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(54) **Paper sheet feeding device and method thereof**

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Dispositif d'alimentation en papier et méthode associée

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(73) Proprietor: **NEC Corporation**
Minato-ku
Tokyo 108-8001 (JP)

(72) Inventors:
- **Imamura, Makoto**
  Minato-ku
  Tokyo (JP)
- **Nakayama, Hiroyuki**
  c/o NEC Robotics Engineer.,Ltd.
  Fucyu-shi
  Tokyo (JP)

(74) Representative: **Betten & Resch**
Theatinerstrasse 8
80333 München (DE)

(56) References cited:
US-A- 3 347 348

- **PATENT ABSTRACTS OF JAPAN vol. 1995, no. 04, 31 May 1995 (1995-05-31) & JP 07 024420 A (TOSHIBA CORP), 27 January 1995 (1995-01-27)**
- **PATENT ABSTRACTS OF JAPAN vol. 2000, no. 07, 29 September 2000 (2000-09-29) & JP 2000 109230 A (NEC CORP; NEC ROBOTICS ENG LTD), 18 April 2000 (2000-04-18)**
- **PATENT ABSTRACTS OF JAPAN vol. 2003, no. 03, 5 May 2003 (2003-05-05) & JP 2002 332169 A (OKI ELECTRIC IND CO LTD), 22 November 2002 (2002-11-22)**

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Description

BACKGROUND OF THE INVENTION

Field of the Invention

[0001] The present invention relates to a paper sheet feeding device and a method of feeding paper sheets using the device and more particularly to the paper sheet feeding device which is capable of carrying out large-sized paper sheets fed randomly in an upright position from a carrying path placed on an upstream side, one by one, to a downstream side without causing damages to the paper sheets and to the method of feeding paper sheets using the above device.

Description of the Related Art

[0002] Conventionally, as an automatic mail handling machine, an automatic mail sorting / aligning / stamping machine to be employed for regular-size mail is being used. Functions of the automatic mail sorting / aligning / stamping machine can be roughly classified into two types; a first type being to take regular-size mail out of collected large amounts of mail having various sizes (being varied in vertical and horizontal dimensions and thickness) and to detect, for example, a position of a postage stamp, and to align the postage stamp in direction and a second type being to stamp and collect and accumulate the mail.

[0003] In ordinary cases, the above automatic mail sorting /aligning / stamping machine is equipped with a one-paper sheet taking-out device (hereinafter called a "paper sheet feeding device"), since feeding intervals of mail to be carried out from its sorting section are non-uniform and, additionally, the mail is carried out with two or more pieces of mail overlapped in some cases, causing, so long as the mail remains in this state, a process of accurately detecting a postage stamp or other process to be impossible. Moreover, the paper sheet feeding device has a function of temporarily accumulating mail in order to accommodate variations in amounts of mail to be carried.

[0004] Figure 8 is a top view showing rough configurations of a conventional one-paper sheet taking-out device 100. As shown in Fig. 8, the one-paper sheet taking-out device 100 includes a plurality of smoothing means 110 and a one-paper sheet taking-out means 120.

[0005] Each of the smoothing means 110 has a suction belt 111 which rotates in a carrying-out direction, a reverse roller 112 which is mounted in a manner to approximately face a central portion of the suction belt 111 and moves/rotates reversibly, with momentum given in a clockwise direction, and a guide 113 which is mounted in a manner to approximately face an entrance port of the suction belt 111 and moves/rotates reversibly, with momentum given in a clockwise direction. The smoothing means 110, when a plurality of paper sheets 101 is carried in, makes the guide 113 rotate to move the paper sheets 101 to the suction belt 111 side. The reverse roller 112 presses the overlapped paper sheets 101 toward the suction belt 111 side and the suction belt 111 sequentially carries the paper sheets 101 existing on the suction belt 111 side. That is, the smoothing means 110 resolves the state in which paper sheets 101 have overlapped. The one-paper sheet taking-cut device 100 is made up of three smoothing means 110 connected with one another and gradually resolves the state in which the paper sheets 101 have overlapped.

[0006] The one-paper sheet taking-out means 120 includes a plurality of spiral rollers 121 in which a central shaft (not shown) is mounted in a manner to be inclined from a carrying-in direction to the suction belt 123 side, a detected amount guide 122 which is mounted in an upper position of the spiral rollers 121 and moves/rotates reversibly, with momentum given in a clockwise direction, the suction belt 123 which rotates in the carrying-out direction, a reverse roller 124 which is mounted in a manner to approximately face the suction belt 123 and moves/rotates reversibly, with momentum given in a clockwise direction, and an accumulating / catching plate 125 to catch the paper sheets 101 to be carried by the spiral rollers 121.

[0007] The spiral rollers 121 and the detected amount guide 122 move the paper sheets 101 carried from the smoothing means 110 to the accumulating / catching plate 125. If an amount of fed paper sheets 101 is larger than that of processing to be performed by the suction belt 123, the reverse roller 124 temporarily accumulates the paper sheets 101 exceeding the amount of the processing by the suction belt 123. This enables the one-paper sheet taking-out means 120 to accommodate variations in amounts of the paper sheets 101 randomly carried therein.

[0008] Figure 9 is an enlarged top view roughly showing configurations of main components explaining a one-paper sheet feeding operations applied in the conventional one-paper sheet taking-out device 100. A plurality of suction holes (not shown) serving as suction pads is formed on the suction belt 123 and a suction section 127 is mounted on the suction belt 123 in a manner in which the suction section 127 comes into contact with a rear face of the suction belt 123 in a struck state. When the paper sheet 101a existing in a head position reaches the suction section 127, the paper sheet 101a is sucked and held by the suction belt 123 at a place corresponding to the suction hole formed on the suction belt 123 and is sent out by the rotating suction belt 123 in a carrying-out direction. At this time point, if a plurality of succeeding paper sheets 101b overlaps the paper 101a, these paper sheets 101b are dragged by friction force of the paper sheet 101a and are carried together with the paper sheet 101a until the paper sheets 101b are retained in a stopped state by the reverse roller 124.

[0009] The reverse roller 124 is supported by a shaft in a manner to be reversibly rotated so that a distance

between the reverse roller 124 and the suction belt 123 is made variable depending on thickness of the paper sheets 101a and 101b and, therefore, the paper sheets 101a and 101b each having a different thickness can be handled at the same time. Also, the reverse roller 124 is so configured as to gain momentum by a tension spring 126 toward the suction belt 123. However, the thicker the paper sheets 101a and 101b become, the more intense the pushing pressure generated by the tension spring 126 becomes and the larger the resisting force becomes and, therefore, the thickness of the paper sheets 101a and 101b are preferably about 0.2 mm to 6mm. Moreover, the reverse roller 124 has resisting force enough not to allow the two or more paper sheets 101a and 101b with the minimum thickness of about 0.2 mm to simultaneously pass and the paper sheets 101b, which are not sucked and held by the suction belt 123, is retained in a stopped state. That is, carrying of the paper sheet 101b, together with the paper sheet 101a, downstream of the reverse roller 124 can be prevented.

[0010] As described above, according to the conventional one-paper sheet taking-out device 100, its reverse roller 124 serves as an inhibiting unit to prevent both the two paper sheets from being simultaneously carried. That is, it is made possible to prevent the paper sheet 101b overlapping the paper sheet 101a existing in a head position (that is, the paper sheet 101a existing nearest the suction belt 123) from moving together with the paper sheet 101a in a carrying-out direction and, thus, the carrying-out of only one paper sheet 101a can be achieved. Moreover, objects that can be applied to the above one paper sheet taking-out device 100 are not limited to mail, however, for example, paper money or a like can be applied and various one-piece paper sheet taking-out devices corresponding to various objects are proposed.

[0011] For example, a paper sheet taking-out device is disclosed in Japanese Patent Application Laid-open No. 2000-109230 (Patent Reference 1) in which, after a paper sheet has been sucked and held by a suction belt, by reducing a speed of fluctuation in a direction in which the suck/held paper sheet by a movement of the suction belt become more distant from the succeeding paper sheets to a degree to which no negative pressure develops among the paper sheets, the paper sheets accumulated in a supplying base are sucked, held and taken out one by one by the suction belt. According to this technology, when paper sheets are taken out one by one, no shearing force is exerted on the paper sheets and, therefore, such a problem as breakage of the paper sheet can be avoided even in the case of handling letters or books using fragile paper or a like.

[0012] Moreover, a paper sheet separating and accumulating device is disclosed in Japanese Patent Application Laid-open No. 2002-332169 (Patent Reference 2) in which, by giving play on a housing mechanism driving link system and by putting the link system into a non-operational state in a position where the housing mechanism is made to move off paper sheets at time of separation of the paper sheets and by reducing loads on the separated paper sheets to decrease friction force exerted between the separated paper sheet and non-separated paper sheet, the friction force between the separated paper sheet and a pick-up roller is obtained. According to the technology, it is made possible to reduce failures in drawing out and separating by decreasing the friction force between the separated paper sheet and non-separated paper sheet at time of the separation of paper sheet.

[0013] Furthermore, a paper sheet accumulating and taking-out device is disclosed in Japanese Patent No. 3015630 which includes an accumulating means to reduce a speed of feeding paper sheets in an upright position by using a spiral wire to accumulate the paper sheets, a movable buffer head having the means to reduce the speed and being movable in a direction of accumulating the paper sheet so that accumulating capacity of the accumulating means is made variable, and a taking-out means to take out the paper sheets existing in the outmost end portion in the accumulating means in a paper sheet accumulating direction from a rear end. According to this technology, it is made possible to accommodate pulsation of amounts of paper sheets being carried in and to take out paper sheets one by one safely and reliably and to improve handling capability of the entire device.

[0014] However, the conventional technologies have disadvantages. That is, in the case of the above one-paper sheet taking-out device 100, as described above, since the thickness of the paper sheets 101 that can be applied to the device 100 is about 0.2 mm to 6 mm, the device 100 cannot be used for large-sized paper sheets having the thickness of about 0.2 mm to 30 mm. Moreover, if the paper sheets 101 become larger in size, friction force of the overlapped paper sheets 101 increases, causing simultaneous feeding of two or more paper sheets to occur easily. Therefore, it is necessary that the paper sheets 101b, which are not sucked and held by the suction belt 123, are retained in a stopped state by using further larger resisting force. As a result, the paper sheets 101b are easily damaged due to the larger resisting force to be exerted by the reverse roller 124 on the paper sheet.

[0015] Also, the above one-paper sheet taking-out device 100 has three smoothing means 110, which presents another problem that the one-paper sheet taking-out device 100 is made large in size. For example, if the mounting of the smoothing means 110 is omitted in order to make the device 100 smaller in size and if the paper sheet 101 being carried randomly is conveyed to the one-paper sheet taking-out means 120 without the process of smoothing, the paper sheet 101b, overlapping the paper sheet 101a to be sucked and held by the suction belt 123, first reaches the suction belt 123 (that is, earlier than the paper sheet 101a to be sucked and held by the suction belt 123) in some cases. In this case, as shown in Fig. 10, the suction belt 123 sucks and holds both the paper

sheets 101a and 101b at the same time, causing occurrence of feeding of two-piece paper sheets 101. This means that the plurality of the smoothing means 110 is indispensable to the one-piece taking-out device 100, thus making it impossible to miniaturize the device 100.

SUMMARY OF THE INVENTION

[0016] In view of the above, it is an object of the present invention to provide a paper sheet feeding device which is capable of taking out large-sized paper sheets one by one safely and reliably and of miniaturizing the device itself and a method of feeding paper sheets using the feeding device.

[0017] According to a first aspect of the present invention, there is provided a paper sheet feeding device characterized by including:

a first carrying means (21) to carry paper sheets (10) in an upright position which are fed randomly from an upstream side;
a first moving means (22) to move the paper sheets (10) carried by the first carrying means (21) to a first suction belt (25) side;
an accumulating means (23) to accumulate the paper sheets (10) carried by the first carrying means (21);
a first suction belt (25) to hold in a suction manner and send out the accumulated paper sheets (10) with specified timing, one by one, or several by several;
a second carrying means (31) to carry the paper sheets (10), in an upright position, which are sent out from the first suction belt (25);
a stopping means (32) to retain the paper sheets (10), in a stopped state, which are carried by the second carrying means (31), with edges of the paper sheets (10) existing on a carrying direction side evened up;
a second moving means (33, 34, 35) to move the paper sheets (10) with the edges of the paper sheets (10) existing on the carrying direction side evened up by the stopping means (32) and cancel contact with the moved paper sheets (10); and
a second suction belt (37) to hold in a suction manner and send out the paper sheets (10) moved by the second moving means (33, 34, 35) one by one.

[0018] By configuring above, large-sized thin paper sheets can be taken out one by one safely and reliably and the paper sheet feeding device can be so configured as to be small in size.

[0019] In the foregoing, a preferable mode is one, wherein the first carrying means (21) is provided with an attitude-control means (28; 282, 283, 284) to change an attitude of the paper sheets (10) being carried in a portrait orientation and upright position , so that the paper sheets (10) are carried in a landscape orientation and upright position.

[0020] By configuring above, the paper sheets aligned in a landscape orientation can be handled, thus enabling reduction in operational failures.

[0021] Also, a preferable mode is one wherein suction hole groups to suck the paper sheets (10) are formed at a plurality of places on each of the first and second suction belts (25, 37).

[0022] By configuring above, the paper sheets can be intermittently sent out easily by control on positions of the suction hole groups.

[0023] Also, a preferable mode is one wherein a pick-up roller (26, 38) is mounted downstream of each of the first and second suction belts (25, 37).

