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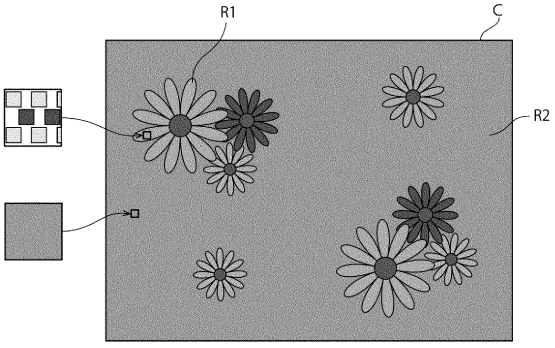
(54) FABRIC PRINTING METHOD AND FABRIC PRINTING APPARATUS

(57) The present invention provides a fabric printing method and a fabric printing apparatus that enable printing in which the characters, pictures, and background printed on the fabric surface are visible from the rear side of the fabric when designed patterns and the backgrounds are printed on the fabric surface by dot printing, thereby reducing the occurrence of granular appearance on the fabric surface.

The fabric printing method of the present invention comprises a plurality of first ink tanks 53 individually filled with inks of a plurality of process colors; at least one second ink tank 54 filled with at least one kind of spot color ink obtained by mixing inks of different process colors, the method comprising performing printing on a fabric by dividing a plurality of print regions set on a first side of a fabric to be printed into one or a plurality of first print regions R1 in which dots are printed with an ink introduced from at least one of the first ink tanks and one or a plurality of second print regions R2 in which dots are printed with an ink introduced from the at least one second ink tank.

Fig.5



EP 3 643 504 A1

Description

Technical Field

[0001] The present invention relates to a fabric printing method and a fabric printing apparatus, more specifically to a fabric printing method and a fabric printing apparatus that perform printing with inks of process color and printing with inks of spot color.

Background Art

[0002] In recent years, printing using a combination of process colors, such as CMYK (cyan, magenta, yellow, and black), has been performed. This type of printing is referred to as "process color printing." For example, an ink-jet printing apparatus disclosed in Patent Document 1 has been suggested. In this ink-jet printing apparatus, conveyance rollers are provided in the upstream and the downstream, and a conveyance belt for conveying fabrics is wound around the conveyance rollers. The fabrics are conveyed by a conveyance belt, and printing is performed with process color inks provided from the printer head.

[0003] In this type of ink-jet printing apparatus, printing is usually performed by dot printing. Dot printing creates dots, and adjusts the intervals between the dots, the sizes of the respective dots, and the overlapping state of the dots of individual colors, thereby expressing the variation and density of colors. This printing method enables the reproduction of various colors.

[0004] For example, as shown in Fig. 7(A) to Fig. 7(C), dot printing expresses various degrees of color density by adjusting the dot area per unit area (area ratio). The color density increases as the density of the dots increases. Fig. 7(C) shows an example having a dot area ratio of 10% in which the color to be expressed is a light color. Fig. 7(A) shows an example having a dot area ratio of 100% in which the color to be expressed is a deep color. Fig. 7(B) shows an example having a dot area ratio of 50% in which the color to be expressed has density in the middle of Figs. 7(A) and 7(C). As is thus clear, the higher the dot area ratio, the deeper the color to be expressed.

Citation List

Patent Documents

[0005] Patent Document 1: Japanese Patent No. 5116542

Summary of Invention

Technical Problem

[0006] For example, when printing is performed on fabrics like silk chiffon or silk twill to be used for clothing accessories, such as a scarf, it is preferable that the ink permeates into the rear side of the fabric (this phenomenon may also referred to as "penetration") penetration so that the characters, pictures, and background printed on the surface can be seen through from the rear side of the fabric. This is because, when clothing accessories such as a scarf are used, they are recognized not only from the surface but also from the rear side.

[0007] However, when a light color is printed on a fabric by dot printing, the dot area ratio becomes small and an area in which dots are not printed is large. Therefore, if the ink in the front surface does not sufficiently permeate into the rear side, the original color of the fabric (e.g., white) will be recognized as the color of the rear side. For example, when a yellow color is printed on the surface of a white fabric with a small dot area ratio, as shown in Fig. 8(A), although the light yellow printing is visible in the fabric surface, the ink used for printing the dots were not permeated into the rear side, and therefore the rear side is substantially recognized as white as shown in Fig. 8(B).

[0008] Further, when dot printing is performed using ink of a plurality of process colors, the dots may stand out in the surface depending on the area ratio of the dots of the respective colors, thus resulting in a problematic granular appearance as shown in Fig. 9.

[0009] The present invention was made in view of the problems described above, and an object of the invention is to provide a fabric printing method and a fabric printing apparatus that enable printing while ensuring that the characters, pictures, and background printed on the fabric surface are visible from the rear side of the fabric when designed patterns and the background are printed on the fabric surface by dot printing, and reducing the occurrence of a granular appearance on the fabric surface.

Solution to Problem

[0010] The fabric printing methods according to some embodiments of the present invention comprise: a plurality of first ink tanks individually filled with inks of a plurality of process colors; and at least one second ink tank filled with at least one kind of spot color ink obtained by mixing inks of different process colors, the method comprising performing printing on a fabric by dividing a plurality of print regions set on a first side of a fabric to be printed into one or a plurality of first print regions in which dots are printed with an ink introduced from at least one of the first ink tanks and one or a plurality of second print regions in which dots are printed with an ink introduced from the at least one second ink tank.

[0011] With this structure, since printing is performed in the second print region using a spot color ink obtained by mixing a plurality of process color inks, the printing is performed while increasing the dot area ratio to be greater than that in the case of using the process color ink. Therefore, the ink in the first side, i.e., the surface, permeates into the second side, i.e., the rear side, of the

fabric, thereby allowing the characters, pictures, and background printed on the fabric surface to be visible from the rear side. Further, since the dot area ratio is large, the granular appearance does not easily occur.

[0012] Further, in the first print region, so-called "process color printing" using a process color ink or a combination of a plurality of process color inks is performed. This enables expression of various colors and minute designs.

[0013] In a preferred embodiment, the area ratio per unit area of the dots formed by the ink of the spot color is not less than 80% and not more than 100%.

[0014] With this structure, since the area ratio of the dots per unit area upon the printing on the fabric surface is large, the ink on the fabric surface permeates into the rear side, thereby allowing the characters, pictures, and background printed on the fabric surface to be visible from the rear side, and reducing the occurrence of a granular appearance on the surface.

[0015] The area ratio is preferably not less than 90% and not more than 100%, further preferably 100%.

[0016] In a preferred embodiment, in the first print region, a designed pattern having at least one of a picture and character is printed as dots with the ink introduced from the first ink tank, and, in the second print region, a background of the designed pattern is printed as dots with the ink introduced from the second ink tank.

[0017] The background of a designed pattern generally has a printing area larger than that of the pattern. Therefore, when process color printing is used for the background printing, the rear side is recognized as white, and the granular appearance is present in the surface. The whiteness of the rear side and the granular appearance undesirably stand out. In the present invention, in the first print region, patterns of various colors are expressed by process color printing, and the background of the pattern is printed in the second print region using a spot color ink. Therefore, the whiteness in the rear side or the granular appearance in the surface do not stand out.

