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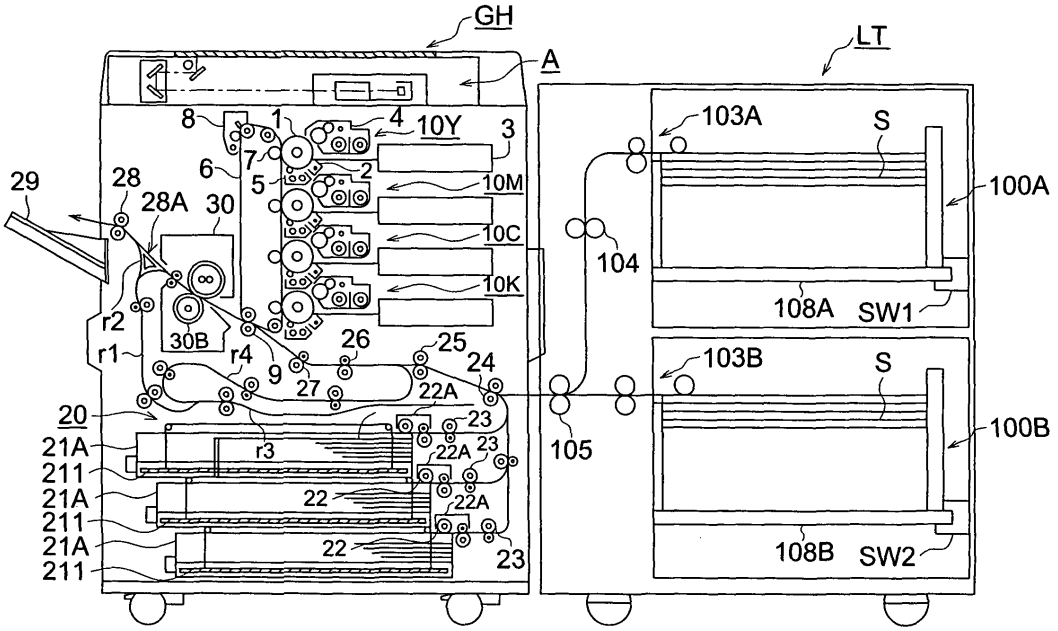
(54) **Paper sheet supplying apparatus and image forming apparatus provided with the same**

(57) There is described a paper sheet supplying apparatus that supplies paper sheets one by one to the image forming apparatus (GH) and conducts the dehumidifying operation of paper sheets only when a specific kind of paper sheets are accommodated in the paper sheet accommodating section, so as to achieve a high operating efficiency. The paper sheet supplying apparatus includes: a paper sheet accommodating section (100A;100B) to accommodate paper sheets; a paper sheet feeding section (103A;103B) to feed the paper sheets one by one from the paper sheet accommodating section; a dehumidification dryer to dehumidify the paper sheet accommodating section; and a control section to control the dehumidification dryer. Only when the control section receives paper kind information representing a specific kind of paper sheet, the control section activates and controls the dehumidification dryer, based on the paper kind information.

FIG. 1



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Description

[0001] This application is based on Japanese Patent Application No. 2006-108395 filed on April 11, 2006 with Japan Patent Office, the entire content of which is hereby incorporated by reference.

BACKGROUND OF THE INVENTION

[0002] The present invention relates to a paper sheet supplying apparatus for supplying paper sheets one by one into an image forming apparatus, etc., and also relates to an image forming apparatus provided with the paper sheet supplying apparatus.

[0003] When a paper sheet, on which an image is to be formed, absorbs moisture, various problems, such as inability of reproducing an image having a desired image quality, a stability degradation of the paper feeding operation, etc., have occurred. To solve such the problem, Patent Documents 1 and 2 (Tokkai 2000-255807 and Tokkai 2005-335837, both are Japanese Non-Examined Patent Publications) set forth a solving method, which includes the steps of: detecting the humidity in the vicinity of the paper sheet supplying apparatus; estimating the rate of moisture absorption of the paper sheet concerned, based on the detected result; activating the dehumidification dryer, such as a heater, a dry air blower, etc., based on the estimated rate of moisture absorption, so as to dehumidify the paper sheet concerned.

[0004] In the conventional countermeasures for moisture absorption problem of the paper sheets, including the above-mentioned method set forth in Patent Documents 1 and 2 (Tokkai 2000-255807 and Tokkai 2005-335837, both are Japanese Non-Examined Patent Publications), such the countermeasures have been applied to all kinds of paper sheets.

[0005] When dehumidifying a paper sheet, it is necessary or desirable to stop the paper sheet feeding operation during the moisture absorbing operation of the paper sheet concerned. This is because, in the apparatus which is designed to conduct the dehumidifying operation when the paper sheet absorbs moisture, a conveyance error or a degradation of the image quality is liable to occur, if the paper sheet is conveyed and the image forming operation is conducted in the mid-course of the moisture absorbing operation at which the rate of moisture absorption of the paper sheet concerned has not decreased to the allowable value.

[0006] The problems with respect to the image forming apparatus, caused by the moisture absorption of the paper sheet, include a paper sheet conveyance problem and an image quality problem. Since a part of the paper sheet conveyance problem and the image quality problem can be solved by improving the conveyance mechanism, by adjusting the image forming process, etc., even when the paper sheet absorbs moisture, it is not necessary to conduct the moisture absorbing operation for every time. On the other hand, since it is difficult to solve a problem of a separation error, caused by the moisture absorption of the paper sheet in the separating process in which a single paper sheet is separated and picked up from a large number of paper sheets accommodated in a paper sheets accommodating section, by improving the conveyance mechanism, etc., it is indispensable to conduct the moisture absorbing operation as a countermeasure to cope with the separation error mentioned in the above.

[0007] Further, as a result of the intensive study conducted by the present inventor, it has been revealed that the abovementioned separation error in the paper sheet feeding process occurs for a specific kind of paper sheet to be used, instead of occurring for all kinds of paper sheets to be used.

[0008] Specifically, with respect to enamel paper sheets, such as art papers, coated papers, etc., when the paper sheets absorb moisture, since the separation error is liable to occur due to the sticking phenomenon between the paper sheets stacked into the paper sheet accommodating section, the moisture absorbing operation becomes necessary. However, with respect to other kinds of paper sheets, it has been revealed that the moisture absorbing operation is not necessary, since the separation error hardly occur, even when the paper sheets absorb moisture. Accordingly, the present inventor has found that, by applying the moisture absorbing operation only to such the specific kind of paper sheet, it becomes possible to eliminate the separation error, which is liable to occur in the paper sheet feeding process, and therefore, it becomes possible to avoid the problem caused by the moisture absorption of paper sheets.

