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

(11) EP 3 012 215 A1

(12) **EUROPEAN PATENT APPLICATION**
published in accordance with Art. 153(4) EPC

(43) Date of publication:
27.04.2016 Bulletin 2016/17

(21) Application number: **14851356.7**

(22) Date of filing: **24.09.2014**

(51) Int Cl.:
B65H 5/06 *(2006.01)* ***B65H 3/08*** *(2006.01)*
B65H 5/02 *(2006.01)* ***B65H 5/24*** *(2006.01)*

(86) International application number:
PCT/JP2014/075252

(87) International publication number:
WO 2015/050021 (09.04.2015 Gazette 2015/14)

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

(30) Priority: **03.10.2013 JP 2013207835**

(71) Applicant: **Mitsubishi Heavy Industries Printing & Packaging Machinery, Ltd.**
Mihara-shi
Hiroshima 729-0393 (JP)

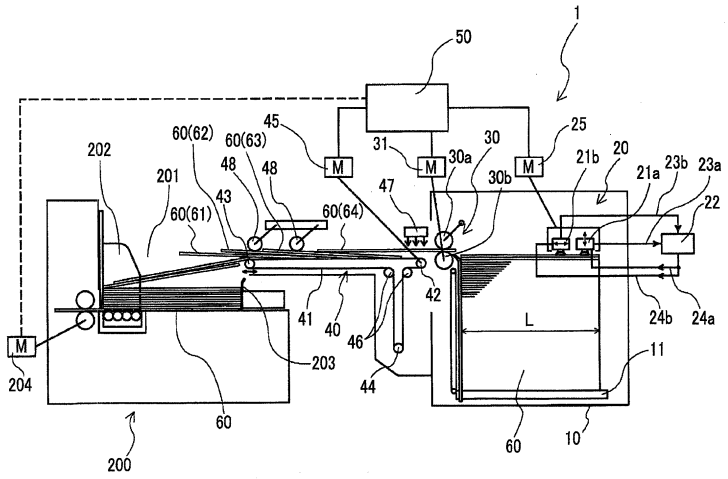
(72) Inventors:
- **NIUCHI, Kunio**
  Mihara-shi
  Hiroshima 729-0393 (JP)
- **SUGIMOTO, Kazuya**
  Mihara-shi
  Hiroshima 729-0393 (JP)
- **KINOSHITA, Hiroo**
  Fukuyama-City
  Hiroshima 729-0111 (JP)

(74) Representative: **Hoffmann Eitle**
Patent- und Rechtsanwälte PartmbB
Arabellastraße 30
81925 München (DE)

(54) **PAPER FEEDING DEVICE AND PAPER FEEDING METHOD**

(57) Provided are a paper feeding device that can stably feed one sheet of paper at a time to a paper feeding unit hopper of a printer or die cutting device. A paper feeding device (1) comprising a paper feeding tray (10) on which a plurality of sheets (60) are stacked in the vertical direction, a sheet feeding means (20) that sends, in the horizontal direction, the sheet (60) that is located at the top of the plurality of sheets (60) stacked on the paper feeding tray (10), and a pair of feeding rollers (30) that deliver the sheet (60) by grasping the leading edge of the sheet (60) that is sent by the sheet feeding means (20), wherein the feeding rollers (30) are variable speed rollers for which the circumferential speed can be increased and decreased while sending one sheet (60) from the leading edge to the trailing edge.

FIG. 1



EP 3 012 215 A1

Description

Technical Field

[0001] The present invention relates to a paper feeding device and a paper feeding method, and more particularly relates to a device and method for supplying a sheet of cardboard or paperboard to a paper feeding unit of printers or die cutting devices.

Background Art

[0002] Some printers or die cutting devices have a hopper for temporarily holding a sheet in a paper feeding unit of the sheet for printing or die cutting. When the printers or the die cutting devices are operated, it is necessary to continuously feed the sheet one by one or to intermittently feed a batch of multiple sheets (in general, approximately 20 sheets) to the hopper so that the sheet held in the hopper does not run out.

[0003] Figs. 5A to 5D illustrate an example of a paper feeding device in the related art in which the sheet is fed to the hopper of the paper feeding unit of these printers or die cutting devices. As illustrated in a schematic front view in Fig. 5A, a paper feeding device 101 is disposed adjacent to the paper feeding unit 200 of the printer. In Fig. 5A, illustration of a printer main body is omitted.

[0004] The paper feeding device 101 includes a paper feeding tray 110 on which multiple sheets 60 are stacked in a vertical direction, a pusher 120 which is disposed above the paper feeding tray 110 and which serves as sheet feeding means for feeding the multiple sheets stacked on the paper feeding tray 110 in a horizontal direction at a time, and a transporting conveyor 140 which is disposed adjacent to the paper feeding tray 110 and which transports the multiple sheets fed by the pusher 120.

[0005] The paper feeding device 101 causes the pusher 120 to push out the multiple sheets 60 stacked on the paper feeding tray 110 onto the transporting conveyor 140 as a batch of multi-stacked sheets 60B.

[0006] Batch dismantling rollers 151 and 152 of a batch dismantling device 150 are disposed above the transporting conveyor 140 by leaving a distance from an upper surface of a belt 141 of the transporting conveyor 140. The batch dismantling rollers (hereinafter, simply referred to as rollers) 151 and 152 are illustrated in Fig. 5B which is a plan view. Within the batch of sheets 60B moving on the transporting conveyor 140, the sheet 60 located at the bottom of the batch is anteriorly fed onto the transporting conveyor 140. In this mode, the respective sheets 60 are brought into a state of partially overlapping each other, and are continuously supplied one by one to a hopper 201 of the paper feeding unit 200 of the printer.

[0007] The reason for bringing the sheets 60 into the state of partially overlapping each other on the transporting conveyor 140 in this way is to stably stack the sheets 60 inside the hopper 201. A trailing edge of the preceding sheet 60 is pressed by the subsequent sheet 60. As a result, when falling into the hopper 201, the sheet 60 maintains a substantially horizontal posture, and thus, the sheet 60 does not fall into the hopper 201 with a tilted posture.

[0008] However, according to the paper feeding device 101 in the related art illustrated in Figs. 5A and 5B, when the sheets 60 as the batch of sheets 60B is pushed out from the paper feeding tray 110 to the transporting conveyor 140 by using the pusher 120, depending on the state of the sheets 60 stacked on the paper feeding tray 110, there is a possibility that the batch of sheets 60B may have a disordered shape.

[0009] More specifically, the sheets 60 stacked on the paper feeding tray 110 are not always horizontally stacked. As illustrated in Figs. 5C and 5D which are views of an arrow A in Fig. 5A, in some cases, the sheets 60 are obliquely stacked or warped. If the sheets 60 stacked on the paper feeding tray 110 are warped or tilted in this way, when the sheets 60 are pushed out by the pusher 120 due to the warpage or tilting, the sheets 60 are caught on a front contact plate 111 which is erected in the paper feeding tray 110 and which is located on a leading edge side of the sheets 60, or are twisted inside a plane by only one side being pressed in a width direction of the sheets. As a result, in some cases, the sheets 60 in an oblique state are pushed out onto the transporting conveyor 140, or the respective sheets 60 cannot be stably separated from each other in the hopper 201.

[0010] Figs. 6a and 6B are views for describing paper feeding performed by the paper feeding device in the related art. Fig. 6A illustrates a front view illustrating the vicinity on an upper side of the paper feeding tray 110, and Fig. 6B illustrates a plan view of sheets 61 to 64 at a position corresponding to Fig. 6A, respectively. As illustrated in Figs. 6A and 6B, when the batch of sheets 60B is pushed out, if the sheet 61 at the bottom of the batch of sheets 60B is caught on the front contact plate 111, the sheet 61 remains in the paper feeding tray 110 in a state where the sheet 61 is tilted toward the front contact plate 111 as illustrated in Fig. 6B, thereby hindering a smooth forward movement of the sheets 62 and 63 located above the sheet 61. Consequently, the sheets 62 and 63 pushed out over the sheet 61 are tilted. The reference numeral L in Fig. 6B represents a length dimension of the sheets 60 (60 (sic) to 64).

[0011] In addition, Figs. 7A and 7B are views for describing another case of paper feeding performed by the paper feeding device in the related art. Fig. 7A illustrates a front view illustrating the vicinity on the upper side of the paper feeding tray 110, and Fig. 7B illustrates a plan view of the sheets 61 to 64 at a position corresponding to that of Fig. 7A, respectively. As illustrated in Figs. 7A and 7B, the sheet 61 at the bottom of the batch of sheets 60B pushed out onto the transporting conveyor 140 comes into contact with the front contact plate 111, and thus, the leading edge of the sheet 61 is folded or torn. This leads to trouble when the sheet 61 falls into the

hopper 201 of the paper feeding unit 200 of the printer.

[0012] Then, if the sheets are brought into a state illustrated in Figs. 6A to 7B, the batch dismantling rollers 151 and 152 disposed above the transporting conveyor 140 feed each sheet 60 in the batch of sheets 60B one by one sequentially starting from the sheet 60 located below to the paper feeding unit 200 of the printer so that the sheets 60 partially overlap each other. When the sheets 60 are separated and stacked in the hopper 201, the continuously fed sheets 61 to 64 are horizontally misaligned with each other, or the overlapped volume becomes uneven, thereby causing difficulty in allowing stable flow conditions. For example, as illustrated in Fig. 8A (partial front view illustrating the vicinity of the transporting conveyor of the paper feeding device in the related art), a case may be considered in which the sheets 60 are supplied to the hopper 201 of the paper feeding unit 200 of the printer in a state where the sheets 61 and 62 located at the bottom of the batch of sheets 60B pushed out onto the transporting conveyor 140 are tilted, as illustrated in Fig. 8B (plan view of the batch of sheets 60B). In this case, as Figs. 9A and 9B illustrate a configuration in the vicinity of the hopper 201 of the paper feeding unit 200 (Fig. 9A is the front view, and Fig. 9B is the plan view), when the sheets 60 are intended to fall into the hopper 201 from the transporting conveyor 140, the sheets 61 and 62 are caught on a side guide 202 of the hopper 201, and do not fall into the hopper 201 in some cases. In addition, if the sheets 60 are tilted, a degree of the sheets 60 overlapping on the transporting conveyor 140 becomes unstable. Thus, a posture of the sheets 60 when falling into the hopper 201 deviates from a normal posture. In this regard, the sheets 61 and 62 also do not fall into the hopper 201 by adopting the normal posture.

