in FIG. 1.

[0095] With the above-described configuration, the solid content separation device 85 can facilitate the separation of the carrier and the solid contents K contained in the used liquid toner T. In the solid content separation device 85, the aggregated solid contents K and the liquid C are stored in separate tanks. Therefore, in the solid content separation device 85, the amount of the solid contents K introduced to the cartridge-type filter 55 can be reduced. Accordingly, in the solid content separation device 85, a reduction in the service life of the cartridge-type filter 55 can be reduced. This allows a reduction in the frequency of maintenance of the solid content separation device 85 and also allows a reduction in the time and effort required for maintenance.

[0096] The solid content separation devices in the first to fifth embodiments are examples of a device used for a liquid toner T containing solid contents K that are positively charged by corona discharge. However, these devices can be applied to a liquid toner T containing solid contents K that are negatively charged by corona discharge. In this case, each of the solid content separation devices includes, for example a second positive electrode member, in addition to the positive electrode member and the negative electrode section facing each other. The second positive electrode member is disposed downstream of the positive electrode member and the negative electrode section in the flow direction of the liquid toner T so as to be capable of coming into contact with the liquid toner T. In this case, in the solid content

separation devices, the solid contents K are negatively charged by the positive electrode member and the negative electrode section. Then in the solid content separation devices, the negatively charged solid contents K are attracted by the second positive electrode member and aggregated thereon. Even in this case, the solid content separation devices can facilitate the separation of the carrier and the solid contents K contained in the liquid toner T.

(Sixth Embodiment)

[0097] FIG. 11 is a schematic diagram illustrating a solid content separation device in the sixth embodiment. The solid content separation device 90 in the present embodiment shown in FIG. 11 is characterized in that the used liquid toner T is heated to facilitate the aggregation of the solid contents K. The solid content separation device 90 includes a heater 91 in addition to the components of the solid content separation device 50 shown in FIG. 2. The rest of the configuration of the solid content separation device 90 is the same as the configuration of the solid content separation device 50 shown in FIG. 2.

[0098] The heater 91 is disposed on the bottom 51a. The heater 91 disposed may or may not come into contact with the liquid toner flowing along the bottom 51a. In the present embodiment, the heater 91 is disposed on the rear side of the bottom 51a (the side on which the liquid toner T flows is defined as a front side) or disposed on the front side of the bottom 51a with a sufficient spacing from the bottom 51a. Therefore, the heater 91 does not come into contact with the liquid toner T. The heater 91 is disposed upstream of the positive electrode member 52 and the aggregation section 51h in the flow direction of the liquid toner T. More specifically, the heater 91 is disposed on the bottom 51a and located between the aggregation section 51h and the rear surface 51c. The heater 91 heats the used liquid toner T flowing on the bottom 51a toward the aggregation section 51h.

[0099] The heater 91 in the present embodiment heats the used liquid toner T to its glass transition temperature or higher, for example, 60°C or higher. In the solid contents K contained in the used liquid toner T heated to a temperature equal to or higher than the glass transition temperature, the dispersing members K2 shown in FIG. 4 fall off the capsules K1. Alternatively, in the solid contents K, the dispersing members K2 deform. Therefore, the function of the dispersing members K2 is reduced. This function is to suppress the aggregation of the solid contents K to allow them to be dispersed in the carrier. The solid contents K are thereby more easily aggregated by corona discharge when they pass through the aggregation section 51h.

[0100] The liquid C that has passed through the aggregation section 51h is introduced to the recycled carrier tank 54b. The solid contents K aggregated and accumulated on the aggregation section 51h are introduced to

the solid content tank 54c by the pushing blade 53. With the above-described configuration, the solid content separation device 90 can more preferably facilitate the separation of the carrier and the solid contents K contained in the used liquid toner T. In the solid content separation device 90, the aggregated solid contents K and the liquid C are stored in separate tanks. Therefore, in the solid content separation device 90, the amount of the solid contents K introduced to the cartridge-type filter 55 can be reduced. Accordingly, in the solid content separation device 90, a reduction in the service life of the cartridge-type filter 55 can be reduced.

[0101] As described above, in the solid content separation device 90 in the present embodiment, the used liquid toner T is first heated, and the heated used liquid toner T is introduced between the positive electrode member and the aggregation section. However, in the solid content separation device 90, the used liquid toner T may be aggregated by corona discharge while being heated. In this case, the heater 91 is disposed in the aggregation section 51h. Even in this case, the solid content separation device 90 can facilitate the aggregation of the solid contents K more preferably.

[0102] This embodiment is an example in which the idea that the used liquid toner T is heated to facilitate the aggregation of the solid contents K is added to the solid content separation device 50 in the first embodiment shown in FIG. 2. Therefore, this idea may be added to the solid content separation device 60 in the second embodiment shown in FIG. 7, the solid content separation device 70 in the third embodiment shown in FIG. 8, the solid content separation device 80 in the fourth embodiment shown in FIG. 9, and the solid content separation device 85 in the fifth embodiment shown in FIG. 10. When this idea is added to the solid content separation device 80 in the fourth embodiment shown in FIG. 9, the heater 91 is disposed to face, for example, the metal belt 81c and heats the used liquid toner T on the metal belt 81c. Alternatively, the heater 91 is disposed on the rear side of the metal belt 81c (a side opposite to the surface coming into contact with the used liquid toner T) to heat the metal belt 81c, and the used liquid toner T on the metal belt 81c is thereby heated. When the above idea is applied to the solid content separation device 85 in the fifth embodiment shown in FIG. 10, the heater 91 heats, for example, the metal roller 86 to thereby heat the used liquid toner T on the metal belt 81c.

[0103] Even in these cases, the solid content separation devices can facilitate the aggregation of the solid contents K. Therefore, the solid content separation devices can more preferably facilitate the separation of the carrier and the solid contents K contained in the used liquid toner T. In the solid content separation devices, the aggregated solid contents K and the liquid C are stored in separate tanks. Therefore, in the solid content separation devices, the amount of the solid contents K introduced to the cartridge-type filter 55 can be reduced. Accordingly, in the solid content separation devices, a

reduction in the service life of the cartridge-type filter 55 can be reduced.

(Modification)

[0104] FIG. 12 is a schematic diagram illustrating a solid content separation device in a modification of the sixth embodiment. The solid content separation device 95 in this modification shown in FIG. 12 is characterized in that the used liquid toner T is heated to aggregate the solid contents K. The solid content separation device 95 is different from the solid content separation device 50 shown in FIG. 2 in that a heater 96 used as aggregating means is provided instead of the positive electrode member 52 shown in FIG. 2. The rest of the configuration of the solid content separation device 95 is the same as the configuration of the solid content separation device 50 shown in FIG. 2.

[0105] The heater 96 is disposed on the bottom 51a. The heater 96 is disposed so as not to come into contact with the liquid toner flowing along the bottom 51a. In the present embodiment, the heater 96 is disposed on the rear side of the bottom 51a (the side on which the liquid toner T flows is defined as a front side) or disposed on the front side of the bottom 51a with a sufficient spacing from the bottom 51a. The heater 96 is disposed on the bottom 51a and located between the opening 51e and the rear surface 51c. In the bottom 51a, a section in which the heater 96 is disposed functions as the aggregation section 51h. The heater 96 heats the used liquid toner T passing through the aggregation section 51h. The heater 96 in the present embodiment heats the used liquid toner T to its glass transition temperature or higher, for example, 60°C or higher. The function of the dispersing members K2 shown in FIG. 4 is thereby reduced. In the solid content separation device 95, the solid contents K contained in the used liquid toner T passing through the aggregation section 51h are thereby aggregated.

[0106] The liquid C that has passed through the aggregation section 51h is introduced to the recycled carrier tank 54b. The solid contents K aggregated and accumulated on the aggregation section 51h are introduced to the solid content tank 54c by the pushing blade 53. With the above-described configuration, the solid content separation device 95 can facilitate the separation of the carrier and the solid contents K contained in the used liquid toner T. In the solid content separation device 95, the aggregated solid contents K and the liquid C are stored in separate tanks. Therefore, in the solid content separation device 95, the amount of the solid contents K introduced to the cartridge-type filter 55 can be reduced. Accordingly, in the solid content separation device 95, a reduction in the service life of the cartridge-type filter 55 can be reduced.

[0107] This embodiment is an example in which the idea that the used liquid toner T is heated to aggregate the solid contents K is applied to the solid content separation device 50 in the first embodiment shown in FIG.