[0009] As aforementioned, conventionally, the moisture absorbing operation has been applied to all kinds of paper sheets, when the moisture absorption of the paper sheets is detected. Accordingly, there has been a problem that the efficiency of the apparatus is lowered due to the lengthy waiting time for stopping the apparatus to conduct the moisture absorbing operation for every kind of paper sheet. Specifically, since a total time period for forming images on the normal paper sheets occupies most of all operating time of the image forming apparatus, there has been a problem that a substantial operating efficiency of the image forming apparatus is considerably deteriorated, when the waiting time for stopping the apparatus to conduct the moisture absorbing operation is introduced even in such the image forming operation that uses the normal paper sheets.

SUMMARY OF THE INVENTION

[0010] According to an aspect of the present invention, a paper sheet supplying apparatus comprises: a paper sheet

accommodating section to accommodate paper sheets; a paper sheet feeding section to feed the paper sheets one by one from the paper sheet accommodating section; a dehumidification dryer to dehumidify the paper sheet accommodating section; and a control section to control the dehumidification dryer; wherein, only when the control section receives paper kind information representing a specific kind of paper sheet, the control section activates and controls the dehumidification dryer, based on the paper kind information.

[0011] According to another aspect of the present invention, an image forming system comprises: an image forming apparatus to form an image on a paper sheet; and a paper sheet supplying apparatus to supply the paper sheet to the image forming apparatus; wherein the paper sheet supplying apparatus includes: a paper sheet accommodating section to accommodate paper sheets; a paper sheet feeding section to feed the paper sheets one by one from the paper sheet accommodating section; a dehumidification dryer to dehumidify the paper sheet accommodating section; and a control section to control the dehumidification dryer; wherein, only when the control section receives paper kind information representing a specific kind of paper sheet, the control section activates and controls the dehumidification dryer, based on the paper kind information.

BRIEF DESCRIPTION OF THE DRAWINGS

[0012] Embodiments will now be described, by way of example only, with reference to the accompanying drawings which are meant to be exemplary, not limiting, and wherein like elements are numbered alike in several Figures, in which:

Fig. 1 shows a brief configuration of an image forming apparatus embodied in the present invention;
Fig. 2 shows a cross sectional schematic diagram of the paper sheet feeding apparatus;
Fig. 3(a) and Fig. 3(b) show perspective views of a paper sheet feeding tray serving as a paper sheet feeding apparatus embodied in the present invention;
Fig. 4 shows a block diagram of a dehumidification control system for conducting a dehumidifying operation; and
Fig. 5 shows a flowchart of controlling operations.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENT

[0013] Referring to the drawings, the embodiments of the present invention will be detailed in the following. However, the scope of the present invention is not limited to the embodiments described in the following.

[0014] Fig. 1 shows a brief configuration of an image forming apparatus embodied in the present invention.

[0015] The image forming apparatus is constituted by an image forming apparatus proper GH and a mass-storage paper sheet supplying apparatus LT, serving as a paper sheet supplying apparatus embodied in the present invention.

[0016] The image forming apparatus proper GH, called a tandem-type color image forming apparatus, is constituted by a plurality of image forming sections 10Y, 10M, 10C, 10K, a belt-type intermediate transfer member 6, a paper sheet feeding section 20, a fixing device 30, etc.

[0017] The image forming apparatus proper GH is provided with an image reading section A disposed on its upper side. An image of a document placed on a platen glass is exposed by scanning a light beam emitted from a document image exposure -scanning device equipped in the image reading section A, so that a line image sensor reads the image of the document. Analogue image signals generated by the photoelectric converting actions performed in the line image sensor are inputted into an image processing section, in order to apply various kinds of image processing, such as an analogue processing, an analogue-to-digital conversion processing, a shading correction processing, etc., to the inputted analogue image signals. Then, the digital image data generated from the analogue image signals are inputted into an exposing section 3.

[0018] Each of the image forming sections 10Y, 10M, 10C, 10K for forming unicolor images of colors Y (Yellow), M (Magenta), C (Cyan), K (Black), respectively, is provided with a photoreceptor drum 1, a charging section 2, the exposing section 3, a developing section 4, a cleaning section 5 and a primary transferring section 7. In Fig. 1, the reference numbers are only attached to the sections included in the image forming section 10Y, and with respect to the image forming sections 10M, 10C, 10K, the reference numbers are omitted.

[0019] The belt-type intermediate transfer member 6 is threaded on a plurality of rollers, so as to circulate along the plurality of image forming sections 10Y, 10M, 10C, 10K.

[0020] The unicolor toner images of colors Y (Yellow), M (Magenta), C (Cyan), K (Black) respectively formed by the plurality of image forming sections 10Y, 10M, 10C, 10K are sequentially transferred one by one onto the belt-type intermediate transfer member 6 currently circulating along the plurality of image forming sections 10Y, 10M, 10C, 10K (primary transferring operation) by the primary transferring sections 7, respectively, in such a manner that the unicolor images are superimposed with each other so as to form a full color toner image.

[0021] A paper sheet S, accommodated in a paper sheet feeding cassette 21A of a paper sheet supplying section 20, is picked up by a paper sheet feeding section 22A and conveyed to a secondary transferring section 9 by pairs of paper

sheet feeding rollers 23, 24, 25, 26, a pair of registration roller 27, etc. Then, the full color toner image formed on the belt-type intermediate transfer member 6 is further transferred onto the paper sheet S by the secondary transferring section 9 (secondary transferring operation).

[0022] Incidentally, since the paper sheet feeding cassettes, aligned in a vertical direction as three stages, have substantially the same structure, the same reference number of 21A is attached to each of them. Further, since the paper sheet feeding sections also have substantially the same structure, the same reference number of 22A is attached to each of them.

[0023] The paper sheet S, having the full color toner image transferred on it, is tightly griped by a pair of a heating roller 30A and a pressing roller 30B equipped in the fixing device 30, so as to apply heat and pressure onto the paper sheet S. As a result of this action, the full color toner image residing on the paper sheet S is fixed onto the paper sheet S. Then, the paper sheet S is tightly griped by a pair of ejecting rollers 28 so as to eject and stack it onto an ejecting tray 29 disposed outside the apparatus.