[0013] If the sheets 60 do not tidily fall into the hopper 201 in this way, an operator needs to carry out work for correcting this untidiness.

[0014] Therefore, it is desirable to provide a paper feeding device or a paper feeding method by which the sheets 60 can be stably fed one by one to the hopper 201 of the paper feeding unit 200 of the printer, in a state where the sheets 60 which are not bent or twisted overlap each other on the transporting conveyor 140 at substantially constant intervals, even in a state where the sheets 60 stacked on the paper feeding tray 110 are curvedly or obliquely stacked and overlapped at a top position as illustrated in Fig. 5C or 5D.

[0015] With regard to the paper feeding method and the paper feeding device, PTL 1 discloses a method and device as follows. When paper sheets are adsorbed one by one sequentially from the top of heaped paper sheets, and an adsorption tool adsorbing the paper sheet is moved forward so as to supply the paper sheet to a section between a delivery roller and a paper pressing roller (hereinafter, referred to as an inter-roller section) via multiple blade plates disposed forward in parallel, transferring work of paper sheets is smoothly carried out in the inter-roller section by blowing air to the paper sheets from below so as to guide the paper sheets to the inter-roller section.

Citation List

Patent Literature

[0016] [PTL 1] Japanese Unexamined Patent Application Publication No. 11-106070

Summary of Invention

Technical Problem

[0017] According to the paper feeding method and device disclosed in PTL 1, the paper sheets can be smoothly supplied to a section between the delivery roller and the paper pressing roller. However, PTL 1 does not disclose a configuration in which the sheets are arranged on the transporting conveyor so as to overlap each other at substantially constant intervals.

[0018] In addition, a technique disclosed in PTL 1 does not focus on the speed of the paper sheets delivered by the adsorption tool and the circumferential speed of the rollers (speed of the paper sheets delivered by the delivery roller and the paper pressing roller). For example, if the speed of the paper sheets delivered by the adsorption tool is too fast, a trailing edge of the preceding paper sheet while being delivered by the rollers and a leading edge of the subsequent paper sheet delivered by the adsorption tool interfere with each other, thereby causing the possibility that the paper sheet may be folded or may be delayed when being transferred from the adsorption tool to the rollers.

[0019] The present invention aims to provide a paper feeding device and a paper feeding method by which sheets can be stably fed one by one to downstream equipment (for example, a hopper of a paper feeding unit of printers or die cutting devices), in a state where the sheets which are not bent or twisted overlap each other on a transporting conveyor at substantially constant intervals, even in a state where the sheets stacked on a paper feeding tray are curvedly or obliquely stacked and overlapped at a top position.

Solution to Problem

[0020] A paper feeding device according to the present invention for solving the above-described problems includes a paper feeding tray on which multiple sheets are stacked in a vertical direction, sheet feeding means for horizontally feeding one sheet located on the top of the multiple sheets stacked on the paper feeding tray, and a pair of feeding rollers that are disposed adjacent to the paper feeding tray, and that grasp a leading edge in a moving direction of the sheet fed by the sheet feeding means so as to deliver the sheet in a direction away from the paper feeding tray. The feeding rollers are variable

speed rollers which can increase and decrease circumferential speed while one sheet is delivered entirely from the leading edge in the moving direction to a trailing edge in the moving direction.

[0021] In the paper feeding device according to the present invention, an aspect may be adopted in which the feeding roller is the variable speed roller that maintains the circumferential speed which is the same as the speed of the sheet fed by the sheet feeding means when the sheet feeding means grasps the sheet, that increases the speed from the circumferential speed which is the same as the speed of the sheet fed by the sheet feeding means after the sheet feeding means grasps the sheet, and that decreases the speed down to the feeding speed of the sheet until the sheet feeding means subsequently grasps the subsequent sheet. In addition, the paper feeding device may further include a transporting conveyor that transports the sheet delivered from the feeding rollers. It is preferable that transporting speed of the transporting conveyor is set to be slower than an average circumferential speed obtained from when one sheet is grasped by the feeing roller until the subsequent sheet is grasped by the feeding rollers. In addition, it is preferable that the sheet feeding means transports the sheet by fixing a rear portion of the sheet. Furthermore, it is preferable that the transporting conveyor is a variable speed conveyor which can adjust the transporting speed in accordance with the length of a sheet.

[0022] There is provided a paper feeding method according to the present invention in which sheet feeding means takes out multiple stacked sheets one by one starting from a sheet located on the top, and transfers the sheet to a pair of feeding rollers so as to supply one sheet to another device via the feeding rollers. The paper feeding method includes a first step of causing circumferential speed when the feeding rollers grasp the sheet to coincide with speed of the sheet fed by the sheet feeding means, a second step of increasing the circumferential speed of the feeding rollers while the subsequent one sheet is delivered entirely from a leading edge to a trailing edge, and a third step of decreasing the speed so that the circumferential speed of the feeding rollers coincides with the speed of the sheet fed by the sheet feeding means until the feeding rollers subsequently grasp the subsequent sheet.

[0023] In the paper feeding method according to the present invention, downstream equipment may be a transporting conveyor. It is preferable to adopt an aspect in which multiple sheets partially overlap each other on the transporting conveyor by setting the transporting speed of the transporting conveyor to be slower than an average circumferential speed obtained from when one sheet is grasped by the feeing rollers until the subsequent sheet is grasped by the feeding rollers.

Advantageous Effects of Invention

[0024] According to the present invention, sheet feeding means for horizontally feeding one sheet located on the top of multiple sheets stacked on a paper feeding tray is used so as to deliver the sheet to a pair of feeding rollers. The pair of feeding rollers are variable speed rollers which can increase and decrease circumferential speed while one sheet is delivered entirely from a leading edge to a trailing edge. In this manner, even in a state where the sheets stacked on the paper feeding tray are curvedly or obliquely stacked and overlapped at a top position, the sheet feeding means can take out the sheets one by one starting from the sheet located on the top. Therefore, unlike a technique of pushing out a batch of sheets such as a technique in the related art, the sheet can be taken out by adopting a normal posture. In addition, the feeding roller is configured to be the variable speed roller. Accordingly, the circumferential speed of the feeding roller can be appropriately changed from when the sheets are received by upstream equipment until the sheets are transferred to downstream equipment. In this manner, the sheets can be smoothly transported. Therefore, the sheets in a state where the sheets are not bent or twisted can be stably fed one by one to the downstream equipment (for example, printers or die cutting devices).

[0025] Furthermore, in a case including a transporting conveyor which transports the sheets delivered from the feeding rollers, the transporting speed of the transporting conveyor is set to be slower than an average circumferential speed obtained from when one sheet is grasped by the feeing rollers until the subsequent sheet is grasped by the feeding rollers. This enables the transporting conveyor to transport the sheets in an overlapping state. Therefore, the trailing edge of the preceding sheet is pressed by the subsequent sheet. In this regard, the sheets can also be stably fed to the downstream equipment (for example, a paper feeding hopper of printers) by adopting a correct posture.

Brief Description of Drawings

[0026]

Fig. 1 is a schematic front view illustrating an overall configuration of a paper feeding device according to an embodiment of the present invention.

Figs. 2A to 2F are schematic views for describing a paper feeding method of using the paper feeding device according to an embodiment of the present invention, and are front views of a main section in which Figs. 2A to 2F sequentially illustrate operations of the paper feeding device in a time-dependent manner.

Fig. 3 is a schematic front view illustrating another configuration of sheet feeding means according to an embodiment of the present invention.

Fig. 4 is a schematic front view illustrating another configuration of sheet feeding means according to an embodiment of the present invention.

Figs. 5A to 5D are schematic views for describing a paper feeding device in the related art. Fig. 5A is a front view illustrating an overall configuration thereof, Fig. 5B is a plan view illustrating a configuration of a batch dismantling roller thereof, and Figs. 5C and 5D are views of an arrow A in Fig. 5A.

Figs. 6A and 6B are views for describing paper feeding performed by the paper feeding device in the related art. Fig. 6A is a front view illustrating an upper portion and the vicinity of a paper feeding tray 110, and Fig. 6B is a plan view at a position corresponding to Fig. 6A.

Figs. 7A and 7B are views for describing another case of paper feeding performed by the paper feeding device in the related art. Fig. 7A is a front view illustrating the upper portion and the vicinity of the paper feeding tray 110, and Fig. 6B is a plan view at a position corresponding to Fig. 7A.

Figs. 8A and 8B are partial configuration diagrams illustrating the vicinity of a transporting conveyor of the paper feeding device in the related art. Fig. 8A is a front view thereof, and Fig. 8A (sic) is a plan view at a position corresponding to Fig. 8A.

Figs. 9A and 9B are views for describing the vicinity of a hopper of a paper feeding unit of printers in the related art. Fig. 9A is a front view thereof, and Fig. 9B is a plan view thereof.

Description of Embodiments

[0027] Hereinafter, an embodiment of a paper feeding device and a paper feeding method according to the present invention will be described in detail with reference to the drawings.

[0028] As illustrated in a schematic front view in Fig. 1, a paper feeding device 1 according to the present embodiment is disposed adjacent to a paper feeding unit 200 of a printer. In Fig. 1, illustration of a printer main body is omitted. The paper feeding unit 200 of the printer includes a hopper 201, and functions as a mechanism which delivers sheets stacked in the hopper 201, for example, cardboard sheets, one by one starting from the bottom. In the present embodiment illustrated in the drawing, the paper feeding device 1 is disposed adjacent to the paper feeding unit 200 of the printer. However, instead of the paper feeding device 1 disposed adjacent to the paper feeding unit 200 of the printer, the paper feeding device 1 may be disposed adjacent to a paper feeding unit of a paperboard die cutting device.