[0024] By configuring above, the paper sheets sent out from each of the first and second suction belts can be carried with ease and reliability.

[0025] Also, a preferable mode is one wherein the first suction belt (25) does not send out the paper sheets (10) until the second suction belt (37) entirely sends out one or several paper sheets (10) moved by the second moving means (33, 34, 35).

[0026] By configuring above, collision of the succeeding paper sheet with the paper sheet first sent out can be prevented reliably and reliability by taking out the paper sheets one by one can be improved.

[0027] Also, a preferable mode is one wherein the first suction belt (25) does not send out the paper sheet (10) until the second moving means (33, 34, 35) moves the paper sheet (10) to the second suction belt (37) side and returns back to its original position.

[0028] By configuring above, even before the second suction belt sends out all the moved paper sheets, the first suction belt sends out at a time point when the stopping unit stands prepared to receive the paper sheet, which can improve the handling capability.

[0029] Also, a preferable mode is one wherein the first suction belt (25) does not send out the paper sheet (10) until the second moving means (33, 34, 35) moves the paper sheet (10) to the second suction belt (37) side and returns back to its original position and until a sensor to detect whether or not the paper sheet (10) is retained in the stopped state by the stopping means (32) detects that the paper sheet (10) is not retained in the stopped state by the stopping means (32).

[0030] By configuring above, operational failures can be avoided in that the paper sheets are carried by the first suction belt though the paper sheets are still retained in the stopping unit and the left paper sheets become an obstacle that causes the carried paper sheet to be retained in a state in which edges of the carried paper sheet on a carrying direction side are not evened up, which prevents carrying abnormality and improves the handling capability.

[0031] Also, a preferable mode is one that wherein includes at least one movable guide (33, 34, 35) serving as the second moving means.

[0032] By configuring above, the paper sheets can be reliably moved to the second suction belt side.

[0033] According to a second aspect of the present invention, there is provided a method of feeding paper sheets characterized by including:

a step of making a first carrying means (21) carry paper sheets (10), in an upright position, which are randomly fed from an upstream side;
a step of making a first moving means (22) move the paper sheets (10) carried by the first carrying means (21) toward a first suction belt (25) side;
a step of making an accumulating means (23) accumulate the paper sheets (10) carried by the first carrying means (21);
a step of making the first suction belt (25) hold in a suction manner and send out the accumulated paper sheets (10) with specified timing, one by one, or several by several;
a step of making a second carrying means (31) carry the paper sheets (10), in the upright position, fed from the first suction belt (25);
a step of making a stopping means (32) retain the paper sheets (10) in the stopped state, which are carried by the second carrying means (31), with edges of the paper sheets (10) existing on the carrying direction side evened up;
a step of making a second moving means (33, 34, 35) move the paper sheets (10) with edges of the paper sheets (10) existing on the carrying direction side evened up and cancel contact with the moved paper sheets (10); and
a step of making a second suction belt (37) send out the paper sheets (10) moved by the second moving means (33, 34, 35) one by one.

[0034] By the method described above, large-sized thin paper sheets can be taken out one by one safely and reliably.

[0035] In the foregoing, a preferable mode is one wherein the timing with which the first suction belt (25) sends out the paper sheets (10) is set during a period of time when the first suction belt (25) is holding the paper sheet (10) in a suction state, after the second suction belt (37) has sent out one or several paper sheets (10) moved by the second moving means (33, 34, 35).

[0036] By the method described above, the first suction belt can be operated effectively and a risk of causing damages to paper sheets can be reduced.

[0037] Also, a preferable mode is one wherein the timing with which the first suction belt (25) sends out the paper sheet (10) is set to a timing with which the second moving means (33, 34, 35) completes the movement of the paper sheet (10) to the second suction belt (37) side and the stopping means (32) stands prepared to receive the paper sheet.

[0038] By the method described above, while the second moving unit is sending out the moved paper sheet, the stopping unit retains the paper sheet in a stopped state, which enables standby time of the stopping unit to be shortened and the handling capacity to be so improved.

[0039] According to a third aspect of the present invention, there is provided a method of feeding paper sheets characterized by including:

a first carrying means (21) to carry paper sheets (10), which are fed randomly from an upstream side, to a downstream side;
a first moving means (22) to move the paper sheets (10) carried by the first carrying means (21) to a first suction belt (25) side;
an accumulating means (23) to accumulate the paper sheets (10) carried by the first carrying means (21);
a first suction belt (25) to hold in a suction manner and send out the accumulated paper sheets (10) with specified timing, one by one, or several by several;
a second carrying means (31) to carry the paper sheets (10), which are sent out from the first suction belt (25), to a downstream side;
a stopping means (32) to retain the paper sheets (10), in a stopped state, which are carried by the second carrying means (31), with edges of the paper sheets (10) existing on a carrying direction side evened up;
a second moving means (33, 34, 35) to move the paper sheets (10) with the edges of the paper sheets (10) existing on the carrying direction side evened up by the stopping means (32) ; and
a second suction belt (37) to hold in a suction manner and send out the paper sheets (10) moved by the second moving means (33, 34, 35) one by one.

[0040] According to a fourth aspect of the present invention, there is provided a method of feeding paper sheets characterized by including:

a step of making a first carrying means (21) carry paper sheets (10), which are randomly fed from an upstream side, to a downstream side;
a step of making a first moving means (22) move the paper sheets (10) carried by the first carrying means (21) toward a first suction belt (25) side;
a step of making an accumulating means (23) accumulate the paper sheets (10) carried by the first carrying means (21);
a step of making the first suction belt (25) hold in a suction manner and send out the accumulated paper sheets (10) with specified timing, one by one, or several by several;
a step of making a second carrying means (31) carry the paper sheets (10) fed from the first suction belt (25), to a downstream side;
a step of making a stopping means (32) retain the paper sheets (10) in the stopped state, which are carried by the second carrying means (31), with edges of the paper sheets (10) existing on the carrying

direction side evened up;
a step of making a second moving means (33, 34, 35) move the paper sheets (10) with edges of the paper sheets (10) existing on the carrying direction side evened up; and
a step of making a second suction belt (37) send out the paper sheets (10) moved by the second moving means (33, 34, 35) one by one.

[0041] With the above configurations, large-sized paper sheets being randomly carried in can be taken out one by one safely and reliably.

[0042] With still another configuration, it is not necessary that a plurality of smoothing means is mounted, which enables the paper sheet feeding device to be small in size.

BRIEF DESCRIPTION OF THE DRAWINGS

[0043] The above and other objects, advantages, and features of the present invention will be more apparent from the following description taken in conjunction with the accompanying drawings in which:

Fig. 1 is a plan view roughly showing configurations of a paper sheet feeding device according to an embodiment of the present invention;
Figs. 2A and 2B are rough expanded diagrams explaining an attitude controlling member employed in the paper sheet feeding device according to the embodiment of the present invention and Fig. 2A is its top view and 2B is its perspective view taken along a line A-A of Fig. 2A;
Fig. 3 is a flowchart roughly explaining operations of a first suction belt employed in the paper sheet feeding device according to the embodiment of the present invention;
Fig. 4 is a flowchart roughly explaining operations of a second supplying section employed in the paper sheet feeding device of the embodiment of the present invention;
Fig. 5 is a rough enlarged top view explaining operations in which a paper sheet is carried in by the second supplying section of the paper sheet feeding device of the embodiment of the present invention;
Fig. 6 is a rough enlarged top view explaining operations in which carried paper sheets are moved to a second suction belt by the second supplying section of the paper sheet feeding device of the embodiment of the present invention;
Fig. 7 is also a rough enlarged top view explaining operations in which carried paper sheets are moved to the second suction belt by the second supplying section of the paper sheet feeding device of the embodiment of the present invention;
Fig. 8 is a top view roughly showing configurations of a conventional one paper sheet taking-out device;
Fig. 9 is an enlarged top view roughly showing configurations of main components explaining one-paper sheet feeding operations applied in the conventional one-paper sheet taking-out device; and
Fig. 10 is an enlarged top view roughly showing configurations of main components explaining two paper sheet feeding operations applied in the conventional one paper sheet taking-out device.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

[0044] Best modes of carrying out the present invention will be described in further detail using an embodiment with reference to the accompanying drawings.

Embodiment

[0045] Figure 1 is a plan view roughly showing configurations of a paper sheet feeding device according to an embodiment of the present invention. The paper sheet feeding device 1 (hereinafter, may be referred to simply as "feeding device 1") includes a first supplying section 2 to sequentially accumulate large-sized thin paper sheets 10 (hereinafter, may be referred to simply as "paper sheets 10") carried in and to intermittently feed the paper sheets 10 downstream and a second supplying section 3 to even up edges of the paper sheets 10 carried in from the first supplying section 2 and to take out the paper sheets 10 one by one. Moreover, the thickness of the large-sized thin paper sheet 10 is ordinarily about 0. 2 mm to 30 mm, however, the present invention is not limited to the thickness.

[0046] The first supplying section 2 includes a bottom belt (first carrying means) 21 to carry the paper sheets 10 fed from an upstream side, an amount detecting guide (first moving means) 22 to move the paper sheets 10 to a first suction belt 25 side, a reverse roller (accumulating means) 23 to separate about five to six paper sheets 10 collectively (in an ordinary case) fed into about one to three paper sheets 10, a suction chamber 24, the first suction belt 25 to hold the paper sheet 10 existing in a head position out of the accumulated paper sheets 10, under suction of the suction chamber 24, and to send out the held paper sheet 10, the first suction belt 25 being sandwiched between the suction chamber 24 and the paper sheets 10, and a pick-up roller 26 to carry the sent-out paper sheet 10 downstream.

[0047] The bottom belt (first carrying means) 21 is rotated all the time by a driving means (not shown) such as an induction motor or a like and carries the paper sheets 10 being randomly fed from the upstream side downstream in an upright position. The bottom belt 21 also has attitude controlling members 28 at its inlet section.

[0048] Figures 2A and 2B are an enlarged diagram roughly explaining attitude controlling members 28 employed in the paper sheet feeding device 1 according to the embodiment of the present invention and Fig. 2A is

its top view and 2B is its perspective view taken along a line A-A of Fig. 2A. The attitude controlling members 28, which serve as attitude controlling means rotating/changing the attitude of the paper sheet 10 from the portrait orientation into the landscape orientation, are made up of an attaching plate 281 mounted in a stood state on the first suction belt 25 side of the bottom belt 21 and of attitude rotating plates 282, 283, and 284 mounted in a manner to extrude from the attaching plate 281 all being leaned in a carrying direction relative to a receiving belt 27. Also, the attitude rotating plates 282, 283, and 284 are mounted, in order, from higher positions to lower positions in the carrying direction in a manner in which the attitude changing plates 282, 283, and 284 rotate the paper sheets 10 sideways (that is, from the portrait orientation into the landscape orientation) depending on their height. Moreover, the attitude changing plates 282, 283, and 284 are ordinarily an elastic body made of resin or a like and are so configured as to cause no damage even by contact with the paper sheets 10.

[0049] By mounting the above attitude controlling members 28, even if slim paper sheets 10 are being carried in a portrait orientation and upright position, the paper sheets 10 come into contact with the attitude changing plates 282, 283, and 284 in a struck manner and are rotated so that the paper sheets 10 are being carried in a landscape orientation and upright position and, therefore, the paper sheet 10 can be put in a state in which the paper sheets 10 are carried easily, thus enabling the improvement of carrying reliability and reduction of operational failures.

[0050] The amount detecting guide (first moving means) 22 is supported by a shaft so as to be rotated reversibly and is mounted downstream of the receiving belt 27 with momentum given in a clockwise direction. The amount detecting guide 22 moves the paper sheets 10 to be carried by the bottom belt 21 to the first suction belt 25 side. If the supplied amount of the paper sheet 10 is larger than amounts to be handled by the first suction belt 25, the amount detecting guide 22 pushes the paper sheets 10 which have been fed to a degree to which the fed amount of the paper sheets 10 exceed the amount of the paper sheet 10 that can be handled by the first suction belt 25 and have been temporarily accumulated, to the first suction belt 25 side. When the amount detecting guide 22 detects that the accumulated amount of the paper sheets 10 has increased and exceeded a predetermined level, the carrying of the paper sheet 10 existing upstream of the first supplying section 2 is temporarily stopped.

[0051] The reverse roller (accumulating means) 23 is made of a deformable material such as a sponge and is rotated at low speed, all the time, by a driving source (not shown) such as an induction motor or a like in a direction opposite to the carrying direction. A deformable member is employed as the material for the reverse roller 23, which allows the paper sheets 10 each having a different thickness to be handled and the reverse roller 23 retains, in a stopped state, the paper sheets 10 exceeding an amount that can be handled and temporarily accumulates the paper sheets 10. Also, by using the deformable member as the material for the reverse roller 23, the problem of causing damage to the paper sheets 10 can be prevented.

[0052] Moreover, it is not necessary that the reverse roller 23 of the embodiment has resisting force that can separate the overlapped paper sheets 10 one by one and it is enough if the reverse roller 23 has the resisting force that can separate five to six accumulated paper sheets 10 one to three by one to three. This means that the resisting force applied by the reverse roller 23 to separate the paper sheets 10 is not so intense and, therefore, even in the case of the paper sheet 10 with a thickness of about 30 mm, handling without causing damage to the paper sheet is made possible.