[0024] On the other hand, after the full color toner image is transferred onto the paper sheet S by the secondary transferring section 9 and the paper sheet S is peeled off the belt-type intermediate transfer member 6 by a curvature separating action, the belt-type intermediate transfer member 6 is cleaned by a cleaning device 8.

[0025] When the paper sheet S, having the fixed full color toner image is to be ejected in a reverse ejecting mode, the paper sheet S passes through a conveyance path located at the lower side of a switching gate 28A in Fig. 1 so that the paper sheet S is conveyed into a first conveyance path r1 extended toward the bottom of the apparatus. Then, the conveyance direction of the paper sheet S is switched to the reverse direction, so that the paper sheet S passes through a second conveyance path r2 located at the left side of the switching gate 28A in Fig. 1. Successively, the paper sheet S is tightly griped by the pair of ejecting rollers 28 and ejected outside the apparatus.

[0026] When the duplex image forming mode in which the toner images are formed on the both sides of the paper sheet S is to be performed, after the full color toner image formed on the first side of the paper sheet S is fixed onto the paper sheet S, the paper sheet S is conveyed into the first conveyance path r1 and further conveyed into a third conveyance path r3. Then, the conveyance direction of the paper sheet S is switched to the reverse direction, so that the paper sheet S is conveyed into a fourth conveyance path r4, serving as a detour path toward the upper direction, and further conveyed by the pair of paper sheet feeding rollers 26. Successively, through the same process as mentioned in the above, another full color toner image is transferred onto a second side of the paper sheet S, being a reverse side of the first side, and fixed onto the paper sheet S by applying heat and pressure onto both the full color toner image and the paper sheet S in the fixing device 30, and then, the paper sheet S having the fixed toner image is ejected outside the apparatus.

[0027] Incidentally, although the image forming apparatus proper GH described in the foregoing is an image forming apparatus for forming a full color image, it is needless to say that the present invention can be also applied for an image forming apparatus for forming a monochrome image.

[0028] The mass-storage paper sheet supplying apparatus LT for supplying a large number of paper sheets, for instance, more than 1000 paper sheets, is coupled to the right side surface of the image forming apparatus proper GH.

[0029] The mass-storage paper sheet supplying apparatus LT is provided with a paper sheet feeding tray 100A and a paper sheet feeding tray 100B, which serves as two-stage paper sheet accommodating sections divided into upper and lower stages.

[0030] A paper sheet feeding unit 103A picks up and separates a single paper sheet, namely, a paper sheet S, from paper sheets stacked on the paper sheet feeding tray 100A located at the upper stage. Then, pairs of conveyance rollers 104, 105 conveys the paper sheet S into the image forming apparatus proper GH through the pair of paper sheet feeding roller 24.

[0031] A paper sheet feeding unit 103B picks up and separates a single paper sheet, namely, a paper sheet S, from paper sheets stacked on the paper sheet feeding tray 100B located at the lower stage. Then, the pair of conveyance rollers 105 conveys the paper sheet S into the image forming apparatus proper GH through the pair of paper sheet feeding roller 24.

[0032] Each of numeral 108A and 108B indicates a paper sheet stacking plate on which the paper sheets S are stacked. Each of the paper sheet stacking plates 108A, 108B elevates in response to an upper surface detecting signal outputted from a paper sheet sensor 120 for detecting the uppermost surface of the stacked paper sheets S, so as to keep a height of the uppermost surface of the stacked paper sheets S constant, irrespective of a number of paper sheets currently stacked, as detailed later.

[0033] Each of numeral SW1 and SW2 indicates a switching unit serving as a mount/demount detecting element for detecting whether each of the paper sheet feeding tray 100A and the paper sheet feeding tray 100B is mounted or demounted into/from the mass-storage paper sheet supplying apparatus LT.

[0034] Referring to Fig. 2 and Fig. 3, the paper sheet feeding trays 100A, 100B will be detailed in the following. Incidentally, in the description in the following, since the structures of the paper sheet feeding trays 100A, 100B are the same as each other, the alphabetical symbols A and B to be attached to the reference numbers will be omitted. For

instance, as shown in Fig. 2, each of the paper sheet feeding trays 100A, 100B is simply indicated by a paper sheet feeding tray 100, and has the configuration and the function as detailed in the following so as to independently perform the dehumidifying operation described as follow.

[0035] Fig. 2 shows a cross sectional schematic diagram of the paper sheet feeding apparatus, while Fig. 3(a) and Fig. 3(b) show perspective views of the paper sheet feeding tray 100 serving as the paper sheet feeding apparatus embodied in the present invention.

[0036] Fig. 3(a) shows a perspective view of a main section of the paper sheet feeding tray 100 in such a state that a cover is removed from the paper sheet feeding tray 100, while Fig. 3(b) shows a perspective view of a height detecting section for detecting the uppermost surface of the stacked paper sheets.

[0037] As shown in Fig. 3(a), the paper sheets S are stacked on a paper sheet stacking plate 108 (equivalent to each of the paper sheet stacking plates 108A, 108B shown in Fig. 1) and movably supported in such a manner that a bunch of the paper sheets S can be elevated or descended by an elevating/descending mechanism (not shown in the drawings). A pair of side regulating members 111, 112, serving as a paper sheet edge-portion regulating member, is movable in both a conveyance direction of the paper sheet S (Y-axis direction shown in Fig. 3) and a width direction intersecting the Y-axis (X-axis direction shown in Fig. 3), so as to contact the both edge sides of the paper sheet S to regulate the both side positions of the paper sheet S. A trailing edge regulating member 118 is also movable in the conveyance direction of the paper sheet S (Y-axis direction shown in Fig. 3) so as to regulate the trailing edge position of the paper sheet S, and also serves as a paper sheet edge-portion regulating member. A paper sheet feeding unit 103 is disposed at the leading edge-portion of the paper sheet S in the conveyance direction of the paper sheet S, and a delivery roller 103a of the paper sheet feeding unit 103 contacts an uppermost paper sheet Sa while pressing the uppermost paper sheet Sa with an appropriate pressure.

[0038] The positions of the pair of side regulating members 111, 112 and the trailing edge regulating member 118 are regulated (adjusted), corresponding to a size of the paper sheet to be employed.

[0039] When the delivery roller 103a rotates in a direction indicated by arrow a1, the uppermost paper sheet Sa progresses in the Y-axis direction indicated by arrow Y, and then, is separated into a single paper sheet by a separating unit including a separating roller 103b and a reverse roller 103c, and conveyed to a pair of conveyance rollers 104.