[0029] The paper feeding device 1 includes a paper feeding tray 10 on which multiple sheets 60 are stacked in a vertical direction, sheet feeding means 20 that is disposed above the paper feeding tray 10 so as to horizontally feed one sheet 60 located on the top of the multiple sheets 60 stacked on the paper feeding tray 10, feeding rollers 30 having a pair of an upper roller 30a and a lower roller 30b which are disposed adjacent to the paper feeding tray 10 and which grasp a leading edge in a moving direction of the sheet 60 fed by the sheet feeding means 20 so as to deliver the sheet 60 in a direction away from the paper feeding tray 10, and a transporting conveyor 40 that is disposed on a downstream side in the sheet moving direction of the feeding rollers 30, and that transports the sheet delivered from the feeding rollers.

[0030] The paper feeding tray 10 on which the multiple sheets 60 are stacked in the vertical direction includes a lifting device 11. The lifting device 11 lifts up the paper feeding tray 10 by each predetermined amount so that a position of the sheet 60 on the top maintains a predetermined height for the sheet feeding means 20, since the height of the sheets 60 stacked on the paper feeding tray 10 is lowered while the sheet feeding means 20 feeds the sheets 60 stacked on the paper feeding tray 10 toward the transporting conveyor 40 sequentially starting from the sheet 60 on the top. The lifting device 11 is raised by the predetermined amount, if the sheet feeding means 20 and the feeding rollers 30 completely transport the sheet 60 on the top to a transporting belt (sic) 40. In this manner, a constant distance is maintained between the sheet 60 on the top of the sheets 60 stacked on the paper feeding tray 10 and suction pads 21a and 21b (to be described later) serving as a configuration member of the sheet feeding means 20.

[0031] The sheet feeding means 20 feeds the sheets 60 stacked on the paper feeding tray 10 one by one starting from the top toward the feeding rollers 30. According to the present embodiment illustrated in Fig. 1, the sheet feeding means 20 includes the suction pad 21a which is disposed near a trailing edge of the sheet 60 located on the top of the stacked sheets 60 so as to adsorb the sheet 60, and the suction pad 21b which is disposed separately from the suction pad 21a so as to adsorb the sheet 60 and which is horizontally movable. The suction pad 21a and the suction pad 21b are connected to a suction pump 22. An intake pipe 23a is disposed between the suction pad 21a and an intake side of the suction pump 22, and an intake pipe 23b is disposed between the suction pad 21b and the intake side of the suction pump 22. In addition, an exhaust pipe 24a is disposed between the suction pad 21a and an exhaust side of the suction pump 22, and an exhaust pipe 24b is disposed between the suction pad 21b and the exhaust side of the suction pump 22. A motor 25 is disposed as a drive source for horizontally moving the suction pad 21b. An operation of the motor 25 is controlled by a control device 50. The suction pad 21a and the suction pad 21b can respectively and independently adsorb and release the sheet 60.

[0032] The sheet feeding means 20 operates the suction pump 22, and causes the suction pad 21a to adsorb and lift up the vicinity of the trailing edge of the sheet 60 on the top via the intake pipe 23a. The sheet feeding means 20 causes the suction pad 21b to adsorb and hold the sheet 60 on the top via the intake pipe 23b, and operates the motor 25 so as to move the suction pad 21b together with the sheet 60 toward the feeding rollers 30. In this manner, the sheets are fed to the feeding rollers

30. Exhaust air of the suction pump 22 is used in order to release the sheet 60 adsorbed by the suction pads 21a and 21b, and air is blown out from the suction pads 21a and 21b via the exhaust pipes 24a and 24b so as to detach the sheet 60.

[0033] When the sheet 60 is divided into a front portion and a rear portion based on the sheet moving direction, it is preferable to dispose the suction pad 21a of the sheet feeding means 20 in the rear portion (in detail, it is preferable that an adsorption position of the suction pad 21a is located on the rear side of the sheet 60). According to the present embodiment illustrated in Fig. 1, the suction pad 21a is disposed in the vicinity (rear portion) of the trailing edge of the sheet 60. Since the suction pad 21a is disposed in the rear portion, a time required to feed one sheet 60 can be further shortened compared to a case where the suction pad 21a is disposed on the leading edge side (in the front portion). The reason is that working efficiency can be improved.

[0034] The following reason shows that the time required to feed the sheet 60 to the feeding rollers 30 can be shortened if the suction pad 21a is disposed in the rear portion, rather than the front portion, of the sheet 60.

[0035] That is, after the suction pad 21a adsorbs the preceding sheet 60, the suction pad 21a can adsorb the subsequent sheet 60 after transportation using the suction pad 21b by causing the trailing edge of the preceding sheet 60 to pass below the suction pad 21a. Therefore, as the suction pad 21a is disposed further away on the rear side, the suction pad 21a is closer to the trailing edge of the sheet 60. Accordingly, the time required until the trailing edge of the sheet 60 passes below the suction pad 21a (that is, the time required until the subsequent sheet 60 can be adsorbed) can be shortened, and thus, the time required to feed the sheet 60 to the feeding rollers 30 can be shortened correspondingly.

[0036] The feeding rollers 30 grasp the sheet 60, and supply the sheet 60 to the transporting conveyor 40. The feeding rollers 30 are disposed between the sheet feeding means 20 and an entrance side of the transporting conveyor 40. The feeding rollers 30 have a pair of the upper roller 30a and the lower roller 30b which are vertically disposed, and a motor 31 for driving the lower roller 30b. The operation and rotation speed of the motor 31 are controlled by the control device 50. The feeding rollers 30 grasp one sheet 60 between the upper roller 30a and the lower roller 30b, and deliver the sheet 60 to the transporting conveyor 40 by using a drive force of the motor 31. In order to improve the drive force for delivering the sheet 60, a configuration can be adopted in which the motor 31 drives not only the lower roller 30b, but also the upper roller 30a. Alternatively, a configuration can also be adopted in which a separate motor 31 is disposed so that the separate motor drives the upper roller 30a. The circumferential speed (to be described later) of the feeding rollers 30 is caused to substantially coincide with the supply speed of the sheet 60 fed from the sheet feeding means 20 at an initial stage (until the leading edge of the sheet 60 is grasped between the upper roller 30a and the lower roller 30b). The circumferential speed is increased up to a predetermined speed after the leading edge of the sheet 60 is grasped between the upper roller 30a and the lower roller 30b.

[0037] The transporting conveyor 40 feeds the sheet 60 to the hopper 201 of the paper feeding unit 200 of the printer. The transporting conveyor 40 has an endless belt 41 which transports the sheet 60 delivered from the feeding rollers 30. The belt 41 is wound around a drive roller 42 disposed on an entrance side of the transporting conveyor 40, an exit-side roller 43 disposed on an exit side of the transporting conveyor 40, and a belt tightening roller 44 for maintaining constant tension by adjusting tension of the belt. The drive roller 42 is driven by a motor 45 so as to circularly move the belt 41. The operation and rotation speed of the motor 45 are controlled by the control device 50. The conveyor speed of the transporting conveyor 40 is set so that the multiple sheets 60 overlap each other on the belt 41 of the transporting conveyor 40 with a suitable overlapping amount. The exit-side roller 43 is a driven roller rotating together with the belt 41.

[0038] The sheet 60 delivered from the feeding rollers 30 is placed on an upper surface of the belt 41 between the drive roller 42 and the exit-side roller 43, and is transported to a position of the exit-side roller 43 by the drive roller 42 circularly moving the belt 41 so as to be supplied to the hopper 201 of the paper feeding unit 200 of the printer. In the hopper 201, a position of a backstop 203 erected on the trailing edge side of the sheet 60 is adjusted in accordance with a length L of the sheet 60. Therefore, the exit-side roller 43 is movable as illustrated by an arrow in the drawing so that a horizontal position of the exit-side roller 43 can be adjusted corresponding to the position of the backstop 203. The belt tightening roller 44 has a vertically movable structure corresponding to a position where the exit-side roller 43 is moved. A guide roller 46 is disposed in a moving route of the belt 41.

[0039] A transporting surface (upper side on an outer peripheral surface of the belt 41) of the transporting conveyor 40 is lower than an upper end of the lower roller 30b of the feeding rollers 30. In this manner, the subsequent sheets are sequentially delivered onto the sheet 60 on the belt 41 from the feeding rollers 30 located above. Accordingly, a structure is adopted in which the multiple sheets 60 can easily overlap each other on the belt 41.

[0040] A blower 47 which blows out air toward the sheet 60, and the belt 41 is installed above the belt 41 and at an exit of the pair of feeding rollers 30 so that the sheet 60 easily falls onto the upper surface of the belt 41. In addition, a presser roller 48 is arranged in multiple rows on the upper side of the transporting conveyor 40 so that the posture of the sheet 60 transported on the belt 41 is in disorder.

[0041] A paper feeding method using the paper feeding device 1 according to the present embodiment will be described. Hereinafter, description will be made by using

the reference numerals 61 to 63 in order to individually distinguish the sheets 60 from each other.

[0042] The paper feeding device 1 uses the sheet feeding means 20 so as to deliver the sheets 60 stacked on the paper feeding tray 10 one by one starting from the top. In contrast, on the transporting conveyor 40, as illustrated in Fig. 1, the paper feeding device 1 supplies the sheet to the paper feeding unit 200 of the printer after the subsequent sheet 62 is caused to partially overlap (wrap) the upper side of the sheet 61 previously fed onto the transporting conveyor 40. In order to bring the sheet 60 into supplying and transporting states in this way, an operation of the feeding rollers 30 is important.

[0043] The leading edge of the subsequent sheet 62 is fed into a section between the upper roller 30a and the lower roller 30b (hereinafter, referred to as an inter-roller section) of the feeding rollers 30 after the trailing edge of the sheet 61 previously supplied to the feeding rollers 30. Otherwise, the trailing edge of the sheet 61 and the leading edge of the sheet 62 collide with each other, thereby causing the possibility that the sheets 61 and 62 may become jammed in the inter-roller section.

