(19) Europäisches Patentamt
European Patent Office
Office européen des brevets

(11) **EP 4 166 342 A1**

(12) **EUROPEAN PATENT APPLICATION**

(43) Date of publication:
19.04.2023 Bulletin 2023/16

(21) Application number: **22193027.4**

(22) Date of filing: **31.08.2022**

(51) International Patent Classification (IPC):
B41J 3/407 *(2006.01)* ***B41J 2/005*** *(2006.01)*
B41J 11/00 *(2006.01)* ***B41M 5/00*** *(2006.01)*
B41J 15/06 *(2006.01)*

(52) Cooperative Patent Classification (CPC):
B41J 3/4078; B41J 2/0057; B41J 11/0015; B41M 5/0017; B41J 15/06

(84) Designated Contracting States:
AL AT BE BG CH CY CZ DE DK EE ES FI FR GB GR HR HU IE IS IT LI LT LU LV MC MK MT NL NO PL PT RO RS SE SI SK SM TR
Designated Extension States:
BA ME
Designated Validation States:
KH MA MD TN

(30) Priority: **18.10.2021 JP 2021170175**

(71) Applicant: **KONICA MINOLTA, INC.**
Tokyo 100-7015 (JP)

(72) Inventor: **Matsui, Yasuhiro**
Tokyo, 100-7015 (JP)

(74) Representative: **Gille Hrabal**
Partnerschaftsgesellschaft mbB
Patentanwälte
Brucknerstraße 20
40593 Düsseldorf (DE)

(54) **TRANSFER DEVICE AND TRANSFER METHOD THEREOF, AND PRETREATMENT DEVICE AND PRETREATMENT METHOD THEREOF**

(57) Provided is a transfer device equipped with a conveying section, a pretreatment section and a transfer section, wherein the conveying section conveys a fabric to the transfer section; the pretreatment section supplies a pretreatment liquid to one side of the fabric; the transfer section is located downstream of the pretreatment section in a conveying direction of the conveying section; and an image on a transfer medium is transferred to the fabric by pressing and heating a surface of the fabric supplied with the pretreatment liquid by the pretreatment section and the transfer medium.

EP 4 166 342 A1

Description

BACKGROUND

Technological Field

[0001] The present invention relates to a transfer device and a transfer method thereof, and to a pretreatment device and a pretreatment method thereof. More specifically, the present invention relates to a transfer device which is capable of shortening the drying time of the pretreatment liquid and improve the transfer rate and a transfer method thereof, and the present invention relates to a pretreatment device which is detachable from the transfer device and a pretreatment method thereof.

Description of the Related Art

[0002] As a method of forming an image on a fabric, it is known a transfer textile printing method, in which an image is formed on a transfer medium and then the image on the transfer medium is transferred to the fabric. Among them, the transfer textile printing method using a sublimation dye (sublimation transfer method) has been widely used in recent years because of its good dyeability (dye density and dye fastness) of the resulting products and its ability to reduce environmental load.

[0003] The sublimation transfer method, for example, is a method in which a sublimation dye is used to form an image on a transfer medium with an inkjet method, and then the transfer medium and a fabric are pressed together and heated to fix the vaporized sublimation dye on the fabric.

[0004] The sublimation dyes used are disperse dyes, which themselves are not soluble in water, but are soluble in water when mixed with a dispersant. Dispersed dyes are dyed by diffusion of dye molecules into the interior of fibers through gaps in amorphous portions of the fibers, and the dye molecules and the fiber molecules are bonded by an intermolecular force or a hydrogen bonding.

[0005] For example, in polyester, the gaps in the amorphous portions are small at room temperature, making it difficult for dye molecules to penetrate. By heating the polyester above its glass transition temperature, micro-Brownian motion is activated, to open the gaps in the polymer chains and facilitating the penetration of dye molecules. Thereafter, the gaps in the polymer chains are closed at room temperature, and dye molecules are trapped inside the fiber for dyeing.

[0006] Therefore, fabrics used in the sublimation transfer method are usually limited to synthetic fibers that may be dyed with sublimation dyes, such as polyester, but the sublimation transfer method is also expected to be used for natural fibers such as cotton, and research thereof is underway.

[0007] One method of forming an image on natural fiber fabrics such as cotton by the sublimation transfer method is to give a pretreatment liquid to the fabric in advance. For example, in the conventional method of imparting a pretreatment liquid, the fabric is dipped in the pretreatment liquid, the fabric is squeezed with a roller, and then dried, but if the drying is insufficient, good dye density may not be obtained. In order to dry the fabric sufficiently, the drying process requires time, which is a problem to be solved. See Non-Patent Documents 1 to 3.

Non-patent Documents

[0008]

Non-Patent Document 1: Mazharul Islam Kiron, "Wet Transfer Printing Method Steps of Wet Transfer Printing Process", Textile Learner 2013, Internet <URL: https://textilelearner.net/steps-of-wet-transfer-printing-process/>

Non-Patent Document 2: Takeru TAKEBE, "Recent trends in the development of textile printing machine", SEN-I GAKKAISHI (Textile and Industry), 1976 Vol. 32, No. 8, p. 302-307

Non-Patent Document 3: Jiro AIHARA, "Transfer Textile Printing Method for Natural Fibers and Their Blends", Journal of the Textile Machinery Society of Japan, Fiber Engineering, 1977 Vol. 30, No. 3, p. 128-133

SUMMARY

[0009] The present invention was made in view of the above problems and situations, and an object of the present invention is to provide a transfer device and a transfer method thereof, in which the drying time of the pretreatment liquid may be shortened and the transfer rate may be improved, and a pretreatment device and a pretreatment method thereof, which is detachable from the transfer device.

[0010] In order to solve the above problem, the present inventor investigated the cause of the above problem, and found that supplying the pretreatment liquid to the surface of the fabric in contact with the transfer medium shortens the

drying time of the pretreatment liquid and improves the transfer rate, leading to the present invention. That is, the above issues related to the present invention are solved by the following means. To achieve at least one of the above-mentioned objects of the present invention, a transfer device that reflects an aspect of the present invention is as follows.

1. A transfer device equipped with a conveying section, a pretreatment section and a transfer section,

wherein the conveying section conveys a fabric to the transfer section;
the pretreatment section supplies a pretreatment liquid to one side of the fabric;
the transfer section is located downstream of the pretreatment section in a conveying direction of the conveying section; and
an image on a transfer medium is transferred to the fabric by pressing and heating a surface of the fabric supplied with the pretreatment liquid by the pretreatment section and the transfer medium.

2. The transfer device according to item 1, wherein the pretreatment section has a plurality of nozzles that spray the pretreatment liquid.
3. The transfer device according to item 2, wherein an average droplet diameter of the pretreatment liquid sprayed from the nozzles is 100 μm or less.
4. The transfer device according to item 2 or 3, wherein the pretreatment section has a drop prevention mechanism that prevents the pretreatment liquid from falling from the nozzle when the nozzle is not in use.
5. The transfer device according to any one of items 2 to 4, wherein the pretreatment section has a shielding member that prevents the pretreatment liquid from scattering, and the pretreatment liquid is sprayed in a space covered by the shielding member.
6. The transfer device according to item 5, wherein the pretreatment section has a gutter to receive the pretreatment liquid falling from the shielding member.
7. The transfer device according to item 5 or 6, wherein the pretreatment section has a duct for discharging gas and liquid in the space covered by the shielding member.
8. The transfer device according to item 1, wherein the pretreatment section has a roller that applies the pretreatment liquid.
9. The transfer device according to item 8, wherein a surface layer of the roller has elasticity.
10. The transfer device according to any one of items 1 to 9 having a supply control section, wherein the supply control section controls the pretreatment section in accordance with a conveying speed of the fabric.
11. The transfer device according to item 10, wherein the supply control section controls the pretreatment section according to a type of the fabric.
12. The transfer device according to any one of items 1 to 11, wherein the fabric is a natural fiber.
13. The transfer device according to any one of items 1 to 12, wherein the fabric is cotton or a cotton blend.
14. The transfer device according to any one of items 1 to 13, wherein the pretreatment liquid contains a solvent having a value of a ratio of an inorganic value to an organic value (I/O value) of 1.5 or more and an aromatic heterocyclic compound.
15. The transfer device according to any one of items 1 to 14, wherein the pretreatment section is detachable from the transfer device.
16. The transfer device according to any one of items 1 to 15, wherein the transfer section sublimates an ink that forms the image on the transfer medium, and transfers the image to the fabric.
17. A method for transferring an image on a transfer medium to a fabric by pressing and heating using the transfer device according to any one of items 1 to 16,

wherein, the conveying section conveys the fabric to the transfer section;
the pretreatment section supplies the pretreatment liquid to one side of the fabric; and
the transfer section transfers the image on the transfer medium to the fabric by pressing and heating the surface of the fabric supplied with the pretreatment liquid by the pretreatment section and the transfer medium.

18. A pretreatment device attached to a transfer device equipped with a transfer section that transfers an image on the transfer medium to the fabric by pressing and heating the fabric and the transfer medium,

wherein the pretreatment device is equipped with a conveying section and a pretreatment section;
the conveying section conveys the fabric to the transfer section; and
the pretreatment section supplies a pretreatment liquid to a surface of the fabric in contact with the transfer medium.

19. A pretreatment method of supplying a pretreatment liquid to a fabric on which an image on a transfer medium is transferred by pressing and heating, using the transfer device according to any one of items 1 to 16, or the pretreatment device according to item 18,

wherein the conveying section conveys the fabric to the transfer section; and
the pretreatment section supplies a pretreatment liquid to a surface of the fabric in contact with the transfer medium.

[0011] The above means of the present invention makes it possible to provide a transfer device and a transfer method thereof, in which the drying time of the pretreatment liquid is shortened and the transfer rate is improved, and it is possible to provide a pretreatment device which is detachable from the transfer device and a pretreatment method thereof.

[0012] The expression mechanism and the action mechanism of the effect of the present invention is not clear, but is inferred as follows.

[0013] In recent years, the sublimation transfer method has been widely used from the viewpoint of high quality and reduced burden on the environment. However, fabrics used in the sublimation transfer method are usually limited to synthetic fibers that may be dyed with sublimation dyes, such as polyester. When natural fibers such as cotton are used, there were problems such as poor dyeability (dye density and dye fastness) and color fading during dry cleaning.

[0014] Therefore, in the case of sublimation transfer to natural fibers such as cotton, a method of applying a pretreatment liquid to the fabric in advance is known. In the conventional method, the fabric is immersed in the pretreatment liquid, after squeezing the fabric with a roller, it is dried. If the drying is insufficient, good dyeing will not be obtained, and there is a problem that it takes time for the drying step to sufficiently dry.

[0015] However, with respect to the pretreatment section according to the present invention, since it is possible to prevent the pretreatment liquid from being supplied in excess of the required amount to the surface of the fabric in contact with the transfer medium, it is not necessary to squeeze or dry the fabric. As a result, the transfer rate in the transfer device of the present invention may be improved.

BRIEF DESCRIPTION OF THE DRAWINGS

[0016] 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 drawing which are given by way of illustration only, and thus are not intended as a definition of the limits of the present invention.

FIG. 1 is a schematic diagram of the transfer device of the present invention.
FIG. 2 is a schematic diagram (front view) of an example of a pretreatment section with a scattering prevention cover according to the present invention.
FIG. 3 is a schematic diagram (left side view) of an example of a pretreatment section with a scattering prevention cover according to the present invention.
FIG. 4A and FIG. 4B each are a schematic view (cross-sectional view) of an area around the cover wall including the gutter.

