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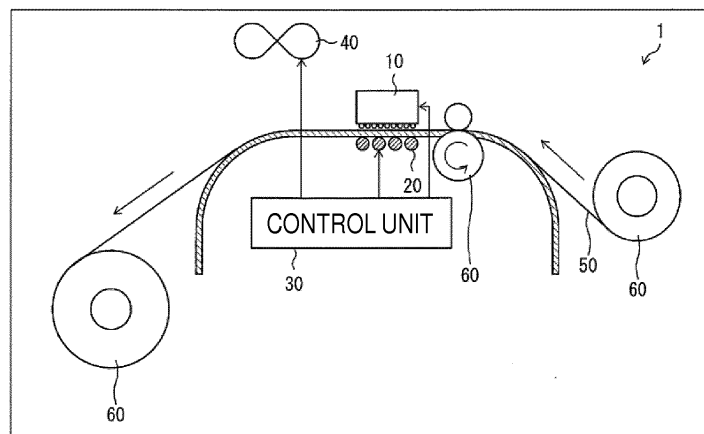
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(54) **INKJET PRINTING DEVICE, INKJET PRINTING METHOD, PRINTING CONTROL DEVICE, PROGRAM, AND RECORDING MEDIUM**

(57) An object is to suppress occurrence of density unevenness of printed materials attributable to unevenness in drying. As a solution, an inkjet printing device (1) includes a printing unit (10) having an inkjet head (11), a heater (20) and a fan (40) for drying ink, a cleaning

means (12) for cleaning the inkjet head (11), and a control unit (30). The control unit (30) performs at least one of control for reducing the ink drying efficiency during cleaning and control for increasing the ink drying efficiency during ejection of ink.

FIG. 1



Description

TECHNICAL FIELD

[0001] The present invention relates to an inkjet printing device, an inkjet printing method, a printing control device, a program, and a recording medium.

BACKGROUND ART

[0002] PLT 1 discloses an inkjet recording apparatus for reducing the time required to record a plurality of images.

CITATION LIST

PATENT LITERATURE

[0003] PLT 1: JP-A-2002-36644 (published on February 6, 2002)

SUMMARY OF INVENTION

TECHNICAL PROBLEM

[0004] Some of inkjet printing devices of the related art like the inkjet recording apparatus disclosed in PLT 1 have maintenance systems for regularly stopping and cleaning inkjet heads configured to eject ink.

[0005] In such an inkjet printing device, even when an inkjet head is in a stop state for maintenance of the inkjet head, drying of ink ejected on a recording medium progresses. Therefore, in the portion dried during the printing stop period, unevenness in drying ink occurs. Further, this unevenness in drying emerges as density unevenness on the printed material, resulting in a reduction in the quality of the printed material. Especially, in a case of using ink required to be dried at high temperature by a heater or the like, such as latex ink, there is a possibility that occurrence of density unevenness on printed materials will be remarkably appear.

[0006] The present invention was made in order to solve the above described problem, and an object of the present invention is to provide an inkjet printing device, an inkjet printing method, a printing control device, a program, and a recording medium capable of suppressing occurrence of unevenness in drying during cleaning on an inkjet head.

SOLUTION TO PROBLEM

[0007] In order to achieve the above described object, an inkjet printing device according to the present invention includes a printing means having an inkjet head configured to perform printing by ejecting ink onto a recording medium, a drying means configured to dry ink that has landed on the recording medium, and a control means configured to control the drying means, wherein the con-

trol means performs at least one of control for making the ink drying efficiency during cleaning on the inkjet head lower than the ink drying efficiency during ejection of ink from the inkjet head, and control for making the ink drying efficiency during ejection of ink from the inkjet head higher than the ink drying efficiency during cleaning on the inkjet head.

[0008] During cleaning on inkjet head, printing using the inkjet head is in a stop state, whereas drying of ink ejected on the recording medium progresses. For this reason, in the portion dried during the printing stop period, unevenness in drying ink may occur. Further, this unevenness in drying emerges as density unevenness on the printed material, resulting in a reduction in the quality of the printed material. Especially, in a case of using ink required to be dried at high temperature, such as latex ink, there is a possibility that occurrence of density unevenness on printed materials will be remarkably appear.

[0009] As the result of repetition of earnest examination for preventing occurrence of drying unevenness during cleaning on the inkjet head, the inventors of the present invention found that it is possible to prevent occurrence of drying unevenness by making the drying efficiency during cleaning on the inkjet head lower than the drying efficiency during printing of the inkjet head or making the drying efficiency during printing of the inkjet head higher than the drying efficiency during manufacturing of the inkjet head, and finally completed the present invention.

[0010] In other words, if the progress of drying of ink during cleaning on the inkjet head is slowed down, it becomes difficult for drying unevenness to occur between a portion dried during a printing period and a portion dried during a printing stop period. Also, even in a case where the progress of drying of ink during printing of the inkjet head is accelerated, similarly, it becomes difficult for drying unevenness to occur between a portion dried during a printing period and a portion dried during a printing stop period. As a result, it is possible to suppress occurrence of density unevenness of the printed material attributable to drying unevenness, thereby preventing a reduction in the quality of the printed material.

[0011] Also, in the inkjet printing device according to the present invention, the drying means may include a fan configured to blow air toward the printing surface of the recording medium, and the control means may make the rotation speed of the fan during cleaning on the inkjet head lower than the rotation speed of the fan during ejection of ink from the inkjet head.

[0012] According to the above described configuration, it is possible to make the ink drying efficiency during cleaning on the inkjet head lower than the ink drying efficiency during ejection of ink from the inkjet head, and it is possible to slow down the progress of drying of ink during cleaning on the inkjet head. As a result, it is possible to suppress occurrence of density unevenness of the printed material attributable to drying unevenness, thereby preventing a reduction in the quality of the printed

material.

[0013] Further, in the inkjet printing device according to present invention, the control means may stop the operation of the fan during cleaning on the inkjet head, and operate the fan during ejection of ink from the inkjet head.

[0014] According to the above described configuration, since the fan is operated during ejection of ink, and the fan is stopped during cleaning of ink, it is possible to make the ink drying efficiency during cleaning on the inkjet head lower than the ink drying efficiency during ejection of ink from the inkjet head. As a result, it is possible to slow down the progress of drying of ink during cleaning on the inkjet head, and it is possible to suppress occurrence of density unevenness of the printed material attributable to drying unevenness, thereby preventing a reduction in the quality of the printed material.