[0044] One measure to avoid collision between the trailing edge of the sheet 61 and the leading edge of the sheet 62 is to adjust speed of the sheet 60 fed by the sheet feeding means 20 so as to be slower. However, in order to adjust the speed of the sheet 60 fed by the sheet feeding means 20, the time required to feed one sheet 60 may be longer than that in the related art. Therefore, in a viewpoint of working efficiency of the paper feeding device, it is desirable to prevent the sheet 60 from becoming jammed in the inter-roller section of the feeding rollers 30 by setting the speed of the sheet 60 fed by the sheet feeding means 20 to be the same as that in the related art. For this reason, as the feeding roller 30, the present invention employs a variable speed roller which can increase and decrease the circumferential speed of the upper roller 30a and the lower roller 30b.

[0045] The upper roller 30a and the lower roller 30b of the feeding rollers 30 have a function to reliably feed the sheets 60 including the trailing edge one by one onto the transporting conveyor 40 in a state where a predetermined interval is maintained between the sheets 60 without causing the trailing edge of the preceding sheet 61 and the leading edge of the subsequent sheet 62 to interfere with each other (entering a state of being jammed) in the section (feeding rollers 30).

[0046] As an example, the speed at which the sheet feeding means 20 feeds the sheet 60 to the feeding rollers 30 (hereinafter, referred to as feeding speed) is set to be the same as the sheet moving speed at which the transporting conveyor 40 feeds the sheet 60 to the hopper 201 of the paper feeding unit 200 of the printer. The feeding speed of the sheet 60 of the sheet feeding means 20 is converted into a progressing amount per one cycle during which the suction pad 21b sends one sheet 60 on the top so as to be smaller than the length L of the sheet 60 and to be approximately 50% of the length L of the sheet 60.

[0047] When the circumferential speed of the upper roller 30a and the lower roller 30b which grasp the sheet 61 after receiving the sheet 61 from the sheet feeding means 20 is the same speed as the feeding speed at which the sheet feeding means 20 feeds the sheet 60, before the trailing edge of the preceding sheet 61 passes through the section between the upper roller 30a and the lower roller 30b, the leading edge of the subsequent sheet 62 collides with the trailing edge of the sheet 61, thereby clogging the section between the upper roller 30a and the lower roller 30b. Therefore, the circumferential speed of the upper roller 30a and the lower roller 30b is set to be faster than the feeding speed of the sheet feeding means 20. For example, it is necessary to set the circumferential speed of the upper roller 30a and the lower roller 30b to be 200% to 300% or greater than the feeding speed of the sheet feeding means 20. However, if the circumferential speed of the upper roller 30a and the lower roller 30b is simply set to be 200% to 300% or greater than the feeding speed of the sheet feeding means 20, a great speed difference occurs between the circumferential speed of the upper roller 30a and the lower roller 30b and the feeding speed of the sheet feeding means 20, thereby causing the possibility that a disadvantage may occur (to be described later).

[0048] When a case is considered where the sheet 60 is transferred from the sheet feeding means 20 to the upper roller 30a and the lower roller 30b, if the speed difference is great between the circumferential speed of the upper roller 30a and the lower roller 30b and the feeding speed of the sheet feeding means 20, the sheet 60 is less likely to be smoothly transferred from the sheet feeding means 20 to the feeding rollers 30. Consequently, the sheet 60 is bent at the transferring stage, or a surface of the sheet 60 (hereinafter, referred to as a sheet surface) is scraped. In some cases, friction scratches appear on the sheet surface, or a surface layer is separated.

[0049] Therefore, in the paper feeding device 1 according to the present embodiment, the feeding rollers 30 employ variable speed rollers. In this manner, the above-described disadvantage is relieved by changing the circumferential speed of the upper rollers 30a and the lower roller 30b of the feeding rollers 30 during one cycle on which the sheet feeding means 20 feeds one sheet 60.

[0050] That is, when the feeding rollers 30 receive the sheet 61, the circumferential speed of the upper rollers 30a and the lower roller 30b of the feeding rollers 30 is set to coincide with the feeding speed of the sheet feeding means 20. After the feeding rollers 30 receive the sheet 61, the circumferential speed is increased at the timing when the trailing edge of the sheet 61 is released from the sheet feeding means 20. The trailing edge of the sheet 61 is caused to pass until the subsequent sheet 62 arrives. At the timing when the subsequent sheet 62 arrives, the speed is decreased down again to the feeding speed of the sheet feeding means 20 so that the circum-

ferential speed and the sheet feeding speed coincide with each other.

[0051] The circumferential speed of the feeding rollers 30 as described above is adjusted. In this manner, the feeding rollers 30 grasp the sheets 60 located on the top of the paper feeding tray 10 one by one, and deliver the sheets 60 onto the transporting conveyor 40.

[0052] On the transporting conveyor 40, the subsequently delivered sheet 62 overlaps the sheet 61 previously delivered by the feeding rollers 30, and this operation (partially overlapping the preceding sheet 60 with the subsequent sheet 60) is repeatedly performed, thereby continuously bringing the multiple sheets 60 into a state of partially overlapping each other. For this reason, the moving speed of the belt 41 of the transporting conveyor 40 (that is, the transporting speed of the transporting conveyor 40) is set to be slower than the speed of the sheet 60 delivered from the feeding rollers 30, that is, the circumferential speed of the upper roller 30a and the lower roller 30b (in this case, an average circumferential speed). An overlapping degree between the previously delivered sheet 61 and the subsequently delivered sheet 62 is properly adjusted by controlling the moving speed of the belt 41 of the transporting conveyor 40 in accordance with the size (length L) of the sheets 61 and 62.

[0053] Here, the above-described average circumferential speed of the upper roller 30a and the lower roller 30b means time average circumferential speed of the circumferential speed changed during a period from when the sheet 60 delivered by the sheet feeding means 20 is grasped (received) until the sheet 60 subsequently delivered by the sheet feeding means 20 is grasped (received).

[0054] For example, the average circumferential speed of the upper roller 30a and the lower roller 30b is converted into the sheet feeding speed of the sheet feeding means 20, that is, a progressing amount (hereinafter, referred to as a "sheet length Ls") of the sheet 60 per one cycle on which the suction pad 21b sends one sheet 60 on the top, and is expressed by sheet length Ls = sheet length L + predetermined distance (approximately 50 mm).

[0055] With respect to this average circumferential speed of the upper roller 30a and the lower roller 30b, the moving speed of the belt 41 of the transporting conveyor 40 is set as the above-described sheet progressing amount per one cycle for the average circumferential speed so that the sheet progressing amount is smaller than the sheet length Ls. Accordingly, the sheet 61 and the sheet 62 partially overlap each other, and the sheet 62 and the sheet 63 partially overlap each other on the transporting conveyor 40. In this manner, the multiple sheets 60 are sequentially brought into a state of overlapping each other.

[0056] An overlapping amount of the sheets 60 can be optionally changed by changing the moving speed of the belt 41 of the transporting conveyor 40 in accordance with other conditions, for example, a state of the sheets 60, specifically such as size, thickness, and weight.

[0057] The sheets 60 are caused to fall one by one starting from the transporting conveyor 40 into the hopper 201 of the paper feeding unit 200 of the printer. In this case, if the sheets 60 are in a state of partially overlapping each other on the transporting conveyor 40, the trailing edge of the sheet 61 is pressed by the subsequent sheet 62. Accordingly, the sheets 60 stably fall by adopting a more substantially horizontal posture.

[0058] With regard to the above-described paper feeding method using the paper feeding device 1 according to the present embodiment, an operation of each configuration element for allowing the preceding sheet 61 and the subsequent sheet 62 to partially overlap each other on the transporting conveyor 40 will be described with reference to Figs. 2A to 2F.

[0059] Similarly to the device in the related art, the sheet feeding means 20 in Figs. 2A to 2F is a device which adsorbs the rear portion of the sheet 60 so as to transfer the sheet 60 to the feeding rollers 30.

[0060] First, as illustrated in Fig. 2A, the suction pad 21a of the sheet feeding means 20 is lowered for the sheet 60 on the top of the sheets 61 stacked on the paper feeding tray 10 (refer to Fig. 1). The suction pump 22 (refer to Fig. 1) is operated so as to bring the inside of the suction pad 21a into a state of negative pressure. The suction pad 21a adsorbs the sheet 61, and then is raised so as to lift up the sheet 61.

[0061] Next, as illustrated in Fig. 2B, similar to the suction pad 21a, the inside of the suction pad 21b is brought into a state of negative pressure, and the lifted sheet 61 is held by the suction pad 21b. Thereafter, air is blown to the suction pad 21a by using exhaust air of the suction pump 22 so as to detach the sheet 61 from the suction pad 21a.

[0062] Then, as illustrated in Fig. 2C, in a state of being held by the suction pad 21b, the sheet 61 is moved forward (moved to the left in the drawing), and is transferred to a section between the upper roller 30a and the lower roller 30b of the feeding rollers 30. A distance between the lower end of the upper roller 30a and the upper end of the lower roller 30b can be changed in accordance with the thickness of the sheet 61.

[0063] Next, as illustrated in Fig. 2D, after the sheet 61 arrives at the section between the upper roller 30a and the lower roller 30b, the sheet 61 is grasped by the upper roller 30a and the lower roller 30b so as to be delivered to the transporting conveyor 40. When the sheet 61 is received, the circumferential speed of the upper roller 30a and the lower roller 30b is synchronized with the moving speed of the suction pad 21b. After the sheet 61 is grasped by the upper roller 30a and the lower roller 30b, the suction pad 21b releases the holding of the sheet 61 similarly to the suction pad 21a, and is moved rearward so as to move to a standby position.

[0064] Next, as illustrated in Fig. 2E, the circumferential speed of the upper roller 30a and the lower roller 30b

is increased after the sheet 61 is grasped, and the sheet 61 is discharged to the transporting conveyor 40 before the subsequent sheet 62 starts to be fed to the paper feeding (sic) rollers 30. The speed of the transporting conveyor 40, that is, the moving speed of the belt 41 is set be slower than the circumferential speed of the upper roller 30a and the lower roller 30b of the feeding rollers 30 so that the multiple sheets 60 overlap each other in accordance with the length L of the sheet 60, and is variable in accordance with the length L of the sheet 61.

[0065] Then, the operations in Figs. 2A to 2E are repeatedly performed. As illustrated in Fig. 2F, the sheets can be brought into a state where the subsequent sheet 62 partially overlaps the upper side of the preceding sheet 61.