[0040] In order to detect a height of the uppermost surface of the stacked paper sheets, the paper sheet sensor 120 shown in Fig. 3(b) is provided. The paper sheet sensor 120 is constituted by a detecting arm 121 having a hole shaped in an elliptical and arcuate ring into which a shaft 103ax of the delivery roller 103a is inserted in a freely movable state, a rotating shaft 103bx for supporting the detecting arm 121 in a freely rotatable state, a shading plate 122 fixed onto the paper sheet sensor 120 and a photo-coupler 123 disposed in such a manner that a top portion of the shading plate 122 can be freely inserted into a gap between a photo-receiving port and a photo-emitting port of the photo-coupler 123. The separating roller 103b is rotated by the driving force of the rotating shaft 103bx. Since the detecting arm 121 is heavier than the shading plate 122, the detecting arm 121 always keeps contacting the uppermost surface of the stacked paper sheets S with a little pressure. According as a level of the surface of the uppermost paper sheet Sa descends due to a reduction of the number of stacked paper sheets as a result of the paper sheet feeding operation, the top portion of the detecting arm 121 is gradually lowered, and, at the same time, the top portion of the shading plate 122 swings out of the gap of the photo-coupler 123. As a result, since the photo-receiving port of the photo-coupler 123 receives a light emitted from the photo-emitting port of the same, the fact that the level of the surface of the uppermost paper sheet Sa descends can be detected. Then, the elevating/descending mechanism (not shown in the drawings) is activated to elevate the paper sheet stacking plate 108, so that the level of the surface of the uppermost paper sheet Sa is elevated to a position at which the top portion of the shading plate 122 again shades the light emitted from the photo-emitting port of the photo-coupler 123. When the paper sheet sensor 120 detects the fact that the level of the surface of the uppermost paper sheet Sa reaches a predetermined position, the elevating/descending mechanism is deactivated.

[0041] According to the abovementioned operation, it becomes possible to always keep the height of the upper surface of the paper sheet S, namely, the level of the surface of the uppermost paper sheet Sa, constant. The scope of a structure of the paper sheet sensor 120 is not limited to that shown in Fig. 3(a). Any other structure capable of detecting a position of the upper surface of the paper sheet is applicable in the present invention.

[0042] The dehumidification dryer shown in Fig. 2 includes a air blower for blowing air against the paper sheets accommodated in the paper sheet feeding tray 100 and a heater for heating the air so as to decrease the relative humidity of the air.

[0043] An air duct 113, which is provided with an air intake inlet 113A disposed at its upper section and an air exhaust outlet 113B disposed at its lower section, is equipped on the side surface of the paper sheet feeding tray 100, while a heater 114 is mounted inside the air duct 113.

[0044] Further, a side regulating member 111 is shaped in a vertically lengthy box, and provided with an air exhaust outlet 111A disposed at its upper section, an air intake inlet 111B disposed at its lower section and a fan 116 disposed at its lower section.

[0045] Still further, a side regulating member 112 is shaped in a vertically lengthy box, and provided with an air exhaust

outlet 112A disposed at its upper section, an air intake inlet 112B disposed at its lower section and a fan 117 disposed at its lower section.

[0046] By activating a fan 115, the fan 116 and the fan 117, the air circulates inside the paper sheet feeding tray 100 according to the arrows indicated in Fig. 2, and the dry air dehumidified by the heating action of the heater 114 is blown against the paper sheets S stacked on the paper sheet stacking plate 108.

[0047] Since the air is brown against the upper portion of the stacked paper sheets, the air also has a role for separating a single paper sheet form the stacked paper sheets, in order to help the separating operation to be conducted by the pair of separating roller 103b and the reverse roller 103c and to securely achieve the single paper separating operation.

[0048] Further, by blowing the dried air, the relative humidity of which is decreased by the heating action of the heater 114, against the stacked paper sheets, the dehumidifying operation for reducing a moisture content included in the paper sheet S can be conducted.

[0049] Although the dehumidification dryer, which blows the dried air against the paper sheets, is exemplified in the foregoing, any one of conventional dehumidification dryers, such as a dryer that is provided with a heater disposed at its lower side to heat and dehumidify the paper sheet, a dehumidification dryer that performs both the heating operation of the paper sheet and the blowing operation of the dried air, etc., can be employed in the embodiment of the present invention.

[0050] Fig. 4 shows a block diagram of the dehumidification control system for conducting the dehumidifying operation.

[0051] In the embodiment of the present invention, based on information representing a kind of paper sheets (hereinafter, referred to as paper kind information) sent from a paper kind setting section SK, only when enamel paper sheets, such as art papers, coated papers, etc., are loaded in the paper sheet feeding tray 100, a control section CR activates a dehumidification dryer HC to conduct the dehumidifying operation of the paper sheets accommodated in the paper sheet accommodating section.

[0052] An operating section of the image forming apparatus includes the paper kind setting section SK, so that paper kind information are inputted into the control section CR, when the operator sets a kind of paper sheets to be accommodated in the paper sheet accommodating section. In addition, at the time when the operator selects and draws out the paper sheet feeding tray either 100A or 100B, the switching unit either SW1 or SW2, serving as the mount/demount detecting switch, is turned ON so as to designate the paper sheet feeding tray either 100A or 100B. Then, the control section CR receives information indicating that paper sheets of the specific kind set by the operator are loaded into the paper sheet feeding tray either 100A or 100B.

[0053] A humidity sensor HS is attached to an outer wall of the image forming apparatus. Since a rate of moisture absorption of the paper sheet, accommodated in the supplemental paper sheet accommodating section installed outside the image forming apparatus, substantially corresponds to a humidity of the outside air, the rate of moisture absorption of the paper sheets to be loaded can be estimated by detecting the humidity of the outside air with the humidity sensor HS.

[0054] Further, based on outside humidity information sent from the humidity sensor HS serving as a humidity detecting element, the control section CR determines whether or not the dehumidifying operation should be conducted and sets a duration time for the dehumidifying operation, corresponding to the rate of moisture absorption of the paper sheets to be loaded.

[0055] Still further, based on a paper-sheet differential residual amount detected from the difference between a residual amount of paper sheets remaining in the paper sheet accommodating section before the paper sheet loading operation and that after the paper sheet loading operation, the control section CR not only can determine whether or not the dehumidifying operation should be conducted, but also can set the duration time for the dehumidifying operation based on the residual amount of paper sheets.