[0053] Moreover, in the above embodiment, the position of the reverse roller 23 is fixed, however, its position is not limited to this. For example, the reverse roller 23 may be of a type of a tension roller to be mounted so as to be movable with momentum given on the first suction belt 25 side. By configuring like this, the position of the reverse roller 23 can be changed depending on the thickness of the paper sheet 10.

[0054] On the first suction belt 25 are formed a plurality of groups of suction holes (not shown) serving as suction pads, each group having about two to six holes, each hole being formed in the proximity to one another. Each of the suction hole groups is formed at equal intervals on the first suction belt 25. When the suction hole group formed on the first suction belt 25 is positioned on an air-intake portion of the suction chamber 24, the first suction belt 25 can suck and hold the paper sheet 10 by the forces of attraction of the suction chamber 24 via the suction hole group. The first suction belt 25 also has an optical sensor 251 and a servo motor (not shown) and is driven by a control section (not shown) in a manner in which its rotation position and amounts of rotation are controlled. For example, the control section controls the servo motor so as to rotate the first suction belt 25, when the carrying of the paper sheet 10 to a downstream side becomes impossible, until a subsequent group of the suction holes is placed on the sucking face of the suction chamber 24 and so as to stop the rotation of the first suction belt 25 at the place where the first suction belt 25 is rotated until the carrying of the paper sheet 10 is resumed. That is, the first suction belt 25 is able to intermittently send out the paper sheet 10 with ease by controlling positions of each of the suction hole groups.

[0055] The pick-up roller 26 is supported by a shaft so as to be reversibly rotated on a downstream side of the reverse roller 23 with momentum given in a clockwise direction. The pick-up roller 26 also has a driving roller 261 which is rotated all the time by a driving source (not shown) such as an induction motor or a like in a carrying direction, in a manner to face the pick-up roller 26, downstream of the first suction belt 25. By configuring as

above, the paper sheets 10 sent out from the suction belt 25 can be carried, with ease and reliability, to the second supplying section 3 with the paper sheets 10 sandwiched between the pick-up roller 26 and driving roller 261.

[0056] Preferably, curvatures corresponding to one another (for example, one curvature being convex and another being concave) may be formed on side faces of the cylindrical pick-up roller 26 and driving roller 261. With such configuration, the paper sheet 10 sandwiched between the pick-up roller 26 and driving roller 261 bend depending on a shape of the curvature and, therefore, mechanical strength and rectilinearity increase, thus enabling the paper sheets 10 to be conveyed up to a stopper 32 with reliability.

[0057] The second supplying section 3 includes a bottom belt (second carrying means) 31 to carry the paper sheets 10 fed from the pick-up roller 26, the stopper (stopping means) 32 to retain one or several paper sheets 10 in a stopped state, by coming into contact with edges of the paper sheets 10 existing on a carrying direction side, with the edges of the paper sheets 10 existing on the carrying direction side evened up, movable guides (second moving means) 33, 34, and 35 to move the paper sheet 10 to a second suction belt 37 side with the edges of the paper sheets 10 existing on the carrying direction side evened up and to cancel contact with the moved paper sheets 10, a suction chamber 36, and the second suction belt 37 to hold the moved paper sheet 10 under suction of the suction chamber 24 and to send out the held paper sheet 10 downstream side one by one, and a pick-up roller 38 to carry the paper sheet 10 sent out from the second suction belt 37 to a downstream side.

[0058] The bottom belt (second carrying means) 31 is rotated all the time by a driving means (not shown) such as an induction motor or a like and carries one or several paper sheets 10 fed from the pick-up roller 26 placed on an upstream side to a downstream side in an upright position.

[0059] The stopper (stopping means) 32 is ordinarily a rectangular plate being slim in a horizontal direction and is placed downstream of the bottom belt 31. The stopper 32 retains one or several paper sheets 10 to be carried, in a stopped state, by the bottom belt 31 with the edges of the paper sheets 10 existing on the carrying direction side evened up.

[0060] The movable guides 33, 34, and 35 have rotary solenoids 331, 341, and 351 respectively and each of the rotary solenoids 331, 341, and 351 serves as a driving source. The movable guides 33, 34, and 35 rotate by a predetermined angle according to instructions from the control section (not shown). The movable guides 33, 34, 35 rotate first in a normal direction to move one or several paper sheets 10, with edges of the paper sheets 10 existing on the carrying direction side evened up, to the second suction belt 37 side and then rotate in a reverse direction to cancel contact with the moved paper sheets 10. By configuring above, several paper sheets are moved to the second suction belt 37 side and, even with the paper sheets 10 being leaned against the second suction belt 37 in an overlapped state, only small force required to support the paper sheets 10 in an upright position is exerted and, therefore, the friction force occurring among the overlapped paper sheets 10 can be reduced greatly. That is, when the paper sheets 10 existing in a head position are sent out by the second suction belt 37, the paper sheets 10 overlapping the head paper sheet 10 are not dragged, thus preventing, with reliability, two paper sheets 10 from being taken out at the same time.

[0061] On the second suction belt 37 are formed a plurality of groups of suction holes (not shown), each group having about two to six holes, each hole being formed in the proximity to one another. The plurality of the suction hole groups are formed at equal intervals on the second suction belt 37. The second suction belt 37, when the suction hole groups reach an air-intake face and function as an air-intake section, can suck and hold the paper sheet 10 by the forces of attraction of the suction chamber 36 via the suction hole group. Also, the second suction belt 37 has an optical sensor 371 and a servo motor (not shown) which are controlled by a control section (not shown) and, therefore, are driven with a rotation position and amounts of rotation being controlled. For example, the control section, when the second suction belt 37 cannot convey the paper sheet 10 downstream, until a subsequent group of the suction holes reaches the sucking face on the suction chamber 36, exercises control on the servo motor so as to make the second suction belt 37 rotate and stop the rotation after the second suction belt 37 rotates to an appropriate degree.

[0062] The pick-up roller 38 is supported by a shaft so as to be reversibly rotated on a downstream side of the stopper 32 with momentum given in a clockwise direction. Also, the pick-up roller 38 has a driving roller 381 which is attached downstream of the pick-up roller 38 in a manner to face the pick-up roller 38 and which is rotated all the time by a driving source (not shown) such as an induction motor or a like in a carrying direction. By these operations, the paper sheet 10 carried out from the second suction belt 37 can be discharged easily and reliably with the paper sheet 10 sandwiched between the pick-up roller 38 and driving roller 381.

[0063] A sensor 41 serving as a reflection-type optical sensor is placed in a manner to face the suction chamber 24 and detects that the paper sheet 10 reaches the suction chamber 24. A sensor 43 serving as a transmission-type optical sensor is placed upstream of the stopper 32 and detects that the paper sheet 10 reaches the stopper 32. Moreover, a plurality of sensors 42 (three sensors 42 in the embodiment) serving also as the transmission-type optical sensor is placed upstream of the second suction belt 37 and detects whether or not the paper sheets 10 stay in the second supplying section 3.

[0064] Information detected by these sensors 41, 42, and 43 is transmitted to a control section made up of a computer, sequencer, or a like for use in each section.

[0065] Next, operations of the paper sheet feeding device 1 having configurations described above are described. First, in ordinary cases, the paper sheets 10 are carried in, at non-uniform intervals with two or more paper sheets 10 being overlapped, from an upstream side to the first supplying section 2. For example, even when slim paper sheets 10 are fed in a portrait orientation and upright position, the paper sheets 10 are made to fall toward a landscape orientation and, therefore, the paper sheets 10 are aligned in a direction in which the paper sheets 10 can be carried out easily, which can increase reliability of the carrying function of the paper sheet feeding device 1.

[0066] Then, when the paper sheets 10 are further moved by the bottom belt 21, the edges of the paper sheets 10 existing on the carrying direction side contact with the amount detecting guide 22 in a struck manner and the paper sheets 10 are conveyed to the first suction belt 25 side. For example, when a plurality of the paper sheets 10 is collectively carried in, a paper sheet 10a existing nearest to the first suction belt 25 is held by the forces of attraction of the suction chamber 24 via the suction hole group on the first suction belt 25, and moved by the first suction belt 25. Moreover, the paper sheet 10 carried in following the paper sheet 10a is moved to the first suction belt 25 by the amount detecting guide 22 which rotates in a counterclockwise direction and contacts with the reverse roller 23 in a struck manner to be temporarily accumulated.

[0067] Next, operations of the first suction belt 25 are described by referring to Fig. 3. Figure 3 is a flowchart roughly explaining operations of the first suction belt 25 employed in the paper sheet feeding device 1 according to the embodiment. As shown in the flowchart of Fig. 3, the control section judges whether or not the sensor 41 detects the existence of the paper sheet 10 and, if it does not, judges whether or not the sensor 42 detects the existence of the paper sheet 10. When the sensor 41 detects the existence of the paper sheet 10, the routine proceeds to a next step S2 (Step S1). That is, if the paper sheet 10 is not sucked/held by the first suction belt 25, the first suction belt 25 remains stopped without rotating.

[0068] Next, while the sensor 41 is detecting the existence of the paper sheet 10, the control section judges whether or not the sensor 42 is detecting the paper sheet 10 and, if detecting, again judges whether or not the sensor 42 is detecting the existence of the paper sheet 10. If the sensor 41 is not detecting the existence of the paper sheet 10, the routine proceeds to a next step S3 (Step S2). That is, even if the paper sheet 10 has been held by the first suction belt 25 in a sucked state, so long as the paper sheet 10 remains left within the second supplying section 3, the first suction belt 25 continues to stop without rotating. Then, the control section, while the sensor 42 is not detecting the existence of the paper sheet 10, makes the first suction belt 25 rotate by a specified amount and stops the rotation of the first suction belt 25 and again judges whether or not the sensor 41 is detecting the existence of the paper sheet 10 (Step S3). When the first suction belt 25 is rotated by a specified amount, the paper sheet 10a held by the first suction belt 25 in a sucked state and several paper sheets 10 overlapping the paper sheet 10a are sent out and are then carried by the pick-up roller 26 to the second supplying section 3. That is, even when the paper sheet 10 has been held by the first suction belt 25 in a sucked state, the first suction belt 25 rotates by a specified amount after it is confirmed that no paper sheet 10 is left within the second supplying section 3 and the paper sheet 10 is then carried to the first supplying section 2.

[0069] In the paper sheet feeding device 1 of the embodiment, the first supplying section 2 does not carry the paper sheet 10 to the second supplying section 3 until the second supplying section 3 completes the handling of the paper sheets 10 existing within the second supplying section 3 and, therefore, it is made possible to avoid a problem that the paper sheet 10 fed from the first supplying section 2 is bumped against the paper sheet 10 being left in the second supplying section 3.

[0070] Also, in the paper sheet feeding device 1 of the embodiment, when the paper sheet 10 is carried in from the upstream side while the first suction belt 25 in the first supplying section 2 stops, the paper sheets 10 are retained by the reverse roller 23 so that the paper sheets 10 are accumulated one after another under a rear surface of the paper sheet 10a sucked and held by the first suction belt 25.

[0071] Next, operations of the second supplying section 3 are described by referring to Fig. 4. Figure 4 is a flowchart roughly explaining operations of the second supplying section 3 employed in the paper sheet feeding device 1 according to the embodiment of the present invention. As shown in Fig. 4, the control section first judges whether or not the sensor 43 is detecting the existence of the paper sheet 10 and, if not detecting, again judges whether or not the sensor 43 is detecting the existence of the paper sheet 10. If the sensor 43 is detecting the existence of the paper sheet 10, the routine proceeds to a next step S12 (Step S11). That is, when the paper sheet 10 has not reached the stopper 32, the second suction belt 37 and movable guides 33, 34, and 35 remain stopped.

[0072] Then, the control section is put on standby for a specified time when the sensor 43 detects the existence of the paper sheet 10 (Step S12). While the control section is on standby, the second suction belt 37 and movable guides 33, 34, 35 stop, however, the bottom belt 31 is rotating in a carrying direction. The reason why the control section is put on standby, as shown in Fig. 5, is that all the paper sheets 10 (including, for example, paper sheets 10b and 10c) with the edges of the paper sheets 10 existing on the carrying direction side displaced and a plurality of overlapped paper sheets 10 carried in is made to reach the stopper 32. By operating as above, though not shown, the edges of the paper sheets 10 (for example, the paper sheets 10b and 10c) existing on the

carrying direction side and being carried with their edges displaced can be evened up.

[0073] Next, as shown in Fig. 6, the control section makes the movable guides 33, 34, and 35 rotate and moves the paper sheets 10b and 10c to the second suction belt 37 side (Step S13). Then, though not shown, the movable guides 33, 34, and 35, after having moved the paper sheets 10b and 10c to the second suction belt 37 side, are made to return back to their original positions and contact with the moved paper sheets 10 is cancelled (Step S14).

[0074] Then, the second suction belt 37 is made to be rotated by a specified amount (Step S15). Figure 7 is also a rough enlarged top view explaining operations in which the carried paper sheet 10 is moved to the second suction belt 37 by the second supplying section 3 of the paper sheet feeding device 1 according to the embodiment. As shown in Fig. 7, the paper sheet 10b existing nearest to the second suction belt 37 out of the paper sheets 10 made to move to the second suction belt 37 side is carried downstream, when the second suction belt 37 has rotated by a specified amount, in synchronization with the rotation of the second suction belt 37.

