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(54) **Printing method, transfer material, and inkjet discharge device**

(57) A printing method according to the invention includes forming an adhesion layer (7) using a printing whereby adhesive is ink-jetted, in a pattern intended to be transferred, onto a transfer layer (6) of a transfer material (3) in which the transfer layer (6) is provided on a base material (4), or onto a transferring medium (2);

stacking and pressing so that the adhesion layer (7) is sandwiched by the transfer material (3) and transferring medium (2); and transferring the transfer layer (6) to the transferring medium (2) in the pattern intended to be transferred, wherein when forming the adhesion layer (7), the jetting amount of the adhesive is switched between at least two or more stages.

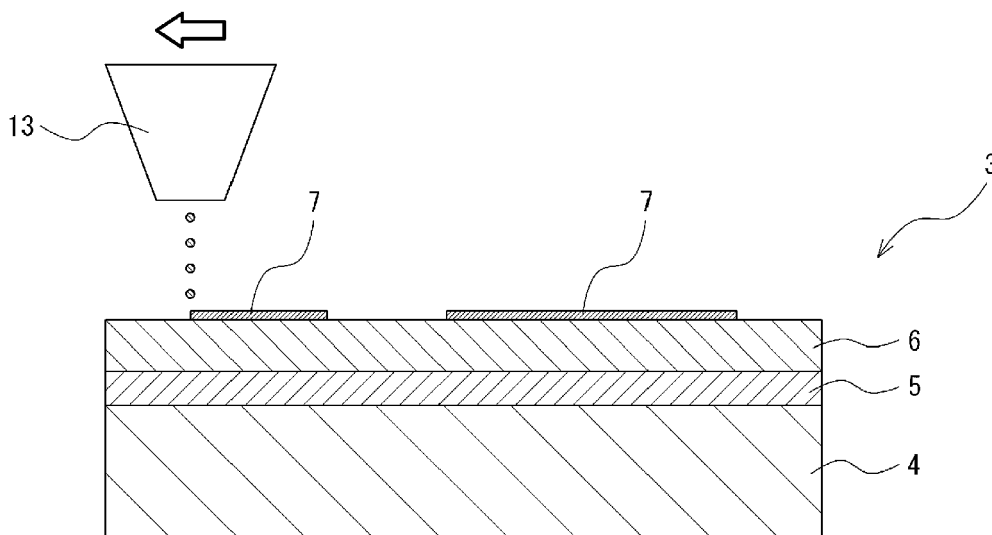


Fig. 4

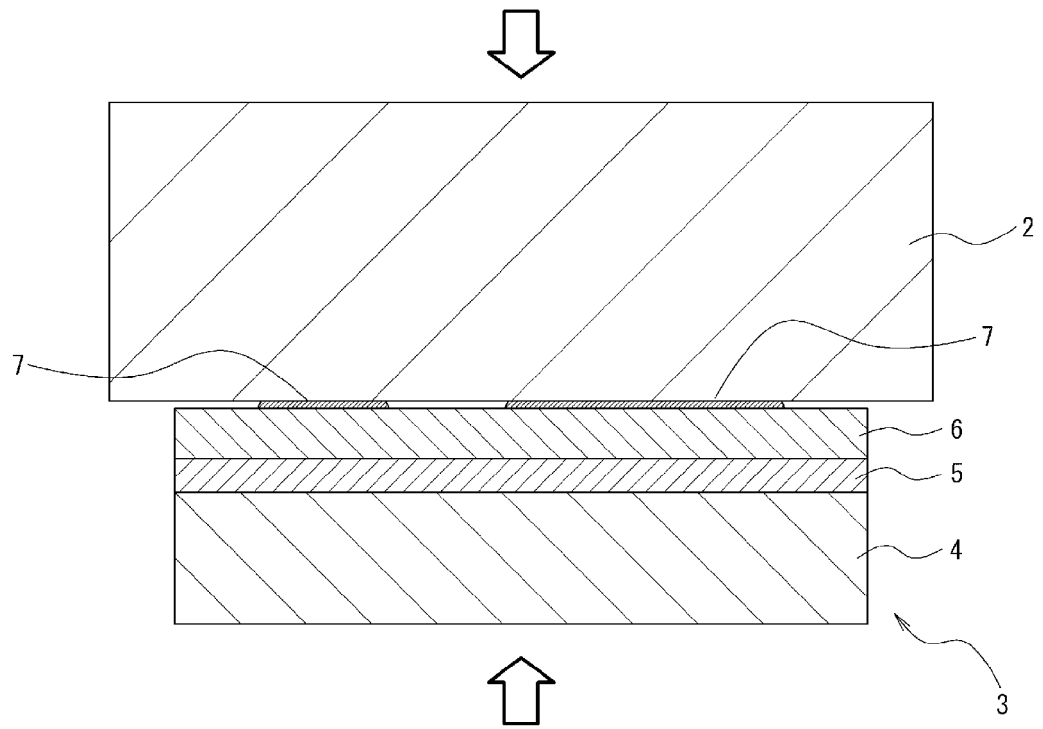


Fig. 5

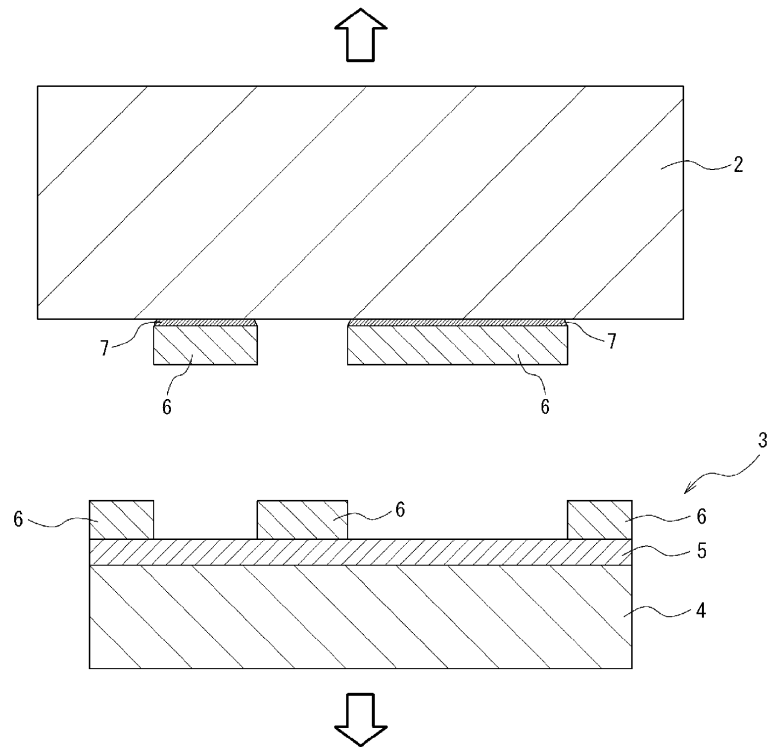


Fig. 6

Description

BACKGROUND OF THE INVENTION

1. Technical Field

[0001] The present invention relates to a printing method, a transfer material, and an inkjet discharge device, and more particularly, to a transfer printing method, and a transfer material and inkjet discharge device used in the printing method.

2. Related Art

[0002] As one method of printing a design, a character, or the like, directly on a surface of any kind of product, there is a transfer printing method whereby a design printed in advance on a base material film surface is transferred to a surface of a product.

[0003] Herein, as a heretofore known example of the transfer printing method, a printing method is known whereby adhesive is inkjetted and thereby applied, in a pattern intended to be transferred, to one of a transfer material or a transferring medium, and the transfer material and transferring medium are pressed against each other, thus transfer printing a transfer layer of the transfer material on the transferring medium (refer to JP-A-2005-501761).

[0004] However, in the printing method illustrated in JP-A-2005-501761, when using a printer for, for example, inkjet printing to form an adhesion layer by jetting adhesive, in a pattern intended to be transferred, onto the transfer material or transferring medium, the contact between the transfer layer and adhesion layer is unstable in a peripheral portion of the pattern, and it is thus not possible to separate the transfer layer from a base material as intended, meaning that a problem may arise in that it is difficult to accurately reproduce the pattern.

