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(54) **POWDER PASTING DEVICE, IMAGE FORMING APPARATUS, POWDER PASTING METHOD, AND IMAGE FORMING METHOD**

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(57) **ABSTRACT**

Provided is a powder pasting device for pasting powder on an image pattern formed on one main surface of a recording medium, the powder pasting device includes: a powder holding member having a powder holding surface holding powder by sticking; a powder supplying member that supplies powder to the powder holding surface; a rubbing member that rubs the powder holding surface to which powder has been supplied from the powder supplying member; and a facing member that is disposed at a position facing the powder holding surface of the powder holding member, sandwiches a recording medium having an image pattern functioning as an adhesive between the powder holding surface and the facing member, and thereby transfers the powder held on the powder holding surface by sticking onto the image pattern.

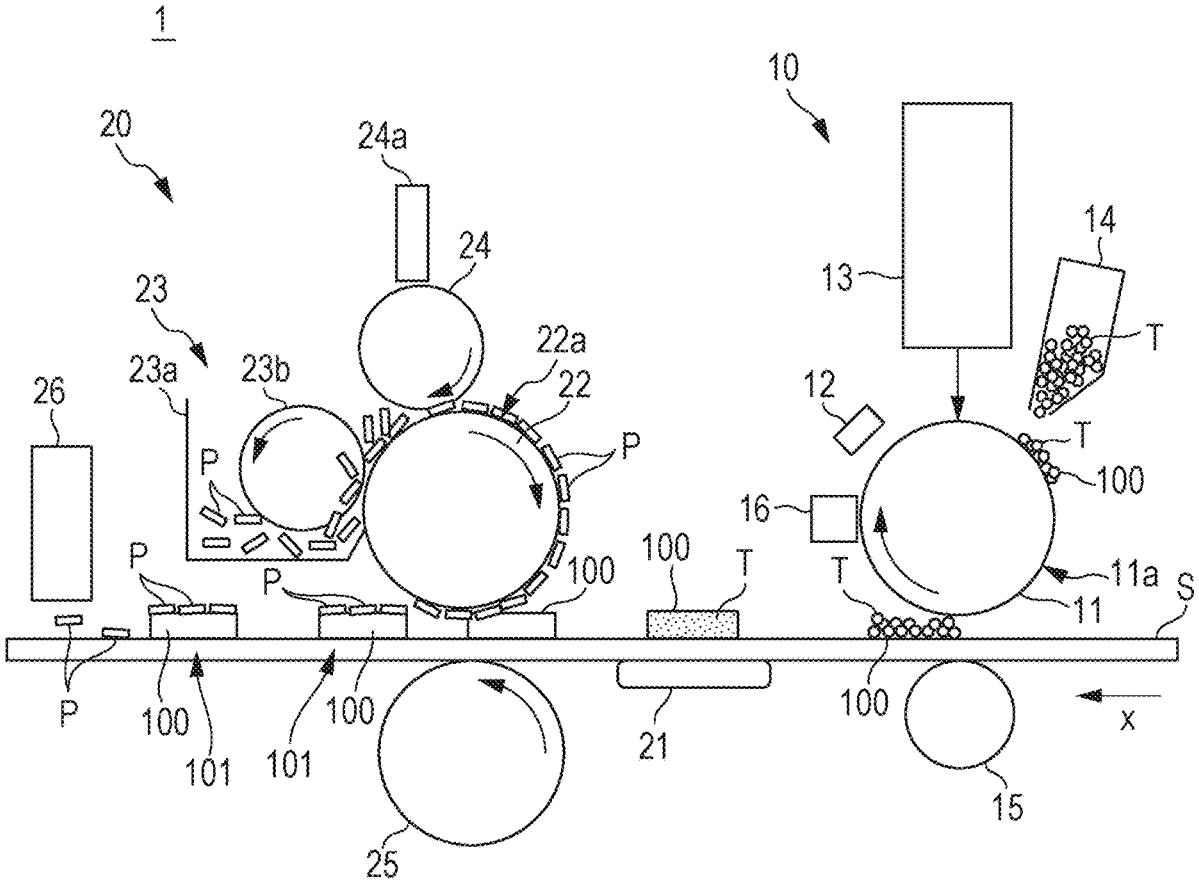
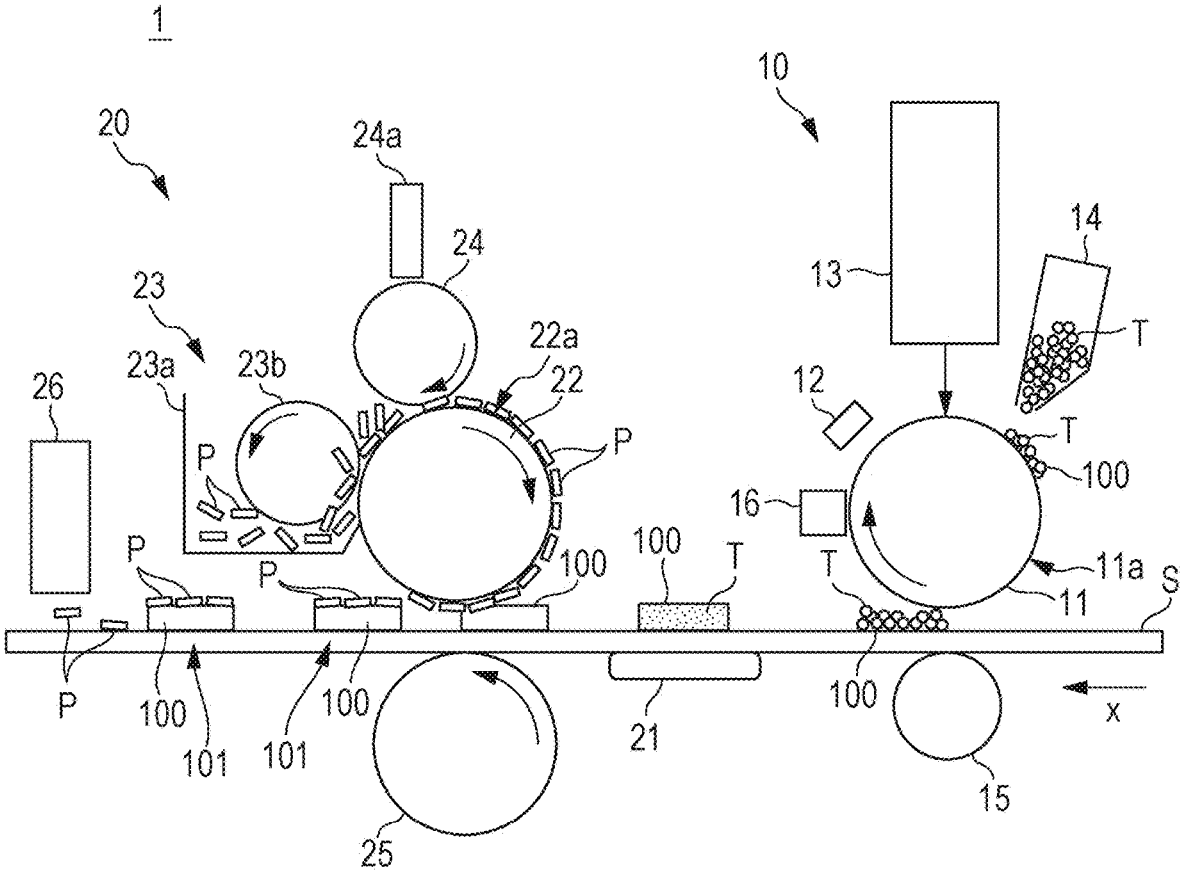


FIG. 1


1
10
20
24a
24
23
22a
22
23a
23b
26
P
100
T
11a
11
S
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21
25
15
101
x