2. Therefore, this idea may be applied to the solid content separation device 60 in the second embodiment shown in FIG. 7, the solid content separation device 70 shown in the third embodiment in FIG. 8, the solid content separation device 80 shown in the fourth embodiment in FIG. 9, and the solid content separation device 85 shown in the fifth embodiment in FIG. 10.

[0108] Even in these cases, these solid content separation devices can facilitate the separation of the carrier and the solid contents K contained in the used liquid toner T. In the solid content separation devices, the aggregated solid contents K and the liquid C are stored in separate tanks. Therefore, in the solid content separation devices, the amount of the solid contents K introduced to the cartridge-type filter 55 can be reduced. Accordingly, in the solid content separation devices, a reduction in the service life of the cartridge-type filter 55 can be reduced.

(Seventh Embodiment)

[0109] FIG. 13 is a schematic diagram illustrating a solid content separation device in the seventh embodiment. FIG. 14 is an enlarged diagram of the solid content separation device in the seventh embodiment. This solid content separation device is characterized as follows: A liquid toner on a roller is separated into solid contents and a carrier using aggregating means, and the carrier is collected, and then the carrier remaining in the solid contents is further separated therefrom, and the separated carrier is returned to the upstream side of the aggregating means in the rotation direction of the roller.

[0110] The solid content separation device 100 includes a roller 101 used as a flow passage, a carrier supply port 107, a solid content removing blade 103 used as scraping means, a tray 104 used as carrier separating means, and a carrier feeding pump 106 used as circulating means. In the present embodiment, the solid content separation device 100 further includes a carrier collecting blade 102 used as carrier collecting means, a carrier bath 105, and a positive electrode member 88.

[0111] As shown in FIG. 14, the roller 101 rotates about a rotation axis ZM (in a direction indicated by an arrow in FIG. 14). Used liquid toner T is supplied from the carrier supply port 107 to the outer circumferential surface 101S of the roller 101. More specifically, the carrier supply port 107 supplies the liquid toner T collected by liquid toner collecting pumps 41a, 41b, and 41c to the outer circumferential surface 101S of the roller 101. In the present embodiment, the carrier supply port 107 also supplies, to the outer circumferential surface 101S of the roller 101, the carrier (liquid C) separated from the solid contents K by the tray 104 and returned to the carrier supply port 107 by the carrier feeding pump 106. Part of the outer circumferential surface of the roller 101 corresponds to a flow passage along which the liquid toner T can flow. The roller 101 is formed from a conductor. The roller 101 is electrically connected to a GND (earth).

[0112] In the present embodiment, the solid content

separation device 100 may include: a used liquid toner tank for temporarily storing the carrier (liquid C) separated from the solid contents K by the tray 104; and a liquid toner feeding pump used as supplying means for supplying the carrier in the used liquid toner tank to the outer circumferential surface 101S of the roller 101. In such a case, the carrier separated from the solid contents K by the tray 104 is supplied to the used liquid toner tank by the carrier feeding pump 106 and temporarily stored in the used liquid toner tank. The liquid toner T collected by the liquid toner collecting pumps 41a, 41b, and 41c is also temporarily stored in the used liquid toner tank. The liquid toner feeding pump supplies the carrier and the liquid toner T in the used liquid toner tank to the outer circumferential surface 101S of the roller 101.

[0113] The positive electrode member 88 used as the aggregating means is disposed between the solid content removing blade 103 and a position on the outer circumferential surface 101S of the roller 101 where the carrier supply port 107 supplies the liquid toner T. The positive electrode member 88 is disposed to face the outer circumferential surface 101S of the roller 101 with a prescribed spacing therebetween so that the positive electrode member 88 does not come into contact with the liquid toner T adhering to the outer circumferential surface 101S of the roller 101. The positive electrode member 88 is composed of, for example, a plurality of conductive wires arranged along the outer circumferential surface 101S of the roller 101. In the roller 101, a portion of the outer circumferential surface 101S that faces the positive electrode member 88 functions as a negative electrode section and also as an aggregation section.

[0114] When corona discharge is generated between the positive electrode member 88 and the outer circumferential surface 101S of the roller 101, the solid contents K in the liquid toner T adhering to the outer circumferential surface 101S of the roller 101 are positively charged. The solid contents K contained in the liquid toner T thereby move toward a negative side, i.e., the outer circumferential surface 101S of the roller 101. Therefore, the solid contents K come close to each other and aggregate on the outer circumferential surface 101S of the roller 101. The carrier contained in the liquid toner T is separated as the liquid C and gathers toward the positive electrode member 88.

[0115] The carrier collecting blade 102 is disposed on the downstream side of the positive electrode member 88 in the rotation direction of the roller 101. The carrier collecting blade 102 comes into contact with the outer circumferential surface 101S of the roller 101 to separate the liquid C, i.e., the carrier, from the liquid toner T adhering to the outer circumferential surface 101S. More specifically, the carrier collecting blade 102 scrapes the liquid C that has been separated from the solid contents K using the positive electrode member 88 and the outer circumferential surface 101S of the roller 101 and has moved outward in the radial direction of the roller 101.

The liquid C collected by the carrier collecting blade 102 is supplied to the cartridge-type filter 55 by the recycled carrier supply pump 17 shown in FIG. 13, then filtrated, and supplied to the carrier tank 22. The carrier collecting blade 102 is more flexible (has lower flexural rigidity) than the solid content removing blade 103. The carrier collecting blade 102 is formed from, for example, a resin film.

[0116] The solid content removing blade 103 is disposed on the downstream side of the carrier supply port 107 in the rotation direction of the roller 101 and comes into contact with the outer circumferential surface 101S to scrape the solid contents K adhering to the outer circumferential surface 101S. The solid contents K scraped with the solid content removing blade 103 drop onto the tray 104 disposed below the solid content removing blade 103. The tray 104 is inclined such that one end thereof is located lower than the other end. In such a structure of the tray 104, the liquid C remaining in the solid contents K scraped with the solid content removing blade 103 is separated from the solid contents K by the action of the gravity. The liquid C passes through a net 104N and is then stored in the carrier bath 105. The tray 104 has the net 104N at its lower end. The net 104N is means for preventing the solid contents K from which the liquid (carrier) C has been separated from dropping into the carrier bath 105.

[0117] The liquid C stored in the carrier bath 105 is supplied to the carrier supply port through the carrier feeding pump 106. More specifically, the carrier feeding pump 106 returns the carrier (liquid C) separated from the solid contents K by the tray 104 to the carrier supply port 107. As described above, in the solid content separation device 100, the carrier remaining in the solid contents K is separated therefrom and then returned to the outer circumferential surface 101S of the roller 101, and the solid contents K are separated by the positive electrode member 88.

[0118] Even after the carrier (liquid C) separated from the solid contents K by the tray 104 passes through the net 104N, the solid contents K may remain present in the resultant carrier. In the solid content separation device 100, the carrier (liquid C) separated from the solid contents K is returned to the outer circumferential surface 101S of the roller 101 to repeat the separation of the solid contents K performed using the positive electrode member 88. The amount of the solid contents K remaining in the carrier (liquid C) is thereby reduced. Therefore, the amount of impurities contained in the carrier (liquid C) supplied to the filter 55 can be significantly reduced, and the service life of the filter 55 can thereby be extended.

[0119] In the present embodiment, the solid content removing blade 103 is secured to a bracket 108 used as securing means. The distance between the solid content removing blade 103 and the roller 101 is maintained constant. In the present embodiment, the solid content removing blade 103 may be always in contact with the outer circumferential surface 101S of the roller 101. Therefore, it is not necessary to switch between a state in which the

solid content removing blade 103 is in contact with the outer circumferential surface 101S and a state in which the solid content removing blade 103 is not in contact with the outer circumferential surface 101S. Therefore, a simple support structure can be used for the solid content removing blade 103. In addition, the actuator for moving the solid content removing blade 103 is not required.

[0120] The solid content separation device 100 repeats the process of separating the carrier remaining in the solid contents K, returning the separated carrier to the outer circumferential surface 101S of the roller 101, and separating the solid contents K using the positive electrode member 88. In the solid content separation device 100, the rate of collection of the carrier can thereby be improved. In addition, in the solid content separation device 100, the concentration factor of the waste toner can be improved by repeating the above-described separation process, i.e., the separation of the carrier and the separation of the solid contents K. In the solid content separation device 100, even when the pressing force of the carrier collecting blade 102 is weak, the carrier can be collected by repeating the above-described separation process. In the solid content separation device 100, the rate of collection of the carrier and the concentration factor of the waste toner can be ensured sufficiently by repeating the above-described separation process, regardless of the degree of scraping of the waste toner with the solid content removing blade 103. Therefore, the setting of the solid content removing blade 103 is simplified.