[0056] Correlation between the humidity and the duration time of the dehumidifying operation, and correlation between the residual amount of paper sheets and the duration time of the dehumidifying operation are found from the experiments in advance, and a operating time table of them are stored in a storage section MR in advance.

[0057] Fig. 5 shows a flowchart of the controlling operations to be conducted by the control section CR, described in the foregoing.

[0058] As aforementioned, the control section CR receives the paper kind information sent from the paper kind setting section SK (Step S1) to determine whether or not the concerned paper sheets are enamel paper sheets (Step S2). When determining that the concerned paper sheets are not enamel paper sheets (Step S3; No), the control section CR finalizes the operation (END).

[0059] When determining that the concerned paper sheets are enamel paper sheets (Step S3; Yes), the control section CR receives residual amount information sent from a paper-sheet residual amount detecting section PD (Step S4). The paper-sheet residual amount detecting section PD detects the height of the paper sheet stacking plate 108 shown in Fig. 2, and derives the paper-sheet residual amount information from a number of rotations of a motor (not shown in the drawings) for driving the paper sheet stacking plate 108.

[0060] When the paper-sheet residual amounts before and after demounting/mounting operations of the paper sheet feeding tray 100, namely, before drawing it and after reloading it, differ from each other, it can be determined that

additional paper sheets are newly loaded into the paper sheet feeding tray 100. While, when the paper-sheet residual amounts before and after demounting/mounting operations do not differ from each other, it can be determined that the demounting/mounting operations are conducted without loading additional paper sheets.

[0061] Accordingly, when determining that the paper-sheet residual amounts before and after demounting/mounting operations are the same (Step S5; No), the control section CR finalizes the operation (END).

[0062] On the other hand, when determining that the paper-sheet residual amounts before and after demounting/mounting operations differ from each other (Step S5; Yes), the control section CR reads the output value of the humidity sensor HS (Step S6).

[0063] The presence or absence of the change of paper-sheet residual amount can be detected by employing the information sent from the paper-sheet residual amount detecting section PD and the other information sent from the switching units SW1, SW2.

[0064] Concretely speaking, a paper-sheet residual amount before drawing the paper sheet feeding tray 100 is detected by employing information sent from the paper-sheet residual amount detecting section PD before drawing it, a mount/demount status of the paper sheet feeding tray 100 is detected by employing information sent from the switching units SW1, SW2, and a paper-sheet residual amount after mounting the paper sheet feeding tray 100 is detected by employing information sent from the paper-sheet residual amount detecting section PD after mounting it. Then, by comparing the paper-sheet residual amount before drawing with that after mounting, the presence or absence of the change of paper-sheet residual amount can be detected.

[0065] When the output value of the humidity sensor HS, namely, the humidity of outside air, is a sufficiently low value to such an extent that the dehumidifying operation is not necessary (Step S7; No), the control section CR finalizes the operation (END). On the other hand, when the output value of the humidity sensor HS indicates a necessity of the dehumidifying operation (Step S7; Yes), the control section CR implements the dehumidifying operation of the paper sheets S (Step S8).

[0066] Concretely speaking, to implement the dehumidifying operation of the paper sheets S, the control section CR not only activates the fan 115, the fan 116 and the fan 117, but also drives the heater 114 so as to circulate the dried air around the inside of the paper sheet feeding tray 100 (Step S8).

[0067] At the time when the dehumidifying operation is commenced, the control section CR immediately bans the paper sheet feeding operation during the dehumidifying operation (Step S8).

[0068] The control section CR reads the table of dehumidifying duration time so as to select an appropriate duration time corresponding to the humidity of outside air. Table 1 is an example of the table of dehumidifying duration time.

[0069] The control section CR deactivates the dehumidifying operation, just after the selected duration time has elapsed, and removes the ban on the paper sheet feeding operation to finalize the operation.

<Table 1>

Humidity of outside air	Target temperature in tray	Duration time of dehumidifying activation
≤ 55%	No dehumidifying operation	0
56 - 60%	"Temperature of outside air" +6°	6 minutes
61 - 65%	"Temperature of outside air" +7°	7 minutes
66 - 70%	"Temperature of outside air" +8°	8 minutes
71 - 75%	"Temperature of outside air" +9°	9 minutes
≥76%	"Temperature of outside air" +10°	10 minutes

[0070] The control section CR deactivates the dehumidifying operation, just after each of the duration times indicated in Table 1 has elapsed, and removes the ban on the paper sheet feeding operation (Step S9) to finalize the operation (END).

[0071] Incidentally, although the two-stage controlling operation corresponding to the presence or absence of the change of paper-sheet residual amount is conducted in the example shown in Fig. 5, it is also applicable that, by reading a duration time of dehumidifying operation corresponding to the paper-sheet residual amount from the storage section MR, the dehumidifying operation is conducted during the time interval corresponding to the paper-sheet residual amount.

[0072] According to the present invention, since the dehumidifying operation is conducted only when a specific kind of paper sheets are accommodated in the paper sheet accommodating section, even if the paper sheet feeding operation is deactivated during the dehumidifying operation, the reduction rate of the image forming efficiency is kept at a low level. Accordingly, it becomes possible to provide a paper sheet supplying apparatus having a high operating efficiency, and therefore, it also becomes possible to provide an image forming apparatus to be operated at a high efficiency.

[0073] Specifically, since no deactivation of the image-forming operation due to the dehumidifying operation of the recording materials occurs during the image forming operation employing normal paper sheets whose usage frequency is normally high, it becomes possible to drastically improve its practical operating efficiency.

[0074] While the preferred embodiments of the present invention have been described using specific term, such description is for illustrative purpose only, and it is to be understood that changes and variations may be made without departing from the spirit and scope of the appended claims.

Claims

1. A paper sheet supplying apparatus that comprises:

a paper sheet accommodating section to accommodate paper sheets;
a paper sheet feeding section to feed the paper sheets one by one from the paper sheet accommodating section;
a dehumidification dryer to dehumidify the paper sheet accommodating section; and
a control section to control the dehumidification dryer;

characterized in that, only when the control section receives paper kind information representing a specific kind of paper sheet, the control section activates and controls the dehumidification dryer, based on the paper kind information.

2. The paper sheet supplying apparatus, recited in claim 1, further comprising:

an outside humidity detecting member to detect a humidity of air outside the paper sheet supplying apparatus; and **characterized in that**
the control section activates and controls the dehumidification dryer, based on the humidity detected by the outside humidity detecting member.