[0075] At this time point, since the movable guides 33, 34, and 35 have already returned back to their original positions, almost no friction force is exerted between the paper sheet 10b and the paper sheet 10c and, therefore, even if the paper sheet 10b is sent out by the second suction belt 37, carrying-out of the paper sheet 10c having overlapped the paper sheet 10b induced by the drawing out of the paper sheet 10b does not occur. Moreover, since edges of the paper sheets 10b and 10c existing on the carrying direction side, by being struck against the stopper 32, have been evened up, simultaneous sucking/holding of two or more paper sheets 10 by the second suction belt 37 does not occur (see Figs. 6 and 7). That is, the second supplying section 3 can send out only the paper sheet 10b existing on a head position out of a plurality of the fed paper sheets 10b and 10c. The paper sheet 10b sent out by the second suction belt 37 is carried out from the paper sheet feeding device 1 by the pick-up roller 38. The suction hole groups are formed at several places on the second suction belt 37 and it is, therefore, made possible that the paper sheet 10c is not sucked and not held by the second suction belt 37 until end portions of the paper sheet 10b existing on a non-carrying direction side pass by the stopper 32.

[0076] Next, the routine returns back to the step S11 so that the control section judges whether or not the sensor 43 detects the existence of the paper sheet 10. The sensor 43 detects the existence of the paper sheet 10c having overlapped the paper sheet 10b. Then, by repeatedly performing processes in the step S12 to S15 on the paper sheet 10c, the paper sheet 10c can be carried out from the paper sheet feeding device 1. Though not shown, even if further more paper sheets 10 overlap the paper sheet 10c, only the paper sheet 10c can be carried out singly from the paper sheet feeding device 1 with reliability.

[0077] As described above, according to the paper sheet feeding device 1 of the present invention, the reverse roller 23 (for example, the reverse roller 124 employed in the conventional device) is not required to prevent simultaneous drawing-out of two paper sheets 10 and, therefore, the paper sheet feeding device 1 of the present invention can be applied to handling of a large-sized thin paper sheet 10 with a thickness of about 0.2 to 30 mm and, additionally, the application of large external force is not required to handle the large-sized thin paper sheet 10, thus enabling only one paper sheet 10 to be singly carried out safely and reliably without causing damage to the large-sized thin paper sheet 10. Moreover, the paper sheet feeding device 1 according to the present invention requires no mounting of a plurality of smoothing devices employed in the conventional example, thus enabling the paper sheet feeding device 1 to be made smaller.

[0078] Furthermore, operations of the paper sheet feeding device 1 of the present invention are not limited to those described above, that is, by applying other operations, its handling capacity can be more improved. More specifically, the paper sheet feeding device 1 may be so configured that, after the movable guides (second moving means) 33, 34, and 35 move the paper sheets 10 to the second suction belt 37 side and then return back to a state in which the movable guides 33, 34, and 35 are in parallel with the bottom belt 31 (that is, return back to their original position), the first suction belt 25 sends out the paper sheet 10. By configuring above, even before the suction belt 37 sends out all the moved paper sheets 10, at a time point when the stopper 32 stands prepared to receive the paper sheet 10, the first suction belt 25 sends out the paper sheet 10, thus achieving improvements of the handling capability of the paper sheet feeding device 1.

[0079] Also, preferably, the paper sheet feeding device 1 of the present invention may be so configured that, the movable guides 33, 34, and 35 serving as the second moving means, after having moved the paper sheet 10 to the second suction belt 37, return back to a state in which the movable guides 33, 34, and 35 are in parallel with the bottom belt 31 (that is, returns back to their original points) and the first suction belt 25 does not send out the paper sheet 10 until the sensor (not shown) used to detect whether or not the paper sheet 10 moved to the second suction belt 37 side is retained in a stopped state detects that the paper sheet is not left any more in the stopper 32. These operations can avoid the problem that the paper sheet 10 is carried out from the first suction belt 25 irrespective of the existence of the paper sheet 10 still left in the stopper 32 and the left paper sheet 10 produces a trouble causing the carried paper sheet 10 not to be retained in a stopped state with the edges of the paper sheet 10 existing on the carrying direction side evened up, which can prevent carrying abnormality and can improve the handling capability.

[0080] The present invention is effective also as a method of feeding paper sheets. The method of feeding paper sheets of the present invention includes a step of making the first carrying means carry paper sheets, in an upright position, randomly fed from an upstream side, a step of making the first moving means move the paper sheet carried by the first carrying means to the first suction belt side, a step of making an accumulating means accumulate the paper sheet carried by the first carrying means, a step of making the first suction belt send out one or several paper sheets out of accumulated paper sheets with specified timing, a step of making the second carrying means carry the paper sheets fed from the first suction belt in an upright position, a step of making a stopping means retain the paper sheets, in a stopped state, which are carried by the second carrying means, with edges of the paper sheets existing on the carrying direction side evened up, a step of making the second moving means move the paper sheet retained in the stopping means to the second suction belt side with the edges of the paper sheets existing on the carrying direction side evened up and cancel contact with the moved paper sheets, and a step of making the second suction belt send out the paper sheet moved by the second moving means one by one. By applying the above method, it is made possible to take out the large-sized thin paper sheets one by one safely and reliably.

[0081] Also, preferably, the timing with which the first suction belt sends out the paper sheet may be timing with which the first suction belt sucks and holds the paper sheet and the second suction belt sends out one or several paper sheets moved by the second moving means. By operating like this, it is made possible to activate the first suction belt effectively and to reduce a risk of causing damages to the paper sheet.

[0082] Also, preferably, the timing with which the first suction belt sends out the paper sheet may be timing with which the second moving means completes the movement of the paper sheet to the second suction belt side and the stopping means stands prepared to receive the paper sheet (for example, no paper sheet is left any longer in the stopping means). By operating like this, while the second moving means is sending out the moved paper sheet, the stopping means retains the paper sheet in a stopped state, which enables standby time of the stopping means to be shortened and the handling capacity to be so improved.

[0083] It is apparent that the present invention is not limited to the above embodiments but may be changed and modified without departing from the scope of the invention. For example, in the above embodiment, the first supplying section 2 and the second supplying section 3 are so constructed as to be separated from each other, however, the present invention is not limited to this. That is, the first supplying section 2 and second supplying section 3 may be constructed integrally.

[0084] The paper sheet feeding device and the method of feeding the paper sheet can be most suitably applied to objects to be taken out which are larger in size than a postcard such as documents, magazines, books, CD (Compact Disc), or a like. However, the objects are not limited to large-sized objects to be taken out and the present invention can be applied to small-sized objects to be taken out such as a postcard, small-sized envelopes, or a like.

[0085] In summary an embodiment of the invention can be described as follows:

[0086] A paper sheet feeding device (1) is provided which is capable of taking out large-sized paper sheets (10) one by one safely and reliably and of allowing the device to be miniaturized, and a method of feeding paper sheets (10) using the above device. The paper sheet feeding device (1) is so configured that a reverse roller (23) accumulates paper sheets (10), a first suction belt (25) sends out one or several paper sheets (10) with specified timing, a stopper (32) retains paper sheets (10) with edges of the paper sheets (10) existing on a carrying direction side evened up, movable guides (33, 34, 35) move the paper sheets (10) to a second suction belt (37) side with the edges of the paper sheets (10) existing on a carrying direction side evened up and cancel contact with the moved paper sheets (10), and the second suction belt (37) sends out the moved paper sheets (10) one by one. (See Fig. 1)

Claims

1. A paper sheet feeding device (1) comprising:

a first carrying means (21) to carry paper sheets (10), which are fed randomly from an upstream side, to a downstream side;

a first moving means (22) to move the paper sheets (10) carried by said first carrying means (21) to a first suction belt (25) side;

an accumulating means (23) to accumulate the paper sheets (10) carried by said first carrying means (21);

a first suction belt (25) to hold in a suction manner and send out the accumulated paper sheets (10) with specified timing, one by one, or several by several;

a second carrying means (31) to carry the paper sheets (10), which are sent out from said first suction belt (25), to a downstream side;

a stopping means (32) to retain the paper sheets (10), in a stopped state, which are carried by said second carrying means (31), with edges of the paper sheets (10) existing on a carrying direction side evened up;

a second moving means (33, 34, 35) to move the paper sheets (10) with the edges of the paper sheets (10) existing on the carrying direction side evened up by said stopping means (32); and

a second suction belt (37) to hold in a suction manner and send out the paper sheets (10) moved by said second moving means (33, 34, 35) one by one.

2. The paper sheet feeding device (1) according to Claim 1 wherein
said first carrying means (21) and said second carrying means (31) each are configured to carry the paper sheets (10) in an upright position, to the downstream side; and
wherein said second moving means (33, 34, 35) is configured to move the paper sheets (10) with the edges of the paper sheets (10) existing on the carrying direction side evened up by said stopping means (32) and cancel contact with the moved paper sheets (10).

3. The paper sheet feeding device (1) according to Claim 2, wherein said first carrying means (21) is provided with an attitude-control means (28; 282, 283, 284) to change an attitude of the paper sheets (10) being carried in a portrait orientation and upright position, so that the paper sheets (10) are carried in a landscape orientation and upright position.

4. The paper sheet feeding device (1) according to Claim 2 or Claim 3, wherein suction hole groups to suck the paper sheets (10) are formed at a plurality of places on each of said first and second suction belts (25, 37).

5. The paper sheet feeding device (1) according to any one of Claims 2 to 4, wherein a pick-up roller (26, 38) is mounted downstream of each of said first and second suction belts (25, 37).

6. The paper sheet feeding device (1) according to any one of Claims 2 to 5, wherein said first suction belt (25) does not send out the paper sheets (10) until said second suction belt (37) entirely sends out one or several paper sheets (10) moved by said second moving means (33, 34, 35).

7. The paper sheet feeding device (1) according to any one of Claims 2 to 5, wherein said first suction belt (25) does not send out the paper sheet (10) until said second moving means (33, 34, 35) moves the paper sheet (10) to said second suction belt (37) side and returns back to its original position.

8. The paper sheet feeding device (1) according to Claim 7, wherein said first suction belt (25) does not send out the paper sheet (10) until said second moving means (33, 34, 35) moves the paper sheet (10) to said second suction belt (37) side and returns back to its original position and until a sensor to detect whether or not the paper sheet (10) is retained in the stopped state by said stopping means (32) detects that the paper sheet (10) is not retained in the stopped state by said stopping means (32).

9. The paper sheet feeding device (1) according to any one of Claims 2 to 8, further comprising at least one movable guide (33, 34, 35) serving as said second moving means.

10. A method of feeding paper sheets (10) comprising:

a step of making a first carrying means (21) carry paper sheets (10), which are randomly fed from an upstream side, to a downstream side;
a step of making a first moving means (22) move the paper sheets (10) carried by said first carrying means (21) toward a first suction belt (25) side;
a step of making an accumulating means (23) accumulate the paper sheets (10) carried by said first carrying means (21);
a step of making said first suction belt (25) hold in a suction manner and send out the accumulated paper sheets (10) with specified timing, one by one, or several by several;
a step of making a second carrying means (31) carry the paper sheets (10) fed from said first suction belt (25), to a downstream side;
a step of making a stopping means (32) retain the paper sheets (10) in the stopped state, which are carried by said second carrying means (31), with edges of the paper sheets (10) existing on the carrying direction side evened up;
a step of making a second moving means (33, 34, 35) move the paper sheets (10) with edges of the paper sheets (10) existing on the carrying direction side evened up; and
a step of making a second suction belt (37) send out the paper sheets (10) moved by the second moving means (33, 34, 35) one by one.

11. The method of feeding paper sheets (10) according to Claim 10,
wherein said first carrying means (21) and said second carrying means (31) each are configured to carry the paper sheets (10) in an upright position, to the downstream side; and
wherein said second moving means (33, 34, 35) is configured to move the paper sheets (10) with edges of the paper sheets (10) existing on the carrying direction side evened up and cancel contact with the moved paper sheets (10).

12. The method of feeding paper sheets (10) according to Claim 11, wherein the timing with which said first suction belt (25) sends out the paper sheets (10) is set during a period of time when said first suction belt (25) is holding the paper sheet (10) in a suction

state, after said second suction belt (37) has sent out one or several paper sheets (10) moved by said second moving means (33, 34, 35).

13. The method of feeding paper sheets (10) according to Claim 11, wherein the timing with which said first suction belt (25) sends out the paper sheet (10) is set to a timing with which said second moving means (33, 34, 35) completes the movement of the paper sheet (10) to said second suction belt (37) side and said stopping means (32) stands prepared to receive the paper sheet.

Patentansprüche

1. Papierbogenzuführvorrichtung (1), umfassend:

eine erste Trägereinrichtung (21) zum Tragen von Papierbögen (10), die in zufälliger Weise von einer stromaufwärtigen Seite an eine stromabwärtige Seite zugeführt werden;
eine erste Bewegungseinrichtung (22) zum Bewegen der von der ersten Trägereinrichtung (21) getragenen Papierbögen (10) zur Seite eines ersten Saugbands (25);
eine Sammeleinrichtung (23) zum Sammeln der von der ersten Trägereinrichtung (21) getragenen Papierbögen (10);
ein erstes Saugband (25), um die gesammelten Papierbögen (10) durch Saugen zu halten und sie mit einem vorbestimmten Timing einzeln oder zu mehreren auszusenden;
eine zweite Trägereinrichtung (31) zum Tragen der Papierbögen (10), die von dem ersten Saugband (25) ausgesandt werden, zu einer stromabwärtigen Seite;
eine Stoppeinrichtung (32) zum Halten der Papierbögen (10), die durch die zweite Trägereinrichtung (31) getragen werden, in einem gestoppten Zustand, wobei Ränder der Papierbögen (10) in einer Tragrichtungsseite ausgeglichen sind;
eine zweite Bewegungseinrichtung (33, 34, 35) zum Bewegen der Papierbögen (10), wobei die Ränder der Papierbögen (10) an der Tragrichtungsseite durch die Stoppeinrichtung (32) ausgeglichen sind; und
ein zweites Saugband (37), um die durch die zweite Bewegungseinrichtung (33, 34, 35) bewegten Papierbögen (10) durch Saugen zu halten und einzeln auszusenden.