FIG. 2

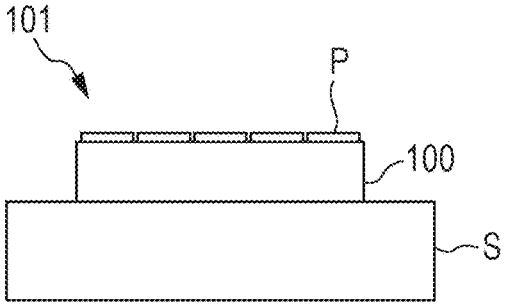

101
P
100
S

FIG. 3

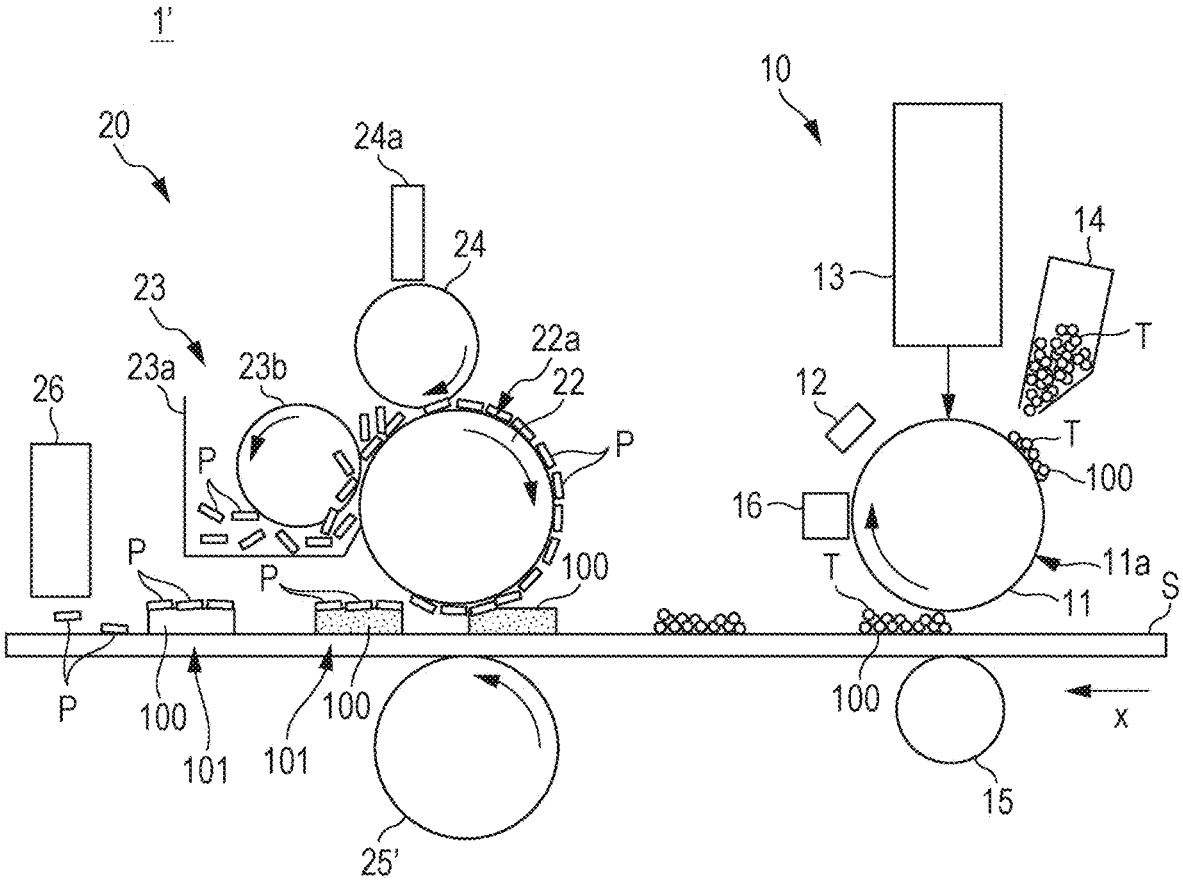
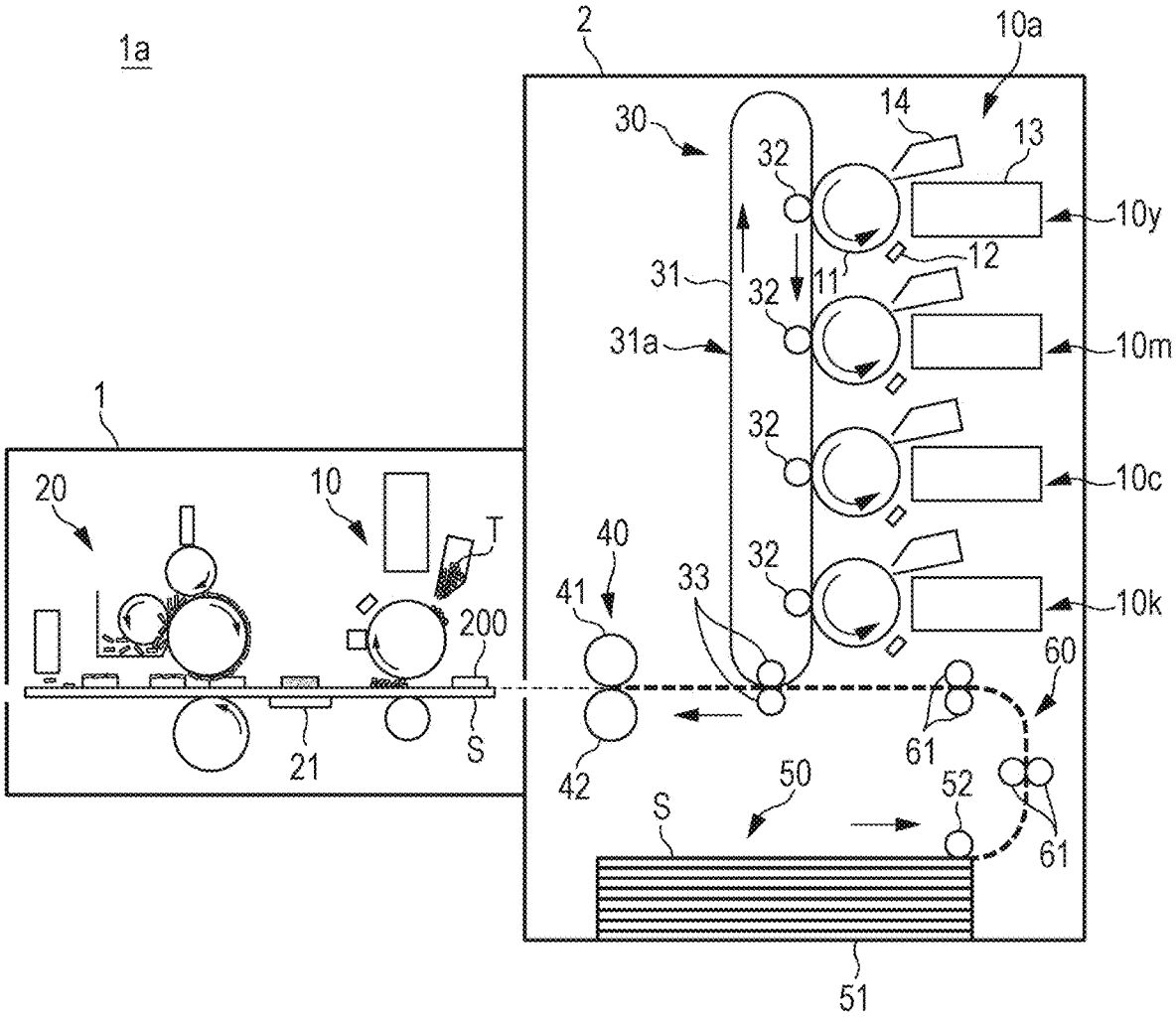

