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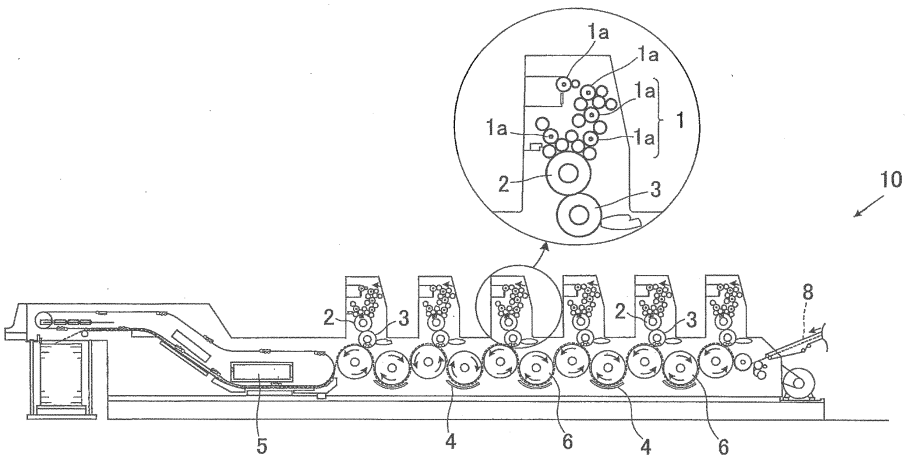
(54) **PRINTING METHOD USING OFFSET PRINTER**

(57) A printing method using an offset printing press having excellent image formability is provided. The present invention is a printing method using an offset printing press 10 including a plurality of conveying rolls 6 for conveying a substrate 8, a blanket 3 positioned adjacent to the conveying roll 6, a waterless plate 2 positioned adjacent to the blanket 3, an ink conveying roll group 1 positioned adjacent to the waterless plate 2, and a UV irradiation apparatus 5 for irradiating the printed substrate 8 with UV, the printing method including an offset printing step S1 of transferring UV curable ink applied to the waterless plate 2 to the blanket 3, and then printing the UV curable ink on the substrate 8, and a UV irradiating step S2 of irradiating the printed substrate 8 with UV to cure the UV curable ink, wherein the running speed of the substrate 8 is in a range of 1700 m/h or less, and the film thickness of the applied UV curable ink is in a range of 3 to 7 μm.

FIG.1



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Description

Technical Field

[0001] The present invention relates to a printing method using an offset printing press, and in particular to a printing method using an offset printing press having excellent image formability.

Background Art

[0002] Offset printing is known as a printing technique.
[0003] Such an offset printing adopts a system of transferring ink applied to a plate to an intermediate transferring member, such as a blanket, and then printing a substrate, such as paper.
[0004] Conventionally, in the field of offset printing, from the viewpoints of shortening delivery time and reducing costs, methods of operating an offset printing press at a high speed have been suggested.
[0005] For example, an offset printing press is known that performs printing using quick-drying ink that is cured by irradiating a printing surface of a running printing substrate with ultraviolet rays, via a printing plate mounted on an outer periphery of a plate cylinder and a blanket mounted on an outer periphery of a blanket cylinder (for example, see Patent Literature 1).
[0006] In the offset printing press, using quick-drying ink makes high-speed printing possible.
[0007] On the other hand, a back-printed article obtained by providing a print layer onto a substrate having transparency by offset printing and coating the printed layer with white ink by means of a coater is disclosed (for example, see Patent Literature 2).
[0008] In such a printed matter, offset printing is performed using UV curable ink on a polypropylene sheet treated by corona discharge, where UV curing is performed at a printing speed of 6500 sheets per hour (approximately 30 m/min).
[0009] By the way, in the offset printing, printing is generally performed on a wet plate using water.
[0010] In printing on a wet plate, control of the heaped amount of ink, pattern edges, or the like can be performed not only by ink supply but also by the amount of dampening water to the plate.
[0011] However, there is the disadvantage that image quality is unstable because the amount of dampening water depends on a humidity or a temperature in the air, or the like.
[0012] There is also the disadvantage that emulsification proceeds on the border between water and ink and quality is impaired if the emulsified part remains. In this case, it also becomes difficult to perform post-process on a film or a plate after the offset printing separately or to perform resin application after the post-process.
[0013] On the other hand, in recent years, in the offset printing, a waterless plate having a structure in which a pattern is lipophilic and a silicon layer is formed on a non-image area (an area which is not printed) has been developed.
[0014] In printing using a waterless plate, since water is not used, such a problem as a variation in image quality due to the amount of dampening water or emulsification caused due to water and ink are solved.