[0066] The sheet feeding means 20 illustrated in Figs. 1 and 2A to 2F employs a method of adsorbing the rear portion of the sheet 60 stacked on the paper feeding tray 10 so as to be fed to the upper roller 30a and the lower roller 30b of the feeding rollers 30. However, the sheet feeding means according to the present invention is not limited to the sheet feeding means 20 illustrated in Fig. 1.

[0067] For example, general sheet feeding means for feeding the stacked sheets 60 one by one starting from the top includes not only those which adsorb the rear portion of the sheet 60 as illustrated in Fig. 1, but also those which adsorb the front portion of the sheet 60. The sheet feeding means according to the present invention may be configured in this way.

[0068] In addition, Fig. 3 illustrates another example of the sheet feeding means. Sheet feeding means 20A illustrated in Fig. 3 adopts a configuration in which a suction-type transporting belt 26 for circularly moving the sheet 60 while adsorbing the sheet 60 is disposed above the sheet 60.

[0069] That is, the sheet feeding means 20A adopts a configuration in which the suction-type transporting belt 26 is arranged above the paper feeding tray 10. The suction-type transporting belt 26 is a circularly moving endless belt which has a suction hole. Suction means 26a is disposed on an inner peripheral side thereof. The transporting belt 26 feeds the sheet 60 stacked on the paper feeding tray 10 to the feeding rollers 30 by adsorbing the sheets 60 one by one starting from the top.

[0070] Fig. 4 illustrates further another example of the sheet feeding means. Sheet feeding means 20B illustrated in Fig. 4 has a kicker 27 which presses the trailing edge of one sheet 60, and feeds the sheets 60 one by one starting from the top of the stacked sheets 60.

[0071] That is, the kicker 27 is movable forward to and rearward from the feeding rollers 30 by a type of means (not illustrated). The sheets 60 can be fed one by one to the feeding rollers 30 from the top of the sheets 60 stacked on the paper feeding tray 10 by moving the kicker 27 forward to the feeding rollers 30.

[0072] The sheet feeding means 20A and 20B illustrated in Figs. 3 and 4 are combined with the above-described feeding rollers 30 whose circumferential speed is variable. In this manner, it is possible to obtain the same operation and effect as those of the paper feeding device 1 illustrated in Figs. 1 and 2.

[0073] That is, the paper feeding device according to an embodiment of the present invention can be configured by employing the above-described sheet feeding means 20A or the above-described sheet feeding means 20B, instead of the sheet feeding means 20 illustrated in Figs. 1 and 2.

[0074] The feeding rollers 30 according to the present invention can correspond to the sheet feeding means 20 illustrated in Fig. 1, the sheet feeding means 20A illustrated in Fig. 3, and the sheet feeding means 20B illustrated in Fig. 4. In addition, the feeding rollers 30 can also correspond to any system as long as the sheet feeding means is similarly configured and is further configured to be capable of feeding the sheets 60 one by one starting from the top of the multiple stacked sheets.

[0075] That is, the sheet feeding means in the paper feeding device according to an embodiment of the present invention is not limited to the above-described sheet feeding means 20, 20A, and 20B, and can employ any type as long as the type is sheet feeding means which can take out and feed the sheets 60 one by one starting from the top of the stacked sheets.

[0076] In addition, in the paper feeding device 1 according to the embodiment illustrated in Fig. 1, the motor 25 for horizontally moving the suction pad 21b of the sheet feeding means 20, the motor 31 for driving the lower roller 30b of the feeding rollers 30, and the motor 45 for driving the belt 41 of the transporting conveyor 40 are respectively disposed in the paper feeding unit 200 of the printer. The rotation speed of the motors 25, 31, and 45 is controlled by the control device 50 so as to allow proportional follow-up, based on the rotation speed of a motor 204 for driving a roller which delivers sheets one by one to a printer main body. However, when the respective motors of the paper feeding device 1 are controlled by the control device 50, it is not essential to control the respective motors based on the rotation speed of the drive motor 204.

[0077] The circumferential speed of the lower roller 30b of the feeding rollers 30 and the moving speed of the belt 41 of the transporting conveyor 40 can be appropriately changed in accordance with the length L of the sheet 60. For this reason, the paper feeding device 1 according to the present embodiment adopts a configuration in which the motor 31 and the motor 45 are respectively and independently disposed in the lower roller 30b and the belt 41, and in which the operation amounts of the motors 31 and 45 can be respectively and independently controlled by the control device 50. That is, the lower roller 30b and the belt 41 are driven by using an independent drive system so that the circumferential speed of the lower roller 30b and the belt moving speed of the belt 41 are respectively and independently controlled by the control device 50.

[0078] According to the above-described paper feed-

ing device 1 in the present embodiment, the feeding rollers 30 continuously feed the sheets 60 one by one starting from the top of the stacked sheets 60 onto the transporting conveyor 40. In a state where the posture of the sheets 60 is stabilized by overlapping multiple sheets with each other on the transporting conveyor 40, the sheets 60 can be supplied to the hopper 201 of the paper feeding unit 200 of the printer.

[0079] That is, the sheet feeding means supplies the sheets 60 one by one starting from the top of the stacked sheets 60. Accordingly, even when the sheet 60 stacked on the supply tray (sic) 10 is warped or tilted, the thickness becomes narrow compared to a case where the multiple sheets 60 are collectively pushed out from the supply tray (sic), as in the technique in the related art. Accordingly, the sheets 60 are less likely to interfere with the supply tray (sic) 10. Therefore, the sheets 60 can be stably supplied to the transporting conveyor 40 without the sheets 60 being twisted or folded.

[0080] An overlapping amount of the sheets 60 can be set in accordance with the sheet length L by a servo motor driving the feeding rollers 30 and the transporting conveyor 40. Accordingly, it is possible to maintain a substantially constant sheet overlapping amount. This stabilizes the posture of the sheets 60 falling into the hopper 201 of the paper feeding unit 200 of cardboard printers or paperboard die cutting devices. Therefore, it is possible to prevent the sheets 60 from not being accommodated inside the hopper 201 after being caught on the side guide 202 (from not falling tidily).

Reference Signs List

[0081]

1	PAPER FEEDING DEVICE
10	PAPER FEEDING TRAY
11	LIFTING DEVICE
20	SHEET FEEDING MEANS
21a,	21b SUCTION PAD
22	SUCTION PUMP
23a, 23b	INTAKE PIPE
24a, 24b	EXHAUST PIPE
25	MOTOR
30	FEEDING ROLLER
30a	UPPER ROLLER
30b	LOWER ROLLER
31	MOTOR
40	TRANSPORTING CONVEYOR
41	BELT
42	DRIVE ROLLER
43	EXIT-SIDE ROLLER.
44	BELT TIGHTENING ROLLER
45	MOTOR
46	GUIDE ROLLER
47	BLOWER
48	PRESSER ROLLER
50	CONTROL DEVICE
60 to 64, 60B	SHEET
200	PAPER FEEDING UNIT OF PRINTER
201	HOPPER
202	SIDE GUIDE
203	BACKSTOP
204	MOTOR

Claims

1. A paper feeding device comprising:

a paper feeding tray on which multiple sheets are stacked in a vertical direction;
sheet feeding means for horizontally feeding one sheet located on the top of the multiple sheets stacked on the paper feeding tray; and
a pair of feeding rollers that is disposed adjacent to the paper feeding tray, and that grasps a leading edge in a moving direction of the sheet fed by the sheet feeding means so as to deliver the sheet in a direction away from the paper feeding tray,
wherein the feeding rollers are variable speed rollers which can increase and decrease circumferential speed while one sheet is delivered entirely from the leading edge in the moving direction to a trailing edge in the moving direction.

2. The paper feeding device according to Claim 1, wherein the feeding roller is the variable speed roller that maintains the circumferential speed which is the same as speed of the sheet fed by the sheet feeding means when the sheet feeding means grasps the sheet, that increases the speed from the circumferential speed which is the same as the speed of the sheet fed by the sheet feeding means after the sheet feeding means grasps the sheet, and that decreases the speed down to the feeding speed of the sheet until the sheet feeding means subsequently grasps the subsequent sheet.

3. The paper feeding device according to Claim 2, further comprising:

a transporting conveyor that transports the sheet delivered from the feeding rollers,
wherein transporting speed of the transporting conveyor is set to be slower than an average circumferential speed obtained from when one sheet is grasped by the feeing roller until the subsequent sheet is grasped by the feeding rollers.

4. The paper feeding device according to any one of Claims 1 to 3,
wherein the sheet feeding means transports the sheet by fixing a rear portion of the sheet.

5. The paper feeding device according to any one of Claims 1 to 4,
wherein the transporting conveyor is a variable speed conveyor which can adjust the transporting speed in accordance with a length of the sheet.

6. A paper feeding method in which sheet feeding means takes out multiple stacked sheets one by one starting from a sheet located on the top and transfers the sheet to a pair of feeding rollers so as to supply one sheet to another device via the feeding rollers, the method comprising:

a first step of causing circumferential speed when the feeding rollers grasp the sheet to coincide with speed of the sheet fed by the sheet feeding means;
a second step of increasing the circumferential speed of the feeding rollers while the subsequent one sheet is delivered entirely from a leading edge to a trailing edge; and
a third step of decreasing the speed so that the circumferential speed of the feeding rollers coincides with the speed of the sheet fed by the sheet feeding means until the feeding rollers subsequently grasp the subsequent sheet.

7. The paper feeding method according to Claim 6,
wherein the sheet delivered from the feeding rollers is supplied to another device via a transporting conveyor, and
wherein multiple sheets partially overlap each other on the transporting conveyor by setting the transporting speed of the transporting conveyor to be slower than an average circumferential speed obtained from when one sheet is grasped by the feeing rollers until the subsequent sheet is grasped by the feeding rollers.