1'
10
20
24a
24
23
22a
22
23a
23b
26
P
100
101
25'
13
14
T
12
16
11a
11
S
15
x

FIG. 4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13
32
10y
12
11
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32
31a
10m
1
32
10c
20
10
T
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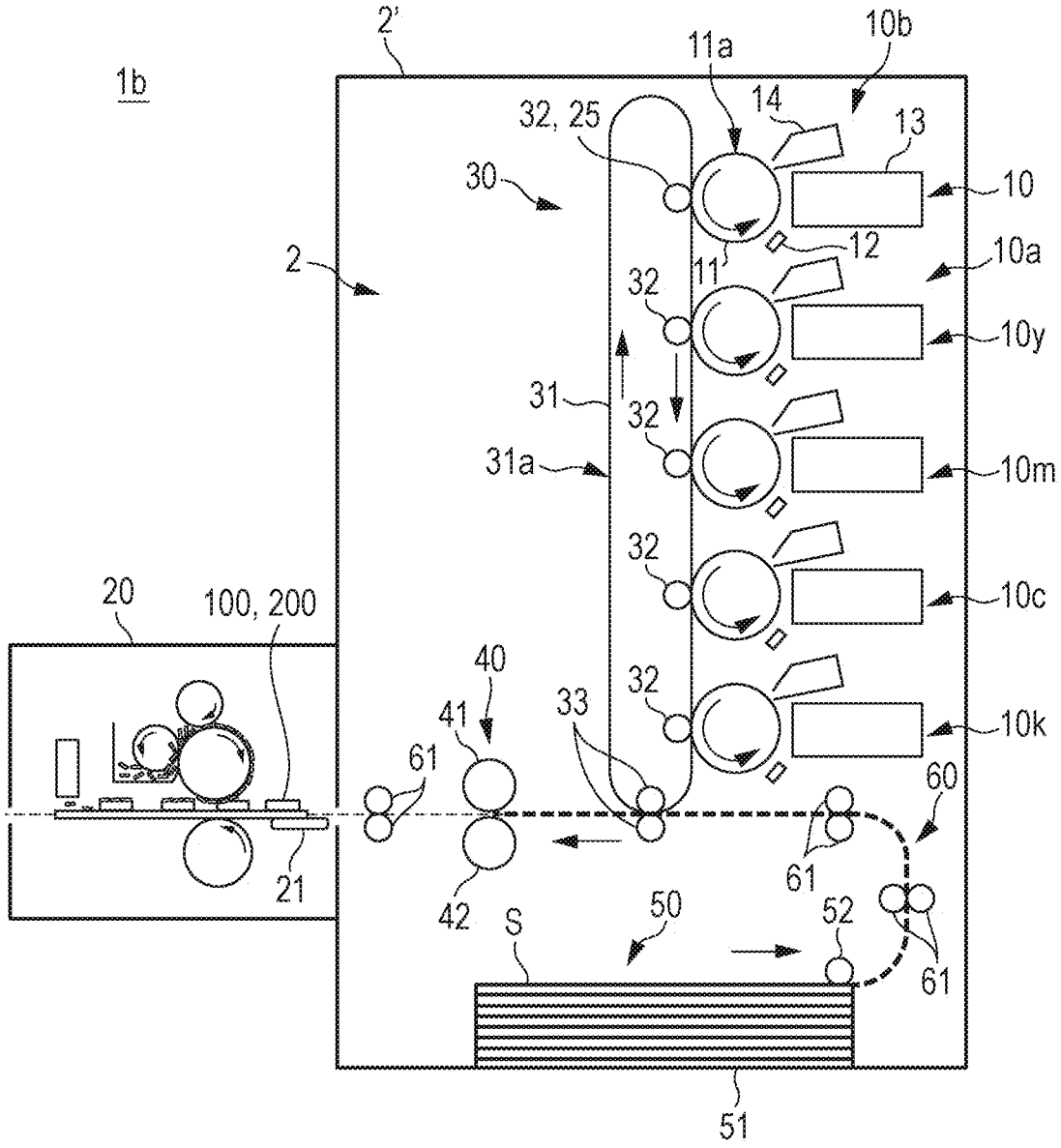
33
32
10k
200
60
61
42
21
S
50
52
S
61
51

FIG. 5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2'
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10b
32, 25
14
13
30
10
12
2
11
10a
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10y
31
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31a
10m
32
10c
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33
10k
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42
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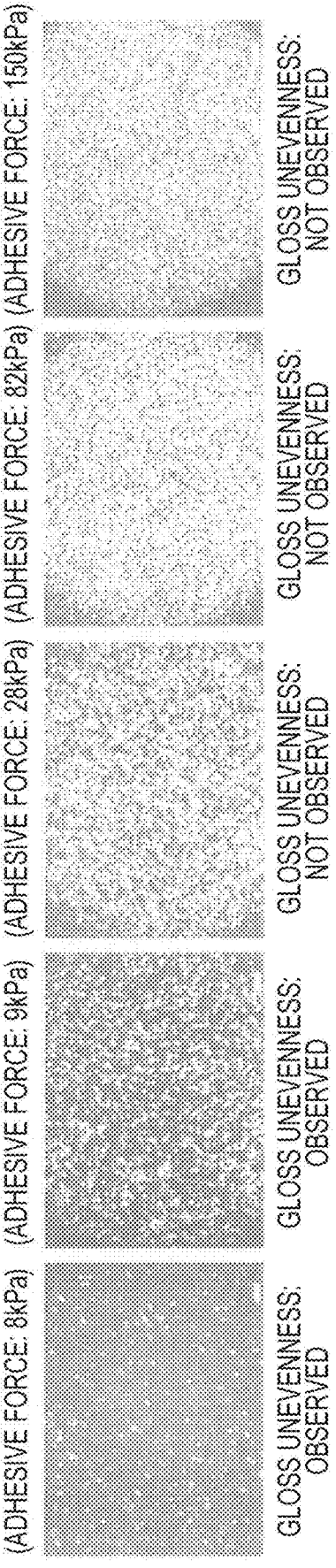
50
52
61
51

FIG. 6


EPBM
(ADHESIVE FORCE: 8kPa)
GLOSS UNEVENNESS: OBSERVED
NBR
(ADHESIVE FORCE: 9kPa)
GLOSS UNEVENNESS: OBSERVED
FLUORORUBBER
(ADHESIVE FORCE: 28kPa)
GLOSS UNEVENNESS: NOT OBSERVED
SILICON RUBBER
(ADHESIVE FORCE: 82kPa)
GLOSS UNEVENNESS: NOT OBSERVED
URETHANE RUBBER
(ADHESIVE FORCE: 150kPa)
GLOSS UNEVENNESS: NOT OBSERVED

POWDER PASTING DEVICE, IMAGE FORMING APPARATUS, POWDER PASTING METHOD, AND IMAGE FORMING METHOD

BACKGROUND

[0001] The entire disclosure of Japanese patent Application No. 2018-234374, filed on Dec. 14, 2018, is incorporated herein by reference in its entirety.

Technological Field

[0002] The present invention relates to a powder pasting device, an image forming apparatus, a powder pasting method, and an image forming method.

Description of the Related art

[0003] As one of metallic printing techniques for forming a glossy image, a technique for attaching powder to a toner image is known. For example. JP 2013-178452 A discloses a technique for melting a printed toner image to impart stickiness thereto, and attaching coating powder to the sticky toner image. In this case, magnetic powder or charge powder to be charged by frictional charging is used as the coating powder, and the magnetic powder or the charge powder is adsorbed and, held on a powder holding means by magnetic force or electrostatic force. The coating powder adsorbed and held on the powder holding means is captured by the sticky toner image, and the coating powder is thereby selectively supplied to the toner image.

[0004] However, when the magnetic powder or the charge powder to be charged by frictional charging is used as the coating powder, the powder holding means for adsorbing and holding the magnetic powder or the charge powder by magnetic force or electrostatic force adsorbs and holds the coating powder in a plurality of layers. If the coating powder is non-spherical, the coating powder is adsorbed and held in various directions. For this reason, in a state where the coating powder is captured by the sticky toner image from the powder holding means, the number of layers of the coating powder and the direction thereof on a surface of the toner image are non-uniform, and an image to which the coating powder is attached cannot be sufficiently glossy.

SUMMARY

[0005] Therefore, an object of the present invention is to provide a powder pasting device, an image forming apparatus, a powder pasting method, and an image forming method capable of obtaining a sufficiently glossy image.

[0006] To achieve the abovementioned object, according to an aspect of the present invention, there is provided a powder pasting device for pasting powder on an image pattern formed on one main surface of a recording medium, and the powder pasting device reflecting one aspect of the present invention comprises: a powder holding member having a powder holding surface holding powder by sticking; a powder supplying member that supplies powder to the powder holding surface, a rubbing member that rubs the powder holding surface to which powder has been supplied from the powder supplying member, and a facing member that is disposed at a position facing the powder holding surface of the powder holding member, sandwiches a recording medium having an image pattern functioning as an adhesive between the powder holding surface and the facing member, and thereby transfers the powder held on the powder holding surface by sticking onto the image pattern.

BRIEF DESCRIPTION OF THE DRAWINGS

[0007] The advantages and features provided by one or more embodiments of the invention will become more fully understood from the detailed description given hereinbelow and the appended drawings which are given by way of illustration only, and thus are not intended as a definition of the limits of the present invention:

[0008] FIG. **1** is a configuration view of an image forming apparatus according to a first embodiment of the present invention;

[0009] FIG. **2** is a cross-sectional view for explaining an image formed by the image forming apparatus according to the first embodiment;

[0010] FIG. **3** is a configuration view illustrating a modification of the first embodiment;

[0011] FIG. **4** is a configuration view of an image forming apparatus according to a second embodiment of the present invention;

[0012] FIG. **5** is a configuration view of an image forming apparatus according to a third embodiment of the present invention; and

[0013] FIG. **6** is an observation image of a glossy image formed in Example.

DETAILED DESCRIPTION OF EMBODIMENTS

[0014] Hereinafter, one or more embodiments of image forming apparatuses and image forming methods according to the present invention will be described with reference to the drawings. However, the scope of the invention is not limited, to the disclosed embodiments. Note that in each of the embodiments, the same constituent elements are denoted by the same reference numerals, and duplicate description is omitted.