[0005] In response to this, the inventor has found that, in comparison with a case of an adhesion layer formed from an aggregate of relatively small jetting droplets, an adhesion layer formed from an aggregate of relatively large jetting droplets is such that, as an incline α of an interface 107b of a peripheral portion 107a of an adhesion layer 107 of a transfer material 103 is gradual, as shown in Fig. 9, the contact between a transfer layer 106 and the adhesion layer 107 in the peripheral portion 107a is unstable, and it is thus difficult to obtain a high-definition transfer image. The outline and jetting position of each droplet (of adhesive 107A) jetted as an inkjet droplet is shown by an alternate long and short dash line, and the outline of the adhesion layer 107 formed by the adhesive 107A jetted as inkjet droplets being fixed as an aggregate is shown by a solid line, on the transfer layer 106 in Fig. 9.

[0006] Meanwhile, when intending to form an adhesion layer from an aggregate of relatively small jetting droplets in order to solve the heretofore described problem, it is necessary to print by reducing an inkjet droplet jetting

amount, meaning that a problem may arise in that it is not possible to print at high speed.

SUMMARY OF THE INVENTION

[0007] The invention, having been contrived bearing in mind the heretofore described problems, has an object of providing a printing method whereby it is possible to speed up steps, and it is possible to obtain a high-definition transfer image.

[0008] As one embodiment, the problems are solved by kinds of solution disclosed below.

[0009] A printing method disclosed includes forming an adhesion layer using a printing whereby adhesive is inkjetted, in a pattern intended to be transferred, onto a transfer layer of a transfer material in which the transfer layer is provided on a base material, or onto a transferring medium; stacking and pressing so that the adhesion layer is sandwiched by the transfer material and transferring medium; and transferring the transfer layer to the transferring medium in the pattern intended to be transferred. When forming the adhesion layer, the jetting amount of the adhesive is switched between at least two or more stages. According to this, by switching the adhesive jetting amount, it is possible to carry out printing (jetting) with relatively large droplets when applying the adhesive over a large region, while it is possible to carry out printing (jetting) with relatively small droplets when applying the adhesive to other than the large region (particularly, to a peripheral portion). Consequently, it is possible to form the adhesion layer at high speed, and obtain a high-definition transfer image. Furthermore, it is also possible to easily carry out a control of the film thickness of the adhesion layer when adding the adhesive to a region in which the film thickness decreases.

[0010] Also, in the invention, it is preferable that, when forming the adhesion layer, the adhesive is printed on a peripheral portion of the adhesion layer in a smaller jetting amount than on other than the peripheral portion, and at closer jetting intervals than on other than the peripheral portion. According to this, by making the jetting intervals closer in the peripheral portion and thus increasing resolution, it is possible to form a high-definition adhesion layer at high speed. Inkjet droplets (the adhesive) may or may not be overprinted on the peripheral portion.

[0011] Also, in the invention, it is preferable that, when forming the adhesion layer, the adhesive is printed in plural batches on the peripheral portion of the adhesion layer, and second and subsequent printings are carried out over a region on which a first printing has been carried out. According to this, by carrying out the second and subsequent printings over a peripheral portion of a pattern intended to be transferred, on which the first printing has been carried out, the film thickness of an adhesion layer interface increases, and it is thus possible to realize a stable transfer at an adhesion layer boundary too.

[0012] Also, in the invention, it is preferable that, when forming the adhesion layer, the adhesive is printed in

plural batches on the peripheral portion of the adhesion layer, and the second and subsequent printings are carried out, with an adhesive jetting amount smaller than that in the first printing, over the region on which the first printing has been carried out. According to this, by printing (jetting) the adhesive as relatively large droplets in the first printing, and printing (jetting) the adhesive as relatively small droplets, that is, droplets smaller than those in the first printing, on the peripheral portion of the pattern intended to be transferred, the incline of the adhesion layer interface increases, and it is thus possible to realize a stable transfer at the adhesion layer boundary too.

[0013] Also, in the invention, it is preferable that, when forming the adhesion layer, adhesive to which a filler is added is used. According to this, it is possible to form an adhesion layer to which a filler is added. Consequently, a deformation of the adhesion layer when transferring is prevented, and it is thus possible to obtain a high-definition transfer image.

[0014] A transfer material disclosed is used in the heretofore described printing method. The adhesion layer, as well as being provided on the transfer layer, is formed from the adhesive jetted by switching between at least two or more stages. According to this, it is possible to realize a stable transfer at the adhesion layer boundary too, and thus possible to obtain a high-definition transfer image.

[0015] An inkjet discharge device disclosed, being used in the heretofore described printing method, includes an inkjet head which jets the adhesive as inkjet droplets; and a controller which controls the action of the inkjet head. The controller, when forming the adhesion layer, switches the adhesive jetting amount between at least two or more stages. According to this, as it is possible, when forming the adhesion layer, to switch the adhesive jetting amount between at least two or more stages, it is possible to form the adhesion layer at high speed, and it is possible to obtain a high-definition transfer image.

[0016] According to the printing method disclosed, it is possible to speed up the steps, and it is possible to obtain a high-definition transfer image.

BRIEF DESCRIPTION OF THE DRAWINGS

[0017]

Fig. 1 is a plan view (a schematic view) showing an example of an inkjet discharge device according to an embodiment of the invention;

Fig. 2 is a side view (a schematic view) of the inkjet discharge device of Fig. 1;

Fig. 3 is an explanatory diagram for explaining a printing method according to the embodiment of the invention;

Fig. 4 is an explanatory diagram for explaining the printing method according to the embodiment of the

invention;

Fig. 5 is an explanatory diagram for explaining the printing method according to the embodiment of the invention;

Fig. 6 is an explanatory diagram for explaining the printing method according to the embodiment of the invention;

Figs. 7A and 7B are partial enlarged views (a first embodiment) of Fig. 4;

Figs. 8A and 8B are partial enlarged views (a second embodiment) of Fig. 4; and

Fig. 9 is an explanatory diagram for explaining a problem in a printing method according to a heretofore known embodiment.

DETAILED DESCRIPTION OF THE EMBODIMENTS

[0018] Hereafter, referring to the drawings, a detailed description will be given of an embodiment of the invention. In all the drawings for describing the embodiment, the same reference numerals and signs will be given to members having the same functions, and a redundant description thereof may be omitted.

[0019] A printing method according to the embodiment is a printing method whereby, on a transfer layer of a transfer material or on a transferring medium, an adhesion layer is formed by a printing whereby adhesive is inkjetted in a pattern intended to be transferred (that is, onto a region intended to be transferred), and next, stacking and pressing is carried out so that the adhesion layer is sandwiched by the transfer material and transferring medium, thus transferring to the transferring medium the transfer layer within the pattern intended to be transferred (that is, within the region intended to be transferred).

Transfer Material

[0020] Firstly, a description will be given of a transfer material 3 according to the embodiment. The transfer material 3 has a transfer layer 6 provided on a base material 4 (refer to Figs. 3, 4, and the like). In the embodiment, a configuration is adopted wherein a release layer 5 is provided between the base material 4 and transfer layer 6, but a configuration is also conceivable wherein the release layer 5 is omitted.

[0021] Also, in the embodiment, a description will be given taking as an example a case in which an adhesion layer 7 is provided by a printing whereby adhesive (inkjet droplets, to be described hereafter) is inkjetted onto the transfer layer 6 of the transfer material 3 in a pattern intended to be transferred. A configuration may be adopted wherein an adhesion layer is provided by a printing whereby adhesive (inkjet droplets, to be described hereafter) is inkjetted onto a transferring medium 2 (to be described hereafter) in a pattern intended to be transferred (not shown).

[0022] The base material 4 is configured using a resin film, or the like, having flexibility. Although a constituent

material is not particularly limited, for example, a film resin material, such as a polyethylene series film, a polyester series film, an olefin series film, a polypropylene series film, or a polycarbonate film, or paper is used.

[0023] Also, the release layer 5 is formed stacked by a method such as coating, using a material having mold releasability, such as completely saponified polyvinyl alcohol, fluorine series resin, or silicon series resin. The release layer 5 is formed by, for example, diluting silicon resin with a solution and coating the base material 4 with the diluted silicon resin.

[0024] Also, the transfer layer 6 is configured of a metal foil, a metal deposited film, a hologram film, a pearl toned film, a rainbow-color film, a monochrome film, a color film, a clear film, or the like. The transfer layer 6 is formed stacked on the base material 4 by, for example, depositing a metal material, sputtering, or applying pigment or dye ink (in the embodiment, the transfer layer 6 is formed stacked on the base material 4 across the release layer 5). The transfer layer 6 formed from a metal foil or a metal deposited film, or the like, may be configured not solely, but combined with a plastic film, in order to increase the strength (not shown). Also, as a method of formation by ink application, an ink absorbing layer (not shown) may be provided on the transfer layer 6, and coloring (ink application) carried out on the ink absorbing layer.