DETAILED DESCRIPTION OF THE EMBODIMENTS

[0017] Hereinafter, one or more embodiments of the present invention will be described. However, the scope of the invention is not limited to the disclosed. However, the scope of the invention is not limited to the disclosed embodiments.

[0018] The transfer device of the present invention is a transfer device equipped with a conveying section, a pretreatment section, and a transfer section, wherein the conveying section conveys a fabric to the transfer section, the pretreatment section supplies a pretreatment liquid to one side of the fabric, and the transfer section is located downstream of the pretreatment section in the conveying direction of the conveying section, and transfers the image on the transfer medium to the fabric by pressing and heating the surface of the fabric supplied with the pretreatment liquid by the pretreatment section and the transfer medium. This feature is a technical feature common to or corresponding to the following embodiments.

[0019] From the viewpoint of being able to uniformly supply the pretreatment liquid, it is preferable that the pretreatment section has a plurality of nozzles that spray the pretreatment liquid, and it is more preferable that the average droplet diameter of the pretreatment liquid sprayed from the nozzles is 100 μm or less.

[0020] From the viewpoint of being able to prevent supplying more than the required amount of pretreatment liquid, it is preferable that the pretreatment section has a drop prevention mechanism that prevents the pretreatment liquid from falling from the nozzle when the pretreatment section is not in use.

[0021] From the viewpoint of safety, it is preferable that the pretreatment section has a shielding member that prevents

the pretreatment liquid from scattering, and that the pretreatment liquid is sprayed in the space covered by the shielding member.

[0022] From the viewpoint of being able to prevent supplying more than the required amount of pretreatment liquid, it is preferable that the pretreatment section has a gutter to receive the pretreatment liquid falling from the shielding member.

[0023] From the viewpoint of being able to prevent supplying more than the required amount of pretreatment liquid, it is preferable that the pretreatment section has a duct to discharge gas and liquid in the space covered by the shielding member.

[0024] From the viewpoint of being able to uniformly supply the pretreatment liquid, it is preferable that the pretreatment section has a roller that applies the pretreatment liquid, and it is more preferable that the surface layer of the roller has elasticity.

[0025] From the viewpoint of being able to prevent supplying more pretreatment liquid than necessary, it is preferable that the transfer device has a supply control section, and that the supply control section controls the pretreatment section according to the conveying speed of the fabric.

[0026] From the viewpoint of being able to supply only the necessary amount of pretreatment liquid, it is preferable that the supply control section controls the pretreatment section according to the type of fabric.

[0027] From the viewpoint of expressing the effect of the invention, it is preferable that the fabric is a natural fiber, and furthermore, it is more preferable that the fabric is cotton or a cotton blend.

[0028] From the viewpoint of being able to achieve both dyeability and texture, and to suppress bleed-out of the dye, it is preferable that the pretreatment liquid contains a solvent having a value of a ratio of an inorganic value to an organic value (I/O value) of 1.5 or more and an aromatic heterocyclic compound.

[0029] From the viewpoint of being able to attach or detach as needed, it is preferable that the pretreatment section is detachable from the transfer device.

[0030] From the viewpoint of expressing the effect of the invention, it is preferable that the transfer section sublimates the ink that forms the image on the transfer medium and transfers the ink to the fabric.

[0031] The transfer method of the present invention is to transfer an image on a transfer medium to a fabric by pressing and heating the image on the transfer medium. It uses a transfer device of the present invention, wherein, the conveying section conveys the fabric to the transfer section; the pretreatment section supplies the pretreatment liquid to one side of the fabric; and the transfer section transfers the image on the transfer medium to the fabric by pressing and heating the surface of the fabric supplied with the pretreatment liquid by the pretreatment section and the transfer medium.

[0032] The pretreatment device of the present invention is a pretreatment device attached to a transfer section equipped with a transfer section that transfers an image on the transfer medium to the fabric by pressing and heating the fabric and transfer medium, the pretreatment device being equipped with a conveying section and a pretreatment section, the conveying section conveys the fabric to the transfer section, and the pretreatment section supplies a pretreatment liquid to the surface of the fabric in contact with the transfer medium.

[0033] The pretreatment method of the present invention is a pretreatment method of supplying a pretreatment liquid to a fabric on which an image on a transfer medium is transferred by pressing and heating. Using the transfer device or the pretreatment device of the present invention, wherein the conveying section conveys the fabric to the transfer section, and the pretreatment section supplies the pretreatment liquid on the surface of the fabric which is in contact with the transfer medium.

[0034] Hereinafter, the present invention, its constituent elements, and configurations and embodiments for carrying out the present invention will be described. In the present application, when a numerical range is indicated, "to" is used in the meaning that the numerical values described before and after "to" are included as a lower limit value and an upper limit value.

«Outline of the transfer device»

[0035] The transfer device of the present invention is a transfer device equipped with a conveying section, a pretreatment section, and a transfer section, wherein the conveying section conveys a fabric to the transfer section, the pretreatment section supplies a pretreatment liquid to one side of the fabric, and the transfer section is located downstream of the pretreatment section in the conveying direction of the conveying section, and transfers the image on the transfer medium to the fabric by pressing and heating the surface of the fabric supplied with the pretreatment liquid by the pretreatment section and the transfer medium.

[0036] The transfer device of the present invention transfers an image forming material onto a fabric by a sublimation transfer method. Hereafter, transferring to a fabric by a sublimation transfer method is also referred to simply as "sublimation transfer".

[0037] The term "sublimation transfer method" refers to a method in which, after forming an image on a transfer medium using a sublimation dye, the transfer medium and fabric are pressed together and heated to fix the vaporized sublimation dye on the fabric.

[0038] The sublimation dyes used are disperse dyes, which are themselves insoluble in water, but are soluble in water when mixed with a dispersing agent. Disperse dyes have good dyeability and are used for dyeing hydrophobic synthetic fibers.

[0039] FIG. 1 is a schematic diagram of the transfer device of the present invention. As shown in FIG. 1, the transfer device of the present invention is equipped with a conveying section 10, a pretreatment section 20, and a transfer section 30. In addition, it is preferably equipped with a supply control section, a conveyance control section, and a peeling section (not shown).

[0040] In the present invention, "pretreatment" refers to a treatment applied to the fabric before sublimation transfer is performed on the fabric. Therefore, the transfer section 30 is located downstream of the pretreatment section 20 in the conveying direction A of the conveying section 10.

«Configuration of the transfer device of the present invention»

[1. Pretreatment section]

[0041] The transfer device of the present invention is equipped with a conveying section, a pretreatment section, and a transfer section, with the transfer section located downstream of the pretreatment section in the conveying direction of the conveying section. If necessary, only the pretreatment section may be detached (detachable) to make it a stand-alone pretreatment section.

[0042] The transfer device of the present invention may shorten the drying time of the pretreatment liquid and improve the transfer rate by pretreating one side of the fabric in the pretreatment section.

[0043] In the present invention, "pretreatment" refers to a treatment applied to the fabric before sublimation transfer is performed on the fabric, specifically, it refers to a treatment supplying a pretreatment liquid to the fabric. The pretreatment liquid is described below, but it is not limited as long as it is a pretreatment liquid used for sublimation transfer on fabrics.

[0044] The pretreatment section is not limited to any particular configuration as long as it is capable of supplying a pretreatment liquid to one side of the fabric being conveyed, and may have different configurations depending on the supply method.

[1.1. Supply method]

[0045] The method of supplying the pretreatment liquid to the fabric is not restricted, but it is preferable to use a nozzle spray (spray coating method) or a roller application. By using the above methods, only the necessary amount may be uniformly supplied to the fabric.

[0046] In the present invention, "supplying the pretreatment liquid to the fabric" means that the pretreatment liquid is adhered to the fabric by the operation of the pretreatment section.

[0047] The term "supplied on one side" means that the pretreatment liquid supplied by the pretreatment section and the fabric are in contact on one side of the fabric, and this does not include cases where the fabric is in contact on both sides. For example, when the fabric is supplied by dipping it into a container containing the pretreatment liquid, both sides of the fabric are in contact with the pretreatment liquid, and therefore, it is not included in the "supplied on one side" form. If the pretreatment liquid that comes in contact with the fabric on one side is absorbed by the fabric and reaches the back of the fabric and seeps out, it is included in the "supplied on one side" form, but it is preferable that the pretreatment liquid does not seep out on the back of the fabric from the viewpoint of shortening the drying time.

[1.1.1. Supply method by nozzle]

[0048] It is preferable that the pretreatment section of the present invention has a plurality of nozzles that inject the pretreatment liquid. By having nozzles, the pretreatment liquid may be ejected through the nozzles, and the pretreatment liquid may be uniformly supplied to the fabric. Also, the plurality of nozzles allows the pretreatment liquid to be supplied more evenly to the fabric.

<Nozzle>

[0049] From the viewpoint of being able to uniformly supply the pretreatment liquid, it is preferable that the nozzle is able to eject the pretreatment liquid in the width direction of the fabric over an area longer than the width length of the fabric. By ejecting pressurized pretreatment liquid through the nozzle injection ports, droplets may be atomized.

[0050] The type of nozzle is not restricted and may be either a one-fluid nozzle or two-fluid nozzle. The jetting pattern of the one-fluid nozzle may be empty conical, filled conical, fan-shaped, or film-shaped.

[0051] The arrangement of the multiple nozzles is not restricted, but it is generally preferred that they are arranged in a staggered pattern because when the liquid is pressurized and sprayed from the nozzles, the droplets are sprayed in a conical shape. Each nozzle is supplied with the pretreatment liquid by a pump from a pretreatment liquid tank in a known manner.

[0052] The distance between the nozzle injection port and the fabric is preferably in the range of 50 to 400 mm. By arranging within the above range, only the necessary amount of pretreatment liquid may be uniformly supplied to the fabric.

[0053] It is preferable to inject compressed air at the same time as the droplets from the nozzle injection port. By injecting compressed air at the same time, the droplets are moved by the air current, which allows the pretreatment liquid to be supplied more evenly to the fabric.

<Average droplet diameter>

[0054] It is preferable that the average droplet diameter of the pretreatment liquid sprayed from the nozzle above is 100 μm or less. The average droplet diameter of 100 μm or less allows the pretreatment liquid to be supplied only in the necessary amount and evenly to the fabric, thereby reducing the drying time of the pretreatment liquid.

[0055] In the present invention, the "average droplet diameter" means the Sauter average particle diameter when the particle size distribution of water droplets is measured at a point 30 cm from the tip of the nozzle using a phase Doppler droplet size measuring device. It is an average value of the ratio of the sum of the volume to the sum of the surface areas of the measured droplets, and is also referred to as an "average volume-surface diameter".

[0056] The Sauter average particle diameter D_{32} for a diameter d_i with n_i particles is calculated by the following equation.

$$\text{Equation:}\quad D_{32} = (\Sigma n_i\, d_i^3) / (\Sigma n_i\, d_i^2)$$

[1.1.1.2. Drop prevention mechanism]

[0057] It is preferable that the pretreatment section of the present invention has a drop prevention mechanism that prevents pretreatment liquid from falling from the nozzle when the nozzle is not in use. Having a drop prevention mechanism prevents the pretreatment liquid remaining in the nozzle from falling onto the fabric, and it prevents supplying more pretreatment liquid than necessary. The drop prevention mechanism is not limited as long as it prevents the residual pretreatment liquid remaining in the nozzle from falling onto the fabric when the nozzle is not in use (i.e., prevents dripping).

[0058] The term "when nozzles are not in use" includes the case when only some of the multiple nozzles are not in use. As will be explained in detail later, when the pretreatment liquid supply is controlled by switching the use or non-use of each nozzle, some nozzles are temporarily unused even when the pretreatment section is in operation.