3. The paper sheet supplying apparatus, recited in claim 1 or 2, further comprising:

a paper-sheet residual amount detecting section to detect a residual amount of paper sheets remaining in the paper sheet accommodating section; and
a mount/dismount detecting member to detect a mounting or dismounting status of the paper sheet accommodating section; and **characterized in that**
the control section activates and controls the dehumidification dryer, when the residual amount of paper sheets, detected by the paper-sheet residual amount detecting section, changes before and after the mount/dismount detecting member detects the dismounting and mounting status of the paper sheet accommodating section.

4. The paper sheet supplying apparatus, recited in any one of claims 1 - 3, **characterized by** further comprising:

a storage section to store at least an operating time table in which an amount of paper sheets accommodated in the paper sheet accommodating section is correlated with an activating time of the dehumidification dryer; and
the control section controls the activating time of the dehumidification dryer, based on change of a residual amount of paper sheets remaining in the paper sheet accommodating section.

5. The paper sheet supplying apparatus, recited in any one of claims 1 - 3, **characterized by** further comprising:

a storage section to store at least an operating time table in which a humidity of air outside the paper sheet supplying apparatus is correlated with an activating time of the dehumidification dryer; and
the control section controls the activating time of the dehumidification dryer, based on the humidity of the air outside the paper sheet supplying apparatus.

6. The paper sheet supplying apparatus, recited in any one of claims 1 - 5, **characterized in that**
the control section bans a paper sheet feeding operation to be conducted by the paper sheet feeding section, during an activating time of the dehumidification dryer.

7. The paper sheet supplying apparatus, recited in any one of claims 1 - 6, **characterized in that**,
only when the paper kind information represents an enamel paper sheet as the specific kind of paper sheet, the

control section activates and controls the dehumidification dryer, based on the paper kind information.

8. The paper sheet supplying apparatus, recited in any one of claims 1 - 7, **characterized in that** the dehumidification dryer is provided with a blower section to blow dry air against the paper sheets accommodate in the paper sheet accommodating section from a side edge direction of the paper sheets.

9. The paper sheet supplying apparatus, recited in claim 8, **characterized in that** the blower section includes a heater to heat air, an air exhaust outlet to blow off the air heated by the heater against an upper portion of the paper sheets stacked on the paper sheet accommodating section and a fan to blow off the air heated by the heater from the air exhaust outlet.

10. An image forming system, **characterized by** comprising:

an image forming apparatus to form an image on a paper sheet; and
the paper sheet supplying apparatus, recited in any one of claims 1 - 9, to supply the paper sheet to the image forming apparatus.

FIG. 1

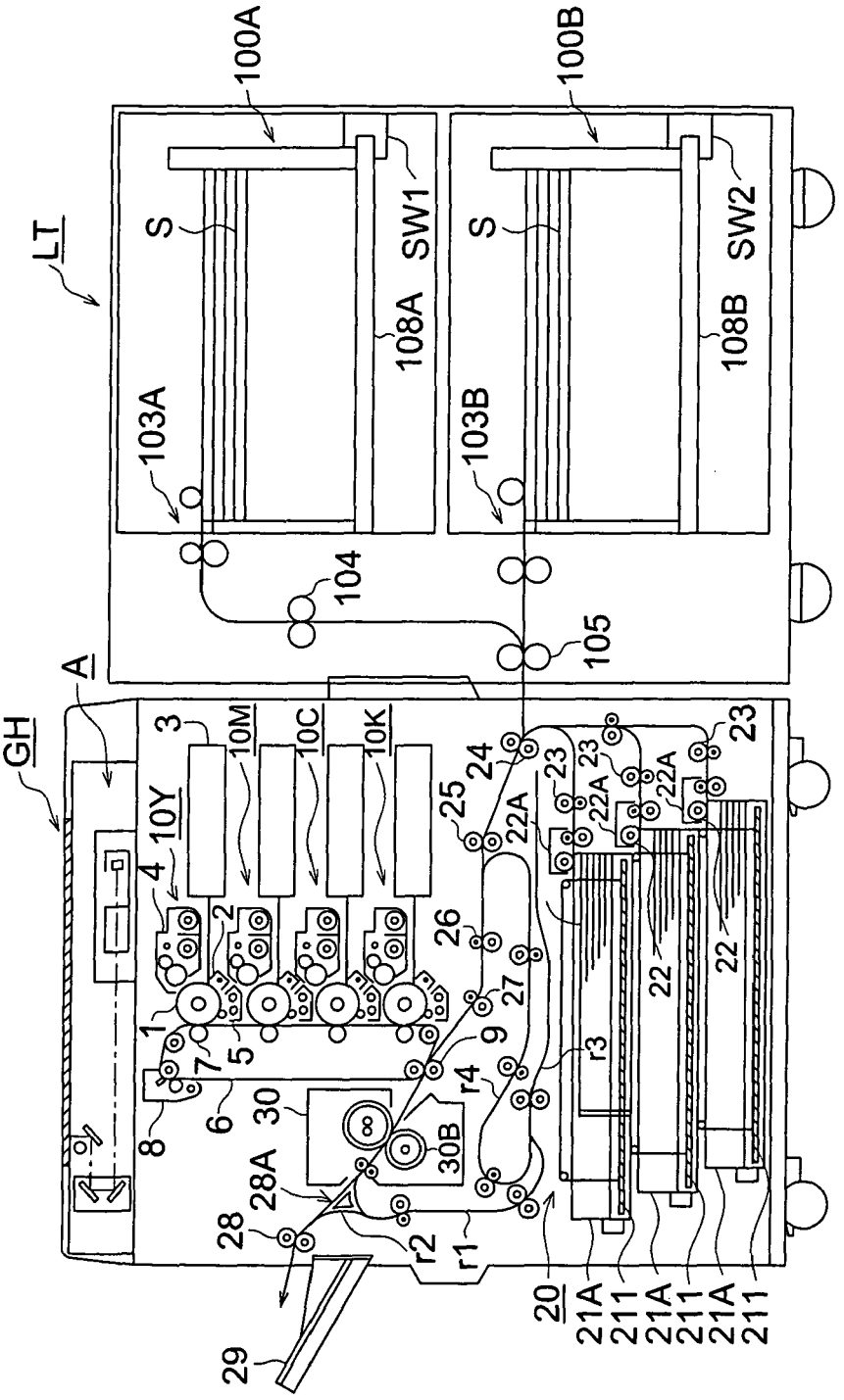

100A
100B
LT
S
SW1
SW2
108A
108B
103A
103B
104
105
A
GH
3
10M
10C
10K
10Y
4
2
1
7
5
6
30
30B
8
28A
28
29
r1
r2
r3
r4
9
25
24
23
22A
22
26
27
20
21A
211