[0121] In the solid content separation device 100, even when the pressing force of the carrier collecting blade 102 is weak, the carrier can be collected by repeating the above-described separation process. Therefore, the solid contents are less likely to be mixed into the collected carrier. The purity of the collected carrier is thereby improved. In the solid content separation device 100, the purity of the collected carrier can be improved by repeating the above-described separation process, and the service life of the cartridge-type filter 55 disposed in the downstream stage can thereby be extended.

Reference Signs List

[0122]

- 10 electrophotographic printing press
- 11 printing unit
- 12 intermediate transfer member
- 12a blanket
- 13 backup roller
- 14a, 14b, 14c, 14d developing unit
- 15 photosensitive drum
- 16a bowl
- 16b liquid toner conveying roller
- 17 recycled carrier supply pump
- 20 liquid toner supplying device
- 21 concentrated toner tank
- 21a toner bottle

22 carrier tank
 22a carrier can
 23 liquid toner tank
 24 stirring tank
 25a concentrated toner pump
 25b, 32 carrier pump
 25c liquid toner pump
 25d, 25e collecting pump
 26, 34a, 34b, 34c collecting blade
 27 concentration sensor
 30 cleaning device
 31 carrier nozzle
 33a first cleaning roller
 33b second cleaning roller
 40 carrier collecting unit
 50, 60, 70, 80, 85, 90, 95 solid content separation device
 41a, 41b, 41c liquid toner collecting pump
 51, 71 tray (flow passage)
 51a bottom
 51b side surface
 51c rear surface
 51d open section
 51e opening (solid content discharge section)
 51f open-close member
 51g electric actuator
 51h, 81d, 86d aggregation section (negative electrode section)
 52, 82, 88 positive electrode member (aggregating means)
 53 pushing blade (solid content moving means)
 53a, 63a, 73a cylinder device (solid content moving means)
 54a, 84a used liquid toner tank
 54b, 84b recycled carrier tank
 54c, 74c, 84c, 87c solid content tank (solid content storage unit)
 55 cartridge-type filter
 61 bag-type filter (solid content storage unit)
 71d first open section
 71j second open section (solid content discharge section)
 81 belt conveyor device (solid content moving means)
 81a first roller
 81b second roller
 81c metal belt (negative electrode section)
 83, 89 solid content collecting blade
 86 metal roller (solid content moving means)
 86a outer circumference (flow passage)
 87a dual purpose tank
 91 heater
 96 heater (aggregating means)
 C, C1 liquid
 K solid content
 K1 capsule
 K2 dispersing member
 K3 coloring material

N1, N2 nip portion
 S printing sheet
 T liquid toner
 Zr, Zr1, Zr2, Zr3 rotation axis

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Claims

1. A solid content separation device for a liquid toner, comprising:

a flow passage along which a liquid toner containing a carrier and a solid content dispersed in the carrier can flow; and

aggregating means for aggregating the solid content, the aggregating means being disposed so as not to be in contact with the liquid toner flowing along the flow passage.
2. The solid content separation device for a liquid toner according to claim 1, wherein

the flow passage includes a negative electrode section electrically connected to a ground, and

the aggregating means includes a positive electrode member that is disposed to face the negative electrode section and is capable of generating corona discharge between the positive electrode member and the negative electrode section.
3. The solid content separation device for a liquid toner according to claim 2, further comprising:

a solid content storage unit capable of storing the solid content aggregated by the aggregating means; and

solid content moving means capable of moving the aggregated solid content to the solid content storage unit.
4. The solid content separation device for a liquid toner according to claim 3, further comprising a solid content discharge section that is disposed in the flow passage and is capable of introducing the aggregated solid content to the solid content storage unit, wherein

the solid content moving means includes

a blade, and

blade moving means capable of moving the blade along the flow passage to the solid content discharge section.
5. The solid content separation device for a liquid toner according to claim 4, wherein

the solid content discharge section is an opening, and

the solid content separation device includes an open-close member that is disposed in the flow pas-

sage and is capable of opening and closing the opening.

6. The solid content separation device for a liquid toner according to claim 3 or 4, wherein the solid content storage unit includes a filter section capable of collecting the aggregated solid content and allowing the carrier to pass therethrough, and the aggregated solid content and the liquid toner that has passed between the positive electrode member and the negative electrode section can be introduced to the solid content storage unit. 5
7. The solid content separation device for a liquid toner according to claim 3, wherein the solid content moving means is a belt conveyor device having a belt including the negative electrode section and is disposed such that the liquid toner can be supplied to the belt. 10
8. The solid content separation device for a liquid toner according to claim 3, wherein the solid content moving means is a roller having an outer circumference including the negative electrode section, and the roller is disposed rotatably with at least part of the outer circumference of the roller being in contact with the liquid toner. 15
9. The solid content separation device for a liquid toner according to any one of claims 2 to 8, further comprising a heater capable of heating the liquid toner. 20
10. The solid content separation device for a liquid toner according to claim 1, wherein the aggregating means includes a heater capable of heating the liquid toner. 25
11. The solid content separation device for a liquid toner according to claim 1 or 2, wherein the flow passage is part of an outer circumferential surface of a roller, and the solid content separation device further comprises: 30
 - supplying means for supplying the liquid toner to the outer circumference; 45
 - scraping means for scraping the solid content, the scraping means being disposed on a downstream side of the supplying means in a rotation direction of the roller and being in contact with the outer circumferential surface to scrape the solid content; 50
 - carrier separating means for separating the carrier from the solid content scraped with the scraping means; and 55
 - circulating means for returning the carrier separated by the carrier separating means to an upstream side of the aggregating means in the ro-

tation direction of the roller, wherein the aggregating means is disposed between the supplying means and the scraping means.

12. The solid content separation device for a liquid toner according to claim 11, further comprising carrier collecting means for separating the carrier from the liquid toner adhering to the outer circumferential surface while being in contact with the outer circumferential surface, the carrier collecting means being disposed on a downstream side of the aggregating means in the rotation direction of the roller. 5
13. The solid content separation device for a liquid toner according to claim 11 or 12, wherein the scraping means is secured to a securing means with a distance between the scraping means and the roller being maintained constant. 10