[0025] As a modification example, it is conceivable that a configuration is adopted wherein a protective layer (not shown) is provided between the release layer 5 and transfer layer 6. According to this, as the transfer layer 6 after a transfer is protected by the protective layer, it is difficult for the front surface to be damaged, and it is thus possible to enhance durability against fingerprints, water, alcohol, ultraviolet rays, or the like. In particular, by using as the protective layer a clear film to which an ultraviolet absorber is added, it is possible to realize a clear coating having high light resistance, which has been difficult to realize with a heretofore known ultraviolet curable ink.

[0026] Herein, as adhesive used to form the adhesion layer 7, it is possible to use, for example, ink (to be described hereafter in detail). According to this, it is possible to form the adhesion layer 7 using a printing whereby adhesive (that is, ink) is inkjetted. The adhesion layer 7 performs an action of adhering to the transferring medium 2 by being heated and pressed.

[0027] As a modification example, it is conceivable that a configuration is adopted wherein the adhesion layer 7 is stacked on a protective layer (not shown) across the transfer layer 6. According to this, a colored portion of the transfer layer 6 can be protected by the protective layer.

Transferring Medium

[0028] Next, a description will be given of the transferring medium 2 according to the embodiment. The transferring medium 2 is, for example, any kind of plastic molding (including a film, a plate, or the like), a metal, glass,

stone, or cloth. As the transferring medium 2, it is possible to use one either with or without flexibility in this way. It is preferable that at least one of the transferring medium 2 and transfer material 3 has flexibility. The reason is that this leads to higher adhesion when transferring.

[0029] By carrying out transfer printing on the transferring medium 2 using the transfer material 3, it is possible to optimally carry out the following printing which has heretofore been impossible or difficult. Specifically, it is possible to decorate a plastics molding, a metal, glass, stone, cloth, or the like. Also, printing using color out of which it is difficult to make inkjet printing ink, such as high gloss metallic, pearl, rainbow color, phosphorescent, luminescent, or retroreflective printing, is possible. Also, it is possible to carry out a printed wiring or antenna formation using a copper foil.

[0030] In the embodiment, a case in which the adhesion layer 7 is provided by printing adhesive 7A on the transfer layer 6 of the transfer material 3 is taken as an example, as previously described, but it is also conceivable that a configuration is adopted wherein an adhesion layer is provided by printing adhesive on the transferring medium 2 (not shown). As there is no more need to exactly align the transfer material 3 and transferring medium 2 when providing an adhesion layer on the transferring medium 2, in comparison with when providing an adhesion layer on the transfer material 3, it is possible to obtain the advantage of being able to simplify steps.

Inkjet Discharge Device

[0031] Next, a description will be given of an inkjet discharge device 1 used when forming the adhesion layer 7 of the transfer material 3. Fig. 1 is a plan view showing an example of the inkjet discharge device 1 according to the embodiment, and Fig. 2 is a side view (a schematic diagram) thereof.

[0032] The inkjet discharge device 1 of the invention includes a platen (a support body) 12 which supports a discharging medium (herein, the transfer material 3), an inkjet head 13 which jets ink from plural discharge orifices while moving in an X direction, causing inkjet droplets to land on the front surface of the transfer material 3 (herein, the front surface of the transfer layer 6), and a controller (not shown) which controls the action of each unit.

[0033] Herein, the inkjet head 13, having a structure wherein inkjet droplets are jetted by a piezoelectric method, or the like, from nozzles (not shown) arranged in alignment in the lower surface of the inkjet head 13, is fixed to a unit mount 14, and can be scanned in the X direction along a guide rail 15 by a scanning unit (not shown). The scanning unit is configured of an electric motor, an electronic circuit, and the like. However, the scanning unit is not limited to the heretofore mentioned configuration.

[0034] Also, reference numeral 16 in the drawing is an ink droplet curing unit used as necessary, which can cure inkjet droplets. The ink droplet curing unit is configured using an energy beam radiation device such as, for ex-

ample, an infrared heater, a hot air heater, an ultraviolet irradiation unit, or an electron beam irradiation unit.

[0035] Also, reference numeral 17 in the drawing is a printing heater which heats inkjet droplets, caused to land on the front surface of the transfer material 3, from the rear surface side of the transfer material 3. As the printing heater 17, it is possible to use an electrical heater, an infrared heater, or an electromagnetic induction (IH) heater.

[0036] The printing heater 17, being inside the platen 12, is disposed on the rear surface side of the transfer material 3. However, the printing heater 17, not being limited to this disposition, may be disposed on the front surface side of the transfer material 3 (the upper surface side of the adhesion layer 7) or one on each of the two sides (not shown).

[0037] Meanwhile, when providing a printing heater on the front surface side of the transfer material 3, the printing heater can be put on the same guide rail 15 as that of the inkjet head 13 or in a position fixed toward a Y direction (platen conveyance direction) front in a condition in which the printing heater is separated from the guide rail 15.

[0038] When providing a printing heater on the same guide rail as that of the inkjet head 13, and when carrying out a unidirectional printing, the printing heater is installed toward a scanning direction rear of the inkjet head 13 (not shown). More particularly, when discharging ink while scanning the inkjet head 13 to an X direction right side, the printing heater is installed on the left side of the inkjet head 13, while when discharging ink while scanning the inkjet head 13 to an X direction left side, the printing heater is installed on the right side of the inkjet head 13. Furthermore, when carrying out a bidirectional printing, the printing heater is installed toward each of the scanning direction front and rear of the inkjet head 13, that is, on each of the left and right sides of the inkjet head 13.

[0039] As an action example of the inkjet discharge device 1, the transfer material 3 (herein, in a condition in which the release layer 5 and transfer layer 6 are stacked on the base material 4), as well as being supported by the platen 12, is sandwiched by conveying rollers 18 and 18, and conveyed in the Y direction by the conveying rollers 18 and 18 rotating at the same time the inkjet head 13 finishes scanning from one end to the other end of the transfer material 3 in the X direction while jetting inkjet droplets (herein, adhesive). In this case, a resin material having flexibility, such as a polyethylene series film, is preferably used for the base material 4 of the transfer material 3.

[0040] As heretofore described, according to the inkjet discharge device 1 according to the embodiment, it is possible to form the adhesion layer 7 using a printing whereby adhesive is inkjetted as inkjet droplets. More specifically, firstly, inkjet droplets (adhesive) are jetted from the inkjet head 13 onto the front surface of the transfer material 3 (herein, in a condition in which the release layer 5 and transfer layer 6 are stacked on the base ma-

terial 4) supported on the platen (support body) 12. Next, inkjet droplets (adhesive) caused to land on the front surface of the transfer material 3 are heated as necessary by the printing heater 17 positioned on the rear surface side of the transfer material 3, and the inkjet droplets are cured and fixed on the transfer layer 6 as the adhesion layer 7. By so doing, it is possible to form the transfer material 3 provided with the adhesion layer 7 in a desired pattern intended to be transferred. By using the inkjet discharge device 1, it is possible to form the adhesion layer 7 at high speed. That is, it is possible to speed up the step of forming the transfer material 3 having a desired image to be transferred (to be described hereafter in detail). It is also possible to provide an adhesion layer by printing adhesive on the transferring medium 2, as previously described.

Ink

[0041] Next, a description will be given of ink used as an example of adhesive forming the adhesion layer 7 of the transfer material 3. As the ink, ink which can be inkjet printed on the transfer material 3 (or the transferring medium 2), and which, after being fixed by carrying out jet application to (jet printing on) the transfer material 3 (or the transferring medium 2), maintains predetermined viscosity even when heated and pressed in order to be transferred, is preferable. For example, latex ink in which natural rubber latex or synthetic rubber latex is used, thermosetting resin, dry-curable resin, resin cured by a radiant energy beam such as an ultraviolet beam or an electron beam, or ink wherein any of the resins is emulsified, is preferable. However, the ink is not limited to these.