Citation List

Patent Literature

[0015]

PTL 1: Japanese Patent Application Laid-Open No. 2009-274432
PTL 2: Japanese Patent Application Laid-Open No. 2007-29830

Summary of Invention

Technical Problem

[0016] In printing using a waterless plate, however, the formability of an image is not sufficient. That is, the transferability of ink from a waterless plate to a blanket and the transferability of ink from a blanket to a substrate are not sufficient.
[0017] Incidentally, ink and a substrate suitable for offset printing using a waterless plate that solves such a problem have not been developed yet.
[0018] The present invention has been made in view of the above circumstances, and an object thereof is to provide a printing method using an offset printing press having excellent image formability.

Solution to Problems

[0019] As a result of intensive research of the present inventor to solve the above problem, the present inventor has found that the above problem can be solved, unexpectedly, by positively making the printing speed of the offset printing slower than an ordinary printing speed and making the film thickness of UV curable ink constant, and has completed the present invention.
[0020] The present invention lies in (1) a printing method using an offset printing press including a plurality of conveying rolls for conveying a substrate, a blanket positioned adjacent to the conveying roll, a waterless plate positioned adjacent to the blanket, an ink conveying roll group positioned adjacent to the waterless plate, and a UV irradiation apparatus for irradiating the printed substrate with UV, the printing method including an offset printing step of transferring UV curable ink applied to the waterless plate to the blanket, and then printing the UV curable ink on the substrate, and a UV irradiating step of irradiating the printed substrate with UV to cure the UV curable ink, wherein the running speed of the substrate is in a range of 1700 m/h or less, the ink conveying roll

group comprises a temperature-regulating ink conveying roll for regulating the temperature of the UV curable ink; and hot water flows through a core portion of the temperature-regulating ink conveying roll.

[0021] The present invention lies in (2) the printing method using an offset printing press according to the above aspect (1), wherein the running speed of the substrate is in a range of 250 m/h to 1700 m/h.

[0022] The present invention lies in (3) the printing method using an offset printing press according to the above aspect (1) or (2), wherein the substrate is a non-water-absorbing synthetic paper, a plastic film, or a paperboard.

[0023] The present invention lies in (4) the printing method using an offset printing press according to any one of the above aspects (1) to (3), wherein the film thickness of the applied UV curable ink is in a range of 3 to 7 μm.

[0024] The present invention lies in (5) the printing method using an offset printing press according to the above aspect (4), wherein the temperature of the UV curable ink in use is regulated to a range of 20 °C to 50 °C by the temperature-regulating ink conveying roll, and the viscosity of the UV curable ink in use is set in a range of 5 Pa·s to 1500 Pa·s.

[0025] The present invention lies in (6) the printing method using an offset printing press according to any one of the above aspects (1) to (5), wherein a U-shaped guide is provided below the conveying roll along the shape of the conveying roll.

[0026] The present invention lies in (7) the printing method using an offset printing press according to the above aspect (6), wherein air is blown to between the conveying roll and the guide so as to prevent the substrate from hanging down.

[0027] The present invention lies in (8) the printing method using an offset printing press according to any one of the above aspects (1) to (7), wherein post-process is performed after offset printing and UV irradiation are performed.

[0028] The present invention lies in (9) the printing method using an offset printing press according to the above aspect (8), wherein the post-process is silk-screen printing.

Advantageous Effects of Invention

[0029] In the printing method using an offset printing press of the present invention, since the printing speed of offset printing is made so slow as to be within a predetermined range, transferability of UV curable ink from a waterless plate to a blanket and transferability of UV curable ink from a blanket to a substrate can be improved.

[0030] For example, since the printing speed is slow, the density of UV curable ink can be increased, and the transfer amount of the UV curable ink can also be increased. Thus, the film thickness of the UV curable ink can also be set in a range of 3 to 7 μm.

[0031] In addition, since the film thickness can be set in the range of 3 to 7 μm, it is possible not only to improve decorativeness but also to use various functional inks and let the inks exert their functions sufficiently.

[0032] Further, since the printing speed is slow, UV irradiation can be sufficiently performed, so that the curing strength of cured UV curable ink can be raised up to a level capable of withstanding post-process sufficiently.

[0033] In the printing method using an offset printing press of the present invention, since a waterless plate is used, a variation in image quality due to the amount of dampening water or emulsification of water and UV curable ink can be prevented.

[0034] In addition, since the waterless plate is used, the influence of static electricity on an image area (an area to be printed) can be made as small as possible. Thus, a non-antistatic material, such as molding material, can be automatically fed and conveyed without any problems.

[0035] In the printing method using an offset printing press of the present invention, since the UV curable ink is used, the post-process can be started immediately after UV irradiation, and consequently the delivery time can be shortened.

[0036] In view of these matters, according to the printing method using an offset printing press of the present invention, a printed substrate having excellent image formability is obtained.

[0037] In the printing method using an offset printing press of the present invention, since the printing speed is within the above range when the substrate is a non-water-absorbing synthetic paper, a plastic film, or a paperboard, image formability can be improved, and, since the UV curable ink is used, offset printing can be performed at a speed that does not impose a burden on the speed of post-process.