FIG. 2

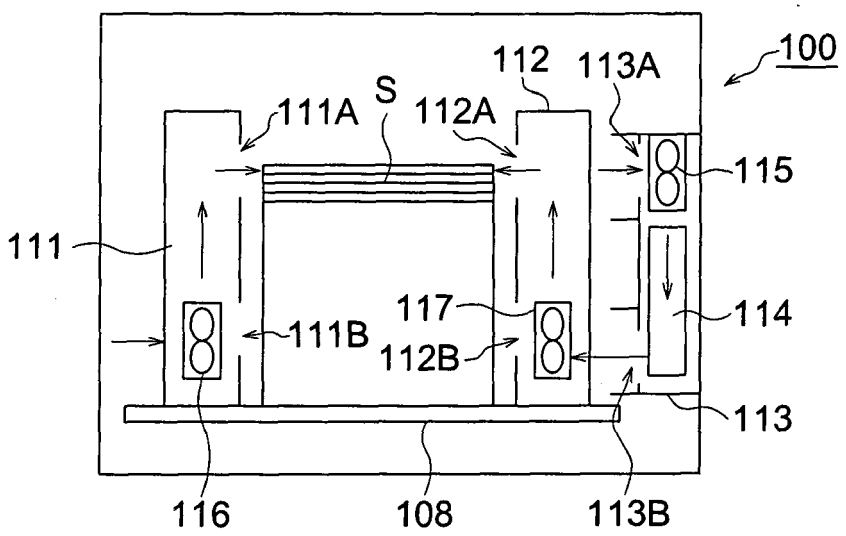

100
112
113A
S
111A
112A
115
111
117
114
111B
112B
113
116
108
113B

FIG. 3 (a)

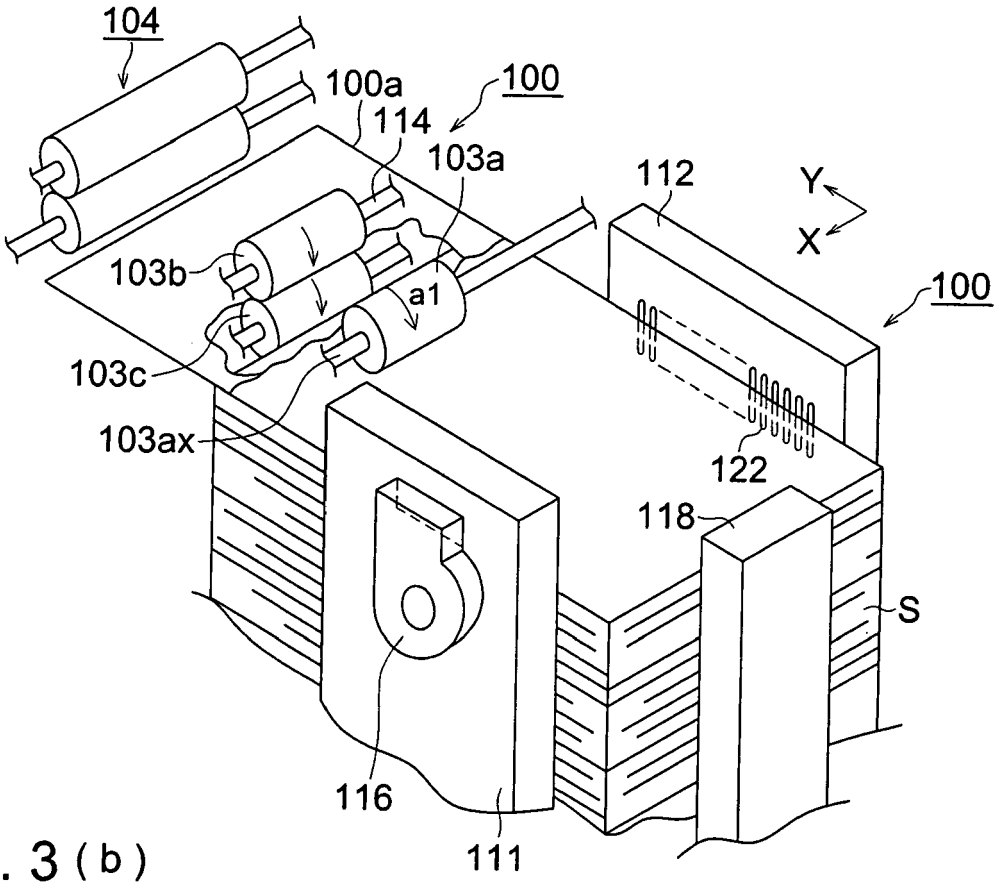

104
100a
100
114
103a
112
Y
X
103b
a1
100
103c
103ax
122
118
S
116
111

FIG. 3 (b)