[0042] It is also conceivable that a configuration is adopted wherein a filler (not shown) is mixed in adhesive. According to this, it is possible to obtain the advantage of suppressing a deformation of the adhesion layer 7 when the adhesive is heated and pressed in order to be transferred. In particular, by a deformation of a peripheral portion 7a (to be described hereafter) of the adhesion layer 7 being suppressed, the contact between the transfer layer 6 and adhesion layer 7 in the peripheral portion 7a is stabilized, and it is thus possible to obtain a high-definition transfer image. Herein, as the filler, it is preferable to use powder, which is insusceptible to heat and can be inkjet printed, having a particle size of, for example, in the order of 1.0 μm or less in diameter. Specifically, a configuration is conceivable wherein powder of titanium oxide, zinc oxide, hollow silica, hollow glass, talc, silica, alumina, zeolite, kaolinite, or the like, is used.

Printing Method According to First Embodiment

[0043] Next, a description will be given of a printing method according to a first embodiment of the invention.

[0044] Firstly, the transfer material 3 is prepared. As shown in Fig. 3, in this step, the transfer material 3 is

used in a condition in which the release layer 5 and transfer layer 6 are stacked on the base material 4. As the material, forming method, and the like, of each layer are as previously described, a redundant description is omitted.

[0045] Next, as shown in Fig. 4, the adhesion layer 7 is formed, by inkjet printing, in a pattern intended to be transferred, that is, on the transfer material 3 transfer layer 6 within the region intended to be transferred. The inkjet printing is carried out using the inkjet discharge device 1. As the action of forming the adhesion layer 7 on the transfer material 3 (herein, the transfer layer 6) using the inkjet discharge device 1 is as previously described, a redundant description is omitted.

[0046] Next, as shown in Fig. 5, the transfer material 3 is pressed against the transferring medium 2 from the adhesion layer 7 side, and heating is carried out. Conditions such as a heating temperature, a pressing force, a pressing time period, and the like, are appropriately set in accordance with the configuration, or the like, of the transfer material 3. The heating temperature is, for example, in the order of 80 to 300°C.

[0047] Next, the transferring medium 2 and the transfer material 3 are separated, as shown in Fig. 6. At this time, only a region (the region intended to be transferred) in which the adhesion layer 7 is provided adheres to the transferring medium 2, and the transfer layer 6 separates from the release layer 5 at a boundary between the two in the region. That is, the transfer layer 6 within the region intended to be transferred is transferred, thus obtaining the transferring medium 2 which the desired pattern (the pattern intended to be transferred) is printed on (transferred to).

[0048] In particular, the printing method according to this embodiment includes a characteristic configuration in the step of forming the adhesion layer 7 shown in Fig. 4. More specifically, the printing method includes a configuration wherein an adhesive (inkjet droplet) jetting amount is switched between at least two or more stages when forming the adhesion layer 7. For example, printing of adhesive is carried out in plural batches on the peripheral portion 7a of the adhesion layer 7.

[0049] In the case of this embodiment, a partial enlarged view of Fig. 4 showing the step of forming the adhesion layer 7 is as in Fig. 7A. Herein, Fig. 7B is an explanatory diagram of the adhesive jetting amount and position in Fig. 7A seen from a planar direction, and an X-X section in Fig. 7B corresponds to Fig. 7A.

[0050] As shown in Figs. 7A and 7B, firstly, a first printing is carried out by jetting the adhesive 7A. Next, a second printing is carried out by jetting adhesive 7B onto the peripheral portion 7a. Herein, the outline and jetting position of each droplet (the adhesive 7A) jetted as an inkjet droplet is shown by a chain double-dashed line, and the outline of the adhesion layer 7 formed by the adhesive 7A jetted as inkjet droplets being fixed as an aggregate is shown by a solid line, on the transfer layer 6 in Figs. 7A and 7B. The broken line in Fig. 7A, indicating a bound-

ary 107b and incline α formed by a heretofore known printing method (refer to Fig. 9), is drawn in order to compare with the printing method according to this embodiment.

[0051] At this time, the jetting amount of the adhesive 7B is set to be relatively smaller than the jetting amount of the adhesive 7A jetted in the first printing. Also, the second printing is carried out over a first printing region in the peripheral portion 7a, as in Figs. 7A and 7B.

[0052] Herein, the heretofore mentioned "jetting amount" indicates a jetting amount per spot (per dot). As the method of setting the jetting amount of the adhesive 7B in the second printing to be relatively smaller than the jetting amount of the adhesive 7A in the first printing, for example, a method is conceivable whereby the inkjet droplet jetting amount of the adhesive 7A with which printing is carried out on other than the peripheral portion 7a is set to be large (for example, 24p1), and the inkjet droplet jetting amount of the adhesive 7B with which printing is carried out on the peripheral portion 7a is set to be small (for example, 6p1), as shown in Figs. 7A and 7B.

[0053] Also, at this time, it is preferable that the adhesive 7B with which printing is carried out on the peripheral portion 7a is printed (jetted) at closer jetting intervals than the adhesive 7A with which printing is carried out on other than the peripheral portion 7a, as shown in Fig. 7B. The reason for this is that, by making the jetting intervals closer and thus increasing resolution, it is possible to form a high-definition adhesion layer 7.

[0054] According to the above, it is possible to form an incline β of an interface 7b of the predetermined peripheral portion 7a of the adhesion layer 7 so as to be larger than the incline α formed by the heretofore known printing method (that is, so as to be close to perpendicular to the front surface of the transfer layer 6), as shown in Fig. 7A. As a result of this, it is possible to solve a heretofore known problem, that is, a problem in that, as the incline of the interface of a peripheral portion is gradual, the contact between a transfer layer and an adhesion layer in the peripheral portion is unstable, and it is thus difficult to obtain a high-definition transfer image. More specifically, as the incline β of the interface 7b of the predetermined peripheral portion 7a of the adhesion layer 7 is close to perpendicular to the front surface of the transfer layer 6, the contact between the transfer layer 6 and adhesion layer 7 is stable, so that the transfer layer 6 can be separated from the base material 4 as intended, and it is thus possible to accurately reproduce a pattern. At the same time, a printing speed, that is, the speed of formation of the adhesion layer 7 by jetting inkjet droplets (the adhesive 7B) decreases relatively in the predetermined peripheral portion 7a of the adhesion layer 7 but, as it is possible to carry out a formation of the adhesion layer 7 by jetting inkjet droplets (the adhesive 7A) at a normal printing speed, it is possible to solve the previously described problem, that is, a problem in that it is not possible to print at high speed because it is necessary to print by reducing an inkjet droplet jetting amount when

intending to form an adhesion layer from an aggregate of relatively small jetting droplets.

[0055] As a modification example, a method is also conceivable whereby, when printing adhesive in plural batches on the peripheral portion 7a of the adhesion layer 7, and carrying out the second and subsequent printings over the region on which the first printing has been carried out, the jetting amount of adhesive is made smaller in the first printing than in the second and subsequent printings. The method is, for example, to first jet (print) the adhesive 7B with a relatively small jetting amount in Figs. 7A and 7B, and next jet (print) the adhesive 7A with a relatively large jetting amount. In this way too, it is possible to obtain advantages the same as previously described.

[0056] Also, a description has been given taking a case of "two" as an example of "plural batches", but the plural batches, not being limited to "two", may be taken to be "three" or more. In this case, it is sufficient, for example, to repeat the heretofore described second step.

[0057] According to the printing method of this embodiment, in particular, it is possible to form the adhesion layer 7 at high speed, and thus possible to obtain a high-definition transfer image. Furthermore, the following kind of printing (transfer printing) which has heretofore been impossible or difficult is possible. Specifically, it is possible to realize a high-gloss metallic printing, hologram printing, pearl, rainbow color, phosphorescent, luminescent, or retroreflective printing, ultrahigh lightfastness clear coat printing, a high-precision electrode formation on a printed substrate by printing, or the like.

Printing Method According to Second Embodiment

[0058] Next, a description will be given of a printing method according to a second embodiment of the invention.

[0059] The basic configuration of the printing method according to the second embodiment is the same as that of the printing method according to the first embodiment, but has a differing point particularly in the step of forming the adhesion layer 7. Hereafter, a description will be given of this embodiment, focusing on the differing point.

[0060] In the case of this embodiment, a partial enlarged view of Fig. 4 showing the step of forming the adhesion layer 7 is as in Fig. 8A. Herein, Fig. 8B is an explanatory diagram of the adhesive jetting amount and position in Fig. 8A seen from a planar direction, and a Y-Y section in Fig. 8B corresponds to Fig. 8A.