[0038] In the printing method using an offset printing press of the present invention, since the ink conveying roll group includes a temperature-regulating ink conveying roll for regulating the temperature of the UV curable ink, and hot water flows through a core portion of the temperature-regulating ink conveying roll, the temperature of UV curable ink applied can be regulated by heating or cooling. It should be noted that if the printing speed is fast, UV curable ink is heated by frictional heat and becomes easy to transfer, but, like the present invention, when the printing speed is low, the UV curable ink is not heated and consequently difficult to transfer. Therefore, UV curable ink needs to be heated.

[0039] In this regard, it is preferred that the temperature of UV curable ink in use be regulated to a range of 20 °C to 50 °C, and the viscosity of UV curable ink in use be set in a range of 5 Pa·s to 1500 Pa·s.

[0040] In the printing method using an offset printing press of the present invention, since a U-shaped guide is provided below the conveying roll along the shape of the conveying roll, such an event can be prevented as occurrence of a wrinkle on a substrate between the con-

veying rolls due to hanging-down of a part of the substrate. It should be noted such an event does not occur if the printing speed of offset printing is fast because rotational momentum of the conveying roll causes the substrate to wrap around the conveying roll.

[0041] In this regard, since air is blown to between the conveying roll and the guide, the substrate can be further prevented from hanging down.

[0042] In the printing method using an offset printing press of the present invention, when post-process is performed after offset printing and UV irradiation are performed, a printed substrate having excellent decorativeness can be obtained. In this regard, when the post-process is silk-screen printing, since the printing speed of offset printing and the printing speed of silk-screen printing can be equalized, offset printing and silk-screen printing can be performed in succession.

Brief Description of Drawings

[0043]

Figure 1 is a schematic view showing an offset printing press used in a printing method according to an embodiment of the present invention; and
Figure 2 is a flowchart showing a printing method using an offset printing press according to an embodiment of the present invention.

Description of Embodiments

[0044] With reference to the drawings, if necessary, a preferred embodiment of the present invention will be described below in detail. Incidentally, in the drawing, identical elements are denoted by identical reference signs, so that a duplicated description is omitted. In addition, a positional relationship, such as top and bottom or right and left, is based on a positional relationship shown in the drawing, unless otherwise noted. Further, the ratio of dimensions on the drawings is not limited to the illustrated ratio of dimensions.

[0045] Fig. 1 is a schematic view showing an offset printing press used in a printing method according to an embodiment of the present invention.

[0046] As shown in Fig. 1, an offset printing press 10 has a plurality of conveying rolls 6 for conveying a substrate 8, a blanket 3 positioned adjacent to the conveying roll 6, a waterless plate 2 positioned adjacent to the blanket 3, an ink conveying roll group 1 positioned adjacent to the waterless plate 2, and a UV irradiation apparatus 5 for irradiating the printed substrate 8 with UV

[0047] In this regard, the ink conveying roll group 1 is an assembly of inking rolls or anilox rolls. It should be noted that the ink conveying roll group 1 may be an assembly of only inking rolls, may be an assembly of only anilox rolls, or may be an assembly of a mixture of both.

[0048] In the offset printing press 10, the conveying rolls 6 adjacent to each other rotate in arrow directions with the substrate 8 therebetween, thereby conveying the substrate 8.

[0049] In addition, ink conveying rolls constituting the blanket 3, the waterless plate 2, and the ink conveying roll group 1, and a temperature-regulating ink conveying roll described later are all cylindrical, and rotate in different directions or identical directions according to the directions of rotation of the conveying rolls 6.

[0050] During rotation, UV curable ink is transferred.

[0051] In the offset printing press 10, as described above, the ink conveying roll group 1 is composed of a plurality of ink conveying rolls and temperature-regulating ink conveying rolls 1a disposed among the ink conveying rolls.

[0052] The temperature-regulating ink conveying roll 1a has a sheath core structure that is so hollow at a core portion that hot water flows through the core portion. Thus, the temperature of UV curable ink is regulated. It should be noted that if it is unnecessary to heat UV curable ink with hot water, it is unnecessary to cause hot water to flow through the temperature-regulating ink conveying roll, or, conversely, if cooling is needed, it is also possible to cause cold water to flow therethrough.

[0053] Incidentally, the ink conveying rolls are inking rolls or anilox rolls, and the temperature-regulating ink conveying roll is an inking roll or an anilox roll having the sheath core structure in the same manner as described above.

[0054] In the offset printing press 10, a U-shaped guide 4 is provided below the conveying roll 6 along the shape of the conveying roll 6. Thus, such an event can be prevented as occurrence of a wrinkle on the substrate 8 due to that a part of the substrate 8 hangs down to be caught in a folded state of the substrate 8 in between the conveying rolls 6.

[0055] In addition, air is blown to between the conveying roll 6 and the guide 4 by a blower (not shown) or the like in order to prevent the substrate 8 from hanging down. Thus, the substrate can be further prevented from hanging down.