[0059] There are no restrictions on how to prevent dripping, and known methods may be used. Examples thereof include attaching a valve to the injection port of the nozzle to make it difficult to drip, adjusting the pressure inside the nozzle and the amount of compressed air injected at the same time.

[1.1.1.3. Scattering prevention cover]

[0060] The pretreatment section of the present invention has preferably a shielding member that prevents scattering of the pretreatment liquid (hereinafter referred to as "scattering prevention cover" or simply a "cover"). It is preferred that the pretreatment liquid is injected in the space covered by the shielding member (hereinafter referred to as an "inside the scattering prevention cover" or simply an "inside the cover"). When the pretreatment section has a scattering prevention cover, it is possible to suppress the scattering and diffusion of the pretreatment liquid and reduce the influence of the components contained in the pretreatment liquid on the human body.

[0061] It is also preferred that the pretreatment section has a gutter that receives the pretreatment liquid falling from the shielding member (cover). By having the gutter, the pretreatment liquid that adheres to the inner wall of the cover does not fall on the fabric but is collected, thus preventing relatively large droplets of the pretreatment liquid from forming and falling on the fabric and supplying more pretreatment liquid than necessary.

[0062] Furthermore, it is preferable that the pretreatment section has a duct that discharges gas and liquid in the space covered by the shielding member (inside the cover). By having the duct, it is possible to prevent a relatively large droplet of the pretreatment liquid from being formed in the cover and falling onto the fabric to supply the pretreatment liquid in an amount exceeding a required amount.

[0063] Hereinafter, an example of a shattering prevention cover will be described. FIG. 2 and FIG.3 show a schematic diagram of an example of a pretreatment section 100 with a shattering prevention cover 102. An arrow D indicates the fabric width direction and arrow A indicates the fabric conveying direction. FIG. 2 is a front view from the fabric conveying direction and FIG. 3 is a left side view from the fabric width direction.

[0064] It is preferable that the cover 102 cover an area in the width direction (arrow D) of the fabric over the length of the width, and the length is not limited with respect to the conveying direction (arrow A). The shape of the cover is preferably a box shape having left and right walls and front and rear walls with respect to the conveying direction of the fabric and the lower end side is open. By using such a shape, the left and right walls and front and rear walls of the cover will shield the pretreatment liquid sprayed from the nozzle, preventing the pretreatment liquid from scattering around the device.

[0065] Further, as shown in FIG. 3, the upper wall of the cover 102 is preferably shaped like a roof. With such a shape, the droplets adhering to the upper inner wall may easily reach from the upper inner wall to the front and rear inner walls. In addition, it is possible to prevent the droplets adhering to the inner wall from aggregating to form relatively large droplets and falling onto the fabric.

[0066] The front, rear, left, right, and upper walls of the cover 102 are formed by shielding members. Although there are no particular restrictions on the shielding members, it is preferable that they are difficult to deteriorate due to adhesion of the pretreatment liquid. It is preferable that they are made of metal or glass.

[0067] As shown in FIG. 2 and FIG. 3, the cover 102 is fixed to the frame 104 of the belt conveyor 106 through a pair of frame guides 103 made of metal. The lower end side of each of the left and right walls of the cover 102 is fixed to the frame guides 103. The lower end sides of the left and right walls of the cover 102 are fixed to the frame guide 103. It is preferable to have an exhaust air opening 108 between the lower end of the cover 102 and the fabric 107 on the conveyor belt 105 of the belt conveyor 106. The belt conveyor 106 corresponds to the conveying section of the present invention.

[0068] It is preferable that a gutter for collecting the pretreatment liquid adhering to the inner wall is provided on the lower end (lower part) side of the front and rear walls of the cover. FIG. 4A and FIG. 4B show a schematic (cross-sectional) view of the area around the cover wall including the gutter 120 according to the present invention.

[0069] In the present invention, the "gutter" refers to an apparatus or equipment for recovering the pretreatment liquid that has passed through the inner wall of the cover. The shape and material of the gutter are not restricted, the shape is preferably a semicircular shape (square shape) as if a cylinder (or a square cylinder) is vertically divided, and is attached to the inner wall of the cover, as shown in FIG. 4A and FIG. 4B. The material is preferably the same as the wall of the cover.

[0070] When the pretreatment liquid 109 sprayed from the nozzle 101 adheres to the inner wall of the cover 102, the excess pretreatment liquid that adheres to the inner walls of the cover 102 hangs down to the lower end side along the front and rear inner walls, and is collected by the gutter 120. By reusing the collected pretreatment liquid, waste of the pretreatment liquid may be eliminated and the overall amount of pretreatment liquid used may be reduced. From the same perspective, it is preferable to have gutters on the lower end sides of the left and right walls as well.

[0071] As shown in FIG. 2, the cover 102 preferably has a duct 110, and further preferably connects the duct 110 and a blower 111. From the viewpoint of being installed for the purpose of discharging gases and liquids inside the cover to the outside of the cover, the blower is preferably be a suction blower. The shape and material of the duct is not restricted.

[1.1.2. Supply method with roller]

[0072] It is preferable that the pretreatment section of the present invention has a roller to apply the pretreatment liquid. By having a roller, the pretreatment liquid may be applied by the roller, and the pretreatment liquid may be uniformly supplied to the fabric. It is also preferable that the surface layer of the roller has elasticity. The elasticity of the surface layer of the roller allows the roller to adhere to the fabric, so that the pretreatment liquid may be supplied more evenly to the fabric.

[0073] From the viewpoint of being able to uniformly supply the pretreatment liquid, it is preferable that the roller is able to apply the pretreatment liquid to an area that is longer than the length of the width in the width direction of the fabric. From the viewpoint of uniform application, it is preferable to apply the liquid by means of a roll coater combining various types of rollers. The type of roll coater and application method are not restricted, and any known type of roll coater may be used.

[0074] In a roll coater, the roller that comes into contact with a strip of fabric or other material and applies the coating liquid is called the applicator roll. From the viewpoint of uniform application, the surface layer of the applicator roll preferably has elasticity. The elastic member is not restricted and known elastic members may be used, examples include rubber and sponge.

[1.2. Pretreatment liquid]

[0075] The pretreatment liquid according to the present invention is not restricted as long as it is a pretreatment liquid used for sublimation transfer on fabrics. However, a pretreatment liquid used for a fabric containing natural fibers in recent years will be described. The fabric will be described later. Pretreatment liquids used for fabrics containing natural fibers include swelling agents and water repellents.

[1.2.1. Swelling agent]

[0076] In the present invention, a "swelling agent" refers to a compound that has a swelling effect on natural fibers. By using a swelling agent as a pretreatment liquid, the dye may be easily diffused into the fiber, thereby improving dyeability. Examples of swelling agent include polyhydric alcohols and their derivatives.

[0077] Examples of the polyhydric alcohol (polyol) include ethanediol (ethylene glycol), propanediol (propylene glycol), butylene glycol, butenediol, pentamethylene glycol (pentanediol), tetramethylene glycol, trimethylene glycol, and ethylhydroxymethylpropanediol (hexaglycerol), hexanetriol, hexylene glycol (methylpentanediol), ethylhexanediol, octylene glycol, glycerin, polyethylene glycol, polypropylene glycol, polybutylene glycol, chloropropanediol, dioxaoctanediol, dipropylene glycol, tripropylene glycol and nitrilotripropanol.

[0078] Also included are polyether polyols (polyoxypropylene polyols, polyether polyols, polyoxytetramethylene glycol), polyester polyols, hydrocarbon polyols, and mixtures thereof.

[0079] Among them, alkyleneoxyglycols represented by the following Formula (I) and mixtures thereof are preferred.

Formula (I): $HO-(RO)_n-H$

[0080] In Formula (I), R represents a saturated hydrocarbon group having 2 to 10 carbon atoms. Also, n is an integer in the range where an average molecular weight of alkyleneoxyglycol is a predetermined value.

[0081] Examples of R include an ethanediyl group, a propanediyl group, and a butanediyl group.

[0082] The lower limit of the weight average molecular weight of the swelling agent is preferably 200 or higher, more preferred is 300 or higher, and even more preferred is 500 or higher. The upper limit value is preferably 800 or less, and more preferred is 700 or less.

[0083] The supply amount of the swelling agent is preferably in the range of 2 to 8 % by mass, more preferably in the range of 3 to 6 % by mass, based on the total mass of the natural fiber.

[1.2.1.1. Pretreatment liquid containing aromatic heterocyclic compound]

[0084] It is preferable that the pretreatment liquid according to the present invention contains a solvent having a ratio of an inorganic value to an organic value (I/O value) of 1.5 or more, and an aromatic heterocyclic compound (hereinafter also referred to as a "pretreatment liquid containing aromatic heterocyclic compound"). By using the above pretreatment liquid, dyeability may be improved without damaging the texture, and bleed-out of dyes over time may be prevented.

<I/O value>

[0085] The value of the ratio of the inorganic value to the organic value (I/O value) of the solvent contained in the pretreatment liquid is preferably 1.5 or more, and more preferably in the range of 1.5 to 5.0.

[0086] The "I/O value" is the ratio of inorganic value (I) to organic value (O). It is also called as an "IOB value" (Inorganic Organic Balance: IOB). It is one of the indicators showing the magnitude of the polarity of a compound or a member.

[0087] The I/O value is described in detail in a book of "Organic Concept Diagram" by Yoshio Koda, Sankyo Shuppan (1984)), and the literatures of KUMAMOTO PHARMACEUTICAL BULLETIN, No. 1, p. 1-16 (1954); and The FIELD OF CHEMISTRY Vol. 11, No. 10, p. 719-725 (1957).

[0088] The I/O value is a value that deals with the polarity of a compound or a member in an organic concept. This method is one of the functional group contribution methods in which parameters are set for each functional group, and the inorganic value and the organic value are shown for each functional group.

[0089] The I/O value indicates the properties of the compound or member, roughly classified into organic groups representing covalent bonding and inorganic groups representing ionic bonding, and positioned at one point each on the orthogonal coordinates named the organic and inorganic axes.

[0090] Here, the "inorganic value (I)" is a numerical value of the magnitude of the influence of various substituents or bonds possessed by the organic compound on the boiling point based on the hydroxy group.

[0091] Specifically, if the distance between the boiling point curve of a straight-chain alcohol and the boiling point curve of a straight-chain paraffin is taken in the vicinity of 5 carbons, it is approximately 100 °C. Therefore, the influence of one hydroxy group is defined as 100. The value obtained by quantifying the influence of various substituents or various bonds on the boiling point based on this numerical value is the inorganic value (I) of the substituent possessed by the organic compound.

[0092] For example, the inorganic value (I) of the -COOH group is 150 and the inorganic value (I) of a double bond is 2. Therefore, the inorganic value (I) of a certain organic compound means the sum of the inorganic values (I) of the various substituents and bonds possessed by the compound.

[0093] The "organic value (O)" is determined, using the methylene group in the molecule as a unit, based on the

influence of the carbon atoms represented by the methylene group on the boiling point.

[0094] That is, since the average value of the boiling point increase due to the addition of one carbon in the vicinity of 5 to 10 carbon atoms of the straight-chain saturated hydrocarbon compound is 20 °C, the organic value of one carbon atom is set to 20 based on this basis. Based on this, the organic value (O) is a value obtained by quantifying the influence of various substituents or bonds on the boiling point. For example, the organic value (O) of the nitro group ($-NO_2$) is 70.

[0095] In general, when the I/O value is closer to 0, the organic material is more nonpolar (more hydrophobic, more organic), while the higher value indicates that the organic material is more polar (more hydrophilic, more inorganic).