Amended claims under Art. 19.1 PCT

1. Amended] A paper feeding device comprising:

a paper feeding tray on which multiple sheets are stacked in a vertical direction;
sheet feeding means for horizontally feeding one sheet located on the top of the multiple sheets stacked on the paper feeding tray;
a pair of feeding rollers that are disposed adjacent to the paper feeding tray, and that grasps a leading edge in a moving direction of the sheet fed by the sheet feedi ng means so as to deliver the sheet in a direction away fr om the paper feeding tray; and
a transporting conveyor that transports the sheet delivered from the feeding rollers,
wherein the feeding rollers are variable speed rollers which can increase and decrease circumferential speed while one sheet is delivered entirely from the leading edge in the moving direction to a trailing edge in the moving direction,
wherein the transporting conveyor is a variable speed conveyor in which the transporting speed of the transporting conveyor is set to be slower than an average circumferential speed obtained from when the feeding rollers grasp the sheet until the feeding rollers grasp the subsequent sheet, so that the subsequent sheet presses a trailing edge of the previously supplied sheet by causing the subsequent sheet to partially overlap an upper side of the sheet previously supplied onto the transporting conveyor, and
wherein the transporting speed of the transporting conveyor is changed in accordance with the length, size, thickness, or weight of the sheet so as to adjust an overlapping amount between the previously supplied sheet and the subsequent sheet, and a falling posture of the sheet is controlled so that the sheet is supplied to other devices.

2. The paper feeding device according to Claim 1,
wherein the feeding roller is the variable speed rolle r that maintains the circumferential speed which is the sam e as speed of the sheet fed by the sheet feeding means when the sheet feeding means grasps the sheet, that increases th e speed from the circumferential speed which is the same as the speed of the sheet fed by the sheet feeding means after the sheet feeding means grasps the sheet, and that decrease s the speed down to the feeding speed of the sheet until the sheet feeding means subsequently grasps the subsequent shee t.

3. Deleted]

4. Amended] The paper feeding device according to Claim 1 or 2,
wherein the sheet feeding means transports the sheet by fixing a rear portion of the sheet.

5. Deleted]

6. Amended] A paper feeding method in which sheet feeding means takes out multiple stacked sheets one by one starting from a sheet located on the top and transfers the sheet to a pair of feeding rollers so as to supply one sheet to another device via the feeding rollers, the method comprising:

a first step of causing the circumferential speed when the feeding rollers grasp the sheet to coincide with the speed of the sheet fed by the sheet feeding means;
a second step of increasing the circumferential

speed of the feeding rollers while the subsequent one sheet is delivered entirely from a leading edge to a trailing edge; and

a third step of decreasing the speed so that the cir cumferential speed of the feeding rollers coincides with t he speed of the sheet fed by the sheet feeding means until the feeding rollers subsequently grasp the subsequent she et,

wherein the transporting speed of the transporting conveyor is set to be slower than an average circumferential speed obtained from when the feeding rollers grasp the sheet until the feeding rollers grasp the subsequent sheet, so that the subsequent sheet presses a trailing edge of the previously supplied sheet by causing the subsequent sheet to partially overlap the sheet delivered from the feeding rollers on an upper side of the sheet previously supplied onto the transporting conveyor, and

wherein the transporting speed of the transporting conveyor is changed in accordance with the length, size, thickness, or weight of the sheet so as to adjust an overlapping amount between the previously supplied sheet and the subsequent sheet, and the falling posture of the sheet is controlled so that the sheet is supplied to other devices.

7. Deleted]

Statement under Art. 19.1 PCT

(Amended Claim 1)

In amended Claim 1, the following Items 1 to 3 are added to Claim 1 which is initially filed.

Item 1: including "a transporting conveyor that transports the sheet delivered from the feeding rollers"

Item 2: including "the transporting conveyor is a variable speed conveyor which can adjust the transporting speed and in which the transporting speed of the transporting conveyor is set to be slower than an average circumferential speed obtained from when the feeding rollers grasp the sheet until the feeding rollers grasp the subsequent sheet, so that the subsequent sheet presses a trailing edge of the previously supplied sheet by causing the subsequent sheet to partially overlap an upper side of the sheet previously supplied onto the transporting conveyor"

Item 3: "the transporting speed of the transporting conveyor is changed in accordance with the length, size, thickness, or weight of the sheet so as to adjust an overlapping amount between the previously supplied sheet and the subsequent sheet, and the falling posture of the sheet is controlled so that the sheet is supplied to other devices"

Amendment including Item 1 added thereto is based on the description in Claim 3 which is initially filed.

Amendment including Item 2 added thereto is based on the description in Claim 7 and Paragraph [0042] which are initially filed.

Amendment including Item 3 added thereto is based on the description in Paragraphs [0039], [0041], [0042], and [0055] which are initially filed.

(Amended Claim 4) Claim 4 is amended due to Claim 3 deleted from cited Claims since Claim 3 is deleted.

(Amended Claim 6) In amended Claim 6, the following Items 4 and 5 are added to Claim 6 which is initially filed.

Item 4: "the transporting speed of the transporting conveyor is set to be slower than an average circumferential speed obtained from when the feeding rollers grasp the sheet until the feeding rollers grasp the subsequent sheet, so that the subsequent sheet presses a trailing edge of the previously supplied sheet by causing the subsequent sheet to partially overlap the sheet delivered from the feeding rollers on an upper side of the sheet previously supplied onto the transporting conveyor"

Item 5: "the transporting speed of the transporting conveyor is changed in accordance with the length, size, thickness, or weight of the sheet so as to adjust an overlapping amount between the previously supplied sheet and the subsequent sheet, and the falling posture of the sheet is controlled so that the sheet is supplied to other devices"

Amendment including Item 4 added thereto is based on the description in Claim 7 and Paragraph [0042] which are initially filed.

Amendment including Item 5 added thereto is based on the description in Paragraphs [0039], [0041], [0042], and [0055] which are initially filed.

Claims 3, 5, and 7 are deleted. In addition, Claim 2 is not amended.

FIG. 1

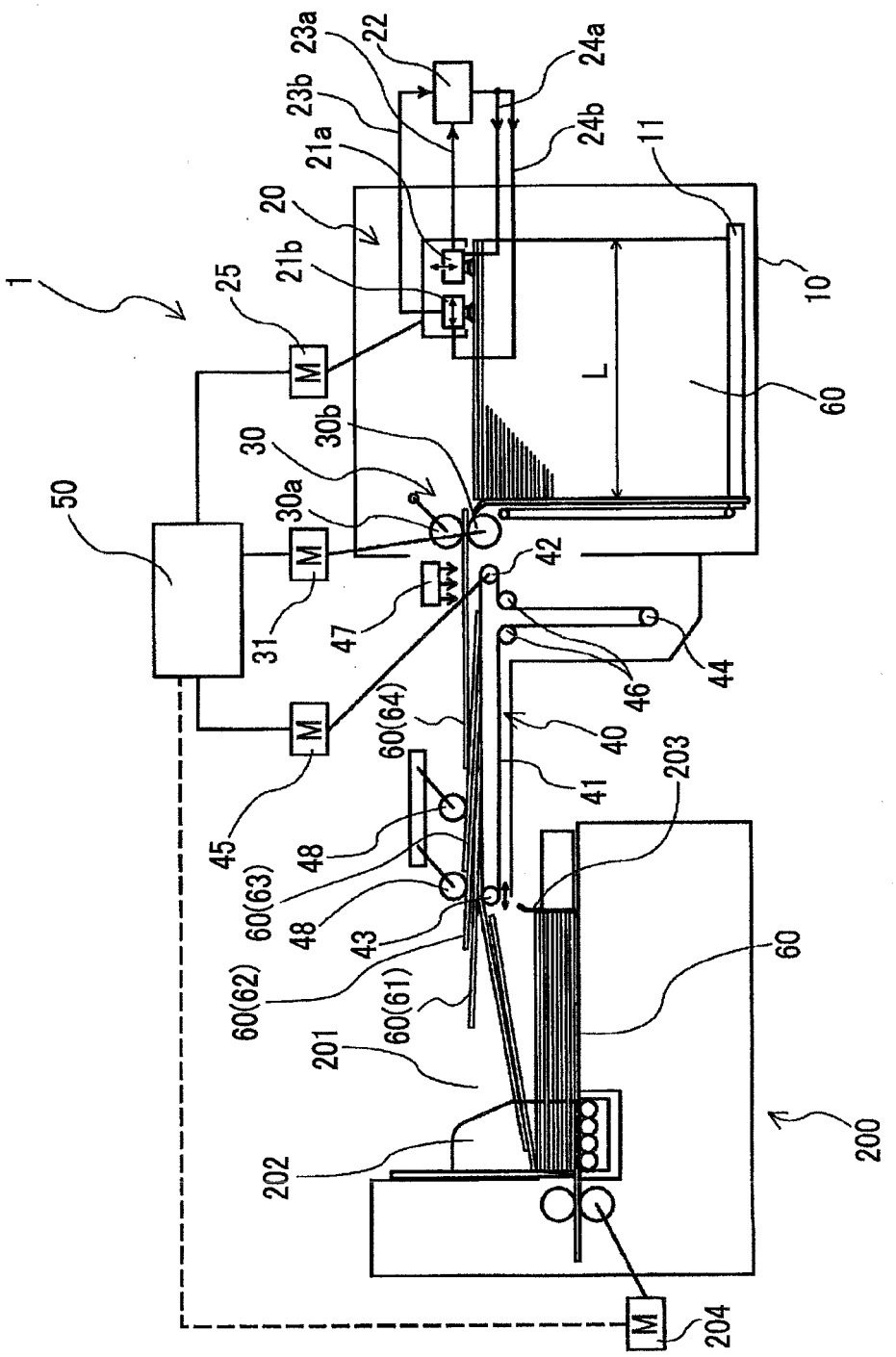

1
10
11
20
21a
21b
22
23a
23b
24a
24b
25
30
30a
30b
31
40
41
42
43
44
45
46
47
48
50
60
60(61)
60(62)
60(63)
60(64)
200
201
202
203
204
L
M