[0056] In this regard, it is preferred that the substrate 8 be a non-water-absorbing synthetic paper, a plastic film, or a paperboard.

[0057] Using these substrates 8 makes it possible to reduce the weight of a product (a printed substrate) and to give the product durability.

[0058] Incidentally, the plastic film to be used can be, but is not particularly limited to, a polyester film, a polyethylene film, a polyethylene naphthalate film, a polypropylene film, a polyamide film, a polyimide film, a polyvinyl alcohol film, a polyvinyl chloride film, a polyvinylidene chloride film, a polycarbonate film, a polystyrene film, a polyacrylonitrile film, an ethylene-vinyl acetate copolymer film, an ethylene-vinyl alcohol copolymer film, an ethylene-methacrylic acid copolymer film, a cellulose triacetate film, an ionomer film, cellophane, or the like.

[0059] In the offset printing press 10, UV curable ink is applied to the waterless plate 2 by the ink conveying

roll group 1, and printing is performed on the substrate 8 via the waterless plate 2 and the blanket 3. The details will be described later.

[0060] In the offset printing press 10, UV curable ink is here used.

[0061] Since the UV curable ink is used, post-process can be started immediately after irradiation with UV, and consequently the delivery time can also be shortened.

[0062] At this time, as described above, since the waterless plate 2 is used as the printing plate, it is preferred that the UV curable ink be lipophilic.

[0063] Using the lipophilic UV curable ink has the advantage that the UV curable ink is well dissolved in a lipophilic portion constituting a pattern on the waterless plate 2.

[0064] The UV curable ink includes a UV curable resin, a polymerization initiator, and a pigment. Incidentally, the UV curable ink may further include such an additive as a solvent, a sensitizer, a polymerization inhibitor, an antifoamer, or a surfactant.

[0065] The UV curable resin can be an acrylate, methacrylate, or unsaturated polyester resin having a polymerizable ethylenic double bond, or the like. More specifically, the UV curable resin can be polyester acrylate, epoxyacrylate, urethane acrylate, or the like.

[0066] The polymerization initiator can be a benzopenone, benzoin, acetophenone, or thioxanthone polymerization initiator, or the like.

[0067] In addition, as described later, since the film thickness of the UV curable ink can be made sufficiently thick, the UV curable ink can include functional ink.

[0068] The functional ink can be conductive ink, insulating ink, thermochromic ink, water color-developing hydrophilic ink, perfume ink, UV-ray color-developing ink, fluorescent ink, light-accumulating ink, or the like. These inks all need leveling in a thick film in order to exert their functions. It should be noted that their functions are not exerted unless these inks are dried to certain extents.

[0069] Therefore, when the functional ink is used, it is possible not only to improve decorativeness but also to let the functional ink exert its function sufficiently.

[0070] It is preferred that the temperature of the UV curable ink in use be in a range of 20 °C to 50 °C. It should be noted that the temperature is regulated by the temperature-regulating ink conveying roll 1a described above.

[0071] In addition to the temperature of the UV curable ink in use being within the above range, it is preferred that the viscosity of the UV curable ink in use be in a range of 5 Pa·s to 1500 Pa·s.

[0072] When the physical properties of the UV curable ink in use are within the above ranges, transfer of the UV curable ink to the waterless plate 2, transfer of the UV curable ink to the blanket 3, and transfer of the UV curable ink to the substrate 8 can be performed securely and stably.

[0073] The UV irradiation apparatus 5 is a device for irradiating the printed substrate with UV.

[0074] The UV irradiation apparatus 5 is not limited to a specific one, and a commercially-available one can be used according to situations.

[0075] Incidentally, the UV irradiation apparatus 5 may be disposed inside the offset printing press 10, for example, between cylinders, or may be disposed outside.

[0076] Fig. 2 is a flowchart showing a printing method using an offset printing press according to an embodiment of the present invention.

[0077] As shown in Fig. 2, a printing method using the offset printing press 10 has an offset printing step S1 of printing UV curable ink on the substrate 8 after transferring the UV curable ink applied to the waterless plate 2 to the blanket 3 by means of the ink conveying roll group 1, and a UV irradiating step S2 of irradiating the printed substrate 8 with UV to cure the UV curable ink.

[0078] In the printing method using the offset printing press 10, the offset printing step S1 and the UV irradiating step S2 are performed in succession.

[0079] At the offset printing step S1, UV curable ink is applied to the waterless plate 2 by means of the ink conveying roll group 1.

[0080] In this regard, in the printing method using the offset printing press 10, since the ink conveying roll group 1 is used, when the UV curable ink is applied to the waterless plate 2, a constant amount of ink can be stably supplied to the waterless plate 2 even at a low printing speed.

[0081] In addition to this, mist occurs when an inking roll is used, but the mist can be prevented from occurring by means of the ink conveying roll group.