First Embodiment

[0015] FIG. **1** is a configuration diagram of an image forming apparatus **1** according to a first embodiment of the present invention. The image forming apparatus I illustrated in this figure is for forming a glossy image, and includes a pattern forming device **10** and a powder pasting device **20**. Among these apparatuses, the pattern forming device **10** is for forming an image pattern **100** formed of a material functioning as an adhesive as described below on a main surface of a recording medium S. Note that the recording medium S has a sheet shape, and may have an image formed on one main surface or both main surfaces by another image forming apparatus. The image may be a color image. The recording medium S may be one on which no image is formed.

[0016] The powder pasting device **20** is for forming a glossy image **101** in which, for example, glossy powder is pasted on the image pattern **100** formed in the pattern forming device **10**. The pattern forming device **10** and the powder pasting device **20** have such configurations as follows.

[0017] <Pattern Forming Device **10**>

[0018] The pattern forming device **10** only needs to be an image forming apparatus capable of forming the image pattern **100** formed of a material functioning as an adhesive on a main surface of the recording medium S. As the pattern

forming device **10**, a known image forming apparatus such as a dry or wet electrophotographic apparatus or an ink jet apparatus can be used.

[0019] Here, a case where a dry electrophotographic image forming apparatus is applied as the pattern forming device **10** will be described. As an example, the pattern forming device **10** includes a cylindrical photoreceptor **11**, and a charging device **12**, an optical writing device **13**, a developing device **14**, a transfer roller **15**, and a cleaner **16** disposed around the photoreceptor **11**. Hereinafter, the configuration of each of these members will be described, and then the configuration of a material functioning as an adhesive used here (hereinafter referred to as an adhesive material) will be described.

[0020] [Photoreceptor **11**]

[0021] The photoreceptor **11** has a cylindrical shape and rotates around a cylindrical axis by a drive motor A cylindrical side peripheral surface is used as an image carrying surface **11***a*.

[0022] [Charging Device **12**]

[0023] The charging device **12** is for charging the image carrying surface **11***a* of the photoreceptor **1** by corona discharge.

[0024] [Optical Writing Device **13**]

[0025] The optical writing device **13** is a writing unit that forms an electrostatic latent image by irradiating the image carrying surface **11***a* of the charged photoreceptor **11** with a laser beam on the basis of image data, and is disposed on a downstream side of the charging device **12** in a rotation direction of the photoreceptor **11**. The image data is data generated by an image reading unit (not illustrated) included in the image forming apparatus **1** or data received from an external device such as a personal computer connected, to the image forming apparatus **1** or another image forming apparatus.

[0026] [Developing Device **14**]

[0027] The developing device **14** is for attaching a toner to an electrostatic latent image formed on the image carrying surface **11***a* by supplying a toner T that has been stirred and charged to the image carrying surface **11***a* of the photoreceptor **11**, and is disposed on a downstream side of the optical writing device **13** in the rotation direction of the photoreceptor **11**. Note that the toner used here is used as an adhesive material.

[0028] [Transfer Roller **15**]

[0029] The transfer roller **15** is for transferring the toner T attached to the image carrying surface **11***a* of the photoreceptor **11** onto a main surface of the sheet-shaped recording medium S, and is disposed on a downstream side of the developing device **14** in the rotation direction of the photoreceptor **11**. To the transfer roller **15**, a voltage having the opposite polarity to that of the toner T is applied. The transfer roller **15** forms a nip portion that sandwiches the sheet-shaped recording medium S between the transfer roller **15** and the image carrying surface **11***a* of the photoreceptor **11**. As a result, the toner T attached onto the image carrying surface **11***a* of the photoreceptor **11** is transferred onto a main surface of the recording medium S supplied to the nip portion between the image carrying surface **11***a* of the photoreceptor **11** and the transfer roller **15** toward the photoreceptor **11**, and an image pattern **100** formed of the toner T is formed on the main surface of the recording medium S.

[0030] Note that the recording medium S which has passed through the nip portion between the image carrying surface **11***a* of the photoreceptor **11** and the transfer roller **15** and on which the image pattern **100** is formed is conveyed to the powder pasting device **20** by a conveyance mechanism (not illustrated).

[0031] [Cleaner **16**]

[0032] The cleaner **16** is for removing the toner T remaining on the image carrying surface **11***a* of the photoreceptor **11**, and is disposed on a downstream side of the transfer roller **15** and on an upstream side of the charging device **12** in the rotation direction of the photoreceptor **11**. As a result, an image carrying surface **21***a* to which the toner T is not attached is supplied to the charging device **12**.

[0033] [Adhesive Material (Toner T)]

[0034] An adhesive material in the present embodiment is the toner T supplied from the developing device **14**, and is a material that is melted by being heated to a predetermined temperature to exhibit stickiness, and is cured by heat dissipation after being melted to exhibit adhesiveness. Note that the adhesive material may be cured more firmly by cooling or light irradiation The adhesive material may be either a colored toner or a transparent toner, and is appropriately selected depending on the color tone of an image formed by the image forming apparatus **1**.

[0035] If the pattern forming device **10** is a wet electrophotographic image forming apparatus or an ink jet apparatus, liquid ink is used instead of the toner T as the adhesive material.

[0036] <Powder Pasting Device **20**>

[0037] The powder pasting device **20** is for forming the glossy image **101** by pasting the glossy powder P, for example, decorative powder on the image pattern **100** formed on a main surface of the recording medium S, and is disposed on a downstream side of the pattern forming device **10** and in the latter stage with respect to a conveyance direction x of the recording medium S. As an example, the powder pasting device **20** includes a heating member **21** and a cylindrical powder holding member **22**, and a powder supplying member **23**, a rubbing member **24**, and a facing member **25** disposed around the powder holding member **22**, and further includes a powder collecting member **26**. Hereinafter, the configuration of each of these members will be described, and then the configuration of the glossy powder P used here will be described.

[0038] [Heating Member **21**]

[0039] The heating member **21** is for melting the image pattern **100** formed on a main surface of the recording medium S by heating in the pattern forming device **10**, and is disposed on a conveyance path of the recording medium S on which the image pattern **100** is formed in the pattern forming device **10**. The image pattern **100** heated by the heating member **21** is melted to exhibit stickiness, and then is cured to exhibit adhesiveness. Note that a pressure member (not illustrated) may be disposed at a position sandwiching the conveyance path of the recording medium S between the pressure member and the heating member **21**, and the recording medium S and the image pattern **100** sandwiched between the heating member **21** and the pressure member may be heated and pressurized. With such a configuration, a surface of the image pattern **100** can be smoothed. It is only required to melt the image pattern **100** at the heating

temperature of the image pattern **100** by the heating member **21**. For example, the heating temperature is 60° C. to 130° C.

[0040] Note that the heating member **21** only needs to be disposed as necessary. When the image pattern **100** formed in the pattern forming device **10** has stickiness without being melted by heating, the heating member **21** does not need to be disposed. However, in this case, a heating unit or a light irradiation unit is disposed for exhibiting adhesiveness by curing the image pattern **100** after the powder P is transferred onto the image pattern **100** by passing through the facing member **25** described below.

[0041] [Powder Holding Member **22**]

[0042] The powder holding member **22** has a cylindrical shape and rotates around a cylindrical axis by a drive motor. A cylindrical side peripheral surface is used as a powder holding surface **22***a*. The powder holding surface **22***a* of the powder holding member **22** has stickiness, and holds the powder P described next by sticking.

[0043] The powder holding surface **22***a* preferably has adhesive force (also referred to as cohesive force) of 28 kPa or more. This makes it possible to hold the powder P well as described in the following Example. An upper limit of the adhesive force of the powder holding surface **22***a* is within a range in which powder is transferred from the powder holding surface **22***a* onto the image pattern **100** when the image pattern **100** described below exhibits adhesive force. Therefore, the upper limit of the adhesive force of the powder holding surface **22***a* is 470 kPa or less, and preferably 350 kPa or less. This makes it possible to transfer powder from the powder holding surface **22***a* onto the image pattern **100**. Examples of a material constituting the powder holding surface **22***a* include fluororubber, silicon rubber, and urethane rubber. However, the material is not limited to these rubber materials and may be another resin materials or a metal material as long as having adhesive force capable of holding powder

[0044] The powder holding member **22** is disposed on a downstream side of the heating member **21** on the conveyance path of the recording medium S and on a main surface where the image pattern **100** is formed on the recording medium S. The powder holding member **22** rotates in a direction along the conveyance direction x of the recording medium S on a side toward the recording medium S. Note that when the image pattern **100** is heated by the heating member **21** to exhibit stickiness, heat is also transmitted to the powder holding member **22**. Therefore, a material constituting the powder holding member **22**, particularly a material constituting the powder holding surface **22***a* preferably has heat resistance. As such a material, silicon rubber is preferably used among the rubber materials described above.