FIG. 2A

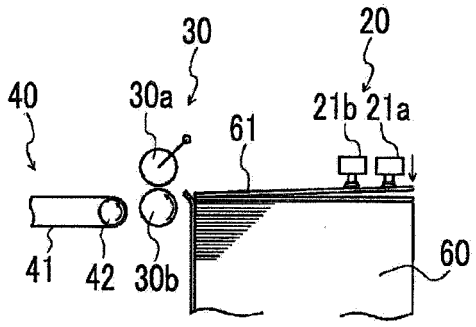


FIG. 2B

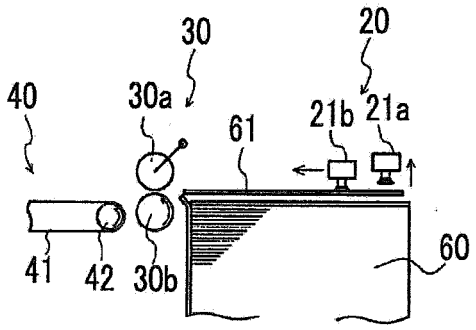


FIG. 2C

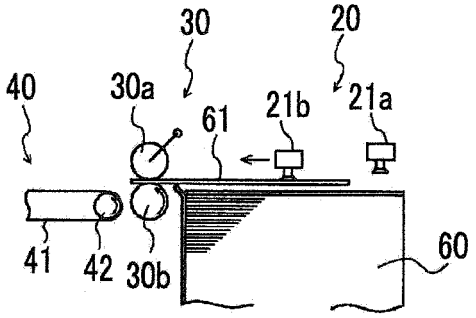


FIG. 2D

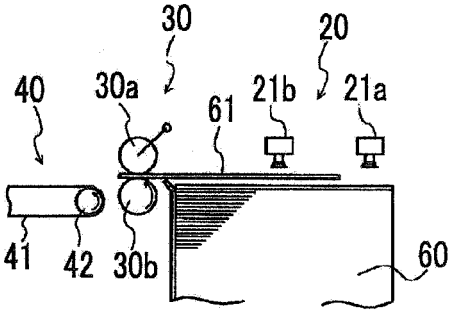


FIG. 2E

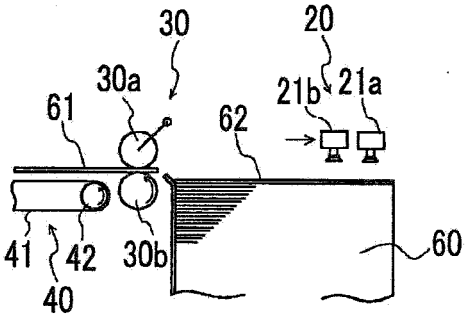


FIG. 2F

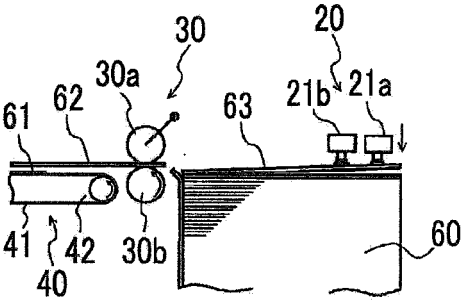


FIG. 3

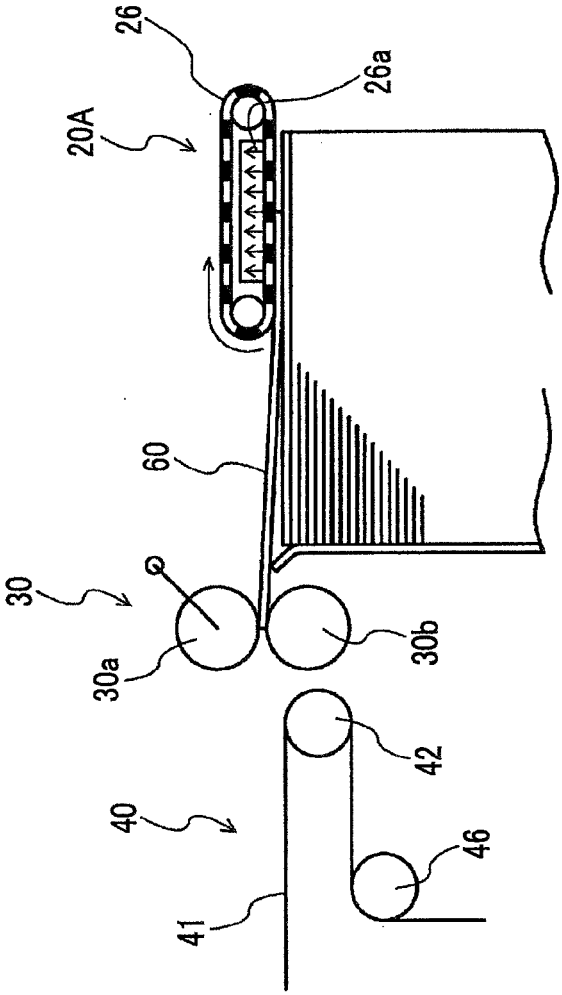
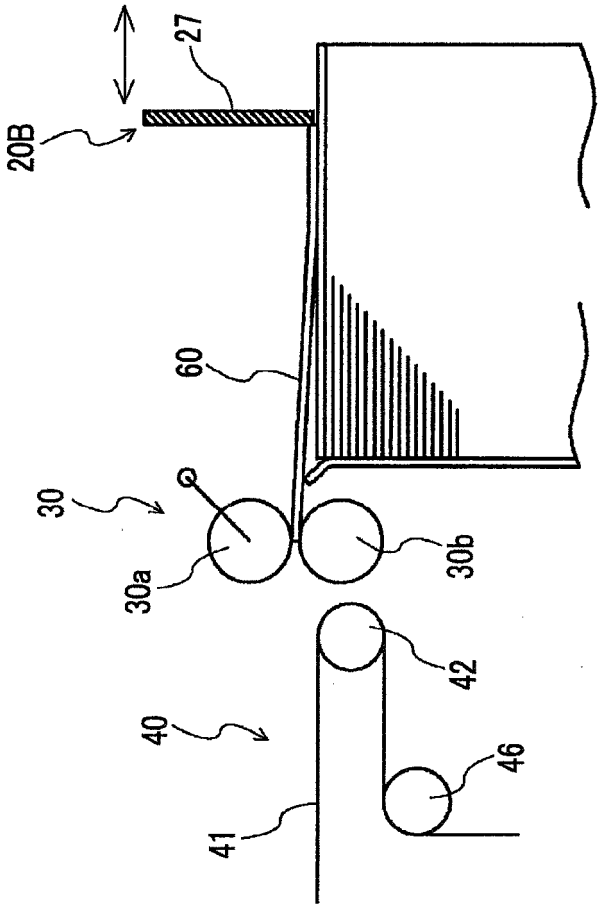


FIG. 4



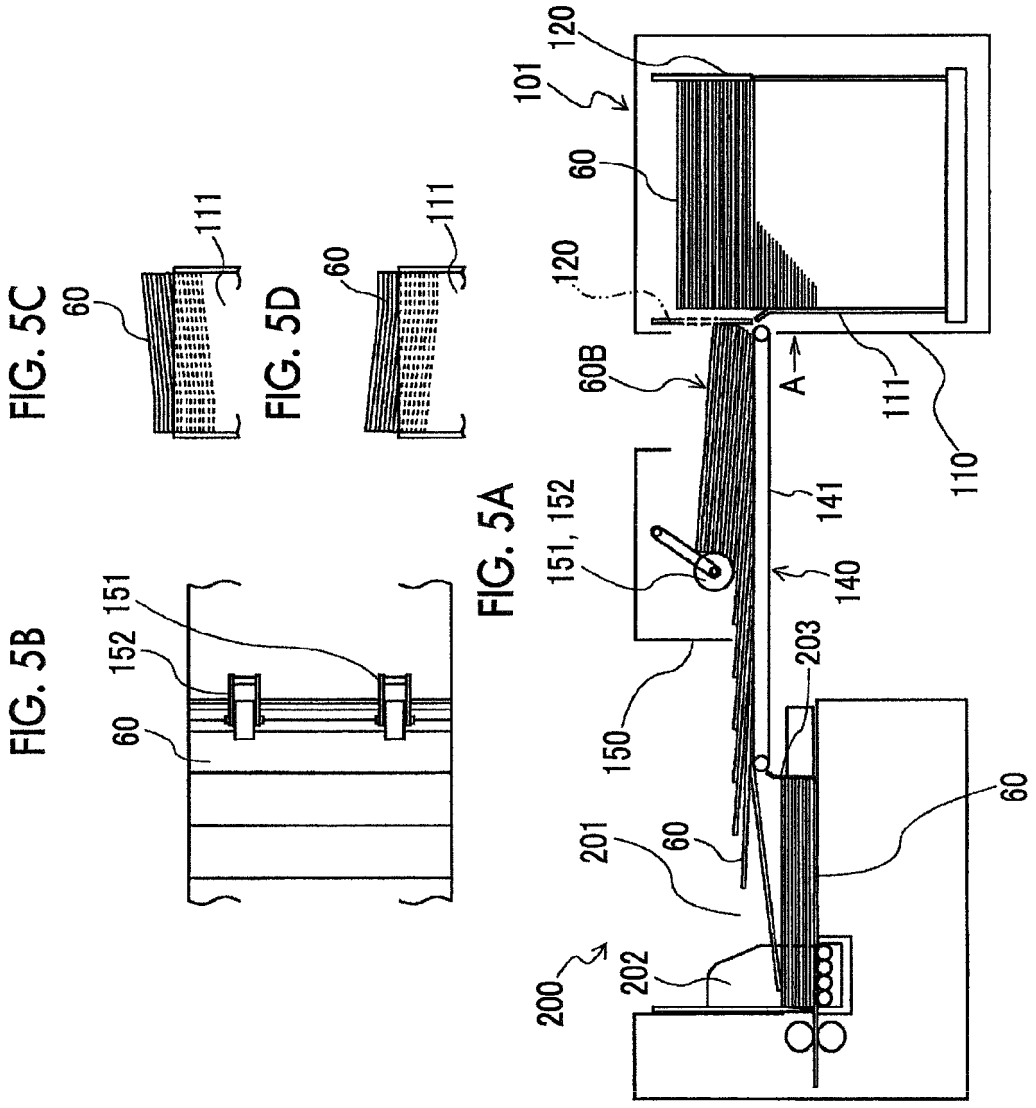


FIG. 5A
120
101
60
120
60B
A
111
110
141
151, 152
140
150
203
201
60
60
200
202
FIG. 5B
151
152
60
FIG. 5C
111
60
FIG. 5D
111
60