[0082] In addition, in the printing method using the offset printing press 10, since the waterless plate is used, a variation in image quality due to the amount of dampening water or emulsification caused by water and the UV curable ink can be prevented.

[0083] In addition to this, the influence of static electricity on an image area (an area to be printed) can be reduced.

[0084] Then, the UV curable ink applied to the waterless plate 2 is transferred to the blanket 3 made of rubber, and thereafter printed on the substrate 8.

[0085] At this time, the running speed of the substrate 8 is a low speed. It should be noted that the running speed of the substrate 8 and the printing speed onto the substrate 8 are identical with each other. Therefore, by making the running speed of the substrate 8 low, the speed of printing onto the substrate 8 becomes lower.

[0086] Specifically, the running speed of the substrate 8 is in a range of 1700 m/h or less, preferably, in a range of 250 m/h to 1700 m/h, more preferably, in a range of 250 m/h to 1500 m/h.

[0087] By setting the running speed of the substrate 8 in a range of 1700 m/h or less, transferability of the UV curable ink from the waterless plate 2 to the blanket 3, and transferability of the UV curable ink from the blanket 3 to the substrate 8 can be improved. Incidentally, the printing speed in a commercially-available ordinary offset

printing press is 3000 m/h at the lowest.

[0088] Further, the density of the UV curable ink can be increased, and the transfer amount can be increased. Thus, the film thickness can be increased.

[0089] Specifically, in the printing method using the offset printing press 10, the film thickness of applied UV curable ink is in a range of 3 to 7 μm. Incidentally, the film thickness of UV curable ink in an ordinary offset printing press is in a range of 1 to 2 μm.

[0090] Thus, since the film thickness can be set in a range of 3 to 7 μm, it is possible not only to improve decorativeness but also to use various functional inks and let the inks exert their functions sufficiently.

[0091] Further, sufficient UV irradiation can be performed, so that the strength of the cured UV curable ink can be increased up to a level capable of withstanding post-process sufficiently.

[0092] In the offset printing press 10 according to the embodiment, as described above, since the substrate 8 is a non-water-absorbing synthetic paper, a plastic film, or a plastic sheet, and the printing speed is set within the above range, image formability can be improved, and, as described above, since the UV curable ink is used, offset printing can be performed at a speed that does not impose a burden on the speed of post-process.

[0093] Incidentally, if a water-absorbing substrate is used and the printing speed is low, the water-absorbing synthetic paper absorbs moisture in the air, and UV curable ink applied thereto may bleed.

[0094] At the UV irradiating step S2, the UV curable ink is cured by irradiating the printed substrate 8 with UV.

[0095] The UV irradiating method is not limited to a particular one, and a conventional known method can be used.

[0096] According to the printing method using the offset printing press 10 according to the embodiment, a printed substrate having excellent image formability is obtained through the above steps.

[0097] In the offset printing press 10 according to the embodiment, it is preferred that post-process is performed after the offset printing step S1 and the UV irradiating step S2 are performed in succession. That is, it is preferred that the post-process be performed after the offset printing is performed and the UV irradiation is performed. In this case, a printed substrate having excellent decorativeness can be obtained.

[0098] The post-process can be, for example, silk-screen printing, flexography, roller coating, coating, molding, or the like.

[0099] Among these, the post-process is preferably silk-screen printing. In this case, a printed substrate having excellent decorativeness can be obtained. In this case, the printing speed of offset printing and the printing speed of silk-screen printing can be made equal to each other, so that offset printing (the offset printing step S1 and the UV irradiating step S2) and silk-screen printing can be performed in succession.

Industrial Applicability

[0100] The present invention is used as a printing method using an offset printing press applying UV curable ink to a substrate. According to the printing method using the offset printing press of the present invention, a printed substrate having excellent image formability is obtained.

Reference Signs List

[0101]

1...ink conveying roll group,
1a...temperature-regulating ink conveying roll,
2...waterless plate,
3...blanket,
4...guide,
5...UV. irradiation apparatus,
6...conveying roll,
8...substrate,
10...offset printing press,
S1...offset printing step,
S2...UV irradiating step,

Claims

1. A printing method using an offset printing press (10) including a plurality of conveying rolls (6) for conveying a substrate (8), a blanket (3) positioned adjacent to the conveying roll (6), a waterless plate (2) positioned adjacent to the blanket (3), an ink conveying roll group (1) positioned adjacent to the waterless plate (2), and a UV irradiation apparatus (5) for irradiating the printed substrate (8) with UV, the printing method comprising:

   an offset printing step (S1) of transferring UV curable ink applied to the waterless plate (2) to the blanket (3), and then printing the UV curable ink on the substrate (8); and
   a UV irradiating step (S2) of irradiating the printed substrate (8) with UV to cure the UV curable ink, wherein
   the running speed of the substrate (8) is in a range of 1700 m/h or less, and
   the ink conveying roll group (1) comprises a temperature-regulating ink conveying roll (1a) for regulating the temperature of the UV curable ink; and
   hot water flows through a core portion of the temperature -regulating ink conveying roll (1a).