[0061] In this embodiment, as shown in Figs. 8A and 8B, firstly, a first printing is carried out by jetting the adhesive 7A. Next, a second printing is carried out by jetting the adhesive 7B over a first printing region in the peripheral portion 7a. Furthermore, a third printing is carried out by jetting adhesive 7C over a second printing region in the peripheral portion 7a. Herein, the outline and jetting position of each droplet (the adhesive 7A) jetted as an inkjet droplet is shown by a chain triple-dashed line, and

the outline of the adhesion layer 7 formed by the adhesive 7A jetted as inkjet droplets being fixed as an aggregate is shown by a solid line, on the transfer layer 6 in Figs. 8A and 8B. The broken line in Fig. 8A, indicating the boundary 107b and incline α formed by the heretofore known printing method (refer to Fig. 9), is drawn in order to compare with the printing method according to this embodiment.

[0062] At this time, the jetting amounts of the adhesive 7B and adhesive 7C are set to be relatively smaller than the jetting amount of the adhesive 7A jetted in the first printing. Also, the second and third printings are carried out over the first printing region in the peripheral portion 7a, as in Figs. 8A and 8B.

[0063] For example, the jetting amounts of the adhesive 7B with which the second printing is carried out and the adhesive 7C with which the third printing is carried out are set to be the same. It is possible to carry out a printing control of the inkjet discharge device 1, for example, in order to additionally print the same dots. Specifically, a configuration is conceivable wherein the inkjet droplet jetting amount of the adhesive 7A with which printing is carried out on other than the peripheral portion 7a is set to be large (for example, 24p1), and the inkjet droplet jetting amount of the adhesive 7B and adhesive 7C with which printing is carried out on the peripheral portion 7a is set to be small (for example, 6p1).

[0064] Also, at this time, it is preferable that the adhesive 7B with which printing is carried out on the peripheral portion 7a is printed (jetted) at closer jetting intervals than the adhesive 7A with which printing is carried out on other than the peripheral portion 7a, as shown in Fig. 8B. The reason for this is that, by making the jetting intervals closer and thus increasing resolution, it is possible to form a high-definition adhesion layer 7.

[0065] According to the above, for example, as shown in Fig. 8A, it is possible to form the predetermined peripheral portion 7a of the adhesion layer 7 in a protuberant form. As a result of this, it is possible to bring the adhesion layer 7 and transfer layer 6 into reliable contact, particularly, in the peripheral portion 7a, and it is thus possible to secure an adhesion force enough to cause the transfer layer 6 to become detached. However, the form of the adhesion layer 7 is not limited to a form in which the predetermined peripheral portion 7a is protuberant, and it is also possible to form the adhesion layer 7 in a form in which the peripheral portion 7a is not protuberant (refer to Fig. 7A), in the same way as in the first embodiment.

[0066] Whether adopting the form in which the peripheral portion 7a is protuberant or the form in which it is not protuberant, it is possible to form an incline β of an interface 7b of the predetermined peripheral portion 7a of the adhesion layer 7 so as to be larger than the incline α formed by the heretofore known printing method (that is, so as to be close to perpendicular to the front surface of the transfer layer 6), in the same way as in the first embodiment.

[0067] As other operational advantages obtained by

the printing method according to this embodiment are basically the same as the operational advantages obtained by the printing method according to the first embodiment, a redundant description is omitted.

[0068] A description has been given taking a case of "three" as an example of "plural batches", but the plural batches, not being limited to "three", may be taken to be "two" or "four" or more. For example, in the case of "four" or more, it is sufficient to repeat the heretofore described second or third step.

[0069] As heretofore described, according to the disclosed printing method, as it is possible to speed up the steps (in particular, to speed up the adhesion layer formation step) in comparison with the heretofore known printing method, it is possible to obtain a high-definition transfer image particularly sharp in the peripheral portion (boundary portion) of a transfer region. Furthermore, it is possible to optimally carry out the following printing which has heretofore been impossible or difficult. That is, it is possible to decorate a plastics molding, a metal, glass, stone, cloth, or the like. Also, printing using color out of which it is difficult to make inkjet printing ink, such as high-gloss metallic, pearl, rainbow color, phosphorescent, luminescent, or retroreflective printing, is possible. Also, it is possible to carry out a fine printed wiring and antenna formation using a copper foil.

[0070] Also, in particular, the following characteristic operational advantages are achieved by the embodiments.

[0071] A printing method includes forming an adhesion layer 7 using a printing whereby adhesive is inkjetted, in a pattern intended to be transferred, onto a transfer layer 6 of a transfer material 3 in which the transfer layer 6 is provided on a base material 4, or onto a transferring medium 2; stacking and pressing so that the adhesion layer 7 is sandwiched by the transfer material 3 and transferring medium 2; and transferring the transfer layer 6 to the transferring medium 2 in the pattern intended to be transferred. When forming the adhesion layer 7, at least one of an adhesive jetting amount and jetting interval is switched between at least two or more stages. According to this, by switching the adhesive jetting amount, it is possible to carry out printing (jetting) with relatively large droplets when applying the adhesive over a large region, while it is possible to carry out printing (jetting) with relatively small droplets when applying the adhesive to other than the large region (particularly, to a peripheral portion). Consequently, it is possible to form the adhesion layer 7 at high speed, and obtain a high-definition transfer image. Furthermore, it is also possible to easily carry out a control of the film thickness of the adhesion layer 7 when adding the adhesive to a region in which the film thickness decreases.

[0072] Also, it is preferable that, when forming the adhesion layer 7, the adhesive is printed on a peripheral portion 7a of the adhesion layer 7 in a smaller jetting amount than on other than the peripheral portion 7a, and at closer jetting intervals than on other than the peripheral

portion 7a. According to this, by making the jetting intervals closer in the peripheral portion 7a and thus increasing resolution, it is possible to form a high-definition adhesion layer 7 at high speed. Inkjet droplets (the adhesive) may or may not be overprinted on the peripheral portion 7a.

[0073] Also, when forming the adhesion layer 7, the adhesive is printed in plural batches on the peripheral portion 7a of the adhesion layer 7, and second and subsequent printings are carried out over a region on which a first printing has been carried out. According to this, by carrying out the second and subsequent printings over the peripheral portion of the pattern intended to be transferred, on which the first printing has been carried out, the film thickness of the peripheral portion 7a (particularly, an interface 7b) of the adhesion layer 7 increases, and it is thus possible to realize a stable transfer in a boundary portion of the adhesion layer 7 too.

[0074] Also, when forming the adhesion layer 7, the adhesive is printed in plural batches on the peripheral portion 7a of the adhesion layer 7, and the second and subsequent printings are carried out, with an adhesive jetting amount smaller than that in the first printing, over the region on which the first printing has been carried out. According to this, by printing (jetting) the adhesive as relatively large droplets in the first printing, and printing (jetting) the adhesive as relatively small droplets, that is, droplets smaller than those in the first printing, on the peripheral portion of the pattern intended to be transferred, the incline of the interface 7b of the adhesion layer 7 increases, and it is thus possible to realize a stable transfer in the boundary portion of the adhesion layer 7 too.

[0075] Also, it is preferable that, when forming the adhesion layer 7, adhesive to which a filler is added is used. The reason for this is that, by forming an adhesion layer 7 to which a filler is added, a deformation of the adhesion layer 7 when transferring is prevented, and it is thus possible to obtain a high-definition transfer image.

[0076] A transfer material 3 is used in the printing method. The adhesion layer 7, as well as being provided on the transfer layer 6, is formed from the adhesive jetted by switching between at least two or more stages. According to this, it is possible to realize a stable transfer in the boundary portion of the adhesion layer 7 too, and thus possible to obtain a high-definition transfer image.

[0077] An inkjet discharge device 1, being used in the heretofore described printing method, includes an inkjet head 13 which jets the adhesive as inkjet droplets; and a controller which controls the action of the inkjet head 13. The controller, when forming the adhesion layer 7, switches the adhesive jetting amount between at least two or more stages. According to this, as it is possible, when forming the adhesion layer 7, to switch the adhesive jetting amount between at least two or more stages, it is possible to form the adhesion layer 7 at high speed, and it is possible to obtain a high-definition transfer image.

[0078] It goes without saying that the invention, not be-

ing limited to the heretofore described embodiments, can be variously changed without departing from the scope of the invention.

Claims

1. A printing method, comprising:

forming an adhesion layer using a printing whereby adhesive is inkjetted, in a pattern intended to be transferred, onto a transfer layer of a transfer material in which the transfer layer is provided on a base material, or onto a transferring medium;

stacking and pressing so that the adhesion layer is sandwiched by the transfer material and transferring medium; and

transferring the transfer layer to the transferring medium in the pattern intended to be transferred, wherein

when forming the adhesion layer, at least one of an adhesive jetting amount and jetting interval is switched between at least two or more stages.