[0018] In a preferred embodiment, the fabric to be printed is a fabric for clothing accessories.

[0019] The fabrics for clothing accessories are, for example, fabrics for use in scarves, handkerchiefs, stoles, shawls and the like in which the characters, pictures, and background printed on the fabric surface are preferably visible from the rear side.

[0020] The fabric printing apparatuses according to some embodiments of the present invention comprise: a plurality of first ink tanks individually filled with inks of a plurality of process colors; at least one second ink tank filled with at least one kind of spot color ink obtained by mixing inks of different process colors; a plurality of first printheads that are individually connected to the plurality of first ink tanks and that perform the printing of dots in one or a plurality of first print regions set on a first side of a fabric to be printed with an ink of a process color; and at least one second printhead that is connected to the at least one second ink tank and that performs the printing of dots in one or a plurality of second print regions set on the first side of the fabric to be printed with an ink of a spot color.

[0021] The spot color ink is supplied to the second printhead from the second ink tank, and dots are printed in the first print region on the first side, i.e., the surface, of the fabric by the first printhead. In the second print region, the printing is performed using a spot color ink obtained by mixing a plurality of process color inks while increasing the dot area ratio to be greater than that in the case of using the process color ink. Therefore, the ink in the surface permeates into the second side, i.e., the rear side, of the fabric, thereby allowing the characters, pictures, and background printed on the surface of the fabric to be visible from the rear side, and the granular appearance does not easily occur.

[0022] Further, the process color ink is supplied to the first printhead from the first ink tank, and dots are printed in the first print region by the first printhead. In the first print region, so-called "process color printing" using a process color ink or a combination of a plurality of process color inks is performed. This enables the expression of various colors and designs.

[0023] One embodiment of the present invention further comprises a blending device comprising ink storage tanks individually storing inks of a plurality of process colors; and a mixture ink storing container that is connected to the ink storage tanks and that stores a mixture ink obtained by mixing inks of different process colors introduced from the ink storage tanks. The mixture ink storing container is connected to the at least one second ink tank.

[0024] With this structure, since the spot color ink is prepared by color blending by a blending device, and is introduced into the second ink tank, it is possible to easily prepare a desired spot color ink by color blending and supply the ink to the second ink tank.

Advantageous Effects of Invention

[0025] The present invention enables the rear side of the fabric to be permeated with the ink in the surface, thereby allowing the characters, pictures, and background printed on the fabric surface to be visible from the rear side.

Brief Description of Drawings

[0026]

Fig. 1 is a schematic view showing the entire structure of a fabric printing apparatus according to one embodiment of the present invention.

Fig. 2 is an explanatory view showing a flow of ink supplied to a first printhead.

Fig. 3 is an explanatory view showing a flow of ink supplied to a second printhead.

Fig. 4 is a schematic view showing a structure of a

blending device.

Fig. 5 is an explanatory view showing an example of printing on a fabric surface.

Fig. 6 is an explanatory view showing the second print region. (A) shows the surface and (B) shows the rear side of the second print region in the fabric.

Fig. 7 is an explanatory view showing dot printing. (A) shows an example in which the dot area per unit area is 10%, (B) shows an example in which the dot area per unit area is 50%, and (C) shows an example in which the dot area per unit area is 100%.

Fig. 8 shows (A) the surface and (B) the rear side of a fabric upon printing with a low dot area ratio.

Fig. 9 shows a state of printing in which a granular appearance is present.

Description of Embodiments

[0027] Hereinbelow, embodiments of the present invention are described by referring to drawings.

[0028] Fig. 1 is an explanatory view showing the entire structure of a fabric printing apparatus 10 according to one embodiment of the present invention, and Fig. 2 is an explanatory view showing a flow of ink in supplying ink to a first printhead 51. Fig. 3 is an explanatory view showing a flow of ink in supplying ink to a second printhead 52.

[0029] The fabric printing apparatus 10 comprises a printing apparatus main body 20, an ink supplying device 30, an ink blending device 40, and a control device (not shown). The printing apparatus main body 20 comprises a support 21, a conveyance belt 22 for conveying a fabric C, and a driven roller 23A (upstream) and a driving roller 23B (downstream) attached to the support 21 for running the conveyance belt 22. A bonding device 24 for bonding the fabric C to the conveyance belt 22 with an adhesive or the like is provided above the driven roller 23A in the upstream, and a belt water-washing device 25 for washing off starch or ink remaining on the conveyance belt 22 is provided below the driving roller 23B in the downstream.

[0030] A printhead carrier unit 50 is provided above the conveyance belt 22 between the driving roller 23B and the driven roller 23A.

[0031] The printhead carrier unit 50 is supported by a unit supporting mechanism 26 attached to the upper face of the support 21. A unit moving mechanism (not shown) reciprocatingly moves the printhead carrier unit 50 in the direction orthogonal to the direction toward which the fabric C is conveyed.

[0032] The printhead carrier unit 50 comprises a plurality of first printheads 51, first negative-pressure ink tanks 53 of the same number as that of the first printheads 51, at least one second printhead 52, second negative-pressure ink tanks 54 of the same number as that of the second printhead(s) 52, and deaeration modules 55 of the same number as the total number of the first and second printheads 51 and 52.

[0033] Each first printhead 51 is connected to each first negative-pressure ink tank 53 with a tube through each deaeration module 55. The first negative-pressure ink tanks 53 are individually filled with inks of a plurality of process colors, and the inks in the respective first negative-pressure ink tanks 53 are individually supplied to the respective first printheads 51. Each first printhead 51 has a nozzle. The nozzle discharges an ink of a process color to the fabric C and prints dots in one or a plurality of first print regions R1 (see Fig. 5) set on the first side, i.e., the surface, of the fabric C to be printed. The deaeration modules 55 serve to remove gasses contained in the inks.

[0034] The at least one second printhead 52 is connected to the at least one second negative-pressure ink tank 54 with a tube through each deaeration module 55. The at least one second negative-pressure ink tank 54 is filled with at least one kind of spot color ink obtained by mixing inks of different process colors. The ink in the at least one second negative-pressure ink tank 54 is supplied to at least one second printhead 52. The second printhead 52 has a nozzle. The nozzle discharges an ink of a process color to the fabric C and prints dots in one or a plurality of second print regions R2 (see Fig. 5) set on the surface of the fabric C to be printed.

[0035] In this embodiment, twelve first printheads 51, twelve second printheads 52, twelve first and second negative-pressure ink tanks 53 and 54, and twenty-four deaeration modules 55 are provided; however, the numbers of these components are not limited to these numbers.

[0036] It is also possible to fill some of the plurality of first negative-pressure ink tanks 53 with a penetrant instead of ink, and cause the penetrant to be discharged at the same time as the printing of dots on the fabric C.