[0015] Also, in the inkjet printing device according to the present invention, the drying means may include a fan configured to blow air toward the printing surface of the recording medium, and the control means may make the rotation speed of the fan during ejection of ink from the inkjet head higher than the rotation speed of the fan during cleaning on the inkjet head.

[0016] According to the above described configuration, it is possible to make the drying efficiency during printing of the inkjet head higher than the drying efficiency during cleaning on the inkjet head, and it is possible to accelerate the progress of drying of ink during printing. As a result, it is possible to suppress occurrence of density unevenness of the printed material attributable to drying unevenness, thereby preventing a reduction in the quality of the printed material.

[0017] Further, in the inkjet printing device according to the present invention, the printing means may have a plurality of inkjet heads, and the control means may stop cleaning when some of the plurality of inkjet heads have been cleaned by the cleaning means, and perform printing on the recording medium by ejecting ink from the inkjet heads, and then perform control such that the cleaning means restarts cleaning and cleans the other uncleaned inkjet heads of the plurality of inkjet heads.

[0018] According to the above described configuration, it is possible to shorten the period of one cleaning event on the inkjet head, that is, the printing stop period, and it becomes difficult for drying unevenness to occur between a portion dried during printing and a portion dried during the printing stop period. As a result, it is possible to suppress occurrence of density unevenness of the printed material attributable to drying unevenness, thereby preventing a reduction in the quality of the printed material.

[0019] Also, in the inkjet printing device according to the present invention, the drying means may include a heater disposed at a position facing the inkjet head and configured to heat the recording medium from the surface side that is opposite to the printing surface, and the control means may make the heating temperature of the heater during cleaning on the inkjet head lower than the

heating temperature of the heater during ejection of ink from the inkjet head.

[0020] According to the above described configuration, it is possible to make the ink drying efficiency during cleaning on the inkjet head lower than the ink drying efficiency during ejection of ink from the inkjet head, and it is possible to slow down the progress of drying of ink during cleaning on the inkjet head. As a result, it is possible to suppress occurrence of density unevenness of the printed material attributable to drying unevenness, thereby preventing a reduction in the quality of the printed material.

[0021] Further, in the inkjet printing device according to the present invention, the drying means may include a heater disposed at a position facing the inkjet head and configured to heat the recording medium from the surface side that is opposite to the printing surface, and the control means may make the heating temperature of the heater during ejection of ink from the inkjet head higher than the heating temperature of the heater during cleaning on the inkjet head.

[0022] According to the above described configuration, it is possible to make the drying efficiency during printing of the inkjet head higher than the drying efficiency during cleaning on the inkjet head, and it is possible to accelerate the progress of drying of ink during printing. As a result, it is possible to suppress occurrence of density unevenness of the printed material attributable to drying unevenness, thereby preventing a reduction in the quality of the printed material.

[0023] An inkjet printing method according to the present invention is an inkjet printing method including a printing process of performing printing by ejecting ink from an inkjet head onto a recording medium, a drying process of drying ink that has landed on the recording medium, and a cleaning process of stopping ejection of ink from the inkjet head and cleaning the inkjet head, and performs at least one of making the ink drying efficiency in the cleaning process lower than the ink drying efficiency in the printing process, and making the ink drying efficiency in the printing process higher than the ink drying efficiency in the cleaning process.

[0024] According to the above described configuration, the same effects as those of the inkjet printing device according to the present invention are obtained.

[0025] A printing control device according to the present invention is a printing control device for controlling a printing device having an inkjet head configured to perform printing by ejecting ink onto a recording medium, and performs at least one of control for making the ink drying efficiency during cleaning on the inkjet head lower than the ink drying efficiency during ejection of ink from the inkjet head, and control for making the ink drying efficiency during ejection of ink from the inkjet head higher than the ink drying efficiency during cleaning on the inkjet head.

[0026] According to the above described configuration, the same effects as those of the inkjet printing device

according to the present invention are obtained.

[0027] The printing control device of the present invention may be implemented by a computer. In this case, a printing-control-device control program for implementing the printing control device in a computer by making the computer operate as means for performing the control which the printing control device performs, and a computer-readable recording medium retaining that program are also included in the scope of the present invention.

ADVANTAGEOUS EFFECTS OF INVENTION

[0028] According to the present invention, an effect that it is possible to suppress occurrence of density unevenness of a printed material attributable to drying unevenness, thereby preventing a reduction in the quality of the printed material is obtained.

BRIEF DESCRIPTION OF DRAWINGS

[0029]

[Fig. 1] Fig. 1 is a schematic diagram illustrating an inkjet printing device according to an embodiment of the present invention.

[Fig. 2] Fig. 2 is a schematic diagram illustrating a portion of the inkjet printing device according to the embodiment of the present invention.

[Fig. 3] Fig. 3 is a schematic diagram illustrating another example of the portion of the inkjet printing device according to the embodiment of the present invention.

DESCRIPTION OF EMBODIMENTS

[INKJET PRINTING DEVICE]

[0030] An inkjet printing device according to an embodiment of the present invention will be described below with reference to Figs. 1 and 2. Fig. 1 is a schematic diagram illustrating an inkjet printing device according to an embodiment of the present invention, and Fig. 2 is a schematic diagram illustrating a portion of the inkjet printing device according to the embodiment of the present invention. An inkjet printing device 1 includes a printing unit (a printing means) 10, a heater 20 and a fan 40 configured as drying means, a wiper 12 configured as a cleaning means, and a control unit (a control means) 30.

[0031] The printing unit 10 has an inkjet head 11 configured to perform printing on a recording medium 50 by ejecting ink. The printing unit 10 makes the inkjet head 11 scan the recording medium 50 which is conveyed in a direction shown by arrows in Fig. 1 by a conveying means 60 composed of a plurality of rollers, over the recording medium. In this way, the relative position between the recording medium 50 and the inkjet head 11 is moved. Further, the printing unit ejects ink from the inkjet head 11 moved to a predetermined position, onto

the recording medium 50, thereby performing printing on the recording medium 50.

[0032] The inkjet head 11 injects ink drops from nozzles 13 arranged on the bottom of the inkjet head as shown in Fig. 2, onto the recording medium 50. The printing unit 10 needs only to have one inkjet head 11; however, it may be configured to have a plurality of independently controllable inkjet heads such as inkjet heads 11a and 11b shown in Fig. 2.