FIG. 6B

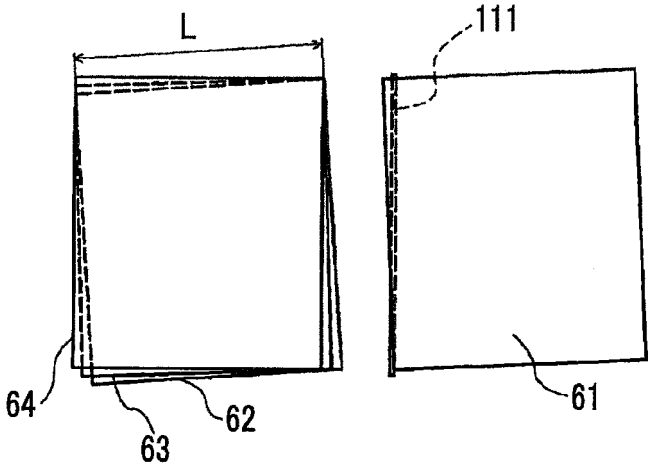


FIG. 6A

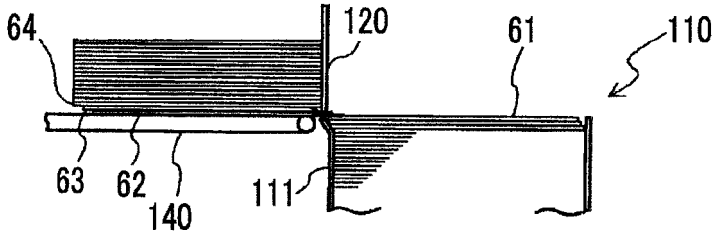


FIG. 7B

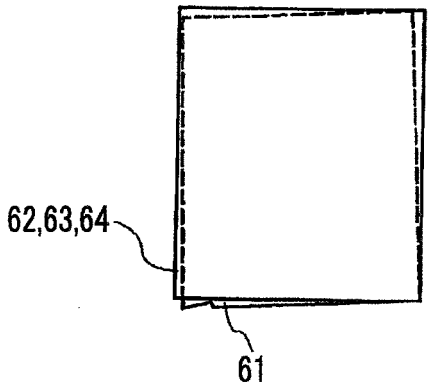


FIG. 7A

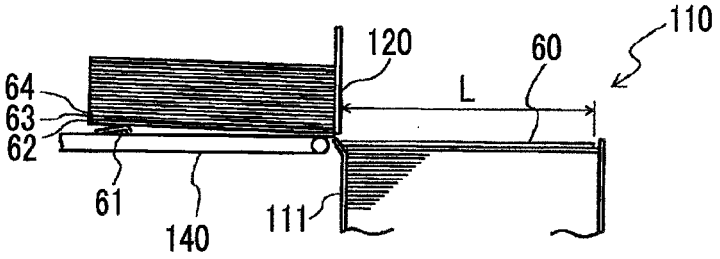


FIG. 8B

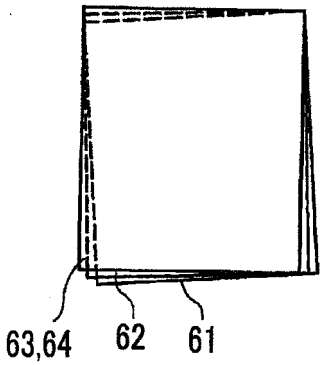


FIG. 8A

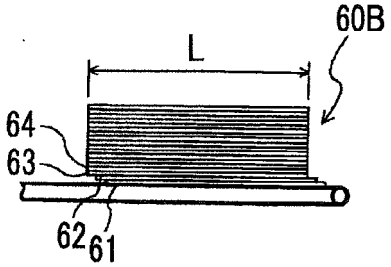


FIG. 9B

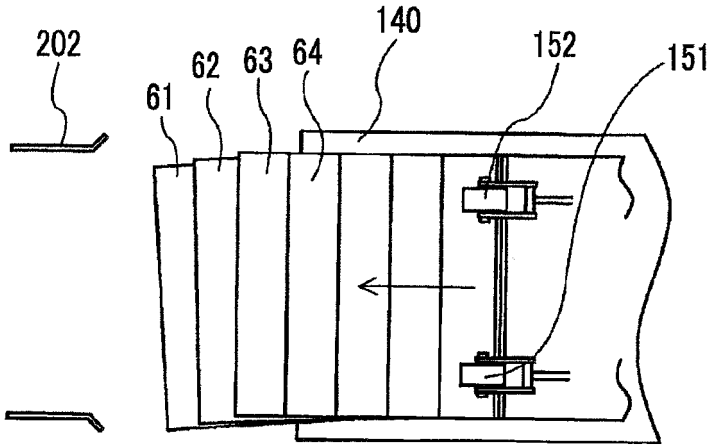
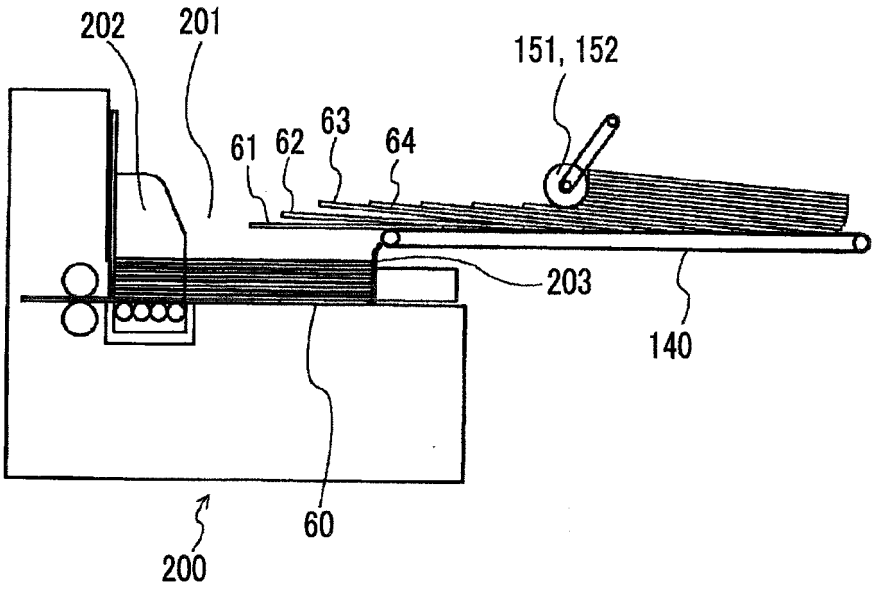

202
61
62
63
64
140
152
151

FIG. 9A


202
201
151, 152
61
62
63
64
203
140
60
200

INTERNATIONAL SEARCH REPORT

International application No.
PCT/JP2014/075252

A. CLASSIFICATION OF SUBJECT MATTER
B65H5/06(2006.01)i, *B65H3/08*(2006.01)i, *B65H5/02*(2006.01)i, *B65H5/24*(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)
B65H5/06, B65H3/08, B65H5/02, B65H5/24

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	1996-2014
Kokai Jitsuyo Shinan Koho	1971-2014	Toroku Jitsuyo Shinan Koho	1994-2014

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

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X Y	JP 2006-36439 A (Canon Inc.), 09 February 2006 (09.02.2006), paragraphs [0042] to [0059]; fig. 3 (Family: none)	1-2,6 3-5,7
X Y	JP 2001-151361 A (Xerox Corp.), 05 June 2001 (05.06.2001), paragraph [0026]; fig. 1 & US 6279896 B1 & EP 1092659 A2 & DE 60027104 T2 & BR 4784 A	1 2-7
X Y	JP 10-203661 A (Fuji Photo Film Co., Ltd.), 04 August 1998 (04.08.1998), paragraphs [0078] to [0080]; fig. 1 (Family: none)	1 4

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

* Special categories of cited documents:
"A" document defining the general state of the art which is not considered to be of particular relevance
"E" earlier application or patent but published on or after the international filing date
"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)
"O" document referring to an oral disclosure, use, exhibition or other means
"P" document published prior to the international filing date but later than the priority date claimed
"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone
"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art
"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
18 December 2014 (18.12.14)	06 January 2015 (06.01.15)
Name and mailing address of the ISA/ Japan Patent Office Facsimile No.	Authorized officer Telephone No.

Form PCT/ISA/210 (second sheet) (July 2009)

INTERNATIONAL SEARCH REPORT

International application No.
PCT/JP2014/075252

C (Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	JP 8-248371 A (Hankyu Zoki Kogyo Kabushiki Kaisha), 27 September 1996 (27.09.1996), claim 1; paragraphs [0006], [0037] to [0039]; fig. 2 (Family: none)	2-7
Y	JP 2001-277173 A (Kabushiki Kaisha Yamaden Kogyo), 09 October 2001 (09.10.2001), paragraph [0042]; fig. 6 (Family: none)	3-5
Y	JP 2005-520756 A (Magnum Manufacturing Ltd.), 14 July 2005 (14.07.2005), paragraphs [0001], [0005] to [0007], [0021] & US 2003/0218292 A1 & EP 1523445 B1 & WO 2003/080490 A2 & CA 2483679 A1 & AU 2003213906 A1 & CN 1649787 A & AT 512106 T	3-5,7
Y	JP 2003-48643 A (Hamada Printing Press Co., Ltd.), 21 February 2003 (21.02.2003), paragraph [0026]; fig. 1 (Family: none)	4-5
A	Microfilm of the specification and drawings annexed to the request of Japanese Utility Model Application No. 105651/1972(Laid-open No. 135889/1974) (Iijima Mfg. Co., Ltd.), 22 November 1974 (22.11.1974), entire text (Family: none)	1-7

Form PCT/ISA/210 (continuation of second sheet) (July 2009)

REFERENCES CITED IN THE DESCRIPTION

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

Patent documents cited in the description

- JP 11106070 A **[0016]**