[0037] In the printing apparatus main body 20 in Fig. 1, only one first printhead 51, one second printhead 52, two deaeration modules 55, one first negative-pressure ink tank 53, and one second negative-pressure ink tank 54 are shown. The rest of the first printheads 51, the second printheads 52, deaeration modules 55, and the first and second negative-pressure ink tanks 53 and 54 are omitted in Fig. 1. The tubes for connecting the respective structures are also omitted in Fig. 1. Further, Fig. 2 shows a flow of ink supplied to one first printhead 51, and Fig. 3 shows a flow of ink supplied to one second printhead 52. The structures of supplying inks to other first printheads 51 and other second printheads 52 are the same as those shown in Figs. 2 and 3, and the illustration and the explanation thereof are omitted.

[0038] In this specification, "process color" means a color of an ink supplied to the first printhead 51.

Further, the "spot color" means a color of an ink supplied to the second printhead 52 obtained by mixing inks of different process colors.

[0039] As shown in Fig. 1, the ink supplying device 30 comprises first and second ink main tanks 31 and 32, first and second ink sub-tanks 33 and 34, first and second ink supplying pumps 35 and 36, and a vacuum pump 37,

in a housing 301. In this embodiment, the numbers of the first and second ink main tanks 31 and 32, the first and second ink sub-tanks 33 and 34, and the first and second ink supplying pumps 35 and 36 are the same as those, i.e., 12, of the first and second negative-pressure ink tanks 53 and 54. In the ink supplying device 30 in Fig. 1, only one each of the first and second ink main tanks 31 and 32, only one each of the first and second ink sub-tanks 33 and 34, and only one each of the first and second ink supplying pumps 35 and 36 are shown, and other structures are omitted. Further, tubes for connecting the structures, ink collecting tube 39, ink supplying tube 38, and deaeration module tube 56 are also omitted in the figure.

[0040] As shown in Fig. 2, the first ink main tank 31 is connected to the first ink sub-tank 33 through a tube, and the first ink sub-tank 33 is connected to the first negative-pressure ink tank 53 through the ink supplying tube 38. Midway in the ink supplying tube 38, the first ink supplying pump 35 is provided to adjust the supplying amount of the process color ink.

[0041] Each first printhead 51 is connected to each first ink sub-tank 33 through the ink collecting tube 39. By opening a pinch valve (not shown) provided in the ink collecting tube 39 upon cleaning of the first printhead 51, ink is collected from the first printhead 51 to the first ink sub-tank 33.

[0042] As shown in Fig. 3, the second ink main tank 32 is connected to the second ink sub-tank 34 through a tube, and the second ink sub-tank 34 is connected to the second negative-pressure ink tank 54 through the ink supplying tube 38. Midway in the ink supplying tube 38, the second ink supplying pump 36 is provided to adjust the supplying amount of the spot color ink.

[0043] Each second printhead 52 is connected to each second ink sub-tank 34 through the ink collecting tube 39. By opening a pinch valve (not shown) provided in the ink collecting tube 39 upon cleaning of the second printhead 52, ink is collected from the second printhead 52 to the second ink sub-tank 34.

[0044] A vacuum pump 37 is provided in the ink supplying device 30, and is connected to each one of the deaeration modules 55 individually provided in the first and second printheads 51 and 52 through the deaeration module tube 56. The vacuum pump 37 may alternatively be provided for each of the deaeration modules 55.

[0045] As shown in, for example, Fig. 4, the ink blending device 40 comprises a plurality of storage tanks 41 individually storing inks of a plurality of process colors, and a mixture ink storing container (mixing tank) 42 in which the inks introduced from the storage tanks 41 through a tube are stored and mixed by stirring.

[0046] A first metering pump (not shown) is provided in the outlet of each storage tank 41, and the ink measured by the first metering pump is introduced into the mixture ink storing container 42. The mixture ink storing container 42 therein comprises a mixing means, such as a rotary blade.

[0047] The mixture ink storing container 42 is connected to each of the second ink main tanks 32 of the ink supplying device 30 through a tube (not shown). A second metering pump (not shown) is provided in the outlet of the mixture ink storing container 42, and the mixture ink measured by the second metering pump is introduced into the second ink main tank 32. The operation of the first and second metering pumps are controlled by a control device (not shown).

[0048] The ink blending device 40 may comprise a cleaning mechanism for cleaning the mixture ink storing container 42 and the tubes.

[0049] The structure of the ink blending device 40 is not limited to that described above. The ink blending device 40 may have any structure insofar as it is capable of producing a mixture ink of a predetermined spot color by mixing inks of process colors stored in the plurality of storage tanks 41. For example, the ink blending device 40 may be structured such that mixture ink storing containers 42 of the same number as that of the second ink main tanks 32 are provided and connected to each other through a tube, and that all of the mixture ink storing containers 42 are connected to all of the storage tanks 41. A predetermined amount of process color ink stored in each storage tank 41 is introduced into each of the mixture ink storing containers 42, thereby producing a mixture ink of a predetermined spot color, which is then introduced into each of the second ink main tanks 32. Alternatively, the ink blending device 40 may be structured such that the mixture ink storing container 42 also serves as the second ink main tank 32, and that the mixture ink storing container 42 is directly connected to the ink sub-tank.

[0050] The ink blending device 40 may also be structured such that, instead of connecting the mixture ink storing container 42 with each of the second ink main tanks 32 with a tube, the mixture ink storing container 42 is made removable from the support by which the mixture ink storing container 42 is supported, and the operator carries the mixture ink storing container 42 near the printing apparatus main body 20 and pours the mixture ink into each of the second ink main tanks 32.

[0051] Further, the fabric printing apparatus 10 may not be provided with the ink blending device 40. In this case, it may also be arranged such that each second ink main tank 32 of the ink supplying device 30 is made removable from the support, and when the amount of ink stored in the second ink main tank 32 becomes small, the second ink main tank 32 is replaced with a new second ink main tank 32. Further, the operator may pour the spot color ink into each of the second ink main tank 32.

[0052] The control device comprises a control unit, a storage unit, and an interface unit. The control unit is composed of, for example, a CPU, a memory serving as a working area, and the like. The control unit executes the program stored in the storage unit to control the operations of the printing apparatus main body 20, the ink supplying device 30, and the ink blending device 40. The

storage unit is composed, for example, of a storage device such as a flash memory or a nonvolatile memory, and stores a program to be executed by the control unit. The storage unit stores data of color-separated printing patterns, including designs and backgrounds, to be printed on the fabric C. The interface unit comprises an input port for receiving a signal, an output port for transmitting a signal, an A/D conversion circuit, and the like. The interface unit transmits/receives signals to/from the printing apparatus main body 20, the ink supplying device 30, and the ink blending device 40. The control device transmits driving signals to the first and second printheads 51 and 52 and a unit moving mechanism so as to move the printhead carrier unit 50 in a direction orthogonal to the direction toward which the fabric C is conveyed, while ejecting process color inks and a spot color ink from the nozzles of the first and second printheads 51 and 52. Further, the control device also transmits driving signals to drive the vacuum pump 37, the first and second ink supplying pumps 35 and 36 to thereby fill the first and second printheads 51 and 52 with the inks, while driving the driving roller 23B in the downstream, the bonding device 24, and the belt water-washing device 25 to convey the fabric C. Furthermore, the control device drives the first metering pump of the ink blending device 40 to measure predetermined amounts of process color inks, causes a mixing means to mix the inks extracted to the mixture ink storing container 42 to thereby produce a mixture ink of a predetermined color, and controls the second metering pump so that the produced mixture ink is introduced into each of the second ink main tanks 32.