[0033] The heater 20 and the fan 40 accelerate drying of ink that has landed on the recording medium 50. In the present embodiment, the configuration having both of the heater 20 and the fan 40 as drying means is described as an example; however, the inkjet printing device may have only one of the heater and the fan. Driving of the heater 20 and the fan 40 is controlled by the control unit 30. Since drying of ink that has landed on the recording medium 50 is accelerated by the heater 20 and the fan 40, it is possible to appropriately fix the ink on the recording medium 50 while preventing bleeding of the ink on the recording medium 50.

[0034] The heater 20 is disposed at a position facing the inkjet head 11 with the recording medium 50 interposed therebetween, and heats the recording medium 50 from the surface side that is opposite to the printing surface. In this way, the heater accelerates drying of ink that has landed on the printing surface of the recording medium 50. The heater 20 needs only to be configured to heat the recording medium 50 by transmitting heat to the recording medium 50. As this heater 20, an electric heater or the like using ceramic or nichrome wire can be used.

[0035] Also, a pre-heater (not shown) for heating the recording medium 50 from the printing surface side or the surface side that is opposite to the printing surface may be provided on the upstream side from a position of the recording medium 50 facing the inkjet head 11. By heating the recording medium 50 before landing of ink by the pre-heater, it is possible to accelerate drying of ink immediately after landing of ink, and further prevent bleeding of ink. Also, an after-heater (not shown) for heating the recording medium 50 from the printing surface side or the surface side that is opposite to the printing surface may be provided on the downstream side from the position of the recording medium 50 facing the inkjet head 11. By heating the recording medium 50 after landing of ink by the after-heater, it is possible to accelerate drying of the ink on the recording medium 50, and more appropriately fix the ink on the recording medium 50.

[0036] The fan 40 sends air toward the printing surface of the recording medium 50. The fan 40 needs only to be set, for example, on the ceiling or the like of the inside of a housing containing the individual components of the inkjet printing device 1, and circulate air of the inside of the housing, thereby producing a current of air. Since this current of air is sent to the printing surface of the recording medium 50, drying of ink that has landed on the printing surface of the recording medium 50 is accelerated. Also,

a plurality of fans 40 may be provided in the housing containing the individual components of the inkjet printing device 1.

[0037] The wiper 12 is for cleaning the inkjet head 11. If ink is struck in the nozzles 13 or drew is condensed on the inkjet head 11, it may become impossible to appropriately eject ink from the inkjet head 11 during printing (such as a failure in ejection of the nozzles). In order to prevent this, the inkjet head 11 is regularly maintained and cleaned. A method of cleaning the inkjet head 11 is not particularly limited, and it is possible to wipe the nozzle surface of the inkjet head 11, like the wiper 12 shown in Fig. 2.

[0038] It is also possible to move the inkjet head 11 into a maintenance station (not shown) provided at a position spaced from the recording medium 50, and clean the inkjet head inside the maintenance station. In this case, the cleaned inkjet head 11 is returned to the position facing the recording medium 50, and printing restarts.

[0039] The control unit 30 controls driving of the printing unit 10, the heater 20, the fan 40, and the wiper 12. Further, the control unit 30 stops ejection of ink from the inkjet head 11, and makes the wiper 12 clean the inkjet head 11. At this time, the control unit 30 controls driving of the heater 20 and the fan 40, thereby dissimulating drying efficiency during printing of the inkjet head 11 and drying efficiency during cleaning on the inkjet head 11.

[0040] In other words, the control unit 30 performs at least one of control for making the ink drying efficiency during cleaning on the inkjet head 11 lower than the ink drying efficiency during ejection of ink from the inkjet head 11, and control for making the ink drying efficiency during ejection of ink from the inkjet head 11 higher than the ink drying efficiency during cleaning on the inkjet head 11.

[0041] During cleaning on the inkjet head 11, printing using the inkjet head 11 is in a stop state, whereas drying of ink ejected on the recording medium 50 progresses. For this reason, in the portion dried during the printing stop period, unevenness in drying ink may occur. Further, this unevenness in drying emerges as density unevenness on the printed material, resulting in a reduction in the quality of the printed material. Especially, in a case of using ink required to be dried at high temperature, such as latex ink, there is a possibility that occurrence of density unevenness on printed materials will be remarkably appear.

[0042] As the result of repetition of earnest examination for preventing occurrence of drying unevenness during cleaning on the inkjet head 11, the inventors of the present invention found that it is possible to prevent occurrence of drying unevenness by making the drying efficiency during cleaning on the inkjet head 11 lower than the drying efficiency during printing of the inkjet head 11 or making the drying efficiency during printing of the inkjet head 11 higher than the drying efficiency during manufacturing of the inkjet head 11, and finally completed the present invention.

[0043] In other words, if the progress of drying of ink during cleaning on the inkjet head 11 is slowed down, it becomes difficult for drying unevenness to occur between a portion dried during a printing period and a portion dried during a printing stop period. Also, even in a case where the progress of drying of ink during printing of the inkjet head 11 is accelerated, similarly, it becomes difficult for drying unevenness to occur between a portion dried during a printing period and a portion dried during a printing stop period.

[0044] As a method of making the ink drying efficiency during cleaning on the inkjet head 11 lower than the ink drying efficiency during ejection of ink from the inkjet head 11, the control unit 30 may make the rotation speed of the fan 40 during cleaning on the inkjet head 11 lower than the rotation speed of the fan 40 during ejection of ink from the inkjet head 11. By reducing the rotation speed of the fan 40 during cleaning on the inkjet head 11, it is possible to slow down the progress of drying of ink.

[0045] Also, as another method of making the ink drying efficiency during cleaning on the inkjet head 11 lower than the ink drying efficiency during ejection of ink from the inkjet head 11, the control unit 30 may make the heating temperature of the heater 20 during cleaning on the inkjet head 11 lower than the heating temperature of the heater 20 during ejection of ink from the inkjet head 11. By reducing the heating temperature of the heater 20 during cleaning on the inkjet head 11, it is possible to slow down the progress of drying of ink.

[0046] As a method of making the drying efficiency during printing of the inkjet head 11 higher than the drying efficiency during cleaning on the inkjet head 11, the control unit 30 may make the rotation speed of the fan 40 during ejection of ink from the inkjet head 11 higher than the rotation speed of the fan 40 during cleaning on the inkjet head 11. By increasing the rotation speed of the fan 40 during printing of the inkjet head 11, it is possible to accelerate the progress of drying of ink during printing.