2. The printing method using an offset printing press (10) according to claim 1, wherein the running speed of the substrate (8) is in a range of 250 m/h to 1700 m/h.

3. The printing method using an offset printing press 10 according to claim 1 or 2, wherein the substrate 8 is a non-water-absorbing synthetic paper, a plastic film, or a paperboard.

4. The printing method using an offset printing press (10) according to any one of claims 1 to 3, wherein the film thickness of the applied UV curable ink is in a range of 3 to 7 μm.

5. The printing method using an offset printing press (10) according to claim 4, wherein the temperature of the UV curable ink in use is regulated to a range of 20 °C to 50 °C by the temperature-regulating ink conveying roll 1a, and the viscosity of the UV curable ink in use is set in a range of 5 Pa·s to 1500 Pa·s.

6. The printing method using an offset printing press (10) according to any one of claims 1 to 5, wherein a U-shaped guide (4) is provided below the conveying roll (6) along the shape of the conveying roll (6).

7. The printing method using an offset printing press (10) according to claim 6, wherein air is blown to between the conveying roll and the guide (4) so as to prevent the substrate (8) from hanging down.

8. The printing method using an offset printing press (10) according to any one of claims 1 to 7, wherein post-process is performed after offset printing is performed and UV irradiation is performed.

9. The printing method using an offset printing press (10) according to
claim 8, wherein the post-process is silk-screen printing.

Amended claims under Art. 19.1 PCT

1. (Amended) A printing method using an offset printing press including a plurality of conveying rolls for conveying a substrate, a blanket positioned adjacent to the conveying roll, a waterless plate positioned adjacent to the blanket, an ink conveying roll group positioned adjacent to the waterless plate, and a UV irradiation apparatus for irradiating the printed substrate with UV, the printing method comprising:

an offset printing step of transferring UV curable ink applied to the waterless plate to the blanket, and then printing the UV curable ink on the substrate; and
a UV irradiating step of irradiating the printed substrate with UV to cure the UV curable ink, wherein
the running speed of the substrate is in a range of 1700 m/h or less, the ink conveying roll group comprises a temperature-regulating ink conveying roll for regulating the temperature of the UV curable ink; and
hot water flows through a core portion of the temperature-regulating ink conveying roll.

2. The printing method using an offset printing press according to claim 1, wherein the running speed of the substrate is in a range of 250 m/h to 1700 m/h.

3. The printing method using an offset printing press according to claim 1 or 2, wherein the substrate is a non-water-absorbing synthetic paper, a plastic film, or a paperboard.

4. (Amended) The printing method using an offset printing press according to any one of claims 1 to 3, wherein the film thickness of the applied UV curable ink is in a range of 3 to 7 μm.

5. The printing method using an offset printing press according to claim 4, wherein the temperature of the UV curable ink in use is regulated to a range of 20 °C to 50 °C by the temperature-regulating ink conveying roll, and the viscosity of the UV curable ink in use is set in a range of 5 Pa·s to 1500 Pa·s.

6. The printing method using an offset printing press according to any one of claims 1 to 5, wherein a U-shaped guide is provided below the conveying roll along the shape of the conveying roll.

7. The printing method using an offset printing press according to claim 6, wherein air is blown to between the conveying roll and the guide so as to prevent the substrate from hanging down.

8. The printing method using an offset printing press according to any one of claims 1 to 7, wherein post-process is performed after offset printing is performed and UV irradiation is performed.

9. The printing method using an offset printing press according to claim 8, wherein the post-process is silk-screen printing.

Statement under Art. 19.1 PCT

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Applicant: YAMATO GRAND CO., LTD.
Agent: SHIRASAKI Shinji
Applicant's or Agent's File reference: PCT-13-07

Dear Sir/Madam

The Applicant hereby files amendment under Article 19(1) as in the attached sheets.

We have amended claim 1 so that the clause "the

film thickness of the applied UV curable ink is in a range of 3 to 7 μm" is replaced by the clause "the ink conveying roll group comprises a temperature-regulating ink conveying roll for regulating the temperature of the UV curable ink; and hot water flows through a core portion of the temperature-regulating ink conveying roll". The clause "the ink conveying roll group comprises a temperature-regulating ink conveying roll for regulating the temperature of the UV curable ink; and hot water flows through a core portion of the temperature-regulating ink conveying roll" in claim 1 thus amended was recited in claim 4 as originally filed.

We have amended claim 4 so that the clause "the ink conveying roll group comprises a temperature-regulating ink conveying roll for regulating the temperature of the UV curable ink; and hot water flows through a core portion of the temperature-regulating ink conveying roll" is replaced by the clause "the film thickness of the applied UV curable ink is in a range of 3 to 7 μm". The clause "the film thickness of the applied UV curable ink is in a range of 3 to 7 μm" in claim 4 thus amended was recited in claim 1 as originally filed.