[0053] Next, with reference to Fig. 2, the flow of ink when each of the first printheads 51 is filled with a process color ink is explained.

[0054] The ink stored in the first ink main tank 31 in advance is introduced into the first ink sub-tank 33, and is then introduced to the first negative-pressure ink tank 53 by the first ink supplying pump 35 through the ink supplying tube 38. The ink introduced from the first negative-pressure ink tank 53 is deaerated by the deaeration module 55, and is supplied to the first printhead 51 so as to be used for the printing of dots in the first print region R1.

[0055] Next, with reference to Fig. 3, the flow of ink when each second printhead 52 is filled with a spot color ink is explained. A mixture ink (spot color ink) is introduced from the ink blending device 40 to the second ink main tank 32. The ink is introduced to the second ink sub-tank 34, and is introduced to the second negative-pressure ink tank 54 by the second ink supplying pump 36 through the ink supplying tube 38. The ink introduced from the second negative-pressure ink tank 54 is deaerated by the deaeration module 55, and is supplied to the second printhead 52 so as to be used for the printing of dots in the second print region R2.

[0056] A fabric printing method using the fabric printing apparatus 10 is described below.

[0057] The fabric C to be printed is also referred to as a textile or a fabric, which includes woven fabric, dyed fabric, knitted fabric, and nonwoven fabric. In this embodiment, the fabric C is a fabric for use in a scarf, handkerchief, stole, shawl and the like, which preferably enables the printing on its first side, i.e., the surface, to permeate into the second side, i.e., the rear side thereof. Examples of such fabric include silk chiffon and silk twill. The fabric C is produced by a fabric producing method, which comprises a step of performing printing on the fabric C by the following fabric printing method.

[0058] Fig. 5 shows an example of printing on the surface of the fabric C. A plurality of print regions are set on the surface of the fabric C, which are divided into a plurality of first print regions R1 and a second print region R2. It is also possible to set a single first print region R1 and a plurality of second print regions R2.

[0059] The first print region R1 is a region in which dots are printed by the first printhead 51 using one or a plurality of process color inks introduced from the first negative-pressure ink tank 53. The area ratio of the dots per unit area and the overlapping state of the dots of individual colors are adjusted to express the variation and density of colors. Designed patterns are printed in the first print region R1. The patterns include pictures with patterns, and characters such as Chinese characters, *hiragana, katakana,* alphabets, numbers, symbols and pictograms. In the example shown in Fig. 5, a plurality of flower patterns are printed. The first print region R1 does not always have a printed pattern, and may be unprinted. The dot area ratio is determined depending on the design to be expressed; the designed pattern may be printed with only one process color ink, or with a combination of a plurality of process color inks. In the first print region R1, when the dot area ratio is high (for example, not less than 80% and not more than 100%), the ink penetrates into the rear side, and the pictures and the characters printed on the surface are easily visible from the rear side. Further, when the dot area ratio is low (for example, not less than 0% and not more than 30%), the ink does not sufficiently permeate into the rear side, and the rear side is recognized as white or as the original color of the fabric in some cases; however, since the first print region R1 has a smaller printing area than that of the second print region R2, even if the rear side of the first print region R1 is recognized as white, it does not significantly stand out.

[0060] The process colors include cyan, magenta, yellow, and black, which are the basic colors of printing. In this embodiment, 12 more colors in total are selected from light cyan, light magenta, light black, blue, red, orange, navy, fluorescent magenta, fluorescent yellow, and the like. These colors are selected in this embodiment because inks of these colors can be easily obtained from commercial suppliers. The colors used as the process colors are not limited to those described above, and any colors may be used insofar as they are contained in the first negative-pressure ink tank 53.

[0061] The second print region R2 is a region in which dots are printed by the second printhead 52 using the

spot color ink introduced from the at least one second negative-pressure ink tank 54. In the second print region R2, printing is made by using a single spot color ink with a dot area (dot area ratio) of 100% per unit area. Fig. 6 shows an example of printing in the second print region R2. Fig. 6(A) shows a part of the surface of the fabric C. Since the printing was made with a dot area ratio of 100%, no granular appearance is present in the surface. Fig. 6(B) shows a part of the rear side of the fabric C in which the ink in the surface permeates thereto, and the background color is visible. In Fig. 6(B), the color is recognized as slightly lighter than the color of the surface according to the degree of permeation of the ink. The dot area ratio is not limited to 100%, and may be, for example, not less than 80% and not more than 100%, preferably not less than 90% and not more than 100%, as long as no granular appearance is present on the surface of the fabric C and the ink of the printing in the surface permeates into the rear side so that the characters, pictures, and background printed on the surface are visible from the rear side. In the example shown in Fig. 5, the second print region R2 is printed as the background of the designed pattern printed in the first print region R1. It is also possible to print a designed pattern in the second print region R2.

[0062] The spot colors include colors not selected as the process color. "Spot color" is a color of ink obtained by mixing inks of a plurality of process colors or by mixing a thinner with the ink of a process color. This embodiment uses, as the inks of spot colors, 12-color inks obtained by mixing color inks selected from cyan, magenta, yellow, black, light cyan, light magenta, light black, blue, red, orange, navy, fluorescent magenta, fluorescent yellow, and the like, which are process colors. As a spot color, a color with higher brightness compared with the process color, more specifically, a light color, may be selected if the hue is the same. This is because, although the dot area ratio becomes small when a light color is printed with a process color ink, by performing printing using a spot color ink, the dot area ratio may be set to 100%, thereby allowing the ink to more easily permeate into the rear side. A spot color may be selected to express a color that is difficult to be expressed or that tends to cause unevenness by process color printing. For example, for a spot color, if the hue is the same, a color having a higher chroma than that of the process color may be selected. For example, a color having a hue of red, green, or blue and having a significantly higher chroma than that of the process color may be selected as a spot color because such a color cannot be expressed by process color printing. In addition, for some certain colors, such as brown or deep green, when process color printing is performed by reciprocatingly moving the first printerhead 51 in the direction orthogonal to the direction toward which the fabric C is conveyed, the color printed at the time of forward movement and the color printed at the time of backward movement are slightly different, thereby easily causing color unevenness. Therefore, spot colors are selected to express these colors.

[0063] According to the above embodiment, since printing in the second print region R2 is performed using a spot color ink obtained by mixing a plurality of process color inks, the dot area ratio can be increased to be greater than that in the case of using the process color ink to express the spot color. Therefore, the inks in the surface permeates into the rear side of the fabric C, thereby allowing the characters, pictures, and background printed on the surface of fabric C to be visible from the rear side, and the granular appearance does not easily occur. Further, since process color printing is performed in the first print region R1, various colors and designs can be expressed.