[0045] [Powder Supplying Member **23**]

[0046] The powder supplying member **23** is for supplying the powder P to the powder holding surface **22***a* of the powder holding member **22**, and is disposed in an axial direction of the cylindrical powder holding member **22**. The powder supplying member **23** includes a storage container **23***a* for storing the powder P and a conveying member **23***b* housed in the storage container **23***a*.

[0047] Among these, the storage container **23***a* has an opening formed in an axial direction of the powder holding surface **22***a* of the cylindrical powder holding member **22**.

[0048] The conveying member **23***b* is, for example, a rotating cylindrical brush or sponge, or has a screw shape. The conveying member **23***b* rotates in the opposite direction to the powder holding member **22**, thereby conveys the powder P stored in the storage container **23***a* to the opening of the storage container **23***a*, and supplies the powder P to the powder holding surface **22***a* of the powder holding member **22**.

[0049] Note that the powder supplying member **23** is not limited to such a configuration, and for example, may directly bring the powder holding surface **22***a* of the powder holding member **22** into contact with the powder P stored in the storage container **23***a*.

[0050] [Rubbing Member **24**]

[0051] The rubbing member **24** is for orienting the powder P on the powder holding surface **22***a* of the powder holding member **22** by rubbing the powder holding surface **22***a* of the powder holding member **22**, and is disposed on a downstream side of the powder supplying member **23** in the rotation direction of the powder holding member **22**. The rubbing member **24** includes a powder collecting member **24***a*.

[0052] The rubbing member **24** has a cylindrical shape and is disposed in contact with the powder holding surface **22***a* to rub the powder holding surface **22***a* of the rotating powder holding member **22**. A side peripheral surface of the rubbing member **24** that nibs the powder holding surface **22***a* is preferably formed of a material having voids for housing the powder P. As such a material, for example, a brush or a porous material such as a sponge or a nonwoven fabric is used.

[0053] The rubbing member **24** rubs the powder holding surface **22***a* of the rotating powder holding member **22** to remove excess powder P not stuck on the powder holding surface **22***a* out of the powder P supplied to the sticky powder holding surface **22***a*. At this time, the excess powder P is captured in the, voids on the side peripheral surface of the rubbing member **24**.

[0054] As a result, one layer of the powder P is left in a state of being directly stuck to the sticky powder holding surface **22***a*. At this time, as described in detail later, if the powder P is non-spherical, the powder P is rubbed by the rubbing member **24** on the powder holding surface **22***a*, and directionality of the powder P with respect to the powder holding surface **22***a* can be thereby aligned.

[0055] The rubbing member **24** preferably rotates around, a cylindrical axis. As a result, the powder P captured and housed in the voids can be continuously conveyed in the rotation direction. Therefore, the powder P does not accumulate in the nip portion between the powder holding surface **22***a* and the rubbing member **24**, and an effect of removing the excess powder P from the powder holding surface **22***a* is enhanced. This also makes it possible to stabilize a rubbing property of the powder holding surface **22***a* by the rubbing member **24**.

[0056] Furthermore, if the rotation direction of the rubbing member **24** is the same as the rotation direction of the powder holding member **22**, a relative speed of the rubbing member **24** with respect to the powder holding member **22** is further increased, the powder holding surface **22***a* of the powder holding member **22** can be rubbed by the rubbing member **24** at a higher speed, and a higher rubbing effect can be obtained.

[0057] Pressing force [N] of the rubbing member **24** against the powder holding surface **22***a* of the powder holding member **22** is preferably 1 to 10 kPa, and more preferably 1 to 5 kPa. If the pressing force [N] is too low, pressing of the powder holding member **22** in an axial direction is unstable. Meanwhile, if the pressing force [N] is too high, a torque for rotating the rubbing member **24** increases, causing drive unevenness of the rubbing member **24** or material deterioration of the rubbing member **24** and the powder holding member **22**.

[0058] The powder collecting member **24***a* disposed in the rubbing member **24** is disposed so as to face a side peripheral surface of the rubbing member **24**, and collects the powder P stored in the voids on the side peripheral surface of the rubbing member **24**. The powder collecting member **24***a* may be an air suction type member or a member that brings a roller or a blade-shaped member into contact with the side peripheral surface of the rubbing member **24** and ejects the powder P from the voids by a restoring force of a material constituting the side peripheral surface of the rubbing member **24**.

[0059] By disposing the powder collecting member **24***a* in the rubbing member **24**, it is possible to maintain an effect of removing the powder P by the rubbing member **24**, and to maintain a rubbing property of the powder holding surface **22***a* by the rubbing member **24** for a long time. Note that the rubbing member **24** as described above may also serve as the conveying member **23***b* in the powder supplying member **23**.

[0060] [Facing Member **25**]

[0061] The facing member **25** is for transferring the powder P stuck and held on the powder holding surface **22***a* of the powder holding member **22** onto the image pattern **100** formed on a main surface of the recording medium S. The facing member **25** has a roller shape, and constitutes a nip portion that sandwiches the recording medium S between the facing member **25** and the powder holding member **22**. As a result, the powder P stuck and held on the powder holding surface **22***a* of the powder holding member **22** in a state of being oriented is brought into contact with and pressed against the image pattern **100** melted by heating with the heating member **21** and exhibiting stickiness, and the powder P in a state of being oriented is transferred from the powder holding surface **22***a* onto the image pattern **100**. In addition, the image pattern **100** is in a stage where the image pattern **100** is cured by fall of temperature after passing through the heating member 21. Therefore, adhesiveness is exhibited by cluing, and the powder P is bonded and held onto the image pattern **100**. As a result, the glossy image **101** in which the glossy powder P is pasted on a surface of the image pattern **100** constituted by the toner T serving as an adhesive material can be obtained.

[0062] [Powder Collecting Member **26**]

[0063] The powder collecting member **26** is for collecting the excess powder P on the recording medium S that has passed through the nip portion between the powder holding member **22** and the facing member **25**. The powder collecting member **26** is disposed on a downstream side of the nip portion between the powder holding member **22** and the facing member **25** on the conveyance path of the recording medium S, and on a side where the image pattern **100** is formed on the recording medium S. Here, the excess powder P on the recording medium S is the powder P that is not bonded and held onto the image pattern **100**.

[0064] Examples of the powder collecting member **26** include a member that sucks the powder P by air suction, but the powder collecting member **26** is not limited thereto.

[0065] [Glossy Powder P]

[0066] Next, the configuration of the glossy powder P used in the powder pasting device **20** as described above will be described. The powder P has a non-spherical shape that is not a true sphere. The powder P is preferably flat from a viewpoint of orientation along the powder holding surface **22***a*. Here, the flat powder P means that the powder P has a shape in which a ratio of a minor axis [W] to a thickness [t] is 3 or more when a maximum length of the powder P is represented by a major axis [L], a maximum length of the powder P in a direction orthogonal to the major axis [L] is represented by the minor axis [W], and a minimum length of the powder P in a direction orthogonal to the major axis [L] and the minor axis [W] is represented by the thickness [t]. As a result, the flat powder P is rubbed by the rubbing member **24** on the powder holding surface **22***a*, and a wide surface including the major axis [L] direction and the minor axis [W] direction is thereby stuck on the powder holding surface **22***a*. The flat powder P is held on the powder holding surface **22***a* in a state of being oriented.

[0067] The thickness [t] of the flat powder P is preferably about 0.2 to 10 μm, and more preferably 0.2 to 5.0 μm from a viewpoint of sufficiently exhibiting glossiness due to the powder P when the powder P is bonded to the image pattern **100** in an oriented state.

[0068] When the thickness [t] is too small, it is difficult to collect the powder P that is not stuck on the powder holding surface **22***a* but is superimposed on other particles of the powder P. In this case, the flat powder P cannot be sufficiently oriented in a state where the surface including the major axis [L] direction of the flat powder P and the minor axis [W] direction thereof is stuck on the sticky powder holding surface **22***a*, and it is difficult to directly stick one layer of the powder P on the powder holding surface **22***a*. In addition, the powder P is easily broken during a process, and variation is likely to occur in the sizes of particles of the powder P. Meanwhile, when the thickness [t] is too large, the powder P bonded to the image pattern **100** is easily detached from the image pattern **100**.

[0069] The major axis [L] of the flat powder P and the minor axis [W] thereof are each preferably about 1 to 50 μm, and more preferably 15 to 50 μm. When the major axis [L] and the minor axis [W] are too small, handling is difficult. Meanwhile, when the major axis [L] and the minor axis [W] are too large, it is difficult to form an image with high resolution. This causes a reduction in gradation of the image.