FIG.1

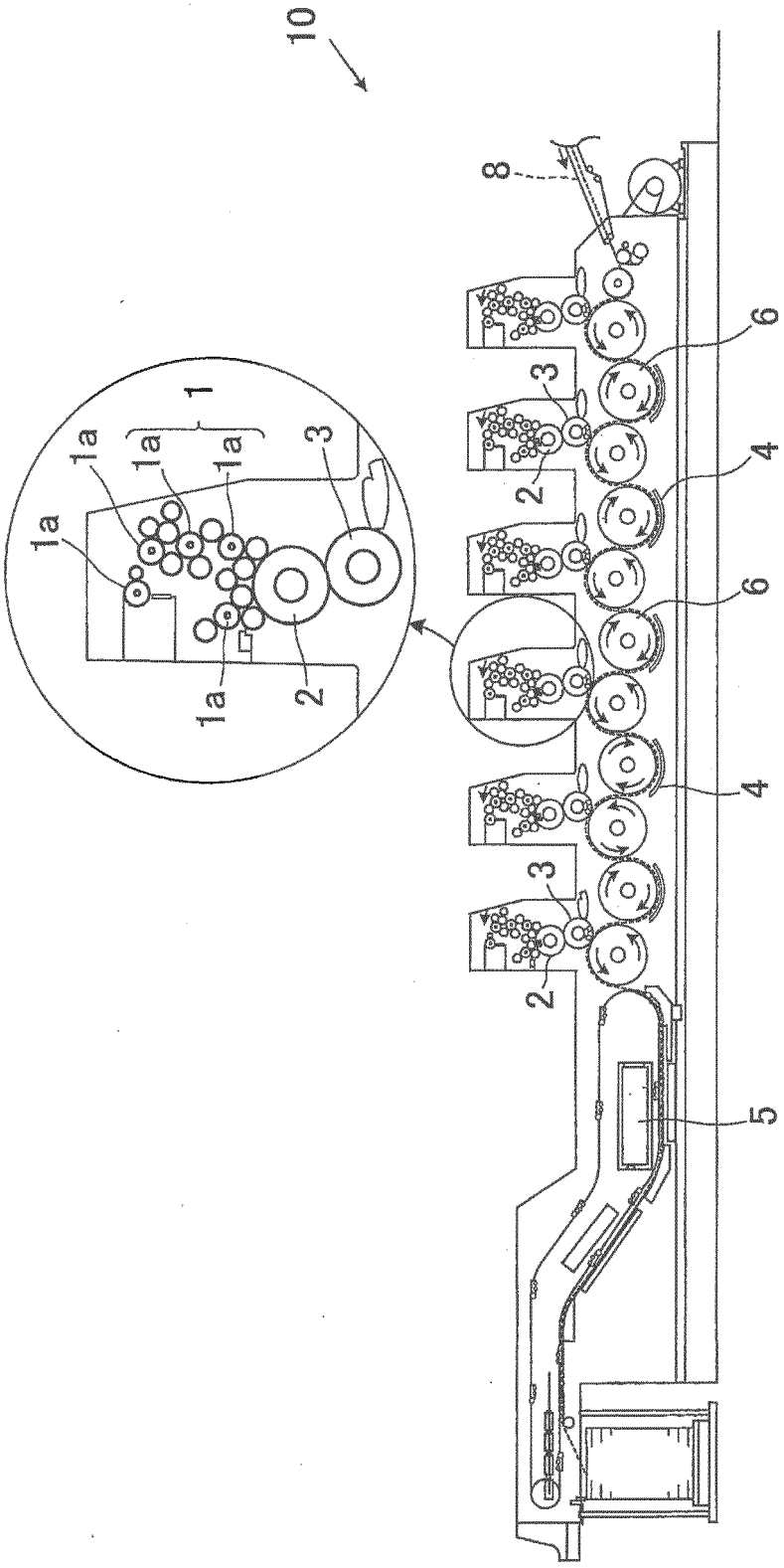
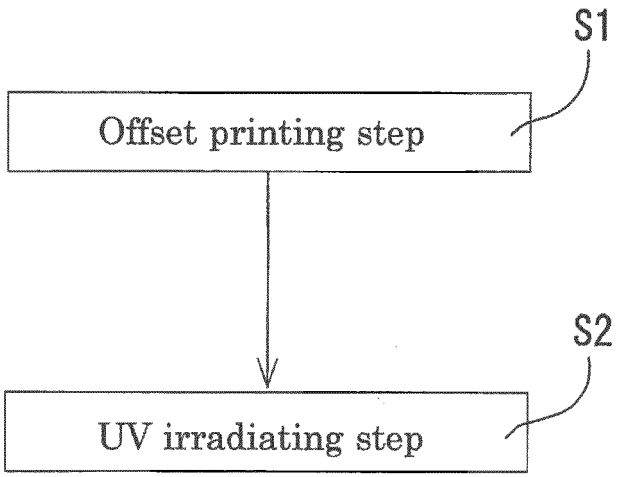