2. The printing method according to claim 1, wherein when forming the adhesion layer, the adhesive is printed on a peripheral portion of the adhesion layer in a smaller jetting amount than on other than the peripheral portion, and at closer jetting intervals than on other than the peripheral portion.

3. The printing method according to claim 1, wherein when forming the adhesion layer, the adhesive is printed in a plurality of batches on the peripheral portion of the adhesion layer, and second and subsequent printings are carried out over a region on which a first printing has been carried out.

4. The printing method according to claim 3, wherein when forming the adhesion layer, the adhesive is printed in a plurality of batches on the peripheral portion of the adhesion layer, and the second and subsequent printings are carried out, with an adhesive jetting amount smaller than that in the first printing, over the region on which the first printing has been carried out.

5. The printing method according to any one of claims 1 to 4, wherein when forming the adhesion layer, adhesive to which a filler is added is used.

6. A transfer material used in the printing method according to any one of claims 1 to 4, wherein the adhesion layer, as well as being provided on the transfer layer, is formed from the adhesive jetted by switching between at least two or more stages.

7. An inkjet discharge device used in the printing method according to any one of claims 1 to 4, comprising:

an inkjet head which jets the adhesive as inkjet droplets; and

a controller which controls the action of the inkjet head, wherein

the controller, when forming the adhesion layer, switches the adhesive jetting amount between at least two or more stages.