<Solvent>

[0096] Examples of the solvent having an I/O value of 1.5 or more include ethylene glycol monoethyl ether (I/O value: 1.5), dimethyl sulfoxide (I/O value: 1.75), butyric acid (I/O value: 1.875), polyethylene glycol (I/O value: 2.0), isobutyric acid (I/O value: 2.143), 2,3-butanediol (I/O value: 2.5), trimethylolethane (I/O value: 3.0), propylene glycol (I/O) value: 3.3), polypropylene glycol (I/O value: 3.3), and ethylene glycol (I/O value: 5.0). Of these, one or more of dimethyl sulfoxide, ethylene glycol, or propylene glycol is preferred because it may swell the fabric fibers and enable high-concentration dyeing.

[0097] The solvent preferably has a boiling point in the range of 150 to 250 °C. Examples of the solvent having a boiling point in the range of 150 to 250 °C include propylene glycol (188 °C), ethylene glycol (197 °C), dimethyl sulfoxide (189 °C), and 2,3-butanediol (177 °C).

[0098] From the viewpoint of dye concentration, the solvent content is preferably in the range of 5 to 95 % by mass of the total mass of the pretreatment liquid containing the aromatic heterocyclic compound, and it is more preferably in the range of 15 to 50 % by mass.

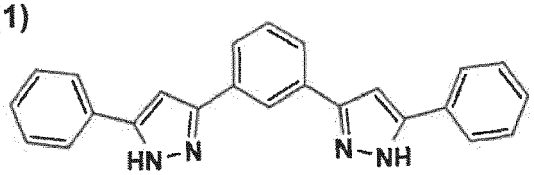
<Aromatic heterocyclic compound>

[0099] The aromatic heterocyclic compound is a compound having aromaticity composed of carbon and a heteroatom other than carbon as an element constituting the aromatic ring, but not including cases where the element constituting the aromatic ring is carbon only and the heteroatom constitutes a substituent that is substituted into the aromatic ring.

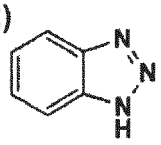
[0100] In the present invention, the heteroatom comprising the aromatic ring is preferably selected from oxygen, nitrogen, and sulfur atoms, and from the viewpoint of being able to capture dyes, it is preferred to be a nitrogen atom.

[0101] From the viewpoint of being able to capture more dyes, examples of the nitrogen-containing heterocyclic compounds include compounds having a pyrazole ring, a triazole ring, an imidazole ring, a triazine ring, a pyridine ring, a pyrazole ring, an aziridine ring, an indole ring, a quinoline ring, a pyrrole ring and a thiophene ring. In particular, at least one selected form the compounds having a pyrazole ring, a triazole ring or an imidazole ring is preferable. Specifically, example compounds (1) to (11) represented by the following structural formulas are cited.

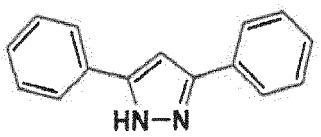
(1)



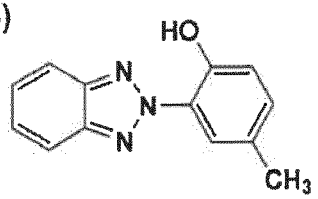
(2)



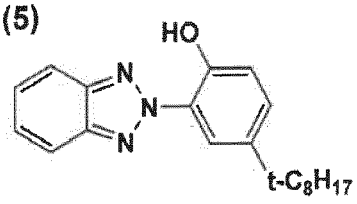
(3)



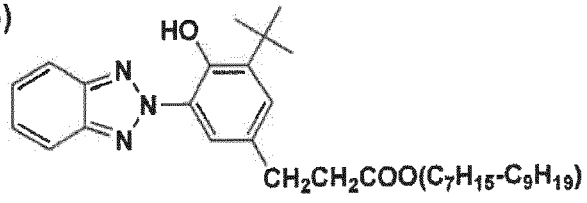
(4)



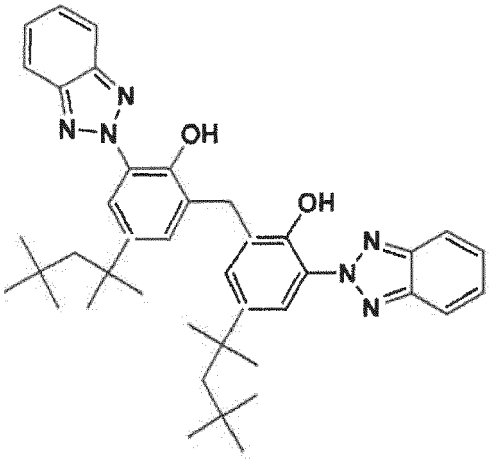
(5)



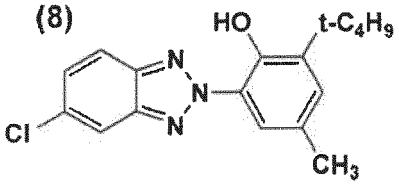
(6)



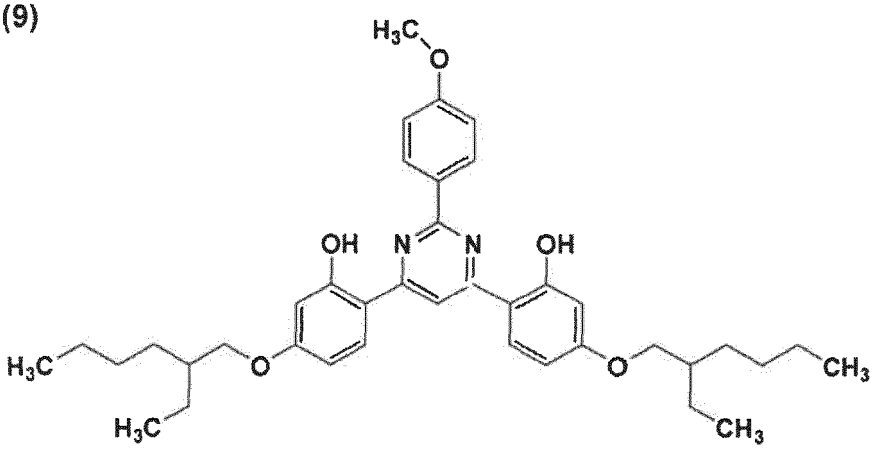
(7)



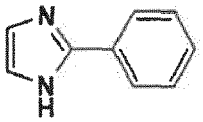
(8)



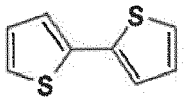
(9)



(10)



(11)



[0102] From the viewpoint of being able to capture the dye inside the fibers of the fabric, the aromatic heterocyclic compound preferably has a low molecular weight (e.g., in the range of 200 to 1000) is preferred.

[0103] From the viewpoint of being able to capture dyes, it is preferable that the content of the aromatic heterocyclic compound is in the range of 1 to 30 % by mass relative to the total mass of the pretreatment liquid containing the aromatic heterocyclic compound. It is more preferable that the content is in the range of 10 to 20 % by mass.

<Water>

[0104] The above pretreatment liquid containing an aromatic heterocyclic compound may contain water. Water is not restricted and may be ion-exchanged water, distilled water, or pure water.

[0105] The content of water is preferably in the range of 0 to 95 % by mass based on the total mass of the pretreatment liquid containing an aromatic heterocyclic compound. It is more preferable that the content of water is in the range of 0 to 50 % by mass.

<Other ingredient>

[0106] The above pretreatment liquid containing an aromatic heterocyclic compound may further contain other ingre-

dients other than those listed above as needed. Examples of the other ingredient include a surfactant, a preservative, and a pH adjuster.

[0107] The surfactants are not restricted, but when an anionic compound is included in the ink components, the ionic nature of the surfactant may be anionic, nonionic (also called "non-ionic") or amphoteric, and the amphoteric ionic surfactant is preferably a betaine type.

[0108] Specific examples include fluorinated or silicone surfactants with high static surface tension lowering ability, anionic surfactants such as dioctyl sulfosuccinate and sodium dodecyl sulfate with high dynamic surface tension lowering ability, polyoxyethylene alkyl ethers with relatively low molecular weight, polyoxyethylene alkyl phenyl ethers, acetyl glycols, Pluronic surfactants (Pluronic is a registered trademark of BASF), and sorbitan derivatives. Fluorinated or silicone surfactants and surfactants with high dynamic surface tension lowering capacity may be used in combination.

[0109] Examples of the preservative include aromatic halogen compounds (e.g. Preventol CMK), methylene dithiocyanate, halogen-containing nitrogen sulfur compounds, and 1,2-benzisothiazolin-3-one (e.g. PROXELGXL).

[0110] Examples of the pH adjuster include citric acid, sodium citrate, hydrochloric acid, and sodium hydroxide.

[1.2.2. Water repellent]

[0111] By using a water repellent as a pretreatment liquid, the dye may be easily trapped inside the fiber, thereby improving the dye density. In addition, the water repellent adhering to the surface of the fiber prevents the fiber from swelling due to water used during washing, causing the dye inside the fiber to drop out and lowering the dye density, in other words, improving dye fastness. Examples of the water repellent include fluorinated and silicone water repellents.

[0112] Examples of the fluorinated water repellent include poly(meth)acrylate containing a polyfluoroalkyl group and polyurethane containing a polyfluoroalkyl group. The state of the fluorinated water repellent is preferably an emulsion containing a fluorinated polymers in an aqueous medium. In the present invention, a "polymer" refers to a compound having a repeating unit by polymerization and includes oligomers.

[0113] The polyfluoroalkyl group (hereinafter also referred to as the "Rf group") contained in the above fluorinated polymers refers to a group in which two or more hydrogen atoms of an alkyl group are replaced by fluorine atoms. In the present invention, the alkyl group of the Rf group also includes a fluorooxaalkyl group having an ether bond between carbon-carbon bonds. The Rf group may also contain other halogen atoms other than fluorine atoms. The other halogen atom is preferably a chlorine atom.

[0114] The number of carbon atoms of the Rf group is preferably in the range of 4 to 20, and it is more preferably in the range of 6 to 16. The Rf group may be straight-chain or branched, but a straight-chain structure is preferred.

[0115] When the structure is branched, the branched portion is preferably present near the end of the Rf group and the number of carbon atoms is preferably a short chain in the range of 1 to 4. When the above Rf group is a fluorooxaalkyl group containing an ether bond, it is assumed that the chain containing an etheric oxygen atom corresponds to a long chain.

[0116] From the viewpoint of superior water repellency, the content ratio of the above Rf(meth)acrylate portion in the poly(meth)acrylate containing the Rf group is preferably in the range of 5 to 100 % by mass, more preferably in the range of 20 to 100 % by mass, and still more preferably the content is in the range of 40 to 100 % by mass.

[0117] Poly(meth)acrylate containing an Rf group may be a homopolymer of Rf(meth)acrylate or a copolymer of two or more Rf(meth)acrylates.

[0118] The poly(meth)acrylate containing an Rf group is preferably a copolymer containing a portion derived from non-fluorinated polymerizable compounds as other polymerizable compounds. One or more of these non-fluorinated polymerizable compound sections may be included.

[0119] The term "non-fluorinated polymerizable compound" refers to a polymerizable compound that does not contain a fluorine atom. Non-fluorinated polymerizable compounds may or may not have a reactive group other than polymerizable groups.