2. Papierbogenzuführvorrichtung (1) nach Anspruch 1, wobei
die erste Trägereinrichtung (21) und die zweite Trägereinrichtung (31) jeweils dazu ausgelegt sind, die Papierbögen (10) in einer aufrechten Position zur stromabwärtigen Seite zu tragen; und
wobei die zweite Bewegungseinrichtung (33, 34, 35) dazu ausgelegt ist, die Papierbögen (10) zu bewegen, wobei die Ränder der Papierbögen (10) an der Tragrichtungsseite durch die Stoppeinrichtung (32) ausgeglichen sind, und den Kontakt mit den bewegten Papierbögen (10) zu beenden.

3. Papierbogenzuführvorrichtung (1) nach Anspruch 2, wobei die erste Trägereinrichtung (21) mit einer Einstellungssteuerungseinrichtung (28; 282, 283, 284) ausgestattet ist, um eine Einstellung der Papierbögen (10) zu ändern, die in einer Portraitorientierung und aufrechten Position getragen werden, derart, dass die Papierbögen (10) in einer Landschaftsorientierung und aufrechten Position getragen werden.

4. Papierbogenzuführvorrichtung (1) nach Anspruch 2 oder Anspruch 3, wobei Sauglochgruppen zum Ansaugen der Papierbögen (10) an einer Mehrzahl von Stellen sowohl des ersten als auch des zweiten Saugbands (25, 37) gebildet sind.

5. Papierbogenzuführvorrichtung (1) nach einem der Ansprüche 2 bis 4, wobei eine Aufnahmerolle (26, 38) stromabwärts sowohl des ersten als auch des zweiten Saugbands (25, 37) montiert ist.

6. Papierbogenzuführvorrichtung (1) nach einem der Ansprüche 2 bis 5, wobei das erste Saugband (25) die Papierbögen (10) nicht aussendet, bis das zweite Saugband (37) ein oder mehrere durch die zweite Bewegungseinrichtung (33, 34, 35) bewegte Papierbögen (10) vollständig aussendet.

7. Papierbogenzuführvorrichtung (1) nach einem der Ansprüche 2 bis 5, wobei das erste Saugband (25) den Papierbogen (10) nicht aussendet, bis die zweite Bewegungseinrichtung (33, 34, 35) den Papierbogen (10) zu der Seite des zweiten Saugbands (37) bewegt und in ihre ursprüngliche Position zurückkehrt.

8. Papierbogenzuführvorrichtung (1) nach Anspruch 7, wobei das erste Saugband (25) den Papierbogen (10) nicht aussendet, bis die zweite Bewegungseinrichtung (33, 34, 35) den Papierbogen (10) zur Seite des zweiten Saugbands (37) bewegt und in ihre ursprüngliche Position zurückkehrt, und bis ein Sensor zum Erfassen, ob oder ob nicht der Papierbogen (10) durch die Stoppeinrichtung (32) in dem gestoppten Zustand gehalten wird, erfasst, dass der Papierbogen (10) nicht durch die Stoppeinrichtung (32) in dem gestoppten Zustand gehalten wird.

9. Papierbogenzuführvorrichtung (1) nach einem der Ansprüche 2 bis 8, ferner umfassend wenigstens eine bewegliche Führung (33, 34, 35), die als die zwei-

te Bewegungseinrichtung dient.

10. Verfahren zum Zuführen von Papierbögen (10), umfassend:

einen Schritt des Bewirkens, dass eine erste Trägereinrichtung (21) Papierbögen (10), die in zufälliger Weise von einer stromaufwärtigen Seite zugeführt werden, zu einer stromabwärtigen Seite trägt;
einen Schritt des Bewirkens, dass eine erste Bewegungseinrichtung (22) die durch die erste Trägereinrichtung (21) getragenen Papierbögen (10) zur Seite eines ersten Saugbands (25) bewegt;
einen Schritt des Bewirkens, dass eine Sammeleinrichtung (23) die durch die erste Trägereinrichtung (21) getragenen Papierbögen (10) sammelt;
einen Schritt des Bewirkens, dass das erste Saugband (25) die gesammelten Papierbögen (10) durch Saugen hält und sie einzeln oder zu mehreren mit vorbestimmtem Timing aussendet;
einen Schritt des Bewirkens, dass eine zweite Trägereinrichtung (31) die von dem ersten Saugband (25) zugeführten Papierbögen (10) zu einer stromabwärtigen Seite trägt;
einen Schritt des Bewirkens, dass eine Stoppeinrichtung (32) die Papierbögen (10), die durch die zweite Trägereinrichtung (31) getragen werden, in dem gestoppten Zustand hält, wobei Ränder der Papierbögen (10) an der Tragrichtungsseite ausgeglichen sind;
einen Schritt des Bewirkens, dass eine zweite Bewegungseinrichtung (33, 34, 35) die Papierbögen (10) bewegt, wobei Ränder der Papierbögen (10) an der Tragrichtungsseite ausgeglichen sind; und
einen Schritt des Bewirkens, dass ein zweites Saugband (37) die durch die zweite Bewegungseinrichtung (33, 34, 35) bewegten Papierbögen (10) einzeln aussendet.

11. Verfahren zum Zuführen von Papierbögen (10) nach Anspruch 10,
wobei die erste Trägereinrichtung (21) und die zweite Trägereinrichtung (31) jeweils dazu ausgelegt sind, die Papierbögen (10) in einer aufrechten Position zur stromabwärtigen Seite zu tragen; und
wobei die zweite Bewegungseinrichtung (33, 34, 35) dazu ausgelegt ist, die Papierbögen (10) zu bewegen, wobei die Ränder der Papierbögen (10) an der Tragrichtungsseite ausgeglichen sind, und den Kontakt mit den bewegten Papierbögen (10) zu beenden.

12. Verfahren zum Zuführen von Papierbögen (10) nach Anspruch 11, wobei das Timing, mit dem das erste Saugband (25) die Papierbögen (10) aussendet, während einer Zeitdauer eingestellt ist, wenn das erste Saugband (25) den Papierbogen (10) in einem Saugzustand hält, nachdem das zweite Saugband (37) ein oder mehrere durch die zweite Bewegungseinrichtung (33, 34, 35) bewegte Papierbögen (10) ausgesandt hat.

13. Verfahren zum Zuführen von Papierbögen (10) nach Anspruch 11, wobei das Timing, mit dem das erste Saugband (25) den Papierbogen (10) aussendet, auf ein Timing eingestellt wird, mit dem die zweite Bewegungseinrichtung (33, 34, 35) die Bewegung des Papierbogens (10) zur Seite des zweiten Saugbands (37) vervollständigt und die Stoppeinrichtung (32) bereitsteht, um den Papierbogen zu empfangen.

Revendications

1. Dispositif d'approvisionnement en feuilles de papier (1) comprenant :

un premier moyen porteur (21) pour transporter des feuilles de papier (10), qui sont approvisionnées aléatoirement d'un côté amont à un côté aval ;
un premier moyen de déplacement (22) pour déplacer les feuilles de papier (10) transportées par ledit premier moyen porteur (21) vers un côté de première courroie d'aspiration (25) ;
un moyen d'accumulation (23) pour accumuler les feuilles de papier (10) transportées par ledit premier moyen porteur (21) ;
une première courroie d'aspiration (25) pour maintenir de manière aspirante et envoyer les feuilles accumulées (10) avec un minutage spécifié, une par une, ou à plusieurs ;
un second moyen porteur (31) pour transporter les feuilles de papier (10), qui sont envoyées de ladite première courroie d'aspiration (25) vers un côté aval ;
un moyen d'arrêt (32) pour retenir les feuilles de papier (10), dans un état arrêté, qui sont transportées par ledit second moyen porteur (31), des bords des feuilles de papier (10) se trouvant égalisés sur un côté de direction de transport ;
un second moyen de déplacement (33, 34, 35) pour déplacer les feuilles de papier (10) avec les bords des feuilles de papier (10) se trouvant égalisés sur le côté de direction de transport par ledit moyen d'arrêt (32) ; et
une seconde courroie d'aspiration (37) pour maintenir de manière aspirante et envoyer les feuilles de papier (10) déplacées par ledit second moyen de déplacement (33, 34, 35) une

par une.

2. Dispositif d'approvisionnement en feuilles de papier (1) selon la revendication 1, dans lequel
ledit premier moyen porteur (21) et ledit second moyen porteur (31) sont chacun configurés pour transporter les feuilles de papier (10) dans une position verticale, vers le côté aval ; et
dans lequel ledit second moyen de déplacement (33, 34, 35) est configuré pour déplacer les feuilles de papier (10) avec les bords des feuilles de papier (10) se trouvant égalisés sur le côté de direction de transport par ledit moyen d'arrêt (32) et pour annuler un contact avec les feuilles de papier (10) déplacées.

3. Dispositif d'approvisionnement en feuilles de papier (1) selon la revendication 2, dans lequel ledit premier moyen porteur (21) est doté d'un moyen de régulation de disposition (28 ; 282, 283, 284) pour modifier une disposition des feuilles de papier (10) transportées dans une orientation en portrait et une position verticale, de sorte que les feuilles de papier (10) soient transportées dans une orientation en paysage et une position verticale.

4. Dispositif d'approvisionnement en feuilles de papier (1) selon la revendication 2 ou la revendication 3, dans lequel des groupes d'orifices d'aspiration pour aspirer les feuilles de papier (10) sont formés en une pluralité d'endroits sur chacune desdites première et seconde courroies d'aspiration (25, 37) .

5. Dispositif d'approvisionnement en feuilles de papier (1) selon l'une quelconque des revendications 2 à 4, dans lequel un galet preneur (26, 38) est monté en aval de chacune desdites première et seconde courroies d'aspiration (25, 37) .

6. Dispositif d'approvisionnement en feuilles de papier (1) selon l'une quelconque des revendications 2 à 5, dans lequel ladite première courroie d'aspiration (25) n'envoie pas les feuilles de papier (10) jusqu'à ce que ladite seconde courroie d'aspiration (37) envoie totalement une ou plusieurs feuilles de papier (10) déplacées par ledit second moyen de déplacement (33, 34, 35).

7. Dispositif d'approvisionnement en feuilles de papier (1) selon l'une quelconque des revendications 2 à 5, dans lequel ladite première courroie d'aspiration (25) n'envoie pas la feuille de papier (10) jusqu'à ce que ledit second moyen de déplacement (33, 34, 35) déplace la feuille de papier (10) vers le côté de ladite seconde courroie d'aspiration (37) et retourne à sa position d'origine.

8. Dispositif d'approvisionnement en feuilles de papier (1) selon la revendication 7, dans lequel ladite première courroie d'aspiration (25) n'envoie pas la feuille de papier (10) jusqu'à ce que ledit second moyen de déplacement (33, 34, 35) déplace la feuille de papier (10) vers le côté de ladite seconde courroie d'aspiration (37) et retourne à sa position d'origine et jusqu'à ce qu'un capteur pour détecter si la feuille de papier (10) est retenue ou non dans l'état arrêté par ledit moyen d'arrêt (32) détecte que la feuille de papier (10) n'est pas retenue dans l'état arrêté par ledit moyen d'arrêt (32).

9. Dispositif d'approvisionnement en feuilles de papier (1) selon l'une quelconque des revendications 2 à 8, comprenant en outre au moins un guide mobile (33, 34, 35) servant de dit second moyen de déplacement.

10. Procédé d'approvisionnement en feuilles de papier (10) comprenant :

une étape consistant à amener un premier moyen porteur (21) à transporter des feuilles de papier (10), qui sont approvisionnées aléatoirement d'un côté amont à un côté aval ;
une étape consistant à amener un premier moyen de déplacement (22) à déplacer les feuilles de papier (10) transportées par ledit premier moyen porteur (21) vers un côté de première courroie d'aspiration (25) ;
une étape consistant à amener un moyen d'accumulation (23) à accumuler les feuilles de papier (10) transportées par ledit premier moyen porteur (21) ;
une étape consistant à amener ladite première courroie d'aspiration (25) à maintenir de manière aspirante et envoyer les feuilles de papier accumulées (10) avec un minutage spécifié, une par une, ou à plusieurs ;
une étape consistant à amener un second moyen porteur (31) à transporter les feuilles de papier (10) approvisionnées depuis ladite première courroie d'aspiration (25), vers un côté aval ;
une étape consistant à amener un moyen d'arrêt (32) à retenir les feuilles de papier (10) dans l'état arrêté, qui sont transportées par ledit second moyen porteur (31), avec des bords des feuilles de papier (10) se trouvant égalisés sur le côté de direction de transport ;
une étape consistant à amener un second moyen de déplacement (33, 34, 35) à déplacer les feuilles de papier (10) avec les bords des feuilles de papier (10) se trouvant égalisés sur le côté de direction de transport ; et
une étape consistant à amener une seconde courroie d'aspiration (37) à envoyer les feuilles de papier (10) déplacées par le second moyen de déplacement (33, 34, 35) une par une.