[0047] Also, as another method of making the drying efficiency during printing of the inkjet head 11 higher than the drying efficiency during cleaning on the inkjet head 11, the control unit 30 may make the heating temperature of the heater 20 during ejection of ink from the inkjet head 11 higher than the heating temperature of the heater 20 during cleaning on the inkjet head 11. By increasing the heating temperature of the heater 20 during printing of the inkjet head 11, it is possible to accelerate the progress of drying of ink during printing.

[0048] The control unit 30 transmits a drive signal for driving the wiper 12, to a wiper driving unit (not shown), at a predetermined timing or in response to an input from a user. The control unit 30 determines whether the inkjet head 11 is being cleaned by, for example, determining whether the wiper 12 has been driven. Alternatively, a control means different from the control unit 30 may control the wiper, and the control unit 30 may recognize whether the wiper is being driven, whereby the control unit 30 may determine whether cleaning is being per-

formed. Then, if determining that the inkjet head 11 is being cleaned, the control unit 30 transmits a signal for changing the drying efficiency depending on at least one of the heater 20 and the fan 40, to the heater driving unit (not shown) and a fan driving unit (not shown). The signal for changing the drying efficiency may be a signal for changing the temperature of the heater 20 or the rotation speed of the fan 40 to a predetermined value, or may be a signal for changing the temperature of the heater 20 and the rotation speed of the fan 40 on the basis of a dry state obtained by performing dry-state detection. Also, it is possible to make the user input a desired drying efficiency, and compute at least one of the temperature of the heater 20 and the rotation speed of the fan 40 according to the desired drying efficiency, and drive the heater 20 and the fan 40 such that the computed temperature and the computed rotation speed are achieved. Also, the control unit 30 may determine whether ink has been ejected from the inkjet head 11, thereby determining whether ink is being ejected from the inkjet head 11. In this case, if determining that ink is being ejected from the inkjet head 11, the control unit 30 transmits a signal for making the drying efficiency depending on at least one of the heater 20 and the fan 40 higher than that during cleaning, to the heater driving unit and the fan driving unit.

[0049] The control unit 30 may make a voltage value to be applied to the fan 40 during cleaning on the inkjet head 11 lower than a voltage value to be applied to the fan 40 during ejection of ink from the inkjet head 11, thereby decreasing the rotation speed of the fan 40 during cleaning on the inkjet head 11. The control unit 30 may perform control for applying a voltage of 24 V during ejection of ink from the inkjet head 11, for example, by performing control such a voltage to be applied to the fan 40 during cleaning on the inkjet head 11 becomes 0 V (control for stopping the fan).

[0050] Also, the control unit 30 may stop the operation of the fan 40 during cleaning on the inkjet head 11, and operate the fan 40 only during ejection of ink from the inkjet head 11. Also, in a case where the inkjet printing device 1 has a plurality of fans, it is possible to make the number of fans which are operated during cleaning on the inkjet head 11 smaller than the number of fans which are operated during ejection of ink from the inkjet head 11.

[0051] The control unit 30 may make the heating temperature of the heater 20 during cleaning on the inkjet head 11 lower than the heating temperature of the heater 30 during ejection of ink from the inkjet head 11, for example, by performing control for stopping heating of the heater 20 during cleaning on the inkjet head 11 and performing control for making the heating temperature of the heater 20 during ejection of ink from the inkjet head 11 equal to or higher than 60°C. Also, the control unit 30 may stop the operation of the heater 20 during cleaning on the inkjet head 11 and operate the heater 20 only during ejection of ink from the inkjet head 11.

[0052] Also, control of the control unit 30 for making

the ink drying efficiency during cleaning on the inkjet head 11 lower than the ink drying efficiency during ejection of ink from the inkjet head 11, or control of the control unit for making the drying efficiency during printing of the inkjet head 11 higher than the drying efficiency during cleaning on the inkjet head 11 may be performed by any one of control on the operation of the heater 20 and control of the operation of the fan 40, or may be performed by both of control on the operation of the heater and control of the operation of the fan.

[0053] Cleaning on the inkjet head 11 may be appropriately performed depending on the state of the inkjet head 11, or may be regularly performed at intervals of a predetermined period. In order to shorten the printing stop period, it is preferable to perform control such that the period of one cleaning event becomes short as much as possible, and it is more preferable that the cleaning period should be equal to or less than 8 seconds.

[0054] Also, in a case where the printing unit 10 has a plurality of inkjet heads 11, such as inkjet heads 11a and 11b, as shown in Fig. 2, the control unit 30 may stop cleaning, for example, when the inkjet head 11a has been cleaned by the wiper 12, and perform printing on the recording medium 50 by ejecting ink from at least one of the inkjet heads 11a and 11b, and move the wiper 12 toward the inkjet head 11b, and clean the inkjet head 11b.

[0055] In other words, the control unit 30 stops cleaning when some of the plurality of inkjet heads 11 have been cleaned by the wiper 12, and performs printing on the recording medium 50 by ejecting ink from the inkjet heads 11, and then restarts cleaning by the wiper 12, thereby cleaning the other uncleaned inkjet heads 11 of the plurality of inkjet heads 11. As a result, it is possible to reduce the period of one cleaning event, that is, the printing stop period, and it becomes difficult for drying unevenness to occur between a portion dried during printing and a portion dried during the printing stop period.

[0056] Information on a timing to stop cleaning, a cleaning range representing where the wiper 12 should clean until the corresponding timing, and a timing to restart cleaning may be input in advance, for example, by the user, and the control unit 30 may make the user input a desired printing speed and the degree of suppression of drying unevenness, and compute the timings and the cleaning range described above, from the information input by the user. According to the information input by the user and/or the information computed by the control unit 30, the control unit 30 drives the wiper 12, the inkjet head 11, and the like.

[0057] As described above, in the inkjet printing device 1, since the control unit 30 performs at least one of control for making the ink drying efficiency during cleaning on the inkjet head 11 lower than the ink drying efficiency during ejection of ink from the inkjet head 11, and control for making the ink drying efficiency during ejection of ink from the inkjet head 11 higher than the ink drying efficiency during cleaning on the inkjet head 11, it becomes difficult for drying unevenness to occur between a portion

dried during a printing period and a portion dried during a printing stop period, and it is possible to suppress occurrence of density unevenness of the printed material attributable to drying unevenness, thereby preventing a reduction in the quality of the printed material.