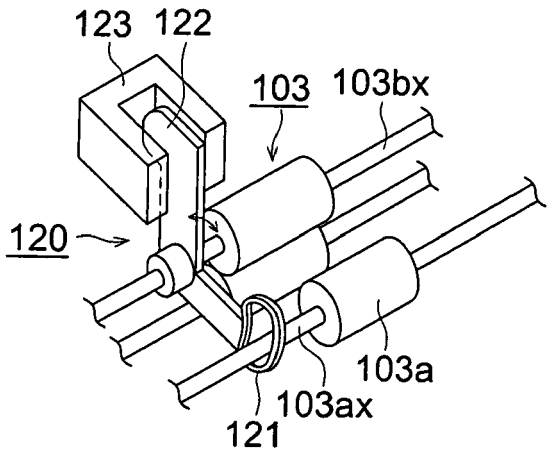

123
122
103
103bx
120
103a
103ax
121

FIG. 4

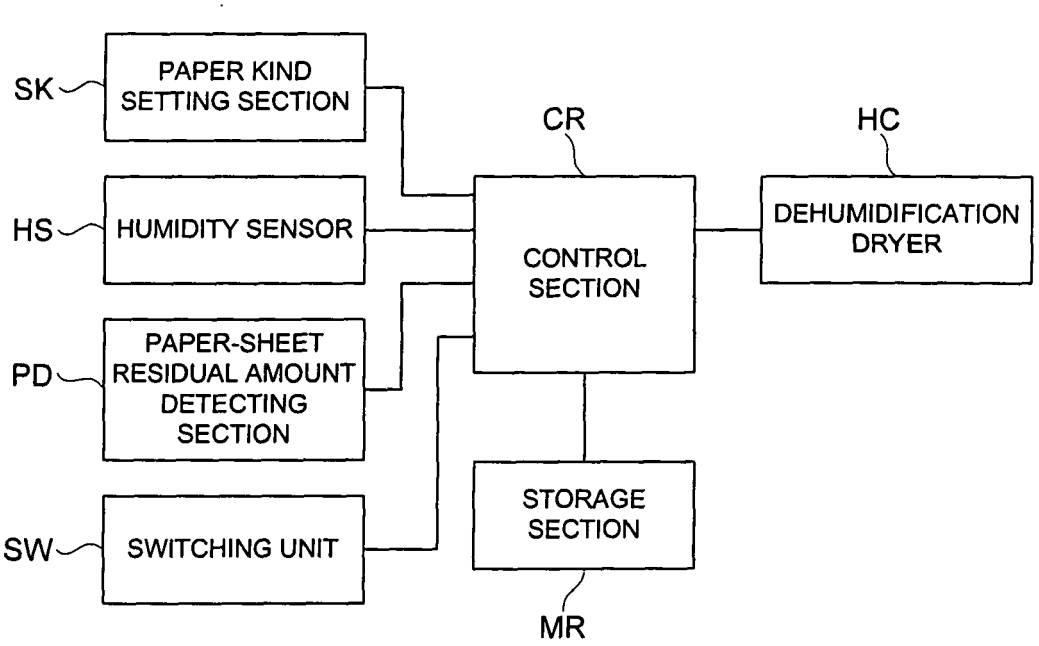
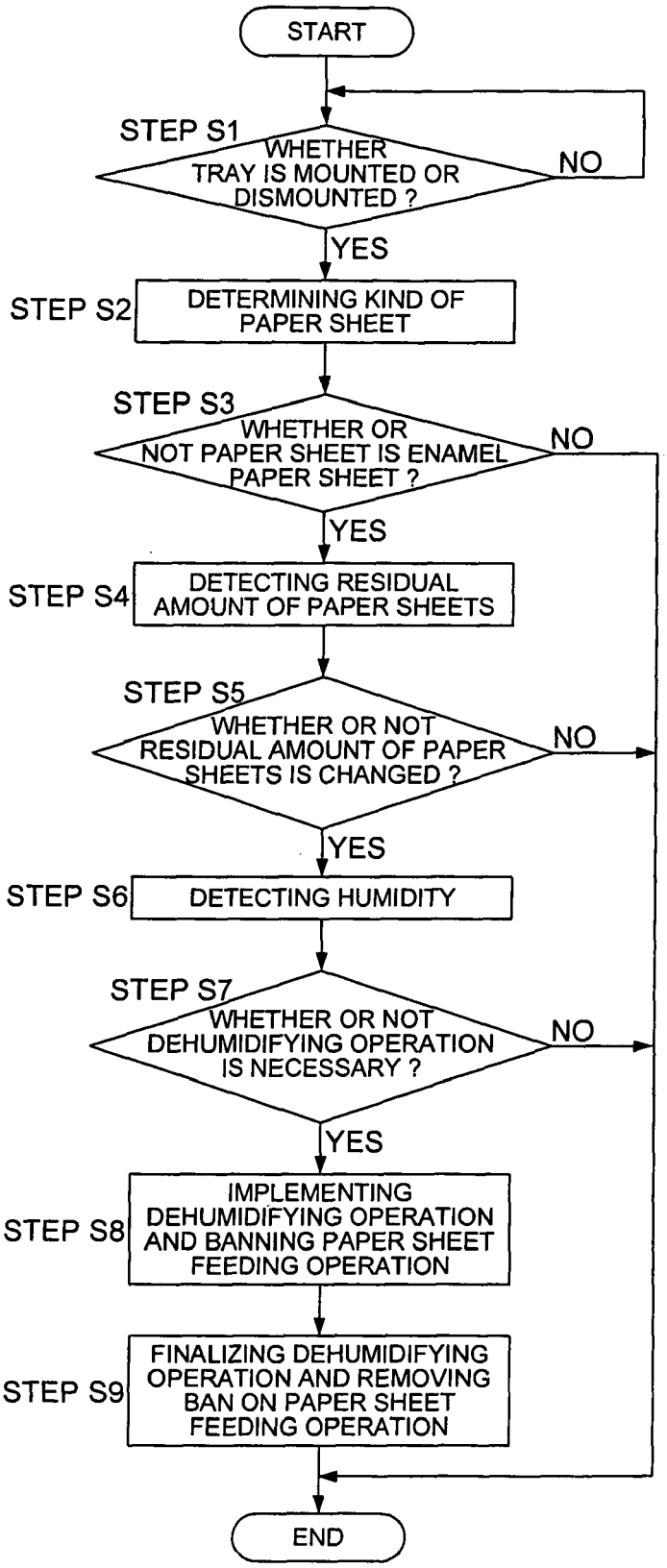

SK
PAPER KIND SETTING SECTION
HS
HUMIDITY SENSOR
PD
PAPER-SHEET RESIDUAL AMOUNT DETECTING SECTION
SW
SWITCHING UNIT
CR
CONTROL SECTION
STORAGE SECTION
MR
HC
DEHUMIDIFICATION DRYER

FIG. 5


START
STEP S1
WHETHER TRAY IS MOUNTED OR DISMOUNTED ?
NO
YES
STEP S2
DETERMINING KIND OF PAPER SHEET
STEP S3
WHETHER OR NOT PAPER SHEET IS ENAMEL PAPER SHEET ?
NO
YES
STEP S4
DETECTING RESIDUAL AMOUNT OF PAPER SHEETS
STEP S5
WHETHER OR NOT RESIDUAL AMOUNT OF PAPER SHEETS IS CHANGED ?
NO
YES
STEP S6
DETECTING HUMIDITY
STEP S7
WHETHER OR NOT DEHUMIDIFYING OPERATION IS NECESSARY ?
NO
YES
STEP S8
IMPLEMENTING DEHUMIDIFYING OPERATION AND BANNING PAPER SHEET FEEDING OPERATION
STEP S9
FINALIZING DEHUMIDIFYING OPERATION AND REMOVING BAN ON PAPER SHEET FEEDING OPERATION
END

REFERENCES CITED IN THE DESCRIPTION

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Patent documents cited in the description

- JP 2006108395 A **[0001]**
- WO 2000255807 A **[0003] [0004]**
- WO 2005335837 A **[0003] [0004]**