[0064] The present invention is not limited to the Example described above, and may be carried out with various modifications within a scope in which the gist of the present invention is maintained.

Reference Numerals

[0065]

10: Fabric printing apparatus
20: Printing apparatus main body
30: Ink supplying device
40: Ink blending device
41: Storage tank
42: Mixture ink storing container
50: Printhead carrier unit
51: First printhead
52: Second printhead
53: First negative-pressure ink tank
54: Second negative-pressure ink tank
C: Fabric
R1: First print region
R2: Second print region

Claims

1. A fabric printing method comprising:

a plurality of first ink tanks individually filled with inks of a plurality of process colors; and
at least one second ink tank filled with at least one kind of spot color ink obtained by mixing inks of different process colors,
the method comprising performing printing on a fabric by dividing a plurality of print regions set on a first side of a fabric to be printed into one or a plurality of first print regions in which dots are printed with an ink introduced from at least one of the first ink tanks and one or a plurality of second print regions in which dots are printed with an ink introduced from the at least one second ink tank.

2. The fabric printing method according to claim 1, wherein the area ratio per unit area of the dots formed by the ink of the spot color is not less than 80% and not more than 100%.

3. The fabric printing method according to claim 1 or 2, wherein a designed pattern having at least one of picture and character is printed as dots in the first print region with the ink introduced from the first ink tank, and a background of the designed pattern is printed as dots in the second print region with the ink introduced from the second ink tank.

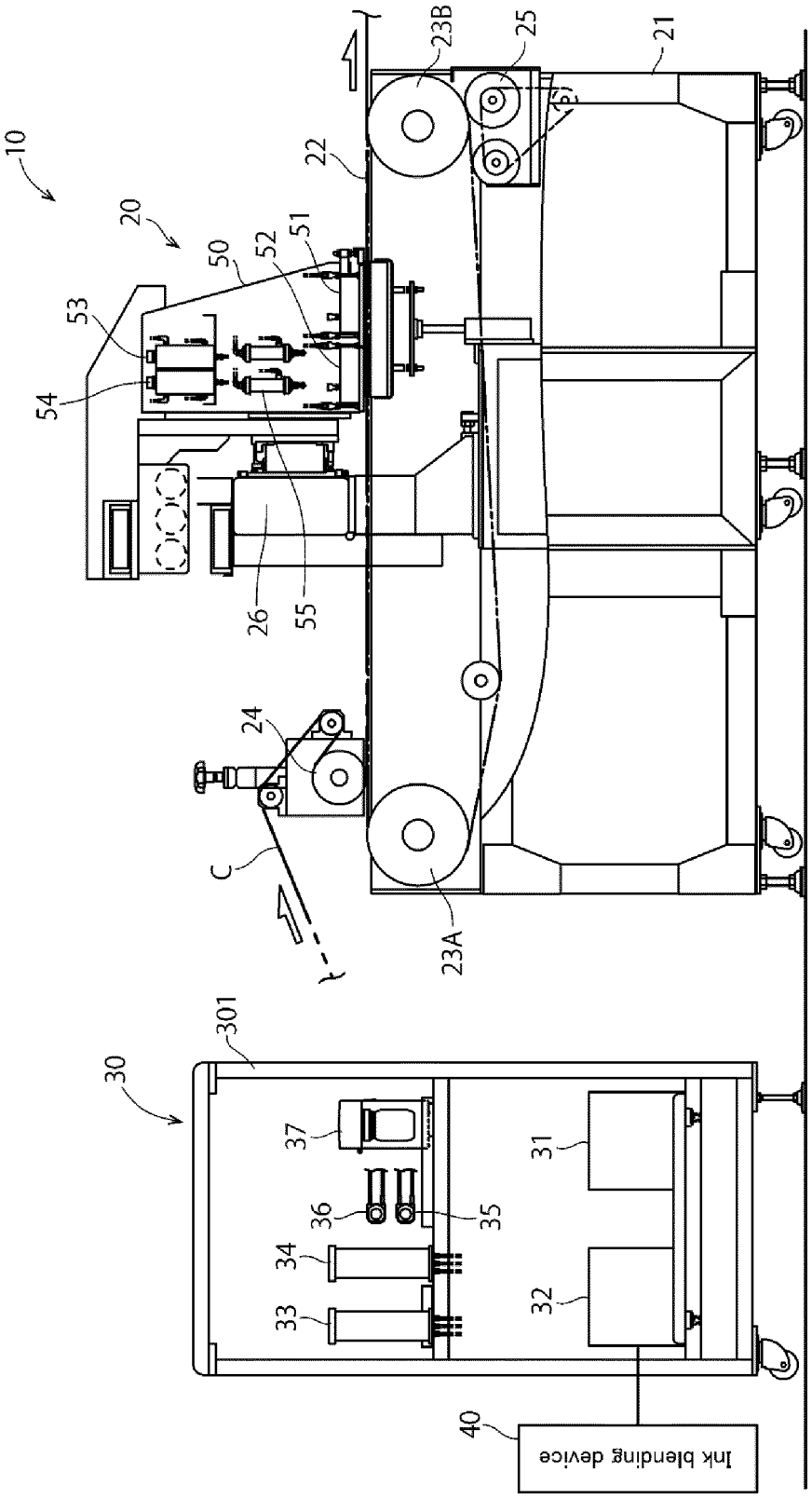
4. The fabric printing apparatus according to claim 1 or 3, wherein the fabric to be printed is a fabric for clothing accessories.

5. A fabric printing apparatus comprising:

a plurality of first ink tanks individually filled with inks of a plurality of process colors;
at least one second ink tank filled with at least one kind of spot color ink obtained by mixing inks of different process colors;
a plurality of first printheads that are individually connected to the plurality of first ink tanks and that perform printing of dots in one or a plurality of first print regions set on a first side of a fabric to be printed with an ink of a process color; and
at least one second printhead that is connected to the at least one second ink tank and that performs printing of dots in one or a plurality of second print regions set on the first side of the fabric to be printed with an ink of a spot color.

6. The fabric printing apparatus according to claim 5, further comprising a blending device comprising ink storage tanks individually storing inks of a plurality of process colors; and a mixing tank that is connected to the ink storage tanks and that mixes inks of different process colors stored in the ink storage tanks,
wherein the mixing tank is connected to the at least one second ink tank.