11. Procédé d'approvisionnement en feuilles de papier (10) selon la revendication 10,
dans lequel ledit premier moyen porteur (21) et ledit second moyen porteur (31) sont chacun configurés pour transporter les feuilles de papier (10) dans une position verticale, vers le côté aval ; et
dans lequel ledit second moyen de déplacement (33, 34, 35) est configuré pour déplacer les feuilles de papier (10) avec des bords des feuilles de papier (10) se trouvant égalisés sur le côté de direction de transport et pour annuler un contact avec les feuilles de papier (10) déplacées.

12. Procédé d'approvisionnement en feuilles de papier (10) selon la revendication 11, dans lequel le minutage selon lequel ladite première courroie d'aspiration (25) envoie les feuilles de papier (10) est établi pendant une période de temps pendant laquelle ladite première courroie d'aspiration (25) maintient la feuille de papier (10) dans un état d'aspiration, après que ladite seconde courroie d'aspiration (37) a envoyé une ou plusieurs feuilles de papier (10) déplacées par ledit second moyen de déplacement (33, 34, 35) .

13. Procédé d'approvisionnement en feuilles de papier (10) selon la revendication 11, dans lequel le minutage selon lequel ladite première courroie d'aspiration (25) envoie la feuille de papier (10) est établi à un minutage selon lequel ledit second moyen de déplacement (33, 34, 35) achève le déplacement de la feuille de papier (10) vers le côté de ladite seconde courroie d'aspiration (37) et ledit moyen d'arrêt (32) se tient prêt à recevoir la feuille de papier.

FIG.1

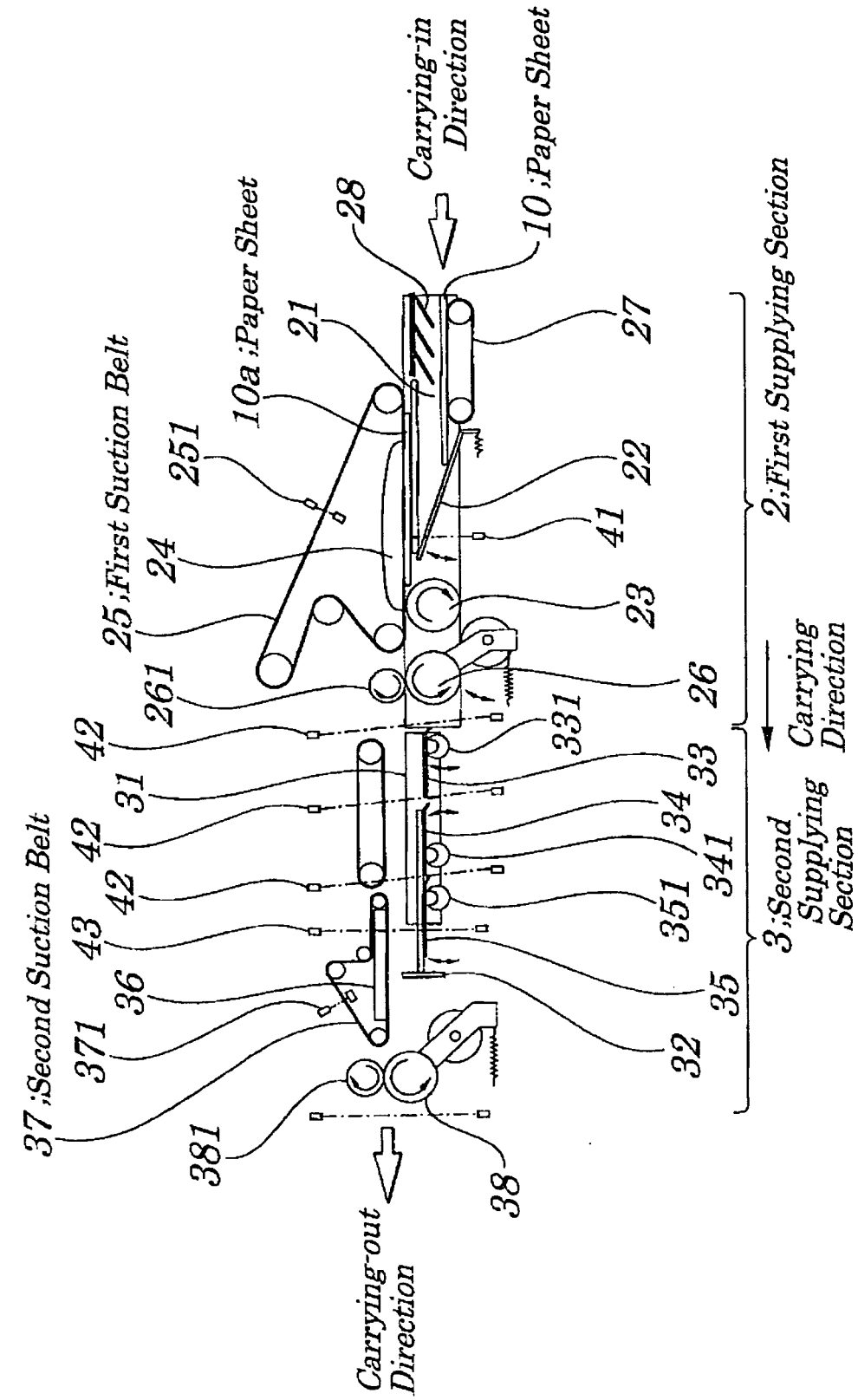

1;Paper Sheet Feeding Device
10;Paper Sheet
Carrying-in Direction
10a;Paper Sheet
25;First Suction Belt
37;Second Suction Belt
2;First Supplying Section
3;Second Supplying Section
Carrying Direction
Carrying-out Direction
21
22
23
24
251
261
26
27
28
31
32
33
331
34
341
35
351
36
371
381
38
41
42
43

FIG.2A

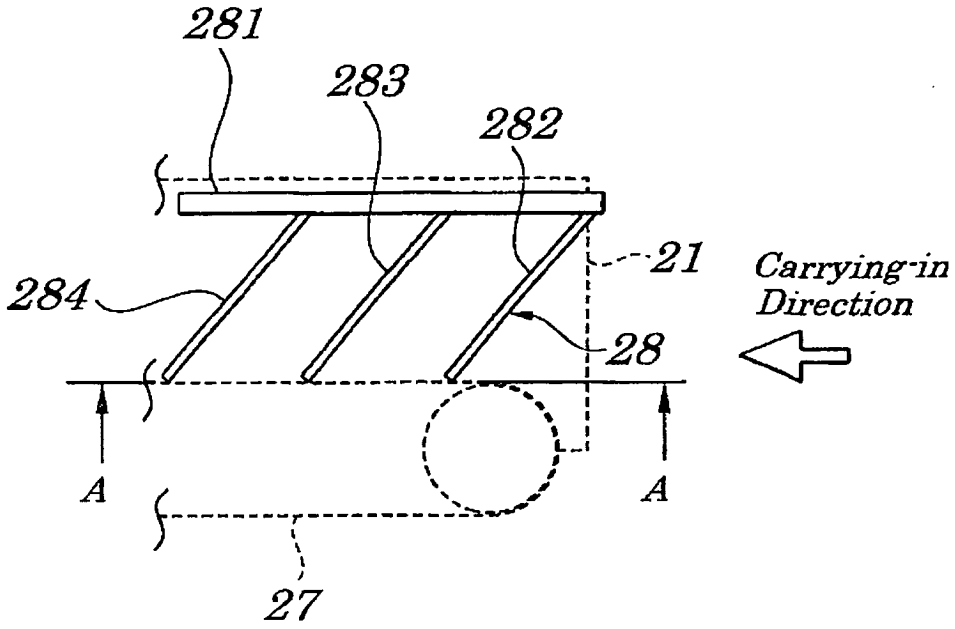

281
283
282
21
Carrying-in Direction
284
28
A
A
27

FIG.2B

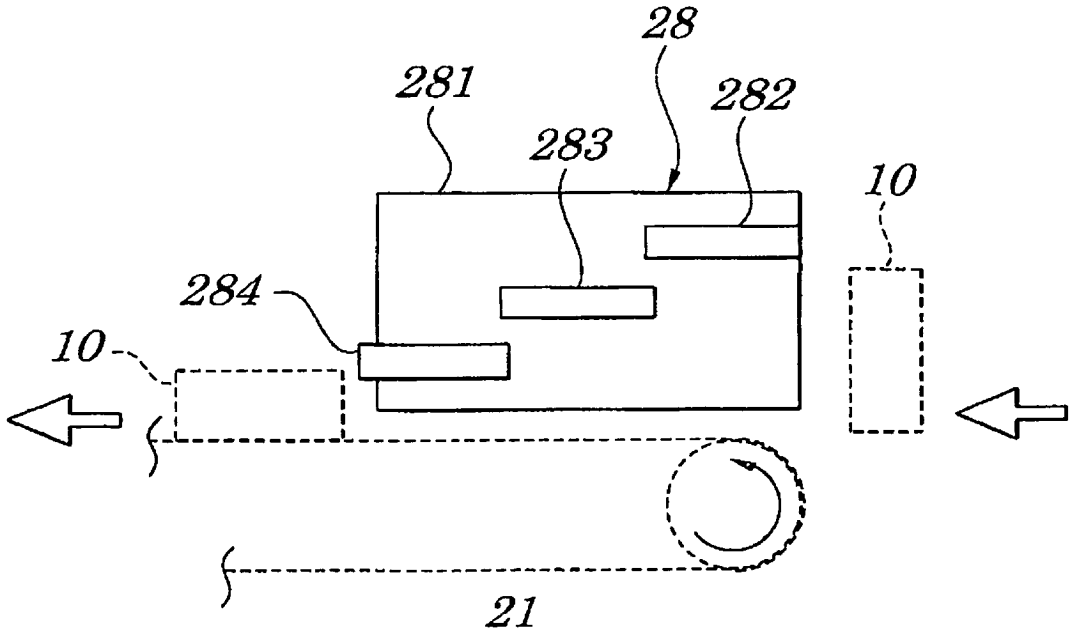

28
281
282
283
10
284
10
21

FIG.3

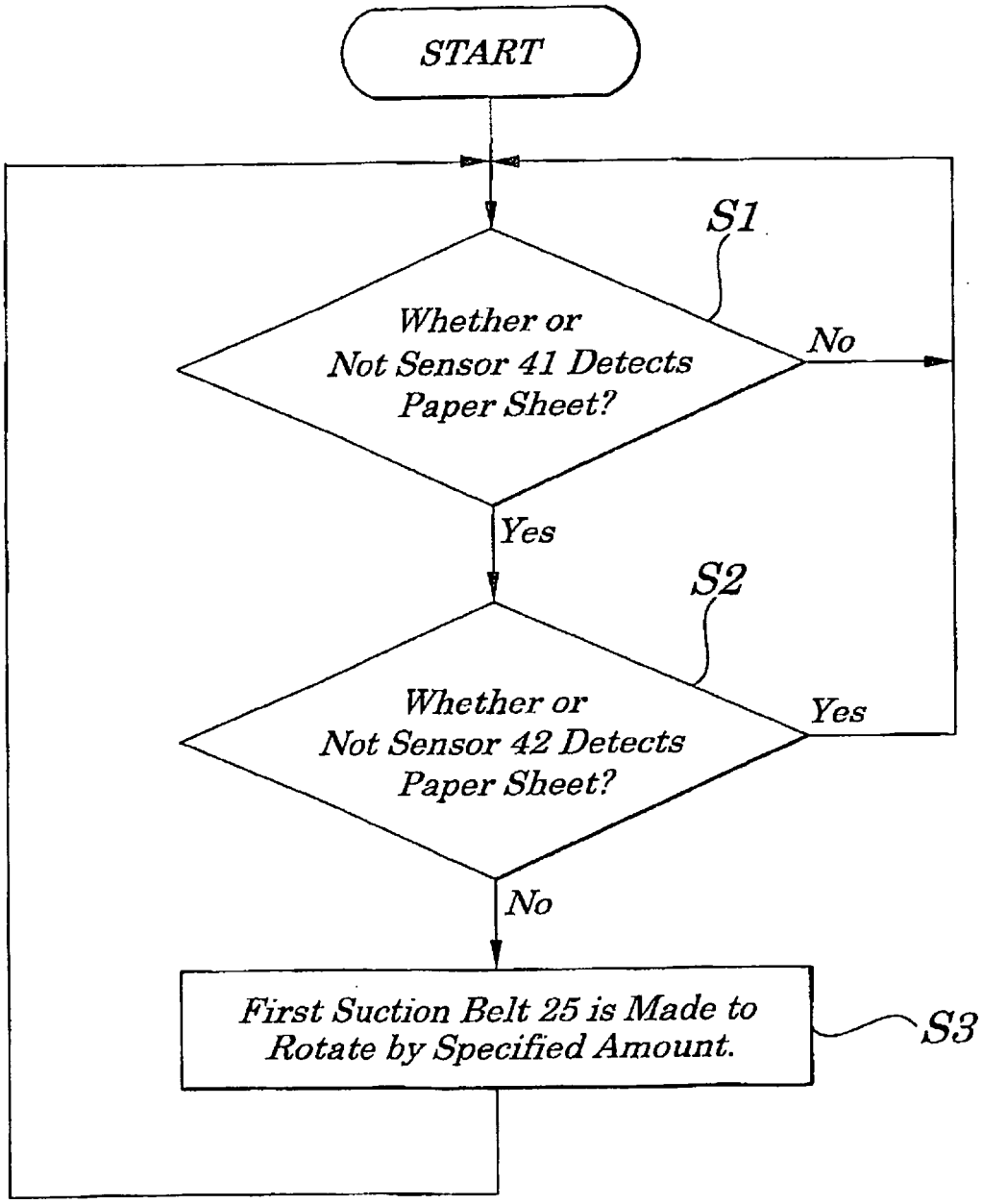

START
S1
Whether or Not Sensor 41 Detects Paper Sheet?
No
Yes
S2
Whether or Not Sensor 42 Detects Paper Sheet?
Yes
No
First Suction Belt 25 is Made to Rotate by Specified Amount.
S3