[0058] Also, although the case where the inkjet heads 11a and 11b are arranged side by side in the transverse direction as shown in Fig. 2 has been described, the present invention is not limited thereto. For example, as shown in Fig. 3, the inkjet heads 11a and 11b may be staggered. Fig. 3 is a schematic view illustrating the modification of the inkjet heads 11. Even by inkjet heads staggered as shown in Fig. 3, it is possible to suppress density unevenness, and provide high-quality printed materials.

[INKJET PRINTING METHOD]

[0059] An inkjet printing method according to an embodiment of the present invention includes a printing process of printing by ejecting ink from an inkjet head onto a recording medium, a drying process of drying ink that has landed on the recording medium, and a cleaning process of stopping ejection of ink from the inkjet head and cleaning the inkjet head, and performs at least one of control for making the ink drying efficiency of the cleaning process lower than the ink drying efficiency of the printing process, and control for making the ink drying efficiency of the printing process higher than the ink drying efficiency of the cleaning process.

[0060] In other words, the embodiment of the inkjet printing method according to the present invention is a printing method which is performed by the inkjet printing device of the present invention described above. Therefore, the embodiment of the inkjet printing method according to the present invention conforms the above description of the inkjet printing device of the present invention.

[PRINTING CONTROL DEVICE]

[0061] A printing control device according to an embodiment of the present invention is a printing control device configured to control a printing device having an inkjet head for performing printing by ejecting ink onto a recording medium, and performs at least one of control for making the ink drying efficiency during cleaning on the inkjet head lower than the ink drying efficiency during ejection of ink from the inkjet head, and control for making the ink drying efficiency during ejection of ink from the inkjet head higher than the ink drying efficiency during cleaning on the inkjet head.

[0062] In other words, the embodiment of the printing control device according to the present invention is the control unit of the inkjet printing device of the present invention described above. Therefore, the embodiment of the printing control device according to the present invention conforms the above description of the inkjet printing device of the present invention.

[IMPLANTATION EXAMPLE USING SOFTWARE]

[0063] Control of the control unit 30 may be implemented by a logic circuit (hardware) formed on an integrated circuit (an IC chip) and so on, or may be implemented by software which is executed by a CPU (Central Processing Unit).

[0064] In the latter case, the control unit 30 includes a CPU configured to execute commands of a program which is software for implementing its individual functions, a ROM (Read Only Memory) or a storage unit (referred to as the "recording medium") in which the above described program and a variety of data have been recorded so as to be readable in a computer (or a CPU), a RAM (Random Access Memory) for developing the program, and so on. Therefore, if the computer (or the CPU) reads the program from the recording medium and executes the program, the object of the present invention is achieved. As the above described recording medium, a "non-transitory tangible medium", such as a tape, a disk, a card, a semiconductor memory, or a programmable logic circuit, can be used. Also, the program may be supplied to the computer via an arbitrary transmission medium (such as a communication network or a broadcast wave) capable of transmitting the program. Also, the present invention can be implemented in the form of a data signal embedded as an embodiment of the program based on electronic transmission in a carrier wave.

[SUPPLEMENTARY INFORMATION]

[0065] The inkjet printing device 1 includes the printing unit 10 having the inkjet head 11 for performing printing by ejecting ink onto the recording medium 50, the drying means for drying ink that has landed on the recording medium 50, the wiper 12 for cleaning the inkjet head 11, and the control unit 30 for performing at least one of control for making the ink drying efficiency during cleaning on the inkjet head 11 lower than the ink drying efficiency during ejection of ink from the inkjet head 11, and control for making the ink drying efficiency during ejection of ink from the inkjet head 11 higher than the ink drying efficiency during cleaning on the inkjet head 11.

[0066] During cleaning on the inkjet head 11, printing using the inkjet head 11 is in a stop state, whereas drying of ink ejected on the recording medium 50 progresses. For this reason, in the portion dried during the printing stop period, unevenness in drying ink may occur. Further, this unevenness in drying emerges as density unevenness on the printed material, resulting in a reduction in the quality of the printed material. Especially, in a case of using ink required to be dried at high temperature, such as latex ink, there is a possibility that occurrence of density unevenness on printed materials will be remarkably appear.

[0067] As the result of repetition of earnest examination for preventing occurrence of drying unevenness during cleaning on the inkjet head 11, the inventors of the

present invention found that it is possible to prevent occurrence of drying unevenness by making the drying efficiency during cleaning on the inkjet head 11 lower than the drying efficiency during printing of the inkjet head 11 or making the drying efficiency during printing of the inkjet head 11 higher than the drying efficiency during manufacturing of the inkjet head 11, and finally completed the present invention.

[0068] In other words, if the progress of drying of ink during cleaning on the inkjet head 11 is slowed down, it becomes difficult for drying unevenness to occur between a portion dried during a printing period and a portion dried during a printing stop period. Also, even in a case where the progress of drying of ink during printing of the inkjet head 11 is accelerated, similarly, it becomes difficult for drying unevenness to occur between a portion dried during a printing period and a portion dried during a printing stop period. As a result, it is possible to suppress occurrence of density unevenness of the printed material attributable to drying unevenness, thereby preventing a reduction in the quality of the printed material.

[0069] Also, in the inkjet printing device 1, the drying means includes the fan 40 for sending air toward the printing surface of the recording medium 50, and the control unit 30 makes the rotation speed of the fan 40 during cleaning on the inkjet head 11 lower than the rotation speed of the fan 40 during ejection of ink from the inkjet head 11.

[0070] According to the above described configuration, it is possible to make the ink drying efficiency during cleaning on the inkjet head 11 lower than the ink drying efficiency during ejection of ink from the inkjet head 11, and it is possible to slow down the progress of drying of ink during cleaning on the inkjet head 11. As a result, it is possible to suppress occurrence of density unevenness of the printed material attributable to drying unevenness, thereby preventing a reduction in the quality of the printed material.

[0071] Further, in the inkjet printing device 1, the control unit 30 stops the operation of the fan 40 during cleaning on the inkjet head 11, and operates the fan 40 during ejection of ink from the inkjet head 11.