FIG.2



INTERNATIONAL SEARCH REPORT

International application No.
PCT/JP2013/004440

A. CLASSIFICATION OF SUBJECT MATTER
B41M1/08(2006.01)i, *B41F7/02*(2006.01)i, *B41F23/04*(2006.01)i, *B41M1/30*(2006.01)i

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

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
B41M1/08, B41F7/02, B41F23/04, B41M1/30

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched
Jitsuyo Shinan Koho 1922-1996 Jitsuyo Shinan Toroku Koho 1996-2013
Kokai Jitsuyo Shinan Koho 1971-2013 Toroku Jitsuyo Shinan Koho 1994-2013

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

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	JP 11-58923 A (Toppan Printing Co., Ltd.), 02 March 1999 (02.03.1999), claims 1 to 2; paragraphs [0015] to [0020] (Family: none)	1-9
Y	JP 8-324141 A (Kyodo Printing Co., Ltd.), 10 December 1996 (10.12.1996), paragraphs [0021] to [0023] (Family: none)	1-9
Y	Mitsugu HOSHIKAWA, "Shiki eno Mizunashi UV Insatsu", Japan Printer, Insatsu Gakkai Shuppanbu, 15 November 2003 (15.11.2003), page 12	1-9

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

* Special categories of cited documents:
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"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
02 August, 2013 (02.08.13)	13 August, 2013 (13.08.13)
Name and mailing address of the ISA/ Japanese Patent Office Facsimile No.	Authorized officer Telephone No.

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INTERNATIONAL SEARCH REPORT

International application No.
PCT/JP2013/004440

C (Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	JP 2008-80591 A (Yamato Grand Co., Ltd.), 10 April 2008 (10.04.2008), paragraphs [0028], [0032] (Family: none)	1-9
Y	JP 2-39940 A (Toppan Printing Co., Ltd.), 08 February 1990 (08.02.1990), page 3, upper left column, line 7 to upper right column, line 18; fig. 2 (Family: none)	1-9
Y	JP 9-269566 A (Fuji Photo Film Co., Ltd.), 14 October 1997 (14.10.1997), paragraph [0036] (Family: none)	1-9
Y	JP 2004-106186 A (Toyo Ink Manufacturing Co., Ltd.), 08 April 2004 (08.04.2004), paragraph [0018] (Family: none)	1-9
Y	JP 2001-162919 A (Dainippon Ink and Chemicals, Inc.), 19 June 2001 (19.06.2001), paragraph [0026] (Family: none)	1-9
Y	JP 9-104104 A (Mitsubishi Heavy Industries, Ltd.), 22 April 1997 (22.04.1997), paragraph [0004]; fig. 2 (Family: none)	4-9
Y	JP 9-29937 A (Toppan Printing Co., Ltd.), 04 February 1997 (04.02.1997), paragraphs [0039], [0057]; fig. 1 (Family: none)	4-9
Y	JP 2010-742 A (DIC Corp.), 07 January 2010 (07.01.2010), paragraph [0069] (Family: none)	4-9
Y	JP 2008-291167 A (Toyo Ink Manufacturing Co., Ltd.), 04 December 2008 (04.12.2008), paragraphs [0073] to [0074] (Family: none)	4-9

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INTERNATIONAL SEARCH REPORT

International application No.
PCT/JP2013/004440

C (Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	JP 11-99625 A (Mitsubishi Heavy Industries, Ltd.), 13 April 1999 (13.04.1999), claim 1; fig. 1 (Family: none)	6-9
Y	JP 2001-225441 A (Komori Corp.), 21 August 2001 (21.08.2001), paragraph [0013]; fig. 1, 3 & US 2002/0002916 A1 & EP 1125733 A1	8-9
A	JP 8-501589 A (Deluxe Corp.), 20 February 1996 (20.02.1996), page 18, lines 3 to 8; page 53, line 20 to page 59, line 11 & WO 1994/006873 A1 & EP 677090 A & US 5602089 A & DE 69332658 T & CN 1095693 A	1-9
A	JP 2007-296830 A (Dainippon Ink and Chemicals, Inc.), 15 November 2007 (15.11.2007), paragraph [0042] (Family: none)	1-9
A	JP 63-252777 A (Toyo Ink Manufacturing Co., Ltd.), 19 October 1988 (19.10.1988), page 4, lower right column, line 18 to page 5, upper left column, line 6 (Family: none)	1-9

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REFERENCES CITED IN THE DESCRIPTION

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Patent documents cited in the description

- JP 2009274432 A **[0015]**
- JP 2007029830 A **[0015]**