[0120] Examples of the non-fluorinated polymerizable compound having the above reactive group include (meth)acrylates containing hydroxy groups such as 3-chloro-2-hydroxypropyl (meth)acrylate, 2-hydroxyethyl (meth)acrylate, 2-hydroxypropyl (meth)acrylate, diethylene glycol mono(meth)acrylate, polypropylene glycol mono(meth)acrylate, poly(oxyethylene)/Oxypropylene) glycol mono(meth)acrylate, glycerin mono(meth)acrylate, and trimethylolpropane mono(meth)acrylate; amides such as (meth)acrylamide, N-methylol(meth)acrylamide, diacetone (meth)acrylamide, N,N-dimethyl (meth)acrylamide, N,N-diethyl (meth)acrylate, N-diethyl(meth)acrylamide, N,N-diisopropyl (meth)acrylamide, N-butoxymethyl (meth)acrylamide; γ-trimethoxysilylpropyl (meth)acrylate, glycidyl (meth)acrylate, aziridinyl (meth)acrylate, and blocked isocyanate group-containing (meth)acrylate.

[0121] Commercially available fluorinated water repellents may be used. Examples thereof include AG-E060 (aqueous emulsion of fluoroacrylate copolymer manufactured by Meisei Chemical Works, Ltd., active ingredient concentration 20 % by mass), AG-E500D (aqueous emulsion manufactured by Meisei Chemical Works, Ltd.), AGE550D (aqueous emulsion manufactured by Meisei Chemical Works, Ltd.), AG-E300D (aqueous emulsion manufactured by Meisei Chemical

Works, Ltd.), and AF-901K (aqueous emulsion manufactured by Ohara Paragium Chemical Co., Ltd.).

[0122] Examples of the silicone-based water repellent include hydrogen silicones, amino-modified silicones, dimethyl silicones, epoxy-modified silicones, and carbinol-modified silicones. Hydrogen silicone and amino-modified silicone are preferred from the viewpoint that the resulting textile products have good water repellency.

[0123] Commercially available silicone water repellents may be used. Examples of the commercially available product include KM-9772 (manufactured by Shin-Etsu Chemical Co., Ltd.).

[0124] The amount of water repellent supplied is preferably in the range of 0.5 to 10 % by mass of the total mass of the natural fiber. It is more preferably in the range of 2 to 6 % by mass.

[2. Conveying section]

[0125] In the transfer device of the present invention, the "conveying section" is not restricted as long as it has a configuration that may transport fabrics, but as shown in FIG. 1, it is preferable to have a fabric take-out roller 11 and a fabric take-up roller 12. Hereafter, they are also referred to simply as a "take-out roller" and a "take-up roller".

[0126] As for the transfer medium take-out roller 21 and take-up roller 22 shown in FIG. 1, they are not involved in the transport of the fabric, and therefore do not fall under the category of the transport section.

[0127] When the fabric is in a continuously connected roll, it is preferable that the fabric is taken out from the take-out roller 11 and wound by the take-up roller 12. However, when the fabric is not continuously connected, it is preferable to have a conveyor belt (not shown). An example of a case with a conveyor belt is described below. In the case where the fabric is continuously connected rolls, a conveyor belt may also be used.

[0128] The conveyor belt is bridged between the take-out roller and the take-up roller, and moves circumferentially along the circumferential path as the take-out roller rotates and operates driven by the conveyor motor. The conveyor belt may be unbroken or broken. The fabrics are not limited to those that are continuously connected, but those that have been cut or sewn may also be conveyed at predetermined intervals. In this case, the conveyor belt may also have a conveyor surface (a surface in contact with the conveyed fabric) intermittently at the conveyor interval of each fabric.

[0129] By moving the outer circumference of the conveyor belt as the conveyor surface relative to the pretreatment section and the transfer section in a predetermined conveying direction (predetermined direction), the conveyor section performs a conveying operation that moves the fabric placed on the conveyor surface at a predetermined conveying speed in the predetermined conveying direction.

[0130] The conveyor belt is made of a material that flexes flexibly at the contact surface with the take-out and take-up rollers and securely supports the fabric. For example, a cloth belt with good heat resistance is cited.

[0131] The fabric is preferably placed on the conveying surface by contacting the conveying surface upstream in the conveying direction from the pretreatment position where the pretreatment process by the pretreatment section is performed, for example, by being pressed between two rollers to stretch out wrinkles. Furthermore, the fabric is lightly pressed against the conveying surface by the roller to suppress fluffing on the surface of the fabric and rising of the fabric edges from the conveying belt.

[0132] Under the control of the conveyance control section, the conveyance motor is preferably able to rotate and operate the take-out roller at a predetermined rotational speed. The conveyance motor may also reverse the direction of the take-out roller in the opposite direction of the normal conveyance direction, so that the conveyance belt may convey the fabric at a conveyance speed corresponding to the rotational speed of the take-out roller. Even when the conveyor belt is not present, it is preferable to have a conveyor motor, and the conveyor motor is preferably controlled by the conveyance control section.

[3. Transfer section]

[0133] In the transfer device of the present invention, the "transfer section" is not limited to any particular configuration as long as it is capable of transferring the image on the transfer medium to the fabric by pressing and heating the fabric and the transfer medium. An example of the transfer section is described below. The transfer medium includes, for example, transfer paper.

[0134] As shown in FIG. 1, the transfer section according to the present invention preferably has a printing device 40 for forming an image for transfer on the transfer medium, a pressurizing and heating device for pressurizing the fabric and the transfer medium (pressurizing-heating roller 31), a transfer medium take-out roller 21 and a transfer medium take-up roller 22.

[0135] The rolled transfer medium is ejected from the transfer medium take-out roller 21 and wound up by the transfer medium take-up roller 22. However, when the transfer medium is not continuously connected, it is preferable to have a conveyor belt, which is be similar to the conveyor belt for fabric mentioned above.

[0136] The printing device 40 is not restricted as long as it is capable of discharging an ink containing a sublimation dye onto a transfer medium, but it is preferred that it is an inkjet printing device. Known inkjet printing devices may be

used. The transfer image may be formed on the transfer medium in advance, or as shown in FIG. 1, the image may be formed immediately prior to transfer.

[0137] The pressurizing-heating device is not particularly limited as long as it is a device capable of pressing and heating the fabric and the transfer medium. It is preferable to use a pressurizing-heating roller 31. The pressure force (applied pressure) exerted on the fabric and transfer medium to be pressed is preferably in the range of 1.0 to 2.0 MPa, and more preferably in the range of 1.6 to 2.0 MPa, and still more preferably it is about 1.6 MPa. The pressurization and heating time should be 2 seconds or longer.

[0138] After the fabric and transfer medium are pressurized and heated to transfer the image, the transfer medium is peeled off from the fabric and wound up by the take-up roller for the transfer medium.

[4. Supply control section]

[0139] The transfer device of the present invention preferably has a supply control section, wherein the supply control section controls the pretreatment section according to the fabric transport speed and the type of fabric. In the present invention, having the supply control section prevents supplying more pre-treatment liquid than necessary.

[0140] The term "controlling the pretreatment section" means, in detail, controlling the amount of pretreatment liquid sprayed or applied, for example, by the operation of the pretreatment section for the purpose of controlling the amount of pretreatment liquid supplied on the fabric, and "supplied amount" means the amount actually adhered to the fabric.

[0141] Therefore, for example, in the aforementioned supply of pretreatment liquid by nozzles in the scattering prevention cover, part of the sprayed pretreatment liquid adheres to the fabric, but part adheres to the inner wall of the cover. Therefore, the injection amount and the amount that actually adheres to the fabric do not necessarily match, but the supply amount may be controlled to some extent by controlling the injection amount.

[0142] For example, when the pretreatment liquid is supplied by nozzles, it is preferable to control the supply amount of the pretreatment liquid by switching between the use and non-use of each nozzle.

[0143] The supply amount of the pretreatment liquid is controlled, for example, by controlling the coating conditions such as the supply amount from each nozzle according to the transport speed of the fabric, and the type of fabric. The number of rows of nozzles used is determined according to the application conditions, and the pretreatment liquid is supplied to the fabric.

[0144] In the present invention, the "type of fabric" refers to the material, form (woven, non-woven, and knitted) and thickness of the fabric, and is described in detail below.

[0145] In the case of supplying the pretreatment liquid by rollers, it is preferable to control the amount of pretreatment liquid supplied by controlling the application conditions, such as the peripheral speed and pressing pressure of the various rollers, for example, according to the fabric conveyance speed and the type of fabric.

«The transfer method of the present invention»

[0146] The transfer method of the present invention is a transfer method of transferring an image on a transfer medium to a fabric by pressing and heating. Using the above transfer device, the conveying section conveys the fabric to the transfer section, the pretreatment section supplies the pretreatment liquid to one side of the fabric, and the transfer section transfers an image on the transfer medium to the fabric by pressing and heating the surface to which the pretreatment liquid is supplied by the pretreatment unit of the fabric and the transfer medium.

[0147] The pretreatment method of the present invention is a pretreatment method of supplying a pretreatment liquid to a fabric on which an image on a transfer medium is transferred by pressing and heating. Using the transfer device or the pretreatment device, the conveying section conveys the fabric to the transfer unit, and the pretreatment section supplies the pretreatment liquid to the surface of the fabric in contact with the transfer medium.

[0148] Therefore, (1) the conveying section coveys the fabric to the transfer section (conveying process) and (2) the pretreatment section supplies a pretreatment liquid to one side of the fabric (pretreatment process) are processes common to the transfer method and pretreatment method of the invention. (3) The process in which the transfer section transfers the image on the transfer medium to the fabric by pressing and heating the surface of the fabric to which the pretreatment liquid has been supplied by the pretreatment section and the transfer medium (sublimation transfer process) is a process that only the transfer method of the present invention has.

[1. Conveying process]

[0149] In the conveying process, the fabric, which is the recording medium, is conveyed to the preprocessing section and the transfer section by the conveying section.

[0150] When the fabric is in the form of a continuously connected roll, the fabric may be conveyed by unrolling the fabric from the take-out roller and winding it up with the take-up roller. When the conveying section has a conveying

belt, the fabric is placed on the outer circumference of the conveying belt as the conveying surface and moved relative to the pretreatment section and the transfer section in a predetermined conveying direction (predetermined direction), and the conveying section performs a conveying operation to move the fabric placed on the conveying surface at a predetermined conveying speed in the conveying direction.

[0151] In the present invention, the conveying section preferably has a conveyor motor and a conveyance control section, with or without a conveyor belt.

[0152] Under the control of the conveyance control section, the conveyance motor is preferably able to rotate and operate the take-out roller at a predetermined rotational speed. The conveyance motor may also reverse the direction of the take-out roller in the opposite direction of the normal conveyance direction, so that the conveyance belt may convey the fabric at a conveyance speed corresponding to the rotational speed of the take-out roller. Even when the conveyor belt is not present, it is preferable to have a conveyor motor, and the conveyor motor is preferably controlled by the conveyance control section.

[2. Pretreatment process]

[0153] The pretreatment process is a process in which the pretreatment section supplies a pretreatment liquid on one side of the fabric. In the present invention, "supplying the pretreatment liquid to the fabric" means that the pretreatment liquid is adhered to the fabric by the operation of the pretreatment section. In addition, "supplying on one side" means that the pretreatment liquid supplied by the pretreatment section and the fabric come in contact with the fabric on only one side of the fabric.

[0154] The method of supplying the pretreatment liquid to the fabric is not restricted, but as mentioned above, it is preferable to use a nozzle spray (spray coating method) or a roller application. By using the above methods, only the necessary amount may be uniformly supplied to the fabric.

[0155] The amount of pretreatment liquid supplied is not particularly limited and may be adjusted according to the content of the solvent and the aromatic heterocyclic compound in the pretreatment liquid and the amount of the ink supplied for transfer.