[0072] According to the above described configuration, since the fan 40 is operated during ejection of ink, and the fan 40 is stopped during cleaning of ink, it is possible to make the ink drying efficiency during cleaning on the inkjet head 11 lower than the ink drying efficiency during ejection of ink from the inkjet head 11. As a result, it is possible to slow down the progress of drying of ink during cleaning on the inkjet head 11, and it is possible to suppress occurrence of density unevenness of the printed material attributable to drying unevenness, thereby preventing a reduction in the quality of the printed material.

[0073] Also, in the inkjet printing device 1, the drying means includes the fan 40 for sending air toward the printing surface of the recording medium 50, and the control unit 30 makes the rotation speed of the fan 40 during ejection of ink from the inkjet head 11 higher than the

rotation speed of the fan 40 during cleaning on the inkjet head 11.

[0074] According to the above described configuration, it is possible to make the drying efficiency during printing of the inkjet head 11 higher than the drying efficiency during cleaning on the inkjet head 11, and it is possible to accelerate the progress of drying of ink during printing. As a result, it is possible to suppress occurrence of density unevenness of the printed material attributable to drying unevenness, thereby preventing a reduction in the quality of the printed material.

[0075] Also, in the inkjet printing device 1, the printing unit 10 includes the plurality of inkjet heads 11, and the control unit 30 performs control for stopping cleaning when some of the plurality of inkjet heads 11 have been cleaned by the wiper 12, and performing printing on the recording medium 50 by ejecting ink from the inkjet heads 11, and then restarting cleaning by the wiper 12, thereby cleaning the other uncanceled inkjet heads 11 of the plurality of inkjet heads 11.

[0076] According to the above described configuration, it is possible to shorten the period of one cleaning event on the inkjet heads 11, that is, the printing stop period, and it becomes difficult for drying unevenness to occur between a portion dried during printing and a portion dried during the printing stop period. As a result, it is possible to suppress occurrence of density unevenness of the printed material attributable to drying unevenness, thereby preventing a reduction in the quality of the printed material.

[0077] Also, in the inkjet printing device 1, the drying means includes the heater 20 disposed at a position facing the inkjet head 11 and configured to heat the recording medium 50 from the surface side that is opposite to the printing surface, and the control unit 30 makes the heating temperature of the heater 20 during cleaning on the inkjet head 11 lower than the heating temperature of the heater 20 during ejection of ink from the inkjet head 11.

[0078] According to the above described configuration, it is possible to make the ink drying efficiency during cleaning on the inkjet head 11 lower than the ink drying efficiency during ejection of ink from the inkjet head 11, and it is possible to slow down the progress of drying of ink during cleaning on the inkjet head 11. As a result, it is possible to suppress occurrence of density unevenness of the printed material attributable to drying unevenness, thereby preventing a reduction in the quality of the printed material.

[0079] Also, in the inkjet printing device 1, the drying means includes the heater 20 disposed at a position facing the inkjet head 11 and configured to heat the recording medium 50 from the surface side that is opposite to the printing surface, and the control unit 30 makes the heating temperature of the heater 20 during ejection of ink from the inkjet head 11 higher than the heating temperature of the heater 20 during cleaning on the inkjet head 11.

[0080] According to the above described configuration, it is possible to make the drying efficiency during printing of the inkjet head 11 higher than the drying efficiency during cleaning on the inkjet head 11, and it is possible to accelerate the progress of drying of ink during printing. As a result, it is possible to suppress occurrence of density unevenness of the printed material attributable to drying unevenness, thereby preventing a reduction in the quality of the printed material.

[0081] The inkjet printing method includes the printing process of performing printing by ejecting ink from the inkjet head 11 onto the recording medium 50, the drying process of drying ink that has landed on the recording medium 50, and the cleaning process of stopping ejection of ink from the inkjet head 11 and cleaning the inkjet head 11, and performs at least one of control for making the ink drying efficiency in the cleaning process lower than the ink drying efficiency in the printing process, and control for making the ink drying efficiency in the printing process higher than the ink drying efficiency in the cleaning process.

[0082] According to the above described configuration, the same effects as those of the inkjet printing device 1 are achieved.

[0083] The printing control device is a printing control device configured to control the inkjet printing device 1 having the inkjet head 11 for performing printing by ejecting ink onto the recording medium 50, and performs at least one of control for making the ink drying efficiency during cleaning on the inkjet head 11 lower than the ink drying efficiency during ejection of ink from the inkjet head 11, and control for making the ink drying efficiency during ejection of ink from the inkjet head 11 higher than the ink drying efficiency during cleaning on the inkjet head 11.

[0084] According to the above described configuration, the same effects as those of the inkjet printing device 1 are achieved.

[0085] The printing control device may be implemented by a computer. In this case, a printing-control-device control program for implementing the printing control device in a computer by making the computer operate as means for performing the control which the printing control device performs, and a computer-readable recording medium retaining that program are also included in the scope of the present invention.

[0086] The present invention is not limited to the above described embodiments, and can be variously modified within the scope defined by claims, and embodiments which can be obtained by appropriately combining the individual technical means disclosed in the different embodiments are also included in the technical scope of the present invention.

EXAMPLE

[0087] The inventors conducted experiments using an inkjet printer (JV400-160LX made by MIMAKI ENGINEERING CO., LTD.) similar to the inkjet printing device

1, with respect to occurrence of drying unevenness of printed materials depending on regular cleaning on inkjet heads using a wiper.

[0088] The inventors performed printing on media under the condition of a printing speed of 11 m²/h, 900×900 ND, 12 pB (6p×2layer), and 65/55/70+10. As an example, the inventors conducted wiping on two inkjet heads alternately at regular intervals of 5 minutes. As a comparative example, the inventors conducted wiping on two inkjet heads once at regular intervals of 10 minutes. Also, in the example, the period of each of regular wiping events was set to 7 seconds, and in the comparative example, the period of each of regular wiping events was set to 15 seconds. Further, in the example, a voltage to be applied to a ceiling fan was set to 24 V, and the ceiling fan was stopped during wiping. In the comparative example, a voltage to be applied to the ceiling fan during printing and during wiping was set to 20 V.

[0089] As a result, strip patterns attributable to wiping and corresponding to printing parts dried during wiping were seen thinly on the printed materials of the example, but were seen thickly and clearly on the printed materials of the comparative example. Also, the color difference ΔE (between stripe patterns and the normal state) in the printed materials of the example was 0.9; however, the color difference ΔE in the printed materials of the comparative example was 3.5.