FIG. 4

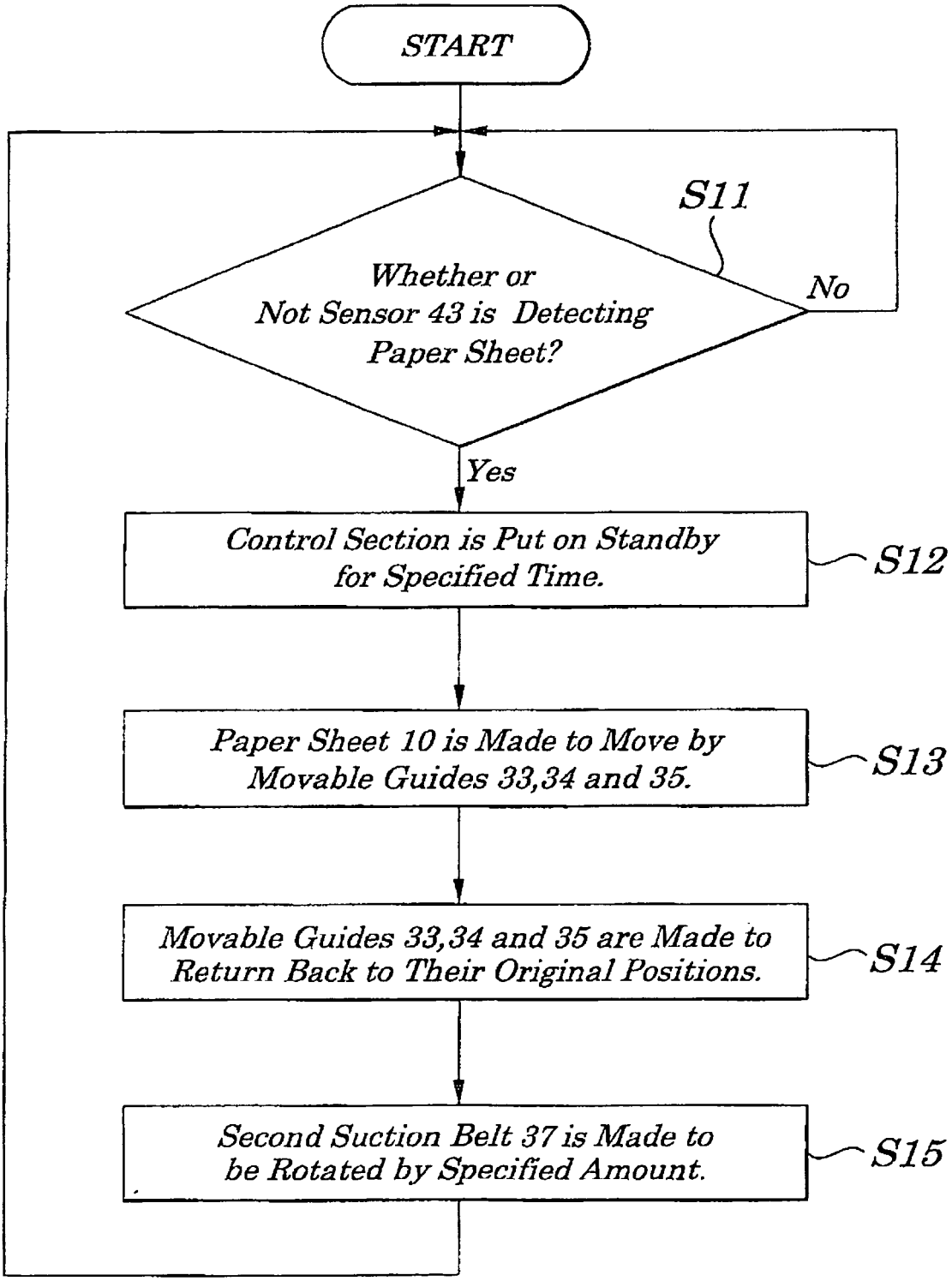
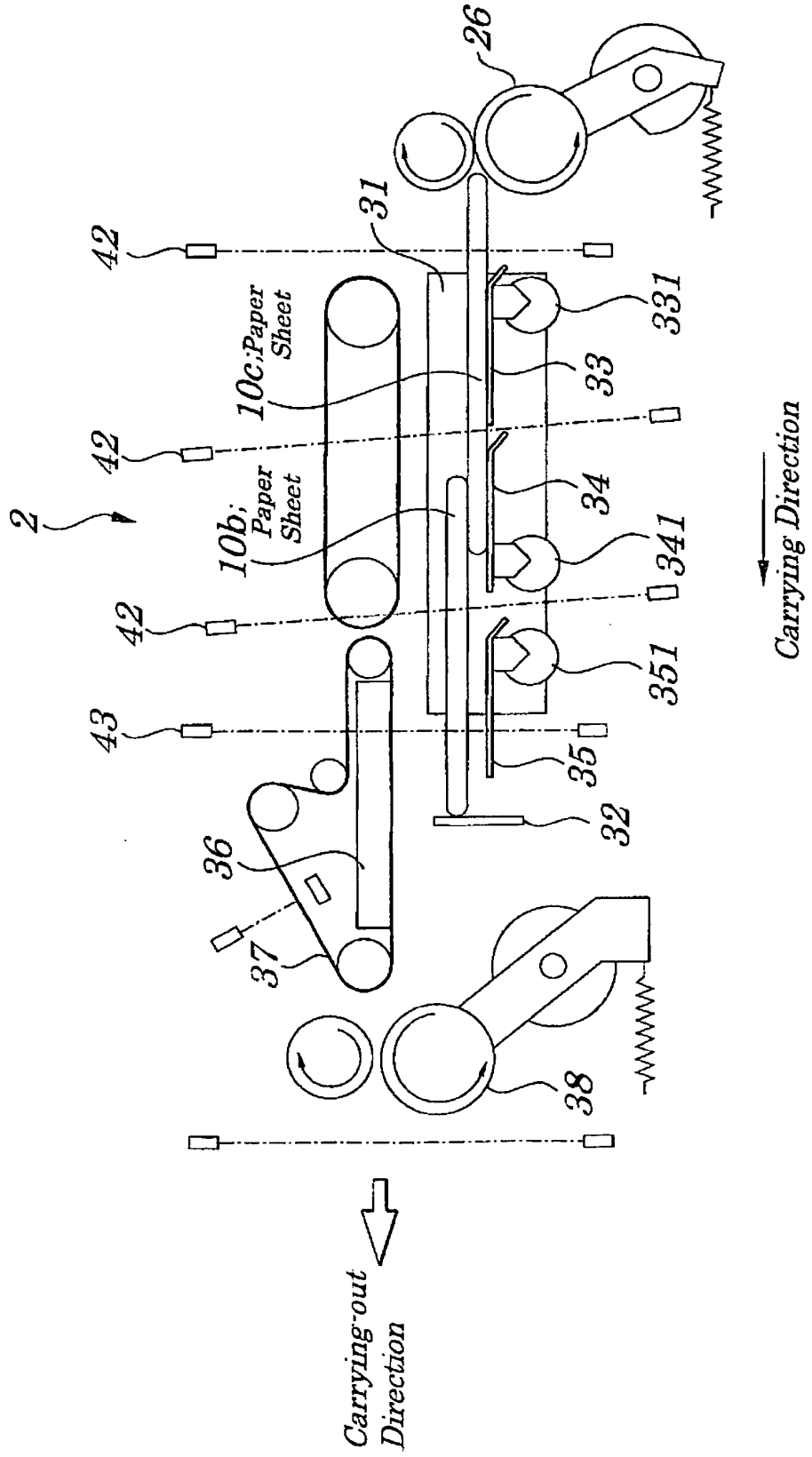

START
S11
Whether or Not Sensor 43 is Detecting Paper Sheet?
No
Yes
Control Section is Put on Standby for Specified Time.
S12
Paper Sheet 10 is Made to Move by Movable Guides 33,34 and 35.
S13
Movable Guides 33,34 and 35 are Made to Return Back to Their Original Positions.
S14
Second Suction Belt 37 is Made to be Rotated by Specified Amount.
S15

FIG.5


2
26
31
42
42
42
43
10c:Paper Sheet
10b:Paper Sheet
331
33
34
341
351
35
32
36
37
38
Carrying Direction
Carrying-out Direction

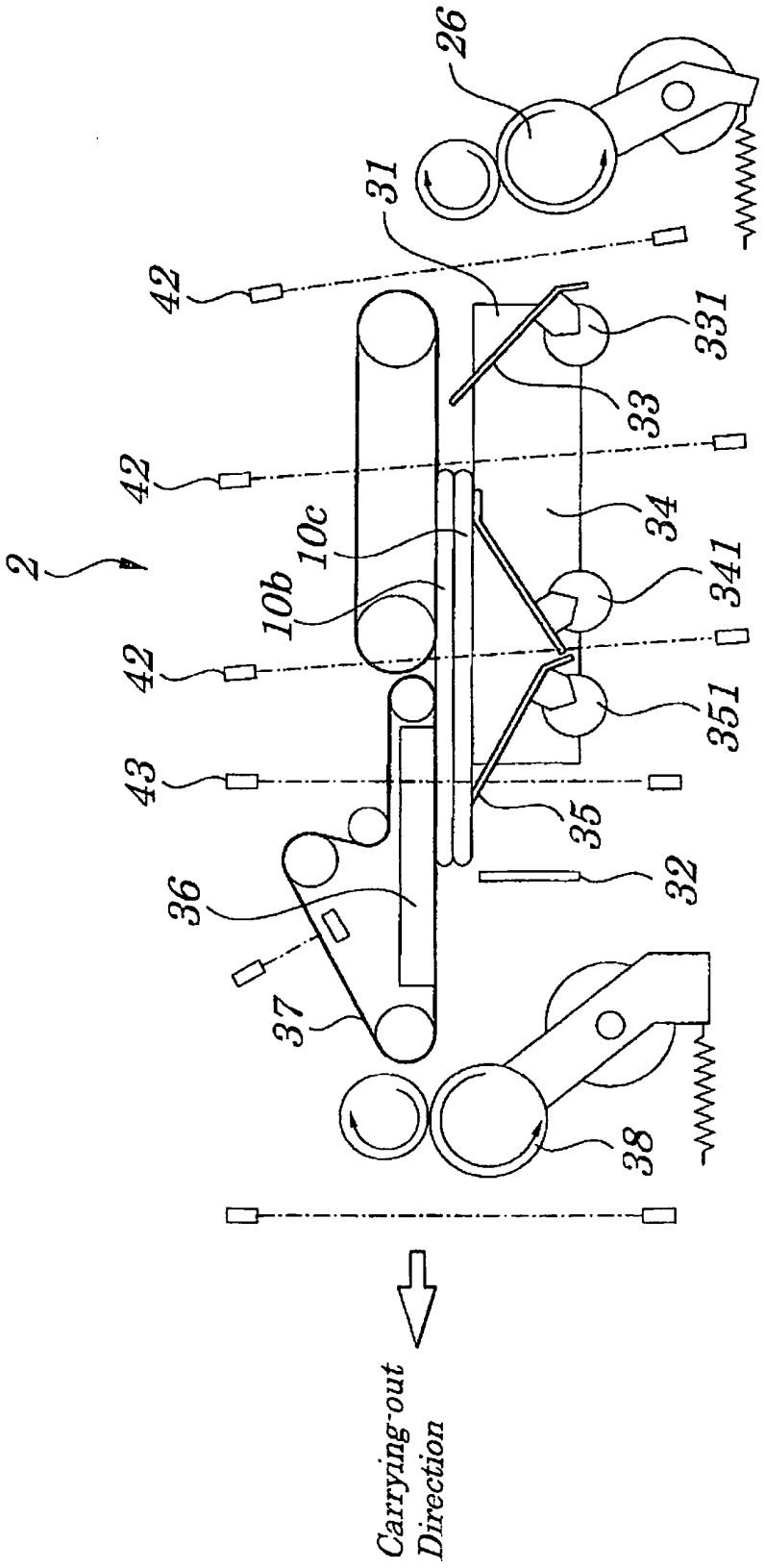

26
31
42
331
33
42
2
34
10c
10b
341
42
351
43
35
36
32
37
38
Carrying-out Direction