[3. Sublimation transfer process]

[0156] In the sublimation transfer process, after the image for transfer is formed on the transfer medium, the transfer medium is pressed and heated to the fabric supplied with the pretreatment liquid in the pretreatment process, and the image for transfer formed on the transfer medium is sublimation transferred to the fabric.

[0157] Here, sublimation transfer is preferred to sublimation transfer the image for transfer onto the fabric before the pretreatment liquid supplied to the fabric completely dries. This makes it easier for the fibers of the fabric to swell due to the solvent in the pretreatment liquid, and the solvent in the pretreatment liquid acts as a carrier for the transferred dye, thereby making it easier for the dye to penetrate into the fibers and improving the dyeability and texture.

[0158] The image for transfer formed on the transfer medium is specifically formed using the ink described below, which contains a sublimation dye and liquid medium (solvent and water).

[0159] Specifically, an ink is first applied to a transfer medium by a known ink application method such as an inkjet method using a printing device, and then dried to form an ink layer (image for transfer).

[0160] The transfer medium used in the present invention is not restricted as long as the transfer medium may form an ink layer on its surface, and furthermore, the ink layer may be transferred to the fabric, and the transfer medium does not interfere with the sublimation of the sublimation dye during transfer, for example. The transfer medium is preferably a transfer paper. As a transfer paper, for example, paper on which an ink-receiving layer is formed on the surface with inorganic fine particles such as silica is preferred, and a special paper for inkjet printing or a transfer paper is cited.

[0161] Next, the surface of the image for transfer on the transfer medium is pressed and heated (heat press) with the surface of the fabric supplied with the pretreatment liquid (pretreatment surface) to transfer. As a result, the sublimation dye in the transfer image formed on the transfer medium is sublimated and transferred to the fabric, specifically, to the pretreatment liquid supplied to the fabric, and dyed, thereby it is possible to form the desired image on the fabric.

[0162] The transfer temperature (heat press temperature) depends on the sublimation temperature of the sublimation dye, but it is preferably in the range of 180 to 210 °C, for example. By making the transfer temperature higher than the boiling point of the solvent contained in the pretreatment liquid, the solvent is removed and the dye is more immobilized to enhance the bleed-out inhibiting effect.

[0163] In addition, the press pressure is preferably in the range of 200 to 500 g/cm^2 for a flat type, and 2 to 6 kg/cm^2 for a continuous type. The press time is preferably in the range of 30 to 180 seconds, depending on the temperature.

<Ink>

[0164] The ink used in the present invention preferably contains a sublimation dye, solvent, and water.

(Sublimation dye)

[0165] The dye itself is insoluble or hardly soluble in water, but a dye that performs dyeing in a state of being dispersed as fine particles in water is called a disperse dye. Among disperse dyes, dyes having a property of sublimation by heating are called sublimation dyes. In the present invention, it is preferable to use sublimation dyes from the viewpoint of effect expression.

[0166] The term "insoluble or hardly soluble in water" means that the solubility in water at 25 °C is 10 mg/L or less, preferably 5 mg/L or less, and still more preferably it is 1 mg/L or less.

[0167] The types of sublimation dye are not restricted, and examples include azo and anthraquinone dyes. Specifically, the following dyes are listed.

[0168] C.I. Disperse Yellow 3, 4, 5, 7, 9, 13, 24, 30, 33, 34, 42, 44, 49, 50, 51, 54, 56, 58, 60, 63, 64, 66, 68, 71, 74, 76, 79, 82, 83, 85, 86, 88, 90, 91, 93, 98, 99, 100, 104, 114, 116, 118, 119, 122, 124, 126, 135, 140, 141, 149, 160, 162, 163, 164, 165, 179, 180, 182, 183, 186, 192, 198, 199, 202, 204, 210, 211, 215, 216, 218 and 224.

[0169] C.I. Disperse Orange 1, 3, 5, 7, 11, 13, 17, 20, 21, 25, 29, 30, 31, 32, 33, 37, 38, 42, 43, 44, 45, 47, 48, 49, 50, 53, 54, 55, 56, 57, 58, 59, 61, 66, 71, 73, 76, 78, 80, 89, 90, 91, 93, 96, 97, 119, 127, 130, 139, and 142.

[0170] C.I. Disperse Red 1, 4, 5, 7, 11, 12, 13, 15, 17, 27, 43, 44, 50, 52, 53, 54, 55, 56, 58, 59, 60, 65, 72, 73, 74, 75, 76, 78, 81, 82, 86, 88, 90, 91, 92, 93, 96, 103, 105, 106, 107, 108, 110, 111, 113, 117, 118, 121, 122, 126, 127, 128, 131, 132, 134, 135, 137, 143, 145, 146, 151, 152, 153, 154, 157, 159, 164, 167, 169, 177, 179, 181, 183, 184, 185, 188, 189,190, 191, 192, 200, 201, 202, 203, 205, 206, 207, 210, 221, 224, 225, 227, 229, 239, 240, 257, 258, 277, 278, 279, 281, 288, 289, 298, 302, 303, 310, 311, 312, 320, 324, and 328.

[0171] C.I. Disperse Violet 1, 4, 8, 23, 26, 27, 28, 31, 33, 35, 36, 38, 40, 43, 46, 48, 50, 51, 52, 56, 57, 59, 61, 63, 69, and 77.

[0172] C.I. Disperse Green 9; and
C.I. Disperse Brown 1, 2, 4, 9, 13, and 19.

[0173] C.I. Disperse Blue 3, 7, 9, 14, 16, 19, 20, 26, 27, 35, 43, 44, 54, 55, 56, 58, 60, 62, 64, 71, 72, 73, 75, 79, 81, 82, 83, 87, 91, 93, 94, 95, 96, 102, 106, 108, 112, 113, 115, 118, 120, 122, 125, 128, 130, 139, 141, 142, 143, 146, 148, 149, 153, 154, 158, 167, 171, 173, 174, 176, 181, 183, 185, 186, 187, 189, 197 287, 288, 291, 293, 295, 297, 301, 315, 330, 333, 359, and 360; and
C.I. Disperse Black 1, 3, 10, and 24.

[0174] The molecular weight of the sublimation is not particularly limited, but from the viewpoint of easy sublimation, it is preferable to have a low molecular weight (e.g., 200 to 350). On the other hand, from the viewpoint of making it difficult for the sublimation dye that has penetrated into the fabric to escape, it is preferred that the molecular weight be moderately large (e.g., 350 to 500). The sublimation dye in the ink may or may not be crystallized.

[0175] Examples of the method of applying an ink on the transfer medium include an inkjet method for coating. An inkjet method may be used to form a highly accurate image.

[0176] The average particle size of the sublimation dye in the ink is not particularly limited, but from the viewpoint of discharge stability by the inkjet method, it is preferable that the average particle size is 300 nm or less. The average particle size may be determined by a commercially available particle size measuring instrument using a light scattering method, an electrophoresis method, or a laser Doppler method. As the particle size measuring instrument, for example, Zetasizer 1000 made by Malvern Corporation may be cited.

[0177] Although the content of the sublimation dye in the ink is not particularly limited, it is preferable that the content of the sublimation dye is in the range of 2 to 10 % by mass with respect to the total mass of the ink. When the content of the sublimation dye is 2 % by mass or more, it is easy to form images of high density, and when the content is 10 % by mass or less, the viscosity of the ink does not become too high and sufficient discharge stability is obtained. From the same viewpoint, it is more preferable that the content of the sublimation dye is in the range of 5 to 10 % by mass relative to the total mass of the ink.

(Water)

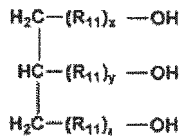
[0178] Water may be ion-exchanged water, distilled water, or pure water. The water content in the ink is preferably in the range of 90 to 98 % by mass, and more preferably in the range of 90 to 95 % by mass.

(Solvent)

[0179] The ink may contain other solvents in addition to water. Other solvents are not restricted, but water-soluble organic solvents are preferred. It is preferable that the total content of water and water-soluble organic solvent is in the range of 90 to 98 % by mass of the total mass of the ink. It is more preferred that the total content of water and water-soluble organic solvent is in the range of 90 to 95 % by mass.

[0180] Examples of the water-soluble organic solvent include alcohols (e.g., methanol, ethanol, propanol, pentanol, hexanol, cyclohexanol, and benzyl alcohol), polyhydric alcohols (e.g., ethylene glycol, diethylene glycol, triethylene glycol, polyethylene glycol, propylene glycol, dipropylene glycol, tripropylene glycol, polypropylene glycol, glycerin, compounds represented by the following Formula (1)), polyhydric alcohol ethers (e.g., ethylene glycol monomethyl ether, ethylene glycol monoethyl ether, ethylene glycol monobutyl ether, ethylene glycol monophenyl ether, diethylene glycol monomethyl ether, diethylene glycol monoethyl ether, diethylene glycol monobutyl ether diethylene glycol monobutyl ether, diethylene glycol dimethyl ether, propylene glycol monomethyl ether, propylene glycol monoethyl ether), amines (e.g., ethanolamine, N-ethyl diethanolamine, morpholine, N-ethylmorpholine, ethylenediamine, diethylenediamine, triethylenetetetramine), amides (e.g., formamide, N,N-dimethylformamide, N,N-dimethylacetamide), heterocyclics (e.g., 2-pyrrolidone, N-methyl-2-pyrrolidone, N-cyclohexyl-2-pyrrolidone, 2-oxazolidone, 1,3-dimethyl-2-imidazolidine), sulfoxides (e.g., dimethyl sulfoxide), and sulfones (e.g., sulfolane).

Formula (1)



[0181] In Formula (1), R_{11} represents an ethylene glycol group or a propylene glycol group, x, y, and z each are a positive integer, and x + y + z = 3 to 30.

[0182] When the fabric contains hydrophilic fibers such as cellulose fibers, the water-soluble organic solvent is preferably a high boiling point solvent with a boiling point of 200 °C or higher. The use of a high-boiling point solvent may promote penetration of the ink into the fabric because the ink does not easily thicken due to drying. In addition, sufficient ejection stability may be obtained when the ink is ejected by the inkjet method.

[0183] Polyols and polyalkylene oxides are preferred as the high-boiling water-soluble organic solvent with a boiling point of 200 °C or higher. Examples of the polyol with a boiling points of 200 °C or higher include divalent alcohols such as 1,3-butanediol (boiling point of 208 °C), 1,6-hexanediol (boiling point 223 C), and polypropylene glycol; and trivalent or higher a alcohols such as glycerin (boiling point 290 °C), and trimethylolpropane (boiling point 295 °C).

[0184] Examples of the polyalkylene oxide with a boiling point of 200 °C or higher include diethylene glycol monoethyl ether (boiling point 202 °C), triethylene glycol monomethyl ether (boiling point 245 °C), tetraethylene glycol monomethyl ether (boiling point 305 °C), tripropylene glycol monoethyl ether (boiling point 256 °C); ethers of divalent alcohols such as polypropylene glycol; ethers of trivalent or higher alcohols such as glycerin (boiling point 290 °C); and ethers of trivalent alcohols such as hexanetriol.

[0185] The content of the water-soluble organic solvent is preferably in the range of 20 to 70 % by mass relative to the total mass of the ink. When the content of the water-soluble organic solvent is 20 % by mass or more, dispersibility of the sublimation dye and discharge stability as an ink may be sufficiently obtained. When the content is 70 % by mass or less, drying property of the ink is not easily impaired.

(Other Ingredients)

[0186] The ink may further contain other components as needed. Examples of other component include dispersants, surfactants, preservatives, and pH adjusters.