FIG.1

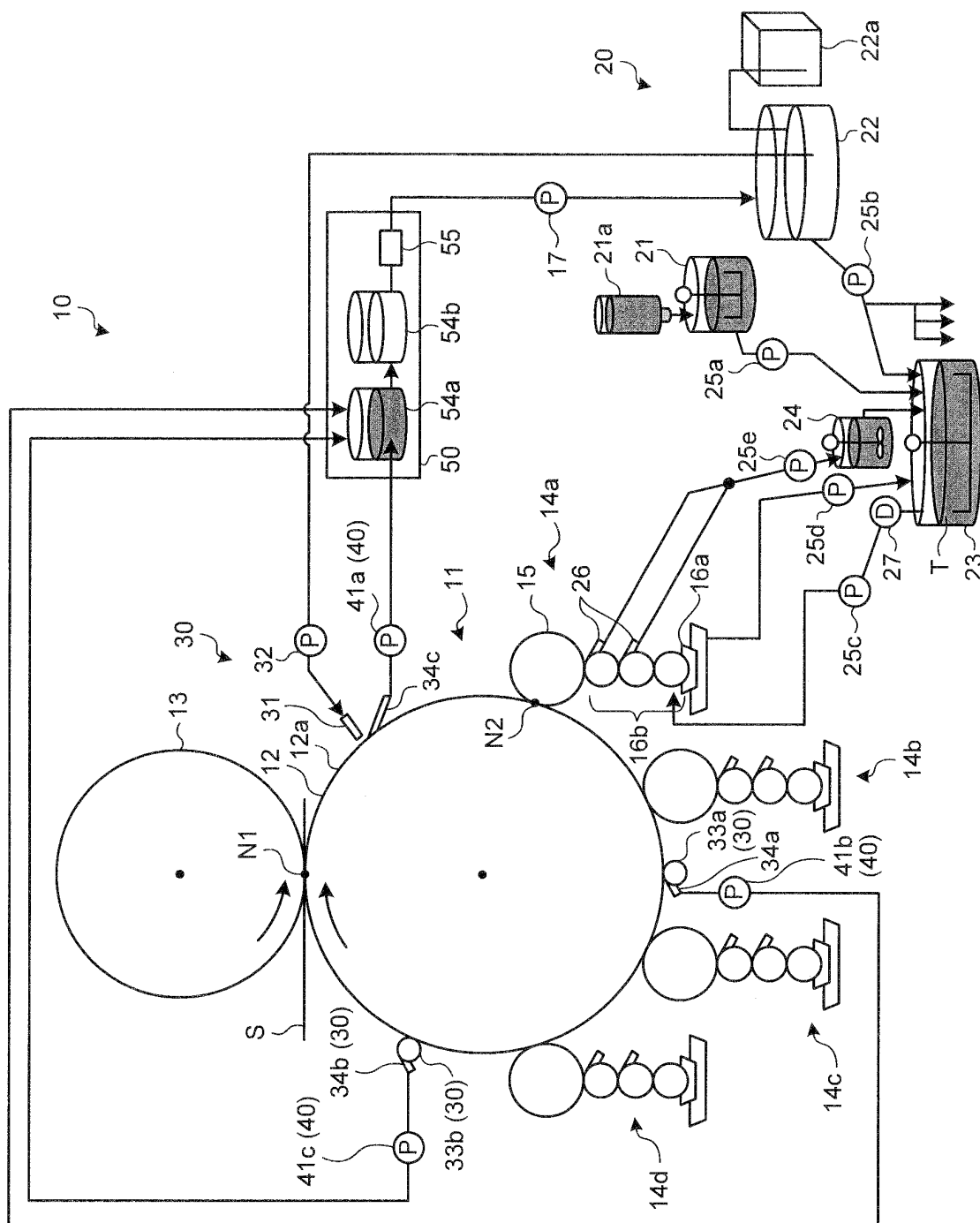


FIG.2

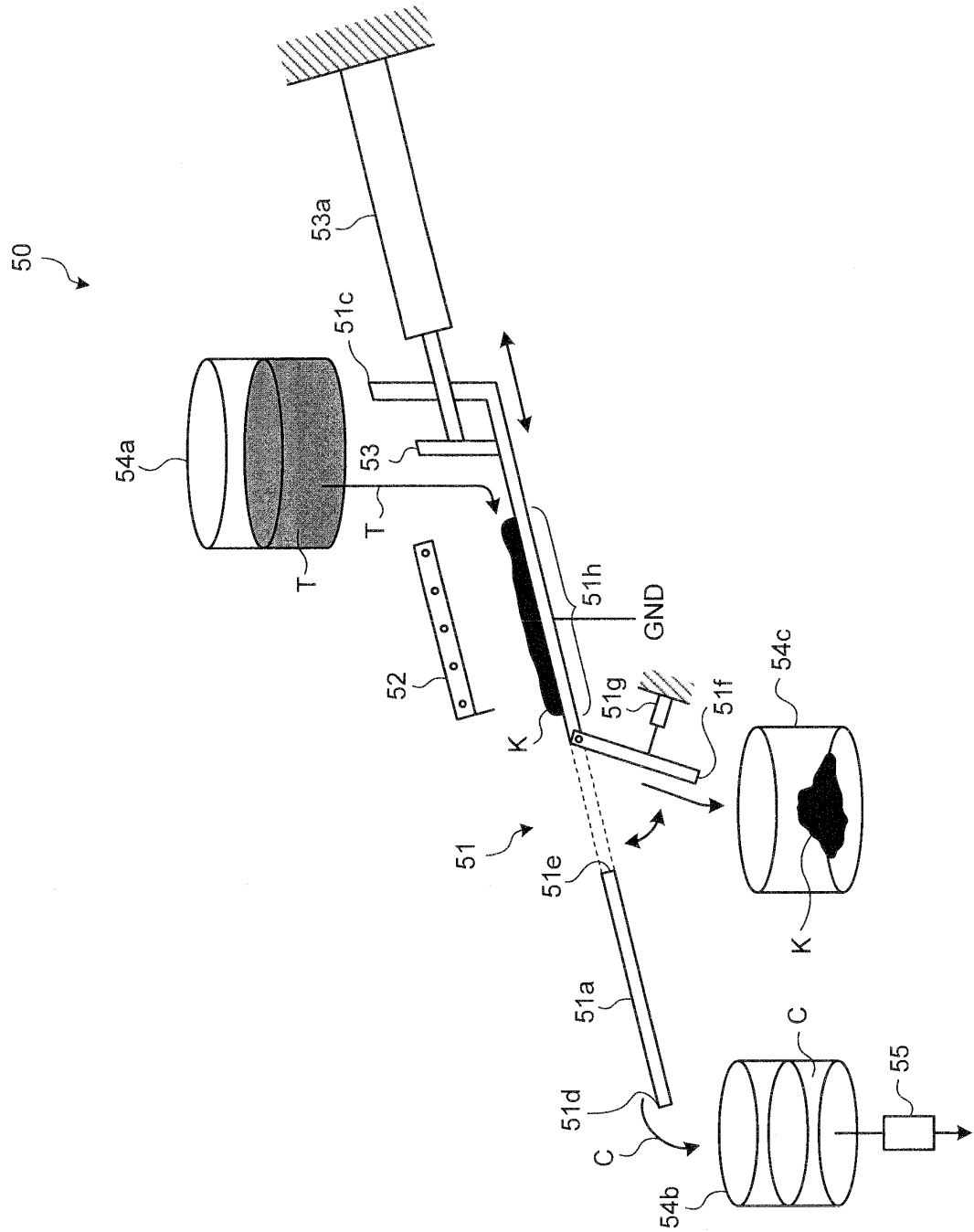


FIG.3

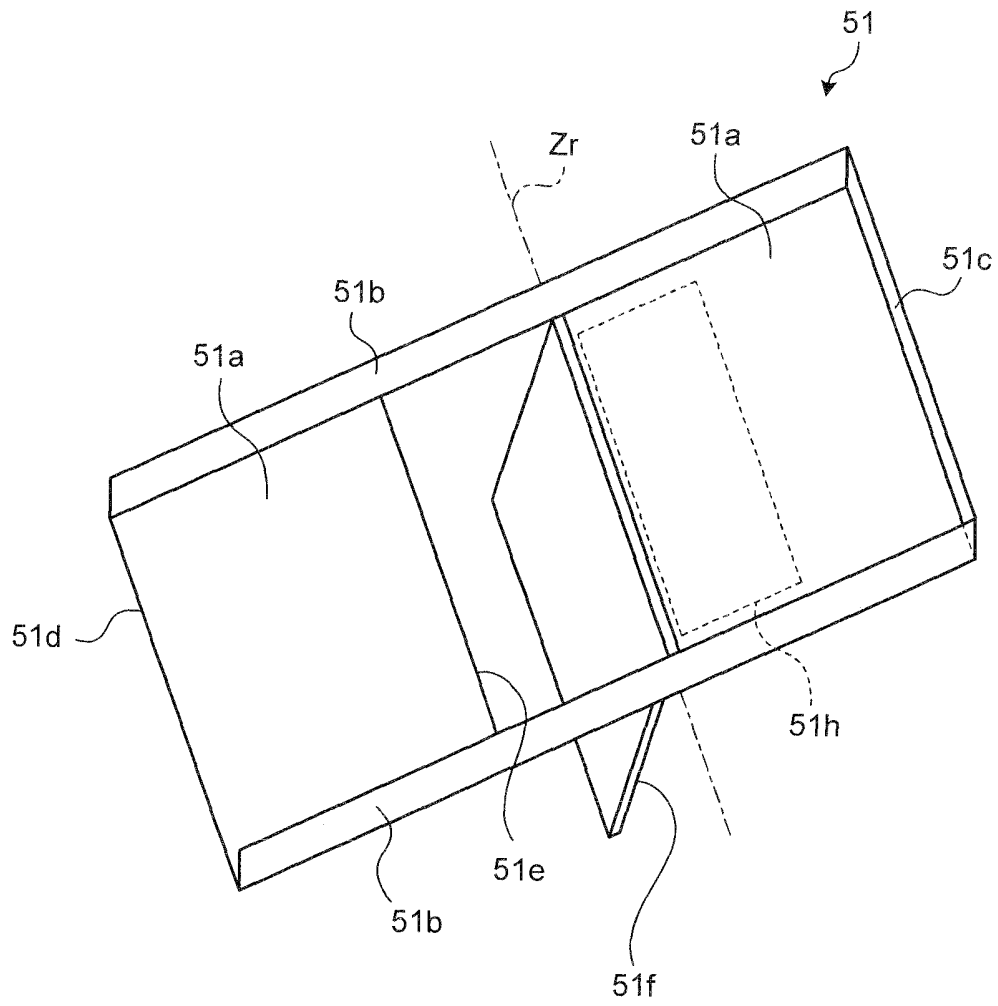


FIG.4

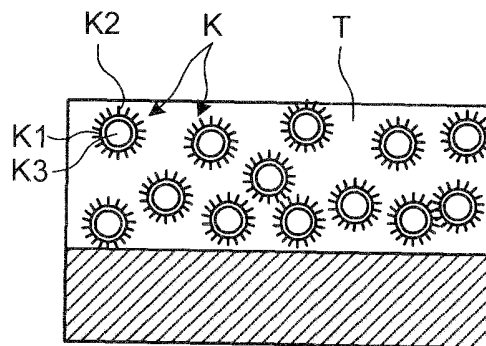


FIG.5

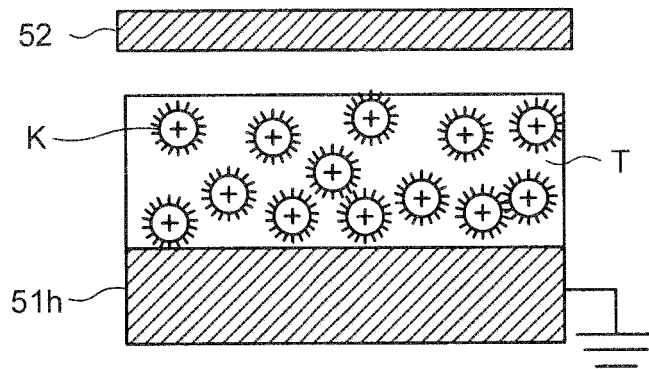


FIG.6

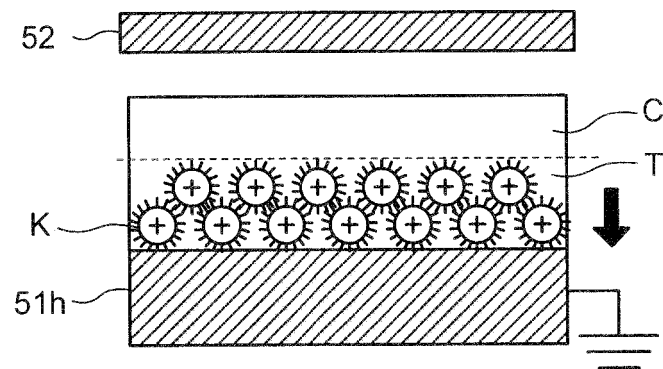


FIG. 7

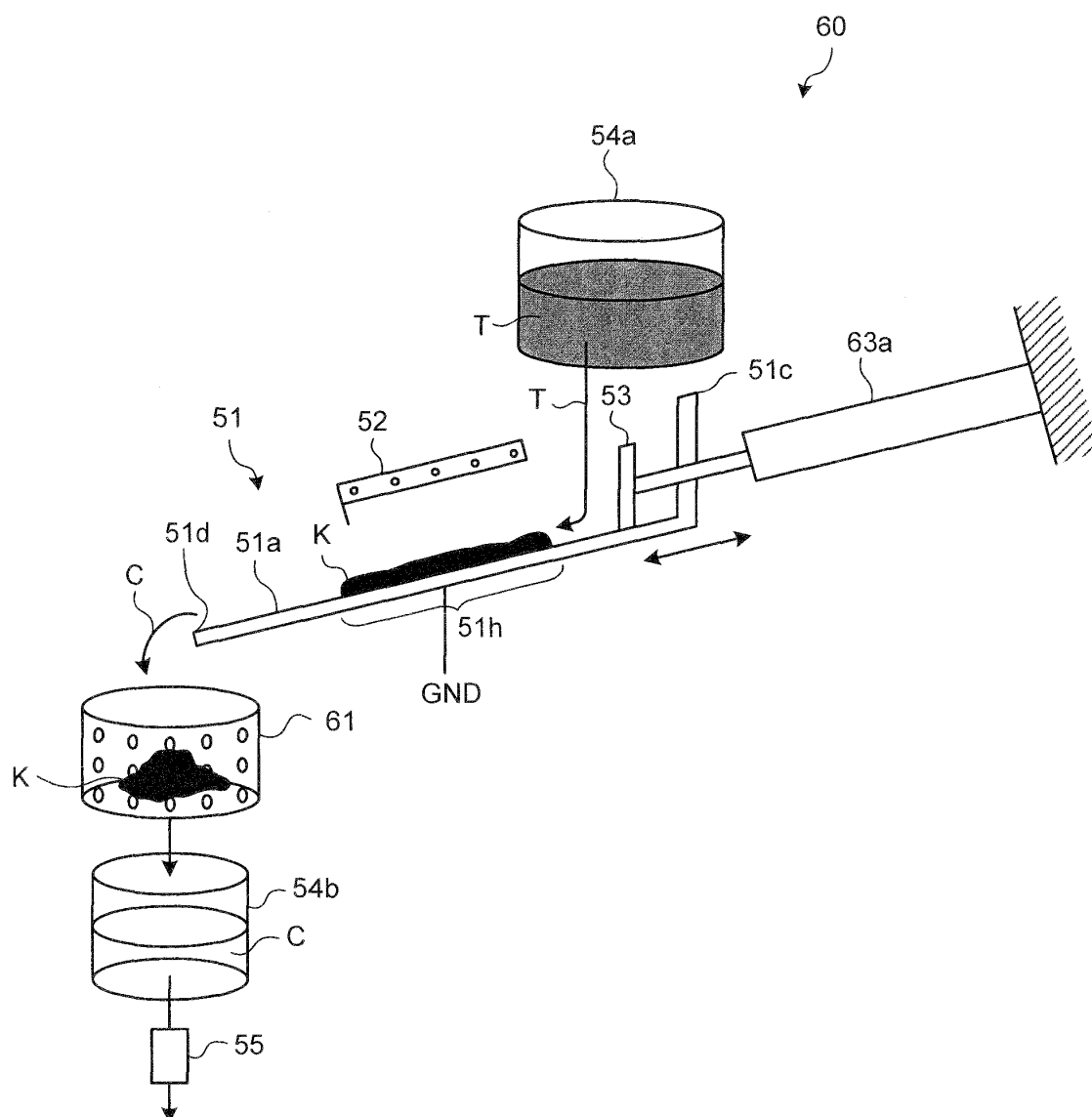


FIG.8

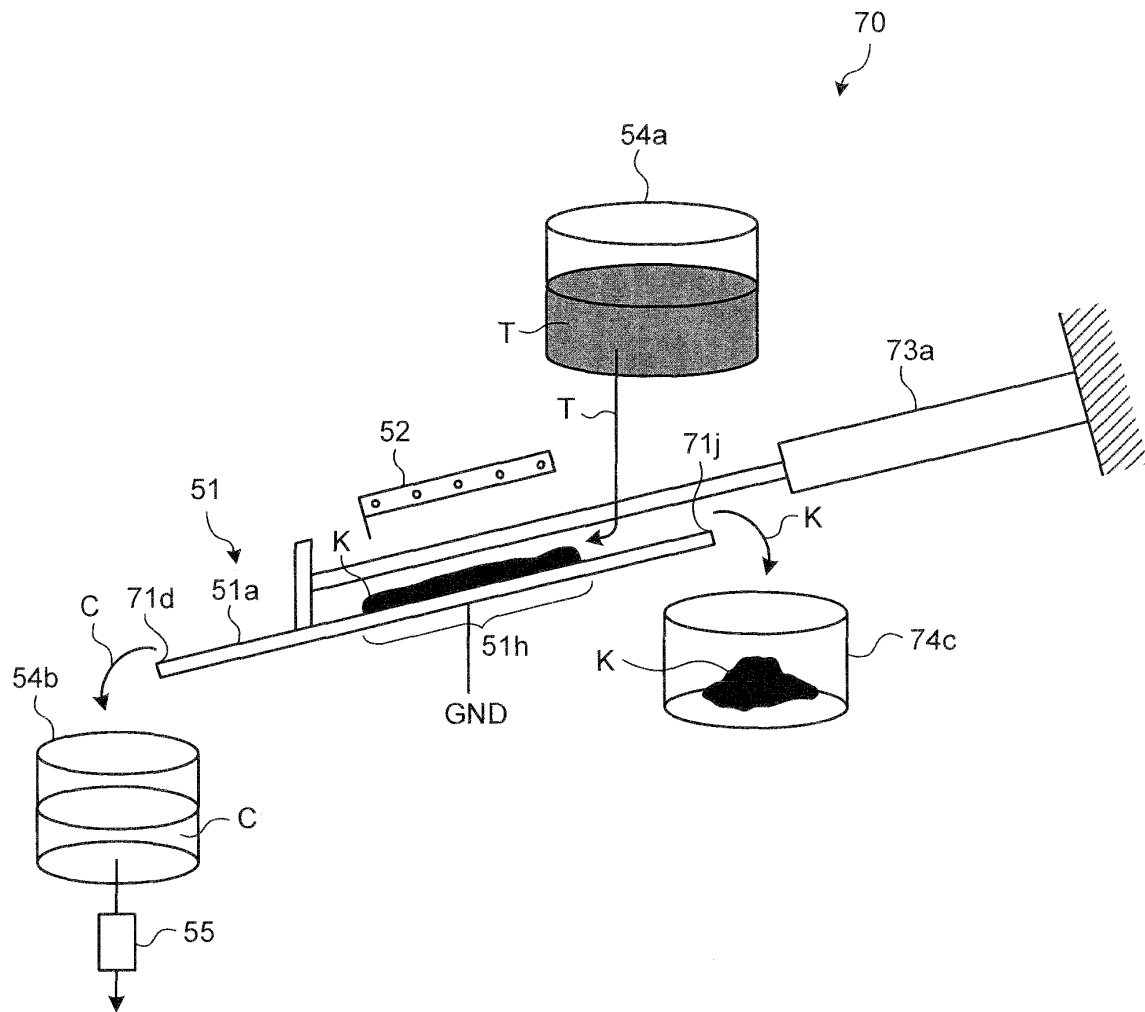


FIG.9

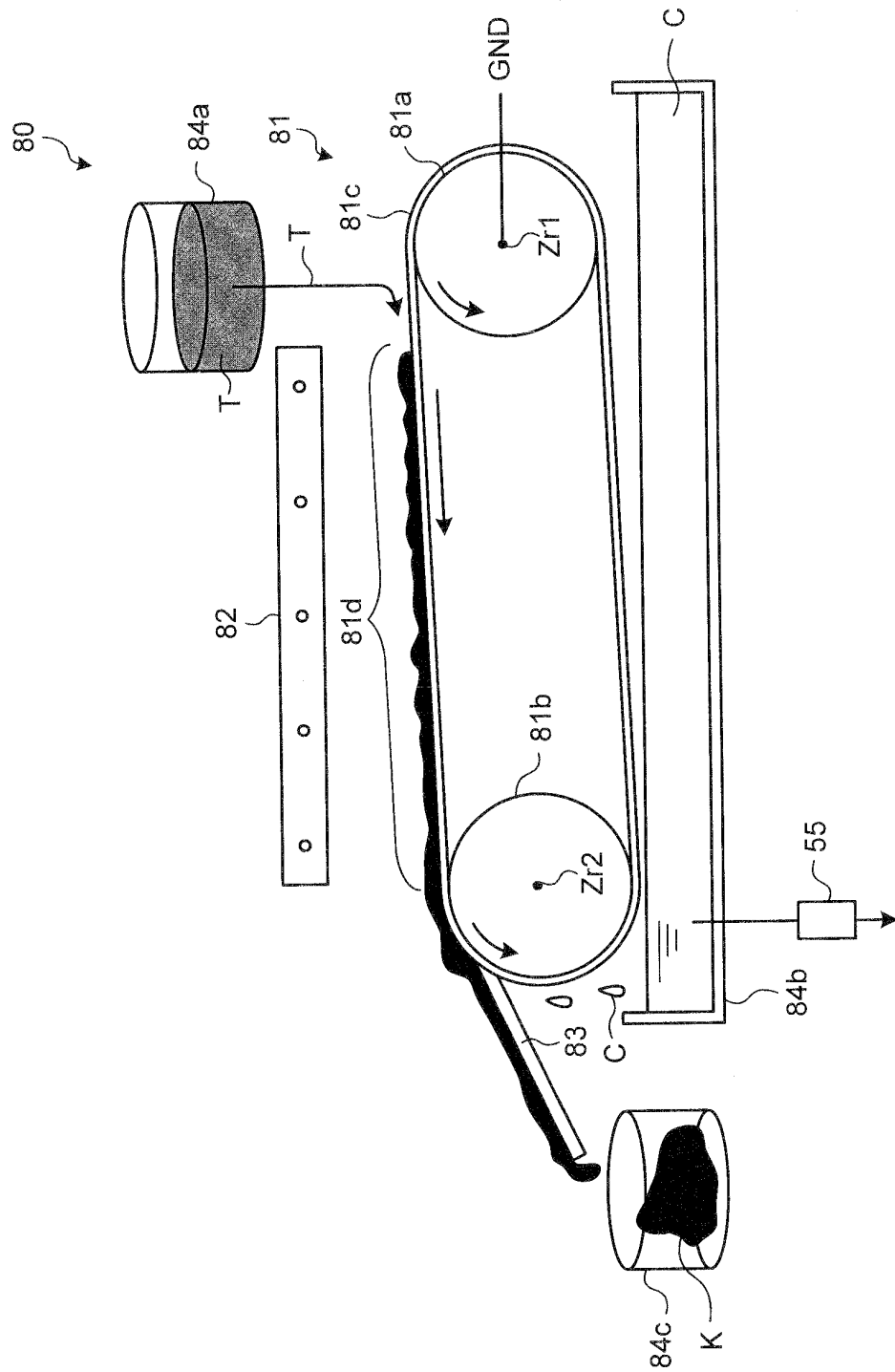


FIG.10

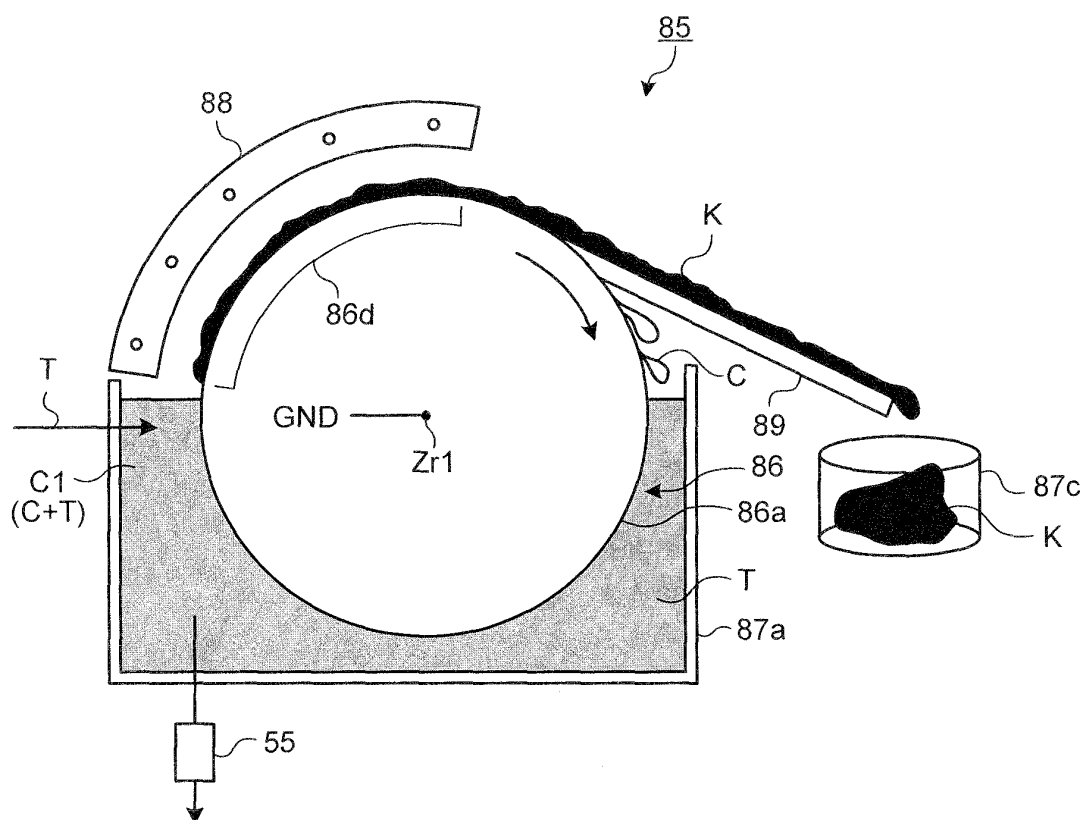


FIG.11