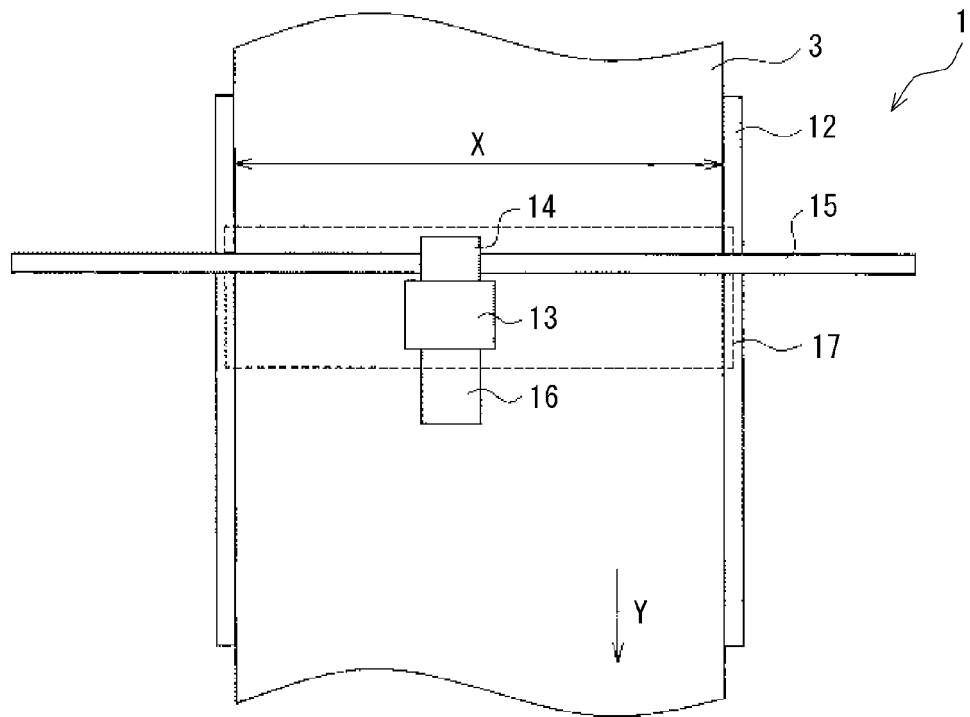


Fig. 1

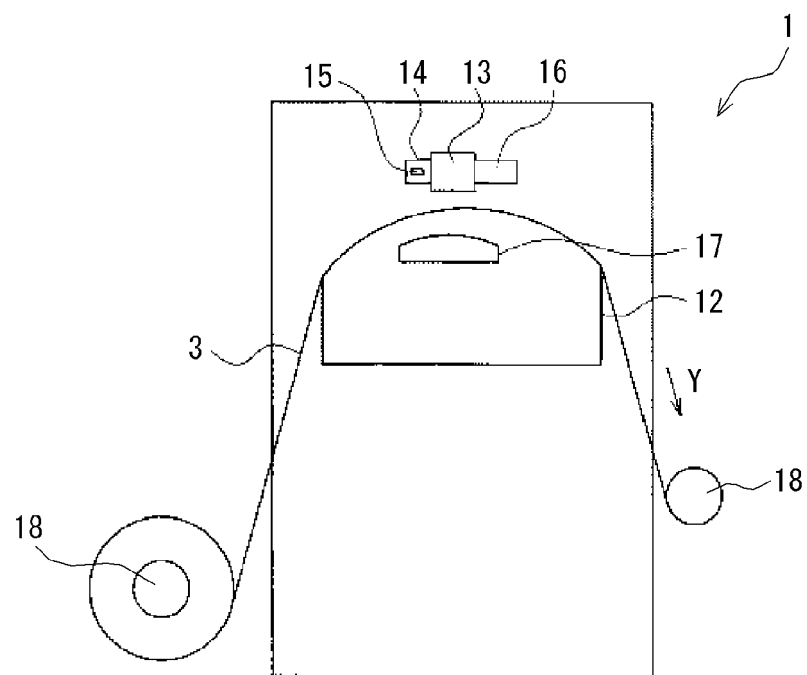


Fig.2

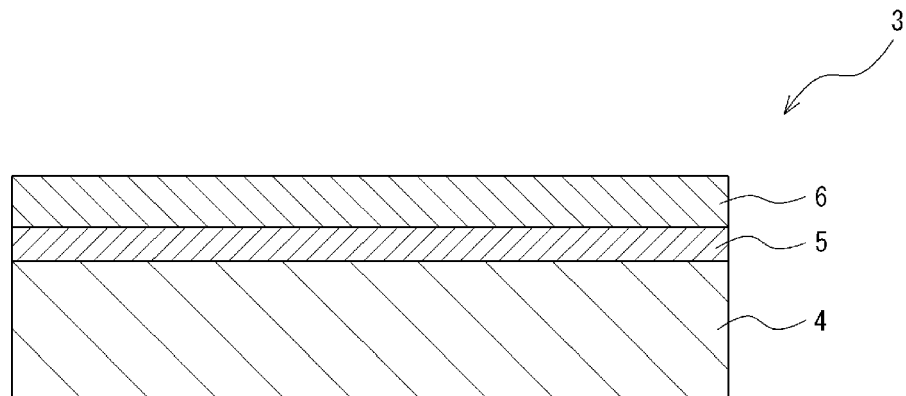


Fig. 3

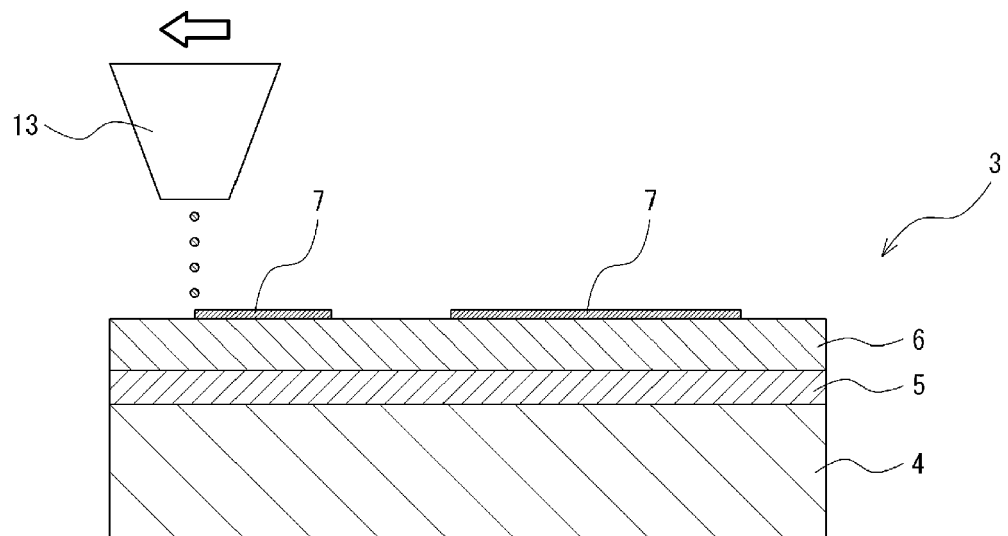


Fig. 4

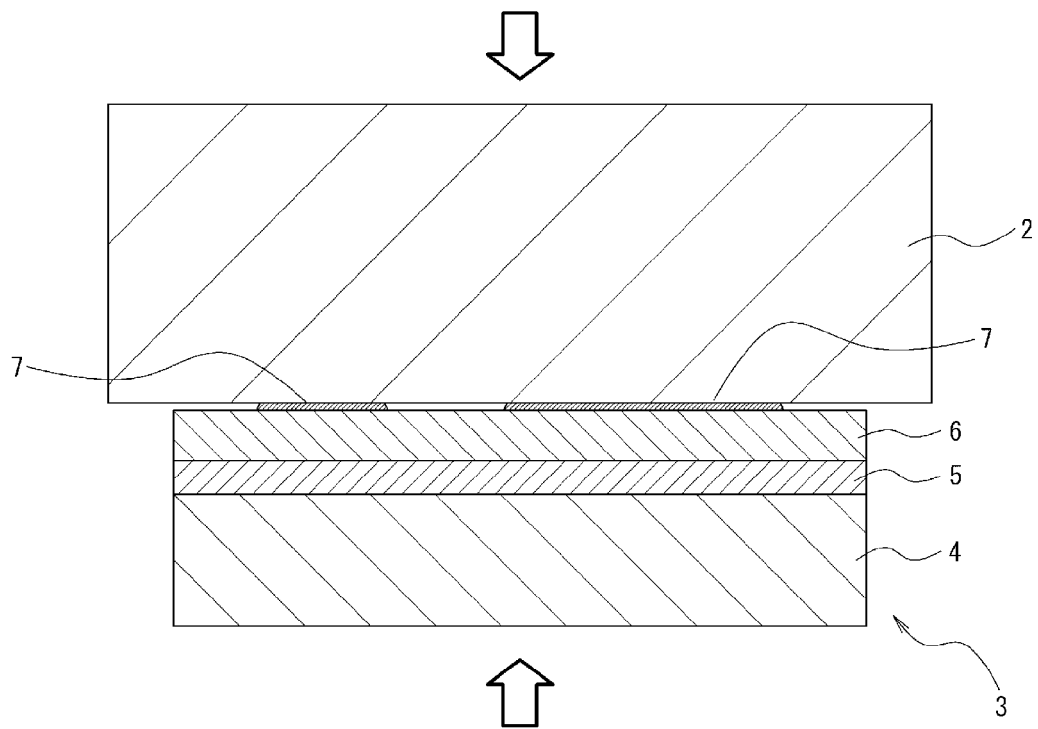


Fig. 5

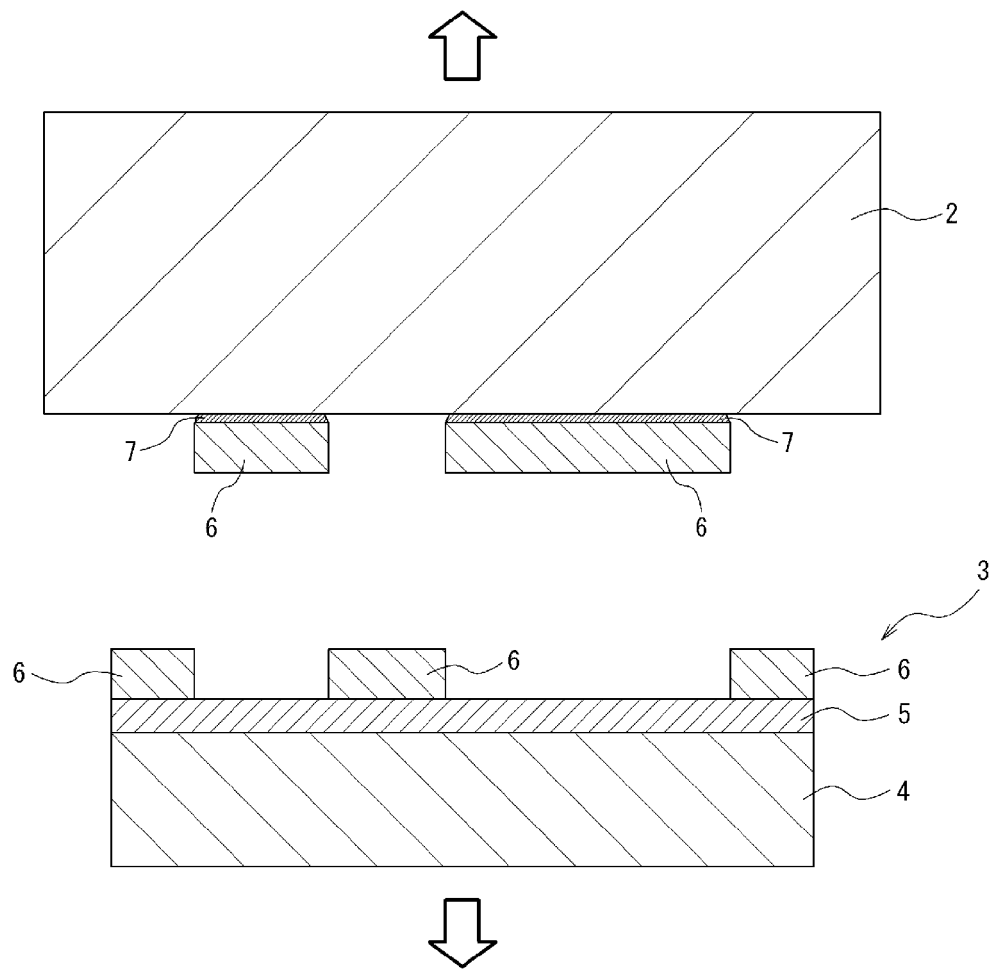
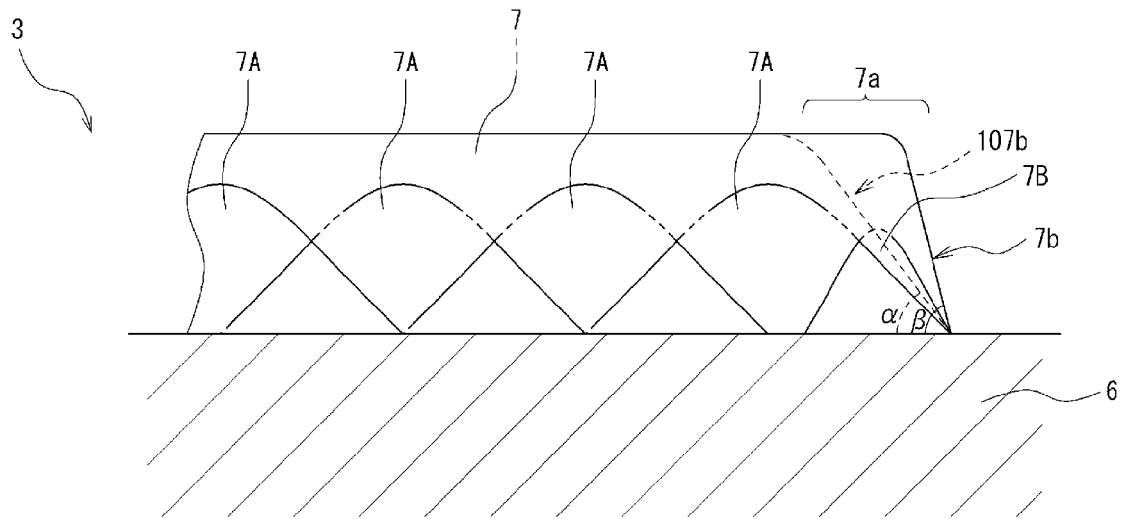


Fig. 6

(a) X-X



(b)