(Dispersant)

[0187] The dispersant may be selected depending on the type of sublimation dye. Examples of the dispersant include formalin condensate of sodium creosote oil sulfonate, formalin condensate of sodium cresol sulfonate and sodium 2-naphthol-6-sulfonate, formalin condensate of sodium cresol sulfonate, formalin condensate of sodium phenol sulfonate, formalin condensate of sodium β-naphthol sulfonate, formalin condensate containing sodium β-naphthalene sulfonate and sodium β-naphthol sulfonate, alkylene oxide containing ethylene oxide and propylene oxide, fatty alcohols, fatty amines, fatty acids, phenols, alkylphenols and alkylating compounds containing amine carboxylates, lignin sulfonates,

sodium paraffin sulfonates, copolymers of α-olefins and maleic anhydride and known comb-shaped block polymers.

[0188] Examples of the comb-shaped block polymer include DISPERBYK-190, DISPERBYK-194N, DISPERBYK-2010, DISPERBYK-2015 and BYK-154, manufactured by BYK Chemie, Co., Ltd. ("DISPERBYK" and "BYK" are registered trademarks of the same company.)

[0189] Although the content of the dispersant is not particularly limited, it is preferable that the content of the dispersant is in the range of 20 to 200 % by mass with respect to the total mass of the sublimation dye. When the content of the dispersing agent is 20 % by mass or more, dispersibility of the sublimation dye may be sufficiently obtained. When the content is 200 % by mass or less, it is easy to suppress the decrease in discharge stability due to the dispersant.

(Surfactant, preservative, pH adjuster)

[0190] As the surfactant, preservative and pH adjuster, the same ones as the pretreatment liquid may be used.

(Physical properties of ink)

[0191] The viscosity of the ink at 25 °C is not restricted, as long as it is sufficient to obtain sufficient discharge stability by the inkjet method, and it is preferred to be in the range of 3 to 20 mPa·s, and more preferably in the range of 4 to 12 mPa·s. The viscosity of the ink may be measured at 25 °C with an E-type viscometer.

<Fabric>

[0192] The material of the fibers constituting the fabric that may be used for the transfer device of the present invention is not particularly restricted, but from the viewpoint of effect expression, it is preferable that the fabric is made of a material that may be used for sublimation transfer by supplying a pretreatment liquid.

Examples thereof include natural fibers (hydrophilic fibers) such as cellulose fibers (natural cotton), hemp, wool or silk, and chemical fibers such as rayon, vinylon, nylon, acrylic, polyurethane, polyester or acetate.

[0193] Although fabrics made of only one type of polyester may be used for sublimation transfer even without supplying a pretreatment liquid, a pretreatment liquid may be used as appropriate when the fabric further contains other fibers other than polyester or depending on other conditions.

[0194] The fabric preferably includes natural fibers such as cellulose fibers, hemp, wool, and silk. It is preferable that the fabric includes cellulose fibers, and it is more preferable that the fabric is cotton, because it may significantly express the effect of the present invention. The fabric may be composed of one type of natural fiber or two or more types of natural fibers. The fabric may further contain one or more kinds of chemical fibers when it contains natural fibers. Therefore, a cotton blend is preferred.

[0195] The fabric may be made of any of these fibers in any form, such as woven, non-woven, or knitted fabric. The fabric may also be a blended woven or non-woven fabric of two or more types of fibers. As mentioned above, it is preferable that the fabric contains cellulose fibers. From the viewpoint of good transfer quality, when the fabric includes cellulose fibers and other fibers other than cellulose fibers, it is preferred that the other fibers include polyester fibers.

[0196] The natural fiber ratio and the chemical fiber ratio in the fibers constituting the fabric are expressed as the ratio of the mass of natural fibers and the mass of chemical fibers contained in the fabric to the total mass of the fabric (the total amount of natural fibers and chemical fibers). When the fabric contains natural fibers and optionally chemical fibers, the natural fiber ratio in the fabric is in the range of 5 to 100 % by mass and the chemical fiber ratio is in the range of 0 to 95 % by mass. For example, when the fabric contains cellulose and polyester fibers, the cellulose fiber ratio is preferably in the range of 35 to 100 % by mass and the polyester fiber ratio 0 to 65 % by mass.

«Outline of the pretreatment device of the present invention»

[0197] The pretreatment device of the present invention is a pretreatment device that may be attached to a transfer device equipped with a transfer section that transfers an image on the transfer medium to the fabric by pressing and heating the fabric and the transfer medium.

[0198] The pretreatment device is equipped with a conveying section and a pretreatment section, wherein the conveying section conveys the fabric to the transfer section and the pretreatment section supplies a pretreatment liquid to the surface of the fabric that is in contact with the transfer medium.

[0199] The elements constituting the pretreatment device of the present invention include elements common to the elements constituting the pretreatment section included in the transfer device of the present invention described above.

«Outline of the pretreatment method of the present invention»

[0200] The pretreatment method of the present invention is a pretreatment method of supplying a pretreatment liquid to a fabric on which an image on a transfer medium is transferred by pressing and heating. Using the transfer device or the pretreatment device of the present invention described above, the conveying section conveys the fabric to the transfer section, and the pretreatment section supplies the pretreatment liquid to the surface of the fabric in contact with the transfer medium.

[0201] In the pretreatment method of the present invention, the process of conveying the fabric to the transfer section and the process of the pretreatment section supplying the pretreatment liquid to the surface of the fabric in contact with the transfer medium correspond to the conveying process and the pretreatment method in the transfer method of the present invention described above.

[0202] 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 be interpreted by terms of the appended claims.

Description of Symbols

[0203]

1: Transfer device
2: Transfer medium
3: Fabric
10: Conveying section
11: Fabric take-out roller
12: Fabric take-up roller
20: Pretreatment section
21: Transfer medium take-out roller
22: Transfer medium take-up roller
30: Transfer section
31: Pressurizing-heating roller
40: Printing device
100: Pretreatment section
101: Nozzle
102: Scattering preventing cover
103: Frame guide
104: Frame
105: Conveyor belt for fabric
106: Belt conveyor
107: Fabric
108: Exhaust air opening
109: Pretreatment liquid droplet
110: Duct
111: Blower
120: Gutter
121: Cover wall
A: Conveying direction
D: Fabric width direction

Claims

1. A transfer device equipped with a conveying section, a pretreatment section and a transfer section,

wherein the conveying section conveys a fabric to the transfer section;
the pretreatment section supplies a pretreatment liquid to one side of the fabric;
the transfer section is located downstream of the pretreatment section in a conveying direction of the conveying section; and
an image on a transfer medium is transferred to the fabric by pressing and heating a surface of the fabric supplied

with the pretreatment liquid by the pretreatment section and the transfer medium.

2. The transfer device according to claim 1, wherein the pretreatment section has a plurality of nozzles that spray the pretreatment liquid.

3. The transfer device according to claim 2, wherein an average droplet diameter of the pretreatment liquid sprayed from the nozzles is 100 μm or less.

4. The transfer device according to claim 2 or 3, wherein the pretreatment section has a drop prevention mechanism that prevents the pretreatment liquid from falling from the nozzle when the nozzle is not in use.

5. The transfer device according to any one of claims 2 to 4, wherein the pretreatment section has a shielding member that prevents the pretreatment liquid from scattering, and the pretreatment liquid is sprayed in a space covered by the shielding member.

6. The transfer device according to claim 5, wherein the pretreatment section has a gutter to receive the pretreatment liquid falling from the shielding member.

7. The transfer device according to claim 5 or 6, wherein the pretreatment section has a duct for discharging gas and liquid in the space covered by the shielding member.

8. The transfer device according to claim 1, wherein the pretreatment section has a roller that applies the pretreatment liquid.

9. The transfer device according to claim 8, wherein a surface layer of the roller has elasticity.

10. The transfer device according to any one of claims 1 to 9 having a supply control section, wherein the supply control section controls the pretreatment section in accordance with a conveying speed of the fabric.

11. The transfer device according to claim 10, wherein the supply control section controls the pretreatment section according to a type of the fabric.

12. The transfer device according to any one of claims 1 to 11, wherein the fabric is a natural fiber.

13. The transfer device according to any one of claims 1 to 12, wherein the fabric is cotton or a cotton blend.

14. The transfer device according to any one of claims 1 to 13, wherein the pretreatment liquid contains a solvent having a value of a ratio of an inorganic value to an organic value (I/O value) of 1.5 or more and an aromatic heterocyclic compound.

15. The transfer device according to any one of claims 1 to 14, wherein the pretreatment section is detachable from the transfer device.

16. The transfer device according to any one of claims 1 to 15, wherein the transfer section sublimates an ink that forms the image on the transfer medium, and transfers the image to the fabric.

17. A method for transferring an image on a transfer medium to a fabric by pressing and heating using the transfer device according to any one of claims 1 to 16,

wherein, the conveying section conveys the fabric to the transfer section;
the pretreatment section supplies the pretreatment liquid to one side of the fabric; and
the transfer section transfers the image on the transfer medium to the fabric by pressing and heating the surface of the fabric supplied with the pretreatment liquid by the pretreatment section and the transfer medium.

18. A pretreatment device attached to a transfer device equipped with a transfer section that transfers an image on the transfer medium to the fabric by pressing and heating the fabric and the transfer medium,

wherein the pretreatment device is equipped with a conveying section and a pretreatment section;

the conveying section conveys the fabric to the transfer section; and
the pretreatment section supplies a pretreatment liquid to a surface of the fabric in contact with the transfer medium.

19. A pretreatment method of supplying a pretreatment liquid to a fabric on which an image on a transfer medium is transferred by pressing and heating, using the transfer device according to any one of claims 1 to 16, or the pretreatment device according to claim 18,

wherein the conveying section conveys the fabric to the transfer section; and
the pretreatment section supplies a pretreatment liquid to a surface of the fabric in contact with the transfer medium.