INDUSTRIAL APPLICABILITY

[0090] The present invention can be used in printing using an inkjet printing device.

LIST OF REFERENCE NUMERALS

[0091]

- 1 inkjet printing device
- 10 printing unit (printing means)
- 11 inkjet head
- 12 wiper (cleaning means)
- 13 nozzle
- 20 heater (drying means)
- 30 control unit (control means)
- 40 fan (drying means)
- 50 recording medium
- 60 conveying means

Claims

1. An inkjet printing device comprising:

- a printing means having an inkjet head configured to perform printing by ejecting ink onto a recording medium;
- a drying means configured to dry ink that has landed on the recording medium;

a cleaning means configured to clean the inkjet head; and
a control means configured to control the drying means,

wherein the control means performs at least one of control for making the ink drying efficiency during cleaning of the inkjet head lower than the ink drying efficiency during ejection of ink from the inkjet head, and control for making the ink drying efficiency during ejection of ink from the inkjet head higher than the ink drying efficiency during cleaning of the inkjet head.

2. The inkjet printing device according to claim 1, wherein:

the drying means includes a fan configured to blow air toward the printing surface of the recording medium, and
the control means makes the rotation speed of the fan during cleaning of the inkjet head lower than the rotation speed of the fan during ejection of ink from the inkjet head.

3. The inkjet printing device according to claim 2, wherein:

the control means stops the operation of the fan during cleaning of the inkjet head, and operates the fan during ejection of ink from the inkjet head.

4. The inkjet printing device according to claim 1, wherein:

the drying means includes a fan configured to blow air toward the printing surface of the recording medium, and
the control means makes the rotation speed of the fan during ejection of ink from the inkjet head higher than the rotation speed of the fan (40) during cleaning of the inkjet head.

5. The inkjet printing device according to claim 1, wherein:

the printing means has a plurality of inkjet heads, and
the control mean stops cleaning when some of the plurality of inkjet heads have been cleaned by the cleaning means, and performs printing on the recording medium by ejecting ink from the inkjet heads, and then controls the cleaning means such that the cleaning means restarts cleaning and cleans the other uncleaned inkjet heads of the plurality of inkjet heads.

6. The inkjet printing device according to any one of

claims 1 to 5, wherein:

the drying means includes a heater disposed at a position facing the inkjet head and configured to heat the recording medium from the surface side that is opposite to the printing surface, and the control means makes the heating temperature of the heater (20) during cleaning of the inkjet head lower than the heating temperature of the heater during ejection of ink from the inkjet head.

7. The inkjet printing device according to any one of claims 1 to 5, wherein:

the drying means includes a heater disposed at a position facing the inkjet head and configured to heat the recording medium from the surface side that is opposite to the printing surface, and the control means makes the heating temperature of the heater (20) during ejection of ink from the inkjet head higher than the heating temperature of the heater during cleaning of the inkjet head.

8. An inkjet printing method comprising:

a printing process of performing printing by ejecting ink from an inkjet head onto a recording medium;
a drying process of drying ink that has landed on the recording medium; and
a cleaning process of stopping ejection of ink from the inkjet head and cleaning the inkjet head,

wherein at least one of making the ink drying efficiency in the cleaning process lower than the ink drying efficiency in the printing process, and making the ink drying efficiency in the printing process higher than the ink drying efficiency in the cleaning process is performed.

9. A printing control device for controlling a printing device having an inkjet head configured to perform printing by ejecting ink onto a recording medium (50), wherein:

at least one of making the ink drying efficiency during cleaning of the inkjet head lower than the ink drying efficiency during ejection of ink from the inkjet head, and making the ink drying efficiency during ejection of ink from the inkjet head higher than the ink drying efficiency during cleaning of the inkjet head is performed.

10. A program for making a computer function as the printing control device according to claim 9 such that

the computer functions as means configured to perform the control.