[0070] A material of the powder P is not limited as long as being able to obtain desired gloss. The material may be insulating or conductive, and may be magnetic or non-magnetic. The powder P preferably includes a metal or a metal oxide from a viewpoint of exhibiting desired gloss, and can include particles of two or more types of materials.

[0071] Examples of the powder P include powder formed of a metal material, powder formed of a metal oxide, metal powder having a surface coated with a metal oxide layer or a resin layer, metal oxide powder having a surface coated with a metal layer or a resin layer, and resin powder having a surface coated with a metal layer or a metal oxide layer.

[0072] The powder P as described above may be a synthetic product or a commercial product. Examples of the commercial product used as the powder P include Sunshine

Baby Chrome Powder, Aurora Powder, and Pearl Powder (these are manufactured by GG Corporation), ICEGEL Mirror Metal Powder (manufactured by TAT Co., Ltd). Pika-ace MC Shine Dust, Effect. C (manufactured by Kurachi Co. Ltd., "Pika-ace" is registered trademark of Kurachi Co., Ltd.), PREGEL Magic Powder, Mirror Series (manufactured by PREANFA Ltd., "PREGEL is registered trademark of PREANFA Ltd.), Borman Shine Powder (manufactured by K's Planning Co., Ltd., "BONNAIL" is registered trademark of K's Planning Co., Ltd.), Metashine (manufactured by Nippon Sheet Glass Co., Ltd., Metashine is registered trademark of Nippon Sheet Glass Co., Ltd.), LG neo (manufactured by OIKE Co., Ltd., LG neo is registered trademark of OIKE Co., Ltd.), Astroflake (manufactured by Nihoriboshitsu Co., Ltd., registered trademark of Hajime Okazaki), and aluminum pigment (manufactured by Toyo Aluminum Co., Ltd.).

[0073] <Image Forming Method>

[0074] Next, an image forming method according to the first embodiment will be described. The image forming method described here is an image forming method performed by the image forming apparatus **1** described with reference to FIG. **1**, and is performed as follows. First, in the pattern forming device **10** of the image forming apparatus **1**, the image pattern **100** constituted by the toner T functioning as an adhesive is formed on one main surface of the recording medium S.

[0075] Subsequently, the recording medium S on which the image pattern **100** is formed is conveyed to the powder pasting device **20**, and the image pattern **100** formed on the recording medium S is heated to a predetermined temperature by the heating member **21** of the powder pasting device **20** to be melted.

[0076] Meanwhile, to the powder holding surface **22***a* of the powder holding member **22** in the powder pasting device **20**, the glossy powder P is supplied. Furthermore, the powder holding surface **22***a* is rubbed by the rubbing member **24**, and the powder P is thereby stuck and held on the powder holding surface **22***a* in a state of being oriented in a single layer. In this state, the recording medium S that has passed through the heating member **21** is conveyed to the nip portion between the powder holding member **22** of the powder pasting device **20** and the facing member **25**. As a result, while the powder P that is stuck and held on the powder holding surface **22***a* of the powder holding member **22** holds the sticky state on the powder holding surface **22***a*, that is, while the powder P is oriented in a single layer, the powder P is transferred onto the image pattern **100** exhibiting stickiness by melting.

[0077] Thereafter, the powder P that has been transferred onto the image pattern **100** is bonded to the image pattern **100** by curing the image pattern **100** by heat dissipation. As a result, the glossy image **101** in which the glossy powder P is pasted on the image pattern **100** formed of the toner T is obtained.

[0078] FIG. **2** is a cross-sectional view for explaining an image formed by the image forming apparatus according to the first embodiment. As illustrated in this figure, the glossy image **101** formed on the recording medium S by this image forming apparatus has the glossy powder P pasted on a surface of the image pattern **100** functioning as an adhesive in a state where the powder P is oriented in a single layer.

Effect of First Embodiment

[0079] According to the image forming apparatus **1** and the image forming method described above, the glossy powder P is pasted on a surface of the image pattern **100** functioning as an adhesive in a state of being oriented in a single layer. As a result, the glossy image **101** having sufficient glossiness can be obtained. In addition, since the powder P is directly pasted on the image pattern **100** in a state of being oriented in a single layer, attachment force between the image pattern **100** and each particle of the powder P is high, and the powder P is not detached from the image pattern **100**. For this reason, the glossiness of the glossy image **101** can be stably maintained over a long period of time. Furthermore, it is possible to prevent attachment of the powder P to a region other than the image pattern **100** in a step of pasting the powder P.

Modification of First Embodiment

[0080] FIG. **3** is a configuration view illustrating a modification of the first embodiment. An image forming apparatus **1'** illustrated in this figure does not include a special heating member, and a facing member **25'** forming a nip portion between the powder holding member **22** and the facing member **25'** also serves as a heating member. In the image forming apparatus **1'** having such a configuration, when the image pattern **100** is heated by the facing member **25'** to exhibit stickiness, heat is also easily transmitted to the powder holding member **22**. For this reason, a material constituting the powder holding member **22**, particularly a material constituting the powder holding surface **22***a* preferably has heat resistance like the silicon rubber described above.

[0081] Even with the configuration of such a modification, it is possible to exhibit similar effects to the effects exhibited by the image forming apparatus according to the first embodiment. Note that this modification can be similarly applied to the following embodiments.

Second Embodiment

[0082] FIG. **4** is a configuration view of an image forming apparatus **1***a* according to a second embodiment of the present invention. In the image forming apparatus **1***a* according to the second embodiment illustrated in this figure, the image, forming apparatus **1** for glossy image formation described in the first embodiment is connected to the latter stage of a dry electrophotographic color image forming apparatus **2**. Therefore, only the configuration of the color image forming apparatus **2** will be described below.

[0083] <Color Image Forming Apparatus **2**>

[0084] The color image forming apparatus **2** is disposed in the former stage of the image forming apparatus **1** for glossy image, and may be a normal image forming apparatus. A known image forming apparatus such as a dry or wet electrophotographic image forming apparatus or an inkjet image forming apparatus can be used. However, here, a dry electrophotographic image forming apparatus is used. The color image forming apparatus **2** includes a color image forming unit **10***a*, a transfer unit **30**, a fixing unit **40**, a paper supplying unit **50**, and a paper conveying unit **60**, and these each have such a configuration as follows.

[0085] [Color Image Forming Unit **10***a*]

[0086] The color image forming unit **10***a* includes, for example, four pattern forming units **10***y*, **10***m*, **10***c*, and **10***k*

for forming colored toner patterns of yellow (Y), magenta (M), cyan (C), and black (K). Each of the pattern forming units **10***y*, **10***m*, **10***c*, and **10***k* includes a photoreceptor **11**, a charging device **12**, an optical writing device **13**, and a developing device **14**. These devices may be similar to those of the pattern forming device **10** described above.

[0087] However, toners supplied from the developing devices **14** of the pattern forming units **10***y*, **10***m*, **10***c*, and **10***k* are colored toners of the respective colors. These colored toners have a higher melting temperature than the toner T serving as an adhesive used in the image forming apparatus **1**, and are not melted by heating in the heating member **21** included in the powder pasting device **20**. Note that when the glossy powder P is to be pasted also on the colored image pattern **200** formed of a colored toner in the image forming apparatus **1**, the melting temperature of the colored toner may be about the same as the melting temperature of the toner T used in the image forming apparatus **1**.

[0088] [Transfer Unit **30**]

[0089] The transfer unit **30** is disposed in parallel with the color image forming unit **10***a*. The transfer unit **30** includes an intermediate transfer belt **31**, a primary transfer roller **32**, and a pair of secondary transfer rollers **33**.

[0090] Among these, the intermediate transfer belt **31** is configured as a rotating endless belt, and an outer peripheral surface thereof is an image carrying surface **31***a*. The intermediate transfer belt **31** rotates in the opposite direction to rotation of each of the photoreceptors **11**, and is disposed in a state where the image carrying surface **31***a* is sequentially brought into contact with all of the photoreceptors **11**.

[0091] To the primary transfer roller **32**, a voltage having the opposite polarity to that of the toner is applied, and the primary transfer roller **32** is disposed in a state where the intermediate transfer belt **31** is sandwiched between the primary transfer roller **32** and each of the photoreceptors **11**. As a result, the colored toner attached onto the image carrying surface **21***a* of the photoreceptor **11** is transferred onto the image carrying surface **31***a* of the intermediate transfer belt **31**, and a colored image pattern **200** in which the toner images of the respective colors are superimposed on the image carrying surface **31***a* of the intermediate transfer belt **31** is formed.

[0092] The pair of secondary transfer rollers **33** is disposed in a state of sandwiching the intermediate transfer belt **31** therebetween and transfers the colored image pattern **200** formed on the image carrying surface **31***a* of the intermediate transfer belt **31** onto the sheet-shaped recording medium S conveyed from the paper supplying unit **50** described below.