FIG. 1

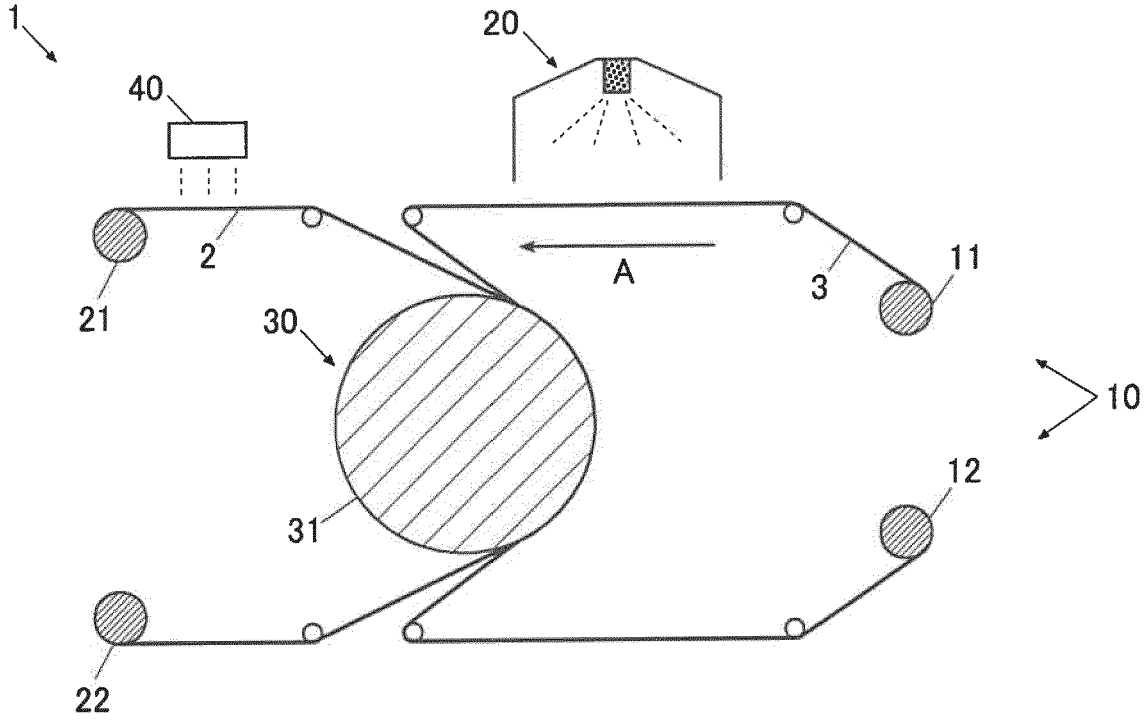

1
20
40
2
A
3
11
21
30
10
31
12
22

FIG. 2

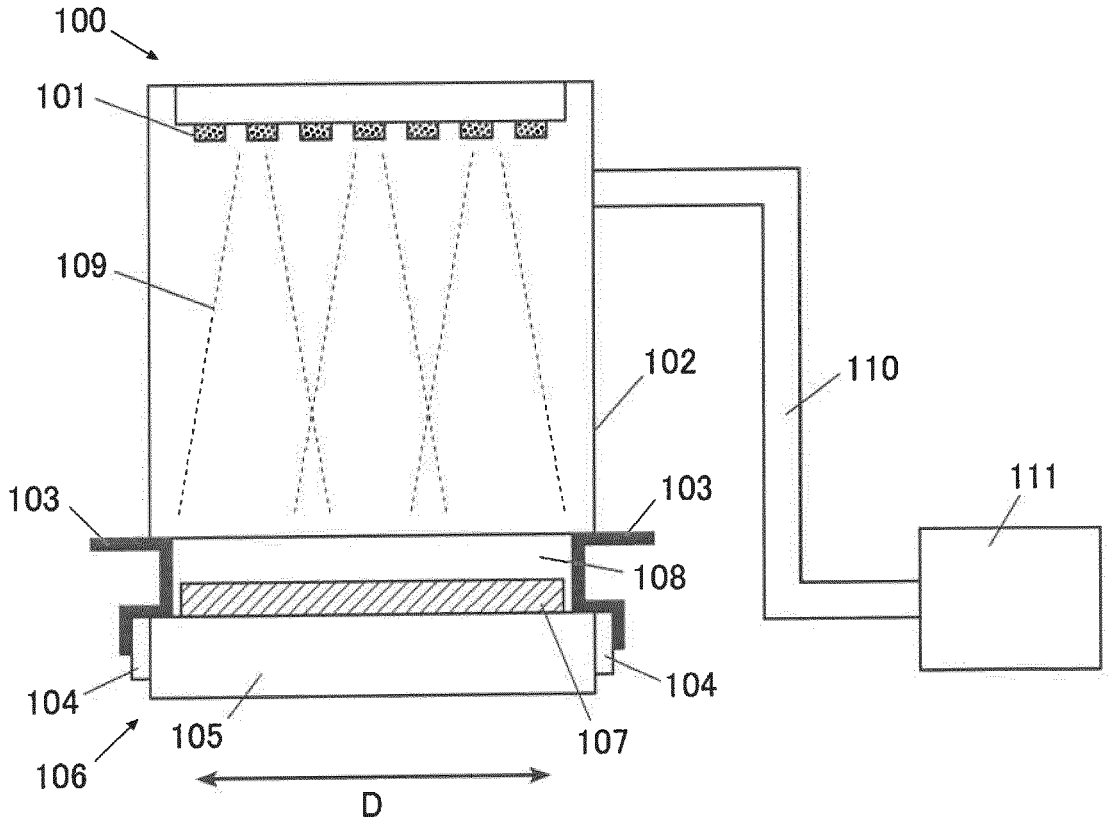

100
101
109
102
110
111
103
103
108
104
104
105
107
106
D

FIG. 3

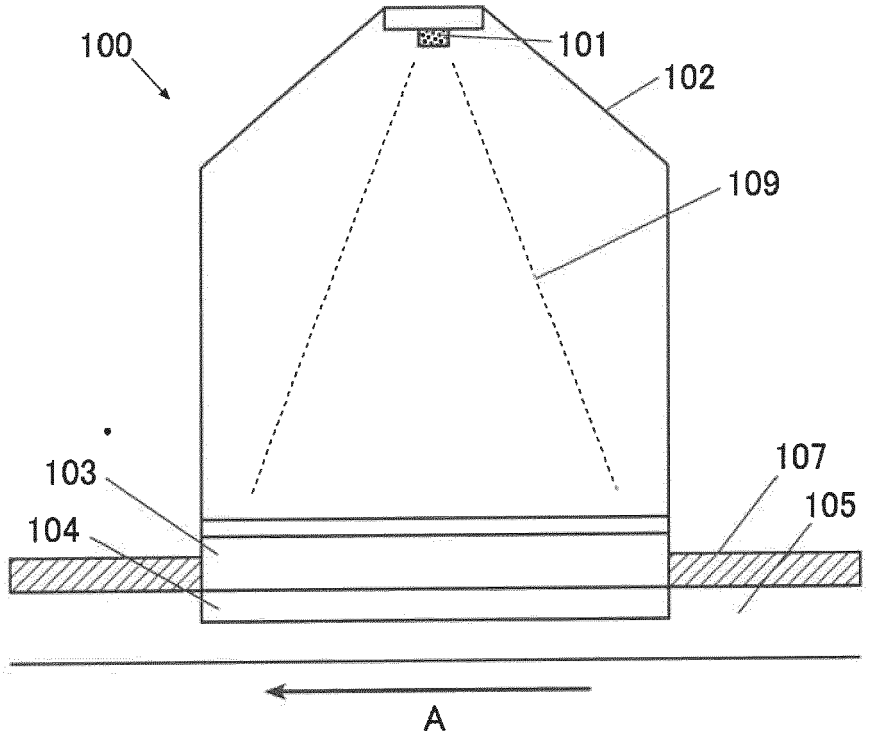


FIG. 4A

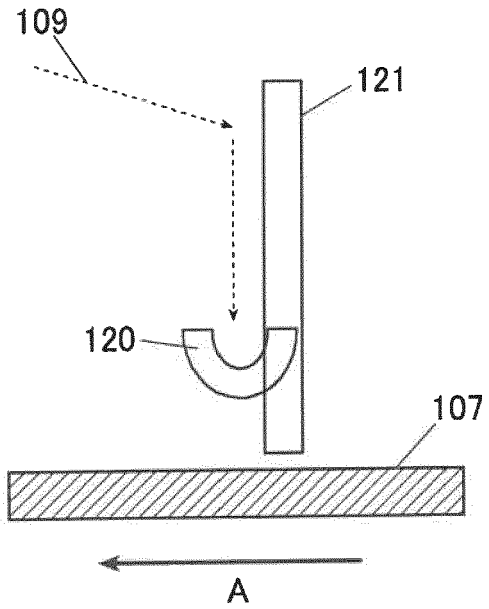
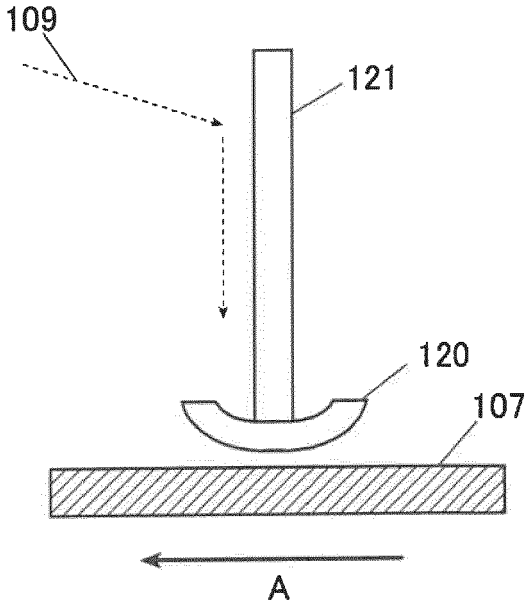


FIG. 4B



Europäisches Patentamt
European Patent Office
Office européen des brevets

EUROPEAN SEARCH REPORT

Application Number
EP 22 19 3027

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
Y	US 2017/320336 A1 (BUTT NOUMAN IDRIS [PK] ET AL) 9 November 2017 (2017-11-09) * paragraphs [0005], [0031]; figure 4A *	1-19	INV. B41J3/407 B41J2/005 B41J11/00
Y	US 2009/293209 A1 (CHUNG KWANG-CHOON [KR] ET AL) 3 December 2009 (2009-12-03) * paragraphs [0053], [0054], [0055]; figures 6, 7 *	1-7, 10-19	B41M5/00 ADD. B41J15/06
Y	US 2019/009552 A1 (KANKE TSUYOSHI [JP] ET AL) 10 January 2019 (2019-01-10) * figure 2 *	1,8,9	
A,P	JP 2022 100506 A (KONICA MINOLTA INC) 6 July 2022 (2022-07-06) * the whole document *	1-19	

TECHNICAL FIELDS SEARCHED (IPC)

B41J
B41M

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
The Hague	21 December 2022	Loi, Alberto

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
Y : particularly relevant if combined with another document of the same category
A : technological background
O : non-written disclosure
P : intermediate document

T : theory or principle underlying the invention
E : earlier patent document, but published on, or after the filing date
D : document cited in the application
L : document cited for other reasons

& : member of the same patent family, corresponding document

EPO FORM 1503 03.82 (P04C01)

ANNEX TO THE EUROPEAN SEARCH REPORT ON EUROPEAN PATENT APPLICATION NO. EP 22 19 3027

This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report. The members are as contained in the European Patent Office EDP file on
The European Patent Office is in no way liable for these particulars which are merely given for the purpose of information.

21-12-2022

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
US 2017320336 A1	09-11-2017	NONE	
US 2009293209 A1	03-12-2009	NONE	
US 2019009552 A1	10-01-2019	NONE	
JP 2022100506 A	06-07-2022	NONE	

EPO FORM P0459

For more details about this annex : see Official Journal of the European Patent Office, No. 12/82

REFERENCES CITED IN THE DESCRIPTION

This list of references cited by the applicant is for the reader's convenience only. It does not form part of the European patent document. Even though great care has been taken in compiling the references, errors or omissions cannot be excluded and the EPO disclaims all liability in this regard.

Non-patent literature cited in the description

- **MAZHARUL ISLAM KIRON.** Wet Transfer Printing Method Steps of Wet Transfer Printing Process. *Textile Learner,* 2013, https://textilelearner.net/steps-of-wet-transfer-printing-process **[0008]**
- **TAKERU TAKEBE.** Recent trends in the development of textile printing machine. *SEN-I GAKKAISHI (Textile and Industry),* 1976, vol. 32 (8), 302-307 **[0008]**
- **JIRO AIHARA.** Transfer Textile Printing Method for Natural Fibers and Their Blends. *Journal of the Textile Machinery Society of Japan, Fiber Engineering,* 1977, vol. 30 (3), 128-133 **[0008]**
- **YOSHIO KODA.** Organic Concept Diagram. Sankyo Shuppan, 1984 **[0087]**
- *KUMAMOTO PHARMACEUTICAL BULLETIN,* 1954, (1), 1-16 **[0087]**
- *The FIELD OF CHEMISTRY,* 1957, vol. 11 (10), 719-725 **[0087]**