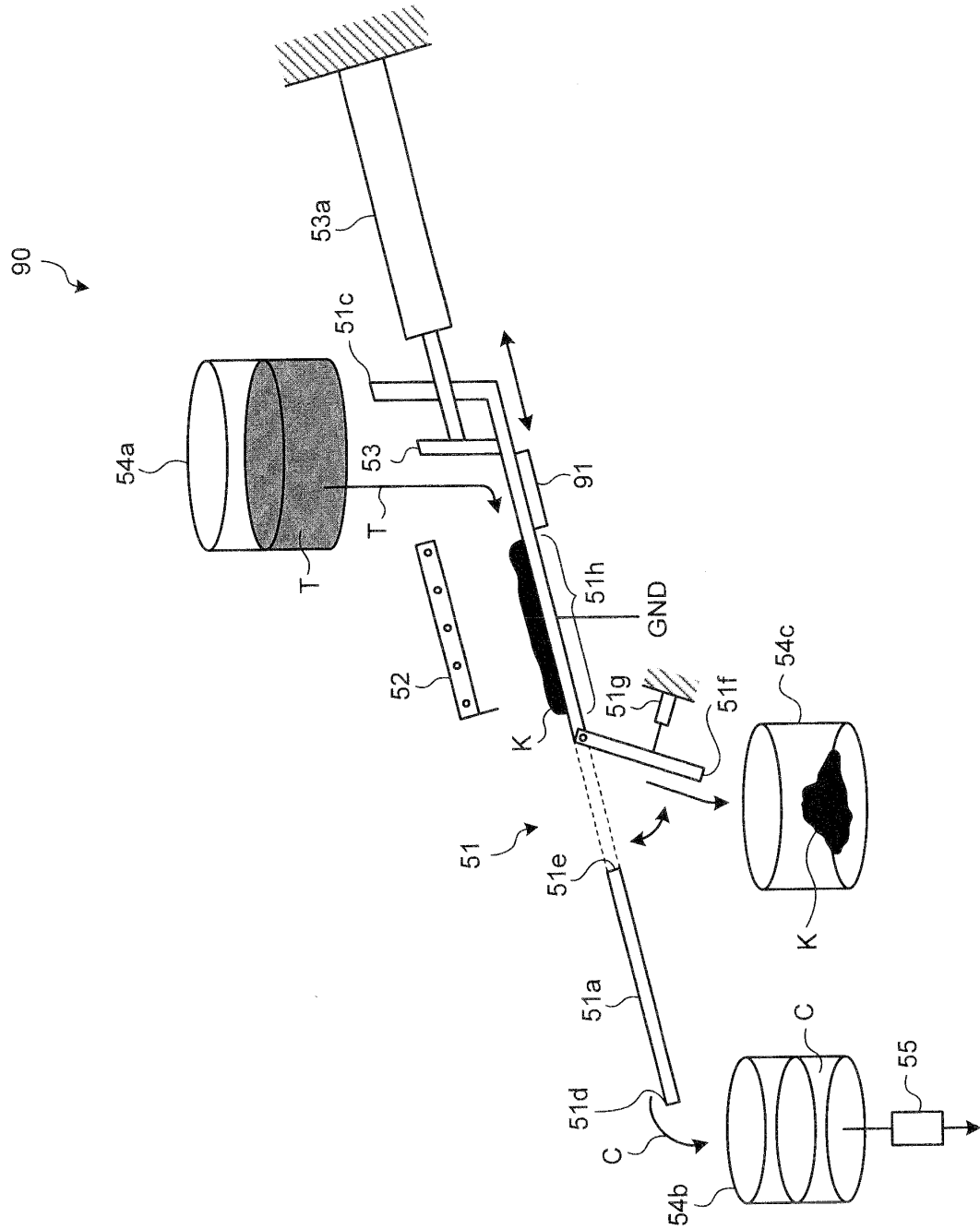


FIG.12

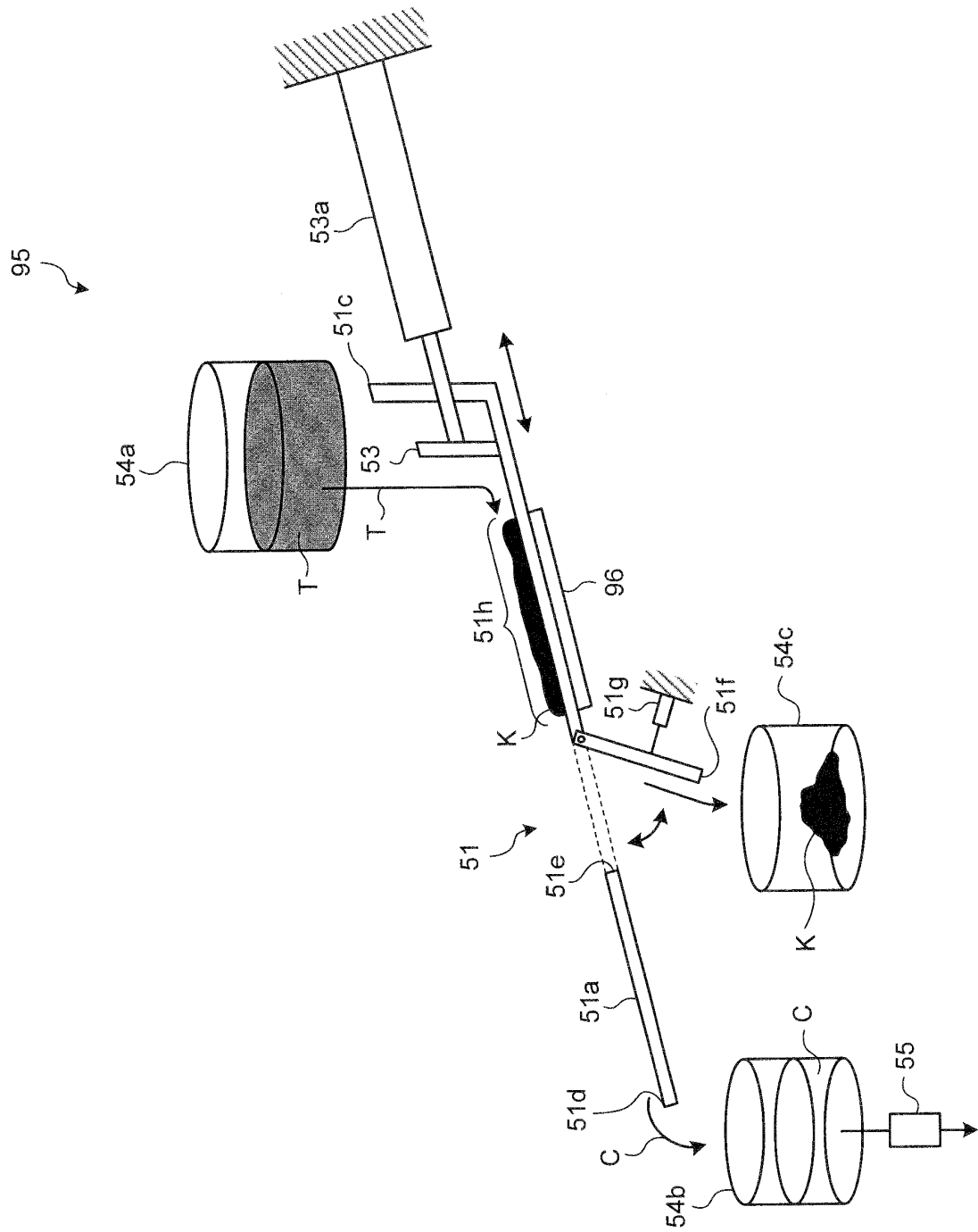


FIG.13

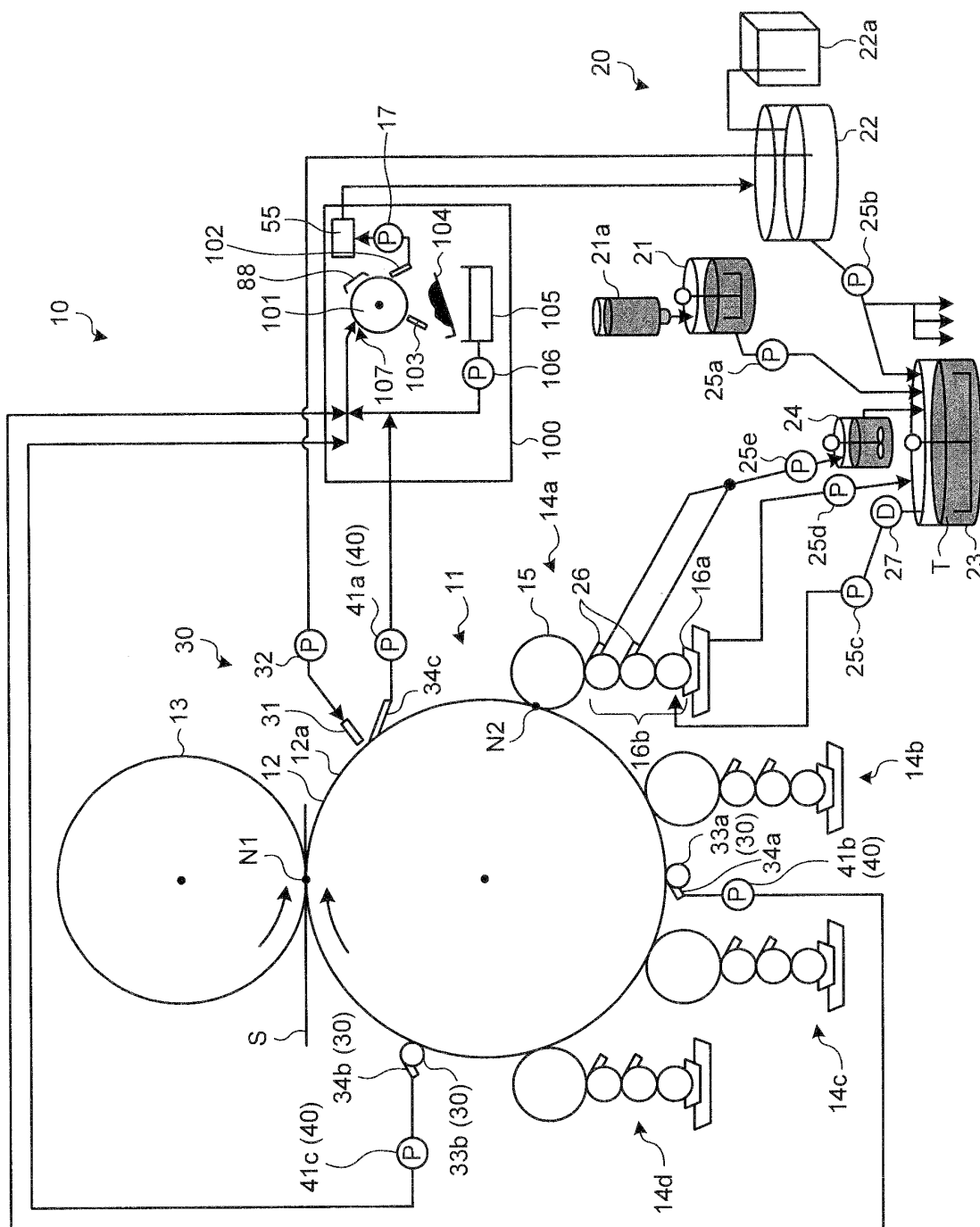
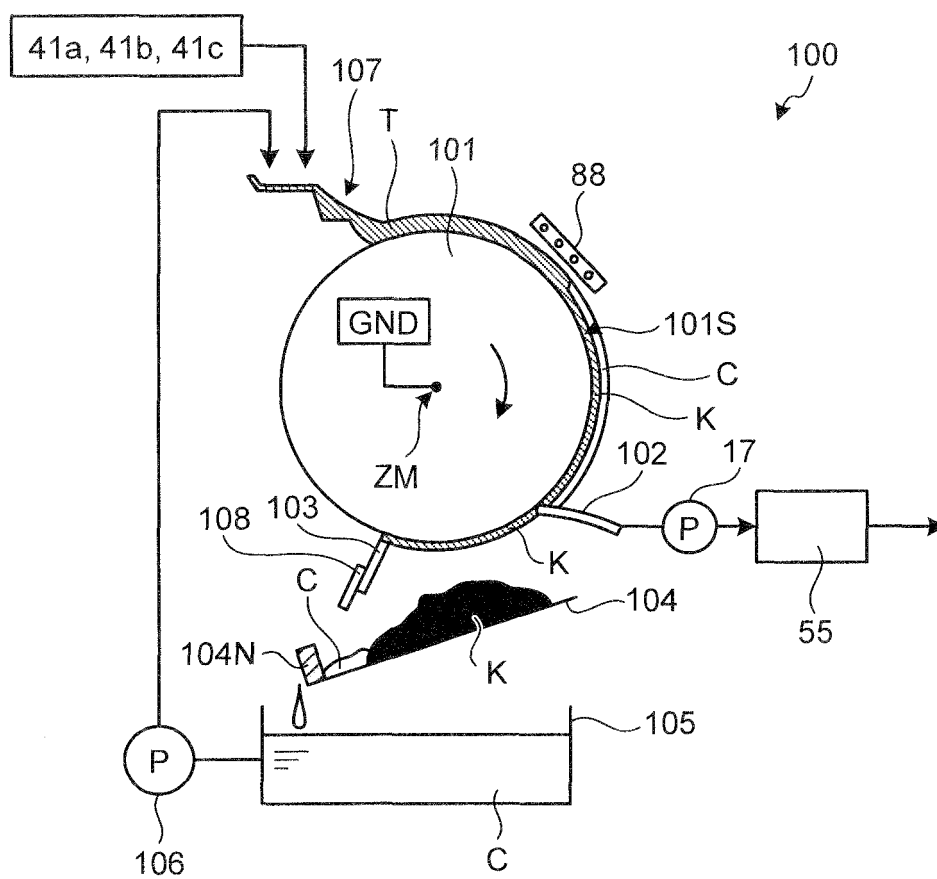


FIG. 14



INTERNATIONAL SEARCH REPORT

International application No.

PCT/JP2011/051621

A. CLASSIFICATION OF SUBJECT MATTER

G03G15/10 (2006.01) i

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

G03G15/10

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Jitsuyo Shinan Koho	1922-1996	Jitsuyo Shinan Toroku Koho	1996-2011