FIG.6

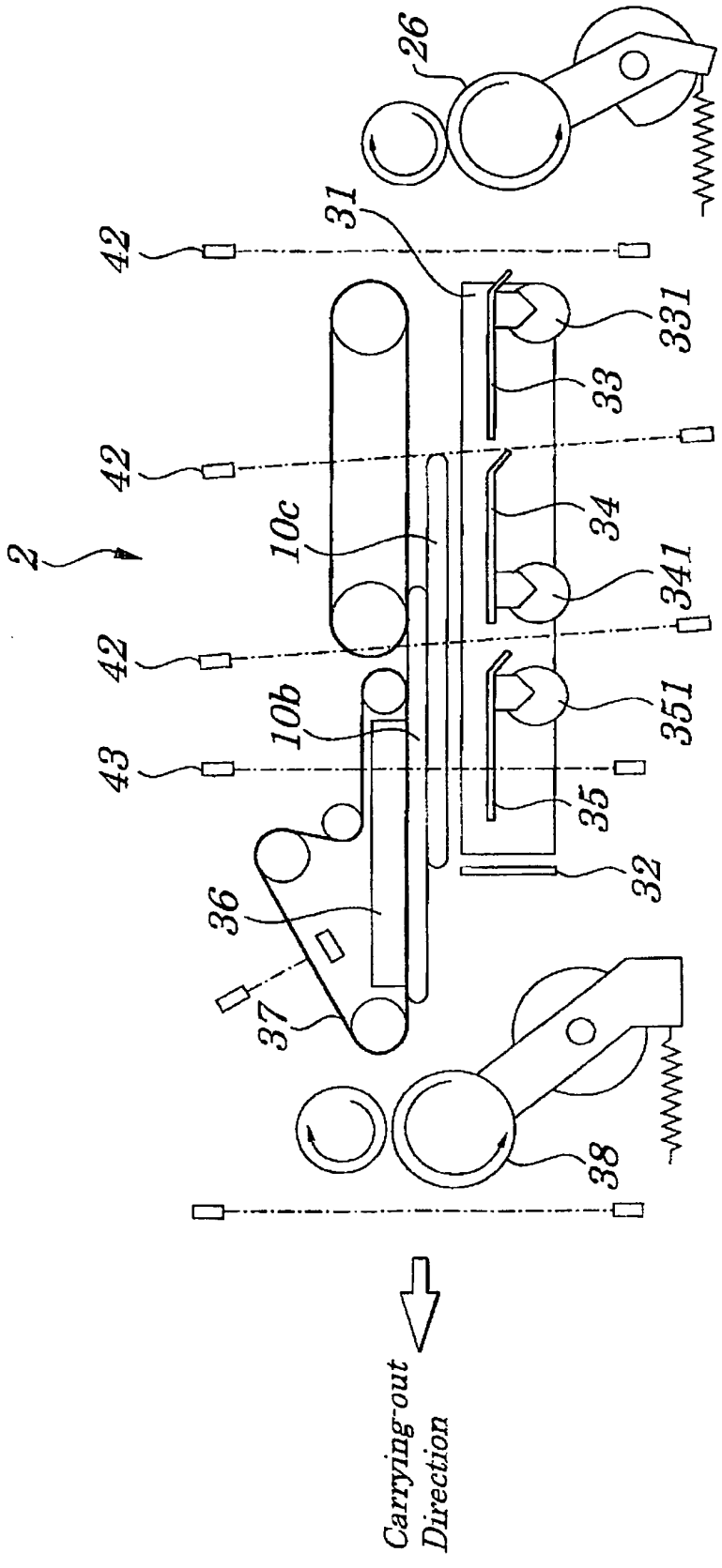

26
31
42
331
33
42
34
2
10c
341
42
351
10b
43
35
32
36
37
38
Carrying-out Direction

FIG. 7

FIG.8 (PRIOR ART)

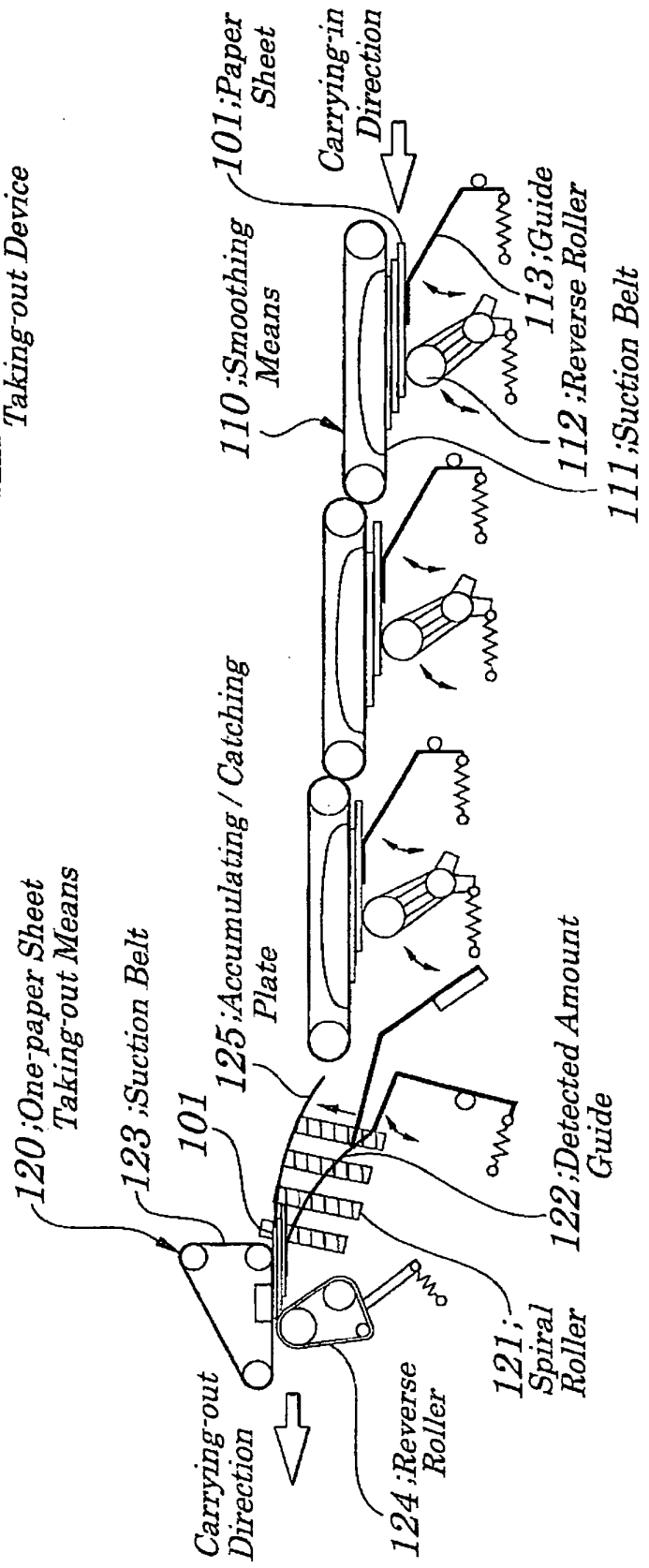


FIG.9 (PRIOR ART)

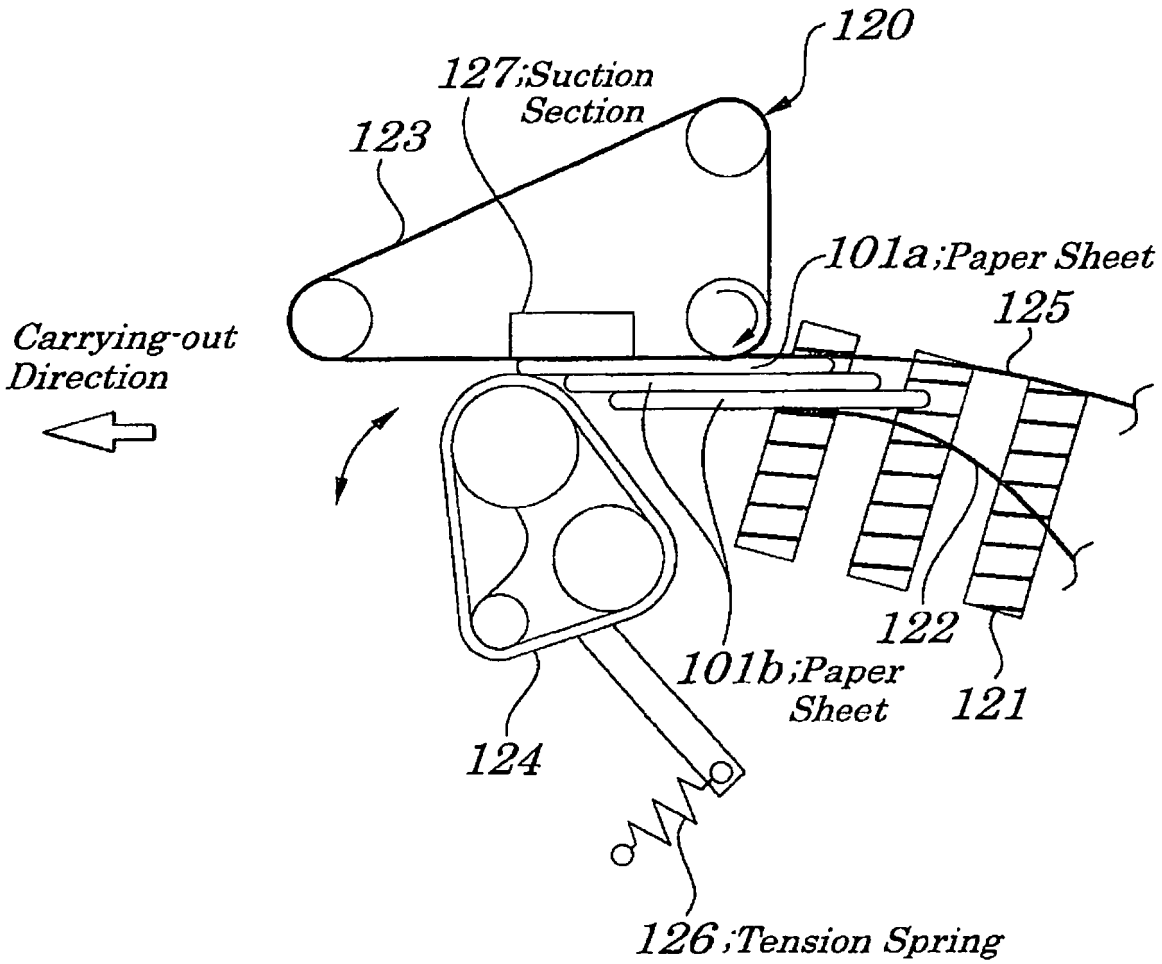
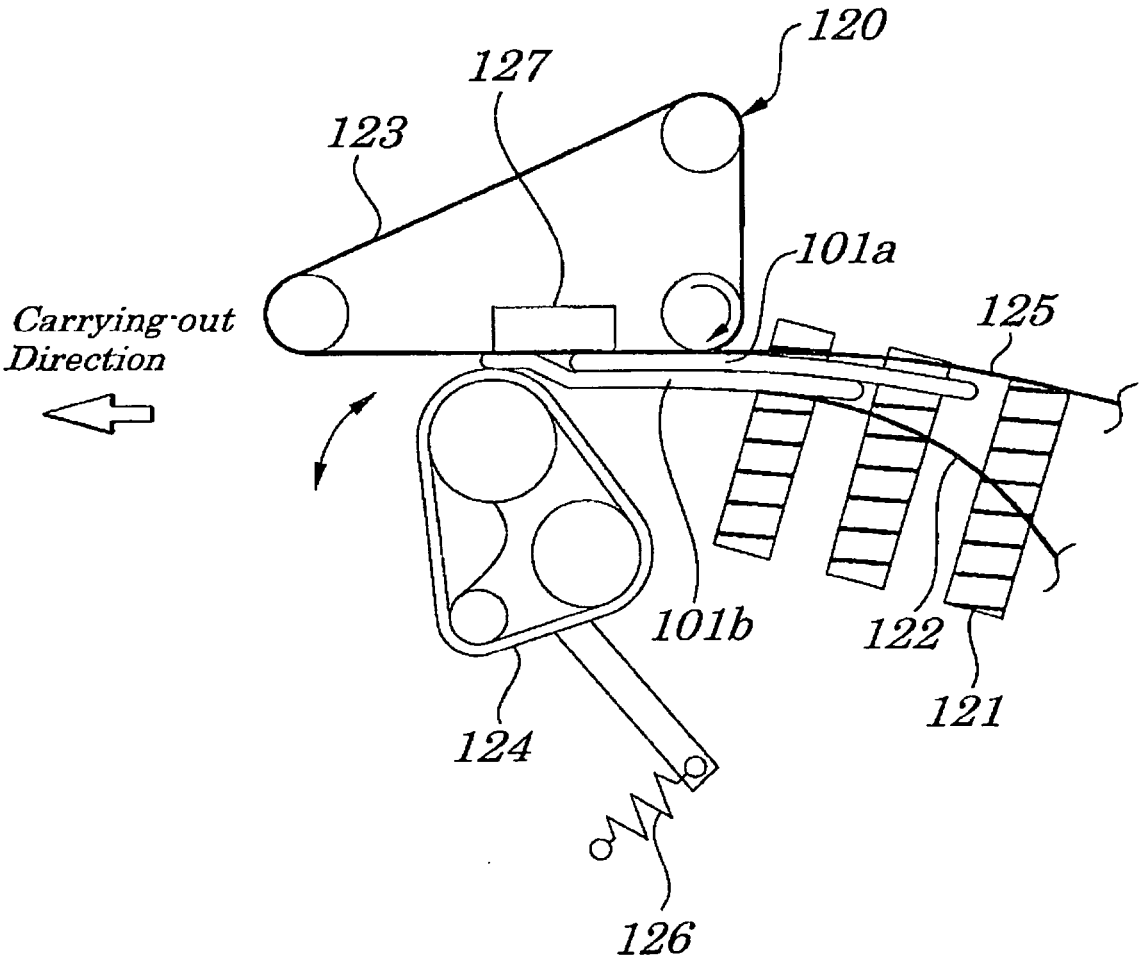


FIG. 10 (PRIOR ART)



REFERENCES CITED IN THE DESCRIPTION

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Patent documents cited in the description

- JP 2000109230 A **[0011]**
- JP 2002332169 A **[0012]**
- JP 3015630 B **[0013]**