[0093] [Fixing Unit **40**]

[0094] The fixing unit **40** includes a heating unit **41** and a pressure bonding roller **42** disposed so as to face the heating unit **41**. The fixing unit **40** nips the recording medium S conveyed from the secondary transfer roller **33** and fixes the color image transferred onto the recording medium S to the recording medium S.

[0095] [Paper Supplying Unit **50**]

[0096] The paper supplying unit **50** includes a cassette **51** that stores the recording medium S and a feeding roller **52** that feeds the recording medium S stored in the cassette **51** one by one from the cassette **51**, and supplies the recording medium S from the cassette **51** to the paper conveying unit **60**.

[0097] [Paper Conveying Unit **60**]

[0098] The paper conveying unit **60** conveys the recording medium S supplied from the paper supplying unit **50** along a predetermined route, and includes a plurality of roller pairs **61**. The paper conveying unit **60** conveys the recording medium S supplied from the paper supplying unit **50** to the secondary transfer roller **33** and the fixing unit **40**, and further conveys the recording medium S to the pattern forming device **10**.

[0099] <Image Forming Method>

[0100] In the image forming method performed by the image forming apparatus **1***a* as described above, first, the color image forming apparatus **2** forms the colored image pattern **200** on one main surface of the recording medium S. Subsequently, the recording medium S on which the colored image pattern **200** is formed is supplied to the pattern forming device **10** of the image forming apparatus **1**. Thereafter, the glossy image **101** is formed in a similar procedure to the image forming method according to the first embodiment.

Effect of Second Embodiment

[0101] With the image forming apparatus **1***a* and the image forming method according to the second embodiment described above, it is possible to form the glossy image **101** having sufficient glossiness and stably maintaining sufficient glossiness over a long period of time on the recording medium S on which the colored image pattern **200** is formed.

[0102] Note that in the image forming method described in the second embodiment, when the glossy powder P only needs to be pasted only on the colored image pattern **200** formed of a colored toner, it is only required to make the color image forming apparatus **2** function as a pattern forming device. In this case, the image forming apparatus **1***a* may omit the pattern forming device **10**. By using the colored toners used in the pattern forming units **10***y*, **10***m*, **10***c*, and **10***k* of the color image forming apparatus **2** as the toner T serving as the adhesive material described above, the color image pattern that functions as an adhesive only needs to be formed by the color image forming apparatus **2**. With such a configuration, it is also possible to obtain a glossy color image.

Third Embodiment

[0103] FIG. **5** is a configuration view of an image forming apparatus **1***b* according to a third embodiment of the present invention. In the image forming apparatus **1***b* according to the third embodiment illustrated in this figure, a part of the image forming apparatus **1** for glossy image formation described in the first embodiment is incorporated in an electrophotographic color image forming apparatus **2'**, and the image forming apparatus **1***b* has such a configuration as follows.

[0104] <Color Image Forming Apparatus **2'**>

[0105] The color image forming apparatus **2'** is obtained by combining the color image forming apparatus **2** described in the second embodiment with the pattern forming device **10** described in the first embodiment. The pattern forming device **10** is for forming an image pattern **100** formed of a material functioning as an adhesive, and is disposed in parallel with four pattern forming units **10***y*, **10***m*, **10***c*, and

10*k* for forming a colored toner pattern. The pattern forming device **10** forms the image pattern **100** on an intermediate transfer belt **31**.

[0106] In the color image forming apparatus **2'**, the four pattern forming units 10*y*, **10***m*, **10***c*, and **10***k* for forming a colored toner pattern form a colored image pattern **200** in which toner images of the respective colors are superimposed on an image carrying surface **31***a* of the intermediate transfer belt **31**, and the pattern forming device 10 further forms the image pattern **100** formed of a toner T serving as an adhesive material on the image carrying surface **31***a* of the intermediate transfer belt **31**.

[0107] Similarly to the first embodiment, the colored toners used in the four pattern forming units **10***y*, **10***m*, **10***c*, and **10***k* each have a higher melting temperature than the toner T serving as an adhesive material used in the pattern forming device **10**. That is, the colored toners used in the pattern forming units **10***y*, **10***m*, **10***c*, and **10***k* are not melted by heating in a heating member **21** included in a powder pasting device **20**.

[0108] <Powder Pasting Device **20**>

[0109] The powder pasting device **20** is disposed in the latter stage of the color image forming apparatus **2'**, and the recording medium S on which the colored image pattern **200** and the image pattern **100** are formed by the color image forming apparatus **2'** is conveyed to the powder pasting device **20**. The configuration of the powder pasting device **20** is similar to that described in the first embodiment.

[0110] Note that when the image pattern **100** is melted by heating at a fixing unit **40** of the color image forming apparatus **2'** and exhibits stickiness, and the stickiness is maintained to a powder holding member **22** of the powder pasting device **20**, the heating member **21** does not need to be disposed in the powder pasting device **20**.

[0111] <Image Forming Method>

[0112] In the image forming method performed by the image forming apparatus **1***b* as described above, first, the color image forming apparatus **2'** forms the colored image pattern **200** on one main surface of the recording medium S and the image pattern **100** formed of the toner T serving as an adhesive material. Subsequently, the recording medium S on which the colored image pattern **200** and the image pattern **100** are formed is supplied to the powder pasting device **20**. Thereafter, a glossy image **101** is formed in a similar procedure to the image, forming method according to the first embodiment.

Effect of Third Embodiment

[0113] With the image forming apparatus **1***b* and the image forming method according to the third embodiment described above, it is possible to form the colored image pattern **200** and the glossy image **101** having sufficient glossiness and stably maintaining sufficient glossiness over a long period of time on the recording medium S.

[0114] Note that as described in the second embodiment, when the glossy powder P only needs to be pasted only on a colored image pattern formed of a colored toner, the image forming apparatus **1***b* may omit the pattern forming device **10**. By using the colored toners used in the pattern forming units **10***y*, **10***m*, **10***c*, and **10***k* of the color image forming apparatus **2** as the toner T serving as the adhesive material described above, the color image pattern functioning as an adhesive only needs to be formed by the color image forming apparatus **2**. With such a configuration, it is also possible to obtain a glossy color image.

[0115] The powder pasting device **20** may be separate from the color image forming apparatus **2'**, or may be attached to the color image forming apparatus **2'** afterwards. In this case, if a toner functioning as an adhesive can be used as a colored toner, it is also possible to obtain a glossy color image by attaching the powder pasting device **20** to a normal color image forming apparatus.

EXAMPLE

[0116] Next, description will be given of experimental results of examining adhesive force of a powder holding surface of a powder holding member in the image forming apparatus according to an embodiment of the present invention.

[0117] <Measurement of Adhesive Force of Powder Holding Member 22>

[0118] First, a result of measuring adhesive force of each material constituting a powder holding surface of a powder holding member will be described. Adhesive force was measured by using a tacking tester FSR-1000 (manufactured by RHESCA Co., LTD.: trade name) and by regarding force required for pressing a tip of a probe against a sample surface and peeling the tip off as adhesive force. Measurement conditions are as follows.

[0119] (1) Probe diameter: Diameter 10 mm

[0120] (2) Pressing speed: 5 mm/sec

[0121] (3) Pressing pressure: 50 kPa

[0122] (4) Pressing holding time: 1 second

[0123] (5) Probe lifting speed: 5 mm/sec

[0124] (6) Measurement temperature: 20° C.

[0125] The following Table 1 illustrates measurement results. Note that adhesive force is expressed in terms of pressure based on the area of the tip of the probe.

TABLE 1

Type	Product No.	Rubber thickness (mm)	Hardness (JISA) (°)	Adhesive force (kPa)
EPDM	EB270N	2	68	8
NBR	RBTM	2	53	9
Fluororubber	RBFM	2	75	28
Silicon rubber	RBAM	2	53	82
Urethane rubber	UTM	2	77	150

Values of adhesive force are values under pressing force of 50 kPa

[0126] <Formation of Glossy Image>

[0127] Next, a glossy image was formed using a powder holding member having adhesive force measured as described above, and gloss unevenness of the formed glossy image was observed. Here, the image formation of Experiments No. 1 to No. 15 in which the combination of a powder holding member, a rubbing member, and powder was changed was performed as follows, and gloss unevenness in each of the formed glossy images was observed.

[0128] [Formation of Image Pattern]

[0129] An image pattern formed of a black toner was formed using an electrophotographic image forming apparatus (AccurioPress C2060: manufactured by Konica Minolta, Inc.).