11. A computer-readable recording medium retaining the program according to claim 10.

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FIG. 1

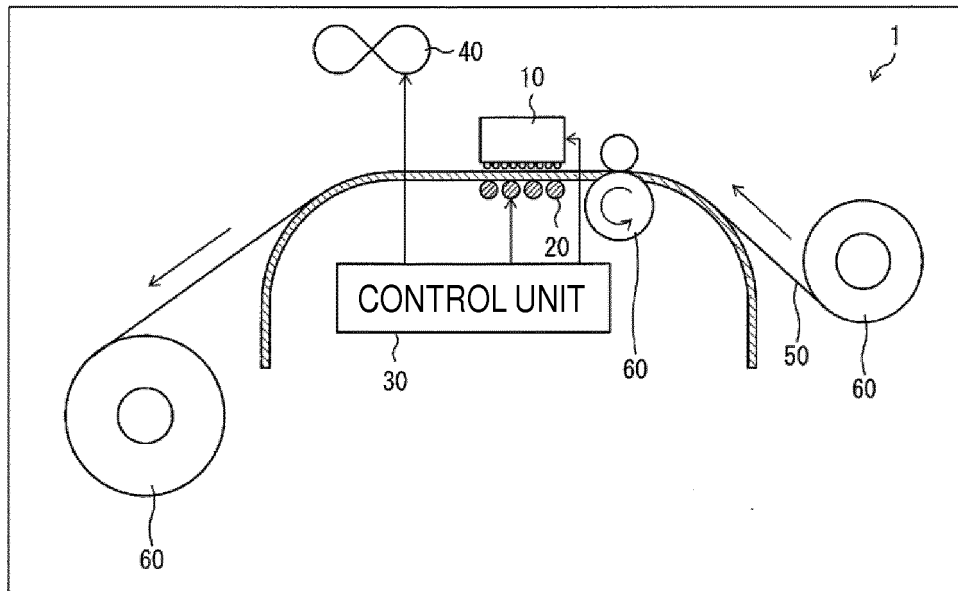


FIG. 2

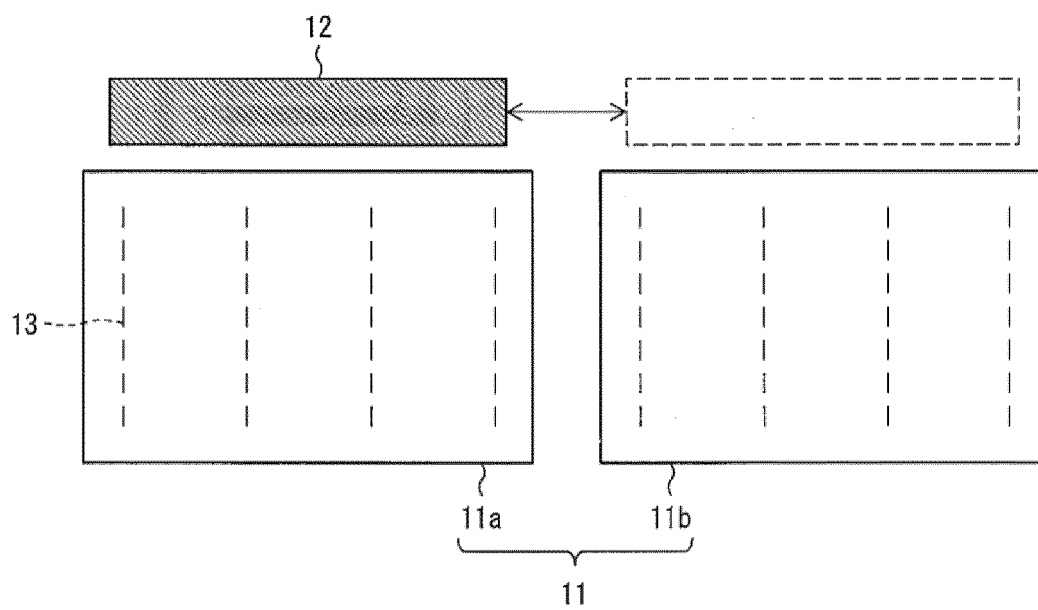
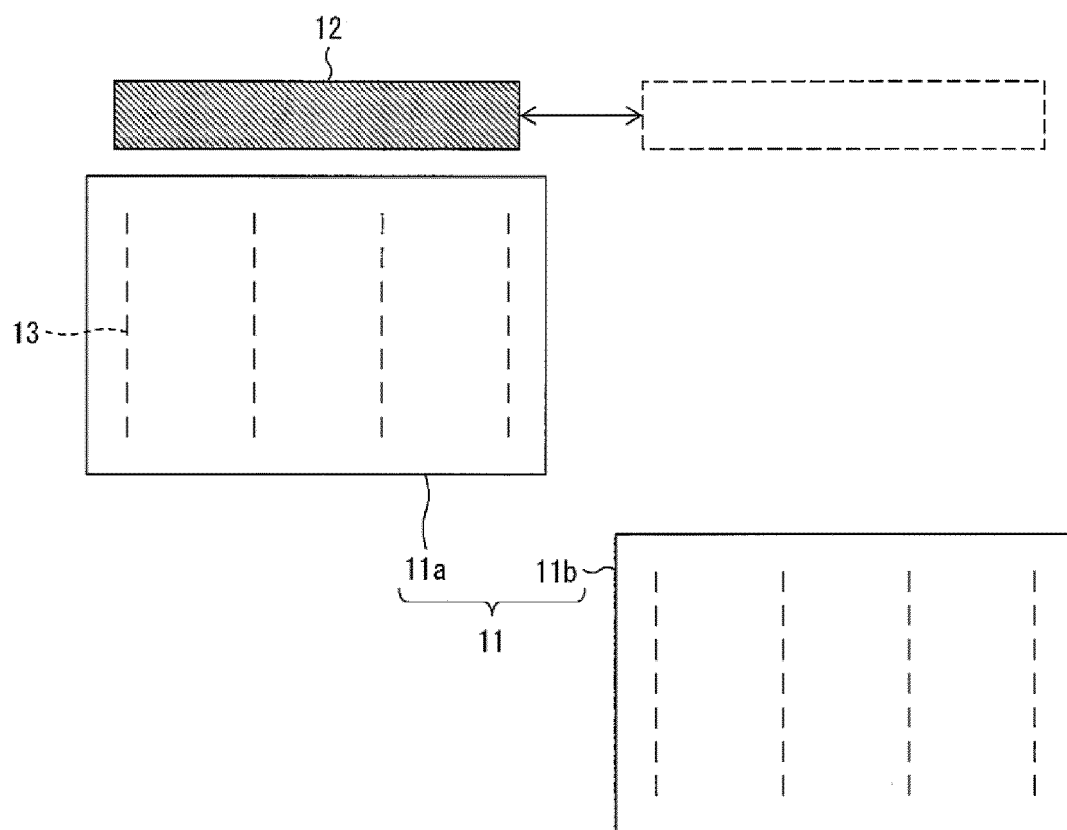


FIG. 3



INTERNATIONAL SEARCH REPORT

International application No.

PCT/JP2015/052239

A. CLASSIFICATION OF SUBJECT MATTER

B41J2/01(2006.01)i, B41J2/165(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)

B41J2/01, B41J2/165

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	1996-2015
Kokai Jitsuyo Shinan Koho	1971-2015	Toroku Jitsuyo Shinan Koho	1994-2015

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 A	WO 2004/094150 A1 (Mimaki Engineering Co., Ltd.), 04 November 2004 (04.11.2004), page 10, line 10 to page 13, line 14; page 18, line 3 to page 20, line 2; fig. 1 to 4 & US 2005/0151815 A1 & US 2010/0194816 A1 & US 2012/0176439 A1 & EP 1557266 A1 & CA 2519790 A & CN 1652939 A	1-4, 6-11 5
Y A	JP 2013-60018 A (Mimaki Engineering Co., Ltd.), 04 April 2013 (04.04.2013), paragraphs [0034] to [0036] (Family: none)	1-4, 6-11 5

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

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Date of the actual completion of the international search
25 March 2015 (25.03.15)Date of mailing of the international search report
07 April 2015 (07.04.15)Name and mailing address of the ISA/
Japan Patent Office
3-4-3, Kasumigaseki, Chiyoda-ku,
Tokyo 100-8915, Japan

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INTERNATIONAL SEARCH REPORT

International application No.

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C (Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y A	JP 2011-101974 A (Canon Inc.), 26 May 2011 (26.05.2011), paragraphs [0014] to [0015], [0017], [0028], [0037] to [0039]; fig. 10 & US 2011/0109682 A1	1-4, 6-11 5

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REFERENCES CITED IN THE DESCRIPTION

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Patent documents cited in the description

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