Kokai Jitsuyo Shinan Koho	1971-2011	Toroku Jitsuyo Shinan Koho	1994-2011

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	JP 2003-270957 A (PFU Ltd.), 25 September 2003 (25.09.2003), paragraphs [0021] to [0026]; fig. 2 to 4 (Family: none)	1-10
Y	JP 2009-300656 A (Ricoh Co., Ltd.), 24 December 2009 (24.12.2009), paragraph [0023]; fig. 3 (Family: none)	1-13
Y	JP 2007-148083 A (Seiko Epson Corp.), 14 June 2007 (14.06.2007), paragraph [0030]; fig. 1 (Family: none)	1-13

☒ Further documents are listed in the continuation of Box C.☐ See patent family annex.

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Date of the actual completion of the international search
03 March, 2011 (03.03.11)Date of mailing of the international search report
15 March, 2011 (15.03.11)Name and mailing address of the ISA/
Japanese Patent Office

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INTERNATIONAL SEARCH REPORT

International application No.

PCT/JP2011/051621

C (Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
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Y	JP 2003-316164 A (PFU Ltd.), 06 November 2003 (06.11.2003), paragraphs [0047] to [0058], [0062] to [0067]; fig. 2, 5 to 8 (Family: none)	11-13
E,X	JP 2010-256763 A (Konica Minolta Holdings, Inc.), 11 November 2010 (11.11.2010), paragraphs [0063] to [0099]; fig. 1, 2 (Family: none)	1,10

Form PCT/ISA/210 (continuation of second sheet) (July 2009)

REFERENCES CITED IN THE DESCRIPTION

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