Fig.1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23A
23B
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301
C
Ink blending device

Fig.2

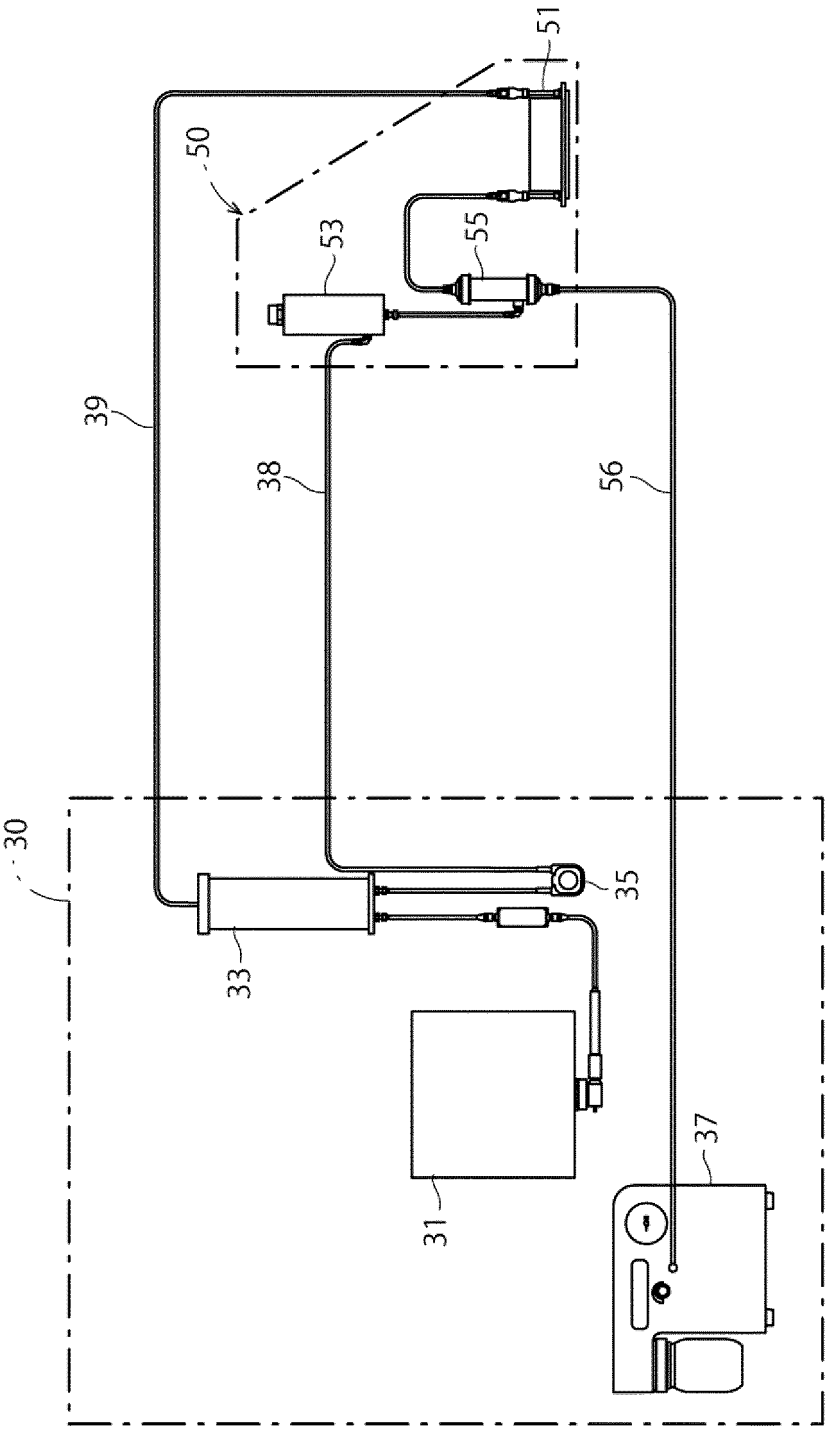


Fig.3

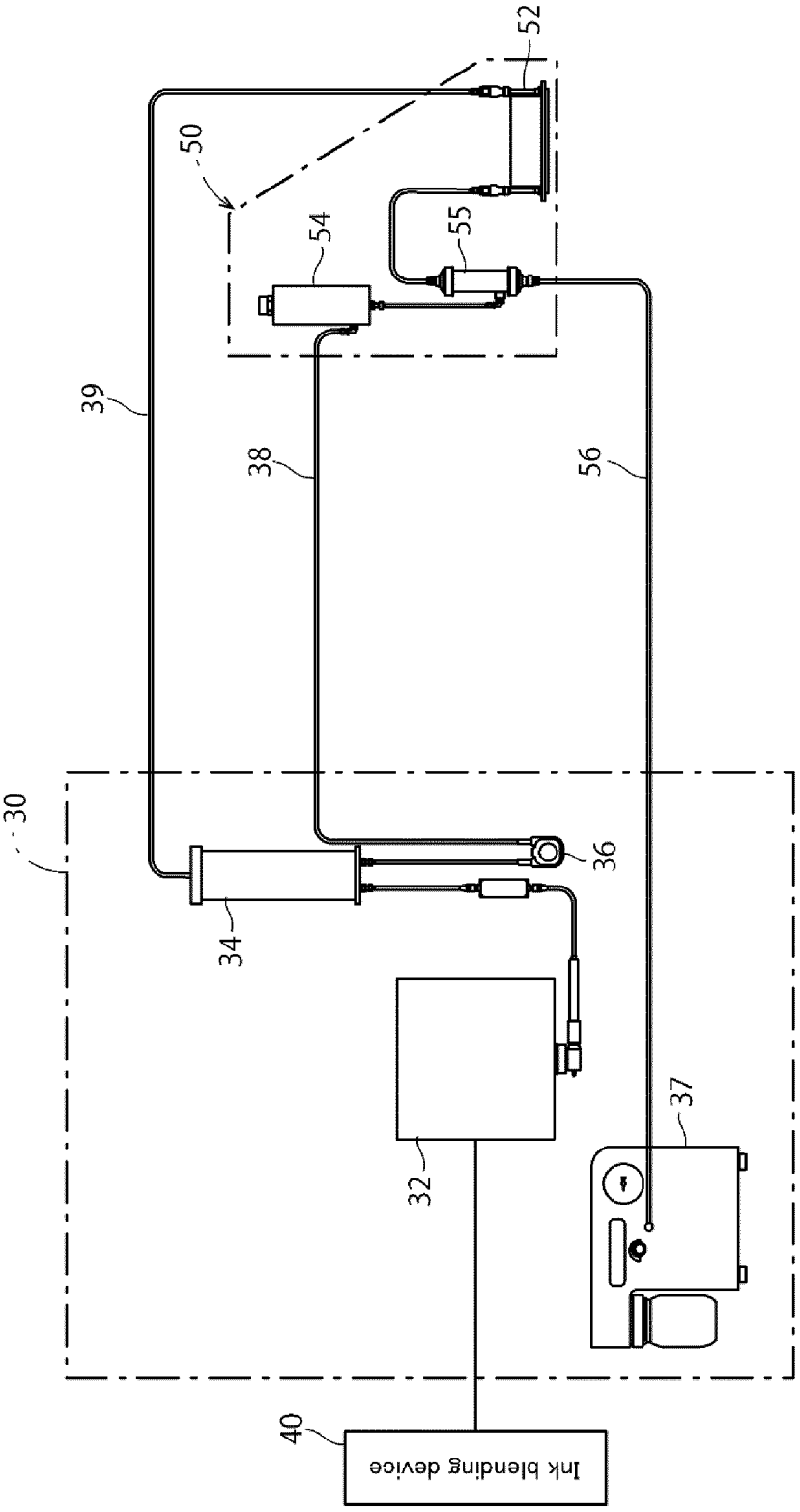


Fig.4

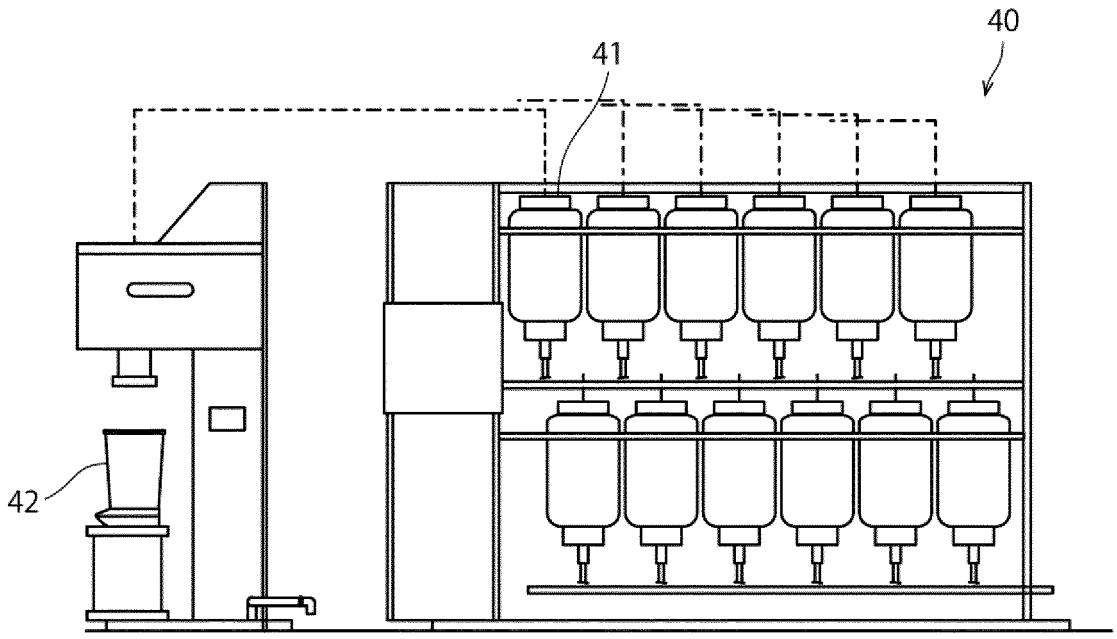


Fig.5

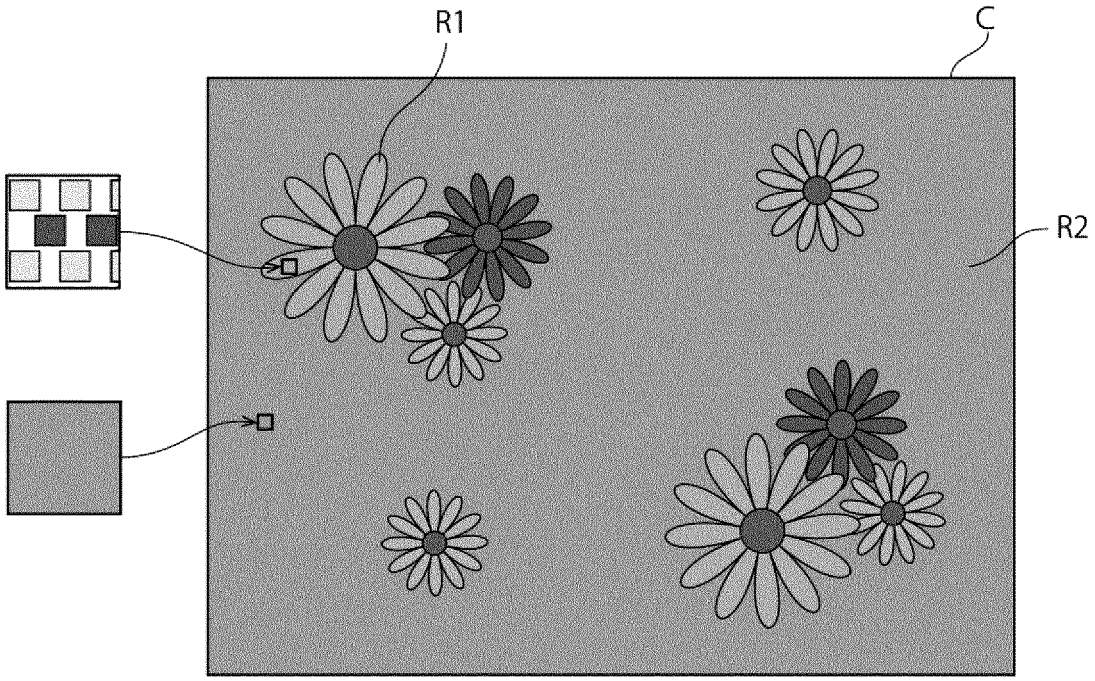


Fig.6

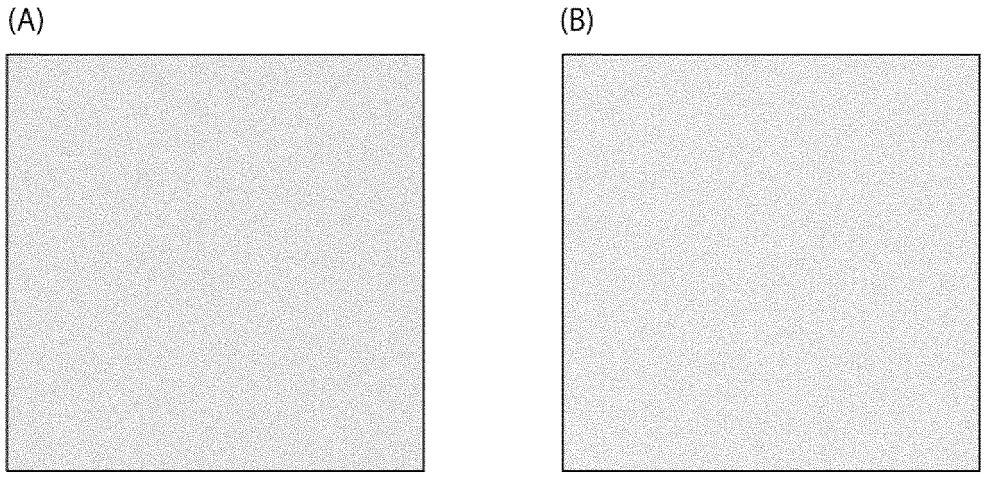


Fig.7

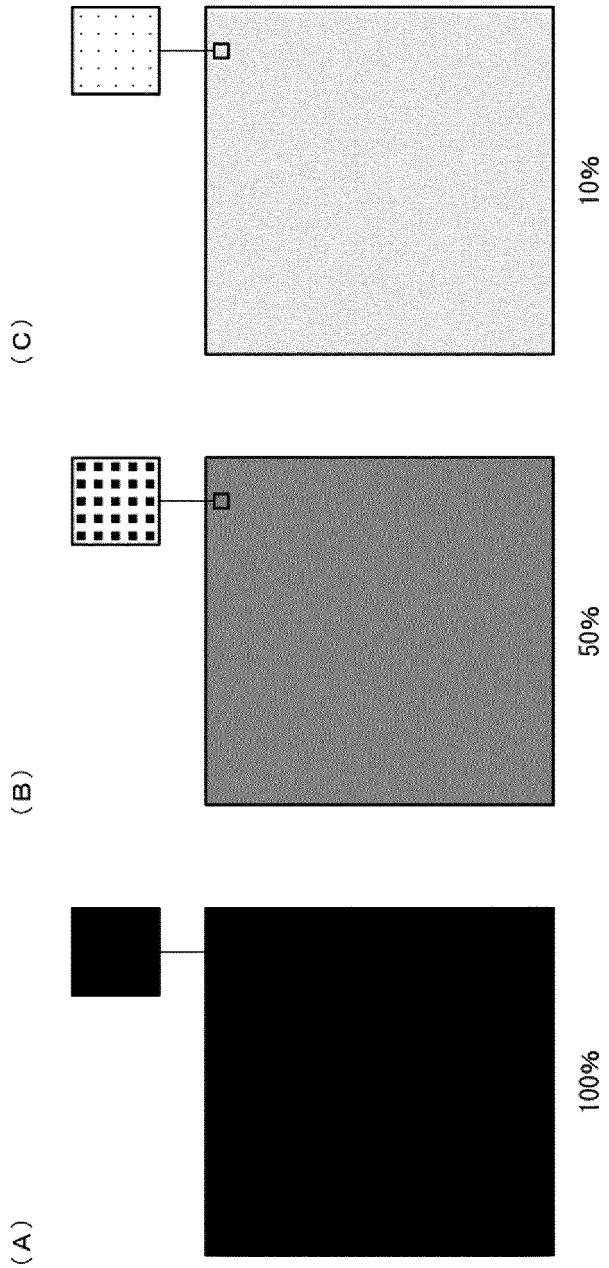


Fig.8

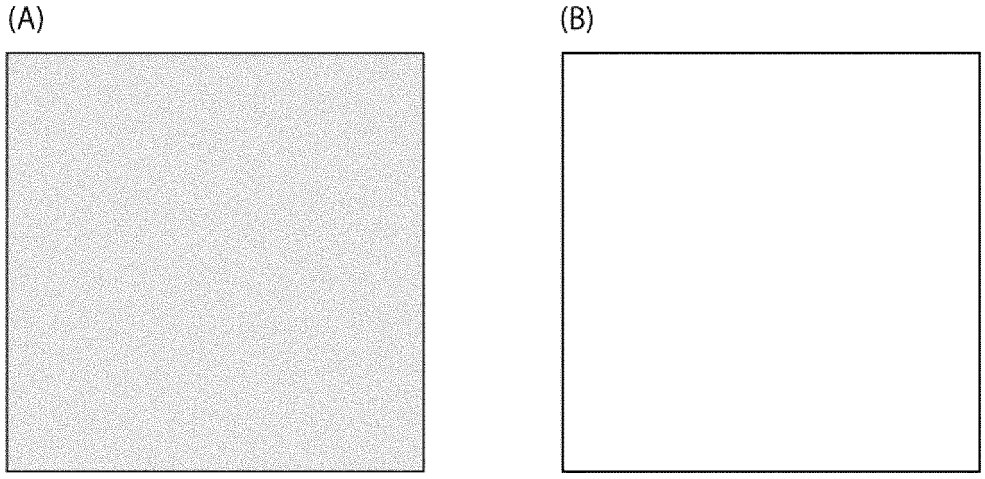
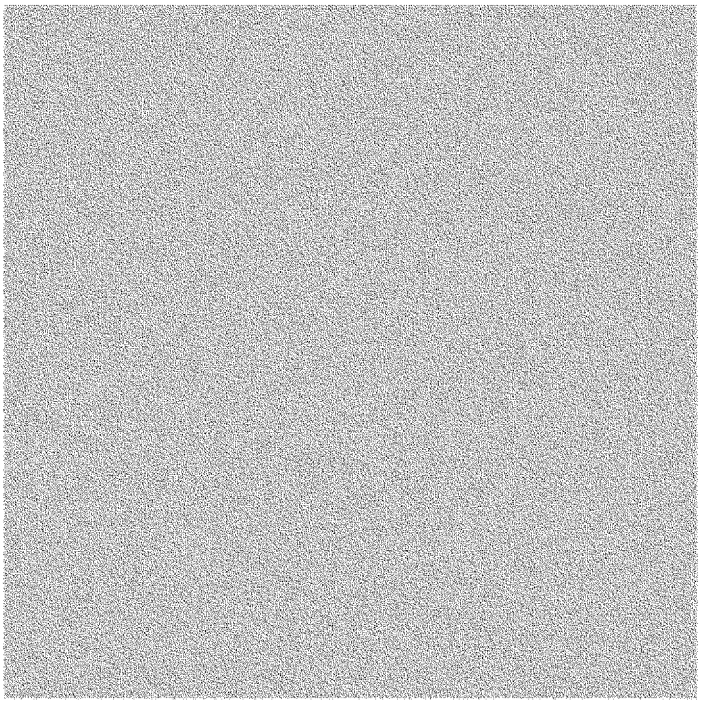


Fig.9



INTERNATIONAL SEARCH REPORT

International application No.
PCT/JP2018/023495

A. CLASSIFICATION OF SUBJECT MATTER
Int. Cl. B41J2/21(2006.01)i, B41J2/175(2006.01)i, B41J2/18(2006.01)i, D06B11/00(2006.01)i, D06P5/30(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)