[0130] [Orientation of Powder by Rubbing]

[0131] Powder was supplied onto a powder holding surface of each powder holding member fixed on a flat plate, and a rubbing member was moved in parallel with the powder holding surface in a state of being in contact with the powder holding surface to rub the powder holding surface. Rubbing conditions are as follows.

[0132] (1) Rubbing member: wiping cloth (foray see: manufactured by Foray Industries, Inc.), sponge (styrene butadiene (SBR) sponge: Ramuse Makeup Sponge)

[0133] (2) Powder: LG NEO #325 (manufactured by HORI METAL LEAF & POWDER CO., LTD.: metal material surface is coated with resin: insulating), Metashine ME2025PS (manufactured by Nippon Sheet Glass Co., Ltd.: glass substrate surface is coated with silver: conductive)

[0134] (3) Pressing force during rubbing [N]: 5 kPa

[0135] (4) Rubbing distance: 1 cm

[0136] (5) Rubbing speed: 200 mm/sec

[0137] (6) Rubbing frequency: 5 times

[0138] [Pasting Powder]

[0139] A recording medium was placed on a hot plate heated to 120° C. with the image pattern formed of the black toner facing upward, and rubbing was performed under the above conditions. A powder holding member having a thin layer of powder was thereby brought into contact with and pressed against the image pattern. As a result, the powder was transferred only onto the image pattern formed of the black toner to form a glossy image.

[0140] [Observation of Gloss Unevenness]

[0141] Using a digital microscope VHX-6000 (manufactured by Keyence Corporation), observation was performed at a magnification of 100 times, and it was determined whether gloss unevenness was observed or not in the glossy image formed. The results are illustrated in Table 2 below together with the combination of the powder holding member, the rubbing member, and the powder.

TABLE 2

	Powder holding member				
Experiment No.	Type	Adhesive force (kPa)	Type of rubbing member	Type of powder	Gloss unevenness
No. 1	EPDM	8	Sponge	LG neo	Observed
No. 2	NBR	9	Sponge	LG neo	Observed
No. 3	Fluororubber	28	Sponge	LG neo	Not observed
No. 4	Silicon rubber	82	Sponge	LG neo	Not observed
No. 5	Urethane rubber	150	Sponge	LG neo	Not observed
No. 6	EPDM	8	Wiping cloth	LG neo	Observed
No. 7	NBR	9	Wiping cloth	LG neo	Observed
No. 8	Fluororubber	28	Wiping cloth	LG neo	Not observed
No. 9	Silicon rubber	82	Wiping cloth	LG neo	Not observed
No. 10	Urethane rubber	150	Wiping cloth	LG neo	Not observed
No. 11	EPDM	8	Sponge	Metashine	Observed
No. 12	NBR	9	Sponge	Metashine	Observed
No. 13	Fluororubber	28	Sponge	Metashine	Not observed
No. 14	Silicon rubber	82	Sponge	Metashine	Not observed
No. 15	Urethane rubber	150	Sponge	Metashine	Not observed

Values of adhesive force are values under pressing force of 50 kPa

[0142] FIG. **6** illustrates observation images of the glossy images formed in Example, and are images obtained by photographing the glossy images formed in Experiments No. 1 to No. 5 at a magnification of 100 times.

[0143] As illustrated in the above results of Table 2 and FIG. **6**, it has been confirmed that if adhesive force of a powder holding surface in a powder holding member is 28 kPa or more, glossy powder is well bonded to and held on a surface of an image pattern, and a glossy image having sufficient glossiness and no gloss unevenness is formed. In addition, as a result of observing these images, it has been confirmed that the powder is pasted in a state of being oriented in a single layer in an image having no gloss unevenness.

[0144] In addition, from this result, it has been confirmed that if a powder holding surface in a powder holding member has adhesive force of 28 kPa or more, by rubbing the powder holding surface with a rubbing member, even when an excess of powder supplied to the powder holding surface is removed, powder directly stuck on the powder holding surface can be continuously held. Furthermore, it has been confirmed that the powder directly stuck on the powder holding surface is stuck and held on the powder holding surface in a well-oriented state, and the powder stuck and held in such a manner can he transferred onto an image pattern.

[0145] Although embodiments of the present invention have been described and illustrated in detail, the disclosed embodiments are made for purposes of illustration and example only and not limitation. The scope of the present invention should he interpreted by terms of the appended claims.

What is claimed is:

1. A powder pasting device for pasting powder on an image pattern formed on one main surface of a recording medium, the powder pasting device comprising:

a powder holding member having a powder holding surface holding powder by sticking;

a powder supplying member that supplies powder to the powder holding surface;

a rubbing member that nibs the powder holding surface to which powder has been supplied from the powder supplying member; and

a facing member that is disposed at a position facing the powder holding surface of the powder holding member, sandwiches a recording medium having an image pat-

tern functioning as an adhesive between the powder holding surface and the facing member, and thereby transfers the powder held on the powder holding surface by sticking onto the image pattern.

2. The powder pasting device according to claim **1**, wherein

the powder is non-spherical.

3. The powder pasting device according to claim **1**, wherein

the powder is flat.

4. The powder pasting device according to claim **1**, wherein

the powder holding surface has adhesive force of 28 kPa or more.

5. The powder pasting device according to claim **1**, wherein

in the rubbing member, a surface that rubs the powder holding surface can house the powder

6. The powder pasting device according to claim **1**, wherein

in the rubbing member, a surface that rubs the powder holding surface is constituted by a porous material or a brush.

7. The powder pasting device according to claim **5**, wherein

the rubbing member includes a powder collecting member that collects the powder housed in the surface that rubs the powder holding surface.

8. The powder pasting device according to claim **1**, wherein

the rubbing member is pressed with pressing force of 1 to 10 kPa against the powder holding surface and rubs the powder holding member.

9. The powder pasting device according to claim **1**, wherein

the image pattern is formed of a material that is melted by heating and exhibits stickiness.

10. The powder pasting device according to claim **1**, wherein

the image pattern is formed of a toner material.

11. The powder pasting device according to claim **9**, further comprising

a heating member that heats an image pattern on one main surface of the recording medium sandwiched between the powder holding surface of the powder holding member and the facing member.

12. The powder pasting device according to claim **11**, wherein

the facing member also serves as the heating member.

13. The powder pasting device according to claim **11**, wherein

the powder holding member is formed of a heat resistant material.

14. The powder pasting device according to claim **1**, wherein

the powder holding surface of the powder holding member is formed of silicon rubber.

15. The powder pasting device according to claim **1**, wherein

the powder holding member rotates with a cylindrical side peripheral surface as the powder holding surface, and

the rubbing member rubs the powder holding surface by bringing a cylindrical side peripheral surface into contact with the powder holding surface, and is disposed on a downstream side of the powder supplying member in a rotation direction of the powder holding member.

16. The powder pasting device according to claim **1**, wherein

the powder holding member rotates with a cylindrical side peripheral surface as the powder holding surface, and

the rubbing member rubs the powder holding surface by bringing a cylindrical side peripheral surface into contact with the powder holding surface, and also serves as the powder supplying member.

17. The powder pasting device according to claim **15**, wherein

the rubbing member rotates in the same direction as the powder holding member.

18. The powder pasting device according to claim **1**, further comprising

a powder collecting member that is disposed on one main surface of the recording medium and collects the powder from the one main surface of the recording medium in a state where the powder has been transferred onto the image pattern.

19. The powder pasting device according to claim **1**, wherein

the powder is glossy.

20. An image forming apparatus comprising: the powder pasting device according to claim **1**; and a pattern forming device that forms the image pattern on one main surface of the recording medium, wherein

the powder holding member of the powder pasting device is disposed on one main surface of the recording medium on which the image pattern is formed in the pattern forming device.

21. A powder pasting method for pasting powder on an image pattern formed on one main surface of a recording medium, the powder pasting method comprising:

supplying the powder to a powder holding surface of a powder holding member;

removing excess powder on the powder holding surface by rubbing the powder holding surface to which the powder has been supplied with a rubbing member, and sticking and holding the powder on the powder holding surface in a state where the powder is oriented; and

transferring the powder onto the image pattern by pressing the powder holding surface to which the powder is stuck and held against the image pattern formed on the one main surface of the recording medium and functioning as an adhesive.

22. An image forming method for pasting powder on an image pattern formed on one main surface of a recording medium, the image forming method comprising:

forming the image pattern functioning as an adhesive on the one main surface of the recording medium;

supplying the powder to a powder holding surface of a powder holding member;

removing excess powder on the powder holding surface by rubbing the powder holding surface to which the powder has been supplied with a rubbing member, and sticking and holding the powder on the powder holding surface in a state where the powder is oriented; and

transferring the powder onto the image pattern by pressing the powder holding surface on which the powder is stuck and held against the image pattern formed on the one main surface of the recording medium.

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