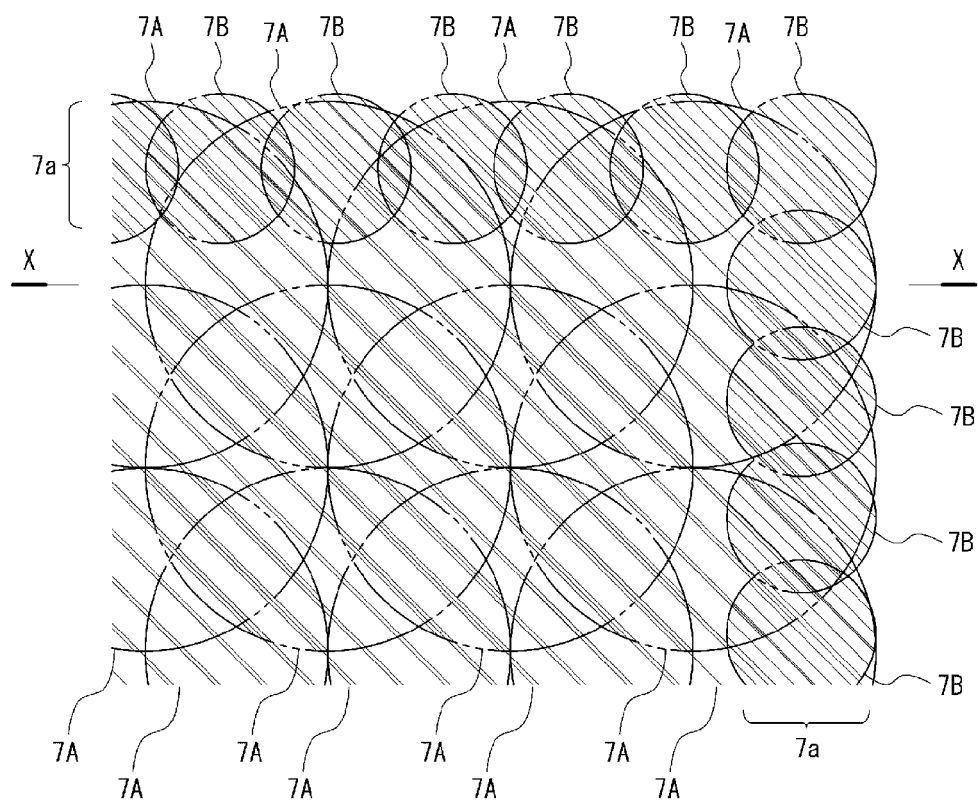
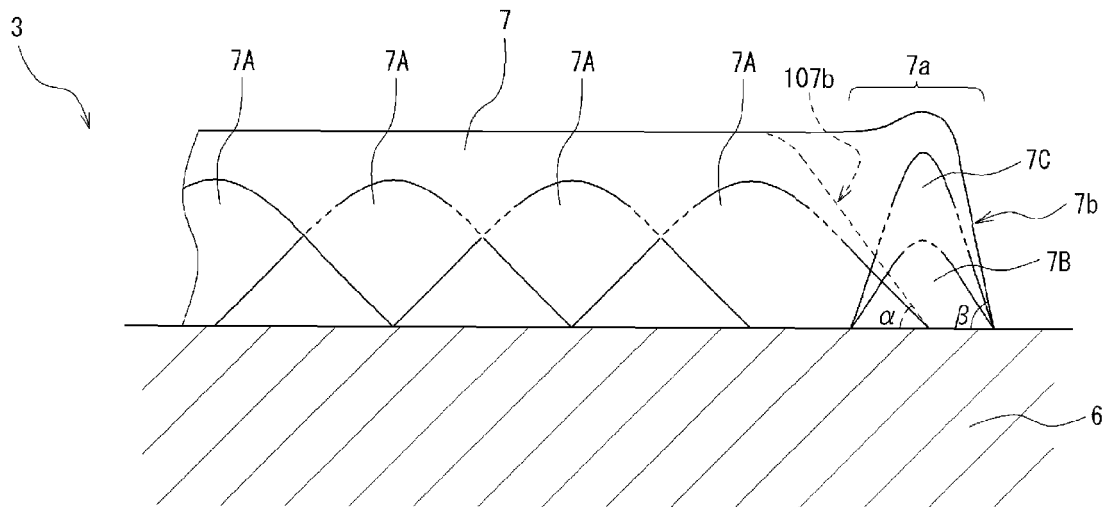


Fig. 7

(a) Y-Y



(b)

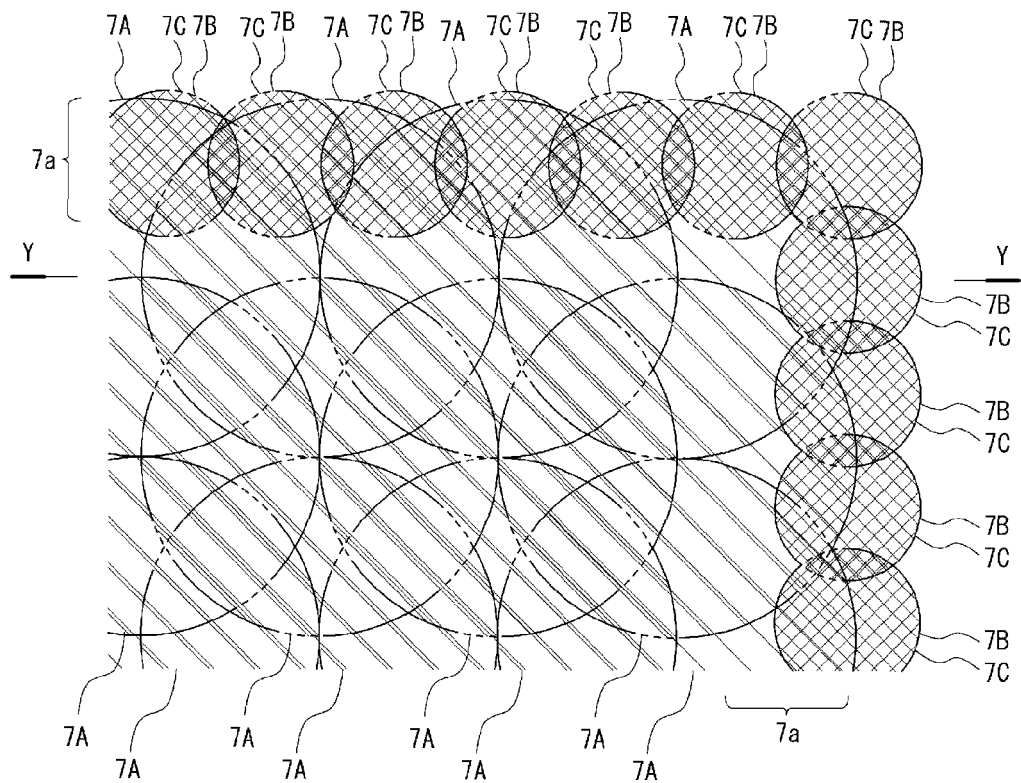


Fig. 8

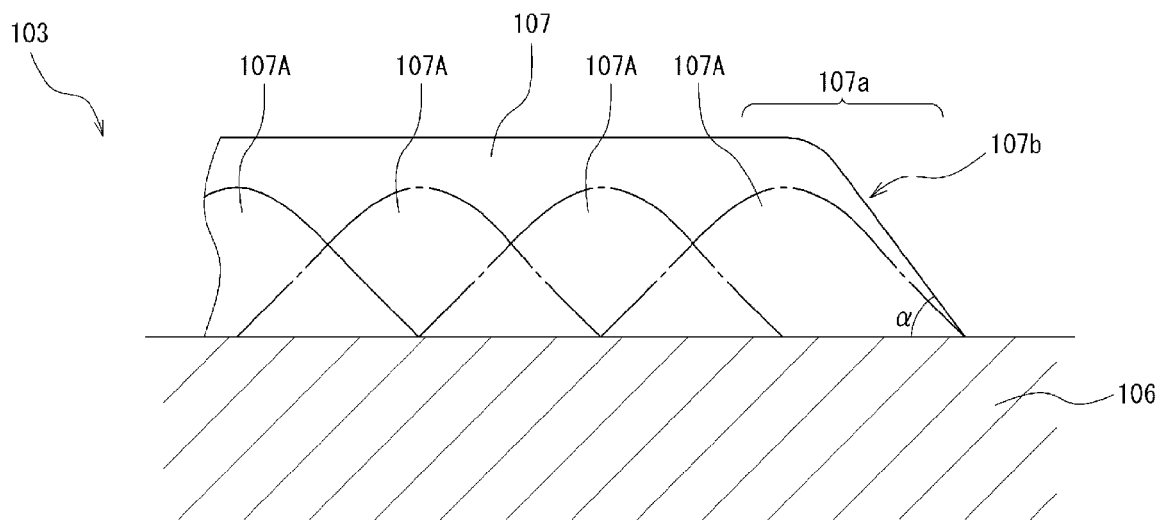


Fig. 9

REFERENCES CITED IN THE DESCRIPTION

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