Int. Cl. B41J2/21, B41J2/175, B41J2/18, D06B11/00, D06P5/30

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

Published examined utility model applications of Japan	1922-1996
Published unexamined utility model applications of Japan	1971-2018
Registered utility model specifications of Japan	1996-2018
Published registered utility model applications of Japan	1994-2018

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.
X	JP 2017-65076 A (MIMAKI ENGINEERING CO., LTD.) 06 April 2017, paragraphs [0008], [0009], [0033], [0039]-[0047], [0054]-[0058], [0150], fig. 1 (Family: none)	1-6
X A	JP 2014-227638 A (MIMAKI ENGINEERING CO., LTD.) 08 December 2014, paragraphs [0034]-[0037], [0052], [0062], [0068]-[0070], fig. 1, 3 & US 2014/0347423 A1, paragraphs [0039]-[0042], [0057], [0067], [0073]-[0075], fig. 1, 3 & EP 2805828 A2 & CN 104175723 A	1-2, 4-5 3, 6
A	US 2017/0165963 A1 (GREAT COMPUTER CORPORATION) 15 June 2017, entire text, all drawings (Family: none)	1-6

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

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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
24.07.2018	07.08.2018
Name and mailing address of the ISA/ Japan Patent Office 3-4-3, Kasumigaseki, Chiyoda-ku, Tokyo 100-8915, Japan	Authorized officer Telephone No.

Form PCT/ISA/210 (second sheet) (January 2015)

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Patent documents cited in the description

- JP 5116542 B **[0005]**